ENVIRONMENTAL ASSESSMENT FOR A SHORLINE SETBACK VARIANCE APPLICATION

RETAINING WALL

LOCATION:

47-079 Kamehameha Highway, Kaneohe, HI

APPLICANT AND OWNER:

Joseph and Kristen Souza

ACCEPTING AUTHORITY:

City and County of Honolulu
Department of Planning and Permitting

PREPARED BY:

Joseph and Kristen Souza
(808) 236-2480
April 2006
Revised September 2008

September 11, 2008

Joseph N. Souza
Kristen L. Souza
47-079 Kamehameha Hwy
Kaneohe, HI 96744

TMK: 4-7-019-049

City and County of Honolulu
Department of Planning and Permitting
650 South King Street
Honolulu, HI 63813

Aloha,

Enclosed is an updated environmental assessment. A notice of incomplete application was received in 2004 and 2007 which are included in this packet. We have made all the specified adjustments. Due to the nature of our existing application we decided to add the plans for slope stabilization. In this application you will find numerous letters, photos and documents supporting our proposal.

We appreciate your review of our Environmental Assessment requesting a shoreline variance. This is an updated EA which we have made the suggested changes. It is completely understood that our situation is unusual. The limited amount of space from the home to the property line is very minimal. It is necessary to utilize all of our land in order to properly build the recommended retaining walls for stabilization. We did look at other alternatives which were not feasible. We also looked at bringing the walls closer together and remaining in the shoreline. This again was not feasible. It raised numerous safety issues and the walls need to comply with the engineers recommendations. Complying with City, State, Army Corp, DLNR regulations is understood and we have noted our situation the best of our ability while trying to meet all regulations.

Please let us know if you have any questions. We are always happy to assist you. We look forward to your favorable response.

Mahalo,

Joseph N. Souza III

Kristen L. Souza

September 11, 2008

City and County of Honolulu
Department of Planning and Permitting
650 South King Street
Honolulu, HI 63813

Joseph and Kristen Souza
47-079 Kamehameha Hwy
Kaneohe, HI 96744
808-236-2480

Reference: Request for Emergency Permit for Tax Map Key: 4-7-019:049

Aloha Mr. Challacombe,

We are requesting a through review pertaining to the above referenced property. The property is in great need of stabilization on the east side (ocean side). The hillside is approximately 32' in elevation from the shore and has minimal vegetation. The red dirt is clearly visible, lose and falling at an alarming rate. As the tide rises daily it is washing red dirt into Kaneohe Bay. With each rain fall the dirt is land sliding lessening our hill side. Our home/structure is anywhere from 3' to 5 feet from the drop off. This varies along the property. You will be able to clearly see the evident land slides which pull the little vegetation down with its fall.

The cliff is an extreme danger due to the magnitude of its elevation. A huge concern of ours is that someone, either a visitor or one of our children will fall and be severely injured. A worse case scenario would be loose a life. This is a very serious concern of ours.

By stabilizing our property at the shoreline as well as the hillside of our property it will definitely relieve many hardships on both the ocean and our home. We are asking for your quick review of our application. Thus allowing us to build a seawall which will stop land erosion. As you well know the red dirt is not healthy for the sea life it smoothers anything it lands on. In addition to the sea wall two separate 12' retaining walls along the entire length of the property. These retaining walls will stabilize the slope from further land slides. In turn the structure will be stabilized and accidents will be avoided.

Unfortunately we do not have a large window of time here. This as you know is hurricane season. We have had large down pours of rain in the last two weeks which have put fear in our hearts. Our property does not have excess dirt which it can afford to

loose. With weather as our uncertain natural occurrence we never know when the heavy rains will approach again. Our only option is to properly build three structures which will provide a relief to both parties.

It is our goal to follow the proper procedures and take your advice to its fullest. Having known this is a major issue in our lives we had begun researching our options. Joe and I had an architect draw a stabilization plan. The drawings have been stamped by a structural engineer. These two experts were able to utilize our shoreline survey and topographic map done by Gil of Gils Surveying Company. Horst Brandes is our Geotechnical Engineer. Both have completed their reports. You will be able to clearly see Dr. Brandes strong statements. He was able to identify the rock and where the placement of the walls needs to be. We followed his directions when having the plans drawn.

As you can see we are very concerned about our property and would like to obtain authorization for an emergency permit. As you can see our only option is to secure the cliff. If we elect to dismiss this option our home will be in great danger along with Kaneohe Bay.

Please contact me should you have any questions. Thank you for taking the time to review our situation. We look forward to a favorable response. Take care and our best to you!

Sincerely,

Kristen L. Souza

Environmental Assessment

Retaining Wall TMK: 4-7-019-049, 47-079 Kamehameha Hwy, Kaneohe, Hawaii

Table of Contents

1. GENERAL INFORMATION..... 2

2. LOCATION AND GENERAL DESCRIPTION OF THE RETAINING WALL.....
   - 2.1 Location .....
   - 2.2 Proposed Retaining Wall Description .....
   - 2.3 Exhibit 1 – CMU Wall
   - 2.4 Exhibit 2 – Back Filled Concrete Area South View
   - 2.5 Exhibit 3 – Back Filled Concrete Area North View

3. ENVIRONMENTAL SETTING .....
   - 3.1 General Characteristics .....
   - 3.2 Shoreline Characteristics .....
   - 3.3 Oceanographic Characteristics .....

4. SUMMARY OF IMPACTS .....
   - 4.1 Potential Short Term and Long Term Impacts
   - 4.2 Exhibit 4 – View from railing from proposed dwelling
   - 4.3 Exhibit 5 – Photo of Cliff (Right Side)
   - 4.4 Exhibit 6 – Photo View of Cliff Half Way down
   - 4.5 Exhibit 7 – Photo of Cliff (Left Side)
   - 4.6 Exhibit 8 – Photo of front View Straight Down
   - 4.7 Exhibit 9- Standing at top of the cliff
   - 4.8 Exhibit 10- Looking right from the existing deck area down towards the water Kaneohe direction.
   - 4.9 Exhibit 11- This photo is taken from the existing left side of the deck looking straight down towards the water.
   - 5.0 Exhibit 12- This photo is taken from the right side of our property on the existing deck.
   - 5.1 Exhibit 13- This photo is taken from about 3/4th the way down the hill.
   - 5.2 Exhibit 14- The photo is taken from the far right (Kaneohe side)
   - 5.3 Exhibit 15- Photo from mid/upper left side section looking down towards water.
   - 5.4 Exhibit 16- Photo taken from about ½ way down hillside looking towards the right, Kaneohe direction.
   - 5.5 Exhibit 17- Photo taken at top of hillside, looking right Kaneohe Direction.

5. ALTERNATIVES CONSIDERED .....
5.1 Tear Down Structure.....
5.2 Maintain Existing Retaining/Deck Wall
.....

6. REVIEW AND COMMENTS .....

List of Figures

1. Location Map .....
2. Project Area TMK Map .....
3. Certified Shoreline Survey Dated December 23, 2004 and June 4, 2008 .....
4. Letter from Eric Crispin, Department of Planning and Permitting.....
5. Site Plan and Shoreline Setback .....
6. Geotechnical Report, Applied Geosciences
7. Retaining Wall Details Existing and New Coral Rock Wall Drawings.....
8. Kaneohe Bay – Property Location .....
9. Wallace Ho, neighboring property
10. Site Photos .....
11. Project Plans stamped by structural engineer .....
12. Structural engineered data sheets .....

1.0 GENERAL INFORMATION

A. Applicant: Joseph N. Souza III
Kristen L. Souza

B. Recorded Fee Owner: Joseph N. Souza III
Kristen L. Souza

C. Agent: Kristen L. Souza

D. Property Profile:

Location:	Kaneohe, Oahu, Hawaii
Site Address:	47-079 Kamehameha Hwy, Kaneohe, HI
TMK:	4-7-019:049
Lot Area:	9000 square feet
State Land Use:	Urban
Community Development Plan:	Residential
Zoning:	R-10 Residential
Height Limit:	25 feet
Special District:	No
Shoreline Management Area:	Yes
Shoreline Setback:	Yes
Existing Land Use:	Residential, currently occupied

E. Agencies Consulted:
- City & County of Honolulu, Department of Planning and Permitting
- State of Hawaii, Department of Land & Natural Resources
- Army Corps of Engineers

F. Permits Required:
- Shoreline Setback Variance
- Building Permit

2.0 LOCATION AND GENERAL DESCRIPTION OF THE PROPOSED RETAINING WALLS

2.1 Location

The project site, TMK 4-7-017-049: at 47-079 Kamehameha Hwy, Kaneohe, Hawaii, is located in a residential neighborhood along the shore of Kaneohe Bay. The 9000 square foot lot which slopes steeply down to the reef of Kaneohe Bay. Vegetation on the site consists of weeds and one milo tree at the base of the cliff. The tree at this point is holding up the mountain. Majority of the cliff is red dirt. The drop from the flat area, retaining wall, of our property is approximately 35 feet straight down. We the owners, propose to obtain a permit and shoreline setback variance for the structure on our single family lot. A general location map for the project site is shown in Figure 1 and a tax map is shown in Figure 2.

The property is surrounded by other properties which have sea walls, decks and docks located in the Kaneohe Bay. Due to the surrounding homes sea walls there is an adverse effect on our property. The water is pushed North towards our shoreline.

The residence is located in a thoroughly developed residential neighborhood, typically with single-family houses along the shore.

The current wall in the 40 foot set back was built April 2004. No permits were acquired. This wall does not block any beach access. The dimensions of the retaining wall are attached via drawings. The height of the wall including footings is 94". With 3'6" high columns made of 16"X8" CMU retaining wall W7# 5 @ 16" fill all cells solid with grout. In addition aluminum fence 2" top and bottom, ¾" verts @ 4" on center. The stairs are the same. The length of the wall is 75 feet 3 inches. The stairs are built of concrete with 7" risers and 11" treads. Please refer to drawings. We are asking to have this included in this permit process.

2.2 Proposed Project Description

A shoreline survey for the project site was completed on December 23, 2003 and the shoreline survey was certified by the Chairman, Board of Land and Natural Resources, on February 11, 2004. A copy of the certified shoreline is shown on Figure 3. There has been an updated shoreline survey completed and submitted for approval on June 4, 2008. Approximately 323 square feet of the total property area of 9000 square feet has eroded over the years. The erosion is continuing to worsen and needs to be addressed in

a separate manner. We are trying to regain lost property through this maintenance project. Several retaining walls are necessary to stop the erosion. The erosion will eventually begin to undermine the retaining wall and existing structure, Souza residence. There is approximately 2 to 3 feet of dirt between the retaining wall and the cliff down to the water. The home will be in great danger if the erosion continues. Fortunately the retaining wall is in place which is supporting the house structure from becoming under minded. If the structure is demolished it will be very detrimental to the people.

We are requesting an expedited permit process due to the severity of danger. If there should be several days straight of rain the land slides will be enormous. After consulting the Army Corps of Engineers they informed me that if there is an emergency to contact them right away and they will be able to assist us. "This is the worst situation they have heard about on a residential property" says Peter Galloway.

The only solution to our problem is to establish a control system. This will be accomplished by a sea wall and two retaining walls. Joe and Kristen Souza are requesting 3 new structures. One coral rock wall at the shoreline, and two 12 foot coral rock retaining walls. Please see attached drawings. Included are the structural engineered stamped plans and all of his finds and data sheets. Please refer to attached plans. Our contractor will follow all directions from Dr. Brandes of Applied Geosciences. We intend to have proper debris control insuring no waste will be emitted into Kaneohe Bay. The contractor will be responsible for following all plans. There will proper checks done by the structural engineer.

The existing soil will be properly removed. The fill will be completely clean of any harmful products. Everything will be purchased from liable vendors. The contractor will also insure proper drainage. This is important for the bay along with the longevity of the wall and stabilization.

Our neighbors to the Kaneohe side of our property, Wallace and Louise Ho are very supportive of us controlling the slope and maintaining our property. As you will see in our list of figures #8 they have existing retention walls on their property. Their walls are permitted and we have included a copy of the agreement between them and the State of Hawaii along with their payment for the lease.

History of Erosion:

Please take note of Wallace Ho's shoreline survey which notes the Souza's shoreline on the property. As you can clearly see 10 plus years have passed and the Souza's shoreline has receded drastically. Historically Kaneohe Bay along with the island of Oahu has continual erosion. There is no stopping nature. The erosion is more dramatic on the Souza's property due to neighboring seawalls.

Our neighbor to the north, Joe Myer is also very supportive of us constructing these walls and maintaining our existing deck. Joe Myer does not have a structure on his property. It has been a vacant lot for over 10 years since we purchased our property. He is in the process of trying to obtain permitting as well. His intentions are to stabilize his shoreline and build a home. We completely support each other. His property and our property are the only two remaining with out any type of seawall.

Our current retaining wall/deck structure is along the entire length of the property and is concrete bolted into the house. The wall is made of CMU tile with rebar. The wall is backfilled with compacted dirt from the property and is covered with concrete. The flooring is made with rebar beneath a 4" thick field with a 9" thickened edge. The flooring is connected to the house structure using rebar. There is a set of small stairs midway allowing access to the ground. The stairs are made of concrete and rebar. In addition there are columns along the edge of the wall. These columns are made of CMU blocks and are filled with rebar posts and concrete for stability. An aluminum fence is in place for protection. The aluminum fencing is 4" on center and 4" off the ground. The entire structure is very sound is vital to our homes protection. The concrete columns are stable with rebar and concrete filling. Please refer to drawings.

Please see attached photos:

Exhibit 1- EXISTING CMU Wall
(Looking at the wall from the ocean side)

Exhibit 2 – Back Filled Concrete Area South View
(House with proposed deck area, looking left to right)

Exhibit 3 – Back Filled Concrete Area North View
(House with proposed deck area, looking right to left)

3. ENVIRONMENTAL SETTING

General Description

The Kaneohe Bay area was formed as part of the Kailua, Ko'olau and Honolulu volcanic series. Only three of the volcanic ridges that separate streams flowing into Kaneohe Bay are present today. One of the ridges is Puu Pohakea which projects into Kaneohe Bay between Kaneohe and He'eia. The ridge continues offshore as the basalt core of Moku o Loe (Coconut Island). The project site is located along the shore of He'eia.

A combination of soil formation, weathering and erosion created valleys and deposited alluvial material on the windward coast. The drainage area of Kaneohe Bay is covered by young and old alluvium from the mountain cliffs. Concurrently, the shorelines were formed through ocean wave erosion, coral reef building, and marine deposits.

3.1 Shoreline Characteristics

According to the 1978 Kaneohe *Bay Water Resources Study*, the surface of Kaneohe Bay is approximately eight miles long and 2.6 miles wide. About midway across the mouth of the bay there is an extensive barrier reef that protects the waters of the bay form the ocean. The fringing reef lat borders the shoreline almost continuously except for stream channels and extends between 1,000 and 2,500 feet off of the shoreline.

3.2 Oceanographic Characteristics

The general ocean and near shore environment of the Hawaiian Islands is discussed in the study by Gerritsen.

Winds

The winds in Hawaii can be classified into four different groups: trade winds, kona winds, tropical storms and tropical cyclones. The northeast trade winds are the prevailing winds. Winds affect the direction and magnitude of the surface currents in the ocean, as well as the currents in shallow coastal areas. The project area, located on the northeast or windward side of Oahu, is exposed to the trade winds.

Waves

The wave patterns in the Hawaiian Islands are generally categorized in five major types: trade wind waves, North Pacific swell, Kona storm waves, south swell, and cyclonic or hurricane waves. The project site, while exposed to trade wind waves which occur about 75 percent of the time with an average significant wave height of 4.8 feet, is somewhat buffered from extreme direct wave energy due to its interior location on the bay. The waves which are generated have a tremendous affect on our property. Our lot and our neighbor to the Kahalu'u direction are the only two lots with out sea walls. The outcome is horrific due to all of the outer homes having sea walls and the water being directed to our property first. The wave action comes from the east and our neighbor is north of us. Thus our property is getting hit first by the water. Every day when the tide rises it disperses red dirt into the bay covering a large portion of the reef in Kaneohe Bay. This has been going on ever since we purchased

our property over 10 years ago. The wave action amplifies the erosion as well as outer lying walls next to us along the shoreline. The continuous flow of water is slowly deteriorating our property. Unfortunately the red dirt enters the bay and acts as a blank on the reef fronting our property. The red dirt completely smothers the coral. In addition the red dirt kills the sea life living in the reef. This problem can be eliminated by controlling the shoreline and the slope of our property.

SUMMARY OF IMPACTS

3.1 Potential Short-Term and Long-Term Impacts

The retaining wall is in place on the proposed property. In reference to the short term affects of the wall. The structure is not impacting the ocean in way. It is 35 feet away from the ocean. Currently it is a retaining structure stabilizing our home. We have taken necessary measures to avoid erosion in to the bay from rain run off. We have installed a gutter system which collects rain water. This is a two part assistant. The gutter is keeping the rain water from eroding our cliff which fronts our home on the ocean side. With heavy rain our cliff has had four major land slides.
Eventually the cliff will undermine our entire retaining wall. This is possible if there is a long period of rain. In Hawaii's history rain fall is typical and can occur for many days straight.

If the retaining wall is demolished the residence, home and environment will be in great danger. In actuality the property should have a sea wall with a tiered wall system. By getting the slope of the cliff under control on the property and its surrounding will greatly benefit. This would stabilize the erosion in to Kaneohe Bay as well as protect the family and the dwelling. In reference to the long term affects of the wall. There are no affects to the ocean or land. The construction of this wall was done during the construction of our home which was permitted. Nothing entered the ocean.

There is no other option than to maintain this structure. The bottom line is if the structure is to be demolished our home will fall down the cliff. In actuality the property needs a lot of work on the ocean side. Every home along our shoreline has a see wall and slope control walls from left to right.

There is one exception with our neighbor on our left who does not have a house on his property and does not have a retaining wall. During the heavy rains last February 2006 his retaining wall fell over into the ocean dragging large amount of our cliff which included our plants, an entire Milo tree and huge amounts of red dirt down with it.

The land slides are quite awful and need to be addressed properly. This information is evident that if we do not maintain this retaining wall and incorporate new retaining walls or over the next few years our home will be undermined. Worst off is the ocean. The fish, coral and seaweed are being killed with every rain. If the wall is destroyed our home will stand approximately 10 feet higher than the ground. We will have no way to step out of our sliding glass doors. The bottom line is without the variance of our current retaining wall and the new structures the ocean, house and us the occupants will be in grave danger.

Removing the proposed property, retaining wall, back fill, concrete top and railing will cause great hardship. By removing the above mentioned items we will be deprived of reasonable use of our land. If we are granted the variance we will be able to continue to use our doors which exit on to the concrete filled area. This is a reasonable use of our land. We feel that this is a necessity for our well being as well as the ocean. We can not continue to have more erosion. The wall has permanently sustained our property and will for our life time.

We have attached a few exhibits clearing showing the danger that the home is in. The cliff which is 2 feet away from the retaining wall continues to erode at a very alarming rate. There is an average of one to two land slides quarterly. The land/hill side along Kaneohe Bay of 47-079 Kamehameha Hwy, needs to be addressed, which is a whole other issue in its self. The Souza's need to control the slope and can assist in this only by maintaining the retaining wall in discussion. They have also been advised to quickly take care of the undermining of their property.

Please refer to exhibits clearly showing the erosion and slope. We felt that these photos are great tools for your review. The new retaining structures will maintain and stabilize the cliff.

Exhibit 4 - View from railing from proposed dwelling
(Looking down at the water from proposed deck)

Exhibit 5 - Photo of cliff (Right Side)
(Standing half way down the hillside towards the right of the property)

Exhibit 6 - Photo of cliff half way down
(Standing half way down the hillside looking straight down on the property)

Exhibit 7 - Photo of cliff (Left Side)
(Standing half way down the hillside towards the left of the property)

Exhibit 8 – Photo of front view
(Standing half way down the hillside looking towards the left of the property)

Exhibit 9- Standing at top of the cliff (center of property) looking left down towards the water. Surrounding area are weeds, bushes and red dirt.

Exhibit 10- Looking right from the existing deck area down towards the water Kaneohe direction. Please note the grass area on the lower area is our neighbor, Wallace Ho. Their property is approximately 10 feet further out than ours. They have a lease with the City for the property gained.

Exhibit 11- This photo is taken from the existing left side of the deck looking straight down towards the water. The large tree on the left is our neighbors Kahalu'u side.

Exhibit 12- This photo is taken from the right side of our property on the existing deck. The view is looking north. The large trees are our neighbor's property, Joseph Meyer.

Exhibit 13- This photo is taken from about 3/4th the way down the hill. This is center of our property from left to right. Please notice the red dirt. With each rain this creates a thick layer of red dirt creating a blanket for the reef.

Exhibit 14- The photo is taken from the far right (Kaneohe side) of our property next to Wallace Ho. The white fence and rock wall is their property. Please note the severity of height elevation. This is 35' high.

Exhibit 15- Photo from mid/upper left side section looking down towards water.

Exhibit 16- Photo taken from about ½ way down hillside looking towards the right, Kaneohe direction. This is one of the many land slides which occur annually. This part of the hillside is just below exhibit 17.

Exhibit 17- Photo taken at top of hillside, looking right Kaneohe Direction.

Additional information pertinent to Environmental Assessment:

We have been diligently working with other government agencies in an effort to resolve our current situation. To notify you the City and County Honolulu of these additions and recommendations we have included correspondence between the Souza's and Department of Land and Natural Recourses. Due to the emergency setting they have

granted us permission to place a temporary stabilization at the shoreline. DLNR has clearly stated that in order to properly resolve all issues we will need to build one sea wall and two 12' retaining walls. Clearly the sandbags will not stabilize the hillside whatsoever. Three DLNR representatives visited our property for an inspection. The inspection was two part: one to determine if our property falls under emergency action which is does, two is to verify our shoreline survey done by Gil Bumanglag April 2008. Gil also completed a topographic survey which was used by the draftsman and engineer in development of the safest conforming (to city and county regulations) retention system for our property.

Agencies Consulted in Preparation of Environment Assessment:

It is important to do early consultation regarding our proposed plan for stabilization. The outcome was tremendous. As the evidence clearly shows there is a dire need for immediate action.

Applied Geosciences, LLC was contacted and hired to perform a professional review of the proposed property. Dr. Brandes concluded a number of facts. They are included in his review which you can view in figure 6.

DLNR requested us complete a Performance Bond which will allow us time to clean up our property while stabilizing the soil with the retaining walls. They stated this is the only option in being able to refer our shoreline survey for approval by DLNR. Chris Conger of DLRN e-mailed us the contact which we are currently working on with our contractor. Once this is completed we will have an approved Shoreline Survey. The existing one is included in this EA for your review.

On August 13, 2008 I, Kristen Souza attended the Kahaluu neighborhood board meeting to present our property and our plan. It went extremely well. They did not have any negative comments only positive. The said that because our property and our neighbor (Kahaluu side) are the only two properties with out protection from the ocean that is it imperative to maintain our land and protect our home. The only question they had for me is: "Why do you have to get a Shoreline Survey done every year?" The board had no objections.

We have been in contact with the Army Corps of Engineers and they are willing to work with us through the permitting process. I am in contact with Joy Anamizu and Peter Galaway. Due to the limited distance we have on our property in order to build the proper footings and be able to maintain the three walls we need to utilize all of our land. We are asking to regain the lost square footage which has eroded due to the neighboring walls and other natural occurrences.

The building of these walls quickly is our only option. In a short statement this is what we are dealing with. It is our goal to follow the proper procedures and take your advice to its fullest. Having known this is a major issue in our lives we had begun researching our options. Joe and I had an architect draw a stabilization plan. The drawings have been stamped by a structural engineer. These two experts were able to utilize our shoreline survey and topographic map done by Gil of Gils Surveying Company. Horst Brandes a geotechnical engineer visited our property and arranged for drilling to be completed. He was able to

identify the rock and where the placement of the walls needs to be. We followed his directions when having the plans drawn.

As you can see we are very concerned about our property and would like to obtain approval of our Environmental Assessment. As you can see our only option is to secure the cliff. If we elect to dismiss this option our home will be in great danger along with Kaneohe Bay.

4. ALTERNATIVES CONSIDERED

4.1 Demolish Existing Structure

The Souza family will endure great hardship if demolishing the structure is determined as the resolution. There is no other way to state this but if the encroachment into the shoreline setback area is not allowed the house could be undermined with extensive few days of rain. The detrimental outcome is just too great. We are confident from your experience and knowledge that you know that this existing structure is vital to our safety. The structure as summarized above needs to remain in place.

4.2 Maintain Existing Structure

The existing retaining wall is necessary to both the homeowner as well as the environment. The findings in this assessment are too great to be over looked. It is vital that the existing structure is maintained. In addition, your expertise and knowledge will allow you to be able to confident know that the seawall and two retaining walls need to be built to protect all parties (land owner and ocean) involved. The new seawall and two retaining walls will control the slope and in turn will add stability to the Souza residence and Kaneohe Bay.

4.3 Other Options for Stabilization

Besides building one seawall and two 12' retaining walls there are two other options which were reviewed. One would be a thick layer of vegetation which you see from the Geotechnical report that is not a valid option. The second option would be a hillside blanket such a retention system allowing vegetation to grow through. This is a system which is very unsightly to the neighborhood, not practical with the slope in mind at a home residence as well at it will stop our access to our property.

5. REVIEW AND COMMENTS

We, Joseph and Kristen Souza are asking that our current retaining wall structure be approved for a variance and permitting. We are also asking that our current plans for three stabilization walls be approved for a variance as well. In addition we are asking that we obtain a permit to build the attached described coral rock walls. Please take into consideration all of the positive aspects of maintaining our deck and securing our slope when making any decisions. It would be dreadful if any thing were to happen physically to our family and the environment. We look forward to your favorable response. Thank you for taking the time to review our situation.

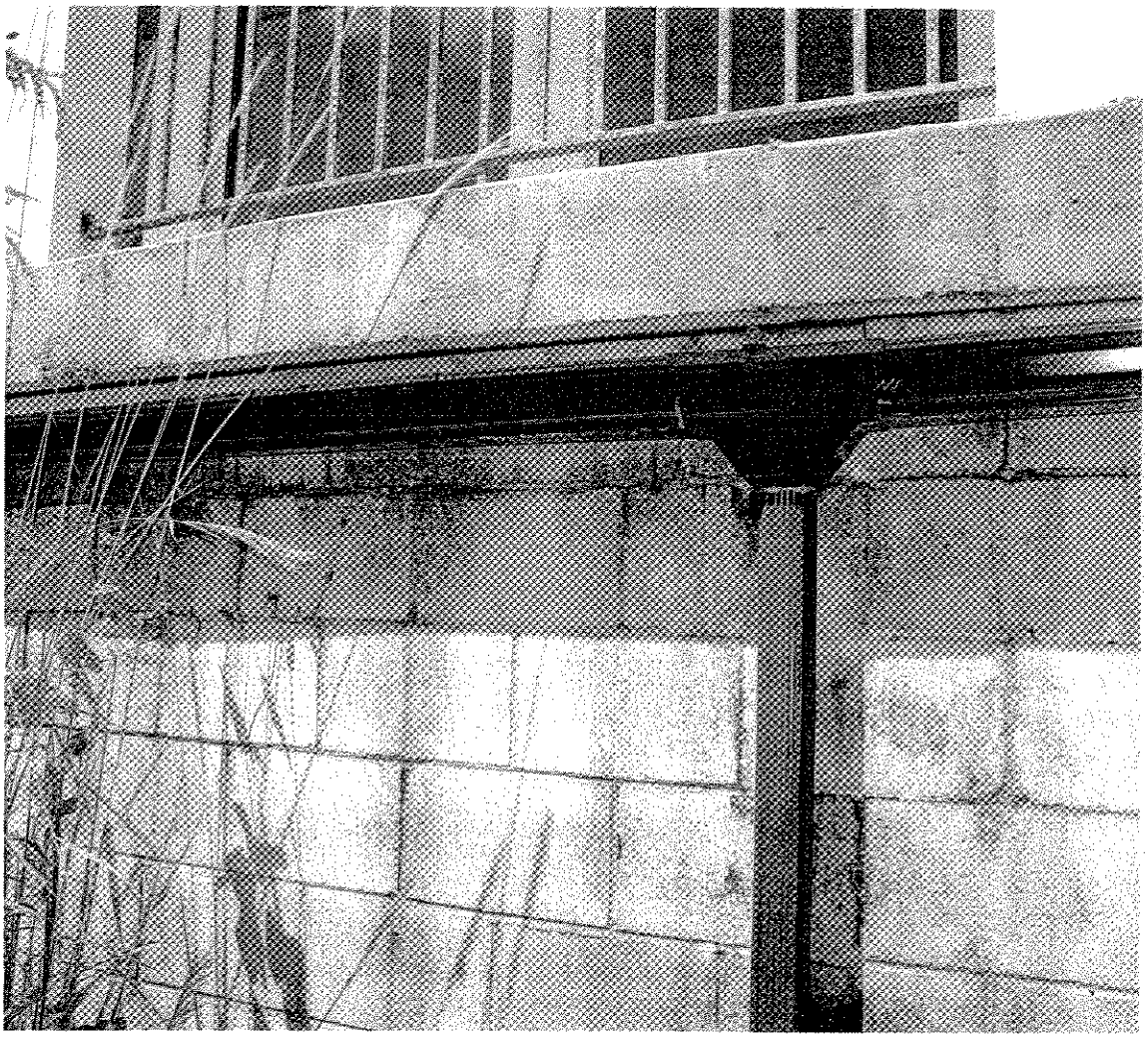


Exhibit 1

CMU wall with gutter system. Below this structure is dirt and weeds. There is about 2 feet some areas are less and some are a bit bigger of dirt and weeds before the cliff to the water.

47-079 Kamehameha Hwy
Kaneohe, HI 96744

Exhibit 2

Proposed retaining wall with back fill and concrete. South View.

47-079 Kamehameha Hwy
Kaneohe, HI

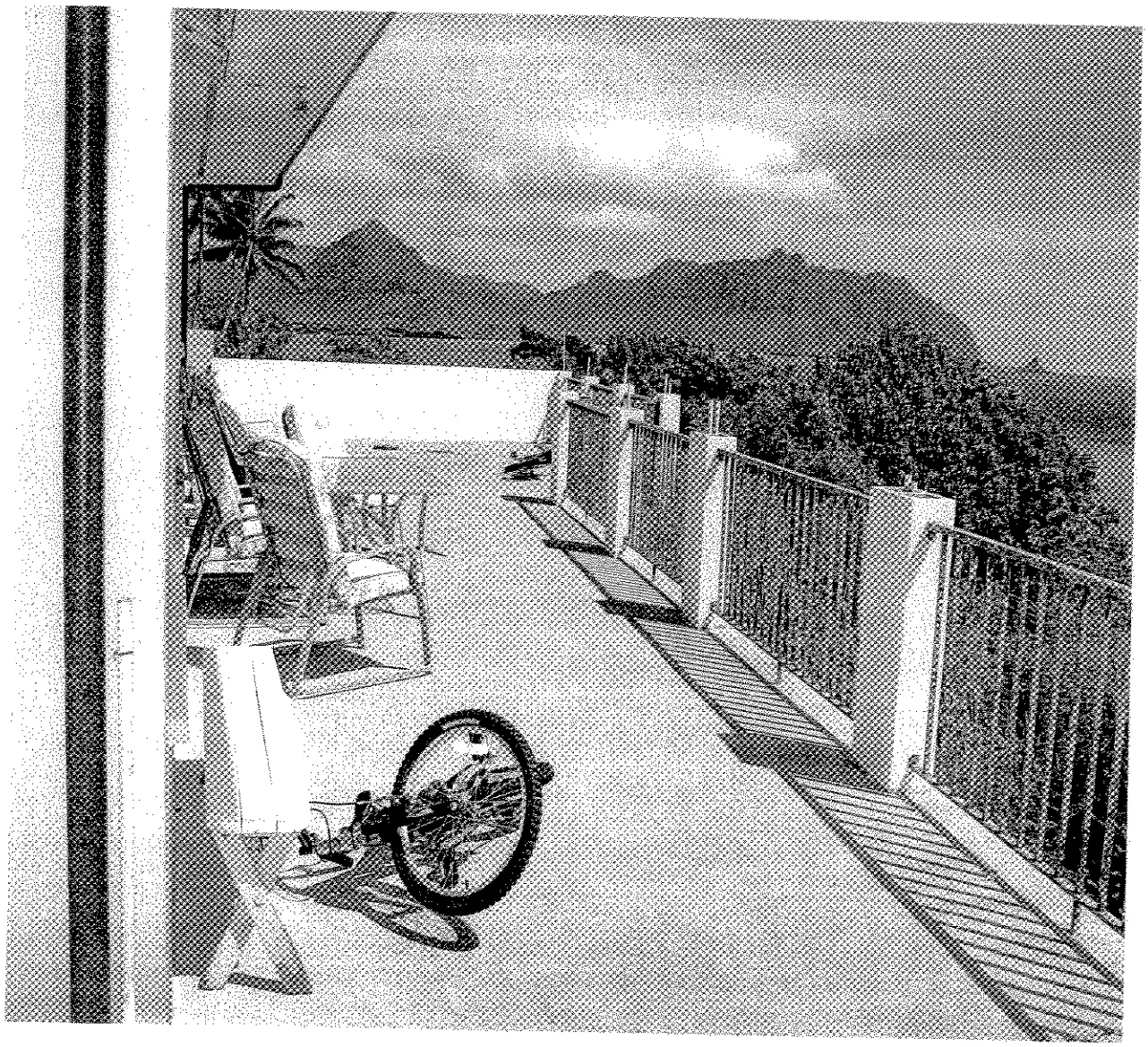


Exhibit 3

Proposed retaining wall with back fill and concrete

47-079 Kamehameha Hwy
Kaneohe, HI

Exhibit 4

This is a photo of the cliff looking down from the retaining wall. Please take note on how dangerous it could be if there was no type of railing or retaining wall.

47-079 Kamehaneha Hwy
Kaneohe, HI

Exhibit 5

Photo of cliff (right side) below the CMU retaining wall. Please take note how the cliff is straight down. Also you are able to see the erosion which has taken place over the last year.

47-079 Kamehameha Hwy
Kaneohe, HI

Exhibit 6

Front view of cliff from about halt way up to the retaining wall from the water line. The erosion as you are well aware of will not stop until we control the slope and situation. Any large rains just create more danger and eat away at our property.

47-079 Kamehameha Hwy
Kaneohe, HI

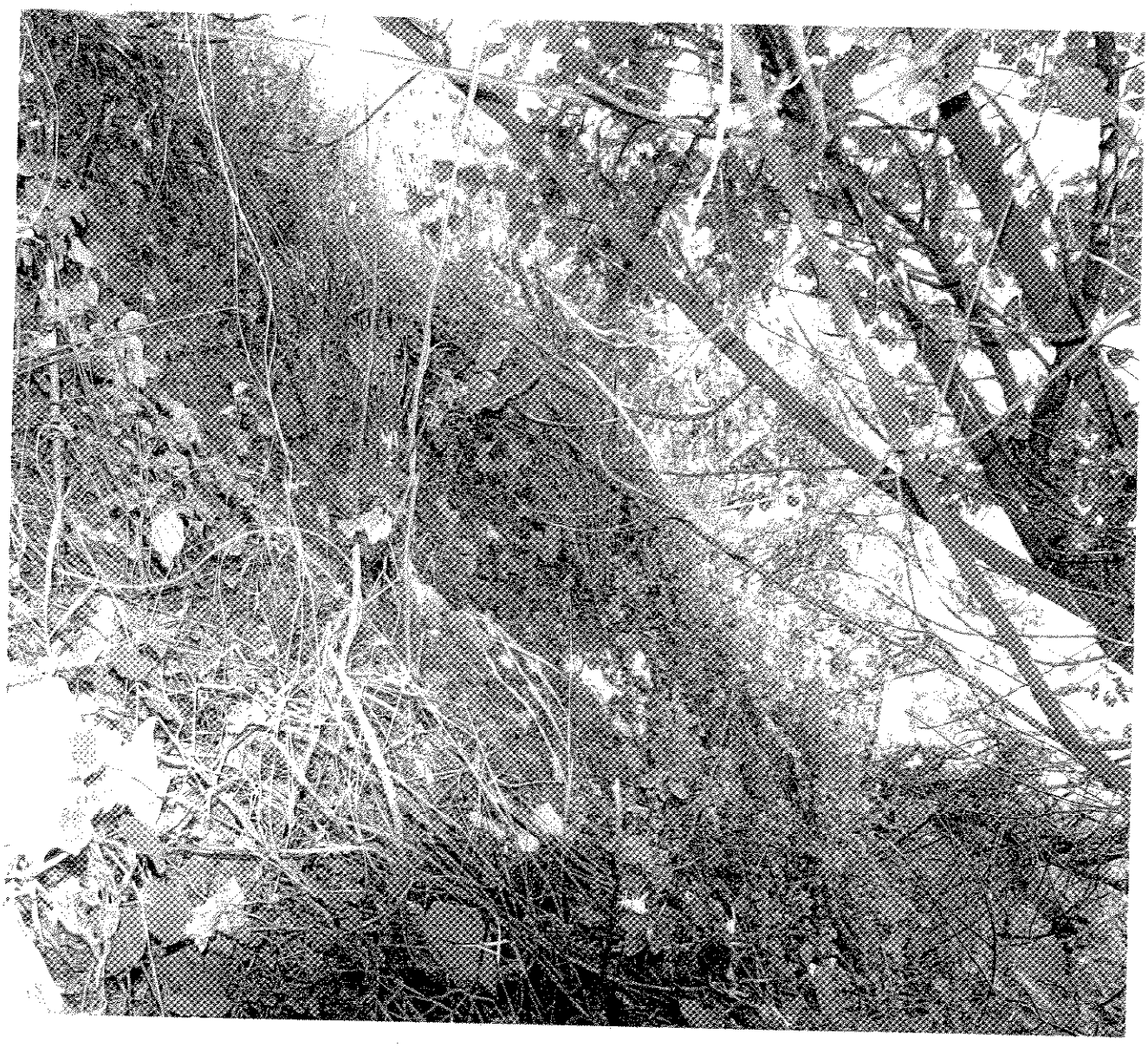


Exhibit 7

Photo of cliff on the left side of the property. The dirt area that you are viewing is one of many land slides. To the left (facing water) of this land slide our neighbors Milo tree has fallen in to the water bringing down majority of our hillside.

47-079 Kamehameha Hwy
Kaneohe, HI

Exhibit 8

This is a very large span of land. This is another front view straight down (about 20 feet) from retaining wall. There is one large Milo tree on the proposed property. There is shrubbery along the hillside.

47-079 Kamehameha Hwy
Kaneohe, HI 96744

Exhibit 9

Standing at top of the cliff (center of property) looking left down towards the water. Surrounding area weeds, bushes and red dirt.

Exhibit 10

Looking right from the existing deck area down towards the water Kaneohe direction. Please note the grass area on the lower area is our neighbor, Wallace Ho. Their property is approximately 10 feet further out than ours. They have a lease with the City for the property gained.

Exhibit 11

This photo is taken from the existing left side of the deck looking straight down towards the water. The large tree on the left is our neighbors Kahahlu'u side.

Exhibit 12

This photo is taken from the right side of our property on the existing deck. The view is looking north. The large trees are our neighbor's property, Joseph Meyer.

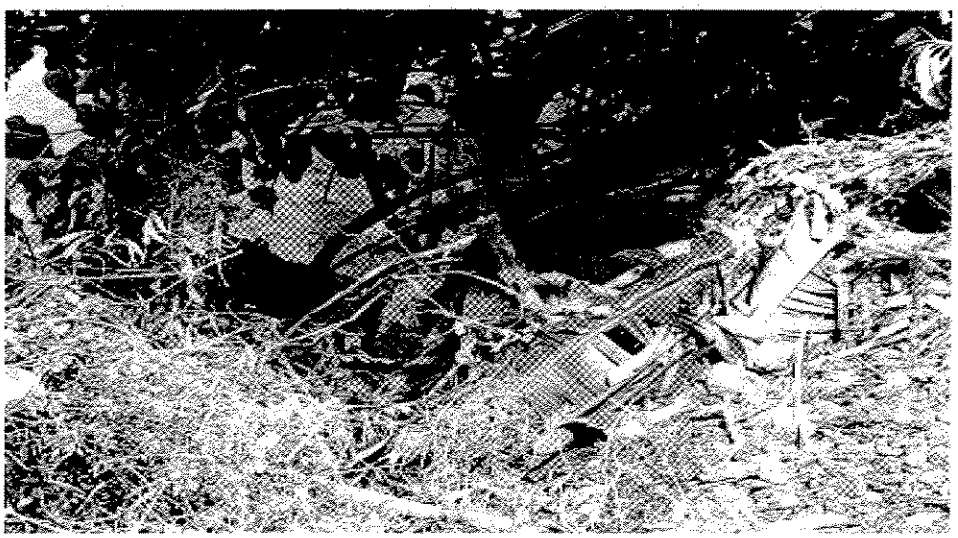


Exhibit 13

This photo is taken from about 3/4th the way down the hill. This is center of our property from left to right. Please notice the red dirt. With each rain this creates a thick layer of red dirt creating a blanket for the reef.

Exhibit 14

The photo is taken from the far right (Kaneohe side) of our property next to Wallace Ho. The white fence and rock wall is their property. Please note the severity of height elevation. This is 35' high.

Exhibit 15

Photo from mid/upper left side section looking down towards water.

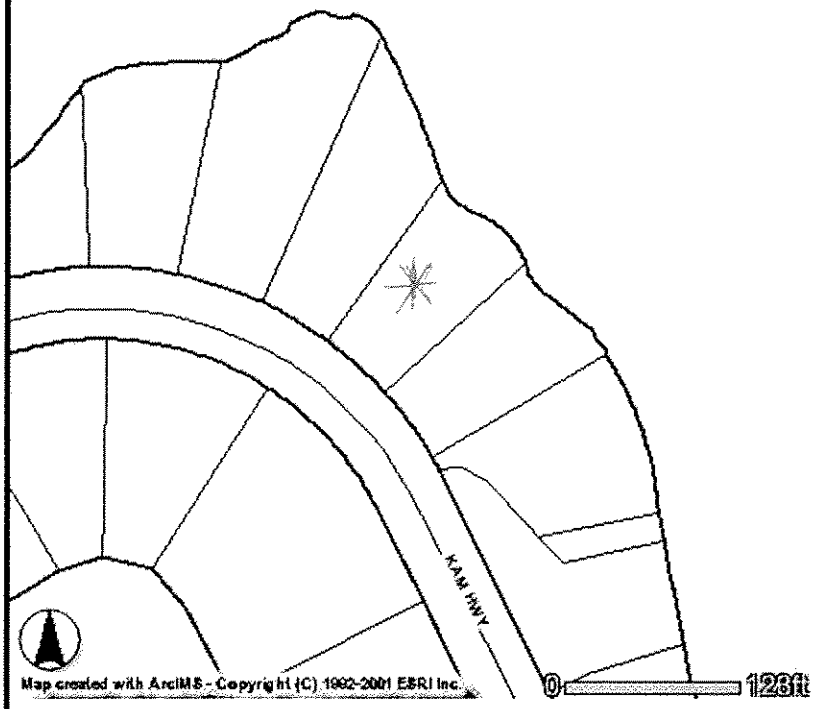
Exhibit 16

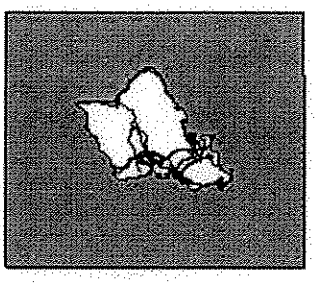
Photo taken from about ½ way down hillside looking towards the right, Kaneohe direction. This is one of the many land slides which occur annually. This part of the hillside is just below exhibit 17.

Exhibit 17

Photo taken at top of hillside, looking right Kaneohe Direction.

Souza overhead shot





Legend

- Plat Maps
- Place Names
- Zoned Planned Development Housing
- Streets
- Flood Elev Lines
- Flood Elev Polys
- Topography 5'
- Building Footprints
- Parcel
- Color Aerial Image (Honolulu)
- coast
- Land
- Ocean

DEPARTMENT OF PLANNING AND PERMI G
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 523-4414 • FAX: (808) 527-6743
DEPT. WEB SITE: www.honoluludpp.org • CITY WEB SITE: www.honolulu.gov

JEREMY HARRIS
MAYOR

ERIC G. CRISPIN, AIA
DIRECTOR

BARBARA KIM STANTON
DEPUTY DIRECTOR

2004/ELOG-2646(DT

NOTICE OF INCOMPLETE APPLICATION

File No. : 2004/SV-22

Applicant : Kristen L. Souza

Location : 47-079 Kamehameha Highway - Kahaluu

Tax Map Key: 4-7-19: 47

Received : November 22, 2004

Request : SHORELINE SETBACK VARIANCE (SV)

The application cannot be accepted for processing because it is not complete. The application must include the following:

1. The environmental assessment (EA) must be submitted with the SV application.

2. A copy of a current (less than one year old) certified shoreline survey. The survey must be certified by the State Department of Land and Natural Resources.

3. Two sets of drawings and/or plans applicable to the project. All drawings/plans must be black line prints, drawn to scale.

4. A site plan that includes the following:

   a. Property and easement lines, including lot dimensions and area.

   b. The location, size, spacing, and dimensions of all existing and proposed and/or after-the-fact structures.

c. The 40-foot shoreline setback line.

5. Floor plans and elevation drawings of all proposals and/or after-the-fact work must be submitted.

The department has EA documents which were prepared for other projects, if you wish to view one for format and content. You can view past SV files at our Permits and Zoning Records Access Branch on the ground floor of the Honolulu Municipal Building.

We have enclosed a copy of the "Content Guide for Preparing an Environmental Assessment" and "Instructions for Filing an Application for a Shoreline Setback Variance."

Please resubmit the SV application, a copy of the certified shoreline survey, 20 copies of the EA, a set of plans drawn to scale, and a check for $1,200. If you have any questions, please call Dana Teramoto of our staff at 523-4648.

Elizabeth Chin

For ERIC G. CRISPIN, AIA
Director of Planning
and Permitting

Date: November 30, 2004

EGC:nt

Encl.

G:\Dana\SV\2004sv22\incom.doc

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
TELEPHONE: (808) 523-4432 • FAX: (808) 527-6743
DEPT. INTERNET: www.honoluludpp.org • INTERNET: www.honolulu.gov

MUFI HANNEMANN
MAYOR

HENRY ENG, FAICP
DIRECTOR

DAVID K. TANOUE
DEPUTY DIRECTOR

2007/ED-6(DT)

April 12, 2007

Mr. Joseph N. Souza
47-079 Kamehameha Highway
Kaneohe, Hawaii 96744

Dear Mr. Souza:

Subject: Draft Environmental Assessment (EA)
Kristen L. Souza
47-079 Kamehameha Highway – Kahaluu
Tax Map Key 4-7-19: 47

The draft environmental assessment (EA) for a shoreline setback variance received on March 9, 2007 cannot be processed because it is incomplete. More information is required to assess the impacts of the proposal and its conformance to the applicable regulations of Chapter 343, Hawaii Revised Statutes (HRS) and Chapter 23, Revised Ordinances of Honolulu (ROH).

1. Page 3 includes a "List of Figures," which refer to the location map, project area map, certified shoreline survey dated December 23, 2003, site plan, retaining wall details, property location, and retaining wall photos. All seven (7) figures were not included in the EA and should be included. Also, the retaining wall photos should be labeled and keyed to a general site map.

2. The site plan must show the property lines, existing structures, ground elevations, shoreline, and 40-foot shoreline setback line. The dwelling setback from the shoreline must also be shown.

3. All plans must include a graphic (bar) scale.

4. If this is an after-the-fact request, it should be clearly explained in the "Proposed Project Description." The length and height of the retaining walls should be included, along with the setback of the walls from the shoreline. Also, clarify if any of the walls block beach access.

5. If the retaining walls have already been built, the date the walls were constructed and whether any permits were acquired for the walls should be included in the EA.

6. The photos of the property submitted should be labeled and keyed to a general site map.

7. The short-term (e.g., construction impacts) and long-term impacts should be discussed in the EA.

8. Complete justification statements which explain the hardship the applicant would experience if the encroachment into the shoreline setback area is not allowed. The explanation of hardship is an essential part of a shoreline setback variance application. We suggest you review the criteria for granting a variance as specified in Chapter 23-1.8, ROH.

We are returning your application materials. The application may be resubmitted when it is complete; i.e., when the above is incorporated into the application. If you have any questions, please call Dana Teramoto of our staff at 768-8025.

Very truly yours,

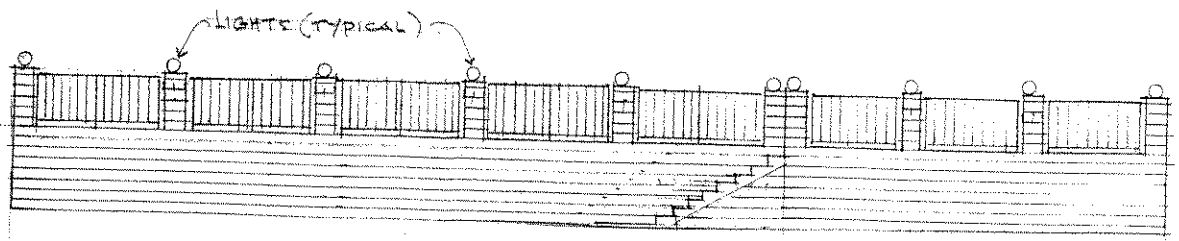
Robert A Bunda

Henry Eng, FAICP, Director
Department of Planning and Permitting

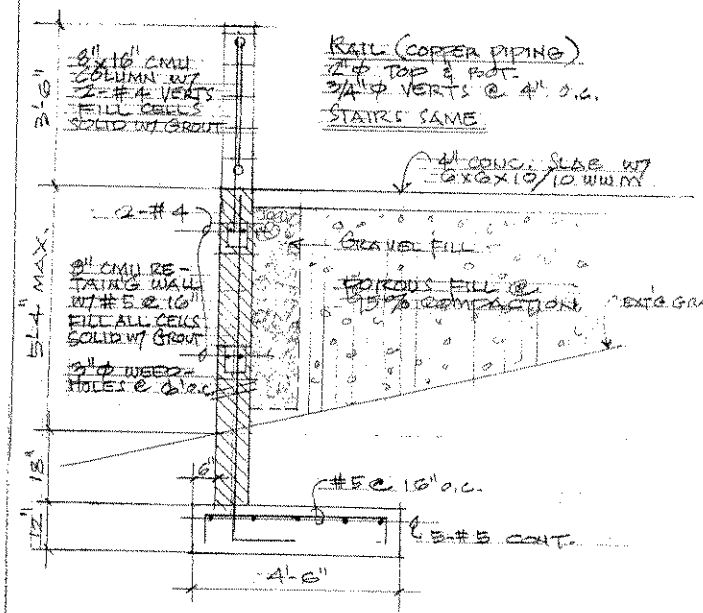
HE:nt

Encl.

G:\LandUse\PosseWorkingDirectory\Dana\ED\2007ed6inc.doc

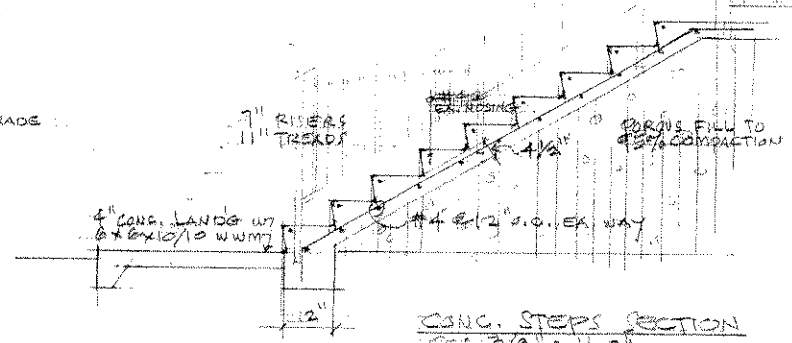


RETAINING & FENCE WALL ELEVATION
Sc: 1/8" = 1'-0"

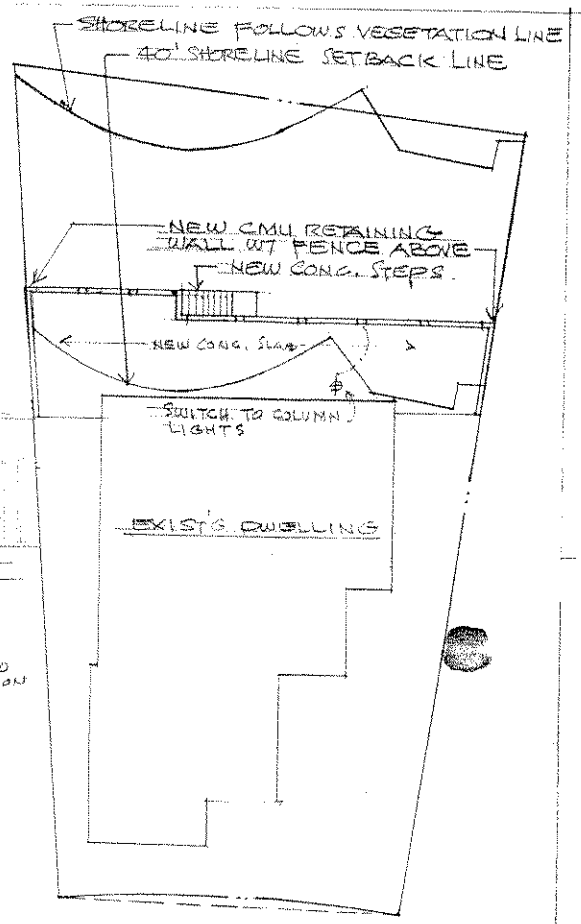


RETAINING & FENCE WALL SECTION
Sc: 3/8" = 1'-0"

0 1 2 3 4 5 6 7 8
3/8" = 1'-0"



CONC. STEPS SECTION
Sc: 3/8" = 1'-0"

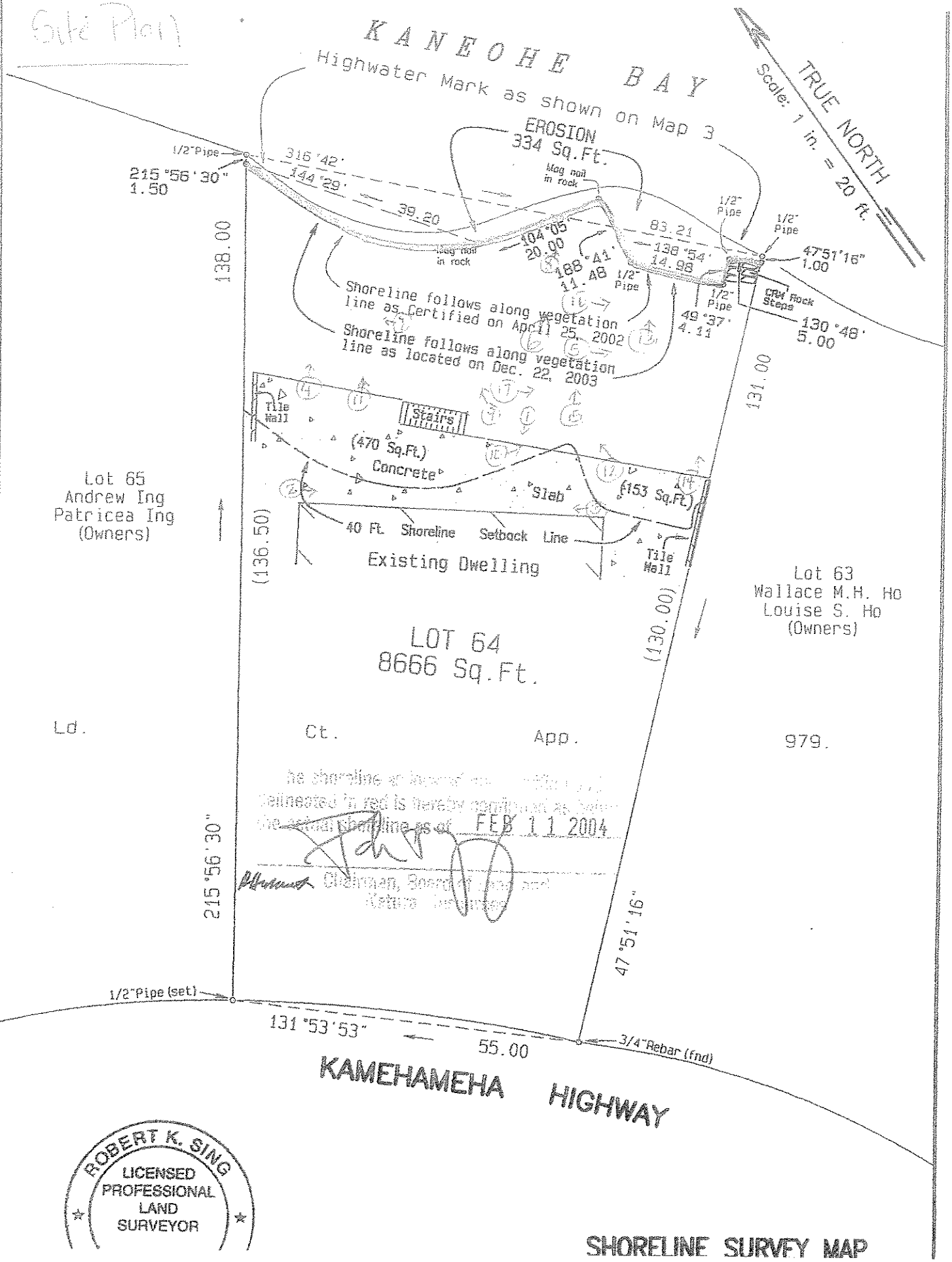


PLOT PLAN
Sc: 1" = 20'
TMK: 4-7-19:49

0 1 2 3 4
1" = 20'

RETAINING & FENCE WALLS for
JOE & KRISTEN SOUZA at
47-079 KAM HWY
238-2480

Site Plan



SHORELINE SURVEY MAP

Refer to this site plan for Exhibits 1 - 17.

LINDA LINGLE
GOVERNOR OF HAWAII

COPY

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

OFFICE OF CONSERVATION AND COASTAL LAND
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF:OCCL:TM

Correspondence: OA 09-22

AUG - 8 2008

Joseph & Kristen Souza
47-079 Kamehameha Hwy
Kaneohe, HI 96744

Dear Mr. & Ms. Souza,

SUBJECT: Request for Emergency Erosion Control Located at 47-079 Kamehameha Hwy, Kaneohe Bay, Oahu, TMK: (1) 4-7-019:049

The Office of Conservation and Coastal is in receipt of your July 21, 2008 correspondence regarding your request for an emergency permit to stabilize the ocean side of your property. According to your information, your makai hillside is ≈ 35-feet in elevation from the shore and has minimal vegetation. There is active erosion; and sediment is entering Kaneohe Bay. Your home is 3-5-feet from the edge of the drop off to the Bay. You are proposing to construct a seawall to stop the erosion and two 12-foot retaining walls along the entire length of the property to stabilized the slope from further land slides.

Based upon a site inspection and on the information provided by you, the Department has made the following determinations:

1. Due to the topography of the land, there is an imminent threat to the existing dwelling with active erosion threatening the structure;

2. Sandbags could provide temporary erosion control; and

3. A long-term plan for erosion control that includes work in the shoreline setback area shall be developed.

At this time, the Department would consider authorizing a temporary 'soft' hardening of the shoreline in the form of sand bags for this request. In order to evaluate plans for a temporary erosion control, more information is required for the proposed response. In order to consider any request for emergency protection, please provide the following:

1. A survey map of the property identifying the parcel and the area of the proposed activities;

2. Scaled drawings (plan and cross section) of the proposed erosion control measures. Be sure to include the property line and probable shoreline location;

3. Include detailed information of the materials proposed (quantity and specifications) including the volume of sand, sand source and sediment grain size analysis of the proposed sand;

4. Describe the construction method and location of stockpiling and staging of equipment;

5. Provide a narrative describing the justification for installation of the material (what will happen if nothing is done?) Describe the erosion history of the area;

It is the Department's understanding that the applicant is concurrently seeking authorization from the City for the majority of the project, which shall take place mauka of the shoreline, within the shoreline setback area. Should a shoreline certification be required for the proposal, please contact our Office for a shoreline delineation. It will be the responsibility of the landowner or responsible party to ensure all necessary permits are obtained prior to starting work activities. The applicant should check with the Army Corps of Engineers to confirm whether a DA permit is necessary for this project as well since the project may involve work below mean high water. In addition the applicant shall obtain a right-of-entry permit from the Oahu District Land Office prior to the inception of project work.

Should you have any questions regarding this matter, contact Dolan Eversole of our Office at 587-0321.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

c: Chairperson
ODLO
City and County of Honolulu Dept. Planning and Permitting
DOH, Clean Water
USACE

COPY

correspondence w/ DLNR

Kanilea Ukulele

From: Chris.L.Conger@hawaii.gov
Sent: Tuesday, July 29, 2008 10:36 AM
To: Kanilea Ukulele
Cc: Ian.C.Hirokawa@hawaii.gov
Subject: Re: aloha
Attachments: Shoreline_Performance_Bond_Agreement.doc

Good morning Mr. and Mrs. Souza,

Attached is a template for the agreement between you, the land owner, and the State, for resolving your shoreline issues. This agreement should be linked to the performance bond you acquire from the contractor who will insure the work is completed. The agreement should reference the bond, and the bond should reference the agreement.

The bond should be written to cover mobilization, removal & disposal of materials, and demobilization. I would suggest giving yourself a sufficient time line to acquire final permits. I would suggest that you word resolution to be accomplished by 1. removing the materials (all), or 2. incorporating some materials into a permitted structure and removal of the remainder (vegetation must be removed).

Materials to address: carbonate boulders and blocks, concrete rubble, CMU blocks, basalt blocks, and vegetation waste. You should not include any natural features or materials.

Please contact me if you have any questions. I will be out of the office for most of the next two weeks, but you can also contact Ian Hirokawa (you met him on the site visit) as he will be a reviewer for the documents.

Sincerely,

Chris Conger

Christopher L. Conger
Shoreline Specialist
University of Hawaii Sea Grant College Program
Department of Land and Natural Resources
1151 Punchbowl St Rm 131
Honolulu Hawaii 96813
(808) 587-0049 work
(808) 520-4892 work cell
(808) 587-0322 fax
Chris.L.Conger@hawaii.gov

COPY

AGREEMENT

THIS AGREEMENT (this "Agreement") made, executed, and delivered this 23 day of September, 2008, by and between Joseph and Kristen Souza, hereinafter called the "Owner", and the DEPARTMENT OF LAND AND NATURAL RESOURCES OF THE STATE OF HAWAII, whose mailing address is P.O. Box 621, Honolulu, Hawaii 96809-0621, hereinafter called the "Department".

WITNESSETH

WHEREAS, the Owner is the current owner of certain oceanfront land situate at 47-079 Kamehameha Hwy, Kaneohe, on the Island of Oahu, being TMK No. (4-7-019:049), (the "Property");

WHEREAS, the Owner wishes to have the shoreline of the Property certified in order to acquire a shoreline variance to put in place a stabilization plan which includes constructing three retaining walls along the seaside of the property;

WHEREAS, the Owner has agreed to remove the all loose coral rock, loose moss rock, all vegetation, any and all debris on or at the shoreline of the property.

WHEREAS, the Department has agreed to allow Owner to apply for certification of the shoreline fronting the Property; and

WHEREAS, the Owner has agreed to a performance bond, the terms of which are subject to review and acceptance by the Department, and equal to the cost of removing all loose coral rock, loose moss rock, all vegetation, any and all debris, as a surety to guarantee the full and faithful performance of the work required by this Agreement. (Attached as Exhibit A)

NOW, THEREFORE, IT IS HEREBY AGREED, by and between Owner and Department, that:

1. Owner shall complete the removal of all loose coral rock, loose moss rock, all vegetation, any and all debris.

2. The removal of all loose coral rock, loose moss rock, all vegetation, any and all debris, described in Item 1 above, shall be completed by no later than September, 2013.

3. In the event Owner fails to complete all removal work within the time specified hereinabove or such extensions as may be mutually agreed upon in writing, or fails to timely complete or abandons the removal work, or this Agreement is terminated by the Department for Owner's noncompliance with any provision contained in this agreement, the Department may complete the improvements through the execution of the performance bond. The Owner shall be solely liable for any cost and expense associated with completion of the improvements to the satisfaction of the Department in excess of the amount or the scope of work guaranteed by the performance bond.

4. Owner's obligations to complete the work as specified in this agreement shall be secured by a performance bond in the amount of twenty five thousand DOLLARS ($25,000.00) tendered by Owner, dated September 2, 2008, the value of which has been determined by the estimate(s) attached as Exhibit "B", and conditioned upon the faithful performance of any and all work required to be done by the Owner in accordance with the provisions of this Agreement. The performance bond shall name the Department as an Obligee, having the power to execute the bond at its sole discretion.

5. Upon the execution of this Agreement, the Department shall process the shoreline certification application for the Property.

IN WITNESS WHEREOF, the parties have caused these presents to be executed the date and year first written.

OWNER:

By:_____

_____,
Owners

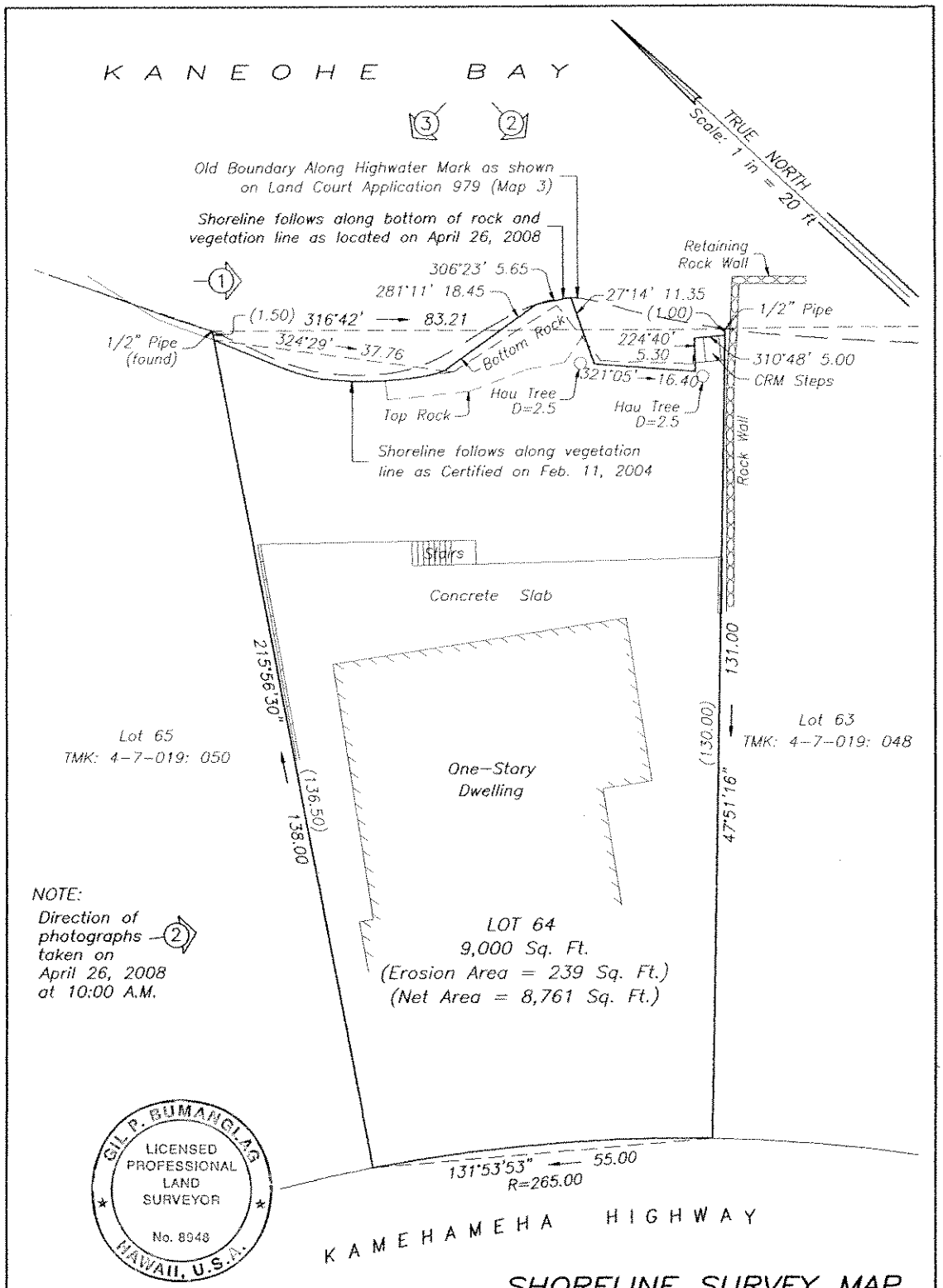
DEPARTMENT OF LAND AND NATURAL RESOURCES:

By_____
Laura H. Thielen, Chairperson

APPROVED AS TO FORM:

Deputy Attorney General

Date:_____



This work was prepared by me or under my supervision

GIL P. BUMANGLAG
Licensed Professional Land Surveyor
Certificate Number 8948

Date: April 26, 2008

SHORELINE SURVEY MAP

LOT 64 OF MAP 3
LAND COURT APPLICATION 979

Tax Map Key: (1) 4-7-019: 049

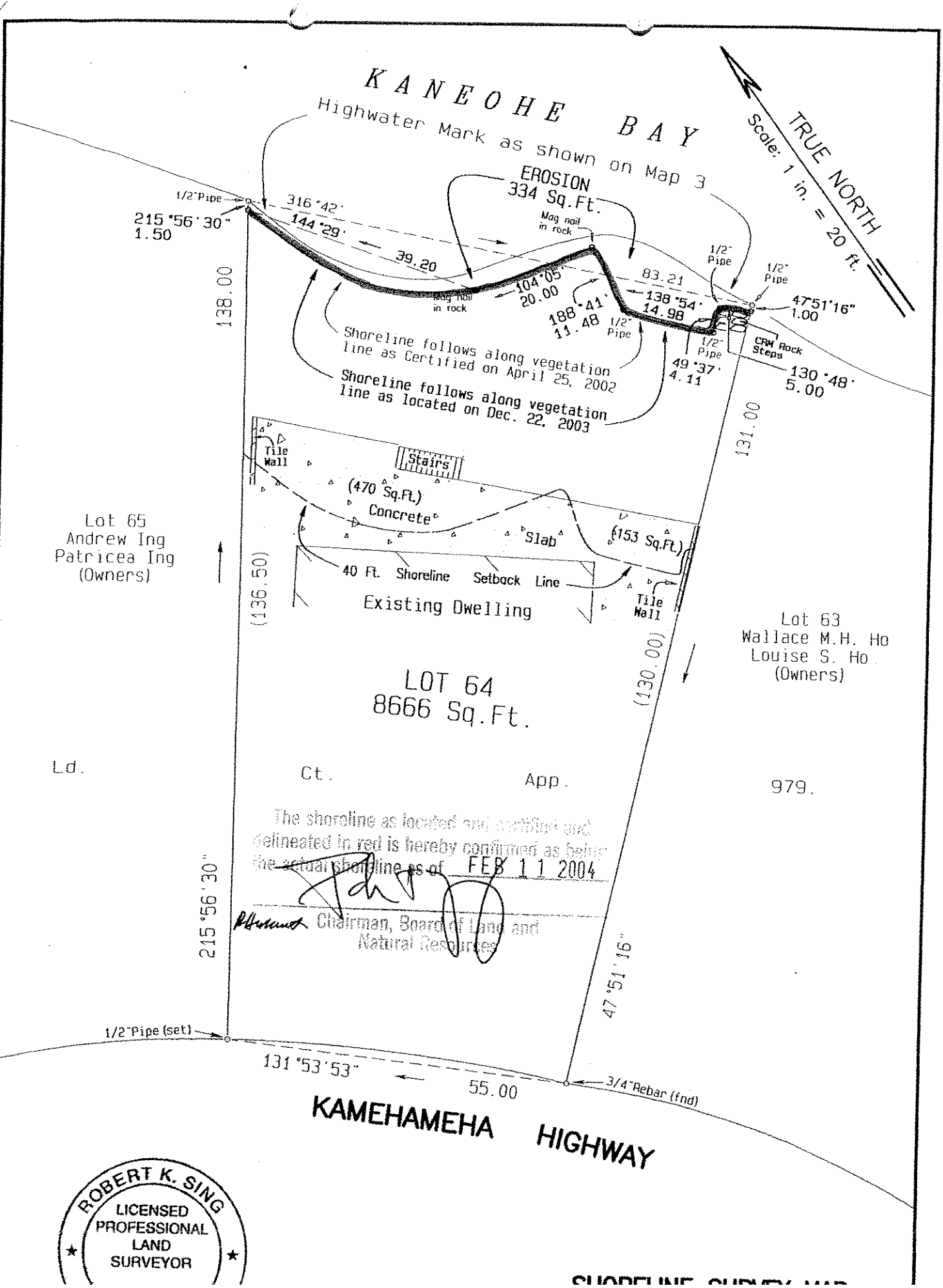
At KAHALUU, KOOLAUPOKO, OAHU, HAWAII

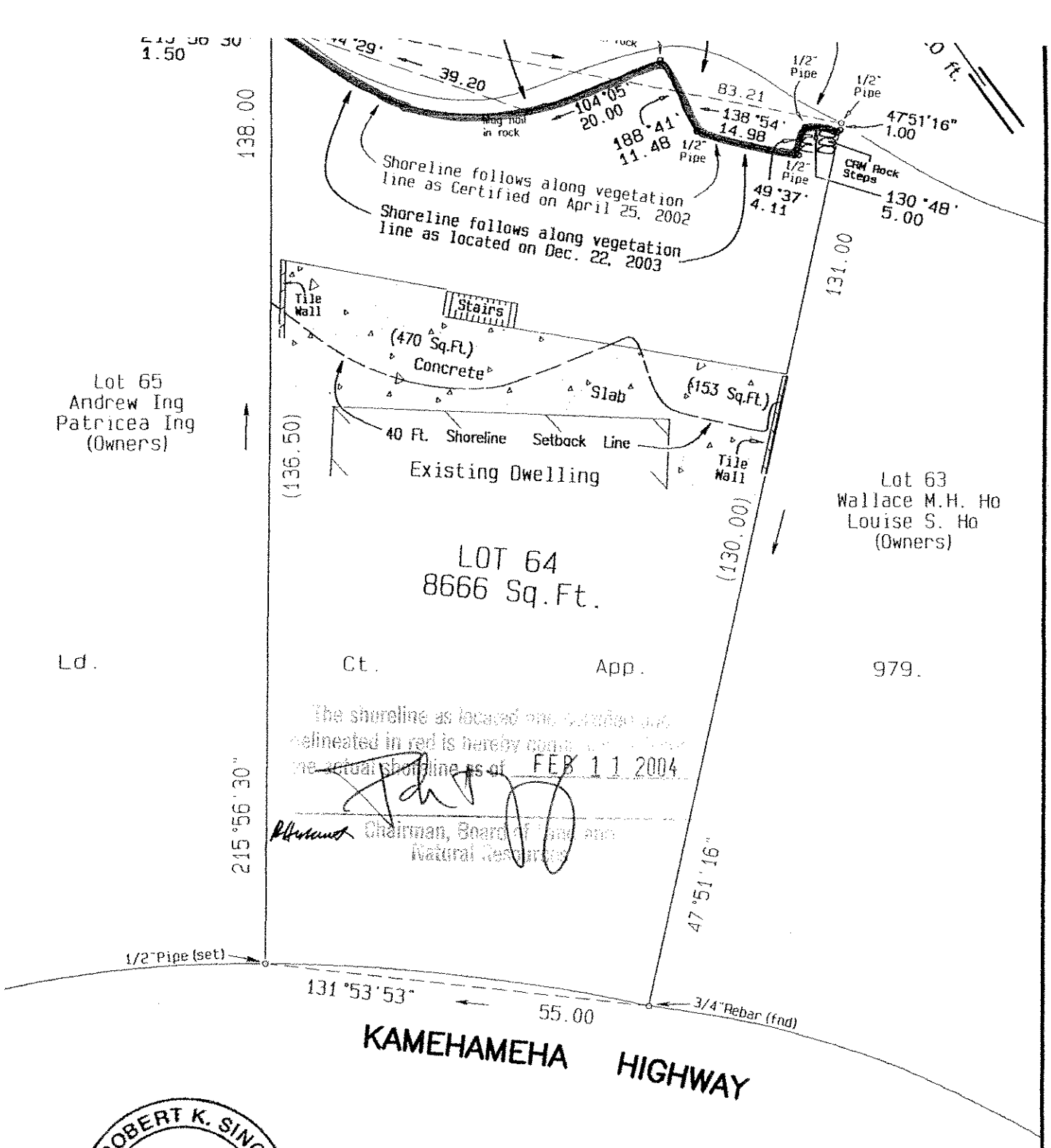
Site Address: 47-079 Kam Hwy, Kaneohe

FB No. C-293: 60
c:\sdsk\proj\shore\8059\47079kam

GIL SURVEYING SERVICES, inc.
1442 UILA STREET HONOLULU HAWAII 96818

8.5" x 13" = 0.77 Sq. Ft.


KANEOHE BAY
Highwater Mark as shown on Map 3
TRUE NORTH
Scale: 1 in. = 20 ft.
EROSION
334 Sq.Ft.
1/2" Pipe
215°56'30"
1.50
316°42'
144°29'
39.20
Mag nail in rock
104°05'
20.00
188°41'
11.48
83.21
138°54'
14.98
47°51'16"
1.00
130°48'
5.00
49°37'
4.11
CRM Rock Steps
138.00
Shoreline follows along vegetation line as Certified on April 25, 2002
Shoreline follows along vegetation line as located on Dec. 22, 2003
131.00
Tile Wall
Stairs
(470 Sq.Ft.)
Concrete
Slab
(153 Sq.Ft.)
40 Ft. Shoreline Setback Line
Existing Dwelling
(136.50)
(130.00)
Lot 65
Andrew Ing
Patricea Ing
(Owners)
Lot 63
Wallace M.H. Ho
Louise S. Ho
(Owners)
LOT 64
8666 Sq.Ft.
Ld.
Ct.
App.
979.
The shoreline as located and certified and delineated in red is hereby confirmed as being the actual shoreline as of FEB 11 2004
Chairman, Board of Land and Natural Resources
215°56'30"
47°51'16"
1/2" Pipe (set)
131°53'53"
55.00
3/4" Rebar (fnd)
KAMEHAMEHA HIGHWAY
ROBERT K. SING
LICENSED PROFESSIONAL LAND SURVEYOR



ROBERT K. SING
LICENSED PROFESSIONAL LAND SURVEYOR
No. 4313
HAWAII, U.S.A.

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

Robert K. Sing

ROBERT K. SING, L.P.L.S.
CERTIFICATE NO. S-4313

SHORELINE SURVEY MAP
LOT 64
OF LAND COURT APPLICATION 979

Kahaluu, Koolaupoko, Oahu, Hawaii
Tax Map Key: 4-7-19: 49
Owner: Joesph N. & Kristin Souza III
Address: 47-079 Kam Hwy
Honolulu, HI 96744
December 23, 2003

F.B. 108-03: 69 (R. K. SING, Surveying & Mapping, LLC) 8 1/2" X 13"

Building Permit No.: _____

Tax Map Key: _____

Application Index No.: _____

BUILDING DEPARTMENT
CITY AND COUNTY OF HONOLULU

BUILDING CODE REQUIREMENTS FOR SPECIAL INSPECTIONS

Section 1701 of the Uniform Building Code requires that the owner employ one or more special inspectors independent of the contractors performing the work. The special inspector shall provide inspection during construction on the following types of work:

1. Concrete
2. Bolts Installed in Concrete
3. Special Moment-Resisting Concrete Frame
4. Reinforcing Steel and Prestressing Steel Tendons
5. Structural Welding
6. High-Strength Bolting
7. Structural Masonry
8. Reinforced Gypsum Concrete
9. Insulating Concrete Fill
10. Spray-Applied Fireproofing
11. Piling, Drilled Piers and Caissons
12. Shotcrete
13. Special Grading, Excavation and Filling
14. Fire-Protection System
15. Special Cases (specify)
16. Sheathed Shear Walls and Diaphragms
17. Complete Load Path and Uplift Ties
18. Termite Protection

(Detailed clarification of above items are listed on the reverse side of this page.)

Circle the number corresponding to the types of work for this project requiring special inspection. Fill the circled numbers in the table below together with the identity of all special inspectors who will be performing the inspection.

Item No.	Identity of Special Inspector	License Number	Telephone Number	Signature of Special Inspector	Approved by Plans Examiner
17	Rescue C Form	3731	9495784	Rescue C Ford	

Duties and responsibilities of the special inspector:

1. Observe work assigned for conformance with approved design drawings and specifications.
2. Furnish inspection reports to the owner, the engineer or architect of record, and other owner-designated persons. All discrepancies shall be brought to the immediate attention of the contractor for correction, then, if uncorrected, to the proper design authority and to the building official.
3. Submit a final signed report stating whether the work requiring special inspection was, to the best of the special inspector's knowledge, in conformance with approved plans and specifications and the applicable workmanship provisions of the Building Code. Also, indicate the type of work that was inspected. This report shall be submitted prior to the issuance of the Certificate of Occupancy.

Rescue C Form — Rescue C Ford — June 4, 2008

Print name and provide signature of the structural engineer or architect responsible for the structural design. — Date

9495784

Telephone Number

DISTRIBUTION:
APPLICANT
BLDG. INSP.
FILE

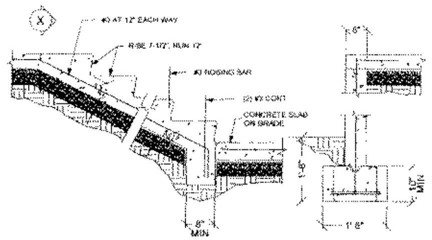
JOB SITE COPY

To the best of my knowledge these plans are drawn to comply with owner's and/or builder's specifications and any changes made on them after prints are made will be done at the owner's and/or builder's expense and responsibility. The contractor shall verify all drawing dimensions. Apptrac Corporation is not liable for errors once construction has begun. While every effort has been made in the preparation of this plan to avoid mistakes, the maker can not guarantee against human error. The contractor of the job must check all dimensions and other details prior to construction and be solely responsible thereafter.

PROPERTY SPECIFICATIONS

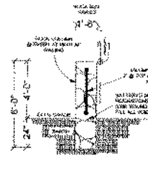
TERRAIN EVALUATION	HILLSIDE WITH VEGETATION
SOIL COMPOSITION	BEDROCK/CLAY, OCCASIONAL DIRT
TOTAL PROPERTY SIZE	9,000 SQ. FT.
MAXIMUM BUILDING FOOTPRINT ALLOWED (50%)	4,500 SQ. FT.
ZONING (LUO)	R-5 RESIDENTIAL DISTRICT
EASEMENTS	40' SHORELINE SETBACK

NOTES: NO CHANGES TO EXISTING DWELLING STRUCTURE

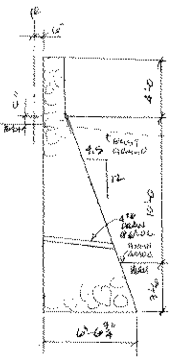


S2 A-1 STAIR DETAILS (SC: 3/4" = 1'-0")

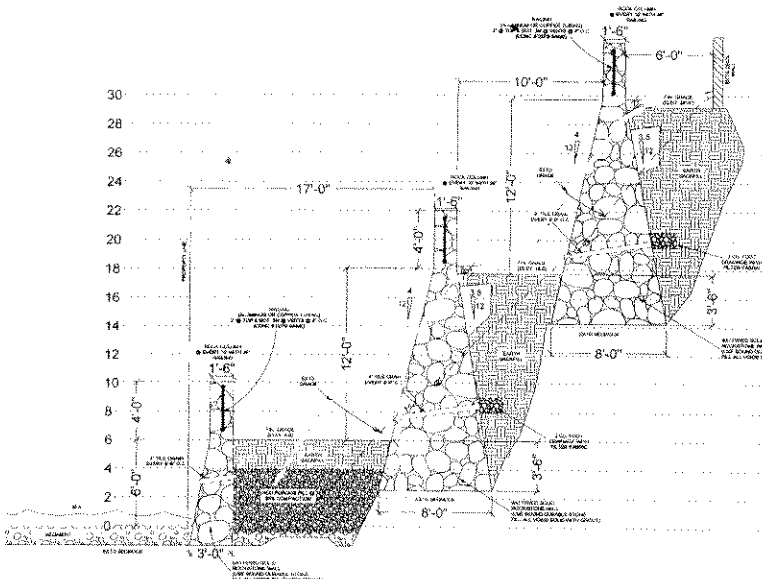
X SECTION



S3 A-1 WALL SECTION (SIDE WALL) (SC: 1/4" = 1'-0")



WALL SECTION 1/4 = 1'-0

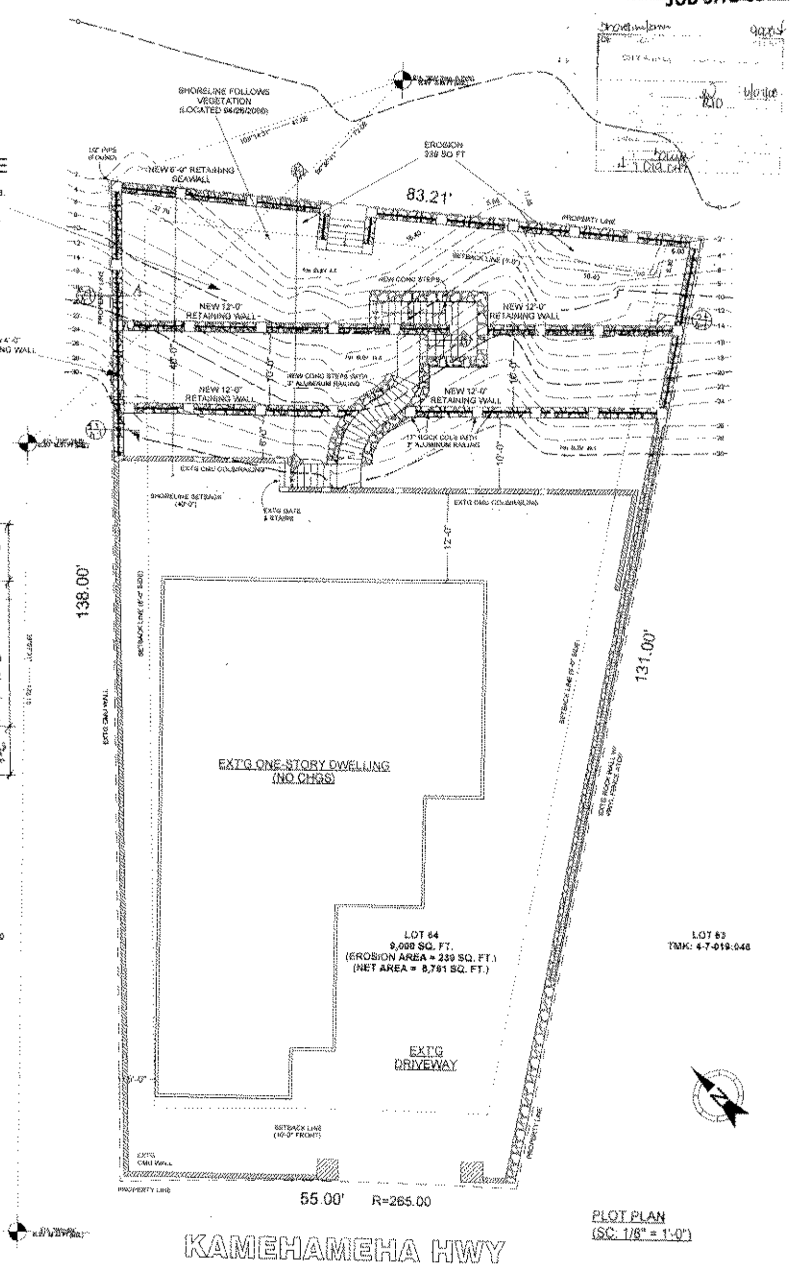


S1 A-1 WALL SECTION (SC: 1/4" = 1'-0")

EARTHWORK QUANTITIES	
EXCAVATION	480 CY
EMBANKMENT	660 CY
GRADED AREA	2000 SF

PROJECT SITE

Reclaim eroded shoreline. Provide conc stairwell & retaining walls to protect from further erosion.



PLOT PLAN (SC: 1/8" = 1'-0")

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Print Date: Monday, June 02, 2008

DRAFTPLANS
HOME & BUSINESS DESIGN PLANS
www.draftplans.com

PROJECT:
OWNER:
MR & MRS JOSEPH SOUZA III
47-079 KAMEHAMEHA HWY
KANEOHE, HAWAII 96744
TMK: 4-7-019:049

NEW ROCK NETS WALLS

REVISIONS:

ARCHITECT / ENGINEER:
LICENSED PROFESSIONAL ENGINEER No. 9731-S HAWAII, U.S.A.
SIGNATURE
LICENSE EXPIRES: 4/30/10
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION. CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

PAGE:
A-1

CRM Retaining Wall Design
Mr. & Mrs Joseph Souza
47-079 Kamehameha Hwy
Kaneohe, HI
TMK: 4-7-019:049

Assumed bed rock

$Pallow := 5000 \cdot psf$

Passive resistance = 300 psf/ft. Friction factor = 0.5.
Active pressure, clayey gravel = 45 psf/ft

Design Parameters

$H := 15.5 \cdot ft$ $top := 18 \cdot in$ $Fric := 0.5 + 0.5 \cdot 2$ $Fric = 1.5$

$\rho rock := 145 \cdot pcf$ $\rho soil := 110 \cdot pcf$ $\sigma := 45 \cdot pcf$ $\sigma p := 150 \cdot pcf$

Front side Soil Side

$slop1 := \frac{2}{12}$ $slop2 := \frac{3.5}{12}$ $B := top + slop1 \cdot H + slop2 \cdot H$

$B = 8.604\,ft$

This work was prepared by me or under my supervision.
Expires 4/30/10

Stability

$P_1 := \frac{H^2}{2} \cdot slop1 \cdot \rho rock \cdot 1 \cdot ft$ $M_1 := P_1 \cdot \left(\frac{2}{3} \cdot slop1 \cdot H\right)$

$P_2 := top \cdot H \cdot \rho rock \cdot 1 \cdot ft$ $M_2 := P_2 \cdot \left(slop1 \cdot H + \frac{top}{2}\right)$

$P_3 := \frac{H^2}{2} \cdot slop2 \cdot \rho rock \cdot 1 \cdot ft$ $M_3 := P_3 \cdot \left(B - slop2 \cdot H \cdot \frac{2}{3}\right)$

$P_4 := \frac{(H - 6 \cdot in)^2}{2} \cdot slop2 \cdot \rho soil \cdot 1 \cdot ft$ $M_4 := P_4 \cdot \left(B - slop2 \cdot \frac{H - 6 \cdot in}{3}\right)$

$i := 1 .. 4$

$\frac{P_i}{kip} =$	$\frac{M_i}{ft \cdot kip} =$
2.903	5
3.371	11.237
5.08	28.4
3.609	25.792

$P := \sum_i P_i$

$Mr := \sum_i M_i$

$P = 1.496 \times 10^4\,lb$ $Mr = 7.043 \times 10^4\,ft \cdot lb$

$Phorz := \sigma \cdot (H - 6 \cdot in)^2 \cdot \frac{ft}{2}$ $Mot := Phorz \cdot (H - 6 \cdot in) \cdot .3333$

$Phorz = 5.062 \times 10^{3}\,lb$ $Mot = 2.531 \times 10^{4}\,ft{\cdot}lb$

$FSot := \frac{Mr}{Mot}$ $FSot = 2.783$ > 2.0, O.K.

Sliding

$Phorz = 5.062 \times 10^{3}\,lb$ $Resist := Fric{\cdot}P$

$Resist = 2.245 \times 10^{4}\,lb$

$FSslid := \frac{Resist}{Phorz}$ $FSslid = 4.434$ > 1.5, O.K.

Soil Stress

$a := \frac{Mr - Mot}{P}$ $a = 3.015\,ft$ $3{\cdot}a = 9.046\,ft$ $B = 8.604\,ft$

$\sigma toe := \frac{P}{B{\cdot}1{\cdot}ft}\cdot\left[1 + \left(6\cdot\frac{\frac{B}{2} - a}{B}\right)\right]$ $\sigma toe = 3.3 \times 10^{3}\,psf$ < $Pallow = 5 \times 10^{3}\,psf$ O.K.

$\sigma heel := \frac{P}{B{\cdot}1{\cdot}ft}\cdot\left[1 - \left(6\cdot\frac{\frac{B}{2} - a}{B}\right)\right]$ $\sigma heel = 178.464\,psf$ $\sigma ave := \frac{\sigma toe + \sigma heel}{2}$

$\sigma ave = 1.739 \times 10^{3}\,psf$

Design Parameters

$H := 15.5{\cdot}ft$ $top := 18{\cdot}in$ $sur1 := 3.896{\cdot}ft$

$\rho rock := 145{\cdot}pcf$ $\rho soil := 110{\cdot}pcf$ $\sigma := 45{\cdot}pcf$ $\sigma p := 150{\cdot}pcf$

Front side Soil Side

$slop1 := \frac{2.5}{12}$ $slop2 := \frac{3.5}{12}$ $B := top + slop1{\cdot}H + slop2{\cdot}H$

Stability $i := 1..4$ $B = 9.25\,ft$

$P_1 := \frac{H^2}{2}{\cdot}slop1{\cdot}\rho rock{\cdot}1{\cdot}ft$ $M_1 := P_1\cdot\left(\frac{2}{3}{\cdot}slop1{\cdot}H\right)$

$P_2 := top{\cdot}H{\cdot}\rho rock{\cdot}1{\cdot}ft$ $M_2 := P_2\cdot\left(slop1{\cdot}H + \frac{top}{2}\right)$

$P_3 := \frac{H^2}{2} \cdot slop2 \cdot \rho rock \cdot 1 \cdot ft$ $M_3 := P_3 \cdot \left(B - slop2 \cdot H \cdot \frac{2}{3} \right)$

$P_4 := \frac{H^2}{2} \cdot slop2 \cdot psoil \cdot 1 \cdot ft$ $M_4 := P_4 \cdot \left(B - slop2 \cdot \frac{H}{3} \right)$

$\frac{P_i}{kip} =$	$\frac{M_i}{ft \cdot kip} =$
3.629	7.812
3.371	13.415
5.08	31.681
3.854	29.842

$P := \sum_i P_i$

$Mr := \sum_i M_i$

$P = 1.593 \times 10^4 \, lb$ $Mr = 8.275 \times 10^4 \, ft \cdot lb$

$Phorz1 := \sigma \cdot H^2 \cdot \frac{ft}{2}$ $Mot1 := Phorz1 \cdot H \cdot .3333$

$Phorz1 = 5.406 \times 10^3 \, lb$ $Mot1 = 2.793 \times 10^4 \, ft \cdot lb$

$Phorz2 := \sigma ave \cdot .2 \cdot sur1 \cdot 1 \cdot ft$ $Mot2 := Phorz2 \cdot \left(\frac{sur1}{2} \right)$

$Phorz2 = 1.355 \times 10^3 \, lb$ $Mot2 = 2.64 \times 10^3 \, ft \cdot lb$

$Phorz := Phorz1 + Phorz2$ $Mot := Mot1 + Mot2$

$Phorz = 6.761 \times 10^3 \, lb$ $Mot = 3.057 \times 10^4 \, ft \cdot lb$

$FSot := \frac{Mr}{Mot}$ $FSot = 2.707$ > 1.5, O.K.

Sliding

$Phorz = 6.761 \times 10^3 \, lb$ $Resist := Fric \cdot P$

$Resist = 2.39 \times 10^4 \, lb$

$FSslid := \frac{Resist}{Phorz}$ $FSslid = 3.535$ > 1.5, O.K.

Soil Stress

$a := \frac{Mr - Mot}{P}$ $a = 3.275 \, ft$ $3 \cdot a = 9.825 \, ft$ $B = 9.25 \, ft$

$\sigma toe := \frac{P}{B \cdot 1 \cdot ft} \cdot \left[1 + \left(6 \cdot \frac{\frac{B}{2} - a}{B} \right) \right]$ $\sigma toe = 3.231 \times 10^3 \, psf$ < $Pallow = 5 \times 10^3 \, psf$ O.K.

$$\sigma heel := \frac{P}{B \cdot 1 \cdot ft}\cdot\left[1 - \left(6 \cdot \frac{\frac{B}{2} - a}{B}\right)\right] \qquad \sigma heel = 214.078\,psf$$

Design Parameters

$H := 13.5 \cdot ft$ $\quad top := 18 \cdot in$ $\quad Fric := .5 + .5 \cdot 2$ $\quad Fric = 1.5$

$\rho rock := 145 \cdot pcf$ $\quad \rho soil := 110 \cdot pcf$ $\quad \sigma := 45 \cdot pcf$ $\quad \sigma p := 150 \cdot pcf$

Front side Soil Side

This work was prepared by me or under my supervision.

Expires 4/30/08

$slop1 := \frac{4.5}{12}$ $\quad slop2 := \frac{0}{12}$ $\quad B := top + slop1 \cdot H + slop2 \cdot H$

$B = 6.563\,ft$

Stability

$$P_1 := \frac{H^2}{2}\cdot slop1 \cdot \rho rock \cdot 1 \cdot ft \qquad M_1 := P_1 \cdot \left(\frac{2}{3} \cdot slop1 \cdot H\right)$$

$$P_2 := top \cdot H \cdot \rho rock \cdot 1 \cdot ft \qquad M_2 := P_2 \cdot \left(slop1 \cdot H + \frac{top}{2}\right)$$

$$P_3 := \frac{H^2}{2}\cdot slop2 \cdot \rho rock \cdot 1 \cdot ft \qquad M_3 := P_3 \cdot \left(B - slop2 \cdot H \cdot \frac{2}{3}\right)$$

$$P_4 := \frac{(H - 6 \cdot in)^2}{2}\cdot slop2 \cdot \rho soil \cdot 1 \cdot ft \qquad M_4 := P_4 \cdot \left(B - slop2 \cdot \frac{H - 6 \cdot in}{3}\right)$$

$i := 1..4$

$\frac{P_i}{kip} =$

4.955
2.936
0
0

$\frac{M_i}{ft \cdot kip} =$

16.723
17.067
0
0

$$P := \sum_i P_i$$

$$Mr := \sum_i M_i$$

$P = 7.891 \times 10^3\,lb$ $\quad Mr = 3.379 \times 10^4\,ft \cdot lb$

$Phorz := \sigma \cdot (H - 6 \cdot in)^2 \cdot \frac{ft}{2}$ $\quad Mot := Phorz \cdot (H - 6 \cdot in) \cdot .3333$

$Phorz = 3.802 \times 10^3\,lb$ $\quad Mot = 1.648 \times 10^4\,ft \cdot lb$

$FSot := \frac{Mr}{Mot}$ $\quad FSot = 2.051$ $\quad > 2.0$, O.K.

Sliding

$Phorz = 3.802 \times 10^{3}\ lb$ $\quad Resist := Fric \cdot P$

$Resist = 1.184 \times 10^{4}\ lb$

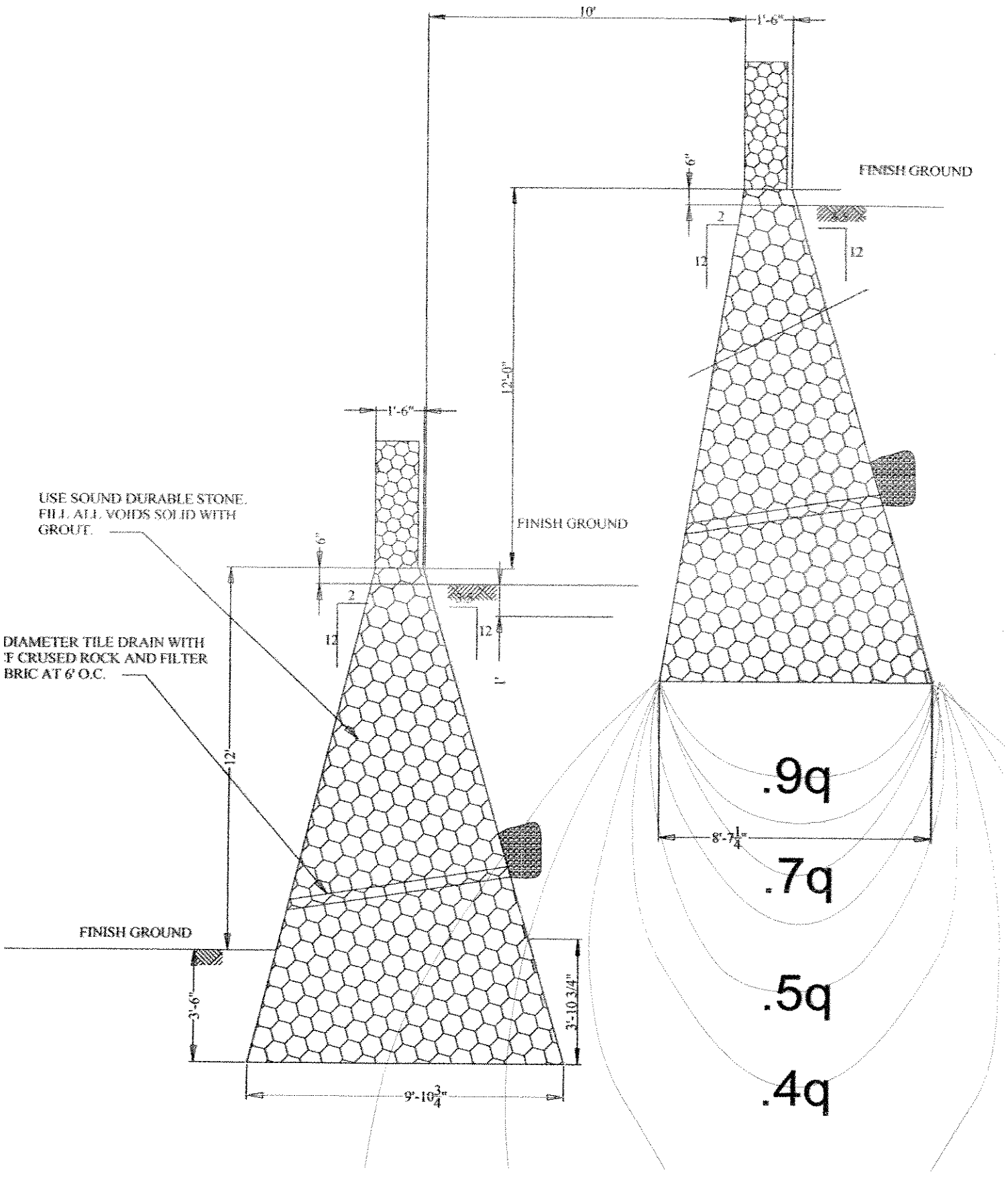
$FSslid := \frac{Resist}{Phorz}$ $\quad FSslid = 3.113$ $\quad > 1.5$, O.K.

Soil Stress

$a := \frac{Mr - Mot}{P}$ $\quad a = 2.194\,ft$ $\quad 3 \cdot a = 6.582\,ft$ $\quad B = 6.563\,ft$

$\sigma toe := \frac{P}{B \cdot 1 \cdot ft} \cdot \left[1 + \left(6 \cdot \frac{\frac{B}{2} - a}{B}\right)\right]$ $\quad \sigma toe = 2.398 \times 10^{3}\ psf$ $\quad < \quad Pallow = 5 \times 10^{3}\ psf$ $\quad$ O.K.

$\sigma heel := \frac{P}{B \cdot 1 \cdot ft} \cdot \left[1 - \left(6 \cdot \frac{\frac{B}{2} - a}{B}\right)\right]$ $\quad \sigma heel = 7.248\,psf$


10'
1'-6"
6"
FINISH GROUND
2
12
12
12'-0"
1'-6"
USE SOUND DURABLE STONE.
FILL ALL VOIDS SOLID WITH
GROUT.
FINISH GROUND
6"
2
12
12
1'
DIAMETER TILE DRAIN WITH
F CRUSED ROCK AND FILTER
BRIC AT 6' O.C.
12'
FINISH GROUND
3'-6"
3'-10 3/4"
9'-10 3/4"
.9q
8'-7 1/4"
.7q
.5q
.4q

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

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

May 13, 1996

CERTIFIED MAIL
P 593 379 341

Ref: GEHO471.948

MR. and Mrs. Wallace Ho
98-380 Kamehameha Hwy.
Aiea, Hawaii. 96701

Dear MR. and Mrs. Ho:

Subject: Direct Sale of a Non-Exclusive Fifty-five Year Term Easement, For Seawall and Landscaping Purposes, Covering Government Lands located at Kahaluu, Koolaupoko, Oahu. Tax Map Key: 4-7-19: Seaward of Parcel 48.

At its meeting held on October 22, 1993, under agenda item F-11, the Board of Land and Natural Resources, State of Hawaii, among other actions, authorized the direct sale of a fifty-five (55) year term, non-exclusive seawall and landscaping easement to Mr. and Mrs. Wallace Ho, affecting the State-owned land located at Kahaluu, Koolaupoko, Oahu, Tax Map Key: 4-7-19: Seaward of parcel 48. The approval is subject to various terms and conditions. One of those conditions requires that Wallace M.H. Ho and Louise S. Ho pay a one time lump sum payment to the State for easement rights (right privilege and authority to construct, use, maintain, and repair seawall and provide landscaping maintenance) over the easement corridor as determined by an independent appraisal.

A detailed narrative appraisal report (copy attached) prepared by Peter Takasaki CCA, covering the subject easement corridor was submitted to the Department of Land and Natural Resources and subsequently approved by the Land Board Chairperson and Oahu Land Board Member.

Based on the research and analyses completed, subject to the limiting Conditions and Assumptions stated in the appraisal report, the fair market one time rental payment for the fifty five (55) year term easement rights has been determined to be, Ten Thousand Eight Hundred ($10,800.00) Dollars, as of October 23, 1993.

Therefore, as time is of the essence and within ten (10) days of receipt of this letter, please remit to the Land Division **a check made payable to the Department of Land and Natural Resources,** in the amount of Ten Thousand Eight Hundred and Fifty Five ($10,855.00) Dollars, which reflects the sum of the following items:

1. Rental 55 years (10/22/93 to 10/21/2048.....$10.800.00
2. Easement Documentation Fee..... 30.00
3. Fee for Survey Maps & Description..... 25.00

TOTAL AMOUNT DUE: $10,855.00

Together with the remittance of the check in the amount of $10,855.00 payable to the Department of Land and Natural Resources, please provide to us the following items:

1. **Marital status, and your current mailing address.**
2. **Inform us of the manner in which you hold the property which adjoins the easement -- Tenants in Common, Tenants by the Entirety, Tenants in Severalty or Joint Tenants.**
3. Obtain Tax Clearance Certificates from both the State Department of Taxation and the City & County of Honolulu, Department of Finance.

Upon receipt of the above requested items, we will request the Department of the Attorney Generals Office, State of Hawaii, to prepare the Grant of Easement documents.

Should you have any questions with regards to this matter, please call Mr. Nicholas A. Vaccaro at 587-0438.

Very truly yours,

Dean Y. Uchida
Administrator

c: Michael H. Nekoba
Colbert M. Matsumoto

BANK OF HAWAII

MAY 15 1996

Private Financial Svcs.
Pearlridge Region HI

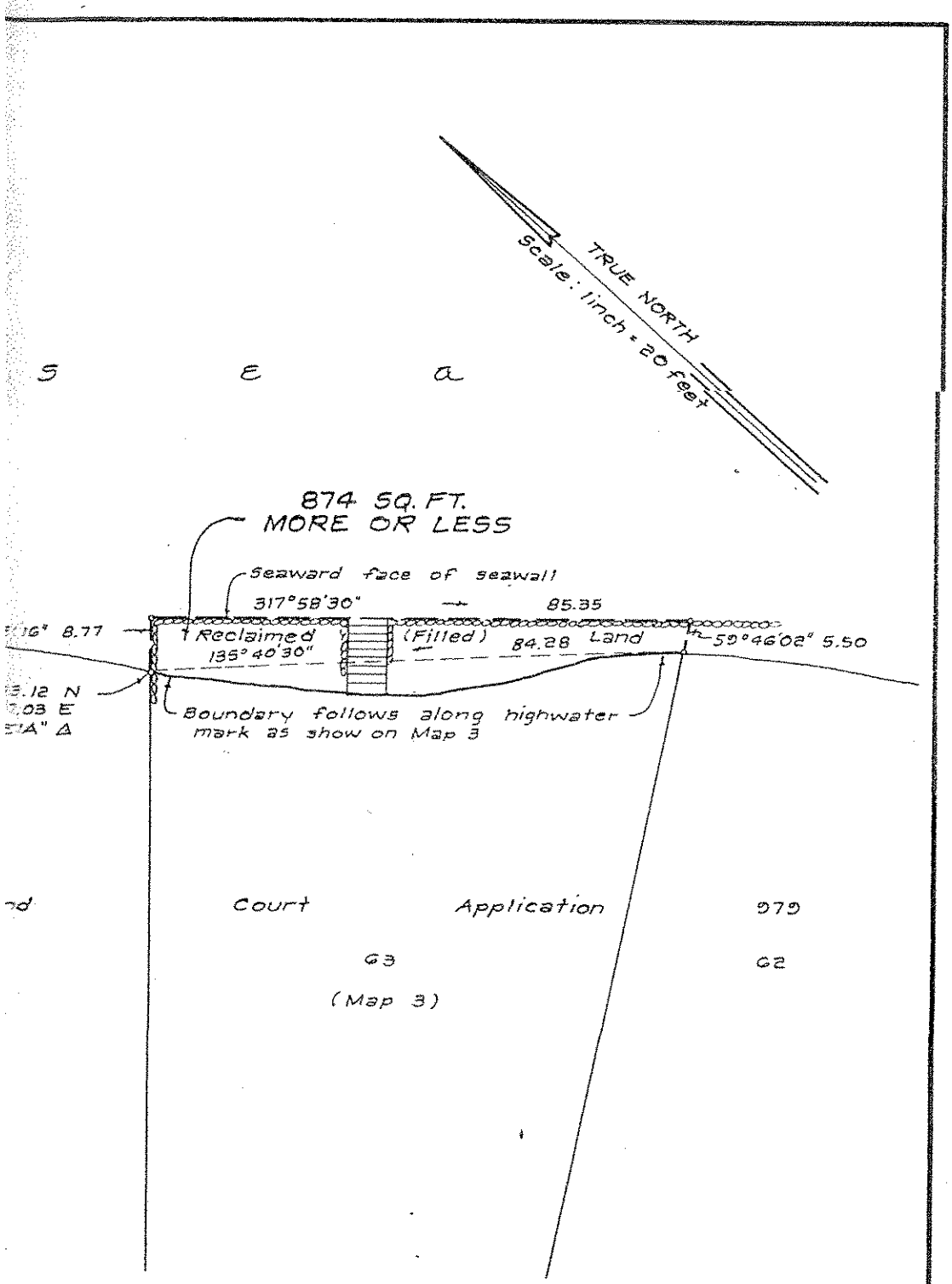
Pearlridge May 16, 96

* * * DEPT. OF LAND & NATURAL RESOURCES * * * 10,855.00* *

; Wallace M.H. & Louise S.

L. Hiyakumoto

NOT NEGOTIABLE



N-EXCLUSIVE SEAWALL AND LANDSCAPING EASEMENT

Kahaluu, Koolaupoko, Oahu, Hawaii
Scale: 1inch = 20feet

94)

7-19:48

SURVEY DIVISION
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
STATE OF HAWAII

2091

JMM Apr. 7, 1994

Tax Map Key: 4-7-019:049
Application Index No.: A2008-06-0391
Project Name: Solar
Building Permit No.: _____

BUILDING DIVISION
DEPARTMENT OF PLANNING AND PERMITTING

SUPPLEMENTAL INFORMATION FOR BUILDING OWNER, PERMIT APPLICANT AND CONTRACTOR

The following information should prove helpful in determining whether additional information should be obtained before starting your project.

1. ☒ A Phone Call May Save Your Life -- if you have underground utilities or if your work is under or near an electrical service line, investigate before you start work. Call:

	WORKING HOURS	AFTER HOURS
Hawaiian Telcom	840-1444	
Hawaiian Electric Company	543-5654	548-7961
GASCO	535-5933	535-5933
Board of Water Supply	748-5382	748-5000

Be Aware of the Sign, Noise and OSH Regulations

Sign Regulations - Building Division	~~523-4505~~	768-8220
Noise Regulations - Department of Health	586-4700	
Occupational Safety & Health - DOSH Department of Labor	586-9100	

Asbestos and Lead-Based Paint Regulations Department of Health - 586-5800

2. ☒ Owners will be responsible to notify the Federal Aviation Administration (FAA) for structures which exceed 200 feet in height above ground line and certain structures within 4 miles from the nearest point of the nearest runway of each airport. (Single-family dwellings exempted.) FAA telephone is 541-1243.

3. ☒ REMINDER - Owners should check their deeds, lease agreements, and/or association by-laws for any building restrictions.

4. ☒ HOUSE NUMBERING REQUIREMENTS - All main entrances to buildings shall be numbered with numbers at least two inches in height. Address signs shall not exceed one square feet. Emergency service agencies such as fire, police, ambulance, etc., can respond more readily with minimum delays when buildings are properly numbered.

5. ☒ To prevent termite entry, the building code requires openings around pipes or other penetrations in concrete slab-on-grade to be filled with non-shrink grout.

6. ☐ Plumbing and/or Electrical plans not checked. Project subject to inspection for code compliance.

7. ☒ Plumbing and/or Electrical work shall be inspected and approved prior to concealment.

8. ☒ PROTECTION OF ADJOINING PROPERTY - The owner and contractor doing the excavation or fill shall be responsible to implement safety measures to protect adjoining properties, streets or natural watercourses from falling rocks, boulders, soil, debris and other dangerous objects.

9. ☒ EROSION AND SEDIMENT CONTROL - Since it is unlawful to discharge pollutants from the construction site, the owner and the contractor shall check the criteria for handling drainage discharges and ensure compliance with all appropriate regulations. Call ~~523-4921~~ for more information.

768-8218 or 19

Signature of Applicant — Date: 9-9-08

DPP-31 (REV. 6/05)

GEOTECHNICAL ENGINEERING EXPLORATION
47-79 KAMEHAMEHA HIGHWAY
TMK: 4-7-019:049

Project No. SRSS00108

September 15, 2008

Prepared for:

JOE AND KRISTEN SOUZA

APPLIED GEOSCIENCES, LLC
2922 Kahaloa Drive, Honolulu, HI 96822 • Tel. (808) 221-0104

Applied Geosciences, LLC

2922 Kahaloa Drive, Honolulu, HI 96822 Phone: (808) 221-0104 ags@pixi.com

September 15, 2008
Project No. SRSS00108

Joe and Kristen Souza
47-079 Kamehameha Highway
Kaneohe, HI 96744

Dear Joe and Kristen:

Applied Geosciences, LLC is pleased to submit our report entitled *Geotechnical Engineering Exploration, 47-79 Kamehameha Highway, TMK: 4-7-019:049.*

Our work was performed in general accordance with our agreement of April 4, 2008.

This report presents our findings from a field and laboratory investigation program. Specific recommendations are presented in the body of the report. Should you have any questions, please contact our office.

Very truly yours,

Horst G. Brandes, Ph.D., P.E.
President

HORST G. BRANDES
LICENSED PROFESSIONAL ENGINEER
No. 9336
HAWAII, U.S.A.

1. Introduction

This report presents the results of a geotechnical engineering field investigation carried out at 47-79 Kamehameha Highway, located in Kaneohe on the Island of Oahu, Hawaii. The general vicinity, topography and location of the project are shown in Figure 1. The intent of this report is to characterize surface and subsurface soil conditions for the specific purpose of evaluating the steep slope that exists at the seaward end of the property and to make recommendations for its stabilization. Drilling and sampling were conducted on April 18, 2008, followed by laboratory testing and analysis. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

2. Scope of Work

Work carried out as part of this project consisted of:

- A review of available soil and geologic data related to the project site
- Coordination of field work with the drilling subcontractor
- Drilling and sampling of three borings to a maximum depth of 10.5 feet
- Performing a field reconnaissance to identify and characterize surface features
- Field sampling and laboratory testing of selected specimens to assist with classification and characterization of engineering properties
- Analysis of field and laboratory results to formulate a set of geotechnical recommendations
- Preparation of this report summarizing our work

The boring logs and sampling locations are presented in Appendix A. Specific results from the laboratory testing program are included in Appendix B. The experimental findings are discussed throughout the report.

3. Geologic Setting

The project site is located on an elevated bluff between Kamehameha Highway and Kaneohe Bay. It is situated within the caldera of the Koolau volcano and close to the northwest-trending rift zone through which massive eruptions occurred some 1.8 to 2.6 million years ago. The Koolau volcano was unusually elongate. Steep cliffs surrounding the Kailua and Kaneohe basins represent one side of the old caldera. Dike complexes and lava fills dominate the area within this caldera. The lava flows have been weathered and laterized extensively near the surface. Immediately offshore lies the Kaneohe Bay reef complex, which is much younger and laps against the older volcanic formations. Kamehameha Highway rises from sea level at the Kaneohe Fishing Pier to about 30 feet at the property lot, where the road and the coastline take a sharp turn to the west (Figure 1). The elevated headland upon which the property is located sticks out into Kaneohe Bay and has resisted erosion better than the lower-laying adjacent areas. The reason for this may very well be the presence of hard dike formations below the surface soils, as can be observed at some locations along the shoreline. The natural surface soils are generally brick red to brown in color due to a high degree of laterization and due to alteration of the original lava fills by heat.

4. Surface and Subsurface Conditions at Project Site

The property stretches from Kamehameha Highway to the Kaneohe Bay shoreline. The lot grades downward gently from street level to the edge of the seaward cliff. The cliff itself descends sharply from about 32 feet elevation to sea level at an average slope of approximately 45°. A residence occupies the majority of the lot and includes a rear concrete porch extending to within about 5 feet of the head of the steep shorefront slope. A set of narrow stairs leads partly down to the ocean. The steep slope is overgrown with trees and low-laying vegetation (Figure 2).

Figure 2. Rear portion of property with steep seaward cliff on the right.

At the base of the cliff is a narrow shore bench that is underlain by calcareous sand and reef limestone. High tides and storm surges from Kaneohe Bay can submerge all of the shoreline and reach the base of the cliff. Fill material to a depth of 2 to 3 feet extends from the edge of the cliff backward beneath the porch (Figure 2). Blue-gray rock, characteristic of dike formations, is exposed along a portion of the toe of the slope. Some of this rock is very hard and essentially un-weathered. However, the bulk of the exposed steep face that descends to sea level consists of highly to moderately weathered reddish volcanic

flows and sapprolite. These materials are fractured, loose and unstable. In many places the soil is held in place only tenuously by vegetation. It is clear that substantial erosion and shallow sliding have taken place in the past, contributing unwanted volcanic soils to the waters of Kaneohe Bay. This process is exacerbated by ocean tides that wash directly against the toe of the cliff and are therefore contributing to its progressive undermining. Continued erosion and sliding are causing progressive headcutting at the top of the slope, which may soon start to undermine the porch area and even the residential foundation.

Three soil borings were drilled at the crest of the seaward slope in a narrow bench adjacent to the porch (Figure 3). Because of space and accessibility restrictions, a hand-operated drill rig was used. The soil profile at the site indicates about 1 to 2 feet of gravelly to silty fill of high plasticity, underlain by typical residual soil consisting of silt of high plasticity (MH) with a fine fraction between 57% and 74%. This residual soil profile is underlain by a hard rock formation that is visible along a portion of the toe of the slope. The depth to this hard rock can be expected to vary from one side of the property to the other. Free swell indices and Atterberg Limits suggest moderate to high swell potential in the residual soil layer beneath the surface fill.

5. Slope Stability Analysis

Deep-seated potential slope instability was investigated by examining the shoreline cliff area and by conducting a series of limit equilibrium stability calculations. Two representative cross sections, referred to as sections AA and BB, were considered for the stability analysis (Figures 3, 4 and 5). The profiles for these lines were determined from the topographic survey provided Gil Surveying Services, Inc. (Figure 3). The soil was modeled using the Mohr Coulomb soil model with strength properties determined from direct shear testing, with soil layering compiled from the borings, and from observation of surface features along each of the sections. Computations were carried out using the Spencer method of limit equilibrium analysis. In the Spencer method inter-slice forces are considered in the analysis and both force and moment equilibrium are satisfied, thus providing a rigorous solution. Numerous computer-assisted trials were conducted in the search of the critical failure surface, i.e. the surface associated with the most probable failure mode.

Figure 4 indicates a minimum factor of safety of 1.19 for line AA. The calculations assume hard rock at a relatively shallow depth, as determined from surface outcrops and borings taken both on this property and the neighboring one on the left. A high water elevation is assumed, as shown in Figure 3. This accounts for substantial ground saturation under extenuating circumstances. Although the computed factor of safety is larger than 1.0 and therefore indicates a stable condition, values less than 1.50 are generally deemed potentially hazardous and unacceptable. A deep-seated failure would be limited in depth by the hard basalt rock beneath. Since the depth and extent of this basalt is expected to be non-uniform, the potential for substantial soil movement in the case of a large failure cannot be discounted with confidence. It is therefore conceivable that under severely adverse condition such a failure could compromise the structural integrity of the existing porch and the main house. A similar conclusion can be drawn from considering the stability analysis results depicted in Figure 5 for section BB. Here the factor of safety is much too close to the threshold of 1.0 for the initiation of deep sliding. Both analysis cross

sections assume a relatively high water table, as may be expected during a severe and sustained rainfall event.

In addition to deep-seated sliding, the potential for shallower soil wasting processes such as erosion and thin sliding need to be considered as well. Indeed, the seaward slope is undergoing continued surface erosion. Limited shallow sliding and soil have already occurred at a number of places. Similar mass wasting processes have taken place on sections of the same seaward cliff located on the property that adjoins to the left. That lot has suffered at least one recent moderate sliding event of the type that may also occur on the property under study. Clearly these types of soil movements are ongoing and can be expected to continue in the future.

It should be mentioned that the effects of earthquake shaking were not included explicitly in the calculations because the level of ground motions at the site are not well understood. In general, shaking will reduce overall stability either during an earthquake or shortly thereafter.

6. Need for Slope Stabilization

The steep slope that constitutes the seaward edge of the elevated cliff is unstable and in dire need of stabilization. Clearly the seaward cliff is undergoing progressive soil loss, mainly in the form of surface erosion and shallow sliding. These processes can be expected to continue, while a more serious deep-seated failure is not out of the question. Presently the exposed soil on the slope is loose, fractured and much of it is on the verge of descending toward the ocean. In many places soil material is barely held in place by weak root systems and the vegetation that covers the slope. This type of quasi-retention is unreliable and not acceptable from an engineering perspective.

Sooner or later the continued loss of soil will begin to undermine the porch and begin to compromise the structural integrity of the house. Aside from structural concerns regarding the porch and the house, the continued transport of volcanic soil from the cliff area into the waters of Kaneohe Bay is undesirable from an environmental perspective. Kaneohe Bay is a fragile ecosystem that in the past has suffered from excessive inflow of volcanic soils. Of particular concern is the underwater reef ecosystem that exists nearby which can easily be damaged by volcanic soils that wash into the bay and are then transported by nearshore currents and tides. The potential negative environmental consequences from soil transport into Kaneohe Bay are sufficient to warrant the construction of an effective retention system.

7. Slope Stabilization Alternatives

The most effective remediation alternative would consist of one or a set of terraced retaining walls with proper backfill and effective drainage provisions, much as it exists on the property adjoining on the right. Such a system can be effective in preventing additional soil loss into Kaneohe Bay and at the same time provide necessary support to the porch and the house that exist on the property. Given the steepness of the slope and the limited amount of space available, other options such as grading or slope reinforcement without a rigid wall may not be feasible. These alternatives are often not fully effective in preventing

surface soil from washing down the slope, particularly during severe rainfall events. In any case, given the height and steepness of the existing slope, and given the limited amount of space on the property to build a retention system, it is likely that some sort of tie-back system will need to be installed in order to provide the necessary stability.

A single retaining wall on the order of 30 feet in height may be quite expensive and unsightly. A set of tiered walls would appear to be a more reasonable choice. However, the details of the retention system need to be designed with care and should be reviewed by Applied Geosciences to insure that it is stable and compatible with the site conditions and this report. Design parameters for retaining walls are presented below.

8. Site Clearing and Construction

Due to the proximity of the slope to the ocean and the generally loose condition of the surface soils on the slope, great care needs to be exercised during site clearing and construction. Best practices for soil erosion control need to be implemented and these should include a turbidity fence immediately offshore of the construction site, among other measures.

After obtaining the proper permits and installing suitable erosion control measures, all loose soils, vegetation, concrete and other debris should be removed from the slope to expose firm soil or rock materials. Clearing and grubbing should be observed by a qualified geotechnical engineer. Utilities, if any, should be located and shut off prior to any grading. If existing utilities are to be abandoned, they should be removed, and the resulting excavation should be properly backfilled with select granular fill material compacted to a minimum of 90 percent relative compaction. The final grade prior to commencing backfilling and/or construction of the new retention system should be approved by a qualified geotechnical engineer.

Given the proximity of the rear porch to the head of the slope, the need for underpinning or providing other means of temporary support for existing structures needs to be assessed to avoid damaging them. Again, this should be done by a qualified engineer.

9. Design of Retaining Structures

Select fill material should be used for backfilling purposes. It should consist of non-expansive select granular soil of coralline or basaltic origin. It should be well graded from coarse to fine, with no particles larger than 3 inches in largest dimension and between 10 and 30 percent particles passing the No. 200 sieve. Fill material should be free of vegetation, deleterious materials and clay lumps. It should have a laboratory CBR value of 20 or more and a maximum swell of 1 percent or less. Imported fill materials should be tested for conformance with these recommendations prior to delivery to the project site.

Fill materials should be placed in level lifts not exceeding 8 inches in loose thickness, moisture-conditioned to above the optimum moisture, and compacted to at least 90 percent relative compaction.

The compaction requirement should be increased to 95 percent relative compaction for fills placed within 3 lateral feet and 2 feet beneath any proposed foundation element. Filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the above fill placement recommendations. Backfilling may occur in tandem with construction of the retention system proceeding from sea level to the head of the slope.

Surface flows on the property should be evaluated so insure that they are collected and properly discharged to minimize seepage into the subsurface where they can cause slope stability problems. These flows should be conveyed to areas off the property in such a manner that they do not add to the groundwater levels.

Retaining structures may be required as part of the slope stabilization remediation. The following recommendations are offered for the design of low retaining structures. If the height of any retaining structure is to exceed 4 feet, additional input should be sought from Applied Geosciences.

- The footing of any retaining structure should be embedded a minimum of 24 inches below the lowest adjacent grade. Retaining structures may be designed assuming an allowable bearing pressure of 2,000 pounds per square foot (psf). Lateral loads may be resisted by frictional resistance developed between the bottom of the wall footing and the bearing soil and by passive earth pressure acting against the vertical face passing through toe of the wall footing. A coefficient of friction of 0.30 may be used for concrete footings in contact with the bearing soil. Resistance due to passive earth pressure may be estimated using an equivalent fluid pressure of 200 pounds per square foot per foot of depth (pcf) assuming that the soils around the footings are well compacted. The passive resistance in the upper 12 inches of the soil should be neglected.

- Retaining structures should be designed to resist lateral earth pressures due to the adjacent soils and surcharge effects. The on-site soils are not suitable as backfill material. It is assumed that any backfill material will have the characteristics of the imported select fill listed above and will be compacted to 90% relative compaction. However, care should be taken not to over-compact the backfill. Recommended lateral earth pressures for design of earth retaining structures are as follows:

	Level Backfill		Maximum Backfill Slope 2H:1V	
	Horizontal	Vertical	Horizontal	Vertical
Active	45	0	65	35
At-Rest	60	0	80	45

- These lateral earth pressures do not include hydrostatic pressures that may be caused by trapped groundwater. Retaining walls that are not free to deflect laterally should be designed for the at-rest condition.

- All retaining walls should be well-drained to reduce the build-up of hydrostatic pressures. Either granular material or a prefabricated drainage product should be used in the back of every retaining wall, in conjunction with a perforated collector pipe along the bottom and regularly spaced weep holes. If granular material is to be used as the means of draining the backfill, it should consist of #3B fine aggregate extending a minimum of 12 inches from the back of the wall. This drainage aggregate should be separated from other soils by a properly selected geotextile to provide adequate separation and cross-plane drainage functions. Alternatively, a suitable drainage geocomposite may be used in place of the granular material. The collector pipe at the bottom of the drainage aggregate or geocomposite should consist of a perforated pipe with a minimum diameter of 4 inches and should be inclined to drain by gravity to an appropriate discharge location. Weep holes should be at least four inches in diameter and should be spaced no more than 4 feet apart and no more than 8 inches above ground. Overall filtration and drainage performance of the drainage system should be evaluated during the design stage.

- Surcharge stresses due to areal surcharges, line loads, and point loads, within a horizontal distance equal to the overall height of the adjacent portion of any wall, should be considered in the design. Corresponding lateral surcharge soil pressures should be selected in consultation with a representative from Applied Geosciences.

10. Final Comments

Preliminary and final drawings and specifications for the proposed project should be forwarded to Applied Geosciences for review and written comments prior to advertisement for bids. This review is necessary to evaluate general conformance of the plans and specifications with the intent of the foundation and earthwork recommendations provided herein. If this review is not made, Applied Geosciences cannot be responsible for misinterpretation of our recommendations.

It is also recommended that Applied Geosciences be retained to provide geotechnical engineering services during all phases of earth and foundation work. Key monitoring elements include observation of subgrade preparation, fill placement and compaction, review of selected slope stabilization measures for adherence to specifications and recommendations in this report, and construction of the retention system. Monitoring by this office should also expedite suggestions for design changes that may be required in the event that subsurface conditions differ from those anticipated at the time this report was prepared. The recommendations provided herein are contingent upon such observations.

If actual exposed subsurface conditions encountered during construction are different from those assumed or considered in this report, appropriate modifications to the design should be made.

11. Limitations

The comments and recommendations presented in this report are based, in part, on the soil conditions encountered in three borings and upon information obtained from literature research and field exploration.

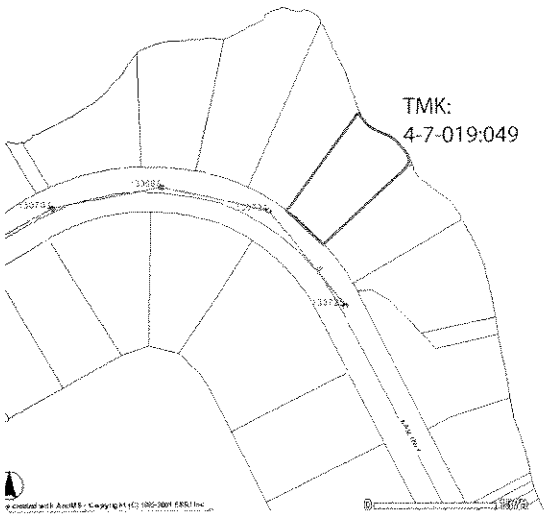
Actual conditions beyond the location of the principal borings may differ from those described in this report. The nature and extent of these variations may not become evident until construction is underway. Applied Geosciences should be notified and retained to check if modifications to the recommendations presented in this report are needed if variations appear evident. The comments and recommendations presented in this report shall not be considered valid unless the changes are reviewed by Applied Geosciences and the recommendations of this report are verified by us in writing.

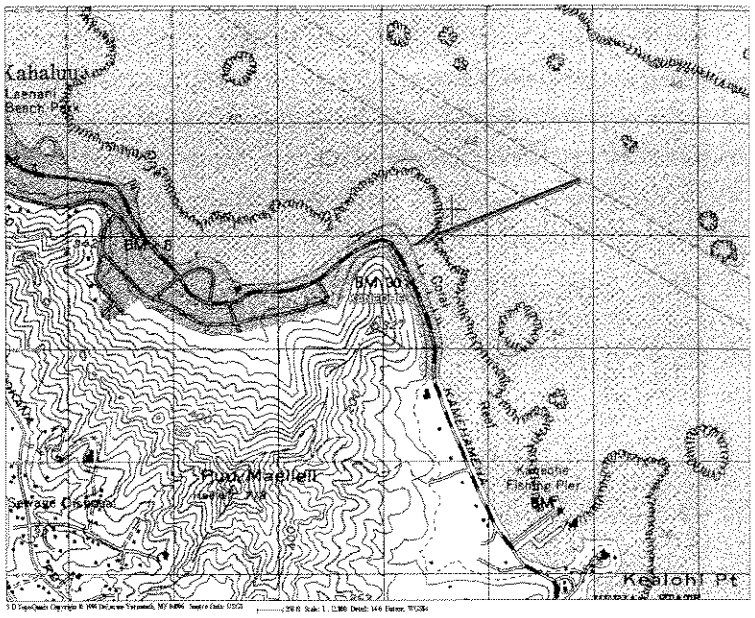
The stratification lines shown on the graphic representation of all the borings depict the approximate boundaries between the various soil and rock units, and as such may denote a gradual transition. Fluctuations in the groundwater level may occur due to variations in rainfall, temperature, tides and other factors that may be different from the conditions that existed at the time the boreholes were drilled. This report does not reflect variations that may result in the subsurface and groundwater conditions. Such subsurface and groundwater conditions may not become evident until construction.

The field exploration portion of this study may not have disclosed the presence of underground structures such as cesspools, drywells, storage tanks, sumps, pits, landfills, buried debris, cavities, voids, etc., that may be present at the site. Should these items be encountered during construction, Applied Geosciences should be notified and retained to provide recommendations for their disposal and/or treatment. Assessment of the presence or absence of these structures was not included in the scope of this study. The scope of Applied Geosciences exploration services was limited to conventional geotechnical engineering services and did not include any environmental assessment or evaluation of potential subsurface and groundwater contamination. Silence in this report regarding any environmental aspects of the site subsurface and groundwater materials does not indicate the absence of potential environmental problems.

This geotechnical report has been prepared for the use of the clients, Joe and Kristen Souza, and their designated engineering consultants in accordance with generally accepted soils and foundation engineering practices. No other warranty, expressed or implied, is made as to the professional advice included in this report and none should be inferred. This report has been developed for the purpose of developing a slope stabilization system as described elsewhere in this report. It does not contain sufficient information for purposes of other parties or for other uses. In addition, this report may not contain sufficient data or proper information to serve as the basis for preparation of construction estimates. A contractor wishing to bid on this project is urged to retain a qualified geotechnical engineer to assist in the interpretation of this report and/or in the performance of additional site-specific exploration for bid estimating purposes.

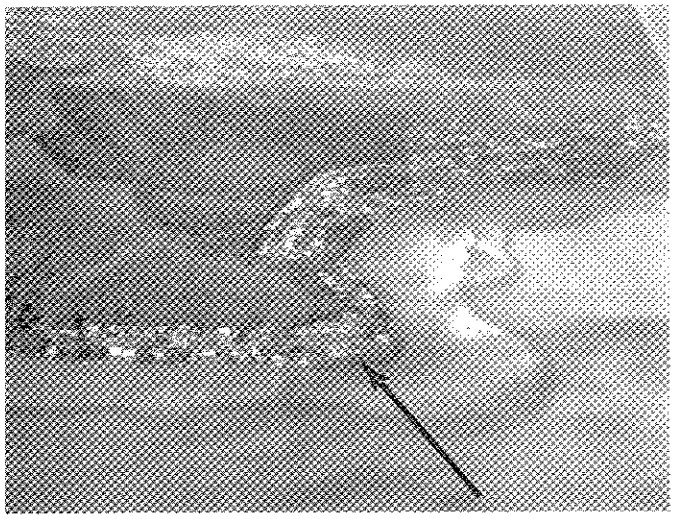
The owner/client should be aware that unanticipated subsurface conditions are commonly encountered. Unforeseen subsurface conditions, such as perched groundwater, soft deposits, hard layers, or cavities, may occur in localized areas and may require additional probing or corrections in the field (which may result in construction delays) to attain a properly constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.





USGS Topographic Quadrangle

Project Location



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Project: 47-079 Kamehameha Hwy.
TMK: 4-7-019:049

Figure 1

Project No: SRSS00108

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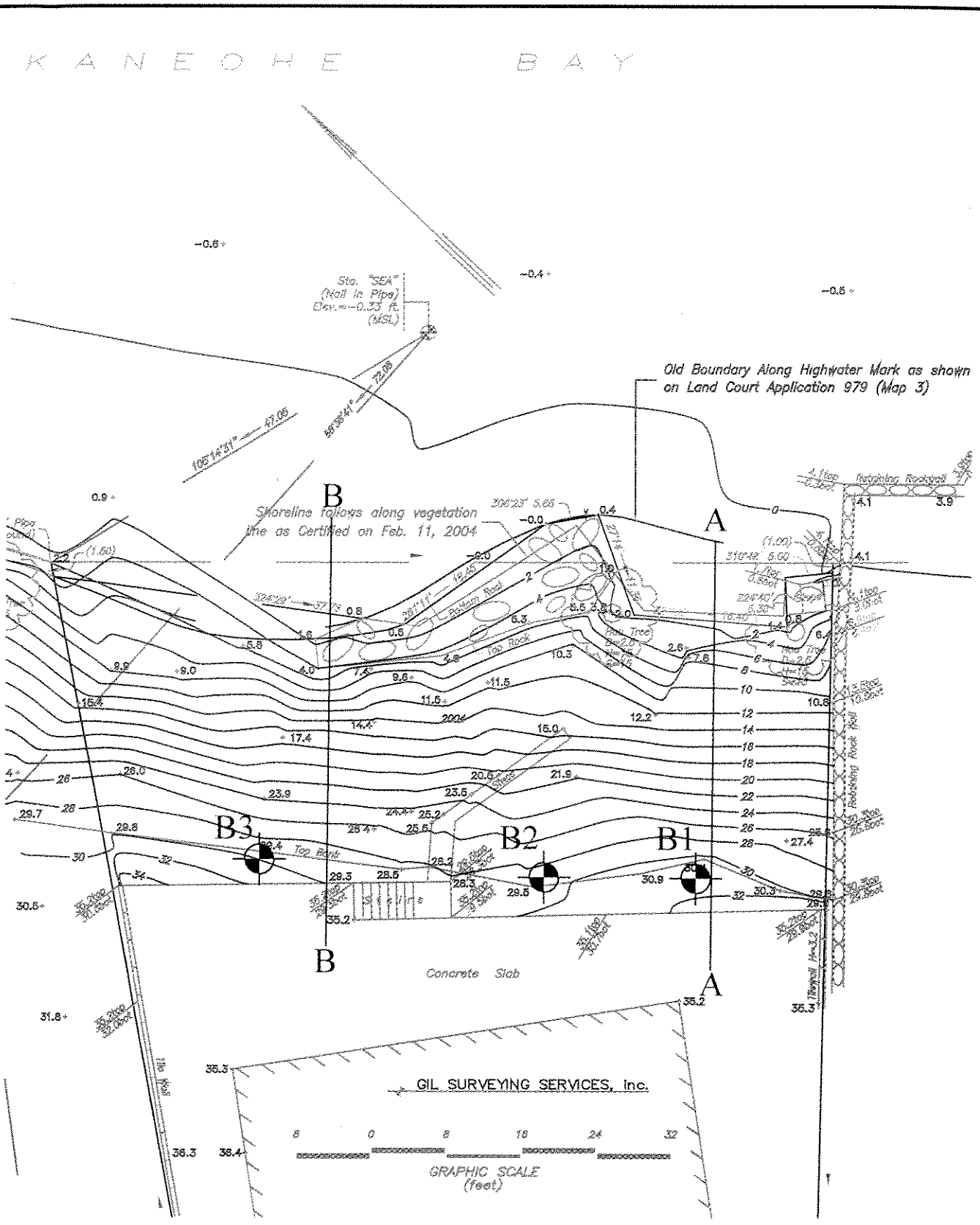

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Project No: SRSS00108

Figure 3

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Stability Analysis - Line AA

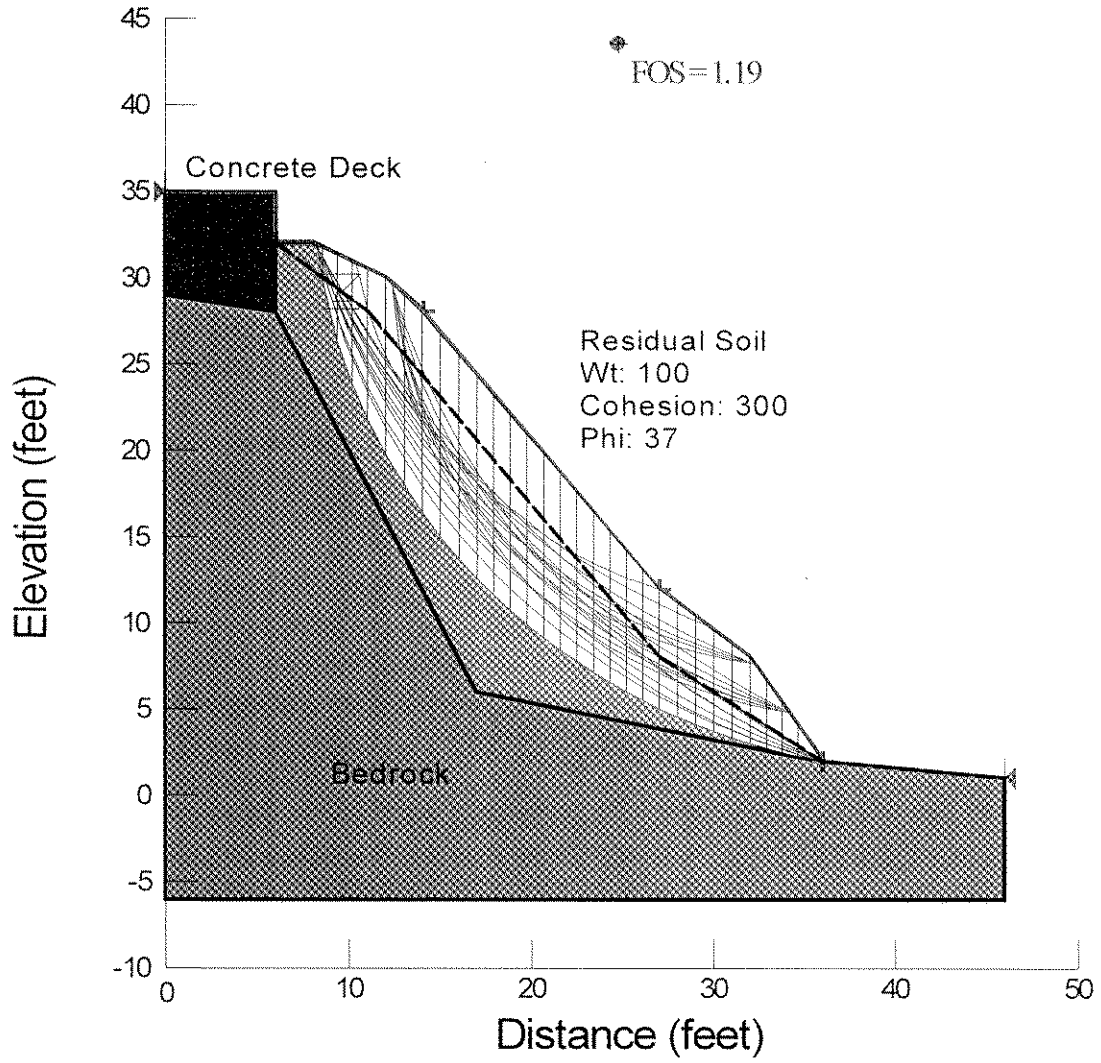

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Figure 4

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Stability Analysis - Line BB

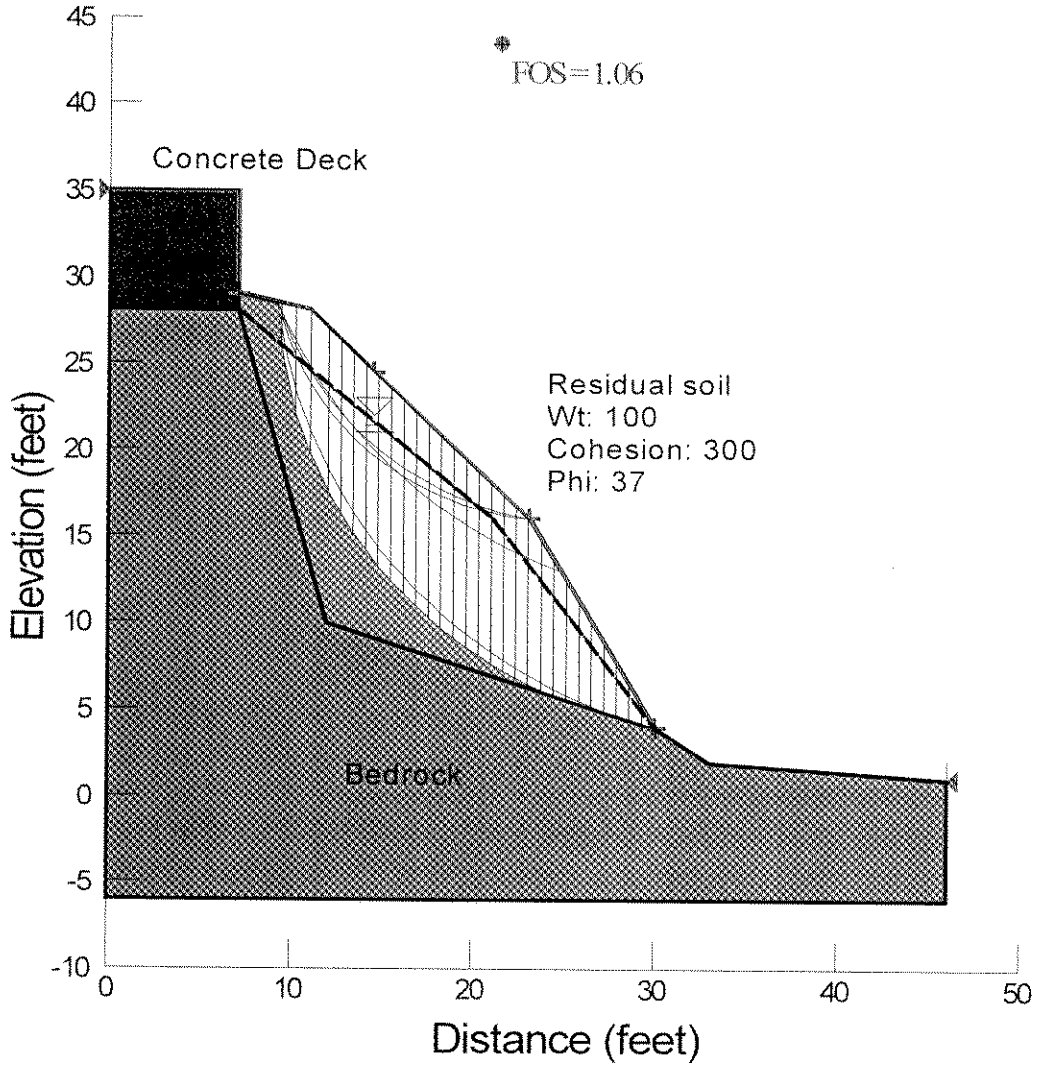

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Figure 5

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APPENDIX A
Field Exploration

The subsurface conditions at the project site were explored by drilling and sampling three borings, designated as B1 through B3.

All the borings were drilled using a hand-powered auger rig that advanced a 4-inch continuous-flight auger. Sampling tools were lowered after retrieving the auger lengths. Samples were obtained with a California sampler containing 2.4-inch brass rings, or with a standard 2-inch split-spoon sampler driven by a 35-lb weight descending a distance of 48 inches. Penetration numbers (blow counts) represent the number of blows needed to advance the sampler 12 inches, following an initial penetration of 6 inches (unless noted otherwise). Soil specimens collected with the split-spoon sampler were inspected, described visually, and stored in sealed bags for laboratory testing.

Laboratory testing (Appendix B) included determining moisture contents, Atterberg Limits, grain size distributions and shear strengths. Soil samples were classified according to the Unified Soil Classification System.

Figures A1-A3:	Boring Logs B1-B3
Figure A4:	Boring Log Legend

BORING NO. B1

Applied Geosciences, LLC

ile: Drilling logs Date Printed: 9/9/2008

PROJECT: 47-079 Kamehameha Hwy. **PROJECT NO.:** SRSS00108

CLIENT: Joe & Kristen Souza **DATE:** 4/18/2008

LOCATION: 47-079 Kamehameha Hwy. **ELEVATION:**

DRILLER: Ali Harada **LOGGED BY:** HB

DRILLING METHOD: Hand-operated rig

DEPTH TO - WATER> INITIAL: - **AFTER 0.5 HOURS:** - **CAVING>** -

DEPTH (feet)	Description	SOIL TYPE	SAMPLERS	SPT	TEST RESULTS
0	Brown plastic FILL (GM), silty, sandy, with roots and plant remains				Plastic Limit ⊢—⊣ Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70 80 90
	Red brown clayey SILT (MH) with some mottling, moderate stiffness, some gravel			15	
	Increasing mottling at 3 ft			34	
5				66	
	MAXIMUM DEPTH = 6.33 FT				
10					
15					
20					
25					
30					
35					

Hand-held drilling rig with 35-lb hammer dropping a distance of 48"

BORING NO. B2

Applied Geosciences, LLC

File: Drilling logs Date Printed: 9/9/2008

PROJECT: 47-079 Kamehameha Hwy. **PROJECT NO.:** SRSS00108

CLIENT: Joe & Kristen Souza **DATE:** 4/18/2008

LOCATION: 47-079 Kamehameha Hwy. **ELEVATION:**

DRILLER: Ali Harada **LOGGED BY:** HB

DRILLING METHOD: Hand-operated rig

DEPTH TO - WATER> INITIAL: - **AFTER 0.5 HOURS:** - **CAVING>** -

DEPTH (feet)	Description	SOIL TYPE	SAMPLERS	SPT
0	Brown plastic FILL (GM), silty, sandy, with roots and plant remains			
	Increasing gravel at 1.5 feet			70
	Blow count = 50 for first 4" at 3 ft			50
	Layer of gravel and cobbles			
5	MAXIMUM DEPTH = 3.33 FT			
10				
15				
20				
25				
30				
35				

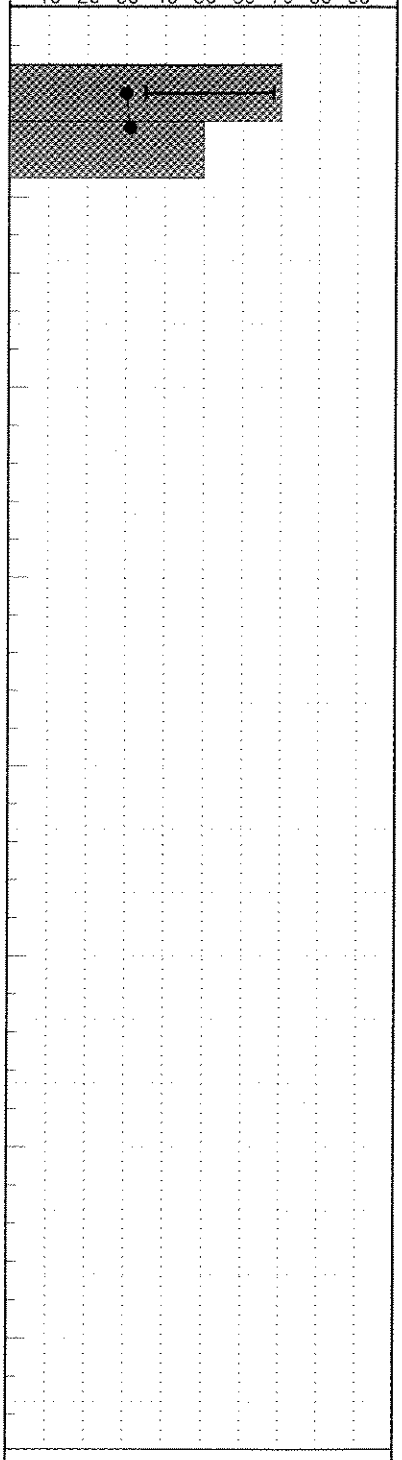
TEST RESULTS

Plastic Limit ⊢——⊣ Liquid Limit

Water Content - ●

Penetration - ▨

10 20 30 40 50 60 70 80 90



DEPTH (feet)

BORING NO. B3

Applied Geosciences, LLC

File: Drilling logs Date Printed: 9/9/2008

PROJECT: 47-079 Kamehameha Hwy. **PROJECT NO.:** SRSS00108

CLIENT: Joe & Kristen Souza **DATE:** 4/18/2008

LOCATION: 47-079 Kamehameha Hwy. **ELEVATION:**

DRILLER: Ali Harada **LOGGED BY:** HB

DRILLING METHOD: Hand-operated rig

DEPTH TO - WATER> INITIAL: - **AFTER 0.5 HOURS:** - **CAVING>** -

DEPTH (feet)	Description	SOIL TYPE	SAMPLERS	SPT
0	Brown plastic FILL (GM), silty, sandy, with roots and plant remains			
	3" layer of gravel & asphalt at 1 ft			
	Red brown clayey SILT(MH) with some mottling, moderate stiffness, some gravel			24
	Becoming redder, less mottling			69
5	Light brick red color, plastic, stiffer			124
	Little or no mottling			25
10	MAXIMUM DEPTH = 10.5 FT			

TEST RESULTS

Plastic Limit ⊢——⊣ Liquid Limit

Water Content - ●

Penetration - ▨

10 20 30 40 50 60 70 80 90

124

DEPTH (feet)

KEY TO SYMBOLS

Symbol Description

Strata symbols

Fill

Residual silt and sapprolite

Soil Samplers

California sampler

Standard penetration sampler

Notes:

1. Exploratory borings were drilled on 4/18/2008 using a hand-held auger.

2. No free water was encountered at the time of drilling.

3. Boring locations were taped from existing features and elevations extrapolated from the survey map.

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

APPENDIX B
Laboratory Testing

Water contents were determined on recovered specimens that were sealed in the field to preserve their in situ moisture (ASTM D2216).

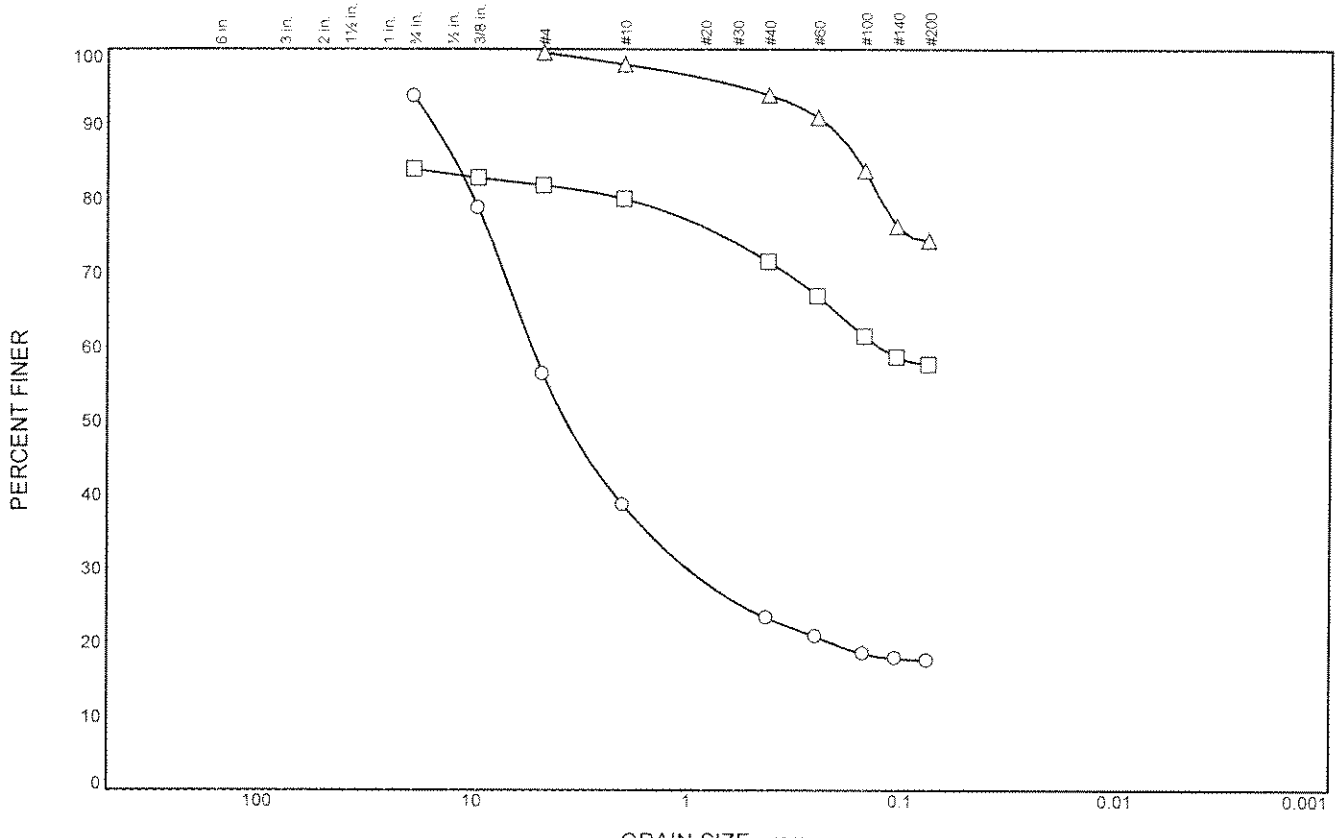
Grain size distributions are based on the results from mechanical sieving (ASTM D422). It should be noted that some of these tests were carried out on samples recovered with a standard split-spoon sampler, which is unable to retrieve particles larger than 1-3/8 inches. Very coarse gravel, cobbles and boulders are not accounted for in the gradation curves, although they are not thought to comprise a substantial portion of the total soil mass.

Atterberg Limits were determined from specimens that were not allowed to dry below their respective plastic limits (ASTM D4318).

Direct shear tests were conducted on largely undisturbed ring samples obtained with a California sampler. Specimens were saturated prior to testing. Tests were conducted in general accordance with ASTM D3080.

Figure B1: Particle Size Distributions
Figure B2: Atterberg Limits
Figure B3: Direct Shear Test: B3 @ 6 feet

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○			37.3	17.8	15.2	5.8	17.5	
□			2.2	1.8	8.4	13.9	57.6	
△				1.6	4.1	19.5	74.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B1		0.75	Gravel, sand and plastic silt	GM
□	B2		2.25	Sandy silt	MH
△	B3		6.75	Plastic residual silt	MH

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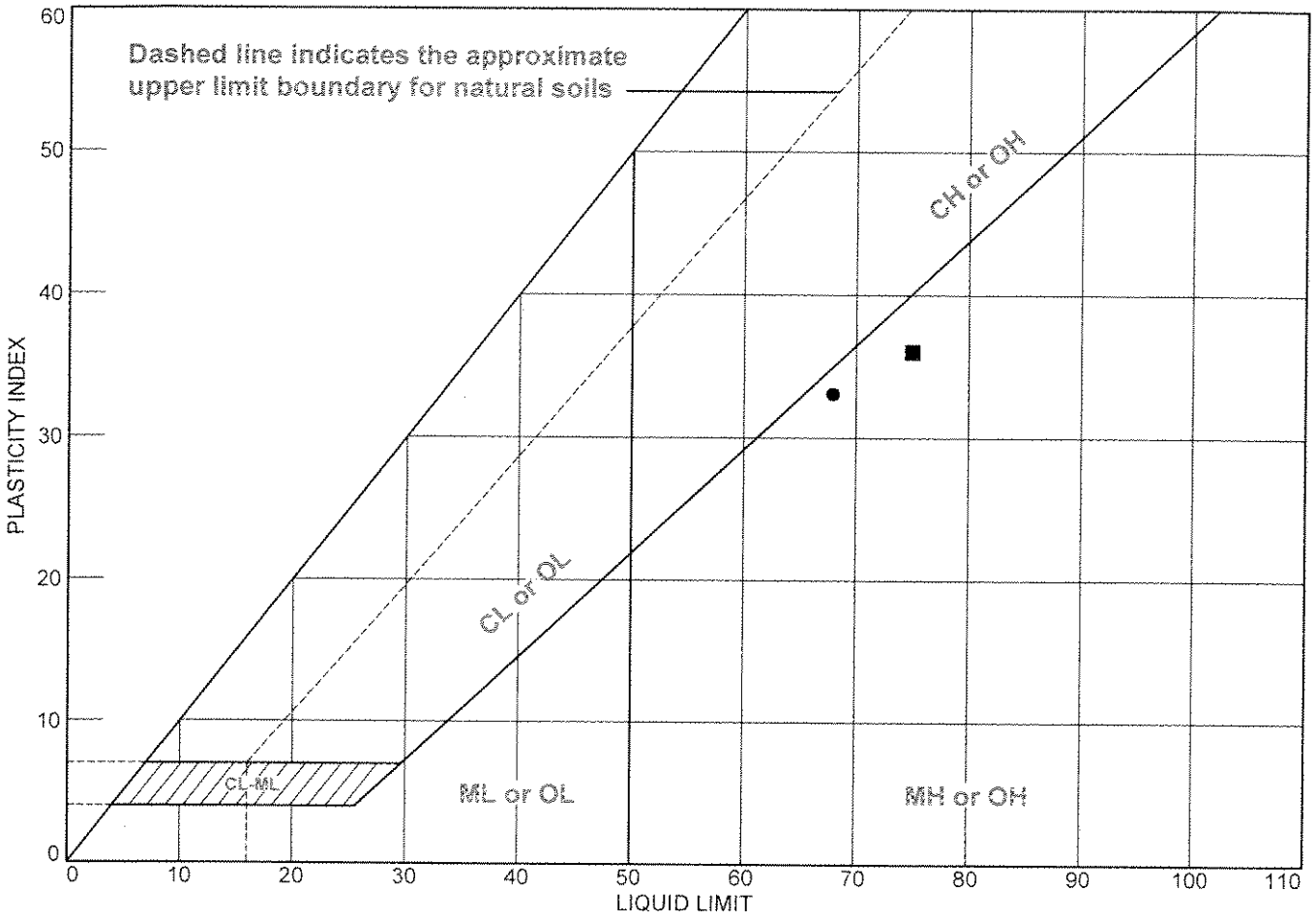
Project: 47-079 Kamehameha Hwy
Project No.: SRSS00108

Tested By: SW **Checked By:** HB

Figure B1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B2		2.25	30	35	68	33	MH
■	B3		6.75	38	39	75	36	MH

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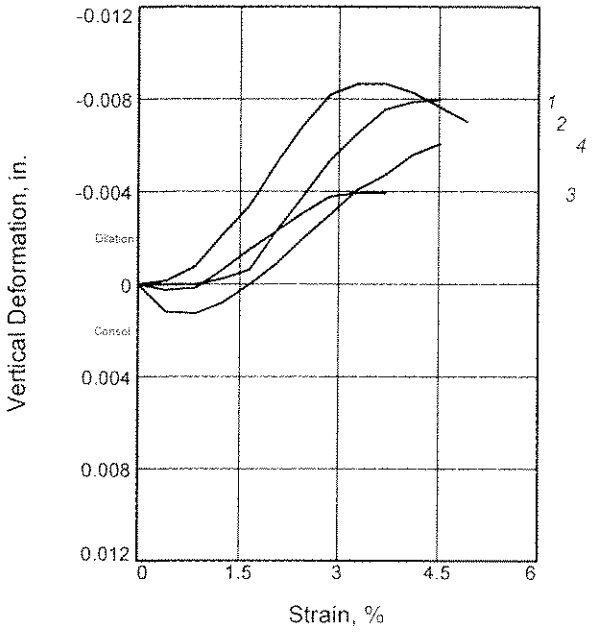
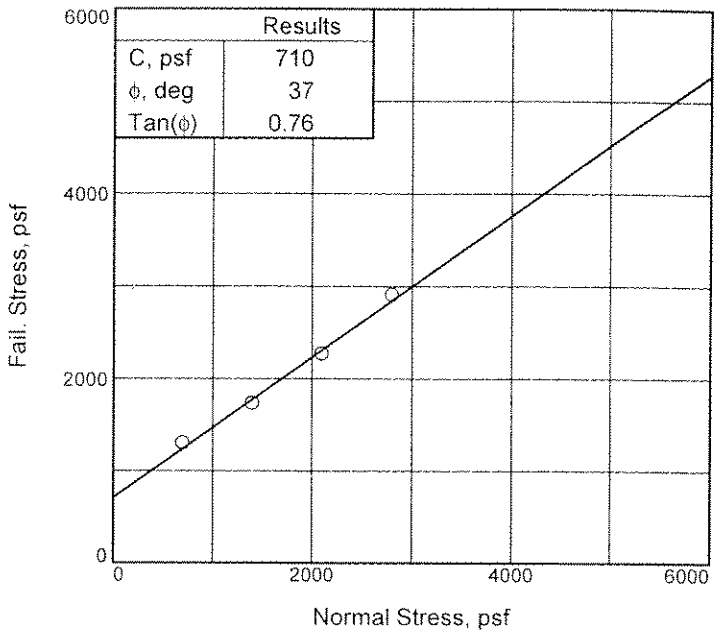
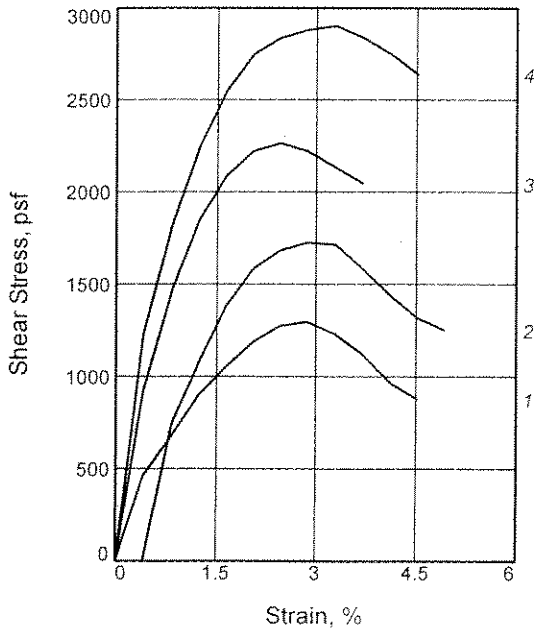
Tested By: SW **Checked By:** HB

Figure B2

Direct Shear Tests: B3 @ 6'







Sample No.		1	2	3	4
Initial	Water Content, %	41.0	40.0	38.7	38.2
	Dry Density, pcf	80.9	83.2	83.9	84.8
	Saturation, %	91.4	93.5	91.9	92.4
	Void Ratio	1.3915	1.3267	1.3059	1.2813
	Diameter, in.	2.40	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00	1.00
At Test	Water Content, %	44.2	42.6	41.3	41.0
	Dry Density, pcf	81.6	84.0	84.8	85.9
	Saturation, %	99.9	101.3	99.8	101.4
	Void Ratio	1.3723	1.3034	1.2828	1.2539
	Diameter, in.	2.40	2.40	2.40	2.40
	Height, in.	0.99	0.99	0.99	0.99
Normal Stress, psf		701	1403	2105	2807
Fail. Stress, psf		1298	1727	2266	2903
Strain, %		2.9	2.9	2.5	3.3
Ult. Stress, psf					
Strain, %					
Strain rate, in./min.		0.04	0.04	0.04	0.04

Assumed specific gravity = 3.1

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Project: 47-079 Kamehameha Hwy
Project No.: SRSS00108

Tested By: SW **Checked By:** HB

Figure B3