DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

JEREMY HARRIS
MAYOR

PATRICK T. ONISHI
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

95/SV-006(AC)
95-03942(AC)

July 17, 1995

The Honorable Gary Gill, Director
Office of Environmental Quality Control
220 South King Street, 4th Floor
State of Hawaii
Honolulu, Hawaii 96813

Dear Mr. Gill:

CHAPTER 343, HRS
Environmental Assessment/Determination
Negative Declaration

Recorded Owner	:	Mary Stewart Trust
Applicant	:	Mary Stewart Trust
Agent	:	Group 70 International, Inc.
Location	:	68-701 Crozier Drive, Mokuleia, Oahu
Tax Map Key	:	6-8-06: 18 and 19
Request	:	Shoreline Setback Variance
Proposal	:	Reconstruction of a Seawall (After-the-Fact)
Determination	:	A Negative Declaration Is Issued

Attached and incorporated by reference is the Final Environmental Assessment (FEA) prepared by the applicant for the project. Based on the significance criteria outlined in Chapter 200, State Administrative Rules, we have determined that preparation of an Environmental Impact Statement is not required.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the FEA. If you have any questions, please contact Art Challacombe of our staff at 523-4107.

Very truly yours,

PATRICK T. ONISHI
Director of Land Utilization

PTO:am
Enclosures

g:neg95sv6.adc

93

1995-08-08-OA-FEA - After the fact Stewart seawall reconstruction Shoreline Setback Variance

AUG 8 1995

APPLICATION FOR SHORELINE SETBACK VARIANCE AND FINAL ENVIRONMENTAL ASSESSMENT

After-the-Fact Approval of Seawall Reconstruction
68-701 Crozier Drive, Mokuleia, Oahu, HI
TMK (1) 6-8-006:018 & 019

Applicant:

Mary Stewart Trust
Hawaiian Trust Company, Limited as Trustee
Honolulu, HI

Applicant's Agent:

Group 70 International, Inc.
Architecture•Planning•Interiors•Environmental Services
Honolulu, HI

June 1995

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AND
FINAL ENVIRONMENTAL ASSESSMENT

June 1995

After-the-Fact Approval of Seawall Reconstruction
68-701 Crozier Drive, Mokuleia, Oahu, HI
TMK (1) 6-8-006:018 & 019

Overview

After-the-fact approval is being sought for a seawall structure that was reconstructed in 1994 along the shoreline frontage of two lots at 68-701 Crozier Drive, Mokuleia. The structure was reconstructed in the same exact location as a pre-existing concrete seawall, originally built around 1965. In terms of oceanographic processes, the replacement seawall has no different effects than did the pre-existing structure.

(1) Applicant

Mary Stewart Trust
Hawaiian Trust Company, Limited as Trustee
P.O. Box 3170
Honolulu, HI 96802-3170
Richard Kuitunen, Real Estate Officer
(808) 538-4570

(1a) Applicant's Agent

Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, HI 96813-4307
Jeffrey Overton, Chief Environmental Planner
(808) 523-5866 ext. 111

(2) Approving Agency

City and County of Honolulu
Department of Land Utilization
650 South King Street, 7th Floor
Honolulu, HI 96813
Art Challacombe, Environmental Review Branch
(808) 523-4107

(3) Agencies Consulted

City and County of Honolulu, Department of Land Utilization
City and County of Honolulu, Building Department
State of Hawaii, Department of Land and Natural Resources

(4) General Description of the Action's Technical, Economic, Social and Environmental Characteristics

Technical Characteristics. The proposed action involves reconstruction of a seawall along the shoreline frontage at 68-701 Crozier Drive in Mokuleia. The general location of the project site is shown in Figure 1.

The subject seawall is located along the shoreline frontage of two lots totaling 23,310 sq. ft. in area. About 30 percent of the property within these two lots lies makai of the seawall structure, the majority of which is below the high water mark. This provides some indication of past erosion activity since the lots were first subdivided. The parcels are relatively level and improved with two buildings consisting of a single-family residence and garage.

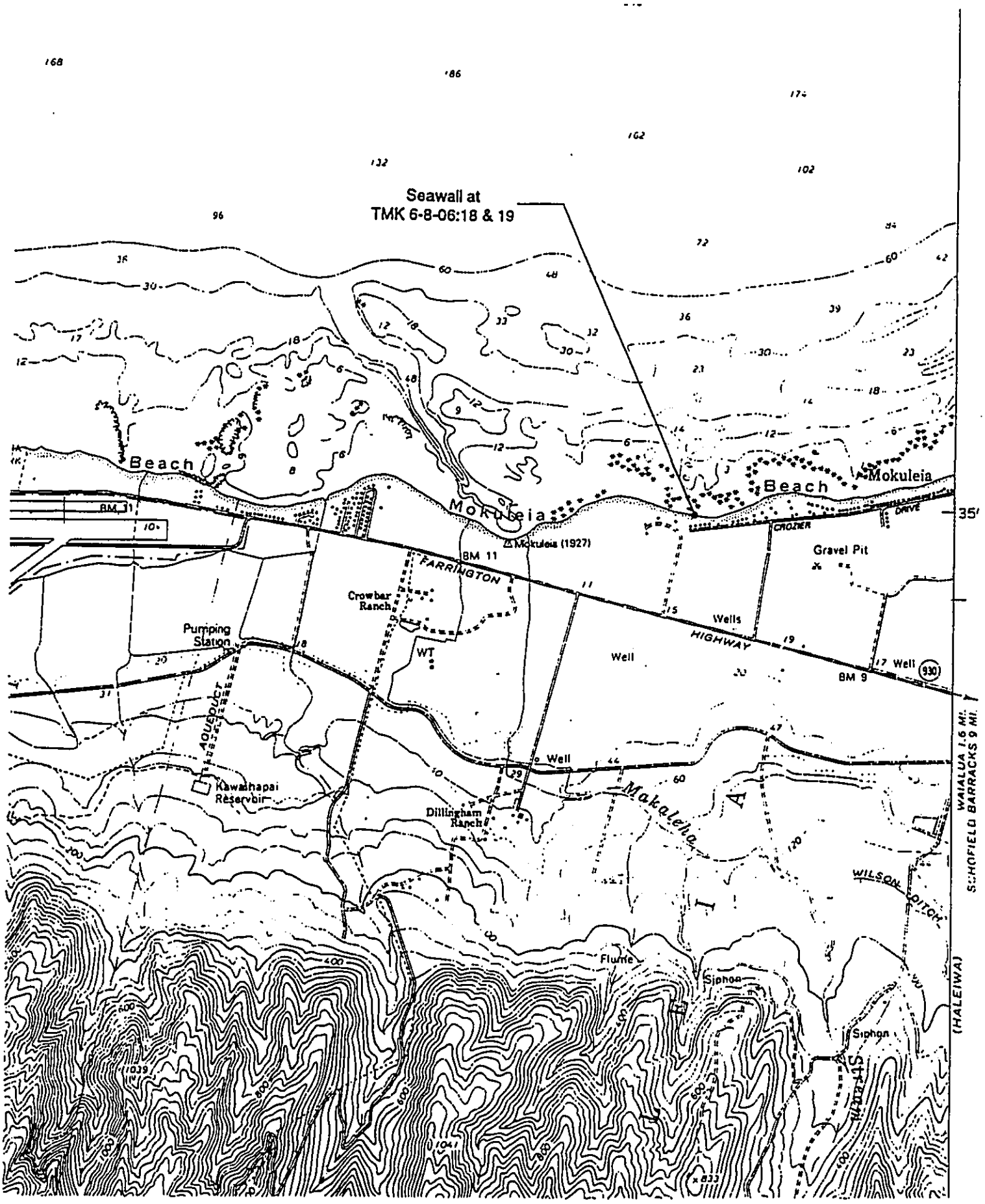
The new seawall has already been reconstructed as a concrete masonry unit (CMU) seawall to replace a partially collapsed pre-existing concrete seawall. The old wall had been in place since around 1965. Deterioration and collapse of one-half of the wall exposed the subject properties to erosion forces during high surf events. The new seawall was constructed without obtaining required County approvals for Shoreline Setback Variance (SSV) and Building Permit. After-the-fact approvals are currently being sought, and this Environmental Assessment is required as part of the SSV application.

Exhibit A includes the Shoreline Survey Map currently being processed for certification by the DLNR. The Certification request was submitted to DLNR by Engineers Surveyors Hawaii on March 2, 1995.

Figure 2 provides site specific details of the wall location and elevation relative to the adjacent beach and residential lots. The new CMU wall spans 108 feet of the shoreline frontage. A portion of the pre-existing seawall was left in place along 35 feet of the western end of the frontage.

Figure 3 shows a cross section of the seawall. Its height ranges from 3.9 to 4.7 feet on the makai side, and 1.6 to 2.7 feet above grade on the mauka side. The new seawall aligns with the timber seawalls fronting each of the adjacent lots. Construction drawings furnished by the contractor, and a re-drawn cross-section of the seawall have been prepared. Twenty copies of the construction plans and re-drawn cross-section are included as Exhibit B.

Exhibit C includes a report completed by Tom Nance Water Resources Engineering (TNWRE)(March 1995). This report provides an oceanographic evaluation of the reconstructed seawall and color photographs. An evaluation of the seawall's structural stability has been completed by Structural Analysis Group, and is also included with the TNWRE report. Materials used in the seawall reconstruction are also described in these reports.



Scale: 1" = 2000'

Source: TNWRE (March 1995)

Figure 1

Location of TMK 6-8-06:18 & 19
Along Crozier Drive in Mokuleia

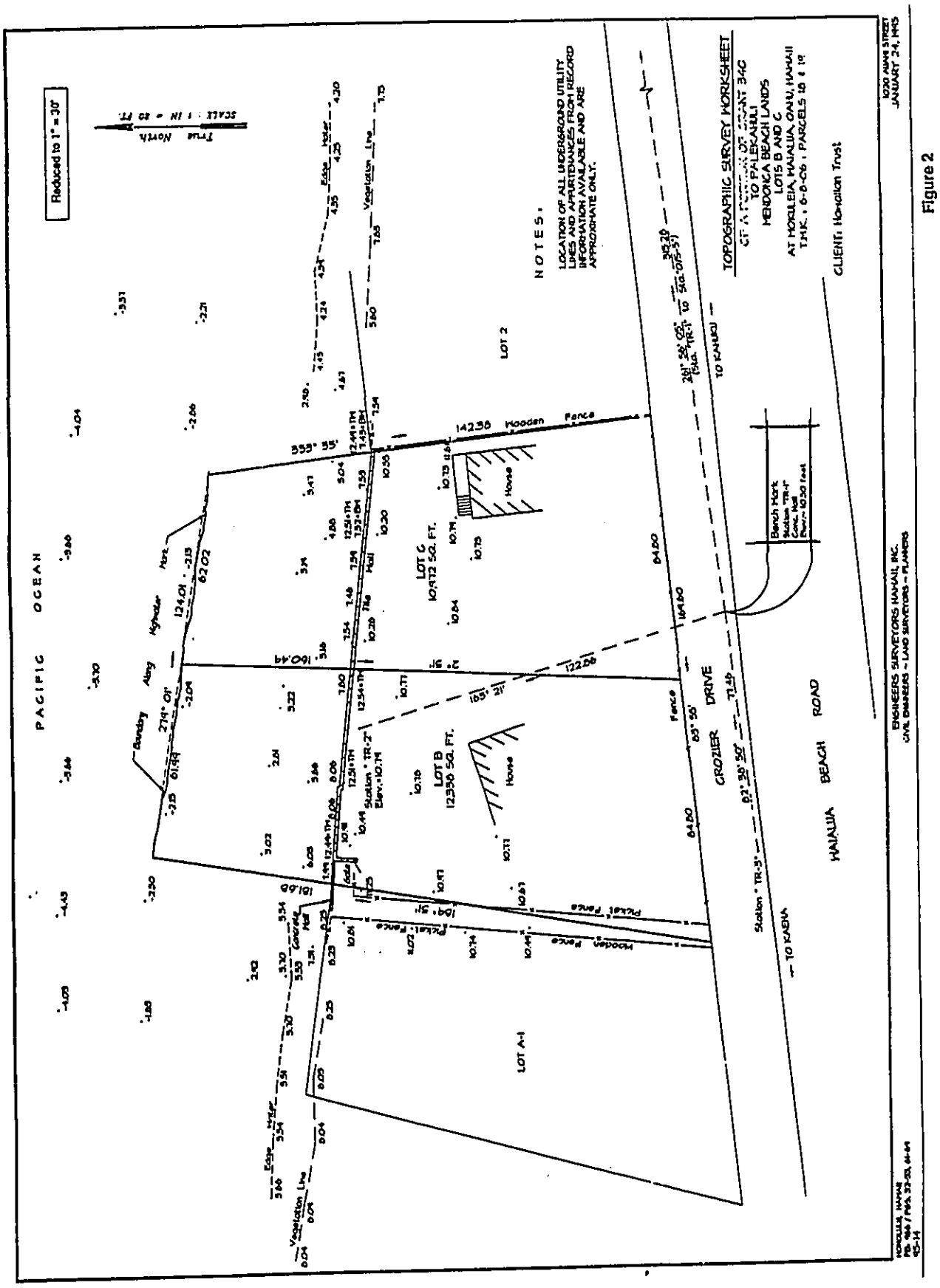
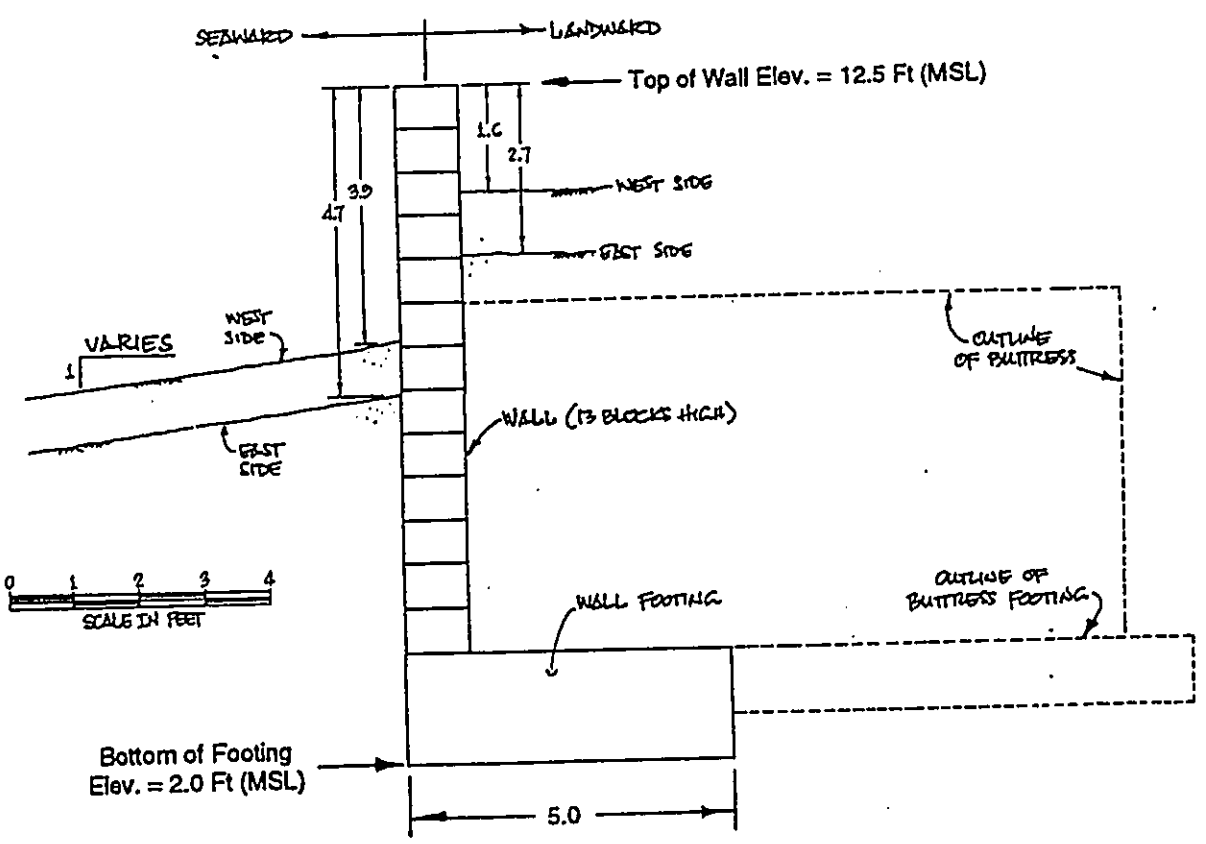


Figure 2

Topographic Survey of TMK 6-8-06:18 & 19



Source: TNWRE (March 1995)

Figure 3

Cross Section of the Retaining Wall Redrawn From Contractor-Furnished Plans

Socio-Economic Characteristics. The total construction cost for the seawall was approximately $45,000. Construction of the seawall was completed by a North Shore-based construction company, Wasco Builders. There are no economic impacts on the immediate community or the community at large.

Without the new wall, further erosion of the shoreline frontage during high surf events could ultimately resulting in damage to the existing residential structures. The property owner could potentially lose the value of a portion of their land and improvements if the wall was not reconstructed. The proposed action was undertaken to protect these assets.

Environmental Characteristics. The seawall was reconstructed in place of an old seawall that has existed at this location since 1965. The old seawall was constructed of concrete, and the new wall is made of CMU block. The new wall is approximately 8 in. higher than the old wall. Photographs from 1969 and 1980 showed naupaka (sea grape) bushes growing along the mauka side and hanging over the top. The owner intends to plant naupaka once again along the mauka side of the wall to return its former aesthetic quality.

The oceanographic study completed by TNWRE (Exhibit C) evaluates the potential for erosion caused by the replacement of this seawall structure. The study shows that the beach structure and sand movement will not be changed from its former condition. Erosion of the adjacent beach areas is not expected to be accelerated by the presence of this structure. Without the new seawall, erosion along the seaward frontage of the two subject properties would likely occur, possibly threatening the residential structures.

Construction activities associated with the new seawall caused no adverse effects to ocean water quality. Fill material and construction activities were limited to areas above high water. No long-term effects to water quality are anticipated.

(5) Summary Description of the Affected Environment.

Soils on this parcel are sandy and well-drained. Excavation for the wall found all subsurface material to be clean, coarse-grained calcareous beach sand. Vegetation on this site primarily consists of introduced landscaping including Bermuda grass, several coconut palms, hibiscus and other ornamental plants. Years ago, the previous wall had naupaka growing along the mauka side. There are no known significant habitat areas for either terrestrial or aquatic flora or fauna directly found at the project site.

Beach and offshore conditions are summarized in this section, based on the detailed assessment provided in TNWRE (March 1995)(Exhibit C).

Adjacent to the seawall is the coastal nearshore environment off Mokuleia. The nearshore area has very good water quality, with bottom cover comprised of dead

coral, coralline algae and cemented sand. This is typical of the nearshore area, extending offshore about 2,000 feet where the reef drops into deeper waters.

The beach along this section of Mokuleia is crescent shaped, extending a distance of 2,650 feet between the headlands. Offshore bathymetry is shown in Figure 4. The offshore bathymetry indicates generally shoal conditions, particularly off the headlands. A popular surfing reef called Silva's Channel is located 2,000 feet offshore.

The reef limits the amount of wave energy which is allowed to reach the beach. Slightly deeper water in the center of the bay allows for waves with greater energy, which maintains the crescent shape of this embayment. There is a typical seasonal effect experienced at this beach, with a winter retreat and summer accretion of the beach.

Sea Engineering (1988) examined the historical movement of the vegetation line at two nearby locations from 1958 to 1988. This study showed a net retreat of the vegetation of 16 feet in the area 600 feet west of the subject seawall, and no vegetation retreat in the area 1,200 feet to the east (headlands area).

Review of historical aerial photographs from May 1971 to July 1992 verified that some retreat of the vegetation line has occurred in the western portion of the crescent beach. The center of the beach has clearly been stabilized by 700 feet of continuous seawall. A beach house three lots to the west of the subject seawall has portions of its foundation undermined, and ironwood trees along the western shore now have exposed roots.

(6) Identification and Summary of Major Impacts and Alternatives Considered

Potential Short-term Impacts. The reconstruction of the seawall along the frontage of these two lots could have some minor short-term effects on vegetation, water quality and noise conditions. Some landscaping vegetation (grass and bushes) will be removed by the construction activity, which will be replanted following construction. During construction, there is always the potential for soils to erode from the upland area and cause silt runoff to ocean waters. Soils were protected to avoid runoff to the ocean. Lastly, construction noise may have been noticeable to residents at neighboring properties. Construction activity took place during allowed daytime periods for construction and did not cause excessive noise levels off-site.

Potential Long-term Impacts.

Shoreline Processes. The effect of the seawall can be viewed in several ways. First, the effect of the new wall can be compared to the one it replaced. Second, the effect of any wall in this location can be considered, given that there are existing walls on adjacent properties to the east and west. Last, the effect of having any seawalls along this beach is considered, including the subject seawall, as part of a continuous 700-foot wall.

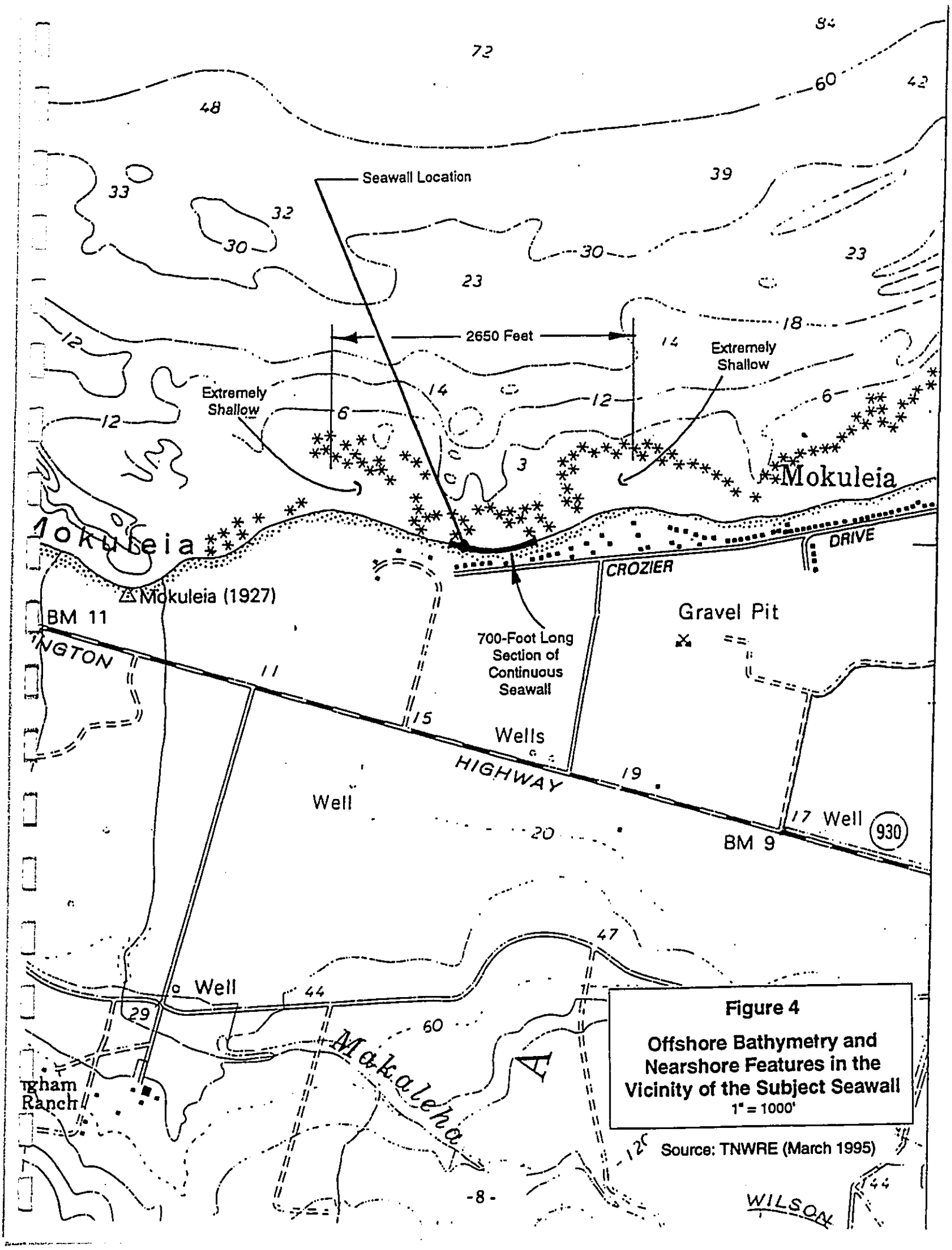


Figure 4

Offshore Bathymetry and Nearshore Features in the Vicinity of the Subject Seawall

1" = 1000'

Source: TNWRE (March 1995)

(7) Proposed Mitigative Measures

Several mitigative measures have been taken and are proposed to reduce or eliminate the potential impacts of the seawall reconstruction at the subject lots.

Best Management Practices. Water quality was protected during construction of the seawall. Measures were taken during the construction activities to avoid erosion and silt runoff to surface water in the ocean. Soils on the mauka side of the seawall were stabilized to prevent silt runoff to the beach and ocean water.

Aesthetic Effects. The new CMU seawall has been reconstructed in the same place as the previous wall. Its height is approximately 8 inches higher than the previous wall. Removal of this upper course of CMU block and rebar would likely reduce the structural stability of the wall.

The owner has agreed to plant new naupaka bushes along the mauka side of the new wall and maintain them so they grow over the top of the wall. This will essentially re-create the previous visual conditions at this site, nullifying any potential aesthetic change resulting from the reconstruction of the seawall.

(8) Alternatives to the Proposed Action & Evaluation of Hardship

There are several issues which must be considered in the evaluation of hardship for the Mary Stewart Trust application for Shoreline Setback Variance. Three alternative approaches are possible at this time, including:

(a) No-action alternative - remove the reconstructed vertical seawall,
(b) Remove the vertical seawall and construction of a sloping revetment, or
(c) Leave the reconstructed vertical seawall in place with modifications.

These options are discussed individually in terms of their potential impacts, including hardship to the applicant.

(a) No action - Remove reconstructed vertical seawall

The no-action scenario would involve removal of the new CMU seawall and leaving the shoreline frontage of these two lots unprotected. This action would expose the property to storm wave erosion, causing the makai 15 to 20 feet of the property to assume the slope of the existing beach. The residence and garage on the site would potentially be exposed to storm wave run-up.

Timber seawall structures fronting parcels on either side of the subject lots could also potentially be back-cut by the erosional activity. The no-action alternative would potentially cause damage and property loss to the two subject lots, and is not considered feasible. As well, the historical setting of these two lots sometime since around 1965 has included a vertical seawall aligned with the adjacent seawall.

(b) Remove vertical seawall in place of a sloping rock revetment

The placement of a sloping revetment structure could potentially be undertaken at this site. It would require removal of the reconstructed vertical seawall structure. The DLU's policy is to recommend sloping revetments because they tend to dissipate rather than reflect wave energy.

A sloped revetment would, however, require the existing seawall to be removed and involve placement of approx. 2 ft. diameter stones on a 2:1 slope. The sub-grade base of the sloped revetment would be at the certified shoreline, aligned with the adjacent property's seawalls on both sides. The top of wall elevation would be 12.5 ft (msl). Refer to the attached cross-section and plan views in Figure 5 and 6, respectively.

A sloped revetment would extend at least 22.5 feet mauka into the usable portion of this property. This would place the edge of the revetment very close to the existing structures -- approximately 15 feet makai of the existing residence, and only 5 feet makai of the garage structure. There are several impacts that would directly result from the construction of a sloped revetment at this location. One of these would be the loss of usable land on these two lots. The other is the significant increased risk of wave run-up overtopping the seawall and damaging the house or garage.

The usable land area lost from construction of the revetment is estimated at 3,250 sq. ft. This property has an estimated real estate market value of approximately $43 per sq. ft. The loss of land value related to the revetment amounts to nearly $140,000. Over 7,000 sq. ft. of land was lost to erosion of this property prior to construction of the pre-existing seawall around 1965. In addition, the owner has already spent $45,000 to reconstruct the vertical seawall. Demolition of this structure would cost in the area of $10,000 to 15,000. The cost to build a new rock revetment would be in the area of $50,000. In terms of lost land value and construction expenditures, the total cost to implement the sloped revetment alternative would exceed $250,000.

Wave runup and overtopping of the sloped revetment during storm conditions and heavy winter surf would directly affect the existing structures on this property. The existing structures are only 5 to 15 feet inland of the revetment. It would also cause damage to the landscaping plantings in the makai portion of the lot.

Wash-up of storm waves would affect the adjoining lots unless protective measures were taken along the first 25 feet of the two side yard boundaries. These owners would need to protect their properties from side yard erosion by extending their walls.

Constructing the revetment would only add economic hardship to the owner. The owner would have to demolish and reconstruct a shore protection structure. They would lose about 3,250 sq. ft. of usable land area on the two lots. The neighbors would incur costs to protect their property side yards. The protection offered by the sloped revetment would actually be less than the vertical seawall, with wave run-up expected to adversely affect the existing structures and yard area.

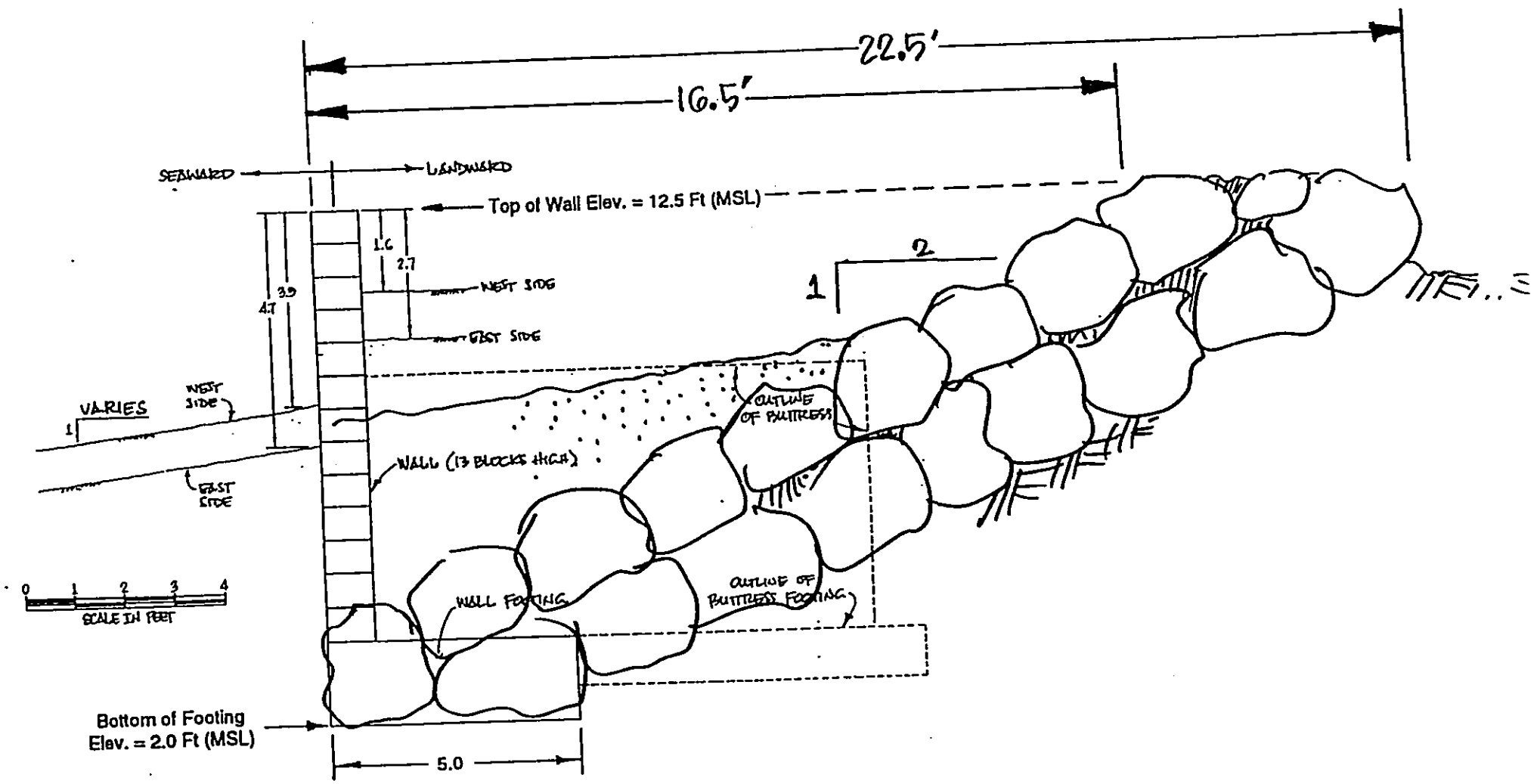


Figure 5

Cross-Section of Sloping Revetment

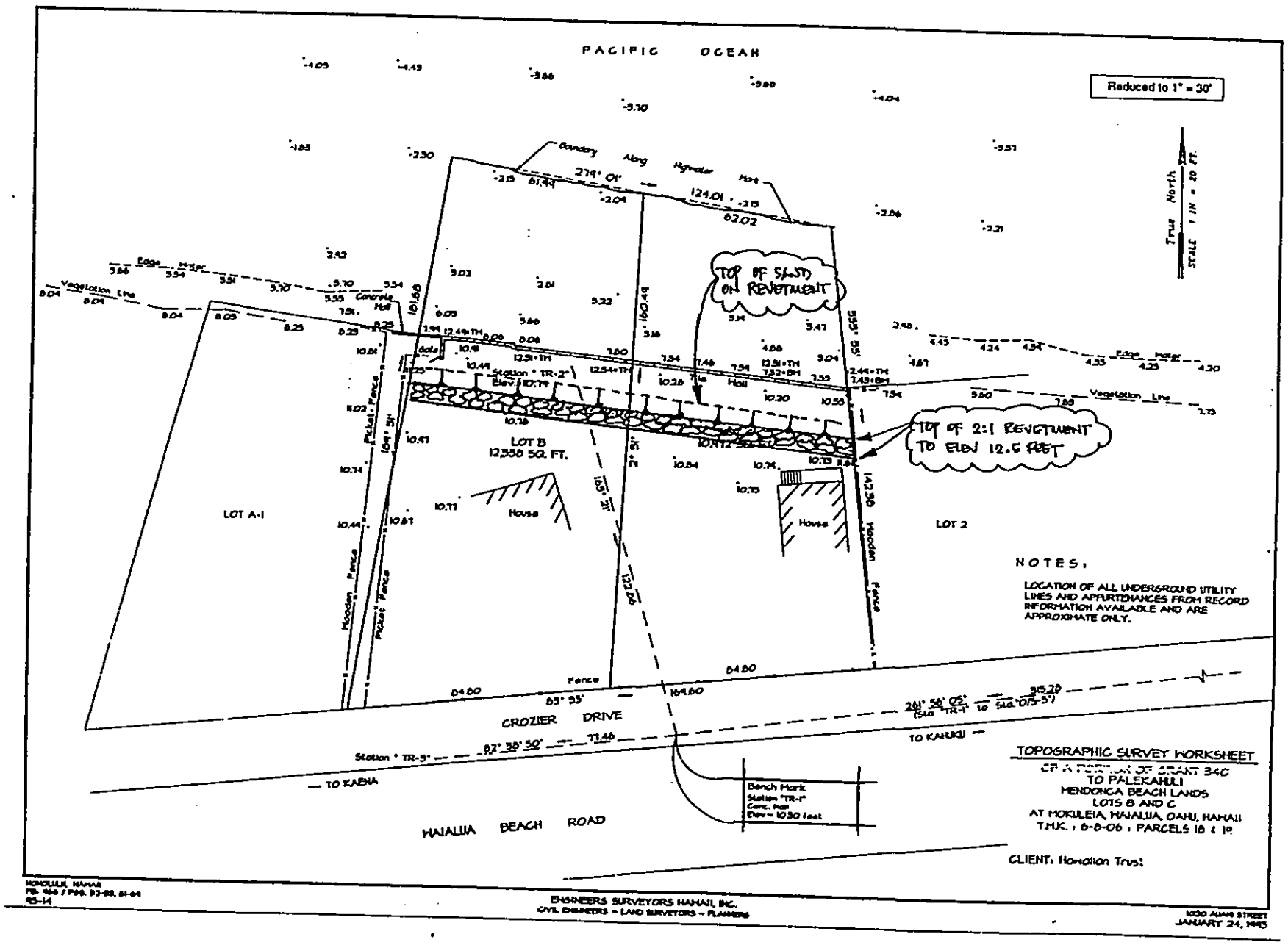


Figure 6

Sloping Revetment Plan View

(c) Leave reconstructed vertical seawall in place with modifications

The subject seawall structure at 68-701 Crozier Drive, Mokuleia, was reconstructed in the same exact location as a pre-existing concrete seawall, originally built around 1965. The proposed action is reasonable when compared with other alternatives at this location. In terms of beach stability, the replacement seawall is no different than the pre-existing structure. The subject seawall is part of a continuous line of seawalls that have stabilized the center of this beach.

The structural evaluation of the reconstructed wall finds that it is structurally stable. The reconstructed wall will not cause any change in the beach dynamics as compared to pre-existing conditions. The landowner would necessarily experience hardship if the seawall was not reconstructed, with loss of property and potential damage to residential structures. For these reasons, and based on the documentation provided, this landowner requests approval of a variance from the shoreline setback ordinance.

As recommended by the DLU staff, the owners have agreed to modify the wall structure to remove the nine CMU columns (40 in. tall - five block courses) placed along the top of the wall. Plantings of naupaka bushes will be made along the inland side of the wall, to allow plant growth to eventually cover the top of the wall. This will re-create the pre-existing condition shown in photos from the late 1960's.

Conclusion

The subject seawall structure at 68-701 Crozier Drive, Mokuleia, was reconstructed in the same exact location as a pre-existing concrete seawall, originally built around 1965. The findings of this Environmental Assessment indicate that no significant environmental impacts are associated with this action. The proposed action is found to be a reasonable activity when considering other possible alternative actions at this location. In terms of oceanographic processes, the replacement seawall has no different effects than did the pre-existing structure. The preparers of this assessment recommend that a Negative Declaration be issued for this action.

The structural evaluation of the reconstructed wall finds that the subject wall is structurally stable. The reconstructed wall will not cause any change in the beach dynamics as compared to pre-existing conditions. The landowner would necessarily experience hardship if the seawall was not reconstructed, with a likely loss of property and potential damage to residential structures. For these reasons, and based on the documentation provided, this landowner requests approval of a variance from the shoreline setback ordinance.

APPLICATION FOR SHORELINE SETBACK VARIANCE AND
FINAL ENVIRONMENTAL ASSESSMENT
Reconstructed Seawall at 68-701 Crozier Drive, Mokuleia

COMMENT LETTERS AND RESPONSES

95-03361

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

Planning Division

June 5, 1995

'95 JUN 7 PM 2 22

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

Mr. Patrick T. Onishi, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Onishi:

Thank you for the opportunity to review and comment on the Application for a Shoreline Setback Variance and Draft Environmental Assessment for the After-the-Fact Approval of a Seawall Reconstruction located at Mokuleia, Oahu (TMK 6-8-6: 18 and 19). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. A DA permit will be required for this action. Please contact Ms. Kathy Dadey of our Regulatory Branch for further information at 438-9258 (extension 15).

b. According to the enclosed Federal Emergency Management Agency's Flood Insurance Rate Map, panel number 150001 0040B (dated September 4, 1987), the project site is located in Zone AE (areas inundated by the 100-year flood with a base flood elevation of 14 feet above mean sea level). Should you require additional information regarding the flood hazard determination, please contact Ms. Jessie Dobinchick of my planning staff at 438-2883.

Sincerely,

Ray H. Jyo, P.E.
Director of Engineering

Enclosure

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

- Flood Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet*
- (D) — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*
- RM7X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY AND COUNTY OF
HONOLULU,
HAWAII

PANEL 40 OF 135
(SEE MAP INDEX FOR PANELS NOT PRINTED)

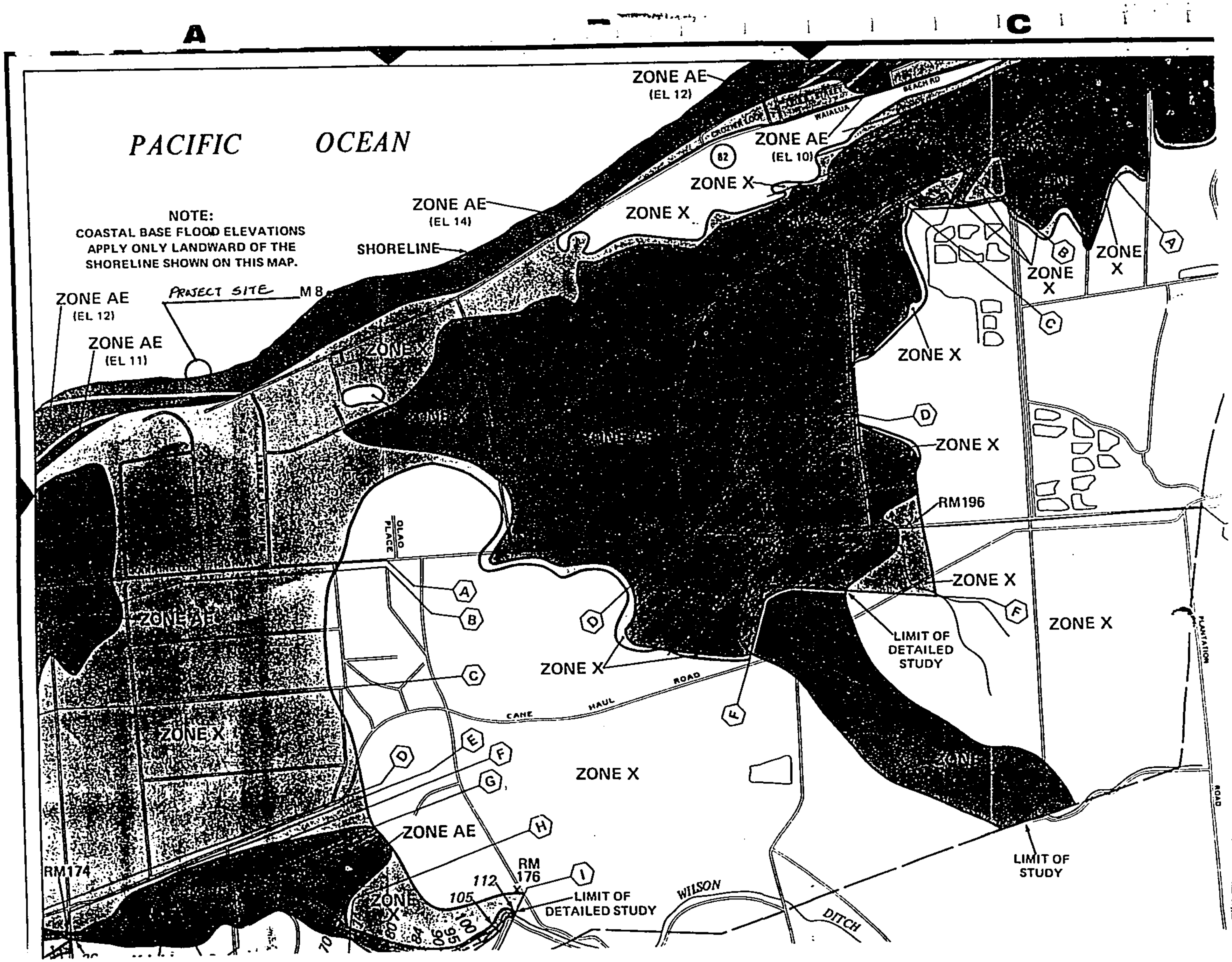
PANEL LOCATION

COMMUNITY-PANEL NUMBER
150001 0040 B

MAP REVISED:
SEPTEMBER 4, 1987

Federal Emergency Management Agency

CUSTOMER COPY


A
C
PACIFIC OCEAN
NOTE:
COASTAL BASE FLOOD ELEVATIONS APPLY ONLY LANDWARD OF THE SHORELINE SHOWN ON THIS MAP.
PROJECT SITE
M8
ZONE AE (EL 12)
ZONE AE (EL 11)
ZONE AE (EL 14)
SHORELINE
ZONE AE (EL 10)
ZONE X
ZONE AE
RM196
RM174
RM 176
LIMIT OF DETAILED STUDY
LIMIT OF STUDY
OLAO PLACE
CANE HAUL ROAD
WILSON DITCH
PLANTATION ROAD
BEACH RD
WAIALUA
82
112
105
100
95
90

GROUP 70
INTERNATIONAL

30 June 1995

Department of the Army
U. S. Army Engineer District, Honolulu
Ft. Shafter, Hawaii 96858-5440

Attention: Ray H. Jyo, P. E., Director of Engineering

Subject: **Mary Stewart Trust , Mokuleia, Oahu**
Response to Comments on Draft Environmental Assessment (EA)

Dear Mr. Jyo:

Thank you for providing comments on the Draft EA for the seawall reconstruction at the Stewart Trust property at Mokuleia. On behalf of the applicant, we have prepared this response to comments included in your letter to Mr. Patrick T. Onishi, dated June 5, 1995.

Our office has had follow-up discussions with Kathy Dadey of your Regulatory Branch. The project only involves activities which are inland of the certified shoreline and high-water mark. For this reason, we do not believe this activity requires a DA permit from the US Army Engineer District, Honolulu.

The information provided regarding the FEMA flood map for this property is appreciated. No new structures are currently planned on these lots.

We thank you for your comments. Please contact me if you have any further comments or questions.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

Group 70 International, Inc. • Architecture • Planning • Interior Design • Environmental Services
925 Bethel Street, Fifth Floor • Honolulu, Hawaii 96813-4307 • Phone (808) 523-5866 • FAX (808) 523-5874

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

Regulatory Branch

28 June 1995

RECEIVED
JUL 5 1995
GROUP 70

Mr. Jeffrey Overton
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, HI 96813

Dear Mr. Overton:

This is to inform you that we have reviewed the information you faxed to this office on June 28, 1995 regarding the after-the-fact seawall reconstruction at TMK 6-8-6: 18 and 19 in Mokuleia, Oahu. The faxed information indicates that the seawall toe is at the certified shoreline, which is above the high tide line and therefore not in navigable waters of the United States; a Department of Army permit is not required.

File Number NP95-089 has been assigned to this project. Please refer to this number in any future correspondence. If you have further questions regarding this matter, feel free to me at 438-9258 extension 15.

Sincerely,

Kathleen A. Dadey
Environmental Engineer

95-03022

BENJAMIN J. CAYETANO
GOVERNOR

'95 MAY 23 AM 10 11

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-2452

May 17, 1995

Mr. Patrick K. Onishi, Director
Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813

Attention: Art Challacombe

Dear Mr. Onishi:

Subject: Draft Environmental Assessment for (Mary) Stewart Trust Reconstruction of Seawall (after-the-fact), Mokuleia, Oahu, TMK 6-8-6: 18 & 19

Our policy is to recommend that seawalls not be constructed. We further recommend that this seawall be removed and replaced with a properly constructed revetment, if needed to protect the residential property. Such revetment should be constructed completely within the owner's property boundary following the strictest guidelines established by the City and County of Honolulu.

We also recommend that you consult the Department of Land and Natural Resources, Land Management Division, and include their comments in the Final Environmental Assessment.

If you have any questions, please call Nancy Heinrich at 586-4185.

Sincerely,

GARY GILL
Director

GG/NH:kk

c: Jeffrey Overton, Group 70 International

GROUP 70
INTERNATIONAL

Francis S. Oda, AIA, AICP
Norman G. Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Robert K.L. Wong, AIA
Hitoshi Hida, AIA
Roy H. Nihei, AIA, CSI
James I. Nishimoto, AIA
Ralph E. Portmore, AICP
Stephen H. Yuen, AIA

Paul P. Chorney, AIA
Dean H. Kitamura, AIA
Norma J. Scott, AIA
Stephen E. Callo, CPA
Walter R. Bell, AIA, CSI, CCS
Walter K. Muraoka
George I. Atta, AICP
Jeffrey H. Overton, AICP
Michael A. Garni
Eric G. Crispin, AIA
Linda L. Chung, AIA
Janet M. Bucholdt
Ronald L. Proctor
Charles F. Schriever, AIA
Teresa P. Davidson, AIA
Kathryn A. Tsukano
Roy A. Inouye
Mary J. O'Leary

30 June 1995

State of Hawaii
Office of Environmental Quality Control
220 South King Street, Fourth Floor
Honolulu, HI 96813

Attention: Mr. Gary Gill, Director

Subject: **Mary Stewart Trust , Mokuleia, Oahu**
Response to Comments on Draft Environmental Assessment (EA)

Director Gill:

Thank you for providing comments on the Draft EA for the seawall re-construction at the Stewart Trust property at Mokuleia. On behalf of the applicant, we have prepared this response to comments included in your letter to Mr. Patrick Onishi, dated May 17, 1995.

Based on your comments, we understand that OEQC has a policy that seawalls not be constructed. Your recommendation in this situation is for the owner to remove the re-constructed seawall and replace it with a sloped revetment. As you are probably aware, each shoreline situation is unique and alternatives to the vertical seawall at this location have been carefully assessed in the EA.

There has been a vertical seawall at this location for about 30 years. This particular seawall is part of a continuous line of vertical seawall extending along 700 feet that have stabilized the center of the beach in this area of Mokuleia. The Sea Engineering (1989) beach studies completed for the Department of Land Utilization verify this trend. The re-constructed seawall is aligned with the adjoining vertical seawalls fronting the neighboring properties on both sides. It represents a continuation of a pre-existing condition with 30 years of history. In terms of beach stability in this particular situation, the oceanographic analysis found the replacement seawall is no different that the pre-existing structure.

If the sloped revetment option is required at this time, the owner will endure significant hardship with loss of property and potential damage to residential structures without creating any public gain or environmental benefit. In comparison to the vertical seawall at this location, there would be no substantial difference or benefit to beach conditions resulting from a sloped revetment. The protection offered by the sloped revetment would actually be less than the vertical seawall, with a significant increased risk of wave run-up over-topping the revetment and damaging the residential structures. In

addition, there would be lost land value and major construction expenditures. The total cost to implement the revetment alternative would exceed $250,000.

As professionals, we concur with your general policy intent to avoid the construction of vertical seawalls along Hawaii's shoreline. In this unique situation, there is no potential adverse impact associated with continuing the pre-existing condition which has stabilized this beach for the past 30 years.

We thank you for your comments. Please contact me if you have any further comments or questions.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

June 22,1995
EA:0119

Mr. Art Challacombe
City and County of Honolulu
Department of Land Utilization
650 South King street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Challacombe:

Draft Environmental Assessment
Seawall (After-the-Fact)
68-701 Crozier Drive (TMK:6-8-06:18 & 19)
Mokuleia, Waialua, Oahu

The Mary Stewart Trust requests an after-the-fact approval for the reconstruction of a 130-foot long seawall fronting Mokuleia. The seawall has been reconstructed to replace a partially collapsed pre-existing concrete seawall. The new wall, which has been constructed as a concrete masonry unit, ranges in height from 3.9 to 4.7 feet and aligns with adjacent seawalls.

We reviewed this Draft Envrionmental Assessment (EA) with the assistance of Charles Fletcher, Geology and Geophysics: and Paul Berkowitz of the Environmental Center.

Shorline Survey

Exhibit A, the Shoreline Survey Map, defines two separate shorelines: one along what is referred to as a "highwater mark" and one following along the toe of the wall. This map apparently has been taken as the basis of Figure 2, "Topographic Survey of TMK 6-8-06:18 & 19," which includes a third shoreline marking labeled "Edge water" appearing on adjacent parcels. The presentation of these three somewhat ambiguous shorelines is confusing.

The presumption implied in this diagram and stated explicitly in the second paragraph of Page 2 is that beach area makai of the seawall (labeled "EROSION" in the map) is part of the subject property. However, the definition of a shoreline provides a regulatory and not a property boundary, in that the defined shoreline separates lands which are under county jurisdiction from those under state jurisdiction. The issue of seaward property

boundaries, particularly along coastlines which fluctuate over variable intervals, is not fully settled, although it has been extensively addressed by the Hawaii State Supreme Court [e.g., Ashford, 50 Haw 314 (1968); Sotomura, 55 Haw 176 (1973); and Sanborn, 57 Haw 585 (1977).] The delineation in Figure 2 of the boundary along the highwater mark presumably reflects a prior shoreline, since it appears considerably makai of the "edge water" lines drawn along adjacent parcels. In view of definitive relevance of the water's edge to boundary determinations, it would be helpful to resolve the shoreline ambiguities which this figure contains.

Inadequate Planning

Requests for after-the-fact approval often are an indication of inadequate planning or design. As stated in the EA, the Mokuleia shoreline has undergone a long-term retreat and erosion due to large winter storm waves. Two obvious questions come to mind: (1) why were the coastal dunes (a natural buffer and an excellent means of protection) graded in the first place, and (2) why were houses placed in such close proximity to an eroding coastline.

More Appropriate Options

As an alternative to perpetuating the seawall tradition which results in loss of beaches and a continued struggle against erosion, more creative, environmentally benign solutions need to be adopted. In a 1992 document written for the Office of State Planning, Charles Fletcher and Dennis Hwang describe the process of setting up Beach Management Districts. The Mokuleia area represents an ideal location for a demonstration of such a technique. To implement this strategy, the State and County could meet with the owners of shoreline properties to negotiate economic, tax, and infrastructure incentives to tear down existing seawalls. In their place, a dune restoration project could be undertaken which would mimic the coastline's former topography. Where necessary, houses could be set back through engineering solutions. Since this type of solution has not beem implemented before in Hawaii, the project could be considered a demonstration project and could possibly gain partial funding from the State and County.

Conclusion

The State of Hawaii is far behind other coastal states which have recongnized that seawalls are an inappropriate short-term solution to coastal erosion. Some states such as North Carolina have enacted legislation to prevent the construction of new seawalls. In the long run, more environmentally benign alternatives such as structure relocation and dune restoration

represent the way of the future. Before any future actions are taken, these concepts should be considered.

Thank you for the opportunity to review the Draft EA.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Mary Stewart Trust
Group 70 International, Inc.✓
Roger Fujioka
Charles Fletcher
Paul Berkowitz

GROUP 70
INTERNATIONAL

Francis S. Oda, AIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Robert K.L. Wong, AIA
Hitoshi Hida, AIA
Roy H. Nihei, AIA, CSI
James I. Nishimoto, AIA
Ralph E. Portmore, AICP
Stephen H. Yuen, AIA
Paul P. Chorney, AIA
Dean H. Kitamura, AIA
Norma J. Scott, AIA
Stephen E. Callo, CPA
Walter R. Bell, AIA, CSI, CCS
Walter K. Muraoka
George I. Atta, AICP
Jeffrey H. Overton, AICP
Michael A. Garni
Eric G. Crispin, AIA
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Janet M. Bucholdt
Ronald L. Proctor
Charles F. Schriever, AIA
Teresa P. Davidson, AIA
Kathryn A. Tsukano
Roy A. Inouye
Mary J. O'Leary

30 June 1995

University of Hawaii at Manoa
Environmental Center
Crawford 317, 2550 Campus Road
Honolulu, HI 96822

Attention: Mr. John T. Harrison, Environmental Coordinator

Subject: **Mary Stewart Trust , Mokuleia, Oahu**
Response to Comments on Draft Environmental Assessment (EA)

Dear Mr. Harrison:

Thank you for providing comments on the Draft EA for the seawall reconstruction at the Stewart Trust property at Mokuleia. On behalf of the applicant, we have prepared this response to comments included in your letter to Mr. Art Challacombe, dated June 22, 1995.

Shoreline Survey. We understand the confusion regarding the edge of water labels in Figure 2, which is a topographic survey worksheet prepared by Engineers Surveyors Hawaii, Inc.. The State uses the certified highwater mark as a regulatory line for setback purposes. In this case, the Certified Shoreline is found at the makai toe of the reconstructed seawall. Even though the seaward portions of these lots are underwater, it is accurate and proper for the surveyor to show on their maps the recorded seaward boundary of the property as documented at the Bureau of Conveyances. The current edge of water on these lots corresponds with the lines shown for the adjoining properties.

Planning and Design. This section of the Mokuleia shore has been stabilized by a 700 foot long vertical seawall, which has been in place for about 30 years. We are not certain of all causes for the loss of shoreline property in this area. Was it due to natural erosion of the coast, grading of the coastal dunes, or some combination of these actions? The placement of homes close to this eroding shoreline was allowed by City land use authorities earlier in this century. Residential land uses on shoreline properties will continue unless the State and City develop new legislation and administrative policies to restrict or remove development rights from coastal landowners.

Dune Restoration Project. Your idea for a dune restoration project is an interesting concept. It would bring back much of the land lost to our client and neighboring landowners. The cost to this handful of landowners to implement such a project would probably not be feasible without substantial government subsidy, which is unlikely under the current fiscal crisis.

As professionals, we concur with your general intent to avoid the construction of vertical seawalls along Hawaii's shoreline. In this unique situation, there is no potential adverse impact associated with continuing the pre-existing condition which has stabilized this beach for the past 30 years.

We thank you for your comments. Please contact me if you have any further comments or questions.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

95-03023

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIIKE
DIRECTOR OF HEALTH

'95 MAY 23 AM 10 11
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLUL

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:

May 16, 1995

95-066/epo

Mr. Patrick Onishi
Director, Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Onishi:

Subject: Environmental Assessment, Chapter 343, HRS
Project within the Shoreline Setback

Project Name: Makuleia Seawall
Location : 68-701 Crozier Drive
Mokuleia, Oahu
TMK: : 6-8-06: 18 and 19

Thank you for allowing us to review and comment on the application for after-the-fact approval of the subject seawall construction. We do not have any comments to offer at this time.

Sincerely,

Lawrence Miike
Director of Health

95-03335

PLANNING DEPARTMENT

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

'95 JUN 6 PM 2 22

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

JEREMY HARRIS
MAYOR

CHERYL D. SOON
CHIEF PLANNING OFFICER

CAROLL TAKAHASHI
DEPUTY CHIEF PLANNING OFFICER

LW 05/95-0950

June 6, 1995

MEMORANDUM

TO: PATRICK T. ONISHI, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: CHERYL D. SOON, CHIEF PLANNING OFFICER
PLANNING DEPARTMENT

SUBJECT: APPLICATION FOR SHORELINE SETBACK VARIANCE AND DRAFT ENVIRONMENTAL ASSESSMENT FOR MOKULEIA SEAWALL AT 68-701 CROZIER DRIVE, TMK 6-8-6: 18 AND 19

We have reviewed the subject proposal and have no comments to offer at this time.

Should you have any questions, please contact Lin Wong of our staff at extension 4485.

Cheryl D. Soon

CHERYL D. SOON
Chief Planning Officer

CDS:js

95-02999

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

'95 MAY 22 PM 3 16

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

JEREMY HARRIS
MAYOR

KENNETH E. SPRAGUE
DIRECTOR AND CHIEF ENGINEER

DARWIN J. HAMAMOTO
DEPUTY DIRECTOR

ENV 95-166

May 22, 1995

MEMORANDUM:

TO: PATRICK T. ONISHI, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: for KENNETH E. SPRAGUE
DIRECTOR AND CHIEF ENGINEER Alex Ho

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA)
MOKULEIA SEAWALL
TAX MAP KEY: 6-8-06: 18 AND 19

We have reviewed the subject DEA and have no comments to offer at this time.

Should you have any questions, please contact Mr. Alex Ho, Environmental Engineer, at local 4150.

95-03231

NORTH SHORE NEIGHBORHOOD BOARD NO. 27

P.O. BOX 607 • HALEIWA, HAWAII 96712

'95 JUN 1 PM 2 53

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

May 26, 1995

Patrick Onishi, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Re: Draft Environmental Impact Statement for seawall project at 68-701 Crozier Drive, Mokuleia

Dear Mr. Onishi,

North Shore Neighborhood Board #27 by voice vote at its May 23 meeting recommended approval of the cited Draft Environmental Impact Statement. It is our understanding that the wall has already been built.

Sincerely yours,

James L. Awai, Jr.
James L. Awai, Jr.
Chairman

cc: Gary Gill, Director
Office of Environmental Quality Control

JLA/ebe

Oahu's Neighborhood Board System-Established 1973

APPLICATION FOR SHORELINE SETBACK VARIANCE AND
FINAL ENVIRONMENTAL ASSESSMENT
Reconstructed Seawall at 68-701 Crozier Drive, Mokuleia

EXHIBIT A

SHORELINE SURVEY MAP

95-17-95A11:08 RCVD

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF LAND MANAGEMENT
P O BOX 621
HONOLULU, HAWAII 96809

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT
WATER RESOURCE MANAGEMENT

MAY 5 1995

Ref.:LM-LY

Land Mgmt. Case No. OA-520

Kendall Hee
Engineers Surveyors Hawaii, Inc.
1020 Auahi St., Ste 1, Bldg 6
Honolulu, HI 96814

Dear Mr. Hee:

Subject: Shoreline Certification Request
Applicant: Engineers Surveyors Hawaii
Property Owner: Mary Stewart Trust
Location - Island: Oahu District: Mokuleia
Tax Map Key: 6-8-6:18 & 19
Property Description: Por. of Grant 340 to Pale Kahui Mendonca Beach Lands, Lots B and C
Land Management Case No.: OA-520

This is to inform you that the subject shoreline certification request has been certified and no appeal has been received. Five (5) certified copies of the map are enclosed herewith.

Should you have any questions regarding this matter, please feel free to contact our Land Management Division at 587-0439.

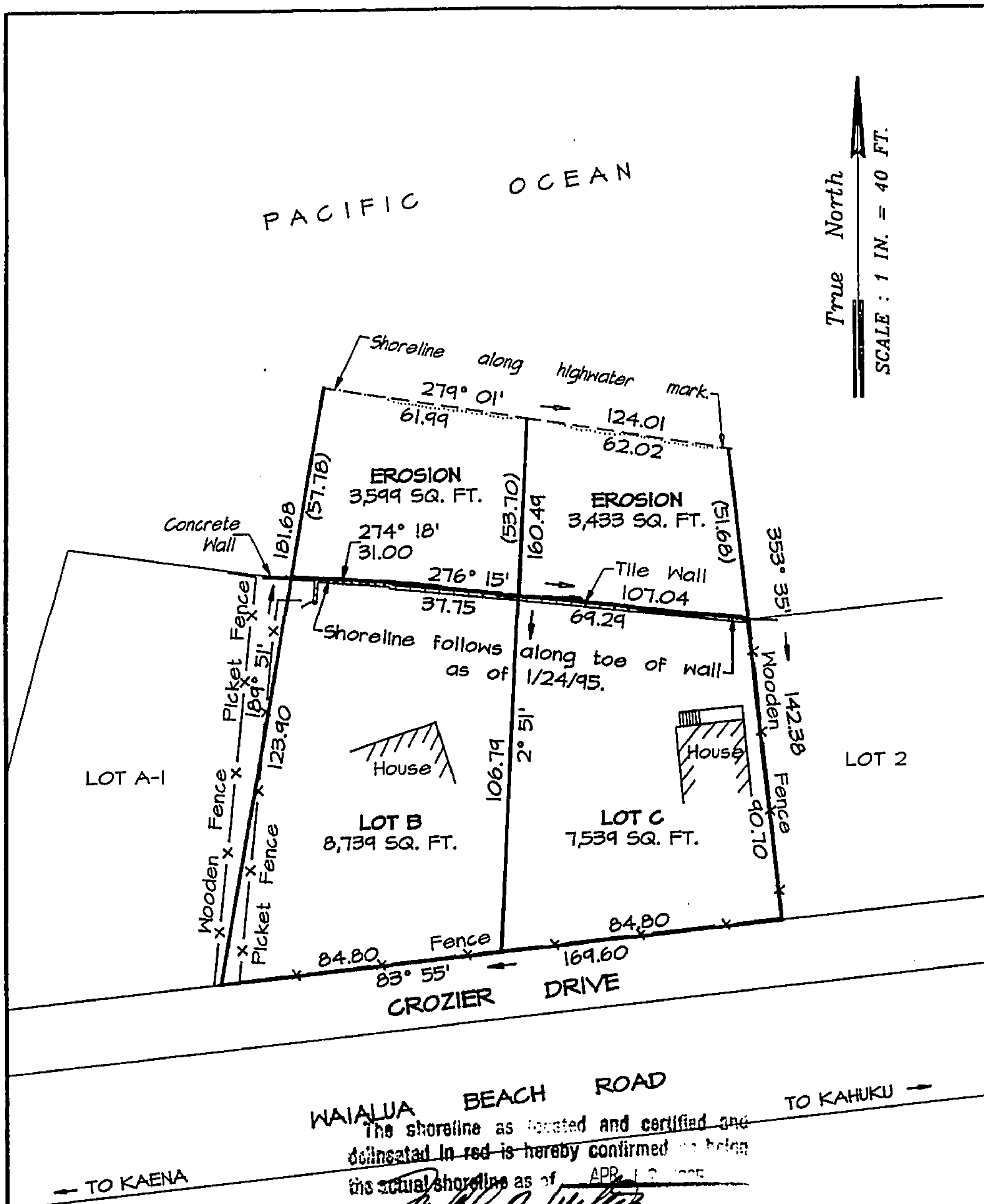
Very truly yours,

W. MASON YOUNG
Land Management Administrator

Enclosure

cc: Oahu Land Board Member
Survey Div., DAGS w/map

1685



The shoreline as located and certified and delineated in red is hereby confirmed as being this actual shoreline as of APR 1 2 1995

Chairman, Board of Land and Natural Resources

KENDALL N. H. HEE
REGISTERED PROFESSIONAL LAND SURVEYOR
No. 5649
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

KENDALL N. H. HEE
REGISTERED PROFESSIONAL LAND SURVEYOR
CERTIFICATE NUMBER 5649

SHORELINE SURVEY

PORTION OF GRANT 340
TO PALEKAHULI
MENDONCA BEACH LANDS
LOTS B AND C
AT MOKULEIA, WAIALUA, OAHU, HAWAII
T.M.K. : 6-8-06 : PARCELS 18 & 19

CLIENT: Hawaiian Trust
Address: 68-701 Crozier Drive
PURPOSE: For Seawall

HONOLULU, HAWAII
FB: 966 / PGS. 1-9
95-14

ENGINEERS SURVEYORS HAWAII, INC.
CIVIL ENGINEERS ~ LAND SURVEYORS ~ PLANNERS

1020 AUAHI STREET
JANUARY 24, 1995

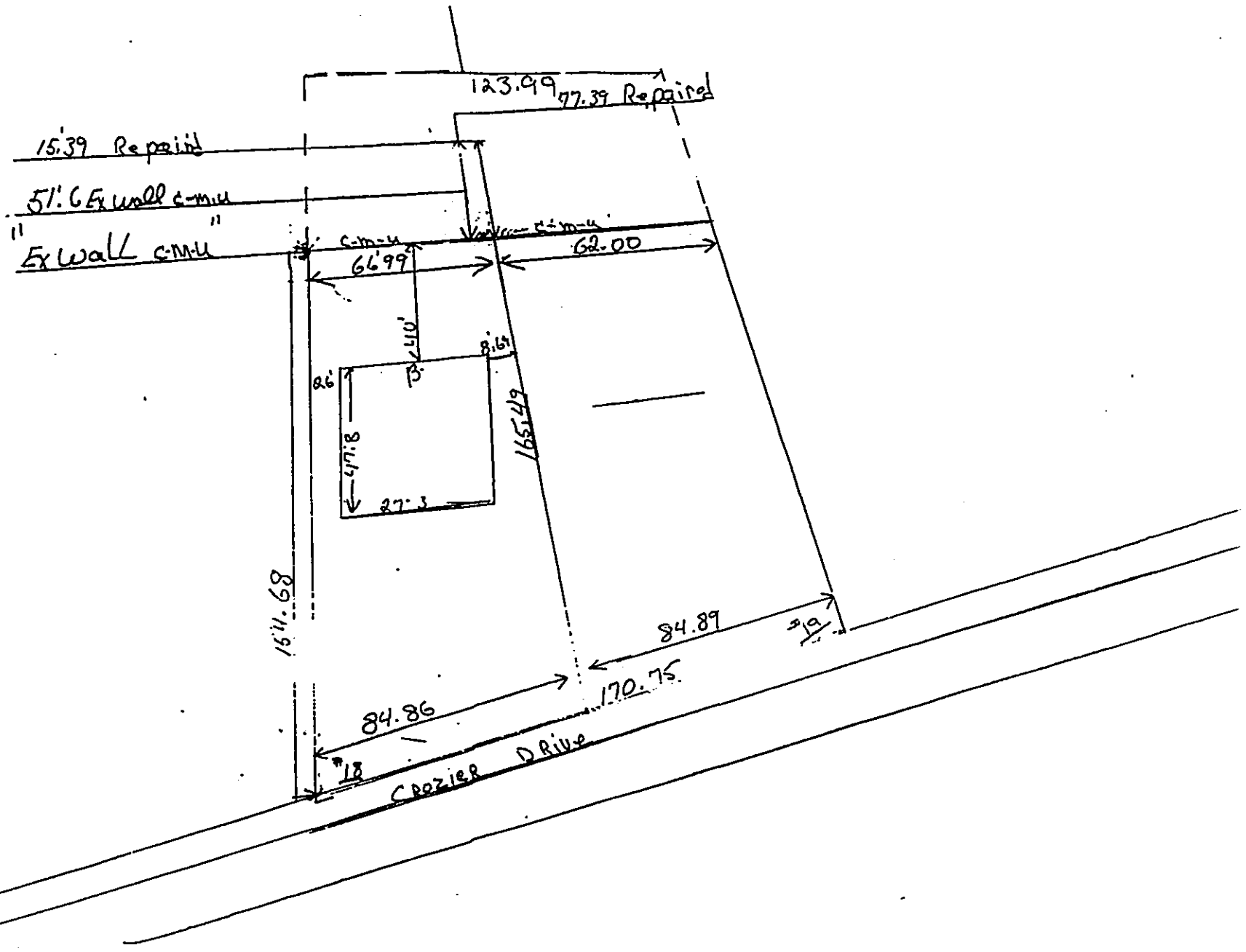
APPLICATION FOR SHORELINE SETBACK VARIANCE AND
FINAL ENVIRONMENTAL ASSESSMENT
Reconstructed Seawall at 68-701 Crozier Drive, Mokuleia

EXHIBIT B

CONSTRUCTION DRAWINGS

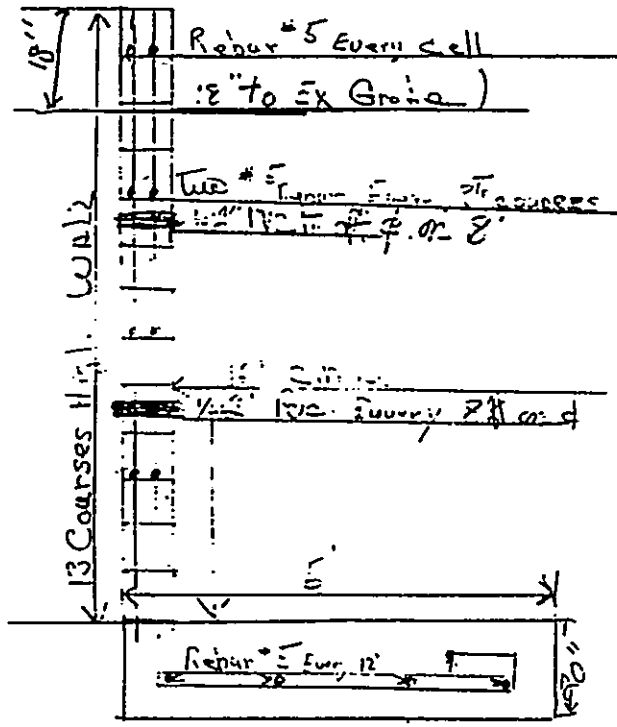
Construction Plans
Prepared by Wasco Builders

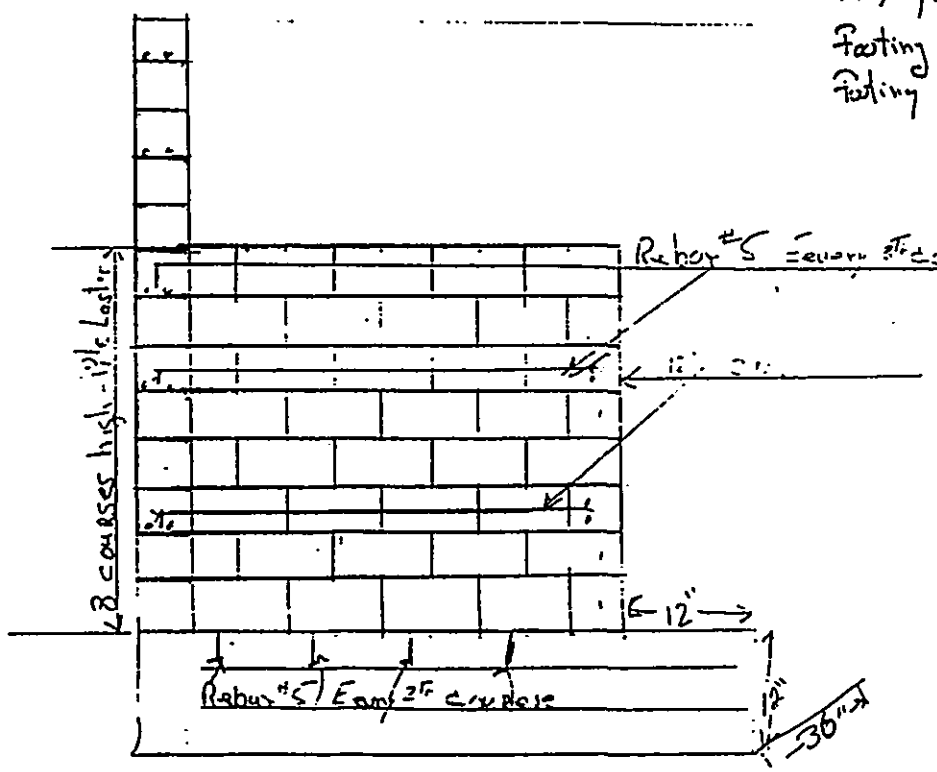
Re-drawn construction plans are in preparation


123.99
77.39 Repaired
15.39 Repaired
51.6 Ex wall c-m-u
Ex wall c-m-u
c-m-u
c-m-u
66.99
62.00
8.61
26'
47.8
27.3
165.29
154.68
84.89
19'
84.86
170.75
18'
CARRIER DRIVE

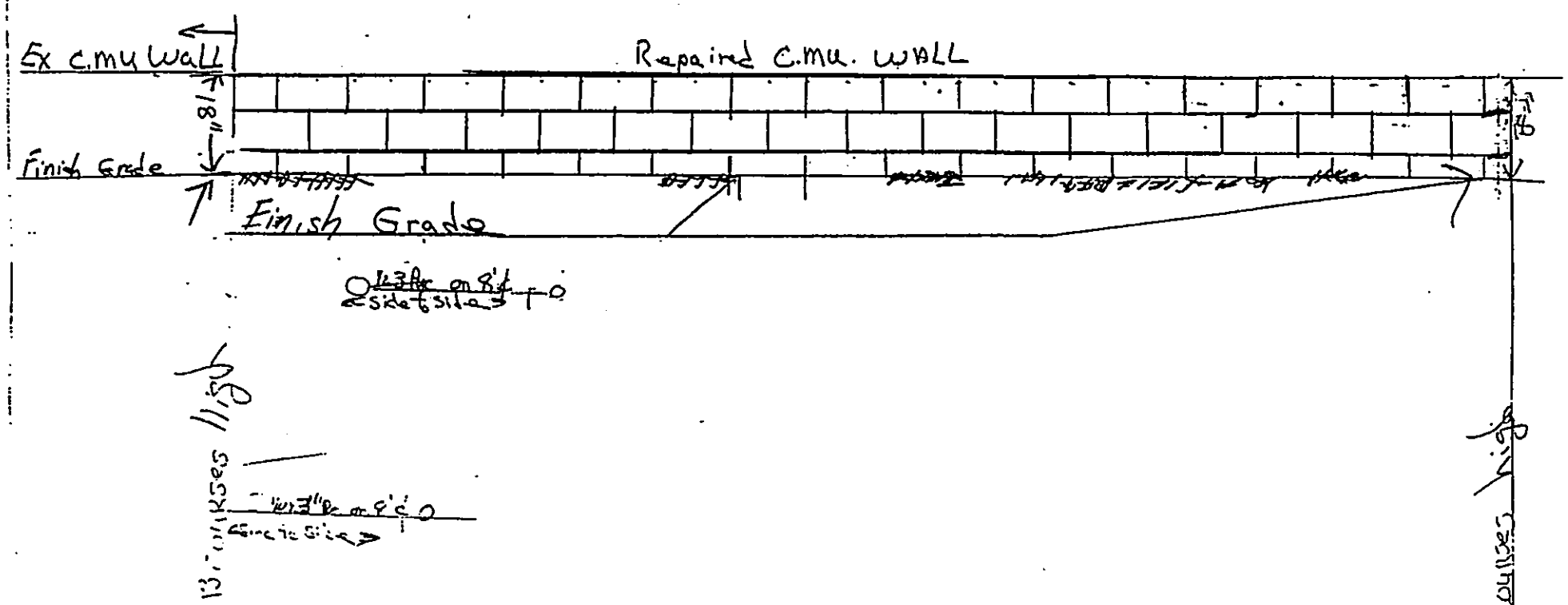
B-1

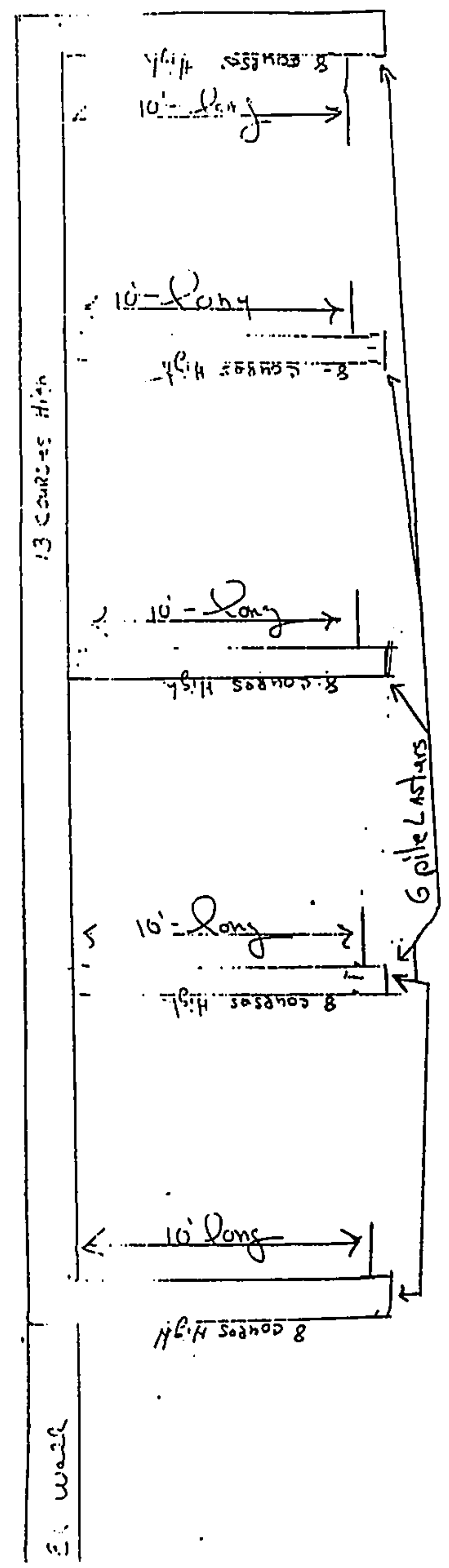
CM-U Wall 'Long X 13 courses:
12-8-16 CMU Wall
8- courese pile Lasters
6- courese Short Wall
Rebar #5 every cell -2 Each cour.
fully grouted every cells
Footing Long wall 5'wide x 20'deep
Footing pile Laster 3'wide x 12" de





For Mary Y Munds Trust
68-701 Crozier Dr
Waialua Hi 96791
6-8-6-18


Ex c.mu wall
Repaired C.mu. WALL
18"
Finish Grade
Finish Grade


13 Courses High
8 courses High
10'-long
10'-long
8 courses High
10'-long
8 courses High
10'-long
8 courses High
10' long
8 courses High
6 pile Lasters
E. Wall

APPLICATION FOR SHORELINE SETBACK VARIANCE AND
FINAL ENVIRONMENTAL ASSESSMENT
Reconstructed Seawall at 68-701 Crozier Drive, Mokuleia

EXHIBIT C

OCEANOGRAPHIC AND STRUCTURAL EVALUATION

Evaluation of the Reconstructed Seawall at 68-701 Crozier Drive in Mokuleia

Prepared for

Mary Stewart Trust
c/o Hawaiian Trust Company, Ltd.
P. O. Box 3170
Honolulu, Hawaii 96802

Prepared by

Tom Nance Water Resource Engineering
680 Ala Moana Boulevard - Suite 406
Honolulu, Hawaii 96813

March 1995

Table of Contents

List of Figures

List of Tables

Introduction

This report presents an evaluation of a seawall constructed in the latter part of 1994 at 68-701 Crozier Drive in Mokuleia. Its general location is shown on Figure 1. A survey done in January 1995 by Engineers Surveyors Hawaii (ESH), reproduced here as Figure 2, provides more site specific details of the wall's location and elevation relative to the adjacent beach and residential lots.

This report has been prepared to provide technical information in support of an after-the-fact Shoreline Setback Variance for the wall's construction. The report covers two aspects of the wall, its structural stability and its influence on shoreline processes. The analysis of its structural stability is based on plans supplied by the present occupant and builder of the wall (Mr. Wasco of Wasco Builders). This analysis was done by Structural Analysis Group (SAG), a subconsultant to Tom Nance Water Resource Engineering (TNWRE). The analysis of the wall's impact on shoreline processes has been done by TNWRE.

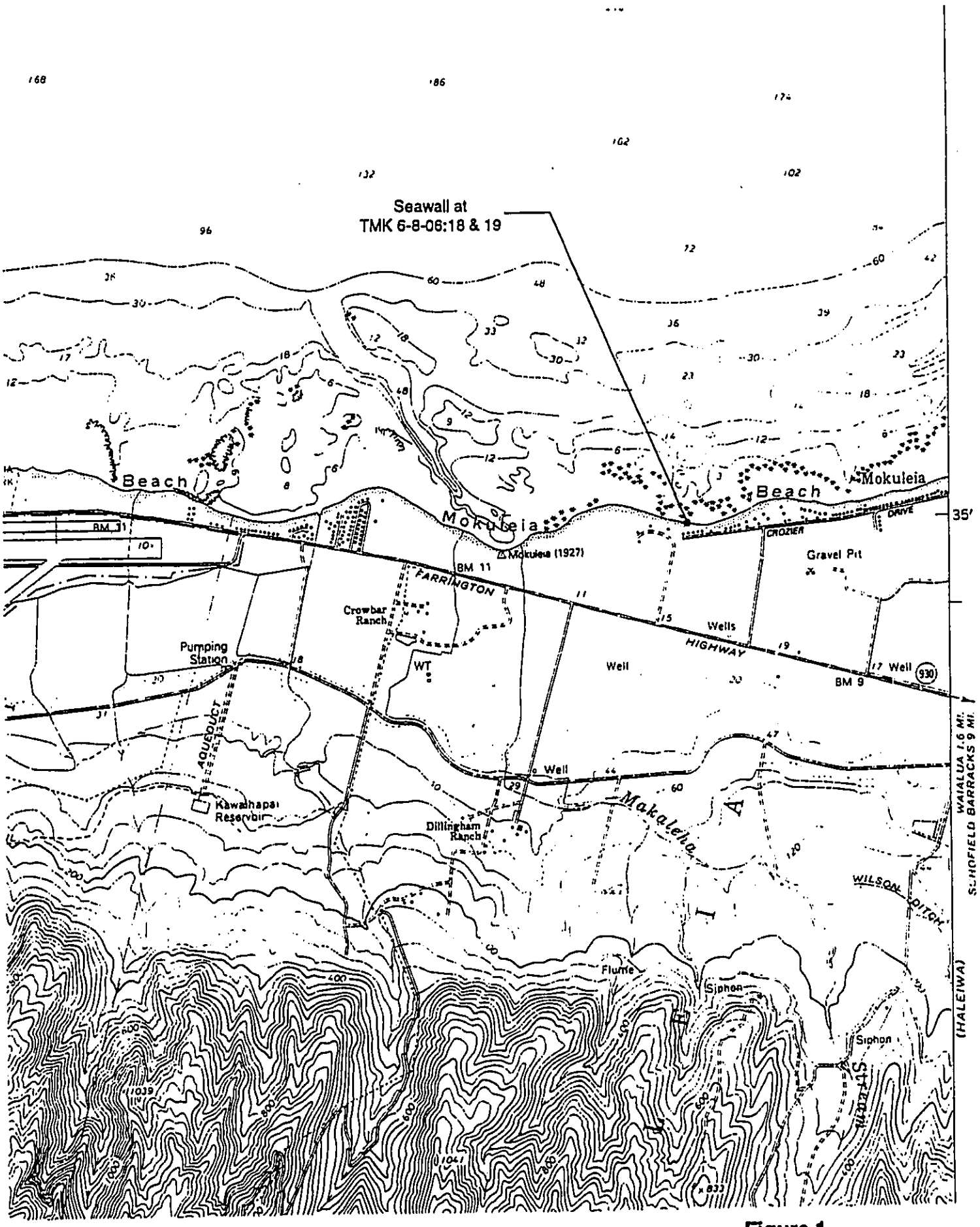
Description of the Seawall

The recently constructed seawall was a replacement of the pre-existing concrete seawall. The old wall had been in place since sometime between 1965 (when the lot was purchased by the present owner) and 1969 (Photo 1 in Appendix A, taken in 1969, shows the wall in place at that time). The new wall spans 108 feet of the shoreline frontage of TMK 6-8-06:18 and 19 (Lots B and C). A portion of the pre-existing seawall was left in place. It constitutes the remaining 35 feet of frontage at the western end of Lot B. At the point where the old and new wall are joined, the new wall is approximately 8 inches landward of the pre-existing wall. According to Mr. Wasco, the entire length of the new wall was constructed slightly landward of the older wall to be better aligned with the timber seawall of the adjacent lots.

The occupant-builder's set of construction plans are in Appendix B. Figure 3 is a cross section of the wall redrawn from these plans. The top of wall elevations shown on the figure are from the ESH topographic survey. The wall is constructed of CMU (16" x 8" x 12" in size) which is reinforced laterally and vertically and grout filled. The CMU are set on a reinforced concrete footing which is 5 feet wide and 20 inches deep. The construction plan drawing shows five buttresses for the wall but the notation on the plan states that there are six (p. 4 of Appendix B). Depending on which number of buttresses is correct, their spacing is at 21.6- or 27-foot intervals. These buttresses (called "pile lasters" on the plans) are also grout filled hollow tile on reinforced concrete footings.

The top of the wall is 12.5 feet above mean sea level (msl) and the bottom of the footing is 2 feet above msl. According to Mr. Wasco, all excavation was in clean, coarse-grained, calcareous beach sand. Elevations of the top of sand on both sides of the wall shown on Figure 3 were measured on February 10, 1995. On the landward side, ground levels were 1.6 to 2.7 feet below the top of the wall. On the seaward side, the beach was 3.9 to 4.7 feet below the top of the wall.

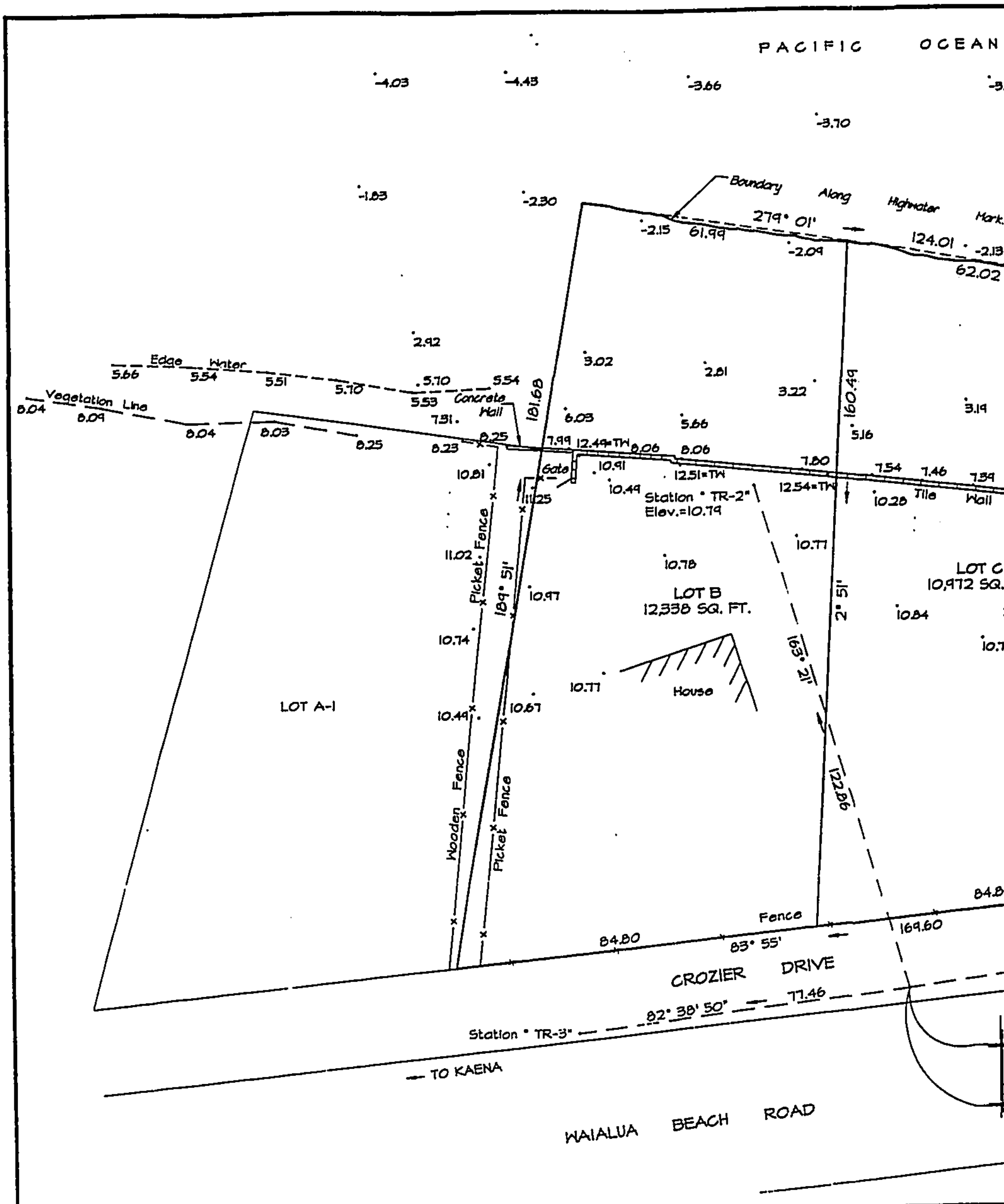
Photo Nos. 2 through 7 in Appendix A show the recently constructed seawall from various angles. These also indicate how its alignment matches with the timber pile seawalls in front of the lots to the east and west.



Scale: 1" = 2000'

Figure 1

Location of TMK 6-8-06:18 & 19
Along Crozier Drive in Mokuleia



HONOLULU, HAWAII
FB. 966 / PGS. 32-33, 61-69
95-14

ENGINEERS SURVEYORS HAWAII, INC.
CIVIL ENGINEERS ~ LAND SURVEYORS ~ PLANNER

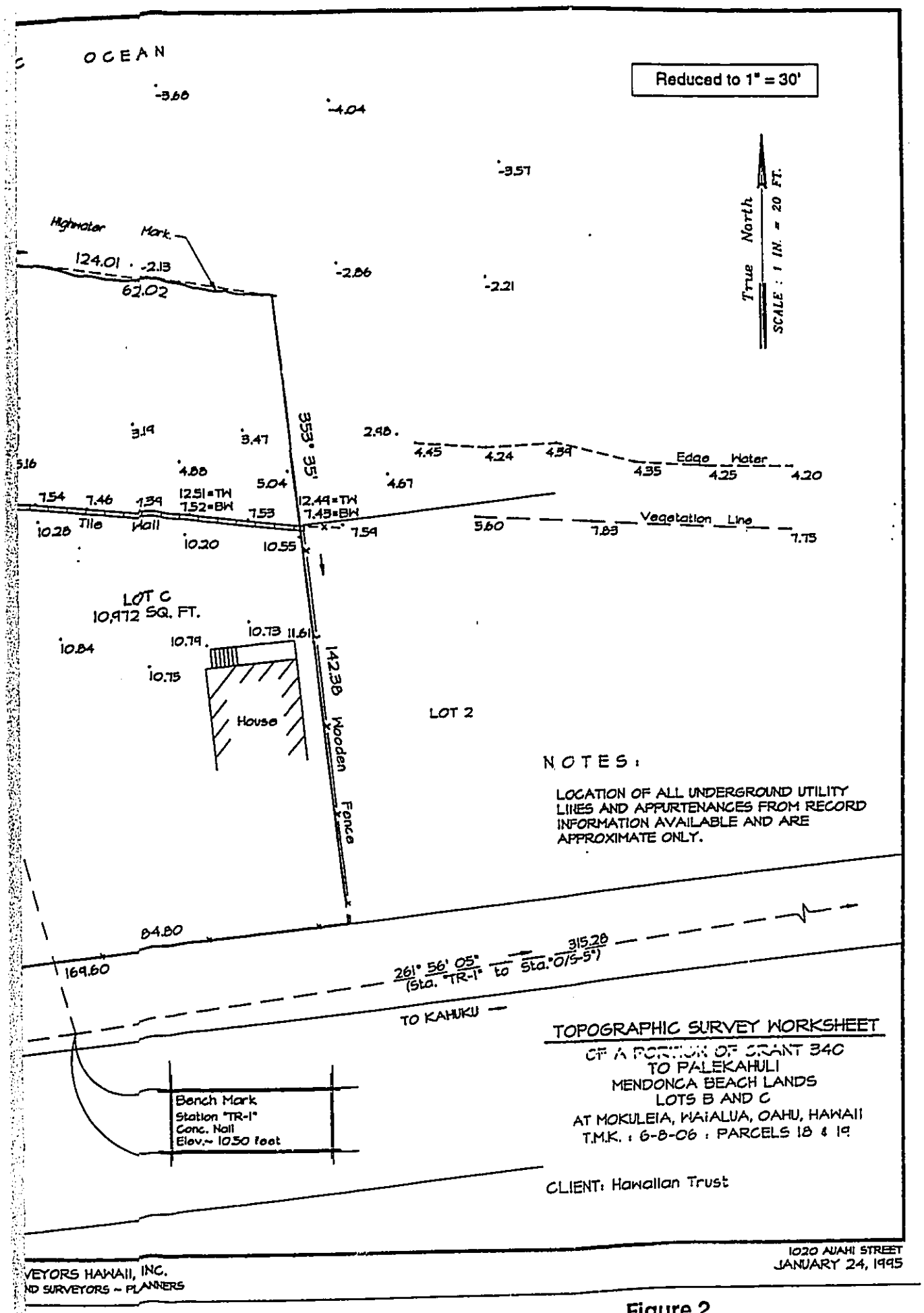


Figure 2

Topographic Survey of TMK 6-8-06:18 & 19

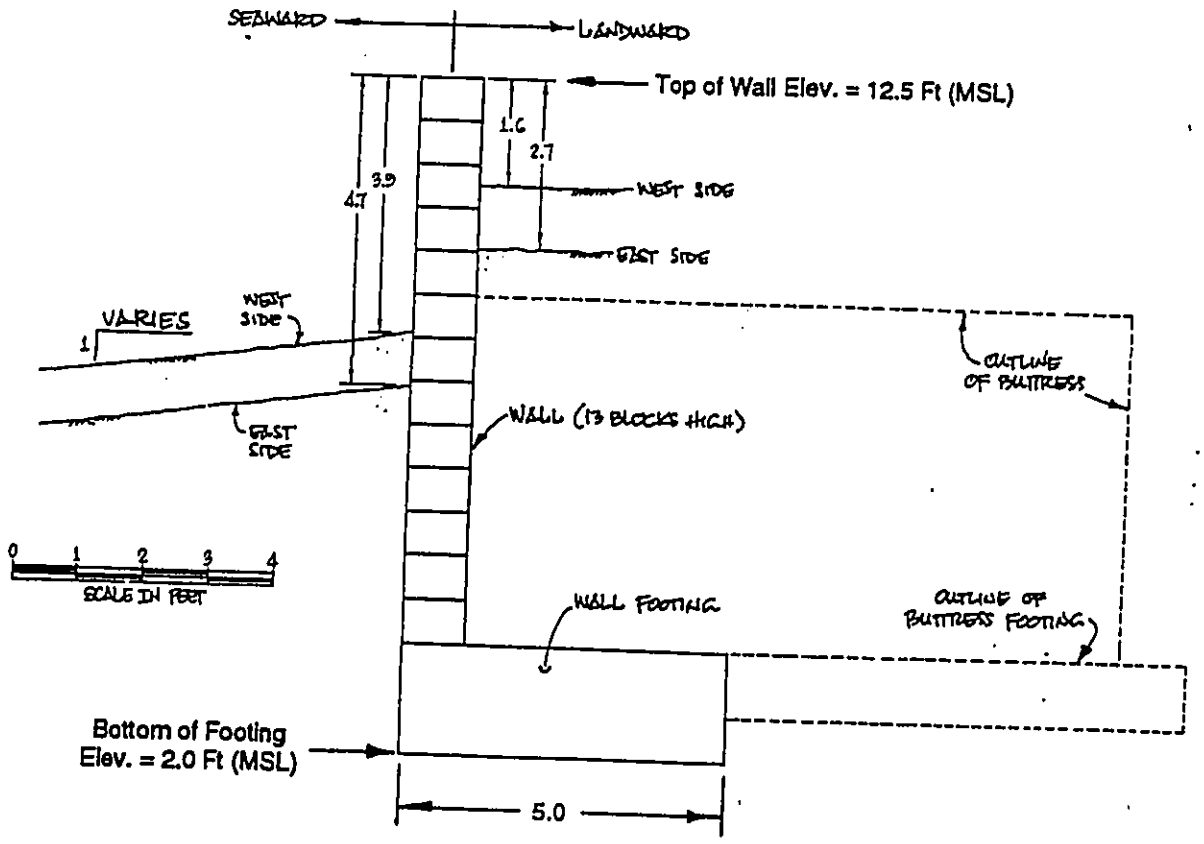


Figure 3

Cross Section of the Retaining Wall Redrawn From Contractor-Furnished Plans

Strength and Stability of the Retaining Wall

The plans by Wasco Builders in Appendix B indicate that the length of the new wall is 77.39 feet. Field measurements indicate that it is actually 108 feet. There is also the discrepancy as to whether five or six (now buried) buttresses were actually constructed. For the strength and stability analysis done by SAG, a very conservative approach was taken: five buttresses were assumed; and due to the spacing between the buttresses, the wall was analyzed as a cantilevered retaining wall, ignoring the strength contributed by the buttresses. For this approach, the buttresses' only contribution was to its sliding friction resistance.

SAG's structural computations can be found in Appendix C. Based on typical bearing strength and coefficient of sliding friction of calcareous sand, the wall's stability and strength is satisfactory. However, this conclusion becomes less confident if the beach sand on the seaward side of the wall were to be significantly eroded. An offsetting factor is that the buttresses do actually make some contribution to stability and strength and there may actually be six of them rather than five considered in the analysis.

Effect of the Wall on Shoreline Processes

Description of the Shoreline Area. The beach along this section of Mokuleia is crescent shaped with a straight line distance of approximately 2650 feet between the headlands. Offshore bathymetry, as shown on the USGS "Kaena" quadrangle map, is reproduced here as Figure 4. The trend of the 6- and 12-foot depth contours creates a small scale, shallow depression offshore of the center of the beach crescent. This feature is significant for the break of short period waves of moderate height. However, it is too small to substantially influence longer period waves of greater height such as storm waves. The nearshore feature of greatest significance is the extremely shallow areas offshore of each of the headlands of the beach crescent. These shoals limit the wave energy which reaches the shore at these locations to significantly less than the wave energy which reaches the center of the beach. Sand samples collected all along the beach crescent suggest this. The coarsest sand is in the center of the crescent. Sand sizes grade to medium coarse at each of the headlands. This bathymetric control of arriving wave energy has created the crescent shape. It also makes this 2650-foot long section of beach its own, separate littoral cell.

The dominant cover offshore is hard substrate comprised of dead coral, coralline algae, and cemented sand. Loose sand does occur in localized depressions, but these are not extensive nor are they deep. The hard substrate extends landward to within 15 to 40 feet of the mean tide shoreline. From that point inland, the sea bottom is covered by coarse grained, moderately well sorted, coralline sand.

On Figure 5, the distance to the edge of the offshore exposure of the hard substrate in front of the seawall is delineated. Also shown are the locations of the seven beach cross sections which are depicted on Figures 6 through 9. Owing to the wave climate and coarse sand grain size, the beach face is relatively steep, varying from 4.4 to 6.8 (horizontal) to 1 (vertical). Offshore, the hard substrate is much flatter, generally 20 to 30 (h):1 (v).

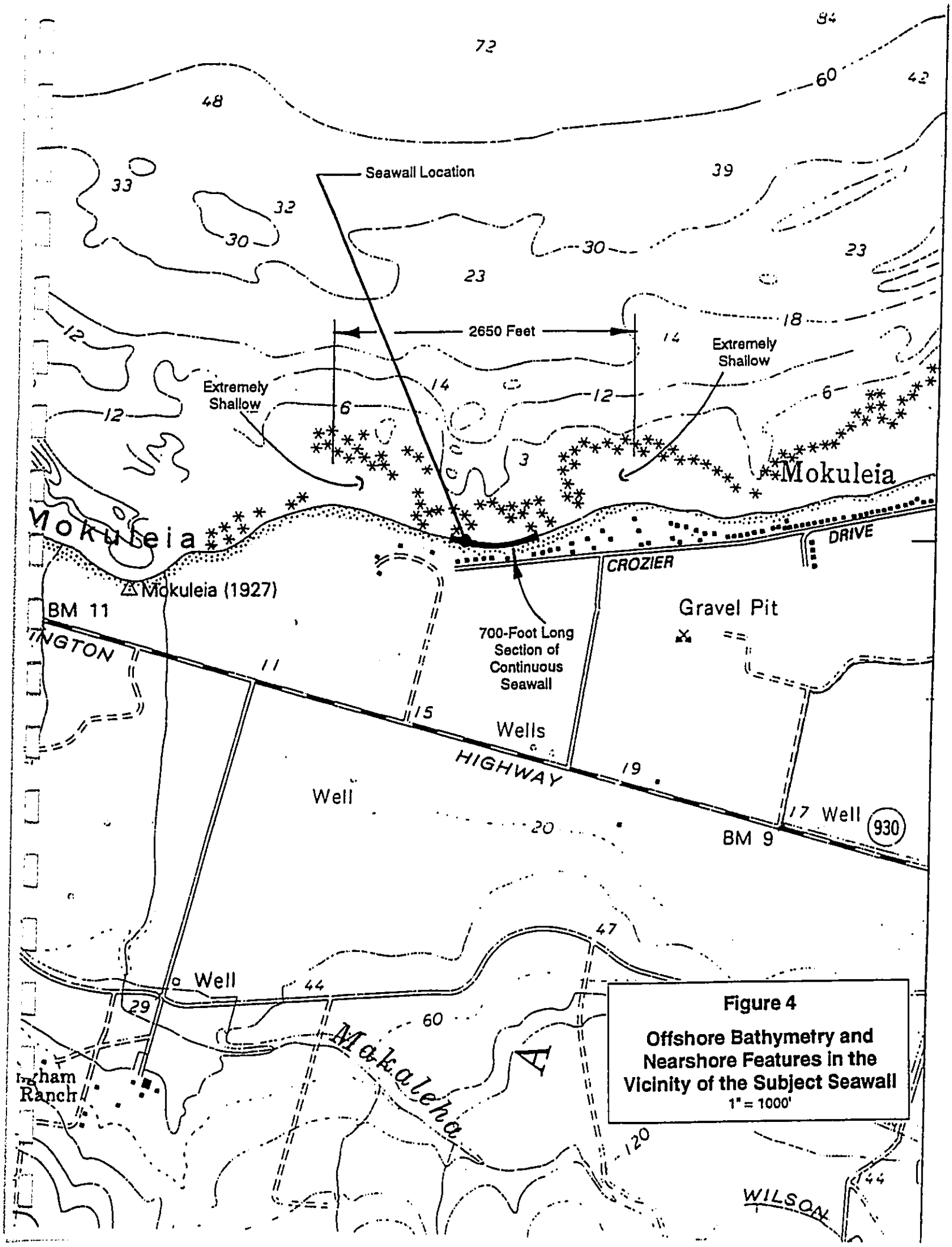
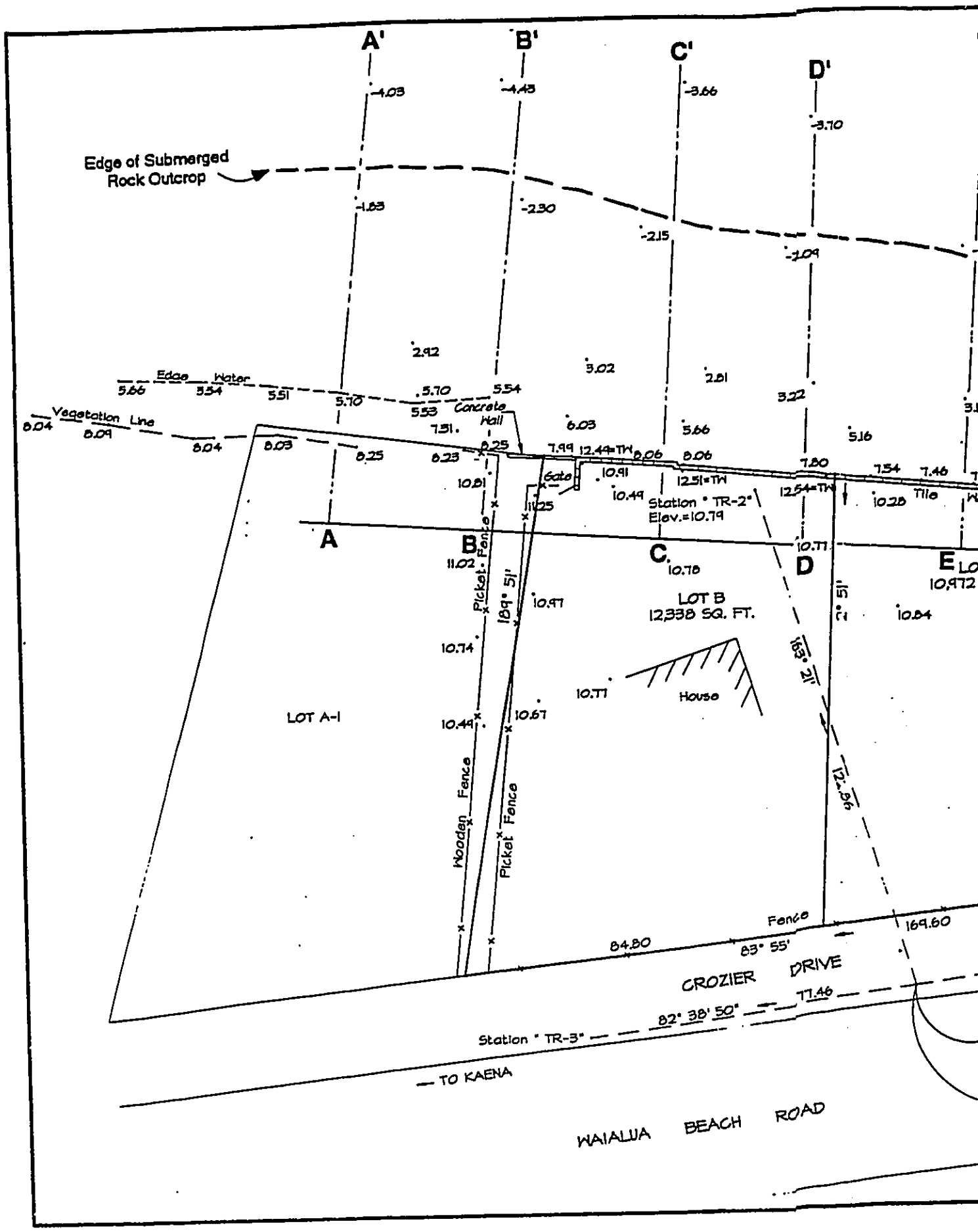


Figure 4

Offshore Bathymetry and Nearshore Features in the Vicinity of the Subject Seawall

1" = 1000'


A'
B'
C'
D'
-4.03
-4.43
-3.66
-3.70
Edge of Submerged Rock Outcrop
-1.83
-2.30
-2.15
-3.09
2.92
3.02
2.81
3.22
Edge Water
5.66
5.54
5.51
5.70
5.70
5.54
5.53
Concrete Wall
Vegetation Line
8.04
8.09
8.04
8.03
8.25
8.23
7.31
6.03
5.66
5.16
7.99
12.44=TW
8.06
8.06
7.80
7.54
7.46
Gate
10.91
10.81
11.25
10.49
12.51=TW
12.54=TW
10.28
Tile
Station " TR-2"
Elev.=10.79
A
B
C
D
E
10.77
11.02
10.78
10.972
Picket Fence
189° 51'
10.97
LOT B
12,338 SQ. FT.
163° 21'
10.84
10.74
10.77
House
LOT A-1
10.44
10.67
Wooden Fence
Picket Fence
12.96
Fence
84.80
83° 55'
169.60
CROZIER DRIVE
77.46
82° 38' 50"
Station " TR-3"
TO KAENA
WAIALUA BEACH ROAD

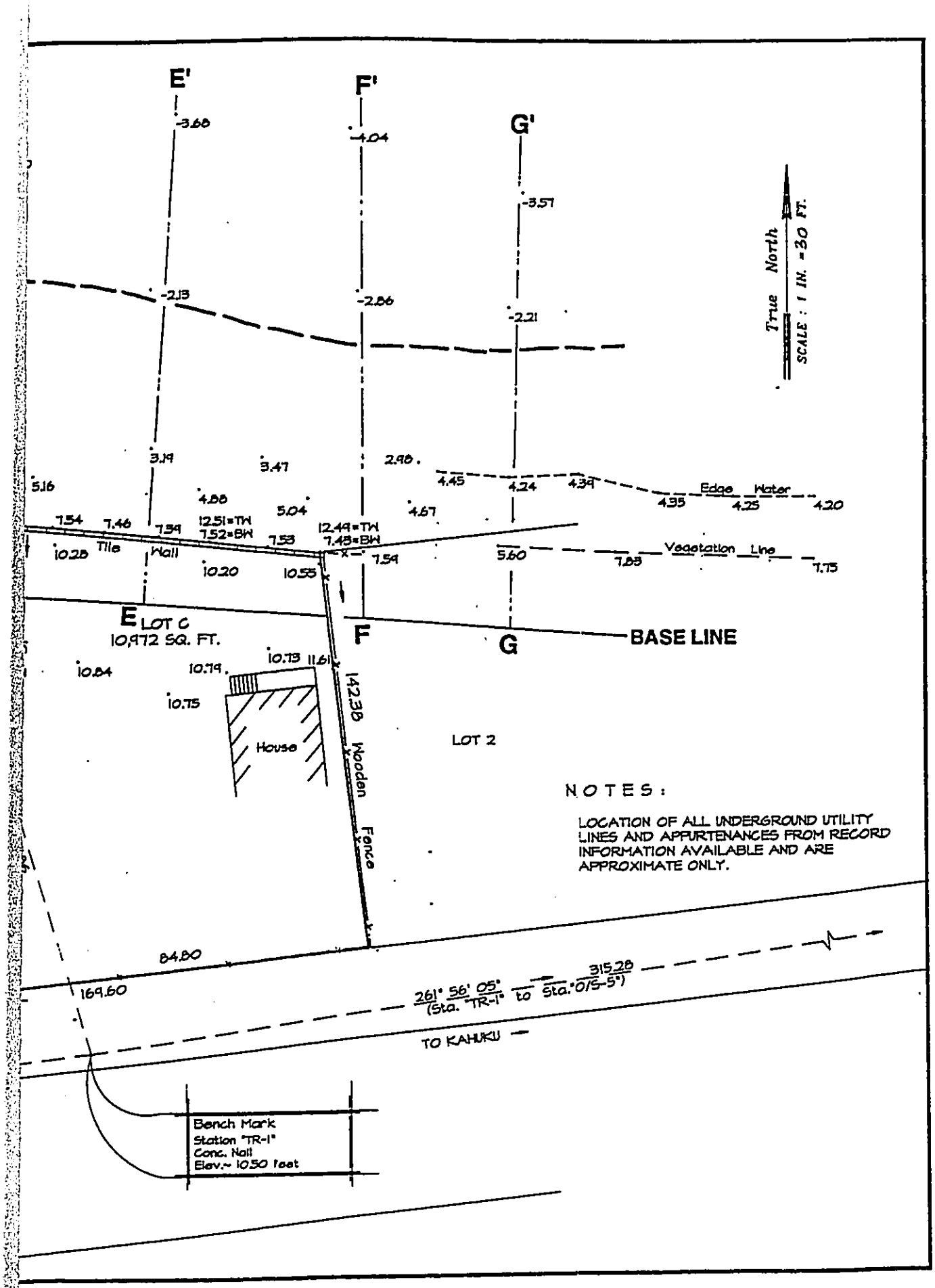


Figure 5

Locations of Cross Sections Depicted in Figures 6, 7, 8, & 9

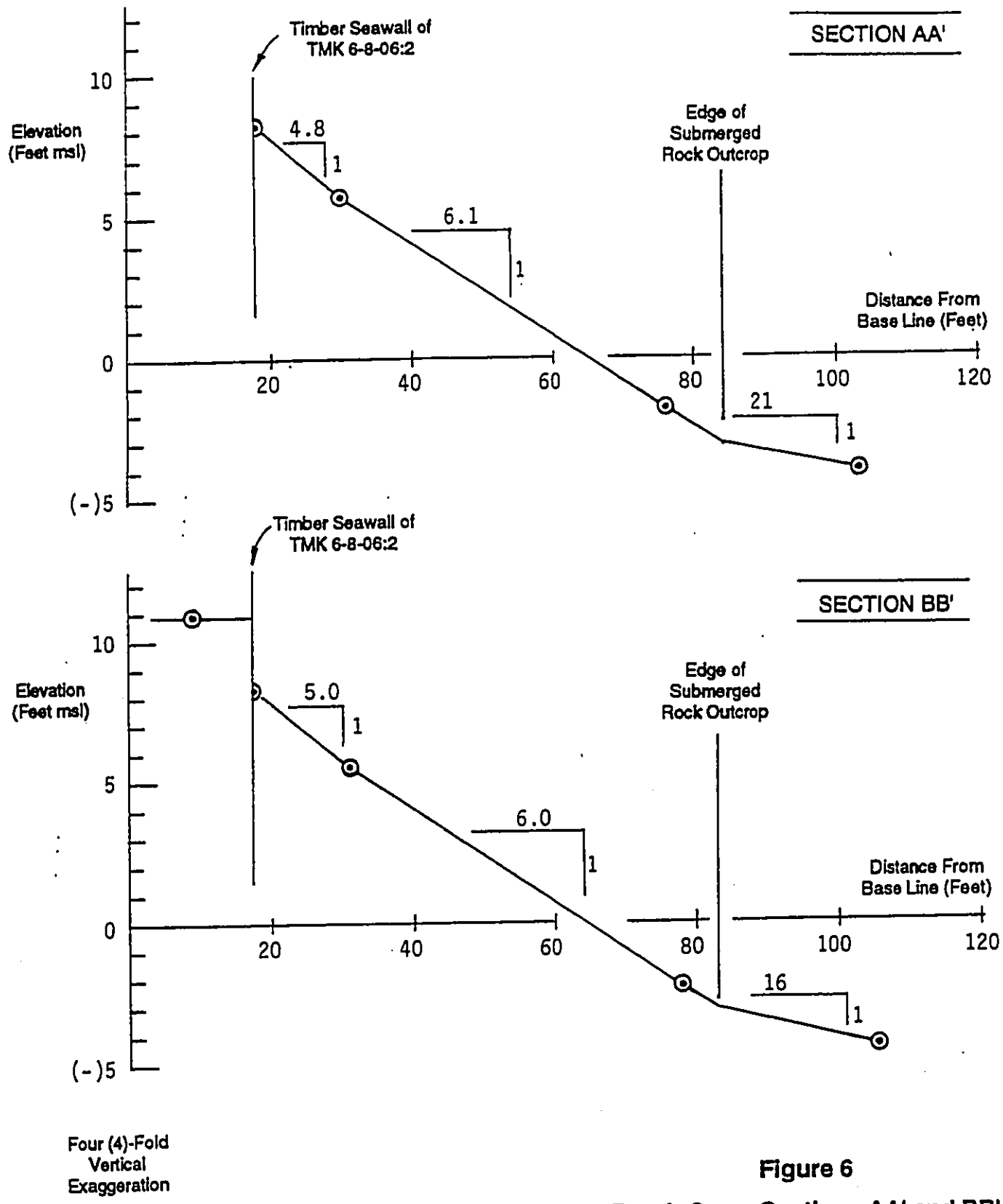


Figure 6

Beach Cross Sections AA' and BB'

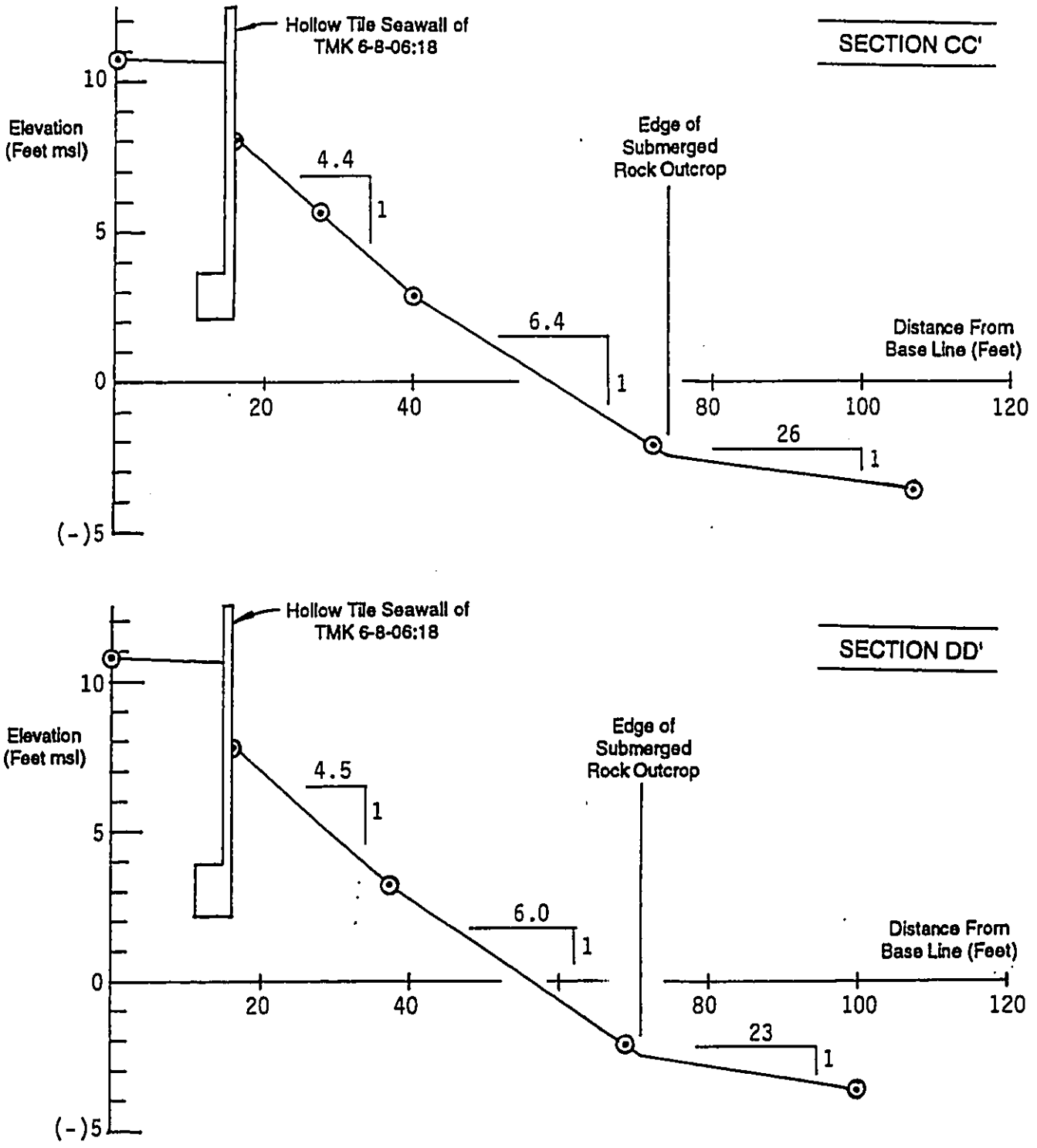


Figure 7

Beach Cross Sections CC' and DD'

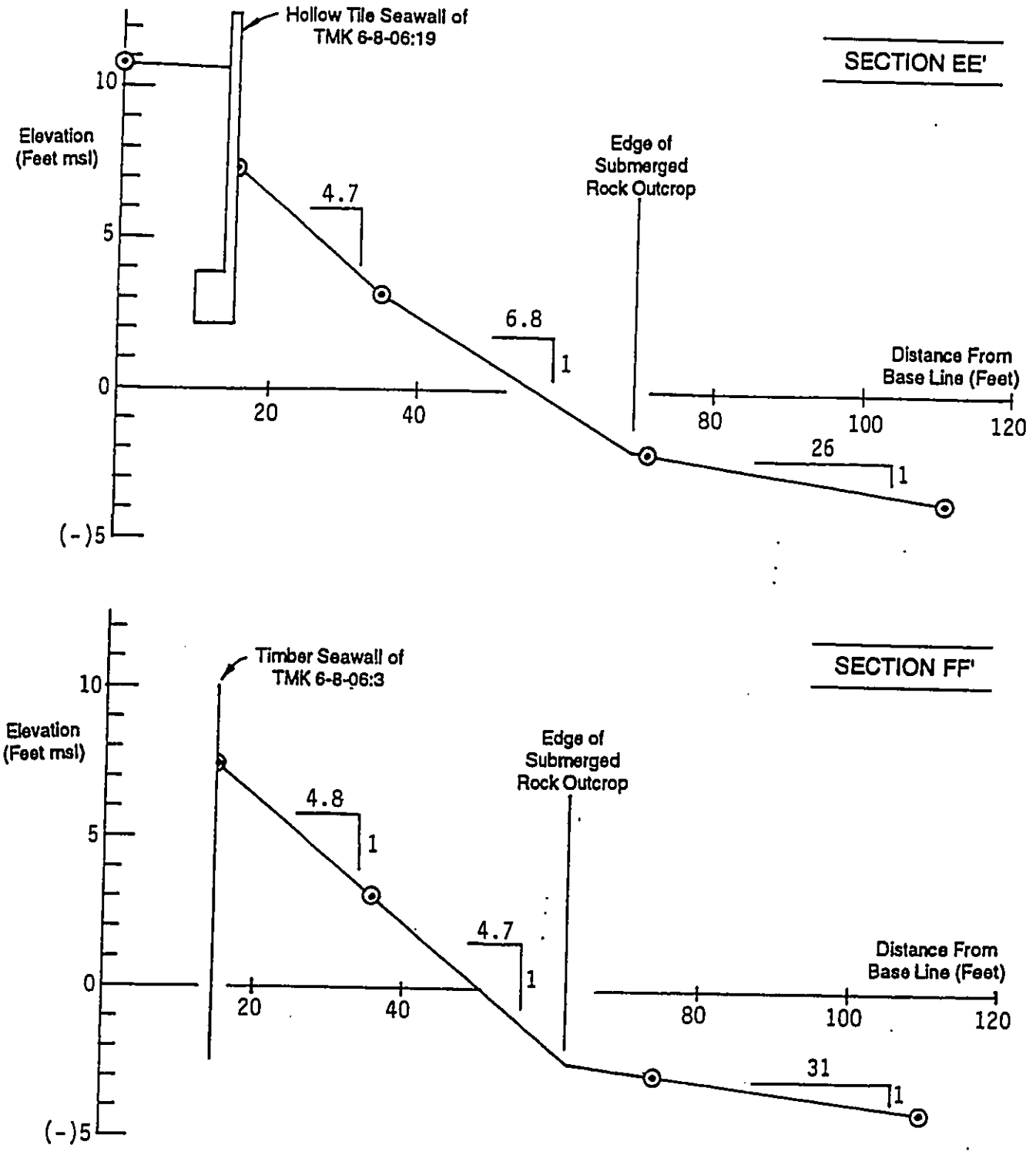


Figure 8

Beach Cross Sections EE' and FF'

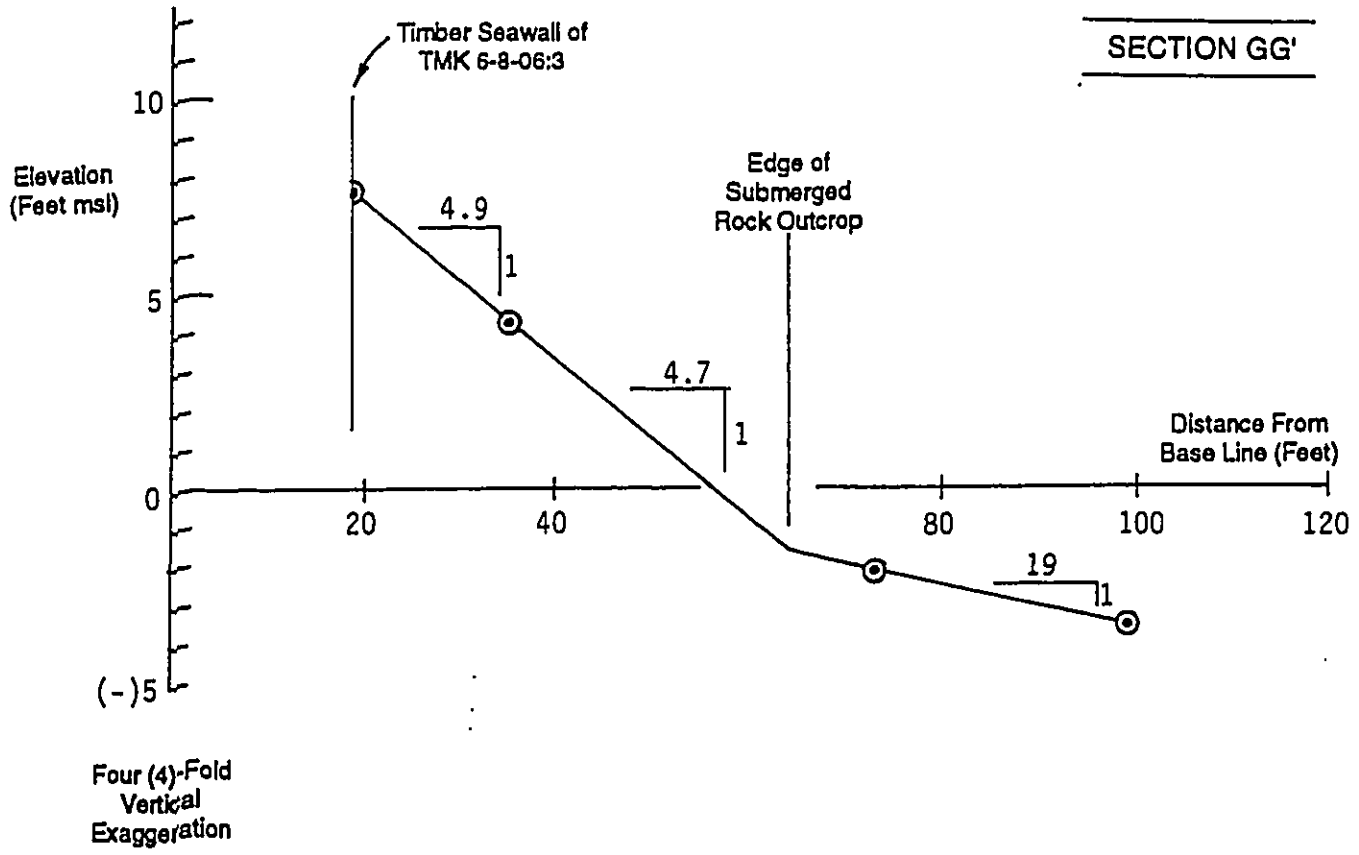


Figure 9

Beach Cross Section GG'

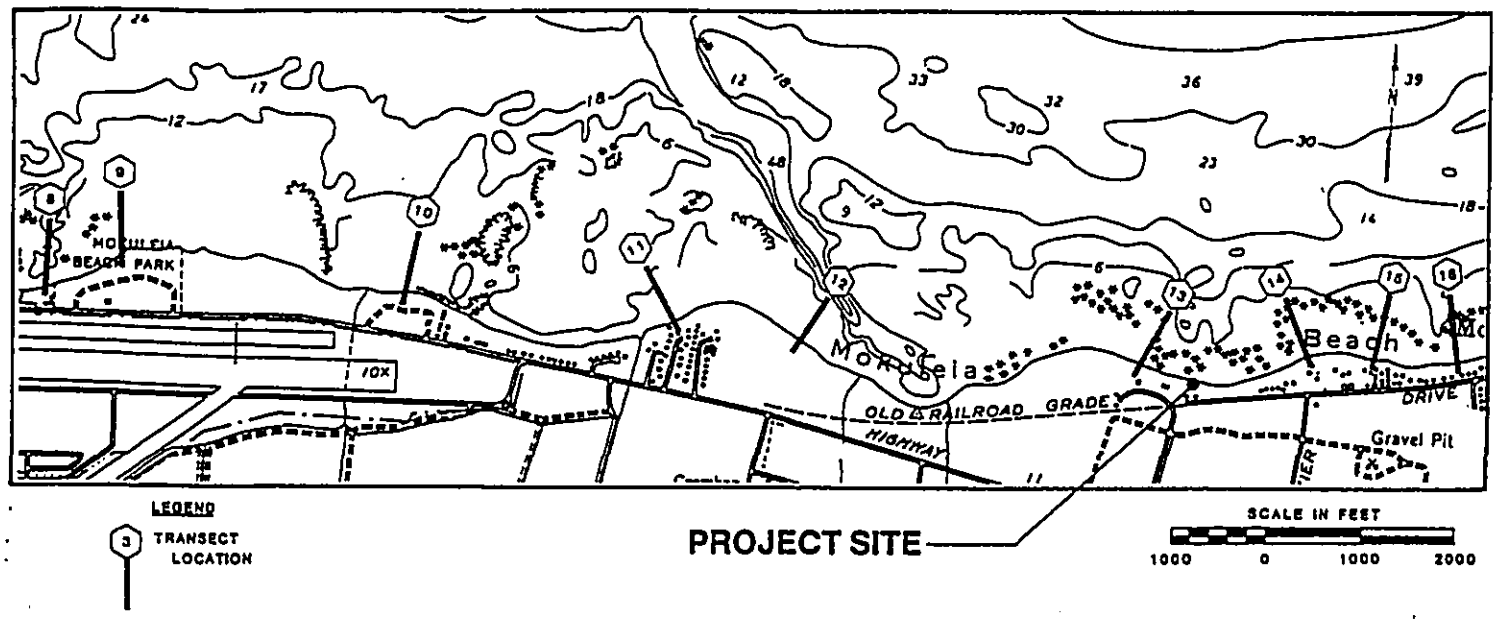
Nearshore Wave Climate and Beach Response. Due to refraction and shoaling of waves as they encounter the hard substrate offshore, waves of moderate height reach the beach in a relatively consistent pattern regardless of their deepwater angle of approach. Due to the width of shallow area offshore, when these waves finally do reach the beach, they are either translating white water with little energy or they are reformed waves of 0.5 to 2 feet in height which collapse on the beach. This relatively consistent pattern produces a relatively stable beach shape. According to residents and surfers, there is a typical winter retreat and summer accretion of the beach. In the winter, the retreat starts as a steepening of the seaward toe of the beach which, depending on the frequency and severity of winter waves, can cut the beach back to the seawalls which line approximately 700 feet of the center portion of the beach. This retreat exposes lithified (cemented) sand all along the intertidal zone. So far this winter, the retreat has been less than typical. In observations made for this report from late January through mid-March, a change in the beach has been observable, but it is no more than a couple of feet. For the section of the beach from 300 to 650 feet west of the subject seawall, lithified sand is continuously exposed along the water line. Judging by the algae growth and darkened surface of this "sandstone", much of it is exposed year-round. Exposures of the lithified sand elsewhere along the beach crescent, including directly in front of the subject seawall, have clean, surfaces which have not been darkened by prolonged exposure. The conclusion is that these are only exposed seasonally.

Long-Term Beach Stability. Sea Engineering's 1988 Oahu Shoreline Study prepared for the Department of Land Utilization (DLU) provides some information on the movement of the vegetation line at two locations along his beach crescent (Sections 13 and 14 on Figure 10). For the period from 1958 through 1988, Section 13, which is 600 feet west of the subject seawall, had a net retreat of the vegetation line of 16 feet. Section 14, which is 1200 feet to the east, showed no change.

Using Photo Nos. 8, 9, and 10 in Appendix A and direct field measurements, the width of the beach, defined by the distance from the rock outcrops offshore to the vegetation line, was determined for the period from May 1971 to March 1995. This information is compiled on Table 1; retreats of the vegetation line result in higher numbers and the seaward movement of the vegetation line is shown by lower numbers. This analysis indicates that the vegetation line's location was reasonably stable, even though the December 1982 photograph was taken in the month following Hurricane Iwa.

Working with aerial photographs made from different heights and printed at different scales has limited accuracy. Despite the results compiled in Table 1, visual observations made for this study support the general premise that some retreat of the vegetation line has occurred and may still be occurring toward the west end of the crescent beach, specifically along the section from 300 to 800 feet west of the subject seawall. Ironwoods with minimal grass undercover is the dominant vegetation there and many of these now have exposed roots. A beach house located three lots to the west of the subject seawall has portions of its foundation undermined. The center of the beach has clearly been stabilized by 700 feet of continuous seawall. At the east end of the beach crescent, sand is presently accreting in front of a stabilized vegetation line and there are virtually no exposures of lithified sand in the intertidal zone.

CENTRAL MOKULEIA



LEGEND

3 TRANSECT LOCATION

PROJECT SITE

CENTRAL MOKULEIA

Beach Description

Central Mokuleia Beach extends from Mokuleia Beach Park to the east end of the Mokuleia residential area.

The beach varies in width from 10 to 100 feet and is composed of medium to fine grained sand of mixed terrigenous and calcareous origin.

Backshore Condition

The backshore of Mokuleia Beach Park (Transects 8 to 10) is undeveloped, and consists mostly of naupaka and grass growing on coastal sand dunes. Evidence of recent erosion was present.

Most of the residential area at Transect 11 is lined by seawalls and the beach is extremely narrow.

The remaining shoreline (Transects 12 to 15) is sparsely developed. Evidence of recent erosion was present along the entire reach and several buildings near Transect 13 are in danger of being undermined. No shore-protection structures have been constructed.

Historical Changes : 1949 - 1979; See Hwang, Pg. 9

Central Mokuleia Beach was relatively stable, with net overall changes at each Transect for the 30-year period of eleven feet or less.

Recent Changes :. 1979 - 1988

Mokuleia Beach Park eroded 20 to 25 feet between 1979 and 1988, the highest rate of the past 40 years. Transects 13, 14 and 16, along Crozier Drive, indicated erosion of 1 to 7 feet, while Transect 15 accreted 20 feet.

Summary

Central Mokuleia Beach had been relatively stable prior to 1979. The overall recent tendency is toward beach recession. Although exposed to the winter waves, it has not, in the past, been greatly influenced by them.

(Pages 8 & 9)

Table 2 - Central Mokuleia Beach. Changes in the Vegetation Line in Feet.

	Transect Number								
Observation Period	8	9	10	11	12	13	14	15	16
Sep 28, 1949 - Nov 01, 1958	*	-6	4	6	-4	*	1	-15	-4
Nov 01, 1958 - Aug 22, 1962	*	-1	-5	-4	3	-62	7	28	20
Aug 22, 1962 - Apr 22, 1967	*	8	7	3	-3	-7	-2	-8	-9
Apr 22, 1967 - Mar 17, 1971	-2	-3	-8	-12	-5	-2	7	-1	*
Mar 17, 1971 - Apr 11, 1975	-1	-2	-8	-11	-7	2	-3	5	23
Apr 11, 1975 - Aug 06, 1979	12	9	-1	*	8	1	-4	-8	1
Aug 06, 1979 - Feb 03, 1988	-22	-26	-7	*	-7	-4	-5	20	-1
Net Change - Vegetation Line	-13	-21	-18	-8	-15	-16	1	21	9
Range - Vegetation Line	22	26	24	14	16	16	13	36	20

* No Data
1 To Seawall
2 Change from 1949 to 1962
3 Change from 1967 to 1975
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 2.

Figure 10

1988 Oahu Shoreline Study by Sea Engineering, Inc. for the Department of Land Utilization

Table 1

Beach Widths From Aerial Photos and Directed Measurements, 1971 to 1995

Date	Method of Determination	Distance West of West Property Line (Feet)				Distance East of West Property Line (Feet)			
		800	1000	1200	1400	800	1000	1200	1400
May 1971	Aerial Photo	--	--	--	--	74	94	110	--
December 1982	Aerial Photo	88	84	113	102	84	123	112	106
July 1992	Aerial Photo	78	76	101	--	76	97	112	119
March 14, 1995	Direct Measurement	90	71	97	78	78	102	102	104

Notes:
1. Numbers in the table are the distances (in feet) from the submerged rock just offshore to the vegetation line or the seawall, if one is present.
2. Dashes in the table are for distances beyond the extent of the aerial photograph.
3. None of the measured distances on March 14, 1995 were to seawalls; all were to vegetation lines of grass, ironwoods, hau trees, or naupaka bushes.

Impact of the Seawall on Shoreline Processes. The effect of the seawall can be viewed in several ways: the effect of the new wall as compared to the one it replaced; the effect of any wall in this location, given that there are existing walls to the east and west; and finally, the effect of having any seawalls along this crescent-shaped beach, including the subject seawall as a part of a continuous, 700-foot long wall. The first of these effects is easily dealt with. The pre-existing seawall had been in place for 25 to 30 years; the new wall is in the identical location; both walls are vertical, energy reflecting surfaces. Their impacts on shoreline processes are identical.

The effect of having or not having a seawall in this location, given that there are timber seawalls in front of lots on both sides of the subject seawall, is also relatively easily dealt with. If the CMU seawall were removed and the timber seawalls to both sides were to remain, the slope of the beachface is not likely to be changed and a vegetation line would be established about 15 to 20 feet landward of the wall. In terms of shoreline processes, the effect would be negligible. The wall's removal would, however, subject the structures behind the wall to possible damage when severe winter storm waves top the crest of the beach. Also, the ends of the adjoining timber seawalls would have to be modified to avoid being damaged. Given that these timber seawalls are in place and will remain so, removal of the CMU seawall in front of TMK 6-8-06:18 and 19 would serve little purpose and expose the structures on the lot to potential wave damage.

The effect of the 700-foot continuous line of seawalls, extending from TMK 6-8-06:2 on the west end to TMK 6-8-06:4 on the east, has obviously stabilized the center of the beach crescent. In doing this, the walls do limit the volume of sand available to the normal seasonal retreat and advance of the beach. Without the walls, the crescent shape of the beach would probably be more deeply recessed and the difference between the summer and winter beaches may also be greater. The key question, however, is whether or not these walls have caused or contributed to the apparently continuous retreat of the beach section from 300 to 800 feet west of the seawall. Some of this erosion does appear to be a function of subtle bathymetric variations, including the lack of a hard substrate immediately in front of the beach (most surfers enter the water here). However, the continuous line of seawalls cannot be entirely ruled out as a contributing, albeit minor, factor.

Summary Conclusions

1. Due to bathymetric control of wave energy, the 2650-foot long, crescent-shaped beach is a relatively stable, littoral cell. Extreme shoals have allowed sand accretion to form the two headlands. Significantly more wave energy reaches the shoreline at the center of the beach crescent.

2. The pre-existing seawall had been in existence for 25 to 30 years (since sometime between 1965 and 1969). Based on the 1969 oblique aerial photograph (No. 1 in Appendix A), the adjacent timber seawalls have also been in place for at least the same length of time.

3. The stability and strength of the newly constructed seawall, analyzed as a retaining wall, is satisfactory. However, if retreat of the beach during a severe storm wave event exposes the wall's footing, the wall would no longer be stable.

4. From the perspective of effecting shoreline processes, the new wall is identical to the one it replaced.

5. If the existing timber seawalls to the east and west remain in place, the presence or absence of the hollow tile wall at TMK 6-8-06:18 and 19 has a negligible impact on shoreline processes.

6. If all 700 feet of the seawalls were removed, the beach crescent is likely to be more deeply recessed and the normal summer-winter differences in the beach are likely to be greater.

7. A trend of long-term beach loss is only apparent in the section of beach from 300 to 800 west of TMK 6-8-06:18. This is primarily due to the angle of approach of long-period storm waves and subtle variations in bathymetry. However, the presence of the 700-foot long continuous line of seawalls may be a minor contributing factor.

References

Moberly, R. and T. Chamberlain. 1964. Hawaiian Beach Systems. Report HIG-64-2, by the Hawaii Institute of Geophysics, University of Hawaii for the Harbors Division, Department of Transportation, State of Hawaii.

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

Appendix A

Photographs

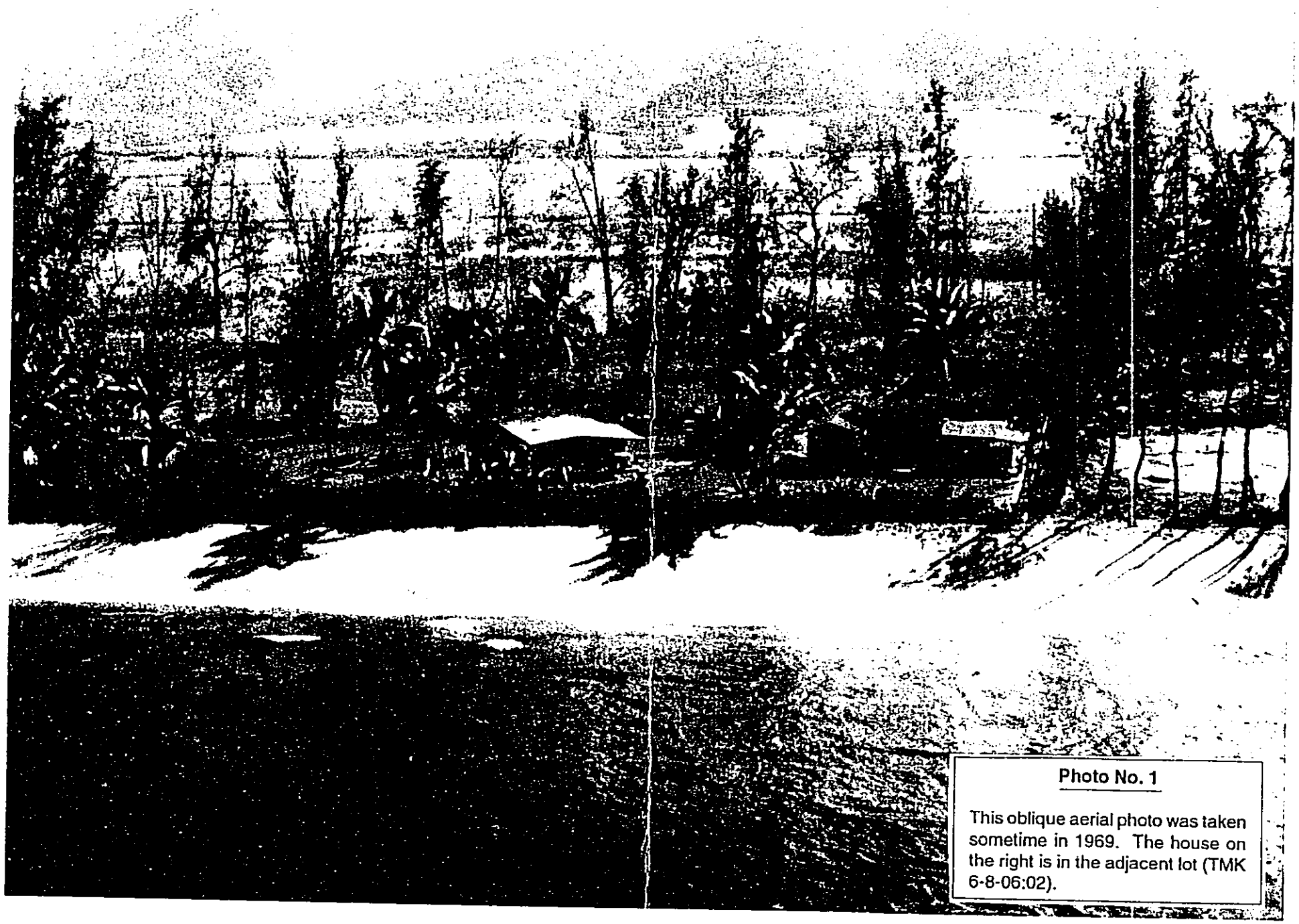


Photo No. 1

This oblique aerial photo was taken sometime in 1969. The house on the right is in the adjacent lot (TMK 6-8-06:02).

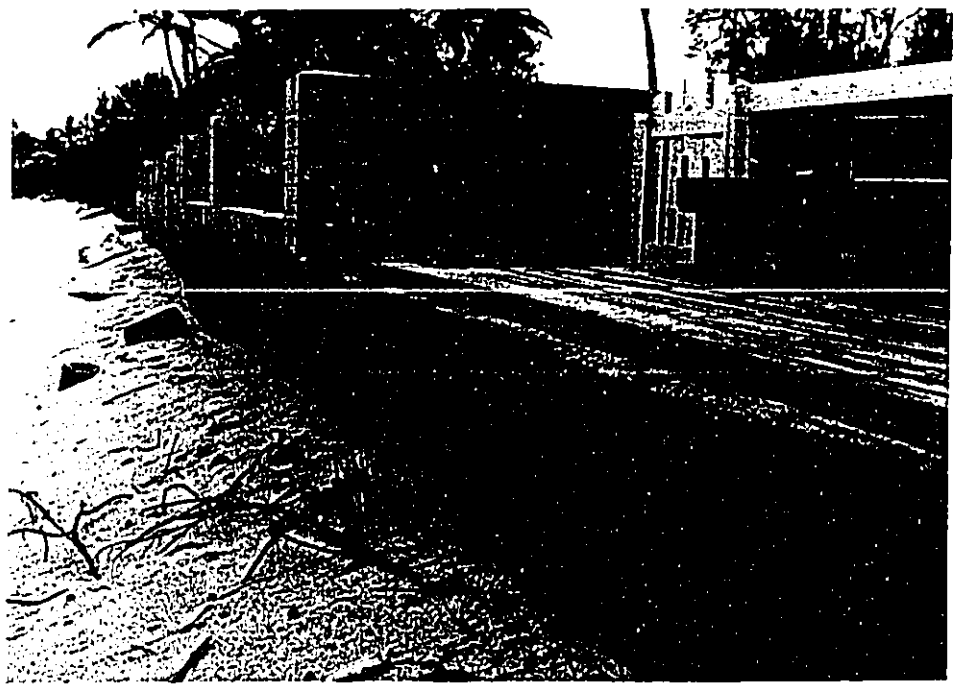


Photo No. 2

The retained portion of the old wall with one course of new blocks on top, is in the foreground.

Photo No. 3

The new and old wall are aligned with timber pile seawalls in front of lots to the east and west.

Photo No. 4

The new wall is set back approximately 8 inches landward of the old wall.

Photo No. 5

The depression in the ground between the trees and wall is apparently where overtopping of the old wall was most severe.

Photo No. 6

This view from east of the wall shows the continuity of the hollow tile wall with the adjacent timber wall.

Photo No. 7

The timber wall extends approximately 500 feet east of the hollow tile wall.

Photo No. 8

May 1971

Approx. Scale: 1" = 230'

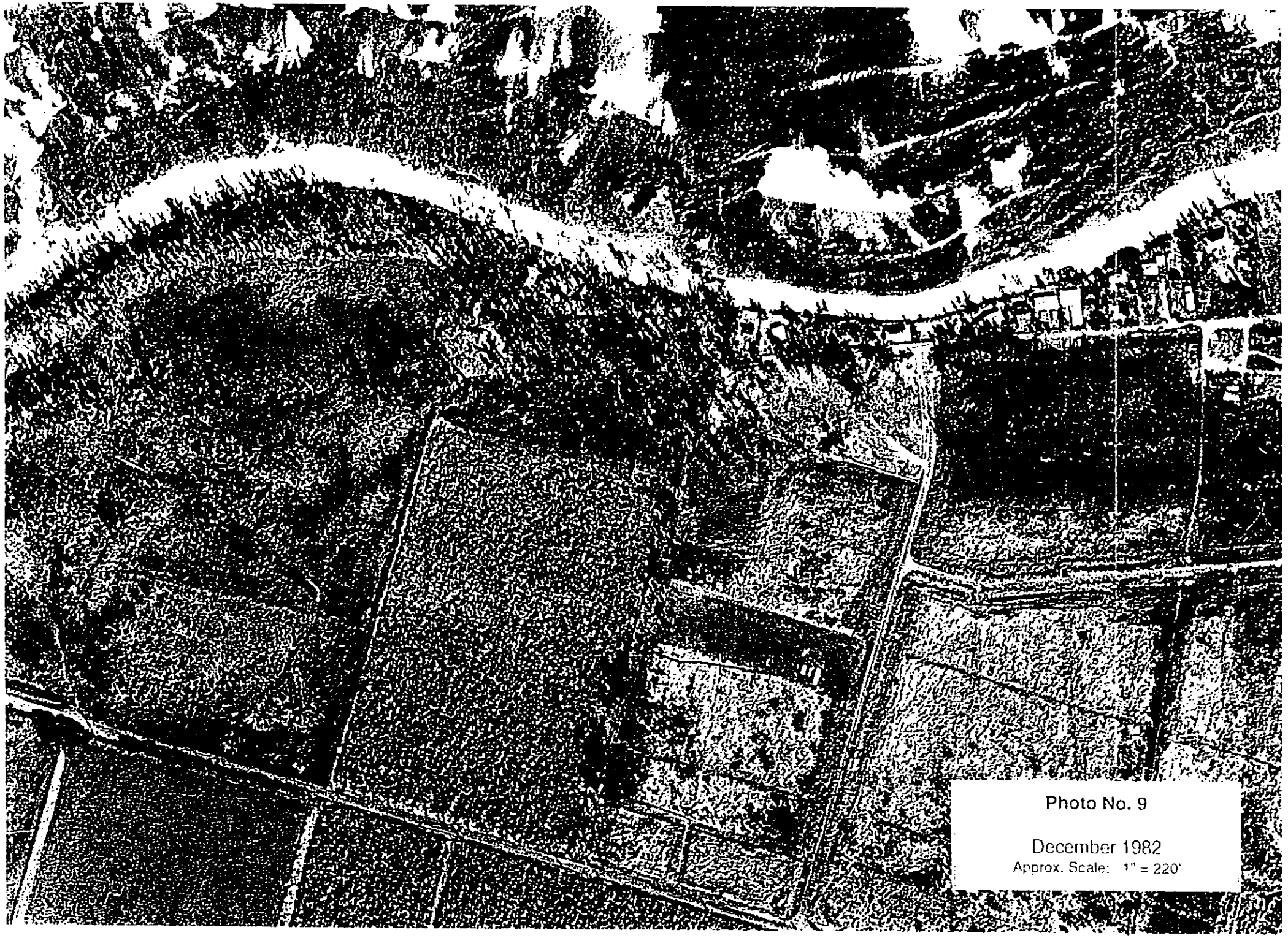


Photo No. 9

December 1982

Approx. Scale: 1" = 220'

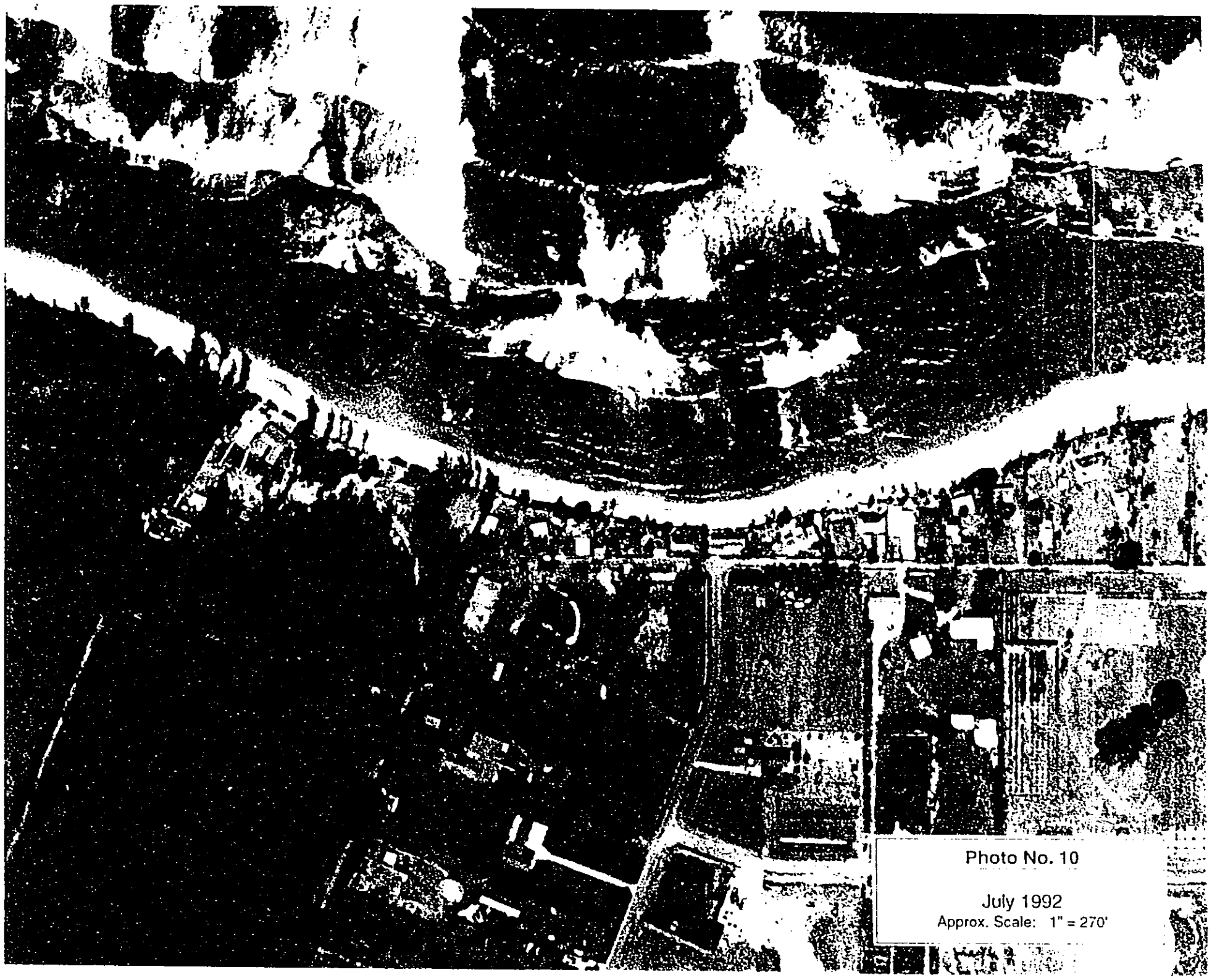


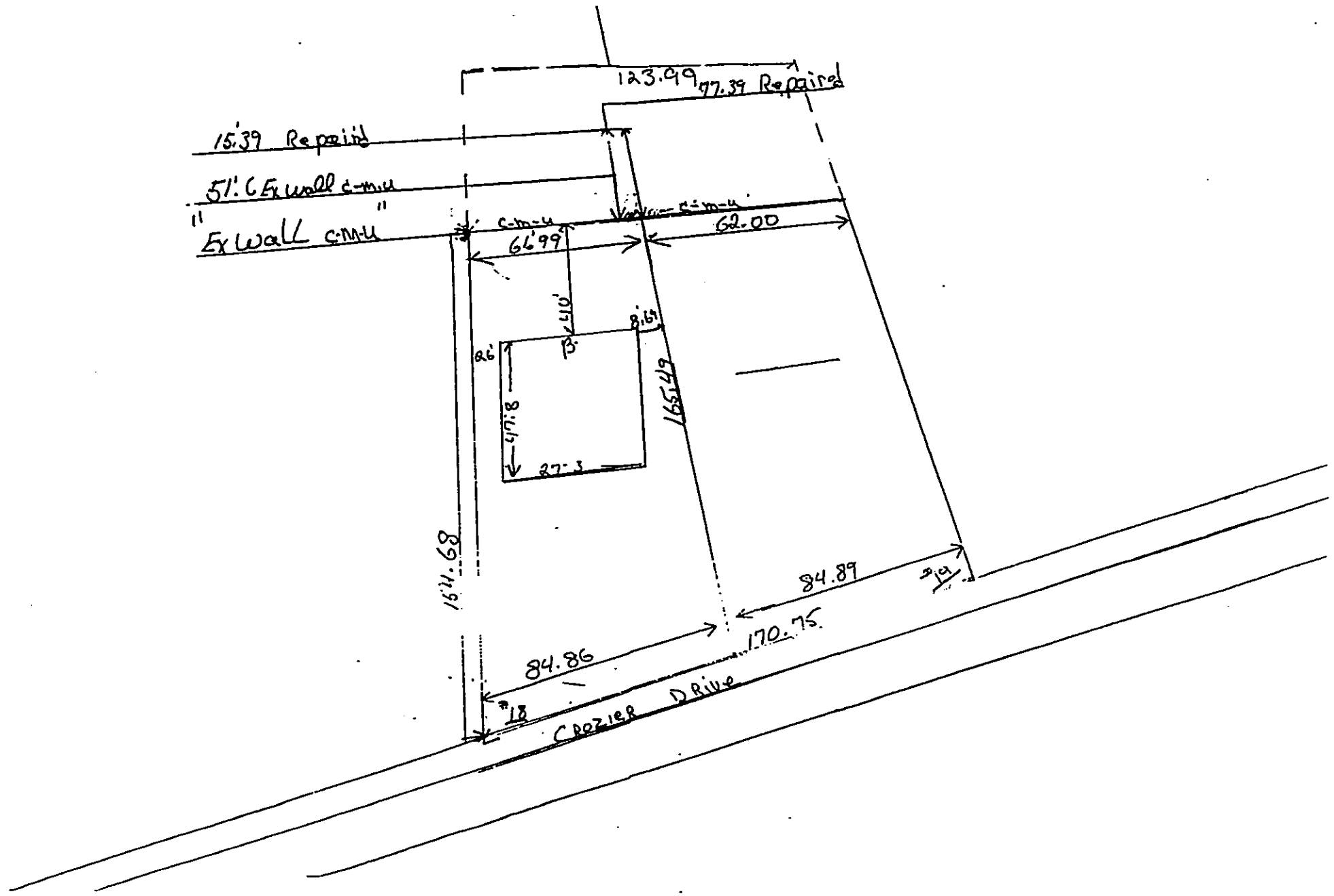
Photo No. 10

July 1992

Approx. Scale: 1" = 270'

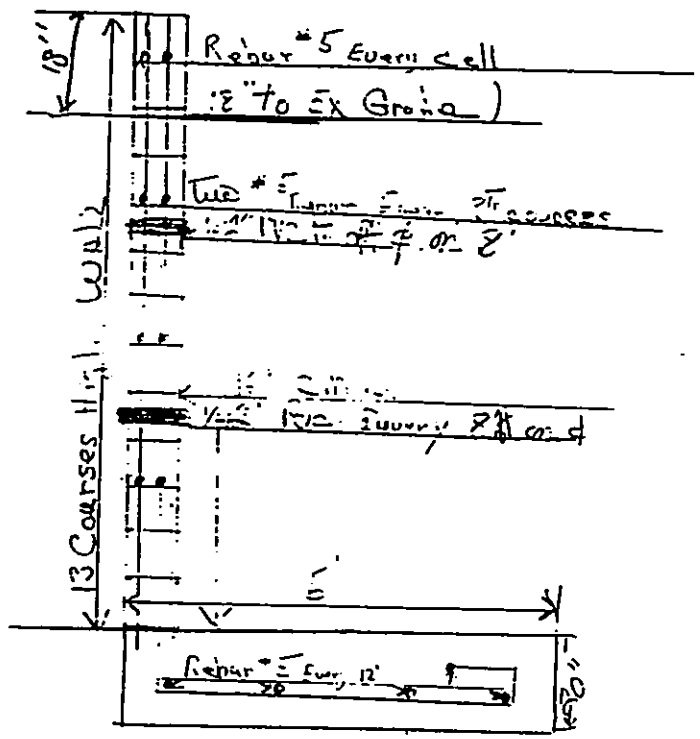
Appendix B

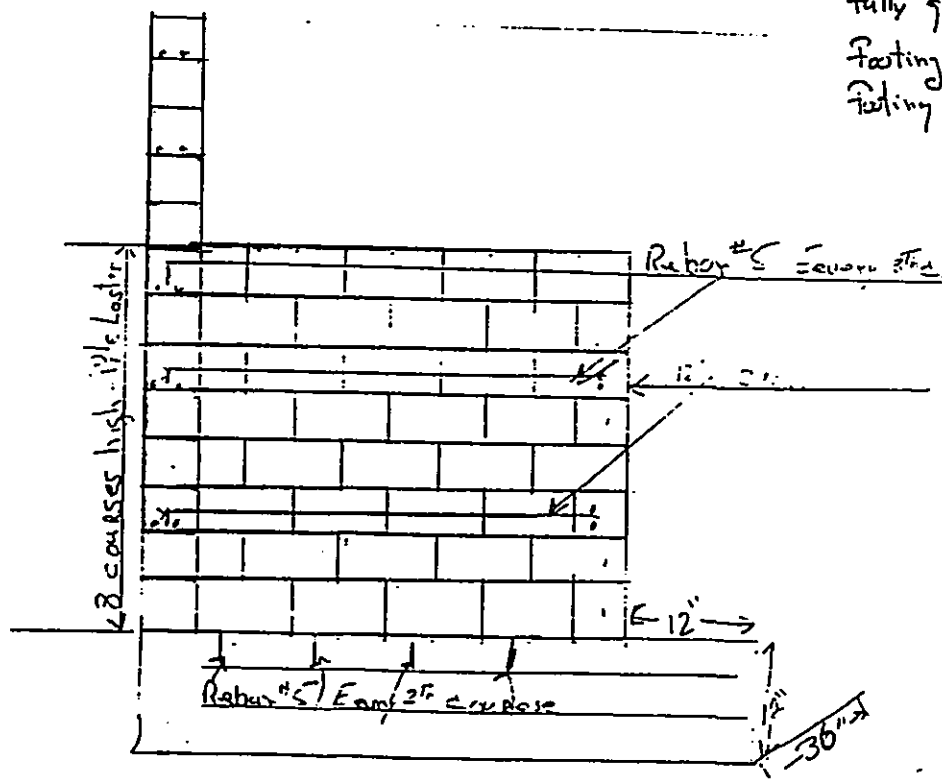
Construction Plans
Prepared by Wasco Builders


123.99
97.39 Repaired
15.39 Repaired
51.6 Ex wall c-m-u
Ex wall c-m-u
c-m-u
66.99
62.00
8.65
8.6
37.3
165.49
15.41.68
84.89
84.86
170.75
18
CROZIER DRIVE

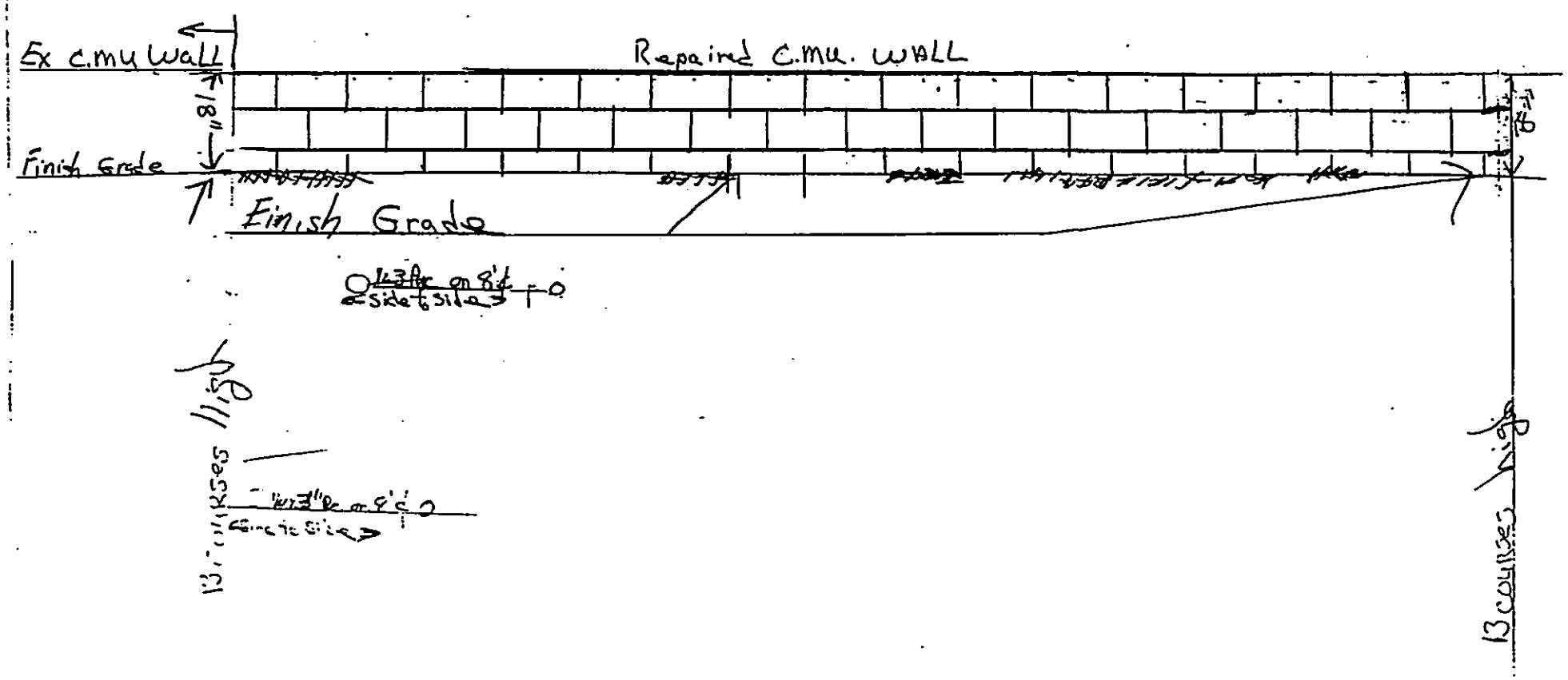
B-1

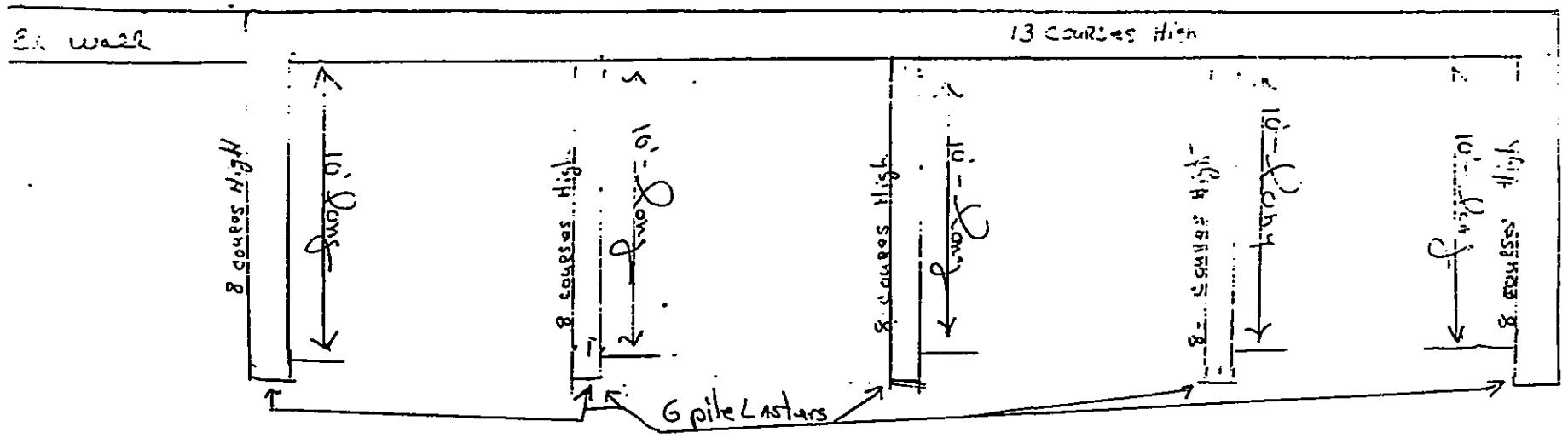
CM-U Wall 'Long x 13 courses
12-8-16 CMU Wall
8- courses pilaster
6- courses short wall
Rebar #5 every cell -2 each courses
fully grouted every cells
Footing Long wall 5'wide x 20'deep
Footing pilaster 3'wide x 12'deep





For Mo Mary Y Munds Trust
GE-701 Ereginer Dr
Wailuku Hi 96791
6-8-6-18


Ex c.mu wall
Repaired C.mu. WALL
18"
Finish Grade
Finish Grade
8'-0"
13 courses high
13 courses high


E. wall
13 courses High
8 courses High
10'-0"
8 courses High
10'-0"
8 courses High
10'-0"
8 courses High
10'-0"
8 courses High
10'-0"
6 pile clusters

Appendix C

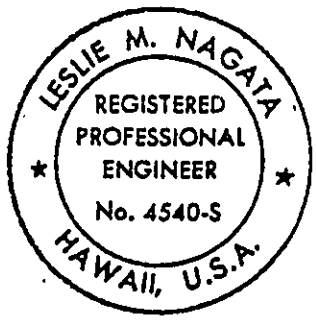
Stability and Strength Analysis by Structural Analysis Group

STRUCTURAL CALCULATIONS

FOR

MOKULEIA SEAWALL

68-701 Crozier Drive
Waialua, Hawaii 96791
TMK: 6-8-6:18



THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

PREPARED BY

STRUCTURAL ANALYSIS GROUP
2353 BERETANIA STREET ROOM 201
HONOLULU, HAWAII 96826

JANUARY, 1995

Structural Analysis Group, Inc.
2353 South Beretania Street #201
Honolulu, Hawaii 96826

Date : February 15, 1995

To : Tom Nance Water Resources Engineering
680 Ala Moana Boulevard, Suite 406
Honolulu, Hawaii 96813

Attn : Mr. Greg Fukumitsu

Re : Mokuleia Seawall - 68-701 Crozier Drive

Mr. Greg Fukumitsu :

We have completed a second evaluation of the subject seawall based on the revised wall length of ~~144~~ 103 feet. It is our understanding that the counterforts are equally spaced along the length of the wall. We analyzed the wall as a cantilever retaining wall rather than a buttress retaining wall. With the increased in wall length the masonry wall can no longer span between buttresses.

In the analysis of strength and stability of this retaining wall we varied several design parameters to see the effect our assumptions would have on the wall's calculated strength and stability. Specifically we varied the fill at the toe (ocean side) of the wall from zero to 4'-8" from bottom of footing. We also varied the soil allowable bearing from 2000 psf to 3000 psf. Reinforcing for the wall and footing is assumed to be as described by the contractor.

In summary we feel this wall will be stable and meet code design criteria if the following criteria are met.

- A minimum of 4'-8" of fill exists at the toe of the wall measured from bottom of footing.
- A minimum soil bearing pressure of 2100 psf can be achieved.
- A passive resistance of 300 pcf can be achieved.
- An active force of not more than 35 pcf is exerted on the wall.
- A coefficient of sliding friction of 0.35 times gravity loads can be achieved.

Attached is a copy of our calculations. If you have any questions please contact the undersigned or Les Nagata.

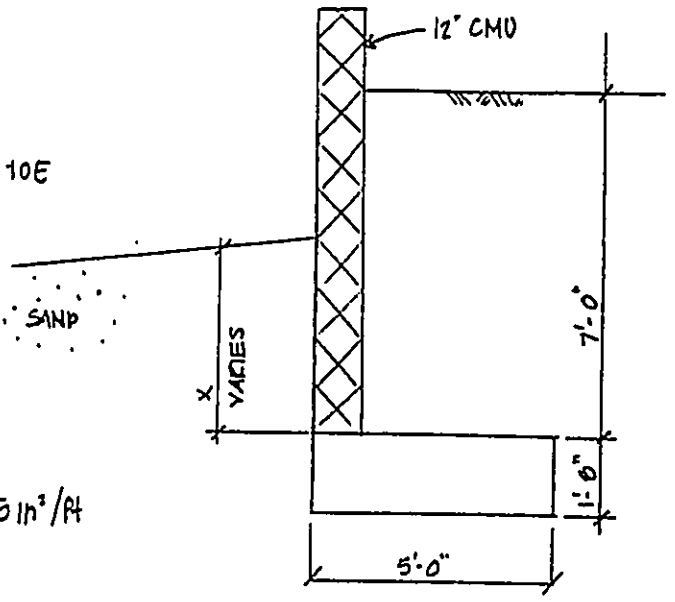
Memorandum by :

Adrian Lee

Structural Analysis Group, Inc.
Adrian Lee

MOKULEIA SEAWALL
CROZIER DR

BEARING PRES.	REQD. SOIL ABOVE TOE
2000 PSF	3'-1"
2500	1'-10"
3000	6"



CHECK WALL #5 @ 8" OC $A_S = 0.465\ in^2/Ft$

$n = 25.8$ $f'_m = 1500\ PSI$ $d = 5.8"$

$\rho = 0.00668$

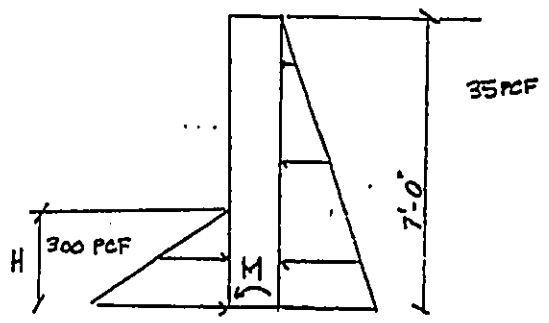
$K = 0.44$

$j = 0.85$

$M_m = 1577\ Ft\cdot\#$

$M_S = 4604\ Ft\cdot\#$

$M_{Wall} = \frac{1}{6}\cdot 35\cdot 7^3 = 2001\ Ft\cdot\#$



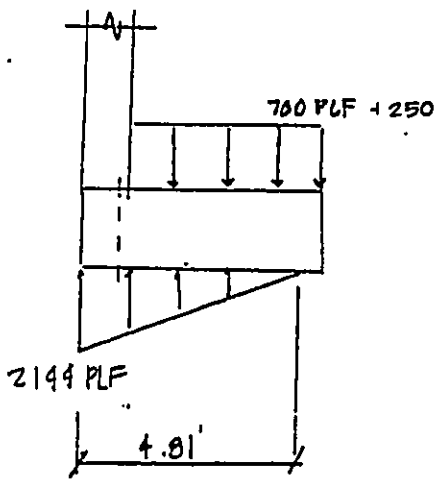
USE PASSIVE RESISTANCE TO REDUCE MOMENT

$M = \frac{1}{6}\cdot 35\cdot 7^3 - \frac{1}{6}\cdot 300\cdot H^3 = 1571$

$H = 2.0'$

HT REQD. = 3.0' ABOVE FOOTING

FOOTING



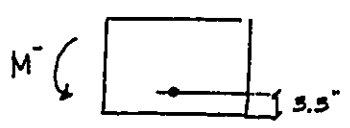
$M = -950\ PLF\cdot 4'\cdot 2.25' + \left(\frac{3.81}{4.81}\cdot 2144\right)\frac{1}{2}\cdot 3.81'\cdot\left(\frac{3.81}{3}+0.25\right)$

$= -8550 + 4917\ Ft\cdot\# = -3632\ Ft\cdot\#$

$M_U = -1.4\cdot 3632 = -5085\ Ft\cdot\#$

BOTTOM STEEL ONLY, $d = 3.3"$ $A_S = 0.31\ in^2/Ft$

$a = \frac{0.31\cdot 60\,000}{0.65\cdot 12"\cdot 2500\ PSI} = 0.73\ in$



$\phi M_n = 0.9\,(0.31\cdot 60\,000)\left(3.3 - \frac{0.73}{2}\right)\frac{1'}{12"} = 4094\ Ft\cdot\#$

$< M_U$ NG

FOOTING

DETERMINE d FROM BOTTOM REQ'D.

$M_U = 5085$ Ft-#

$M_U \leq \phi M_n = 0.9 \cdot A_s F_y (d - 0.73/2) \cdot 1'/12"$

$= 0.9 \cdot 0.31 \cdot 60000 (d - 0.365) \cdot 1'/12"$

$= 1395 (d - 0.365)$

$d \geq \frac{5085}{1395} + 0.365 = 4.01"$

MIN. CLR. FROM BOTTOM = $4.01 - 0.625/2 =$ 3.70 in

CANTILEVER RETAINING WALL [illegible]
14-Feb-95 DESCRIPTION: Kalaiala Seawall
01:0? PM Frazier Drive

OVERTURN F.S. = 1.53 SLIDING F.S. = 2.57 OK

SOIL		WALL	
Unit Wt	100 pcf	Unit Wt	1?0 pcf
Coeff. Friction	0.35	Mat'l. 1=CONC	0
Cohesion	0 psf	0=CMU	
Passive	300 pcf	Height	6.67 ft
Dist Grtr la (Ka?) if	X	Thickness	1 ft
Neglect top	. ft	at Top	1 ft
Active	35 pcf	ADDITIONAL LOADS	
Allow. Bearing	2000 psf	Vert. Ld (+Dn)	0 lb
Surcharge	0 ft	Ecc fr m Wall	0 ft
Ka	0.3	+ towards toe	
Include in Mr	1.00 Kh	Horiz. Ld (+OT)	0 lb
Backfill height	7 ft	Height above Ft	0 ft
Slope V:H	0 :12	Overturning Mo	0 ft-lb
Kv	0 pcf	FOOTING	
Soil over toe	3.67 ft	Unit Wt	150 pcf
KEY		Wall to toe	0 ft
Key to toe	0 ft	Wall to Heel	5 ft
Key width	0 ft	Length	5.00 ft
Key depth	0 ft	Thickness	1.67 ft

Effective soil ht 8.67 ft

Item	OVERTURNING lb	ft	lb-ft	RESISTING lb	ft	lb-ft
Ph	1315.5	2.89	3802	--	--	--
Horizontal Load	0.0	1.67	0	--	--	--
Pp (passive)	0.0	0.00	0	2078.1	1.25	2616
P' (surcharge)	0.0	4.34	0			
Pv	--	--	--	0.0	3.00	0
Vertical Load	--	--	--	0.0	5.00	0
Wall Wt	--	--	--	0.0	0.50	0
Footing Wt	--	--	--	1109.8	0.50	555
Key Wt	--	--	--	1252.5	2.50	3131
Soil @ Toe	--	--	--	0.0	0.00	0
Level soil @ Heel	--	--	--	0.0	0.00	0
Slope soil @ Heel	--	--	--	2800.0	3.00	8400
SUM =			--	0.0	3.67	0
			3801.7	5162.3		12986

Friction Resist.	1806.8 lb	Bearing Len @ Fail	5.00 ft
Cohesion Resist.	0.0 lb	Wt Result from toe	2.34 ft
Total Resist.	3904.9 lb	Wt Mr	3212 ft-lb
		Total Mr	5828 ft-lb

SOIL PRESSURE

Resultant to toe	(ft)	1.60
Eccentricity	(ft)	0.92
L/6	(ft)	0.83
Bearing Length	(ft)	4.81
qmax @ toe	(psf)	2144.5

qmax < qa NO

FOOTING DESIGN

	Toe	Heel
Wall Thick. @ Base		0.67 ft
Crit. Sect frm Wall		0.17 ft
Fy		60000 psi
f'c		2500 psi
p min		0.0033
d toe	1.30	1.46 ft
Mu (Soil)	0	9790 ft-#
Mu (Ftg)Dn	0	3542 ft-#
Mu Design	0	1[illegible] ft-#
Kn	0.0	[illegible]

CANTILEVER RETAINING WALL [illegible]
15-Feb-95 DESCRIPTION Kahuleia Seawall
02:47 AM Crozier Drive

OVERTURN F.S. =	1.52		SLIDING F.S. =	2.09	OK
SOIL			**WALL**		
Unit Wt	100	pcf	Unit Wt	128	pcf
Coeff. Friction	0.35		Matl. 1=CONC	0	
Cohesion	0	psf	0=CMU		
Passive	399	pcf	Height	8.67	ft
Dist 0=tria 1=unif	0		Thickness	1	ft
Neglect top	1	ft	at Top	1	ft
Active	35	pcf	**ADDITIONAL LOADS**		
Allow. Bearing	2500	psf	Vert. "P" (+Dn)	0	lb
Surcharge	0	ft	Ecc from Wall	0	ft
Ka	0.3		- towards toe		
Include in Mr	1.00	%h	Horiz. "H" (+OT)	0	lb
Backfill height	7	ft	Height above Ft	0	ft
Slope V:H	0	:12	Overturning Mo	0	ft-lb
Kv	0	pcf	**FOOTING**		
Soil over toe	1.33	ft	Unit Wt.	150	pcf
KEY			Wall to toe	3	ft
Key to toe	0	ft	Wall to Heel	5	ft
Key width	0	ft	Length	5.00	ft
Key depth	0	ft	Thickness	1.67	ft

Effective soil ht 8.67 ft

Item	OVERTURNING lb	ft	lb-ft	RESISTING lb	ft	lb-ft
Ph	1315.5	2.89	3802	--	--	--
Horizontal Load	0.0	1.47	0	--	--	--
Pp (passive)	0.0	0.00	0	937.5	0.83	781
P' (surcharge)	0.0	4.34	0	0.0	3.00	0
Pv	--	--	--	0.0	5.00	0
Vertical Load	--	--	--	0.0	0.50	0
Wall Wt	--	--	--	1109.0	0.50	555
Footing Wt	--	--	--	1252.5	2.50	3131
Key Wt	--	--	--	0.0	0.00	0
Soil @ Toe	--	--	--	0.0	0.00	0
Level soil @ Heel	--	--	--	2800.0	3.00	8400
Slope soil @ Heel	--	--	--	0.0	3.67	0
SUM =			3801.7	5162.3		12006

Friction Resist.	1866.8 lb	Bearing Len @ Fail	4.13 ft
Cohesion Resist.	0.0 lb	Wt Result from toe	2.34 ft
Total Resist.	2744.3 lb	Wt Mr	4990 ft-lb
		Total Mr	5761 ft-lb

SOIL PRESSURE			**FOOTING DESIGN**			
Resultant to toe	(ft)	1.60	Wall Thick. @ Base		1	ft
Eccentricity	(ft)	0.98	Crit. Sect frm Wall		0.25	ft
L/6	(ft)	0.83	Fy		60000	psi
Bearing Length	(ft)	4.81	f'c		2500	psi
qmax @ toe	(psf)	2144.5	p min		0.0033	
				Toe	Heel	
			d toe	1.38	1.44	ft
			Mu (Soil)	0	8920	ft-#
			Mu (Flg)Dn	0	3156	ft-#
qmax < qa		OK	Mu Design	0	11971	ft-#
			Rn	0.0	171.2	psi
			r			

CANTILEVER RETAINING WALL DESIGN [illegible]
15-Feb-95 DESCRIPTION [illegible] Rulcia Seawall
09:46 AM Cr[illegible]ier Drive

OVERTURN F.S. =	1.64	SLIDING F.S. =	1.53 OK

SOIL		WALL	
Unit Wt	100 pcf	Unit Wt	128 pcf
Coeff. Friction	0.35	Matl. 1=CONC	0
Cohesion	0 psf	0=CMU	
Passive	300 pcf	Height	8.67 ft
Dist 0=tria 1=unif	0	Thickness	1 ft
Neglect top	1 ft	at Top	1 ft
Active	35 pcf	ADDITIONAL LOADS	
Allow. Bearing	3000 pcf	Vert. Ld (+Dn)	0 lb
Surcharge	0 ft	Ecc from Wall	0 ft
Ka	0.3	- towards toe	
Include in Mr	1.00 %h	Horiz. Ld (+OT)	0 lb
Backfill height	7 ft	Height above Ft	0 ft
Slope V:H	0 :12	Overturning Mo	0 ft-lb
Kv	0 pcf	FOOTING	
Soil over toe	0.5 ft	Unit Wt	150 pcf
KEY		Wall to toe	0 ft
Key to toe	0 ft	Wall to Heel	5 ft
Key width	0 ft	Length	5.00 ft
Key depth	0 ft	Thickness	1.67 ft

Effective soil ht 8.67 ft

	OVERTURNING			RESISTING		
Item	lb	ft	lb-ft	lb	ft	lb-ft
Ph	1315.5	2.89	3802	---	---	--
Horizontal Load	0.0	1.67	0	--	--	--
Pp (passive)	0.0	0.00	0	205.3	0.39	80
P' (surcharge)	0.0	4.34	0	0.0	3.00	0
Pv	---	--	--	0.0	5.00	0
Vertical Load	---	--	---	0.0	0.50	0
Wall Wt	--	--	--	1109.8	0.50	555
Footing Wt	---	---	---	1252.5	2.50	3131
Key Wt	--	--	---	0.0	0.00	0
Soil @ Toe	---	---	--	0.0	0.00	0
Level soil @ Heel	--	---	---	2800.0	3.00	8400
Slope soil @ Heel	-	---	--	0.0	3.67	0
SUM =			3801.7	5162.3		12081

Friction Resist.	1806.8 lb	Bearing Len @ Fail	3.44 ft
Cohesion Resist.	0.0 lb	Wt Result from toe	2.34 ft
Total Resist.	2012.1 lb	Wt Mr	6164 ft-lb
		Total Mr	6244 ft-lb

SOIL PRESSURE

Resultant to toe	(ft)	1.60
Eccentricity	(ft)	0.90
L/6	(ft)	0.83
Bearing Length	(ft)	4.81
qmax @ toe	(psf)	2144.5
qmax < qa		[illegible]

FOOTING DESIGN

Wall Thick. @ Base		[illegible]	ft
Crit. Sect frm Wall		0.[illegible]	ft
Fy		60000	psi
f'c		2500	psi
p min		0.0033	
	[illegible]	Heel	
[illegible] toe	[illegible].39	1.47	ft
Mu (Soil)	[illegible]	8021	ft-lb
Mu (Ftg+D)	[illegible]	3156	ft-lb
Mu Design	0	[illegible]	ft-lb
[illegible]	[illegible]	40.[illegible]	[illegible]
	[illegible]	[illegible]	