DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU

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MUFI HANNEMANN
MAYOR

HENRY ENG, FAICP
DIRECTOR

DAVID K. TANOUE
DEPUTY DIRECTOR

2005/ED-4(ST)

September 26, 2005

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
State of Hawaii
State Office Tower, Room 702
235 South Beretania Street
Honolulu, Hawaii 96813-2437

Dear Ms. Salmonson:

Re: FINAL ENVIRONMENTAL ASSESSMENT CHAPTER 343, HAWAII REVISED STATUTES (HRS)
Environmental Assessment (EA)/Determination
Finding of No Significant Impact (FONSI)

Recorded Owner/ Applicant	:	Randall and Shelley Bennett
Agent	:	Sea Engineering, Inc.
Location	:	55-295 Kamehameha Highway - Laie
Tax Map Key	:	5-5-2: 5
Request	:	Shoreline Setback Variance (SV)
Proposal	:	To reconstruct a (fourteen) 14-foot high boulder rip-rap revetment that includes a (five) 5-foot wide toe apron in front of and (one) 1-foot below the existing revetment within the 40-foot shoreline setback.

Attached and incorporated by reference is the Final EA prepared by the applicant for the above project pursuant to Chapter 343, HRS. We have determined that the preparation of an Environmental Impact Statement (EIS) is not required. Enclosed are a 3-1/2" Floppy Disk with a "Summary" of the subject project, Publication Form, and four copies of the Final Environmental Assessment. We request publication of a notice of this document in The Environmental Notice.

If you have any questions, please contact Steve Tagawa of our staff at 523-4817.

Very truly yours,

Barbara A Moon
for Henry Eng, FAICP, Director
Department of Planning and Permitting

HE:cs
Attachments
G:Landuse/posseworkingdirectory/SteveT/SVBennett.fon

2005-10-08-OA FONSI BENNETT AFTER-THE-FACT
RUBBLE RIP RAP (UNGROUTED).

FINAL
ENVIRONMENTAL ASSESSMENT AND COASTAL ENGINEERING EVALUATION FOR SHORELINE SETBACK VARIANCE APPLICATION

TMK: 5-5-02:5
55-295 Kamehameha Highway
Laie, Oahu, Hawaii

SE Sea Engineering, Inc.

FINAL
ENVIRONMENTAL ASSESSMENT AND COASTAL ENGINEERING EVALUATION FOR SHORELINE SETBACK VARIANCE APPLICATION

TMK: 5-5-02:5
55-295 Kamehameha Highway
Laie, Oahu, Hawaii

August 2005

Prepared by:

Sea Engineering, Inc.
Makai Research Pier
Waimanalo, Hawaii 96795

#5-8

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1.0 GENERAL INFORMATION

A. PROJECT LOCATION

55-295 Kamehameha Highway
Laie, Oahu

B. TMK, APPLICANT AND RECORDED FEE OWNER

TMK 5-5-02:5
Name: Randall K. & Shelley D. Bennett
Mailing Address: 2464 East Field Rose Drive
Salt Lake City, UT 84121
Phone: (801) 424-0001

C. AGENT

Sea Engineering, Inc.
Attn: Scott Sullivan
Makai Research Pier
Waimanalo, HI 96795
Phone: (808) 259-7966, ext. 14
Fax: (808) 259-8143
Email: scotts@seaengineering.com

D. LOT AREA

Total	Erosion	Net
39,943 SF	7,412 SF	32,531 SF

E. ZONING: R-5 Residential

F. KOOLAU LOA SUSTAINABLE COMMUNITIES PLAN DESIGNATION:

Rural Residential

G. REQUIRED PERMITS:

City and County of Honolulu, Department of Planning and Permitting
Shoreline Setback Variance
Grading and Building Permit

Department of the Army, Corps of Engineers
(Note: Only required if construction extends seaward of the mean higher high water line.)

2.0 LOCATION AND GENERAL DESCRIPTION OF THE PROPOSED PROJECT

This report has been prepared to accompany a Shoreline Setback Variance application to the City and County of Honolulu, Department of Planning and Permitting (DPP), for a shoreline lot in Laie, Oahu. This environmental assessment and coastal engineering evaluation has been prepared in accordance with the study recommendations of the "Shoreline Hardening *Policy and Environmental Assessment Guidelines" published by the Office of Environmental* Quality Control. The project site is located at 55-295 Kamehameha Highway on the northeastern coast of Oahu. The makai (ocean) side of the highway is almost completely developed with single-family homes, and the Polynesian Cultural Center is located on the mauka (landward) side. South of the cultural center the mauka land is undeveloped open space. Many homes are constructed as near the shore as legally possible, and where shoreline erosion has occurred many homes now extend into what would be the shoreline setback zone today. A general location map for the project area is shown on Figure 2-1, and a tax map key for the area is shown on Figure 2-2.

The project site is located at the south end of Laniloa Beach, an approximately one-mile long stretch of shoreline bounded by Laie Point to the north and Kehukuuna Point to the south. The beach typically varies in width from 20 to 50 feet, and is composed primarily of fine calcareous sand. The shoreline has a history of significant and chronic erosion, and the majority of shoreline homes have vertical seawall or sloping rock revetment shore protection. The report *Oahu Shoreline Study, Part 1 – Data on Beach Changes* (prepared by Sea Engineering, Inc. (SEI) for the City and County of Honolulu, Department of Land Utilization, 1989) documents a landward recession of the vegetation line since 1949, and states that "The south end of Laniloa Beach has a history of shoreline erosion problems, and this trend is expected to continue." Shoreline recession of about 65 feet through 1988 in the project vicinity was documented in the report, and additional erosion has been documented during the 1990's.

The project property (Lot 4) was purchased by Mr. and Mrs. Bennett in October 2003. A shoreline certification approved by the Chairman of the Board of Land and Natural Resources on September 10, 2003 had been obtained by the prior owner. A portion of the property on the south end was protected by an existing rock revetment which extended further south across the shoreline of the adjacent property. This revetment has been proven by the neighbor to the south (TMK 5-5-02:4, Lot 3, owned by the Rogers) to have been constructed prior to 1970, and is considered by DPP to be a nonconforming structure (ROH 23-1.6). The prior existing rock shore protection is shown on the 1967 aerial photograph in Figure 2.3. As a result of a misunderstanding by the Bennett's during discussion with DPP regarding permit requirements, they placed additional rock on the shore within the shoreline setback area in the mistaken belief that they also had a nonconforming revetment which could be repaired without obtaining a Shoreline Setback Variance (SSV). The Bennett's were given a Notice of Violation in November 2003 for this rock placement. It should be noted that the Bennett's neighbor to the south, whose old revetment was constructed prior to 1970 and which is an extension of the Bennett's prior existing revetment, has obtained approval

from DPP to repair their revetment without obtaining an SSV. However, because the Bennett's old revetment protected less than half of their 100-foot wide shoreline, it has been determined by DPP that a SSV is required for construction of shore protection improvements for the Bennett property.

Prior to placing rocks on the shoreline in 2003 the unprotected shoreline was actively eroding and had a near vertical 12- to 15-foot high erosion scarp. The rocks used were approximately 1-2+ feet in diameter (200 to 2,000 pounds), and were placed over a geotextile fabric filter directly on the bank. No backfill material was placed on the shore. Approximately 30 cubic yards of rock was used, obtained from a nearby construction site. The relatively large rocks placed on a steep slope directly over geotextile filter fabric, and without a toe scour apron to prevent undermining and toe instability, began to slump and expose the filter fabric almost immediately. At this time, the rock shore protection has essentially failed and is providing only limited partial protection. However, these rocks are suitable for use in the proposed new engineered rock revetment. During construction of the new revetment the existing rocks will be removed from the shore, stockpiled on the lot, and then used along with additional stone to construct a properly designed revetment.

In December 2003 the Bennett's received building permit number 558739 from the DPP for construction of a 6-foot high CRM fence wall along their landward property line fronting Kamehameha Highway. Following completion of this wall the Bennett's adjacent neighbor on the north side hired the contractor to continue the wall down the property line between the two properties. Because there are existing homes on the adjacent property which are built with minimum setback from the property line, the Bennett's neighbor asked if they could construct the wall partially on the Bennett's side of the property line in order to preserve access between the house and the wall. Because the wall was being built at their neighbor's expense, and desiring to be friendly neighbors, the Bennett's agreed to the wall being partly on their property. However, a recent (August 12, 2005) topographic survey of the Bennett property by Walter P. Thompson, Inc. confirmed that the fence wall for a distance of at least 80 feet back from the shoreline is entirely on the neighbor's side of the property line, and thus does not extend into the Bennett's shoreline setback zone.

The applicant's property is presently undeveloped, and the owners have plans to construct a new single family home on the site. However, without properly designed and constructed shore protection, it is difficult to safely locate a home on the property with confidence that continuing erosion will not soon place it in jeopardy. The adjacent properties on both the north and south have existing shore protection – a CRM seawall protecting the home to the north and a rock revetment protecting the property to the south. Shoreline access steps have been constructed on the side of the CRM wall, and a small portion of these steps extend across the property line and onto the applicant's property.

The existing condition of the shoreline is shown on the photographs on Figures 2.4 and 2.5. The *Certified Shoreline* map is shown on Figure 2.6.

The location and layout of the home proposed to be built on the property is shown on Figure 2.6. A building permit application and construction plans have been submitted to the

Department of Planning and Permitting to initiate the residential home building permit process (Application No. A2004-11-0945). The shore protection project is therefore exempt from Special Management Area (SMA) requirements as an accessory use (Section 25-1.3(2)(A) and (N), ROH).

The owners of TMK 5-5-02:5 propose to remove the existing unpermitted rocks and construct a properly engineered sloping rock revetment to prevent further erosion and stabilize the shore fronting their home site. The revetment would be constructed landward of the September 10, 2003 certified shoreline and inland from the intersection of the mean higher high water line (+1.3-foot MSL) at the existing shoreline. Rock riprap with stones weighing 200 to 2,000 pounds (median weight of 500 pounds) would be placed over an underlayer of 10 to 40 pound stone and geotextile filter fabric. The revetment slope would be 1 vertical on 1.5 horizontal. The toe elevation would be –1 foot below mean sea level (MSL) and the crest elevation would be +15 feet MSL. A 5-foot-wide toe apron would be constructed to protect against scour and possible undermining of the revetment toe. A plan view layout drawing and typical cross section of the proposed shore protection is shown on Figure 2-8. The revetment design is based on a wave height of 2.8 feet at the structure, corresponding to a storm wave with an approximate recurrence interval of 10 years. The unprecedented occurrence of a hurricane near the project site could result in higher water levels and larger waves.

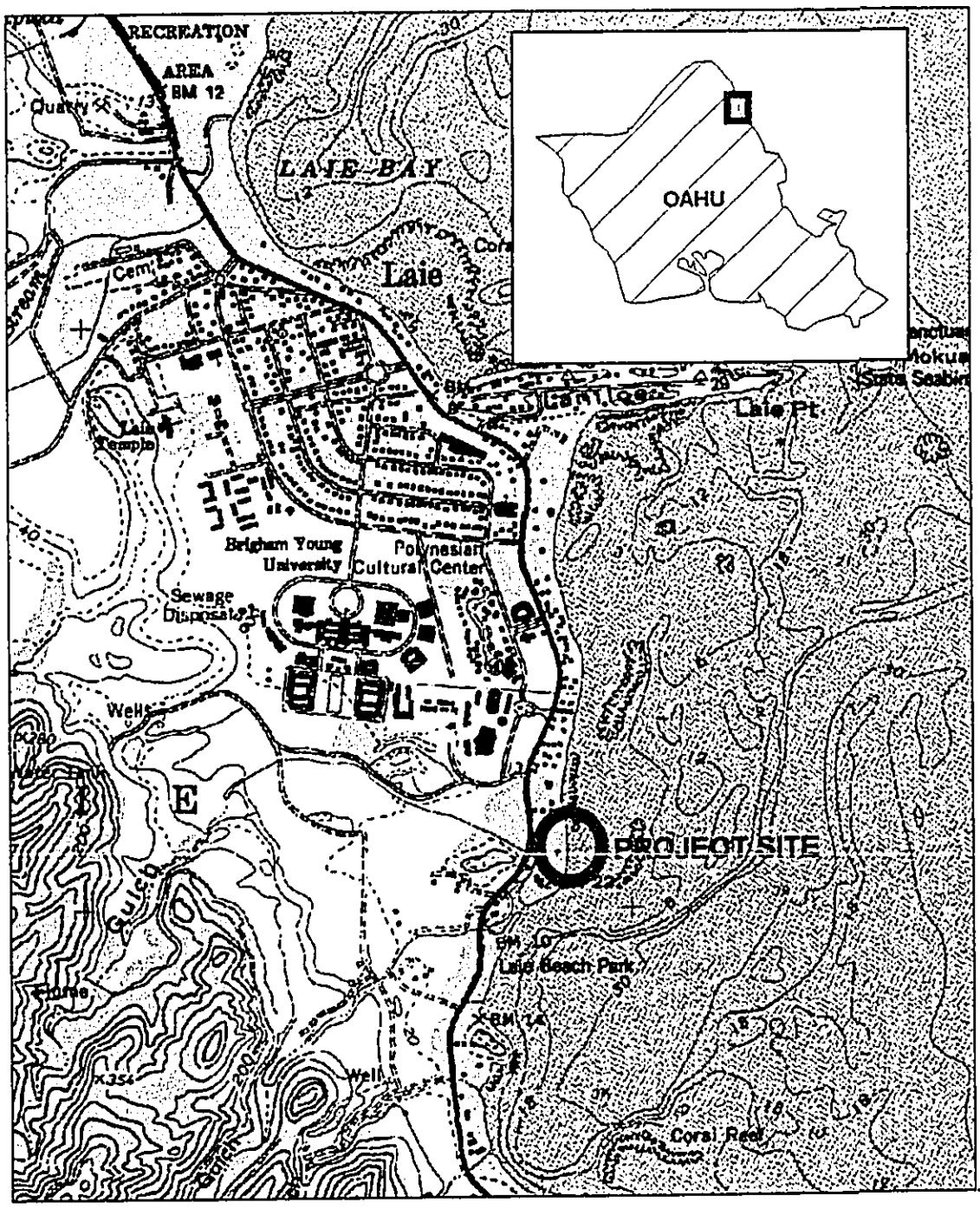


FIGURE 2-1. PROJECT LOCATION

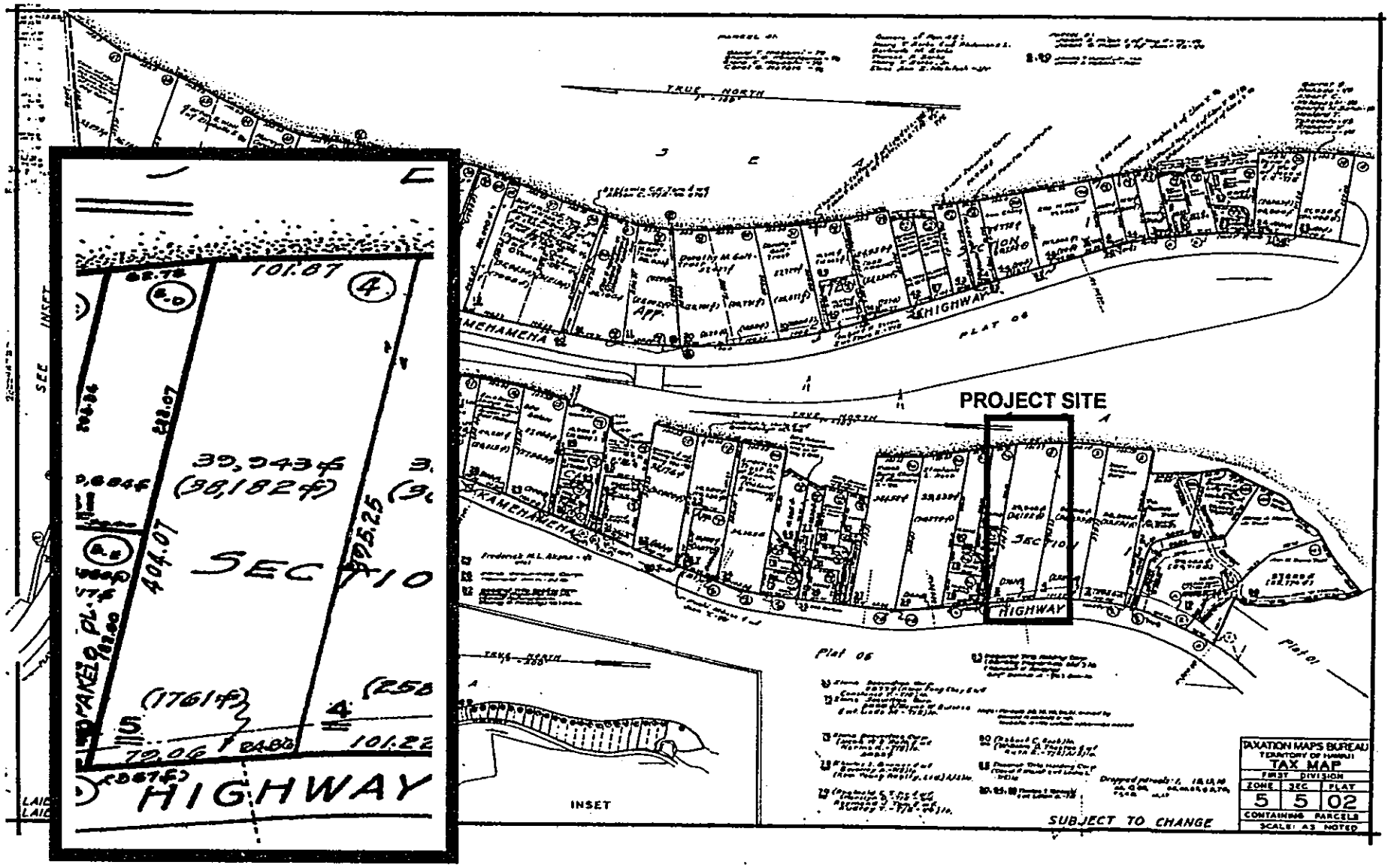


FIGURE 2-2. PROJECT VICINITY TMK MAP

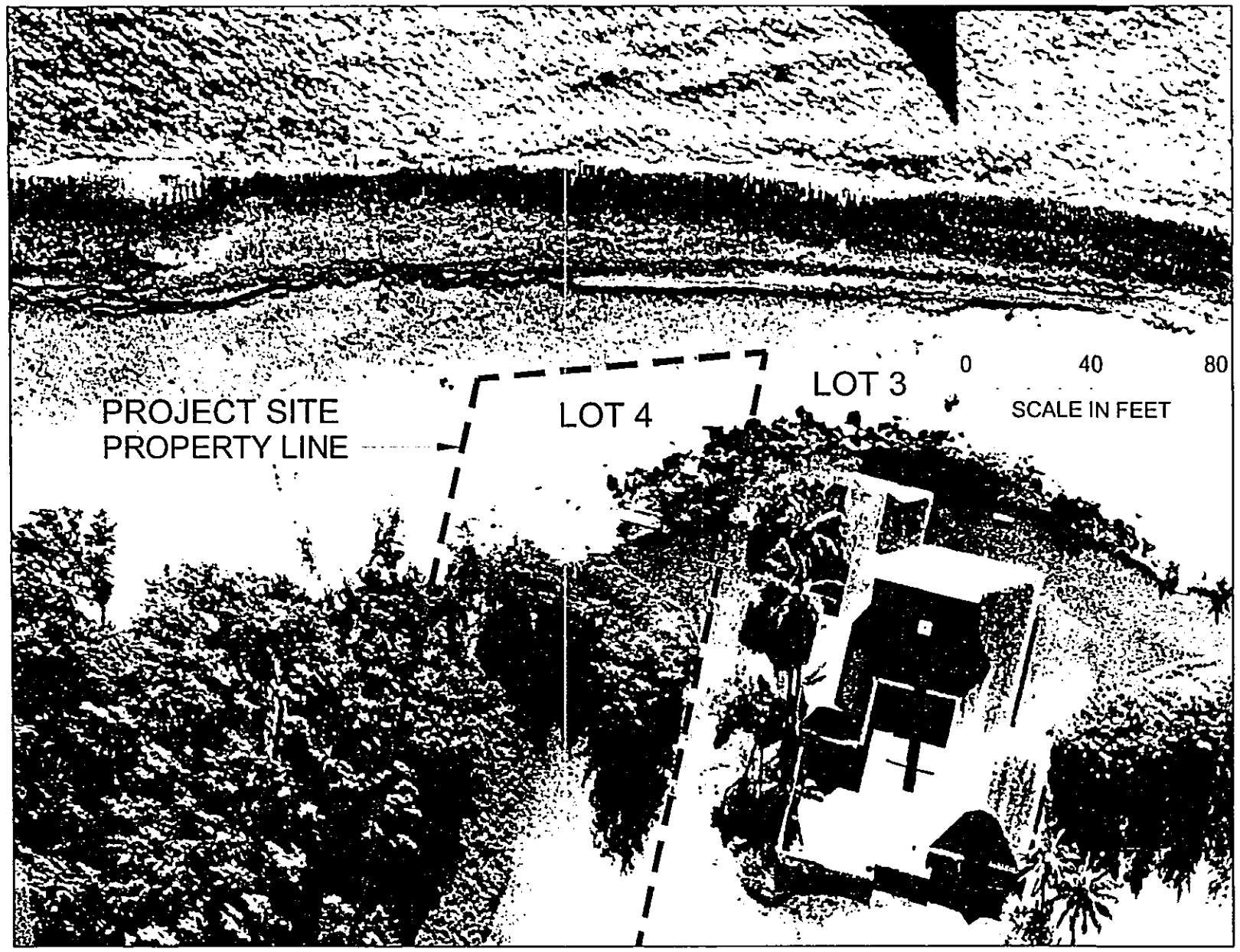


Figure 2-3. 1967 Aerial Photograph Showing Existing Rock Shore Protection Relative to the Property Line of Lot 4, TMK 5-5-02:5

FIGURE 2-4. PROJECT SITE LOOKING NORTH.

FIGURE 2-5. PROJECT SITE LOOKING SOUTH.

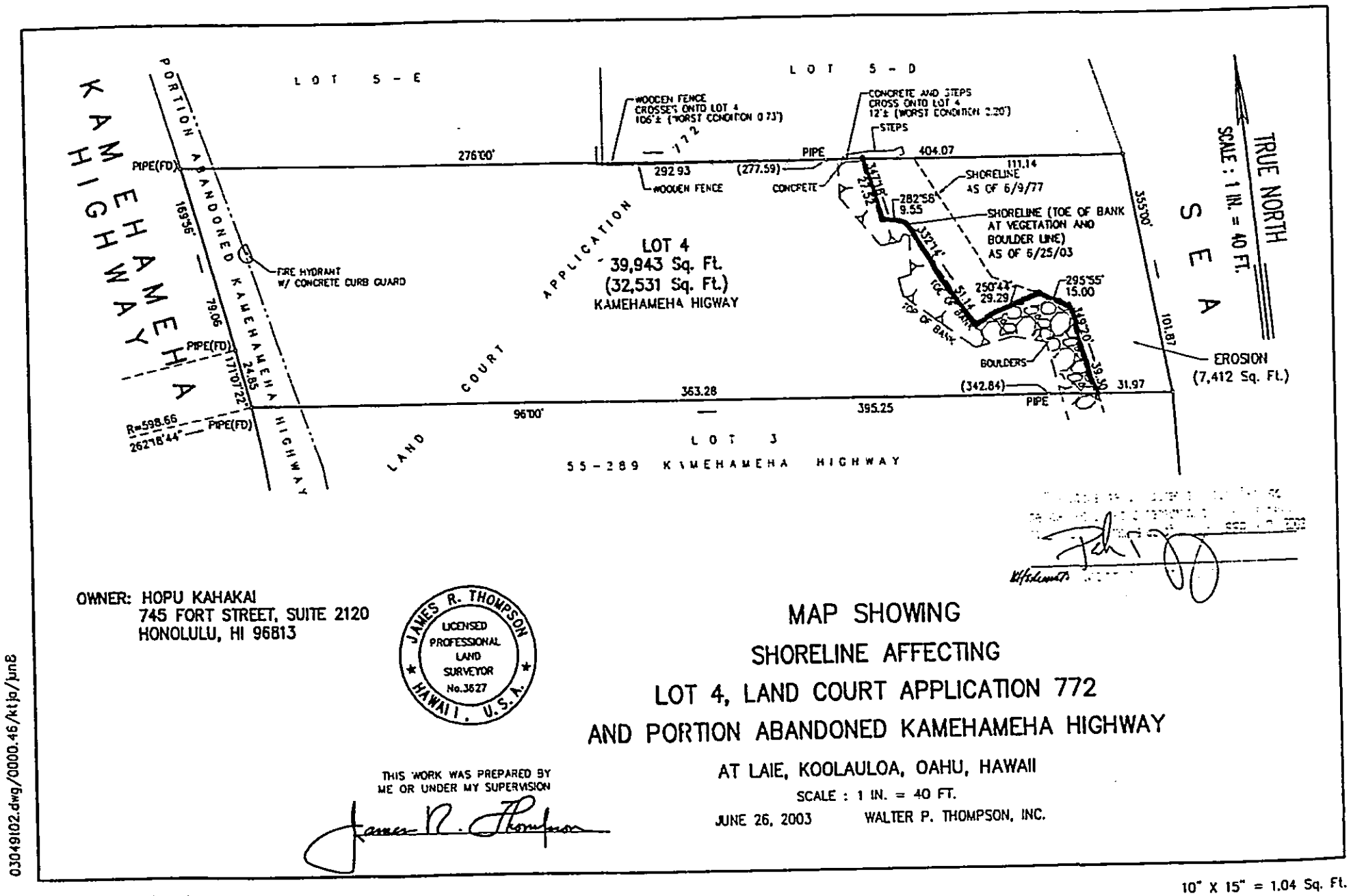


FIGURE 2-6. CERTIFIED SHORELINE MAP DATED SEPTEMBER 10, 2003.

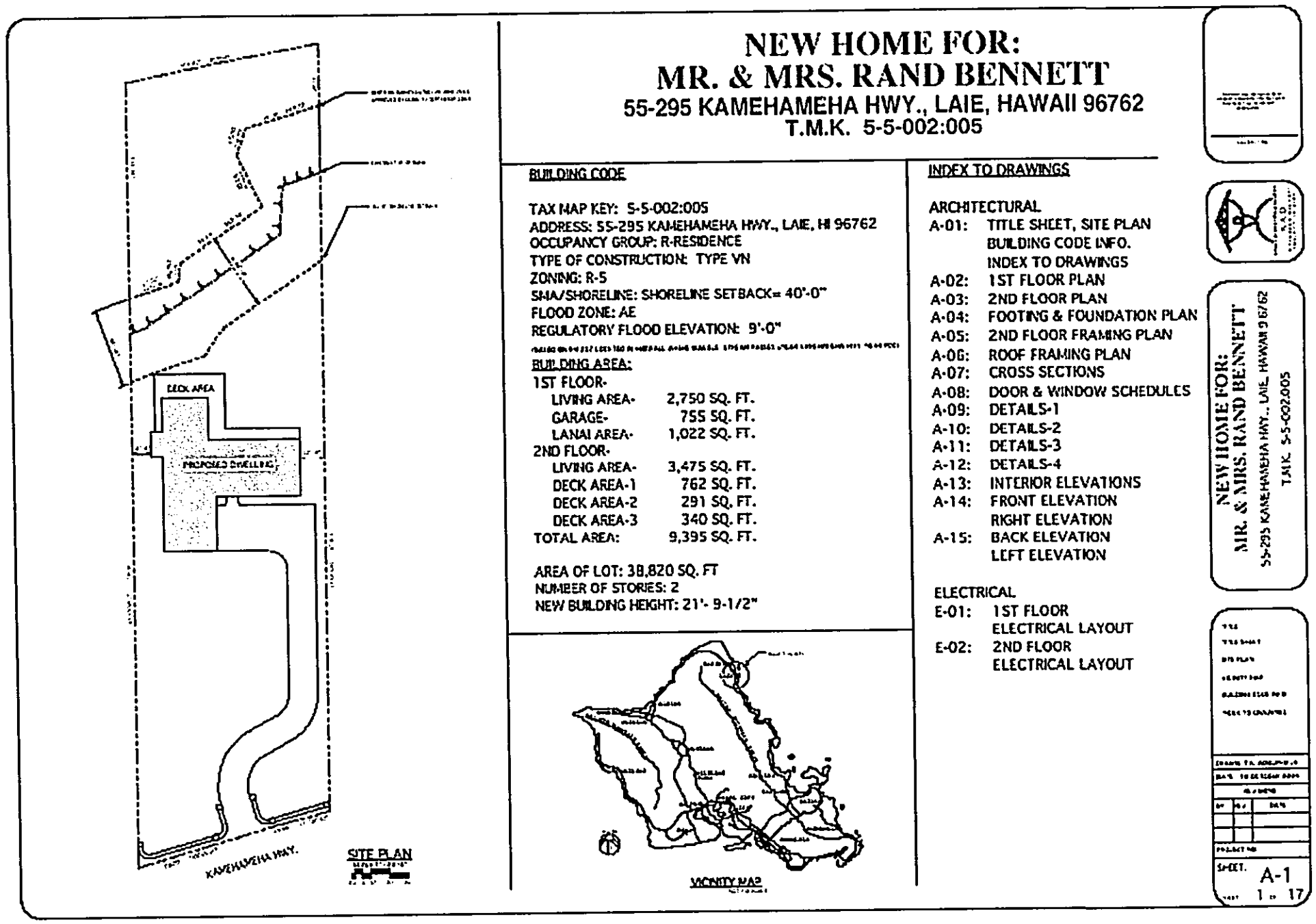
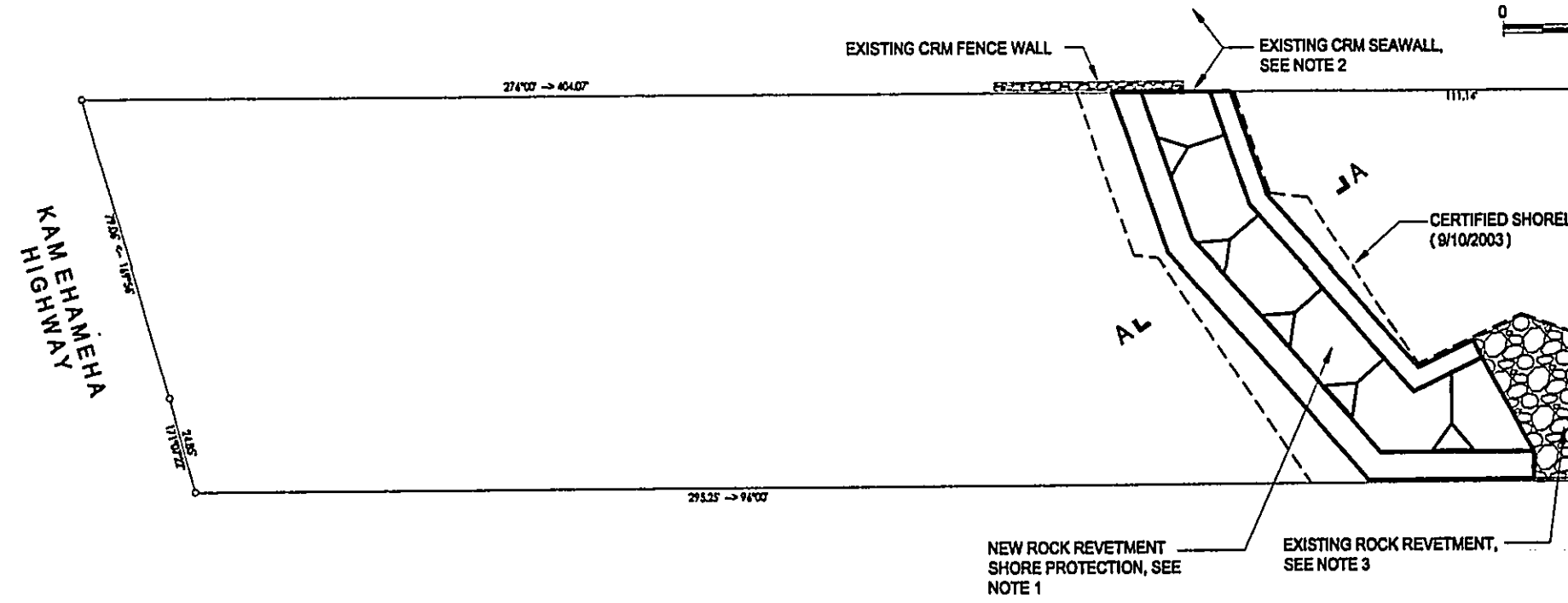
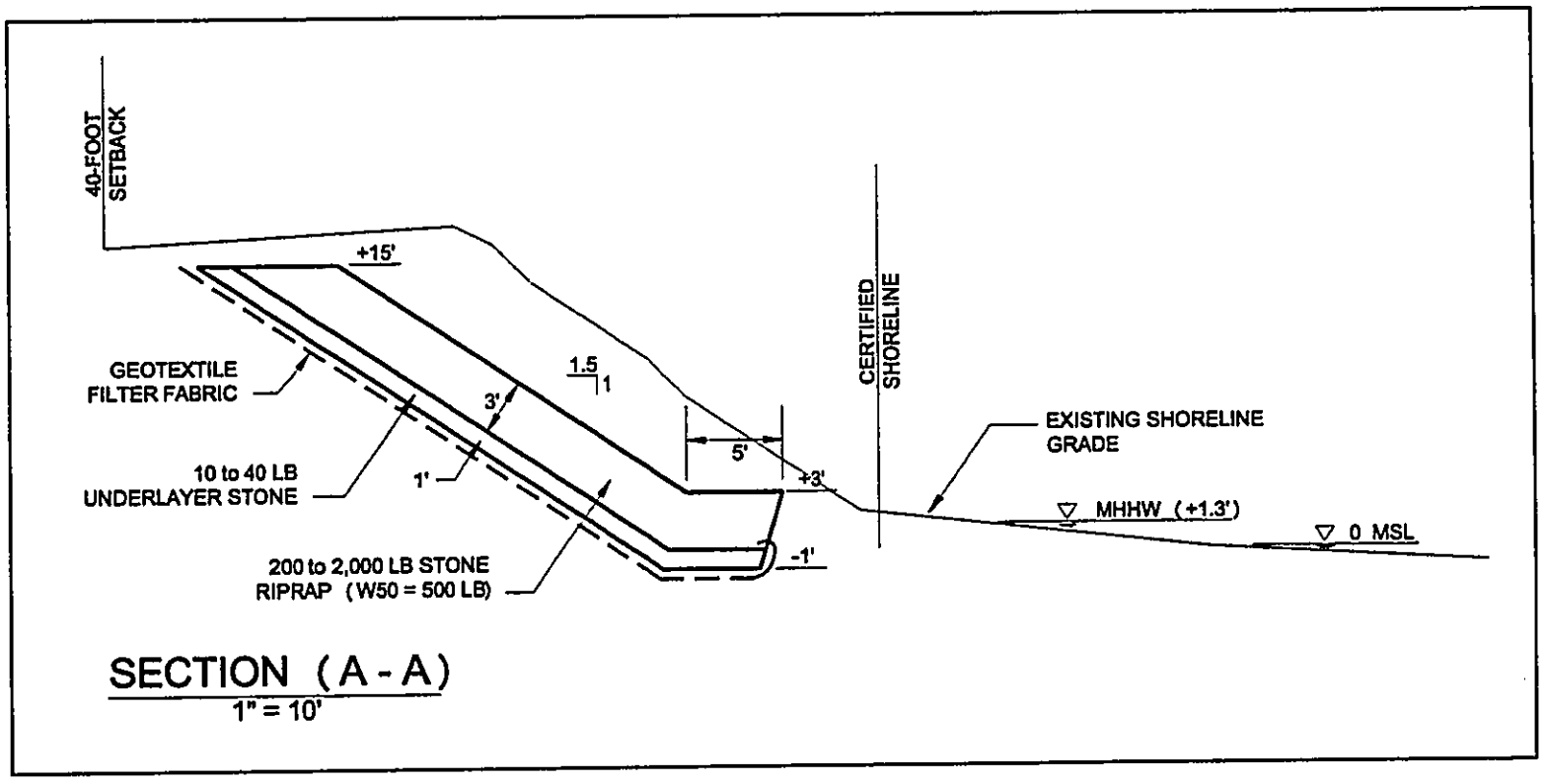


FIGURE 2-7. PROPOSED HOME TO BE CONSTRUCTED



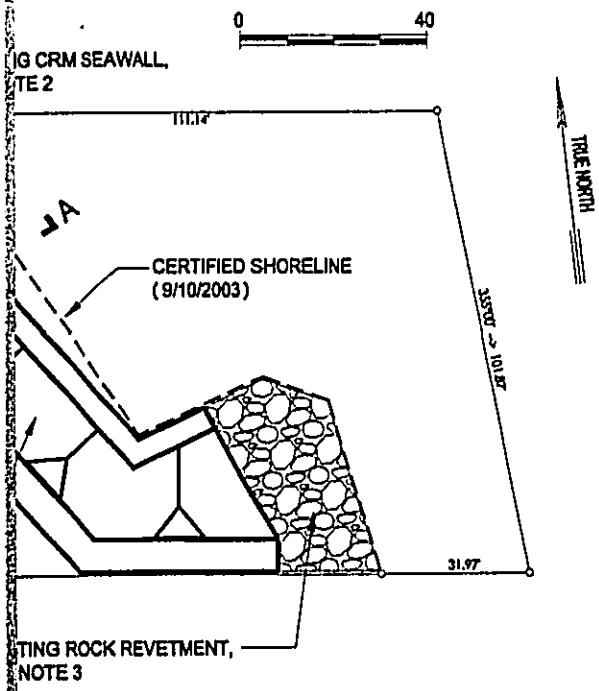


NOTES

1. CONSTRU
   SECTION A
   LANDWAR
2. NEW REVE
   EXISTING
3. REMOVE A
   TRANSITIO

c:\company files\projects\05-08 bennett ea sa\report 2 ea final 2005aug.doc

FIGURE 2-8. SHORE PROTECTION PLAN AND TYPICAL



NOTES

1. CONSTRUCT NEW ROCK REVETMENT AS SHOWN ON PLAN AND SECTION A-A. REVETMENT TO BE CONSTRUCTED ENTIRELY LANDWARD OF THE CERTIFIED SHORELINE.
2. NEW REVETMENT TO FIRMLY ABUT AND BE IN CONTACT WITH EXISTING CRM SEAWALL.
3. REMOVE AND RESET EXISTING STONES AS NECESSARY TO TRANSITION AND TIE INTO NEW REVETMENT.

ROBERT Y. ROCHELEAU
REGISTERED PROFESSIONAL ENGINEER
No. 4792
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Robert Y. Rocheleau

Sea Engineering, Inc.
Makai Research Pier
Waimanalo · Hawaii
(808) 259-7966 · FAX (808) 259-8143

KEYNOTES

SHORE PROTECTION REVETMENT
FOR
TMK 5-05-02:05
RANDALL AND SHELLEY BENNETT
55-295 KAMEHAMEHA HWY.
LAIE, OAHU

Project No.	5-8
Project Engineer	SPS
Drawn by	MLO
Checked by	RYR
Scale	1:40, 1:10
Date	8/12/05

REVISIONS

NO.	DATE	REVISIONS
1	8/16/05	
2	8/17/05	

DRAWING NO.

C-1

N PLAN AND TYPICAL SECTION

3.0 COASTAL ENGINEERING EVALUATION

3.1 Shoreline Type and Characteristics

The project site is near the southern end of Laniloa Beach, an approximate one-mile long stretch of shoreline running north-south between Laie (Laniloa) Point to the north and Kehuku'una Point to the south. The shoreline is primarily sand and exposed beachrock, fronted by a shallow fringing reef. An emergent beach rock bench is located about 150 feet offshore, and parallels the shore for a distance of about 1,200 feet north of the project site. The shoreline landward of this feature is known locally as "bathtub beach." The nearshore reef flat is primarily consolidated limestone rock with pockets of sand and rubble. General shoreline and nearshore physical characteristics are shown on Figure 3-1. The shoreline is heavily eroded, with almost all of the shoreline in the project vicinity protected by rock revetment or seawalls, and a rock groin approximately 1,000 feet north of the project site blocks longshore sand transport.

The applicant's shoreline presently consists of a sloping rock revetment extending from the narrow beach up to the top of bank and lot elevation of about +14 feet above mean sea level (MSL). The majority of these rocks and underlying geotextile filter fabric were placed in November 2003 in the mistaken belief that it could be done as a repair of an old nonconforming but legal revetment. The existing shoreline is shown on the photographs on figures 2.3 and 2.4. A portion of the revetment at the south end of the property is old, and was constructed prior to 1970. Prior to the placement of rocks in 2003 the unprotected shoreline was actively eroding and had a near vertical 10-foot high erosion scarp. The existing topography of the project site is shown on Figure 3.2.

3.2 Existing Shoreline Structures

As previously stated, with the exception of the applicant's property, all of the residential home sites in the "bathtub beach" area are protected by sloping rock revetments or concrete-rubble-masonry seawalls. Most of these shore protection structures were built in the 1960's through 1980's in response to the chronic erosion, and allegedly most if not all were built without permits, although some have subsequently received after-the-fact permits from the City and County. The adjacent properties on both the north and south sides of the applicant have rock revetment shore protection. Two properties approximately 500 feet north of the project site obtained Shoreline Setback Variance approval from the Department of Planning and Permitting in 2003 to construct rock revetment shore protection. A nearby property to the south has submitted a SSV application to construct rock revetment shore protection. The existing structures along the shoreline are identified on Figure 3-3.

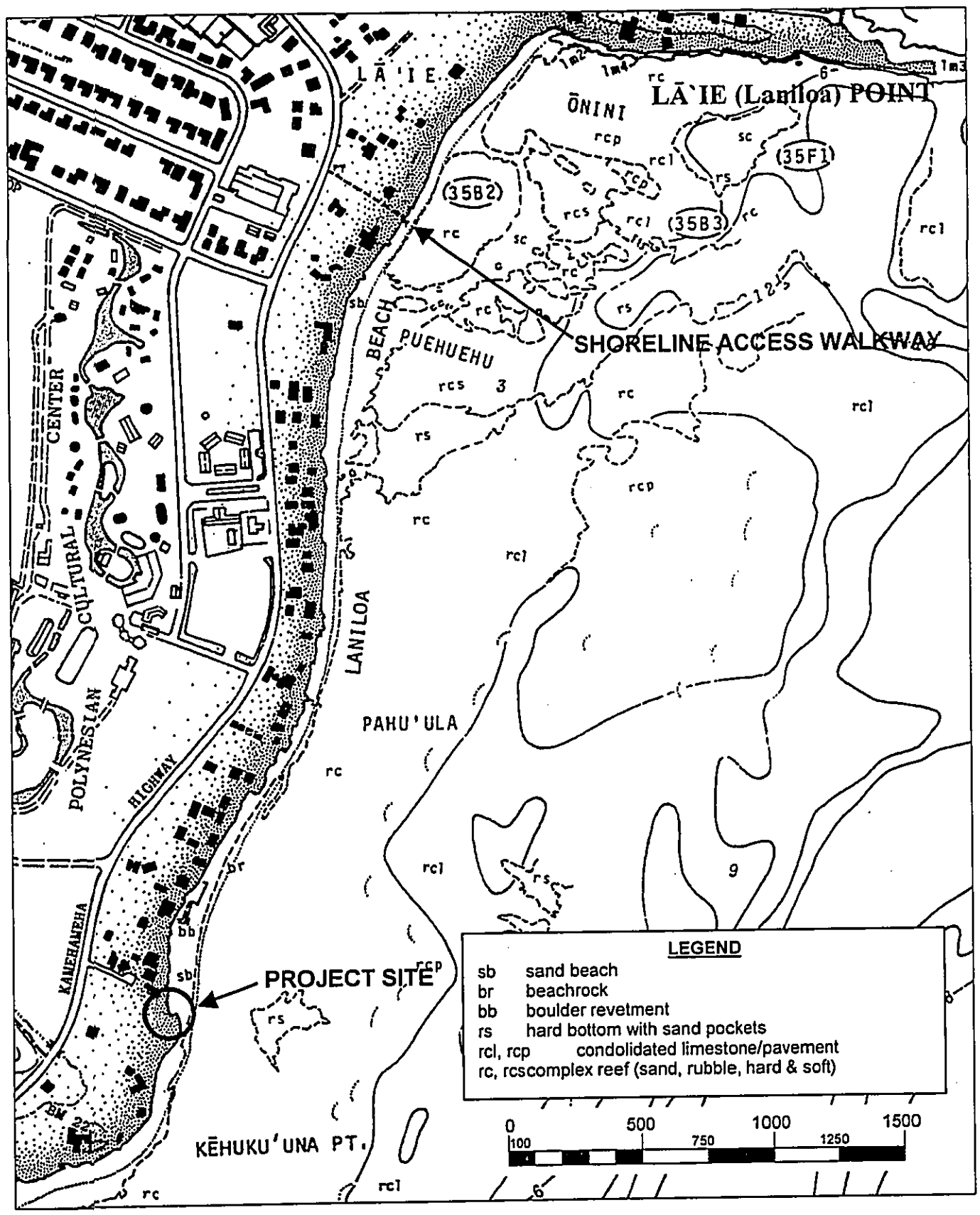


FIGURE 3-1. SHORE AND NEARSHORE CHARACTERISTICS
(from AECOS, 1981)

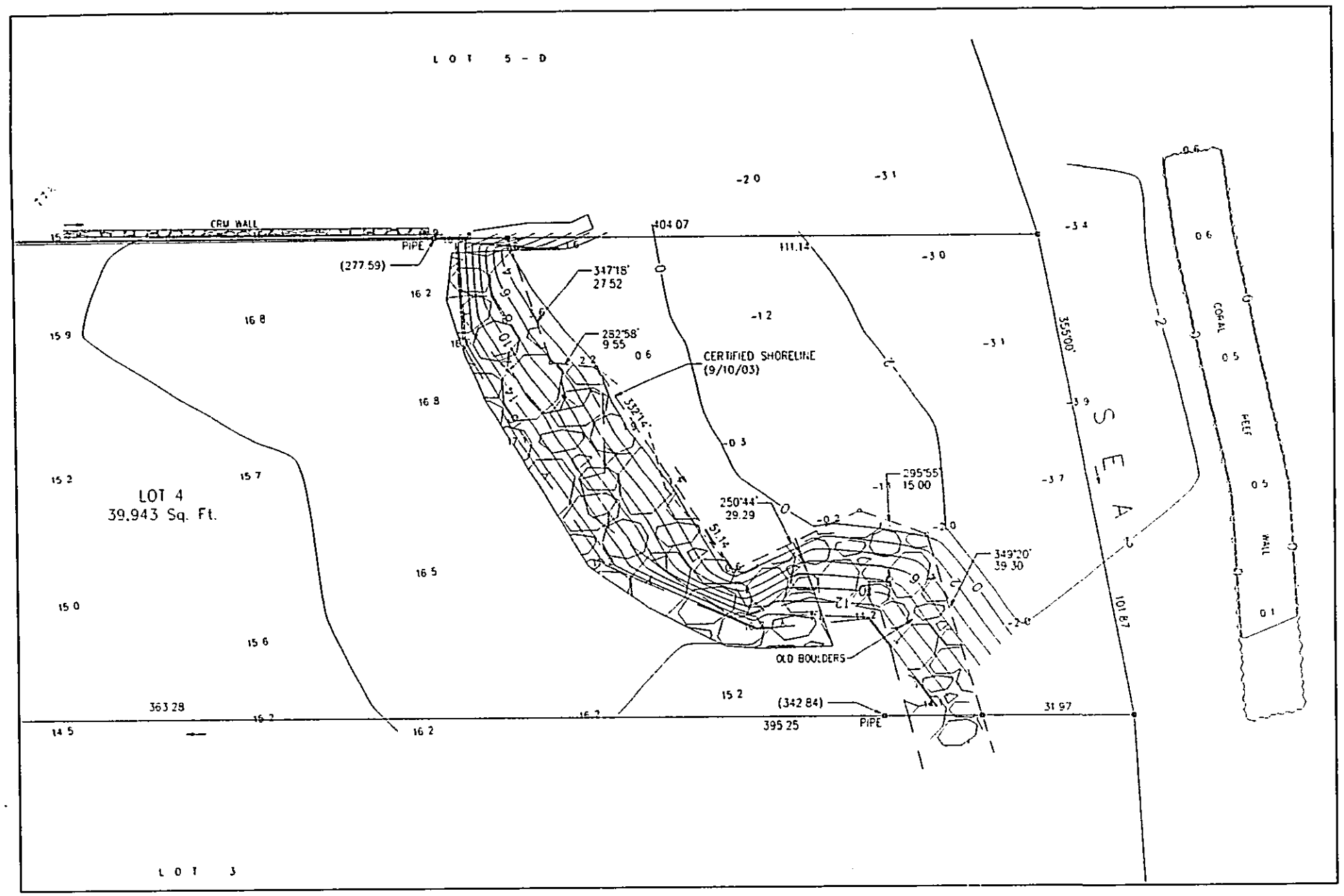


FIGURE 3-2. PROJECT SITE TOPOGRAPHY (by Walter P. Thompson, Inc., 8/12/05)

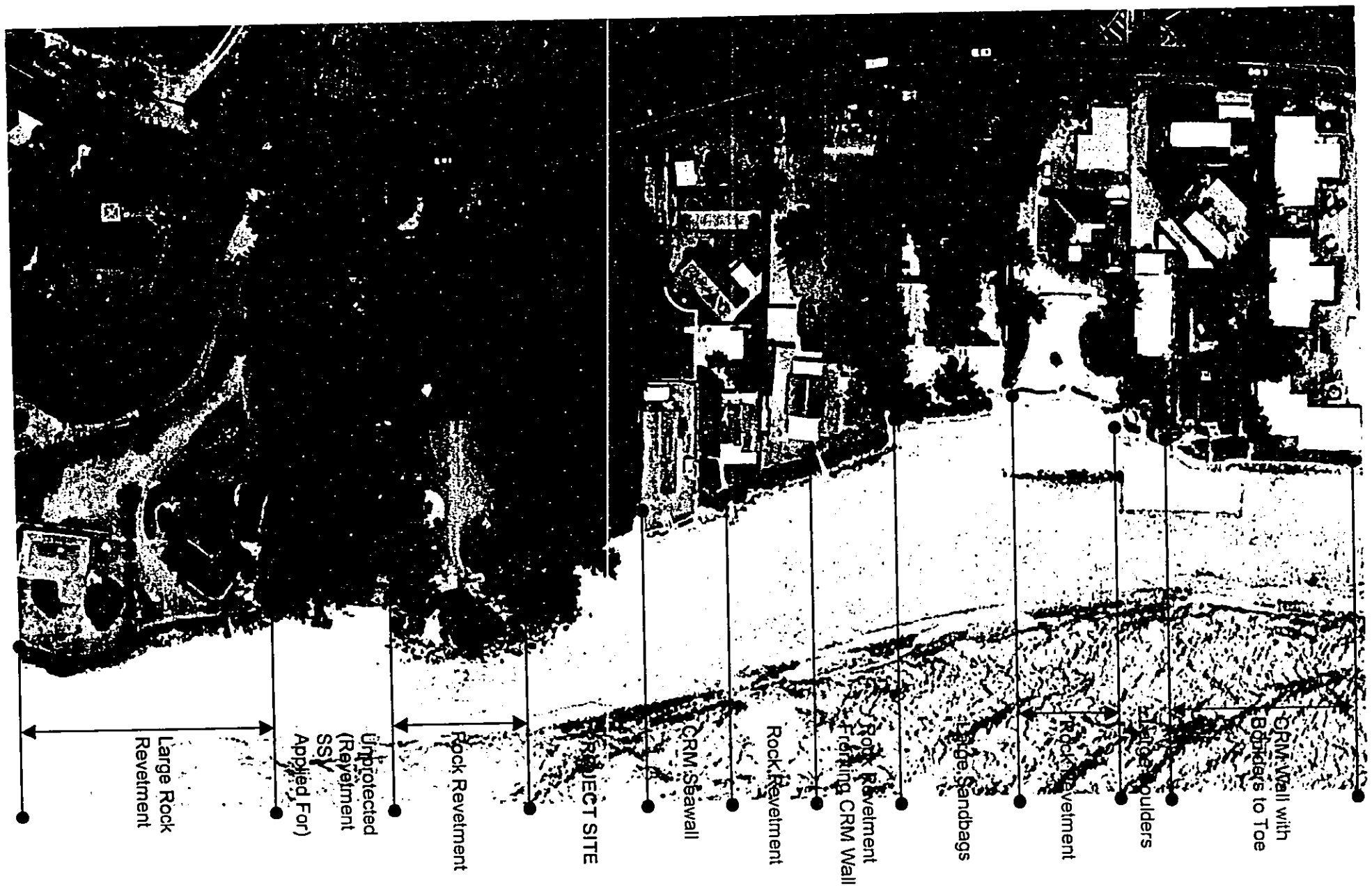


FIGURE 3-3. AERIAL PHOTOGRAPH OF PROJECT VICINITY (MAY 2000) (Approx. Scale: 1" = 100')

3.3 Shoreline History

Hwang (1981) used historical aerial photograph analysis to assess shoreline change around Oahu, based on movement of the vegetation line. During the 25-year period between 1949 and 1975 the middle and south ends of Laniloa Beach experienced "severe erosion." The shoreline in the vicinity of the applicant's property had the worst erosion problem, with continuous erosion throughout the period. The shoreline eroded as much as 65 feet, or about 2.6 feet per year. Hwang noted fallen trees on the aerial photographs, and during a 1980 field check he noted waves breaking against the 15-foot-high shoreline escarpment and large trees on the beach and being undermined. He also noted stone walls and piles of boulders place to protect the homes. Hwang reports that between 1972 and 1975 one house was removed as a result of the erosion, and in 1975 several homes were within 30 feet of the vegetation line.

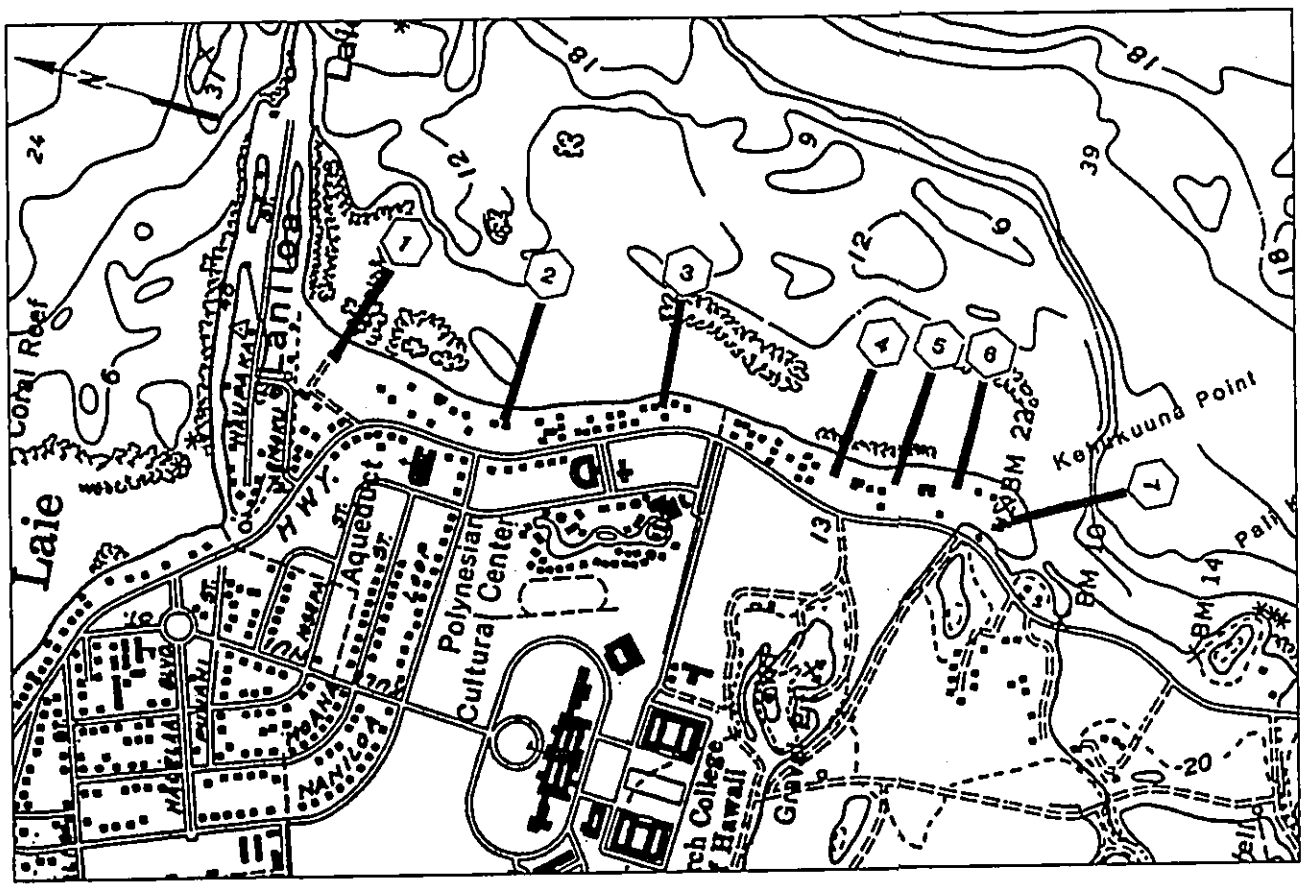
Sea Engineering, Inc. (1988) updated Hwang's work through 1988 for the City and County Department of Land Utilization (now Department of Planning and Permitting). Erosion continued on the unprotected Laniloa Beach shorelines, and erosion was also apparent at the north end of the beach, adjacent to Laie Point, which had previously been relatively stable. A summary of the Hwang and Sea Engineering data is shown on Figure 3-4. The project site is located near Transect Number 6. At the Transect 6 location, adjacent to the project site, boulders were placed on the shore sometime prior to 1964, stopping further erosion at this location. However the applicant's unprotected property has continued to erode.

3.4 Coastal Processes and Sand Transport

The history of shoreline change tells much about the sand transport characteristics along Laniloa Beach. At the north end of the beach, in the lee of Laie Point and thus partially protected from winter season large north swell, sand appears to move predominantly northerly, presumably in response to the prevailing northeast tradewind generated seas. Northerly transport is consistent with the overall accretion at the north end of the beach over the past fifty years.

A storm drain outlet structure is located a little south of the middle of the beach, which extends through the beach and about fifty feet into the water, thus acting like a groin. The beach is roughly similar on both sides of the drain, thus no predominant direction of sand transport is evident by an accreted up drift side or eroded downdrift side of the groin-like structure. The shoreline change analysis shows relative stability in this vicinity, with small movement of the vegetation line but no net change over 50 years. There are also fewer shore protection structures located along this stretch of the beach.

The southern end of the beach, the "bathtub beach" area, shows a strong and dominant southerly sand transport. This is presumably due to the effect of the shallow emergent limestone bench which parallels the shore about 100 to 150 feet seaward of the waterline with a top elevation about 0 to +1-foot msl). Waves approaching the shore break on the shallow bench, and water



LEGEND

TRANSECT LOCATION

Laniloa Beach. Changes in the Vegetation Line (in feet)

Observation Period	Transect Number						
	1	2	3	4	5	6	7
Sep 28, 1949 – Jul 23, 1959	-8	8	2	-35	-44	-22	-4
Jul 23, 1959 – May 12, 1964	11	1	-9	4	-6	-5[1]	*
May 12, 1964 – Apr 23, 1967	-8	1	-1	2	-2	*	-28[2]
Apr 23, 1967 – May 26, 1972	3	-3	11	-2	-14	*	8
May 26, 1972 – Apr 13, 1975	1	8	-6	-3	-4	*	-6
Apr 13, 1975 – Feb 03, 1988	-11	-15	4	-32	5	*	-4
Net Change – Vegetation Line	-12	0	1	-66	-65	-27	-34
Range – Vegetation Line	15	15	11	66	70	27	34

* *No Data*

1 To Boulder Wall

2 Change from 1959 – 1967

Net change is the total change in the position of a beach index line between the earliest and most recent observation year.

Range is the difference between the observed extremes in the position of a beach index line.

Transect locations and historical data from Hwang, Table 17.

Transect 8 was outside the study area.

FIGURE 3-4. SHORELINE CHANGE 1949 – 1988
(from Sea Engineering, Inc., 1989)

ponds between the bench and the shore causing a slight water level increase or setup at the shore. This setup is relieved by a current flow along the shore to the south and out the southern end of the bench in the vicinity of the deeper water near the Koloa Stream mouth at Kehuku'una Point. A rock groin constructed at the north end of the bench restricts water flow northward, further forcing the southern flow of water. The effect of the bench can be seen in the photograph on Figure 3-3.

The erosion along Laniloa Beach has almost certainly been exacerbated by the proliferation of shoreline hardening structures. It is typical for structures on a sandy shoreline to have an adverse impact on adjacent unprotected shores. Reflection and turbulence at the ends of the structures, plus their impact on the natural sand transport processes, typically result in an increase in erosion for some distance from the ends of the structures. For these reasons, shore protection structures on sandy shores should be carefully designed, and should not be constructed randomly or piecemeal along the shore. Ideally, all the property owners along a shoreline requiring shore protection should work together to effect a common solution. If they don't, the first person to build a wall may simply start a chain reaction, as one property owner after another is forced to build something to stop the erosion aggravated by his neighbor's structure, and the problem gets transferred down the shore from one property to the next. This is certainly evident in the recent history of Laniloa Beach.

3.5 Coastal Hazards

In addition to the chronic erosion hazard, the project site is exposed to storm waves and possible tsunami inundation. The coast is directly exposed to the prevailing tradewind generated seas, as well as partially to directly exposed to large winter season north swell generated by north Pacific storms. The coast could also be subject to possible hurricane generated waves and high water levels.

North swell can occur any time during the year, but is largest and most frequent during the winter months of October through March. North swell can approach from the northwest through northeast, but typically the most frequent large swell is from the northwest. These waves refract and diffract around Kahuku Point and approach the project site obliquely. North swell does occasionally approach the site more directly from the north to northeast. The shoreline is protected from direct large wave attack by the wide, shallow fringing reef fronting the shoreline. Large waves break offshore, and then reform and continue shoreward as smaller waves. Wave breaking and reforming may occur several times before the wave finally expends its remaining energy on the shore. The waves reaching the shore are limited by the nearshore water depth, and on a wide and shallow reef typically have a height equal to about 0.6 times the water depth. Winter high tides can be +1.5 to +2 feet above msl, and wave setup along the shore during periods of high surf may add another 0.5 feet to the water level. Assuming a high tide of +1.5 feet, a 0.5-foot wave setup, and a water depth of –3 feet below msl immediately seaward of the offshore emergent limestone bench, wave heights of about three feet can be expected to break on

the offshore bench. Wave heights on the beach at the base of the shoreline escarpment would be less than three feet. This corresponds to storm waves with an approximate recurrence interval of 10 years. Thus, although the occurrence of large north swell is a significant factor in the erosion problem, they do not directly pose a hazard to homes located on the high escarpment.

Although they occur with relative infrequency, hurricane storm wind and waves pose a potential threat to Hawaii. The report *Windward Oahu Hurricane Vulnerability Study, Determination of Coastal Inundation Limits* (Sea Engineering, Inc., 1990) estimates the possible water level rise and wave runup along the shore for various scenario hurricane events. Typical and worst case wave runup elevations along the shore in the vicinity of the project site were determined to be 7.2 feet and 8.7 feet above msl, respectively. Thus the applicant's property, located about 15 feet above msl, is well above the direct hurricane storm wave impact zone. The effect of hurricane storm waves on erosion of an unprotected shore, however, could well pose a hazard to a home located on the property.

The Federal Emergency Management Agency (FEMA), Flood Insurance Rate Maps (FIRM), label the shoreline in the general project area as an AE Zone – Special Flood Hazard Area Inundated By a 100-Year Flood, with a base flood elevation of +9 feet. Thus, again, the applicant's property is above the flood hazard zone.

4.0 ENVIRONMENTAL SETTING

4.1 General Description

The project area is a well-developed residential neighborhood, with single-family homes along the shore. Land use designation by the State is Urban, and City and County of Honolulu zoning is R-5 Residential. Many of the lots are owned in fee simple, while others are owned by Zion Security Corporation and leased to the homeowners. All the shoreline lots in the project vicinity, with the exception of the applicant, have revetments or seawalls to provide shoreline erosion protection.

The only public access to Laniloa Beach is located at the north end, at 55-479 Kamehameha Highway. Two sand pockets on the reef near the access (Onini and Puehuehu) provide the only good swimming spots along the entire beach (Clark, 1977). The closest public park is located at Pounders Beach, south of Kehuku'una Point and approximately 1,500 feet south of the project site.

The shoreline in the project vicinity is sandy, with considerable beachrock and raised limestone reef rock. Backshore elevations range between about 12 to 16 feet above msl. The applicant's shoreline is a high, steep sand and earth escarpment, with an elevation of about 16 feet above msl. The shoreline has a long history of serious and chronic erosion and recession. Almost all of the shoreline in the project vicinity is presently hardened against erosion. The shoreline is fronted by a fringing reef, composed primarily of consolidated limestone reef pavement with some sand and rubble. Large storm waves break offshore in deeper water, and proceed

shoreward as smaller reformed waves. Wave action breaking over a raised limestone bench which parallels the shore about 100 to 150 feet offshore of the project site results in a south flowing current along the shore which contributes significantly to the erosion problem.

4.2 Oceanographic Conditions

Wind - The prevailing winds are the northeast tradewinds, which blow onshore in the project area. The tradewinds are typically present 80 percent of the time during the summer season from April to November, with wind speeds of 10 to 20 mph. During the winter months there is a general weakening of the tradewind system and the occurrence of southerly and westerly winds (kona winds) due to frontal systems passing through the islands and local low-pressure systems.

Waves - The general Hawaiian wave climate can be described by four primary wave types: 1) northeast tradewind seas, 2) North Pacific swell, 3) South Pacific Swell, and 4) westerly (kona) storm waves. The project site is completely sheltered from south swell and kona storm waves by the island of Oahu. The site is directly exposed to tradewind seas approaching from the northeast. These waves result from the strong and steady tradewinds blowing from the northeast quadrant over long fetches of open ocean. Typical deepwater tradewind waves have periods of 5 to 10 seconds and heights of 3 to 10 feet.

North Pacific swell is produced by severe winter storms in the Aleutian area of the North Pacific and by mid-latitude low-pressure systems. North swell may arrive in Hawaiian waters throughout the year, but is largest and most frequent during the winter months of October through March. North swell approached from the west through north, and occasionally from east of north, with periods of 12 to 20 seconds and typical deepwater heights of 5 to 10 feet, and heights of 20 feet plus are common. The project site is partially sheltered from the approach of north swell by the northern tip of the island, with only the more northerly waves arriving at the windward shoreline without extensive height reduction due to refraction and diffraction.

Approaching deepwater waves break offshore in deeper water, then reform and proceed shoreward as smaller waves until finally reaching the shore. Nearshore wave heights on the fringing reef are 3 feet or less during typically prevailing annual wave conditions.

Tide – The tides in Hawaii are semi-diurnal with pronounced diurnal inequalities; i.e. two tidal cycles per day with unequal water level ranges. The mean tidal range is 1.3 feet and the diurnal range is 2.2 feet at Laie Bay, immediately north of the project site. General tide data for the site is as follows, based on a mean sea level (msl) datum:

mean higher high water	1.3 feet
mean high water	0.7 feet
mean sea level	0.0 feet
mean low water	-0.6 feet
mean lower low water	-0.9 feet

Hurricanes – Tropical cyclones originate over the warm ocean, and when the wind speed exceeds 64 knots they are considered hurricane strength. Hurricanes form near the equator, and in the

central North Pacific usually move toward the west or northwest. During the primary hurricane season of July through September, hurricanes generally form off the west coast of Mexico and move westward across the Central Pacific. These storms typically pass south of the Hawaiian Islands, and sometimes have a northward curvature near the islands. Late season hurricanes follow a somewhat different track, forming south of Hawaii and moving north toward the islands. Two hurricanes have actually passed through the Hawaiian islands in the past 20 years, hurricane Iwa in 1982 and Iniki in 1992, both passing near or over the island of Kauai. These storms caused high surf and wave damage on the south and west shores of all the islands. No significant wave action was experienced on the northeast facing shore in the project area from either of these storms. Possible wave runup elevations on the shoreline resulting from direct hurricane storm attack on the project site has been estimated by Sea Engineering, Inc. (1990) to be 7.2 feet and 8.7 feet for a typical and worst case hurricane event, respectively. The applicant's property is thus above the estimated hurricane runup elevation.

Tsunamis – The Hawaiian Islands have a history of destructive tsunami occurrences. Four significant tsunamis have occurred in recent history – 1946, 1957, 1960 and 1964. The 1946 tsunami was generated in the Aleutian islands, and was one of the most destructive tsunamis to strike Hawaii. The water level rise at the shoreline in the project area was 9 to 14 feet (Loomis, 1976). Based on methodology used to develop the Flood Insurance Rate Maps (FIRM) for the state, the predicted 10 and 100-year tsunami elevations are +3 and +8.5 feet msl, respectively (M&E Pacific, Inc., 1978). The applicant's lot is thus above the estimated tsunami runup elevation.

4.3 Marina Flora and Fauna

The following discussion of marine flora and fauna in the vicinity of Laniloa Beach is taken from the *Hawaii Coral Reef Inventory, Island of Oahu* (AECOS, 1979). "Coral cover is sparse (not exceeding 3%) on the shallow reef flat and reef slope off Laniloa Beach. *Porites lobata* is the predominant coral. Algal cover, on the other hand, is high in these areas, reaching 90% of the bottom in some places. Directly south of Laie Point, *Porolithon* sp. and *Asparagopsis taxiforma* are abundant. Coral cover reaches 20% near the breaker zone. *Montipora flabellata* is the dominant species, followed in abundance by *Porites lobata*. *Abudefduf abdominalis* (sergeant major or "mamo") is common on the reef flat. In deeper water (-5 to –15 feet) of the reef front at least 27 species of fish are recorded. However, none can be considered common in occurrence."

4.4 Water Quality

Nearshore waters are designated "Class A" open coastal waters (HAR 11-54-6). Nonpoint source runoff and stream discharges are significant, and coastal waters are generally discolored by red sediment after heavy rains (AECOS, 1979).

4.5 Coastal Use

The only public access to Laniloa Beach is a pedestrian right-of-way located at the north end of the beach, approximately 3,500 feet from the project site. A sand channel and two sandy-bottomed pockets in the reef in the vicinity of the public access form the only good swimming

spots along the entire beach (Clark, 1977). Laie Point and the reef flat off Laniloa Beach are moderately fished by sport and subsistence fishermen (AECOS, 1979). Generally, pole and throw-net fishing for reef fishes is commonest along Laie Point. Spearfishing, pole fishing, and net laying occur primarily on the reef flat off the beach. There is some board surfing in the vicinity of Laie Point when the waves are high. "Pounders" public beach park, a popular body surfing beach, is located south of Kehuku'una Point, approximately 2,000 feet from the project site.

5.0 ALTERNATIVES CONSIDERED

Alternatives to the proposed revetment construction include no action, sandbags, beach restoration and nourishment, and construction of a vertical seawall.

5.1 No Action

The project site has a 50-year history of severe, chronic erosion. The shoreline in the project vicinity receded as much as 65 feet during the 40-year period between 1949 and 1988. All the other homes in the project vicinity have either seawalls or sloping rock revetment shore protection. If shore protection is not provided for the applicant's property it will be difficult to safely locate the home proposed to be constructed on the site. In addition, if the applicant's property is unprotected and continues to erode it will result in flank erosion and damage to the adjacent neighbors revetment to the south, and possible undermining of the flank of the neighbors CRM seawall to the north. Thus no action is not a viable option for this site.

5.2 Sandbags

State DLNR has granted permission for nearby property owners to place large sandbags (Seabags) on the beach fronting their property as temporary erosion protection. The bags provide some short-term erosion protection, but they are typically undermined and displaced by wave action. In addition, the bags require constant maintenance. Any cut or damage to a bag results in the rapid displacement of sand from the bag rendering it useless. Vandalism is a particular problem, and has resulted in the loss of numerous bags. Therefore, the use of sandbags is not considered a satisfactory permanent solution to the erosion problem.

5.3 Beach Nourishment

Constructing and nourishing a protective beach by placing suitable sand in an appropriately designed manner along a shoreline can be an effective and attractive means of mitigating beach loss and protecting against shoreline recession. Unfortunately, the erosion potential of the project site as demonstrated by the long history of shoreline recession makes maintaining a protective beach at this site virtually impossible. In 1998, the State Department of Land and Natural Resources approved placement of 200 cubic yards of sand on the beach fronting property 500 feet to the north. This sand was rapidly eroded and quickly disappeared. It would take significant stabilization structures, such as groins extending perpendicular from the shore into the water or an offshore breakwater parallel to the shore, to retain sand at the site, and even then

there would likely be a need for extensive maintenance and regular renourishment. In addition, beach stabilization structures would have to be built seaward of the certified shoreline, on State Conservation District submerged land. Beach restoration is also not very compatible with the existing seawall and revetment shore protection on both sides of the applicant's property. Beach restoration and nourishment is therefore not considered a viable long-term erosion control measure for this site.

5.4 Seawall

A seawall is a vertical or sloping concrete or concrete-rock-masonry wall used to protect the land from wave damage and erosion. A seawall, if properly designed and constructed, is a proven, long lasting, and relatively low maintenance shore protection method. Seawalls also have the advantage of requiring limited horizontal space along the shore. However the impervious and vertical face of a seawall results in very little wave energy dissipation. Wave energy is deflected both upward and downward, and also a large amount of wave energy is reflected seaward. The downward component can cause scour at the base of the wall, and thus the foundation of a seawall is critical for its stability, particularly on a sandy and eroding shoreline. Ideally a seawall should be constructed on solid, non-erodable substrate. Seawalls are not flexible structures, and their structural stability is dependent on the stability of their foundations. Reflected wave energy can inhibit beach formation in front of the wall, and thus seawalls are not the best alternative if maintaining a beach seaward of the structure is desired.

5.5 Revetment

A revetment is a sloping uncemented structure built of wave resistant material. The most common method of revetment construction is to place an armor layer of stone, sized according to the design wave height, over an underlayer and filter designed to distribute the weight of the armor layer and to prevent loss of fine shoreline material through voids in the revetment. Toe scour protection can be provided by excavating to place the toe on solid substrate where possible, constructing the foundation as much as practicable below the maximum depth of anticipated scour, or extending the toe to provide a scour apron of excess stone. Properly designed and constructed rock revetments are durable, flexible, and highly resistant to wave damage. Should toe scour occur, the structure can settle and readjust without major failure. Damage from large waves is typically not catastrophic, and the revetment can still function effectively even if damage occurs. The rough and porous surface and flatter slope absorb and dissipate more wave energy than smooth vertical walls, thus reducing wave refection, runup and overtopping. Thus there is a greater likelihood of sand accumulation seaward of the structure. The sloping revetment does occupy more horizontal space and has a larger footprint that a seawall would. Because of its durability, particularly considering the potential instability of the erodable sand shoreline on which it would be constructed, and the greater likelihood of sand retention on the shore fronting the structure, a rock revetment is considered the best erosion control/shore protection measure for the site.

6.0 PROJECT IMPACTS

Impacts are addressed in terms of the following significance criteria as presented in *A Guidebook for the Hawaii State Environmental Review Process*, prepared by the State Office of Environmental Quality Control, 1997.

(1) *"Irrevocable commitment to loss or destruction of any natural or cultural resource."* The project site is a severely eroded sandy shoreline. There is no significant flora or fauna which would be lost due to construction of the revetment, and no threatened or endangered species would be impacted by the project. The revetment will occupy approximately 2,500 square feet of shoreline area, replacing the eroding bank with a stable sloping rock revetment. The overall appearance of the site will be improved. No known cultural resources are located on the property.

(2) *"Curtails the range of beneficial uses of the environment."* There will be no impact on public access to the shoreline – the closest public access is 3,500 feet to the north. There will be no significant change in lateral access along the shore, which is already hampered by the almost completely armored Laniloa beach shoreline. There will be no impact to fishing on the reef flat seaward of the project site.

(3) *"Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS."* The project will be constructed landward of the certified shoreline as of September 10, 2003, and thus the project will be constructed entirely out of the State Conservation District along the shore. The project will also be constructed landward of the mean higher high tide line along the shore, and thus will be separated from the nearshore water by the existing sandy shoreline. The natural barrier provided by the beach will be maintained throughout the construction, and will prevent environmental impact to nearshore State waters.

(4) *"Substantially affects the economic or social welfare of the community or state."* The project would have no adverse social or economic impact to the state. The revetment would have some positive economic impact to the applicant and their neighbors by preventing further erosion and loss of land, as well as providing flanking erosion protection for the existing shore protection on adjacent properties.

(5) *"Substantially affects public health."* The project has no public health impacts.

(6) *"Involves substantial secondary impacts."* The project will have no impact on public services or facilities.

(7) *"Involves a substantial degradation of environmental quality."* The project will have no significant adverse environmental impacts nor will it degrade environmental quality. It will not degrade water quality, nor impact marine flora and fauna. It will be constructed entirely behind the shoreline. The project will permit landscaping of the shore above the revetment, improving the visual and aesthetic nature of the shore. The proposed rock

revetment is visually consistent with the existing protected shore on both sides of the project site.

(8) *"Has cumulative impacts."* The revetment would be a stand-alone project, with no cumulative impacts or commitment for larger actions.

(9) *"Substantially affects a rare, threatened, or endangered species or its habitat."* No plant or animal species listed as endangered, threatened, proposed or candidate species by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended, or by the State of Hawaii under it's endangered species program, were detected during site surveys and none is known or anticipated to utilize the property.

(10) *"Detrimentally affects air or water quality or ambient noise levels."* The revetment will be located behind the mean higher high tide shoreline, and the existing sand beach will be maintained during construction to act as a natural turbidity barrier. No material will be placed in the nearshore water. No debris, petroleum products, or other construction-related substances or materials will be allowed to flow, fall, leach or otherwise enter the coastal waters. All construction material will be free of contaminants or pollutants. Stone would come from existing operating quarries or field stone borrow sites. Best Management Practices will be adhered to during construction to minimize environmental pollution and damage. There will be some additional noise above ambient during construction resulting from equipment operation (trucks, back hoe or front end loader). Construction work would be restricted to the hours of 7:30 am to 5 pm Monday through Friday to reduce noise impacts to the neighbors.

(11) *"Affects or is likely to suffer damage by being in an environmentally sensitive area such as a flood plain, tsunami zone, beach or erosion prone area, or coastal waters."* The project site is subject to severe and chronic shoreline erosion. The Federal Flood Insurance Rate Map (FIRM) indicates that the general project area is within the AE Zone (special flood hazard area inundated by a 100-year flood) with base flood elevation of +9 feet msl – thus the proposed revetment would be in the 100-year tsunami zone. The existing ground elevation of 14 feet is well above the flood level. A Flood Hazard District Certification has been provided with the Shoreline Setback Variance application to the City & County. The revetment may be subject to prevailing wave conditions at the shoreline, particularly during winter season high surf from North Pacific storms, and the revetment has been designed to be stable under possible severe wave conditions at the site. The revetment will provide erosion and storm wave protection for a home proposed to be constructed by the applicant on the property.

(12) *"Substantially affects scenic vistas and viewplanes identified in county or state plans or studies."* Private property, most of which is developed with homes, lies between the coastal highway and shoreline in the project area, and it is not possible to see the shore for a significant distance either side of the project site. In addition, existing ground elevation at the site is about +15 feet msl, and the crest of the proposed revetment will not extend above the existing ground level. There is no public access to the shore for several

thousand feet north or south of the project site, so the revetment will not be readily visible to the public.

(13) *"Requires substantial energy consumption."* No significant energy would be expended by construction of the revetment, nor would it entail any long-term commitment to energy use.

7.0 MITIGATION MEASURES

1. All construction would be done landward of the mean higher high tide elevation, and the natural sand beach would be maintained as a barrier between the nearshore water and the construction activity. In addition, a silt fence seaward of the revetment toe will be erected and maintained during the construction period.

2. Work would be limited to the hours between 7:30 am and 5 pm to reduce the disturbance to neighboring properties.

3. The following Best Management Practices will be adhered to during construction.

    a) The Contractor shall perform the work in a manner which minimizes environmental pollution and damage as a result of construction operations. Environmental resources outside the limits of construction shall be protected during the construction period.
    b) The Contractor shall confine all construction activity to areas defined by the construction plans. No construction material shall be placed or stockpiled outside of the immediate area of construction.
    c) All construction materials shall be free of contaminants or pollutants.
    d) No debris, petroleum products, or other construction-related substances or materials will be allowed to flow, fall, leach or otherwise enter the coastal waters.
    e) No construction equipment shall operate in the water, nor shall any construction take place below the mean higher high water line.
    f) A dust control program will be implemented, and wind blown dust shall be prevented from blowing into the water by watering when necessary.
    g) All excavated material will be placed on the land behind the excavation and contained within soil or sandbag berms to prevent any runoff back into coastal waters.
    h) No discharge of dewatering effluent back into coastal waters will be permitted.

4. Should iwi (bones) or Native Hawaiian cultural or traditional deposits be found during ground disturbance for construction of the revetment, work shall cease and the State Historic Preservation Division, Department of Land and Natural Resources notified immediately (telephone 692-8015).

5. Public access along the shoreline during construction shall be maintained so far as practicable and within the limitations necessary to ensure safety. No impediment to public access along the shore shall be placed in the State conservation district seaward of the certified shoreline.

8.0 SHORELINE SETBACK VARIANCE JUSTIFICATION

Criteria for granting a shoreline setback variance are set forth in Section 23-1.8, ROH. The proposed project meets the criteria of part (b) (3), the Hardship Standard, for the following reasons.

(A)(i) The applicant would be deprived of reasonable use of their land if required to comply fully with the shoreline setback rules.

The applicant propose to construct a single-family residence on the property, however given the well documented, chronic erosion, and shoreline recession, it would be difficult to safely locate a dwelling without a properly designed and constructed shore protection structure in place. As previously discussed in this report, the shoreline in the project vicinity has already receded as much as 65 feet during the 40-year period between 1949 and 1988. The eroding condition of an unprotected shoreline, with its near vertical erosion scarp, also makes the shoreline extremely vulnerable to rapid erosion and recession during severe storm wave attack. The erosion and shoreline recession is also beginning to flank the existing shore protection structures on both sides of the applicants property, which expose their neighbors to damage and maintenance problems and potentially deprives their neighbors of reasonable use of their property. These adverse impacts would thus deprive the applicants, and potentially their neighbors, of reasonable use of their property.

(A)(ii) The applicant's request is due to unique circumstances and does not draw into question the reasonableness of the Shoreline Setback Ordinance and Rules.

The entire "Bathtub Beach" shoreline has been chronically and heavily eroded, resulting in all of the other properties being protected by sloping rock revetment or CRM seawall shore protection. The majority of the existing shore protection structures were constructed in the 1970's and 1980's. Two properties approximately 300 feet north of the project site (TMK 5-5-03:92 and 93), and one property 100 feet south of the project site (TMK 5-5-02:3), received DPP approval in 2003 and 2005, respectively, to construct sloping rock revetment shore protection. Approval of the applicants' request would thus be consistent with previous government action. Approval would also be due to the unique site-specific erosion problem, and does not question the general reasonableness of the shoreline setback rules.

(A)(iii) The proposed plan is the most practical and effective alternative, and best conforms to the purpose of the Shoreline Setback Ordinance and Rules.

Alternatives considered include no action, sandbags, beach nourishment, a vertical seawall, and a sloping rock revetment. No action would be ineffective due to the long-term history of chronic erosion. Sandbags have been used in the vicinity of the project site as a temporary erosion control measure, however they are typically undermined and displaced by wave action, require constant maintenance, and subject to damage by vandalism. Thus, the use of sandbags is not considered an effective permanent solution to the erosion problem. Beach nourishment is not considered a viable long-term erosion control measure due to the chronic erosion potential. Stabilization structures such as groins would be required to maintain a beach, and these would

have to be built seaward of the certified shoreline on State conservation district submerged land. Beach nourishment is also not compatible with the existing seawall and revetment shore protection on either side of the applicants' property. A properly designed and constructed seawall is a proven shore protection method. However, their structural stability is dependant on their foundation, and ideally they should be constructed on solid, non-erodable substrate. Seawalls are also highly reflective, and reflected wave energy can inhibit beach formation in front of the wall. Given the sandy nature of the shoreline in the project vicinity, a seawall is thus not considered the best shore protection alternative.

Properly designed and constructed rock revetments are durable, flexible, and highly resistant to wave damage. The rough and porous surface and flatter slope absorbs and dissipates wave energy, thus reducing wave reflection and runup, and providing a greater likelihood of sand accumulation seaward of the structure. Because of its durability, particularly considering the potential instability of the erodable sand shoreline on which it would be constructed, and the greater likelihood of sand retention on the shore fronting the structure, a sloping rock revetment is considered the best erosion control/shore protection measure for the project site. Aligning the proposed revetment with the adjacent existing shore protection structures will prevent damage to the adjacent structures, and would be consistent with the Oahu Shoreline Study – Part 2, Management Strategies (prepared for the City and County of Honolulu, Department of Land Utilization, 1989) which recommends bringing existing and new shore protection structures into a more uniform alignment. It is the most effective and practical alternative which best conforms to the Shoreline Setback Ordinance and Rules.

(B) The applicants' property is zoned R-5 Residential, and designated Rural Residential on the Koolau Loa Sustainable Communities Plan. Numerous homes have been constructed on both sides of the project site, with almost all of the shoreline in the vicinity having already been developed. Thus constructing a single family dwelling on the property is a reasonable use of the land. However, given the history of chronic erosion and the exposure of the shoreline to wave action, properly designed and constructed shore protection is required to safely locate a home on the property.

(C) A significant hardship would be incurred by the applicant due to shoreline erosion without the granting of a shoreline setback variance to construct shore protection. The proposed revetment would be constructed entirely landward of the September 10, 2003 certified shoreline.

(D) The Hardship Standard criteria for the proposed shore protection is not a result of any discretionary land use permit granted after June 16, 1989.

9.0 CONSISTENCY WITH EXISTING PLANS AND POLICIES

Ko'olau Loa *Sustainable* Communities Plan – The proposed shore protection project is consistent with the general nature and provisions of the Ko'olau Loa SCP – to maintain the country character of the area, and to experience little growth over the plan's 20-year planning horizon. The project site is an existing is an existing residential zoned property, and its Ko'olau

Loa SCP designation is rural Residential. Specific to plan section 3.1.3.2 Shoreline Areas, the project:

- Will not impact the makai view (the revetment crest will be at or below the existing ground elevation)
- Will not extend seaward of the certified shoreline, thus will not impact the State Conservation District.
- Will not extend further seaward than other existing shore protection in the vicinity, thus will not further impede lateral access along the shore.
- Will protect the unstable and chronically eroding shoreline.
- Will protect nearshore marine life from damage due to erosion of the land.

State Coastal Erosion Management Plan – the State's Coastal Erosion Management Plan (COEMAP) provides a framework for assessing, understanding, discussing and ultimately managing the issue of coastal erosion and beach loss in Hawaii. COEMAP goals and the relationship of the proposed project to these goals include the following steps.

1) *Replace the current R-5 zoning policy with development of Beach Management Districts for high erosion rate areas.* The project site is in a high erosion rate area. However, the majority of R-5 zoned property in the project vicinity is fully developed with single-family homes and virtually all of the shoreline has existing shore protection structures. Thus conversion of this area into a Beach Management District to conserve the beach is not practical or even possible.

2) *Implement sand nourishment as a viable erosion management option.* Beach nourishment has been evaluated as a possible erosion control alternative for this site, however it is not considered a viable option for reasons discussed in the FEA Section 5.3.

3) *Include scientific data into the management plan.* A coastal engineering evaluation is included in this FEA, prepared in accordance with OEQC and COEMAP recommendations and guidelines.

4) *Include public awareness in the coastal decision making process.* The public is involved in the decision making process for this project by a) publishing a notice of DEA availability in the OEQC *Environmental Notice* and inviting public review and comment, and b) by a public hearing to be conducted by DPP with a 30-day advance notice published in the newspaper and specific notice given to the local Neighborhood Board and nearby residents.

10.0 PUBLIC AND AGENCY INVOLVEMENT, REVIEW AND CONSULTATION

The following agencies were consulted during preparation of the Draft Environmental Assessment (DEA):

- City and County of Honolulu, Department of Planning and Permitting
- State of Hawaii, Department of Land and Natural Resources
- U.S. Army Corps of Engineers, Honolulu Engineer District

Notice of the availability of the Draft EA was made in *The Environmental Notice*, published by the State Office of Environmental Quality Control, in the April 23, 2005 issue. The Draft EA was also sent to concerned Federal, State and County agencies for their review. Draft EA review comments were received from the following agencies:

- City and County of Honolulu, Department of Planning and Permitting
- State of Hawaii, Office of Environmental Quality Control
- State of Hawaii, Land Use Commission

The project will require the following permits:

- Shoreline Setback Variance pursuant to Chapter 23, Revised Ordinances of Honolulu
- Grading and building permit from the City and County of Honolulu
- Department of the Army, Corps of Engineers (only if the revetment footprint extends seaward of the mean higher high water line)

REFERENCES

AECOS, Inc., 1979, *Oahu Coral Reef Inventory*, prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Fort Shafter, Hawaii.

AECOS, Inc., 1981, *Oahu Coastal Zone Atlas*, prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Fort Shafter, Hawaii.

Clark, John R.K., 1977, *The Beaches of Oahu*, The University Press of Hawaii.

Hwang, Dennis, 1981, *Beach Changes on Oahu as Revealed by Aerial Photographs*, Hawaii Institute of Geophysics, University of Hawaii.

Loomis, Harold G., 1976, *Tsunami Wave Runup Heights in Hawaii*, Hawaii Institute of Geophysics, University of Hawaii.

M&E Pacific, Inc., 1978, *Manual for Determining Tsunami Runup Profiles on Coastal Areas of Hawaii*, prepared for U.S. Army Corps of Engineers, Pacific Ocean Division.

Sea Engineering, Inc., 1989, *Oahu shoreline Study, Part 1, Data on Beach Changes (1988)*, prepared for City and County of Honolulu, Department of Land Utilization.

Sea Engineering, Inc., 1990, *Windward Oahu Hurricane Vulnerability Study – Determination of Coastal Inundation Limits*, prepared for the State of Hawaii, Civil Defense and the U.S. Army Corps of Engineers, Honolulu Engineer District.

APPENDIX A

Draft Environmental Assessment

Review Commend and Response Letters

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
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MAY 25 2005

MUFI HANNEMANN
MAYOR

HENRY ENG, FAICP
DIRECTOR

DAVID K. TANOUE
DEPUTY DIRECTOR

2005/ED-4 (ST)

May 23, 2005

Mr. Scott Sullivan
Sea Engineering, Inc.
Makai Research Pier
Waimanalo, Hawaii 96795

Dear Mr. Sullivan:

Draft Environmental Assessment (DEA)
Shoreline Setback Variance (SV) for
Reconstruction of a 14-foot high Rubble Rip-Rap Revetment
55-295 Kamehameha Highway - Laie
Tax Map Key 5-5-2: 5

We have reviewed the Draft Environmental Assessment (DEA) for the above-referenced project and offer the following comments:

Section 1.0 General Information

An item F should be added which indicates that the site is designated as Rural Residential on the Koolau Loa Sustainable Communities Plan (1999).

An Item G should be added that lists "Required Permits," including a Shoreline Setback Variance pursuant to Chapter 23, Revised Ordinances of Honolulu (ROH), grading and building permits, and a Department of the Army (DA) permit from the U.S. Army Corps of Engineers (USCOE).

Section 2.0. Location and General Description

This section must be expanded to:

1) Clarify that although no single-family dwelling exists on site, building permit plans for the construction of a single-family dwelling have been submitted to DPP and

therefore, the proposal is considered exempt from Special Management Area (SMA) requirements as an accessory use (Section 25-1.3(2)(A) and (N), ROH).

2) Describe of the entire site, including <u>all</u> existing improvements, if any (e.g., existing fence walls, walkways, etc.), including their size and distance from the existing rip-rap. The topography of the site should be described.

3) Provide additional detail on the construction of the existing unauthorized rip-rap revetment in 2003, including stone sizes and estimates of the amount and source of boulders and backfill used. The original topography prior to the unauthorized construction should be discussed.

4) The Design Analysis for the proposed rip-rap by the professional engineer should be attached to the Final EA. Construction plans for the proposed structure, stamped by the professional engineer, will also be required prior to acceptance of the application for a shoreline variance.

<u>Section 4.5 Coastal Use</u>

The nature of the nearest public shoreline access should be clarified (i.e., beach park, pedestrian right-of-way, etc.) and indicated on Figure 3.1.

<u>Section 8.0 Shoreline Setback Variance Justification</u>

This section should be expanded to explicitly address the criteria under which a shoreline setback variance (SV) may be granted. It should specifically address the three (3) tests of the Hardship Standard, pursuant to Section 23-1.8(b)(3), ROH.

An additional section should be added which addresses how the proposal is "Consistent with Existing Plans and Policies." This section should address both the City and County's Koolau Loa SCP, and the State's Coastal Erosion Management Plan (COEMAP).

Comment Letters

Finally, we are forwarding a copy of the comment letter received so far for the proposed project. In accordance with the procedural provisions of EIS regulations, all comment letters received during the 30-day comment period, which began with the initial publication of a notice of availability of the DEA in The Environmental Notice on April 23, 2005, require a response addressed directly to the commenter. The final EA must include all comment letters and responses to the letters, as well as appropriately revised text.

If you have any questions, please contact Steve Tagawa of our staff at 523-4817.

Sincerely yours,

HENRY ENG, FAICP
for Director of Planning
and Permitting

HE:pl
Encls.

cc: DLNR-OCCL
OEQC

G:landuse\posseworkingdirectory\SteveT\DEAbennett.com

Sea Engineering, Inc.

Makai Research Pier • 41-202 Kalanianaole Hwy. Suite 8 • Waimanalo, Hawaii 96795-1820
Phone: (808) 259-7966 / FAX (808) 259-8143 • E-mail: sei@seaengineering.com

August 18, 2005

Mr. Henry Eng, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. Eng:

Subject: Response to Draft Environmental Assessment (DEA) Review Comments, Shoreline Setback Variance Application for Shore Protection at 55-295 Kamehameha Hwy., Laie, Oahu, TMK 5-5-02:5, File No. 2005/ED-4

Thank you for your review of the Draft Environmental Assessment (DEA) for the subject project, and the review comments in your letter of May 23, 2005. We are pleased to provide the following responses to your comments, and have revised the Final Environmental Assessment (FEA) accordingly.

Section 1.0 General Information

Item F has been added to the FEA indicating that Koolau Loa Sustainable Communities Plan designation is Rural Residential. Item G has been added listing the permits required. A Department of the Army permit will only be required should construction occur seaward of the intersection of the mean higher high water line (+1.3 feet msl) and the existing shoreline, which intended to be done.

Section 2.0 Location and General Description

1) The location and layout of the home proposed to be built on the property is shown on Figure 2.6. A building permit application and construction plans have been submitted to the Department of Planning and Permitting to initiate the residential home building permit process (Application No. A2004-11-0945). The shore protection project is therefore exempt from Special Management Area (SMA) requirements as an accessory use (Section 25-1.3(2)(A) and (N), ROH). The FEA has been revised to clarify this.
2) In December 2003 the Bennett's received building permit number 558739 from the DPP for construction of a 6-foot high CRM fence wall along their landward property line fronting Kamehameha Highway. Following completion of this wall the Bennett's adjacent neighbor on the north side hired the contractor to continue the wall down the property line between the two properties. Because there are existing homes on the adjacent property which are built with minimum setback from the property line, the Bennett's neighbor asked if they could construct the wall partially on the Bennett's side

of the property line in order to preserve access between the house and the wall. Because the wall was being built at their neighbor's expense, and desiring to be friendly neighbors, the Bennett's agreed to the wall being partly on their property. However, a recent (August 12, 2005) topographic survey of the Bennett property by Walter P. Thompson, Inc. confirmed that the fence wall for a distance of at least 80 feet back from the shoreline is entirely on the neighbor's side of the property line, and thus does not extend into the Bennett's shoreline setback zone. The FEA has been revised to include this description of the fence wall. The topography of the site has also been included in FEA section 3.0 (Figure 3.2).

3) Prior to placing rocks on the shoreline in 2003 the unprotected shoreline was actively eroding and had a near vertical 10-foot high erosion scarp. The rocks used were approximately 1 to 2 feet in diameter (200 to 1,500 pounds), and were placed over a geotextile fabric filter directly on the bank. No backfill material was placed on the shore. Approximately 30 cubic yards of rock was used, obtained from a nearby construction site. The relatively large rocks placed on a steep slope directly over geotextile filter fabric, and without a toe scour apron to prevent undermining and toe instability, began to slump and expose the filter fabric almost immediately. At this time, the rock shore protection has essentially failed and is providing only limited partial protection. However, these rocks are suitable for use in the proposed new engineered rock revetment. During construction of the new revetment the existing rocks will be removed from the shore, stockpiled on the lot, and then used along with additional stone to construct a properly designed revetment. This discussion has been added to the FEA.
4) The design analysis has been appended to the FEA, and construction plans will be submitted along with the FEA.

Section 4.5 Coastal Use

The nature of the public access to Laniloa Beach has been added to the FEA, and its location has been shown on Figure 3.1. Discussion of "Pounders" public beach park 2,000 feet south of the project site has also been added to the FEA.

Section 8.0 Shoreline Setback Variance Justification

Criteria for granting a shoreline setback variance are set forth in Section 23-1.8, ROH. The proposed project meets the criteria of part (b) (3), the Hardship Standard, for the following reasons.

(A)(i) The applicant would be deprived of reasonable use of their land if required to comply fully with the shoreline setback rules.

The applicant propose to construct a single-family residence on the property, however given the well documented, chronic erosion, and shoreline recession, it would be difficult to safely locate a dwelling without a properly designed and constructed shore protection structure in place. As previously discussed in this report, the shoreline in the project vicinity has already receded as much as 65 feet during the 40-year period between 1949 and 1988. The eroding condition of an

unprotected shoreline, with its near vertical erosion scarp, also makes the shoreline extremely vulnerable to rapid erosion and recession during severe storm wave attack. The erosion and shoreline recession is also beginning to flank the existing shore protection structures on both sides of the applicants property, which expose their neighbors to damage and maintenance problems and potentially deprives their neighbors of reasonable use of their property. These adverse impacts would thus deprive the applicants, and potentially their neighbors, of reasonable use of their property.

(A)(ii) The applicant's request is due to unique circumstances and does not draw into question the reasonableness of the Shoreline Setback Ordinance and Rules.

The entire "Bathtub Beach" shoreline has been chronically and heavily eroded, resulting in all of the other properties being protected by sloping rock revetment or CRM seawall shore protection. The majority of the existing shore protection structures were constructed in the 1970's and 1980's. Two properties approximately 300 feet north of the project site (TMK 5-5-03:92 and 93), and one property 100 feet south of the project site (TMK 5-5-02:3), received DPP approval in 2003 and 2005, respectively, to construct sloping rock revetment shore protection. Approval of the applicants' request would thus be consistent with previous government action. Approval would also be due to the unique site specific erosion problem, and does not question the general reasonableness of the shoreline setback rules.

(A)(iii) The proposed plan is the most practical and effective alternative, and best conforms to the purpose of the Shoreline Setback Ordinance and Rules.

Alternatives considered include no action, sandbags, beach nourishment, a vertical seawall, and a sloping rock revetment. No action would be ineffective due to the long term history of chronic erosion. Sandbags have been used in the vicinity of the project site as a temporary erosion control measure, however they are typically undermined and displaced by wave action, require constant maintenance, and subject to damage by vandalism. Thus, the use of sandbags is not considered an effective permanent solution to the erosion problem. Beach nourishment is not considered a viable long term erosion control measure due to the chronic erosion potential. Stabilization structures such as groins would be required to maintain a beach, and these would have to be built seaward of the certified shoreline on State conservation district submerged land. Beach nourishment is also not compatible with the existing seawall and revetment shore protection on either side of the applicants' property. A properly designed and constructed seawall is a proven shore protection method. However, their structural stability is dependant on their foundation, and ideally they should be constructed on solid, non-erodable substrate. Seawalls are also highly reflective, and reflected wave energy can inhibit beach formation in front of the wall. Given the sandy nature of the shoreline in the project vicinity, a seawall is thus not considered the best shore protection alternative.

Properly designed and constructed rock revetments are durable, flexible, and highly resistant to wave damage. The rough and porous surface and flatter slope absorbs and dissipates wave

energy, thus reducing wave reflection and runup, and providing a greater likelihood of sand accumulation seaward of the structure. Because of its durability, particularly considering the potential instability of the erodable sand shoreline on which it would be constructed, and the greater likelihood of sand retention on the shore fronting the structure, a sloping rock revetment is considered the best erosion control/shore protection measure for the project site. Aligning the proposed revetment with the adjacent existing shore protection structures will prevent damage to the adjacent structures, and would be consistent with the Oahu Shoreline Study – Part 2, Management Strategies (prepared for the City and County of Honolulu, Department of Land Utilization, 1989) which recommends bringing existing and new shore protection structures into a more uniform alignment. It is the most effective and practical alternative which best conforms to the Shoreline Setback Ordinance and Rules.

(B) The applicants' property is zoned R-5 Residential, and designated Rural Residential on the Koolau Loa Sustainable Communities Plan. Numerous homes have been constructed on both sides of the project site, with almost all of the shoreline in the vicinity having already been developed. Thus constructing a single family dwelling on the property is a reasonable use of the land. However, given the history of chronic erosion and the exposure of the shoreline to wave action, properly designed and constructed shore protection is required to safely locate a home on the property.

(C) A significant hardship would be incurred by the applicant due to shoreline erosion without the granting of a shoreline setback variance to construct shore protection. The proposed revetment would be constructed entirely landward of the September 10, 2003 certified shoreline.

(D) The Hardship Standard criteria for the proposed shore protection is not a result of any discretionary land use permit granted after June 16, 1989.

The above discussion has been added to section 8.0 of the FEA.

An additional section (9.0 Consistency With Existing Plans and Policies) has been added to the FEA to address the relationship of the project to the Ko`olau Loa Sustainable Communities Plan and the State's Coastal Erosion Management Plan.

Ko`olau Loa *Sustainable* Communities Plan – The proposed shore protection project is consistent with the general nature and provisions of the Ko`olau Loa SCP – to maintain the country character of the area, and to experience little growth over the plan's 20-year planning horizon. The project site is an existing is an existing residential zoned property, and its Ko'olau Loa SCP designation is rural Residential. Specific to plan section 3.1.3.2 Shoreline Areas, the project

- Will not impact the makai view (the revetment crest will be at or below the existing ground elevation)
- Will not extend seaward of the certified shoreline, thus will not impact the State Conservation District.

- Will not extend further seaward than other existing shore protection in the vicinity, thus will not further impede lateral access along the shore.
- Will protect the unstable and chronically eroding shoreline.
- Will protect nearshore marine life from damage due to erosion of the land.

State Coastal Erosion Management Plan – the State's Coastal Erosion Management Plan (COEMAP) provides a framework for assessing, understanding, discussing and ultimately managing the issue of coastal erosion and beach loss in Hawaii. COEMAP goals and the relationship of the proposed project to these goals includes the following steps.
1) *Replace the current R-5 zoning policy with development of Beach Management Districts for high erosion rate areas.* The project site is in a high erosion rate area. However, the majority of R-5 zoned property in the project vicinity is fully developed with single-family homes and virtually all of the shoreline has existing shore protection structures. Thus conversion of this area into a Beach Management District to conserve the beach is not practical or even possible.
2) *Implement sand nourishment as a viable erosion management option.* Beach nourishment has been evaluated as a possible erosion control alternative for this site, however it is not considered a viable option for reasons discussed in the FEA Section 5.3.
3) *Include scientific data into the management plan.* A coastal engineering evaluation is included in this FEA, prepared in accordance with OEQC and COEMAP recommendations and guidelines.
4) *Include public awareness in the coastal decision making process.* The public is involved in the decision making process for this project by a) publishing a notice of DEA availability in the OEQC *Environmental Notice* and inviting public review and comment, and b) by a public hearing to be conducted by DPP with a 30-day advance notice published in the newspaper and specific notice given to the local Neighborhood Board and nearby residents.

DEA Comment Letters
Comment letters received during review of the DEA have been responded to in writing, and the comment and response letters have been included in Appendix A of the FEA along with appropriately revised text.

Should you have any questions or additional comments please contact Scott Sullivan at 259-7966, ext. 14 or by email at scotts@seaengineering.com.

Sincerely,

Scott P. Sullivan
Vice President

LINDA LINGLE
GOVERNOR OF HAWAII

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

MAY 10 2005

May 6, 2005

Mr. Henry Eng, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawai'i 96813

Dear Mr. Eng:

Subject: Draft Environmental Assessment for the Bennett Revetment, Laie, O'ahu

Thank you for the opportunity to review and comment on the subject project. We have the following comments.

1. For assistance in completing the assessment, please review the "Shoreline Hardening Policy and Environmental Assessment Guidelines" available at http://www.state.hi.us/health/oeqc/guidance/shoreline.htm and Dennis Hwang's *Hawaii Coastal Hazard Mitigation Guidebook*, which is available thru Sam Lemmo (587-0318).

2. Please consult with adjacent neighbors and the neighborhood board.

3. Please list the required permits.

If you have any questions, please contact Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson

Genevieve Salmonson
Director

c: Sea Engineering
Bennett

Sea Engineering, Inc.
Makai Research Pier • 41-402 Kalanianaole Hwy. • Waimanalo, Hawaii 96795-1820
Phone: (808) 259-7966 • Fax: (808) 259-8143 • Email: seier@seaengineering.com • Website: www.seaengineering.com

August 11, 2005

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
State of Hawaii
235 South Beretania Street
Honolulu, HI 96813

Dear Ms. Salmonson:

Subject: Environmental Assessment for Shoreline Setback Variance Application.
Bennett Property, 55-295 Kamehameha Hwy. Laie, Oahu (TMK 5-5-02:5)

Thank you for your review of the Draft Environmental Assessment (EA) for the subject project, and the review comments in your letter of May 6, 2005.

The coastal engineering evaluation and environmental assessment for the project has been prepared in accordance with the 13 general topics suggested by the "Shoreline Hardening Policy and Environmental Assessment Guidelines" as promulgated by OEQC. A note to this effect has been added to Section 2.0 of the Final EA. Project development has also considered information presented in the recently published *Hawaii Coastal Hazard Mitigation Guidebook* by Dennis J. Hwang (January 2005).

The project has been discussed with the neighbors on both sides of the project site, and they are anxious for the proposed shore protection project to be implemented in order to provide flank protection for their respective properties. In addition, as part of the Shoreline Setback Variance process, the City and County of Honolulu, Department of Planning and Permitting, will conduct a public hearing to solicit input from agencies and the community. Notice of the hearing and proposed action will be given to the neighborhood board and to individual property owners within 300 feet on either side of the applicant.

The permits required to implement the project are listed in sections 1.0 and 9.0 of the Final EA.

Sincerely,

Scott P. Sullivan
Vice President

Cc: City and County of Honolulu, Department of Planning and Permitting

LINDA LINGLE
GOVERNOR

ANTHONY J.H. CHING
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, Hawaii 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

April 28, 2005

RECEIVED
'05 MAY -2 P5:38
DEPT OF PLANNING AND PERMITTING
CITY & COUNTY OF HONOLULU

Mr. Henry Eng, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Eng:

Subject: Draft Environmental Assessment (DEA) and Coastal Engineering Evaluation for Shoreline Setback Variance Application
Randall K. & Shelly D. Bennett
Laie, Oahu, Hawaii
Tax Map Key: 5-5-02:5

We are in receipt of the subject DEA transmitted by your letter dated April 5, 2005. We understand that the landowners/applicants are proposing to construct a 14-foot-high boulder rip-rap revetment within the 40-foot shoreline setback area to prevent further erosion and stabilize the shore fronting their parcel. The revetment will include a 5-foot-wide toe apron one foot below an existing wall of boulders on the parcel. We further understand that some of the boulders at the south end of the parcel were laid down prior to 1970. The current landowners subsequently placed additional boulders on the shore in 2003.

For your information, the State land use designation of the subject parcel was established on August 23, 1964. While the landward portion of the parcel was designated within the Urban District, the coastal portion having an elevation below the highwater mark as it existed at that time was designated within the Conservation District. Our comparison of the applicable tax map in use in 1964 with the survey map in the DEA confirms that the parcel experienced significant erosion over the years. However, it is unclear to what extent the parcel's shoreline had eroded prior to the placement of the boulders at the south end of the parcel.

Confirmation of the highwater mark location as it existed in 1964, or, in the alternative, as it existed prior to the establishment of the earliest boulders on the parcel, is needed to determine the location of the Urban/Conservation District boundary relative to the proposed improvements. In this case, the certified shoreline is not necessarily indicative of the district boundary location as the existing boulders may have altered the shoreline since the district boundary for the parcel was established. We therefore request that a boundary interpretation request be filed with our office pursuant to section 15-15-22, Hawaii Administrative Rules. Such a request should be accompanied by the appropriate documentation, including, but not limited to, information on the location of the highwater mark as it existed in 1964, or, in the alternative, as it existed prior to the establishment of the earliest boulders on the parcel.

Thank you for the opportunity to comment on the subject DEA. Please feel free to contact Bert Saruwatari of my office at 587-3822, should you require clarification or any further assistance.

Sincerely,

ANTHONY J. H. CHING
Executive Officer

c: Office of Environmental Quality Control

Sea Engineering, Inc.
Makai Research Pier • 41-402 Kalanianaole Hwy. • Waimanalo, Hawaii 96795-1820
Phone: (808) 259-7966 • Fax: (808) 259-8143 • Email: sei@seaengineering.com • Website: www.seaengineering.com

August 11, 2005

Mr. Anthony J.H. Ching, Executive Officer
Land Use Commission
Department of Business, Economic Development & Tourism
State of Hawaii
P.O. Box 2359
Honolulu, HI 96804-2359

Dear Mr. Ching:

Subject: Boundary Interpretation Request for Randall K. & Shelley D. Bennett. 55-295 Kamehameha Hwy., Laie, Oahu, Hawaii, Lot 4, TMK 5-5-02:5

Thank you for your review of the Draft Environmental Assessment (DEA) for Shoreline Setback Variance Application for the subject property, and the review comments in your letter of April 28, 2005. The following information is submitted in response to your request that a boundary interpretation request be filed with your office pursuant to section 15-15-22, HAR.

The enclosed property map prepared by Walter P. Thompson, Inc. shows that the Conservation/Urban Boundary extends along the ocean side property line, well seaward of the existing shoreline and the existing rock shore protection. The map shows that the property has suffered a loss of 7,412 square feet due to shoreline erosion.

It is not known exactly when the initial boulders were placed on the south side of the subject property, however it is believed that they were initially place in the early to mid 1960's. The enclosed aerial photograph dated April 23, 1967, obtained from the R.M. Towill Corporation, shows rock shore protection fronting the adjacent property to the south of the Bennett's (Lot 3, TMK 5-5-02:4)). The rocks were presumably placed to protect the home existing on Lot 3 at the time, and the placement of the rocks extended partially onto Lot 4, what is now the Bennett's property. Lot 4 was undeveloped at that time.

In 2003 the Bennett's placed additional rock on the shoreline to protect their property in the mistaken belief that they had a nonconforming revetment which could be repaired without obtaining a Shoreline Setback Variance. These rocks were placed well landward

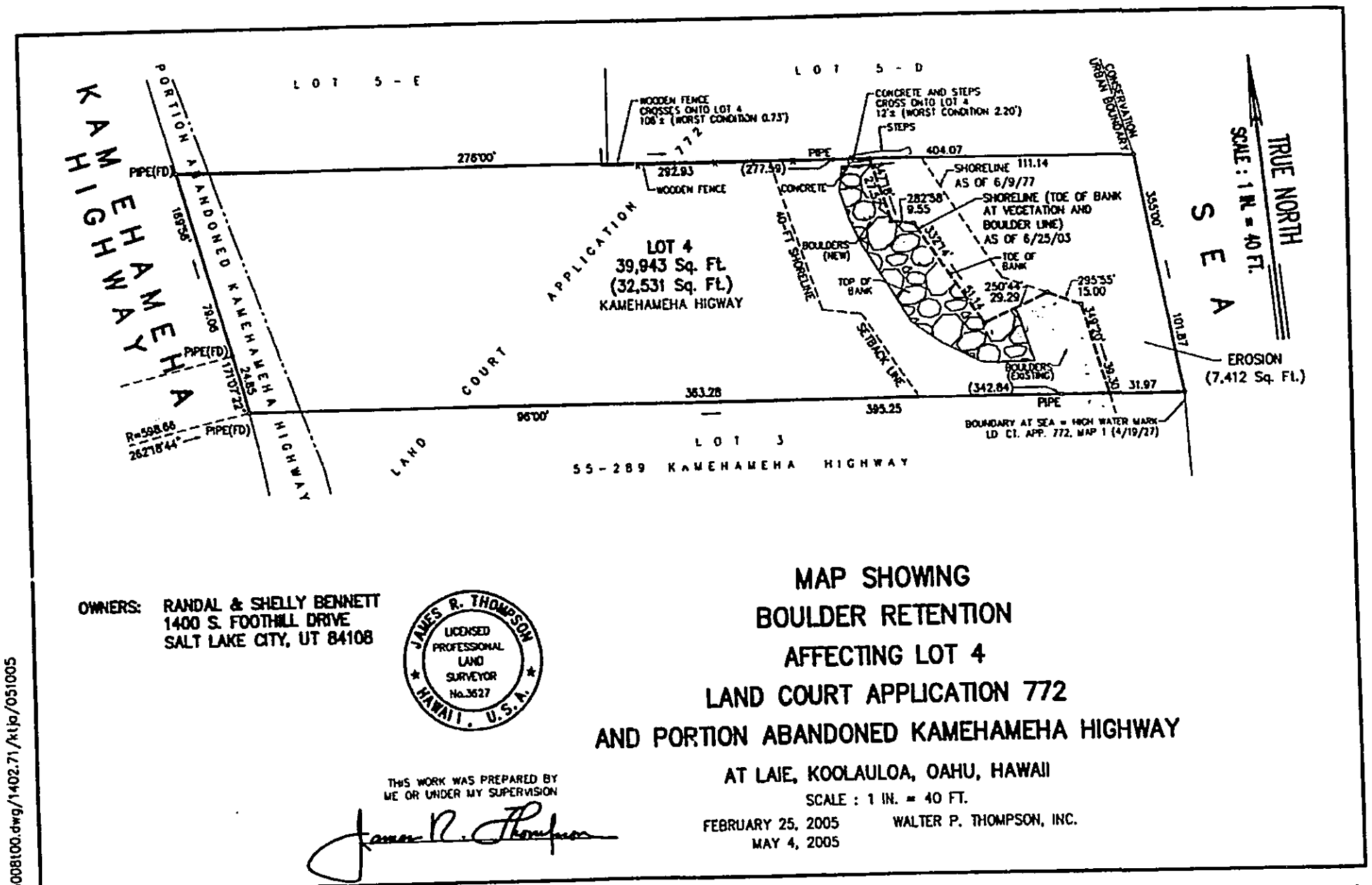
of their property line and the Urban/Conservation Boundary, and landward of the September 10, 2003 certified shoreline. A Shoreline Setback Variance application has been submitted to the City and County of Honolulu, Department of Planning and Permitting, to obtain approval for construction of properly engineered rock revetment shore protection for the Bennett's property.

We trust that this information is sufficient for you to conduct an Urban/Conservation District boundary interpretation. Should you have any questions or desire additional information please contact Scott Sullivan at 259-7966, ext. 14, or by email at scotts@seaengineering.com.

Sincerely,

Scott P. Sullivan
Vice President

Cc: City and County of Honolulu, Department of Planning and Permitting
State of Hawaii, Office of Environmental Quality Control



OWNERS: RANDAL & SHELLY BENNETT
1400 S. FOOTHILL DRIVE
SALT LAKE CITY, UT 84108

JAMES R. THOMPSON
LICENSED PROFESSIONAL LAND SURVEYOR
No. 3627
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

James R. Thompson

MAP SHOWING
BOULDER RETENTION
AFFECTING LOT 4
LAND COURT APPLICATION 772
AND PORTION ABANDONED KAMEHAMEHA HIGHWAY

AT LAIE, KOOLAULOA, OAHU, HAWAII

SCALE : 1 IN. = 40 FT.

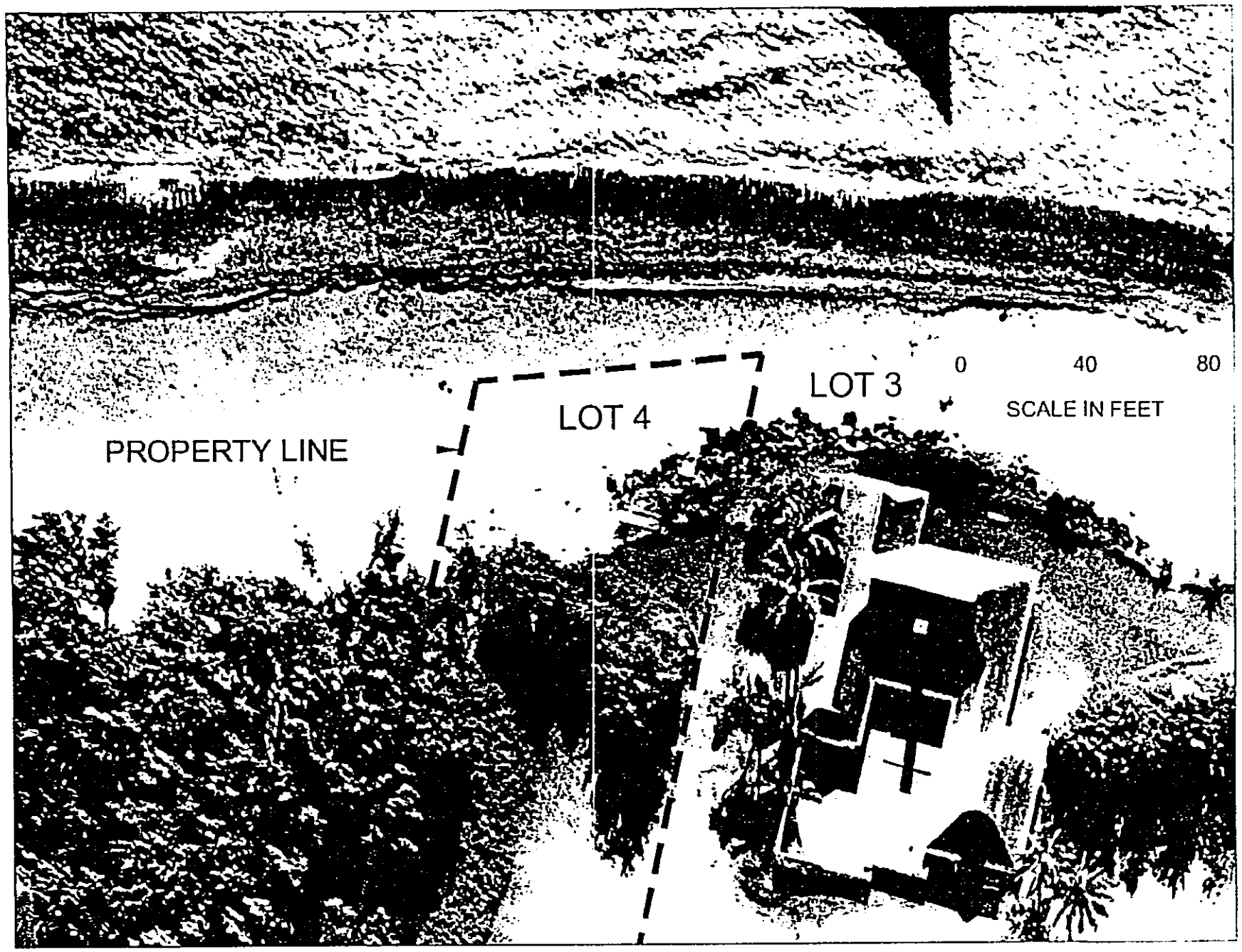
FEBRUARY 25, 2005
MAY 4, 2005

WALTER P. THOMPSON, INC.

05008100.dwg/1402.71/ktp/051005

10" X 15" = 1.04 Sq. Ft.

TAX MAP KEY : 5 - 5 - 02 : 5



1967 AERIAL PHOTOGRAPH SHOWING EXISTING ROCK SHORE PROTECTION RELATIVE TO THE PROPERTY LINE OF LOT 4, TMK 5-5-02:5

APPENDIX B

Design Analysis

Sea Engineering, Inc.
Makai Research Pier
Waimanalo, Hawaii 96795-1820
Ph: (808) 259-7966 Fax: (808) 259-8143

Design Analysis for Riprap Shore Protection Revetment at 55-295 Kamehameha Highway (TMK 5-5-02:05) Laie, Oahu, Hawaii

March 3, 2005

ROBERT Y. ROCHELEAU
REGISTERED PROFESSIONAL ENGINEER
No. 4792
HAWAII, U.S.A.

Robert Y. Rocheleau

This work was prepared by me
or under my supervision.

1. REFERENCES

A. *Shore Protection Manual*, U.S. Army Corps of Engineers, Coastal Engineering Research Center, 1984.

B. *Design of Coastal Revetments, Seawalls, and Bulkheads*, U.S. Army Corps of Engineers, EM 1110-2-1614, April 1985.

C. Shoreline Survey Map, dated June 26, 2004, prepared by James R. Thompson, RLS.

D. *Draft Environmental Assessment and Coastal Engineering Evaluation for Shoreline Setback Variance Application, TMK 5-5-02:5*, prepared by Sea Engineering, Inc., February 2005.

2. SITE DESCRIPTION

The project is located at 55-295 Kamehameha Hwy., Laie, Oahu. The project site is near the southern end of Laniloa Beach, an approximate one-mile long stretch of shoreline running north-south between Laie (Laniloa) Point to the north and Kehuku'una Point to the south. The shoreline is primarily sand and exposed beachrock, fronted by a shallow fringing reef. An emergent beach rock bench is located about 150 feet offshore, and parallels the shore for a distance of about 1,200 feet north of the project site. The shoreline landward of this feature is known locally as "bathtub beach." The nearshore reef flat is primarily consolidated limestone rock with pockets of sand and rubble. The shoreline is heavily eroded, with all of the shoreline in the vicinity except the project site protected by rock revetment or seawalls, and a rock groin approximately 1,000 feet north of the project site blocks longshore sand transport.

3. GENERAL WAVE AND WATER LEVEL CONDITIONS

The coast is directly exposed to the prevailing tradewind generated seas, as well as partially to directly exposed to large winter season north swell generated by north Pacific storms.

North swell can occur any time during the year, but is largest and most frequent during the winter months of October through March. North swell can approach from the northwest through northeast, but typically the most frequent large swell is from the northwest. These waves refract and diffract around Kahuku Point and approach the project site obliquely. North swell does occasionally approach the site more directly from the north to northeast. The shoreline is protected from direct large wave attack by the wide, shallow fringing reef fronting the shoreline. Large waves break offshore, and then reform and continue shoreward as smaller waves. Wave breaking and reforming may occur several times before the wave finally expends its remaining energy on the shore. The waves reaching the shore are limited by the nearshore water depth, and on a wide and shallow reef typically have a height equal to about 0.6 times the water depth. Winter high tides can be +1.5 to +2 feet above msl, and wave setup along the shore during periods of high surf may add another 0.5 feet to the water level. Assuming a high tide of +1.5 feet, a 0.5-foot wave setup, and a water depth of –3 feet below msl immediately seaward of the offshore emergent limestone bench, wave heights of about three feet can be expected to break on the offshore bench. Wave heights on the beach at the base of the shoreline escarpment would be less than 3 feet. This corresponds to storm waves with an approximate recurrence interval of 10 years. The unprecedented occurrence of a hurricane near the project site could result in higher water levels and larger waves.

The mean tidal range is 1.3 feet and the diurnal range is 2.2 feet at Laie Bay, immediately north of the project site. General tide data for the site is as follows, based on a mean sea level (msl) datum:

mean higher high water	1.3 feet
mean high water	0.7 feet
mean sea level	0.0 feet
mean low water	-0.6 feet
mean lower low water	-0.9 feet

4. DESIGN WAVE HEIGHT AT TOE OF REVETMENT

Site Parameters:

Bottom slope seaward of structure (m): 1v on 50 H

Water depth at structure toe: -1' msl

Stillwater level rise above msl:
Tide (mean higher high water) +1.3' msl
Wave setup +0.5' msl

Total design water depth (d_s) 2.8'

Wave period (T) of shallow water reformed wave on the reef flat: 6 seconds

Wave height (H):
From Ref. A, Figure 7-4:
$d_s / gT^2 = 2.6' / (32.2)(6)^2 = 0.0002$
For m = 1:50, $H / d_s = 1.0$
Therefore, $H = 1.0 (d_s) = 1.0 (2.8') = 2.8'$

5. REVETMENT DESIGN

Graded Riprap Stone Size and Layer Thickness

From Ref. A, eq. 7-116:

$$W_{50} = \frac{W_r H^3}{K_D (S_r - 1)^3 \cot\Theta}$$

Where
W_{50} = Median weight of graded riprap stone
W_r = Unit weight of stone (155 lb/ft^3)
H = Design wave height (2.8')
K_D = Stability Coefficient (2.0 for stone)
S_r = Specific gravity of stone (2.42)
Θ = Angle of structure slope (1.5)

$$W_{50} \quad \frac{155 \text{ lbs} / \text{ft}^3 (2.8')^3}{2 (2.42 - 1)^3 (1.5)} = 400 \text{ lbs, use } 500 \text{ lbs}$$

Stone shall be well graded as follows:

Maximum stone size (100th percentile)	= 4 x W_{50} =	2,000 lbs
Median stone size	=	500 lbs
Minimum stone size	= 0.4 x W_{50} =	200 lbs

From Ref. 1, Eq 7-123:

Layer thickness = (2) $(W_{50} / W_r)^{1/3}$ = 3.0'

Underlayer Stone Size and Layer Thickness

Armor minimum ≤ 5 x underlayer maximum = 200 lbs / 5 = 40 lb
Use 10 to 40 lb stone, 1-foot thick.

Filter Layer – Use geotextile filter fabric.

Crest Elevation – The riprap revetment crest elevation for non-overtopping should be 1.5 to 2 times the design wave height (2.8') above the stillwater level rise (+1.8'), or about +7.4 feet msl. Use +8 feet minimum.

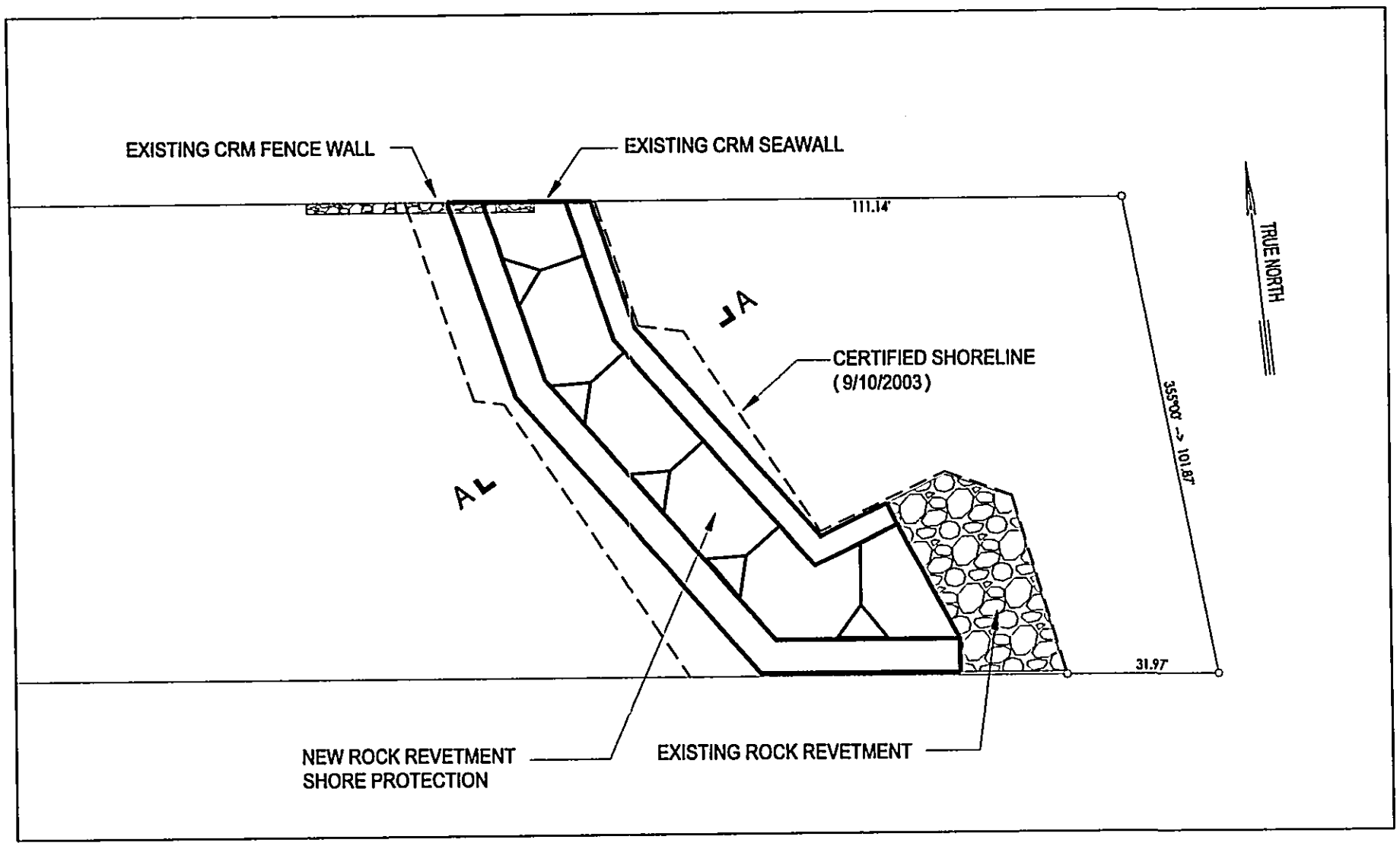
Toe Protection – The existing ground elevation at the toe of the revetment is at an elevation of about +2 ft msl. To protect against possible damage to the revetment due to scour and undercutting of the toe the design includes:

a. Excavation of existing ground to bury the toe at –1' msl, approximately 3 feet or one design wave height below existing grade.

b. The use of a 5-foot wide horizontal toe apron to protect against scour by wave action on the structure.

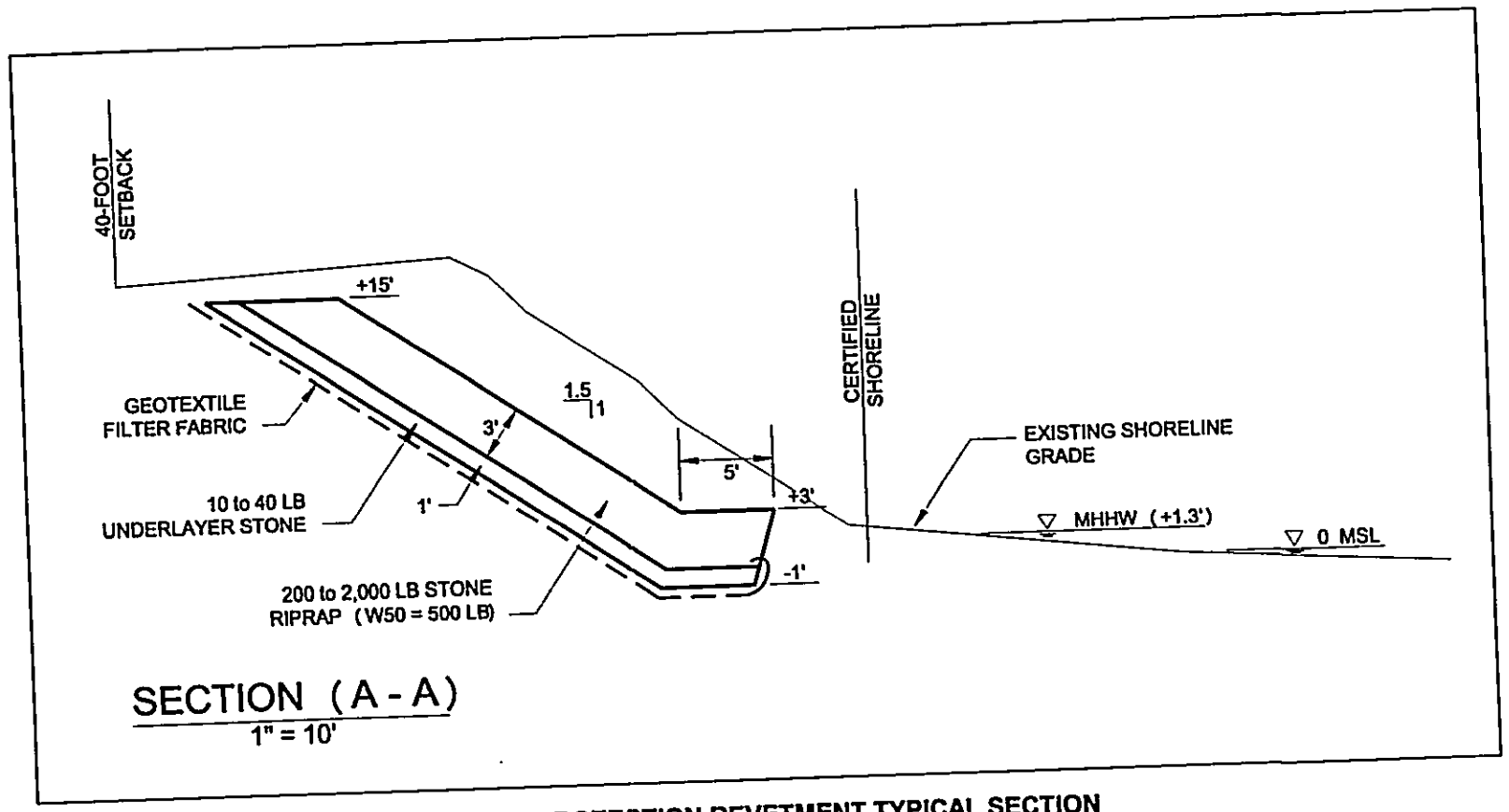
6. PROPOSED REVETMENT PLAN

The revetment would be constructed landward of the September 10, 2003 certified shoreline and approximately 10 feet inland from the intersection of the mean higher high water line (+1.3-foot MSL) at the existing shoreline. Rock riprap with stones weighing 200 to 2,000 pounds (median weight of 500 pounds) would be placed over an underlayer of 10 to 40 pound stone and geotextile filter fabric. The revetment slope would be 1 vertical on 1.5 horizontal. The toe elevation would be –1 foot below mean sea level (MSL) and the crest elevation would be +15 feet MSL. A 5-foot-wide toe apron would be constructed to protect against scour and possible undermining of the revetment toe. A plan view layout drawing and typical cross section of the proposed shore protection are shown on the attached figures.



SHORE PROTECTION PLAN

TMK 5-5-02:5



SHORE PROTECTION REVETMENT TYPICAL SECTION

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