Banyan Drive Sea Level Rise Assessment Report

BANYAN DRIVE IN HILO, HAWAII

Prepared for:

State of Hawaii, Department of Land and Natural Resources

July 2014

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MUNEKIYO HIRAGA, INC.

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I. INTRODUCTION

I. INTRODUCTION

The State of Hawaii, Department of Land and Natural Resources' (DLNR) Land Management Division is evaluating lease arrangement options for the State's inventory of resort/restaurant-type properties situated along Banyan Drive, Hilo Hawaii. Thus, the DLNR is undertaking various studies to facilitate their decision-making process and to formulate recommendations to the Board of Land and Natural Resources (BLNR) in managing these properties after their respective leases expire. One (1) of the tasks associated with this evaluation is to assess the potential effects of Sea Level Rise (SLR) on the use of the properties over the next fifty (50) years utilizing current publicly available data.

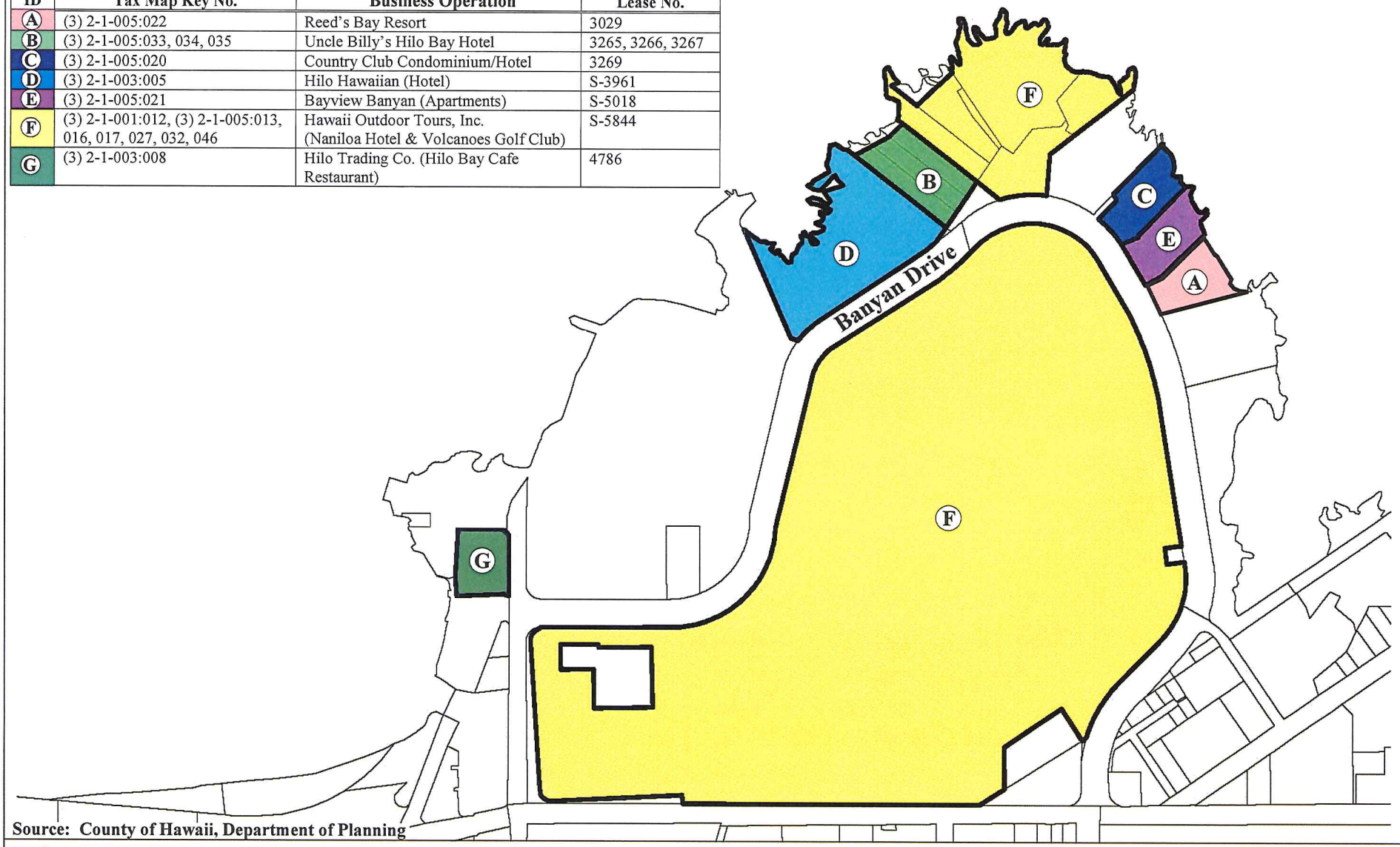
This report evaluates seven (7) properties identified by DLNR for assessment. **Figure 1** identifies the properties for study and **Figure 2** provides an aerial map of the study area. **Figure 3**, **Figure 4**, **Figure 5,** and **Figure 6** provide the real property tax maps for the parcels.

The seven (7) properties are located along the coast of Hilo Bay and Kuhio Bay. Five (5) properties operate as hotel/resorts with two (2) operating as hotel/condo – apartment housing for long-term residents. One (1) of the properties operates primarily as an apartment rental complex. The property located at the east end of Banyan Drive is commercially used by the Hilo Bay Cafe Restaurant whose street address is 123 Lihiwai Street.

To the east of the Hilo Bay Cafe Restaurant is the 20.062-acre Liliuokalani Gardens Park maintained by the County of Hawaii, Department of Parks and Recreation. Offshore into Hilo Bay is Coconut Island which is an approximate 3-acre extension of Liliuokalani Gardens via a concrete pedestrian bridge extending out to the small island. Bordering the park to the east is the Hilo Hawaiian hotel property followed by Uncle Billy's Hilo Bay Hotel, the Naniloa Hotel, the Country Club Condominium/Hotel, the Bayview Banyan Apartments, and Reed's Bay Resort. The Reed's Bay Resort is bordered to the east by a vacant property that was formerly the Orchid Island Hotel and the Reed's Bay Beach Park. See **Figure 7**, **Figure 8**, **Figure 9, Figure 10**, **Figure 11**, **Figure 12**, and **Figure 13** for additional aerial views of each parcel.

According to the County of Hawaii, Real Property Tax Office records, the older buildings situated on the properties were built between 1966 through 1970 and more recently constructed buildings were built between 1978 through 1983. **Table 1** lists various attributes of the properties extracted

ID	Tax Map Key No.	Business Operation	Lease No.
A	(3) 2-1-005:022	Reed's Bay Resort	3029
B	(3) 2-1-005:033, 034, 035	Uncle Billy's Hilo Bay Hotel	3265, 3266, 3267
C	(3) 2-1-005:020	Country Club Condominium/Hotel	3269
D	(3) 2-1-003:005	Hilo Hawaiian (Hotel)	S-3961
E	(3) 2-1-005:021	Bayview Banyan (Apartments)	S-5018
F	(3) 2-1-001:012, (3) 2-1-005:013, 016, 017, 027, 032, 046	Hawaii Outdoor Tours, Inc. (Naniloa Hotel & Volcanoes Golf Club)	S-5844
G	(3) 2-1-003:008	Hilo Trading Co. (Hilo Bay Cafe Restaurant)	4786



Source: County of Hawaii, Department of Planning

Figure 1 Banyan Drive Sea Level Rise Assessment

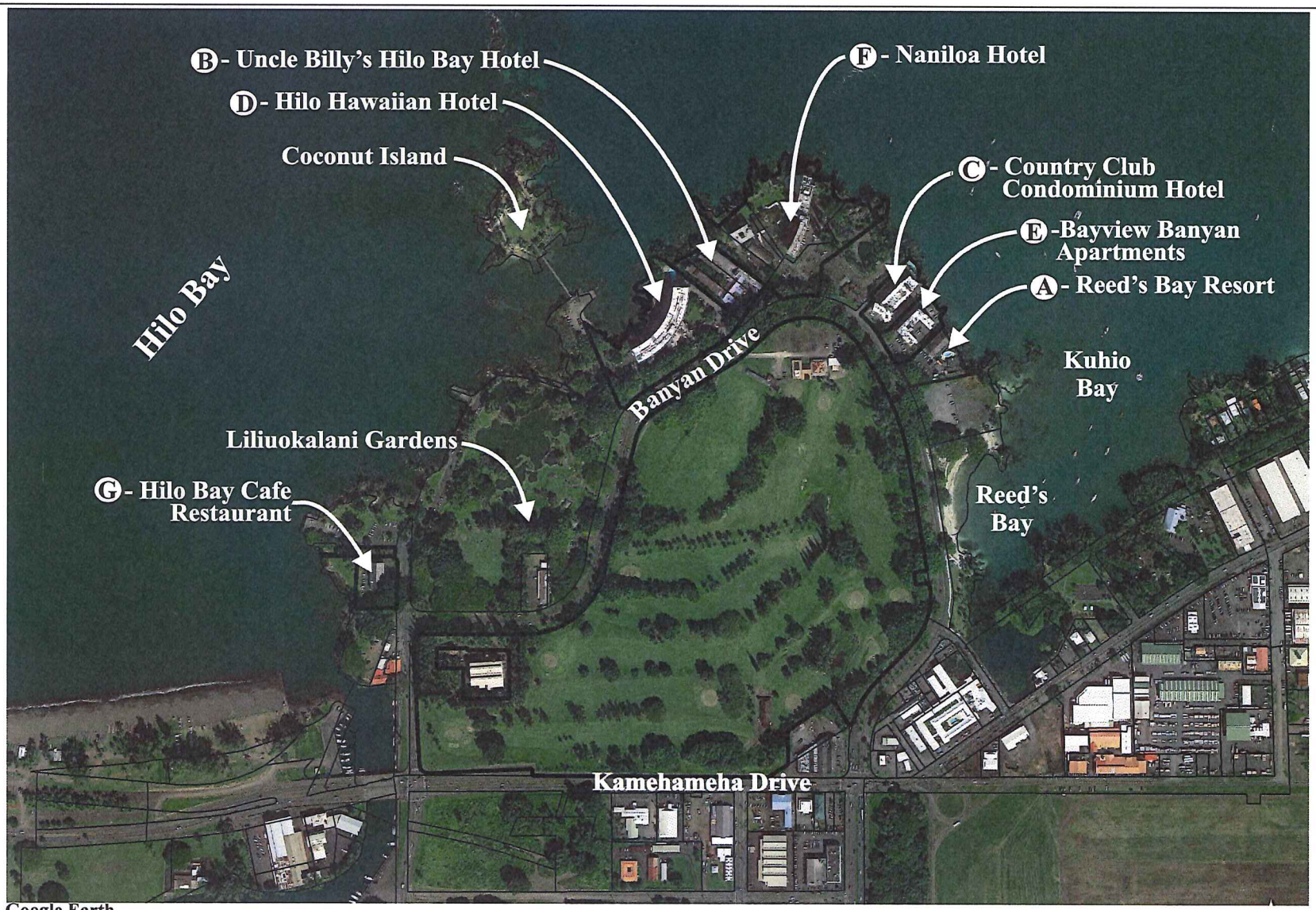
Property Location Map

0 250 Feet
125 500

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\Sea Level Rise Assessment\Property Location Map



Source: Google Earth

Figure 2

Banyan Drive Sea Level Rise Assessment

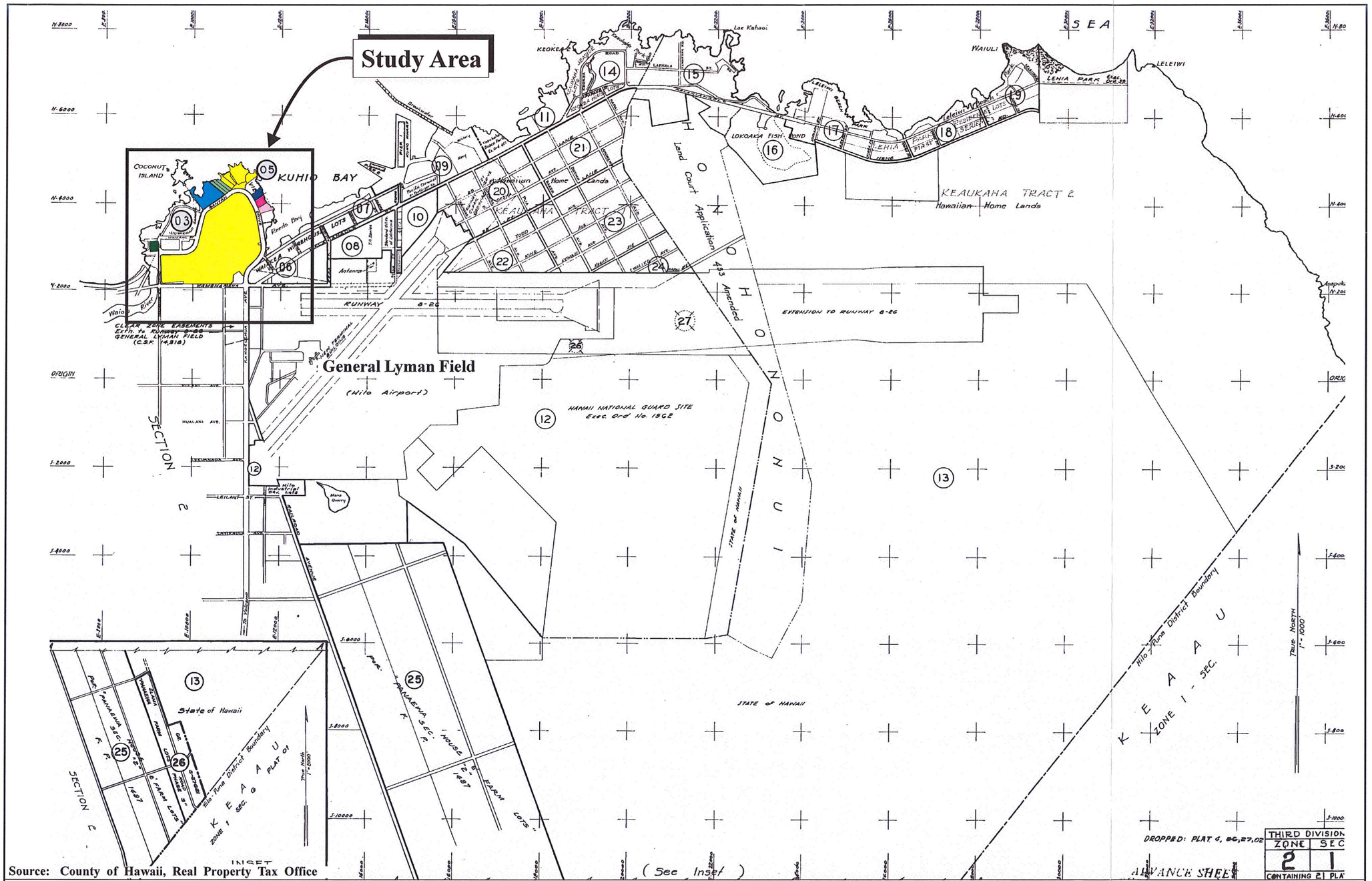
Aerial View of Properties

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\Sea Level Rise Assessment\Aerial View of Properties



Source: County of Hawaii, Real Property Tax Office

Figure 3

Banyan Drive Sea Level Rise Assessment

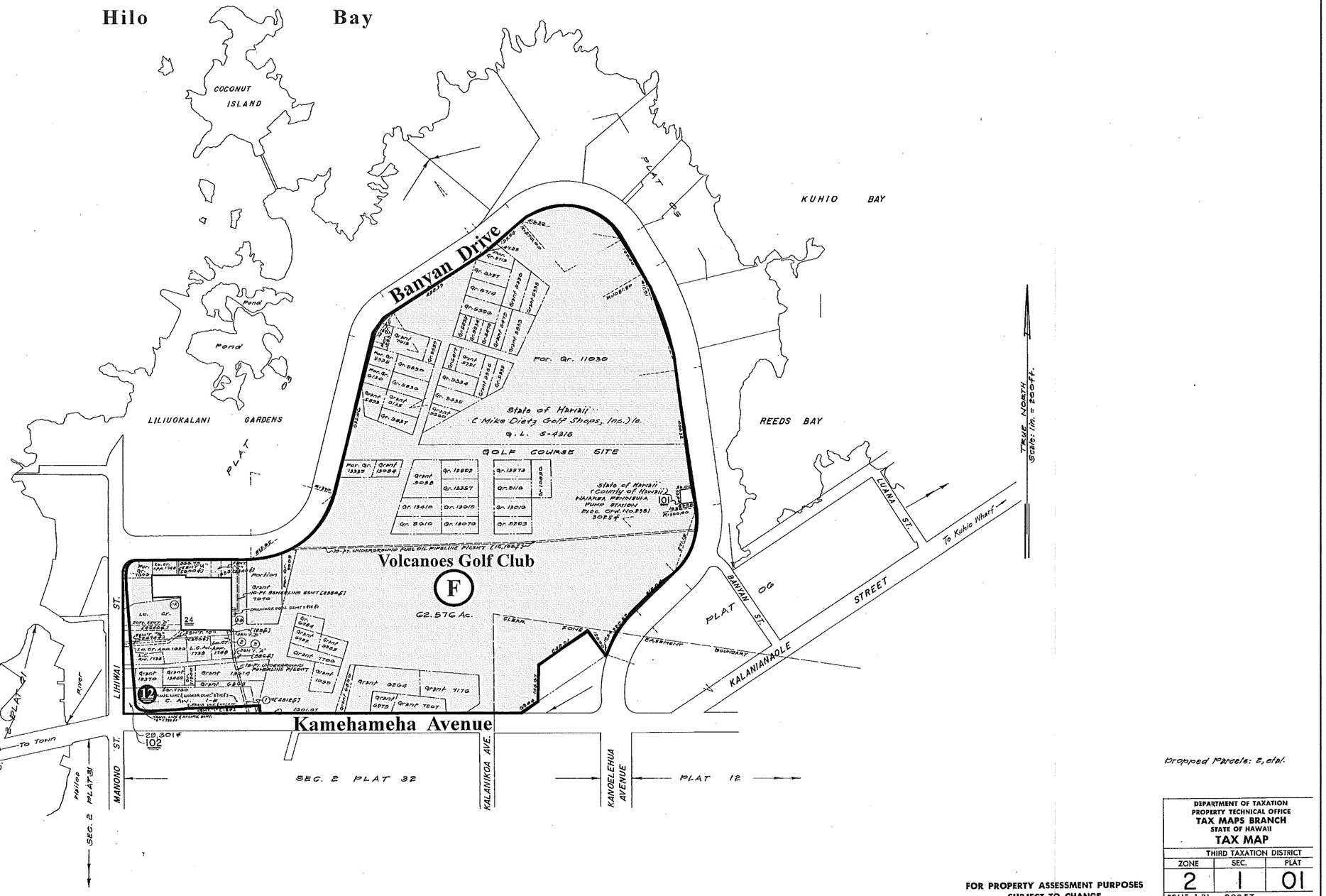
Tax Map (3) 2-1

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\Sea Level Rise Assessment\Tax map (3) 2-1



Proposed Parcels: 2, etal.

DEPARTMENT OF TAXATION
PROPERTY TECHNICAL OFFICE
TAX MAPS BRANCH
STATE OF HAWAII
TAX MAP

THIRD TAXATION DISTRICT

ZONE	SEC.	PLAT
2	1	01

SCALE: 1 IN. = 200 FT.

FOR PROPERTY ASSESSMENT PURPOSES
SUBJECT TO CHANGE

Source: County of Hawaii, Real Property Tax Office

Figure 4

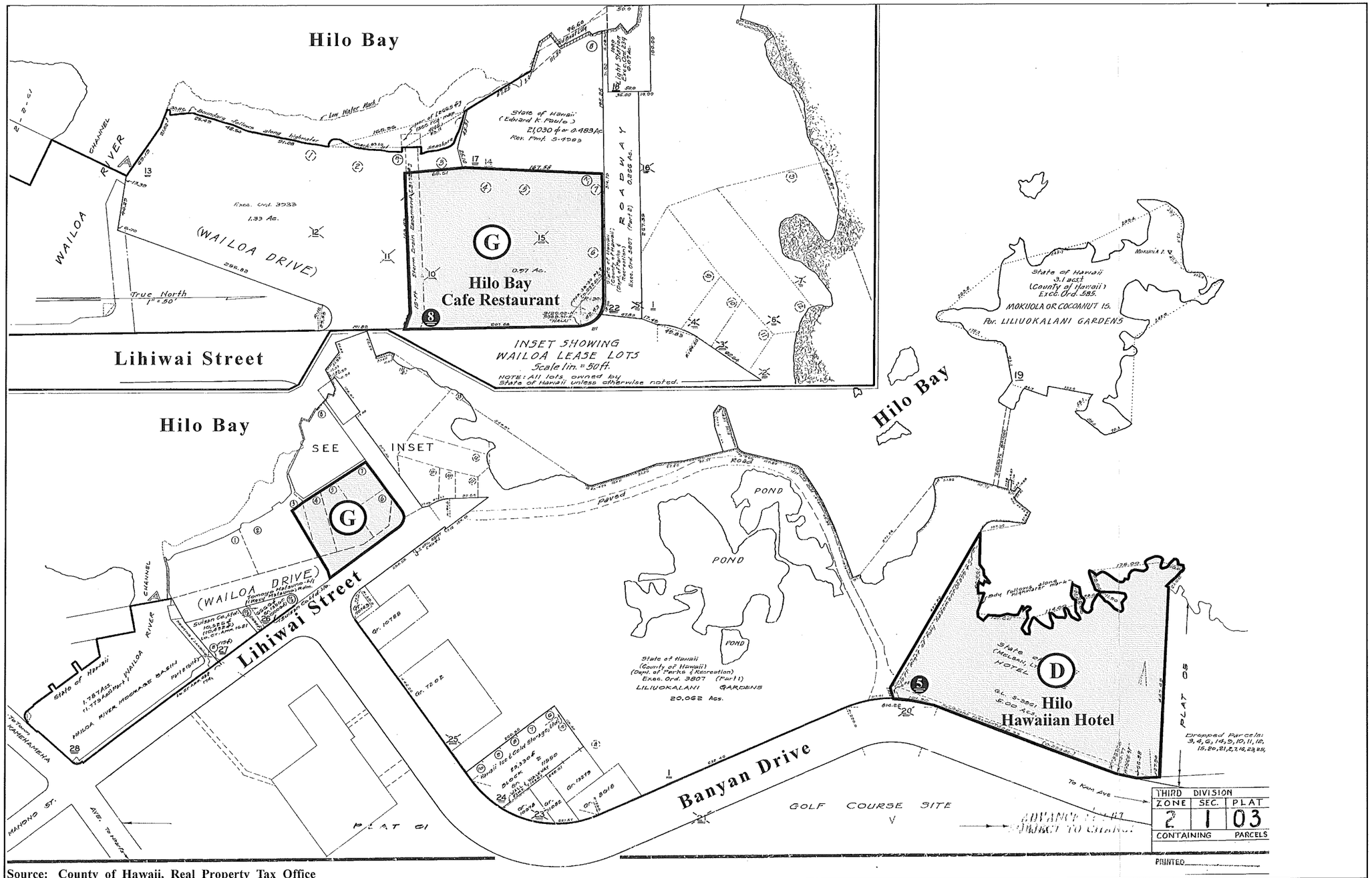
Banyan Drive Sea Level Rise Assessment

Tax Map (3) 2-1-01

NOT TO SCALE

MUNEKIYO & HIRAGA, INC.

Prepared for: State of Hawaii, Department of Land and Natural Resources



Source: County of Hawaii, Real Property Tax Office

Figure 5

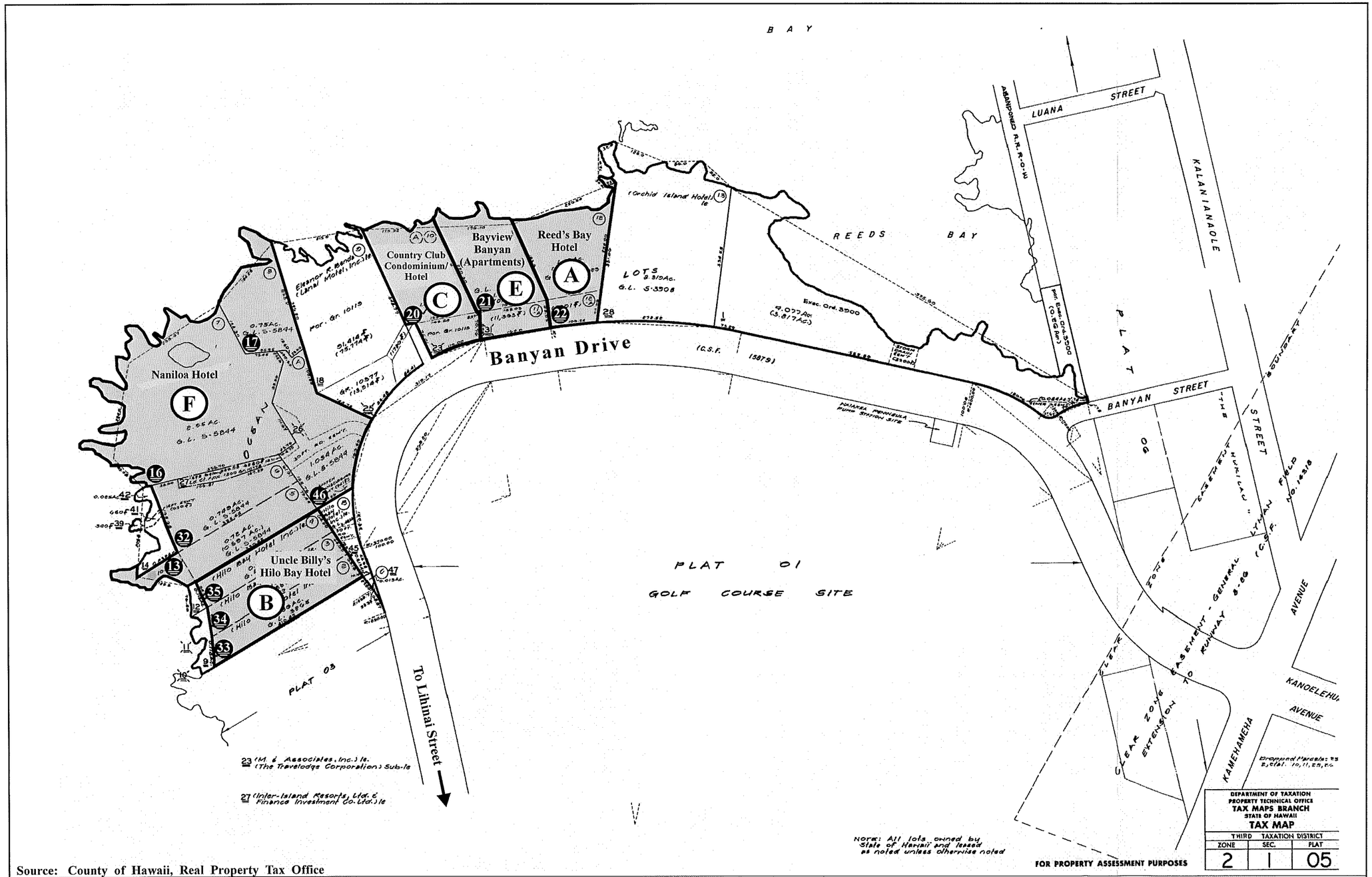
Banyan Drive Sea Level Rise Assessment

Tax Map (3) 2-1-03

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.



Source: County of Hawaii, Real Property Tax Office

Figure 6

Banyan Drive Sea Level Rise Assessment

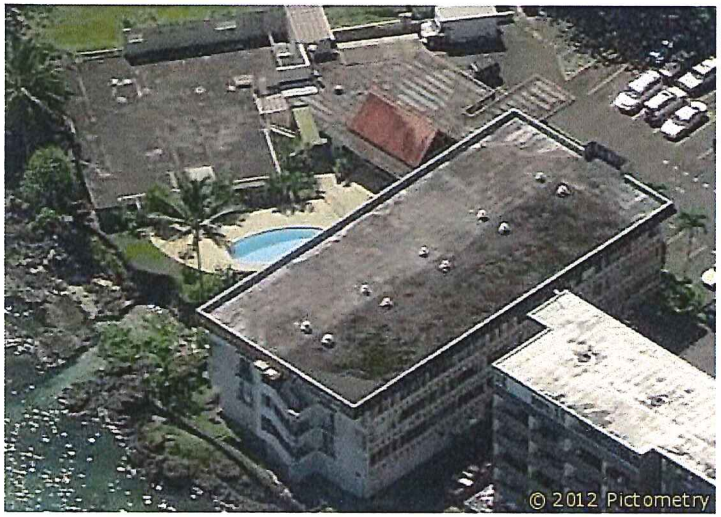
Tax Map (3) 2-1-05

NOT TO SCALE

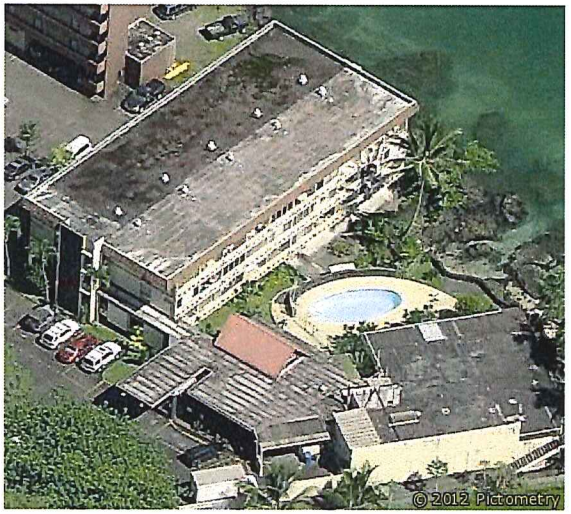
Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

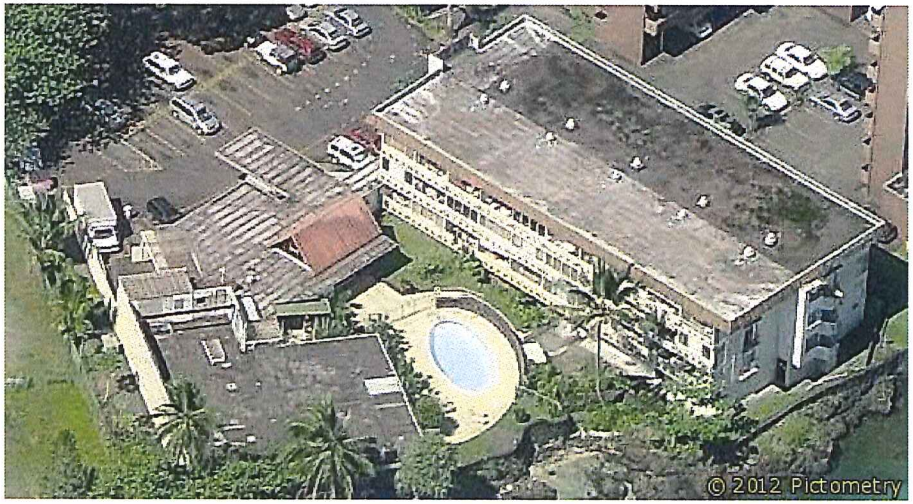
SOH DLNR\Banyan Drive\Sea Level Rise Assessment\Tax map (3) 2-1-05



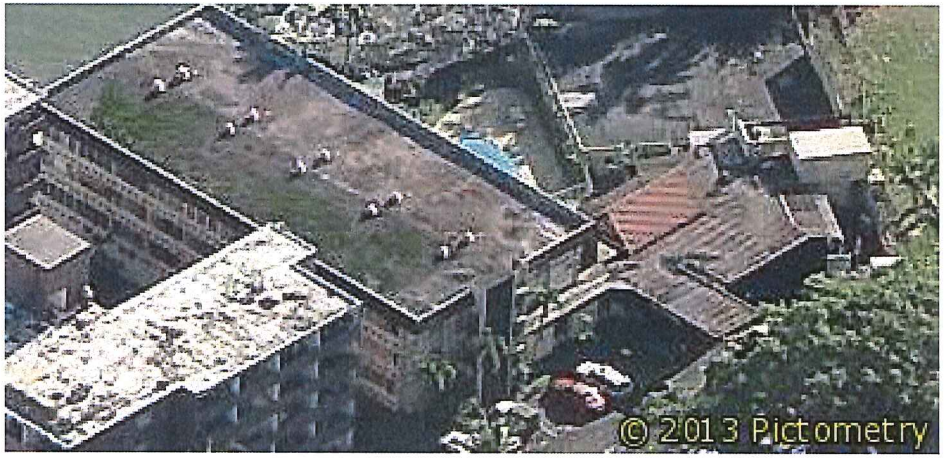
View from North



View from South



View from East



View from West

Source: Pictometry

Figure 7

Banyan Drive Sea Level Rise Assessment

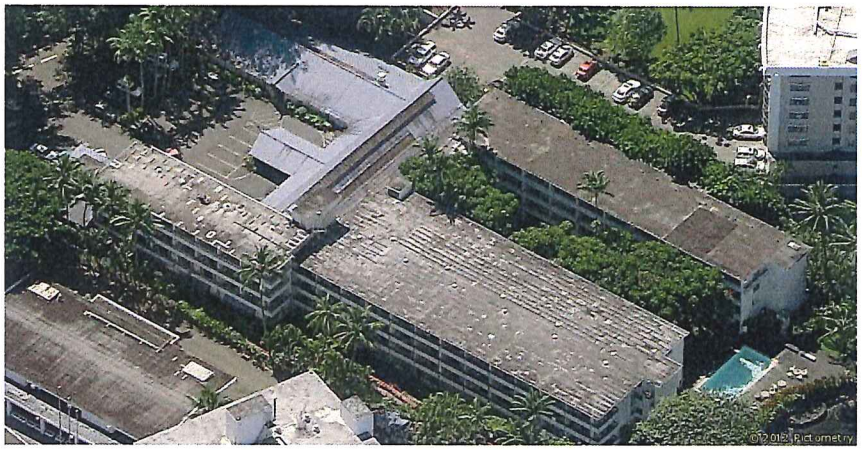
Aerial Views of Reed's Bay Resort

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\Pictometry Reed's Bay



View from North



View from South



View from East



View from West

Source: Pictometry

Figure 8

Banyan Drive Sea Level Rise Assessment

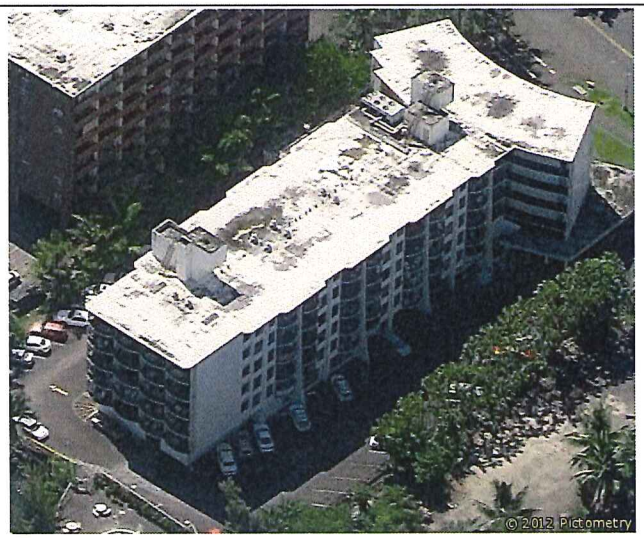
Aerial Views of Uncle Billy's Hilo Bay Hotel

NOT TO SCALE

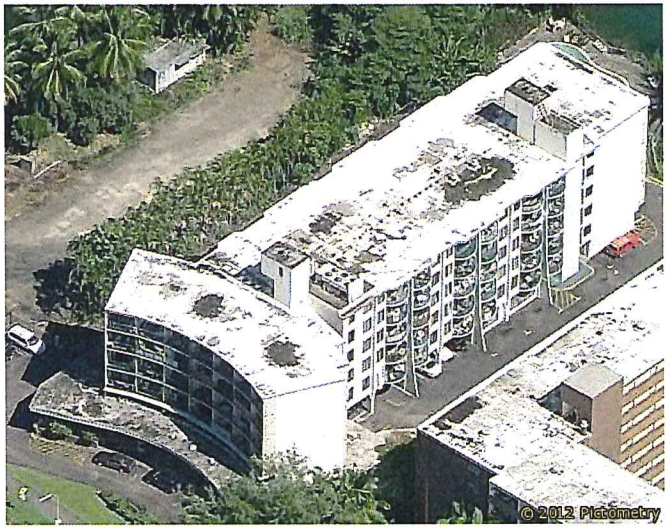
Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

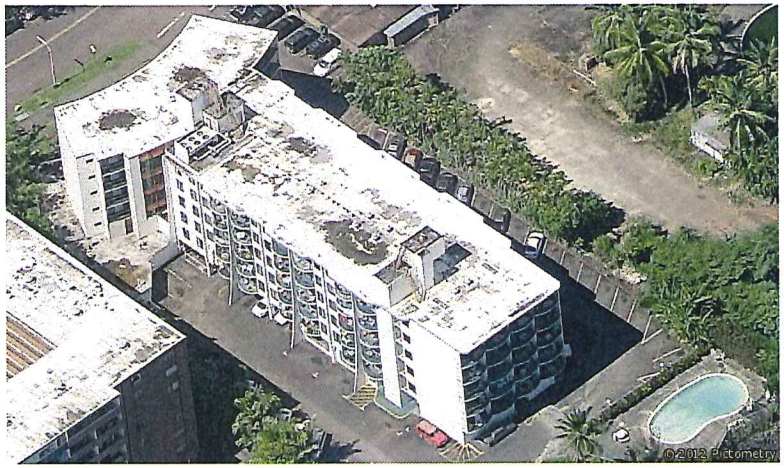
SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\Pictometry Uncle Billy's Hilo Bay Hotel



View from North



View from South



View from East



View from West

Source: Pictometry

Figure 9

Banyan Drive Sea Level Rise Assessment

Aerial Views of Country Club Condominium/Hotel

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

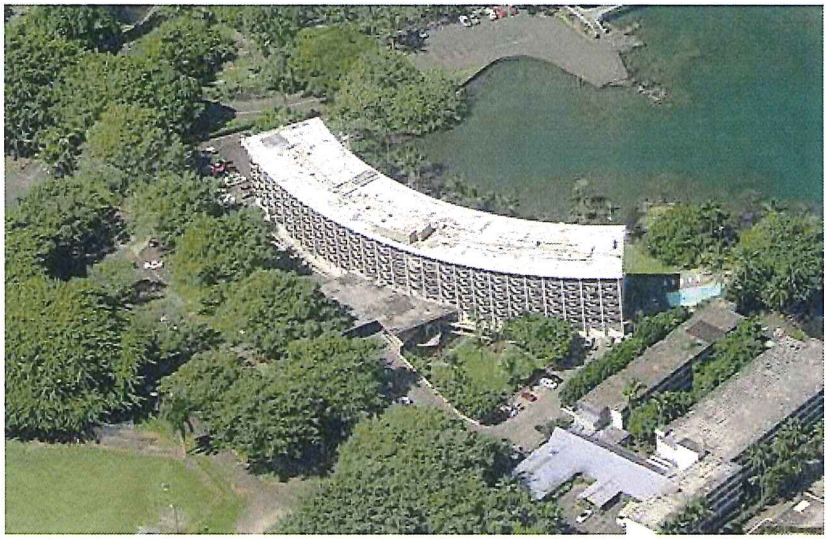
SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\Pictometry Country Blub Condo/Hotel



View from North



View from South



View from East



View from West

Source: Pictometry

Figure 10 Banyan Drive Sea Level Rise Assessment

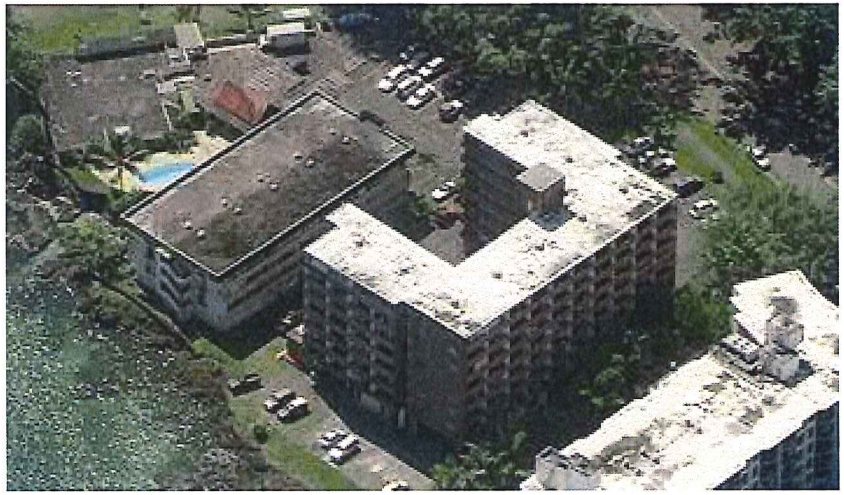
Aerial Views of Hilo Hawaiian Hotel

NOT TO SCALE

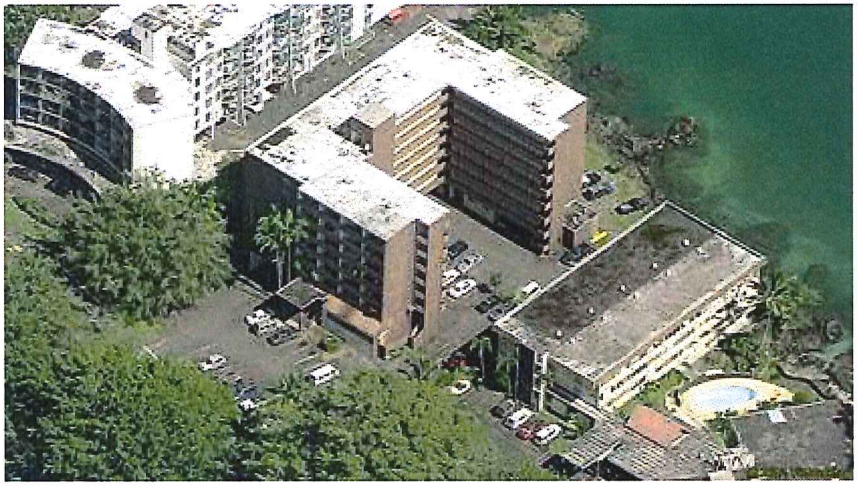
Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\Pictometry HiloHawaiianHotel



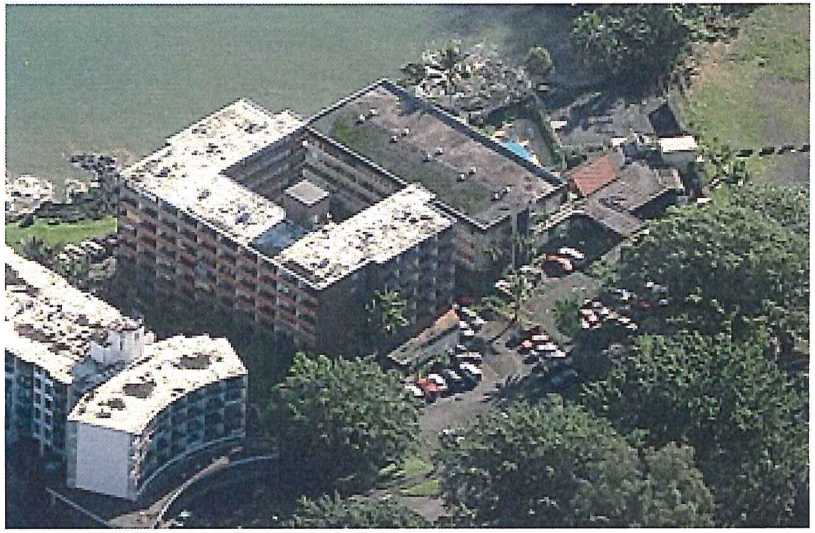
View from North



View from South



View from East



View from West

Source: Pictometry

Figure 11 Banyan Drive Sea Level Rise Assessment

NOT TO SCALE

Aerial Views of Bayview Banyan Apartments

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\Pictometry BayviewBanyanApartments



View from East



View from North

Source: Pictometry

Figure 12

Banyan Drive Sea Level Rise Assessment

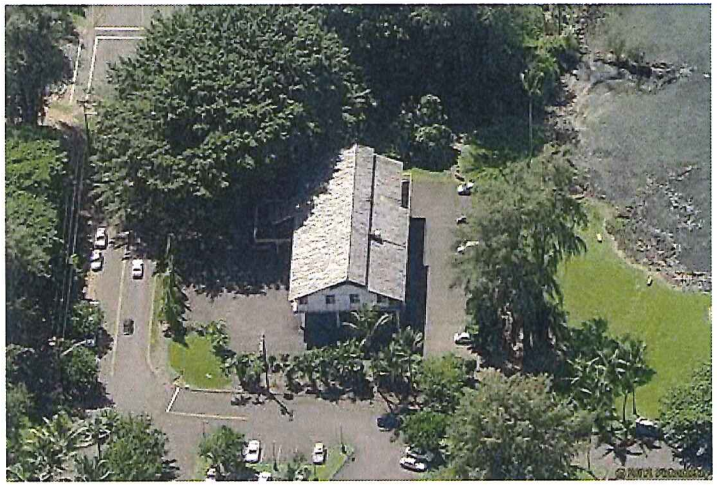
Aerial Views of Naniloa Hotel

NOT TO SCALE

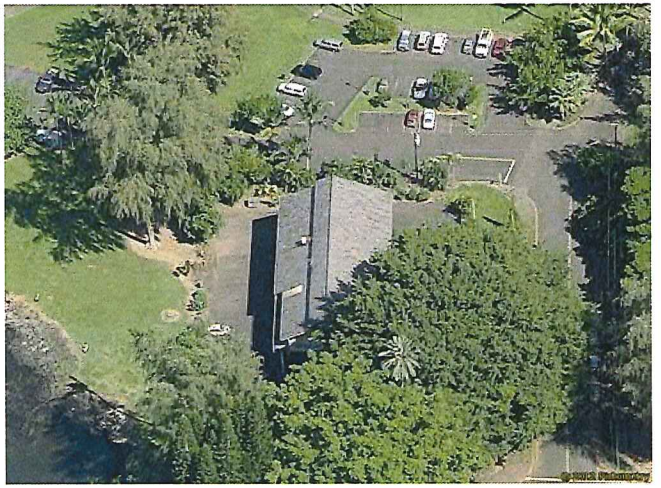
Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

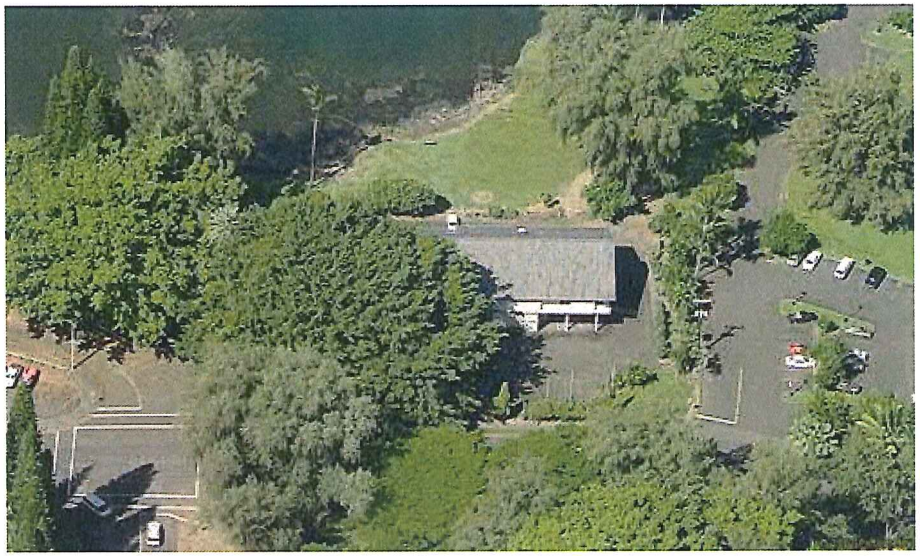
SOH DLNR\Banyan Drive\Sea Level Rise Assessment\Pictometry Naniloa Hotel



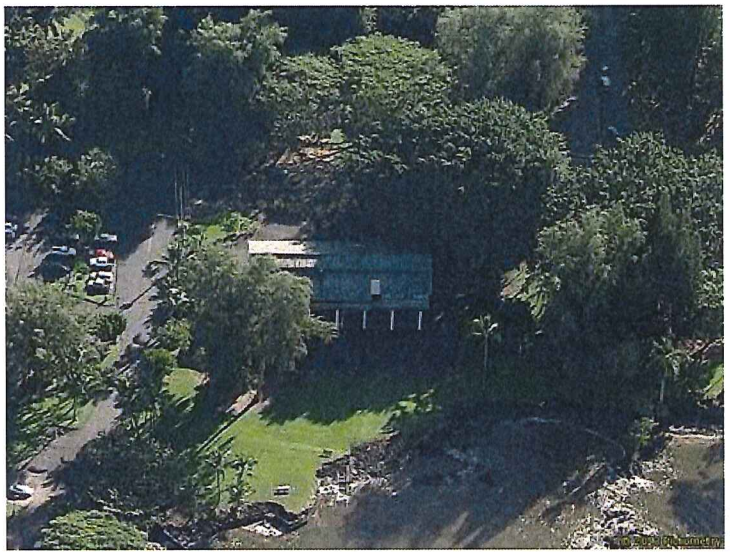
View from North



View from South



View from East



View from West

Source: Pictometry

Figure 13

Banyan Drive Sea Level Rise Assessment

Aerial Views of Hilo Bay Cafe Restaurant

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\Pictometry Hilo Bay Cafe Restaurant

Table 1. Property Attributes Matrix

ID	Tax Map Key No.	Street Address	Business Operation	Lease No.	Building Description	Year Built	Land Area	Bldg Area	2013 Market Land Value	2013 Assessed Bldg Value	Total Value
A	(3) 2-1-005:022	175 Banyan Dr	Reed's Bay Resort	3029	3-story B1,2,3	1978	51,836 sf (1.19 acres)	6,360 sf	$ 777,500.00	$ 1,276,500.00	$ 2,054,000.00
B	(3) 2-1-005:033	87 Banyan Dr	Uncle Billy's Hilo Bay Hotel	3265, 3266, 3267	Bldg #1	1966	25,526 sf (0.586 acre)	4872 sf	$ 363,700.00	$ 4,153,400.00	$ 5,154,000.00
					Bldg #2 (2-story)	1968		4,200			
					Bldg #3 (2-story)	1968		4,320			
					Bldg #4 (2-story)	1968		5,100			
					Bldg.#5 (2-story)	1970		4,450			
	(3) 2-1-005:034						23,130 sf (0.531 acre)	4,320	$ 329,600.00	$0	$ 329,600.00
	(3) 2-1-005:035						21,562 sf (0.495 acre)	4,320	$ 307,300.00	$0	$ 307,300.00
C	(3) 2-1-005:020	121 Banyan Dr	Country Club Condo/Hotel	3269	Condo	1969	50,790 sf (1.166 acres)	*		*	
	(3) 2-1-005:0200001				Restaurant			4,608	$ 72,500.00	$ 280,200.00	$ 352,700.00
	(3) 2-1-005:0200007 to (2) 2-1-005:0200156				Units				$ 792,900.00	$ 1,359,700.00	$ 2,152,600.00
D	(3) 2-1-003:005	71 Banyan Dr	Hilo Hawaiian Associates	S-3961	7-story M-1, B-1 - 7	1983	217,800 sf (5 acres)	26,624	$ 3,267,000.00	$ 11,234,200.00	$ 14,501,200.00
E	(3) 2-1-005:021	161 Banyan Dr	Bayview Banyan Corp	S-5018	7-story B1, 1-7	1978	47,523 sf (1.091 acres)	7,984	$ 712,900.00	$ 4,934,300.00	$ 5,647,200.00
F	(3) 2-1-005:013	93 Banyan Dr	Naniloa Hotel	S-5844			31,363 sf (0.72 acre)	-	$ 423,400.00	-	$ 423,400.00
	(3) 2-1-005:016				Bldg #1 (B1-7)	1967	128,502 sf (2.95 acres)	5,200	$ 1,734,800.00	$ 6,643,800.00	$ 8,378,600.00
					Bldg #2 (2-story)	1967		6,758			
					Bldg #3 (12-story)	1967		5,600			
					Bldg #5	1967		3,996			
					Bldg #7 (10-story)	1967		9,750			
					Bldg #9	1967		6,678			
	(3) 2-1-005:017				Bldg #1 (restaurant)	1966		6,360	$ 490,100.00	$ 287,800.00	$ 777,900.00
	(3) 2-1-005:027						5,729 sf (0.1212 acre)		$ 23,800.00		$ 23,800.00
	(3) 2-1-005:032						32,626 sf (0.749 acre)		$ 489,400.00		$ 489,400.00
	(3) 2-1-005:046						45,912 sf (1.054 acres)		$ 206,600.00		$ 206,600.00
	(3) 2-1-001:012	120 Banyan Dr	Naniloa Golf Course	"	Bldg #1 (offices)	1944	2,72,5810 sf (62.576	4,000	$ 625,800.00	$ 143,300.00	$ 769,100.00
					Bldg.#2 (offices)	1972		3,024			
					Bldg #3 (restaurant)	1972		5,964			
					Bldg #4 (offices)	1972		510			
G	(3) 2-1-003:008	123 Lihiwai St	Hilo Bay Cafe	4786	Restaurant	1983	42,253 sf (0.97 acre)	5,091	$ 464,800.00	$ 603,400.00	$ 1,068,200.00
Data extracted from County of Hawaii, Real Property Office records as of the website's 12/20/2013 update							**Total: 79.2 acres**				**$ 41,567,400.00**

from County of Hawaii, Real Property records. Property attributes include size of parcels, types of buildings situated on the properties, and valuations.

II. METHODOLOGY

II. METHODOLOGY

The methodological foundation for this report is based on work performed by the University of Hawaii, Sea Grant College Program. The Program's Center for Island Climate Adaptation and Policy completed a report entitled "Sea-Level Rise and Coastal Land Use in Hawaii: A Policy Tool Kit for State and Local Governments, 2011". The report recognizes scientific research that indicates sea levels are rising due to climate change. Over the past century, global mean sea level rose about 6 to 8 inches, after little change during the previous 2,000 years. The rate of global sea level rise has approximately doubled since 1990. Scientist project the rise rate to accelerate due to global warming and may rise approximately 1-foot by 2050 and 2.5 to 6.2 feet by 2100 due to sea water thermal expansion and melting ice sheets. Based on the science, the Tool Kit recommends using sea level rise benchmarks of 1-foot by year 2050 and 3-feet by 2100 for Hawaii.

The 50-year milestone of 2065 targeted by DLNR falls within these two (2) recommended benchmarks. Accordingly, this report will focus on both milestones for which data is available to capture a range of effects encompassing the DLNR's 2065 planning benchmark. This approach will maintain consistency with the Sea-Level Rise and Coastal Land Use report benchmarks recommended for government decision making and provide another snapshot of sea level rise effects 35 years beyond year 2065.

Using the benchmarks of 1-foot by year 2050 and 3-feet by 2100, a sea level rise mapping model was applied to the coastal parcels to visualize implications on land use potential for the coastal properties which are the subject of this report.

A. SEA LEVEL RISE MAPPING MODELS

The National Oceanic and Atmospheric Administration (NOAA) has developed a map viewer to provide a preliminary look at sea level rise that uses best available elevation data that meets Federal Emergency Management Administration (FEMA) mapping standards. The map viewer is intended as a screening–level tool for management decisions. The sea level rise model is mapped on top of a baseline elevation reference, defined as the mean higher water heights of each tidal day observed over a specific 19 year period also known as the National Tidal Datum Epoch or NTDE. This datum is adopted to assure all determinations throughout the United States uses the same specific common reference

period[1]. The model has a Root Mean Square Error (RMSE) of 0.6 feet (18.5 centimeters) for mild terrain and 1.2 feet (37.0 cm) for terrain with large grade differences. RMSE is a statistical measure of the difference between a predicted or estimated value and the actual observed value[2]. Taking into account local tide variations of the highest of high tides allows the model to visualize immediate impacts since most developable land is above MHHW. The model does not incorporate a detailed drainage system network analysis that could affect inundation. The mapping tool also assumes present coastal conditions will persist and does not account for possible future changes.

The development of the NOAA mapping tool is a direct result of Federal Executive Order 13514 intended to address the energy efficiency and carbon pollution of the various agencies within the President's control. Initiatives are ongoing to address climate adaptation. In 2008, the U.S. Geological Survey (USGS) and the NOAA partnered to develop a community initiative focused on the need of coastal decision makers at all government levels, to have tools and information to anticipate, plan for, and adapt to climate change. Initial pilot projects were developed in Delaware and Mississippi-Alabama to generate Web-based map viewers. From the pilot projects and follow-up community workshops, Web-based map viewers were further refined to use visualizations using familiar viewers (such as Google Earth) for different scenarios of sea level rise. These mapping applications have led to the development of a next-generation sea level rise and coastal flooding viewers. From 2012-2013, the NOAA mapping viewer was populated with data which includes Hawaii island coastlines which make this model current and relevant to the purposes of this study.

---

1 NTDE is a specific 19-year period over which tide observations are taken to determine Mean Sea Level and other tidal datums such as Mean Low Water and Mean High Water. The current update defines the 19-year period as 1983-2001. A tidal datum is a vertical reference based on a specific stage of tide that serves as a baseline elevation to which sounding depths or topographic heights are referenced. The 19-year period includes an 18.6-year astronomical cycle that accounts for all significant variations in the moon and sun that cause slowly varying changes in the range of tide. NTDE 83-01 is adopted to assure that tidal datum determinations throughout the United States will be based on one specific common reference period.

2 The root mean square error (RMSE) is a measure of the differences between values predicted by a model or an estimator and the values actually observed from the thing being modeled or estimated.

B. APPLICATION OF THE NOAA SEA LEVEL RISE (SLR) MAPPING MODELS

Applying the NOAA mapping models for the current sea level, 1-foot benchmark at year 2050 and 3-feet benchmark at year 2100 yields map visualizations shown in **Figure 14**, **Figure 15** and **Figure 16**. These figures show the relative differences under the different scenarios. **Figure 17** illustrates the 3-feet sea level rise scenario over an aerial map base.

It is noted that some of the properties like Hilo Bay Hotel and Naniloa Hotel do not directly abut the shoreline. Refer to **Figure 6** – Tax Map (3) 2-1-05 which shows unshaded shoreline Parcels 9, 12, and 14 which are not part of the property lease agreements.

At year 2050 or about 35 years from now, the impact of a 1-foot sea level rise shows little to no loss of area on the studied parcels. For the 3-feet benchmark at year 2100 or about 85 years from now, there is some minor sea level rise encroachment landward into the parcels. Assuming a linear rate of change from 2050 to 2100, the situation at year 2065 or about 50 years from now will be about 30 percent change from the 1-foot to 3-feet benchmarks or approximately 0.6 feet.

Visual representations of the relationship between existing landside ground elevations relative to existing ocean delineations are shown in **Figure 18**, **Figure 19**, and **Figure 20**. The three (3) foot sea level rise scenario is mapped on these figures to illustrate the relationship between the predicted sea level rise and existing buildings. The distances of the 3-feet sea level rise inundation noted on these figures are approximate distances to the water's edge as depicted by Google Earth. The distances do not represent setbacks from a certified shoreline. More detailed photographic evidence of ocean to land elevation differentials are presented in **Appendix "A"**.

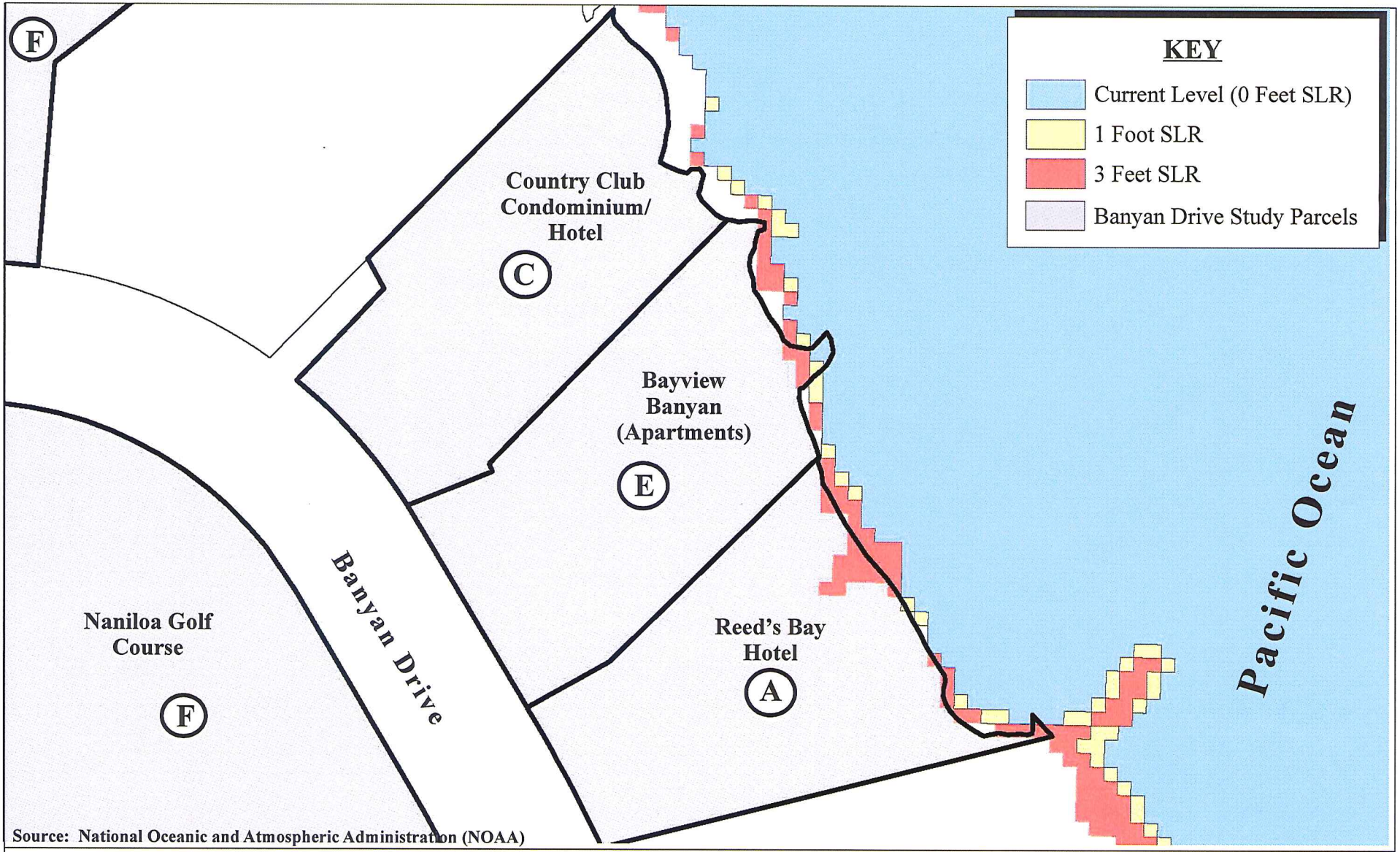


Figure 14

Banyan Drive Sea Level Rise Assessment

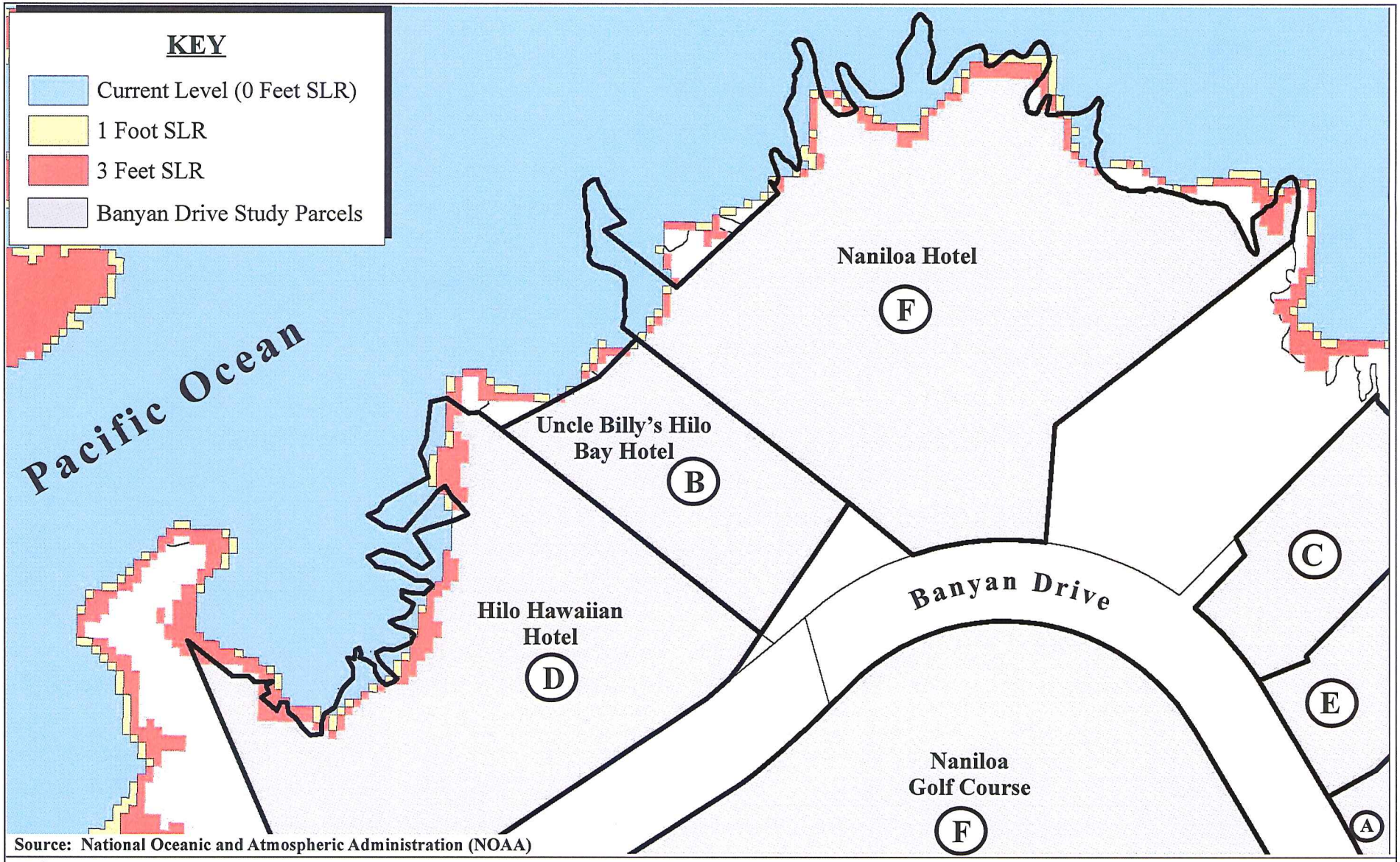
NOAA Sea Level Rise Map Visualizations - Parcels A, E, and C

0 50 Feet
25 100

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\NOAA SLR Map Visualizations - Parcels A, E, and C



Source: National Oceanic and Atmospheric Administration (NOAA)

Figure 15

Banyan Drive Sea Level Rise Assessment

NOAA Sea Level Rise Map Visualizations - Parcels D, B, and F

0 87.5 Feet
43.75 175

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\NOAA SLR Map Visualizations - Parcels D, B, and F REV

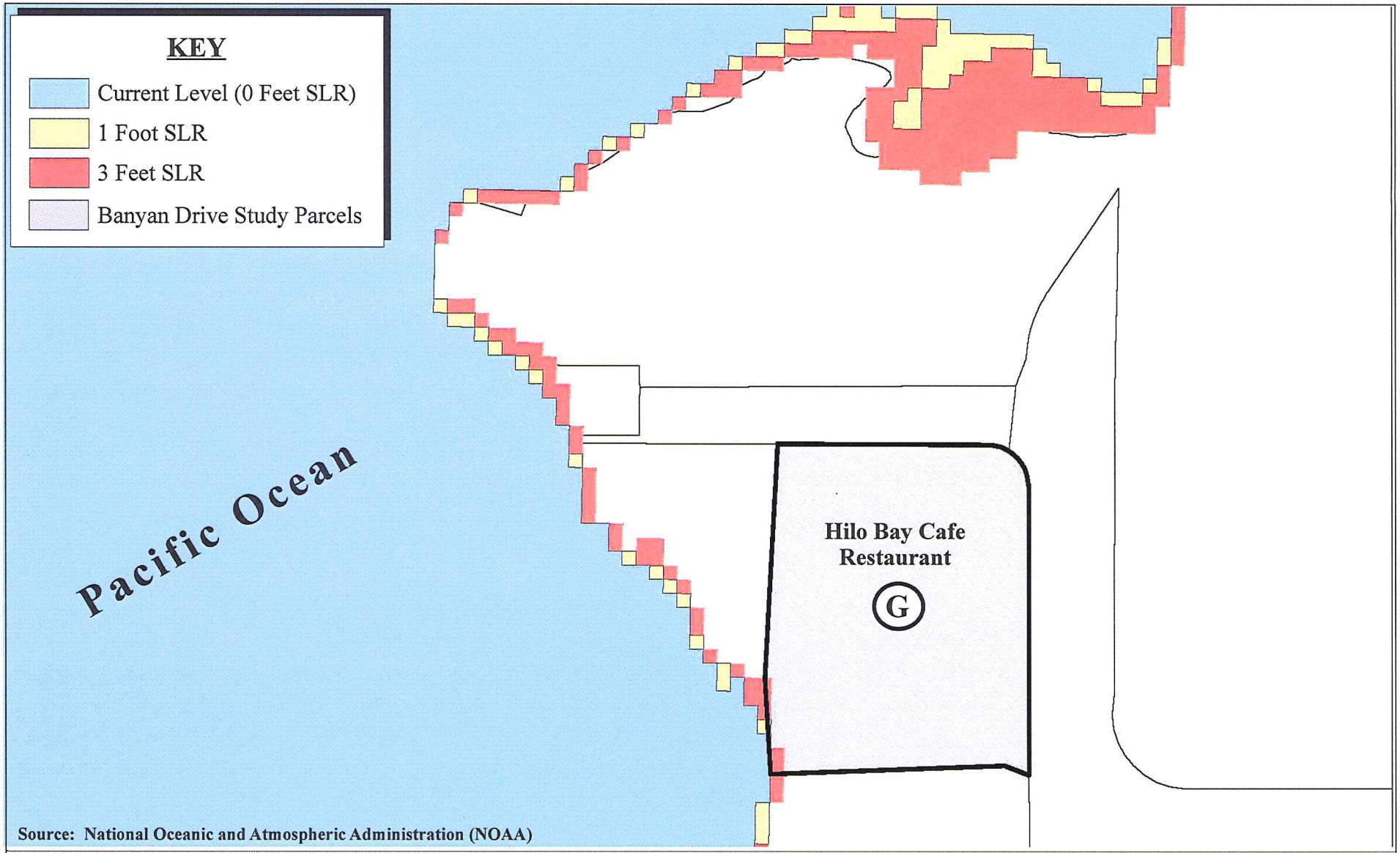


Figure 16

Banyan Drive Sea Level Rise Assessment

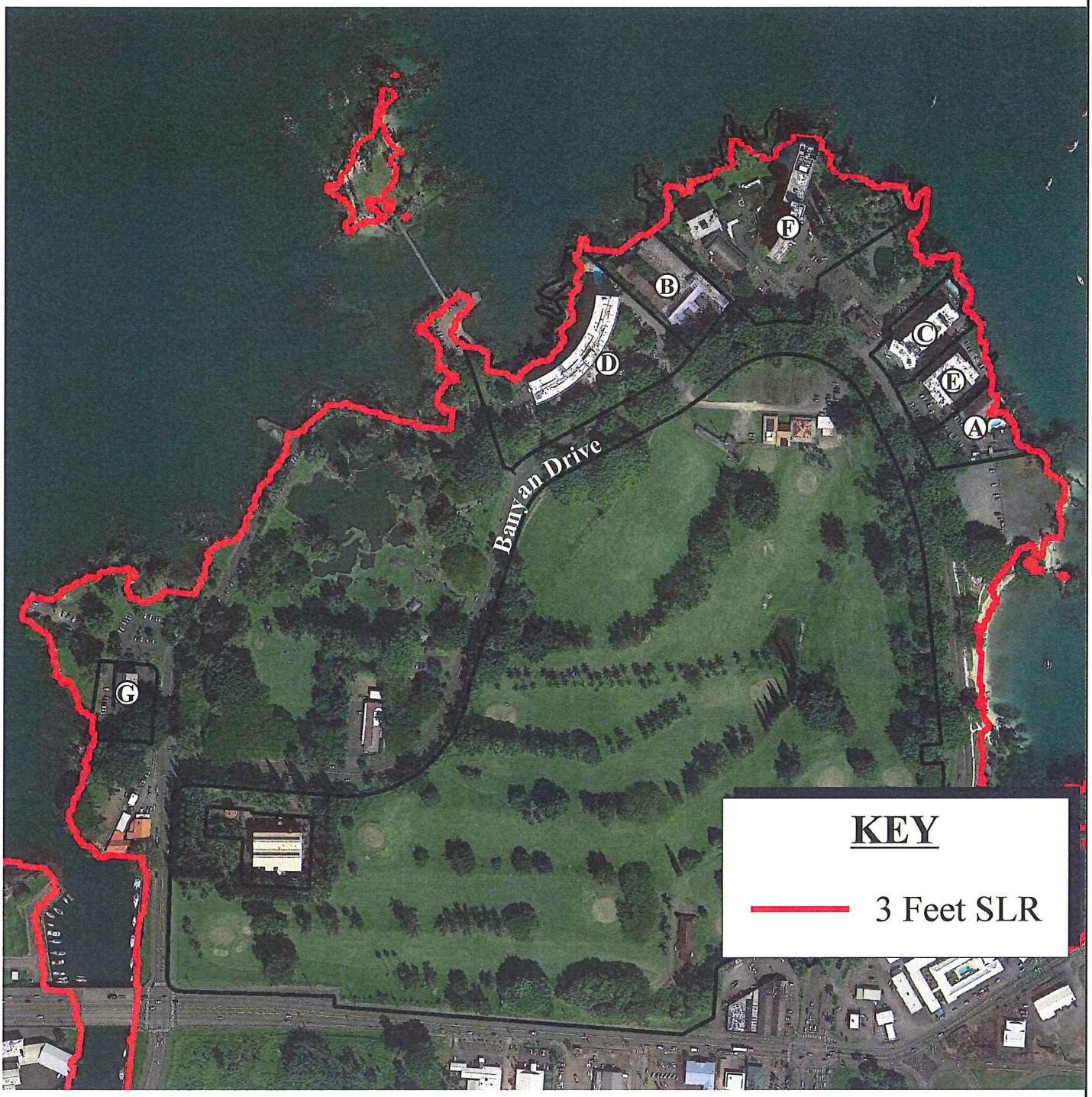
NOAA Sea Level Rise Map Visualizations - Parcel G

0 50 Feet
25 100

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\NOAA SLR Map Visualizations - Parcel G REV



Source: Google Earth

Figure 17

Banyan Drive Sea Level Rise Assessment

3-Feet Sea Level Rise Encroachment Line

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\Sea Level Rise Assessment\3-Feet Sea Level Rise Encroachment Line

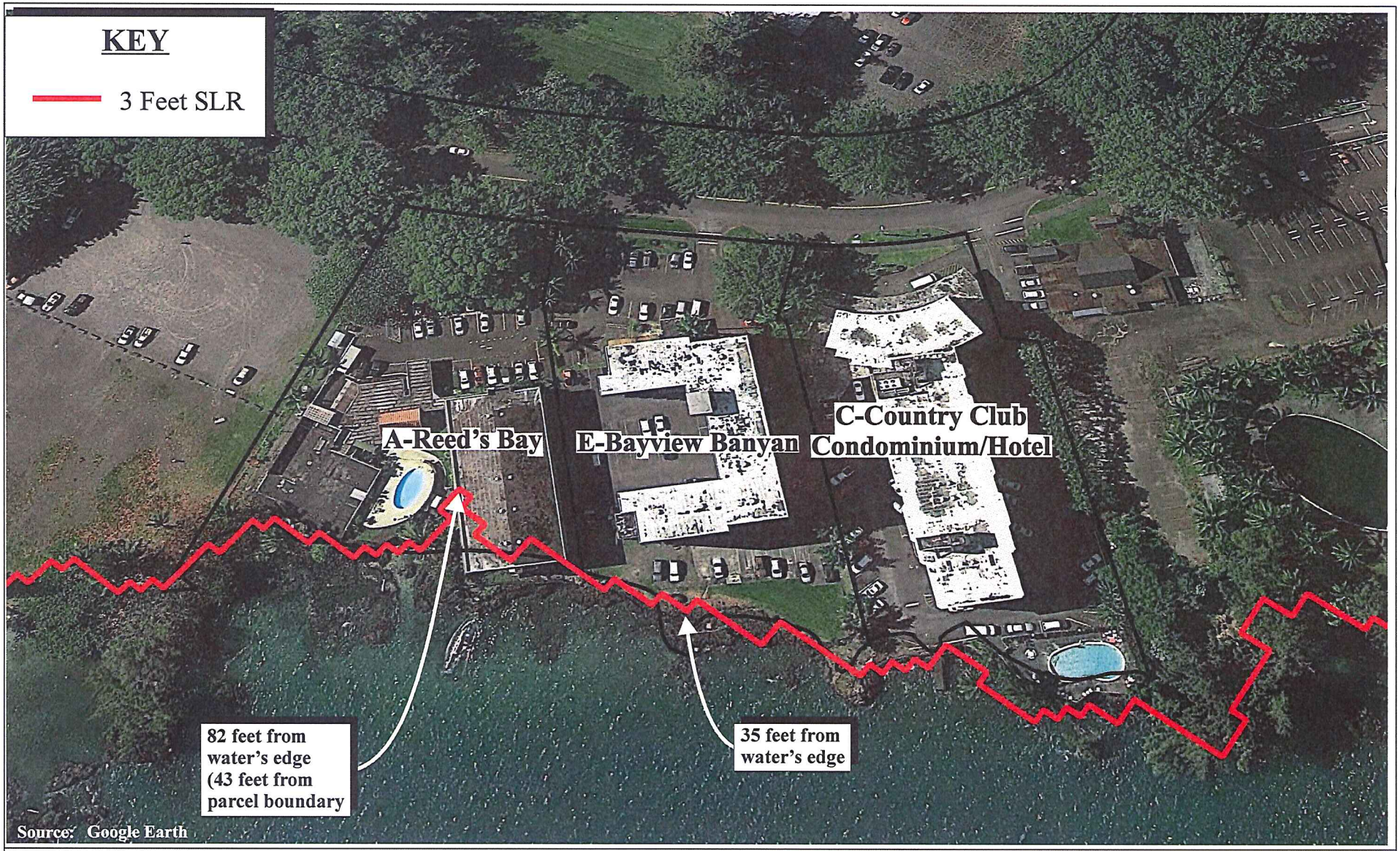


Figure 18 Banyan Drive Sea Level Rise Assessment

NOT TO SCALE

Coastline Bird's Eye View (A-Reed's Bay Resort, E-Bayview Banyan Apartments, and C-Country Club Condominium/Hotel)

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\CoastlineBird'sEyeView(Reed's Bay, Bayview Banyan, and Country Club Condominium) REV

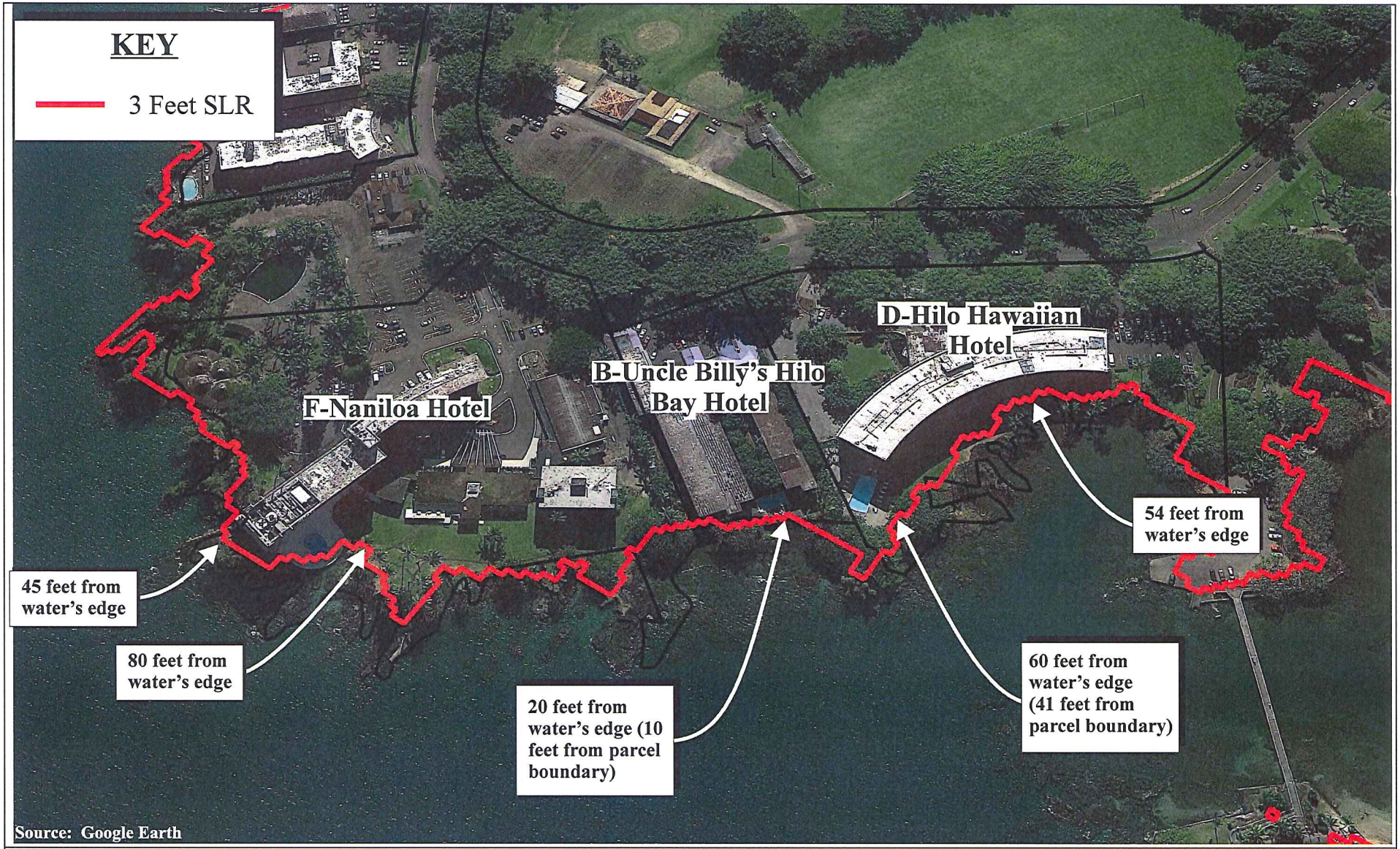


Figure 19 Banyan Drive Sea Level Rise Assessment

NOT TO SCALE

Coastline Bird's Eye View (F-Naniloa Hotel, B-Uncle Billy's Hilo Bay Hotel, and D-Hilo Hawaiian)

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\CoastlineBird'sEyeView(Naniloa, Uncle Billy's, and Hilo Hawaiian)

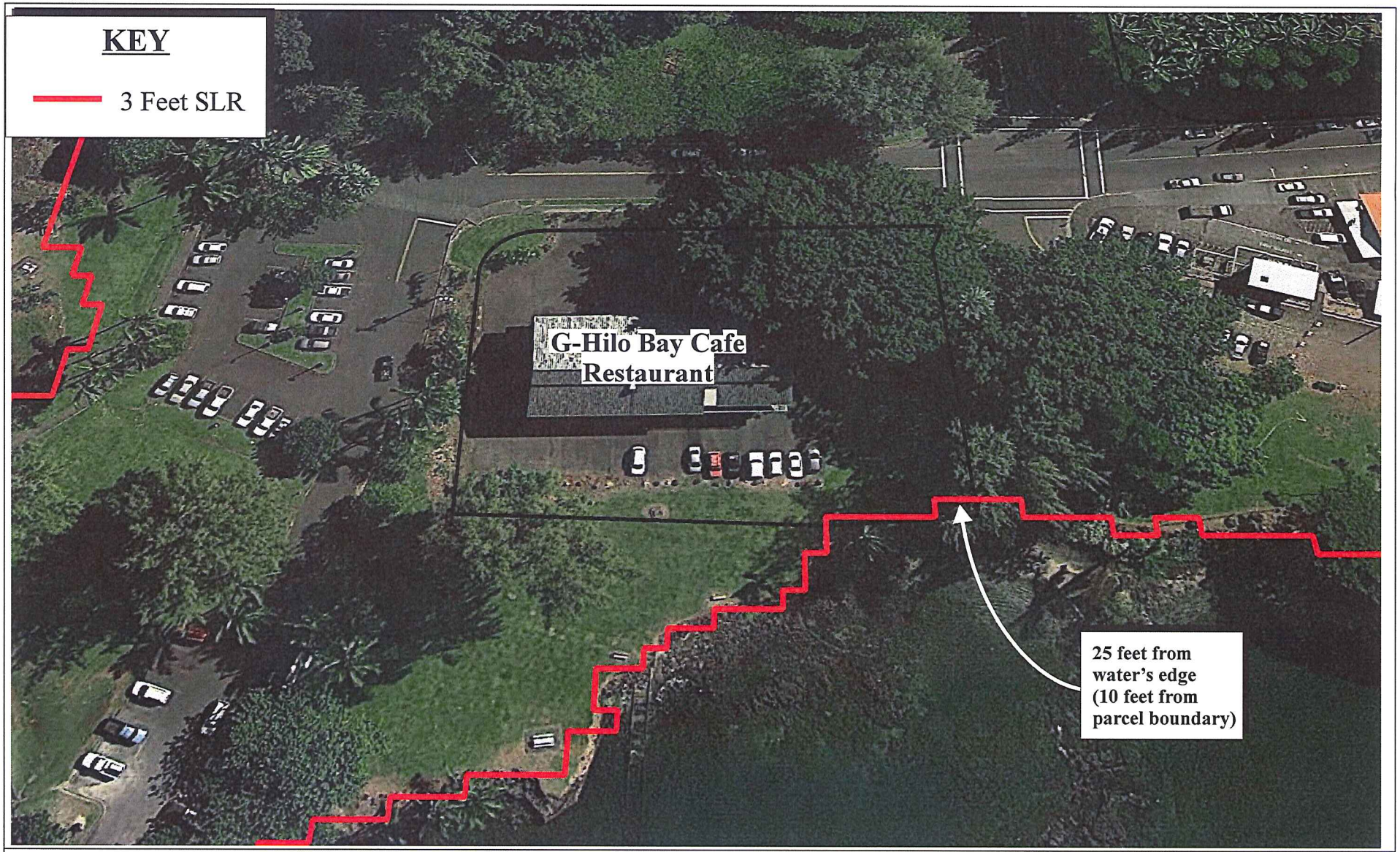


Figure 20

Banyan Drive Sea Level Rise Assessment

Coastline Bird's Eye View (G-Hilo Bay Cafe Restaurant)

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\CoastlineBird'sEyeView(HiloBayCafe)REV

The existing shoreline is characterized primarily by lava rock formations which naturally armor the coastline with the exception of a very small pocket of sandy beach along the western edge of the peninsula fronting the Liliuokalani Gardens park space. Additionally, properties like the Country Club Condominium/Hotel and Uncle Billy's Hilo Bay Hotel have built-up lava rock walls sitting on top of these existing lava rock benches that provide further protection at the edge of their properties. Thus, the natural rock formations along the coastal edges of the parcels that sit above the ocean level together with the man-made rock walls along certain sections, does provide a shoreline protection barrier against anticipated sea level rise into year 2100.

The impacts of the 3-feet sea level rise scenario in the year 2100 for each of the properties are summarized in **Table 2** below.

Table 2. Three (3) Feet Sea Level Rise Impact Analysis

ID	Property	3-feet SLR Inundation (Estimated Landward Distance From Existing Water's Edge)	Minimum Bldg Setback	Discussion
A	Reed's Bay Resort	82 ft.	23 ft.	The sea level rise model indicates that the Reed's Bay Resort property will experience inundation under a 3-feet sea level rise. The existing structure at its closest point is approximately 23 feet from the water's edge. The sea level rise model suggests that the makai portion of the existing structure may be at risk of inundation in year 2100. It is noted, however, that the shoreline is characterized by a high lava rock wall face that may provide some protection to the currently developed portions of the property.
B	Uncle Billy's Hilo Bay Hotel	20 ft.	55 ft.	This property is not predicted to experience substantial property loss due to the 3-feet sea level rise. Its edge sits well beyond the shoreline waters and has built up rock walls on top of the rocky shoreline which provides added protection. Approximate landward encroachment of sea level is predicted to be approximately 20 feet from the water's edge (10 feet from the lot line).
C	Country Club Condominium/Hotel	0 ft.	35 ft.	The sea level rise model predicts no inundation beyond the lot lines. The property's edge sits above the shoreline waters and has built up rock walls on top of the rocky shoreline which provide added protection. According to some of the ground photos, there are some signs of erosion along the property edge reportedly from infrequent occurrences of very high surf.

ID	Property	3-feet SLR Inundation (Estimated Landward Distance From Existing Water's Edge)	Minimum Bldg Setback	Discussion
D	Hilo Hawaiian Hotel	54 ft. and 60 ft.	63 ft.	This property may be vulnerable to sea level rise as the entire hotel and pool area footprint is situated parallel to the shoreline without the protection of sitting high above the shoreline waters or behind built up rock walls. The sea level rise encroachment line may be close to but appears to be clear of the hotel structure. Future shoreline protection improvements, increasing building finished floor elevations, in combination with building setback adjustments, may be desired depending on the nature of any redevelopment of the parcel.
E	Bayview Banyan Apartments	35 ft.	48 ft.	The property sits above the naturally protective rock shoreline with its building setback from the water's indicating no substantial impact to the building footprint. The predicted inundation at the most seaward lot line point is 35 feet inland.
F	Naniloa Hotel	45 ft. and 80 ft.	20 ft.	At the tip of the peninsula within the property, a ten-story building and pool is close to the shoreline high above the rocky shoreline. The sea level rise model indicates that some inundation may affect the swimming pool area near the shoreline. The rest of the property sits above the water and is lined by a vertical rocky shoreline face to keep the remaining structures clear of predicted landward encroachment. The greatest landward encroachment is estimated to be approximately 80 feet near the location of the swimming pool.
G	Hilo Bay Café	25 ft.	64 ft.	The property is predicted to have minimal impacts from a 3-feet sea level rise. This structure, built in 1983, is setback considerably from the shoreline. The parcel is further buffered on three (3) sides by the Liliuokalani Gardens park grounds and open space lands with only its west corner bordering the shoreline. The west corner is predicted to be clipped by a slight 10 feet of inundation.
Note: Distances of 3-feet sea level rise inundation and minimum building setback represented in this table are approximate distances to the water's edge as depicted by Google Earth. Distances do NOT represent setbacks from a certified shoreline.				

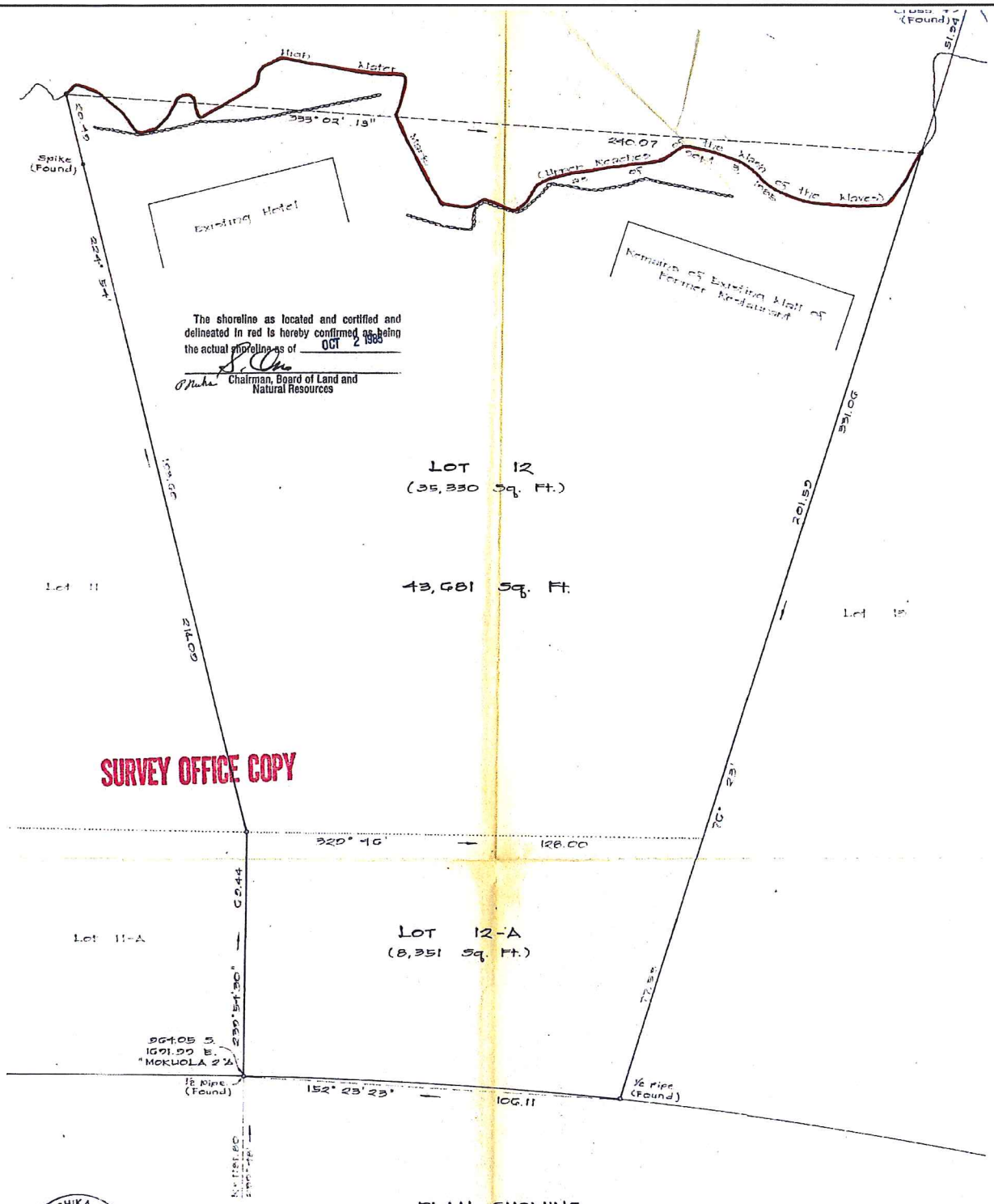
C. CERTIFIED SHORELINE MAP RECORDS

Further research was done to verify if any historical mapping information may suggest any significant trends in changes to the shoreline over the years. The State of Hawaii, Department of Accounting and General Services (DAGS) survey office has limited historical information available relating to Certified Shoreline Maps for the properties studied. See **Figure 21**, **Figure 22**, **Figure 23**, **Figure 24**, and **Figure 25**.

Certified shoreline maps document a survey of the upper reaches of the wash of the waves, other than storm or tidal waves and are measured at high tide during the season of the year in which the highest wash of the waves occurs. The upper reaches of the waves or sometimes called the "highwater" mark, is estimated by looking at vegetation growth or the upper limit of debris left by the wash of the waves and can be somewhat subjective.

Reed's Bay Resort had a record of a September 3, 1985 shoreline survey. The Hilo Hawaiian Hotel had a record of a July 31, 1975 shoreline survey. The Country Club Condo had a record for shoreline surveys done on February 16, 1970 and August 7, 1974 which showed some small changes both landward and seaward of the older high water mark. The Hilo Bay Cafe parcel had its shoreline surveyed on November 6, 1978 and April 23, 1982 with essentially no change.

Although two (2) of the parcels had shoreline surveys done about four (4) years apart, the time period difference was not significant enough to indicate a trend. However, comparing the photographic exhibits in **Appendix "A"**, **Figure 18**, **Figure 19**, and **Figure 20** with the topographic features documented in the certified shoreline surveys for these lava rock shoreline parcels suggests little change since the early to late 1970s. Certified shoreline changes which may have occurred between mapping events would likely be attributed to shoreline interpretation methodologies rather than actual physical changes in the rocky shoreline's characteristics.



PLAN SHOWING
LOT 12 AND LOT 12-A OF OCEAN VIEW LOTS
WAIAKEA, SOUTH HILO
ISLAND OF HAWAII, HAWAII

And the Designation of the Seaward Boundary from Highwater Mark as previously surveyed to Highwater Mark (Upper Reaches of the Wash of the Waves) as of Sept. 3, 1985

Source: DAGS Survey Office

Figure 21 Banyan Drive Sea Level Rise Assessment

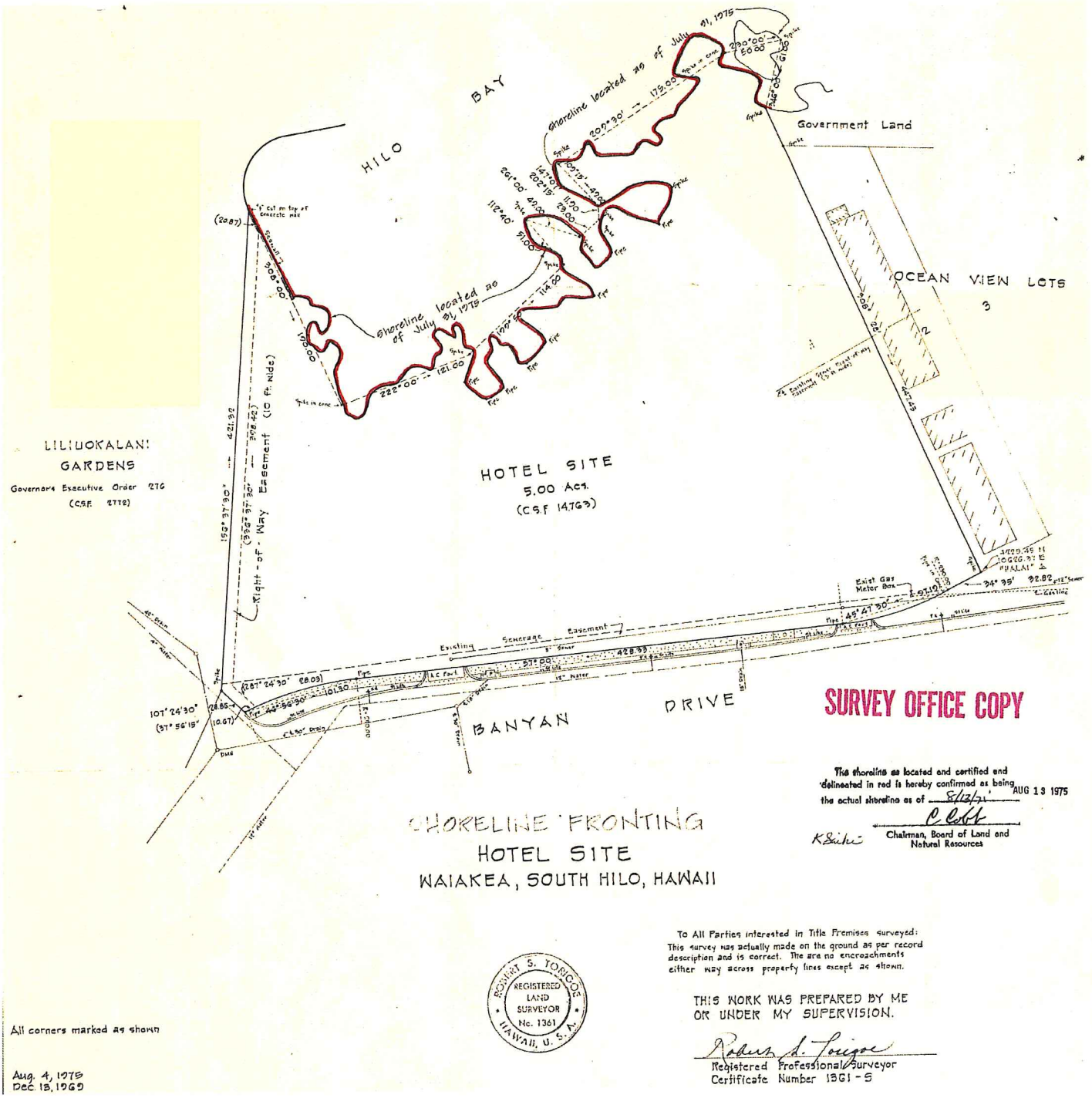
Certified Shoreline Survey - Reed's Bay Resort

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\CertifiedShorelineSurvey-Reed's Bay



Source: DAGS Survey Office

Figure 22 Banyan Drive Sea Level Rise Assessment

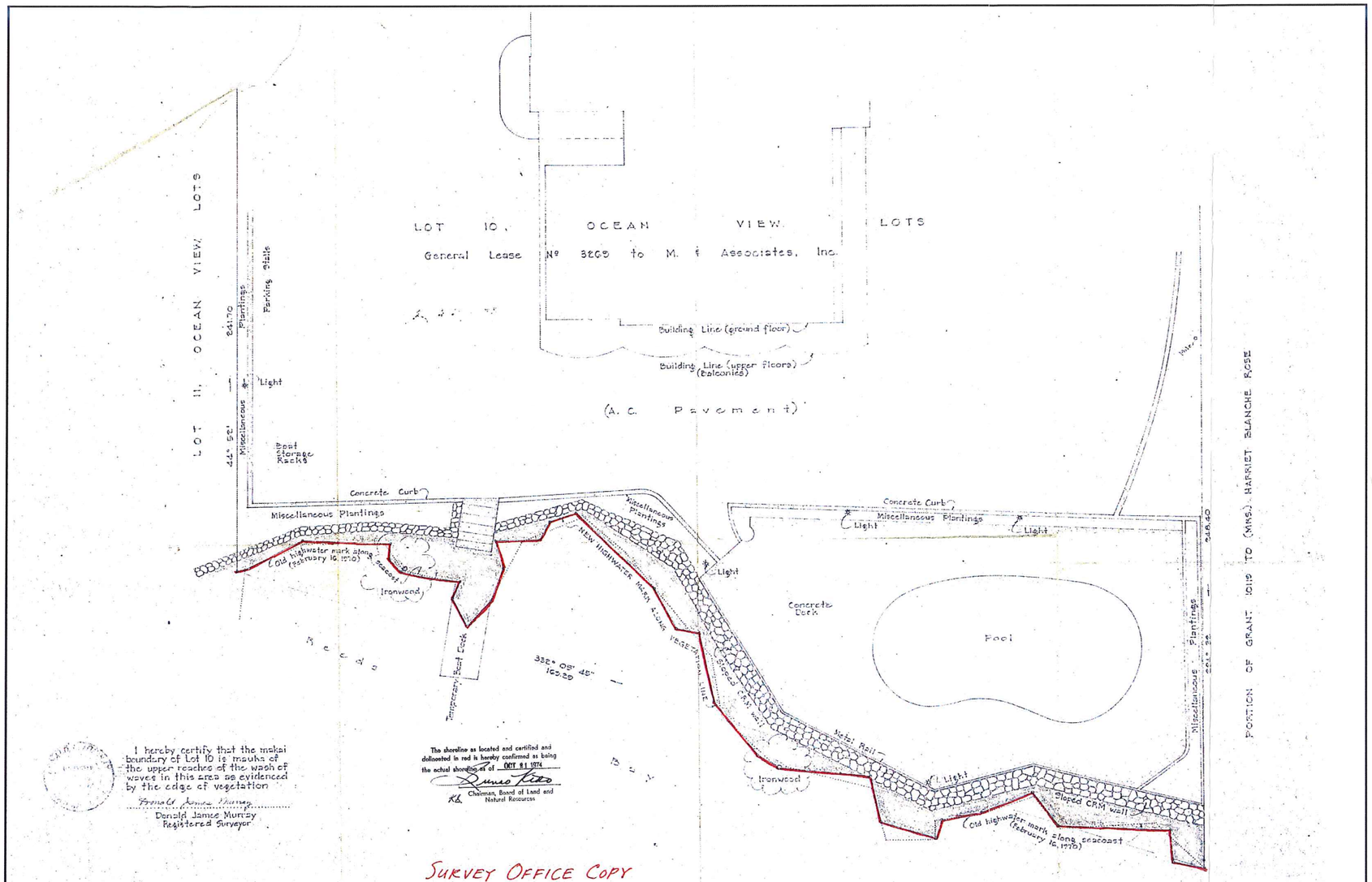
Certified Shoreline Survey - Hilo Hawaiian

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\CertifiedShorelineSurvey-Hilo Hawaiian



I hereby certify that the makai boundary of Lot 10 is mauka of the upper reaches of the wash of waves in this area as evidenced by the edge of vegetation

Donald James Murray
Registered Surveyor

The shoreline as located and certified and delineated in red is hereby confirmed as being the actual shoreline as of OCT 01 1974

Chairman, Board of Land and Natural Resources

SURVEY OFFICE COPY

Plan Showing
Portion of Lot 10 Ocean View Lots
(General Lease No 3269 to M. & Associates, Inc.)
Waiakea, South Hilo, Hawaii

Survey & Plan by Murray, Smith & Associates, Ltd.
P.O. Box 863 Hilo, Hawaii

Applicant: Thomas Harkanyi, AIA
Travel Lodge International, Inc.
P.O. Box 508
El Cajon, California 92022

Tax Map Key: 2-1-5: 20

Source: Kober/Hanssen/Mitchell Architects

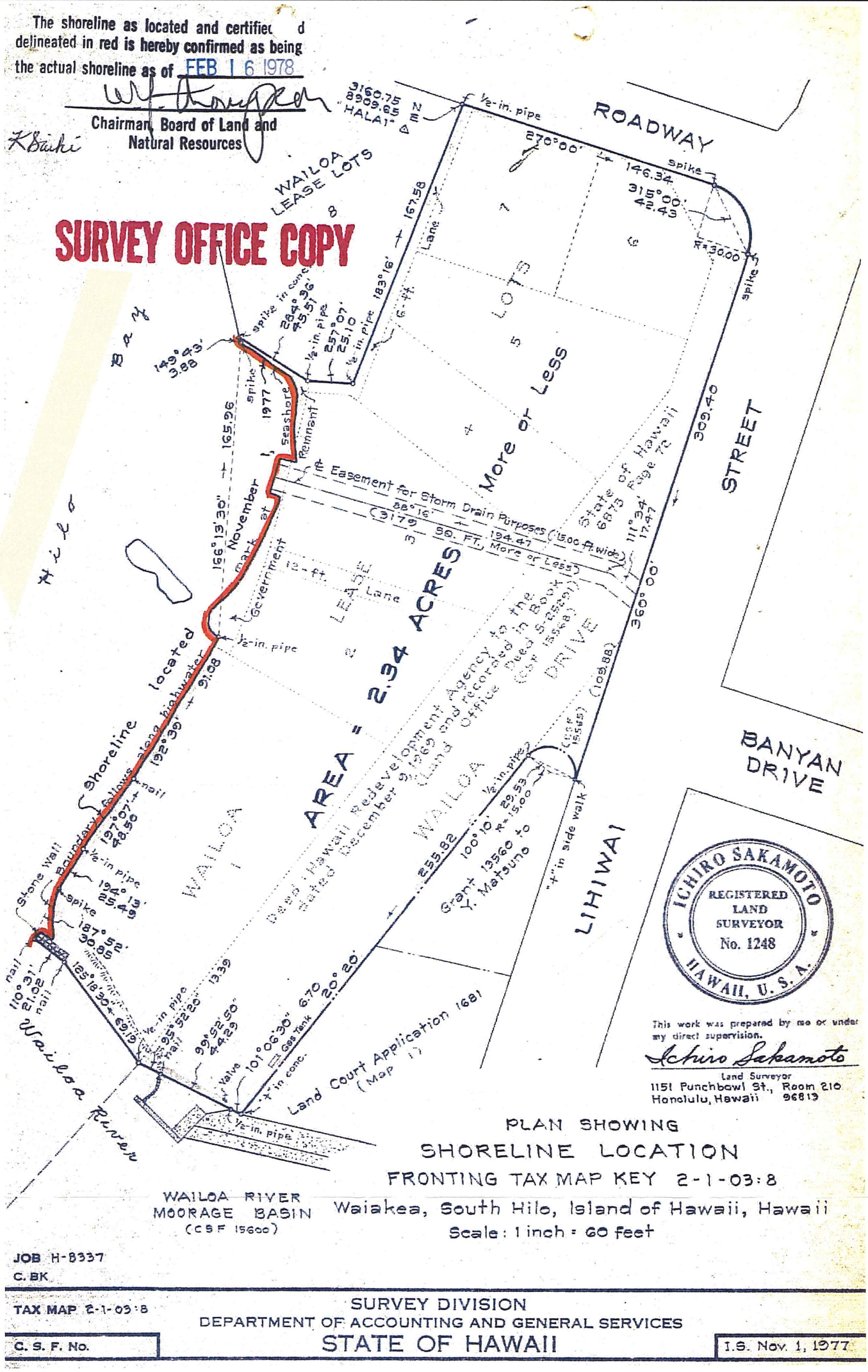
Figure 23 Banyan Drive Sea Level Rise Assessment

Certified Shoreline Survey - Country Club Condominium/Hotel

NOT TO SCALE

MUNEKIYO & HIRAGA, INC.

Prepared for: State of Hawaii, Department of Land and Natural Resources



Source: DAGS Survey Office

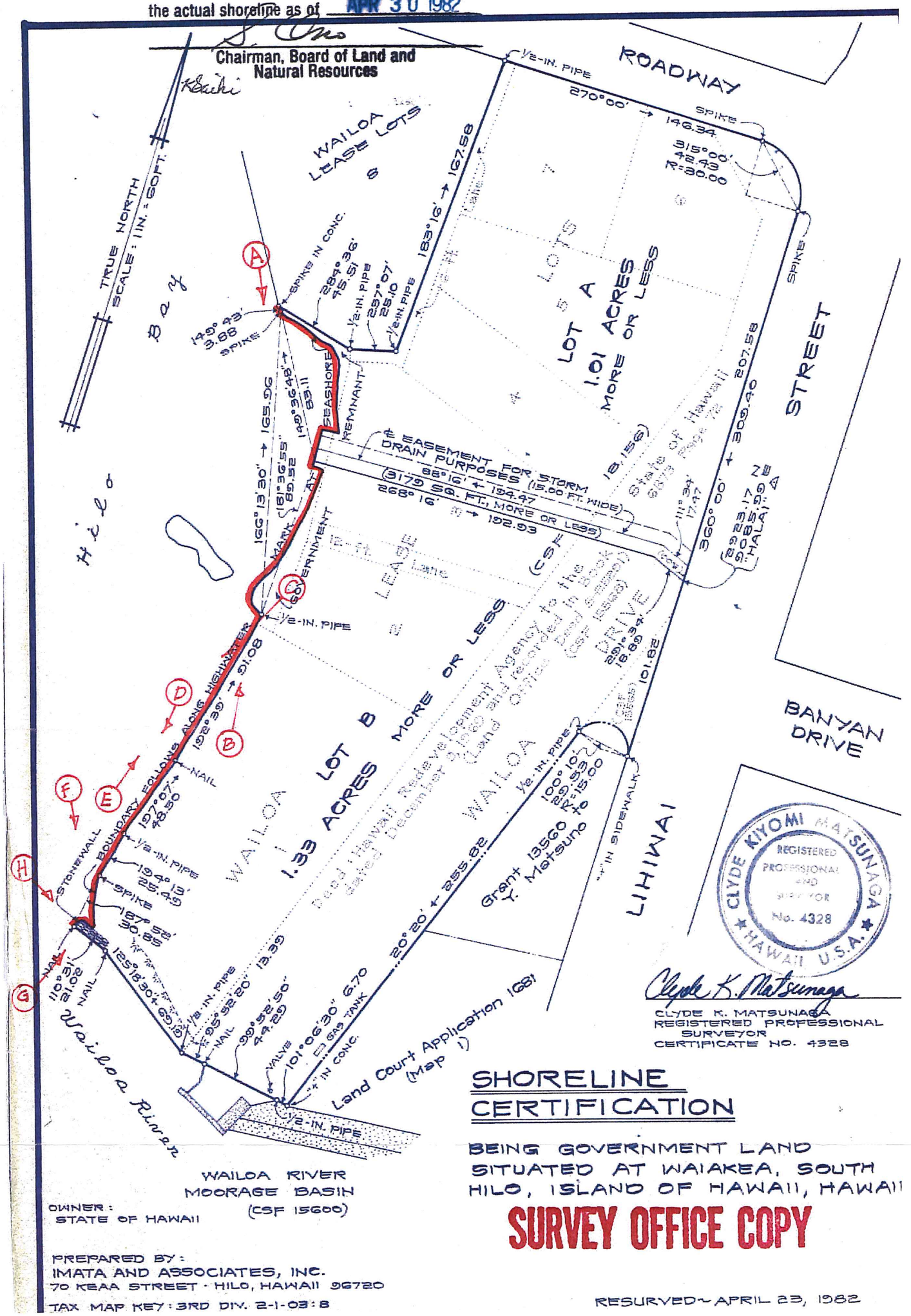
Figure 24 Banyan Drive Sea Level Rise Assessment

Certified Shoreline Survey - Hilo Bay Cafe (November 1, 1977)

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.



Source: DAGS Survey Office

Figure 25 Banyan Drive Sea Level Rise Assessment
Certified Shoreline Survey - Hilo Bay Cafe (April 23, 1982)

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\Sea Level Rise Assessment\CertifiedShorelineSurvey - Hilo Bay Cafe (April 23, 1982)

III. COASTAL HAZARDS

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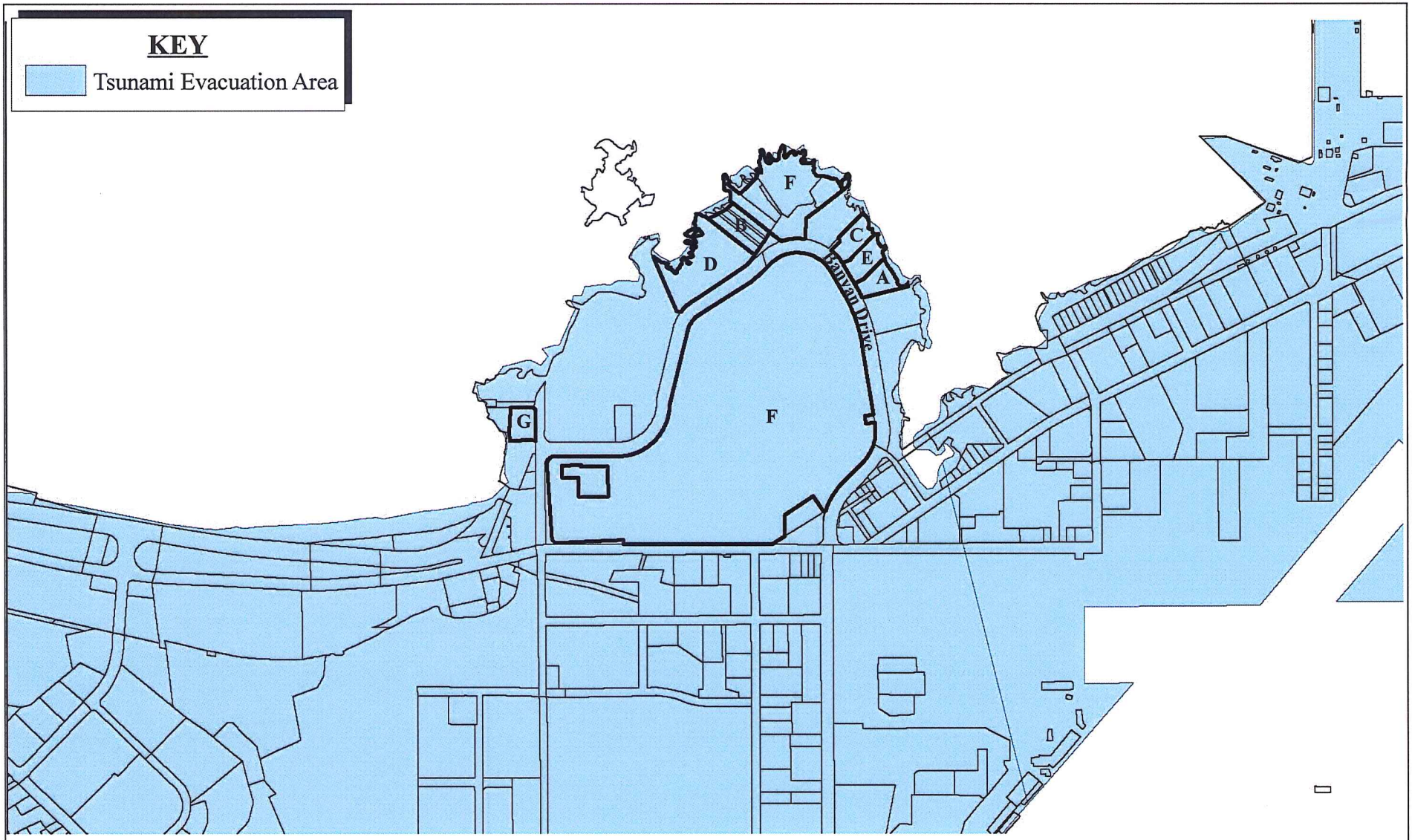
A. TSUNAMI EVACUATION AREAS

The entire peninsula of properties along Banyan Drive lies within a tsunami hazard evacuation zone. See **Figure 26**. According to NOAA, the evacuation zone maps are based on data from tsunamis that hit Hawaii in the past. This is the best information available at this time and the University of Hawaii, under the direction of State Civil Defense is using the latest scientific technology to improve on this information.

This low lying coastal area has not been immune to significant hazardous coastal events. Notable tsunami events occurred on April 1, 1946, from a massive earthquake in the Aleutian Islands. This event resulted in 159 lost lives statewide of which 96 deaths occurred in Hilo alone. Then on May 23, 1960, Hilo was again hit by a series of tsunami waves caused by a 9.5 magnitude earthquake in Chile. Hilo's bay front area was destroyed and 61 lives were claimed. In the time period between the two (2) devastating tsunamis, two (2) other less destructive tsunamis occurred in 1952 and 1957 causing only minor water damage to buildings along the Hilo Bay waterfront. These destructive tsunamis preceded the construction of the existing buildings along Banyan Drive. The most recent non-destructive tsunami to Hilo Bay occurred in February 2010.

B. FLOOD ZONE OVERLAYS

The Banyan Drive properties all lie within the flood hazard zone. **Figure 27** provides FEMA's flood insurance rate map for the area which indicates that the properties fall within Flood Zone VE. Flood Zone VE is a special flood hazard area that corresponds to the one hundred-year coastal floodplains extending from offshore to inland areas subject to high velocity waters, including coastal and tidal inundation or tsunamis.



Source: Pacific Disaster Center

Figure 26

Banyan Drive Sea Level Rise Assessment

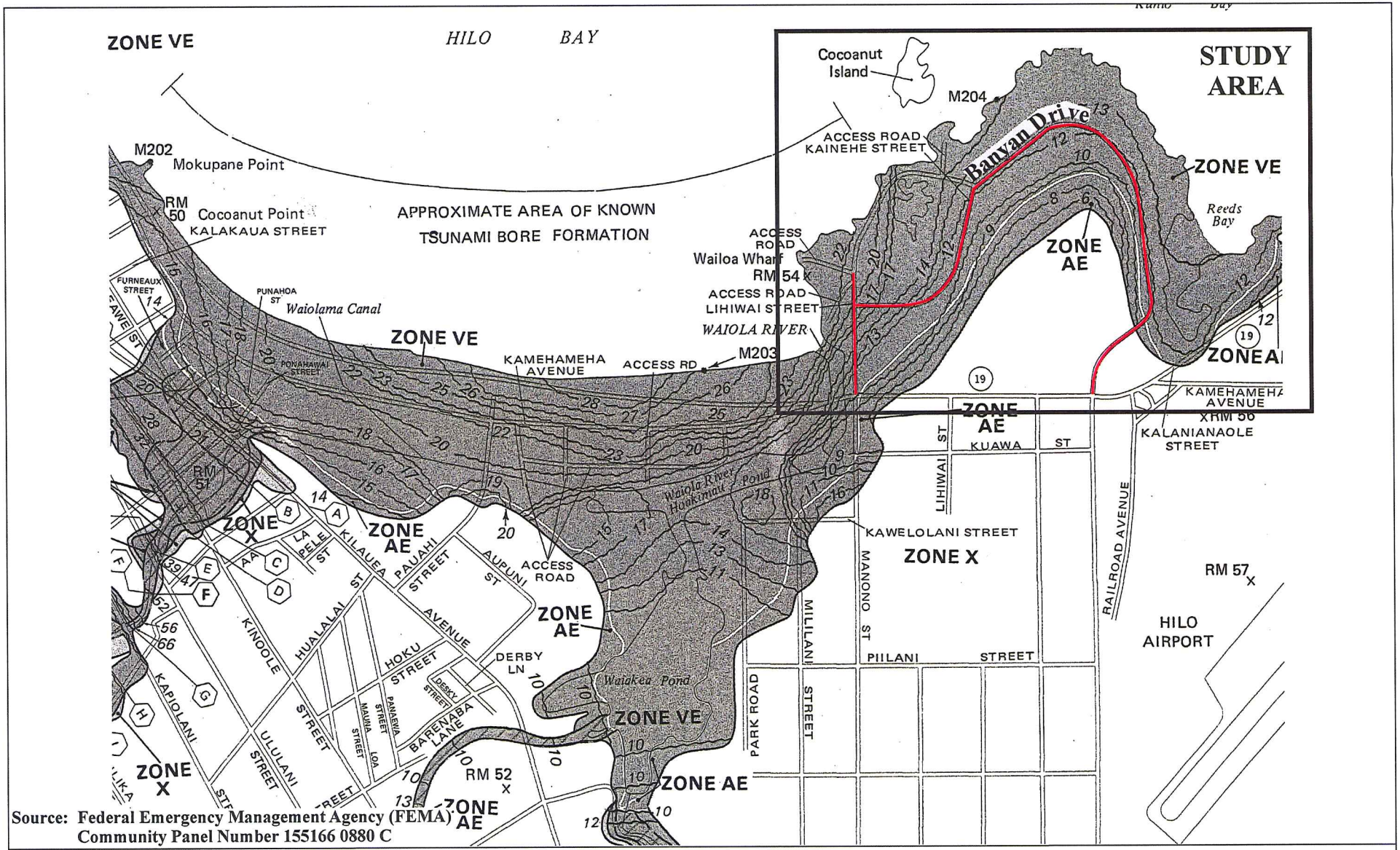
Tsunami Evacuation Areas

0 500 Feet
250 1000

Prepared for: State of Hawaii, Department of Land & Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\Sea Level Rise Assessment\Tsunami Evacuation Areas REV



Source: Federal Emergency Management Agency (FEMA)
Community Panel Number 155166 0880 C

Figure 27 Banyan Drive Sea Level Rise Assessment

Flood Zones

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\SeaLevelRiseAssessment\Flood Zones

IV. CURRENT COASTAL REGULATIONS AND POLICIES

IV. CURRENT COASTAL REGULATIONS AND POLICIES

A. FEDERAL EMERGENCY MANAGEMENT AGENCY

The Federal Emergency Management Agency (FEMA) provides federal level oversight on emergency response planning, preparedness, mitigation, response, and recovery. The agency's policy and functions are set forth in Title 44 of the Code of Federal Register (CFR). One of FEMA's areas of emergency management provides programs for floodplain management. Minimum criteria for regulations, standards, and guidelines are established for states to participate in the National Flood Insurance Program. The County of Hawaii has adopted floodplain regulations and standards for construction in special flood hazard areas identified by FEMA.

B. HAWAII COASTAL ZONE MANAGEMENT PROGRAM

The State of Hawaii's Coastal Zone Management Program (HCZMP) is established through Chapter 205A, Hawaii Revised Statutes (HRS). The HCZMP sets forth a number of objectives and policies aimed at protecting and managing Hawaii's valued coastal resources. Objectives and policies of Chapter 205A, HRS which are considered pertinent to sea level rise considerations include:

- **Coastal hazards**

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

  (B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards.

- **Managing development**

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

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

- **Beach protection**

  (A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion.

Implementation of the HCZMP is, in part, delegated to the various Counties, through their respective Special Management Area (SMA) regulatory framework.

C. COUNTY OF HAWAII REGULATIONS

As noted above, the County of Hawaii manages coastal development through its SMA permitting regulations. Compliance with the HCZMP's objectives and policies, including those cited in the preceding section, is required for the granting of SMA permits. In this regard, the SMA permitting process establishes a sound basis for managing future development and redevelopment along Banyan Drive.

Additionally, there are specific codes which are applicable to the Banyan Drive properties if major redevelopment occurs. County codes that may be applicable to such an action are Chapter 5 – Building; Chapter 23 –Subdivision; Chapter 25 – Zoning; and Chapter 27 – Floodplain Management.

It is noted that Hawaii County Code Chapter 5, Section 5-6 has provisions to allow additions, alterations or repairs not exceeding 50 percent of the replacement value of an existing building or structure within any twelve-month period to be made without the entire building complying with current codes.

All of the Banyan Drive properties are within the SMA and any future development would need approval which may take into account the tsunami hazard zone and FEMA flood hazard mitigation requirements.

D. COUNTY OF HAWAII SHORELINE SETBACK RULES

Section 11-5 of the Planning Department Rules of Practice and Procedure establishes a minimum setback from the certified shoreline within which there are restrictions on the types of structures and uses permitted. In most cases, parcels abutting the shoreline shall have a minimum shoreline setback of 40 feet. Exceptions to the 40-foot shoreline setback are allowed for parcels created prior to the adoption of the shoreline setback rules that have an average lot depth of 100 feet or less or would have the buildable area of the parcel reduced to less than fifty percent after the 40-foot shoreline setback is applied. These conditions do not apply to the Banyan Drive properties. Because current certified shoreline maps are not available for the study parcels, it was not possible to establish the location of the 40-foot shoreline setback line. In-lieu of a mapped shoreline setback, **Figure 28** illustrates the approximate distance between existing structure and the water's edge based on aerial images provided by Google Earth. It is noted that these distances are approximate and do not represent setbacks from a certified shoreline.

As shown in **Figure 28**, buildings on the Reed's Bay Resort, Country Club Condominium/Hotel, and Naniloa Hotel properties appear to have structures that fall within 40 feet of the water's edge. The rules pertaining to the shoreline setback establish permitted uses within the shoreline to minor structures and activities which may include landscape features, such as plantings and sprinkler system, benches, chairs, signs, walkways for access, etc., that shall not alter the existing grades. However, it is noted that structures approved prior to June 16, 1989 are permitted within the shoreline setback area.

There is a variance process to allow for uses within the shoreline based on certain criteria. One of the criteria involves a hardship standard where the Planning Commission first has to determine that the request is a reasonable use of the land. Reasonableness of use has to consider shoreline conditions, erosion, surf and flood conditions and the geography of the lot as it relates to health and safety. Construction within the shoreline setback area (if granted a variance) would also need to comply with other related County ordinances such as Hawaii County Code Chapters 10, Erosion and Sediment Control and Chapter 27,



Source: Google Earth

Figure 28 Banyan Drive Sea Level Rise Assessment

Approximate Building Setbacks

NOT TO SCALE

Prepared for: State of Hawaii, Department of Land and Natural Resources

MUNEKIYO & HIRAGA, INC.

SOH DLNR\Banyan Drive\Sea Level Rise Assessment\Approximate Building Setbacks

Floodplain Management. Building code standards appropriate for special flood hazard areas such as designing for floor levels at least a foot above the base flood elevation and other structural considerations appropriate for hydrodynamic forces would also need to be addressed.

V. CONCLUSION

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The University of Hawaii, Sea Grant College Program predicts that Hawaii will experience a 1-foot sea level rise by 2050 and a 3-feet rise by 2100. Based on the NOAA Sea Level Rise mapping model visualizations, the properties studied will experience negligible loss of property due to sea level rise for the 1-foot benchmark at year 2050 or about 35 years from now. Slightly more encroachment occurs for the 3-feet benchmark at year 2100 or about 85 years from now. For both the 1-foot sea level rise by 2050 and 3-feet rise by 2100, buildings and amenities can generally be spared with a few exceptions. Refer to **Table 2**.

Uncle Billy's Hilo Bay Hotel, the Country Club Condominium/Hotel, Bayview Banyan Apartments, and the Hilo Bay Cafe are anticipated to experience the least effects from a 3-feet sea level rise. These properties have natural shoreline armoring of lava rock formations, have rocky shorelines, and/or greater building setbacks. The Hilo Hawaiian Hotel is situated parallel to the shoreline without the protection of a higher elevation or a rocky cliff or wall. The sea level rise encroachment line at the Hilo Hawaiian Hotel may be close to but appears to be clear of the hotel structure. The Naniloa Hotel has a minimal shoreline setback in certain areas of the property and the sea level rise model indicates that some inundation may affect the swimming pool area near the shoreline. The rest of the property sits above the water and is lined by a vertical rocky shoreline face to keep the remaining structures clear of predicted landward encroachment. Similar to the Naniloa, the Reed's Bay Resort is predicted to experience inundation under a 3-feet sea level rise scenario. The existing structure at its closest point is approximately 23 feet from the water's edge. The model suggests that the makai portion of the existing structure may be at risk of inundation with 3-feet of sea level rise. These conditions associated with a 3-feet sea level rise would be expected in the year 2100 according to the University of Hawaii, Sea Grant College Program. However, at the 1-foot sea level rise benchmark, which is associated with the year 2050, the encroachment is not anticipated to be significantly different from current day conditions.

In the context of the DLNR's 2065 sea level rise horizon year, older buildings currently approaching fifty (50) years of age on properties like the Country Club Condominium/Hotel, Uncle Billy's Hilo Bay Hotel, and Naniloa Hotel would require significant reinvestment commitments. Their ability to continue maintaining the structures without exceeding the fifty (50) percent replacement value threshold may decline to the point where major redevelopment actions on the parcels would be subject to current laws and regulations, such as the County of Hawaii's shoreline setback rules and Special Management Area regulations.

In summary, the context for future uses along Banyan Drive will be dictated by current and newly enacted land use and environmental policies and controls. The age of the existing structures, when measured against the 2100 sea level rise benchmark time horizon, would lead to a reasonable assumption that these properties will be redeveloped, based on functionality, buildings' structural integrity and related value considerations utilized in cost-benefit analyses for parcel use feasibility determinations.

In this regard, it is anticipated that redevelopment of the properties over time will incorporate mitigation measures required by law, such as the lifting of finished floor elevations, increasing setbacks, and identifying uses which are compatible with natural hazard conditions affecting the respective properties. It is noted that in several instances, the 3-feet sea level rise model predicts inundation is greater than 40 feet, the current minimum shoreline setback required by the County of Hawaii. In particular, the Reed's Bay Resort, Hilo Hawaiian Hotel, and Naniloa Hotel are predicted to experience inundation limits greater than 40 feet. An understanding of the potential sea level rise impacts on these properties will be important as redevelopment of these sites are planned to ensure long-term viability of new structures that may be constructed along the shoreline.

VI. REFERENCES

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APPENDIX A.

Shoreline Photographs (Photographs Taken on January 24, 2014)



PHOTO NO. 1: Reed's Bay Resort



PHOTO NO. 2: Reed's Bay Resort



PHOTO NO. 3: Bayview Banyan Apartments



PHOTO NO. 4: Bayview Banyan Apartments



PHOTO NO. 5: Country Club Condominium/Hotel



PHOTO NO. 6: Country Club Condominium/Hotel



PHOTO NO. 7: Naniloa Hotel



PHOTO NO. 8: Naniloa Hotel



PHOTO NO. 9: Uncle Billy's Hilo Bay Hotel



PHOTO NO. 10: Uncle Billy's Hilo Bay Hotel



PHOTO NO. 11: Uncle Billy's Hilo Bay Hotel



PHOTO NO. 12: Looking West Towards Hilo Hawaiian Hotel



PHOTO NO. 13: Liliuokalani Gardens Shorelines



PHOTO NO. 14: Liliuokalani Gardens Shorelines



PHOTO NO. 15: Liliuokalani Gardens Shorelines



PHOTO NO. 16: Liliuokalani Gardens Shorelines