Hilton Hawaiian Village®

VILLAGE MASTER PLAN

Waikīkī, Island of O‘ahu

FINAL

Environmental Impact Statement

Volume 2: Technical Appendices

GROUP 70 INTERNATIONAL

JUNE 2011

TECHNICAL APPENDICES TABLE OF CONTENTS

APPENDIX A

Pedestrian Wind Assessment
Hilton Hawaiian Village
Honolulu, Hawaii

Rowan Williams Davies & Irwin Inc.

March 2011 ~~June 2010~~

Final Pedestrian Wind Assessment

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1. Introduction

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Group 70 International Inc. to assess the wind effects at pedestrian areas around the proposed expansion of the existing Hilton Hawaiian Village resort in Honolulu, Hawaii. The objective of this qualitative analysis is to estimate the pedestrian wind conditions on and around the proposed development when the two new towers are added to the existing buildings.

This qualitative assessment is based on:

- a review of regional long-term meteorological data;
- design drawings received by RWDI on May 3 and 19, 2010;
- our engineering judgement and knowledge of wind flows around buildings;
- our experience of wind tunnel modelling of various building projects in Honolulu;
- use of software developed by RWDI (*Windestimator)* 1,2 for estimating the potential wind comfort conditions around generalized building forms; and,
- use of proprietary Computational Fluid Dynamics (CFD) software *Virtualwind* for visualizing wind flow patterns.

In the absence of wind tunnel testing, this qualitative approach provides a screening-level estimation of potential wind comfort conditions and identifies anticipated areas of accelerated wind speeds. This method can be used for an initial qualitative estimate of pedestrian wind conditions at the planning stage and for an evaluation of different design options. To quantify the wind comfort conditions or refine any conceptual wind control measures, physical scale model tests in a boundary layer wind tunnel facility would be required.

Note that other wind issues, such as those relating to door pressures, stack effect, exhaust re-entrainment, etc. are not considered in the scope of the assessment.

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[1] C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999). "Experience with Remedial Solutions to Control Pedestrian Wind Problems". *10th International Conference on Wind Engineering*. Copenhagen, Denmark.

[2] H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004). "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions". ASCE Structure Congress 2004. Nashville, Tennessee.

2. Site Information

The proposed development is located on the west side of Kalia Road, and to the south of Highway 92, immediately on the Waikiki Beach in Honolulu, Hawaii. The existing development consists of seven towers and two low-rise buildings. Pedestrian areas include the beach, swimming pools, green lawns, building entrances and walkways.

Aerial View of Existing Site
(Courtesy of GoogleEarth™)

The expansion of the existing development includes two new timeshare towers: one 37-storey tower over the existing Bus Loading area; and the other 23-storey tower over the redeveloped Rainbow Bazaar, as shown in the image below.

The focus of this pedestrian wind assessment is to evaluate the potential wind effects that may be caused by the two new buildings on the entire Hilton Hawaiian Village and its surrounding areas.

View of Proposed Development from North

Reference Plan

The map to the right was downloaded from the resort website and is used as a reference plan for the current wind assessment.

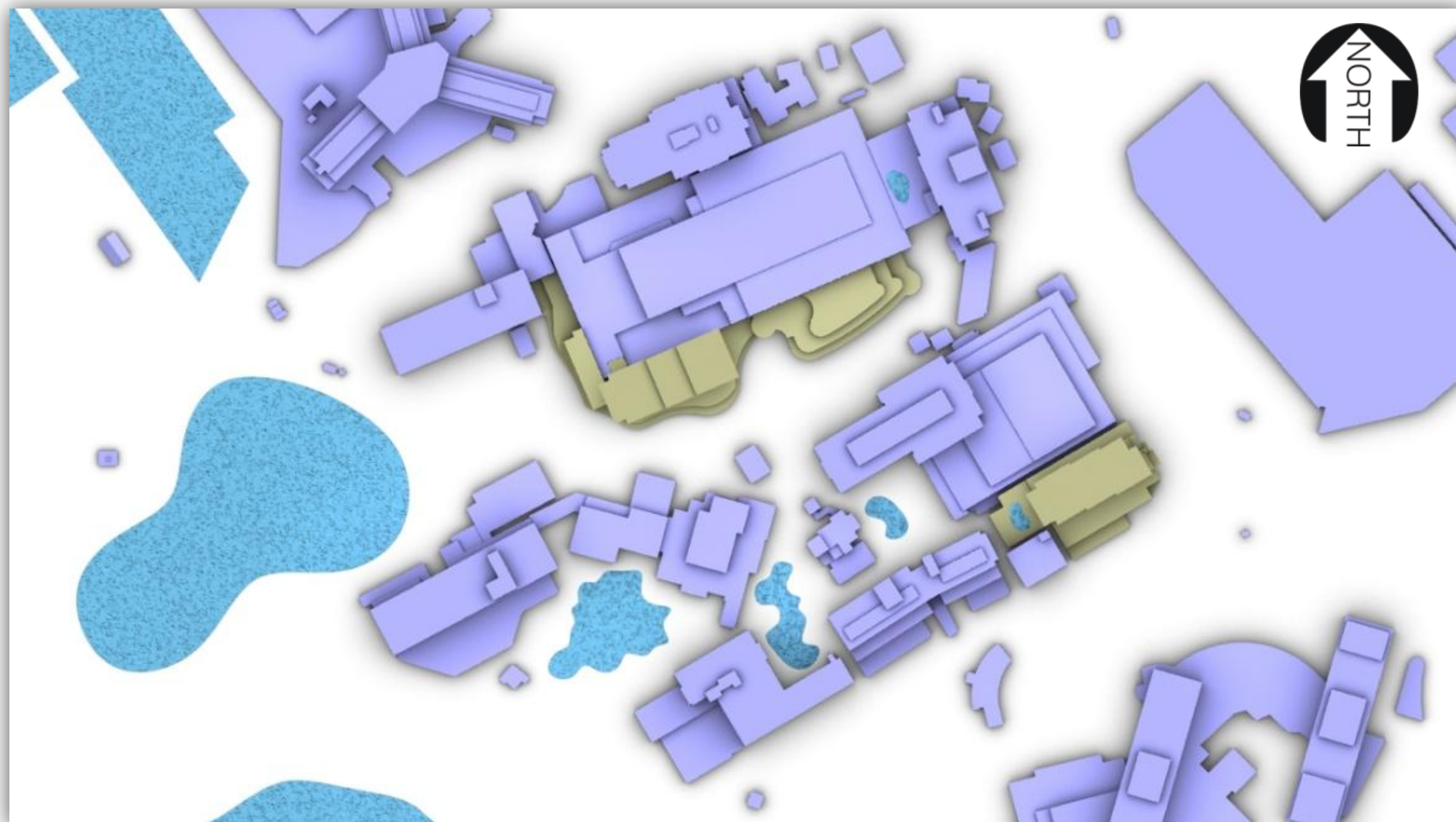
The seven existing towers are Kalia Tower, Tapa Tower, Grand Waikikian, Lagoon Tower, Rainbow Tower, Ali'i Tower and Diamond Head Tower. Among the numerous low-rise buildings, the two main buildings are the Main Lobby and the Conference Center.

As shown in the plan and the image on the previous page, there is extensive landscaping on and around the hotel site. This landscaping was not included in the *Virtualwind* simulations, in order to provide a conservative estimate of the wind conditions on the site. However, it is our experience that such an amount of landscaping will reduce the wind activity considerably.

On the next page there is a top view of the central portion of the 3-D computer model, including the two new towers. This computer model was used for the *Virtualwind* simulations.

Map of the Existing Hilton Hawaiian Village
(*downloaded from the hotel website*)

Proposed Configuration



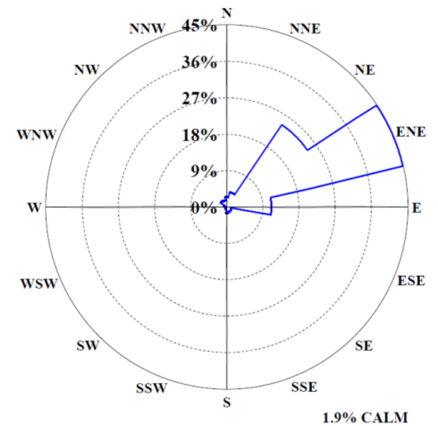
Plan View of 3D Rendered Model

3. Meteorological Data

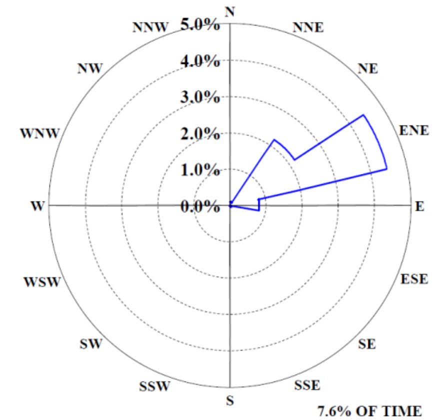
Wind statistics at the Honolulu International Airport between 1949 and 2004 were analysed for the summer (May through October) and winter (November through April) seasons. The wind roses, to the right, graphically depict the distributions of wind frequency and directionality for these two seasons. As shown in the two left hand wind roses, the winds are predominantly from the east-northeast, northeast and east directions.

Strong winds of a mean speed greater than 20 mph measured at 30 ft above grade at the airports occur for 7.6% and 7.5% of the time during the summer and winter seasons, respectively. Again, the east-northeast winds are prevalent for both seasons, as demonstrated by the two right-hand wind roses.

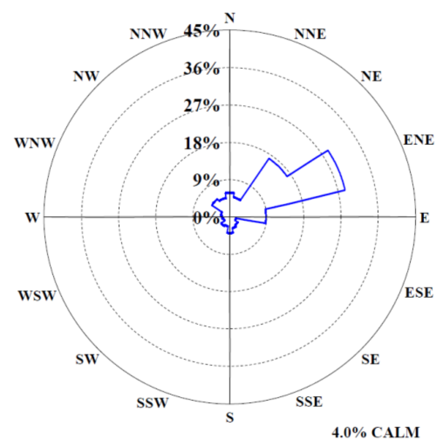
The *Virtualwind* computer simulations will focus on winds from **east-northeast** to illustrate the nature of flows from this predominant wind direction. The **east** winds are also important and, were simulated, due to building orientation and local topographic exposure. The wind comfort assessment using the *WindEstimator* analysis technique considers all wind directions.



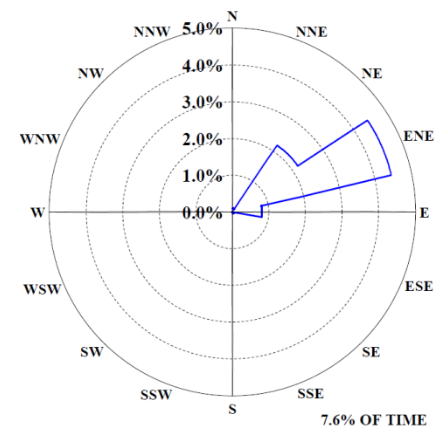
All Summer Winds



Summer Winds Exceeding 20 mph



All Winter Winds



Winter Winds Exceeding 20 mph

Directional Distribution (%) of Winds (Blowing From)

4. RWDI Wind Comfort Criteria

The RWDI wind comfort criteria deal with both pedestrian safety and comfort, as they relate to the force of the wind. Thermal effects (e.g., temperature, humidity, sun/shade, etc.) are not considered in these comfort criteria. These criteria, developed by RWDI through research and consulting practice since 1974, have been published in numerous academic journals and conference proceedings. They have also been widely accepted by municipal authorities as well as by the building design and city planning community. RWDI's criteria have been used in over 1500 pedestrian wind projects and adopted as part of environmental planning guidelines by several major cities around the world. The pedestrian wind comfort criteria used in this assessment are categorized by three typical pedestrian activities:

Sitting: Low wind speeds during which one can read a newspaper without having it blown away. These wind speeds are appropriate for outdoor cafes and other amenity spaces that promote long term sitting.

Standing: Slightly higher wind speeds that are strong enough to rustle leaves. These wind speeds are appropriate at major building entrances, bus stops or other areas where people may linger but not necessarily sit for extended periods of time.

Walking: Winds that would lift leaves, move litter, hair and loose clothing. Appropriate for sidewalks, intersections, plazas, parks or playing fields where people are more likely to be active and receptive to some wind activity.

Wind conditions are considered suitable for sitting, standing or walking if the wind speeds are expected for at least four out of five days (80% of the time). An **uncomfortable** designation means that the criterion for walking is not satisfied.

Safety is also considered by the criteria and is associated with excessive gust wind speeds that can adversely affect a pedestrian's balance and footing. If winds sufficient to affect a person's balance occur more than two times per summer or winter season, the wind conditions are considered severe. Wind control measures are typically required at locations where winds are rated as uncomfortable or they exceed the wind safety criterion.

In the *Virtualwind*™ simulations, the colors represent the following wind comfort conditions:

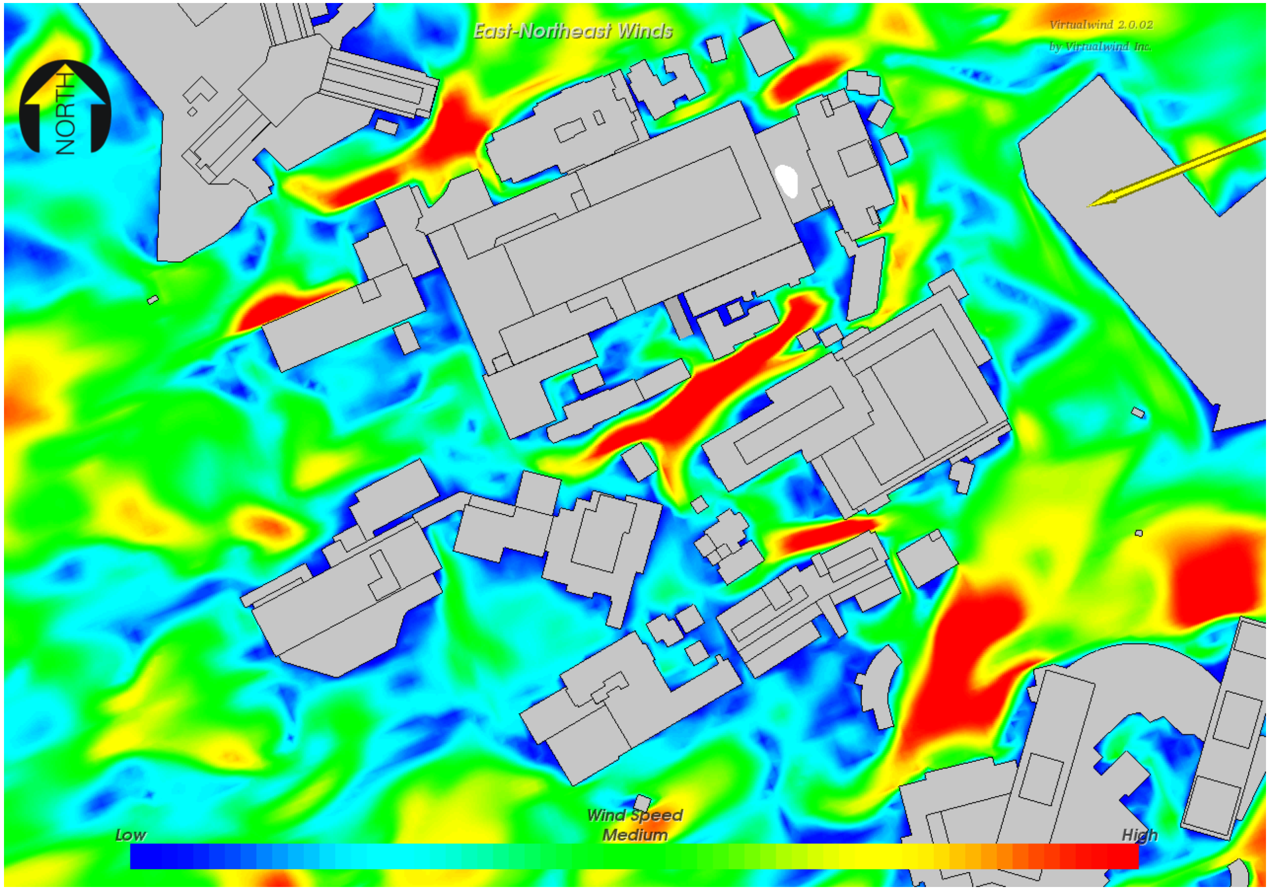
Sitting	**Standing**	**Walking**	**Uncomfortable**	**Severe**
dark blue	*light blue*	*green*	*yellow*	*red*

Red regions are associated with high wind speeds, as indicated by the color legend in the figures and movies. These comfort conditions are approximate and intended for reference; to determine overall wind comfort for an area, all wind directions need to be taken into consideration.

Generally, for walkways, where pedestrians are not expected to linger, walking conditions are considered appropriate. For more passive areas, such as pool decks and terraces, sitting conditions would be considered ideal, but in a warm climate such as Hawaii, a breeze may be desirable. In that case, wind conditions conducive to standing may be appropriate.

The animations of the wind conditions, presented on the following pages, are intended to provide a better understanding of the turbulent nature of wind flows. The followed images of mean wind speeds are more representative of overall comfort.

5. Wind Flow Simulation – East-Northeast Winds, Existing

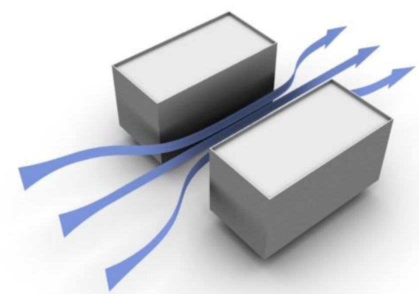


Animation of East-Northeast Winds *(double click to view)*

For the predominant east-northeast winds, wind flow accelerations were observed in various areas between the existing towers. These areas included Rainbow Drive north of the Tapa Tower and between the Tapa Tower podium and the Diamond Head Tower. Along the north and south perimeters of the hotel village, high wind speeds (red and yellow zones) were also evident. These were caused by the channeling of wind flows between the on-site buildings and the adjacent off-site hotel towers.

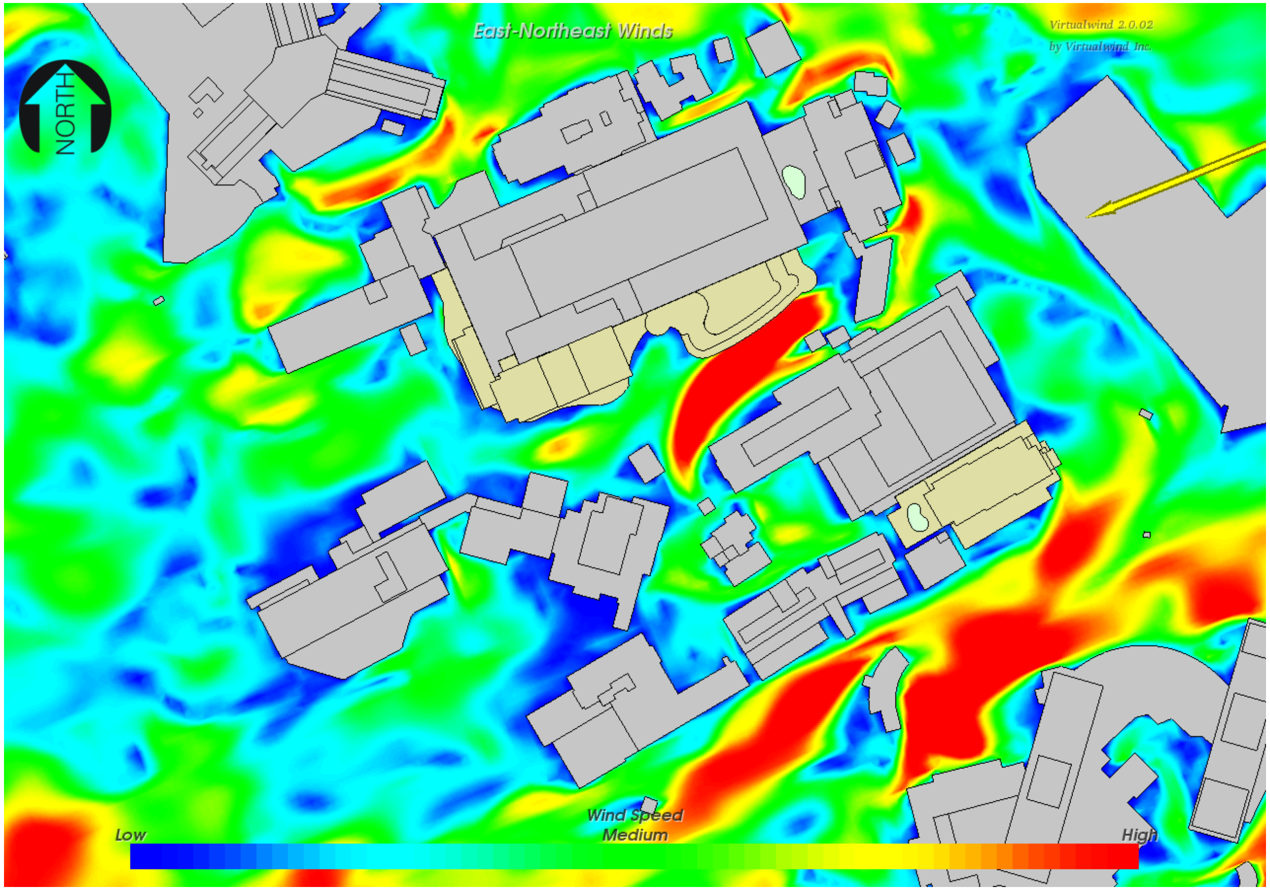
Wind speeds on the west side of the buildings, including the Village Green, Super Pool, Great Lawn and beach areas, were relatively low in general.

As discussed previously, dense landscaping exists on the site and the actual wind speeds on and around the resort are expected to be lower than those that were suggested in the image to the left.



Channelling Effect

5. Wind Flow Simulation – East-Northeast Winds, Proposed



Animation of East-Northeast Winds *(double click to view)*

Generally, with the two new buildings in place, similar wind speeds are expected on and around the resort.

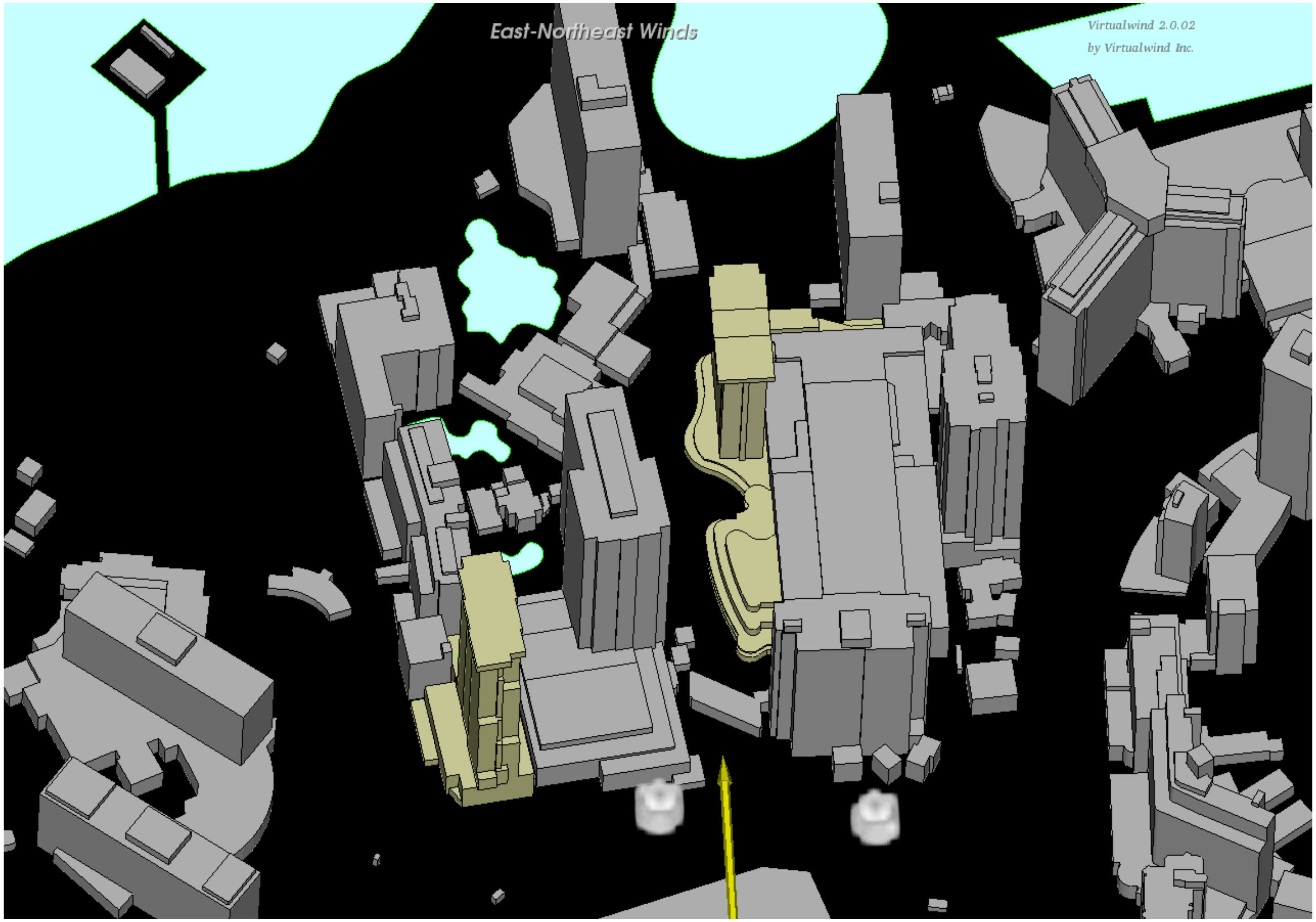
The tower over Bus Loading blocks the gap between the Tapa Tower podium and the Diamond Head Tower for the east-northeast winds and hence, reduces the wind speeds through the gap. As a result, reduced wind speeds were observed around the Tapa Pool.

The low-rise portion of the Rainbow Bazaar is terraced (or stepped), which reduces the potential wind impact on the ground level. However, high wind speeds along Rainbow Drive were expected; these are slightly stronger than the existing conditions. Similarly high wind speeds are also expected on the exposed outdoor terraces on the Rainbow Bazaar.

Wind speeds around the perimeter of the resort, including Kalia Road to the east and the beach to the west, were not affected by the new buildings. Increased wind speeds were predicted in the area between the Tower over Bus Loading area and the existing hotel tower to the south.

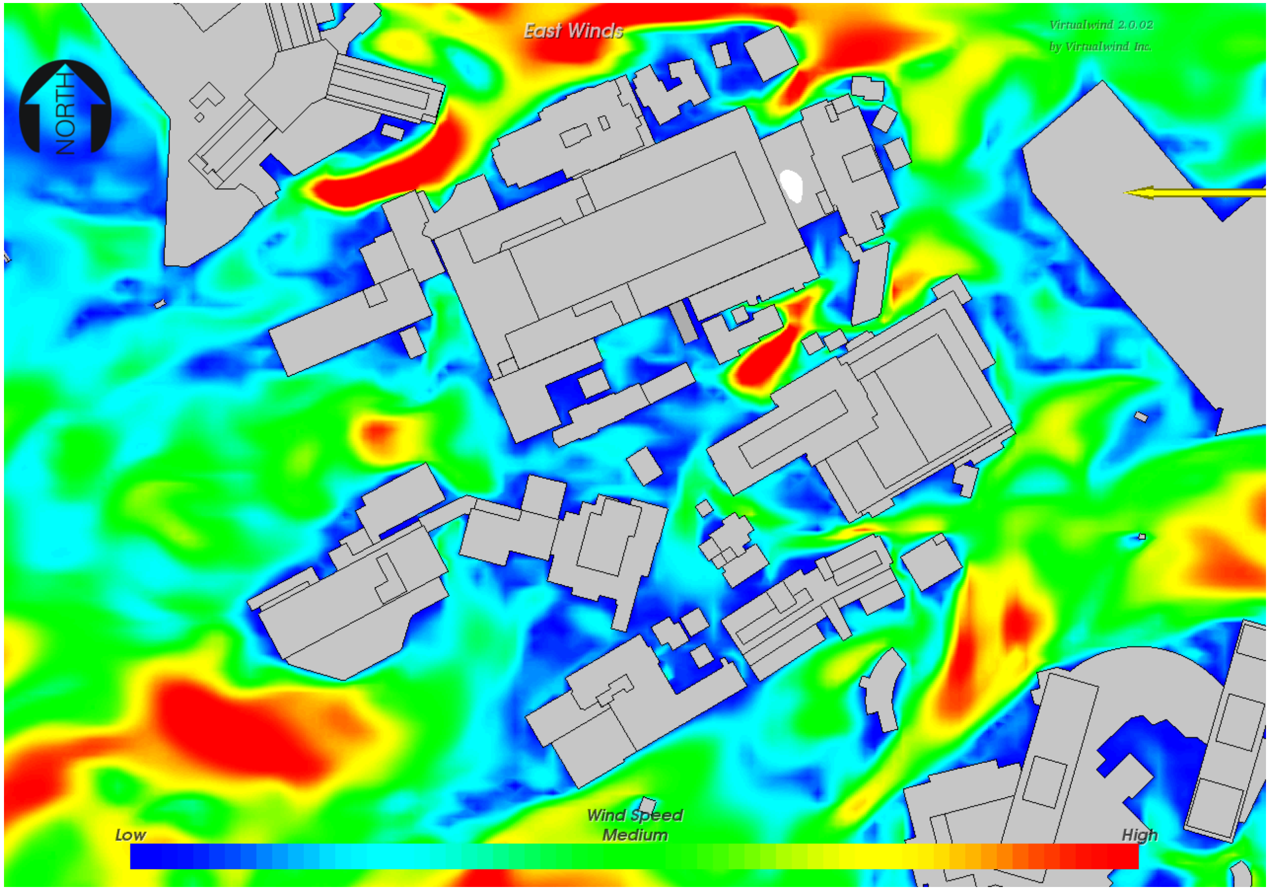
The next slide is the smoke visualization of the east-northeast winds around the existing and proposed buildings.

5. Smoke Visualization – East-Northeast Winds, Proposed



Smoke Flow for East-Northeast Winds *(double click to view)*

5. Wind Flow Simulation – East Winds, Existing



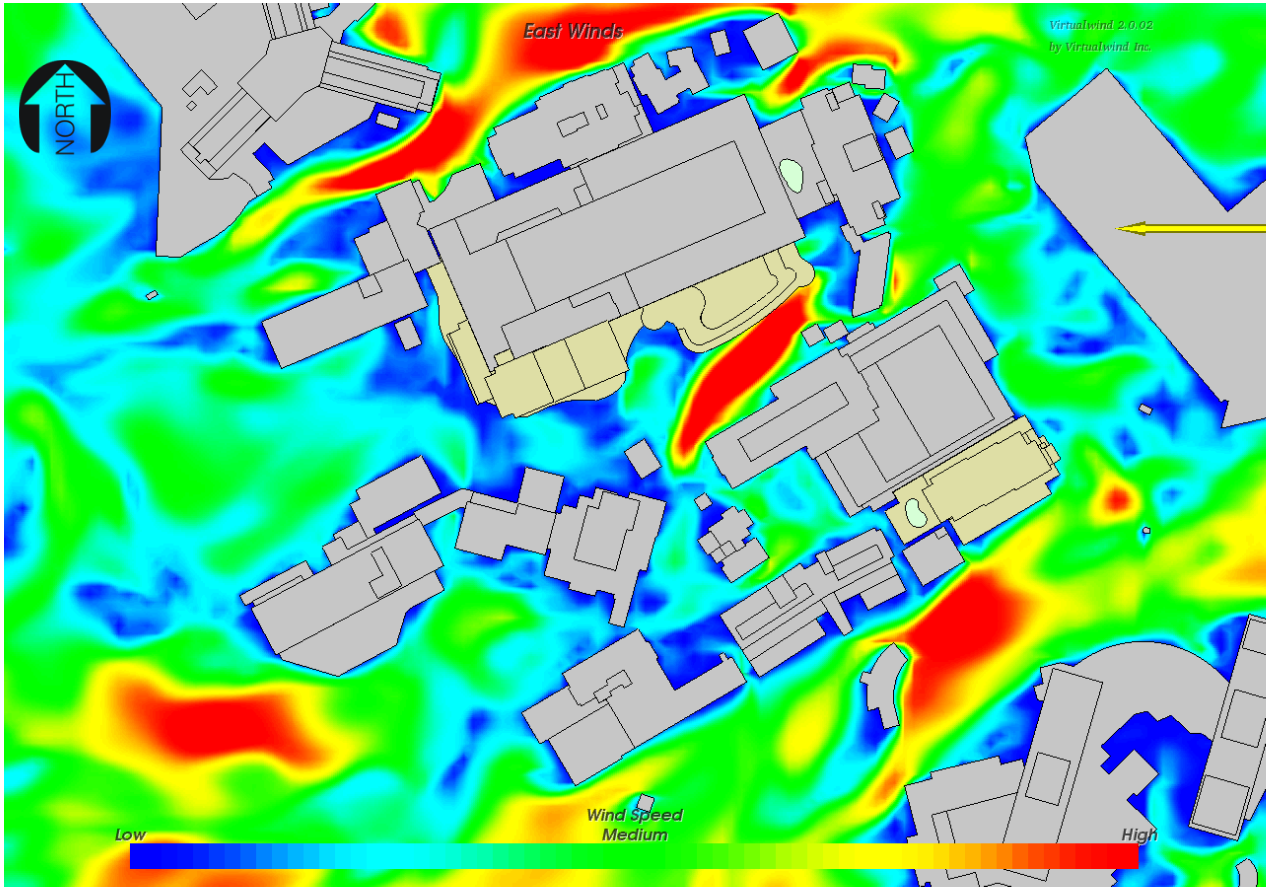
Animation of East Winds *(double click to view)*

When comparing winds from the east and east-northeast directions, a similar wind flow pattern was found on and around the resort, although the east winds are less frequent and are generally lower in speed.

Wind flow accelerations were evident in several areas, including the north and south perimeters of the resort, as well as on Rainbow Drive. Lower wind activity was shown in the areas to the west of the resort, as illustrated by the green color in the vicinity of the pools and beach.

The east winds also accelerated around the existing nearby towers to the south of the site. These accelerations created areas of high wind speed in the Bus Loading area, and in the space to the southeast of the Diamond Head Tower.

5. Wind Flow Simulation – East Winds, Proposed

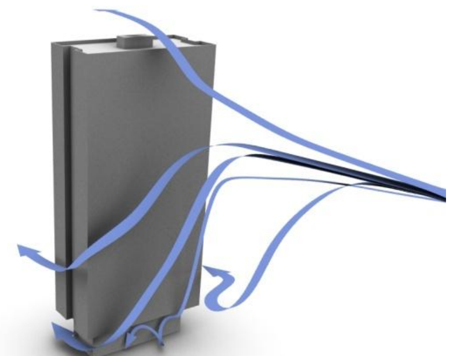


Animation of East Winds *(double click to view)*

The new Tower over the Bus Loading area intercepted the east winds and deflected them down to the ground level. These downwashed flows were then channeled between the buildings, causing increased wind activity along the south facades of the Diamond Head and Ali'i Towers (yellow and red colors).

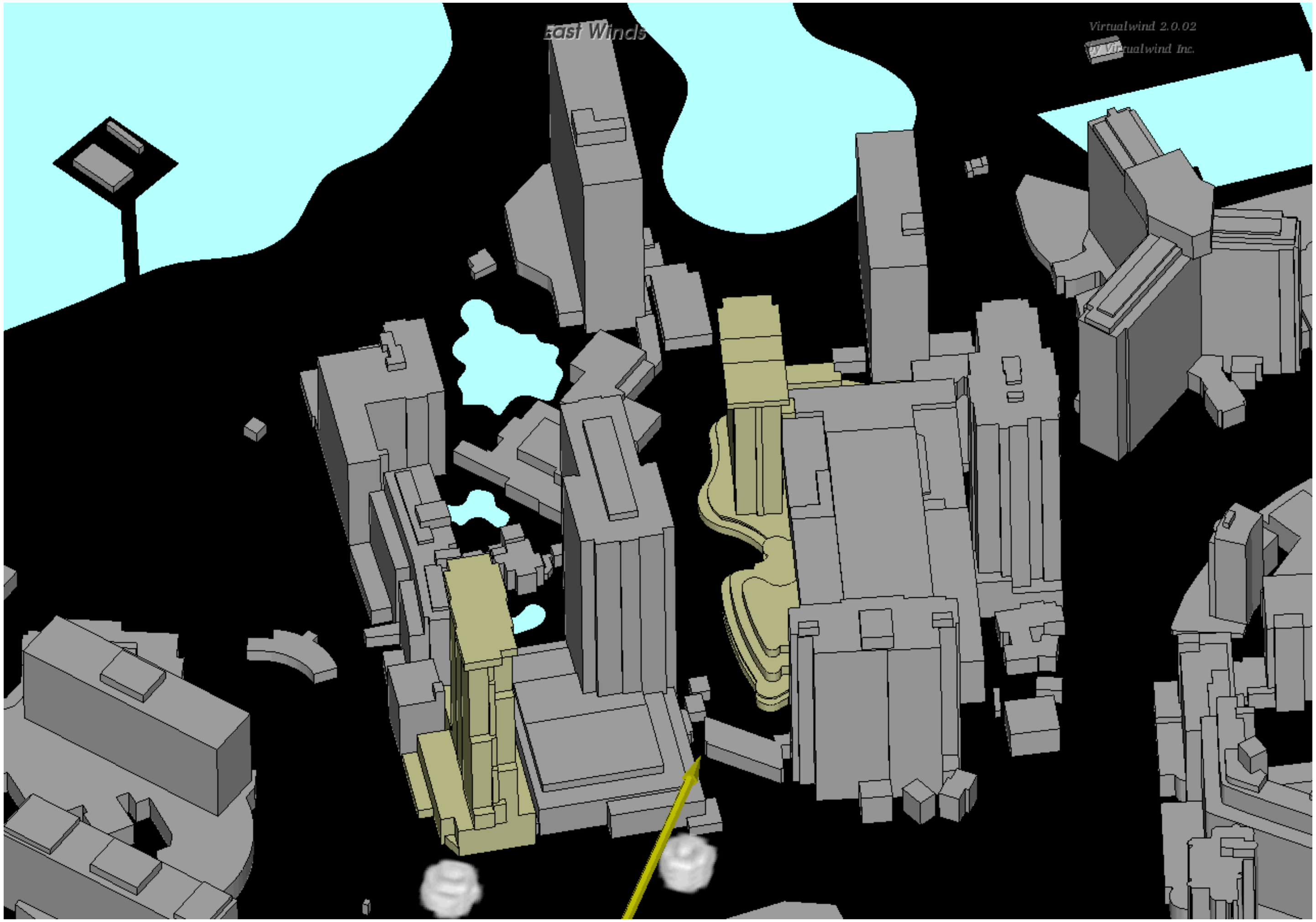
Strong winds were also predicted along Rainbow Drive between the Tapa Tower and the redeveloped Rainbow Bazaar.

The easterly winds may also accelerate between the existing Tapa Tower and the new Tower over the Bus Loading areas, resulting in increased wind activity around the Tapa Pool. This can be observed in the smoke visualization animation on the next slide.



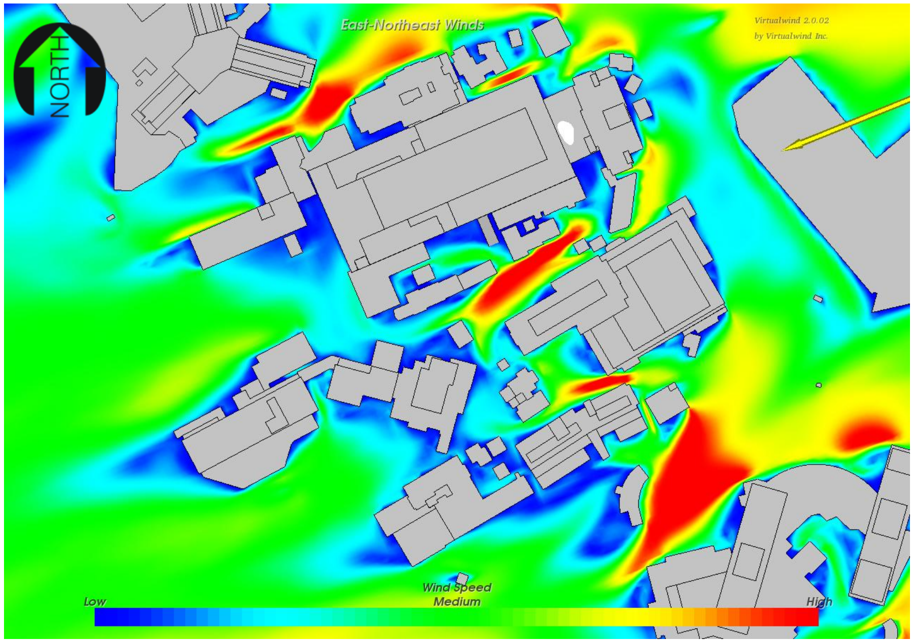
Downwashing Flow

5. Smoke Visualization – East Winds, Proposed

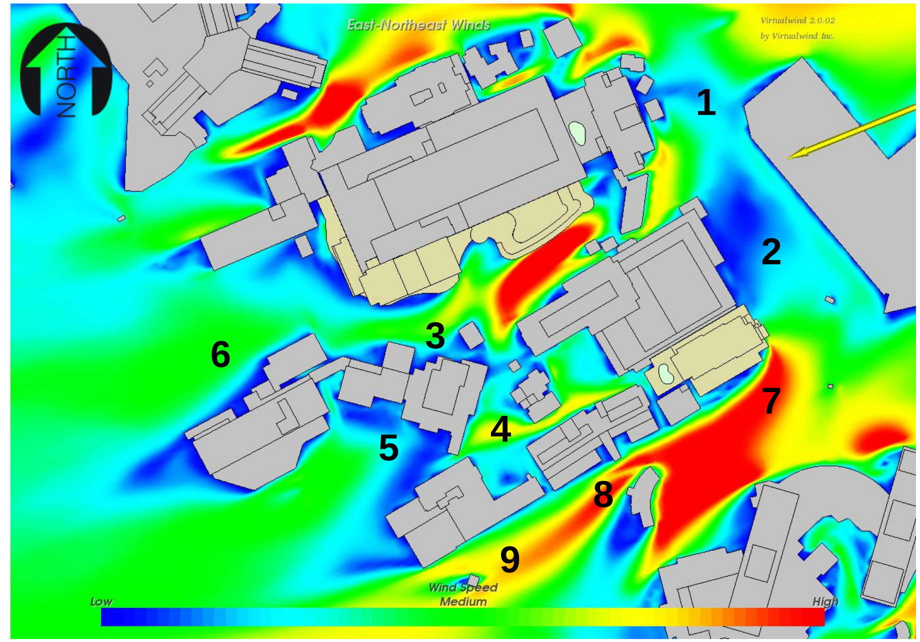


Smoke Flow for East Winds *(double click to view)*

6. Results of Assessment – Mean Wind Speeds, East-Northeast Winds



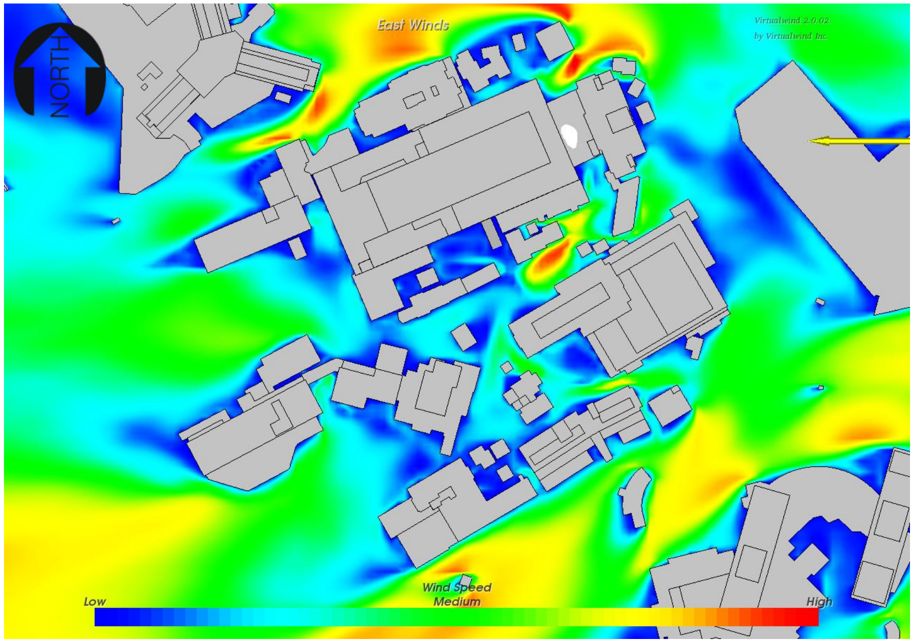
Mean Wind Speed – Existing



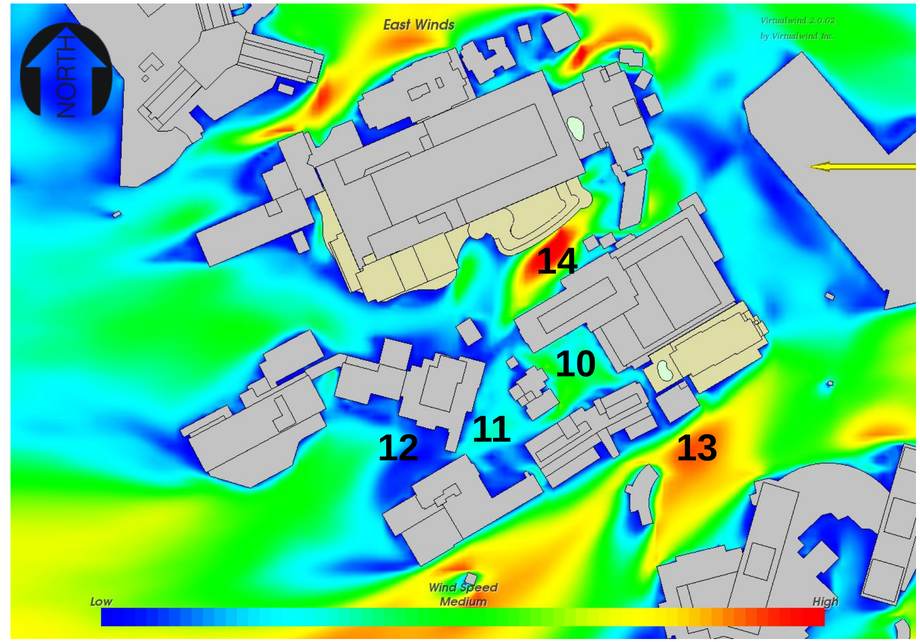
Mean Wind Speed – Proposed

The two new towers have their long axis aligned with the predominant east-northeast winds. As a result, their potential effect on pedestrian wind conditions on and around the resort is minimal. For instance, the proposed development will have minimal influence on wind speeds along Kalia Road **(1 & 2)**. Slightly increased wind speeds are expected on the north and east sides of the Main Lobby Building, **(3 & 4)**, while reduced wind speeds are predicted on the south side of the Main Lobby **(5)** as well as north of the Rainbow Tower **(6)** and the Ali'i Tower **(5)**. Increased wind speeds are predicted on the south side of the new tower over the Bus Loading area, especially at the southeast corner **(7)**. Such a wind flow acceleration will also affect the area immediately south of the Diamond Head Tower and Ali'i Tower **(8 & 9)**.

6. Results of Assessment – Mean Wind Speeds, East Winds



Mean Wind Speed – Existing



Mean Wind Speed – Proposed

When winds are from the east, wind conditions along Kalia Road, with the proposed buildings in place, will remain similar to existing conditions. Slightly increased wind speeds were predicted around the Tapa Pool **(10)** and the Village Green **(11)**, while slightly reduced wind speeds were expected around the Main Lobby **(12)**. Increased wind speeds were observed on the south side of the new tower over the Bus Loading area **(13)**, as well as along Rainbow Drive between the existing Tapa Tower and the low-rise portion of the new Tower over Rainbow Bazaar **(14)**. Wind conditions in the remaining areas are predicted to be similar to those that current exist on the resort.

7. Summary and Recommendations

Based on the above discussions, it is predicted that the proposed new towers will not significantly alter the existing wind conditions on the resort. The general wind conditions along Kalia Road remain comfortable for pedestrian standing or walking and suitable for the intended use.

With the extensive landscaping on site, wind conditions on the resort are expected to be suitable for standing or walking throughout the year. It is unlikely that severe wind conditions will occur on the resort.

Wind speeds higher than desired are predicted along the south and north perimeters of the resort and along Rainbow Drive. In these areas, wind conditions may become uncomfortable from time to time.

It is recommended that pedestrian activity be planned away from the southeast corner of the new Tower over the Bus Loading area. In addition, the existing landscaping in the area should be enhanced with a combination of canopy-type trees and dense underplanting (e.g., bushes and shrubs), as illustrated in the site plan on next page.

Additional landscaping is also recommended along Rainbow Drive to improve the wind conditions. Porous wind screens or dense landscaping should also be considered along the north edge of the Tapa Tower podium to reduce the downwashing flows off the Tapa Tower onto the ground level.

If frequent usage is expected for the terraces on the low-rise portion of the new Tower on Rainbow Bazaar, wind mitigation is suggested, such as tall parapets, dense planting and trellises.

If lower wind activity is desired for the Tapa Pool and Village Green, a porous wind screen can be considered along the west edge the Tapa Tower podium. Additional canopy-type trees and trellises can be installed in these areas for wind reduction – see image on the next page.

Additional landscaping at the southeast corner of the Great Lawn should also be considered to reduce the wind flows along Rainbow Drive between the Main Lobby and the new Tower over Rainbow Bazaar.

The current assessment is qualitative in nature. If more quantitative results are desired, wind tunnel tests can be conducted to quantify the wind conditions and to evaluate the effectiveness of the wind mitigation measures.

7. Summary and Recommendations

Summary of Wind Mitigation

APPENDIX B

Air Quality Study for the Proposed Hilton Hawaiian Redevelopment Project

B.D. Neal & Associates

October 2010

AIR QUALITY STUDY

FOR THE PROPOSED

HILTON HAWAIIAN VILLAGE REDEVELOPEMENT PROJECT

WAIKIKI, OAHU, HAWAII

Prepared for:

Group 70 International, Inc.

October 2010

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Table

1.0 SUMMARY

Hilton Worldwide is proposing to redevelop the Hilton Hawaiian Village in Waikiki on the island of Oahu. The proposed project will consist of the expansion and redevelopment of some of the existing facilities and the construction of two new timeshare towers. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are comparable to the national standards except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the Waikiki area is very much affected by its leeward and coastal situation. Winds are predominantly trade winds from the east northeast except for occasional periods when kona storms may generate strong winds from the south or when the trade winds are weak and landbreeze-seabreeze circulations may develop. Wind speeds typically vary between about 5 and 15 miles per hour providing relatively good ventilation much of the time. Temperatures in leeward areas of Oahu are generally very moderate with average daily temperatures ranging from about 70°F to 84°F.

The extreme minimum temperature recorded at Honolulu Airport is 54°F, while the extreme maximum temperature is 95°F. This area of Oahu is one of the drier locations in the state with rainfall often highly variable from one year to the next. Monthly rainfall has been measured to vary from as little as a trace to as much as 10 inches. Average annual rainfall amounts to about 21 inches with summer months being the driest.

The present air quality of the project area appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawaii Department of Health suggest that all national air quality standards are currently being met, although occasional exceedances of the more stringent state standards for carbon monoxide may occur near congested roadway intersections.

If the proposed project is given the necessary approvals to proceed, it may be inevitable that some short- and/or long-term impacts on air quality will occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

To assess the potential long-term impact of emissions from project-related motor vehicle traffic operating on roadways in the project area after construction is completed, a computerized air quality modeling study was undertaken. The air quality modeling study estimated current worst-case concentrations of carbon monoxide at intersections in the project vicinity and predicted future levels both with and without the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour worst-case carbon monoxide concentrations are well within both the state and the national ambient air quality standards. In the year 2022 without the project, worst-case carbon monoxide concentrations were predicted to decrease (improve), and concentrations would remain well within standards. With the project in the year 2022, worst-case carbon monoxide concentrations were projected to remain unchanged or increase only very slightly compared to the without project case. Concentrations would remain well within standards. Due to the small impact the project is expected to have, implementing mitigation measures for long-term traffic-related air quality impacts is probably unnecessary and unwarranted.

2.0 INTRODUCTION

Hilton Worldwide is proposing to redevelop the Hilton Hawaiian Village located in Waikiki on the island of Oahu (see Figure 1 for project location). The project would include the construction of two new timeshare towers, expansion of the existing Super Pool, and redevelopment of the retail façade along the main entry. The two new timeshare towers would include a total of 550 units. Development of the project would occur in phases and be completed by 2022.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short- and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities as planned. Measures to mitigate project impacts are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide.

National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit.

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. However, during the early part of 2010, the national primary annual and 24-hour standards for sulfur dioxide were revoked in favor of a new 1-hour standard. The Hawaii AAQS for sulfur dioxide have not yet been updated.

In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards were challenged in federal court. A Supreme Court ruling was issued during February 2001, and as a result, the new standards for particulate were finally implemented during 2005. To date, the Hawaii Department of Health has not updated the state particulate standards.

In September 2001, the state vacated the state 1-hour standard for ozone and an 8-hour standard was adopted that was the same as the national standard. During 2008, the national standard for ozone was again revised and made more stringent. The Hawaii standard for ozone has not yet been amended to follow the national standard.

During the latter part of 2008, EPA revised the standard for lead making the standard more stringent. So far, the Hawaii Department of Health has not revised the corresponding state standard for lead.

During early 2010, a national 1-hour primary standard for nitrogen dioxide was implemented. To date, Hawaii has not promulgated a 1-hour standard for nitrogen dioxide, but the Hawaii annual standard for this pollutant is more stringent than the national standard.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affects the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. The site of the proposed project is located in the leeward area of the Koolau Mountains.

Wind frequency data for Honolulu International Airport (HIA), which is located about 10 miles to the east of the project site, are given in Table 2. These data can be expected to be reasonably representative of the project area. Wind frequency for HIA show that the annual prevailing wind direction for this area of Oahu is east northeast. On an annual basis, 34.7 percent of the time the wind is from this direction, and more than 70 percent of the time the wind is in the northeast quadrant. Winds from the south are infrequent occurring only a few days during the year and mostly in winter in association with kona storms. Wind speeds average about 10 knots (12 mph) and mostly vary between about 5 and 15 knots (6 and 17 mph).

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. Based on more than 25 years of data collected at Honolulu International Airport, average annual daily minimum and maximum temperatures in the project area are about 70°F and 84°F, respectively [1]. The extreme minimum temperature on record at the airport is 54°F, and the extreme maximum is 95°F.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is oftentimes measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Waikiki area, stability class 5 is probably the highest stability class that occurs, developing during clear, calm nighttime or early morning hours when temperature inversions form due to radiational cooling. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3000 feet (1000 meters).

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water-soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The Waikiki area is one of the drier areas on Oahu due to its leeward and near sea level location. Average annual rainfall measured at nearby Black Point amounts to about 21 inches [2]. Most of the rainfall usually occurs during the winter months. Monthly rainfall may vary from as little as a trace to more than 10 inches.

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles due to the urban situation. Table 3 presents an air pollutant emission summary for the island of Oahu for calendar year 1993. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Oahu, emissions of particulate and nitrogen oxides may have increased during the last several years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons probably have declined.

Natural sources of air pollution emissions that could affect the project area at times but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station, however, typically does not monitor the full complement of air quality parameters. Table 4 shows annual summaries of air quality measurements that were made nearest to the project area for several of the regulated air pollutants for the period 2004 through 2008. These are the most recent data that are currently available.

During the 2004-2008 period, sulfur dioxide was monitored by the State Department of Health at an air quality station located at downtown Honolulu. Concentrations monitored were consistently low compared to the standards. Annual second-highest 3-hour concentrations (which are most relevant to the air quality standards) ranged from 0.011 to 0.029 parts per million (ppm), while the annual second-highest 24-hour concentrations ranged from 0.004 to 0.010 ppm. Annual average concentrations were only about 0.001 ppm. There were no exceedances of the state/national 3-hour or 24-hour AAQS for sulfur dioxide during the 5-year period.

Particulate matter less than 10 microns in diameter (PM-10) is also measured at the downtown Honolulu monitoring station. Annual second-highest 24-hour PM-10 concentrations ranged from 23 to 35 $\mu g/m^3$ between 2004 and 2008. Average annual concentrations ranged from 13 to 15 $\mu g/m^3$. All values reported were within the state and national AAQS.

Carbon monoxide measurements were obtained at the downtown Honolulu monitoring station. The annual second-highest 1-hour concentrations ranged from 1.6 to 2.7 ppm. The annual second-highest 8-hour concentrations ranged from 1.0 to 1.4 ppm. No exceedances of the state or national 1-hour or 8-hour AAQS were reported.

Nitrogen dioxide is monitored by the Department of Health at the Kapolei monitoring station, which is about 16 miles west of the project area. Annual average concentrations of this pollutant ranged from 0.004 to 0.005 ppm, safely inside the state and national AAQS.

The nearest available ozone measurements were obtained at Sand Island (about 3 miles west of the project area). The annual fourth-highest 8-hour concentrations (which are most relevant to the standards) for the period 2004 through 2008 ranged between 0.033 and 0.046 ppm, which is well inside the state and federal standards. The 8-hour standard for ozone did not exist prior to 2002. Prior to 2002, the now obsolete state 1-hour standard was typically exceeded several times each year.

Although not shown in the table, the nearest and most recent measurements of ambient lead concentrations that have been reported were made at the downtown Honolulu monitoring station between 1996 and 1997. Average quarterly concentrations were near or below the detection limit, and no exceedances of the state AAQS were recorded. Monitoring for this parameter was discontinued during 1997.

Based on the data and discussion presented above, it appears likely that the State of Hawaii AAQS for sulfur dioxide, nitrogen dioxide, particulate matter, ozone and lead are currently being met in the project area. While carbon monoxide measurements at the downtown Honolulu monitoring station suggest that concentrations are within the state and national standards, local "hot spots" may exist near traffic-congested intersections. The potential for this within the project area is examined later in this report.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by roadway lane closures.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [3] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the project site would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [4] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project boundaries could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the annual standard for nitrogen dioxide is not likely to be violated by short-term construction equipment emissions. Also, the new short-term (1-hour) standard for nitrogen dioxide is based on a three-year average; thus it is unlikely that relatively short-term construction emissions would exceed the standard. Carbon monoxide emissions from diesel engines are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Project construction activities will also likely obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area will temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

After construction is completed, use of the proposed roadway improvements by motor vehicle traffic could potentially cause long-term impacts on ambient air quality in the project area. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This legislation required further emission reductions, which have been phased in since 1994. More recently, additional restrictions were signed into law during the Clinton administration, and these began to take effect during the next decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways. It is estimated that carbon monoxide emissions, for example, will go down by an average of about 25 to 30 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To evaluate the potential long-term ambient air quality impact of motor vehicle traffic using the proposed new roadway facilities, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways within the project area. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single project.

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2010 with present conditions, (2) year 2022 without the project, and (3) year 2022 with the project. To begin the modeling study of the three scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. For this study, five of the key intersections identified in the traffic study were also selected for air quality analysis. These included the following intersections:

- Ala Moana Boulevard at Hobron Lane
- Ala Moana Boulevard at Kahanamoku Street
- Ala Moana Boulevard at Ena Road/Kalia Road
- Kalia Road at Rainbow Drive
- Kalia Road at Saratoga Road.

The traffic impact report for the project [5] describes the existing and projected future traffic conditions and laneage configurations of the study intersections in detail. In performing the air quality impact analysis, it was assumed that all recommended traffic mitigation measures would be implemented.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. Comparison of the estimated values to the national and state AAQS was also used to provide another measure of significance.

Maximum carbon monoxide concentrations typically coincide with peak traffic periods. The traffic impact assessment report evaluated morning and afternoon peak traffic periods. These same periods were evaluated in the air quality impact assessment.

The EPA computer model MOBILE6.2 [6] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE6.2 is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 35.4% light-duty gasoline-powered automobiles, 51.7% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.6% heavy-duty diesel-powered trucks and buses, and 0.5% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change slightly with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively.

These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and carbon monoxide emission estimates given by MOBILE6.2 generally have an inverse relationship to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE6.2, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [7] currently recommend that the computer model CAL3QHC [8] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [9] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model had become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Although CAL3QHC is intended primarily for use in assessing atmospheric dispersion near signalized roadway intersections, it can also be used to evaluate unsignalized intersections. This is accomplished by manually estimating queue lengths and then applying the same techniques used by the model for signalized intersections. Currently, all of the study intersections are signalized except for the intersection of Kalia Road and Saratoga Road. In the future with the project, in accordance with the traffic report, all of the study intersections were assumed to be signalized.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings (where applicable). All emission factors that were input to CAL3QHC for free-flow traffic on roadways were obtained from MOBILE6.2 based on assumed free-flow vehicle speeds corresponding to the posted or design speed limits.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway-mixing zone. The roadway-mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied for all three scenarios. This implies that pedestrian sidewalks either already exist or are assumed to exist in the future. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for the morning cases, while atmospheric stability category 4 was assumed for the afternoon cases. These are the most conservative stability categories that are generally used for estimating worst-case pollutant dispersion within urban areas for these periods. A surface roughness length of 100 cm and a mixing height of 1000 meters were used in all cases. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at low levels. Thus, background contributions of carbon monoxide from sources or roadways not directly considered in the analysis were accounted for by adding a background concentration of 1.0 ppm to all predicted concentrations for 2010. Although increased traffic is expected to occur within the project area within the next several years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 1.0 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 5 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for three scenarios: year 2010 with existing traffic, year 2022 without the project and year 2022 with the project. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration within the project vicinity for the present (2010) case was 5.6 ppm. This was projected to occur during the morning peak traffic hour near the intersection of Ala Moana Boulevard at Hobron Lane. Concentrations at other locations and times studied were 4.5 ppm or lower. Predicted worst-case 1-hour concentrations at all locations studied for the 2010 scenario were well within both the national AAQS of 35 ppm and the state standard of 9 ppm.

In the year 2022 without the proposed project, the highest worst-case 1-hour concentration was predicted to continue to occur during the morning at the intersection of Ala Moana Boulevard and Hobron Lane. A value of 3.9 ppm was predicted to occur at this location and time. Peak-hour worst-case values at the other locations and times studied for the 2022 without project scenario ranged between 1.7 and 3.5 ppm. Compared to the existing case, concentrations decreased (improved) at all locations, and worst-case concentrations remained well within the state and national standards.

Predicted 1-hour worst-case concentrations for the 2022 with project scenario remained about the same or increased only slightly at the study intersections. Similar to the 2022 without project case, the maximum concentration was predicted to occur during the morning peak hour at the intersection of Ala Moana Boulevard at Hobron Lane, increasing slightly compared to the without project scenario to a concentration of 4.2 ppm. Other concentrations ranged between 1.7 and 3.8 ppm. Worst-case concentrations at all locations studied remained well within the state and federal standards.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One study based on modeling [10] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [11] recommend using a value of 0.7 unless a locally derived persistence factor is available. Recent monitoring data for locations on Oahu reported by the Department of Health [12] suggest that this factor may range between about 0.2 and 0.6

depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 6. For the 2010 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the five locations studied ranged from 1.1 to 2.8 ppm, with the highest concentration occurring at the intersection of Ala Moana Boulevard and Hobron Lane. The estimated worst-case concentrations for the existing case were well within both the state standard of 4.4 ppm and the national limit of 9 ppm.

For the year 2022 without project scenario, worst-case concentrations ranged between 1.0 and 2.0 ppm, with the highest concentration occurring at the intersection of Ala Moana Boulevard and Hobron Lane. All predicted concentrations were within the standards.

For the 2022 with project scenario, worst-case concentrations remained unchanged or increased very slightly compared to the without project case, indicating minimal project impact. All predicted 8-hour concentrations for this scenario were well within both the national and the state AAQS.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The major potential short-term air quality impact of the project will occur from the emission of fugitive dust during construction. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the site that have been disturbed could be controlled by mulching or by the use of chemical soil stabilizers. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Establishment of landscaping early in the construction schedule will also help to control dust. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program and to adjust the program if necessary.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

After the proposed project is completed, any long-term impacts on air quality in the project area due to emissions from project-related motor vehicle traffic should be negligible. Worst-case concentrations of carbon monoxide should remain within both the state and the national ambient air quality standards. Implementing any air quality mitigation measures for long-term traffic-related impacts is probably unnecessary and unwarranted.

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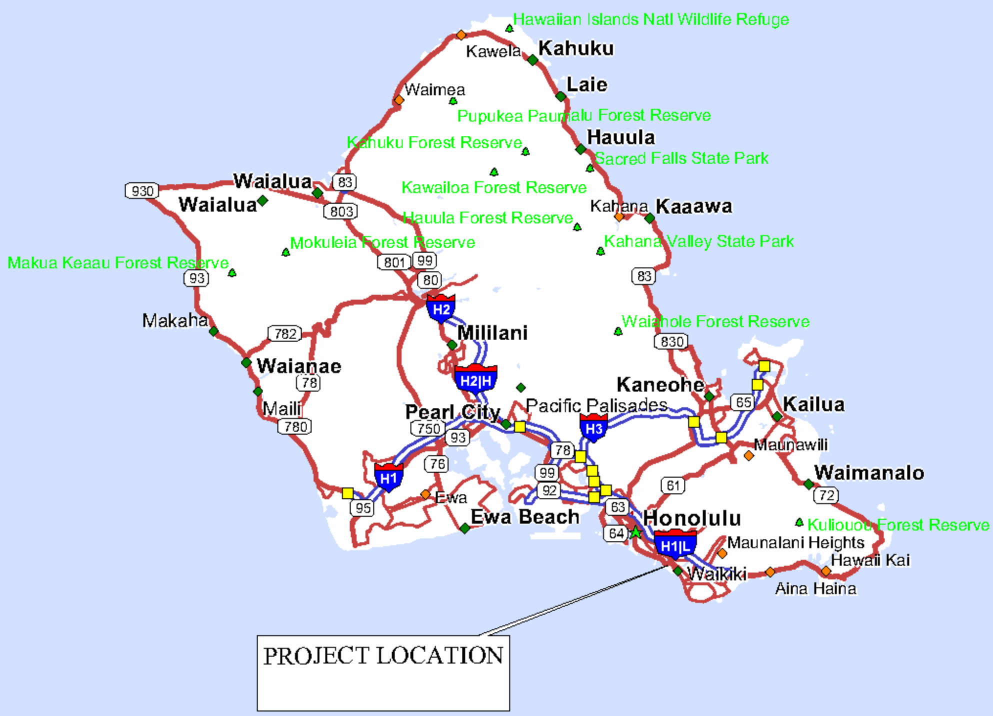
Figure 1 - Project Location



Mag 10.00
Wed Aug 11 09:02 2010
Scale 1:500,000 (at center)
10 Miles
10 KM

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Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual 24 Hours	- 150[a]	- 150[a]	50 150[b]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual 24 Hours	15[c] 35[d]	15[c] 35[d]	- -
Sulfur Dioxide	ppm	Annual 24 Hours 3 Hours 1 Hour	- - - 0.075[e]	- - 0.5[b] -	0.03 0.14[b] 0.5[b] -
Nitrogen Dioxide	ppm	Annual 1 Hour	0.053 0.100[d]	0.053 -	0.04 -
Carbon Monoxide	ppm	8 Hours 1 Hour	9[b] 35[b]	- -	4.4[b] 9[b]
Ozone	ppm	8 Hours	0.075[f]	0.075[f]	0.08[f]
Lead	$\mu g/m^3$	3 Months Quarter	0.15[g] 1.5[h]	0.15[g] 1.5[h]	- 1.5[h]
Hydrogen Sulfide	ppm	1 Hour	-	-	35[b]

[a] Not to be exceeded more than once per year on average over three years.
[b] Not to be exceeded more than once per year.
[c] Three-year average of the weighted annual arithmetic mean.
[d] 98th percentile value of the daily 1-hour maximum averaged over three years.
[e] Three-year average of annual fourth-highest daily 1-hour maximum.
[f] Three-year average of annual fourth-highest daily 8-hour maximum.
[g] Rolling 3-month average.
[h] Quarterly average.

Table 2

ANNUAL WIND FREQUENCY FOR HONOLULU INTERNATIONAL AIRPORT (%)

Wind Direction	Wind Speed (knots)									Total
	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	>40	
N	0.5	2.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	4.8
NNE	0.3	1.2	1.6	1.5	0.2	0.0	0.0	0.0	0.0	4.7
NE	0.3	2.1	6.1	11.0	3.2	0.3	0.0	0.0	0.0	23.0
ENE	0.2	2.5	10.9	16.6	4.1	0.3	0.0	0.0	0.0	34.7
E	0.1	1.0	2.5	2.8	0.5	0.0	0.0	0.0	0.0	7.0
ESE	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
SE	0.0	0.3	0.8	1.0	0.1	0.0	0.0	0.0	0.0	2.2
SSE	0.1	0.4	1.2	0.7	0.1	0.0	0.0	0.0	0.0	2.4
S	0.1	0.5	1.4	0.6	0.1	0.0	0.0	0.0	0.0	2.7
SSW	0.0	0.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0	1.5
SW	0.0	0.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	1.5
WSW	0.0	0.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	1.2
W	0.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1
WNW	0.2	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.0
NW	0.4	2.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	3.8
NNW	0.5	2.3	0.8	0.2	0.0	0.0	0.0	0.0	0.0	3.8
Calm	2.5									2.5
Total	5.4	18.3	30.6	36.5	8.5	0.7	0.0	0.0	0.0	100.0

Source: Climatography of the United States No. 90 (1965-1974), Airport Climatological Summary, Honolulu International Airport, Honolulu, Hawaii, U.S. Department of Commerce, National Climatic Center, Asheville, NC, August 1978.

Table 3

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF OAHU, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	25,891	49,374	75,265
Sulfur Oxides	39,230	nil	39,230
Nitrogen Oxides	92,436	31,141	123,577
Carbon Monoxide	28,757	121,802	150,559
Hydrocarbons	4,160	421	4,581

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 4

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST HILTON HAWAIIAN VILLAGE PROJECT

Parameter / Location	2004	2005	2006	2007	2008
Sulfur Dioxide / Downtown Honolulu					
3-Hour Averaging Period:					
No. of Samples	2889	1483	1138	2827	2876
Highest Concentration (ppm)	0.021	0.029	0.016	0.021	0.011
2^{nd} Highest Concentration (ppm)	0.018	0.022	0.014	0.018	0.011
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
No. of Samples	364	187	146	359	363
Highest Concentration (ppm)	0.010	0.009	0.005	0.007	0.004
2^{nd} Highest Concentration (ppm)	0.005	0.007	0.002	0.005	0.004
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (ppm)	0.001	0.001	0.001	0.001	0.001
Particulate (PM-10) / Downtown Honolulu					
24-Hour Averaging Period:					
No. of Samples	342	173	141	344	343
Highest Concentration ($\mu g/m^3$)	39	64	25	33	33
2^{nd} Highest Concentration ($\mu g/m^3$)	35	28	23	29	31
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	13	15	13	14	14
Carbon Monoxide / Downtown Honolulu					
1-Hour Averaging Period:					
No. of Samples	8673	4197	3612	8627	8732
Highest Concentration (ppm)	2.4	3.4	2.5	2.0	2.1
2^{nd} Highest Concentration (ppm)	2.4	2.7	1.7	1.6	1.8
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
No. of Samples	8684	4180	3610	8635	8735
Highest Concentration (ppm)	1.3	1.4	1.1	1.1	1.0
2^{nd} Highest Concentration (ppm)	1.3	1.4	1.0	1.0	1.0
No. of State AAQS Exceedances	0	0	0	0	0
Nitrogen Dioxide / Kapolei					
Annual Average Concentration (ppm)	0.005	0.005	0.005	0.005	0.004
Ozone / Sand Island					
8-Hour Averaging Period:					
No. of Samples	8474	8670	8591	357	305
Highest Concentration (ppm)	0.056	0.047	0.042	0.036	0.050
2^{nd} Highest Concentration (ppm)	0.055	0.047	0.042	0.035	0.048
4th Highest Concentration (ppm)	-	0.046	0.042	0.033	0.043
No. of State AAQS Exceedances	0	0	0	0	0

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2004 - 2008"

Table 5

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR HILTON HAWAIIAN VILLAGE PROJECT (parts per million)

Roadway Intersection	Year/Scenario					
	2010/Present		2022/Without Project		2022/With Project	
	AM	PM	AM	PM	AM	PM
Ala Moana Boulevard at Hobron Lane	5.6	4.5	3.9	3.2	4.2	3.2
Ala Moana Boulevard at Kahanamoku Street	3.6	2.8	2.6	2.0	2.8	2.1
Ala Moana Boulevard at Ena Road/Kalia Road	5.0	4.2	3.5	3.1	3.8	3.3
Kalia Road at Rainbow Drive	3.4	2.6	2.2	1.8	2.6	2.1
Kalia Road at Saratoga Road	2.2	2.0	1.9	1.7	1.9	1.7

Hawaii State AAQS: 9
National AAQS: 35

Table 6

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR HILTON HAWAIIAN VILLAGE PROJECT (parts per million)

Roadway Intersection	Year/Scenario		
	2010/Present	2022/Without Project	2022/With Project
Ala Moana Boulevard at Hobron Lane	2.8	2.0	2.1
Ala Moana Boulevard at Kahanamoku Street	1.8	1.3	1.4
Ala Moana Boulevard at Ena Road/Kalia Road	2.5	1.8	1.9
Kalia Road at Rainbow Drive	1.7	1.1	1.3
Kalia Road at Saratoga Road	1.1	1.0	1.0

Hawaii State AAQS: 4.4
National AAQS: 9

APPENDIX C

Existing Tree and Palm Inventory
Master Plan: Redevelopment Opportunity Proposal
Hilton Hawaiian Village Beach Resort & Spa

McCelvey & Associates

April 2010
Amended February 2011

Hilton Hawaiian Village
Existing Tree and Palm Inventory

Date April 2010

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
TREES					
T1	Monkey Pod	40'	60	4.5'	Specimen
T2	Monkey Pod	40'	30'	4.5'	Specimen
T3	Monkey Pod	40'	30'	5.5'	Specimen
T4	Monkey Pod	40'	30'	2'	Specimen
T5	Monkey Pod	30'	40'	1.8'	Specimen
T6	Monkey Pod	30'	30'	1.6'	Specimen
T7	Monkey Pod	30'	30'	1.8'	Specimen
T8	Monkey Pod	30'	30'	2'	Specimen
T9	Monkey Pod	40'	60'	2.5'	Specimen
T10	Monkey Pod	40'	40'	1.5'	Specimen
T11	Monkey Pod	40'	40'	1.5'	Specimen
T12	Monkey Pod	40'	50'	1.8'	Specimen
T13	Monkey Pod	25'	30'	2'	Specimen
T14	Monkey Pod	30'	20'	1.2'	Specimen
T15	Monkey Pod	25'	30'	1.5'	Specimen
T16	Ulu	30'	40'	1.2'	Specimen
T17	Ficus - Banyan	50'	80'	5'	Specimen
T18	Ficus - Banyan	30'	30'	2.5'	Pruned Heavily
T19	Sausage Tree	40'	50'	2'	Specimen
T20	Hong Kong Orchid Tree	25'	15'	1.3'	Pruned Heavily
T21	Hong Kong Orchid Tree	25'	15'	1.3'	Heavily Pruned
T22	Plumeria	25'	15'	1'	OK
T23	Plumeria	12'	10'	.3'	Spindly
T24	Plumeria	12'	10'	.3'	Spindly
T25	Plumeria Stump - No Tree	N/A	N/A	N/A	Stump-No Tree
T26	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T27	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T28	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T29	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T30	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T31	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T32	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T33	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T34	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T35	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T36	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T37	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T38	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T39	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T40	Ficus Spp. - Stump / No Tree	N/A	N/A	N/A	Stump-No Tree
T41	Plumeria	25'	15'	1.3'	OK
T42	Plumeria	25'	15'	1.3'	OK
T43	Plumeria	15'	15'	.5'	Leaning
T44	Kiawe	40'	60'	3'	Leaning
T45	Plumeria	8'	8'	.3'	Small
T46	Plumeria	15'	12'	.6'	Leaning
T47	Plumeria	12'	12'	1'	Leaning
T48	Plumeria	15'	15'	.8'	Leaning
T49	Plumeria	15'	15'	.8'	Leaning
T50	Plumeria	15'	15'	.8'	Leaning
T51	Plumeria	15'	15'	.8'	OK
T52	Plumeria	10'	10'	.5'	Spindly
T53	Ficus Spp.	30'	30'	1.5'	
T54	Schefflera	25'	15'	1.3'	Invasive
T55	Schefflera	25'	15'	1.3'	Invasive
T56	Schefflera	25'	15'	1.3'	Invasive
T57	Schefflera	25'	15'	1.3'	Invasive
T58	Schefflera	25'	15'	1.3'	Invasive
T59	Schefflera	25'	15'	1.3'	Invasive
T60	Schefflera	25'	15'	1.3'	Invasive
T61	Fiddle Leaf Fig	40'	25'	2'	
T62	Coral Tree	20'	15'	2'	Heavily Pruned
T63	Coral Tree	20'	15'	2'	Poor Shape
T64	Coral Tree	25'	25'	1.5'	OK
T65	Madagascar Olive	25'	20'	1.3'	OK
T66	Madagascar Olive	25'	20'	1.3'	OK
T67	Madagascar Olive	25'	20'	1.3'	OK
T68	Madagascar Olive	25'	20'	1.3'	OK
T69	Madagascar Olive	25'	20'	1.3'	OK
T70	Ficus celebensis	12'	10'	.5'	Heavily Pruned
T71	Breadfruit / Ulu	30'	20'	1'	OK
T72	Hala Tree (Removed)	N/A	N/A	N/A	No Tree
T73	Hala Tree	25'	20'	.8'	Not Specimen
T74	Shower Tree	40'	35'	1.8'	OK
T75	Shower Tree	40'	40'	2'	OK
T76	Plumeria	10'	10'	.5'	OK
T77	Monkey Pod Tree	40'	60'	3'	Specimen
T78	Fern Tern	30'	20'	.8'	Not Specimen
T79	Travelers Tree	20'	25'	1'	Not Specimen
T80	Travelers Tree	20'	25'	1'	Not Specimen
T81	Plumeria	12'	8'	.5'	Heavily Pruned
T82	Plumeria	12'	8'	.5'	Heavily Pruned
T83	Plumeria	12'	8'	.5'	Heavily Pruned
T84	Plumeria	12'	8'	.5'	Heavily Pruned
T85	Plumeria	12'	8'	.5'	Heavily Pruned
T86	Plumeria	12'	8'	.5'	Heavily Pruned
T87	Plumeria	12'	8'	.5'	Heavily Pruned
T88	Plumeria	12'	8'	.5'	Heavily Pruned
T89	Plumeria	12'	8'	.5'	Heavily Pruned
T90	Travelers Tree	20'	25'	1'	Not Specimen
T91	Travelers Tree	20'	25'	1'	Not Specimen
T92	Plumeria	15'	12'	.6'	Pruned
T93	Plumeria	15'	12'	.6'	Heavily Pruned
T94	Plumeria	15'	12'	.6'	Heavily Pruned
T95	Plumeria	15'	12'	.6'	Heavily Pruned
T96	Plumeria	15'	12'	.6'	Heavily Pruned
T97	Plumeria	15'	12'	.6'	Heavily Pruned
T98	Plumeria	15'	12	.7'	Not Specimen
T99	Plumeria	15'	15'	.6'	OK
T100	Plumeria	12'	12'	.6'	OK
T101	Plumeria	10'	10'	.5'	Not Specimen
T102	Plumeria	15'	15'	.6'	Pruned
T103	Plumeria	10'	10'	.5'	Pruned
T104	Plumeria	12'	12'	.5'	Pruned
T105	Plumeria	12'	12'	.5'	Pruned
T106	Monkey Pod	40'	50'	3'	Specimen
T107	Monkey Pod	40'	60'	3'	Specimen
T108	Plumeria	20'	20'	1.2'	Not Specimen
T109	Monkey Pod	40'	50'	2'	Specimen
T110	Ficus	50'	60'	3.5'	Specimen
T111	Plumeria	20'	20'	1.2'	OK
T112	Banyan Tree / Ficus	40'	40'	3.5'	Not Specimen
T113	Ficus / Banyan	15'	10'	.7'	Heavily Pruned
T114	Dracaena	20'	5'	.4'	Not Specimen
T115	Dracaena	20'	5'	.4'	Not Specimen
T116	Dracaena	20'	5'	.4'	Not Specimen
T117	Dracaena	20'	5'	.4'	Not Specimen
T118	Dracaena	20'	5'	.4'	Not Specimen
T119	Dracaena	20'	5'	.4'	Not Specimen
T120	Dracaena	20'	5'	.4'	Not Specimen
T121	Hala	20'	12'	.75'	Not Specimen
T122	Hala	15'	15'	.7'	Not Specimen
T123	Banyan / Ficus	60'	60'	4.5'	Specimen
T124	Monkey Pod	40'	60'	2.5'	Pruned
T125	Hala	20'	15'	.6'	Not Specimen
T126	Hala	20'	15'	.6'	Not Specimen
T127	Hala	20'	15'	.6'	Not Specimen
T128	Plumeria	15'	15'	.8'	Not Specimen
T129	Plumeria	15'	15'	.8'	Not Specimen
T130	Hulu Tree	40'	70'	3.5'	Specimen
T131	Ficus / Banyan	40'	60'	5'	Specimen
T132	Beach Heliotrope	10'	10'	1'	Pruned / OK / Native
T133	Beach Heliotrope	10'	10'	.6'	Pruned / OK / Native
T134	Autograph Tree	12'	12'	.6'	Pruned / OK
T135	Autograph Tree	12'	12'	.6'	Pruned
T136	Autograph Tree	12'	12'	.6'	Pruned
T137	Autograph Tree	12'	12'	.6'	Pruned
T138	Autograph Tree	12'	12'	.6'	Pruned
T139	Hau Tree	15'	25'	1.5'	OK
T140	Autograph Tree	12'	10'	.8'	Pruned
T141	Autograph Tree	10'	10'	.6'	Pruned
T142	Autograph Tree	12'	10'	.8'	Pruned
T143	Traveler's Palm Cluster	25'	15'	1.5'	Not Specimen
T144	Unknown - Stump	N/A	N/A	N/A	Stump - No Tree
T145	Unknown - Stump	N/A	N/A	N/A	Stump - No Tree
T146	Unknown - Stump	N/A	N/A	N/A	Stump - No Tree
T147	Hala - Removed	N/A	N/A	N/A	No Tree
T148	Hala - Removed	N/A	N/A	N/A	No Tree
T149	Hala - Removed	N/A	N/A	N/A	No Tree
T150	Hala	6'	8'	1'	Native / Small
T151	Hala	6'	8'	1'	Native / Small
T152	Hala	6'	8'	1'	Native / Small
T153	Hala	6'	8'	1'	Native / Small
T154	Hau Tree - Removed	N/A	N/A	N/A	No Tree
T155	Autograph Tree - Removed	N/A	N/A	N/A	No Tree
T156	Beach Heliotrope	10'	8'	.8'	Leaning

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
T157	Autograph Tree	10'	10'	.6'	Heavily Pruned
T158	Beach Heliotrope	15'	12'	.8'	Native / OK
T159	Beach Heliotrope	20'	15'	1'	Native / OK
T160	Beach Heliotrope	15'	12'	.8'	Pruned
T161	Beach Heliotrope	20'	15'	1'	Native / OK
T162	Autograph Tree	10'	10'	.5'	Pruned
T163	Autograph Tree	10'	10'	.5'	Pruned
T164	Autograph Tree	10'	10'	.5'	Pruned
T165	Autograph Tree	12'	8'	.4'	Pruned
T166	Autograph Tree	12'	8'	.4'	Pruned
T167	Autograph Tree	12'	8'	.4'	Pruned
T168	Madagascar Olive	15'	8'	.8'	Not Specimen
T169	Madagascar Olive	15'	8'	.8'	Not Specimen
T170	Madagascar Olive	15'	10'	.6'	Not Specimen
T171	Madagascar Olive	15'	10'	.6'	Not Specimen
T172	Madagascar Olive	15'	10'	.6'	Not Specimen
T173	Madagascar Olive	15'	10'	.6'	Not Specimen
T174	Madagascar Olive	15'	10'	.6'	Not Specimen
T175	Norfolk Island Pine	70'	15'	2'	Not Specimen
T176	Plumeria	15'	15'	.6'	OK
T177	Hala	15'	8'	.6'	Not Specimen
T178	Schefflera	20'	10'	.6'	Heavily Pruned
T179	Schefflera	5'	3'	.1'	Small
T180	Not assigned				
T181	Plumeria	15'	10'	.6'	Heavily pruned
T182	Plumeria	15'	10'	.6'	Heavily pruned
T183	Monkeypod	30'	40'	2.5'	Not Specimen
T184	Hala	10'	8'	.5'	Not Specimen
T185	Tree Removed	N/A	N/A	N/A	No Tree
T186	Tree Removed	N/A	N/A	N/A	No Tree
T187	Tree Removed	N/A	N/A	N/A	No Tree
T188	Hala	6'	5'	.4'	Small
T189	Hala	6'	5'	.4'	Small
T190	Plumeria	15'	15'	.8'	Not Specimen
T191	Plumeria	15'	8'	.6'	Heavily Pruned
T192	Kukui	25'	20'	.8'	Not Specimen
T193	Hala	6'	5'	.4'	Small
T194	Hala	10'	8'	.6'	OK
T195	Hala	20'	10'	.5'	Not Specimen
T196	Hala	20'	10'	.5'	Not Specimen
T197	Hala	20'	10'	.5'	Not Specimen
T198	Kukui	25'	20'	.8'	Not Specimen
T199	Yellow Plumeria	20'	15'	.6'	OK
T200	Yellow Plumeria	20'	15'	.6'	OK
T201	Yellow Plumeria	10'	8'	.4'	Spindly
T202	Hala	20'	12'	.8'	Not Specimen
T203	Hala	15'	15'	.6'	Not Specimen
T204	Monkeypod	30'	40'	2'	OK
T205	Monkeypod	30'	30'	1.5'	Not Specimen
T206	Ficus	25'	30'	4'	OK
T207	Hala	15'	12'	.6'	Not Specimen
T208	Plumeria	15'	15'	.6'	Not Specimen

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
T209	Plumeria	15'	15'	.6'	Not Specimen
T210	Plumeria	15'	15'	.6'	Not Specimen
T211	Plumeria	10'	6'	.6'	Heavily Pruned
T212	Plumeria	10'	6'	.6'	Heavily Pruned
T213	Plumeria	10'	6'	.6'	Heavily Pruned
T214	Plumeria	10'	6'	.6'	Heavily Pruned
T215	Not Assigned				
T216	Not Assigned				
T217	Not Assigned				
T218	Not Assigned				
T219	Not Assigned				
T220	Not Assigned				
T221	Not Assigned				
T222	Not Assigned				
T223	Not Assigned				
T224	Not Assigned				
T225	Not Assigned				
T226	False Kamani	20'	30'	1'	OK
T227	False Kamani	6'	6'	.3'	Small
T228	False Kamani	25'	25'	1'	OK
T229	False Kamani	20'	25'	1'	OK
T230	Milo	20'	20'	.8'	OK
T231	Monkeypod	25'	25'	1.5'	OK
T232	Milo	20'	20'	1.2'	OK
T233	Monkeypod	25'	25'	1.5'	OK
T234	Beach Heliotrope	8'	6'	.5'	Spindly
T235	Beach Heliotrope	8'	6'	.5'	Spindly
T236	Beach Heliotrope	8'	6'	.5'	Spindly
T237	Plumeria	10'	10'	.6'	Not Specimen
T238	Plumeria	8'	8'	.4'	Not Specimen
T239	Plumeria	15'	12'	.6'	Heavily Pruned
T240	Plumeria	15'	12'	.6'	Heavily Pruned
T241	Plumeria	15'	12'	.6'	Heavily Pruned
T242	Plumeria	15'	12'	.6'	Heavily Pruned
T243	Ficus	30'	50'	5'	Specimen
T244	Ficus	30'	50'	4.5'	Specimen
T245	Ficus	20'	10'	2.5'	Not Specimen
T246	Ficus	15'	8'	1'	Not Specimen
T247	Plumeria	20'	12'	1.5'	OK
T248	Dwarf Hau	10'	8'	.6'	Not Specimen
T249	Dwarf Hau	10'	8'	.6'	Not Specimen
T250	Plumeria	8'	10'	.5'	Not Specimen
T251	Plumeria	8'	10'	.5'	Not Specimen
T252	Plumeria	8'	10'	.5'	Not Specimen
T253	Plumeria	8'	10'	.5'	Not Specimen
T254	Plumeria	15'	10'	.6'	Heavily Pruned
T255	Plumeria	15'	10'	.6'	Heavily Pruned
T256	Plumeria	15'	10'	.6'	Heavily Pruned
T257	Schefflera	25'	15'	1.5'	Heavily Pruned
T258	Schefflera	25'	15'	1.5'	Heavily Pruned
T259	Schefflera	25'	15'	1.5'	Heavily Pruned
T260	Schefflera	25'	15'	1.5'	Heavily Pruned
T261	Schefflera	20'	10'	0.6	Heavily Pruned
T262	Schefflera	5'	3'	0.1	Small

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
PALMS					
P1	Coconut	40'	25'	1.7'	OK
P2	Coconut	40'	25'	1.2'	OK
P3	Coconut	40'	25'	1.2'	OK
P4	Pritchardia Spp.	15'	10'	1'	OK
P5	Coconut	40'	25'	1.2'	OK
P6	Pritchardia Spp.	20'	10'	1'	OK
P7	Pritchardia Spp.	20'	10'	1'	OK
P8	Coconut	40'	25'	1.2'	OK
P9	Pritchardia Spp.	25'	15'	1'	OK
P10	Coconut	30'	25'	1'	OK
P11	Coconut	40'	20'	1.7'	OK
P12	Coconut	40'	20'	1.7'	OK
P13	Coconut	40'	20'	1.7'	OK
P14	Coconut	40'	20'	1.7'	OK
P15	Coconut	30'	20'	1.3'	OK
P16	Coconut	30'	20'	1.3'	OK
P17	Coconut	30'	20'	1.3'	OK
P18	Coconut	30'	20'	1.3'	OK
P19	Coconut	30'	20'	1.3'	OK
P20	Coconut	30'	20'	1.0'	OK
P21	Coconut	30'	20'	1'	OK
P22	Coconut	30'	20'	1'	OK
P23	Coconut	30'	20'	1.2'	OK
P24	Coconut	30'	20'	1.2'	OK
P25	Coconut	60'	25'	1.2'	Not Specimen
P26	Coconut	60'	25'	1.2'	Not Specimen
P27	Coconut	40'	20'	1.2'	Double Kink in Trunk
P28	Coconut	40'	25'	1.2'	OK
P29	Coconut	35'	20'	1.2'	OK
P30	Coconut	45'	25'	1.3'	OK
P31	Coconut	45'	20'	1.2'	Spindly
P32	Coconut	60'	20'	1.2'	Bent Trunk
P33	Coconut	35'	20'	1.2'	OK
P34	Coconut	15'	20'	1.2'	OK
P35	Coconut	35'	20'	1.2'	OK
P36	Coconut	60'	25'	1.2'	OK
P37	Coconut	60'	25'	1.2'	OK
P38	Pritchardia Spp.	15'	10'	1'	OK
P39	Manila Palm	20'	15'	.8'	OK
P40	Manila Palm	20'	15'	.8'	OK
P41	Manila Palm	20'	15'	.8'	OK
P42	Manila Palm	20'	15'	.8'	OK
P43	Manila Palm	20'	15'	.7'	OK
P44	Manila Palm	20'	15'	.7'	OK
P45	Manila Palm	20'	15'	.7'	OK
P46	Manila Palm	20'	15'	.7'	OK
P47	Manila Palm	20'	12'	.7'	OK
P48	Manila Palm	20'	10'	.7'	OK
P49	Manila Palm	20'	15'	.7'	OK
P50	Manila Palm	20'	15'	.7'	OK
P51	Manila Palm	20'	15'	.7'	OK
P52	Manila Palm	20'	15'	.7'	OK
P53	Manila Palm	20'	15'	.7'	OK
P54	Pritchardia Spp.	25'	12'	.7'	OK

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P55	Pritchardia Spp.	25'	12'	.7'	OK
P56	Manila Palm	20'	15'	.7'	OK
P57	Manila Palm	20'	15'	.7'	OK
P58	Manila Palm	20'	15'	.7'	OK
P59	Pritchardia Spp.	25'	12'	.6'	OK
P60	Pritchardia Spp.	25'	12'	.6'	OK
P61	Pritchardia Spp.	25'	12'	.6'	OK
P62	Coconut	40'	25'	1.5'	OK
P63	Coconut	45'	30'	1.5'	OK
P64	Manila Palm	20'	15'	.7'	OK
P65	Manila Palm	20'	15'	.7'	OK
P66	Manila Palm	20'	15'	.7'	OK
P67	Manila Palm	20'	15'	.7'	OK
P68	Coconut	40'	25'	1.2'	OK
P69	Manila Palm	20'	15'	.7'	OK
P70	Manila Palm	20'	15'	.7'	OK
P71	Manila Palm - Removed	N/A	N/A	N/A	No Palm
P72	Manila Palm	20'	15'	.7'	OK
P73	Manila Palm	20'	15'	.7'	OK
P74	Manila Palm	20'	15'	.7'	OK
P75	Manila Palm	20'	15'	.7'	OK
P76	Coconut	40'	25'	1.2'	OK
P77	Pritchardia Spp.	30'	12'	.8'	OK
P78	Pritchardia Spp.	30'	12'	.8'	OK
P79	Pritchardia Spp.	30'	12'	.8'	OK
P80	Pritchardia Spp.	30'	12'	.8'	OK
P81	Pritchardia Spp.	30'	12'	.8'	OK
P82	Pritchardia Spp.	30'	12'	.8'	OK
P83	Coconut	40'	25'	1.2'	OK
P84	Coconut	60'	25'	1.3'	OK
P85	Coconut	50'	25'	1.2'	OK
P86	Manila Palm	25'	15'	.6'	OK
P87	Manila Palm	25'	15'	.6'	OK
P88	Manila Palm	25'	15'	.6'	OK
P89	Manila Palm	25'	15'	.6'	Bent Trunk
P90	Manila Palm	25'	15'	.6'	OK
P91	Manila Palm	25'	15'	.6'	OK
P92	Coconut	35'	15'	1'	Bent Trunk
P93	Coconut	60'	20'	1.5'	Spindly / Bent Trunk
P94	Coconut	40'	20'	1.5'	Spindly / Bent Trunk
P95	Coconut	40'	20'	1.5'	OK
P96	Coconut	50'	25'	1.2'	OK
P97	Coconut	50'	25'	1.2'	OK
P98	Coconut	45'	25'	1.2'	OK
P99	Pritchardia Spp.	20'	12'	.8'	OK
P100	Pritchardia Spp.	20'	12'	.8'	OK
P101	Coconut	50'	20'	1'	OK
P102	Pritchardia Spp.	20'	12'	.8'	OK
P103	Pritchardia Spp.	20'	12'	.8'	OK
P104	Coconut	20'	20'	1'	OK
P105	Pygmy Date Palm	5'	4'	.4'	Not Specimen
P106	Pygmy Date Palm	5'	4'	.4'	Not Specimen
P107	Pygmy Date Palm	5'	4'	.4'	Not Specimen
P108	Pygmy Date Palm	5'	4'	.4'	Not Specimen
P109	Pygmy Date Palm	5'	4'	.4'	Not Specimen

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P110	Pygmy Date Palm	5'	4'	.4'	Not Specimen
P111	Pygmy Date Palm	5'	4'	.4'	Not Specimen
P112	Manila Palm	10'	8'	.6'	Not Specimen
P113	Coconut	50'	20'	1.3'	Not Specimen
P114	Coconut	50'	25'	1.2'	OK
P115	Manila Palm	15'	12'	.6'	Not Specimen
P116	Manila Palm	15'	12'	.6'	Not Specimen
P117	Coconut	40'	15'	1.3'	Not Specimen
P118	Coconut	40'	15'	1'	Not Specimen
P119	Manila Palm	15'	12'	.6'	Not Specimen
P120	Manila Palm	15'	12'	.6'	Not Specimen
P121	Manila Palm	15'	12'	.6'	Not Specimen
P122	Coconut	40'	20'	1.2'	Bent Trunk
P123	Manila Palm	15'	12'	.6'	Not Specimen
P124	Coconut	30'	15'	1.1'	Not Specimen
P125	Coconut	50'	15'	1.3'	Leaning
P126	Coconut	30'	15'	1.2'	Not Specimen
P127	Coconut	20'	15'	1.2'	Not Specimen
P128	Manila Palm	15'	12'	.6'	Not Specimen
P129	Manila Palm	15'	12'	.6'	Not Specimen
P130	Manila Palm	15'	12'	.6'	Not Specimen
P131	Manila Palm	15'	12'	.6'	Not Specimen
P132	Coconut	50'	15'	1.2'	Spindly
P133	Manila Palm	15'	10'	.7'	Not Specimen
P134	Manila Palm	15'	12'	.6'	Not Specimen
P135	Manila Palm	20'	12'	.7'	Not Specimen
P136	Manila Palm	20'	10'	.7'	OK
P137	Coconut	40'	20'	1.3'	Spiked trunk
P138	Manila Palm	20'	10'	.7'	OK
P139	Manila Palm	20'	10'	.7'	OK
P140	Coconut	40'	20'	1.5'	Bent Trunk
P141	Coconut	40'	20'	1.5'	Not Specimen
P142	Manila Palm	15'	12'	.6'	Not Specimen
P143	Coconut	30'	20'	1.4'	OK
P144	Coconut	30'	20'	1'	Double Trunk
P145	Coconut	40'	20'	1.5'	OK
P146	Coconut	30'	20'	1.6'	Bent Trunk
P147	Coconut	40'	20'	1.5'	Not Specimen
P148	Coconut	30'	20'	1.2'	Not Specimen
P149	Coconut	N/A	N/A	N/A	No Palm
P150	Coconut	30'	20'	1.2'	Bent Trunk
P151	Coconut	30'	20'	1.4'	Bent Trunk
P152	Coconut	30'	20'	1.5'	OK
P153	Coconut	30'	25'	1.2'	OK
P154	Coconut	30'	20'	1.2'	OK
P155	Coconut	40'	25'	1.6'	Bent Trunk
P156	Pritchardia Spp.	20'	15'	.8'	OK
P157	Pritchardia Spp.	20'	15'	.8'	OK
P158	Pritchardia Spp.	20'	15'	.8'	OK
P159	Pritchardia Spp.	25'	15'	.8'	OK
P160	Pritchardia Spp.	20'	15'	.8'	Ok
P161	Pritchardia Spp.	20'	15'	.8'	OK
P162	Pritchardia Spp.	25'	15'	.8'	OK
P163	Coconut	25'	20'	1.3'	OK
P164	Coconut	35'	20'	1.5'	Bent Trunk

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P165	Coconut	30'	25'	1.6'	Bent Trunk
P166	Coconut	30'	25'	1.2'	Not Specimen
P167	Pritchardia Spp.	8'	8'	.8'	Not Specimen
P168	Pritchardia Spp.	12'	15'	.8'	Not Specimen
P169	Coconut	15'	12'	.9'	Not Specimen
P170	Coconut	25'	20'	.8'	Not Specimen
P171	Coconut	25'	20'	1'	Not Specimen
P172	Coconut	40'	25'	1.2'	Bent Trunk
P173	Pritchardia Spp.	12'	15'	.8'	Not Specimen
P174	Coconut	30'	20'	1.2'	Not Specimen
P175	Coconut	50'	25'	1.5'	OK
P176	Bottle Palm	8'	5'	1.5'	Not Specimen
P177	Bottle Palm	8'	5'	1.5'	Not Specimen
P178	Bottle Palm	8'	5'	1.5'	Not Specimen
P179	Coconut	50'	25'	1.2'	OK
P180	Bottle Palm	8'	5'	1.5'	Not Specimen
P181	Bottle Palm	8'	5'	1.5'	Not Specimen
P182	Coconut	50'	25'	1.2'	Spiked trunk
P183	Coconut	50'	25'	1.2'	Spiked trunk
P184	Coconut	50'	25'	1.2'	Spiked trunk
P185	Coconut	50'	25'	1.2'	Spiked trunk
P186	Coconut	50'	25'	1.2'	Spiked trunk
P187	Coconut	30'	25'	1.2'	Spiked trunk
P188	Coconut	30'	25'	1.2'	Spiked trunk
P189	Coconut	20'	25'	1.2'	Spiked trunk
P190	Coconut	50'	25'	2'	Spiked trunk
P191	Coconut	35'	25'	1.2'	Spiked trunk
P192	Coconut	40'	25'	1.5'	Spiked trunk
P193	Coconut	40'	25'	1.5'	Spiked trunk
P194	Coconut	40'	25'	1.5'	Spiked trunk
P195	Coconut	30'	25'	1.2'	Spiked trunk
P196	Coconut	40'	25'	1.5'	Spiked trunk
P197	Coconut	30'	25'	1.5'	Spiked trunk
P198	Coconut	40'	25'	1.2'	Spiked trunk
P199	Coconut	40'	25'	1.2'	Spiked trunk
P200	Coconut	30'	20'	1.5'	Spiked trunk
P201	Coconut	30'	25'	1.5'	Bent Trunk
P202	Coconut	50'	25'	1.2'	OK
P203	Blue Latan Palm	12'	15'	.8'	OK
P204	Coconut	30'	25'	1.2'	Bent Trunk
P205	Coconut - Removed	N/A	N/A	N/A	Tall Stump / No Palm
P206	Coconut	25'	20'	1'	OK
P207	Coconut	25'	20'	1'	OK
P208	Coconut	50'	25'	1.2'	Spiked trunk
P209	Coconut	50'	25'	1.2'	Spiked trunk
P210	Coconut	50'	25'	1.2'	Spiked trunk
P211	Coconut	50'	25'	1.2'	Spiked trunk
P212	Coconut	30'	25'	1.2'	Bent Trunk
P213	Coconut	25'	15'	1.2'	Bent Trunk
P214	Coconut	25'	15'	1.2'	Bent Trunk
P215	Coconut	50'	25'	1.5'	Spiked trunk
P216	Coconut - Removed	N/A	N/A	N/A	No Palm
P217	Coconut	30'	20'	1.6'	OK
P218	Bottle Palm	8'	5'	1.5'	Not Specimen
P219	Bottle Palm	8'	5'	1.5'	Not Specimen

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P220	Bottle Palm	8'	5'	1.5'	Not Specimen
P221	Bottle Palm	8'	5'	1.5'	Not Specimen
P222	Coconut	30'	15'	1'	Not Specimen
P223	Coconut	30'	15'	1'	Not Specimen
P224	Coconut	30'	20'	1.5'	OK
P225	Coconut	30'	20'	1'	OK
P226	Coconut	30'	15'	1.4'	Not Specimen
P227	Coconut	30'	20'	1.3'	OK
P228	Coconut	35'	20'	1.2'	OK
P229	Coconut	35'	25'	1.5'	OK
P230	Coconut	35'	25'	1.4'	OK
P231	Coconut	35'	20'	1.2'	OK
P232	Coconut	30'	20'	1.2'	OK
P233	Coconut	20'	15'	1'	Not Specimen
P234	Coconut	25'	15'	.9'	Spindly
P235	Coconut	20'	15'	1'	Spindly
P236	Coconut	35'	15'	1.4'	Not Specimen
P237	Coconut Palm	35'	15'	1.4'	Not Specimen
P238	Coconut Palm	35'	20'	1.6'	OK
P239	Coconut Palm	25'	15'	.8'	Thin Trunk
P240	Coconut Palm	40'	20'	1.5'	Not Specimen
P241	Coconut Palm	35'	20'	1.6'	OK
P242	Coconut Palm	30'	20'	1.4'	OK
P243	Coconut Palm	35'	20'	1.6'	OK
P244	Coconut Palm	30'	20'	1.1'	OK
P245	Coconut Palm	30'	20'	.9'	Spindly
P246	Coconut Palm	30'	20'	1'	Spindly
P247	Coconut Palm	25'	20'	.8'	Spindly
P248	Coconut - Removed	N/A	N/A	N/A	No Palm
P249	Coconut	25'	20'	.8'	Not Specimen
P250	Coconut	20'	20'	1.8'	OK
P251	Coconut	25'	12'	1'	Spindly
P252	Coconut	25'	20'	1.5'	OK
P253	Coconut	25'	20'	1.3'	Not Specimen
P254	Coconut	25'	25'	1.6'	OK
P255	Coconut	25'	15'	1.8'	Not Specimen
P256	Coconut	20'	15'	1.2'	Not Specimen
P257	Coconut	20'	15'	1.1'	Thin Trunk
P258	Coconut	25'	15'	1.1'	Spindly
P259	Coconut	30'	15'	1.3'	Spindly
P260	Coconut	30'	15'	1.3'	Not Specimen
P261	Coconut	30'	15'	1.3'	Not Specimen
P262	Coconut	30'	20'	1.2'	OK
P263	Coconut	30'	20'	1.3'	OK
P264	Coconut	15'	15'	1.3'	Not Specimen
P265	Coconut	30'	20'	1.3'	OK
P266	Coconut	60'	15'	1.7'	Not Specimen
P267	Coconut	30'	20'	1.3'	OK
P268	Coconut	25'	20'	1.3'	OK

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P269	Coconut	20'	20'	1.5'	OK
P270	Coconut	50'	20'	1.3'	Spiked trunk
P271	Coconut	60'	20'	1.6'	Spiked trunk
P272	Coconut	30'	20'	1'	OK
P273	Coconut	25'	20'	1'	OK
P274	Coconut	25'	15'	1'	Hole in Trunk
P275	Coconut	40'	25'	1'	OK
P276	Macarthur Palm	20'	10'	.3'	Not Specimen
P277	Licuala Palm	5'	6'	.4'	OK
P278	Licuala Palm	5'	6'	.4'	OK
P279	Licuala Palm	5'	6'	.4'	OK
P280	Licuala Palm	5'	6'	.4'	OK
P281	Licuala Palm	5'	6'	.4'	OK
P282	Coconut	40'	20'	1.1'	OK
P283	Coconut	40'	25'	1.5'	OK
P284	Coconut	40'	25'	1.5'	OK
P285	Manila Palm	20'	12'	.6'	Not Specimen
P286	Manila Palm	20'	12'	.6'	Not Specimen
P287	Manila Palm	20'	12'	.6'	Not Specimen
P288	Coconut	30'	80'	1.2'	OK
P289	Coconut	40'	25'	1.5'	OK
P290	Coconut	35'	20'	1.2'	Not Specimen
P291	Coconut	30'	20'	1.2'	Not Specimen
P292	Manila Palm	25'	20'	.6'	Not Specimen
P293	Manila Palm	25'	12'	.6'	Not Specimen
P294	Manila Palm	3'	5'	.3'	Small
P295	Manila Palm	3'	5'	.3'	Small
P296	Manila Palm	3'	5'	.3'	Small
P297	Manila Palm	3'	5'	.3'	Small
P298	Manila Palm	3'	5'	.3'	Small
P299	Manila Palm	3'	5'	.3'	Small
P300	Manila Palm	3'	5'	.3'	Small
P301	Manila Palm	3'	5'	.3'	Small
P302	Manila Palm	3'	5'	.3'	Small
P303	Coconut	25'	25'	1'	OK
P304	Pritchardia Spp.	20'	12'	.6'	OK
P305	Coconut	30'	20'	1.2'	OK
P306	Coconut	30'	20'	1.2'	OK
P307	Pritchardia Spp.	20'	12'	.6'	OK
P308	Pritchardia Spp.	25'	12'	.6'	OK
P309	Areca Palm Cluster	10'	MASS	N/A	Not Specimen
P310	Coconut	30'	20'	1'	OK
P311	Coconut	30'	20'	1'	OK
P312	Coconut	50'	25'	1.2'	Spiked trunk
P313	Coconut	40'	25'	1.2'	OK
P314	Coconut	15'	20'	1.2'	Not Specimen
P315	Coconut	15'	20'	1.2'	Not Specimen
P316	Coconut	35'	20'	1.5'	OK
P317	Coconut	30'	20'	1.5'	OK
P318	Coconut	40'	20'	1.5'	OK
P319	Coconut	30'	25'	1.5'	OK
P320	Coconut	30'	25'	1.5'	OK
P321	Coconut	25'	20'	1.5'	OK
P322	Coconut	30'	25'	1.5'	OK

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P323	Macarthur Palm	25'	8'	.5'	Not Specimen
P324	Macarthur Palm	25'	8'	.5'	Not Specimen
P325	Coconut	40'	25'	1.5'	OK
P326	Coconut	40'	25'	1.5'	OK
P327	Manila Palm	12'	8'	.5'	Not Specimen
P328	Manila Palm	12'	8'	.5'	Not Specimen
P329	Manila Palm	12'	8'	.5'	Not Specimen
P330	Manila Palm	12'	8'	.5'	Not Specimen
P331	Manila Palm	12'	8'	.5'	Not Specimen
P332	Manila Palm	12'	8'	.5'	Not Specimen
P333	Coconut	40'	25'	1.7'	OK
P334	Macarthur Palm	30'	10'	.5'	Not Specimen
P335	Macarthur Palm	30'	10'	.5'	Not Specimen
P336	Macarthur Palm	30'	10'	.5'	Not Specimen
P337	Macarthur Palm	30'	10'	.5'	Not Specimen
P338	Macarthur Palm	30'	10'	.5'	Not Specimen
P339	Coconut	40'	25'	1.5'	OK
P340	Manila Palm	25'	12'	.6'	OK
P341	Manila Palm	25'	12'	.6'	OK
P342	Manila Palm	25'	12'	.6'	OK
P343	Manila Palm	25'	12'	.6'	OK
P344	Manila Palm	25'	12'	.6'	Bent Trunk
P345	Manila Palm	25'	12'	.6'	OK
P346	Manila Palm	15'	10'	.5'	OK
P347	Manila Palm	15'	10'	.5'	Bent Trunk
P348	Manila Palm	15'	10'	.5'	OK
P349	Areca Palm	8'	6'	.5'	Not Specimen
P350	Areca Palm	8'	6'	.5'	Not Specimen
P351	Coconut	30'	20'	1.2'	OK
P352	Coconut	60'	25'	1.5'	Spiked trunk
P353	Coconut	50'	25'	1.5'	Bent Trunk
P354	Coconut	50'	25'	1.5'	Spiked trunk
P355	Coconut	50'	20'	1.2'	Thin, Bent Trunk
P356	Coconut	50'	25'	1.5'	Bent Trunk
P357	Coconut	40'	20'	1.5'	Bent Trunk
P358	Coconut	40'	25'	1.8'	OK
P359	Coconut	40'	25'	1.8'	Bent Trunk
P360	Areca Palm Cluster	8'	VARIES	N/A	Not Specimen
P361	Areca Palm Cluster	8'	VARIES	N/A	Not Specimen
P362	Areca Palm Cluster	8'	VARIES	N/A	Not Specimen
P363	Areca Palm Cluster	8'	VARIES	N/A	Not Specimen
P364	Areca Palm Cluster	8'	VARIES	N/A	Not Specimen
P365	Coconut	50'	25'	1.2'	OK
P366	Coconut	40'	20'	1	OK
P367	Coconut	50'	25'	1.5'	OK
P368	Coconut	50'	25'	1.5'	OK
P369	Coconut	50'	25'	1.5'	OK
P370	Coconut	50'	25'	1.5'	OK
P371	Areca Palm Cluster	10'	VARIES	N/A	Not Specimen
P372	Coconut	60'	20'	1.2'	Bent Trunk
P373	Coconut	60'	20'	1.2'	OK
P374	Areca Palm Clusters	15'	VARIES	N/A	Not Specimen
P375	Areca Palm Clusters	12'	VARIES	N/A	Not Specimen
P376	Areca Palm Clusters	12'	VARIES	N/A	Not Specimen
P377	Licuala Palm	8'	6'	.4'	OK

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P378	Double-Trunk Manila Palm	10'	10'	.5'	OK
P379	Manila Palm	12'	8'	.5'	OK
P380	Coconut	35'	20'	1.2'	OK
P381	Pritchardia Spp.	10'	8'	.8'	OK
P382	Pritchardia Spp.	8'	6'	.8'	OK
P383	Pritchardia Spp.	8'	6'	.8'	OK
P384	Coconut	60'	15'	1.5'	Bent Trunk
P385	Coconut	60'	15'	1.5'	Bent Trunk
P386	Coconut	60'	15'	1.5'	Bent Trunk
P387	Coconut	60'	15'	1.5'	Bent Trunk
P388	Coconut	60'	15'	1.5'	Bent Trunk
P389	Coconut	25'	20'	1.2'	OK
P390	Coconut	30'	20'	1.2'	OK
P391	Coconut	30'	20	1.2'	OK
P392	Coconut	30'	15'	1.2'	OK
P393	Coconut	30'	20'	1.2'	Leaning
P394	Coconut	25'	15'	1.5	OK
P395	Coconut	25'	15'	1.2'	Trunk Penciling
P396	Coconut	20'	15'	1.2'	OK
P397	Coconut	15'	15'	1.2'	Small Canopy
P398	Coconut	20'	15'	1.2'	OK
P399	Coconut	30'	20'	1.5'	OK
P400	Coconut	30'	20'	1.5'	OK
P401	Coconut	30'	20'	1.5'	OK
P402	Coconut	25'	15'	1.2'	OK
P403	Coconut	25'	20'	1.2'	OK
P404	Coconut	25'	15'	1.2'	OK
P405	Coconut	25'	20'	1.5'	OK
P406	Coconut	30'	20'	1.5'	OK
P407	Coconut	30'	20'	1.5'	OK
P408	Coconut	50'	20'	1.5'	OK
P409	Coconut	25'	20'	1.2'	OK
P410	Coconut	30'	20'	1.5'	OK
P411	Coconut	30'	20'	1.5'	OK
P412	Coconut	30'	15'	1.2'	OK
P413	Coconut	30'	15'	1.5'	OK
P414	Coconut	30'	20'	1.2'	OK
P415	Coconut	30'	20'	1.2'	OK
P416	Coconut	30'	20'	1.2'	OK
P417	Coconut	30'	20'	1.2'	OK
P418	Coconut	30'	15'	1.2'	OK
P419	Coconut	25'	20'	1.2'	OK
P420	Coconut	25'	20'	1.2'	OK
P421	Coconut	25'	20'	1.2'	OK
P422	Coconut	25'	20'	1.2'	OK
P423	Coconut	25'	20'	1.2'	Trunk Penciling
P424	Pritchardia Spp.	20'	12'	1'	OK
P425	Coconut	35'	20'	1.5'	Trunk Penciling
P426	Coconut	30'	20'	1.5'	Bent Trunk
P427	Coconut	35'	20'	1.5'	Bent Trunk
P428	Coconut	30'	20'	1.5'	OK
P429	Pritchardia Spp.	20'	12'	.8'	OK
P430	Coconut	25'	20'	1.2'	Leaning
P431	Coconut	35'	20'	1.2'	OK
P432	Coconut	30'	20'	1.5'	Leaning

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P433	Coconut	35'	20'	1.5'	OK
P434	Coconut	30'	20'	1.5'	Bent / Penciling Trunk
P435	Pritchardia Spp.	20'	12'	.8'	OK
P436	Pritchardia Spp.	20'	12'	.8'	OK
P437	Coconut	30'	20'	1.2'	OK
P438	Coconut - removed	N/A	N/A	N/A	No Palm
P439	Pritchardia Spp.	20'	12'	.6'	OK
P440	Coconut	N/A	N/A	N/A	No Palm
P441	Coconut	N/A	N/A	N/A	Stump Only
P442	Coconut	30'	20'	1.2'	Trunk Penciling
P443	Pritchardia Spp.	10'	6'	.6'	Not Specimen
P444	Coconut	30'	20'	1.2'	Trunk Penciling
P445	Coconut	30'	20'	1.2'	OK
P446	Coconut	25'	20'	1.5'	Bent Trunk
P447	Pritchardia Spp.	20'	15'	1'	OK
P448	Pritchardia Spp.	20'	12'	.6'	OK
P449	Coconut	30'	15'	1.2	OK
P450	Coconut	30'	20'	1.5'	OK
P451	Coconut	30'	20'	1.5'	Trunk Penciling
P452	Pritchardia Spp.	20'	12'	1'	OK
P453	Coconut	30'	20'	1.5'	OK
P454	Pritchardia Spp.	20'	12'	.6'	OK
P455	Pritchardia Spp.	20'	12'	.6'	OK
P456	Pritchardia Spp.	15'	12'	.6'	OK
P457	Coconut	20'	15'	1.2'	Trunk Penciling
P458	Coconut	25'	20'	1.5'	Bent Trunk
P459	Coconut	30'	20'	1.5'	OK
P460	Coconut	30'	20'	1.5'	OK
P461	Coconut	30'	20'	1.5'	OK
P462	Coconut	30'	20'	1.2'	Trunk Penciling
P463	Coconut	50'	15'	1.5'	Small Canopy
P464	Coconut	30'	15'	1.5'	Bent Trunk
P465	Coconut	30'	15'	1.5'	Bent Trunk
P466	Coconut	30'	15'	1.5'	Bent Trunk
P467	Pritchardia Spp.	20'	12'	.6'	OK
P468	Pritchardia Spp.	20'	12'	.6'	OK
P469	Coconut	30'	20'	1.2'	Bent Trunk
P470	Coconut	30'	20'	1.2'	OK
P471	Coconut	30'	20'	1.5'	Trunk Penciling
P472	Pritchardia Spp.	15'	12'	.5'	OK
P473	Pritchardia Spp.	20'	12'	.6'	OK
P474	Coconut	25'	20'	1.5'	Trunk Penciling
P475	Coconut	25'	20'	1.2'	Trunk Penciling
P476	Coconut	30'	20'	1.5'	OK
P477	Coconut	30'	20'	1.2'	Trunk Penciling
P478	Pritchardia Spp.	20'	12'	.6'	OK
P479	Coconut	20'	20'	1.5'	Trunk Penciling
P480	Coconut	30'	20'	1.2'	OK
P481	Coconut	30'	20'	1.2'	OK
P482	Coconut	35'	20'	1.5'	OK
P483	Coconut	30'	20'	1.2'	Trunk Penciling
P484	Coconut	30'	20'	1.5'	OK
P485	Coconut	30'	25'	1.5'	OK
P486	Coconut	30'	25'	1.2'	Bent Trunk
P487	Coconut	40'	20'	1.2'	OK

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P488	Coconut	25'	15'	1.2'	Slight Trunk Penciling
P489	Coconut	25'	15'	1.2'	Bent Trunk
P490	Coconut	15'	12'	.8'	OK
P491	Coconut	25'	20'	1.2'	Not Specimen
P492	Coconut	25'	20'	1.2'	Bent Trunk
P493	Coconut	25'	20'	1.2'	Bent trunk
P494	Coconut	25'	20'	1.2'	Not Specimen
P495	Manila Palm	15'	10'	0.5	Not Specimen
P496	Coconut	25'	15'	1.2'	OK
P497	Not Assigned				
P498	Not Assigned				
P499	Not Assigned				
P500	Not Assigned				
P501	Not Assigned				
P502	Coconut	20'	15'	1.2'	Small
P503	Coconut	20'	15'	1.2'	Small
P504	Coconut	20'	15'	1.2'	Small
P505	Coconut	15'	10'	1.2'	Spindly
P506	Coconut	15'	10'	1.2'	Spindly
P507	Coconut	20'	15'	1.2'	Small
P508	Coconut	20'	15'	1.2'	OK
P509	Coconut	20'	15'	1.2'	OK
P510	Coconut	20'	15'	1.2'	OK
P511	Coconut	20'	15'	1.2'	OK
P512	Coconut	20'	15'	1.2'	OK
P513	Coconut	20'	15'	1.2'	OK
P514	Coconut	20'	15'	1.2'	OK
P515	Coconut	20'	15'	1.2'	OK
P516	Coconut	15'	15'	1.2'	Small
P517	Coconut	20'	15'	1.2'	OK
P518	Coconut	20'	15'	1.2'	OK
P519	Coconut	15'	15'	1.2'	OK
P520	Coconut	20'	15'	1.2'	OK
P521	Coconut	20'	15'	1.2'	OK
P522	Coconut	20'	20'	1.2'	OK
P523	Coconut	20'	20'	1.2'	OK
P524	Coconut	20'	20'	1.2'	OK
P525	Coconut	20'	20'	1.2'	OK
P526	Coconut	20'	20'	1.2'	OK
P527	Coconut	15'	15'	1.2'	OK
P528	Coconut	20'	20'	1.2'	OK
P529	Coconut	20'	20'	1.2'	OK
P530	Coconut	20'	20'	1.2'	OK
P531	Coconut	20'	20'	1.2'	OK
P532	Coconut	20'	20'	1.2'	OK
P533	Coconut	20'	20'	1.2'	OK
P534	Coconut	20'	20'	1.2'	OK
P535	Coconut	30'	20'	1.2'	OK
P536	Coconut	20'	20'	1.2'	OK
P537	Coconut	20'	15'	1.2'	OK
P538	Coconut	25'	20'	1.2'	OK
P539	Coconut	20'	20'	1.2'	OK
P540	Coconut	20'	20'	1.2'	OK
P541	Coconut	20'	20'	1.2'	OK
P542	Coconut	20'	15'	1.2'	OK

KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P543	Coconut	20'	20'	1.2'	OK
P544	Coconut	20'	20'	1.2'	OK
P545	Coconut	20'	15'	1.2'	OK
P546	Coconut	20'	20'	1.2'	OK
P547	Coconut	20'	20'	1.2'	OK
P548	Coconut	25'	20'	1.2'	OK
P549	Coconut	20'	20'	1.2'	OK
P550	Coconut	20'	15'	1.2'	OK
P551	Coconut	20'	15'	1.2'	OK
P552	Coconut	20'	15'	1.2'	OK
P553	Coconut	25'	15'	1.2'	OK
P554	Coconut	25'	15'	1.2'	OK
P555	Coconut	25'	15'	1.2'	OK
P556	Coconut	25'	15'	1.2'	OK
P557	Coconut	30'	20'	1.5'	OK
P558	Coconut	30'	20'	1.2'	OK
P559	Coconut	30'	20'	1.2'	OK
P560	Coconut	30'	20'	1.2'	OK
P561	Coconut	30'	20'	1.2'	OK
P562	Coconut	30'	15'	1.5'	OK
P563	Coconut	30'	15'	1.2'	OK
P564	Coconut	30'	20'	1.5'	OK
P565	Coconut	30'	20'	1.5'	OK
P566	Coconut	50'	20'	1.5'	OK
P567	Coconut	20'	15'	1.2'	OK
P568	Coconut	20'	15'	1.2'	OK
P569	Coconut	30'	20'	1.5'	OK
P570	Coconut	30'	20'	1.5'	OK
P571	Coconut	60'	15'	1.5'	OK
P572	Coconut	60'	15'	1.5'	OK
P573	Coconut	30'	15'	1.5'	OK
P574	Coconut	20'	15'	1.5'	OK
P575	Coconut	25'	15'	1.5'	OK
P576	Coconut	20'	15'	1.5'	OK
P577	Coconut	60'	15'	1.5'	OK
P578	Coconut	60'	15'	1.5'	OK
P579	Coconut	30'	20'	1.5'	OK
P580	Coconut	60'	15'	1.5'	OK
P581	Coconut	30'	20'	1.5'	OK
P582	Coconut	30'	20'	1.5'	OK
P583	Coconut	20'	15'	1.2'	OK
P584	Coconut	20'	20'	1.2'	OK
P585	Coconut	25'	20'	1.2'	OK
P586	Coconut	25'	20'	1.2'	OK
P587	Coconut	30'	20'	1.2'	Leaning
P588	Coconut	15'	15'	1.2'	Small
P589	Coconut	20'	15'	1.2'	OK
P590	Coconut	30'	20'	1.2'	OK
P591	Coconut	30'	20'	1.2'	OK
P592	Coconut	25'	20'	1.5'	OK
P593	Coconut	30'	20'	1.5'	OK
P594	Coconut	30'	15'	1.2'	OK
P595	Coconut	30'	15'	1.2'	OK
P596	Coconut	30'	15'	1.2'	OK
P597	Coconut	30'	15'	1.2'	OK

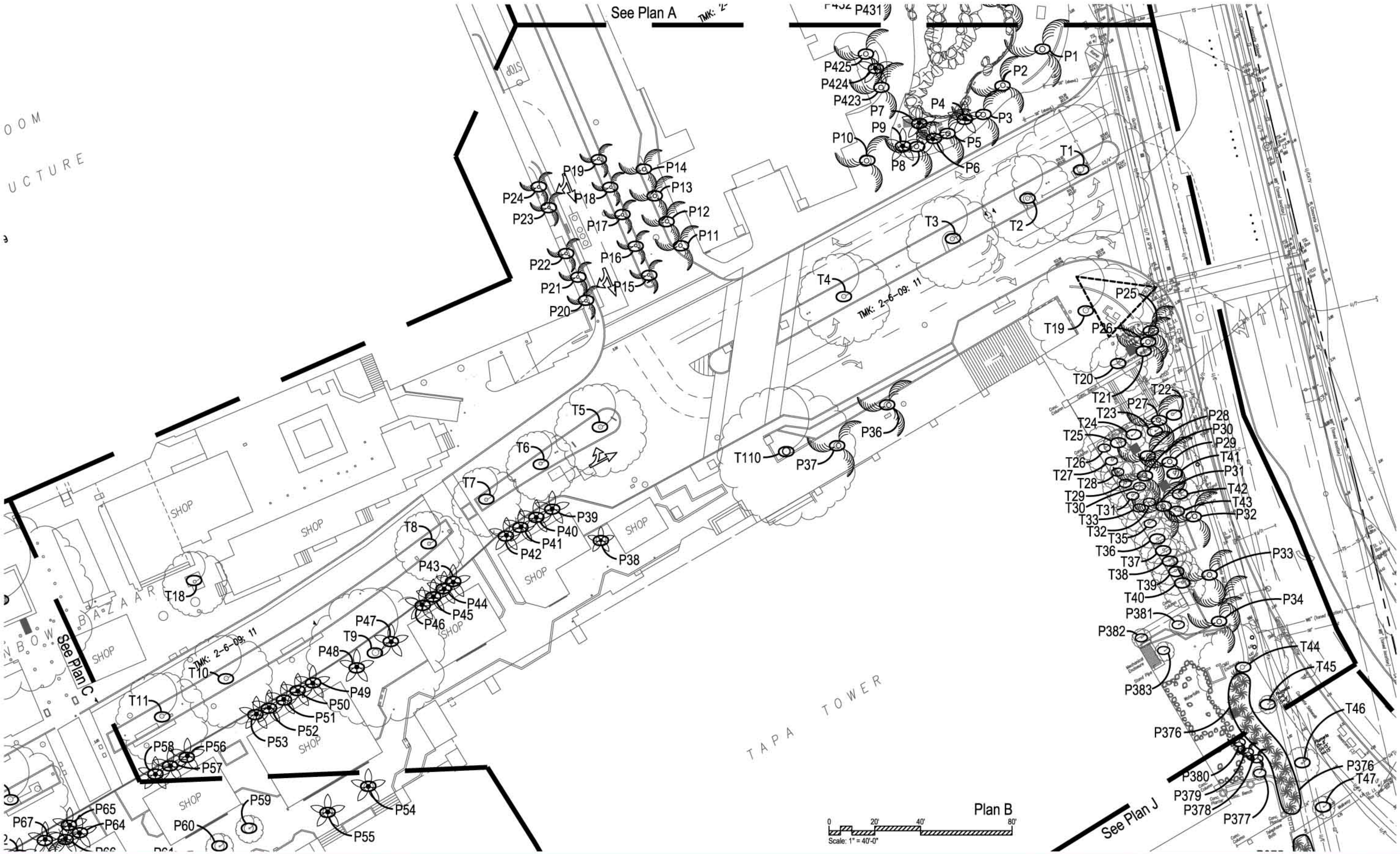
KEY #	SPECIES	HEIGHT	SPREAD	CALIPER	CONDITION
P598	Coconut	30'	15'	1.2'	OK
P599	Coconut	30'	15'	1.2'	OK
P600	Coconut	30'	15'	1.2'	OK
P601	Coconut	30'	15'	1.2'	OK
P602	Coconut	30'	20'	1.2'	OK

Master Plan: Redevelopment Opportunity Proposal

Hilton Hawaiian Village Beach Resort & Spa

GROUP 70 INTERNATIONAL

ALTOON + PORTER ARCHITECTS

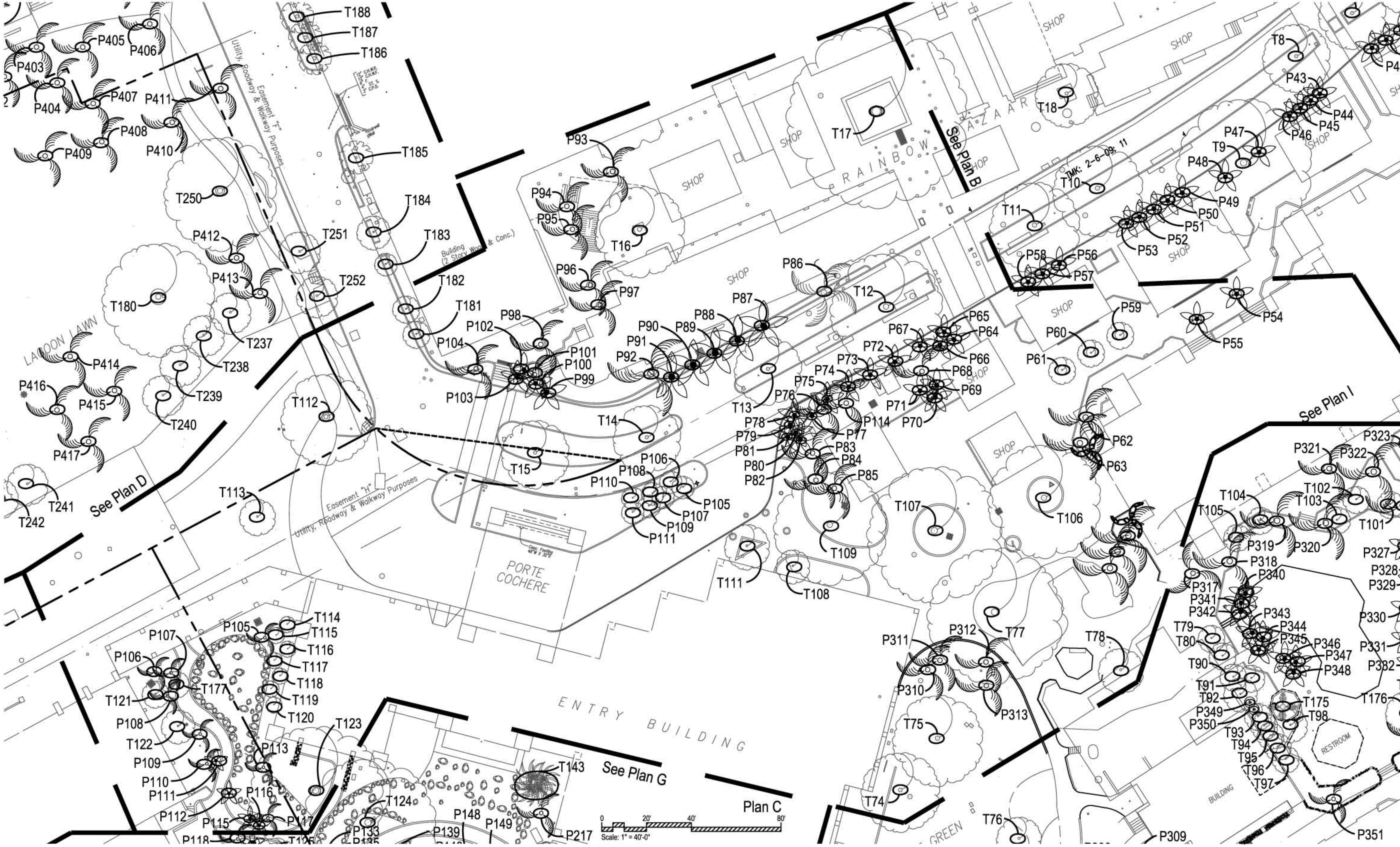


Master Plan: Redevelopment Opportunity Proposal

Hilton Hawaiian Village Beach Resort & Spa

GROUP 70 INTERNATIONAL

ALTOON + PORTER ARCHITECTS



Master Plan: Redevelopment Opportunity Proposal

Hilton Hawaiian Village Beach Resort & Spa

GROUP 70 INTERNATIONAL

ALTOON + PORTER ARCHITECTS

LAGOON TOWER
HILTON GRAND VACATIONS
TMK: 2-6-09: 1
ZONE AO (DEPTH 2)
Easement "E"
Easement "F"
Utility, Roadway & Walkway Purposes
Easement "H"
Utility, Roadway & Walkway Purposes
Building (2 Story Wood & Conc.)
LAGOON LAWN
See Plan C
PORTE COCHERE
T262
T261
T260
T259
T258
T257
T256
T255
T254
T251
T252
T250
T182
T181
T180
T237
T238
T239
T240
T241
T242
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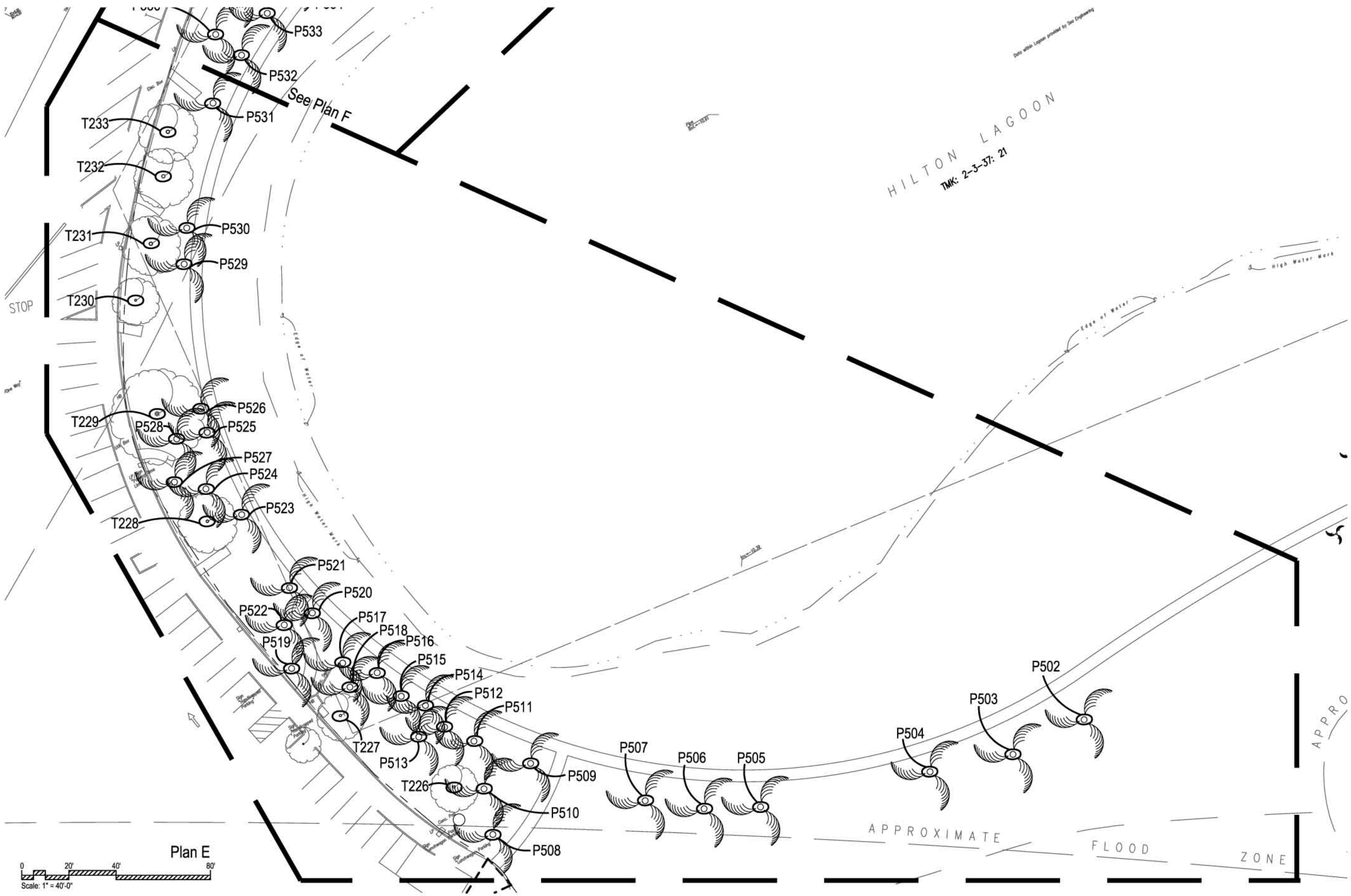
P413
P414
P415
P416
P417
P418
P419
P420
P421
P422
P98
P102
P103
P104
P105
P106
P107
Plan D
0
20'
40'
80'
Scale: 1" = 40'-0"



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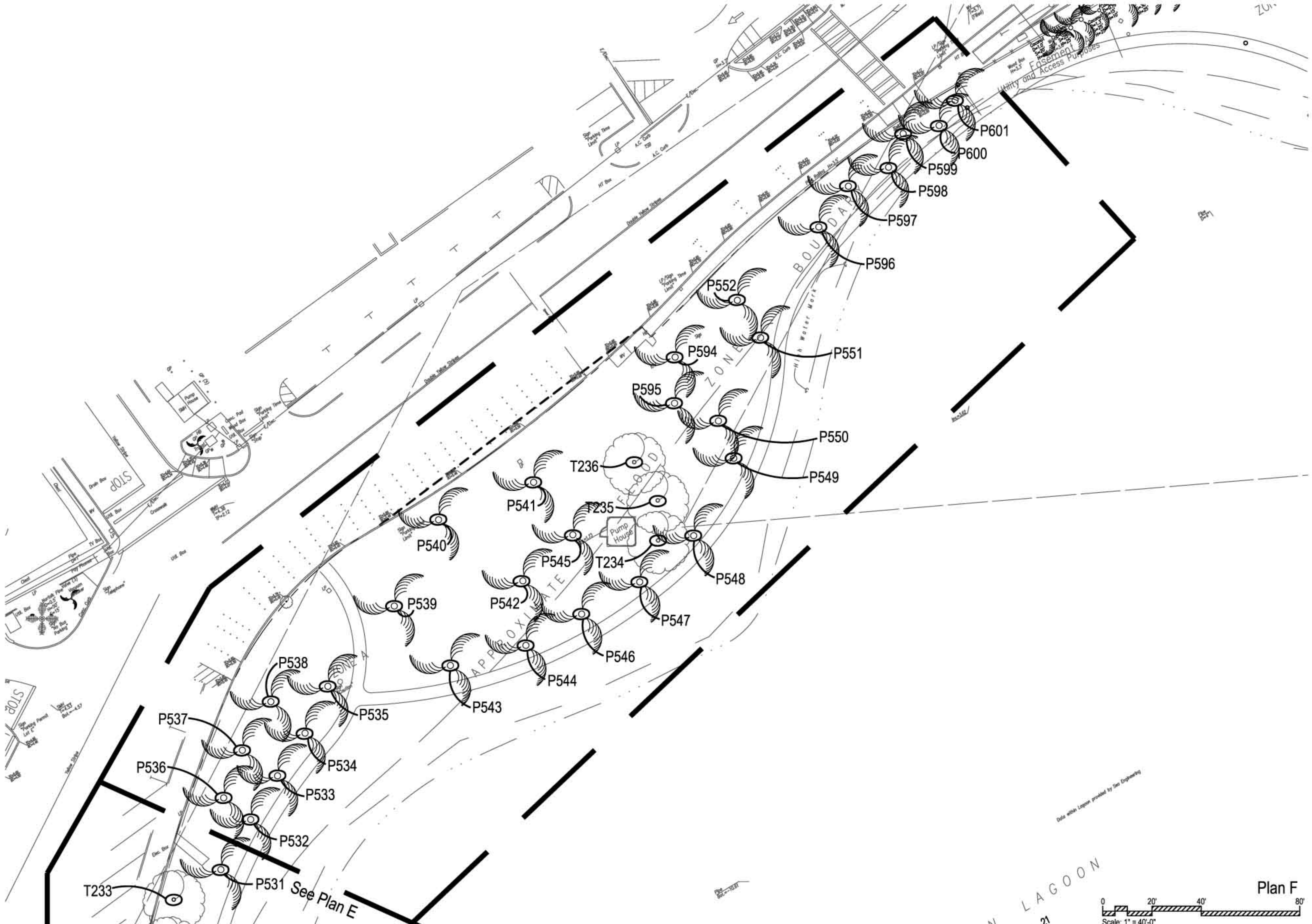

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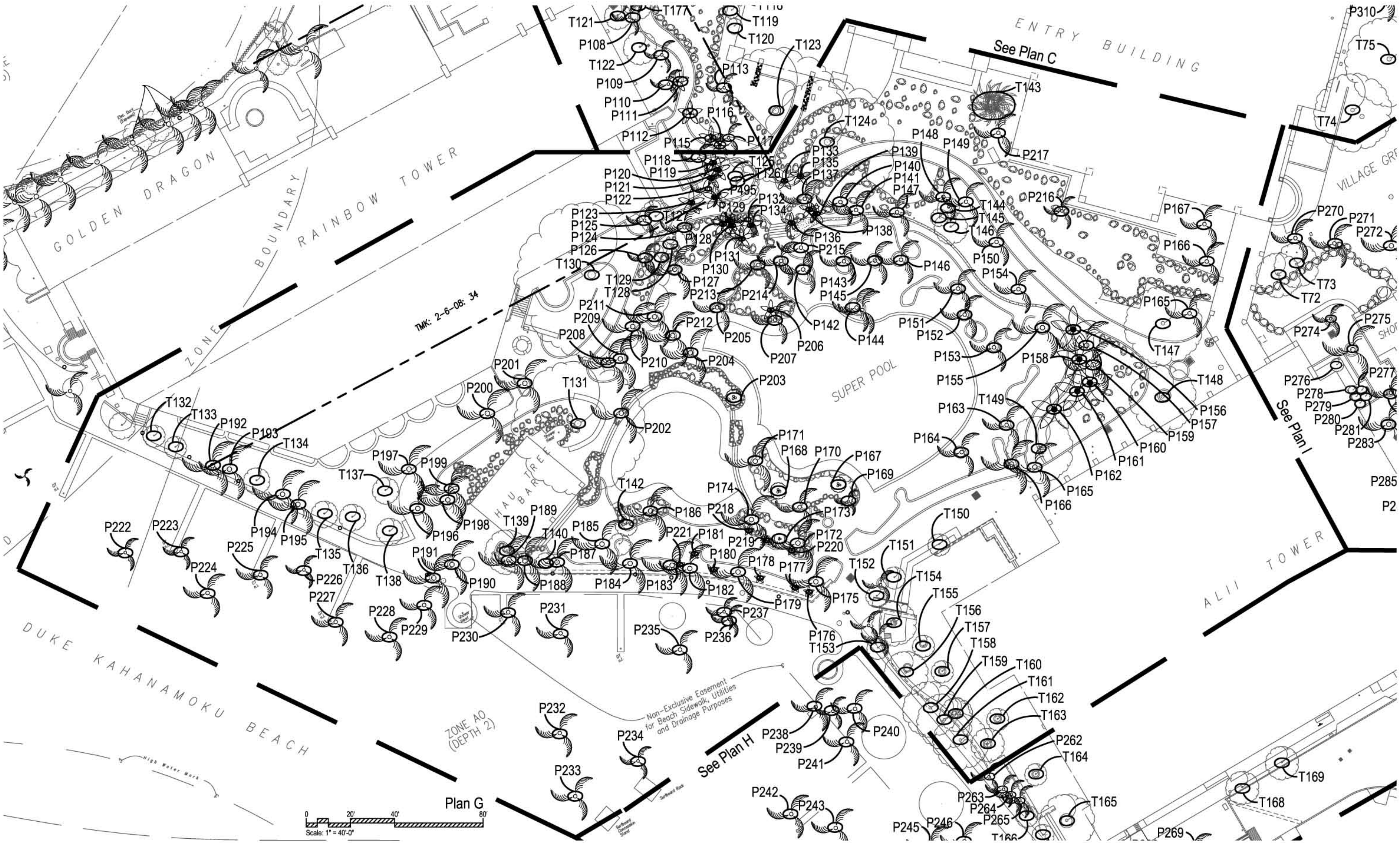

Master Plan: Redevelopment Opportunity Proposal

Hilton Hawaiian Village Beach Resort & Spa

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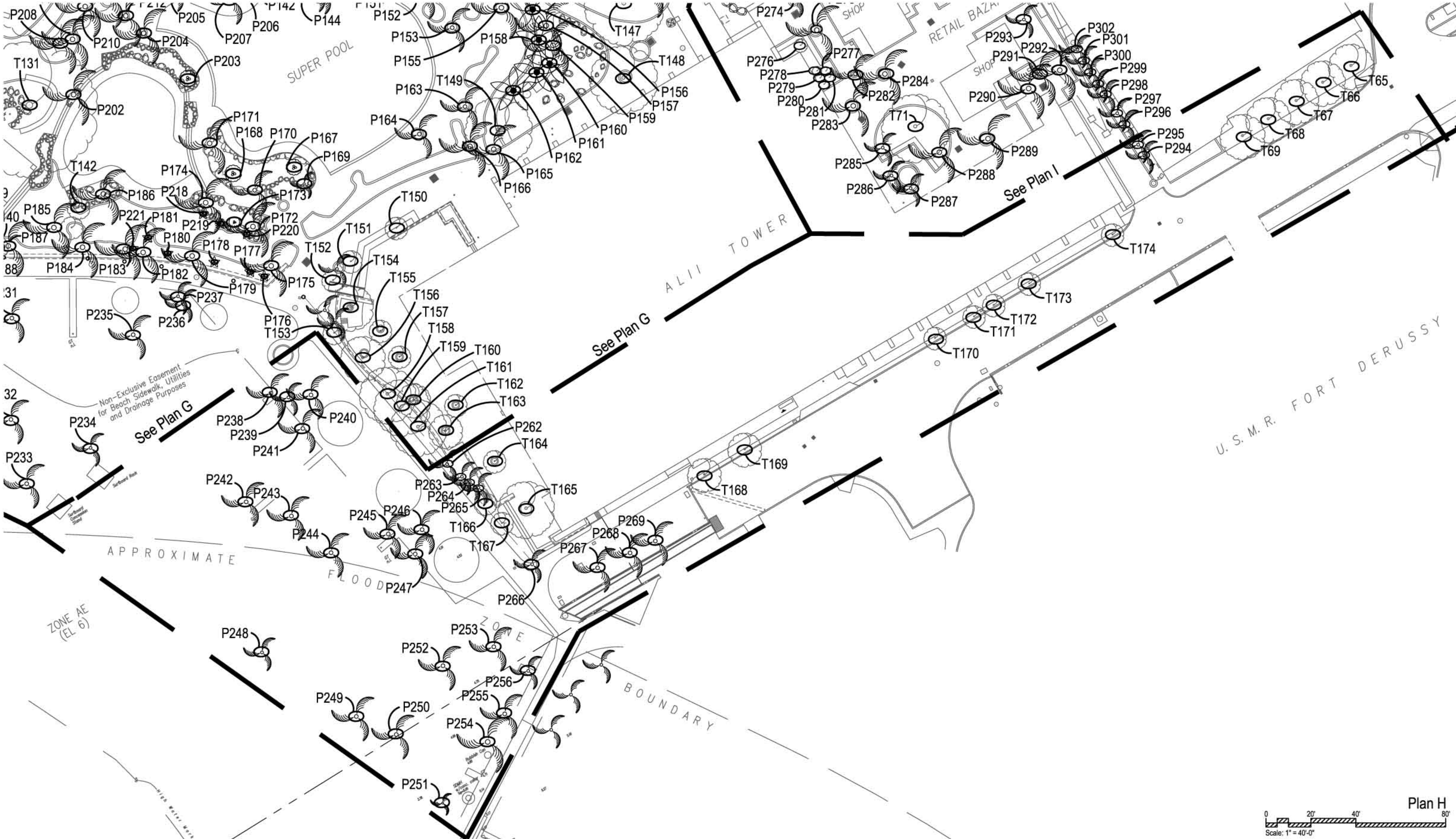

Master Plan: Redevelopment Opportunity Proposal

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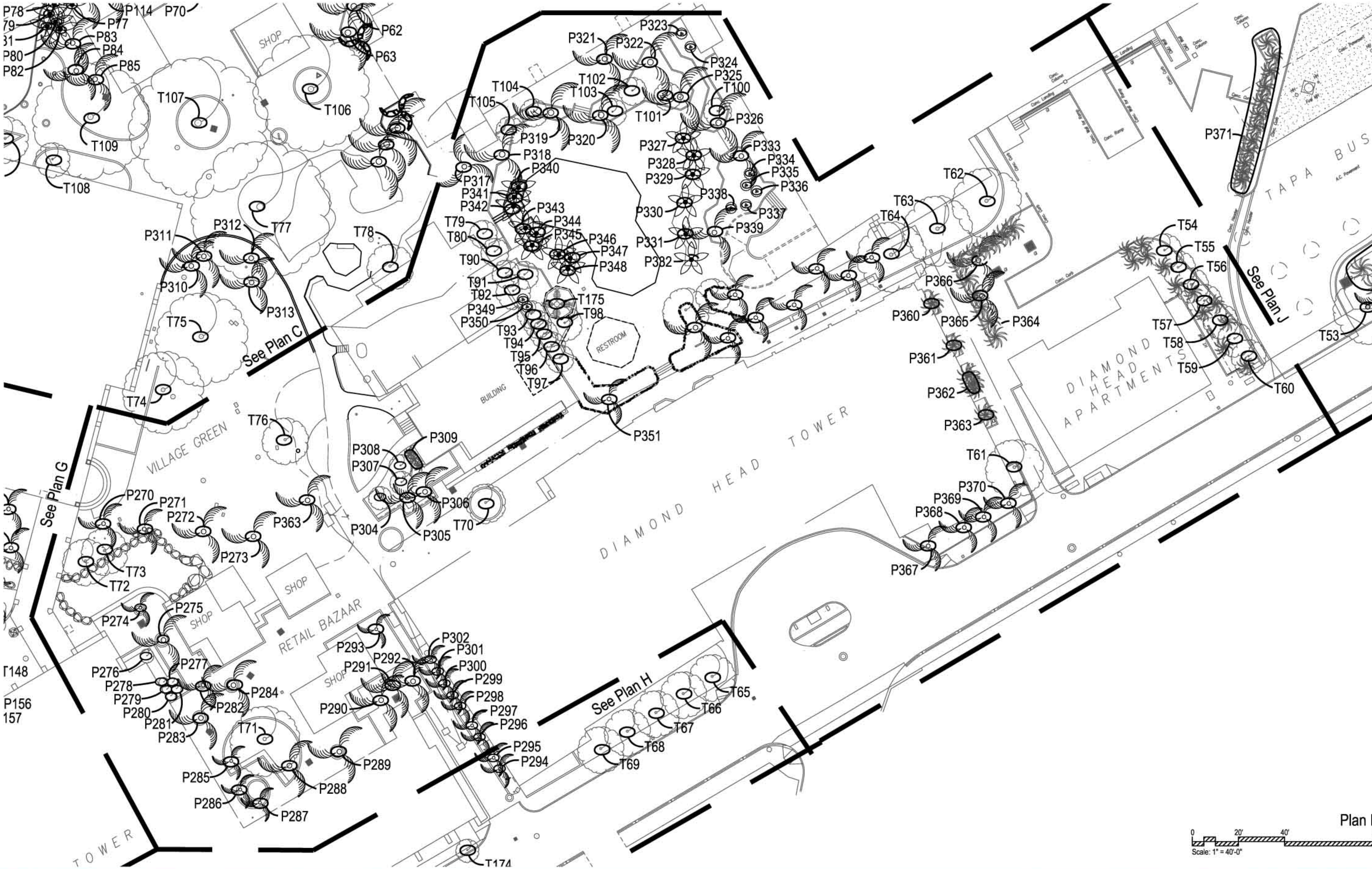

Master Plan: Redevelopment Opportunity Proposal

Hilton Hawaiian Village Beach Resort & Spa

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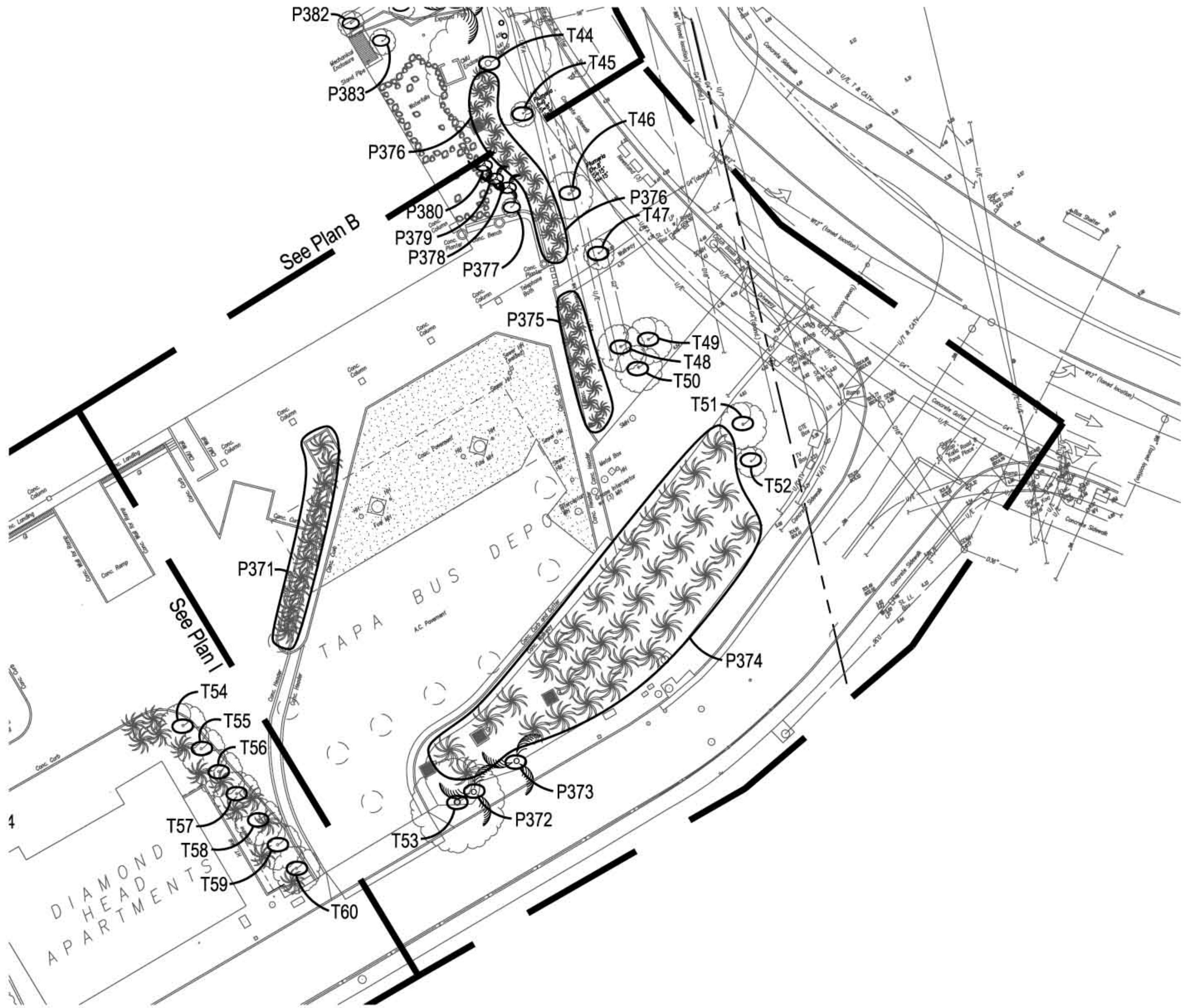


Plan J

0 20' 40' 80'
Scale: 1" = 40'-0"

Hilton Hawaiian Village Native Plant Statement
February 2011

There are currently significant beds, small groves and individual specimens of Hawaiian native plants throughout the property. Significant native trees and palms include: Loulu (Pritchardia spp.), Wiliwili (Erythrina sandwicensis) and Naʻu (Gardenia brighamii). In the future, supplemental plantings of those species, as well as Alaheʻe (Psydrax odorata), Hoʻawa (Pittosproum hosmeri and Pittosporum confertiflorum), Naio (Myoporum sandwicense) and Kokiʻo keʻo keʻo (Hibiscus Arnottianus subsp. punaluuensis) would be anticipated.

In addition, the existing landscape also includes the following native groundcovers and shrubs: ʻĀkia (Wikstroemia uva-ursi), Naupaka (Scaevola taccada), Pohinahina (Vitex rotundifolia), Pohuehue (Ipomoea pes-caprae subsp. Brasiliensis). During future landscape improvement work, additional native shrubs and groundcovers that would be considered include: ʻIlima (Sida fallax), Paʻu o hiʻiaka (Jaquemontia ovalifolia subsp. sandwicensis), ʻAkoko (Chamaesyce celastroides var. celastroides), Aʻaliʻi (Dodonaea viscosa) and Maʻo (Gossypium tomentosum).

The current landscape also includes valuable cultural and Polynesian-introduced plant material, including Coconut (Cocos nucifera), Ti/Kī (Cordyline fruticosa), Taro/Kalo (Colocasia esculenta), Kukui (Aleurites moluccana), Hau (Hibiscus tiliaceus), Milo (Thespesia populnea), Breadfruit/ʻUlu (Artocarpus altilis) and Banana (Musa spp.). These and other related plant materials that help tell of the rich, cultural importance of the original Polynesian plant introduction are important components of the landscape and would be enhanced, where appropriate in future landscape improvement areas.

Water conservation is always an important component of the landscape. Using less-thirsty plants dramatically reduces the requirement for irrigation demand. Over a large property, this reduction is significant and helps protect the island's water resources. Besides appropriate native plants already mentioned, plants that would be considered for use in future projects include drought tolerant plants and soil building methods consistent with the practices already implemented. Plants that may be considered for inclusion to those already in use are: Oyster Plant (Tradescantia spathacea), Natal Plum (Carissa macrocarpa and cultivars), Autograph Tree (Clusia rosea), Tilandsias, Stephanotis (Marsdenia floribunda) and Lignum Vitae (Guaiacum officinale).

APPENDIX D

Arborist Report
Hilton Hawaiian Village

Steve Nimz and Associates Inc.

August 2010

Steve Nimz and Associates Inc.
Consulting Arborist Services
PO BOX 10026 Honolulu, Hawaii 96816
Office # (808) 734-5963 Fax # (808) 732-4433
Email: Steve@stevenimz.com

August 25, 2010

Mr. Jeff Overton
Group 70 International Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813

Re: Hilton Hawaiian Village

Dear Mr. Overton:

The following tree assessment addresses major trees and palms that will be impacted by the proposed improvements at the Hilton Hawaiian Village in Waikiki. The visual inspection includes one-hundred-fifteen trees and two-hundred-forty-nine palms growing in the areas identified for renovation. The report is divided into three areas that include: # 1 Tapa Tower, Kalia Road, bus loading zone, Tapa pool and Café, # 2 Entry and Rainbow Bazaar and # 3 Front desk, Super-pool and Hau Tree Bar (Overall site map).

The tree and palm assessment is based on the numbered site map provided and corresponding spreadsheets identifying all the trees and palms on the Hilton Hawaiian Village site. The map has been divided into three sections that will be impacted by renovations. Each section has its own spreadsheet.

The assessment identified 1) significant trees recommended to remain in place or be relocated on site; 2) trees and palms that are candidates for relocation on or off the project site.

The following comments are in regard to significant trees in each section:

Section # 1 (Site Map # 1) (Tapa Tower, Kalia Road and Bus Area):

Sausage tree # T19 is a significant mature specimen that should be preserved or relocated on site to preserve the structural branching and unique fruiting (Photo).

Sausage Tree # T19

Kiawe tree # T144 is a large mature specimen that has leaned over and re-anchored itself. Care must be taken to preserve the trees stature and allow for re-development of the area (Photo).

Kiawe Tree # T144

Numerous healthy Areca Palm clusters could be relocated (Photos)

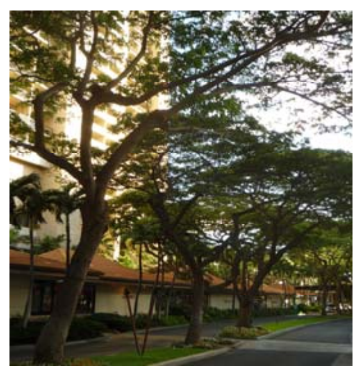
Section # 1A (Site Map # 1A) (Tapa Pool and Café)

The area was recently landscaped with Singapore Plumeria trees, Coconut Palms and Manila Palms (Photos). They are good candidates for relocation.


Section # 2 (Site Map # 2) (Entry and Rainbow Bazaar):

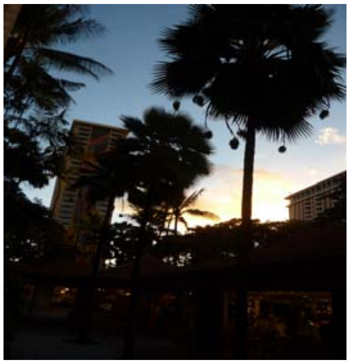
Monkeypod trees # T1 - # T15, # T107, # T108 and # T110 are large mature specimens that provides a dominant entry canopy over the roadway (Photos).





Nine of the Monkeypod trees identified on site map # 2 could be relocated if design factors warrant it. The large Ficus benghalensis tree # T17 is a significant major specimen and will require proper tree protection to minimize negative impact to the root structure and crown during construction (Photos).


Several mature Prichardia palms could be relocated on-site (Photos).



The majority of Manila and Coconut Palms are over mature (Photos).

Section # 3 (Site Map # 3) (Front Desk, Super Pool and Hau Tree Bar)

Ficus tree # T131 and Fish Poison Tree (Hulu) # T130 are significant mature trees that require a tree preservation plan to reduce negative impact during construction (Photos).

Ficus Tree # T131

Fish Poison Tree (Hulu) # T130

The Ficus elastica # T123 is a large mature specimen, approximately seventy-feet tall. The tree is in fair condition. Further inspection of the lower trunk is needed to determine structural integrity. The tree could be a significant asset to the project, if tree root structure can be preserved during design and construction (Photo).

Ficus Tree # T123

The majority of the Coconut Palms are tall and over-mature. The Prichardia, Pygmy Dates and Blue Latan Palm are good candidates for relocation (Photos).

The Hau tree over the bar could be relocated if the same theme is to be preserved (Photo). Several smaller Autograph and Plumeria trees could also be relocated.

If you have any questions, please contact my office at 808-734-5963.

Respectfully yours,

Steve Nimz,
ASCA Consulting Arborist
ISA Certified Arborist # WE- 0314AM
ISA PNW Certified Tree Risk Assessor # 419

Attachments:
Over-all project map
Site maps # 1, # 2, # 3
Spreadsheets

<u>Site Maps Color Code Legend:</u>

Green: Preserve
Blue: Candidate for relocation
Orange: Removal

Green/Orange: Remain in place or remove
Green/Blue: Preserve or Relocate

Improvement Area Zones

AREA 1: Kālia Road Frontage, Tapa Retail and Timeshare 1

AREA 2: Rainbow Bazaar, Pavilion Retail, and Timeshare 2

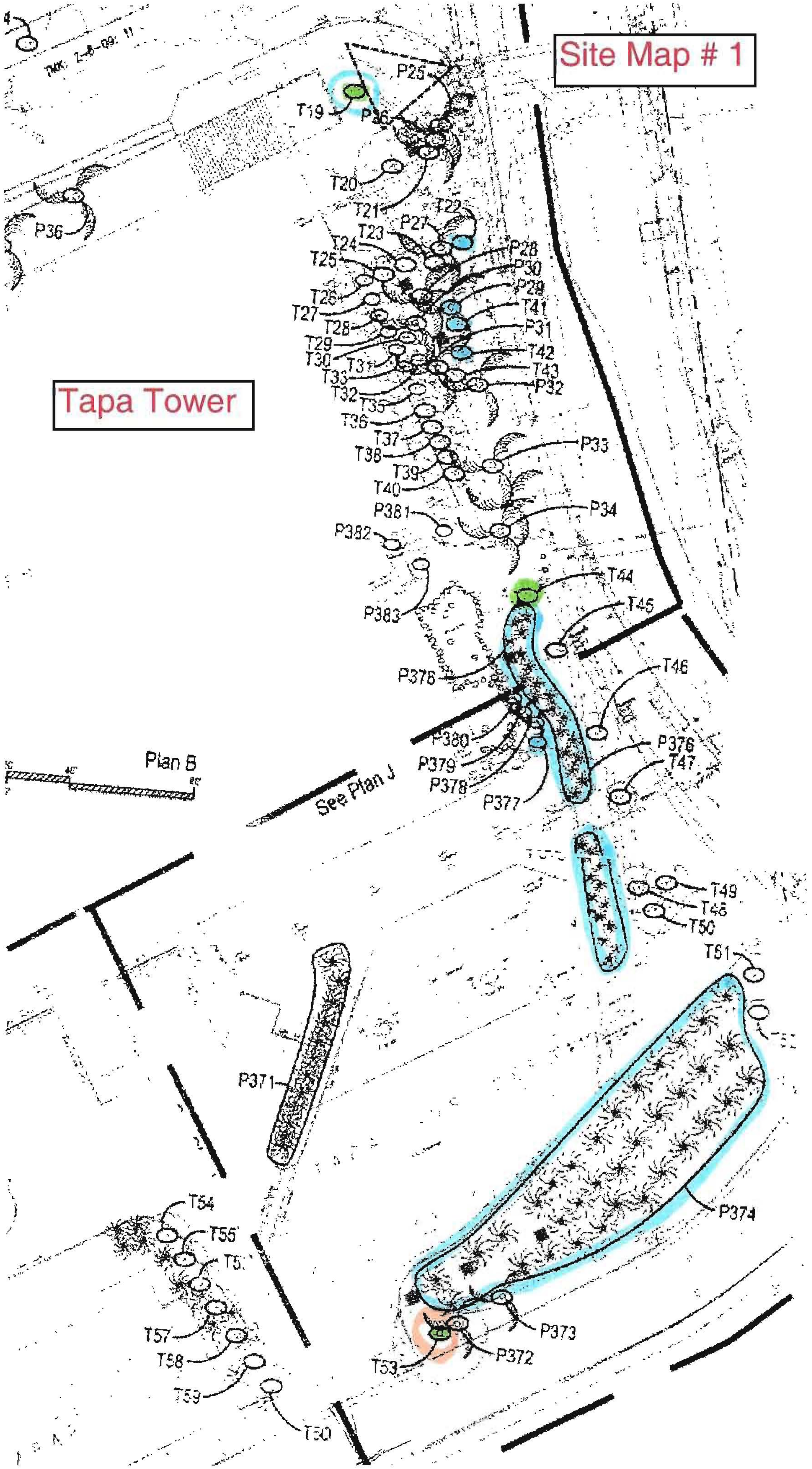
AREA 3: Super Pool, Lobby Arrival Building and Amenities

----- Improvement Area Zone (approximate)

Hilton Hawaiian Village Beach Resort & Spa 11 August 2010 @ 10:00 am DRAFT

Proposed Plans - Overall Zoning Plans

GROUP 70 INTERNATIONAL


Site Map # 1
Tapa Tower
T19
P25
P26
T20
P36
T21
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P376
P379
T47
P378
P377
Plan B
See Plan J
T49
T48
T50
T51
P371
P374
T54
T55
T57
T58
T59
P373
P372
T53

Hilton Hawaiian Village
Section # 1
Tapa Tower

Tree #	Species	Height (feet)	Spread	Diameter (inches)	Health Structural rating	Preserve, Transplant or Remove	Comments
T 19	Sausage Tree	40	50	2	Good	Preserve or Transplant	Relocate on-site along Kalia Road, significant specimen
T 20	Hong Kong Orchid	25	15	1.8	Fair	Remove	Poor structure, leaning trunks
T 21	Hong Kong Orchid	25	15	1.3	Fair	Remove	Poor structure, leaning trunks
T 22	Plumeria	25	15	1	Fair	Remove	
T 23	Plumeria	12	10	3	Good	Preserve or Transplant	
T 24	Plumeria	12	10	3	Good	Preserve or Transplant	
T 41	Plumeria	25	15	1.3	Fair	Remove or Transplant	
T 42	Plumeria	25	15	1.3	Good	Preserve or Transplant	
T 43	Plumeria	15	15	.5	Fair	Remove	
T 44	Kiawe	40	60	3.5	Fair	Preserve	Remove lower dead limb and rear limb, brace main trunk with support, significant specimen
T 45	Plumeria	8	8	.3	Poor	Remove	Poor structure
T 46	Plumeria	15	12	.5	Fair	Preserve or Transplant	
T 47	Plumeria	12	12	1	Fair	Remove	Poor structure
T 48	Plumeria	15	15	.8	Fair	Remove	Poor structure
T 49	Plumeria	15	15	.8	Fair	Remove	Poor structure
T 50	Plumeria	15	15	.8	Fair	Remove	Poor structure
T 51	Plumeria	15	15	.8	Fair	Remove	Poor structure
T 52	Plumeria	10	10	.5	Fair	Remove	Poor structure
T 53	Ficus sp.	30	30	4	Fair	Preserve or Remove	Prune back from construction site
T 54	Schefflera	25	15	1.3	Fair	Remove	Poor structure and decay

Hilton Hawaiian Village
Section # 1
Tapa Tower

Tree #	Species	Height (feet)	Spread	Diameter (inches)	Health Structural rating	Preserve, Transplant or Remove	Comments
T 55	Schefflera	25	15	1.3	Fair	Remove	Poor structure and decay
T 56	Schefflera	25	15	1.3	Fair	Remove	Poor structure and decay
T 57	Schefflera	25	15	1.3	Fair	Remove	Poor structure and decay
T 58	Schefflera	25	15	1.3	Fair	Remove	Poor structure and decay
T 59	Schefflera	25	15	1.3	Fair	Remove	Poor structure and decay
T 60	Schefflera	25	15	1.3	Fair	Remove	Poor structure and decay

Hilton Hawaiian Village
Section # 1 (Palms)
Tapa Tower

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 25	Coconut Palm	60	Fair	Remove	
P 26	Coconut Palm	60	Fair	Remove	
P 27	Coconut Palm	50	Fair	Remove	
P 28	Coconut Palm	50	Fair	Remove	
P 29	Coconut Palm	45	Fair	Remove	
P 30	Coconut Palm	55	Fair	Remove	
P 31	Coconut Palm	50	Fair	Remove	
P 32	Coconut Palm	60	Poor	Remove	
P 33	Coconut Palm	35	Poor	Remove	
P 34	Coconut Palm	25	Fair	Remove	
P 35	Coconut Palm	45	Good	Remove	
P 36	Coconut Palm	60	Fair	Remove	
P 371	Areca Palm clusters	10	Fair-Poor	Remove	
P 372	Coconut Palm	70	Fair	Remove	
P 373	Coconut Palm	70	Fair	Remove	
P 374	Areca Palm clusters	18	Good	Preserve or Transplant	
P 375	Areca Palm clusters	12	Good	Preserve or Transplant	
P 376	Areca Palm clusters	12	Good	Preserve or Transplant	
P 377	Licuala Palm	6	Good	Preserve or Transplant	Specimen

Hilton Hawaiian Village
Section # 1 (Palms)
Tapa Tower

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 378	Double trunk Manila Palm	10	Poor	Remove	
P 379	Manila Palm	12	Fair	Remove	
P 380	Coconut Palm	35	Fair	Remove	
P 381	Pritchardia sp.	10	Good	Transplant	
P 382	Pritchardia sp.	8	Good	Transplant	
P 383	Prichardia sp.	8	Good	Transplant	

Hilton Hawaiian Village
Section # 1A
Tapa Pool Area

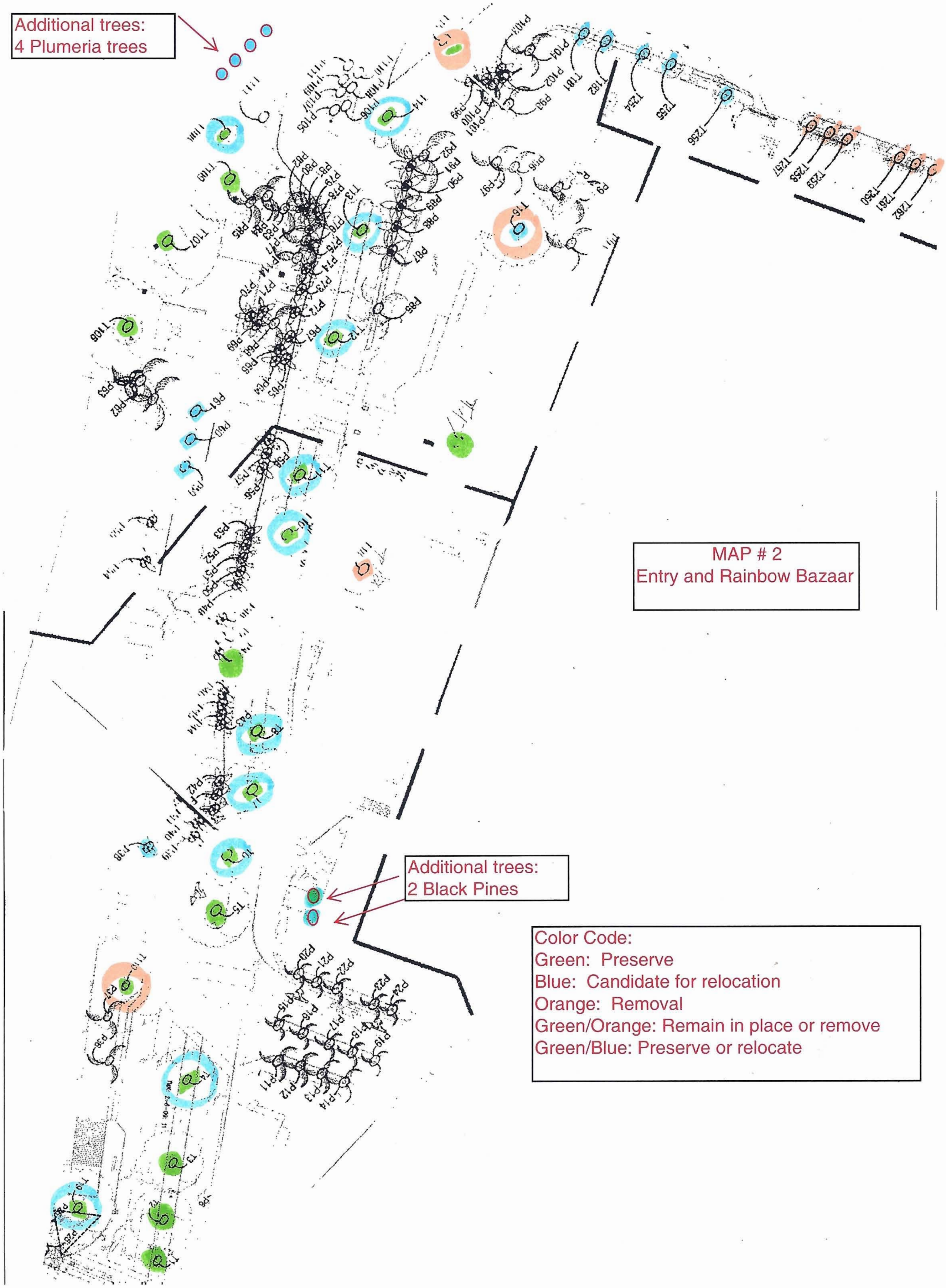
Tree #	Species	Height (feet)	Spread	Diameter (inches)	Health Structural rating	Preserve, Transplant or Remove	Comments
T 62	Coral Tree	20	15	2	Poor	Remove	
T 63	Coral Tree	20	15	2	Fair	Remove	
T 64	Coral Tree	25	15	1.5	Poor	Remove	
T 79	Travelers Tree	20	25	1	Fair	Remove	
T 80	Travelers Tree	20	25	1	Fair	Remove	
T 90	Travelers Tree	20	25	1	Fair	Remove	
T 91	Travelers Tree	20	25	1	Fair	Remove	
T 92	Plumeria	15	12	.6	Good	Preserve or Transplant	
T 93	Plumeria	15	12	.6	Good	Preserve or Transplant	
T 94	Plumeria	15	12	.6	Good	Preserve or Transplant	
T 95	Plumeria	15	12	.6	Good	Preserve or Transplant	
T 96	Plumeria	15	12	.6	Good	Preserve or Transplant	
T 97	Plumeria	15	12	.6	Good	Preserve or Transplant	
T 98	Plumeria	15	12	.7	Good	Preserve or Transplant	
T 100	Plumeria	12	12	.6	Good	Preserve or Transplant	
T 101	Plumeria	10	10	.5	Good	Preserve or Transplant	
T 102	Plumeria	15	15	.5	Good	Preserve or Transplant	
T 103	Plumeria	10	10	.5	Good	Preserve or Transplant	
T 104	Plumeria	12	12	.5	Good	Preserve or Transplant	
T 105	Plumeria	12	12	0.5	Good	Preserve or Transplant	
T 175	Norfolk Island Pine	70	15	2	Fair	Remove	

Hilton Hawaiian Village
Section # 1A (Palms)
Tapa Pool Area

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 317	Coconut Palm	30	Good	Transplant	
P 318	Coconut Palm	40	Good	Transplant	
P 319	Coconut Palm	30	Good	Transplant	
P 320	Coconut Palm	30	Good	Transplant	
P 321	Coconut Palm	25	Good	Transplant	
P 322	Coconut Palm	30	Good	Transplant	
P 323	MacArthur Palm	25	Good	Transplant	
P 324	MacArthur Palm	25	Good	Transplant	
P 325	Coconut Palm	40	Good	Transplant	
P 326	Coconut Palm	40	Fair	Remove	
P 327	Manila Palm	12	Good	Transplant	
P 328	Manila Palm	12	Good	Transplant	
P 329	Manila Palm	12	Good	Transplant	
P 330	Manila Palm	12	Good	Transplant	
P 331	Manila Palm	12	Good	Transplant	
P 332	Manila Palm	12	Good	Transplant	
P 333	Coconut Palm	40	Fair	Remove	
P 334	MacArthur Palm	30	Good	Transplant	
P 335	MacArthur Palm	30	Good	Transplant	

Hilton Hawaiian Village
Section # 1A (Palms)
Tapa Pool Area

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 336	MacArthur Palm	30	Good	Transplant	
P 337	MacArthur Palm	30	Good	Transplant	
P 338	MacArthur Palm	30	Good	Transplant	
P 339	Coconut Palm	40	Good	Transplant	
P 340	Manila Palm	25	Fair	Remove	
P 341	Manila Palm	25	Fair	Remove	
P 342	Manila Palm	25	Fair	Remove	
P 343	Manila Palm	25	Fair	Remove	
P 344	Manila Palm	25	Fair	Remove	
P 345	Manila Palm	25	Fair	Remove	
P 346	Manila Palm	15	Fair	Remove	
P 347	Manila Palm	15	Fair	Remove	
P 348	Manila Palm	15	Fair	Remove	
P 349	Areca Palm	8	Fair	Remove	
P 350	Areca Palm	8	Fair	Remove	
P 351	Coconut Palm	30	Fair	Remove	
P 360	Areca Palm Cluster	8	Fair	Remove	
P 361	Areca Palm Cluster	8	Fair	Remove	
P 362	Areca Palm Cluster	8	Fair	Remove	
P 363	Areca Palm Cluster	8	Fair	Remove	
P 364	Areca Palm Cluster	8	Fair	Remove	
P 365	Coconut Palm	50	Fair	Remove	
P 366	Coconut Palm	40	Fair	Remove	



Additional trees:
4 Plumeria trees
MAP # 2
Entry and Rainbow Bazaar
Additional trees:
2 Black Pines
Color Code:
Green: Preserve
Blue: Candidate for relocation
Orange: Removal
Green/Orange: Remain in place or remove
Green/Blue: Preserve or relocate

Hilton Hawaiian Village
Section # 2
Entry and Rainbow Bazaar

Tree #	Species	Height (feet)	Spread	Diameter (inches)	Health Structural rating	Preserve, Transplant or Remove	Comments
T 1	Monkeypod	40	60	4.5	Good	Preserve	Major entry specimens
T 2	Monkeypod	40	30	4.5	Good	Preserve	Major entry specimens
T 3	Monkeypod	40	30	5.5	Good	Preserve	Major entry specimens
T 4	Monkeypod	40	30	2	Good	Preserve or Transplant	Major entry specimens
T 5	Monkeypod	30	40	2.8	Good	Preserve	Major entry specimens
T 6	Monkeypod	30	30	1.5	Good	Preserve or Transplant	Major entry specimens
T 7	Monkeypod	30	30	1.8	Good	Preserve or Transplant	Major entry specimens
T 8	Monkeypod	30	30	2	Good	Preserve or Transplant	Major entry specimens
T 9	Monkeypod	40	60	2.5	Good	Preserve	Major entry specimens
T 10	Monkeypod	40	40	1.5	Good	Preserve or Transplant	Major entry specimens
T 11	Monkeypod	40	40	1.5	Good	Preserve or Transplant	Major entry specimens
T 12	Monkeypod	40	50	1.8	Good	Preserve or Transplant	Major entry specimens
T 13	Monkeypod	25	30	2	Good	Preserve or Transplant	Major entry specimens
T 14	Monkeypod	30	20	1.2	Good	Preserve or Transplant	Major entry specimens
T 15	Monkeypod	25	30	1.5	Good	Preserve or Remove	Major entry specimens
T 16	Ulu	30	40	1.2	Fair	Remove or Transplant	
T 17	Ficus- Banyan	50	80	5	Good	Preserve	Major dominant specimen
T 18	Ficus- Banyan	30	30	2.5	Fair	Remove	

Hilton Hawaiian Village
Section # 2
Entry and Rainbow Bazaar

Tree #	Species	Height (feet)	Spread	Diameter (inches)	Health Structural rating	Preserve, Transplant or Remove	Comments
T 106	Monkeypod	40	50	3	Good	Preserve	Large specimen
T 107	Monkeypod	40	60	3	Good	Preserve	Large specimen
T 108	Plumeria	20	20	1.2	Good	Preserve or Transplant	
T 109	Monkeypod	40	50	2	Good	Preserve	Large specimen
T 110	Ficus	50	60	3.5	Fair	Preserve or Remove	
T 111	Plumeria	20	20	1.2	Good	Transplant	
T 181	Plumeria	15	10	0.5	Good	Transplant	
T 182	Plumeria	15	10	0.5	Good	Transplant	
T 254	Plumeria	15	10	0.5	Good	Transplant	
T 255	Plumeria	15	10	0.5	Good	Transplant	
T 256	Plumeria	15	10	0.5	Good	Transplant	
T 257	Schefflera	25	15	1.5	Fair-Poor	Remove	
T 258	Schefflera	25	15	1.5	Fair-Poor	Remove	
T 259	Schefflera	25	15	1.5	Fair-Poor	Remove	
T 260	Schefflera	25	15	1.5	Fair-Poor	Remove	
T 261	Schefflera	20	10	.05	Fair-Poor	Remove	
T 262	Schefflera	5	3	.01	Fair-Poor	Remove	

Hilton Hawaiian Village
Section # 2
(Palms)
Rainbow Bazaar and Entry

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 25	Coconut Palm	60		Remove	Over mature
P 26	Coconut Palm	60		Remove	Over mature
P 36	Coconut Palm	60		Remove	Over mature
P 37	Coconut Palm	60		Remove	Over mature
P 38	Prichardia sp.	15	Good	Transplant	
P 39	Manila Palm	20	Good	Remove	Over mature
P 40	Manila Palm	20	Good	Remove	Over mature
P 41	Manila Palm	20	Good	Remove	Over mature
P 42	Manila Palm	20	Good	Remove	Over mature
P 43	Manila Palm	20	Good	Remove	Over mature
P 44	Manila Palm	20	Good	Remove	Over mature
P 45	Manila Palm	20	Good	Remove	Over mature
P 46	Manila Palm	20	Good	Remove	Over mature
P 47	Manila Palm	20	Good	Remove	Over mature
P 48	Manila Palm	20	Good	Remove	Over mature
P 49	Manila Palm	20	Good	Remove	Over mature
P 50	Manila Palm	20	Good	Remove	Over mature
P 51	Manila Palm	20	Good	Remove	Over mature
P 52	Manila Palm	20	Good	Remove	Over mature

Hilton Hawaiian Village
Section # 2
(Palms)
Rainbow Bazaar and Entry

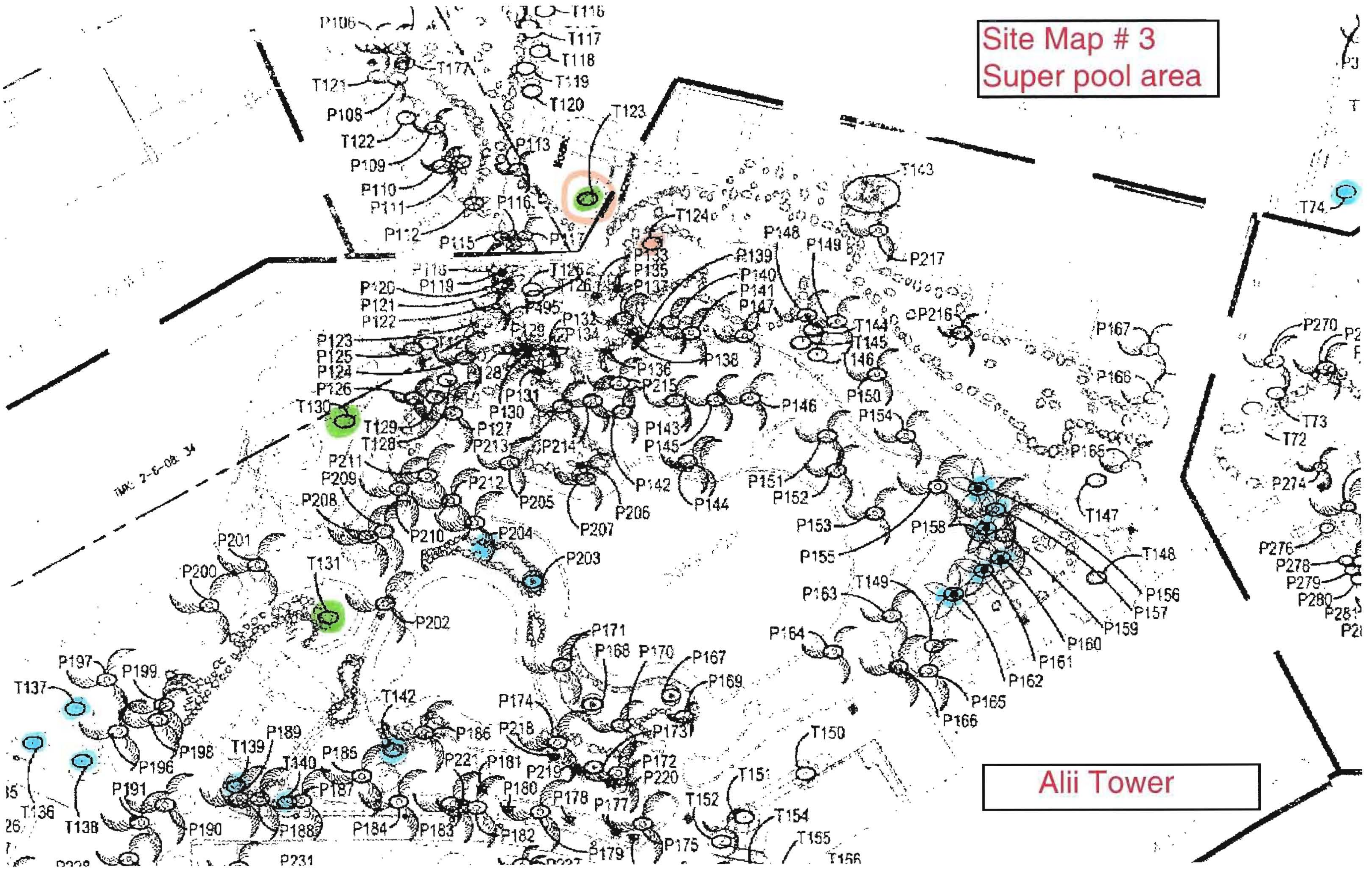
Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 53	Manila Palm	20	Good	Remove	
P 54	Prichardia sp.	25	Good	Transplant	
P 55	Prichardia sp.	25	Good	Transplant	
P 56	Manila Palm	20	Good	Remove	Over mature
P 57	Manila Palm	20	Good	Remove	Over mature
P 58	Manila Palm	20	Good	Remove	Over mature
P 59	Prichardia sp.	25	Good	Transplant	
P 60	Prichardia sp.	25	Good	Transplant	
P 61	Prichardia sp.	25	Good	Transplant	
P 62	Coconut Palm	40	Good	Remove	
P 63	Coconut Palm	45	Good	Remove	
P 64	Manila Palm	20	Good	Remove	Over mature
P 65	Manila Palm	20	Good	Remove	Over mature
P 66	Manila Palm	20	Good	Remove	Over mature
P 67	Manila Palm	20	Good	Remove	Over mature
P 68	Coconut Palm	40	Good	Remove	Over mature
P 69	Manila Palm	20	Good	Remove	Over mature
P 70	Manila Palm	20	Good	Remove	Over mature
P 72	Manila Palm	20	Good	Remove	Over mature
P 73	Manila Palm	20	Good	Remove	Over mature
P 74	Manila Palm	20	Good	Remove	Over mature
P 75	Manila Palm	20	Good	Remove	Over mature

Hilton Hawaiian Village
Section # 2
(Palms)
Rainbow Bazaar and Entry

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 76	Coconut Palm	40	Good	Remove	
P 77	Prichardia sp.	30	Good	Transplant	
P 78	Prichardia sp.	30	Good	Transplant	
P 79	Prichardia sp.	30	Good	Transplant	
P 80	Prichardia sp.	30	Good	Transplant	
P 81	Prichardia sp.	30	Good	Transplant	
P 82	Prichardia sp.	30	Good	Transplant	
P 83	Coconut Palm	40	Good	Remove	Over mature
P 84	Coconut Palm	50	Good	Remove	Over mature
P 85	Coconut Palm	50	Good	Remove	Over mature
P 86	Manila Palm	25	Good	Remove	Over mature
P 87	Manila Palm	25	Good	Remove	Over mature
P 88	Manila Palm	25	Good	Remove	Over mature
P 89	Manila Palm	25	Good	Remove	Over mature
P 90	Manila Palm	25	Good	Remove	Over mature
P 91	Manila Palm	25	Good	Remove	Over mature
P 92	Coconut Palm	35	Good	Remove	Over mature
P 93	Coconut Palm	50	Good	Remove	Over mature

Hilton Hawaiian Village
Section # 2
(Palms)
Rainbow Bazaar and Entry

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 94	Coconut Palm	50	Fair	Remove	Over mature
P 95	Coconut Palm	50	Fair	Remove	Over mature
P 96	Coconut Palm	50	Fair	Remove	Over mature
P 97	Coconut Palm	50	Fair	Remove	Over mature
P 98	Coconut Palm	45	Fair	Remove	Over mature
P 99	Prichardia sp.	20	Good	Transplant	
P 100	Prichardia sp.	20	Good	Transplant	
P 101	Coconut Palm	50	Fair	Remove	Over mature
P 102	Prichardia sp.	20	Good	Transplant	
P 103	Prichardia sp.	20	Good	Transplant	
P 104	Coconut Palm	20	Good	Transplant	



Site Map # 3
Super pool area
Alii Tower

Hilton Hawaiian Village
Section # 3
(Palms)
Super Pool Area

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 106	Pygmy Date Palm	5	Good	Transplant	
P 107	Pygmy Date Palm	5	Good	Transplant	
P 108	Pygmy Date Palm	5	Good	Transplant	
P 109	Pygmy Date Palm	5	Good	Transplant	
P 110	Pygmy Date Palm	5	Good	Transplant	
P 111	Pygmy Date Palm	5	Good	Transplant	
P 112	Manila Palm	10			
P 113	Coconut	50			
P 114	Coconut	50			
P 115	Manila Palm	15			
P 116	Manila Palm	15			
P 117	Coconut	40			
P 118	Coconut	40			
P 119	Manila Palm	15			
P 120	Manila Palm	15			
P 121	Manila Palm	15			
P 122	Coconut	40			
P 123	Manila Palm	15			
P 124	Coconut	30			

Hilton Hawaiian Village
Section # 3
(Palms)
Super Pool Area

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 125	Coconut	50			
P 126	Coconut	30			
P 127	Coconut	20			
P 128	Manila Palm	15			
P 129	Manila Palm	15			
P 130	Manila Palm	15			
P 131	Manila Palm	15			
P 132	Coconut	50			
P 133	Manila Palm	15			
P 134	Manila Palm	15			
P 135	Manila Palm	15			
P 136	Manila Palm	15			
P 137	Coconut	40			
P 138	Manila Palm	20			
P 139	Manila Palm	20			
P 140	Coconut	40			
P 141	Coconut	40			
P 142	Manila Palm	15			
P 143	Coconut	30			
P 144	Coconut	30			
P 145	Coconut	40			
P 146	Coconut	30			
P 147	Coconut	40			
P 148	Coconut	30			

Hilton Hawaiian Village
Section # 3
(Palms)
Super Pool Area

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 150	Coconut	30			
P 151	Coconut	30			
P 152	Coconut	30			
P 153	Coconut	30			
P 154	Coconut	30			
P 155	Coconut	40			
P 156	Pritchardia sp.	20	Good	Transplant	
P 157	Pritchardia sp.	20	Good	Transplant	
P 158	Pritchardia sp.	20	Good	Transplant	
P 159	Pritchardia sp.	25	Good	Transplant	
P 160	Pritchardia sp.	20	Good	Transplant	
P 161	Pritchardia sp.	20	Good	Transplant	
P 162	Pritchardia sp.	25	Good	Transplant	
P 163	Coconut	25			
P164	Coconut	35			
P 165	Coconut	30			
P 166	Coconut	30			
P 167	Pritchardia sp.	8			
P 168	Pritchardia sp.	8			
P 169	Coconut	15			
P 170	Coconut	25			
P 171	Coconut	25			
P 172	Coconut	40			
P 173	Pritchardia sp.	12			
P 174	Coconut	30			
P 175	Coconut	50			

Hilton Hawaiian Village
Section # 3
(Palms)
Super Pool Area

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 176	Bottle Palm	8			
P 177	Bottle Palm	8			
P 178	Bottle Palm	8			
P 179	Coconut	50			
P 180	Bottle Palm	8			
P 181	Bottle Palm	8			
P 182	Coconut	50			
P 183	Coconut	50			
P 184	Coconut	50			
P 185	Coconut	50			
P 186	Coconut	50			
P 187	Coconut	30			
P 188	Coconut	30			
P 189	Coconut	20			
P 190	Coconut	50			
P 191	Coconut	35			
P 192	Coconut	40			
P194	Coconut	40			
P 195	Coconut	30			
P 196	Coconut	40			
P 197	Coconut	30			
P 198	Coconut	40			
P 199	Coconut	40			

Hilton Hawaiian Village
Section # 3
(Palms)
Super Pool Area

Tree #	Species	Height (feet)	Health Structural rating	Preserve, Transplant or Remove	Comments
P 200	Coconut	30			
P 201	Coconut	30			
P 202	Coconut	50			
P 203	Blue Latan Palm	12	Good	Transplant	
P 204	Blue Latan Palm	6	Good	Transplant	
P 206	Coconut	25			
P 207	Coconut	25			
P 208	Coconut	50			
P 209	Coconut	50			
P 210	Coconut	50			
P 211	Coconut	50			
P 212	Coconut	30			
P 213	Coconut	25			
P 214	Coconut	25			
P 215	Coconut	50			
P 217	Coconut	30			
P 218	Bottle Palm	8			
P 219	Bottle Palm	8			
P 220	Bottle Palm	8			
P 221	Bottle Palm	8			

Hilton Hawaiian Village
Section # 3
Super Pool Area

Tree #	Species	Height (feet)	Spread	Diameter (inches)	Health Structural rating	Preserve, Transplant or Remove	Comments
T 116	Dracaena	20	5	.4	Fair	Remove	
T 117	Dracaena	20	5	.4	Fair	Remove	
T 118	Dracaena	20	5	.4	Fair	Remove	
T 119	Dracaena	20	5	.4	Fair	Remove	
T 120	Dracaena	20	5	.4	Fair	Remove	
T 121	Hala	20	12	.75	Fair	Remove	
T 122	Hala	15	15	.7	Fair	Remove	
T 123	Ficus elastica (Rubber tree)	60	60	4.5	Fair-Good	Preserve or Remove	Cavity at base, small leaves, sparse foliage, requires additional inspection
T 124	Monkeypod	40	60	2.5	Fair	Remove	Poor structure
T 125	Hala	20	15	.6	Fair	Remove	Poor structure
T 126	Hala	20	15	.6	Fair	Remove	Poor structure
T 127	Hala	20	15	.6	Fair	Remove	Poor structure
T 128	Plumeria	15	15	.8	Good	Remove or Transplant	Pink flowers, good structure
T 129	Plumeria	15	15	.8	Good	Remove or Transplant	Pink flowers, good structure
T 130	Fish Poison	40	70	3.5	Good	Preserve	Good structure, significant specimen
T 131	Banyan- Ficus	40	50	5	Good	Preserve	Good structure, significant specimen
T 132	Beach Heliotrope	10	10	1	Fair	Remove	
T 133	Beach Heliotrope	10	10	.6	Fair	Remove	
T 134	Autograph Tree	12	12	.6	Good	Transplant	

Hilton Hawaiian Village
Section # 3
Super Pool Area

Tree #	Species	Height (feet)	Spread	Diameter (inches)	Health Structural rating	Preserve, Transplant or Remove	Comments
T 135	Autograph Tree	12	12	.6	Good	Transplant	
T 136	Autograph Tree	12	12	.6	Good	Transplant	
T 137	Autograph Tree	12	12	.6	Good	Transplant	
T 138	Autograph Tree	12	12	.6	Good	Transplant	
T 139	Hau Tree	15	25	1.5	Good	Transplant	
T 140	Autograph Tree	12	10	.8	Good	Transplant	
T 141	Autograph Tree	10	10	.6	Good	Transplant	
T 142	Autograph Tree	12	10	.8	Good	Transplant	
T 143	Travelers Palm Cluster	25	15	1.5	Fair	Remove	
T 150	Hala	6	6	1	Fair-Poor	Remove	
T 151	Hala	6	6	1	Fair-Poor	Remove	
T 152	Hala	6	6	1	Fair-Poor	Remove	
T 153	Hala	6	6	1	Fair-Poor	Remove	
T 156	Beach Heliotrope	10	6	.8	Fair	Remove	

APPENDIX E

Water Quality and Biotic Composition in the Restored Duke Kahanamoku Lagoon and Adjacent Waters Hilton Hawaiian Village Beach Resort & Spa Waikīkī, Oʻahu, Hawaiʻi

Marine Research Consultants

September 2010

HILTON HAWAIIAN VILLAGEMASTER PLAN ENTITLEMENTS

WATER QUALITY AND BIOTIC COMPOSITION IN THE RESTORED DUKE KAHANAMOKU LAGOON and ADJACENT WATERS HILTON HAWAIIAN VILLAGE BEACH RESORT & SPA WAIKIKI, OAHU, HAWAII

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September 28, 2010

EXECUTIVE SUMMARY

In 2002, the Hilton Hotels Corporation (HHC) obtained a Special Management Area Use Permit (SMP) and Planned Development-Resort (PD-R) approval for construction of the new Waikikian Tower and associated facilities and landscaping on its Hilton Hawaiian Village (HHV) property. Among other things, the SMP required HHC to attain and maintain the water quality of the adjacent Duke Kahanamoku Lagoon at acceptable levels as specified by the State Department of Health (DOH). The original construction of the feature, utilizing near-shore ocean water to fill the lagoon through gravity flow, resulted in unacceptable conditions, primarily as a result of long residence time of water resulting in dense plankton growth in the water column, introduction of marine silt that became trapped in the lagoon, and introduction of noxious marine species. To meet the requirement of attaining acceptable water quality standards, a complete re-design of the lagoon configuration, water source, and circulation/discharge system was necessary. These changes were completed in 2007, and have transformed the lagoon into an extremely valuable recreational resource, with high aesthetic appearance, and acceptable water quality.

The key factor of the re-design of the lagoon was isolating the lagoon intake from the offshore ocean. This was accomplished by drilling seven wells along the mauka perimeter to supply saline groundwater to the lagoon. The thick layer of anaerobic silty mud was sealed with geotextile cloth, and volume of water in the lagoon was decreased by filling in the lagoon to a maximum depth of 5 feet. A new circulation system pumps intake water into the lagoon from sumps containing saline groundwater, and water cycled through the lagoon is discharged via pumps into the middle and mauka basins of the Ala Wai Boat Harbor. Design of the circulation system promotes uniform and complete turnover of water within the lagoon up to five times per day. While the source saline groundwater is substantially (and naturally) elevated in dissolved inorganic plant nutrients, the rapid turnover rate prevents substantial uptake of nutrients by plankton, resulting in a consistently clear water column.

Required monitoring of lagoon waters to ensure compliance with State Water Quality Standards was initiated in October 2007 and continues to the present (at the time of this writing 33 monthly water quality monitoring surveys have been conducted). Result of water quality monitoring show that levels of dissolved nutrients decrease slightly between supply water and discharge water, while concentrations of Chlorophyll a and turbidity are slightly elevated in discharge water relative to supply water. These patterns indicate that there is some uptake of dissolved nutrients by plankton and benthic plants during residence time of water in the lagoon. While uptake and growth are analytically detectable, there is no visible indication of effect to water clarity, which remains consistently high throughout the lagoon. Dissolved oxygen is relatively low in saline groundwater intake, but rapidly increases during the circulation cycle.

Monthly measurement of three indicator bacteria (Enterococcus, Fecal Coliform, and *Clostridium perfringens*) since 2007 reveal no consistent elevated readings of any of the indicators in either supply water, lagoon stations, or discharge water. Samples collected over the span of a single day reveal several elevated readings late in the day which may be a response to heavy usage of the lagoon by bathers. Overnight water exchange appears to mitigate any build-up of any organisms that may result from human utilization of the lagoon. Based on the results of monitoring, as well as the overall appearance of the lagoon, the restoration project has succeeded in meeting the requirements of attaining acceptable water quality.

Monitoring of biota within the lagoon, particularly with respect to invasive or alien species indicates a complete lack of noxious marine organisms (e.g., stinging jellyfish) that previously compromised the lagoon for safe swimming. Major biotic components of the lagoon now consist of three species of fish (guppies, tilapia, and tabai) which appear able to complete their life cycles within the lagoon. Periodic netting of fish has kept the numbers relatively small, and these species may feed on algal or cyanobacterial mats, thus serving as a mechanism to control growth on the lagoon floor. Screens placed over the discharge pipes in the Ala Wai Boat Harbor and one-way valves in discharge pipes have been effective in preventing invasion of the lagoon by marine species. Continual monitoring to identify species and subsequent rapid action to eliminate introduced species has been effective in maintaining a balanced and non-intrusive biotic community within the lagoon.

As part of the restoration of the Kahanamoku Lagoon per an agreement with the State DLNR, Division of Boating and Ocean Recreation, a portion of the lagoon discharge water is diverted in the inner and mauka basin of the Ala Wai Harbor. A newly constructed pipeline carries outflow from the lagoon to the makai-Diamond Head corner of the inner harbor basin. The improved bio-chemical cycling system of water exchange between the lagoon and the harbor has resulted in the geometric means of water quality constituents of lagoon water discharge falling between wet and dry water quality standards.

The restoration of the Lagoon also precluded any direct storm water or surface runoff to the water feature. The re-design of the lagoon currently meets the requirements of the State Water Quality Standards. Mitigation will continue in the form of water quality monitoring and through best management practices for daily operations and maintenance of the lagoon and to ensure outflow to the harbor basin is within acceptable standards.

The proposed master plan improvements will increase the amount of treated storm water runoff by 0.14 cfs into the area of Waikiki Beach known as the Port Hilton Basin. Water quality treatment mitigation measures which can be implemented at the outflow include bioretention basins or storm water quality chambers (e.g. Vortechs or CDS system) sized to accommodate approximately 1.26 cfs of flow-through runoff. A storm water quality chamber can be located Diamond Head-makai of the Super Pool, to treat storm water runoff prior to flowing off the property. This would ensure that all storm water runoff that is discharged to this basin has been adequately treated prior to release. Such treatment should result in no significant or long-term effects to water quality or marine biota in the Port Hilton Basin area.

Master plan improvements are anticipated to decrease storm water runoff to the Ala Wai Yacht Harbor by approximateloy 0.11 cfs upon project implementation. Owing to the decreased discharge no mitigation measures are required for the Ala Wai Yacht Harbor. As a result of the decrease in discharge, it can be anticipated that there will be no significant or long-term changes to water quality from present conditions of the Yacht Harbor Basin resulting from the proposed master plan project.

In summary, at present the restored Hilton Hawaiian Village Duke Kahanamoku Lagoon meets the requirement of complying with State Water Quality standards, and provides a resource of high aesthetic value that provides a uniquely pleasing safe recreation resource for residents and visitors. There are no anticipated changes to the status of the Lagoon, nor surrounding marine waters (Ala Wai Harbor and Port Hilton basin) as a result of the proposed master plan improvements.

I. INTRODUCTION

A. Purpose

The purpose of this report is to address existing conditions, potential impacts and mitigation for marine waters in the vicinity of the Hilton Hawaiian Village (HHV) in support of the Environmental Impact Statement (EIS) and the Shoreline Management Area (SMA) Use Permit, and the Planned Development Report (PDR) Permit for the Hilton Hawaiian Village master plan improvements.

The proposed master plan improvement project is a directed effort to reinvigorate the Village's iconic resort setting through a purposeful series of redevelopment activities that will ultimately lead to a contemporary transformation of the entire Village. Overall, the master plan's primary's emphasis is the improvement of retail flow throughout the property, coupled with two key signature timeshare tower developments, and the expansion of recreational amenities and guest services to enrich the overall guest experience. Significant improvements within the master plan are designed to celebrate the vibrancy of the Village from its primary point of entry along Kälia, through points of visitor arrival and check-in, and key enhancements to be experienced through the duration of the guest experience.

The major transformative improvements within the Village Master Plan include the construction of two new timeshare towers, expansion of the existing Super Pool, and redevelopment of the Rainbow Bazaar retail venue and along Rainbow Drive. As shown in the accompanying figure, the Village Master Plan defines three master planned improvement areas (MPAs), which include:

MPA-1: Improvements to the main entry, the Kälia Road streetscape ground floor retail experience along Tapa Tower, improvements to the Tapa Pool and Terrace, and the development of a new 350' timeshare tower (#1) over the existing bus loading area

MPA-2: Improvements to the retail pavilion on the Diamond Head side of Rainbow Drive, the redevelopment of the Rainbow Bazaar, and the development of a 260' new timeshare tower (#2) over the makai end of Rainbow Bazaar

MPA-3: Improvements to the Main Lobby/Arrival Area and expansion of the Super Pool and amenity area

A main feature of the existing HHV is the Duke Kahanamoku Lagoon, which is a man-made water body lying between the HHV and the ocean. In 2006, the lagoon underwent a major restoration, which essentially completely changed the aesthetic and functional features of the lagoon. While the present master plan improvements do not involve further modification of the lagoon, the water feature is a major recreational and aesthetic component of the existing setting of the resort. As such, a review of existing conditions of the Duke Kahanamoku Lagoon is presented below. In addition, relatively small changes to existing storm water drainage are anticipated with the proposed master plan improvements (Engineering Reports provide detailed discussions of these changes). The potential impact of these changes to receiving marine waters is also addressed.

B. Historical Background

The Hilton Hawaiian Village (HHV) is located at the western end of Waikiki Beach. The Duke Kahanamoku Lagoon (DKL) is situated adjacent to the southwestern boundary of the resort property. The lagoon is bordered by public beach to the east and south, the Ala Wai Harbor to the west, and HHV property on the northwest. The DKL was created by a combination of excavation and fill along the shoreline in 1956 when the HHV was originally developed. The State of Hawaii owns the property on which the lagoon is located, but the terms of the September 22, 1955 Indenture and Deed from the Territory of Hawaii gave the HHV the right to construct and use (and the obligation to maintain) the lagoon. Henry J. Kaiser constructed the lagoon in accordance with a design created by the (then) Territorial Harbors Commission. Lagoon construction was part of a littoral rights exchange between the abutting property owners (Kaiser and the Paoa Estate) and the Territory of Hawaii. It was only a part of a planned significant enlargement of “Crescent Beach,” but the other beach improvements were never made. Ownership of the lagoon passed to the Territory of Hawaii, under deed covenants specifying, for the Paoa Property, that the Territory would preserve the lagoon as a “safe and sanitary” body of water and that Hilton maintain the lagoon for as long as economically practical. If HHC determines that this is impractical and notifies the State of its intent to discontinue maintenance of the lagoon, the State must fill the lagoon to make a flat land area, provide an easement to Hilton, and create a “no buildings” zone.

The lagoons original use was scenic and recreational, although recreational uses were limited by poor water quality and undesirable conditions within the lagoon and on the adjacent beach. The water column of the lagoon was generally very turbid, and the floor was covered with fine-grained, anaerobic sediment that emitted noxious odors of hydrogen sulfide when disturbed. In addition, “upside down” stinging jellyfish were common within the lagoon. All of these factors combined to make the area essentially unusable for recreational purposes.

The original water circulation system consisted of two 30-inch diameter corrugated metal ocean water intake pipes that originated in shallow water immediately makai of the lagoon. The intake pipes passed under the beach berm and discharged into the lagoon. Two pipes (24 and 28-inch diameter) conveyed water from the lagoon to a pump house on the Ewa side of the lagoon, and a single 36-inch diameter discharge pipe carried water from a discharge pump in the pump house to the Ala Wai Harbor. By pumping water from the lagoon into the Ala Wai Harbor, the system lowered the water level in the lagoon below that in the adjacent ocean. The resulting difference in water elevation caused water to flow from the ocean into the lagoon at all times. However, because the head difference was a function of the level of the water in the ocean, which fluctuates with the tide, the rate of inflow varied over time, while the discharge into the harbor remained relatively constant. As a result, water level in the lagoon rose and fell in response to the tide.

The original pump capacity was selected to provide a lagoon turnover rate (the time to fully replace one volume of lagoon water) of one per day, which proved to be too slow to support water quality appropriate for the desired recreational uses of the lagoon. Because the positioning of the pipes that supplied and discharged water from the lagoon led to short-circuiting of flow (when water moved directly from the intake to discharge pipes, much of the lagoon was not involved in the overall exchange, resulting in “dead spots” of significantly reduced circulation). Consequently, the average turnover rate for the entire lagoon was far longer than the one day design rate.

One other cause of poor water quality in the lagoon was input of stormwater runoff from adjacent areas (including about one-half of the HHV property).

C. Lagoon Restoration

In 2002, the Hilton Hotels Corporation (HHC) obtained a Special Management Area Use Permit (SMP) and Planned Development-resort approval for construction of the new Waikikian Tower and associated facilities and landscaping on its HHV property. Among other things the SMP required HHC to attain and maintain the water quality of the adjacent DKL at acceptable levels as specified by the State Department of Health (DOH). If it was found that it was not practical or economically feasible to restore the lagoon to a condition that would attain and maintain acceptable water quality, the lagoon would have been filled in.

In November 2005, a Final Environmental Assessment (FEA) was prepared by Planning Solutions Inc. The approving agency (Department of Land and Natural Resources) granted the project a Finding of No Significant Impact (FONSI), allowing the restoration project to proceed. One aspect of the FEA was to describe an array of proposed modifications to the lagoon to meet the criteria for acceptable water quality as specified by DOH which are described below.

Key elements of the lagoon restoration project to improve water quality included:

1) reducing the volume of the lagoon by approximately 50%. Such a reduction was achieved by reducing the maximum depth of the lagoon to 5.0 feet below mean sea level (MSL);

2) reducing the surface area of the lagoon by about 25% (4.64 acres to 3.43 acres);

3) sealing the deposited soft, anaerobic sediments with an impermeable geotextile fabric covered by an overburden of 15,000-20,000 cubic yards of sand. Sealing of the bottom sediments eliminated the need to remove and dispose of bottom sediments.

4) sealing the original ocean intake pipes, eliminating exchange with the surface ocean.

5) replacing the seawater source water with saline groundwater from a series of wells drilled along the perimeter of the lagoon, providing a source of water of supply water with essentially no fine-grained marine sediment or marine organisms.

6) increasing turnover rate of lagoon water to approximately five times per 24 hour period.

7) improving water circulation through placement of intake-discharge piping that equally covered the entire lagoon; and

8) eliminating stormwater drainage into the lagoon.

Below is a description of the restoration procedures that were carried out to implement the goals of the lagoon restoration listed above. All of these procedures were completed in 2007, and the lagoon is presently operating under the complete restoration scenario (Figure 1).

To accomplish the change of lagoon source water from ocean water to saline groundwater, seven wells were drilled along the northwestern side of the lagoon. Each well draws saline groundwater from between 77 and 251 feet below sea level. The specific depth of each well was varied to maximize the well yield while producing water warm enough for comfortable swimming in the lagoon. The design avoids drawing relatively poor quality shallow groundwater and avoids structural foundation problems that might result from dewatering the shallow groundwater aquifer. Each well has the capacity of at 2,500 gallons per minute (gpm). Together the wells can deliver a minimum of 15,000 gpm of saline water into the lagoon, which is approximately three times the volume of the original intake system.

The original 50-year old pipes within the lagoon were removed and replaced with a new circulation system, including a new pump house. While the original circulation system depended solely on pumping to discharge water from the lagoon to the Ala Wai Harbor, the new system uses pumps for both the inflow and outflow from the lagoon. This system gives operators much greater control over the system. The inflow (supply) system consists of manifold piping which connects all seven wells to a sump in a new pump house. The sump is lower than sea level, allowing gravity flow of well water to the sump. Two 7,500 gpm pumps will deliver water to three discharge points situated in the mauka region of the lagoon through pipes laid along the lagoon floor. An effluent sump is also located within the pump house will receive lagoon water pumped from two intakes at the makai end of the lagoon. From the effluent sump water flows to discharge pipes into the Ala Wai Harbor.

The original 36-inch diameter pipe which carried water from the original pump house to a discharge point at the Diamond Head end of the middle basin of the Ala Wai Harbor had sufficient capacity to accommodate the new system's discharge rate. However, in response to a request from the Division of Boating and Outdoor Recreation (DOBOR) of the State Department of Land and Natural Resources, which operates the harbor, HHC agreed to divert a portion of the lagoon discharge water in the inner basin of the Ala Wai

Harbor. To accomplish this, a new pipeline was constructed to carry half of the outflow from the lagoon to the makai-Diamond Head corner of the inner harbor basin.

At present, the typical operation involves reducing inflow to the lagoon at night to lower the water level to a point where the sand along the edges of the lagoon can be swept clean early each morning. Subsequent to sand cleaning, inflow pumps are turned up, and the volume of water within the lagoon is returned to a high level for the course of the day. Such a scenario is ideal for preventing any colonization of benthic bacterial mats along the edges of the lagoon, as well as assuring maximal water exchange, resulting is optimal aesthetic and recreational use conditions.

In addition to the improvements of the lagoon structure and circulation, storm drains that previously sent runoff from approximately half the HHV property into the lagoon were rerouted. The new system, which includes filtration capability, diverts stormwater runoff into the mauka basin of the Ala Wai Harbor, thus eliminating stormwater discharge into the lagoon.

The improvements described above increase the turnover in the lagoon from less than one time per day to approximately five times per day. Hence, the average residence time for water within the lagoon has been reduced from more than 24 hours to less than 5 hours. In, addition, because of the locations of the inlets and outlets, complete turnover of the lagoon volume is occurring uniformly with no dead spots. These improvements, along with elimination of stormwater discharge have resulted in water quality within the lagoon to reach safe recreational standards.

D. Lagoon Monitoring

A component of the permitting process for the DKL restoration project was periodic sampling and testing of the water from the lagoon in accordance with protocols acceptable to the State Department of Health. In addition periodic monitoring the biotic composition of the lagoon was required. Monitoring commenced in October 2007 shortly after the completion of lagoon restoration and continues to the present (and will continue in the future). The results of monthly water quality monitoring and quarterly biotic monitoring are presented in the following section, and provide data sets to evaluate the functional aspects of the present day Duke Kahanamoku Lagoon.

II. RESULTS OF LAGOON MONITORING AND ASSESSMENT

A. Water Quality

1. Water Chemistry

Water quality monitoring consisted of two components; water chemistry, and indicator bacteria. Water chemistry was by collecting samples periodically from the intake water sump and the discharge water pump. Sample constituents included nutrients (Total Phosphorus, Total Nitrogen, Nitrate Nitrogen (NO_3^-), Ammonium (NH_4^+), Phosphate phosphorus (PO_4^{3+}), Silica (Si), Total organic nitrogen (TON), and Total organic phosphorus (TOP). In addition, turbidity, salinity, pH, and chlorophyll a. Temperature, dissolved oxygen and TSS were also measured during three of the samplings. All water samples were collected and reported by Marine Research Consultants, and all laboratory analyses were performed by Marine Analytical Specialists using approved Standard Methods or EPA methods. All monitoring reports have been submitted to the State Department of Health.

Results of the eleven samplings spaced from October 2007 to March 2009 are shown in Table 1. In addition to the results of each individual supply and discharge sample, the difference between supply and discharge water from each sampling date is shown. Difference in values indicates processes of uptake or production that occur during the residence time of water within the lagoon. Positive signs of the differences indicate higher values (production) in the discharge water, while negative differences indicate uptake within the lagoon.

Overall, results of the water chemistry sampling indicate that lagoon supply water, which originates as saline groundwater pumped from depth, is elevated in nutrient concentrations relative to open coastal seawater, although the salinity is essentially oceanic. Chlorophyll a, pH and turbidity are generally lower than nearshore ocean water. Supply water is extremely low in dissolved oxygen with saturation levels of only 10-12%, compared to values near 100% in surface ocean water.

When differences between supply and discharge water are examined, results are consistent throughout the period of sampling. Salinity showed no consistent trend, and can be considered unchanged during water residence time in the lagoon. In all but a single case (11/8/2007), the dissolved inorganic nutrients PO_4^{3+} and NO_3^- were lower in discharge water relative to supply water. While slightly less consistent, the same pattern held for Si, TP and TN. These results indicate that there is without question nutrient uptake within the lagoon. Contrary to nutrient concentrations, the values of the differences in Chlorophyll a are all positive in sign, indicating production within the lagoon. While positive in sign, most of the increases are small, less than 0.1 µg/liter. On two occasions the differences were an order of magnitude greater (1.2 and 3.89 µg/liter). The geometric mean of Chlorophyll a in discharge water was 0.173 µg/liter, with a maximum value of 4.03 µg/liter. State of Hawaii water quality standards for Chlorophyll a for open coastal waters under wet conditions is 0.3 µg/liter and dry condition 0.15 µg/liter. Hence the geometric mean of lagoon discharge water is lower than the wet condition standard, and slightly above the dry condition standard.

In all but one instance, the turbidity is higher in discharge water relative to supply water. The geometric mean of turbidity of the discharge water was 0.26 ntu (nephelometric turbidity units), while the geometric mean standard for wet conditions is 0.5 ntu, and 0.2 ntu for dry conditions. As with chlorophyll a, the geometric mean of lagoon discharge water falls between the wet and dry water quality standards.

These results indicate that the bio-chemical cycling of water in the lagoon results in the typical scenario of uptake of plant nutrients and production of phytoplankton (i.e., increased turbidity). It is also likely that nutrients are utilized by benthic algal mats. While this process can be detected by the relative values of supply and discharge water, the rapid turnover time within the lagoon limits the extent of algal production in the water column. While these processes are occurring, they are not resulting in any visible or functional (with respect to recreational usage) change to water quality and the geometric means of both Chlorophyll a and turbidity remain well below the State limit for wet conditions of marine waters.

Dissolved oxygen increased substantially (16-28%) between supply and discharge water. As noted earlier, saline groundwater is essentially devoid of oxygen when pumped to the surface. Exposure of supply water to the atmosphere and mixing during passage through the lagoon results in increased saturation to a point which is apparently not detrimental to biota. Surprisingly, temperature of supply water and discharge water were not substantially different (Table 1). In summary, operation of the restored lagoon system results in water chemistry conditions that are optimal in terms of maintaining an aesthetically pleasing clear water column that meets water quality standards.

b. Indicator Bacteria

The second aspect of the water quality monitoring program is evaluation of indicator bacteria, which in part are specified in §11-54-8(b) of the State Water Quality Standards. This section states that in marine recreational waters no single enterococcus sample shall exceed the single sample limit of 104 CFU (Colony Forming Units) per 100 milliliters of water, and the geometric mean of these samples taken exceed 35 CFU per 100 milliliters of water.

The monitoring program for the DKL includes monthly sampling of enterococcus as well as two other indicator bacteria, fecal coliform and *Clostridium perfringens*. Neither fecal coliform nor *Clostridium perfringens* have standards set out in the water quality standards. However, it is felt that *Clostridium perfringens* represents a better indication of contamination as enterococcus occurs naturally in Hawaiian aquatic systems (R. Fujioka, personal communication). However, in the present case, supply water emanating from saline groundwater wells should be devoid of all indicator bacteria, and hence and viable bacteria found in the lagoon are highly likely to have come from sources within the lagoon.
Sampling is conducted on a monthly basis at approximately 0900-1000 (this time-frame was requested by DOH). Samples are collected from both the supply water and discharge sumps (with pumps operating in both sumps), as well as six stations spread through the lagoon (Figure 2). Monitoring was initiated in October 2007, and has continued uninterrupted since the origination of the program, with 33 samplings to data. All bacterial analyses have been carried out by Hawaii Food and Water Testing. *Clostridium perfringens* was evaluated using the membrane filter enumeration method; enterococcus was evaluated using EPA method 1600; and fecal coliform was evaluated using Standard Method 9222. A summary of the geometric means of all bacterial sampling is shown in Table 2, while the individual sample results for *Clostridium perfringens*, fecal coliform, and enterococcus are shown in Figures 3, 4, and 5, respectively.

Examination of Table 1 reveals that with a single exception (Enterococcus in the discharge water) the geometric means of all samples to date from each sampling location for each indicator are less than 2 CFU/100 ml. The combined geometric means of all sampling locations are below 1.7 CFU for each indicator. With respect to Enterococcus, which is the only indicator with DOH standards, the geometric mean of each of the individual sampling stations, as well as the pooled data set are an order of magnitude less than the geometric mean standard of 35 CFU. The maximum single measurement of Enterococcus of 34 CFU is also an order of magnitude less than the DOH single event standard of 104 CFU. The individual sampling results for each sampling event reveal that periodically there were somewhat elevated readings, but with no pattern. For example, enterococcus was measured at a peak value of 34 CFU/100 ml on May 23, 2008, while both fecal coliform and Clostridium were below detection limit in the same sample. The value of 34 CFU in intake water is also of interest in that there should be no source of bacteria in pumped saline groundwater.

2. Time-course Evaluation

By stipulation of the Department of Health, all water monitoring was conducted in the early morning, prior to substantial use of the lagoon by people. In order to evaluate if usage of the lagoon by swimmers and waders caused any changes in water chemistry or bacterial content, four samplings of stations 1, 2 and 5 were conducted on March 3, 2010 at 0900, 1200, 1500 and 1800. While occupants of the lagoon were not counted at the time of sampling, it was noted that there were numerous people in the lagoon at the time of each sampling after 0900.

Concentrations of dissolved nutrients at Stations 1 and 5 showed little variation over the day (Figure 3). However, for all nutrients there peak values at Station 2 at 1500. Following the peaks at 1500, all nutrient concentrations returned to former levels at 1800 (Figure 3). There was no clear explanation for this pattern. Salinity showed a similar pattern of slightly increasing values over the course of the day, possibly as a result of evaporation during sunlit hours (Figure 4). Turbidity also increased slightly over the course of the day; Chlorophyll a and temperature increased from 0900 to 1500 and subsequently decreased at 1800. Dissolved oxygen increased slightly at all stations from 0900 to 1800 (Figure 4). All changes in water quality within the lagoon were small, and none resulted in any conditions that could be deemed significant.

Changes in bacterial indicators over the course of a day showed different results for the different indicators. Clostridium perfringens showed virtually no alteration, with all measured values below the level of detection from 0900 to 1800 (Figure 5). Counts of Fecal coliform were below 7 CFU at all stations until 1800, when counts rose to 170, 80 and 11 CFU, respectively at stations 1, 2, and 5. A similar pattern was observed for Enterococcus, where all counts were below 10 CFU until 1800, at which time they increased to 13 and 66 at stations 1 and 2 (counts at station 5 remained low at 3 CFU (Figure 5). While these results must be considered with some uncertainty as it was a single sampling event, the indication is that indicator buildup during the course of the day, likely as a result of usage of the lagoon by swimmers. However, with overnight replacement of the lagoon volume, there does not appear to be a residual or cumulative effect, and the lagoon can be considered relatively free from public health concerns. For a conclusive determination of how bacterial content changes diurnally, repetitive sampling should be conducted.

B. Biotic Community Monitoring

1. Elements of the ASMMP

In January 2007, the Division of Aquatic Resources (DAR) of the State of Hawai'i Department of Land and Natural Resources approved the Aquatic Species Management and Monitoring Program for the Duke Kahanamoku Lagoon (hereafter the ASMMP). The purpose of the ASMMP is to (1) limit the introduction of alien species into the Duke Kahanamoku Lagoon and Ala Wai Harbor, (2) monitor for the presence of newly introduced species in the Lagoon; and (3) control population growth/mitigate for any aquatic species successfully recruiting to the Lagoon. Environmental Assessment, LLC which has been contracted to carry out the ASMMP submitted the first annual monitoring report to DAR in October 2008. This second annual report summarized the results of the second year of monitoring (October 17, 2008 through October 16, 2009). Results of the 2009 report are summarized below.

As provided for in the ASMMP, monitoring of the Lagoon is being carried out at several levels. First, hotel maintenance personnel conduct informal day-to-day monitoring as they perform their (other) normal duties. Second, lagoon maintenance staff members record physical condition of the lagoon as they carry out routine maintenance of the lagoon sides and bottom, inspect lagoon intakes and discharge pipes, and oversee maintenance and repair of the pump. A log of all observations is kept and personnel note changes as they occur. Finally, a qualified marine biologist (Dr. R. Brock) periodically inspects the lagoon as called for in the approved ASMMP.

The biological monitoring program also includes an annual qualitative underwater survey of
the status of any marine communities present in the lagoon, interviews of maintenance personnel to obtain their insights into the lagoon's status, and preparation of an annual report describing the monitoring activities completed, the condition of the lagoon, noteworthy incidents recorded, the corrective actions undertaken.

b. Biological Inspections

Inspections by the biological monitor have been conducted monthly and entailed a visual assessment of the biological resources within the lagoon as viewed from the perimeter. Inspections include one or two separate walks completely around the perimeter by two individuals walking in opposite directions (i.e., moving clockwise and counterclockwise) because the schools of fish often flee from the individual walking along the shoreline by moving ahead and into deeper water on the approach of the observer. Since the three common alien species (tilapia, guppies and tabai) have been well-established and since netting of these fish by Hilton maintenance staff is ongoing, no effort has been made to assess fluctuations in the size of the populations. Thus the intent of the monthly visits is to ascertain (insofar as could be determined from the lagoon perimeter) if any new fish or invertebrate species were becoming established.

Only two of the monthly visits in 2009, new and unusual species were observed in the lagoon. The 17 March inspection was carried out in the morning and noted the usual abundance of tabai, guppies and tilapia in the lagoon. However along the basalt rock wall at the northeast edge of the lagoon, a single damselfish tentatively identified as *Pomacentrus moluccensis,* or lemon damselfish was observed. Hilton staff subsequently lowered the water level (below the level of the rocks) and caught and destroyed the specimen on 24 March. Undoubtedly, this individual fish was released into the lagoon as it does not occur in Hawaiian waters, but is common in the aquarium trade.

During March 2009, visually and numerically dominant species included the following fishes: tilapia (*Sarotherodon melanotheron*), the tabai (*Poecilia* sp. hybrid complex of the *salvatoris/mexicana* group) and the guppy (*Gambusia affinis*). Sargeant major or mamo (*Abudefduf abdominalis*) were observed around the small island in the lagoon. The diversity in the algal and invertebrate communities had increased since the last annual inspection in 2008 with the cyanobacteria *Hormothamnion enteromorphiodes* and at least two genera of diatoms (*Pleurosigma* sp. and *Melosira* probably *nummuloies*) prevalent on the rocks surrounding the island; they were also spread across the sandy substratum in the deeper part of the lagoon.

Less common was the cyanobacteria, *Lyngbya majuscula* on the rocks around the island. Two "new" algal species (*Bryopsis pennata* and *Ulva reticulata*) are also present on the rocks around the island. Also abundant on the rocks is the sea anemone (*Aiptasia pulchella*) and the tube building polychaete, *Branchiomma nigromaculata*. The anemone has also colonized some of the sand bottom in the deeper parts of the lagoon. On the rocky intertidal around the island were seen several black rock crabs (*Metapograpsus thunukar*). A small collection of algae was made for purposes of identification and among the fronds were several unidentified amphipod species and two polychaetes (*Schistomeringos rudolphi* and *Capitella capitata*). Finally two individual sea slugs (*Aplysia dactylomela*) were seen on the sand bottom adjacent to the island. All of the "new" species above are common in a variety of aquatic habitats in Hawai‘i.

A review of the 2009 entries in the logbook (through 26 October 2009) noted no unusual species present. The maintenance staff continues to make daily entries and most of the information in the logbook is focused on water clarity and the visual impact of the cyanobacterial/algal/diatom mats present on the lagoon sand bottom.

All of the species seen in the Duke Kahanamoku lagoon since restoration are either omnivorous or herbivorous in their trophic requirements thus are able to survive on the extant cyanobacterial/algal mats present in the lagoon. There are no strictly carnivorous species that have colonized the lagoon albeit there are considerable carnivore food resources present in the form of mosquito fish and tilapia. The native mamo (*Abudeduf abdominalis*) is primarily planktivorous (i.e., feeding on zooplankton) in its normal habitat but also will ingest algae (Helfrich 1958, Randall 2007). In the Duke Kahanamoku Lagoon the several small mamo seen may be feeding on newly released mosquito fish fry as well as algae and small invertebrates residing in the cyanobacterial/algal mats present in the lagoon.

The three alien fish species (mosquito fish - *Gambusia affinis*, tabai - *Poecilia* sp. Hybrid complex and tilapia - *Sarotherodon melanotheron*) continue to be the dominant aquatic species in the lagoon. These species persist because they are able to complete their lifecycles in the enclosed lagoon system. In contrast, the native fish species that have been occasionally (or once) seen in the lagoon (uhu – *Scarus psittacus*, mamo - *Abudefduf abdominalis*, manini - *Acanthurus triostegus*, mullet - *Mugil cephalus* and/or uouoa - *Neopmyxus leuciscus*) require the open ocean to complete their lifecycles, thus will only occur as individuals that have recruited from elsewhere to the lagoon. This difference in life history requirements explains the large differences seen in the abundance of fishes present. In short, any individual of any native fish species found in the Duke Kahanamoku Lagoon is present as a result of introduction of that individual into the lagoon system. In contrast, alien fish species are the result of successful active spawning occurring within the lagoon. Given these differences in life history traits, no native fish species is ever expected to become very abundant in the lagoon relative to the alien species that are present.

It is unknown if the invertebrates encountered up through December 2009 have the same life
history requirements as do native fishes. Thus some of these species may be able to complete their life cycles within the confines of the lagoon if the appropriate food and larval niche requirements are present. Only time will tell if the conditions in the lagoon are appropriate for reproduction to occur.

Supply water for the lagoon originates from saline groundwater wells which contain inorganic plant nutrients. Discharge water is released through two pipes that terminate at two locations on the east side of the Ala Wai Boat Harbor. These two pipes are the only direct connection between the lagoon and external aquatic environments. To reduce the opportunity for recruitment of fish or invertebrates through the discharge pipes, each pipe is fitted with a screen but has probably not been an effective block to recruiting species. However when pumps are not operating and individual organisms are small enough to get past the screens and pump impellors, recruitment to the lagoon could be successfully accomplished. To reduce the probability of recruitment occurring via this pathway (i.e., from the boat harbor to the lagoon), the discharge lines were fitted in 2008 with check valves (one-way valves) that are closed when the discharge pumps are not operating. This improvement would be expected to reduce the opportunity for further recruitment to occur into the lagoon but the 2009 survey suggests that “new” species are continuing to enter the lagoon.

Since many algae (and probably cyanobacteria) have spores and the ocean is no more than 150 feet seaward of the lagoon, the flora could have recruited via airborne spores especially during periods of high surf. If this is a viable method of spore transfer to the lagoon, it is possible that other species of Hawaiian aquatic flora will possibly recruit through this same mechanism over time.

Yamamoto and Tagawa (2000) report that *Sarotherodon melanotheron* may produce up to 250 fry per spawning, and like many tilapias are sexually precocious and commence breeding at an early age. Because of these traits resulting in a high reproductive rate, tilapia are able to outstrip their food supply in enclosed systems leading to smaller adult body size with successive generations (i.e., less food per individual results in smaller individuals at sexual maturity). Since the Duke Kahanamoku Lagoon is a relatively closed system with source water coming from deep wells hence having no incoming food resources other than inorganic plant nutrients, it is expected that as time passes, the populations of alien herbivores will increase to a point where competition for food resources will limit the sizes of individuals resulting in "stunted" populations of adult tilapia.

Although much smaller in size, the liberty molly can produce 80 to 100 fry every five to six weeks, thus is prolific while the mosquito fish produces ten to eighty fry every five to eight weeks (Yamamoto and Tagawa 2000). These species are probably in competition with the tilapia for the available food resources. The competition among the alien herbivore species resulted in a noticeable decrease in the relative coverage and amount of the cyanobacterial/algal mat present on the lagoon bottom and rock structures in the October 2008 survey relative to the October 2007 survey. The September 2009 annual survey noted little change in the cyanobacterial/algal mat since the October 2008 survey. This suggests that this community has stabilized; it also indicates that the population of herbivorous fishes has also stabilized. The high fecundity of the alien fishes in the lagoon has been controlled by the Hilton maintenance staff through a netting program. Netting is done to reduce the abundance of unwanted fishes and is carried out at times when there is little or no public use of the lagoon. The netting program is implemented approximately every two weeks and fishes caught are disposed of via the Hilton refuse collection system. Maintenance personnel have not attempted to record either the number or biomass of the organisms removed.

The thin diatom mat occurring across some of the sandy lagoon floor first noted in 2008 continued to persist in 2009. This mat appears to include the diatom, *Melosira nummuloides* as well as *Pleurosigma* sp. and is not very obvious being a light yellow-brown in color and is similar in appearance to diatom mats seen on sand in marine low energy settings. This diatom mat probably represents a benthic community that is receiving grazing by herbivores and, visually, is an improvement over the cyanobacterial mat that was much more evident in the earlier (2007) surveys but it still persists. On the rocks forming the intake and discharge structures for the lagoon is a more complex mix of cyanobacteria, macroalgae including *Bryopsis pennata* and *Ulva reticulata* and undoubtedly a number of unidentified microalgal species. Among the forms that continue to be seen on the rocks include the wispy dark-colored cyanobacteria that resembles *Lyngbya majuscula* which was present in the October 2007 survey. As noted previously, the filaments bear a strong resemblance to *Hornothamnion enteromorphiodes* (Brock 2007).

The present operational scenario involves lowering the water level of the lagoon each night and mechanically sweeping the exposed sand around the lagoon perimeter each morning. This procedure eliminates all benthic algal or bacterial growth in the swept area. As a result, when the water height of the lagoon is restored to the normal daytime level, the submerged sand within approximately 20-30 feet of the shoreline is devoid of any growth, resulting in an aesthetically pleasing appearance.

It is anticipated that all of the management methods described above to control the occurrence of biotic components within the lagoon will continue. These methods include daily cleaning of the shoreline, periodic netting of fish, inspection of the discharge system to eliminate any possible pathways of entry into the lagoon via connection with the Ala Wai Harbor.

III. STORMWATER RUNOFF and DISCHARGE

As mentioned above, following circulation within the lagoon, water is discharged into the Ala Wai Harbor. The Ala Wai Harbor is classified as a Class A marine embayment. The State DOH has established water quality standards for concentration parameters for total nitrogen, ammonia nitrogen, nitrate and nitrite nitrogen, total phosphorus, chlorophyll, and turbidity per HAR, Title 11, Chapter 54 (Water Quality Standards). The Ala Wai Harbor exchanges water with nearshore marine waters through its entrance channel. These waters are listed as “Honolulu Harbor and Shore Areas” under the Clean Water Act Sec. 303(d) List of Impaired Waters. The applicable water standard criteria for the harbor is under definitions of “basic” (HAR 11-54-4) and “open coastal waters” (HAR 11-54-6(b)).

The Ala Wai Harbor also exchanges water with the Ala Wai Canal, a two mile long artificial water body that begins at the Kaläkaua Avenue Bridge and drains a 16 square mile watershed. Water quality in the canal is relative poor primarily as a result of erosion in the upper end of the watershed, and urban runoff containing a variety of pollutants that drain into the canal. Poor water circulation resulting from blockage of the diamond-head end of the canal results in long residence times of pollutant materials within the Ala Wai system. Total Maximum Daily Loads have been assigned to the canal to limit inputs of nitrogen and phosphorus.

As part of the restoration of the Kahanamoku Lagoon per an agreement with the State DLNR, Division of Boating and Ocean Recreation, a portion of the lagoon discharge water is diverted in the inner and mauka basin of the Ala Wai Harbor. A newly constructed pipeline carries outflow from the lagoon to the makai-Diamond Head corner of the inner harbor basin. The improved bio-chemical cycling system of water exchange between the lagoon and the harbor has resulted in the geometric means of water quality constituents of lagoon water discharge falling between wet and dry water quality standards.

The restoration of the Lagoon also precluded any direct storm water or surface runoff to the water feature. The re-design of the lagoon currently meets the requirements of the State Water Quality Standards. Mitigation will continue in the form of water quality monitoring and through best management practices for daily operations and maintenance of the lagoon and to ensure outflow to the harbor basin is within acceptable standards.

For the proposed master plan improvements of the Hilton Hawaiian Village no mitigation measures are required for the Ala Wai Yacht Harbor Basin owing to an anticipated decrease of approximately 0.11 cfs of storm water runoff into this area upon project implementation. As a result of the decreased discharge, there will be no significant or long-term changes to water quality from present conditions of the Yacht Harbor Basin resulting from the proposed project.

The proposed master plan improvements will however increase the amount of treated storm water runoff by 0.14 cfs into the area of Waikiki Beach known as the Port Hilton Basin. Water quality treatment mitigation measures which can be implemented at the outflow include bioretention basins or storm water quality chambers (e.g. Vortechs or CDS system) sized to accommodate approximately 1.26 cfs of flow-through runoff. A storm water quality chamber can be located Diamond Head-makai of the Super Pool to treat storm water runoff prior to flowing off the property. This would ensure that all storm water runoff that is discharged to this basin has been adequately treated prior to release. Such treatment should result in no significant alteration or long-term effects to water quality or marine biota in the Port Hilton Basin area.

IV. SUMMARY AND CONCLUSIONS

The Hilton Hawaiian Village (HHV) is presently planning a master plan improvement project that is a directed effort to reinvigorate the Village's iconic resort setting through a purposeful series of redevelopment activities that will ultimately lead to a contemporary transformation of the entire Village. Overall, the master plan's primary's emphasis is the improvement of retail flow throughout the property, coupled with two key signature timeshare tower developments, and the expansion of recreational amenities and guest services to enrich the overall guest experience. As part of the permitting process, assessments of existing conditions, and potential impacts of the proposed project are required.

A key recreational and aesthetic feature of the HHV is the Duke Kahanamoku Lagoon, which is a man-made water feature and surrounding beach that lies between the HHV complex and the ocean. While the master plan improvements do not include any modification of the Lagoon, this report provides a review of the historical and existing condition of the Duke Kahanamoku Lagoon, particularly with respect to the recent restoration of the water feature. Changes to storm water runoff that are anticipated from the master plan improvements are also considered.

In 2002, the Hilton Hotels Corporation (HHC) obtained a Special Management Area Use Permit (SMP) and Planned Development-Resort (PD-R) approval for construction of the new Waikikian Tower and associated facilities and landscaping on its Hilton Hawaiian Village (HHV) property. Among other things, the SMP required HHC to attain and maintain the water quality of the adjacent Duke Kahanamoku Lagoon at acceptable levels as specified by the State Department of Health (DOH). The original construction of the feature, utilizing near-shore ocean water to fill the lagoon through gravity flow, resulted in unacceptable conditions, primarily as a result of long residence time of water resulting in dense plankton growth in the water column, introduction of marine silt that became trapped in the lagoon, and introduction of noxious marine species. To meet the requirement of attaining acceptable water quality standards, a complete re-design of the lagoon configuration, water source, and circulation/discharge system was necessary. These changes were completed in 2007, and have transformed the lagoon into an extremely valuable recreational resource, with high aesthetic appearance, and acceptable water quality.

The key factor of the re-design of the lagoon was isolating the lagoon intake from the offshore ocean. This was accomplished by drilling seven wells along the mauka perimeter to supply saline groundwater to the lagoon. The thick layer of anaerobic silty mud was sealed with geotextile cloth, and volume of water in the lagoon was decreased by filling in the lagoon to a maximum depth of 5 feet. A new circulation system pumps intake water into the lagoon from sumps containing saline groundwater, and water cycled through the lagoon is discharged via pumps into the middle and mauka basins of the Ala Wai Boat Harbor. Design of the circulation system promotes uniform and complete turnover of water within the lagoon up to five times per day. While the source saline groundwater is substantially (and naturally) elevated in dissolved inorganic plant nutrients, the rapid turnover rate prevents substantial uptake of nutrients by plankton, resulting in a consistently clear water column.

Required monitoring of lagoon waters to ensure compliance with State Water Quality Standards was initiated in October 2007 and continues to the present (at the time of this writing 33 monthly water quality monitoring surveys have been conducted). Result of water quality monitoring show that levels of dissolved nutrients decrease slightly between supply water and discharge water, while concentrations of Chlorophyll a and turbidity are slightly elevated in discharge water relative to supply water. These patterns indicate that there is some uptake of dissolved nutrients by plankton and benthic plants during residence time of water in the lagoon. While uptake and growth are analytically detectable, there is no visible indication of effect to water clarity, which remains consistently high throughout the lagoon. Dissolved oxygen is relatively low in saline groundwater intake, but rapidly increases during the circulation cycle.

Monthly measurement of three indicator bacteria (Enterococcus, Fecal Coliform, and *Clostridium perfringens*) since 2007 reveal no consistent elevated readings of any of the indicators in either supply water, lagoon stations, or discharge water. Samples collected over the span of a single day reveal several elevated readings late in the day which may be a response to heavy usage of the lagoon by bathers. Overnight water exchange appears to mitigate any build-up of any organisms that may result from human utilization of the lagoon.

Monitoring of biota within the lagoon, particularly with respect to invasive or alien species indicates a complete lack of noxious marine organisms (e.g., stinging jellyfish) that previously compromised the lagoon for safe swimming. Major biotic components of the lagoon now consist of three species of fish (guppies, tilapia, and tabai) which appear able to complete their life cycles within the lagoon. Periodic netting of fish has kept the numbers relatively small, and these species may feed on algal or cyanobacterial mats, thus serving as a mechanism to control growth on the lagoon floor. Screens placed over the discharge pipes in the Ala Wai Boat Harbor and one-way valves in discharge pipes have been effective in preventing invasion of the lagoon by marine species. Continual monitoring to identify species and subsequent rapid action to eliminate introduced species has been effective in maintaining a balanced and non-intrusive biotic community within the lagoon.

As part of the restoration of the Kahanamoku Lagoon per an agreement with the State DLNR, Division of Boating and Ocean Recreation, a portion of the lagoon discharge water is diverted in the inner and mauka basin of the Ala Wai Harbor. A newly constructed pipeline carries outflow from the lagoon to the makai-Diamond Head corner of the inner harbor basin. The improved bio-chemical cycling system of water exchange between the lagoon and the harbor has resulted in the geometric means of water quality constituents of lagoon water discharge falling between wet and dry water quality standards.

The restoration of the Lagoon also precluded any direct storm water or surface runoff to the water feature. The re-design of the lagoon currently meets the requirements of the State Water Quality Standards. Mitigation will continue in the form of water quality monitoring and through best management practices for daily operations and maintenance of the lagoon and to ensure outflow to the harbor basin is within acceptable standards.

The proposed master plan improvements will increase the amount of treated storm water runoff by 0.14 cfs into the area of Waikiki Beach known as the Port Hilton Basin. Water quality treatment mitigation measures which can be implemented at the outflow include bioretention basins or storm water quality chambers (e.g. Vortechs or CDS system) sized to accommodate approximately 1.26 cfs of flow-through runoff. A storm water quality chamber can be located Diamond Head-makai of the Super Pool, to treat storm water runoff prior to flowing off the property. This would ensure that all storm water runoff that is discharged to this basin has been adequately treated prior to release. Such treatment should result in no significant or long-term effects to water quality or marine biota in the Port Hilton Basin area.

Master plan improvements are anticipated to decrease storm water runoff to the Ala Wai Yacht Harbor by approximateloy 0.11 cfs upon project implementation. Owing to the decreased discharge no mitigation measures are required for the Ala Wai Yacht Harbor. As a result of the decrease in discharge, it can be anticipated that there will be no significant or long-term changes to water quality from present conditions of the Yacht Harbor Basin resulting from the proposed master plan project.

In summary, at present the restored Hilton Hawaiian Village Duke Kahanamoku Lagoon meets the requirement of complying with State Water Quality standards, and provides a resource of high aesthetic value that provides a uniquely pleasing safe recreation resource for residents and visitors. There are no anticipated changes to the status of the Lagoon, nor surrounding marine waters (Ala Wai Harbor and Port Hilton basin) as a result of the proposed master plan improvements.

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FIGURE 1. Aerial view of completely restored Duke Kahanamoku Lagoon at the Hilton Hawaiian Village, Waikiki, Oahu, Hawaii.

FIGURE 2. Duke Kahanamoku Lagoon showing locations of six water sampling stations, lagoon supply water input locations, and discharge intake pipe location.

TABLE 1. Results of water chemistry sampling on intake supply and water discharged from the restored Duke Kahanamoku Lagoon at the Hilton Hawaiian Village. Also shown are the differences between supply anc discharge water on each sampling day. Positive sign of difference indicates higher value in discharge water compared to intake water; negative sign indicates higher value intake water relative to discharge water. For locations where water is supplied to the lagoon and intakes of discharge water, see Figure 2.

LAGOON SUPPLY

SAMPLING	PO_4^{3-}		NO_3^-		NH_4^+		Si		TOP		TON		TP		TN		TURB	SALT	pH	Chl-a	Temp	O2	TSS
DATE	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(ntu)	(o/oo)	(rel)	(µg/l)	deg C.	% sat.	mg/L
10/26/2007	0.58	17.98	2.73	38.22	0.19	2.66	122.98	3456	0.24	7.44	3.73	52.22	0.82	25.42	6.65	93.10	0.17	34.802	7.492	0.031			
10/31/2007	0.71	22.01	2.73	38.22	0.06	0.84	124.45	3497	0.07	2.17	3.99	55.86	0.78	24.18	6.78	94.92	0.10	34.636	7.464	0.021			
11/8/2007	0.67	20.77	2.98	41.72	0.33	4.62	121.71	3420	0.11	3.41	3.86	54.04	0.78	24.18	7.17	100.38	0.24	34.831	7.426	0.010			
11/15/2007	0.58	17.98	1.96	27.44	0.62	8.68	123.18	3461	0.17	5.27	4.86	68.04	0.75	23.25	7.44	104.16	0.13	34.819	7.462	0.042			
11/19/2007	0.53	16.43	2.16	30.24	0.54	7.56	123.43	3468	0.19	5.89	4.88	68.32	0.72	22.32	7.58	106.12	0.07	34.768	7.460	0.021			
12/18/2007	0.74	22.94	2.92	40.88	0.12	1.68	129.90	3650	0.18	5.58	6.24	87.36	0.92	28.52	9.28	129.92	1.61	34.834	7.522	0.042			
1/7/2008	0.75	23.25	2.27	31.78	0.18	2.52	120.42	3384	0.04	1.24	4.22	59.08	0.79	24.49	6.67	93.38	0.10	34.740	7.509	0.010			
3/8/2008	0.82	25.42	2.68	37.52	0.08	1.12	120.34	3382	0.26	8.06	4.94	69.16	1.08	33.48	7.70	107.80	0.06	34.648	7.470	0.157			
6/27/2008	0.79	24.49	2.20	30.80	0.85	11.90	124.56	3500	0.05	1.55	6.69	93.66	0.84	26.04	9.74	136.36	0.14	34.570	7.481	0.136	24.34	11.52	0.8
10/30/2008	0.87	27.84	1.78	24.92	1.14	15.96	121.44	3412	0.04	1.24	5.28	73.92	0.91	28.21	8.20	114.80	0.06	34.681	7.389	0.052	24.13	10.37	2.0
3/19/09	0.60	19.20	1.78	24.92	0.08	1.12	121.50	3414	0.03	0.93	4.79	67.06	0.63	19.53	6.65	93.10	0.07	34.682	7.435	0.031	23.96	11.32	1.6
Geometric Mean	0.69	21.40	2.34	32.79	0.24	3.39	123.06	3457.89	0.10	2.99	4.78	66.97	0.81	25.19	7.56	105.85	0.13	34.73	7.464	0.035	24.14	11.06	1.37
Maximum	0.87	27.84	2.98	41.72	1.14	15.96	129.90	3650.19	0.26	8.06	6.69	93.66	1.08	33.48	9.74	136.36	1.61	34.83	7.52	0.16	24.34	11.52	2.00
Minimum	0.53	16.43	1.78	24.92	0.06	0.84	120.34	3381.55	0.03	0.93	3.73	52.22	0.63	19.53	6.65	93.10	0.06	34.57	7.39	0.01	23.96	10.37	0.80

LAGOON DISCHARGE

SAMPLING	PO_4^{3-}		NO_3^-		NH_4^+		Si		TOP		TON		TP		TN		TURB	SALT	pH	Chl-a	Temp	O2	TSS
DATE	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(ntu)	(o/oo)	(rel)	(µg/l)	deg C.	% sat.	mg/L
10/26/2007	0.06	1.86	2.26	31.64	0.13	1.82	120.92	3398	0.27	8.37	3.65	51.10	0.33	10.23	6.04	84.56	0.18	34.933	7.629	0.042			
10/31/2007	0.41	12.71	2.25	31.50	0.05	0.70	119.38	3355	0.31	9.61	3.44	48.16	0.72	22.32	5.74	80.36	0.10	34.788	7.594	0.052			
11/8/2007	0.96	29.76	8.92	124.88	1.74	24.36	91.12	2560	0.22	6.82	11.37	159.18	1.18	36.58	22.03	308.42	1.82	30.405	7.735	0.734			
11/15/2007	0.56	17.36	1.76	24.64	0.50	7.00	123.98	3484	0.18	5.58	4.19	58.66	0.74	22.94	6.45	90.30	0.17	34.623	7.565	0.063			
11/19/2007	0.53	16.43	1.86	26.04	0.77	10.78	122.07	3430	0.28	8.68	5.38	75.32	0.81	25.11	8.01	112.14	0.08	34.796	7.597	0.042			
12/18/2007	0.62	19.22	1.92	26.88	0.11	1.54	130.51	3667	0.20	6.20	7.13	99.82	0.82	25.42	9.16	128.24	0.34	34.623	7.628	0.105			
1/7/2008	0.50	15.50	1.28	17.92	0.49	6.86	123.15	3461	0.19	5.89	4.79	67.06	0.69	21.39	6.56	91.84	0.25	34.532	7.572	0.115			
3/8/2008	0.50	15.50	0.13	1.82	0.06	0.84	114.11	3206	0.45	13.95	7.56	105.84	0.95	29.45	7.75	108.50	0.29	34.823	7.658	1.385			
6/27/2008	0.38	11.78	0.01	0.14	0.09	1.26	118.81	3339	0.34	10.54	10.15	142.10	0.72	22.32	10.25	143.50	0.48	34.693	7.599	4.028	24.52	39.56	1.8
10/30/2008	0.82	26.24	1.55	21.70	0.88	12.32	119.13	3348	0.02	0.62	5.56	77.84	0.84	26.04	7.99	111.86	0.32	34.676	7.404	0.115	24.30	26.32	3.2
3/19/09	0.54	17.28	1.65	23.10	0.16	2.24	118.41	3327	0.05	1.55	5.08	71.12	0.59	18.29	6.89	96.46	0.18	34.698	7.574	0.126	23.65	30.27	2.1
Geometric Mean	0.46	14.26	1.02	14.25	0.24	3.41	117.90	3313.00	0.18	5.49	5.77	80.85	0.73	22.69	8.14	113.93	0.26	34.30	7.596	0.173	24.15	31.59	2.295517
Maximum	0.96	29.76	8.92	124.88	1.74	24.36	130.51	3667.33	0.45	13.95	11.37	159.18	1.18	36.58	22.03	308.42	1.82	34.93	7.74	4.03	24.52	39.56	3.20
Minimum	0.06	1.86	0.01	0.14	0.05	0.70	91.12	2560.47	0.02	0.62	3.44	48.16	0.33	10.23	5.74	80.36	0.08	30.41	7.40	0.04	23.65	26.32	1.80

DIFFERENCE (DISCHARGE-INTAKE)

SAMPLING	PO_4^{3-}		NO_3^-		NH_4^+		Si		TOP		TON		TP		TN		TURB	SALT	pH	Chl-a	Temp	O2	TSS
DATE	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(µM)	(µg/L)	(ntu)	(o/oo)	(rel)	(µg/l)	deg C.	% sat.	mg/L
10/26/2007	-0.52	-16.12	-0.47	-6.58	-0.06	-0.84	-2.06	-58	0.03	0.93	-0.08	-1.12	-0.49	-15.19	-0.61	-8.54	0.01	0.131	0.137	0.010			
10/31/2007	-0.30	-9.30	-0.48	-6.72	-0.01	-0.14	-5.07	-142	0.24	7.44	-0.55	-7.70	-0.06	-1.86	-1.04	-14.56	0.00	0.152	0.130	0.031			
11/8/2007	0.29	8.99	5.94	83.16	1.41	19.74	-30.59	-860	0.11	3.41	7.51	105.14	0.40	12.40	14.86	208.04	1.58	-4.426	0.309	0.724			
11/15/2007	-0.02	-0.62	-0.20	-2.80	-0.12	-1.68	0.80	22	0.01	0.31	-0.67	-9.38	-0.01	-0.31	-0.99	-13.86	0.04	-0.196	0.103	0.021			
11/19/2007	0.00	0.00	-0.30	-4.20	0.23	3.22	-1.36	-38	0.09	2.79	0.50	7.00	0.09	2.79	0.43	6.02	0.01	0.028	0.137	0.021			
12/18/2007	-0.12	-3.72	-1.00	-14.00	-0.01	-0.14	0.61	17	0.02	0.62	0.89	12.46	-0.10	-3.10	-0.12	-1.68	-1.27	-0.211	0.106	0.063			
1/7/2008	-0.25	-7.75	-0.99	-13.86	0.31	4.34	2.73	77	0.15	4.65	0.57	7.98	-0.10	-3.10	-0.11	-1.54	0.15	-0.208	0.063	0.105			
3/8/2008	-0.32	-9.92	-2.55	-35.70	-0.02	-0.28	-6.23	-175	0.19	5.89	2.62	36.68	-0.13	-4.03	0.05	0.70	0.23	0.175	0.188	1.227			
6/27/2008	-0.41	-12.71	-2.19	-30.66	-0.76	-10.64	-5.75	-162	0.29	8.99	3.46	48.44	-0.12	-3.72	0.51	7.14	0.34	0.123	0.118	3.892	0.18	28.04	1
10/30/2008	-0.05	-1.60	-0.23	-3.22	-0.26	-3.64	-2.31	-65	-0.02	-0.62	0.28	3.92	-0.07	-2.17	-0.21	-2.94	0.26	-0.005	0.015	0.063	0.17	15.94	1.2
3/19/09	-0.06	-1.92	-0.13	-1.82	0.08	1.12	-3.09	-87	0.02	0.62	0.29	4.06	-0.04	-1.24	0.24	3.36	0.11	0.016	0.139	0.095	-0.31	18.95	0.5

TABLE 2. Summary of geometric means of indicator bacteria (C. *perfringens* , Enterococcus, and Fecal Coliform) measured during montly monitoring from October 2007 to June 2010 of intake and discharge water, as well as six sampling stations within the lagoon (n=33). For locations of sampling stations, see Figure 1. Units for all measurements are colony forming units per 100 ml using membrane filtration methods.

Hilton Lagoon Station No.	*Clostridium perfringens*	Enterococcus	Fecal Coliform
Hilton Lagoon Intake	0.991	1.755	1.089
Hilton Lagoon Discharge	0.991	2.164	1.357
Hilton Lagoon #1	0.991	1.447	1.142
Hilton Lagoon #2	1.096	1.685	1.353
Hilton Lagoon #3	1.108	1.580	1.367
Hilton Lagoon #4	1.032	1.636	1.281
Hilton Lagoon #5	1.023	1.455	1.107
Hilton Lagoon #6	1.013	1.312	1.012
Geometric Mean of All Samples to Date	*1.030*	*1.617*	*1.206*
Maximum single sample	*9*	*34*	*81*
State Geometric Mean Standard	n/a	35	n/a
State Single Event Standard	n/a	104	n/a
Exceeds Single Event Standard?	n/a	*No*	n/a
Exceeds Standard?	n/a	*No*	n/a

TABLE 3. Measurement of indicator bacteria *Clostridium perfringens* measured during montly monitoring from October 2007 to June 2010 of intake and discharge water, as well as six sampling stations within the lagoon (n=33). For locations of sampling stations, see Figure 1. Units for all measurements are colony forming units (CFU) per 100 ml using membrane filtration methods. Values shown as 0.99 are reported as <1, which is the mimimum detectable limit of the method.

Clostridium perfringens

Sample Date	Hilton Lagoon #1 (shallow close to pump house)	Hilton Lagoon #2 (shallow, extreme *makai* end)	Hilton Lagoon #3 (center *makai*)	Hilton Lagoon #4 (center *mauka*)	Hilton Lagoon #5 (shallow by Lagoon Tower)	Hilton Lagoon #6 (Shallow by Rainbow Tower)	Hilton Lagoon Intake	Hilton Lagoon Discharge
10/26/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
10/31/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
11/15/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
12/18/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
1/7/2008	0.99	1.00	0.99	0.99	0.99	0.99	0.99	0.99
2/8/2008	0.99	0.99	0.99	0.99	0.99	1.00	0.99	0.99
3/13/2008	0.99	0.99	0.99	0.99	0.99	1.00	0.99	0.99
4/12/2008	0.99	0.99	0.99	0.99	0.99	1.00	0.99	1.00
5/23/2008	0.99	0.99	0.99	0.99	0.99	1.00	0.99	0.99
6/27/2008	0.99	0.99	0.99	0.99	0.99	1.00	0.99	0.99
7/25/2008	1.00	0.99	0.99	0.99	0.99	1.00	0.99	0.99
8/28/2008	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
9/24/2008	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
10/30/2008	1.00	3.00	1.00	2.00	3.00	0.99	1.00	0.99
11/26/2008	0.99	2.00	9.00	2.00	1.00	2.00	1.00	0.99
12/18/2008	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
1/29/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
2/25/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00
3/19/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
4/14/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
5/29/2009	0.99	0.99	0.99	0.99	1.00	0.99	0.99	0.99
6/17/2009	0.99	0.99	5.00	0.99	0.99	0.99	0.99	0.99
7/28/09	0.99	1.00	0.99	1.00	0.99	0.99	0.99	1.00
8/26/2009	0.99	5.00	0.99	0.99	0.99	0.99	0.99	0.99
9/29/2009	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99
10/14/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
11/24/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
12/14/2009	0.99	1.00	0.99	0.99	0.99	0.99	0.99	0.99
1/27/2010	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
2/4/2010	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
3/18/2010	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
4/20/2010	0.99	1.00	0.99	0.99	0.99	1.00	0.99	0.99
5/28/2010	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
6/23/2010	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Geometric Mean	0.99	1.10	1.11	1.03	1.02	1.01	0.99	0.99
Maximum	1.00	5.00	9.00	2.00	3.00	2.00	1.00	1.00
Minimum	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
					Geometric Mean for All Stations			1.03

TABLE 4. Measurement of indicator bacteria Fecal Coliformmeasured during montly monitoring from October 2007 to June 2010 of intake and discharge water, as well as six sampling stations within the lagoon (n=33). For locations of sampling stations, see Figure 1. Units for all measurements are colony forming units (CFU) per 100 ml using membrane filtration methods. Values shown as 0.99 are reported as <1 which is the minimum detection limit for the method.

Fecal Coliform

Sampling Date	Hilton Lagoon #1 (shallow close to pump house)	Hilton Lagoon #2 (shallow, extreme *makai* end)	Hilton Lagoon #3 (center *makai*)	Hilton Lagoon #4 (center *mauka*)	Hilton Lagoon #5 (shallow by Lagoon Tower)	Hilton Lagoon #6 (Shallow by Rainbow Tower)	Hilton Lagoon Intake	Hilton Lagoon Discharge
10/26/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
10/31/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
11/15/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	3.00
12/18/2007	0.99	8.00	2.00	0.99	0.99	0.99	0.99	1.00
1/7/2008	0.99	1.00	0.99	0.99	0.99	0.99	0.99	0.99
2/8/2008	0.99	1.00	1.00	0.99	0.99	1.00	0.99	0.99
3/13/2008	0.99	0.99	0.99	81.00	0.99	0.99	0.99	0.99
4/12/2008	5.00	1.00	0.99	2.00	0.99	1.00	0.99	1.00
5/23/2008	0.99	0.99	0.99	0.99	3.00	0.99	0.99	0.99
6/27/2008	0.99	2.00	0.99	0.99	0.99	0.99	0.99	0.99
7/25/2008	1.00	0.99	1.00	1.00	1.00	0.99	0.99	0.99
8/28/2008	0.99	5.00	2.00	0.99	1.00	0.99	0.99	4.00
9/24/2008	0.99	0.99	0.99	0.99	0.99	0.99	0.99	8.00
10/30/2008	0.99	2.00	4.00	0.99	0.99	0.99	2.00	3.00
11/26/2008	0.99	2.00	4.00	0.99	0.99	0.99	2.00	3.00
12/18/2008	0.99	0.99	0.99	0.99	0.99	1.00	0.99	0.99
1/29/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
2/25/2009	0.99	0.99	0.99	0.99	2.00	0.99	0.99	0.99
3/19/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
4/14/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
5/29/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
6/17/2009	0.99	0.99	17.00	2.00	0.99	0.99	0.99	0.99
7/28/09	2.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99
8/26/2009	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
9/29/2009	0.99	1.00	0.99	0.99	0.99	0.99	0.99	0.99
10/14/2009	4.00	1.00	2.00	1.00	0.99	0.99	0.99	0.99
11/24/2009	1.00	0.99	0.99	2.00	0.99	1.00	0.99	0.99
12/14/2009	0.99	0.99	0.99	0.99	0.99	1.00	3.00	6.00
1/27/2010	3.00	5.00	6.00	9.00	7.00	2.00	1.00	0.99
2/4/2010	0.99	0.99	4.00	0.99	0.99	0.99	2.00	0.99
3/18/2010	0.99	1.00	0.99	0.99	0.99	1.00	0.99	0.99
4/20/2010	0.99	11.00	0.99	1.00	0.99	0.99	0.99	2.00
5/28/2010	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
6/23/2010	0.99	2.00	1.00	0.99	0.99	0.99	0.99	4.00
Geometric Mean	**1.14**	**1.35**	**1.37**	**1.28**	**1.11**	**1.01**	**1.09**	**1.36**
Maximum	**5.00**	**11.00**	**17.00**	**81.00**	**7.00**	**2.00**	**3.00**	**8.00**
Minimum	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**
					Geometric Mean for All Stations			**1.21**

TABLE 5. Measurement of indicator bacteria Enterococcus measured during montly monitoring from October 2007 to June 2010 of intake and discharge water, as well as six sampling stations within the lagoon (n=33). For locations of sampling stations, see Figure 1. Units for all measurements are colony forming units (CFU) per 100 ml using membrane filtration methods. All values of 0.99 are reported as <1, which is the minimum detection limit of the method.

Enterococcus

Sampling Date	Hilton Lagoon #1 (shallow close to pump house)	Hilton Lagoon #2 (shallow, extreme *makai* end)	Hilton Lagoon #3 (center *makai*)	Hilton Lagoon #4 (center *mauka*)	Hilton Lagoon #5 (shallow by Lagoon Tower)	Hilton Lagoon #6 (Shallow by Rainbow Tower)	Hilton Lagoon Intake	Hilton Lagoon Discharge
10/26/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
10/31/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
11/15/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00
12/18/2007	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
1/7/2008	0.99	0.99	0.99	1.00	0.99	0.99	0.99	0.99
2/8/2008	0.99	1.00	1.00	0.99	0.99	1.00	0.99	0.99
3/13/2008	0.99	1.00	0.99	27.00	0.99	1.00	0.99	0.99
4/12/2008	7.00	3.00	2.00	5.00	0.99	3.00	1.00	3.00
5/23/2008	0.99	0.99	0.99	1.00	8.00	0.99	34.00	0.99
6/27/2008	1.00	0.99	0.99	2.00	1.00	0.99	0.99	0.99
7/25/2008	1.00	2.00	1.00	0.99	0.99	1.00	2.00	0.99
8/28/2008	0.99	25.00	3.00	1.00	2.00	0.99	4.00	4.00
9/24/2008	2.00	10.00	0.99	1.00	1.00	2.00	16.00	23.00
10/30/2008	1.00	3.00	1.00	2.00	3.00	0.99	1.00	0.99
11/26/2008	0.99	2.00	9.00	2.00	1.00	2.00	1.00	0.99
12/18/2008	4.00	2.00	4.00	2.00	2.00	2.00	0.99	11.00
1/29/2009	0.99	0.99	0.99	0.99	0.99	1.00	0.99	1.00
2/25/2009	1.00	1.00	2.00	1.00	5.00	1.00	0.99	0.99
3/19/2009	0.99	1.00	1.00	0.99	2.00	2.00	0.99	1.00
4/14/2009	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99
5/29/2009	1.00	0.99	1.00	0.99	0.99	1.00	0.99	1.00
6/17/2009	0.99	1.00	4.00	2.00	0.99	0.99	11.00	33.00
7/28/09	10.00	9.00	16.00	9.00	7.00	8.00	1.00	14.00
8/26/2009	0.99	2.00	1.00	1.00	1.00	0.99	0.99	1.00
9/29/2009	0.99	1.00	0.99	0.99	0.99	0.99	0.99	0.99
10/14/2009	13.00	0.99	0.99	10.00	0.99	2.00	4.00	4.00
11/24/2009	0.99	0.99	1.00	0.99	0.99	0.99	0.99	1.00
12/14/2009	1.00	0.99	1.00	0.99	0.99	0.99	0.99	5.00
1/27/2010	7.00	6.00	17.00	8.00	16.00	8.00	8.00	17.00
2/4/2010	0.99	3.00	7.00	7.00	4.00	2.00	8.00	4.00
3/18/2010	7.00	0.99	1.00	1.00	0.99	0.99	3.00	0.99
4/20/2010	0.99	5.00	0.99	0.99	0.99	0.99	0.99	7.00
5/28/2010	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
6/23/2010	0.99	2.00	2.00	0.99	0.99	0.99	0.99	1.00
Geometric Mean	**1.45**	**1.68**	**1.58**	**1.64**	**1.46**	**1.31**	**1.76**	**2.16**
Maximum	**13.00**	**25.00**	**17.00**	**27.00**	**16.00**	**8.00**	**34.00**	**33.00**
Minimum	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**
					Geometric Mean of All Samples			**1.62**

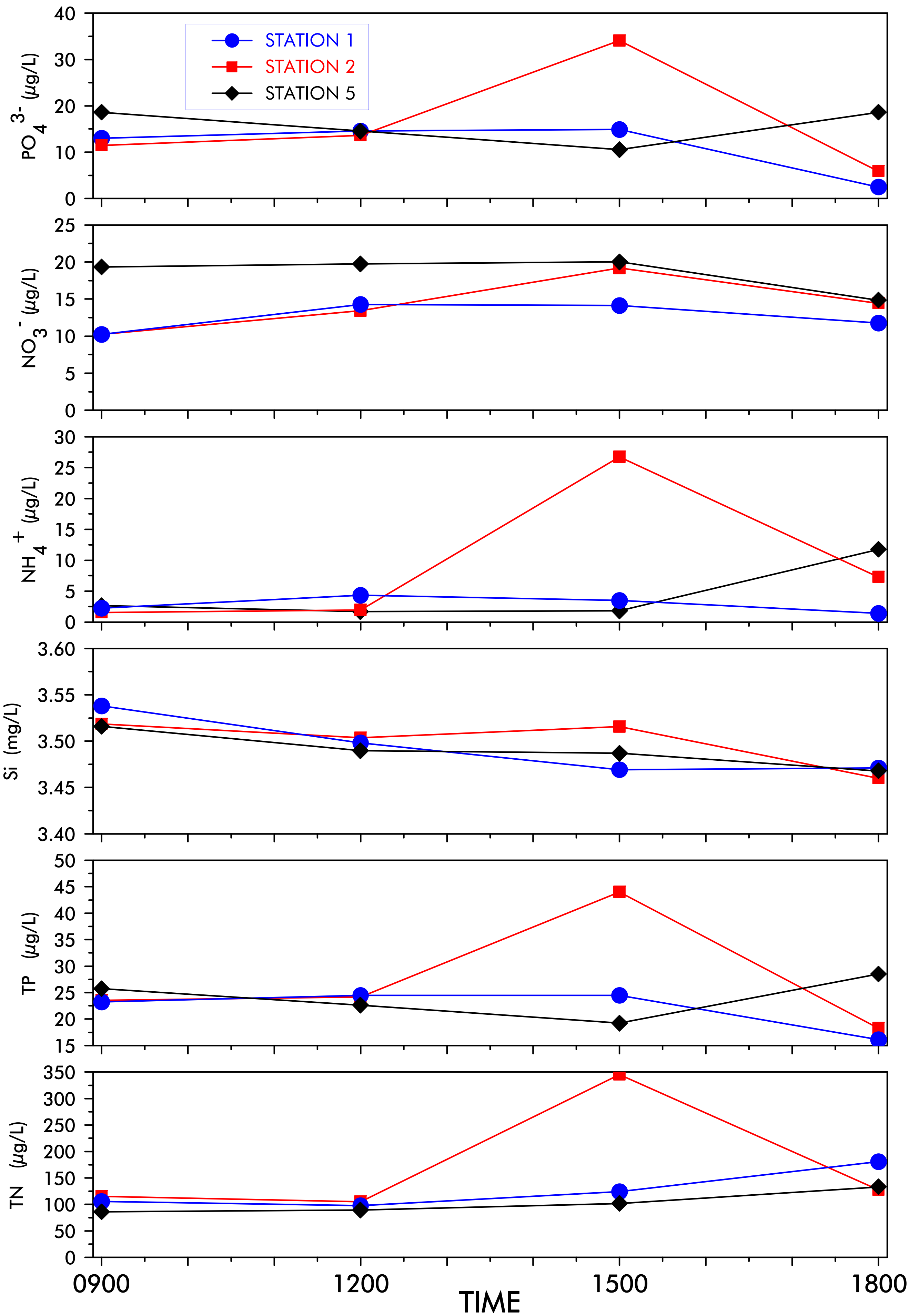

FIGURE 3. Time series measurements of nutrient concentrations at Stations 1, 2 and 5 in the Duke Kahanamoku Lagoon at the Hilton Hawaiian Village collected on March 3, 2010. For station locations, see Figure 1.

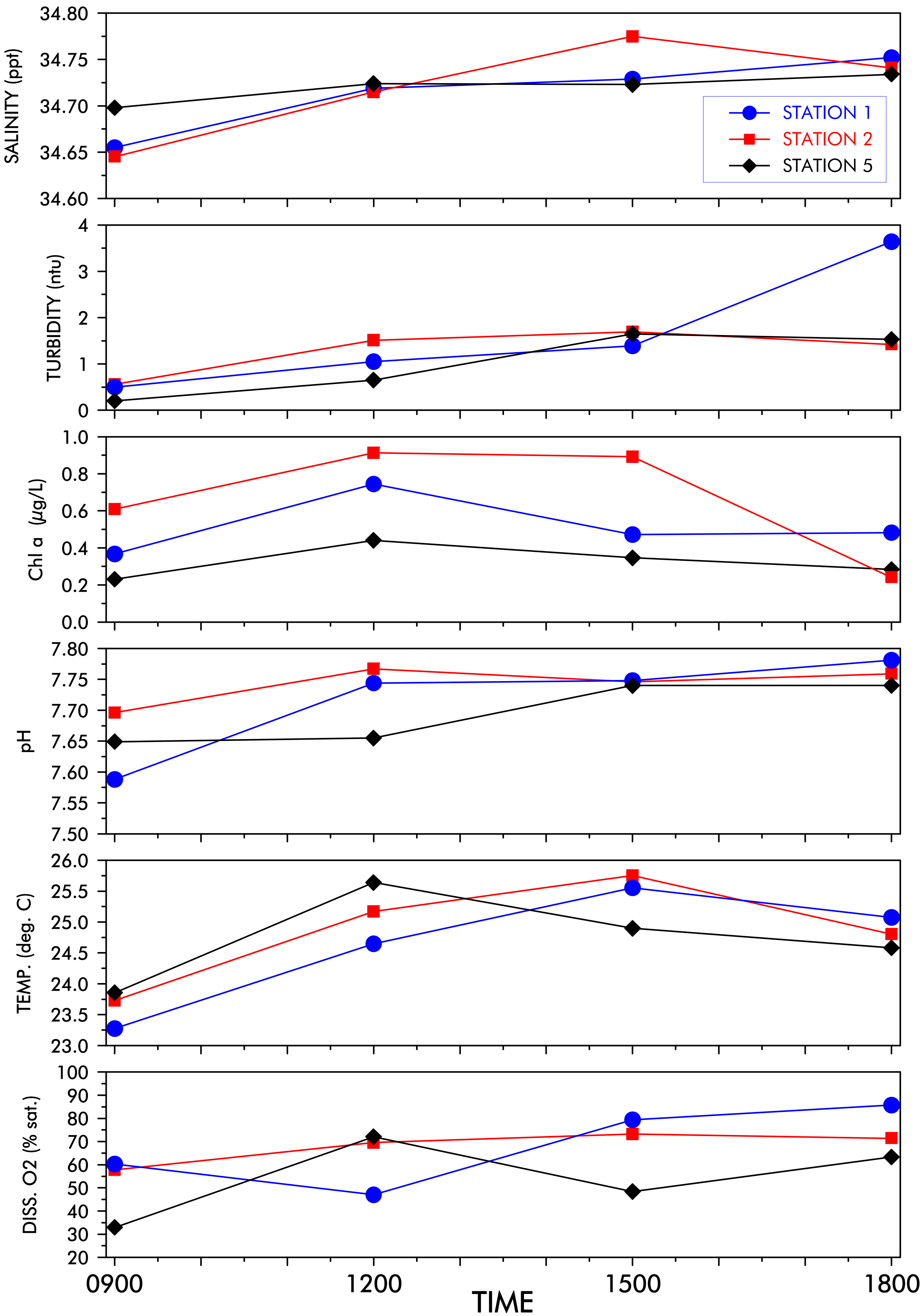

FIGURE 4. Time series measurements of water quality constituents at Stations 1, 2 and 5 in the Duke Kahanamoku Lagoon at the Hilton Hawaiian Village collected on March 3, 2010. For station locations, see Figure 1.

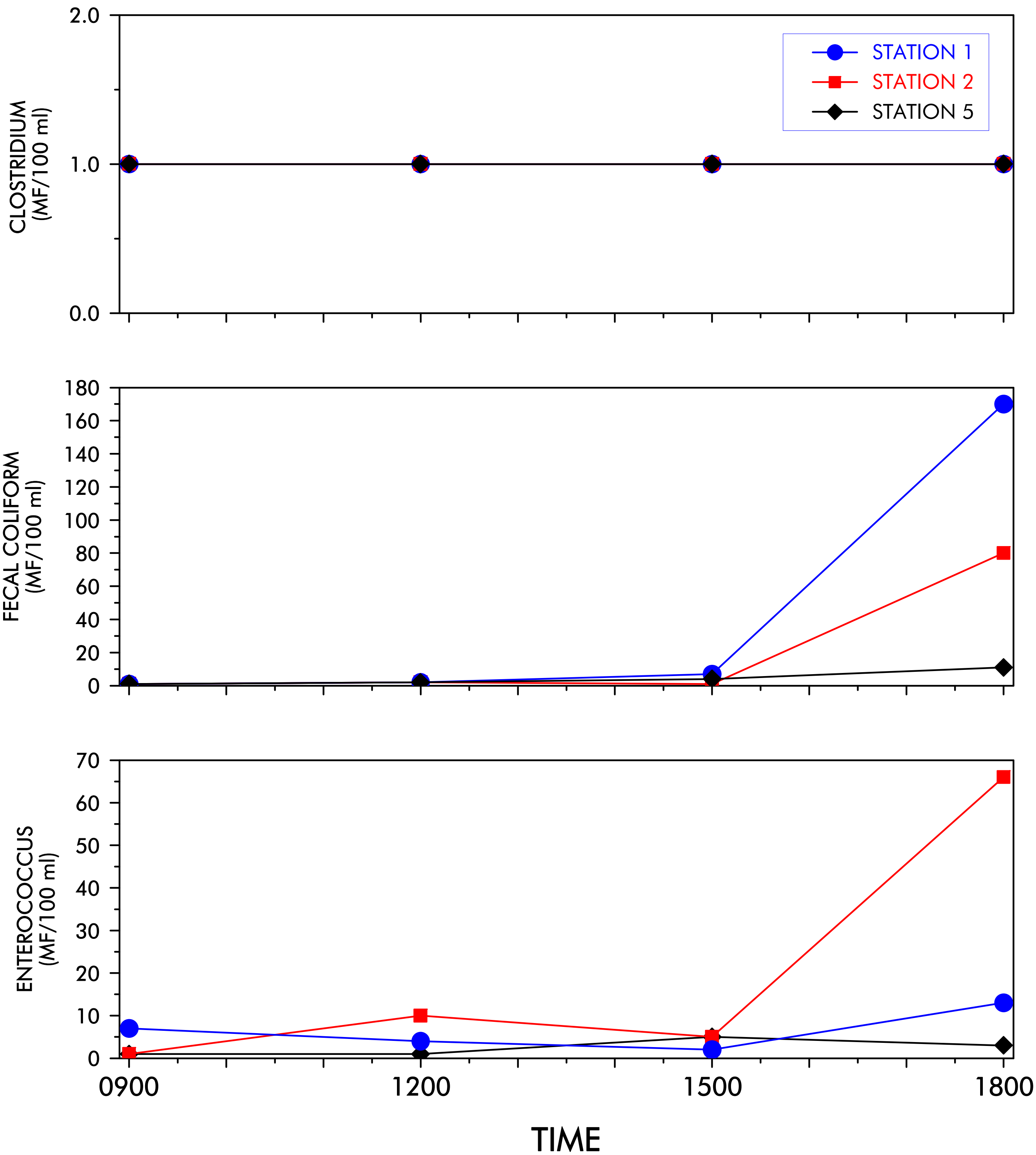

FIGURE 5. Time series measurements of indicator bacteria (Clostridium perfringens, Fecal Coliform, and Enterococcus) at Stations 1, 2 and 5 in the Duke Kahanamoku Lagoon at the Hilton Hawaiian Village collected on March 3, 2010. For station locations, see Figure 2.

APPENDIX F

Archaeological Inventory Survey ~~Plan~~
for the Hilton Hawaiian Village
Master Plan Improvements Project,
Waikīkī Ahupua‘a, Kona District, O‘ahu Island

State Historic Preservation Division Approval Letters
(November 15, 2010 and May 2, 2011)

Cultural Surveys Hawai‘i, Inc.

April 2011 ~~October 2010~~

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

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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

May 2, 2011

Dr. Hallett H. Hammatt
Cultural Surveys Hawaii
P.O. Box 1114
Kailua, Hawaii 96734

LOG NO: 2011.1098
DOC NO: 1105MV01
Archaeology

Dear Dr. Hammatt:

SUBJECT: **Chapter 6E-42Historic Preservation Review –**
Revised Archaeological Inventory Survey of 22.4 Acres for the Hilton Hawaiian Village
Waikiki Ahupua'a, Kona District, Island of O'ahu
TMK: (1) 2-6-008:001-003, :005, :007, :012, :019-021, :023, :024, :027, :034, :038 & (1) 2-6-009:001-007, :009-013

Thank you for the opportunity to review this revised Archaeological Inventory Survey (AIS) titled *Archaeological Inventory Survey for the Hilton Hawaiian Village Master Plan Improvements Project Waikiki Ahupua'a Honolulu (Kona) District, Island of O'ahu TMK: (1) 2-6-008:001-003, :005, :007, :012, :019-021, :023, :024, :027, :034, :038 & (1) 2-6-009:001-007, :009-013* (J. Tulchin, T. Yucha, D. Shideler and H. Hammatt, April 2011). This draft was received on April 21, 2011. According to the report, this AIS was undertaken in preparation for the major improvements to the Hilton Hawaiian Village campus. An Archaeological Inventory Survey Plan (AISP) was developed by CSH and approved by SHPD (Log No. 2010.3328, Doc. No 1011MV07). The AISP called for the excavation of 20 test trenches in the areas of proposed development. 19 of the 20 proposed trenches were excavated, with one trench abandoned due to the presence of underground utilities.

The results of this testing were initially presented as an Archeological Assessment that was submitted to SHPD on February 17, 2011. The SHPD review of that document concluded that significant historic material had been encountered, and the results of the testing should be presented as an Archaeological Inventory Survey (AIS). The changes that were made to this report adequately address the issues raised in our previous correspondence (LOG NO: 2011.0520, DOC NO: 1104MV02). The report is now presented as an AIS pursuant to HAR 13-276. The cultural material that was encountered by this AIS is now described as portions of the previously identified historic site given State Inventory of Historic Places (SIHP) number 50-80-14-2870. This site was previously described by Neller in 1980 through SHPD Rept. No O-131. This site, which consists of a subsurface cultural layer and three historic burials, was determined to be significant under Criteria D, for its information content, and E, for its cultural importance. The sampling strategy has indicated that the subsurface cultural layer was more intact beneath improvement area 2 in the central portion of the campus than in improvement area 1. The testing also indicated that the sediment in Improvement area 1 was highly disturbed and the water table was significantly higher than the central portion of the campus. We believe that the subsurface testing adequately characterized the nature of sediments and the distribution of cultural material within the project area. We agree with your determination of effect with proposed mitigation commitments.

However, the mitigation recommendations are different for the different improvement areas of this project. In area 1 subsurface material has been thoroughly sampled through 13 test trenches. The 13 test trenches identified very little intact historic cultural material and indicated that there is very little natural sediment above the water table. Therefore CSH recommends that an archeological monitoring plan should be implemented for the improvement area 1 project activity. We agree with this recommendation and request the opportunity to review an Archeological Monitoring Plan (AMP) prior to the commencement of project activity. For improvement area 2 there were only 6 trenches that encountered more significant deposits of cultural material with higher levels of undisturbed natural sediment above the water table. For this reason you have recommended that an Archaeological Data Recovery

Program is developed for improvement area 2. The data recovery program will involve additional subsurface excavation on the SIHP# 50-80-14-2870 site to answer questions and hypotheses that will be outlined in a Data Recover Plan. Because this site is associated with historic burials, any burial sites discovered during data recovery excavations will be treated as previously identified, and subject to the decision making authority of the Oahu Island Burial Council. We agree with this recommendation and request the opportunity to review an Archaeological Data Recovery Plan prior to the commencement of excavation.

This reports meets the standards set forth in HAR §13-276 and is therefore accepted by SHPD. Please send one hardcopy of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library.

Please contact Mike Vitousek at (808) 692-8029 or Michael.Vitousek@Hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,

Pua Aiu
Administrator
State Historic Preservation Division

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
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CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

November 15, 2010

Dr. Hallett Hammatt
Cultural Surveys Hawaii
P.O. Box 1114
Kailua, Hawaii 96734

LOG NO: 2010.3328
DOC NO: 1011MV07
Archaeology

Dear Dr. Hammatt:

**SUBJECT: HRS 6E-42 Historic Preservation Review –
Revised Archaeological Inventory Survey Plan for the Hilton Hawaiian Village Master Plan Improvements Project, Waikiki Ahupua‘a, Kona District, Oahu Island.
TMK: [1] 2-6-008:001-:003 :005, :007, :012, :019-:021, :023, :024, :027, :034, :038, &
[1]-2-6-009:001, :007, :009-:013 (DRAFT)**

Thank you for the opportunity to review this draft plan titled *Archaeological Inventory Survey Plan for the Hilton Hawaiian Village Master Plan Improvements Project, Waikiki Ahupua‘a, Kona District, Oahu Island. TMK: [1] 2-6-008:001-:003 :005, :007, :012, :019-:021, :023, :024, :027, :034, :038, & [1]-2-6-009:001, :007, :009-:013 (DRAFT)*, J. Tulchin, D. Shideler, and H. Hammatt (October 2010). We apologize for the delayed review of this submittal, which was received in our office October 14, 2010.

The plan explains the intent to identify and record any remaining historic sites and cultural deposits located within the 22.6 acre project area of the Hilton Hawaiian Village. Because of the extensive development on this property it is highly likely that historic properties would take the form of sub-surface archaeological deposits, including human skeletal remains. To address this issue Cultural Surveys Hawaii has outlined a program of subsurface testing by way of 20 backhoe trenches in various areas of the property. During review of the plan, the Oahu Island Burial Council (OIBC) requested that more trenches be added to the proposed 22 total proposed in the earlier draft.

Despite the decrease in the overall number of proposed test trenches we believe that the revisions made to this document adequately address SHPD’s concerns raised in our review of the previous draft of this document (*Log No. 2010.2456, Doc No. 1006MV59*). In particular, section 3.2.3 stipulates that additional test trenches may be required upon completion of the initial 20 trenches. We believe that the data generated by the 20 test trenches will provide valuable information on the potential location of subsequent trenches. Therefore, we request that upon completion of the initial 20 test trenches you present your findings to SHPD and to the OIBC in order to determine if the coverage is adequate, and consult on the potential locations of additional trenches if needed.

This AISP is accepted pursuant to HAR 13-284-5. Please send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library. Please call Mike Vitousek at (808) 692-8024 if you have any questions or concerns regarding this letter

Aloha,

Theresa K. Donham
Acting Branch Chief
Historic Preservation Division

Final
Archaeological Inventory Survey
For the Hilton Hawaiian Village Master Plan Improvements Project,
Waikīkī Ahupua‘a, Kona District, O‘ahu Island
TMK: [1] 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 & [1] 2-6-009:001-007, 009-013

Prepared for

Group 70 International, Inc.

Prepared by

Jon Tulchin,

Trevor Yucha, B.S.,

David W. Shideler, M.A.,

and

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.

Kailua, Hawai‘i

(Job Code: WAIKIKI 59)

April 2011

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Management Summary

Reference	Archaeological Inventory Survey for the Hilton Hawaiian Village Master Plan Improvements Project, Waikīkī Ahupuaʻa, Kona District, Oʻahu Island, TMK: [1] 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 & [1] 2-6-009:001-007, 009-013 (Tulchin et al. 2011)
Date	April 2011
Project Number (s)	Cultural Surveys Hawaiʻi Inc. (CSH) Job Code: WAIKIKI 59
Investigation Permit Number	CSH completed the fieldwork component of the archaeological inventory survey under Hawaiʻi State Historic Preservation Division/Department of Land and Natural Resources (SHPD/DLNR) permit No. 10-10, issued per Hawaiʻi Administrative Rules (HAR) Chapter 13-13-282.
Project Area Location	The project area consists of the Hilton Hawaiian Village Beach Resort and Spa complex, located along the northwestern coast of Waikīkī. The project area is bounded by Kālia Road to the east, Paoa Place to the south, Duke Kahanamoku Lagoon to the west, and Ala Moana Boulevard to the north. The project area is depicted on the U.S. Geological Survey 7.5-Minute Series Topographic Map, Honolulu Quadrangle (1998).
Land Jurisdiction	Private, Hilton Hawaiian Village LLC
Agencies	State Historic Preservation Division / Department of Land and Natural Resources (SHPD/DLNR).
Project Description	The proposed project involves the redevelopment of the existing Hilton Hawaiian Village Beach Resort and Spa complex (see Figure 4). This would involve the demolition of certain existing structures, the construction of new structures, and the renovation of certain existing structures. Associated ground disturbance will involve excavations related to the project area's redevelopment, to include: structural footing installation, utility installation, swimming pool expansion, and landscaping. Surface grading is also anticipated for roadway improvements and parking area installation.
Project Area Acreage	Approximately 22.4 acres.

Area of Potential Effect (APE)	The project area's built environment is largely developed with multi-story hotel structures, retail shops, pool and beach amenities, driveways and walkways, and parking lots and structures. Based on available information, the proposed redevelopment of the existing Hilton Hawaiian Village beach Resort and Spa complex within this built environment is unlikely to pose additional auditory, visual, or other environmental impacts to any known historic properties (for example, historic buildings or structures) outside of the current project area. Accordingly, the APE for the proposed Hilton Hawaiian Village Master Plan Improvements Project is defined as the entire approximately 22.4-acre project area.
Historic Preservation Regulatory Context	This document was prepared to support the proposed project's historic preservation review under Hawaiʻi Revised Statutes (HRS) Chapter 6E-42 and HAR Chapter 13-13-284. This Archaeological Inventory Survey has been revised following SHPD review (April 15, 2011; Log No. 2011.0520, Doc No 1104MV02) of a previously submitted draft. The Archaeological Inventory Survey work reported here followed an *Archaeological Inventory Survey Plan for the Hilton Hawaiian Village Master Plan Improvements Project, Waikīkī Ahupuaʻa, Kona District, Oʻahu Island, TMK: [1] 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 & [1] 2-6-009:001-007, 009-013* (Tulchin, Shideler & Hammatt 2010) reviewed and accepted by the State Historic Preservation Division in an HRS 6E-42 Historic Preservation Review dated November 15, 2010 (Log No. 2010.3328, Doc No. 1011MV07). In consultation with SHPD/DLNR, the archaeological inventory survey investigation was designed to fulfill the State requirements for an archaeological inventory survey per HAR Chapter 13-13-276.
Fieldwork Effort	The fieldwork component of this archaeological inventory survey comprised the excavation and documentation of 20 backhoe test trenches. The fieldwork was accomplished between November 29, 2010 and December 21, 2010 by CSH archaeologists, Trevor Yucha, B.S., Jon Tulchin, B.A., Nifae Hunkin, B.A., Josephine Paolello, M.S., Ena Sroat, B.A., Douglas Borthwick, B.A. and David W. Shideler M.A. This effort required approximately 50 person-days to complete. All fieldwork was carried out under the supervision of Hallett H. Hammatt, Ph.D. (principal investigator)
Number of Historic Properties Identified	One (1)

Historic Properties Recommended Eligible to the Hawai‘i Register of Historic Places (Hawai‘i Register)	SIHP# 50-80-14-2870, a post-contact buried, culturally-enriched A-Horizon (cultural layer) consisting of three post-contact human burials and multiple pit features
Historic Properties Recommended Ineligible to the Hawai‘i Register	None
Effect Recommendation	CSH’s project specific effect recommendation is “effect, with proposed mitigation commitments.” The recommended mitigation measures will reduce the project’s effect on identified historic properties within the project area.
Mitigation Recommendation	In consultation with the SHPD/DLNR (SHPD/DLNR review of a previously submitted draft study, dated April 15, 2011; Log No. 2011.0520, Doc No 1104MV02) a data recovery program (to begin with a data recovery plan to be submitted for the review and approval of SHPD/DLNR) will be undertaken within Improvement Area 2 and in the immediate vicinity of the proposed Timeshare Tower 2. This is an area proposed for substantial subsurface impact associated with the proposed Timeshare Tower 2. The archaeological data recovery plan will present research goals and hypotheses related to additional analysis of the buried, culturally-enriched A-horizon (SIHP# 50-80-14-2870) that was documented within Improvement Area 2 (Trench 20) during the present archaeological inventory survey. Additional subsurface testing within Improvement Area 2, in the vicinity of Trench 20, will likely be performed in order to further document, sample, and analyze SIHP# 50-80-14-2870 and any other buried cultural deposits that may be encountered. One research foci will be evaluating finds in relationship to the indicated shoreline accretion in this immediate area in the late 1800s. A modest program of subsurface testing (2 to 4 test trenches) is envisioned with the locations of these data recovery test excavations taking into consideration specific areas of proposed ground disturbance. In consultation with SHPD/DLNR, CSH recommends an on-site archaeological monitoring program be implemented for all construction activities related to the current project. A qualified archaeological monitor will remain on-site during all new ground disturbance activities. Archaeological monitoring will facilitate the identification and proper treatment of any historic properties that might be encountered during project construction activities.

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Section 1 Introduction

1.1 Project Background

At the request of Group 70 International, Inc., Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this Archaeological Inventory Survey for the Hilton Hawaiian Village Master Plan Improvements Project, Waikīkī Ahupua‘a, Kona District, O‘ahu Island, TMK: [1] 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 & [1] 2-6-009:001-007, 009-013. This Archaeological Inventory Survey has been revised following SHPD review (April 15, 2011; Log No. 2011.0520, Doc No 1104MV02) of a previously submitted draft study.

The project area consists of the Hilton Hawaiian Village Beach Resort and Spa complex, located along the coast of Waikīkī. It is bounded by Kālia Road to the east, Paoa Place to the south, Duke Kahanamoku Lagoon to the west, and Ala Moana Boulevard to the north. The project area is depicted on a U.S. Geological Survey Topographic Map (Figure 1), a Tax Map Key (TMK) plat map (Figure 2), and on an aerial photograph (Figure 3).

The Archaeological Inventory Survey work reported here followed an *Archaeological Inventory Survey Plan for the Hilton Hawaiian Village Master Plan Improvements Project, Waikīkī Ahupua‘a, Kona District, O‘ahu Island, TMK: [1] 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 & [1] 2-6-009:001-007, 009-013* (Tulchin, Shideler & Hammatt 2010) reviewed and accepted by the State Historic Preservation Division in an HRS 6E-42 Historic Preservation Review dated November 15, 2010 (Log No. 2010.3328, Doc No. 1011MV07).

1.2 Project Setting & Description

1.2.1 Existing Conditions

Covering approximately 22.24 acres of land, the Hilton Hawaiian Village ® Beach Resort & Spa (“Village”) is a self-contained premier resort village destination located at the gateway entry of Waikīkī. The Village is comprised of 26 parcels at the ‘ewa end of Waikīkī. The resort is bounded and accessed by Kahanamoku Street to the northwest, Ala Moana Boulevard to the north, Kālia Road to the northeast, Paoa Place to the southeast, and Waikīkī Beach and the Pacific Ocean to the west and south.

The Village showcases 2,971 hotel guestrooms, which are housed in five distinctive hotel towers: the Tapa Tower (1,044), Rainbow Tower (832), Diamond Head Tower (435) and Apartments (44), Ali‘i Tower (324), and Kālia Tower (292), respectively. Additionally, the Village hosts three timeshare towers that house 656 units: the Grand Waikīkian (331), Lagoon Tower (253), and Kālia Tower (72). These timeshare properties accommodate private owners or are used as rental suites for visitors seeking residential-style accommodations.

The Village property also consists of over 150,000 square feet of indoor and outdoor spaces for banquets, receptions, meetings, conferences, conventions, trade shows, seminars, and major gala events. Indoor venues include the Mid-Pacific Conference Center, which houses the grand

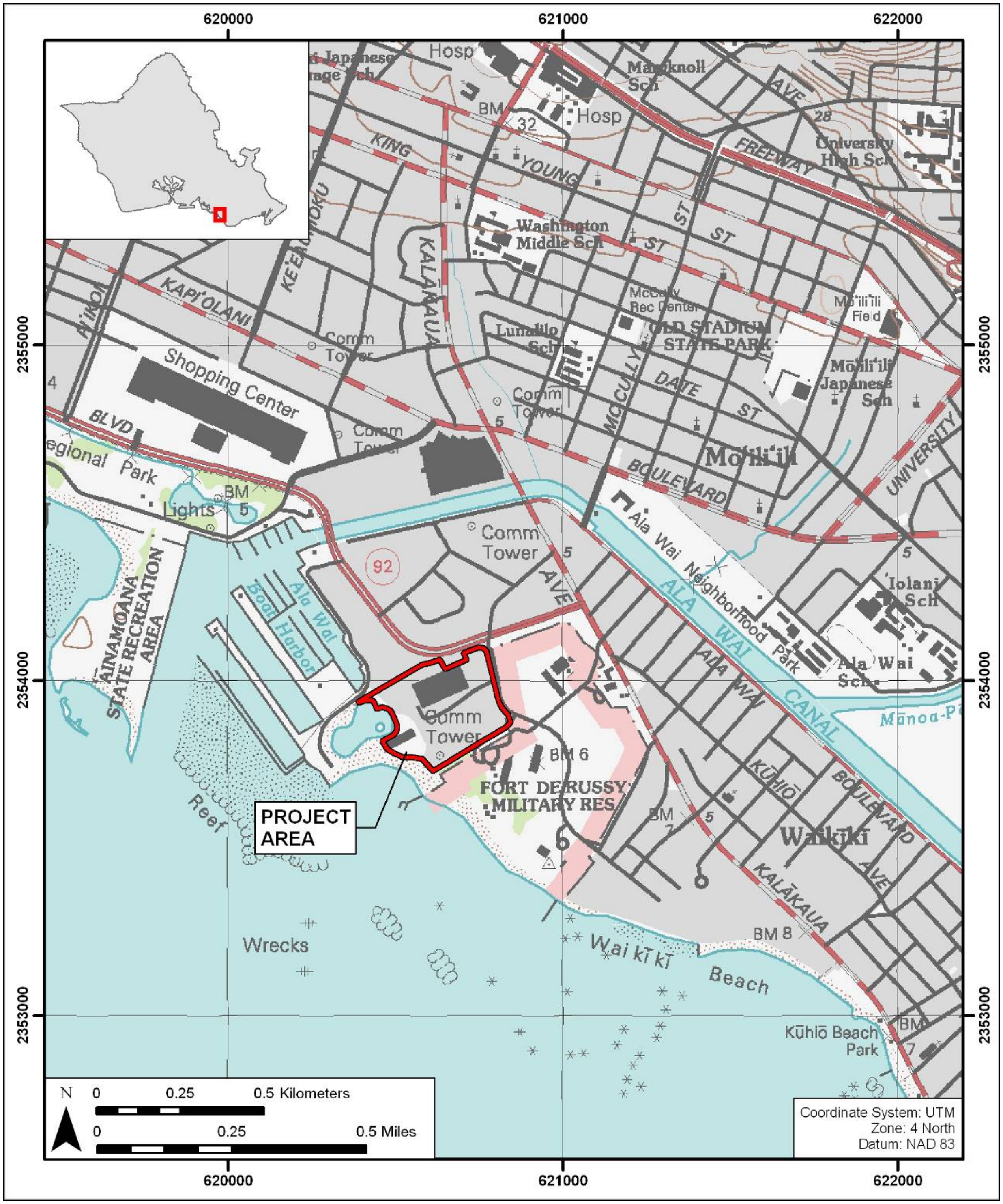

Figure 1. U.S. Geological Survey (USGS) 7.5 Minute Series Topographic Map, Honolulu (1998) Quadrangle, showing the location of the project area

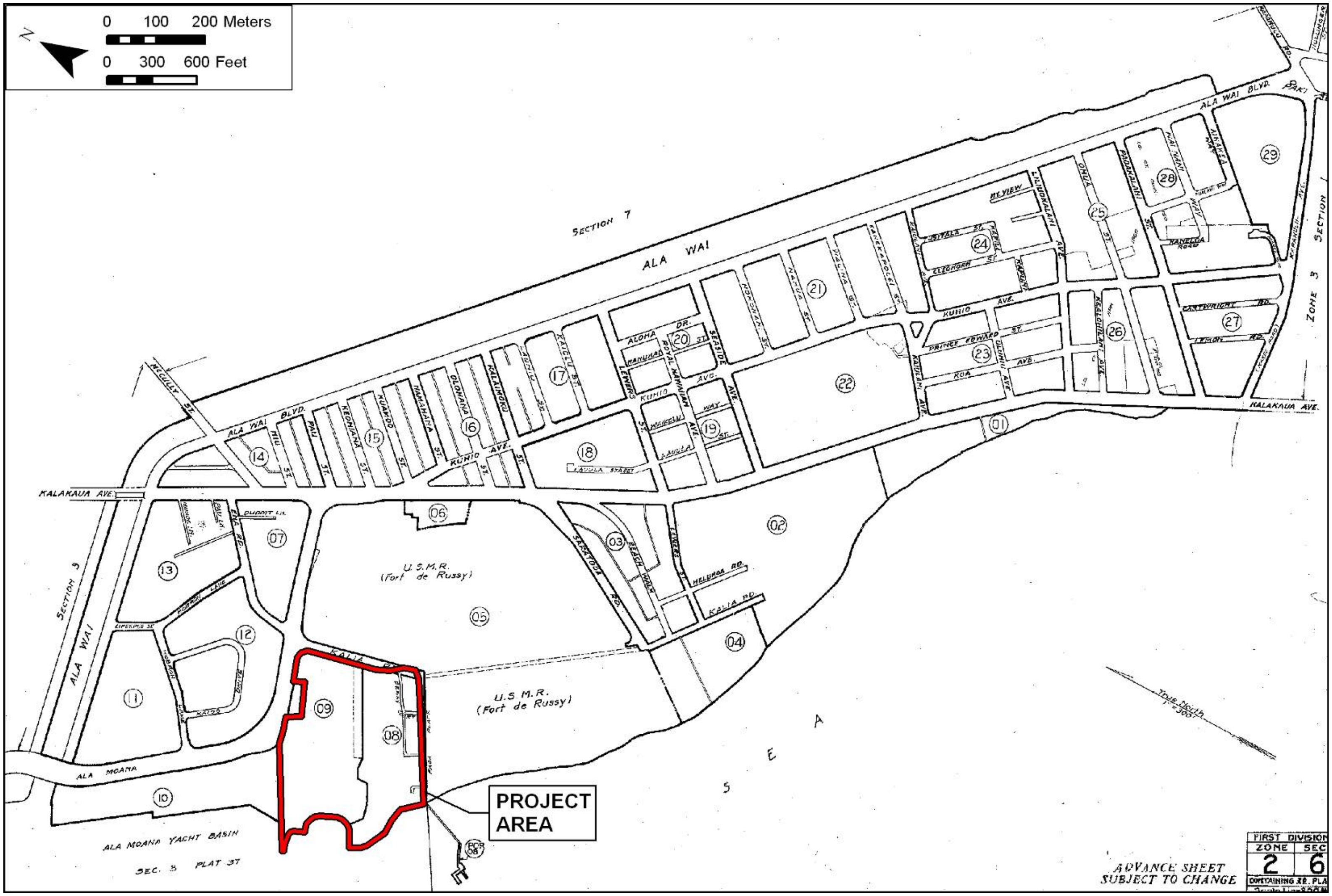

Figure 2. Tax Map Key (TMK) plat [1] 2-6 showing the location of the project area

Figure 3. Aerial Photograph, showing the location of the project area (source: Google Earth 2010)

Coral Ballroom, the Coral Lounge, and the South Pacific Ballroom; the Tapa Ballroom and Conference Center, the Kālia Executive Conference Center, and the Rainbow Suite. Outdoor venues provide a tropical beachfront or garden setting suited for banquet and reception functions, which range in size and setting. These outdoor options include the Great Lawn, the Village Green, the Rooftop Garden, and available terraced pool decks. The Ocean Crystal Wedding Chapel is prominently located in the center of the property.

Resort recreational amenities at the Village include six swimming pools, offering various options of water activities with slides, waterfalls, and whirlpools as design elements interspersed throughout the property. Additionally, the recently renovated Duke Kahanamoku Lagoon is a key signature element of the Village, providing a promenade boardwalk that encircles the lagoon, grassy picnic areas, and selective plantings of coconut trees and a two-tier waterfall to accent. Other programmed activity areas include a fitness center and spa; and demonstration areas for families and children to learn and participate in cultural activities. The Village also provides an eclectic mix of retail experiences that include boutiques, specialty stores, and gift and sundry shops. Finally, the Village offers multiple dining experiences, ranging from a rooftop luau; open air ocean-side dining in fine and casual settings; poolside bars and tropical resort lounges; and a selected array of restaurants representing different cuisines from around the world.

Surrounding the Village property are other hotel and lodging accommodations, residential units, and various dining and shopping venues. One of the most prevalent land features next to the Village is the large open space formed by ʻĀinahau Triangle and Fort DeRussy Beach Park to the east, the adjacent Hale Koa Hotel property, and Battery Randolph, all of which are under the control and jurisdiction of the U.S. Army.

1.2.2 Description of Proposed Master Plan Project

The Village Master Plan Improvements project is a directed effort to reinvigorate the Village's iconic resort setting through a purposeful series of redevelopment activities that will ultimately lead to a contemporary transformation of the entire Village. The redevelopment will reassert the Village's position as a major visitor destination experience in Waikīkī. Overall, the project will improve the flow of retail activity as well as the overall guest experience. Improvements are planned from the point of visitor arrival and through their stay, with planned upgrades to several amenities. The signature improvements within the Village Master Plan will include the construction of two new timeshare towers, which will expand the resort's accommodations of vacation ownership units.

The planned improvements that define the Master Plan are framed in three distinct focused master plan improvement areas (IA) (Figure 4), which include:

Area 1: The first master planned Improvement Area consists of 1) improving the main entry into the Village; 2) improving the retail promenade and pedestrian experience along Kālia Road fronting Tapa Tower; 3) improvements to the Tapa Pool and terrace; and 4) the construction of the a 350' timeshare tower over the existing bus loading area.

Area 2: The second master planned Improvement Area consists of 1) redeveloping a portion of the retail pavilion along the Diamond Head side of Rainbow Drive; 2) redeveloping the entire

Figure 4. Hilton Hawaiian Village site plan showing locations of proposed redevelopment (source: Group 70 International, Inc. 2010)

Rainbow Bazaar area with new configured 4-story *mauka*, 2-story *makai* retail and 3) constructing a second timeshare tower within the *makai* end of the Rainbow Bazaar reconfiguration.

Area 3: The third master planned area consists of: 1) improving the main lobby, porte cochere, and arrival area, and 2) expanding the Super Pool area, including water features, pedestrian walkways, and wildlife habitat.

Improve Retail & Streetscape Experience Along Kālia Road

The Village "front" and main entry leads from Kālia Road onto Rainbow Drive. In general, improvements will be made to the street side appearance and appeal of retail units fronting the Rainbow Drive entry. Currently, the walkway and concourse space connecting the tour bus and group arrival area to and from Rainbow Drive to the entry of the Village is underutilized. Landscaping and pedestrian access fronting Tapa Tower along Kālia Road will be opened up, invoking a more appealing welcoming experience. A newly defined pedestrian path will direct visitors and guests along the major walkway under the Tapa Tower. Existing retail kiosks in this area will be replaced with newly designed retail spaces.

Improve Main Entry, Rainbow Drive, and Center of Resort Retail

One of the main issues to be addressed in this area is the pedestrian-vehicle conflict that exists at the crosswalk between Kālia Tower and Tapa Tower. Currently, pedestrian flow converges at the crosswalk while vehicles maneuver to enter/exit the main parking garage from Rainbow Drive. Proposed improvements include relocating the existing crosswalk approximately 60 to 80 feet *makai* from its current location. This action will direct pedestrian circulation away from the area, thereby alleviating the current congestion. Retail storefronts will be reoriented to the crosswalk, absorbing pedestrian flow and creating new retail activity hubs in the central area of the Village.

Other planned improvements for this area include renovating and infilling an existing retail pavilion to create a single retail space adjacent to and fronting the main lobby. Existing retail units may selectively remain, but will undergo exterior renovations to improve their overall appearance and appeal. Additionally, the existing overhead structure that connects Kālia Tower and Tapa Tower will be removed, increasing and improving the visual corridor through the main entry of the Village. New landscaping and lighting will further enhance the area.

Improve Front Desk, Develop Super Pool, Village Green, and New Hau Tree Bar

The porte cochere entry and front desk lobby are the primary points of guest arrival. The overhang canopy of the porte cochere will be expanded, allowing for more cars to queue under cover for drop off/pick-up and valet service. This expansion will help to alleviate traffic build-up that occurs during peak use periods within the Village along Rainbow and Lagoon Drives.

Most of the existing components of the front desk lobby area will remain. However, portions of the lobby area will be reconfigured and undergo interior renovations to enhance and improve the visual relationships between the lobby and the pool and beach areas. Key modifications within the lobby area and adjoining walkways to Ali‘i Tower, Rainbow Tower, and the Super Pool include the removal of the Shell Bar pavilion, the covered trellis walkway, and development of a landscaping plan for future plantings and best management practices for the existing mature

Banyan tree. The anticipated result of these modifications will be an expanded recreational focal point, centered with the planned expansion of the Super Pool area.

Plans for the Super Pool expansion include the creation of two *keiki* pools, both designed with age-appropriateness in mind. One of these pools will include a series of water slides and other amenity features. Additionally, an adult pool will be created with an expansive deck and chaise lounge space, including cabanas for visitors seeking quiet solace and peaceful environment.

The expansion and improvements result in the relocation of selected retail, food and beverage amenities. The Village Green will be absorbed with an expansion of the wildlife pool, and the creation of a centered plaza fronting Ali‘i Tower. On the *makai* side, the existing Hau Tree Bar will be relocated near the Rainbow Lanai. Overall pedestrian access between the Ali‘i Tower, Rainbow Tower, the main lobby, and adjoining retail spaces will also be reconfigured.

Improve Tapa Pool and Café

The Tapa Pool and its surrounding terrace are currently centered in a more secluded area of the Village than the Super Pool counterpart. Plans will increase the deck space that will be utilized for pool activities during the day, which can convert to function space for evening events. Additionally, the café space, which is adjacent to the Tapa Pool terrace, is currently vacant. This area will be converted into a high ceiling multi-functional space for banquets or possible entertainment venue. Design elements of the area will include the ability to screen the pool and terrace area from the Tapa Bar, as necessary, to utilize the space for outdoor events.

New Timeshare Tower Sequel 1 over Bus Loading

The Village Master Plan proposes the development of a 300-unit timeshare tower, to be located at the existing Group Bus and Tour area on the Diamond Head corner of the property near Kālia Road and Paoa Place. The existing bus loading and service activities will remain on the ground level with some necessary improvements. An arrival lobby will be accessed via a new ramp that leads to the porte cochere on the second floor. Parking for this timeshare will be accommodated within the lower levels. Upon completion of City approvals, construction of this new timeshare tower is planned to commence in late 2013 and would open in 2016.

Acquisition of Remnant City and County of Honolulu Parcel

Kālia Road was realigned to a more *mauka* position around 1993. The ‘ewa *makai* corner of Kālia Road and Paoa Place overlies a remnant portion of the former roadway and right-of-way. The subject land is currently improved with sidewalk and landscaping. The Master Plan Improvements project includes the planned acquisition of approximately 8,200 sq. ft. of TMK 2-6-5:1 (portion) owned by the City and County of Honolulu. This acquisition is currently in process with the appropriate City agencies.

New Timeshare Tower Sequel 2 over Redeveloped Rainbow Bazaar

The Village Master Plan also proposes a second timeshare tower, which will be comprised of 250 units. This tower will be part of a redevelopment of the *makai* side of the Rainbow Bazaar near the Great Lawn. Plans call for a new raised retail plaza, back of house area, and office space on the lower levels with a planned mix of room units. Parking requirements would be met by reallocating space within the existing parking garage to accommodate projected demand and

Land Use Ordinance requirements. Tower 2 would be one of the last phases to be implemented, currently planned for 2019.

Anticipated Net Effect of Redevelopment on Village Retail

Upon completion of planned improvements, the Village Master Plan would result in approximately 23,900 square feet (SF) of renovated retail space, inclusive of food and beverage services. The overall net retail space will increase by 14,359 SF at Hilton Hawaiian Village ®.

1.3 Scope of Work

The following archaeological inventory survey scope of work was designed to satisfy the Hawai‘i state requirements for archaeological inventory surveys per HAR Chapter 13-13-276:

1) Detailed historic and archaeological background research, including a search of historic maps, aerial photographs, written records, Land Commission Award documents, and the reports from prior archaeological investigations. This research was focused on the specific project area’s past land use, with general background on the pre-contact and post-contact settlement patterns of the *ahupua‘a* and district. This background information was used to compile a predictive model for the types and locations of historic properties that could be expected within the project area.
2) A complete (100 %) systematic pedestrian inspection of the project area to identify any potential surface historic properties.
3) Subsurface testing based on the methodology of the approved archaeological inventory survey plan (Moore et al. 2010) to identify and document subsurface historic properties that were not located by surface pedestrian inspection. Appropriate samples from these excavations were analyzed for cultural and chronological information.
4) As appropriate, consultation with knowledgeable individuals regarding the project area’s history, past land use, and the function and age of the historic properties documented within the project area.
5) As appropriate, laboratory work to process and gather relevant environmental and/or archaeological information from collected samples.
6) Preparation of an inventory survey report, which includes the following:
    a) A project description;
    b) A section of a U.S. Geological Survey topographic map showing the project area boundaries and the location of all recorded historic properties;
    c) Historical and archaeological background sections summarizing prehistoric and historic land use of the project area and its vicinity;
    d) Descriptions of all historic properties, including selected photographs, scale drawings, and discussions of age, function, laboratory results, and significance, per the requirements of HAR 13-276. Each historic property will be assigned a Hawai‘i SIHP number;

e) If appropriate, a section concerning cultural consultations [per the requirements of HAR 13-276-5(g) and HAR 13-275/284-8(a)(2)].

f) A summary of historic property categories, integrity, and significance based upon the Hawai‘i Register of Historic Places criteria;

g) A project effect recommendation;

h) Treatment recommendations to mitigate the project's adverse effect on any historic properties identified in the project area that are recommended eligible to the Hawai‘i Register of Historic Places.

This scope of work includes full coordination with the SHPD/DLNR and county relating to archaeological matters. This coordination takes place after consent of the owner or representatives.

1.4 Environmental Setting

1.4.1 Natural Environment

The project area is situated along the southeastern coast of O‘ahu. The Honolulu leeward coastal plain is stratified with late-Pleistocene coral reef substrate overlaid with calcareous marine beach sand, terrigenous sediments, and/or stream-fed alluvial deposits (Armstrong 1973:36). Terrigenous sediments are formed and deposited on land, or are materials derived from land mixed with purely marine material. The modern Honolulu shoreline configuration is primarily the result of three factors: the rising sea level following the end of the Pleistocene (Stearns 1978); the 1.5-2.0 meter high-stand of the sea during the mid to late Holocene; and pre- and post-contact human landscape modification.

The project area receives between 23 and 31 inches (600-800 millimeters) of rainfall per year (Giambelluca et al. 1986), and has little or no naturally occurring vegetation. The resort landscaping relies primarily on introduced ornamental species.

Lands within the project area are relatively level with an elevation of 3 ft above mean sea level (AMSL). According to U.S. Department of Agriculture (USDA) soil survey data, sediments within the project area consist primarily of Jaucas Sand (JaC), with small pockets of Fill Land (FL) and Beaches (BS) located along the western edge (Foote et al. 1972) (Figure 5). The following is a synopsis of each soil series:

> Jaucas series consists of excessively drained, calcareous soils that occur as narrow strips on coastal plains, adjacent to the ocean…developed in wind and water deposited sand from coral and seashells…used for pasture, sugarcane, truck crops, alfalfa, recreational areas, wildlife habitat, and urban development. (Foote et al. 1972)
>
> Fill is described as a land type occurring mostly near Pearl Harbor and in Honolulu, adjacent to the ocean. It consists of areas filled with material dredged from the ocean or hauled from nearby areas, garbage, and general material from other sources. (Foote et al. 1972).

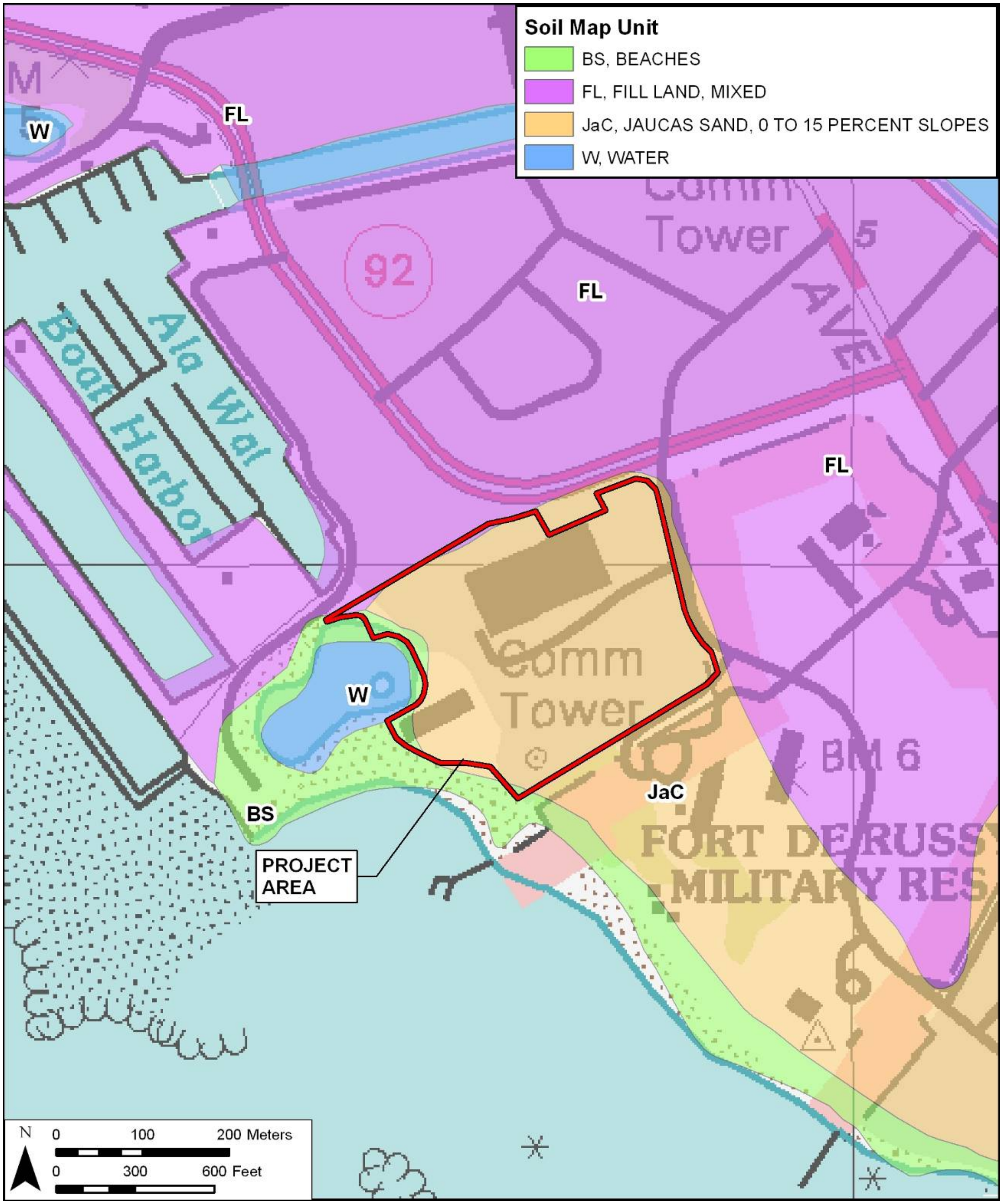

Figure 5. Overlay of the Soil Survey of the State of Hawai‘i (Foote et al. 1972), indicating soil types within the project area

> Beaches occur as sandy, gravelly, or cobbly areas...washed and rewashed by ocean waves. Beaches mainly consist of light colored sands derived from coral and seashells. Beaches have no value for farming...but are highly suitable for recreational uses and resort development. (Foote et al. 1972)

The accretion of the natural shoreline in the *makai* (seaward) portion of the Hilton Hawaiian village lands between 1862 (when reliable documentation of the shoreline begins) and 1908 (the last date of a documentation of shoreline accretion shown in Figure 14) is well documented. This natural accretion in the vicinity probably was on-going before 1862 and continued well after 1908. The naturally accreting sand would have been "Beach sand" becoming "Jaucas Sand" as it became more consolidated and stable over time. In addition to the naturally accreting shoreline there have been many fill episodes (including deposition of Ala Wai Canal spoils in the 1920s and importation of top soil) that have raised the ground surface.

1.4.2 Built Environment

The entire project area has been artificially modified as a result of resort development (see Section 1.2.1 for greater detail). High- and low-rise buildings are present throughout the project area, as well as concrete and asphalt paved roads and walkways. Landscaped trees and hedges are also present throughout the project area.

Section 2 Methods

2.1 Field Methods

2.1.1 Pedestrian Survey

A 100 percent coverage pedestrian inspection was conducted within the project area in order to locate any surface historic properties. The pedestrian survey concluded that the entire project area has been artificially modified as a result of resort development. No surface historic properties were identified within the project area. Accordingly, fieldwork within the project area focused on a program of subsurface testing to locate any buried cultural deposits that may be present beneath the modern land surface.

2.1.2 Ground Penetrating Radar Survey

2.1.2.1 Survey Methodology

The GPR survey was performed using a Geophysical Survey Systems, Inc. (GSSI) SIR-3000 system equipped with 400 MHz antenna. This is a bistatic system, in which electromagnetic energy in the radar frequency range is transmitted into the ground via a sending antenna. Radar energy is reflected off of the subsurface matrix and is then received by another, paired antenna. Reflected energy is sampled and the travel time (in nanoseconds) of the individual reflection waves is recorded. Wave propagation speed varies depending on the nature of the subsurface medium. Any changes in density or electromagnetic properties within the stratigraphic column may cause observable variations in reflection intensity. Reflection features may include discrete objects, stratigraphic layering, or other subsurface anomalies.

The GPR survey was conducted using single-run transects to generate two-dimensional (2D) depth profiles and horizontal depth slices (i.e. plan view maps of subsurface anomalies at selected depths below the surface). GPR data collection parameters (Table 1) were held constant throughout the survey under the assumption that soil conditions were relatively consistent across the survey area. A dielectric constant[1] of 8 was utilized in anticipation of the presence of sand within the project area based on the U.S. Geological Survey soil survey of the area (Foote et al. 1972).

[1] The measure of the ability of a material to store a charge from an applied electromagnetic field and then transmit that energy. In general, the greater the dielectric constant of a material, the slower radar energy will move through it. The dielectric constant is a measurement of how well radar energy will be transmitted to depth.

Table 1. GPR Data Collection Parameters

Parameter	Settings
Antenna	400 MHz
Samples per Scan	512
Format	16-bit
Depth	2 meters
Dielectric	8
Soil	Type 2
Scans per Unit	50/m

The effectiveness of GPR is highly dependent on local soil conditions. The high signal attenuation rate of many soil types restricts the depth of radar penetration and therefore limits the effectiveness of GPR surveys. The National Resource Conservation Service (NRCS) produced maps indicating the relative suitability of GPR applications throughout the U.S. The GPR suitability data was generated based on U.S. Department of Agriculture (USDA) soil survey data. Figure 6 shows the project area on the NRCS GPR Suitability Map for Hawai‘i. The survey area is shown to primarily traverse lands in the high suitability category. This is likely due to the presence of uniform sediments (i.e., Jaucas sands) throughout the entire project area (Foote et al. 1972). Additionally, the project area is not situated directly along the coast, which likely limits amount of salt deposition and water saturation within the project area sediments, which are known to increase the conductivity of the soils causing limited depth “visibility” and inaccurate data collection.

2.1.2.2 Post-processing

All collected radar data was post-processed using the following software: RADAN 6.6, GPR Process, and Surfer 9. Position correction was utilized to remove unwanted surface “noise” from GPR profiles. A Horizontal High Pass Finite Impulse Response “Boxcar” (Background Removal) filter was not utilized in order to retain the image of recorded stratigraphic layers. Horizontal slicing of GPR data was conducted utilizing 25 cm depth intervals. Horizontal slices were not generated for portions of GPR data that was distorted and/or attenuated due to environmental conditions and disturbances. In general, useful GPR data collected for the current study was located between 0 and 100 cmbs.

2.1.3 Subsurface Testing

2.1.3.1 Rationale for Subsurface Test Trench Location Selection

The current archaeological inventory survey sought to make a good faith effort at sampling both in terms of total area of testing and test trench distribution. The main consideration was to focus subsurface testing under the footprint of areas of proposed subsurface disturbance. The greatest anticipated disturbance is expected to be associated with the two timeshare towers. The “New Timeshare Tower Over Bus Loading” in the east corner of the project area (see Figure 4)

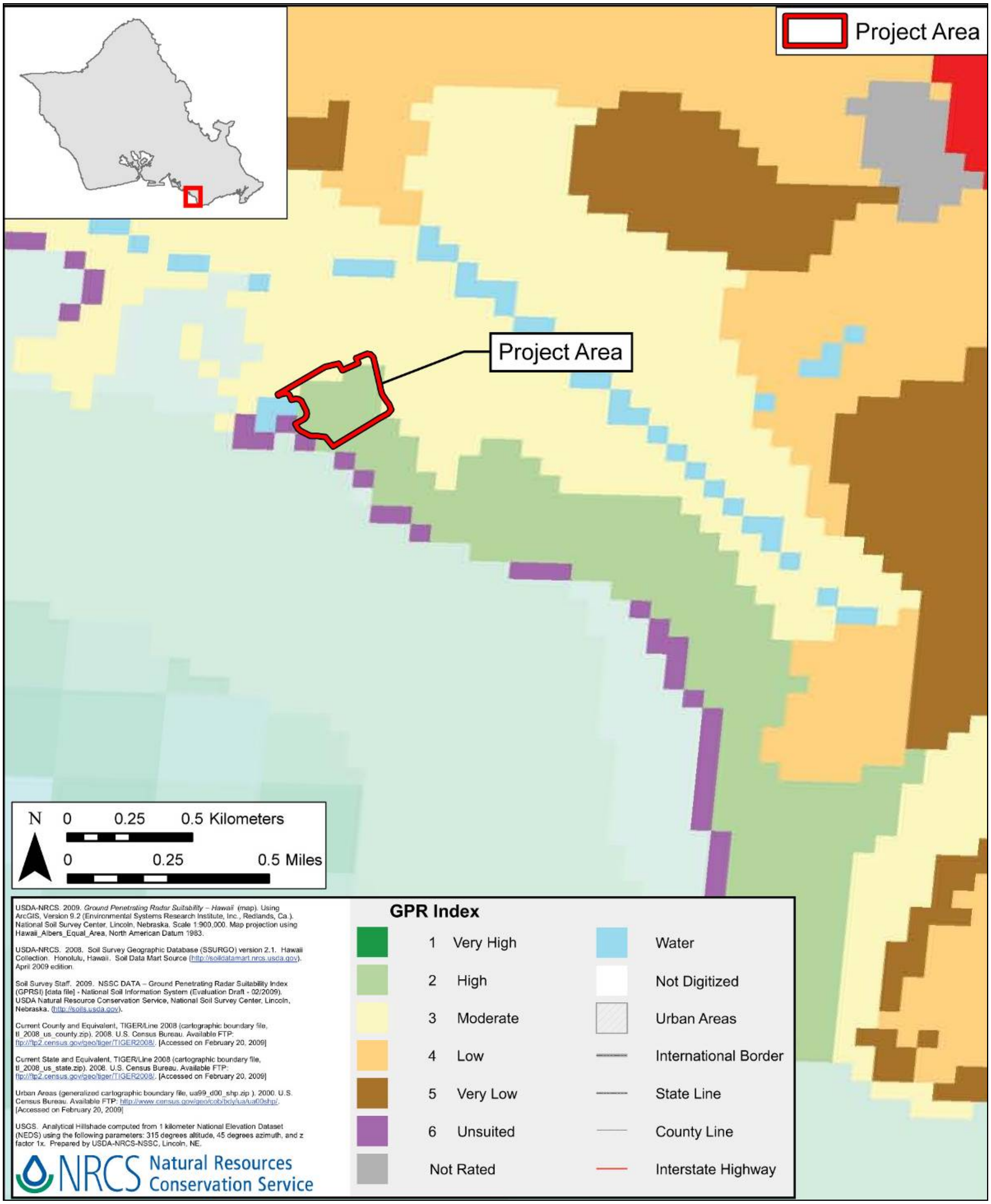

Figure 6. GPR suitability map (source: National Resource Conservation Service) showing the location of the project area

largely overlies the location of a Land Commission Award (LCA 2511 to Alapai) and also lies in close proximity to three known burials previously encountered within the project area. This was sufficient grounds to make this area the primary focus of subsurface testing.

In the case of the "New Timeshare Tower Over Redeveloped Rainbow Bazaar" in the central portion of the project area (see Figure 4) concerns are significantly less inasmuch as virtually the entire footprint of this tower is understood to be on lands that accreted after 1862 and much of the seaward portion of this proposed tower will be on lands understood to have accreted after 1887. Very few burials are believed to have taken place in Waikīkī after circa 1862 and this tower is located well away from LCAs and previously identified burials. Furthermore this central portion of the project area has been fairly extensively monitored with minimal finds. Testing in this area is primarily an effort to confirm present indications that this area is of significantly lesser sensitivity.

Other test trench locations have been specifically located to test areas of indicated subsurface impact which is typically anticipated to be far less intensive and extensive (Figure 7). Large portions of the proposed redevelopment lie within land that accreted after 1887 and are thus of significantly less archaeological concern.

The specific selection of proposed trenches took into consideration the available data on known utilities so as to avoid areas of known significant prior ground disturbance. For health and safety reasons, as well as practicality, trench locating tried to avoid certain areas of particularly high vehicular and pedestrian traffic.

2.1.3.2 Test Trench Excavation

In accordance with the project's SHPD/DLNR-approved archaeological inventory survey plan (Tulchin et al. 2010), CSH conducted subsurface testing in the form of mechanically- and hand-excavated trenches within the project area. Test excavation methodology initially consisted of the saw-cutting of asphalt surfaces or the removal of overlying vegetation. In general, a standard backhoe with a two-foot wide bucket was used to excavate each trench to the water table. When the mechanical advantage was not feasible, excavation was conducted by hand, using shovels, picks, and trowels. All trench excavations were monitored by CSH archaeologists and all resulting backfill piles were thoroughly examined for the presence of cultural material. When potential cultural deposits were encountered during subsurface testing, hand excavation was undertaken in order to minimize any disturbance. Following documentation, all test trenches were backfilled.

2.1.3.3 Documentation of Stratigraphy

The stratigraphy in each trench will be drawn and photographed. Sediments will be described for each of the trenches using U.S. Department of Agriculture soil description observations/terminology. Sediment descriptions include Munsell color, texture, consistence, structure, plasticity, cementation, origin of sediments, descriptions of any inclusions such as cultural material and/or roots and rootlets, lower boundary distinctiveness and topography, and other general observations. Where stratigraphic anomalies or potential cultural deposits were exposed, these were carefully represented on trench excavation profile maps.

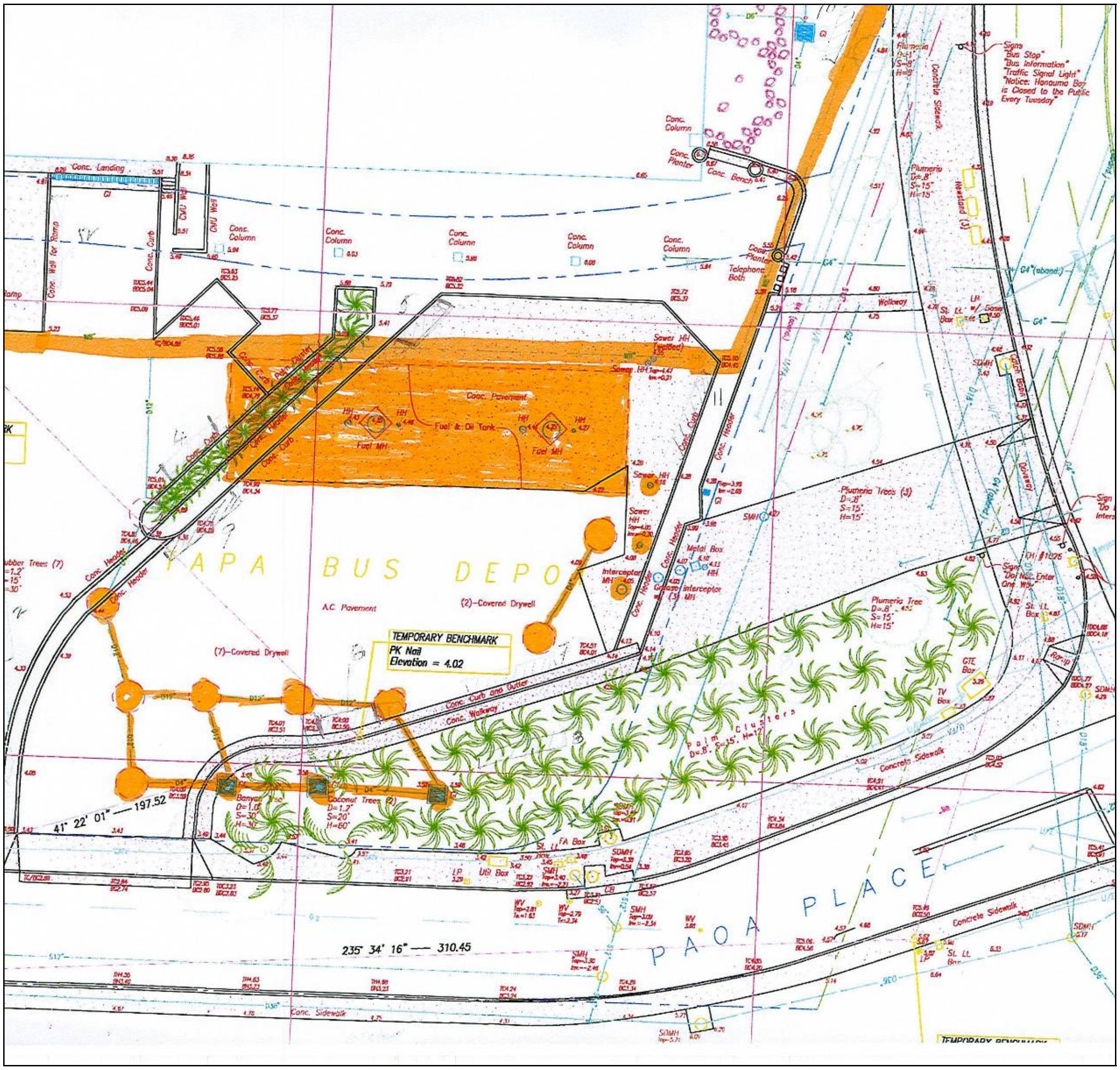

Figure 7. Sketch showing areas of major previous subsurface impact (including an approx. 2,250 sq. ft. Fuel & Oil Tank, 11 dry wells and a water line) in the vicinity of the "New Timeshare Tower Over Bus Loading" in the east corner of the campus

2.1.3.4 Sampling

Bulk sediment samples were collected from potential cultural strata that were observed within the project area. These samples were first examined within the CSH laboratory for individual charcoal fragments that were large enough to be submitted for wood taxa identification and radiocarbon analysis. The remainder of the sediment matrix of each bulk samples was dry-screened through a 1/16-inch mesh screen. All cultural material from within each bulk sample was sorted by provenience and analyzed. The findings of this analysis are presented in Section 5.3.

2.2 Laboratory Methods

Following the completion of fieldwork, all collected material was analyzed using standard archaeological laboratory techniques. Historic cultural material and faunal remains that were collected in the field were returned to the CSH laboratory to be sorted, identified, measured, and quantified. In general, artifact analysis focused on establishing, to the greatest extent possible, material type, formal/functional type, cultural affiliation, and/or age of manufacture. Faunal analysis generally focused on species identification and evidence of food consumption. A catalog of all collected material was prepared and is presented in Section 5 Results of Laboratory Analysis, below. Upon completion of the project, all material collected during subsurface testing will remain at the CSH Waimānalo Office until a permanent facility is determined, based on consultation with the landowner and the SHPD/DLNR.

2.3 Document Review

Background research included: a review of previous archaeological studies on file at the SHPD/DLNR library; review of historical documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Archives of the Bishop Museum; study of historic photographs at the Hawai‘i State Archives and the Archives of the Bishop Museum; study of historic maps at the Hawai‘i State Land Survey Division; and study of historic maps and photographs at the CSH library. This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources consulted were used to formulate a predictive model regarding the expected types and locations of historic properties that may be located in the project area.

Section 3 Background Research

3.1 Traditional and Historical Background

3.1.1 Waikīkī Pre-Contact to 1800s

Waikīkī, by the time of the arrival of Europeans in the Hawaiian Islands during the late eighteenth century, had long been a center of population and political power on O‘ahu. According to Martha Beckwith (1940), by the end of the fourteenth century, Waikīkī had become "the ruling seat of the chiefs of O‘ahu." George Kanahele (1995:62) relates that the ruling chief Ma‘ilikūkāhi made the decision:

> ..to move his capital from ‘Ewa to Waikīkī around 1400. As a result, for the next 400 years – and until Honolulu became the trading center of the Kingdom of Hawai‘i in the early 1800s – Waikīkī remained one of the main political and economic centers of O‘ahu.

Ma‘ilikūkāhi was known as a kind chief and was greatly loved by his subjects who enjoyed prosperity and peace under his reign (Kamakau 1964:223). Ma‘ilikūkāhi won the respect and loyalty of his people: “Because of his exceedingly great concern for the prosperity of the kingdom…”. (Kamakau 1991:55)

The preeminence of Waikīkī continued into the eighteenth century and is betokened by Kamehameha's decision to reside there upon gaining control of O‘ahu by defeating the island's chief, Kalanikūpule (see present Appendix C for an overview of the place of Waikīkī in the wars of conquest). The nineteenth century Hawaiian historian John Papa ‘Ī‘ī (1959), himself a member of the *ali‘i*, described the king's Waikīkī residence:

> Kamehameha's houses were at Pua‘ali‘ili‘i, *makai* of the old road, and extended as far as the west side of the sands of ‘Āpuakehau. Within it was Helumoa where Ka‘ahumanu *mā* went to while away the time. The king built a stone house there, enclosed by a fence.

‘Ī‘ī further noted that the "place had long been a residence of chiefs. It is said that it had been Kekuapoi's home, through her husband Kahahana, since the time of Kahekili." It does seem clear, however, that the foci of documented chiefly residence was well to the east - at Helumoa in the vicinity of the Royal Hawaiian Hotel).

Chiefly residences, however, were only one element of a complex of features which were able to sustain a large population that characterized Waikīkī up to pre-contact times. Beginning in the fifteenth century, a vast system of irrigated taro fields was constructed, extending across the littoral plain from Waikīkī to lower Mānoa and Pālolo valleys. This field system - an impressive feat of engineering the design of which is traditionally attributed to the chief Kalamakua - took advantage of streams descending from Makiki, Mānoa and Pālolo valleys which also provided ample fresh water for the Hawaiians living in the *ahupua‘a*. Water was also available from springs in nearby Mō‘ili‘ili and Punahou. Closer to the Waikīkī shoreline, coconut groves and fishponds dotted the landscape. A sizeable population developed amidst this Hawaiian-engineered abundance. Captain George Vancouver, arriving at "Whyteete" in 1792, captured something of this profusion in his journals:

> On shores, the villages appeared numerous, large, and in good repair; and the surrounding country pleasingly interspersed with deep, though not extensive valleys; which, with the plains near the sea-side, presented a high degree of cultivation and fertility.
>
> [Our] guides led us to the northward through the village, to an exceedingly well-made causeway, about twelve feet broad, with a ditch on each side.
>
> This opened our view to a spacious plain, which, in the immediate vicinity of the village, had the appearance of the open common fields in England; but, on advancing, the major part appeared to be divided into fields of irregular shape and figure, which were separated from each other by low stone walls, and were in a very high state of cultivation. These several portions of land were planted with the eddo or *taro* root, in different stages of inundation; none being perfectly dry, and some from three to six or seven inches under water. The causeway led us near a mile from the beach, at the end of which was the water we were in quest of. It was a rivulet five or six feet wide, and about two or three feet deep, well banked up, and nearly motionless; some small rills only, finding a passage through the dams that checked the sluggish stream, by which a constant supply was afforded to the *taro* plantations.
>
> [We] found the plain in a high state of cultivation, mostly under immediate crops of *taro*; and abounding with a variety of wild fowl, chiefly of the duck kind...The sides of the hills, which were at some distance, seemed rocky and barren; the intermediate vallies, which were all inhabited, produced some large trees, and made a pleasing appearance. The plain, however, if we may judge from the labour bestowed on their cultivation, seemed to afford the principal proportion of the different vegetable productions on which the inhabitants depend for their subsistence (Vancouver, 1798: I, 161-164).

Further details of the exuberant life that must have characterized the Hawaiians' use of the lands that included the *ahupuaʻa* of Waikīkī are given by Archibald Menzies, a naturalist accompanying Vancouver's expedition:

> The verge of the shore was planted with a large grove of cocoanut palms, affording a delightful shade to the scattered habitations of the natives. Some of those near the beach were raised a few feet from the ground upon a kind of stage, so as to admit the surf to wash underneath them. We pursued a pleasing path back to the plantation, which was nearly level and very extensive, and laid out with great neatness into little fields planted with taro, yams, sweet potatoes and the cloth plant. These, in many cases, were divided by little banks on which grew the sugar cane and a species of *Draecena* without the aid of much cultivation, and the whole was watered in a most ingenious manner by dividing the general stream into little aqueducts leading in various directions so as to be able to supply the most distant fields at pleasure, and the soil seemed to repay the labour and

> industry of these people by the luxuriancy of its productions. Here and there we met with ponds of considerable size, and besides being well stocked with fish, they swarmed with water fowl of various kinds such as ducks, coots, water hens, bitterns, plovers and curlews. (Menzies 1920:23-24)

However, the traditional Hawaiian focus on Waikīkī as a center of chiefly and agricultural activities on southeastern O‘ahu was soon to change - disrupted by the same Euro-American contact which produced the first documentation (including the records cited above) of that traditional life. The *ahupua‘a* of Honolulu - with the only sheltered harbor on O‘ahu - became the center for trade with visiting foreign vessels, drawing increasing numbers of Hawaiians away from their traditional environments. The shift in pre-eminence is illustrated by the fact that Kamehameha moved his residence from Waikīkī to Honolulu. Indeed, by 1828, Levi Chamberlain describing a journey into Waikīkī would note:

> Our path led us along the borders of extensive plats of marshy ground, having raised banks on one or more sides, and which were once filled with water, and replenished abundantly with esculent fish; but now overgrown with tall rushes waving in the wind. The land all around for several miles has the appearance of having once been under cultivation. I entered into conversation with the natives respecting this present neglected state. They ascribed it to the decrease of population (Chamberlain 1957:26).

Tragically, the depopulation of Waikīkī was not simply a result of the attractions of Honolulu (where, by the 1820s, the population was estimated at 6,000 to 7,000) but also of the European diseases that had devastating effects upon the Hawaiian populace.

3.1.2 Hilton Hawaiian Village Lands and Immediate Vicinity Pre-Contact to 1800s

Little is certain regarding the Hilton Hawaiian Village Lands in the Pre-Contact period and the early 1800s. The rapid sand accretion documented in the project area and vicinity during the period from 1862 to 1908 (see Figure 14) has led some archaeologists (particularly Earl Neller circa 1980; see Figure 8) to hypothesize that circa A.D. 1000 the shoreline was far inland (near King Street in the McCully Street area for example).

Neller (1980:16-17) believed in:

> … the almost certain knowledge that there are no prehistoric Hawaiian sites in the Hilton Hawaiian Village area of Waikiki. A search through old maps has shown that the beach is not very old in the area, and did not exist in prehistoric times….

While an extrapolation back in time of the shoreline accretion in the project area and vicinity during the period from 1862 to 1908 could suggest something of the sort, this hypothesis of a far *mauka* shoreline a millennium ago is not widely held today. Neller was, however, correct regarding the probability of no sites prior to circa 1862 in the *makai* half of the Hilton Hawaiian Village Lands.

The Hilton Hawaiian Village Lands would have been a dynamic environment at the northwest tip of a sandbar partially blocking the mouth of the Pi‘inaio Stream (see Figure 10). The meaning of Pi‘inaio is uncertain but it could be an allusion to going inland (*pi‘i*) to the location of a *naio*

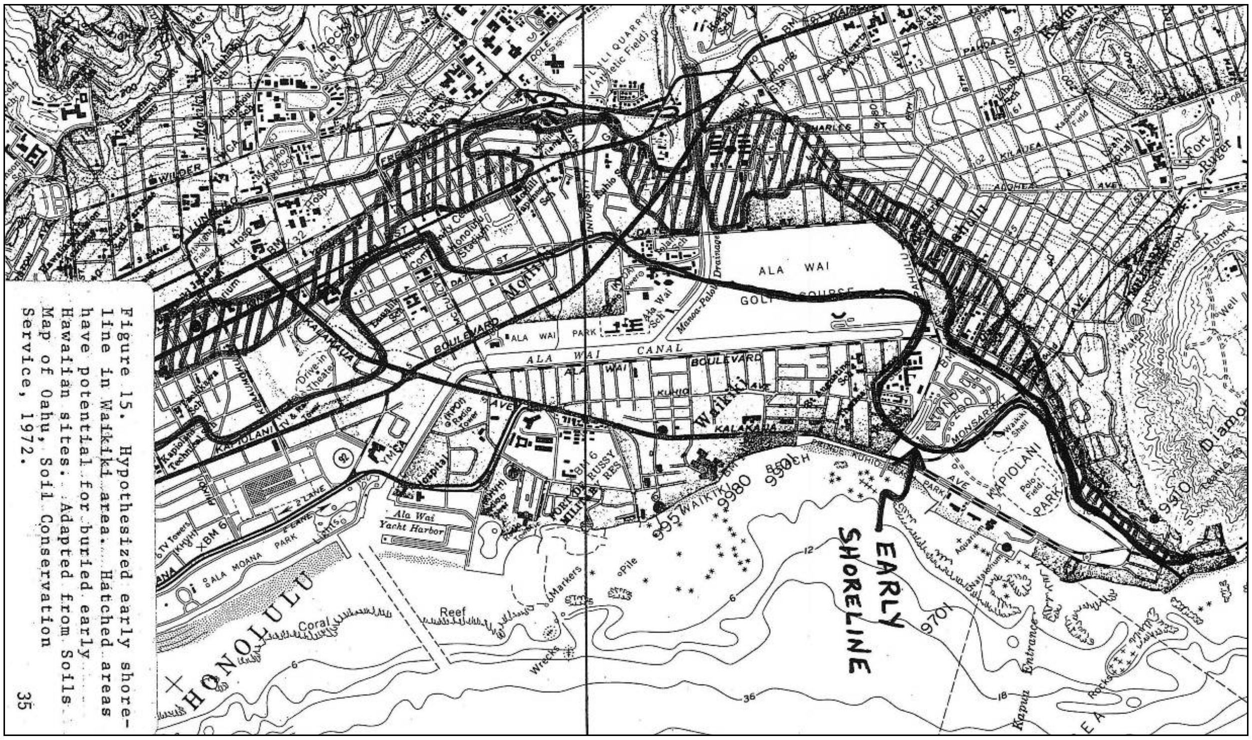

Figure 8. Hypothesized "Early Shoreline" (circa A.D. 1000) for Waikīkī showing shoreline *mauka* of the project area as having been near King Street (from Neller 1980:35) - this is generally rejected today

(bastard sandalwood; *Myoporum sandwicense*) tree, as may have commonly grown in the vicinity, to a stream crossing place. The name of the area "Kālia" translated as "waited for" has a sense of "waiting", "loitering", or "hesitating." While the nuance is uncertain one could imagine that the mouth of the Pi'inaio Stream would be a logical place for travelers to pause.

The shallow relatively protected reefs of Waikīkī and the availability of the riparian resources of the Pi'inaio estuary and the back dune ponds that were easily adaptable into fish ponds (the Loko Pāweo and Loko Kaipuni fishpond complexes shown on Figure 9) would have made the vicinity particularly desirable for Polynesian settlement.

Waikīkī was famous for its fishponds with one listing (see present Appendix A drawn from Bishop Museum 1989: III 8) citing 45 ponds – several of which were at Kālia. John Papa 'Ī'ī (1959:49) relates an account from the early 1800s of a catch at a Kālia fishpond: "so large that a great heap of fish lay spoiling upon the bank of the pond." The waste was disapproved of. This abundance of fishponds may have required significant maintenance and would have provided a potentially huge source of food for distribution at chiefly discretion. While the abundance of fishponds suggest a potentially quite large pre-Contact population the demographics of pre-contact Waikīkī remain uncertain (see Kanahele 1995:32-33). The missionary census of 1831/1832 lists a relatively large population for "Waikiki" of 2,571 (Schmitt 1973:19) but this appears to include all land between Honolulu and Waimanalo (including for example Mānoa and Pālolo) and the population of Kālia remains uncertain. The number of fishponds in the vicinity suggest that cultural deposits in the vicinity may be particularly rich.

Other than the names of Kālia, Pi‘inaio, and the fishponds we know of no other place names in the immediate vicinity.

3.1.3 Waikīkī Mid- to late-1800s

As the 19th century progressed, Waikīkī was becoming a popular site among foreigners – mostly American – who had settled on O‘ahu. An 1865 article in the *Pacific Commercial Advertiser* mentioned a small community that had developed along the beach. The area continued to be popular with the *ali‘i* and several notables had residences there. A visitor to O‘ahu in 1873 described Waikīkī as “a hamlet of plain cottages, whither the people of Honolulu go to revel in bathing clothes, mosquitoes, and solitude, at odd times of the year” (Bliss 1873).

Other developments during the second half of the 19th century (a prelude of changes that would dramatically alter the landscape of Waikīkī during the 20th century) include the improvement of the road connecting Waikīkī to Honolulu (the route of the present Kalākaua Ave.), the building of a tram line between the two areas, and the opening of Kapi‘olani Park in 1877. Traditional land-uses in Waikīkī were abandoned or modified. By the end of the 19th century most of the fishponds that had previously proliferated had been neglected and allowed to deteriorate. The remaining taro fields were planted in rice to supply the growing numbers of immigrant laborers imported from China and Japan, and for shipment to the west coast of the United States (Coulter & Chun 1937).

As the sugar industry throughout the Hawaiian kingdom expanded in the second half of the 19th century, the need for increased numbers of field laborers prompted passage of contract labor laws. In 1852, the first Chinese contract laborers arrived in the islands. Upon completion of their contracts, a number of the immigrants remained in the islands, many becoming merchants or rice farmers. As was happening in other locales, in the 1880’s, groups of Chinese began leasing and buying (from the Hawaiians of Waikīkī) former taro lands for conversion to rice farming (Coulter & Chun 1937). By 1892, Waikīkī had 542 acres planted in rice, representing almost 12% of the total 4,659 acres planted in rice on O‘ahu.

3.1.3.1 The Māhele

The Organic Acts of 1845 and 1846 initiated the process of the Māhele, the division of Hawaiian lands, which introduced private property into Hawaiian society. In 1848, the crown and the *ali‘i* received their land titles. The common people (*maka‘āinana*) received their *kuleana* awards (individual land parcels) in 1850. It is through records for Land Commission Awards (LCAs) generated during the Māhele that the first specific documentation of life in Hawai‘i, as it had evolved up to the mid-nineteenth century come to light. Although many Hawaiians did not submit or follow through on claims for their lands, the distribution of LCAs can provide insight into patterns of residence and agriculture. Many of these patterns of residence and agriculture probably had existed for centuries past. By examining the patterns of *kuleana* (commoner) LCA parcels in the vicinity of the survey area, insight can be gained to the likely intensity and nature of Hawaiian activity in the area.

3.1.4 Hilton Hawaiian Village Lands and Immediate Vicinity Mid- to late-1800s

A review of an 1881 Hawaiian Government survey map by S.E. Bishop indicates 2 LCAs within the project area (LCA 1775 & LCA 2511) (Figure 9). Documentation from the LCAs was reviewed in an attempt to reconstruct indigenous Hawaiian land use patterns within the study area during the mid-nineteenth century (Table 2; see Appendix B). LCA documentation indicates that traditional Hawaiian habitation and agriculture (both wetland and dry land) was occurring within the project area during the mid-nineteenth century.

Table 2. Land Commission Awards Located Within the Project Area

Land Claim #	Claimant	*‘Ili*	Land Use	Landscape Feature
1775	Paoa	Kālia	house lot, *hala*, *hau,* irrigation ditch, taro land	Bounded by a government road to the east, a stream to the north and west, and a government lot to the south.
2511	Alapai	Kālia	Coconut grove, house lot	Bounded by a pond and house to the east, a Government road to the north, a government wall to the west and unused land to the south.

The main development in the Hilton Hawaiian Village Lands in the mid- to late-1800s was shoreline accretion (see Figure 14). It seems likely that denudation of upland slopes that became acute in late pre-Contact times accelerated further with the introduction of grazing animals resulting in a substantial increase in sediment load and run-off with attendant increase in deposition off of stream mouths like the Pi‘inaio Stream.

3.1.5 Waikīkī 1900s

During the first decade of the 20th century, the U.S. War Department acquired more than 70 acres in the Kālia portion of Waikīkī for the establishment of a military reservation called Fort DeRussy, named in honor of Brig. Gen. R.E. DeRussy of the Army Corps of Engineers.

> On 12 November 1908, a detachment of the 1st Battalion of Engineers from Fort Mason, California, occupied the new post...
>
> Between 1909 and 1911 the engineers were primarily occupied with mapping the island of O‘ahu. At DeRussy other activities also had to be attended to - especially the filling of a portion of the fishponds which covered most of the Fort. This task fell to the Quartermaster Corps, and they accomplished it through the use of an hydraulic dredger which pumped fill from the ocean continuously for nearly a year in order to build up an area on which permanent structures could be built. Thus the Army began the transformation of Waikīkī from wetlands to solid ground [Hibbard & Franzen 1986:79].

During the 1920’s Waikīkī landscape would be transformed when the construction of the Ala Wai Drainage Canal – begun in 1921 and completed in 1928 – resulted in the draining and filling in of the remaining ponds and irrigated fields of Waikīkī. The canal was one element of a plan to urbanize Waikīkī and the surrounding districts:

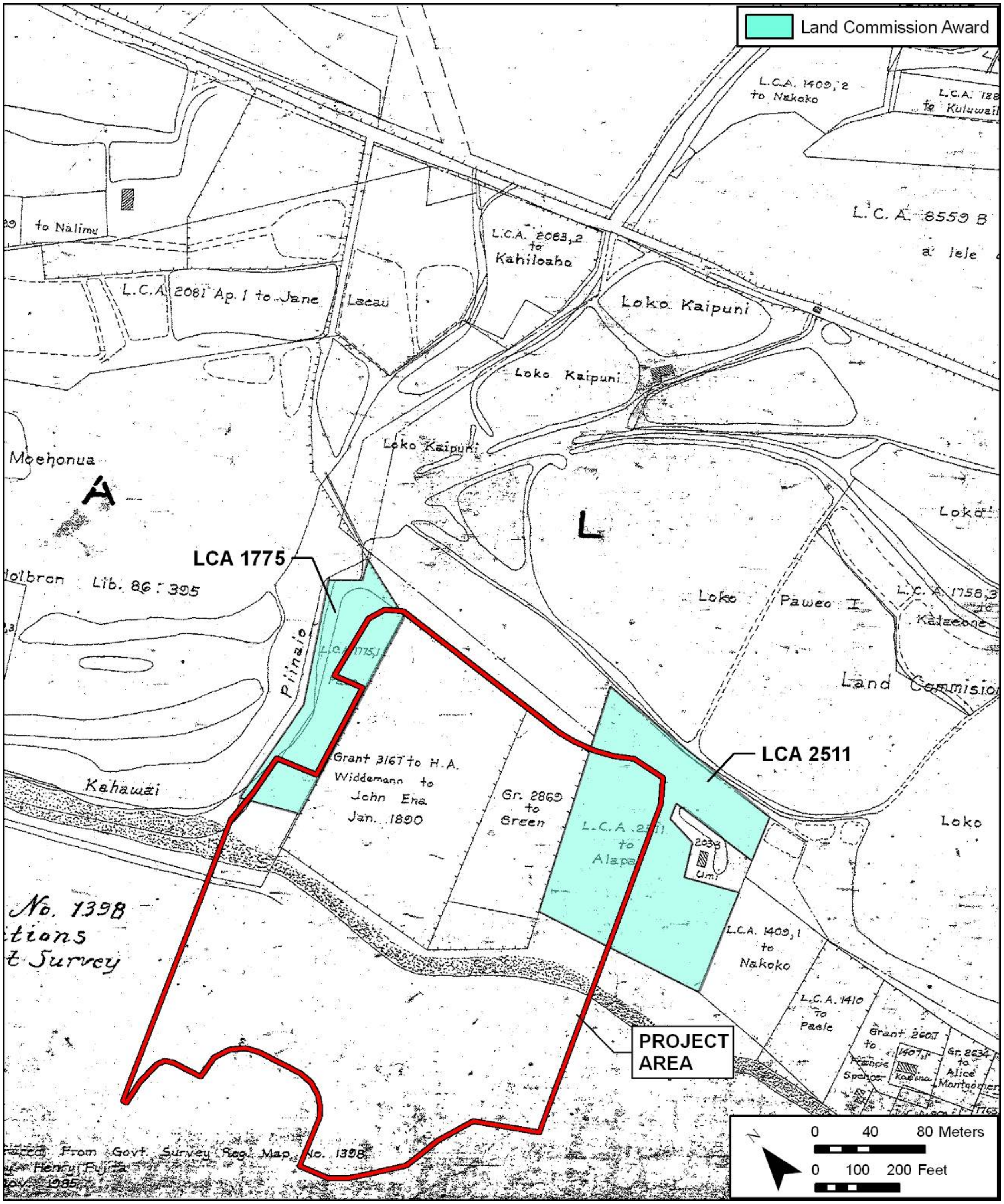

Figure 9. Portion of Registered Map 1398, an 1881 map of Waikīkī by S.E. Bishop showing the locations of Land Commission Awards (LCAs) within the project area

> The [Honolulu city] planning commission began by submitting street layout plans for a Waikīkī reclamation district. In January 1922 a Waikīkī improvement commission resubmitted these plans to the board of supervisors, which, in turn, approved them a year later. From this grew a wider plan that eventually reached the Kapahulu, Mō‘ili‘ili, and McCully districts, as well as lower Makiki and Mānoa.
>
> The standard plan for new neighborhoods, with allowances for local terrain, was to be that of a grid, with 80-foot-wide streets crossing 70-foot-wide avenues at right angles so as to leave blocks of house lots about 260 by 620 feet. Allowing for a 10-foot-wide sidewalk and a 10-foot right-of-way [alley] down the center of each block, there would be twenty house lots, each about 60 by 120 feet, in each block [Johnson 1991:311].

Newly created land tracts following the Ala Wai Canal’s construction spurred a rush to development in the 1930s. An article in the Honolulu Star-Bulletin in 1938 extolled the area’s progress:

> The expansion of apartment and private residence construction is no secret. Examination of building permits will show that more projects have been completed during the past year, and more are now underway in this area, than in any other section of the territory.
>
> These developments are being made by island residents who have recognized the fact that Waikīkī presents the unparalleled possibility for safe investment with excellent return. (Newton 1939: 10)

The entrance of the United States into World War II following the Japanese bombing of Pearl Harbor on December 7, 1941 put on hold plans for the development of Waikīkī as a tourist destination. Until the war’s end in 1945, the tourist trade was non-existent “...since the Navy controlled travel to and from Hawai‘i and did not allow pleasure trips” (Brown 1989: 141). For the duration of the war, Waikīkī was transformed into a recreation area for military personnel.

> It was not the same Waikīkī as before the war, though; barbed wire barricades now lined its sands, and there were other changes too. Fort DeRussy became a huge recreation center, with a dance hall called Maluhia that attracted thousands of men at a time. The Moana Hotel continued to function, but many other establishments and private homes in the area were taken over by the military [Brown 1989:141].

By the mid-1950s there were more than fifty hotels and apartment buildings from the Kālia area to the Diamond Head end of Kapi‘olani Park. The Waikīkī population, by the mid-1950s, was not limited to transient tourists but included 11,000 permanent residents living in 4,000 single dwellings and apartments in stucco or frame buildings.

3.1.6 Hilton Hawaiian Village Lands and Immediate Vicinity 1900s

The land history for the Hilton Hawaiian Village lands is clearly complicated and only an overview is attempted here. A general pattern is that wealthy *haole* leased and bought coastal Kālia lands for their own beach homes and for land speculation and then increasingly for hotel development. Following the Māhele there was Land Commission Award 1775 to Paoa (Pawa) in the northeast corner and Land Commission Award 2511 to Alapai in the east corner of the present Hilton Hawaiian Village lands. There was a significant gap between them that appears to have been government lands ("*ʻĀina o ke Aupuni*") with a large northern portion extended as Grant 316T to H.A. Widdeman and later to John Ena in January of 1890 and a large southern portion becoming Grant 2869 to W. L. Green (see Figure 9 and Figure 10). John Ena held his lands for some time (until after 1897) with a compound of structures in (what was then) the western, coastal portion of his lot. In 1897 the Green lands appear to have been split with the northwestern portion passing to John Cassidy, the eastern portion passing to J. L. McLean and the southeastern portion passing to Mrs. R. F. Bickerton (and subsequently to Frances T. Bickerton?). McLean and Bickerton had houses close on the coast (at that time). The Alapai LCA lands, lying both in the east corner of the Hilton Hawaiian Village campus and extending significantly outside the Hilton lands to the southeast, had passed to Nahuloa as owner and then to C. Hobron (as lessee?) by 1897. In that year these former Alapai lands passed to W. R. Castle Trustee as lessee who subdivided them into approximately 22 lots. By 1913 the McLean lands had passed to B. Cressaty. By the early 1920s Cressaty's Court and a neighboring Hummel's Court were seemingly offering bungalow style coastal rooms and an adjacent Pierpoint Hotel had also opened. Circa 1926 Heen Investment Company purchased the Cressaty's Court, Hummel's Court and Pierpoint Hotel creating the Niumalu ("Sheltering Palms") Hotel. The Niumalu Hotel had some large buildings on the southeast side of the present Hilton Lagoon but, circa 1927 (see Figure 18) appears to have primarily utilized an extensive complex of bungalows for accommodations. By 1955 the Hilton Corporation had taken over the Niumalu Hotel and begun replacing the bungalows with more modern accommodations.

3.2 Historic Maps

A series of historic maps from 1887 to 1955 illustrate the dramatic changes that occurred within the project area as Western commercial interests supplanted the traditional Native Hawaiian way of life (Figure 10 to Figure 23). Of particular note is extensive shoreline accretion and successive waves of resort development.

An 1887 Hawaiian Government Survey map of Honolulu indicates that approximately half of the Hilton Hawaiian Village lands was once situated within coastal tidal flats, likely submerged by the ocean (Figure 10). A complex of fish ponds is indicated just *mauka* (northeast) of the project area, and Piʻinaio Stream is shown running along the northern edge of the project area.

An 1897 map of Honolulu by M.D. Monsarrat still indicates approximately half of the project area situated within coastal tidal flats; however, now a pier appears to have been constructed along the coast (Figure 11). Also of note are the presence of roads that have been constructed along the east and north boundaries of the project area. Piʻinaio Stream appears to have been rerouted due to the recent road construction. John Ena is shown as owning a large rectangle of land in the north portion of the present campus. This is bordered to the southeast by the somewhat irregularly shaped John Cassidy parcel. Adjacent to the southeast side of this is the J. L. McLean parcel which wraps around the northwest and northeast sides of the Mrs. R. F. Bickerton coastal parcel. The east corner of the present campus is owned by C. Hobron as is an adjacent parcel to the east outside of the present Hilton Hawaiian Village lands.

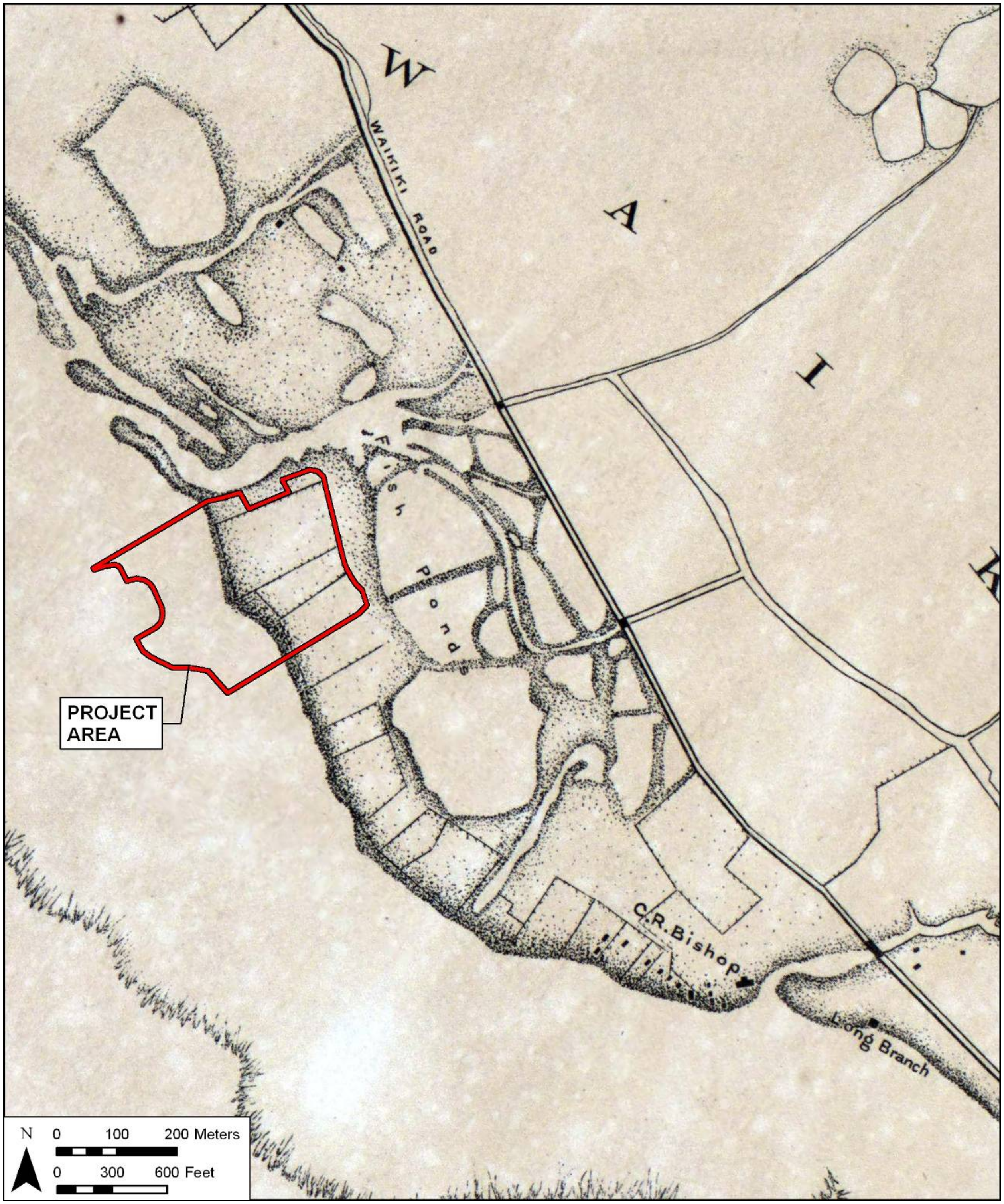

Figure 10. 1887 Hawaiian Government Survey map of Honolulu by W.A. Wall, showing the location of the study area

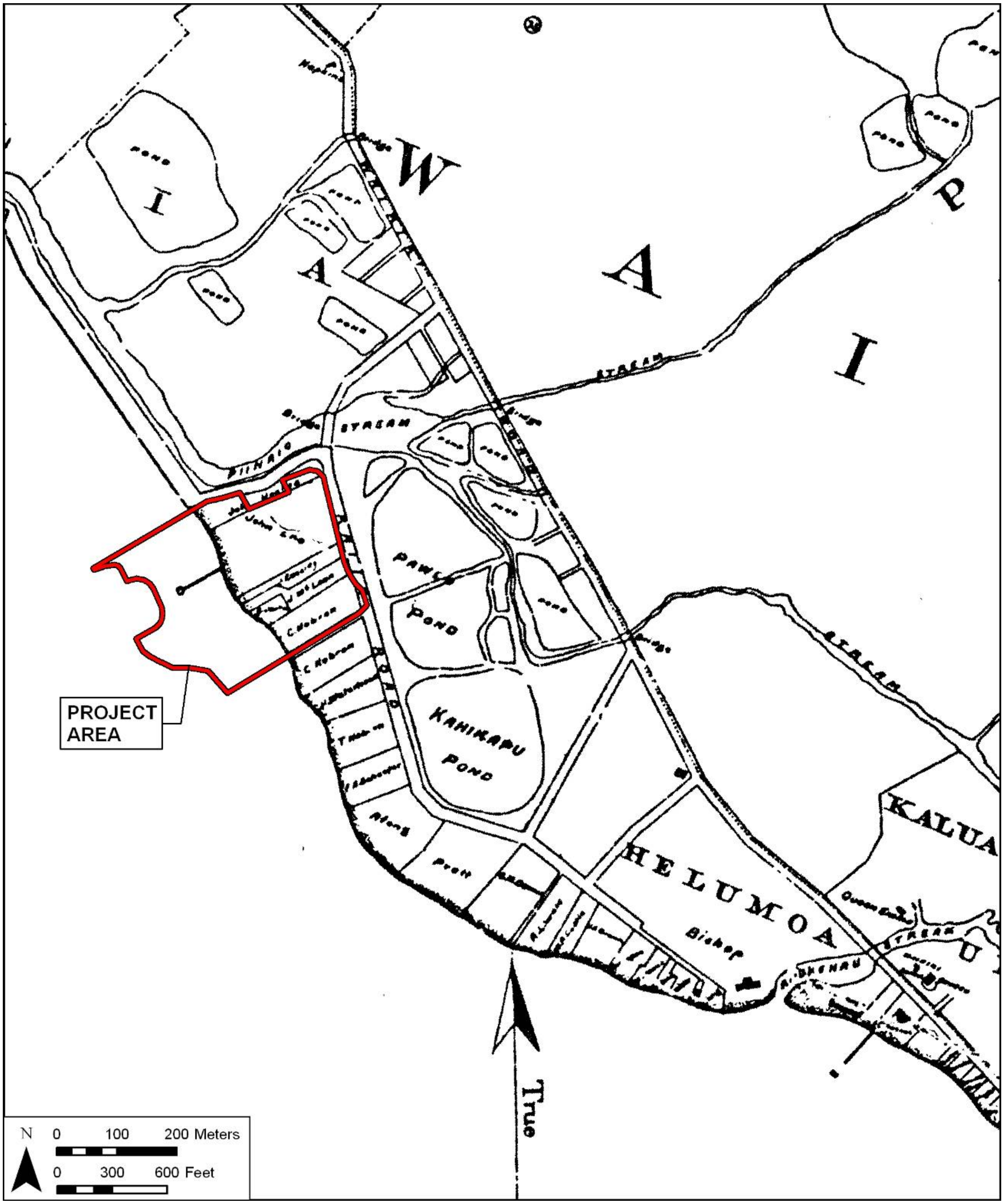

Figure 11. 1897 M. D. Monsarrat map of Honolulu with location of project area indicated

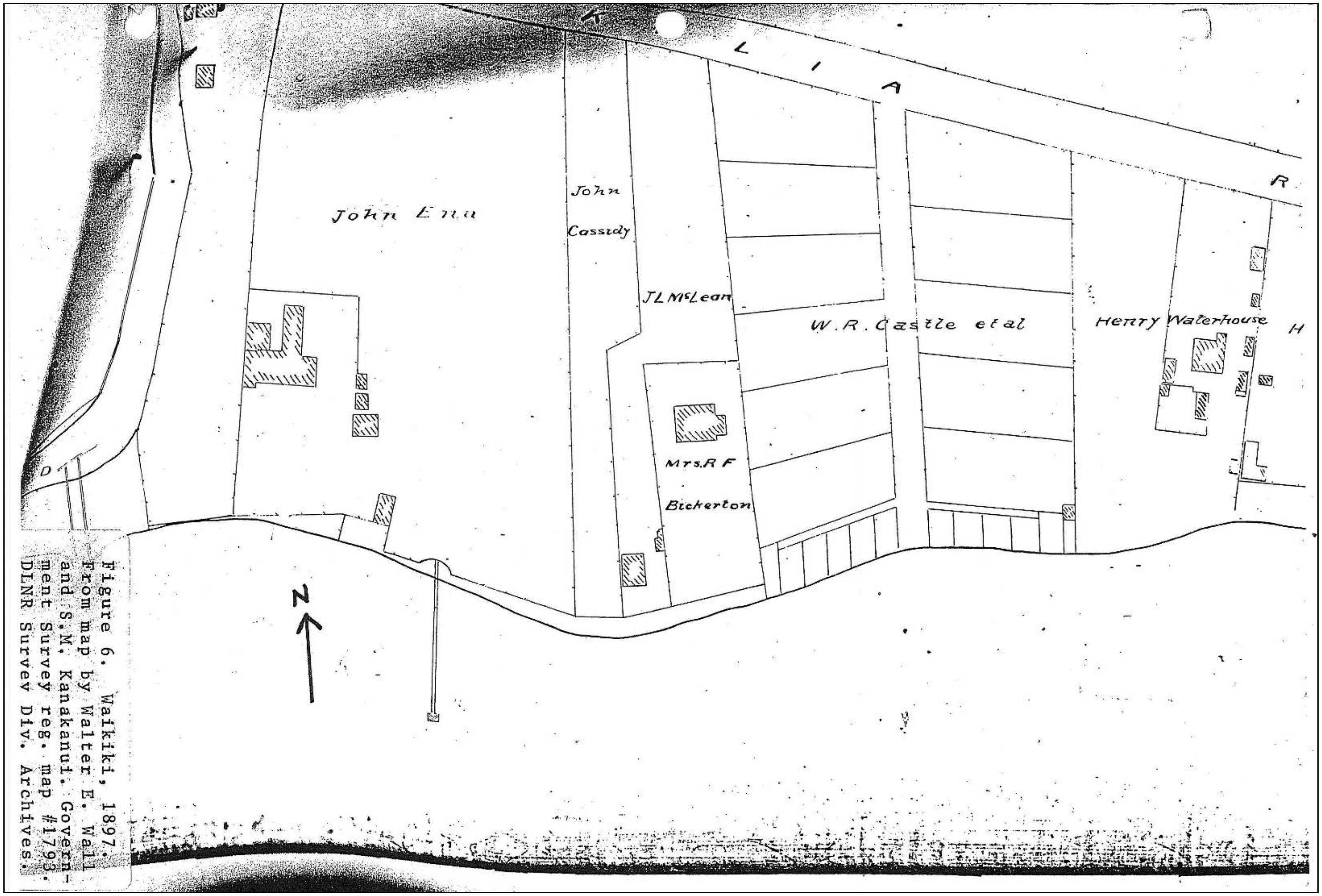

Figure 12. 1897 Walter E. Wall and S. M. Kanakanui map of Waikiki (Reg. Map No. 1793 (from Neller 1980)

An 1897 Walter E. Wall and S. M. Kanakanui map of Waikiki (see Figure 12) shows much the same picture but shows the location of structures on the Ena, McLean and Bickerton properties. It appears that in 1897 the substantial C. Hobron property (lying half within the present Hilton Hawaiian Village lands and half outside adjacent to the east) were sold to W. R. Castle who appears to have immediately subdivided the lands.

A 1910 U.S. Engineers map of Waikīkī indicates that the coastline along the southwestern portion of the project area has extended into the ocean (Figure 13). To what extent this is the result of long shore deposition responding to the new pier and to what extent this is the result of deliberate fill activities is unclear. Roads and dwellings are now indicated within the project area. The fishpond complex to the northeast of the project area appears to have been filled-in, replaced by what appears to be parallel agricultural furrows – perhaps for taro cultivation.

A 1913 map of Land Court Application 264 documents continuing shoreline accretion within the *makai* side of the project area spanning from 1862 to 1908 (Figure 14).

A 1914 Sanborn Fire Insurance Map indicates that the structures within the project area are associated with resort and residential development (Figure 15). A hotel, boarding houses, and associated cottages are indicated within the project area – particularly Cressaty's Boarding House and Cottages and the Japanese Club.

A 1919 War Department topographic map shows extensive development, in the form of roads and dwellings, both within and in the immediate vicinity of the project area (Figure 16). Additionally, a large pier is shown extending from the southwestern portion of the project area in to ocean. Of note is the absence of any remnant of aquaculture or agriculture in the immediate area. Also all that remains of Piʻinaio Stream is a small wetland area to the north.

A 1927-28 U.S. Geological Survey topographic map indicates extensive development within and in the vicinity of the project area (Figure 17). Almost the entire project area has been filled in with dwellings. All ponds and marsh lands have been filled-in and drained, likely associated with the construction of the Ala Wai Canal which is now indicated to the north and east of the project area.

A 1927 Sanborn Fire Insurance map provides details on the dwellings present within the project area during this time period (Figure 18). This map indicates that a majority of the structures are associated with either the Niumalu Hotel or were residential dwellings and apartments.

A 1943 War Department topographic map shows little change within the project area from the late 1920s (Figure 19). However, is appears that the coastline has been slightly expanded within the northwestern portion of the project area.

A 1953 Army Map Service topographic map shows development along the coastline of the project area (Figure 20). A pier is shown jutting out from the southwestern edge of the project area Just north of the pier, the coastline appears to have been modified for the creation of a small boat harbor (adjacent to but outside of the Ala Wai Yacht Harbor), likely used to drop off passengers to the resort. Construction of the boat harbor probably entailed extensive dredging and the fortification of the coastline with some sort of retaining walls. Also of note is the development of the Ala Wai Yacht Harbor just northwest of the project area.

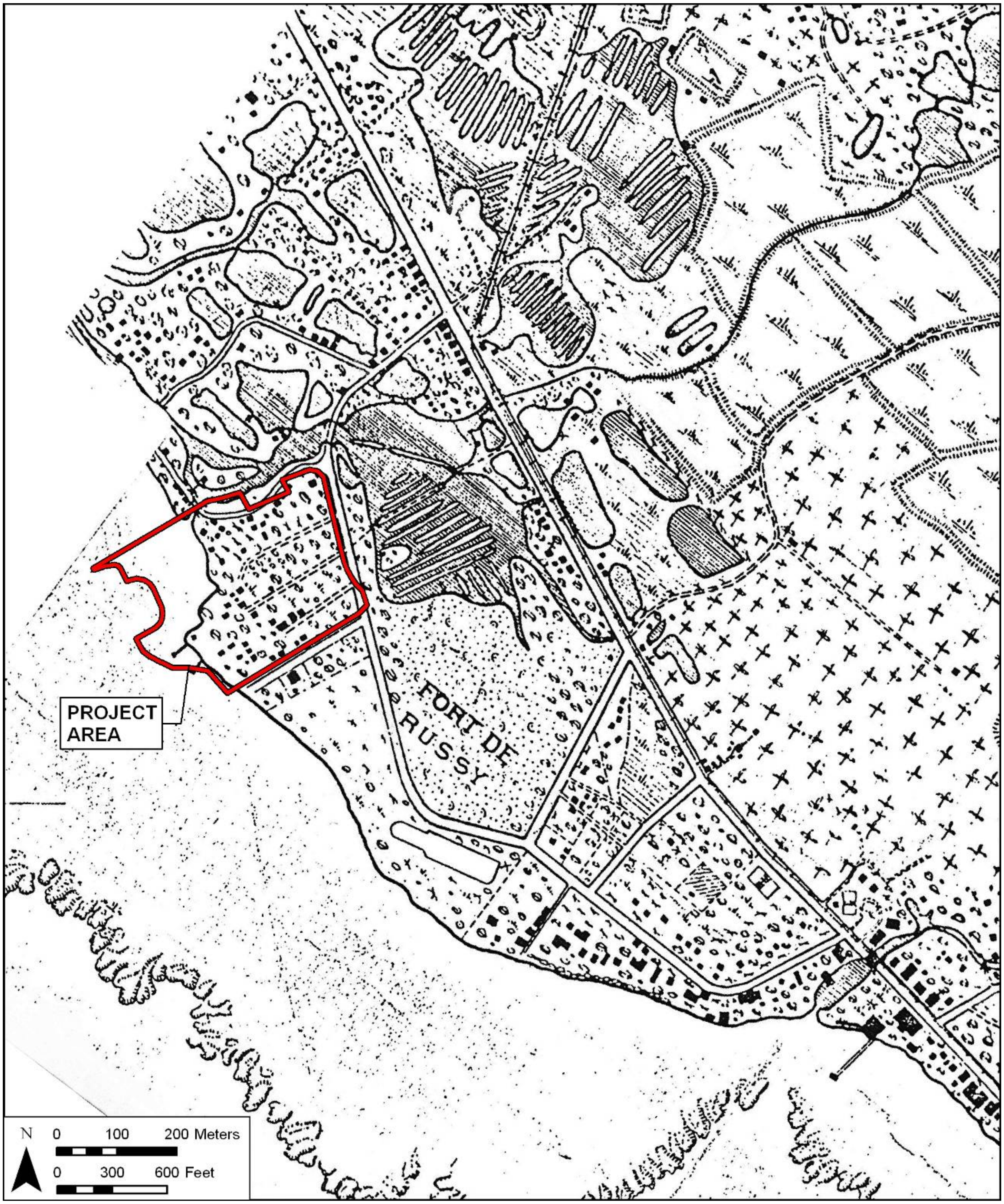

Figure 13. Portion of 1910 U.S. Engineers map of Waikīkī with location of project area indicated

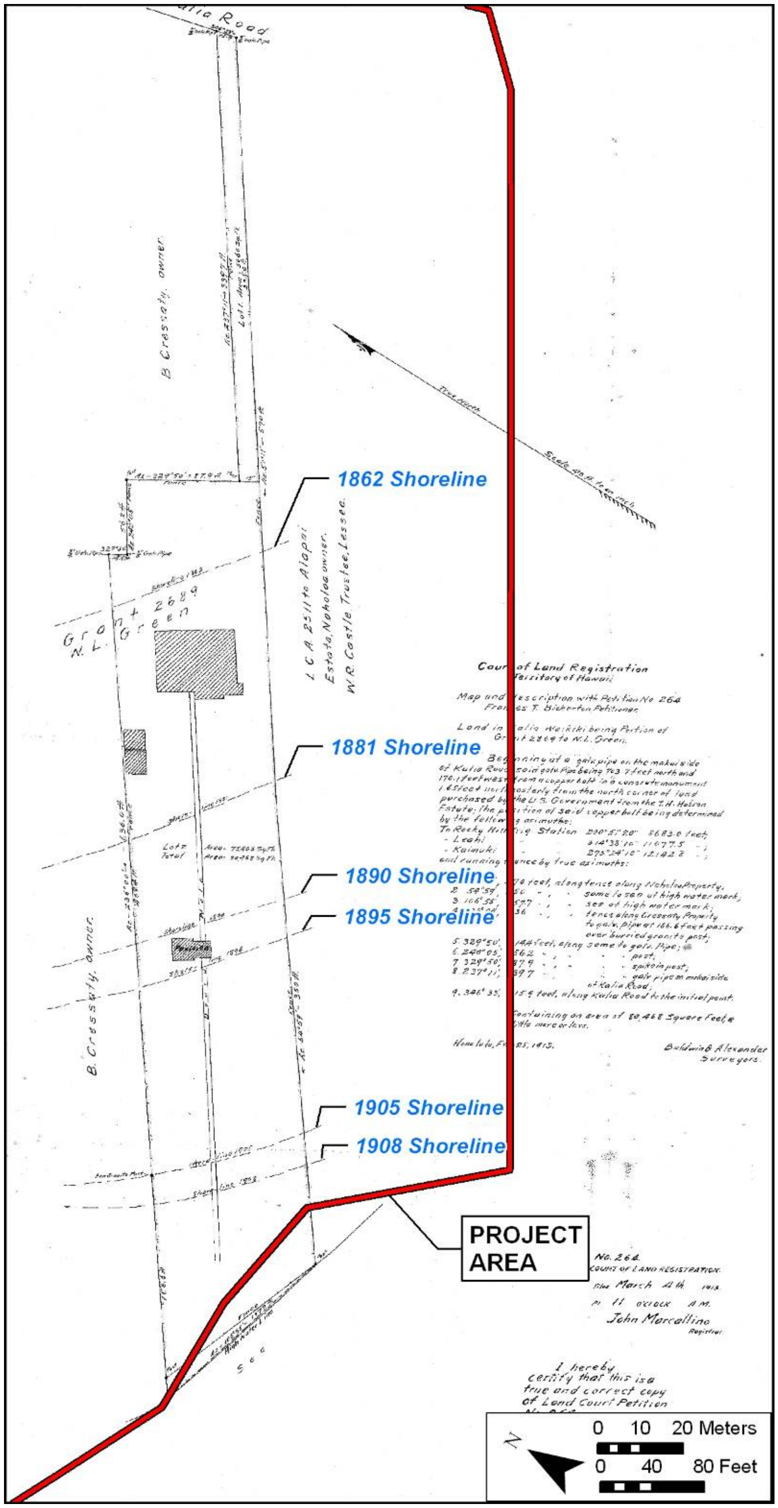

Figure 14. 1913 map of Land Court Application 264 illustrating shoreline accretion just *makai* (southwest) of the project area from 1862 to 1908

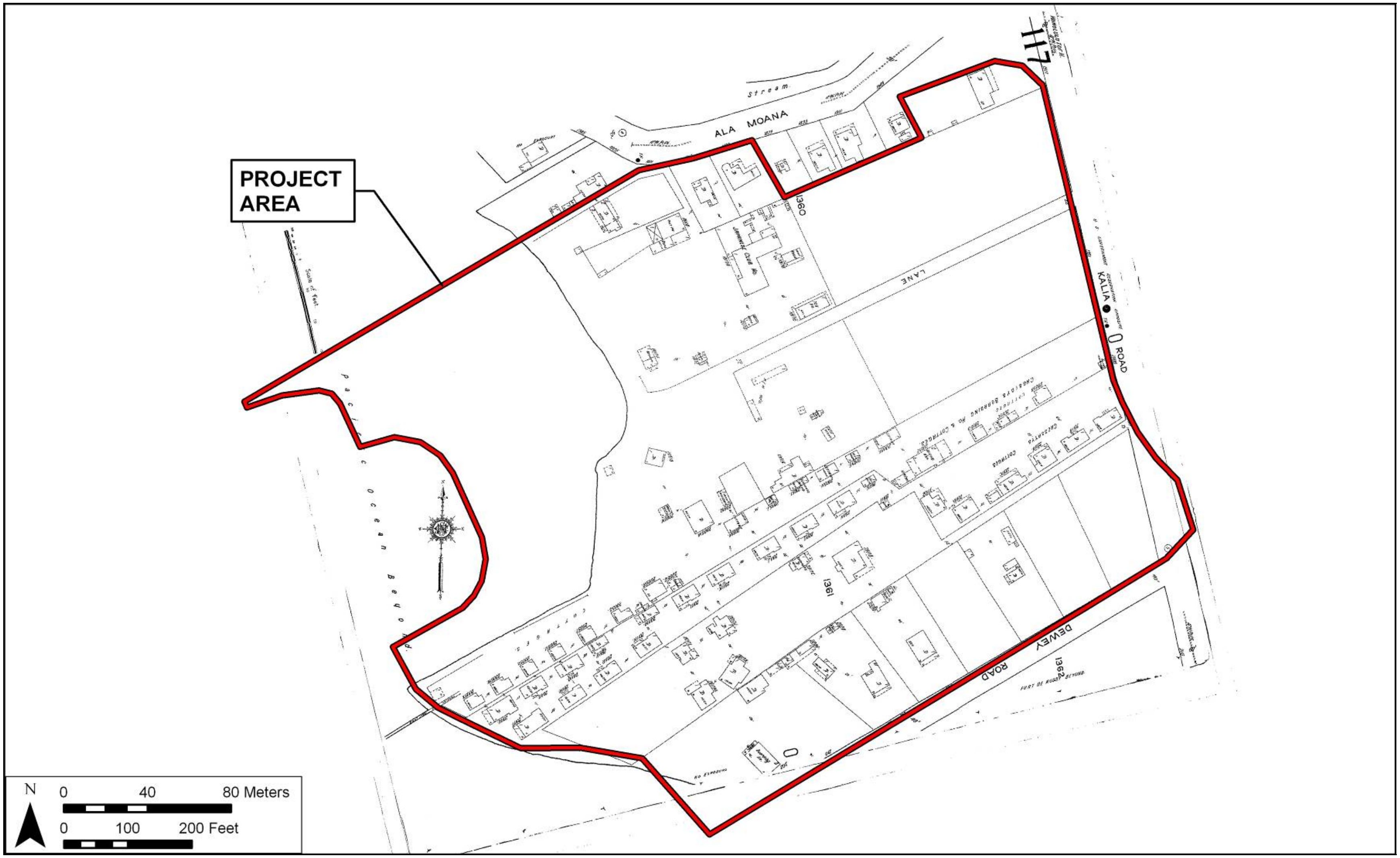

Figure 15. 1914 Sanborn Fire Insurance Map, Sheet 117, with location of project area indicated

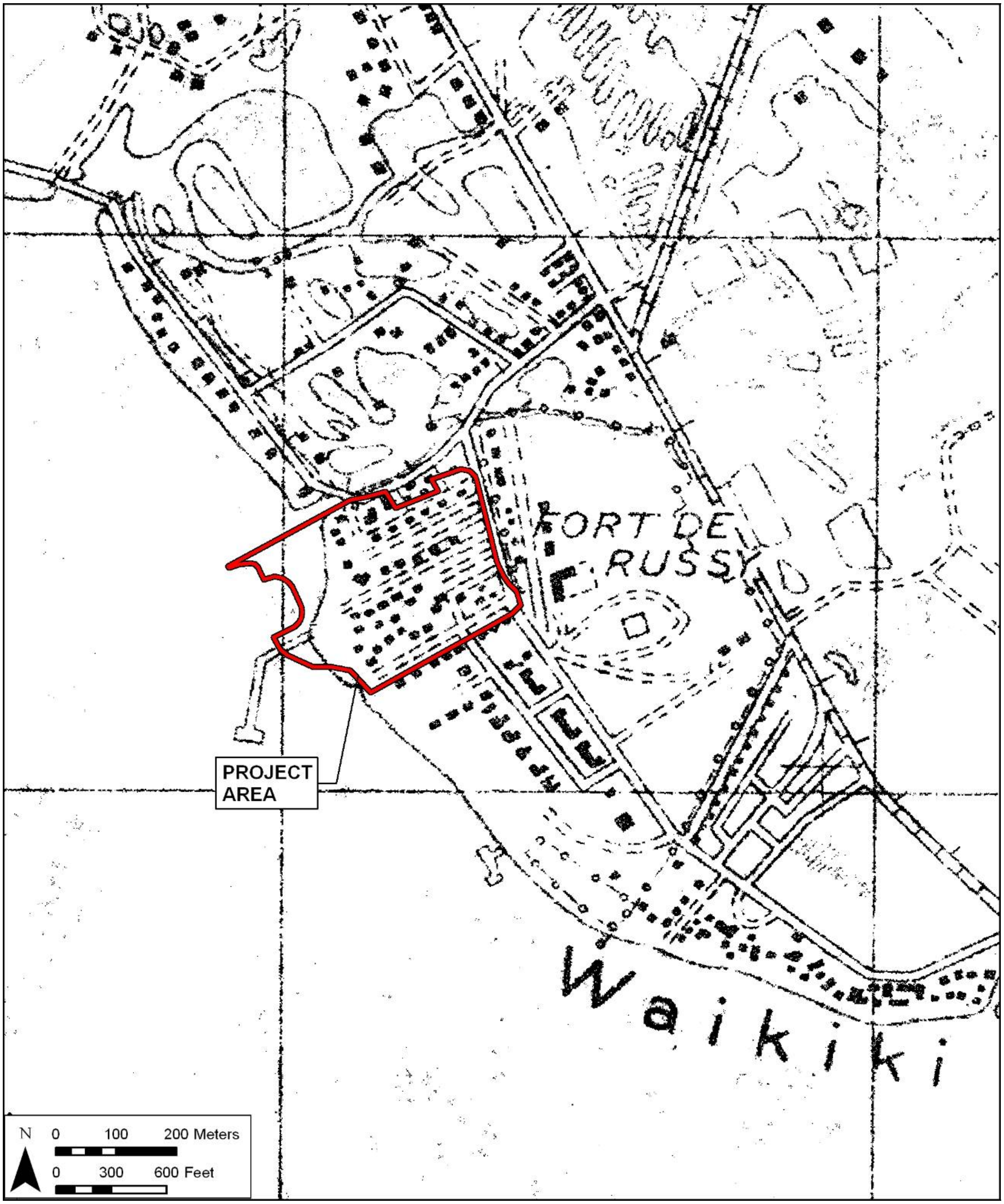

Figure 16. 1919 War Department topographic map, Honolulu Quadrangle, with location of project area indicated

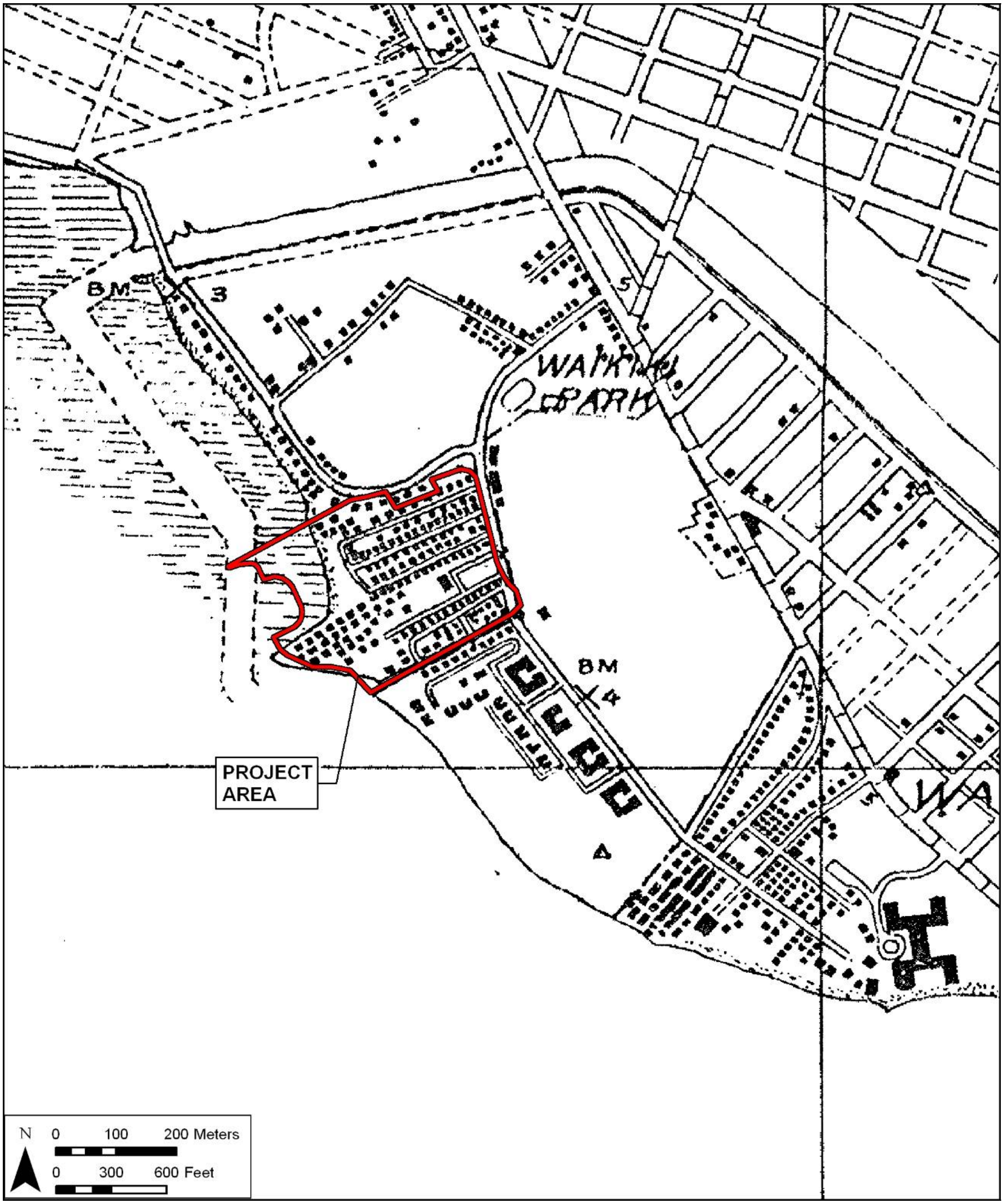

Figure 17. 1927-28 U.S. Geological Survey topographic map, Honolulu Quadrangle, with location of project area indicated

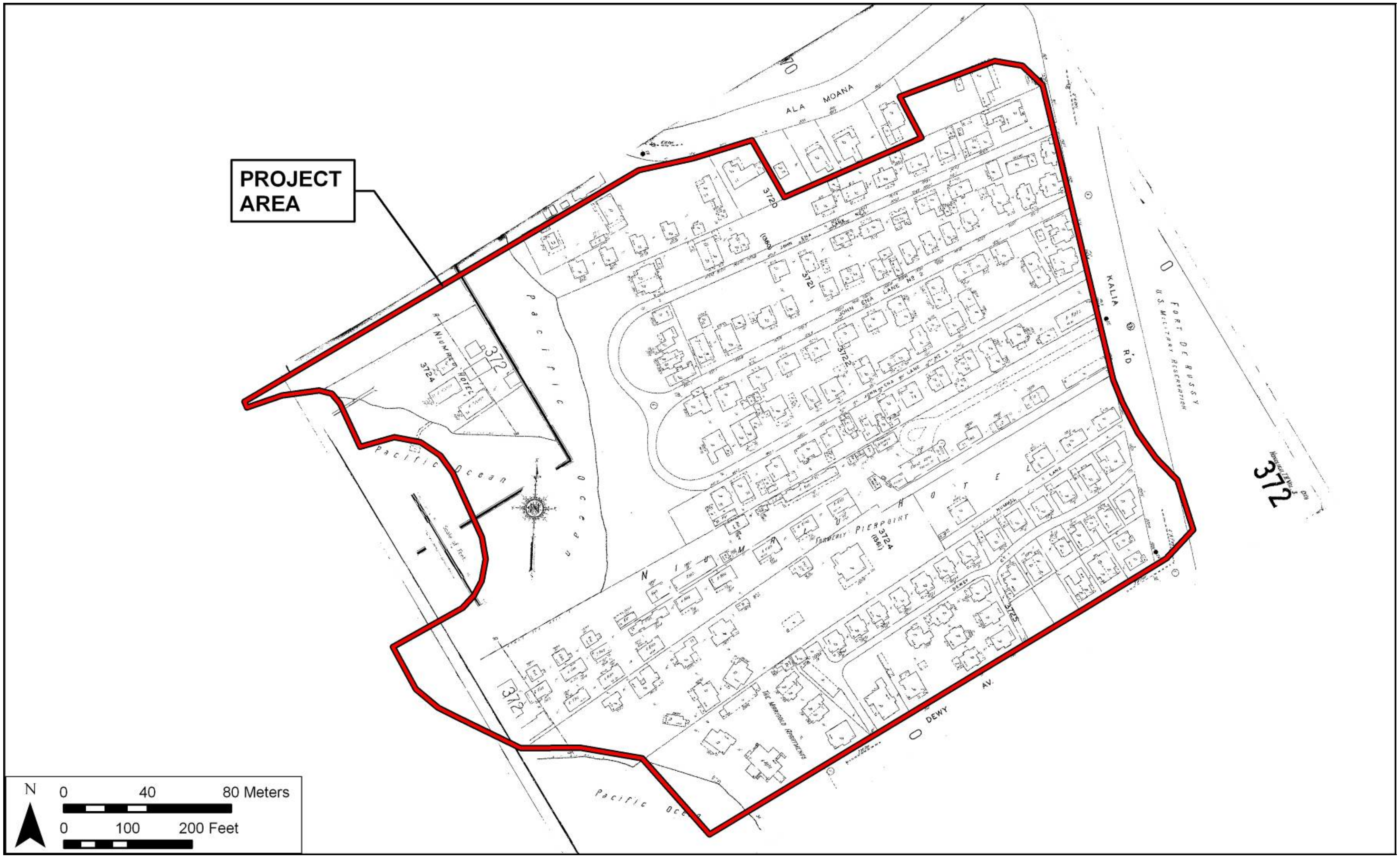

Figure 18. 1927 Sanborn Fire Insurance Map, Sheet 372, with location of project area indicated

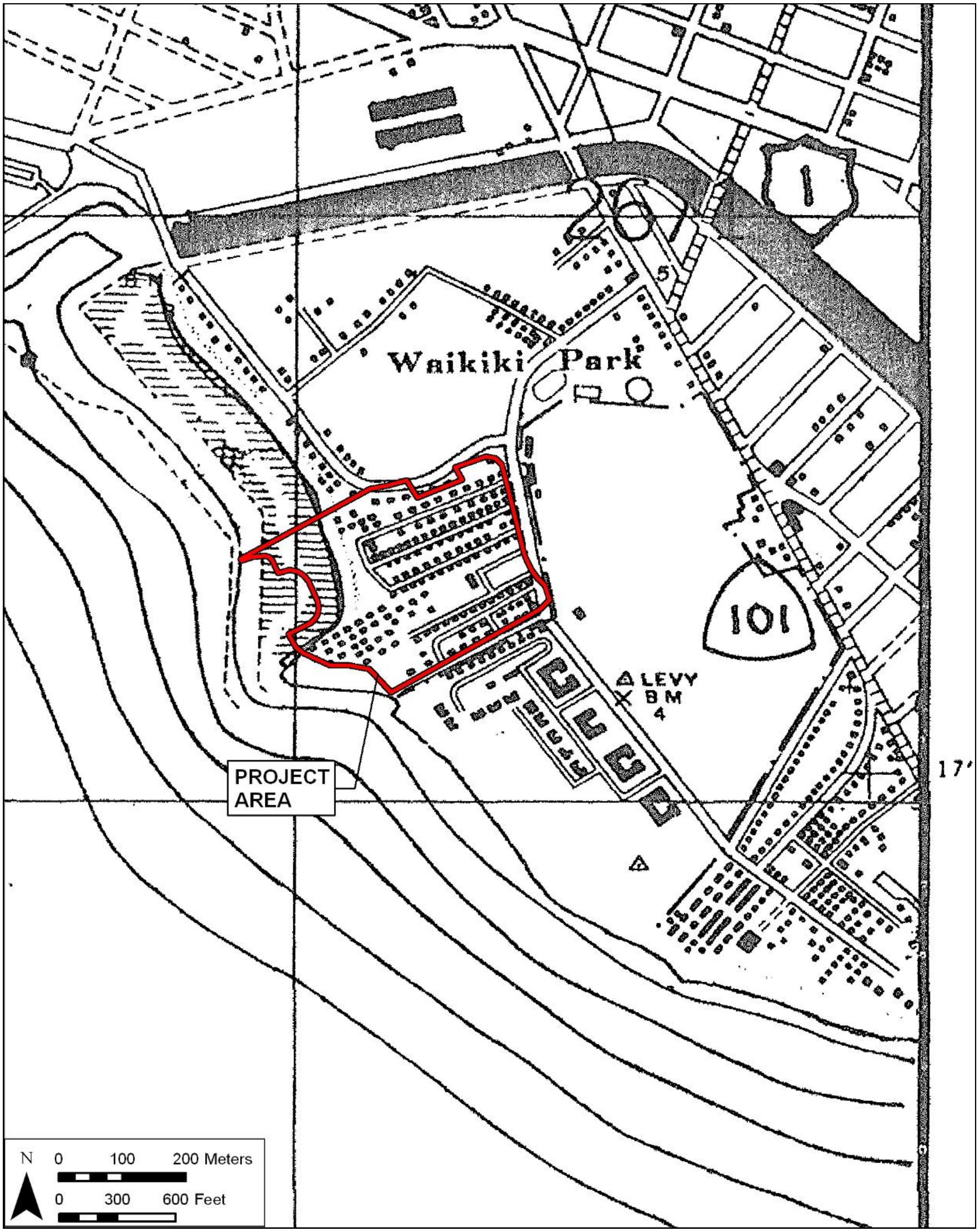

Figure 19. 1943 War Department topographic map, Honolulu Quadrangle, with location of project area indicated

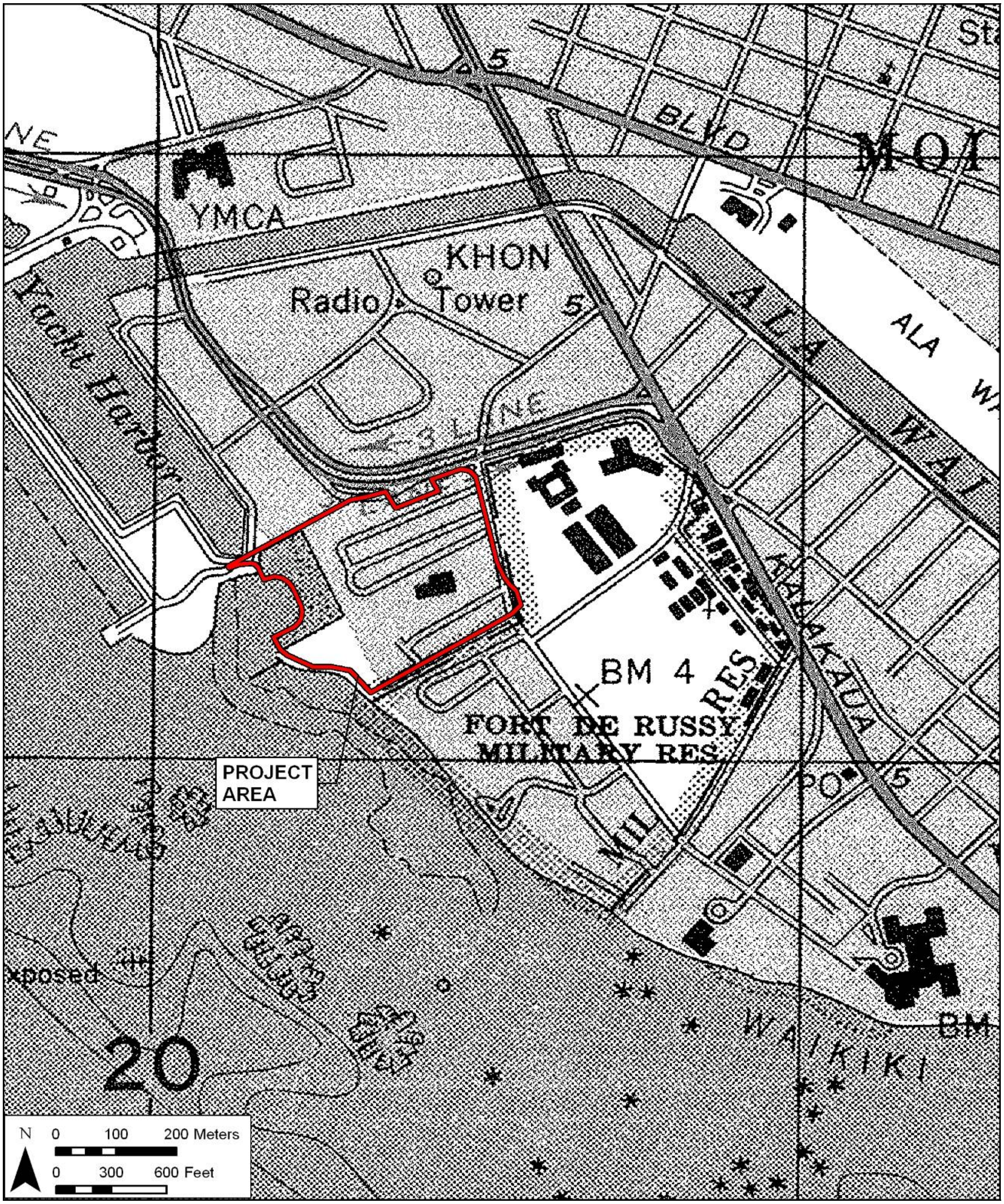

Figure 20. 1953 Army Map Service topographic map, Honolulu Quadrangle, with location of project area indicated

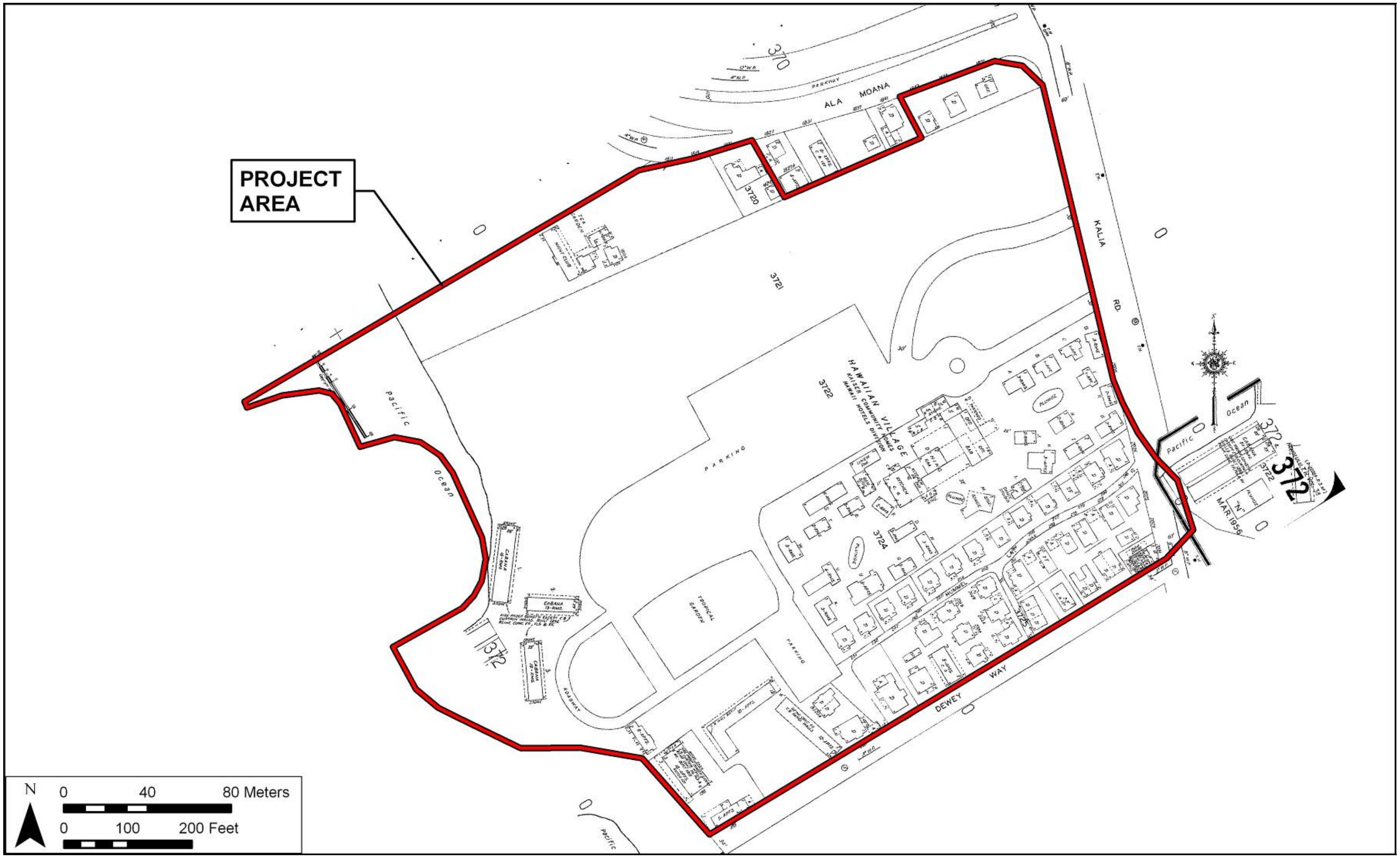

Figure 21. 1955 Sanborn Fire Insurance Map, Sheet 372, with location of project area indicated

A 1955 Sanborn Fire Insurance map shows the first iteration of the resort development currently known as the Hilton Hawaiian Village (see Figure 21). Here the resort is just called the "Hawaiian Village," as primary development was under the direction of Henry Kaiser, Conrad Hilton would not be involved until the 1960s. It appears that many of the dwellings observed in previous maps have been demolished for the installation of parking areas and to clear land for future resort expansion.

A 1958 photograph and a 1978 aerial photograph show the coastline expanded beyond the boundaries of the project area (Figure 22 & Figure 23). A lagoon and beach are now present along the western boundary of the project area, an area that was once situated within the ocean. Extensive resort development (i.e., numerous single and multi-story structures) is also shown within the project area.

3.3 Previous Archaeological Research

The urban, highly developed landscape along the Waikīkī coast was already developed by the 1970s when historic preservation legislation went into effect. As a result, most development took place without prior archaeological investigations. However, during the last 20 years many buildings have been rebuilt and there have been numerous municipal utility line improvements. These recent developments have been accompanied by archaeological investigations that have documented numerous archaeological remains preserved beneath Waikīkī's modern land surface. Burials, pre- and post-Contact cultural layers, buried fishpond remnants, and the remains of extensive wetland agriculture have been identified and documented beneath the extensive fill layers related to land reclamation activities related to urban development and expansion via the construction of the Ala Wai Canal.

3.3.1 Previous Archaeological Investigations in the Vicinity of the Project Area

Archaeological studies in the vicinity of the current project area are shown in Figure 24 and are listed in Table 3. The following is a chronological summary of these archaeological studies. A discussion of the archaeological work specifically within the Hilton Hawaiian Village lands per se is then presented.

Bishop Museum 1961

Neller (1980:7) relates:

> A human mandible (lower jaw) was found at 331 Saratoga Road during construction in 1961. The rest of the burial may still remain in the adjacent unexcavated deposits. There was a refuse layer of charcoal and trash about 23 inches deep, which contained, in addition to the human jaw bone, two glass bottles and nut shell fragments.

Neller gives a B. P. Bishop Museum site # of Oa-A4-19 for this find and Davis (1989:22) gives the associated SIHP site # of -3706.

The *Federal Register* "Notice of Inventory Completion for Native American Human Remains and Associated Funerary Objects from the Island of Oahu" (Bishop Museum NAGPRA

Figure 22. 1958 photograph of the Hilton Hawaiian Village

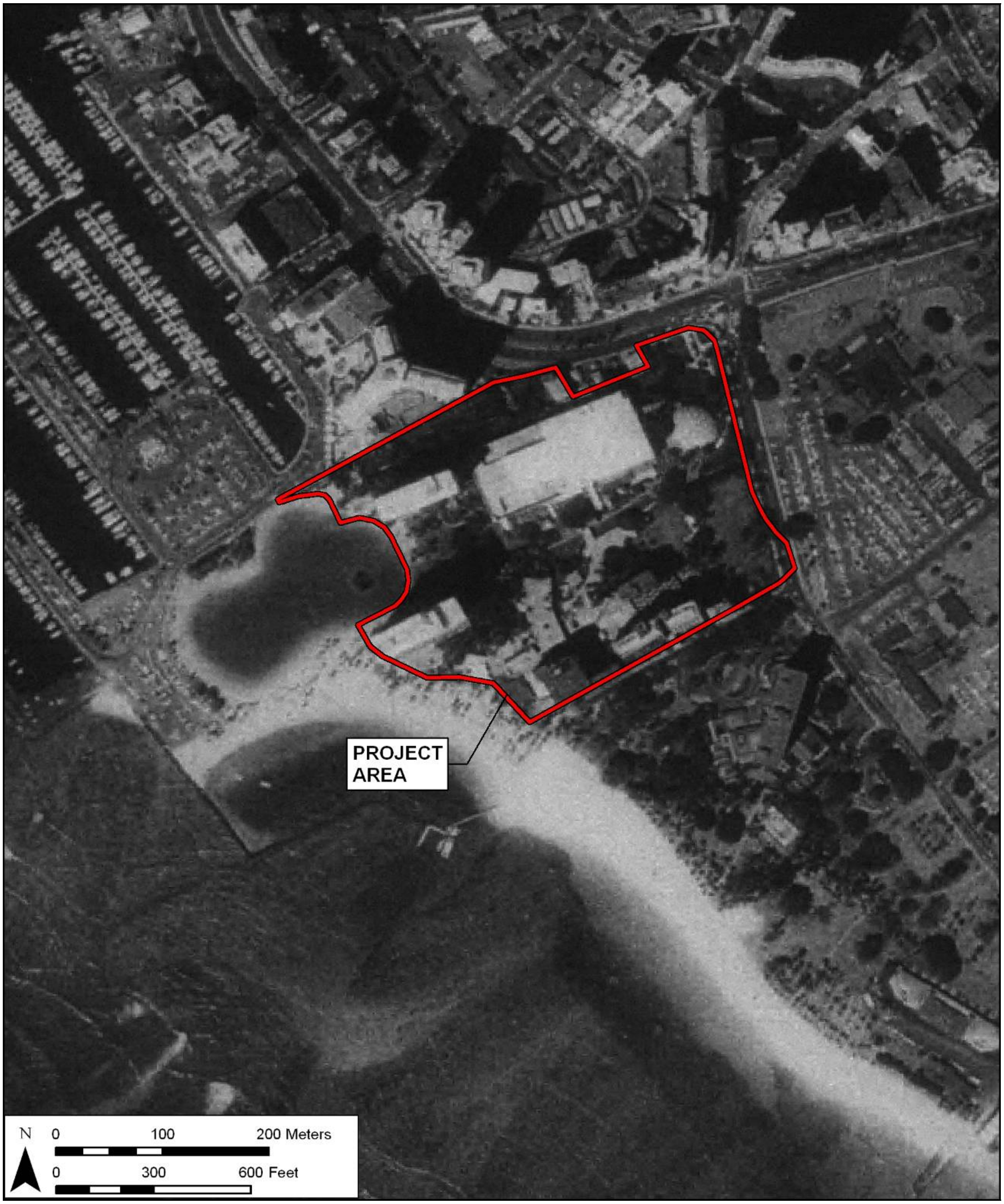

Figure 23. 1978 aerial photograph showing the location of the project area (source: USGS orthophoto quadrangle)

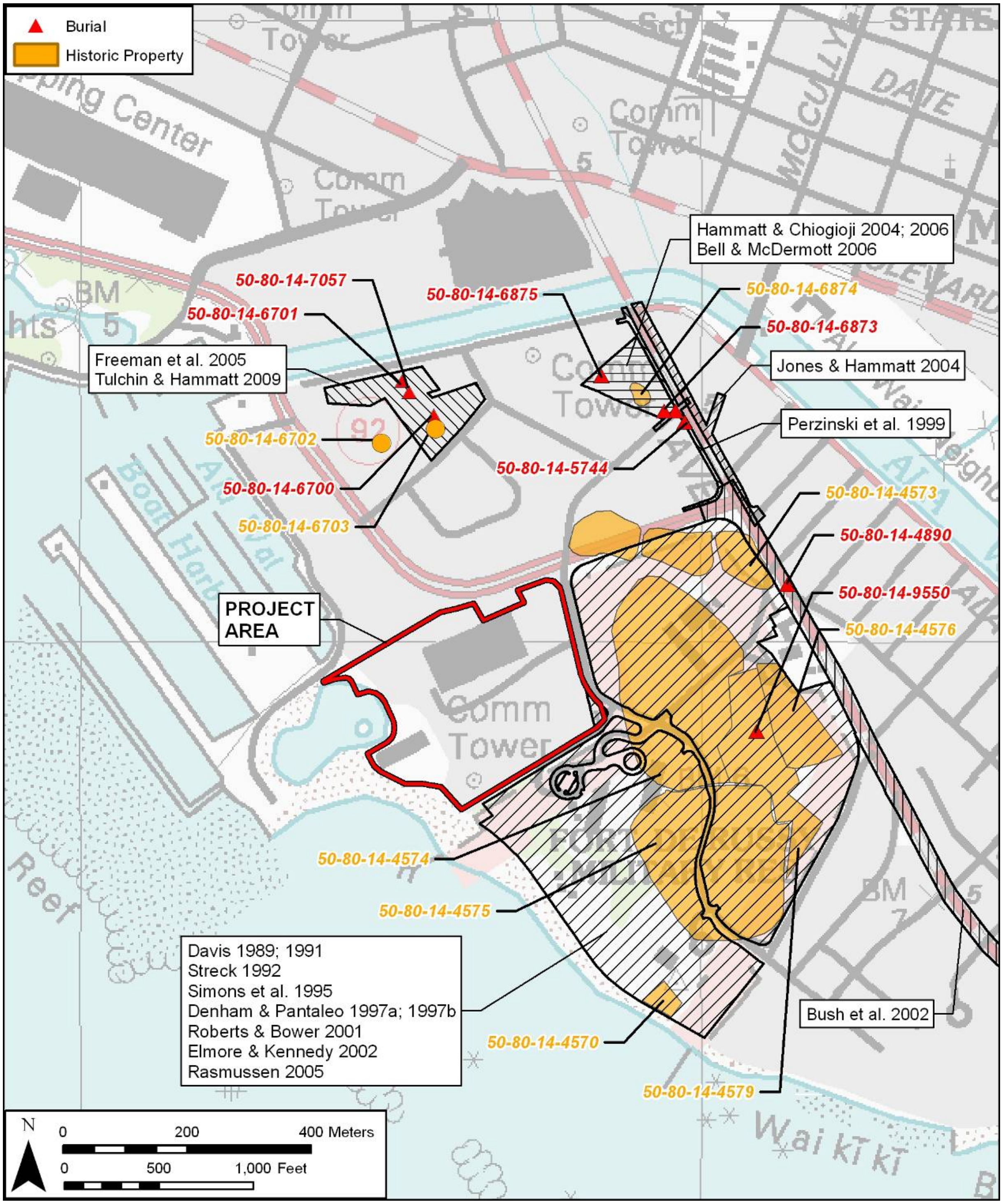

Figure 24. Previous archaeological investigations in the vicinity of the project area showing the general location of the archaeological study (identified on the map by author and date reference) and the location of designated historic properties(see present Figure 25 for details of finds in Fort De Russy studies)

Table 3. Previous Archaeological Studies in the Vicinity of the Project Area (by date)

Author	SIHP #50-80-14	Report Description and Findings
1961 [B. P. Bishop Museum] (referenced in Davis 1989 and *Federal Register*)	-3706 (BPBM # Oa-A4-19)	A human mandible and 19th century artifacts reported from 331 Saratoga Road
Kimble 1976 (referenced in Davis 1989 and Denham and Pantaleo 1997a	-9500 (BPBM # Oa-A4-25)	5 pre-Contact or early historic bundle burials and a sixth possibly twentieth century human burial was encountered during construction of the Hale Koa Hotel on beach at Fort De Russy
Davis 1989	-4570, -4573 thru -4577	Archaeological reconnaissance. Fishponds and other subsurface features observed. Sites -4573 thru -4577 are fishponds, 4570 is a remnant cultural deposit.
Davis 1991	NA	Monitoring. A burial observed south of Battery Randolph/Army Museum
Cleghorn and Jackson 1992	"burial"	Data Recovery operation at Ft. De Russy reported a burial
Streck 1992	-9550	Data recovery. One pre-Contact burial identified (SIHP # 50-80-14-9550)
Carlson, Collins & Cleghorn 1994	"Burial Area 6" and "Burial Area 7" (no SIHP #s assigned)	Biosystems Analysis excavated human remains found during realignment of Kālia Road. Burial Area 6 included 27 – 34 individuals in a common pit feature located just SE of the intersection of Paoa Place and Kālia Rd. Burial Area 7 included 4 individuals in association with a cultural layer located in the vicinity of the Army Museum.
McMahon 1994	-4890	Inadvertent burial discovery.
Simons et al. 1995	-4574, -4576, -4579, -4970	Data recovery. Three previously identified historic properties encountered: Loko Paweo I (SIHP # 50-80-14-4574), Loko Paweo II (SIHP #50-80-14-4576), and SIHP # 50-80-14-4579, a subsurface cultural layer associated with LCA 1785 and containing one set of fragmented skeletal remains. A newly identified ʻ*auwai* system was also discovered (SIHP # 50-80-14-4970).

Author	SIHP #50-80-14	Report Description and Findings
Denham and Pantaleo 1997a	-4570 ; -4574; -4966	Monitoring. Three historic properties observed: SIHP # 50-80-14-4574, consisting of fishpond sediments (Loko Paweo I), three historic trash pits, and two burials; SIHP # 50-80-14-4570 consisting of a historic trash pit, four fire pits, an ash lens, and an unknown number of human burials; and SIHP # 50-80-14-4966 comprised of pre-contact features and burials representing at least five individuals found in the Koko Head portion of the reservation.
Denham and Pantaleo 1997b	-4570; -4575; -4576; -4579; -4970	Data recovery. Five previously identified sites investigated.
Perzinski et al. 1999	-5744	Monitoring. Two pre-contact or early post-contact Native Hawaiian burials observed (SIHP # 50-80-14-5744.
Roberts and Bower 2001	NA	Monitoring. No historic properties observed.
Bush et al. 2002	-5856, -5860, -5864	Monitoring. Four sets of human remains were inadvertently encountered during excavation. Pre-contact deposits, historic and modern rubbish concentrations, and pond sediments were also noted.
Elmore and Kennedy 2002	NA	Monitoring. No historic properties observed.
Hammatt and Chiogioji 2004	NA	Archaeological literature review & field check. Based on background research, there is the potential for subsurface archaeological remains.
Jones and Hammatt 2004	NA	Monitoring. No historic properties observed.
Freeman et al. 2005	-6700, -6701, -6702, -6703	Inventory survey. Four historic properties identified: 1.) SIHP #50-80-14-6700 a set of previously disturbed human skeletal remains; 2.) SIHP #50-80-14-6701, a historic coffin burial; 3.) SIHP #50-80-14-6702, a culturally enriched buried A-horizon containing evidence of both pre- and post-contact habitation; and 4.) SIHP #50-80-14-6703, buried alluvial sediment associated with a buried fishpond.
Rasmussen 2005	NA	Monitoring. No historic properties observed.

Author	SIHP #50-80-14	Report Description and Findings
Bell and McDermott 2006	-6873, -6875, -6874	Inventory survey. Three historic properties documented: SIHP # 50-80-14-6873 and 50-80-14-6875, consisting of isolated traditional Hawaiian burials; and SIHP # 50-80-14-6874 a subsurface cultural layer of pre-contact and post-contact origin.
Hammatt and Chiogioji 2006	NA	Archaeological literature review & field check. Based on background research, there is the potential for subsurface archaeological remains.
Tulchin & Hammatt 2009	-6700, -7057	Monitoring. Two historic properties identified: additional skeletal fragments associated with SIHP #50-80-14-6700, previously identified (Freeman et al. 2005); SIHP #50-80-14-7057, previously disturbed human skeletal remains.

inventory) of January 28, 1998 lists only one accession of human skeletal remains from Waikīkī for 1961 as follows:

> In 1961, human remains representing one individual from Waikiki, Oahu were collected and donated to the Bishop museum by Chet Gorman. No known individual was identified. The three associated funerary objects include two glass bottles, and a kukui nut. (*Federal Register* 1998:4281)

These are believed to refer to one and the same single human mandible find from 331 Saratoga Road near Fort De Russy.

Bishop Museum (Kimble) 1976

Denham and Pantaleo (1997a:9, citing Kimble 1976) relate that in 1976: “Five prehistoric or late-historic [sic. ?] period bundle burials were recovered from a sand deposit” during construction of Hale Koa Hotel on the beach at fort De Russy. A sixth burial was also reported, seemingly from a different context and possibly just pre-dating 1948. The *Federal Register* “Notice of Inventory Completion for Native American Human Remains and Associated Funerary Objects from the Island of Oahu” (Bishop Museum NAGPRA inventory) of January 28, 1998 makes no mention of these remains as in the museum collection at that time which is consistent with Neller’s (1980: 7) account:”All were reburied near the hotel.” Denham and Pantaleo (1997a:33) provide the detail the re-burial site is north of the Hale Koa Hotel and is marked by a stand of red ti plants.

Davis 1989

In 1989, the International Archaeological Research Institute, Inc. conducted a reconnaissance survey at Fort DeRussy. Eleven test trenches were excavated in widespread locations of inland Fort De Russy and nine trenches were excavated in the south coastal portion of Fort De Russy lands. Subsurface testing documented substantial subsurface archaeological deposits, prehistoric, historic, and modern. These deposits included buried fishpond sediments, an ‘*auwai* [irrigation ditch] sediments, midden and artifact enriched sediments, structural remains such as post holes and fire pits, and historic trash pits

Rosendahl 1989a & 1989b

PHRI carried out an archaeological subsurface inventory survey for a new pool location Rosendahl 1989a at the Hale Koa Hotel but finds were minimal and there were no human skeletal remains. A similar study for a Hale Koa Hotel luau facility also yielded minimal finds and no human skeletal remains.

Davis 1991

In 1991, the International Archaeological Research Institute, Inc. monitored an environmental baseline survey for a Fort DeRussy Military Reservation (Davis 1991). While twelve bore holes were monitored in two general areas no archaeological remains were recovered from the coring process. However, based on the excavations conducted in the extreme southern tip of Fort De Russy lands) where intact deposits and features (dating to the 15th century A.D.) were previously noted, it was concluded that nearly continuous, intact prehistoric and early historic cultural deposits underlie the entire area between Battery Randolph and the beach. Davis (1989: 33) reports one burial find, seemingly from his "Burial Pit R" in his "Grid 7" located in LCA 1515:2 which appears to have been located just south (*makai*/Diamond Head) of the Battery Randolph Army Museum. Davis thought this burial dated to circa 1840s/1850s.

Cleghorn and Jackson 1992

Cleghorn and Jackson carried out archaeological data recovery operations at Fort De Russy seemingly identifying one burial well inland of Kālia Road. This report has not been seen. Some of the Army Fort De Russy studies are not publically available.

Streck 1992

In 1992, BioSystems Analysis, Inc. discovered the remains of one post-contact individual (SIHP # 50-80-14-9550) between a probable late pre-Contact burial at the *mauka* end of the Kuroda Parade Ground at Fort DeRussy. Streck (1992:3) notes: "the location of the burial is somewhat unusual for the Waikiki area" in being so far inland (well *mauka* of Kālia Road).

McMahon 1994

On April 28, 1994, an inadvertent burial discovery (SIHP # 50-80-14-4890) was made by the SHPD during excavation for a water line at the intersection of Kalākaua Avenue and Kuamoʻo Street (just *mauka* of Fort DeRussy). No other cultural remains were found in association with the burial. These remains represented a single individual, and ethnicity was not determined (McMahon 1994).

Carlson, Collins and Cleghorn 1994

In 1993 Biosystems Analysis excavated human remains found during realignment of Kālia Road. Burial Area 6 included 27 – 34 individuals in a common pit feature located just SE of the intersection of Paoa Place and Kālia Rd. approximately 20 to 25 m east of the east corner of the Hilton Hawaiian Village campus (see present Figure 25 for indicated location). Denham and Pantaleo 1997a provide an SIHP citation of 50-80-14-4570:8 for what Carlson et al. 1994" call "Burial Area 6".

The study concludes this was a hasty, mass interment and "may well represent the remains of Hawaiian warriors who died in one of the battles of the interisland wars of conquest which occurred during the reign of King Kamehameha I." (Carlson et al. 1994:70). Burial Area 7 included 4 individuals in association with a cultural layer located in the vicinity of the Army Museum just southwest of the intersection of Kālia Road and Saratoga Road.

The Carlson et al. (1994) study includes a Figure (Figure 5-1) indicating the location of a number of burials in the Fort De Russy area. These burials from the 1993 Biosystems Analysis monitoring operations are reported in the Denham and Pantaleo 1997a (Garcia and Associates) monitoring study.

Simons et al. 1995

In 1992, BioSystems Analysis, Inc. conducted data recovery excavations at Fort DeRussy in anticipation of new building construction. Three previously identified historic properties were encountered: Loko Paweo I (SIHP # 50-80-14-4574), Loko Paweo II (SIHP #50-80-14-4576), and SIHP # 50-80-14-4579, a subsurface cultural layer associated with LCA 1785 and containing one set of fragmented skeletal remains. In addition, a newly identified '*auwai* system was discovered (SIHP # 50-80-14-4970).

Denham and Pantaleo 1997a

Biosystems conducted archaeological monitoring along the Kālia Road Realignment Project at Fort DeRussy Military Reservation from January through September 1993. These results were written up by Garcia and Associates nearly four years later (Denham and Pantaleo 1997a). Given the passage of time and the different companies involved it is perhaps no surprise that the data provided is frustratingly incomplete. It appears clear, however, that the descriptions of "Burial" designations in Denham and Pantaleo 1997a correspond directly with the locations provided in Carlson et al. (1994:72; present Figure 25 below) During the monitoring of utility trenches, 10 subsurface features and 9 Burials and Burial Areas were recorded. These were grouped into three sites in the Denham and Pantaleo 1997a report. The sites are discussed below in the order presented.

SIHP # 50-80-14-4574, consisted of fishpond sediments (Loko Paweo I), three historic trash pits, and two burials (authors did not determine the burial's age). The two burials (designated as "4574:5" (these are shown as "Burials 1 and 2" on the following Figure 25) appear to have been north of the intersection of Kālia Road and Saratoga Road (Denham and Pantaleo 1997a 19-20).

SIHP # 50-80-14-4570 consisting of a historic trash pit, four fire pits, an ash lens, and an unknown number of human burials (in six distinct features) found in the sand dunes near the Kālia fishponds. One of these six burial features (50-80-14-4570:8; aka "Burial Area 6") was the focus of the Carlson et al. 1994 study. No information appears to be provided regarding SIHP -4570:7 "Burials 3 &4" but these are shown as just *mauka* of the Hilton Hawaiian Village campus across Kālia Road (see "Burials 3 &4" Figure 25). SIHP 4570:9 "Burial 8", a pre-Contact or early historic interment which was left in situ, is described as "just west of the newly constructed entrance driveway to the Hilton Hawaiian Village." (Denham and Pantaleo 1997a:36) (see "Burials 8 and 9" location on Figure 25). SIHP 4570:10 "Burial 9", is another pre-Contact or early historic interment also left in situ seemingly located on the other side of a trench profile "across from Feature 4570:9" (Denham and Pantaleo 1997a:38) (see "Burials 8 and 9" location

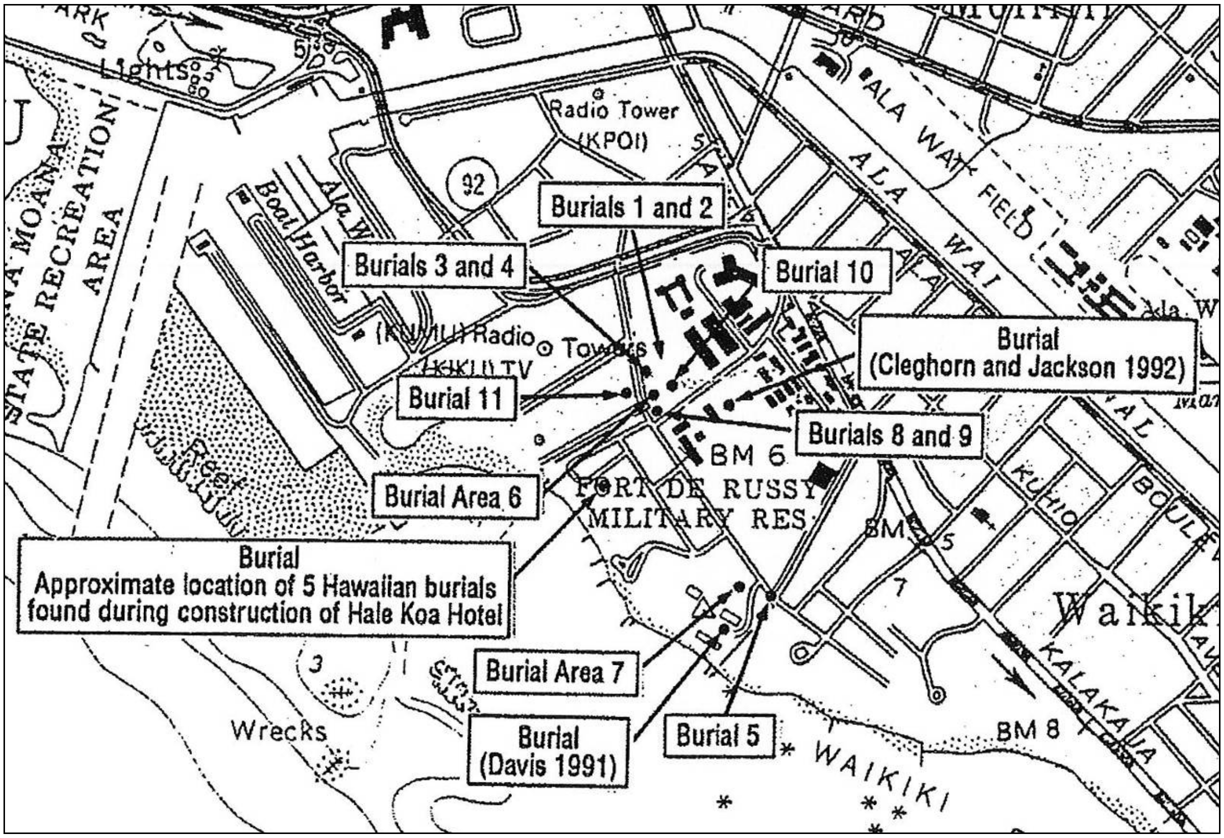

Figure 25. Map showing location of Burials and Burial Areas found during the re-alignment of Kālia Road and during related monitoring of underground utilities (map adapted from Carlson et al. 1994: 72) (see discussion above for "Denham and Pantaleo 1997a" for available details)

on Figure 25). SIHP -4570:11 "Burial 10" is another pre-Contact or early historic interment also left in situ that appears to have no locational information other than "in the west face of the trench" (Denham and Pantaleo 1997a:38) (but see "Burial 10" location on Figure 25). SIHP -4570:12 "Burial 11" was a partial burial left in situ described as "exposed in the south profile of a drain box excavation in the center of old Kālia Road (presently the landscaped area between the new Paoa Place extension and the driveway for the Hilton Hawaiian Hotel)." (Denham and Pantaleo 1997a:38). This would appear to be west of the Kālia Road/Paoa Place intersection immediately adjacent to the Hilton Hawaiian Village owned lands

SIHP # 50-80-14-4966 was comprised of pre-Contact features and burials representing at least five individuals found in the Koko Head portion of the reservation (see "Burial 5" and "Burial Area 7" locations on present Figure 25. The Burial Area 7 finds were described in detail in Carlson et al. 1994. The historic trash pits contained various artifacts of which manufacture dates ranged from the early 19th century through the mid-20th century.

Denham and Pantaleo 1997b

In 1992, Garcia and Associates conducted archaeological data recovery at Fort DeRussy. Five previously identified sites were investigated. One site (SIHP # 50-80-14-4570) was characterized by such features as a fire pit, coral rock concentration, and postholes. An *‘auwai* and bund system (SIHP # 50-80-14-4970) revealed two channels, three bunds, and a charcoal stain. Another site (SIHP # 50-80-14-4579) revealed a number of features related to permanent historic occupation and possible intermittent prehistoric use, such as five fire pits, two historic middens, and a human burial (the burial encountered in “Area A” well inland of Kālia Road was designated site 4579:4. In addition, three fishponds, Loko Paweo I (SIHP # 50-80-14-4570, Loko Ka‘ihikapu (SIHP # 50-80-14-4575), and Loko Paweo II (SIHP # 50-80-14-4576), were identified (Denham and Pantaleo 1997b).

Perzinski et al. 1999

In 1999, two human burials were inadvertently encountered near the intersection of Ena Road and Kalākaua Avenue during excavation for the first phase of the Waikīkī Anti-Crime Lighting Improvements Project (Perzinski et al. 1999). Both appeared to be pre-Contact (possibly early post-Contact) Native Hawaiian burials. These burials (SIHP # 50-80-14-5744) were not associated with any cultural remains.

Roberts and Bower 2001

In 2000, Garcia and Associates monitored excavation associated with the installation of a security fence for the Asia-Pacific Center of Fort DeRussy (Roberts and Bower 2001). Seventeen fence postholes (12 inches in diameter and 24 to 36 inches in depth) were excavated. No archaeological resources were identified.

Elmore and Kennedy 2002

Archaeological monitoring was required for the installation of a security fence for the Asia-Pacific Center at Fort DeRussy and was carried out in 2002 by Archaeological Consultants of the Pacific, Inc (Elmore and Kennedy 2002). No historical sites were found during monitoring.

Bush et al. 2002

In 2002, CSH completed monitoring for the Waikīkī Anti-Crime Street Lighting Improvement Project along portions of Kalākaua Avenue (Bush et al. 2002). Four sets of human remains were inadvertently encountered during excavation. The first burial was encountered on Kalākaua Avenue, just before Dukes Lane and assigned SIHP # 50-80-14-5864. The burial was left in place and the light post was repositioned. The second burial was encountered at the intersection of Kalākaua and Ka‘iulani Avenues and was designated Feature C of a previously identified burial site SIHP 50-80-14-5856. The third and fourth burials were encountered at the intersection of Kalākaua Avenue and Kealohilani, near an area of concentrated burials assigned SIHP 50-80-14-5860. Accordingly, they were designated as Features U and V of SIHP 50-80-14-5860. In addition to human remains, pre-Contact deposits, historic and modern rubbish concentrations, and pond sediments were also observed.

Hammatt and Chiogioji 2004

In September 2004, an archaeological literature review and field check (Hammatt and Chiogioji 2004) was conducted for a project area in Waikīkī bounded by Ala Wai Boulevard, Kalākaua Avenue, Ena Road, Hobron Lane, and Lipe‘epe‘e Street. Based on background and archival research it was determined that there had been no previous archaeological investigations conducted in the project area. Intact stratigraphy, pre-Contact burials and other pre-Contact cultural deposits have been located near the project area (Perzinski et al. 1999). This suggests that subsurface archaeological deposits and burials could exist within the project area as well. A field check of the project area conducted on September 4, 2004, concluded that there had been little subsurface disturbance within this project area.

Jones and Hammatt 2004

In 2004, CSH completed monitoring for the Waikīkī Anti-Crime Street Lighting Improvement Project on the *mauka* side of Kalākaua Avenue from Ala Wai Boulevard to Pau Street (Jones and Hammatt 2004). No significant cultural deposits were located, and much of the project area was dominated by fill. Some pond or *lo‘i* sediments were noted near the intersection of Kalākaua Avenue and McCully Street, and a pre-1920 base course for an older McCully Road was also documented.

Freeman et al. 2005

In 2005, CSH completed an inventory survey for the Ala Wai Gateway bounded by Ala Wai and Ala Moana boulevards, Hobron Lane, and Līpe‘epe‘e Street. Four historic properties were identified during subsurface testing: 1) SIHP #50-80-14-6700 a set of previously disturbed human skeletal remains observed within fill sediments (due to the fragmentary nature of the remains ethnicity could not be determined); 2) SIHP #50-80-14-6701, a historic coffin burial; 3) SIHP #50-80-14-6702, a culturally enriched buried A-horizon containing evidence of both pre- and post-Contact habitation; and 4) SIHP #50-80-14-6703, buried alluvial sediment associated with a buried fishpond.

Rasmussen 2005

In 2005, the International Archaeological Research Institute, Inc. completed archaeological monitoring for construction of the Asia-Pacific Center for Security Studies Perimeter Barrier Wall at Fort DeRussy. Although no cultural artifacts were discovered during monitoring, sediments were observed that were consistent with previous archaeological research (Rasmussen 2005).

Bell and McDermott 2006

In 2006, Cultural Surveys Hawai‘i, Inc., conducted an archaeological inventory survey for the Allure Waikiki Development Project between Ala Wai Boulevard, Kalākaua Avenue, and ‘Ena Road (Bell and McDermott 2006). After a pedestrian inspection was conducted and 35 backhoe assisted trenches were excavated, three historic properties were documented. SIHP # 50-80-14-6873 and 50-80-14-6875, consisting of isolated traditional Hawaiian burials found in sand deposits, and SIHP # 50-80-14-6874 a subsurface cultural layer of pre-contact and post-contact origin.

Hammatt and Chiogioji 2006

In 2006, Cultural Surveys Hawaiʻi, Inc., prepared an archaeological literature review and field inspection for the 2.3-acre Waikiki Allure condominium development at the corner of Kalākaua Boulevard and Ena Road in Waikiki (Hammatt and Chiogioji 2006). Background research indicated that the study area, from traditional Hawaiian times to the modern era, comprised a dryer portion of Waikiki, at least partially elevated above the region's fishponds and wetland agricultural fields. Fieldwork included only a brief pedestrian inspection of the project area. No surface archaeological resources or historic buildings or structures were noted. Based on background research, the authors indicated a potential for subsurface archaeological resources in the project area, including pre- and post-contact habitation and burial deposits.

Tulchin & Hammatt 2009

In 2009, CSH completed monitoring for the Ala Wai Gateway. During the course of monitoring two sets of previously disturbed human skeletal remains were inadvertently encountered. The first set consisted of additional skeletal fragments associated with SIHP #50-80-14-6700, a site previously identified by Freeman et al. (2005). The second set (SIHP #50-80-14-7057) was newly identified. Due to the fragmentary nature of both sets of remains, age and ethnicity could not be determined.

In general, the observed and documented stratigraphy consisted of varying layers of imported fill associated with historic and modern development overlying naturally deposited marine sand and clays indicative of the marsh environment that preceded the land reclamation and subsequent development of the area.

3.3.2 Previous Archaeological Investigations within the Project Area

Archaeological studies conducted within the project area are shown in Figure 26 and listed in Table 4. The following is a summary of these archaeological studies.

Sinoto 1977

In 1977, the Bishop Museum conducted an archaeological reconnaissance survey of the southeast corner of the Hilton Hawaiian Village grounds. No map indicating the specific study area was included with the report, thus making it difficult to pinpoint the exact boundaries of the survey. No historic properties were identified during the surface reconnaissance, however it was noted that the presence of subsurface cultural deposits in the form of human burials and filled-in fishponds were likely (Sinoto 1977:1). Thus it was recommended that all excavations conducted within the survey area be monitored by an archaeologist.

Neller 1980

In 1980, three sets of human remains were inadvertently discovered during construction activities within the southeastern corner of the Hilton Hawaiian Village property and within the current project area (Figure 26). Although the Earl Neller (1980) study only "Presents the results of a brief field inspection", it is particularly germane as not only does it document the only reported burial finds at the Hilton Hawaiian Village campus but it also provides a detailed discussion of the stratigraphy of the northeast corner of the campus (proposed as a primary focus of proposed development and the primary focus of archaeological inventory survey testing). The

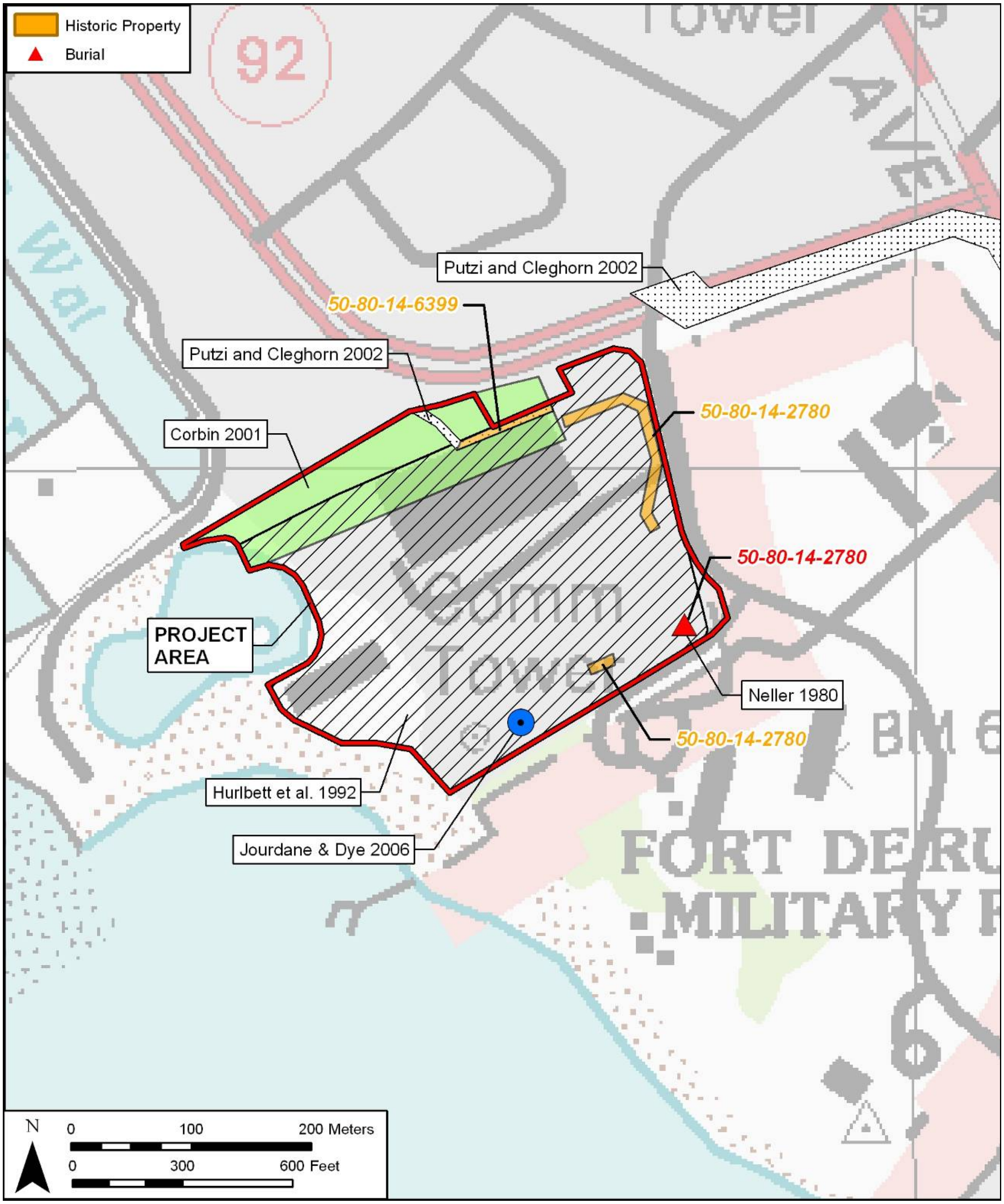

Figure 26. Previous archaeological investigations conducted within Hilton Hawaiian Village showing the general location of the archaeological study (identified on the map by author and date reference) and the location of designated historic properties

Table 4. Previous archaeological studies conducted within the project area (by date)

Author	SIHP #50-80-14	Report Description and Findings
Sinoto 1977	NA	No historic properties were identified during the surface reconnaissance, however it was noted that the presence of subsurface cultural deposits in the form of human burials and filled-in fishponds were likely.
Neller 1980	-2870	Three post-contact burials and three subsurface pit features were documented within the project area.
1986/ 1987 Hilton Hawaiian Village Hotel archaeological monitoring [no report]	-2870	Davis (1989:23 and 1991:19) relates a brief account that in 1987: "Historic remains; construction at the Hilton Hawaiian Village Hotel across from Fort DeRussy." Typically Davis refers to human burials as "human burials" so it is believed he is not aware of any burial finds.
Hurlbett et al. 1992	-2870	15 subsurface pit features associated with post-contact trash disposal were observed. Features were incorporated into SIHP -2870 previously identified by Neller (1980).
Corbin 2001	NA	The stratigraphic sequence consisted of imported fill layers (asphalt, clay loam, crushed coral fill) overlying disturbed sand deposits.
Putzi and Cleghorn 2002	-4573, -6399	Five post-contact pit features documented within the current study area (SIHP -6399). Remnants of the Loko Kaipuni complex (SIHP -4573) were documented east of project area.
Jourdane & Dye 2006	NA	No historic properties were observed. Documented stratigraphy consisted of fill deposits associated with previous development of the area.

Historic Preservation Office (forerunner of today's State Historic Preservation Division) received a call of the discovery of human skeletal remains on March 19, 1980 (seemingly no archaeologist had been on site previously). What Neller encountered was a work site with a quite large pit excavation (Figure 27 to Figure 29). All three sets of remains had been disturbed by construction activities, and were removed from their primary burial context before SHPD archaeologists could document their stratigraphic provenience. The "Results of Field Study" are presented in the following Figure 30 and Figure 31 with photographs of recorded stratigraphy presented in the following Figure 32 to Figure 34 and a somewhat idealized stratigraphic description presented in Figure 35. The Historic Preservation Office determined that all three sets of remains were of Hawaiian ethnicity and post-contact origin (Neller 1980). The burials were determined to be post-1850 in age based on a reconstruction of historic period shorelines (Neller 1980). The burials were assigned State Inventory of Historic Properties (SIHP) #50-80-14-2870.

In addition to the three burials, three subsurface features, consisting of pit features pre-dating the construction of the Ala Wai Canal, were also observed (see Figure 29, and Figure 32 to Figure 33. Two of the features had an undetermined function; however Neller (1980) suggested that they may have been filled-in irrigation ditches. A "coffee bean" sinker, used for octopus lures, was collected from the pit fill of one of these possible ditches. The sinker was constructed of pink granite, an imported material which dated the traditional Hawaiian artifact to the post-contact period. The third documented pit feature consisted of a trash pit containing refuse (ceramic & glass artifacts) dated to the late 1890s.

[1986/1987 Hilton Hawaiian Village Hotel No Report]

Davis (1989:23 and 1991:19) relates a brief account that in 1987: "Historic remains; construction at the Hilton Hawaiian Village Hotel across from Fort DeRussy." Typically Davis refers to human burials as "human burials" so it is believed he is not referencing any burial find. Davis (1989:26) offers:

> Further archaeological work was conducted at the Hilton Hawaiian Village in 1986-1987. However, this was largely restricted to monitoring "renovative construction. As yet, no report is available from this work.

It is unclear who carried out this work or specifically where, or what, if anything was found.

Hurlbett et al. 1992

In 1992, Paul H. Rosendahl, Ph.D., Inc. (PHRI) completed archaeological monitoring of mechanical loop excavations at the Hilton Hawaiian Village (see Figure 26). During the course of monitoring 15 horizontal pit features were observed. 12 of the pit features consisted of post-contact trash pits, with the remaining three consisting of historic to modern filled-in trenches. All of the artifacts collected from the trash pits were dated to the late 19^{th} and early 20^{th} centuries. The pit features were incorporated into SIHP -2870, previously identified by Neller in 1980.

A total of 3,819 artifacts were collected within the study area. All artifacts, with the exception of those collected from the pit features, were situated within disturbed sediments. It was determined that all of the artifacts originated from either household refuse or from construction debris originating from successive periods of demolition and construction conducted within the

Figure 27. General view of Hilton Hawaiian Village project as observed by Earl Neller in 1980 (from Neller 1980: 45) annotated "Hilton Hawaiian Village. Looking northeast. Burial 2 found near exposed pipes."

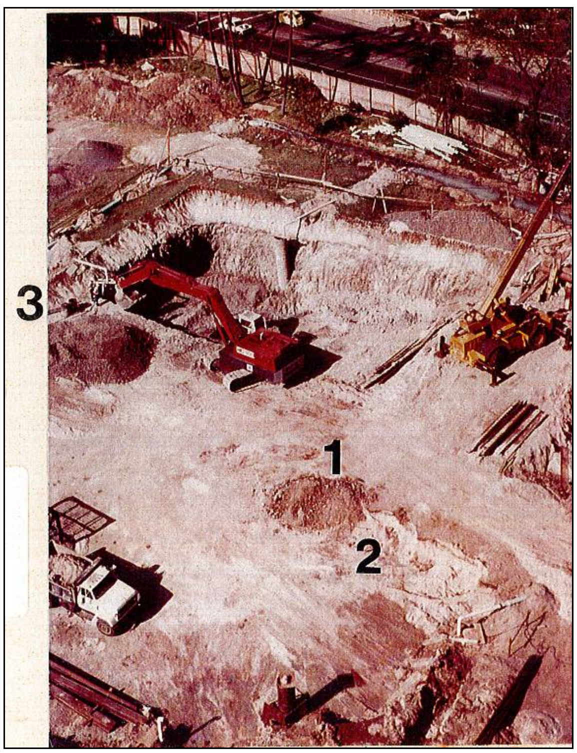

Figure 28. General view of Hilton Hawaiian Village project as observed by Earl Neller in 1980 (from Neller 1980: 45) annotated "Construction site. Looking northeast. Location of burials shown in photo."

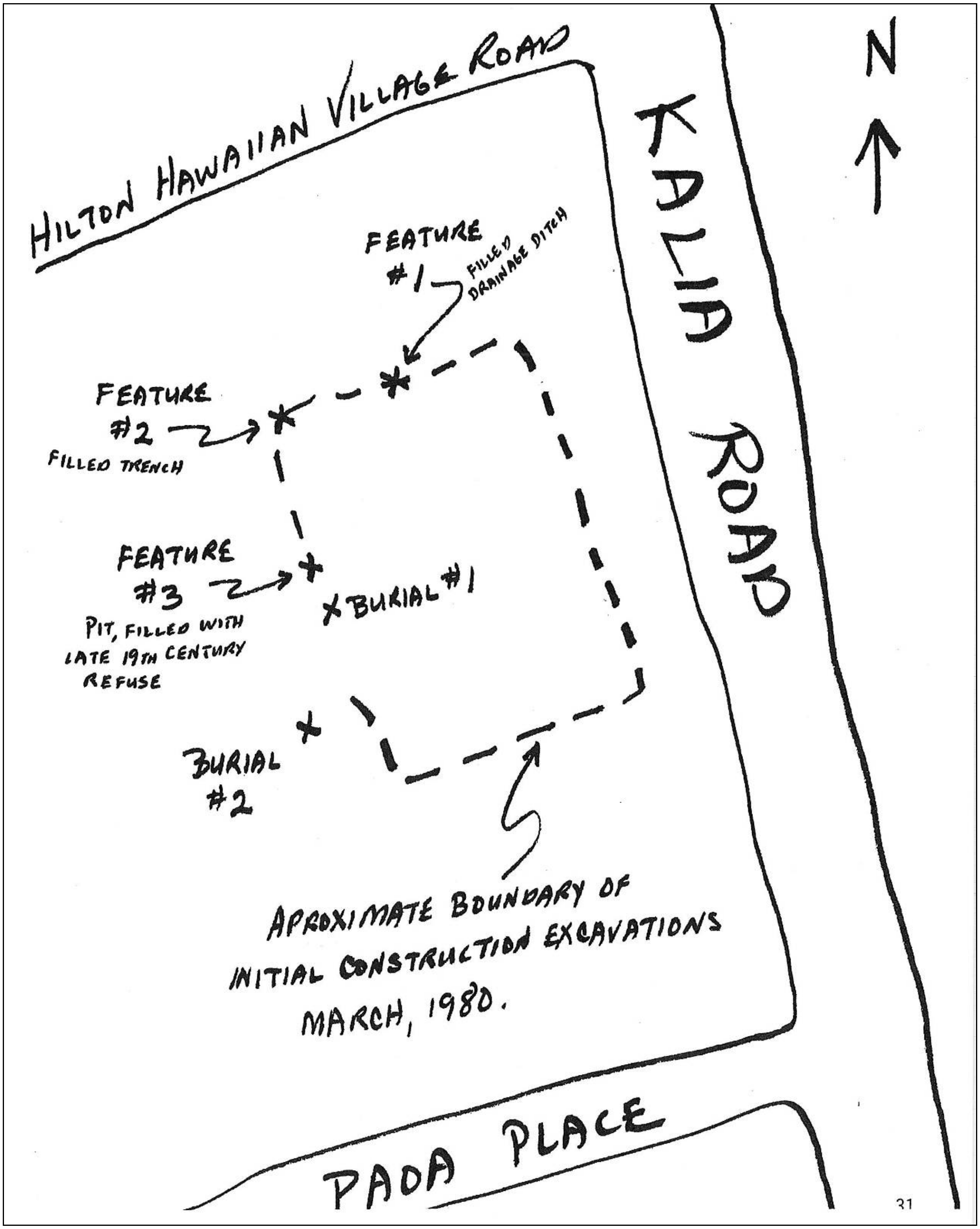

Figure 29. Site map from Neller 1980: 31 annotated "Sketch map of site area, Kalia burial site #2870"

RESULTS OF FIELD STUDY

Approximately 3000 square feet of the local stratigraphy was exposed by the construction project. The deposits were generally uniform throughout the area, and consisted of surface deposits of fill material containing a small amount of historic trash, probably dredged during construction of the Ala Wai Canal, and a buried soil horizon covering a deposit of coral beach sand. (See figure 10, Table 2)

Abandoned water and sewer lines crossed the area, and the fill of one of the trenches contained a rich deposit of historic trash. The remains of an old Hawaiian auwai (irrigation/drainage ditch) could be seen where it crossed a corner of the site. The auwai had been filled in a long time ago, and the fill material contained a small amount of historic trash.

There were no prehistoric Hawaiian features in the project area. There was no sign of additional graves. (See figure 11)

Burial #1. The burial was not observed in situ (in place); but based on the construction workers' comments and the sand adhering to the bones, most likely the bones came from a shallow grave about 3 feet below the original surface. No artifacts were found with the bones. The ends of the bones were crumbly, and the skull was fragmented and incomplete, so most normal skeletal measurements could not be taken. It was impossible to get accurate bone lengths. Had the burial been excavated archaeologically, it would have been possible to make these measurements in situ before the bones were removed. Other important features could have been noted as well, especially the teeth, so important for age determinations, which were never recovered. Based on the bones recovered, the person buried was a young adult, female, and Hawaiian. She was approximately 63 inches tall. All bones had completed their growth, indicating the individual had reached maturity. There were no signs of old age. Based on the tibia length of 35cm, the individual was about 5'3" tall. The sloping forehead and extremely thick skull bones suggested the individual was Hawaiian. The skull may have been intentionally deformed, but this would be difficult to determine based on the limited portion of the skull recovered. (See table 3)

Burial #2. Again, the burial was not observed in situ. Based on construction workers' comments, the grave was separate from the first, but in the same general area. It came from 4 to 5 feet below the surface. No complete long bones were recovered from which measurements could be made. Only a part of the skull was recovered. Everything indicates the skeleton was complete prior to being disturbed by the construction project. No artifacts were found with the burial. The person buried was a young adult, male, and Hawaiian. All bones had completed their growth, indicating the person had reached maturity. The skull portions recovered had large, prominent glabella, well-rounded brow ridges, and a

Figure 30. Neller's (1980: 11) "Results of Field Study" including description of Burial # 1 and Burial # 2

sharp, well-marked supra-mastoid crest, indicating the individual was a male. The heaviness and density of the bones also indicated the person was a male. The muscle attachments on the long bones had extended crests and rough ridges, as is often the case with muscular Hawaiian individuals. (See Table 4)

It is not certain that all of the bones came from the same area, as there are a few that do not belong to this individual, including 3 pig teeth, 1 dog tooth, 1 stew rib (modern), and 1 human femur. (burial #3) One of the workers indicated he thought a third burial was near the filled drainage ditch, and this may be where the extra femur came from. It is also possible the filled area was not a ditch. The exotic character of the fill material argued against it being a burial pit, however, and suggested it was an open feature that required the importation of outside material for filling.

Burial #3. One right femur was picked up somewhere in the vicinity of the filled irrigation/drainage ditch or the other two burials, indicating that a third burial existed, or still exists, somewhere in the area. (See Table 5)

Feature #1. Filled pit, trench, or ditch in north wall of excavation. From its dimensions, about 2½' deep and 5' wide, this appeared to be the profile of a drainage ditch. The absence of obviously gleyed deposits argued against this interpretation, but the floor of the feature did seem to be composed of silty, alluvial deposits. A little excavating and a carefully made profile could have answered this question. The fill material was foreign to the immediate area, suggesting the feature had been open for some time and dirt had to be brought in from somewhere else when it had to be filled. Whatever the feature may have been, it had been dug, used, and filled prior to the dredging of Ala Wai Canal in the 1920s. The dredged deposits from the canal covered this feature unbroken.

In this area, probably in the pit fill, was found a "coffee bean" sinker, the type used for an octopus lure weight. It was made of pink granite, probably obtained from ship ballast stones, and consequently postdates the arrival of foreigners.

Feature #2. Profile of a small pit or trench, function unknown. It was dug and filled prior to the dredging of Ala Wai Canal.

Feature #3. Profile of a deep pit or trench, function unknown. Exact dimensions unknown. The curved shape and extreme depth are unusual. It was filled prior to construction of the overlying crushed coral roadbed, and prior to the dredging of Ala Wai Canal. The fill material was rich with 19th century trash. The crew indicated a number of whole bottles came from this area the following day. This would have been a feature well worth excavating for archaeological purposes. A complete list of the artifacts collected from feature #3, while troweling the soil profile, is what follows.

Figure 31. Neller's (1980: 12) "Results of Field Study" including description of Burial # 3 and a ditch feature

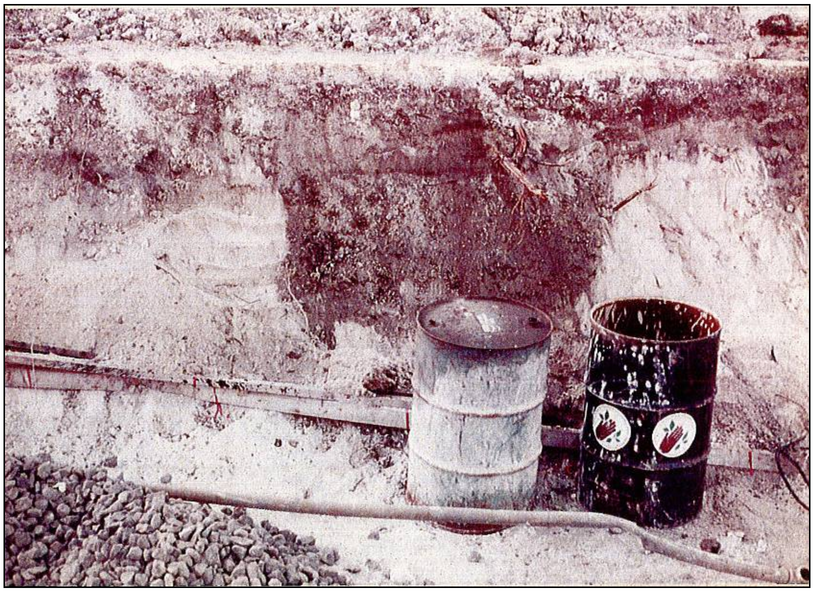

Figure 32. Neller (1980:53) photograph annotated “Feature 1 Note soil horizon between ditch fill and dredged deposits

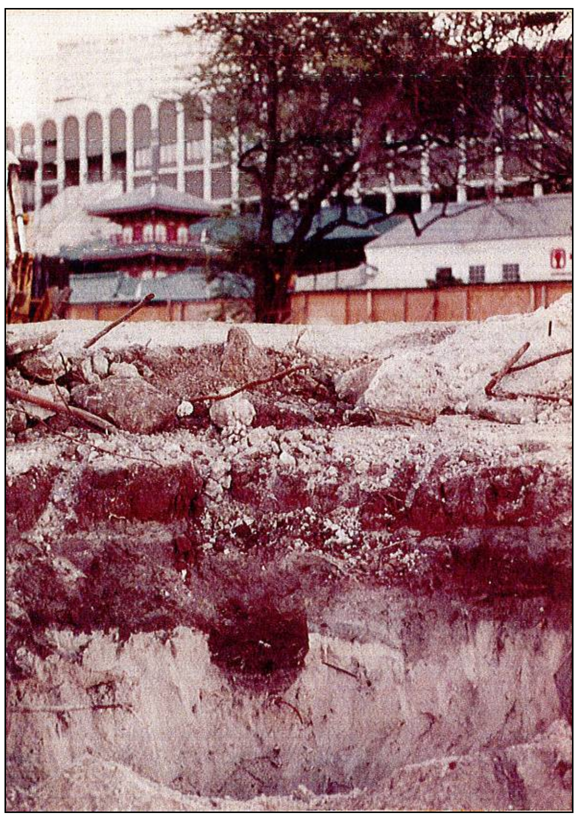

Figure 33. Neller (1980:53) photograph annotated “Feature 2 Note how reddish silt horizon covers and protects earlier deposits”

Figure 34. Two views of soil profiles (Neller 1980:52) annotated "Soil profiles showing the stratigraphy at the construction site, Hilton Hawaiian Village, Waikiki

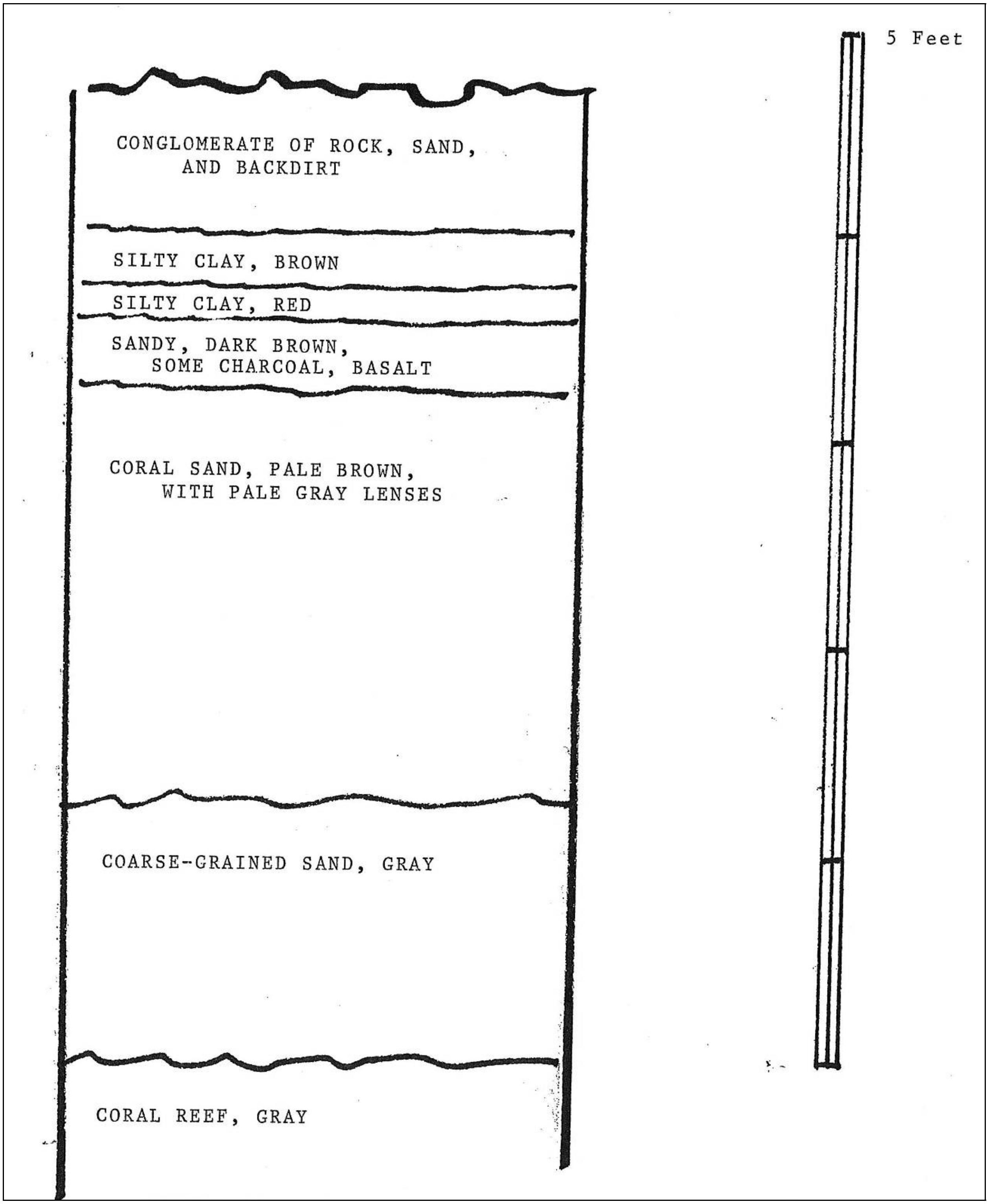

Figure 35. Neller's (1980:30) "Idealized profile of soil horizons at the Kalia Burial Site # 2870

study area. The artifact assemblage consisted primarily of late 19th to early 20th century luxury items associated with health (medicine bottles) and diet (beverage and sauce bottles).

PHRI subdivided their project area into 7 monitoring areas (1-7) in an attempt to geographically organize the data collected during monitoring. These monitoring areas are illustrated in Figure 36 & Figure 37. A summary and analysis of stratigraphic data for monitoring areas 1 thru 7 is provided in Table 5. In general, the documented stratigraphy for the Hilton Hawaiian Village property consisted of multiple fill layers (consisting predominantly of disturbed sand with smaller portions of Ala Wai dredge material and crushed coral) overlying a culturally sterile sand layer, which was determined to be associated with the historic filling of the coral reef for artificial shoreline/beach expansion. Naturally deposited sediments were observed near the eastern edge of the current study area. Limestone bedrock, possibly associated with formerly exposed tidal flats, was observed in the western half of the study area.

Corbin 2001

In 2001, PHRI completed a subsurface archaeological inventory survey for a northern strip of the current study area (see Figure 26). The investigation consisted of the excavation of 21 backhoe trenches (Figure 38 & Figure 39). In general the stratigraphic sequence consisted of imported fill layers (asphalt, clay loam, crushed coral fill) overlying disturbed sand deposits (Corbin 2001). Observed disturbances were associated with prior development of the area (i.e. subsurface utilities and prior building demolition and construction). No historic properties or significant cultural deposits were observed.

Putzi and Cleghorn 2002

In 2002, Pacific Legacy, Inc. completed archaeological monitoring of sewer connections associated with Hilton Hawaiian Village improvements. Excavations were monitored within the northern portion of the current study area and within Ala Moana Boulevard and Kalākaua Avenue (see Figure 26). During monitoring within the study area, five pit features were documented. Three of the pit features consisted of post-contact trash pits, one of the features was a fire pit, and the remaining feature had an undetermined function. All of the pit features originated within a dark sand layer, determined to be fill material associated with prior land reclamation of the area, and were excavated into an underlying layer of sterile sand. All five pit features were assigned as SIHP 50-80-14-6399.

Observed stratigraphy within the current study area consisted of imported and disturbed fill layers (asphalt, gravel, and clay) overlying naturally deposited, culturally sterile sand. Natural deposits were observed from 100-160 cmbs. The coral shelf was encounter at 240 cmbs.

Excavations east of the current study area uncovered remnants of the Loko Kaipuni complex (SIHP -4573). Documented fishpond remnants consisted primarily of a gray clay sediment layer located approximately 120 cm below the existing ground surface.

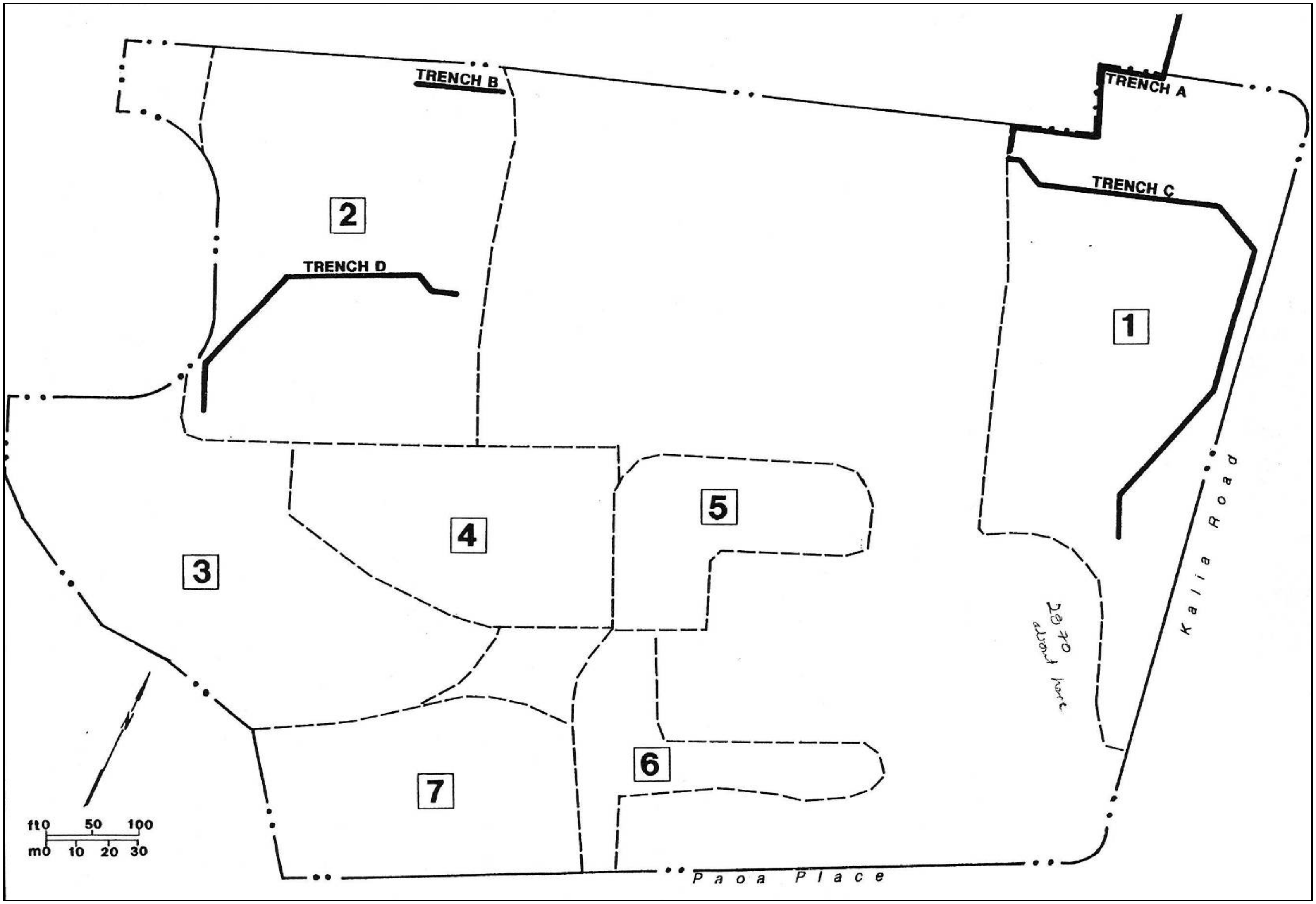

Figure 36. Monitoring areas delineated within Hilton Hawaiian Village by PHRI (source: Hurlbett et al. 1992)

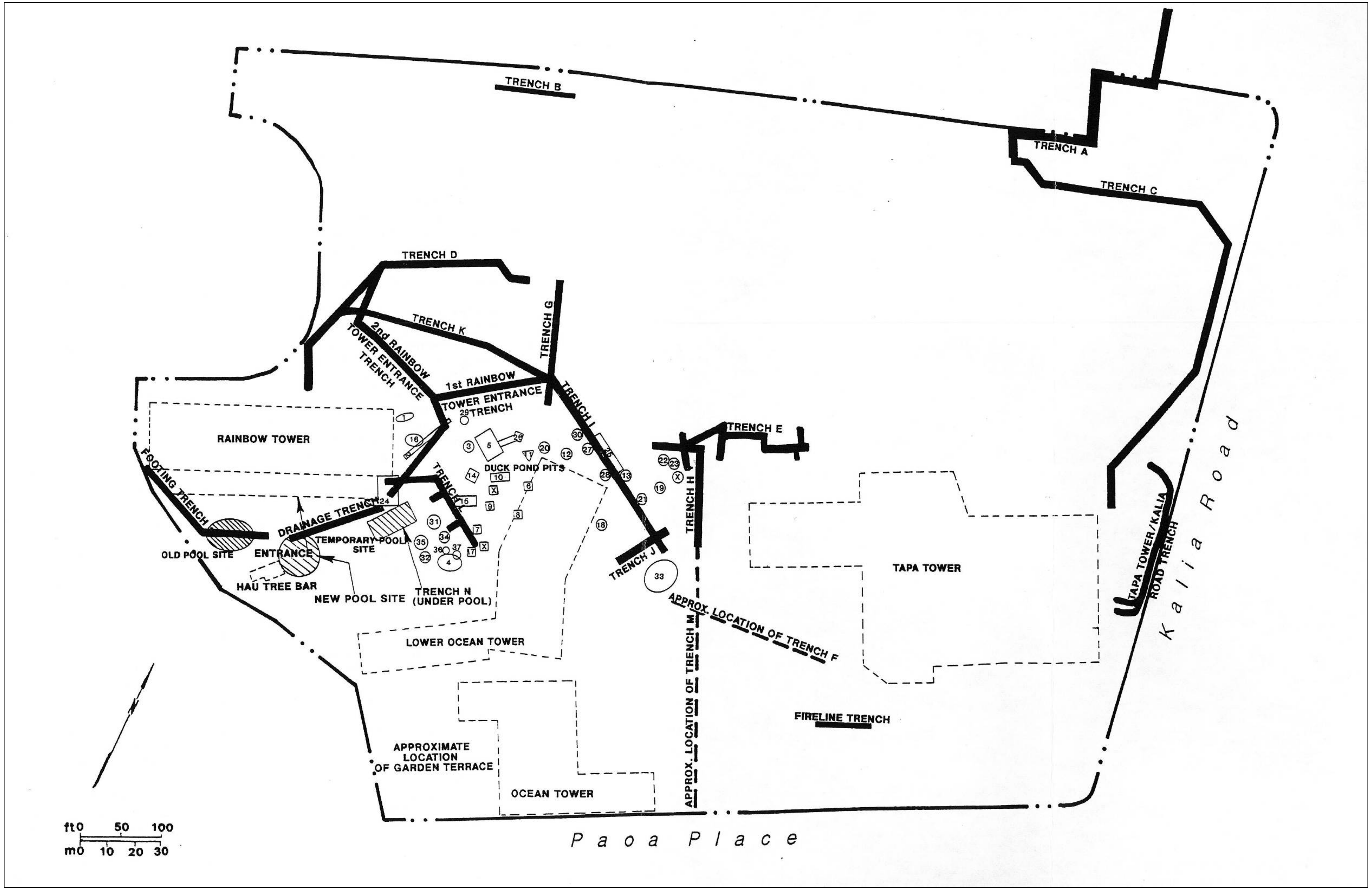

Figure 37. Locations of excavations monitored by PHRI in 1992 (source: Hurlbett et al. 1992)

Table 5. Summary of Archaeological Monitoring at the Hilton Hawaiian Village from 1985 to 1987 (Hurlbett et al. 1992)

Monitoring Area	**Trench Designation**	**Stratigraphy**	**Finds**
1	Trench A	Disturbed fill layers (imported sand) overlying concrete slab at 100 cmbs. Extensive machine disturbance observed throughout excavation.	Artifacts: ceramic, porcelain, glassware, shell, plastic, nails, roofing tiles.
1	Trench C	Disturbed fill layers (imported sand) overlying naturally deposited sand and limestone bedrock. (Depth of natural sediment deposits not noted.)	Artifacts: ceramic, bottles, nails, roofing tiles. Ten pit features documented, consisting primarily of post-contact trash pits.
1	TT/KR	Disturbed fill layers (imported sand) overlying naturally deposited sand. Natural sediments encountered at 140 cmbs.	Artifacts: bottle fragment
2	Trench B	Fill material observed to base of excavation, approximately 130 cmbs. Fill sequence consisted of asphalt, cinder, dredge material, and imported sterile beach sand associated with historic land reclamation.	Artifacts: ceramics and bottle fragments.
2	Trench D	Fill material overlying coral bedrock. Fill sediments consisted of asphalt, clay loam, and imported sterile beach sand associated with historic land reclamation. Bedrock encountered at 170 cmbs	Artifacts: bottles and bottle fragments, ceramic, glassware, clay tiles.
2	Trench G	Disturbed fill material (sand, asphalt, clay loam) overlying sterile beach sand associated with historic land reclamation.. Max depth, 100 cmbs.	No cultural material observed.

Monitoring Area	Trench Designation	Stratigraphy	Finds
2	Trench K	Fill material observed to base of excavation, approximately 90 cmbs. (Type of fill not specified).	No cultural material observed.
2	1st Rainbow Tower Entrance Trench	Fill material observed to base of excavation, approximately 210 cmbs. (Type of fill not specified).	No cultural material observed.
2	2nd Rainbow Tower Entrance Trench	Several layers of fill atop a metal storm drain. Gley soils noted at base of excavation, approximately 200 cmbs.	No cultural material observed.
3	Old Pool Area	Alternating layers of sand and clay overlying a mixture of sand and charcoal at a depth of 100 cmbs.	Artifacts: ceramics, bottles, clay tile.
3	Temporary Pool Area	Fill material observed to base of excavation, approximately 120 cmbs. Fill consisted of disturbed sand layers overlying imported sterile beach sand associated with historic land reclamation. Max depth, 100 cmbs.	Artifacts: ceramics and bottles
3	New Pool Area	Stratigraphic sequence of clay, sandy loam, and sand. Max depth, 100 cmbs.	Artifacts: ceramics, bottles, metal fragments, cut animal bone.
4	2nd Rainbow Tower Entrance Trench	Mixed fill overlying beach sand. Max depth, 180 cmbs.	No cultural material observed.
4	Trench L	Sandy loam with tree root intrusions overlying homogenous beach sand. Max depth, 200 cmbs.	No cultural material observed.
4	Duck Pond Pits (27 pits)	Sand layers, rock fill, sandy loams, and silt observed.	Artifacts: ceramics, bottles, and metal fragments.
5	Trench E	Gravel, loam fill, and loamy clay overlying coral sand. Max depth, 150 cmbs.	Artifacts: bottles

Monitoring Area	Trench Designation	Stratigraphy	Finds
5	Trench H	Asphalt and gravel fill overlying imported sterile beach sand associated with historic land reclamation. Max depth, 150 cmbs.	Artifacts: bottles & ceramics.
5	Trench I	Recent fill and sand overlying limestone bedrock. Max depth, 150 cmbs	Artifacts: bottles and animal bone.
5	Trench J	Recent fill overlying imported sterile beach sand associated with historic land reclamation. Max depth, 150 cmbs	Artifacts: glass and ceramic bottles.
5	Duck Pond Pits (11 pits)	Asphalt overlying beach sand. Max depth, 115 cmbs.	Artifacts: bottles and animal bone.
6	Ocean Tower Pit 4	Loamy fill, sand, and gleyed sand overlying the coral shelf.	Artifacts: bottles.
6	Fire Line Trench	Clay loam and sand fill layers observed to base of excavation, 150 cmbs.	Post-contact trash pit containing metal cans, bottles, and ceramics observed.
6	Trench F	Asphalt, an old road bed, a sand layer, and a layer of coral pebbles and sand observed. Max depth, 270 cmbs.	Artifacts: ceramics, bottles, and animal bone.
6	Trench M	Upper fill layer overlying two sand layers. Max depth, 200 cmbs.	Artifacts: ceramics, bottles, and animal bone.
6	Trench O & P	Upper fill layer overlying two sand layers. Max depth, 120 cmbs.	Artifacts: ceramics and bottles.
6	Trench Q	Upper fill layer overlying two sand layers. Max depth, 150 cmbs.	Artifacts: ceramics and bottles.
6	Trench R	Dark loamy fill overlying sand. Max depth, 120 cmbs.	No cultural material observed.
7	Ocean Tower Trench 1-3	Upper fill layer overlying two sand layers. Max depth, 100 cmbs.	No cultural material observed.
7	Trench F west	Upper fill layer overlying two sand layers. Max depth, 170 cmbs.	Artifacts: ceramics and glass.

Monitoring Area	Trench Designation	Stratigraphy	Finds
7	Trench S	Single layer of recent beach sand. Max depth, 70 cmbs.	No cultural material observed.
7	Trench T	Mixture of light and dark sand with no stratigraphic horizons. Max depth, 70 cmbs.	No cultural material observed.
7	Ocean Tower Pit 1	Fill, two sand layers, a consolidated coral layer, and a basal layer of coral pebbles and coarse sand. Max depth, 400 cmbs.	Artifacts: bottle fragments.
7	Ocean Tower Pit 2 & 3	Sand layer overlying a gley sand layer. Max depth, 250 cmbs.	No cultural material observed.
7	Ocean Tower Pit 5 & 6	Fill, two sand layers, a consolidated coral layer, and a basal layer of coral pebbles and coarse sand. Max depth, 250 cmbs.	No cultural material observed.
7	Ocean Tower Pit 7 & 8	No stratigraphy documented. Max depth, 125 cmbs.	No cultural material observed.
7	Beach Front pits	Single layer of fill observed. Max depth, 100 cmbs.	No cultural material observed.

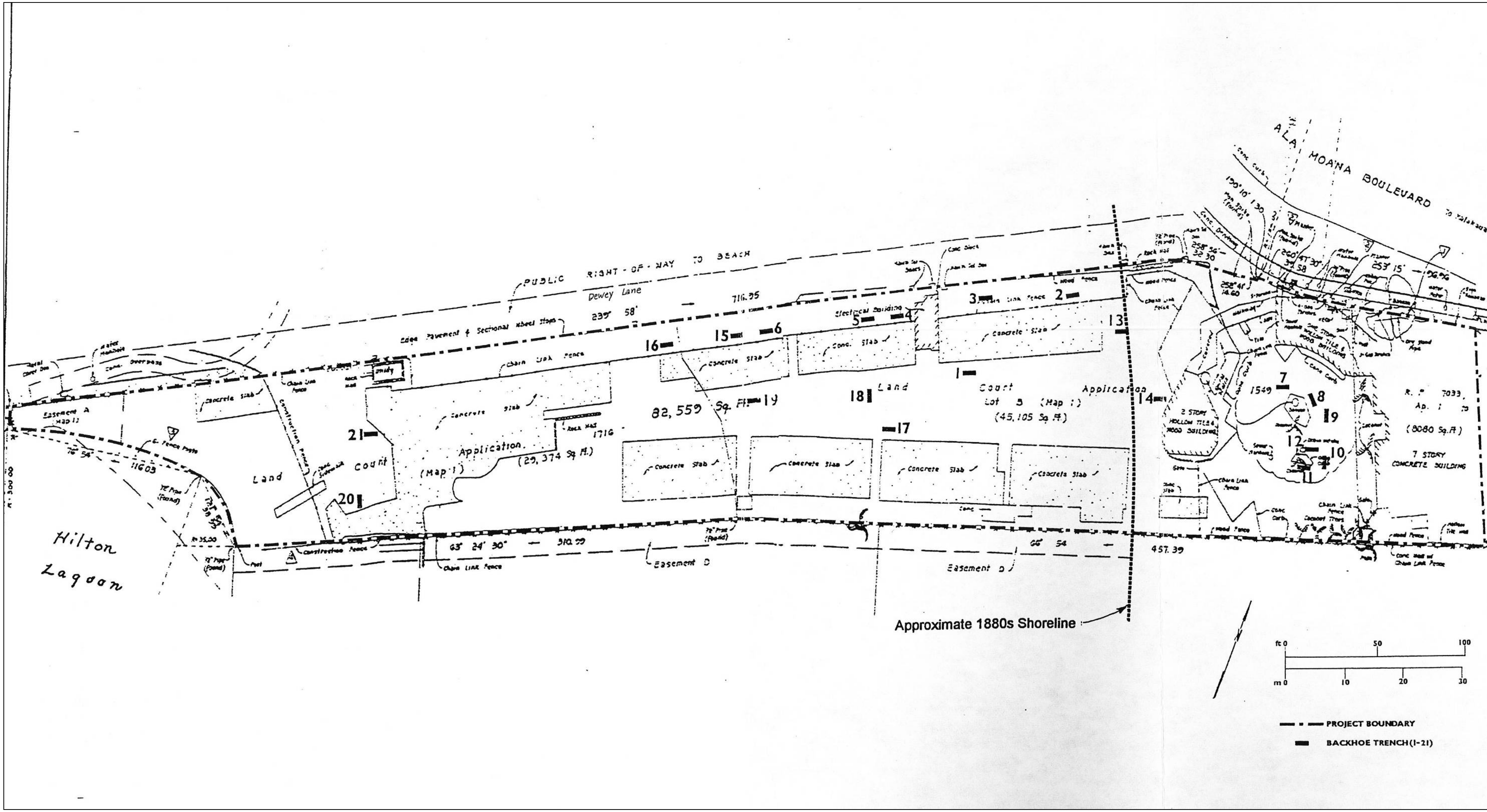

Figure 38. Location of PHRI (2001) backhoe excavations (source: Corbin 2001)

Table 1. Summary of Soil Layers in Backhoe Trenches

B.T. #	Layer I	Layer II	Layer III	Layer IV	Layer V	Layer VI
1	Brown clay fill mixed w/ gravel	Light yellowish brown sand; in southwest corner are modern electric lines	Light gray sand to sea level	-	-	-
2	Brown clay fill mixed w/ gravel	Recent gravel fill w/ concrete rubble	Pale yellow sand	Light gray sand to sea level	-	-
3	Brown clay fill mixed w/ gravel	Recent gravel fill w/ concrete rubble	Pale yellow sand to sea level	-	-	-
4	Brown clay fill mixed w/ gravel	Recent gravel fill w/ concrete rubble	Pale yellow sand to sea level	-	-	-
5	Brown clay fill mixed w/ gravel	Recent gravel fill w/ concrete rubble; underlying concrete curb	Disturbed marbled soil with recent trash, e.g., porcelain bowl frag., #	Pale yellow sand to sea level	-	-
6	Brown clay fill mixed w/ gravel	Crushed limestone mixed w/ bluish gley	Pale yellow sand to sea level	-	-	-
7	Asphalt paving in parking lot	Recent dark gravel fill below asphalt	White crushed limestone fill	Brownish gray sand; disturbed, mixed, and marbled	Pale yellow sand to sea level	-
8	Asphalt paving in parking lot	Recent dark gravel fill below asphalt	White crushed limestone fill	Thin asphalt pavement	Brownish gray sand; disturbed, mixed, and marbled	Pale yellow sand to sea level
9	Asphalt paving in parking lot	Recent dark gravel fill below asphalt	White crushed limestone fill	Thin asphalt pavement	Brownish gray sand; disturbed, mixed, and marbled; metal piece seen at water level	-
10	Asphalt paving in parking lot	Recent dark gravel fill below asphalt	White crushed limestone fill	Brownish gray sand; disturbed, mixed, and marbled; recent materials to sea level: bottle, glass, metal, porcelain, wood	-	-

Table 1. (Continued)

B.T. #	Layer I	Layer II	Layer III	Layer IV	Layer V	Layer VI
11	Asphalt paving in parking lot	Recent dark gravel fill below asphalt	White crushed limestone fill	Brownish gray sand; disturbed, mixed, and marbled	Yellow crushed limestone fill	Brownish gray sand; disturbed, mixed, and marbled; Layer VII contains pale yellow sand to sea level
12	Asphalt paving in parking lot	Recent dark gravel fill below asphalt	White crushed limestone fill	Brownish gray sand; disturbed, mixed, and marbled; metal fragment noted	Pale yellow sand to sea level	-
13	Asphalt paving	Recent dark gravel fill below asphalt	Recent dark brown clay fill	White crushed limestone fill	Asphalt paving	White crushed limestone fill; Layer VII contains thin concrete layer; Layer VIII is pale yellow sand to sea level
14	Asphalt paving	Recent dark gravel fill below asphalt	White crushed limestone fill; B.T. abandoned at this point due to presence of electrical lines and current water main	-	-	-
15	Disturbed grayish brown clay loam; recent materials, e.g., plastic, porcelain, concrete frags.	White crushed limestone fill	Sand mixed w/ bluish gley to sea level	-	-	-
16	Disturbed grayish brown clay loam	Concrete layer	White crushed limestone fill	Bluish gley layer to sea level	-	-
17	Recent dark gravel fill	White crushed limestone fill	Concrete layer	Pale yellow sand	Light gray gley and coarse sand below sea level	-
18	Dark brown clay fill; recent glass, concrete pipe fragment	Disturbed yellowish brown sand	Bluish gray gley mixed w/clay and sand below sea level	-	-	-
19	Dark brown clay fill; recent tiles, concrete frags.	White crushed limestone fill	Bluish gray gley mixed w/ clay and sand; first few cm appear disturbed; below sea level	-	-	-
20	Dark brown clay fill; recent materials;wire,tiles	White crushed limestone fill; recent materials; tiles, concrete frags., wire	Bluish gray gley mixed w/ crushed limestone fill	-	-	-
21	Dark brown clay fill; recent materials; wire,tiles	White crushed limestone fill	Recent dark brown clay fill with concrete chunks; may be remnants of recent pool	Bluish gray gley mixed w/ crushed limestone fill	-	-

Figure 39. Table summarizing stratigraphy of PHRIs 2001 backhoe excavations (source: Corbin 2001)

Jourdane & Dye 2006

In 2006, T.S. Dye & Colleagues, Archaeologists, Inc. completed archaeological monitoring for the construction of the Best Bridal Wedding Chapel at the Hilton Hawaiian Village. No historic properties were observed. Documented stratigraphy consisted of fill deposits associated with previous development of the area. (Jourdane & Dye 2006: 17).

3.4 Consultation

Quite extensive consultation for the Hilton Hawaiian Village Master Plan Project has been carried out within a companion Cultural Impact Assessment (CIA) (Cruz et al. 2010 in progress). Hawaiian organizations, agencies and community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and the vicinity. The organizations consulted include the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), the Oʻahu Island Burial Council (OIBC), and community and cultural organizations including Hui Mālama I Nā Kūpuna O Hawaiʻi Nei and the Waikīkī Hawaiian Civic Club. CSH attempted to contact 123 community members (government agency or community organization representatives, or individuals such as residents, cultural and lineal descendents, and cultural practitioners) for this draft CIA report (see Table 6). A specific point of consultation was:

- Knowledge of cultural sites which may be impacted by future development of the Project area - for example, historic sites, archaeological sites, and burials.

Ten consulted parties responded and five participated in formal interviews for more in-depth contributions to the CIA. No one had any specific knowledge of burials (other than those reported by Neller in 1980) or other subsurface cultural properties. The reader is referred to that study for a detailed account.

The Hilton Hawaiian Village Master Plan Project was presented to the Oʻahu Island Burial Council at their June, July and August meetings along with a detailed discussion of the proposed Archaeological Inventory Survey approach. A face-to-face meeting was held with Dr. Kēhau Abad of the OIBC to discuss the AIS Plan and further comments were received from her by e-mail. The plan was revised to address her concerns. A meeting with lineal and cultural descendants of Waikīkī (and Ms. Phyllis "Coochie" Cayan of the SHPD) was held on August 7, 2010 in which the Archaeological Inventory Survey approach was discussed in detail. Cultural consultation has been extensive (see Table 6).

Table 6. Summary of Community Consultation

Name	Affiliation, Background	Comments
Agard, Louis	Kahea Environmental Alliance. Former fisherman	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Ahlo, Charles	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Ailā, William	Hui Mālama I Nā Kūpuna ‘O Hawai‘i Nei	CSH sent community outreach letter and figures on April 9, 2010. Mr. Ailā responded on April 12, 2010 suggesting that a complete archeological survey be conducted before any design or construction occurs so that any inadvertent *kūpuna* discoveries can be avoided by construction-related activities.
Among, Les A.	Waikīkī Neighborhood Board Sub-district 1-Chair	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Apaka, Jeff	Waikīkī Neighborhood Board Sub-district 2-Chair	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Arcalas, Cara	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned to CSH on April 13, 2010.
Ayau, Halealoha	Hui Mālama I Nā Kūpuna o Hawai‘i Nei, Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Bates, Cline	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Bates, Ke‘ala	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Battle, Cherie Kahealani Keohokālole	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Becket, Jan	Hawaiian historian, author and photographer	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Bissen, Tony	Cultural Historian, Moana Surfrider Hotel	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Blaisdell, Dr. Kekuni	Hawaiian community activist	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.

Name	Affiliation, Background	Comments
Boyd, Manu	Cultural Director, Royal Hawaiian Shopping Center	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Bridges, Cy	Native Hawaiian Hospitality Association president	Recommended by SHPD, CSH contacted Mr. Bridges on June 28, 2010. Mr. Bridges stated that he did not have knowledge of the Project area.
Brown, Desoto	Bishop Museum Archivist	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Cayan, Phyllis, “Coochie”	History and Culture Branch Chief, SHPD	CSH sent community outreach letter and figures on April 9, 2010. See SHPD response below in Appendix E
Cazimero, Anna Ka‘olelo Machado	Waikīkī musician and *kupuna* (elder)	CSH Sent letter on June 21, 2010. Complete interview in companion Cruz et al. 2010 Cultural Impact Assessment.
Del Toro, Benjamin	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Del Toro, Daniel	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Del Toro, Rachel	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Del Toro, Samuel	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Diamond, Van Horn	Waikīkī cultural descendant, former OIBC Chair	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010. Complete interview in companion Cruz et al. 2010 Cultural Impact Assessment.
Downing, George	Save Our Surf Organization, Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Falemei, Hina Wong	OIBC Vice Chair, Hālau Lōkahi Hawaiian Immersion School *kumu*	CSH sent community outreach letter and figures on April 9 and May 25, 2010.
Finley, Bob	Waikīkī Neighborhood Board Sub-district 9-Chair	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	**Affiliation, Background**	**Comments**
Gomes, Phoebe	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Gomes, Robin	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Gora, Amelia K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 25, 2010.
Grace, Nadine	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Harris, Cy K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Hatchie, Andrew	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Hukiku, Clarence Moses	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kaʻawakauo, Emma	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kahanamoku, Samuel A.	Waikīkī/Kālia *kupuna*	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Kaleikini, Aliʻikaua	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kaleikini, Kala	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kaleikini, Noʻeau	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kaleikini, Paulette	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kam, Thelma	Cultural Director, Sheraton Waikīkī	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keanaʻāina, Betty	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keanaʻāina, Kīhei	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Keana'āina, Luther	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana'āina, Michelle	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana'āina, Noelani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana'āina, Regina	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana'āina, Vicky	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana'āina, Wilsam	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kekaula, Ashford	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kekaula, Mary K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keli'inoi, Kalahikiola	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keli'inoi, Moani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keli'ipa'akaua, Chase	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keli'ipa'akaua, Justin	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Adrian K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Dennis Ka'imina'auao	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Emalia E.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, James Hoapili	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Keohokālole, Jeanine Leikeonaona	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Joseph Moses Keaweaheulu	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Lori Lani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kihikihi, Kauna	Waikīkī cultural historian, E Noa Tours	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kini, Debbie (Norman)	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kini, Nalani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Koko, Kanaloa	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Krewson-Reck, Sylvia	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, 2010. Complete interview in companion Cruz et al. 2010 Cultural Impact Assessment.
Kruse, T. Kehaulani	OIBC	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kuhea, Kealoha	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 25, 2010.
Kuloloio, Manuel	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Lew, Haumea	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Lindsey, Keola	OHA	CSH sent community outreach letter and figures on April 9, 2010. OHA response is in present Appendix F.
Lopes, Kamaha‘o	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Lopes, Leinaʻala (Moses-Hukiku)	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Lopes, Puahone Kini	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Luka, Alika	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Mamac, Violet L. Medeiros	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
McDonald, Ruby Keanaʻāina	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jr., Clarence	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010. Complete interview in companion Cruz et al. 2010 Cultural Impact Assessment..
Medeiros, Sr., Clarence	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, David	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jacob L.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jaimison K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jayla A.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jim	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Kareen K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Lincoln K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Roland	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Miller, ‘Ihilani Silva	Entertainer, Sheraton Moana Surfrider	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Naguwa, Joan	Executive Director, Waikīkī Community Center	CSH sent community outreach letter and figures on April 9, May 3 and May 25, 2010.
Nāmu‘o, Clyde	Administrator, OHA	CSH sent community outreach letter and figures on April 9, 2010. OHA response is in present Appendix F.
Napoleon, Nanette	Hawaiian historian, writer and researcher	Recommended by SHPD, CSH contacted Ms. Napoleon on June 28, 2010. Ms. Napoleon stated that she did not have knowledge of the Project area.
Nobrega, Malia	President, Waikīkī Hawaiian Civic Club	CSH sent community outreach letter and figures on April 9, May 3 and May 25, 2010.
Norman, Carolyn	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Norman, Eileen	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Norman, Kaleo	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Norman, Keli‘inui	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Norman, Theodore	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Olds, Nalani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Paglinawan, Richard	Queen Emma Trust, Lua expert	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Paoa, Clarke	Waikīkī/Kālia *kama‘āina*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010. Complete interview in companion Cruz et al. 2010 Cultural Impact Assessment..
Papa, Jr., Richard Likeke	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Pascua, Bruce H.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Peters, David	Queen Liliʻuokalani Trustee	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Rash, Regina	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Rochlen, Lillian Kenuenue Kaeo	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Roy, Corbett	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Shirai, Jacqueline	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9 and May 25, 2010.
Shirai, Jr., Thomas T.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9 and May 25, 2010.
Souza, William D.	Royal Order of Kamehameha, Kūhiō Chapter	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Spinney, Charles	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Sterling, Joanne Kahanamoku	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, 2010. See tribute in Section 7.3.
Suzuki, Ashley	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Suzuki, Kimberly	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Takaki, Miles	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Takaki, Moses	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Takaki, Tracy	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Takizawa, Lorna Medeiros	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 17, 2010.
Theone, Nicole Gulia	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Wagner, Pat (Low)	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Waikīkī Community Center Kūpuna	*Kupuna* center	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Williams, Evern	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Yokooji, Dayleen	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

3.5 Background Summary and Predictive Model

During pre-Contact times the *ahupua‘a* of Waikīkī, was an intensely utilized area with abundant natural and cultivated resources that supported a large population. Multiple *heiau* were built throughout the area and traditional accounts refer to Waikīkī as a center of chiefly residence and governance. Waikīkī also supported a vast network of irrigated taro fields and fishponds, and was an area utilized by the *ali‘i* as a place of residence.

In the nineteenth and early twentieth century, after a period of depopulation, Waikīkī was reanimated by Hawaiians and foreigners residing there and by farmers continuing to work the irrigated field system which had been converted from taro to rice. Farming continued up to the first decades of 20th century until the construction of the Ala Wai Canal in the 1920s drained the remaining ponds and irrigated fields, making way for urban development.

A review of a 1881 Hawaiian Government survey map by S.E. Bishop indicates 2 LCAs within the project area (LCA 1775 to Paoa & LCA 2511 to Alapai) (see Figure 9). Documentation from these LCAs indicates that traditional Hawaiian habitation and agriculture (both wetland and dry land) was occurring within the project area during the mid-nineteenth century.

A series of historic maps from 1887 to 1955 illustrate the dramatic changes that occurred within the project area as Western commercial interests supplanted the traditional Native Hawaiian way of life (see Figure 10 to Figure 21). Of note is extensive shoreline accretion and successive waves of resort development. Based on historic maps it appears that approximately the *makai* half of the project area was formerly situated within tidal flats that were completely submerged by the ocean. Historic maps document shoreline accretion within the makai portion of the study area as early as 1862 (see Figure 14). Figure 40 illustrates the approximate location of the 1860s and 1880s shorelines within the project area. It is believed that shoreline accretion during this time period was a naturally occurring process. However, by 1910 shoreline accretion appears to be a result of massive fill episodes associated with beach front expansion for residential and resort development. As filling was directly associated with beach expansion, fill material within a majority of the project area likely consists of coralline sands deposited on limestone bedrock.

Historic maps also illustrate extensive residential and resort development occurring within the project area as early as 1910. Sanborn Fire Insurance maps from 1914 to 1955 document numerous small dwellings throughout the entire project area (see Figure 15, Figure 18, & Figure 21). Also noted are apartments, boarding houses, and hotels.

Previous archaeological research has documented two historic properties (SIHP 50-80-14-2870 & -6399) within the project area. SIHP 50-80-14-2870 was used by Earl Neller to designate three post-contact burials and numerous pit features containing historic refuse (Neller 1980). While Neller designates no site boundaries per se, he associates this SIHP # with all features in an approximately 3000 square foot area (Neller 1980:11,22, 23, & 31) in the north/central portion of the Hilton Hawaiian Village Campus under his purview at the time. The Hurlbett et al. (1992) archaeological monitoring report describes "15 horizontal features" widely distributed over the Hilton Hawaiian Village campus as well as artifacts, midden and miscellaneous objects recovered from disturbed deposits. It appears that the Hurlbett et al. (1992:2,3) study equates SIHP 50-80-14-2870 with their project area which is basically defined as the Hilton Hawaiian Village campus.

A Putzi & Cleghorn (2002) archaeological monitoring report used the historic property designation SIHP 50-80-14-6399 to include five post-contact pit features containing historic refuse located parallel to and 40 m east of Ala Moana Boulevard just mauka of the Hilton Hawaiian Village Campus.

Archaeological monitoring conducted during various construction activities within the project area provides a good example of the representative stratigraphy for the project area. In general, the documented stratigraphy for the Hilton Hawaiian Village property consisted of multiple fill layers (consisting predominantly of disturbed sand with smaller portions of Ala Wai dredge material, crushed coral, and clay loam) overlying a culturally sterile sand layer, which was determined to be associated with the historic filling of the coral reef for artificial shoreline/beach expansion. Naturally deposited sediments were observed near the eastern edge of the project area, while the western portion of the project area consists entirely of fill.

The project area has been extensively modified by land reclamation and resort development throughout the 20th century. For example a 1927 map (Figure 18) appears to show some 165 structures (mostly bungalow style accommodations) on the Hilton Hawaiian Village campus each of which was probably serviced with underground sewer and water lines. The foundations, utilities and appurtenances for this complex of structures collectively may have entailed very substantial subsurface impact. Background research, however, suggests that intact pre-contact

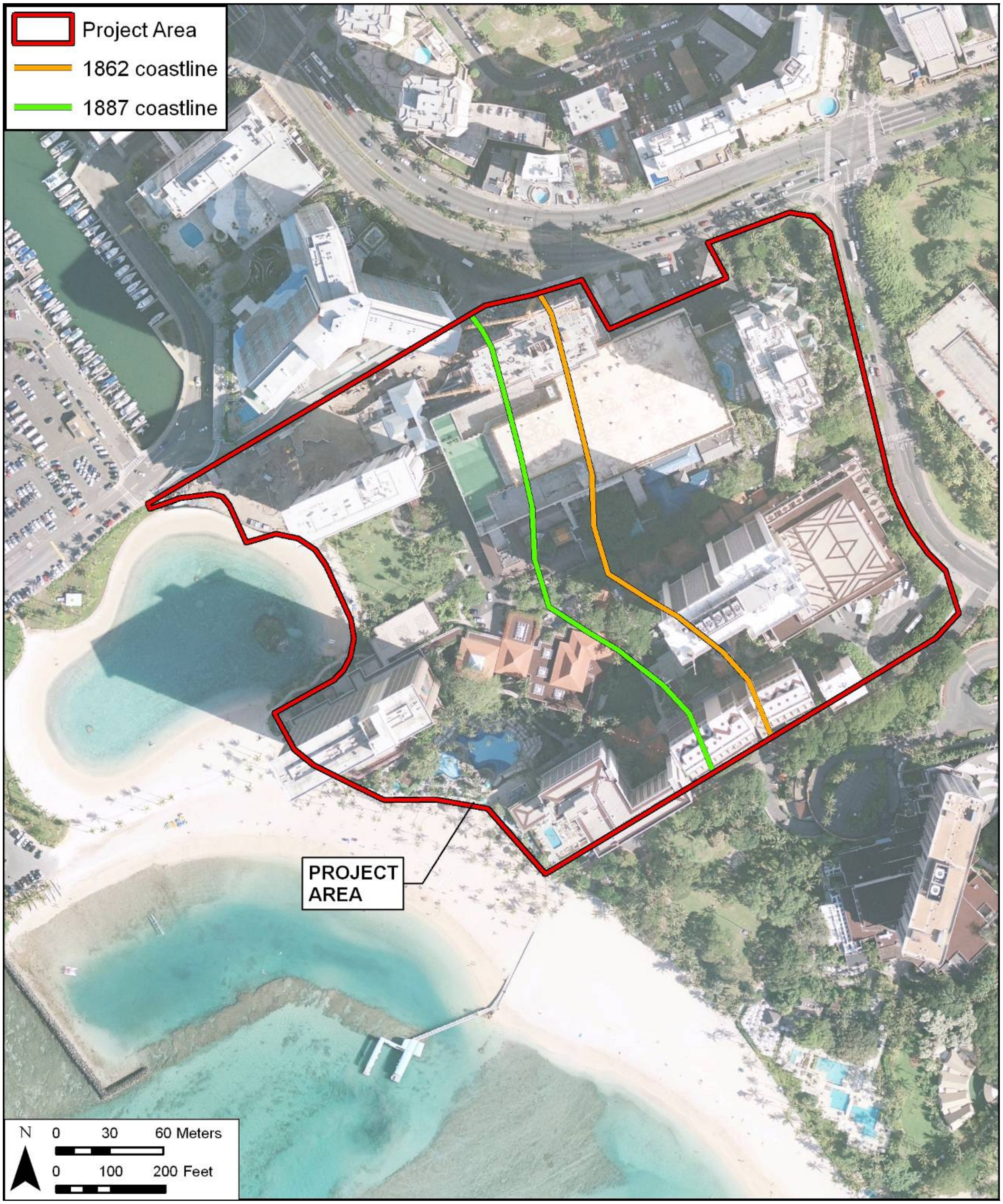

Figure 40. Aerial photograph (source: Google Earth 2010) showing approximate location of the 1862 and 1887 coastlines within the project area

and early post-contact cultural deposits associated with traditional Hawaiian habitation, agriculture, and burial lie undisturbed beneath fill layers within the project area. Post-Contact cultural deposits associated with western settlement and resort development from the 19^{th} and 20^{th} centuries are also likely present.

In conclusion, it is very likely that subsurface historic properties, associated with both pre- and post-Contact land use, are present within the project area in the form of cultural layers and/or structural remnants buried by modern and historic fill layers. Evidence of pre-Contact land use could be in the form of human burials, midden deposits, and artifacts (i.e. stone tools). While there is indeed a significant prospect of such finds it is perhaps worth keeping in mind that despite the massive work undertaken to date at the nearly 23-acre Hilton Hawaiian Village campus that there have only been three identifications of human skeletal remains (and Neller's Burial # 3 consisted of a single bone) and that these appear to have been somewhat geographically spread out and hence not indicative of a burial ground (see Figure 28 and Figure 29). It is not our purpose to discount the prospect of further significant finds but rather to point out that on the basis of present evidence the prospect of such finds is fairly typical for Waikīkī. Evidence of post-contact land use could be in the form of human burials, trash pits, privies, and building foundations.

Section 4 Results of Fieldwork

4.1 Results of Pedestrian Inspection

A 100 percent coverage pedestrian inspection confirmed that there were no surface historic properties within the current project area. The pedestrian survey concluded that the entire project area has been artificially modified as a result of resort development. As there were no surface historic properties, the archaeological inventory survey focused on a program of subsurface testing to locate any buried cultural deposits and to facilitate a thorough examination of stratigraphy and subsurface geologic features within the project area.

4.2 Results of Ground Penetrating Radar

A ground penetrating radar (GPR) survey was conducted within the project area prior to subsurface testing in an attempt to define the local stratigraphy and to prospect for buried cultural deposits. GPR survey corresponded with backhoe trench locations previously selected for subsurface testing. Thirteen of the twenty proposed test trench locations were surveyed (GPR Survey Area 1-13), with the remaining seven trench locations being inaccessible for GPR survey due to access limitation (Figure 41 and Table 7).

Two-dimensional (2D) depth profiles and horizontal slice maps of GPR data collected at each survey area were analyzed. The depth profiles consist of a subsurface profile of the GPR data, illustrating the entire range of subsurface radar penetration that was possible during the survey, while the horizontal slices are similar to plan view maps taken at arbitrary depth intervals, and are useful for displaying the general shape and spatial distribution of recorded subsurface anomalies.

4.2.1 Overview of Ground Penetrating Radar

In general, the GPR survey was successful as subsurface anomalies were able to be accurately located and maximum depth "visibility" (i.e. radar wave penetration) reached approximately 100 cm below the surface. These results are consistent with the NRCS which indicated that the project area was situated within a high GPR suitability area (see Methods discussion above; see Figure 6).

Identified subsurface anomalies within the project area were of varying size, distribution, and prominence. Due to the project area's location within urban Waikiki, observed anomalies could correspond to subsurface features associated with modern urbanization, such as: backfilled machine excavations, abandoned or in-use utility lines, buried building foundations, and miscellaneous construction debris. However, background research has indicated that the project area was also intensively utilized by both pre- and post-contact populations, thus indicating that the observed anomalies may also correspond to buried archaeological deposits including: fire pits, refuse pits, midden and artifact concentrations, and human burials. The interpretation of these anomalies prior to ground-truthing via excavation is not an exact science, but rather an educated guess based on an analysis of the size, distribution, and prominence of observed anomalies and incorporating that data with background research of the project area's prior land

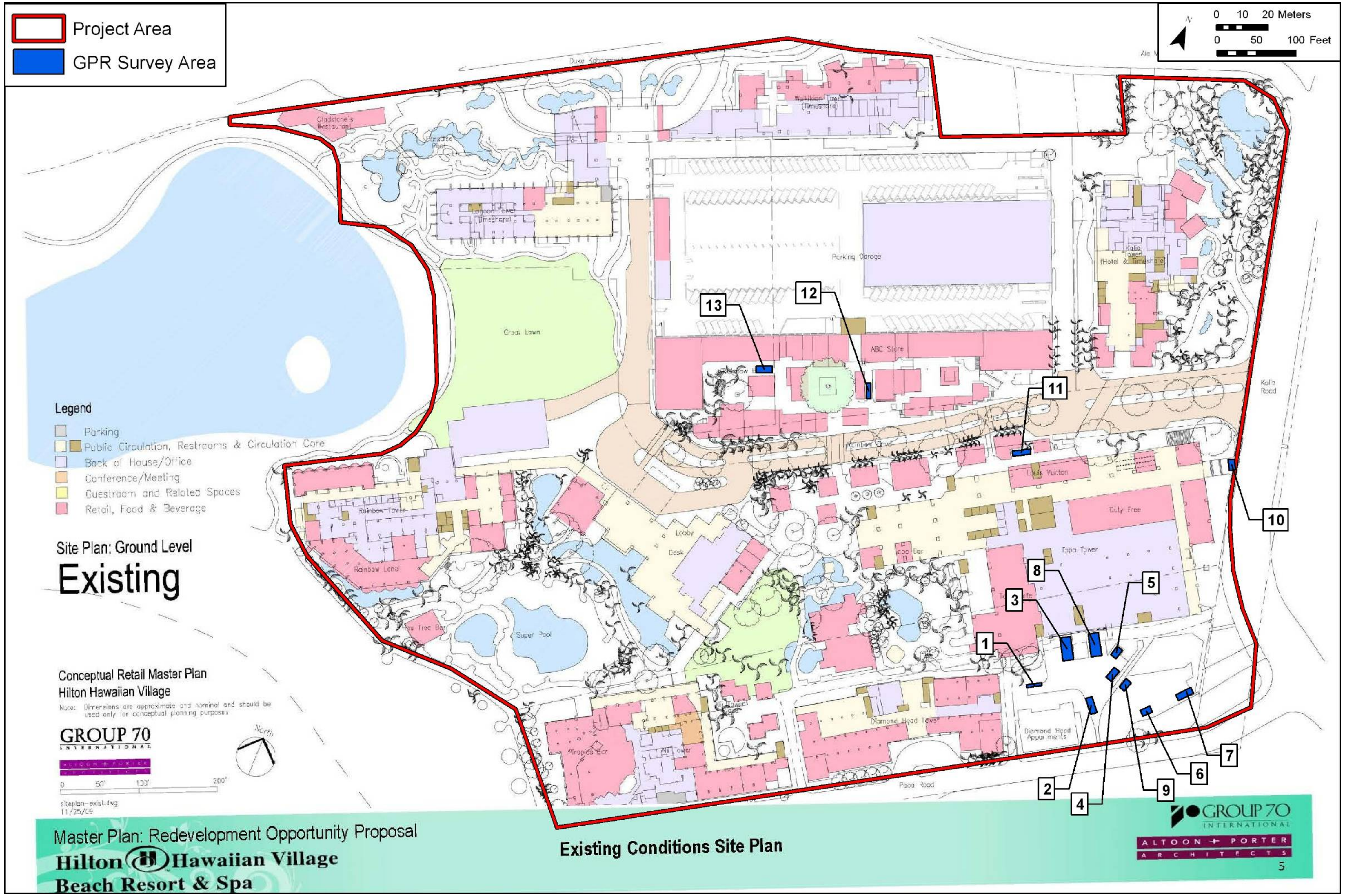

Figure 41. Site plan of existing conditions within the project area (source: Group 70 International, Inc. 2010) showing the locations of GPR survey areas

Table 7. Correlation of GPR survey areas and backhoe trenches

Backhoe Trench	GPR Survey Area	GPR Survey Access Limitation
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7	7	
8	-	Location was obscured by landscape vegetation (potted plants/areca palm)
9	9	
10	-	Location was wet, muddy, and uneven
11	-	Location was obscured by landscape vegetation (areca palm)
12	8	
13	10	
14	-	Location obscured by landscape vegetation (groundcover)
15	11	
16	-	Location beneath existing wood deck
17	-	Location beneath existing wood deck
18	-	Location beneath existing wood deck
19	12	
20	13	

use history. A detailed analysis of the observed anomalies per survey area follows this general discussion below (see GPR Data Analysis section).

The distribution and prominence of the observed subsurface anomalies within the project area indicate extensive subsurface disturbance in the form of backfilled machine excavations, utility lines, and buried concrete slabs. Anomalies associated with subsurface cultural deposits were not observed, and may have been obscured by more prominent anomalies associated with the prior development of the project area. Additionally if subsurface cultural deposits were present they would likely have been disturbed and/or completely removed during extensive development activities conducted within the project area, which spanned from modern times back into the late 1800's.

In regard to project area stratigraphy, GPR depth profiles indicated that the soils within the project area were relatively uniform, consisting of a single sediment type underlying either asphalt or concrete surfaces. The exception was the presence of horizontal banding observed from 40 to 70 cmbs within the GPR depth profiles collected at Survey Areas 1-3, 8, and 9. It is believed that this horizontal banding corresponds to buried former land surfaces which were filled over during hotel development within the project area. It is unclear if these buried former land surfaces were the result of natural soil deposition or were artificially created. However the numerous anomalies present within the horizontal banding are indicative of subsurface disturbance and seem to indicate that the buried former land surfaces were artificially created, likely associated with a historic episode of hotel development.

Overall, the analysis of GPR data suggests that project area stratigraphy consists of thin imported fill sediments associated with asphalt and concrete surfaces that overly a single, uniform sediment, which is likely Jaucas sand, based on soil survey data (Foote et al. 1972) and previous archaeological research (Hurlbett et al. 1992). While the presence of extensive Jaucas sand deposits indicate a high probability of encountering subsurface cultural deposits associated with pre-contact traditional Hawaiian habitation, GPR survey has identified extensive subsurface disturbances throughout the project area. These disturbances consist of previously excavated and backfilled machine excavations, utility lines, and buried concrete slabs, all likely associated with numerous waves of residential and resort development dating back to the late 1800's. Thus any pre-contact cultural deposits that may have been present within the project area have likely been disturbed or have been completely removed. If cultural deposits are encountered during subsurface testing, they will likely be post-contact in age, associated with historic habitation and resort development.

4.2.2 GPR Data Analysis

4.2.2.1 Survey Area 1

Survey Area 1 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 6 m by 1 m, and involved of the collection of five, 6 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 1 indicate the presence of prominent subsurface anomalies just below the surface and extending approximately 45 cmbs (Figure 42). These anomalies appear to have a solid consistency, possibly depicting metal or basalt objects, and may

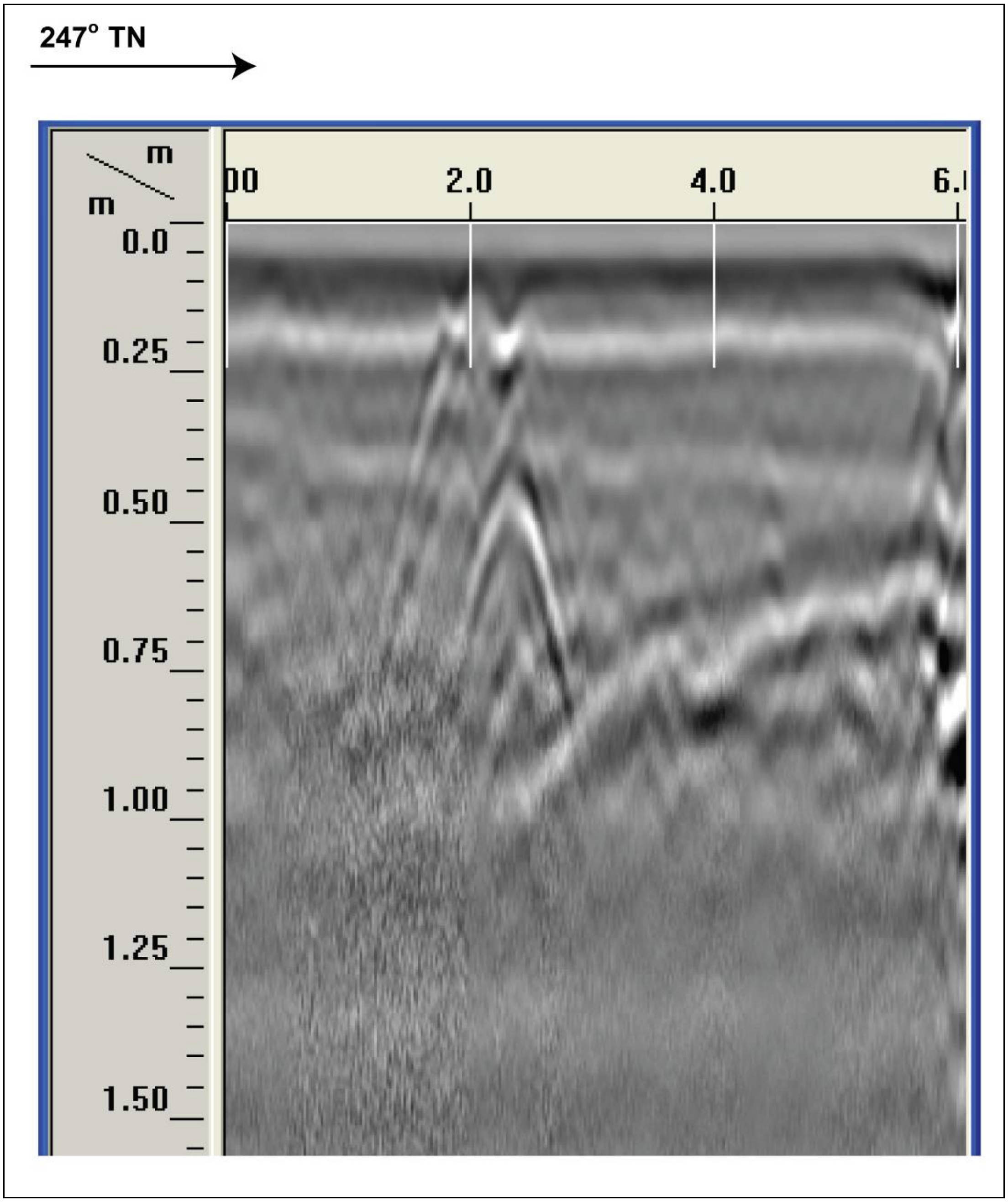

Figure 42. Representative GPR profile collected at Survey Area 1

correspond to utility lines, or artificially deposited boulder alignments. Also of note is a narrow roughly horizontal band present from 55 to 100 cmbs. This type of banding is typically associated with a change in stratigraphy and may represent the presence of a buried A-horizon (former land surface) due to its sloped and irregular topography.

A review of horizontal slice maps indicates the presence of two linear anomalies extending perpendicularly across the survey area (Figure 43). These anomalies are present from 0 to 50 cmbs and likely correspond to utility lines. A large prominent anomaly is also present at the southwestern end of the survey area (see Figure 43). The anomaly is present from 0 to 100 cmbs and may correspond to a buried concrete slab or basalt boulder. Also of note are ephemeral anomalies observed from 50 to 75 cmbs (see Figure 43). These anomalies likely correspond to the horizontal banding observed in the depth profiles and could be associated with a buried A-horizon and/or cultural deposits.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.2 Survey Area 2

Survey Area 2 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 6 m by 2 m, and involved of the collection of nine, 6 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 2 identified a large continuous concentration of subsurface anomalies throughout the entire survey area (Figure 44). The anomalies were present from 35 to 85 cmbs and are very prominent, indicating the presence of a solid object(s). The anomalies are sandwiched between two level horizontal bands, which are indicative of changes in stratigraphy. The combination of tightly packed prominent anomalies and the level horizontal banding suggests the presence of a buried artificial land surface, consisting of a concrete slab and associated fill or a buried asphalt surface with underlying subsurface utilities. Regardless of the exact source of the anomalies and horizontal banding, it is clear that extensive subsurface disturbance is present immediately beneath the surface in this area.

Horizontal slice maps corroborate the analysis generated from the depth profiles. Anomalies appear to be arranged in linear patterns which run both parallel and perpendicular to the survey area, indicating the presence of numerous utility lines beneath the ground surface (Figure 45).

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.3 Survey Area 3

Survey Area 3 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 9 m by 4 m, and involved of the collection of 17, 9 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 3 identified a large continuous concentration of subsurface anomalies throughout the entire survey area (Figure 46). The anomalies were present from 45 to 100 cmbs and are very prominent, indicating the presence of a solid object(s). Horizontal banding is present just above the anomaly concentration and may indicate the

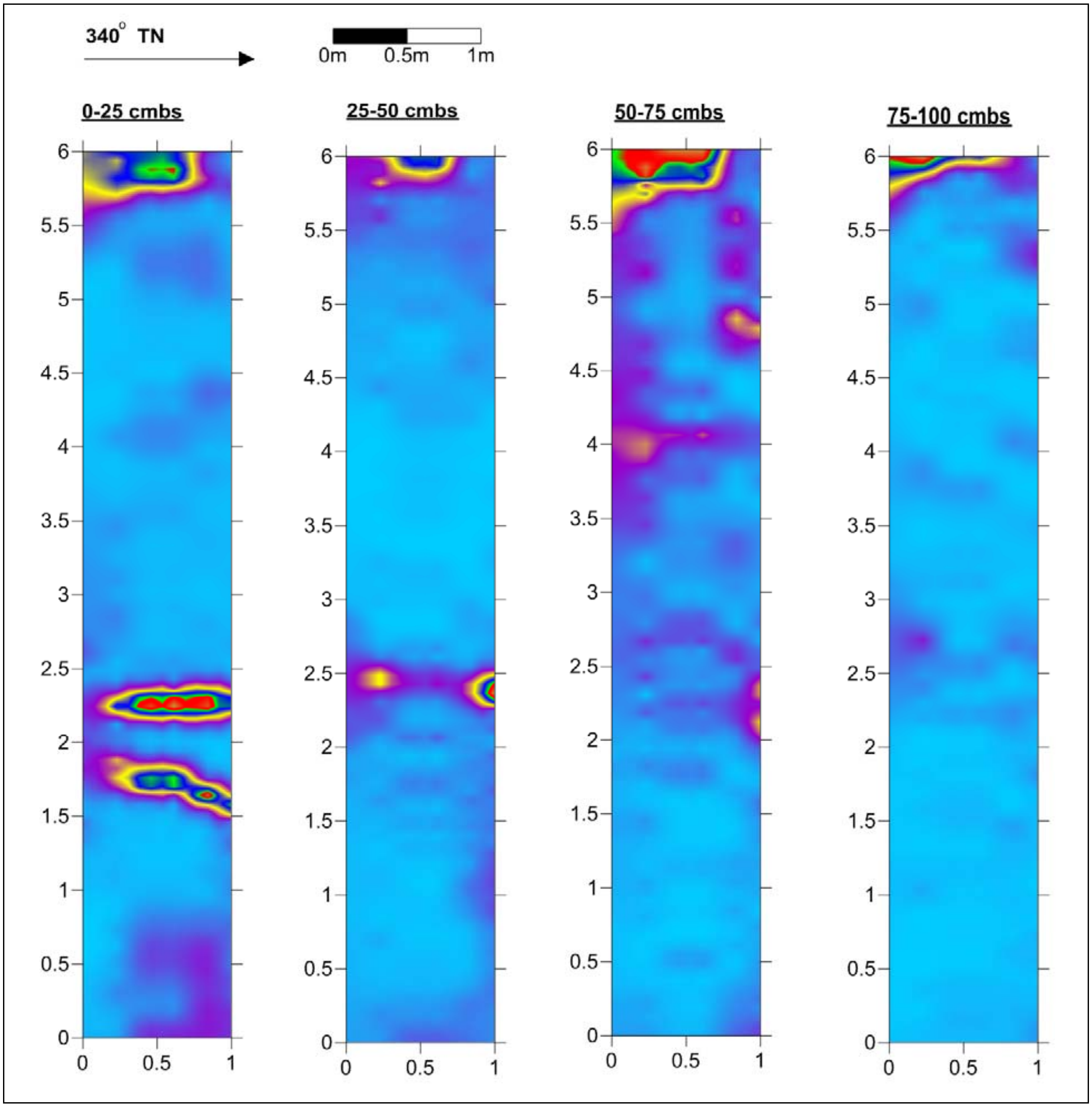

Figure 43. Horizontal slice maps collected at Survey Area 1

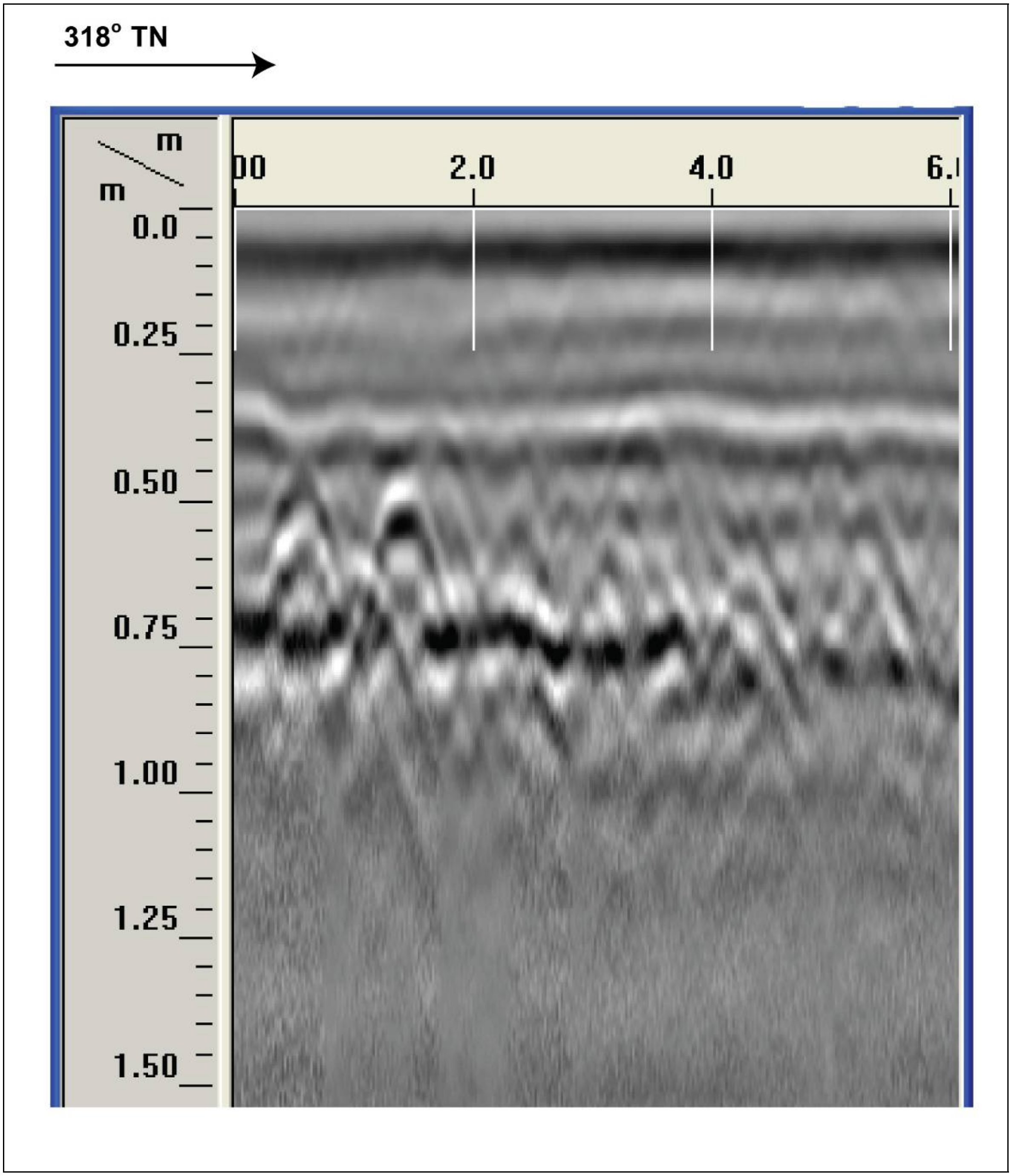

Figure 44. GPR profile collected at Survey Area 2

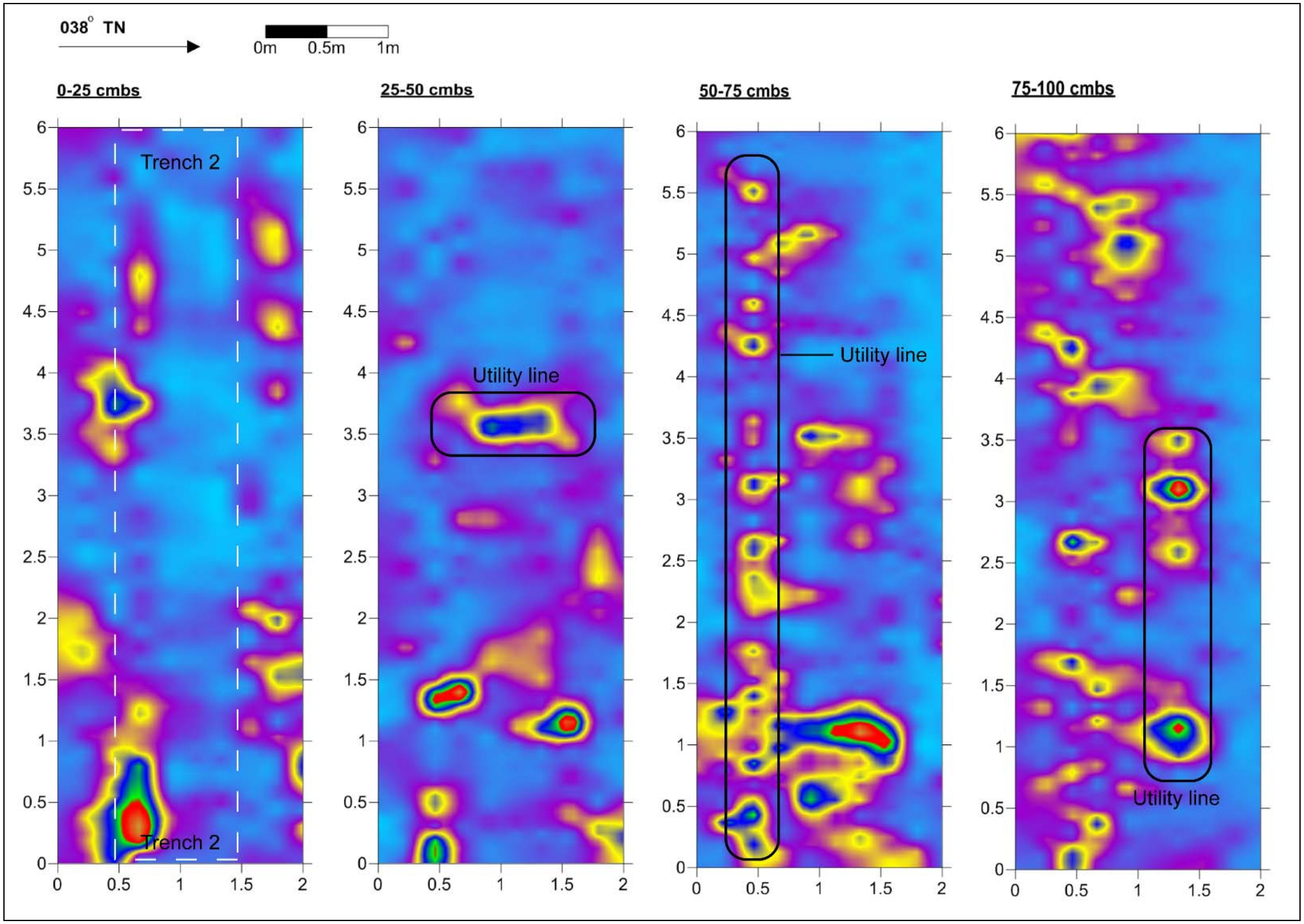

Figure 45. Horizontal slice maps collected at Survey Area 2

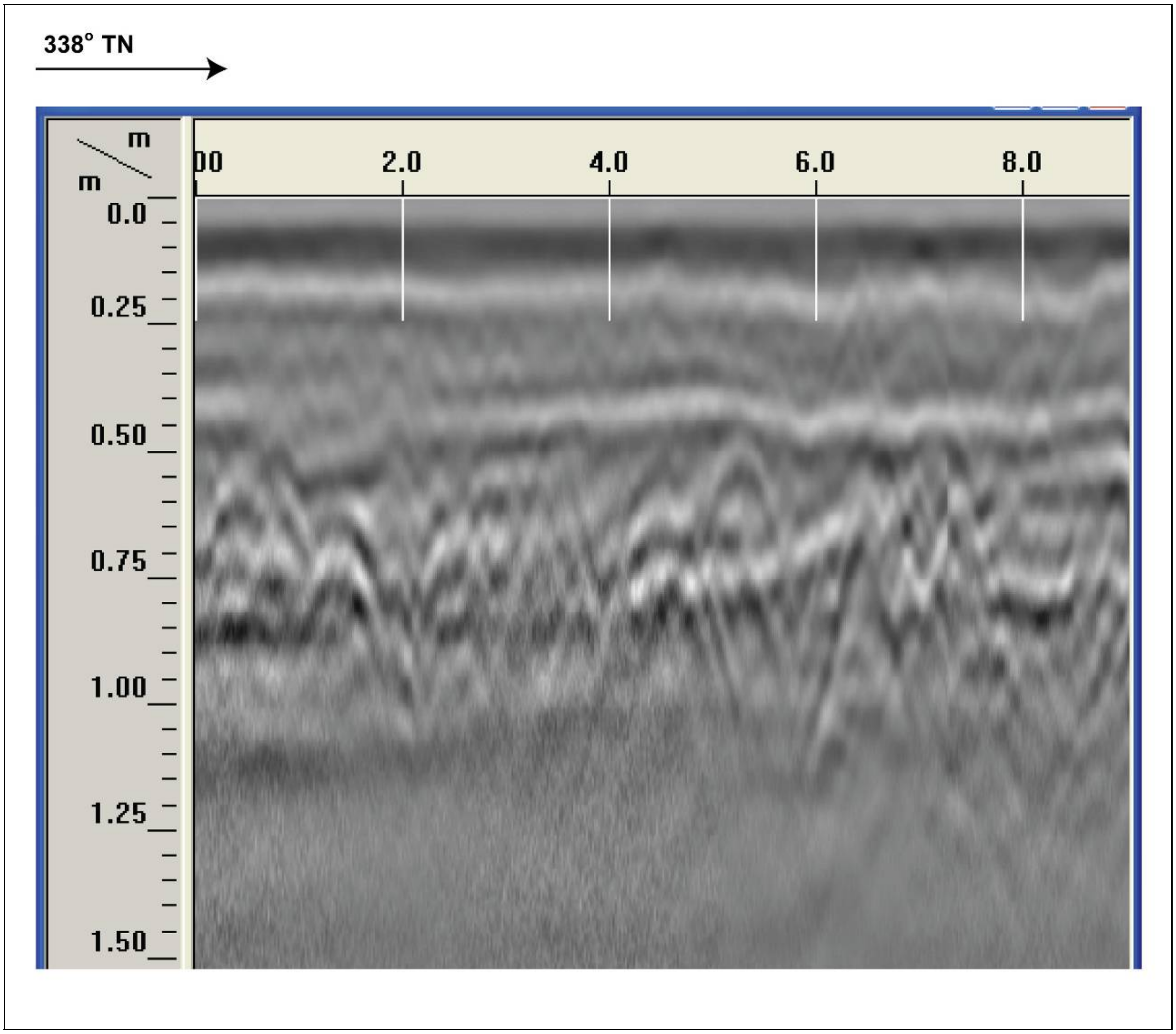

Figure 46. GPR profile collected at Survey Area 3

presence of a buried artificial land surface, consisting of a concrete slab and associated fill or a buried asphalt surface with underlying subsurface disturbance (i.e., backfilled machine excavations). Regardless of the exact source of the anomalies and horizontal banding, it is clear that extensive subsurface disturbance is present immediately beneath the surface in this area.

Horizontal slice maps collected from Survey Area 3 indicated numerous anomalies scattered throughout the entire area (Figure 47). The anomalies are present from 0 to 100 cmbs and have no apparent pattern or shape, indicating that they may be associated with a buried concrete slab or are related to extensive subsurface disturbance (i.e., backfilled machine excavations).

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.4 Survey Area 4

Survey Area 4 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 5 m by 2 m, and involved of the collection of 9, 5 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 4 identified moderate subsurface disturbance and a potential utility line (Figure 48). The subsurface disturbance, likely associated with a backfilled machine excavation, is represented by dense clusters of anomalies focused at the southern end of the survey area, ranging in depth from 0 to 75 cmbs. Just below this cluster of anomalies is a more prominent anomaly at a depth of 80 cmbs, which may represent a utility line.

Horizontal slice maps collected from Survey Area 4 also indicate subsurface disturbance and potential utility lines within the southern end of the survey area (Figure 49). These subsurface disturbances appear to originate just below the surface and extend to 100 cmbs, the maximum range of the GPR survey.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.5 Survey Area 5

Survey Area 5 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 4 m by 2 m, and involved of the collection of nine, 4 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 5 identified subtle anomalies throughout the entire survey area that may correspond to subsurface disturbance and/or cultural deposits (Figure 50).

Horizontal slice maps collected from Survey Area 5 indicate no clear pattern to the anomalies, thus making an accurate interpretation difficult (Figure 51). However due to their location within an area that has undergone numerous episodes of redevelopment, it is likely that these anomalies correspond to subsurface disturbances associated with backfilled machine excavations.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

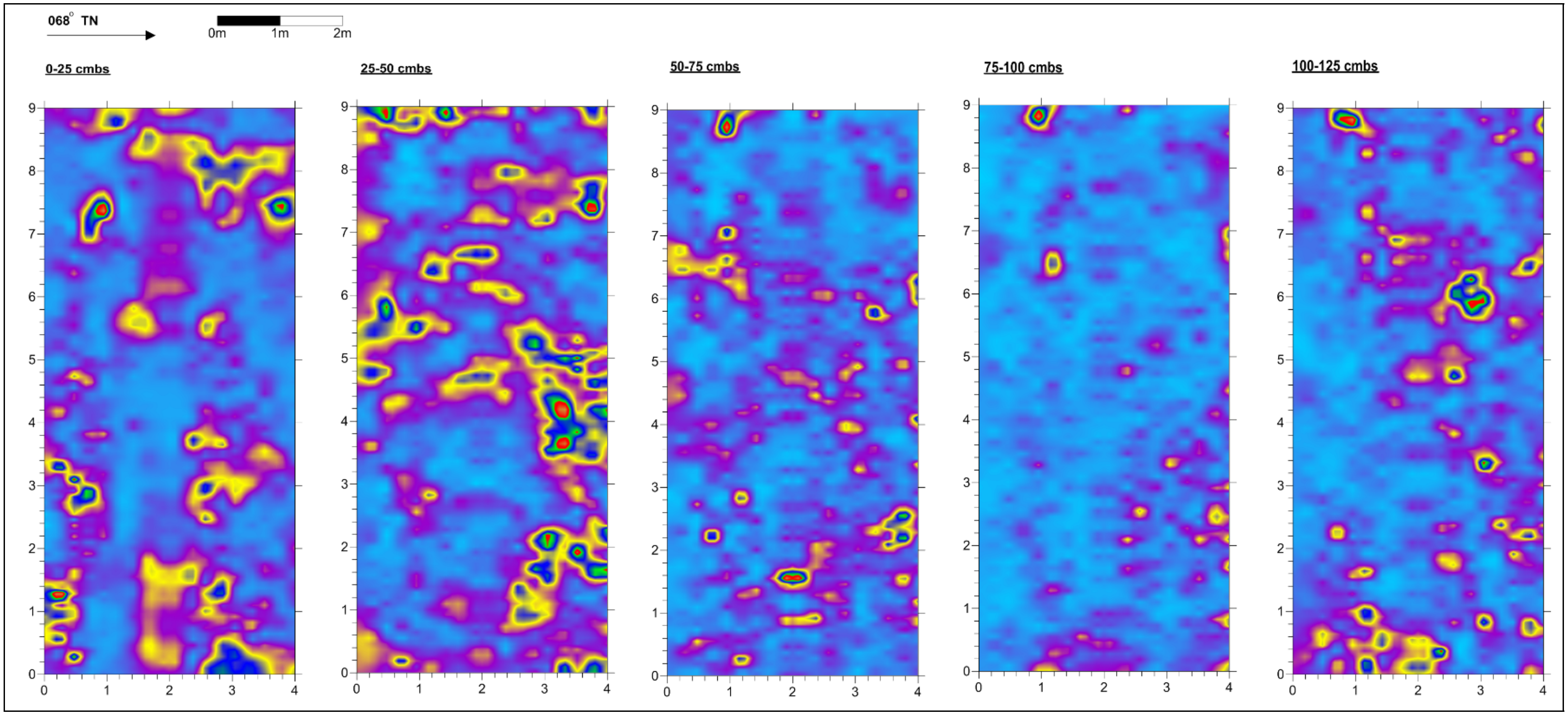

Figure 47. Horizontal slice maps collected at Survey Area 3

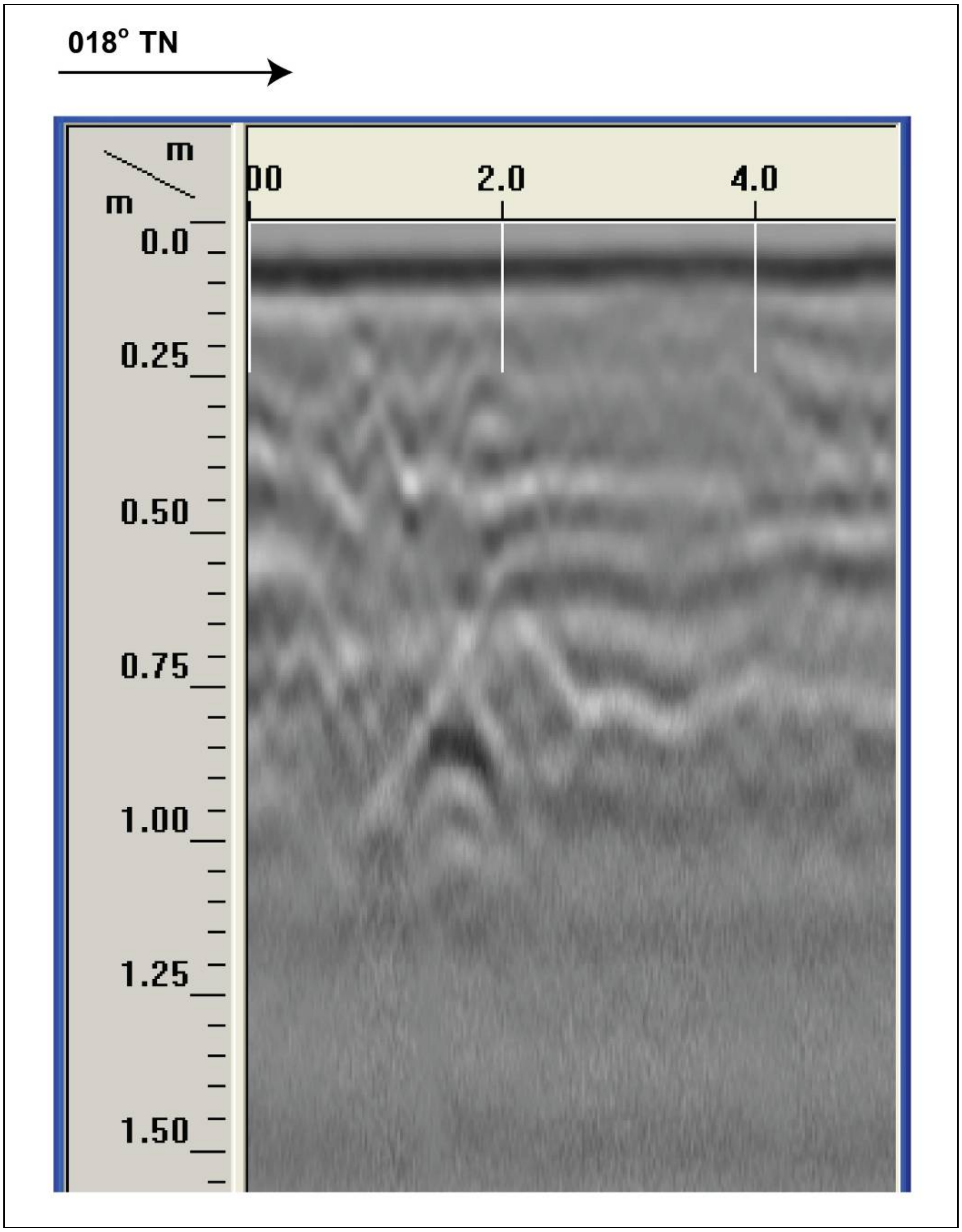

Figure 48. GPR profile collected at Survey Area 4

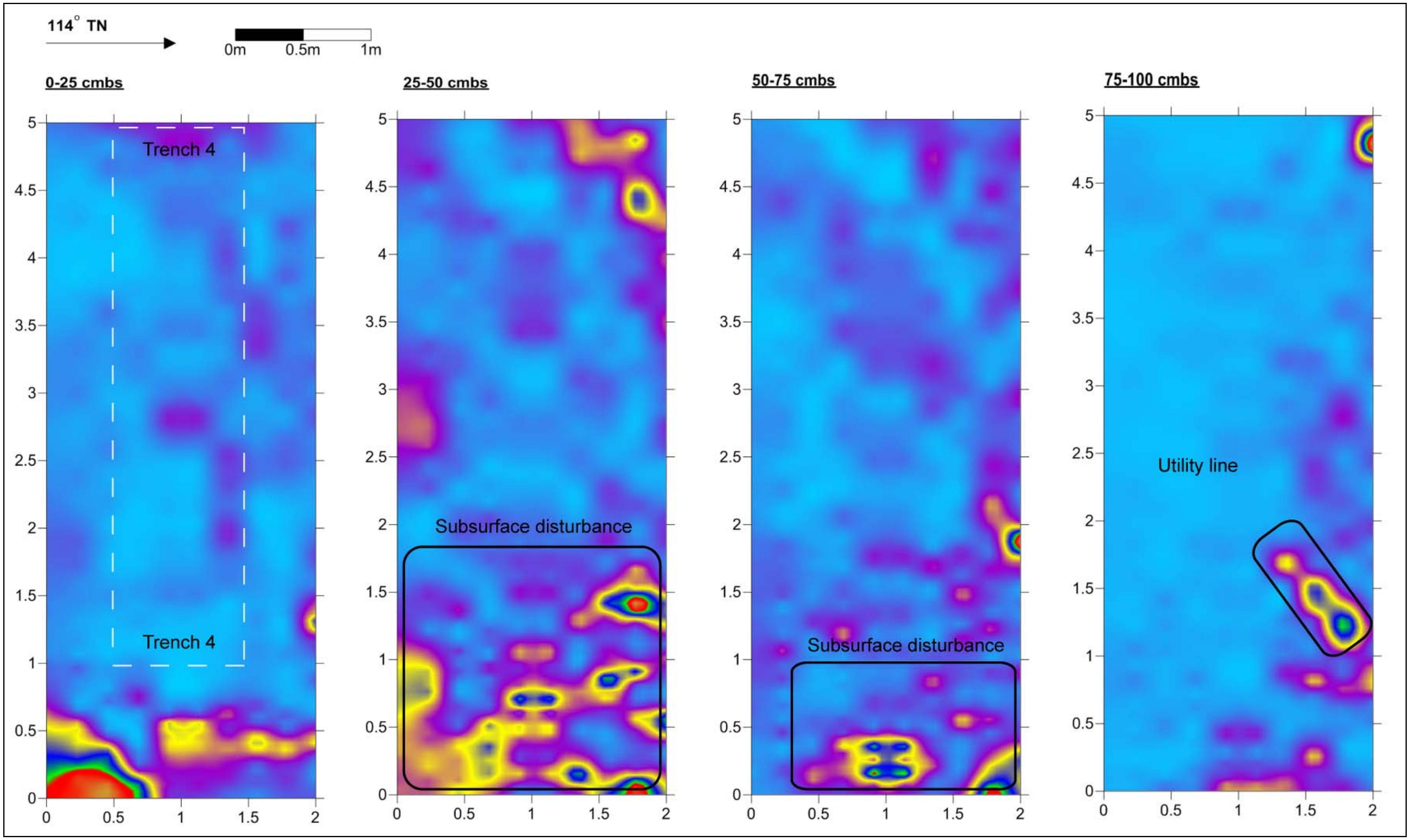

Figure 49. Horizontal slice maps collected at Survey Area 4

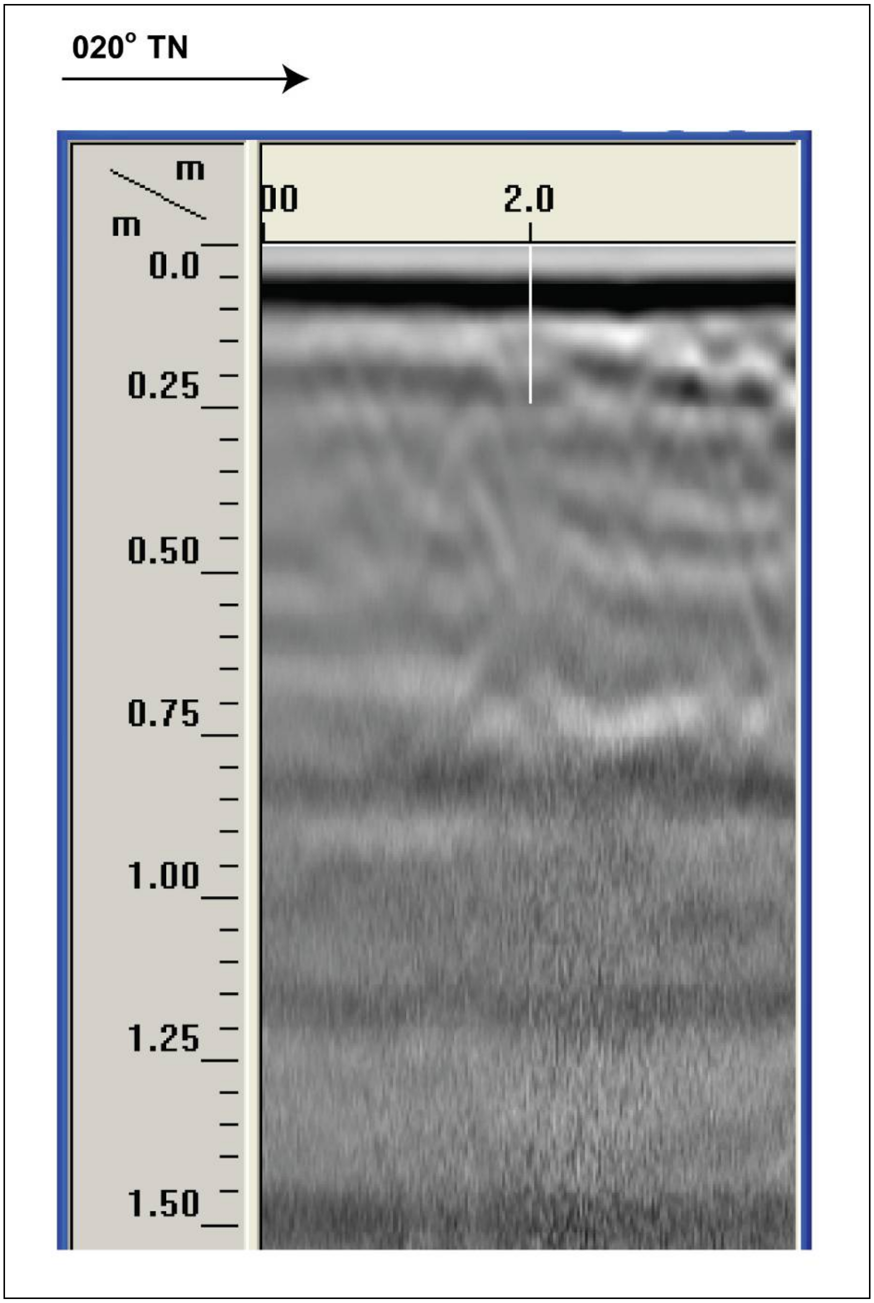

Figure 50. GPR profile collected at Survey Area 5

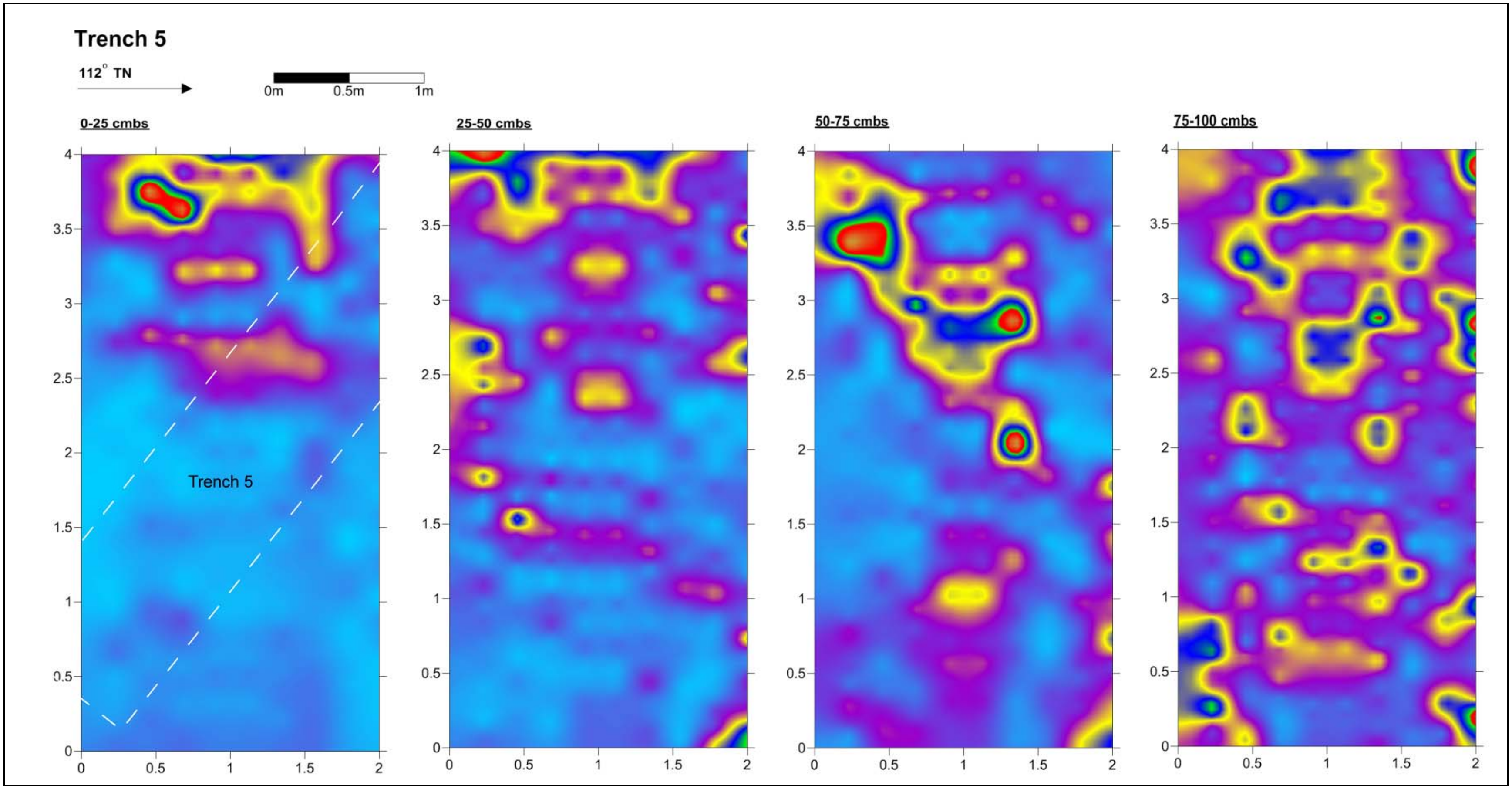

Figure 51. Horizontal slice maps collected at Survey Area 5

4.2.2.6 Survey Area 6

Survey Area 6 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 6 m by 2 m, and involved of the collection of nine, 6 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 6 indicate the presence of concrete within the northeastern end of the survey area, at a depth of 35 cmbs (Figure 52).

A review of horizontal slice maps corroborates the data from the depth profiles, indicating a large mass of anomalies within the northeastern end of the survey area (Figure 53). The buried concrete may be associated with a utility jacket or could be the edge of a monitoring well which is known to be in the immediate area.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.7 Survey Area 7

Survey Area 7 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 6 m by 2 m, and involved of the collection of nine, 6 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 7 identified subtle anomalies throughout the entire survey area that may correspond to subsurface disturbance and/or cultural deposits (Figure 54).

Horizontal slice maps collected from Survey Area 7 indicate no clear pattern to the anomalies, thus making an accurate interpretation difficult (Figure 55). However due to their location within an area that has undergone numerous episodes of redevelopment, it is likely that these anomalies correspond to subsurface disturbances associated with backfilled machine excavations.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.8 Survey Area 8

Survey Area 8 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 9 m by 4 m, and involved of the collection of 17, 9 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 8 identified large concentrations of subsurface anomalies throughout the entire survey area (Figure 56). The anomalies were present from 0 to 150 cmbs and likely represent extensive subsurface disturbances associated with backfilled machine excavations.

Horizontal slice maps collected from Survey Area 8 indicated numerous anomalies scattered throughout the entire area (Figure 57). The anomalies have no apparent pattern or shape making an accurate interpretation difficult. However due to their location within an area that has undergone numerous episodes of redevelopment, it is likely that these anomalies correspond to subsurface disturbances associated with backfilled machine excavations.

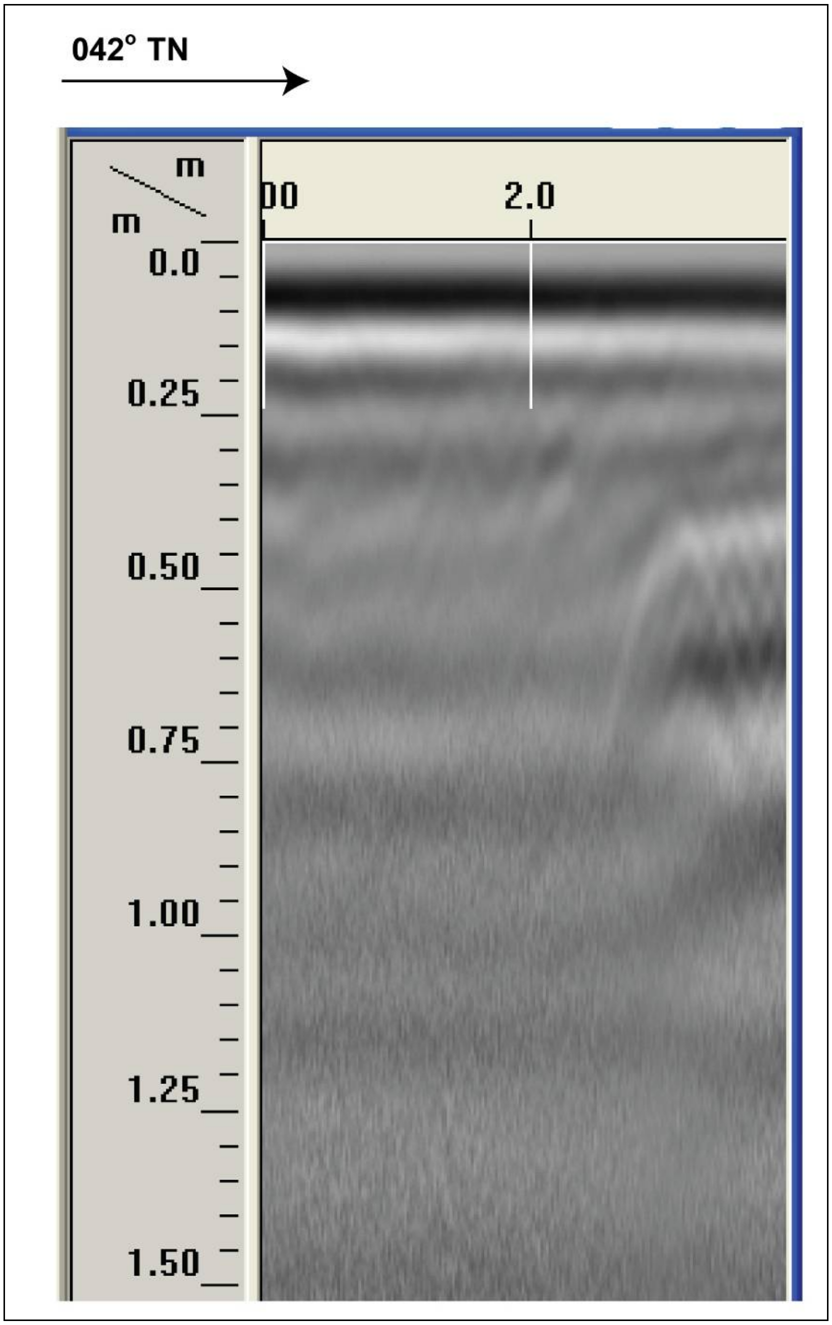

Figure 52. GPR profile collected at Survey Area 6

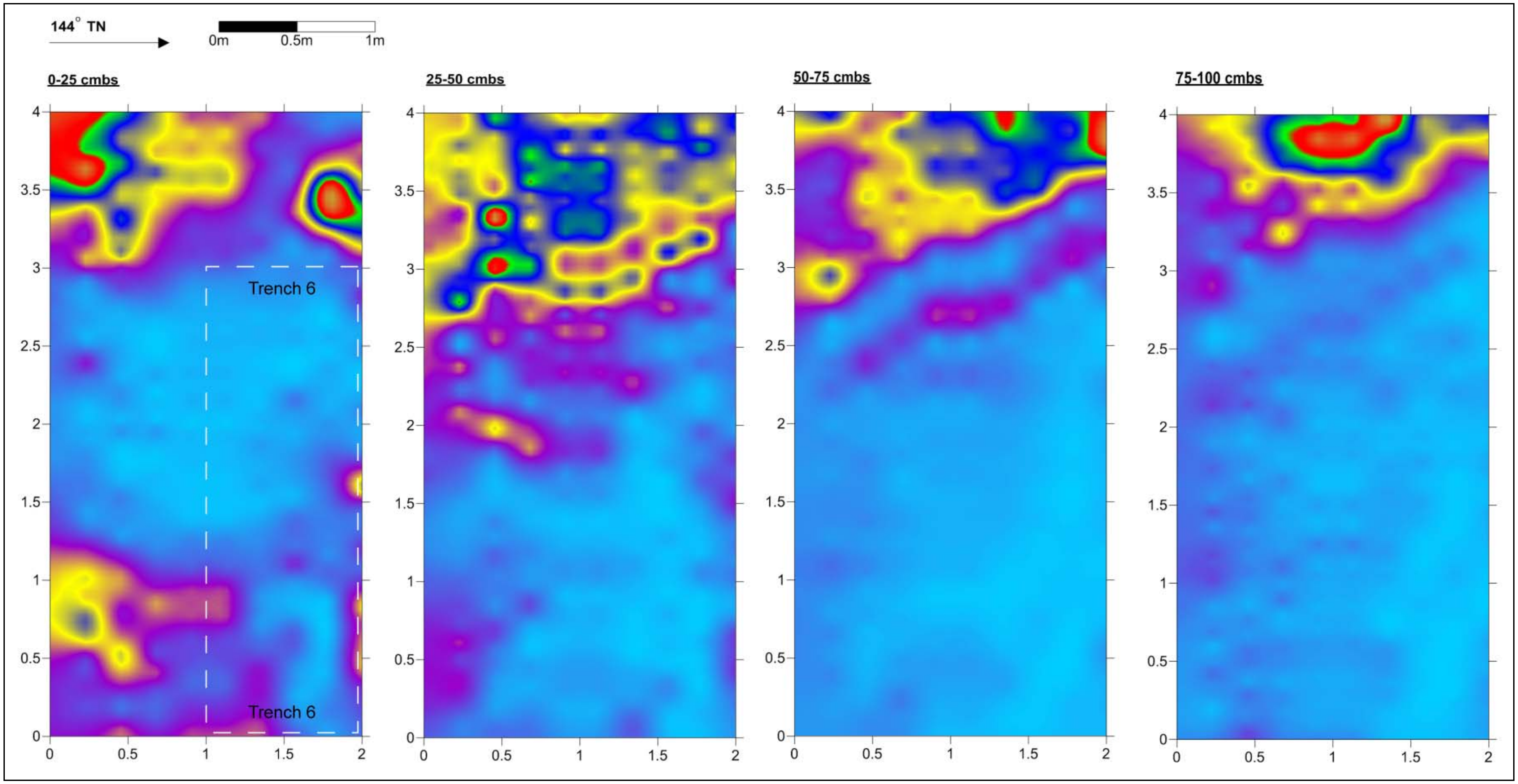

Figure 53. Horizontal slice maps collected at Survey Area 6

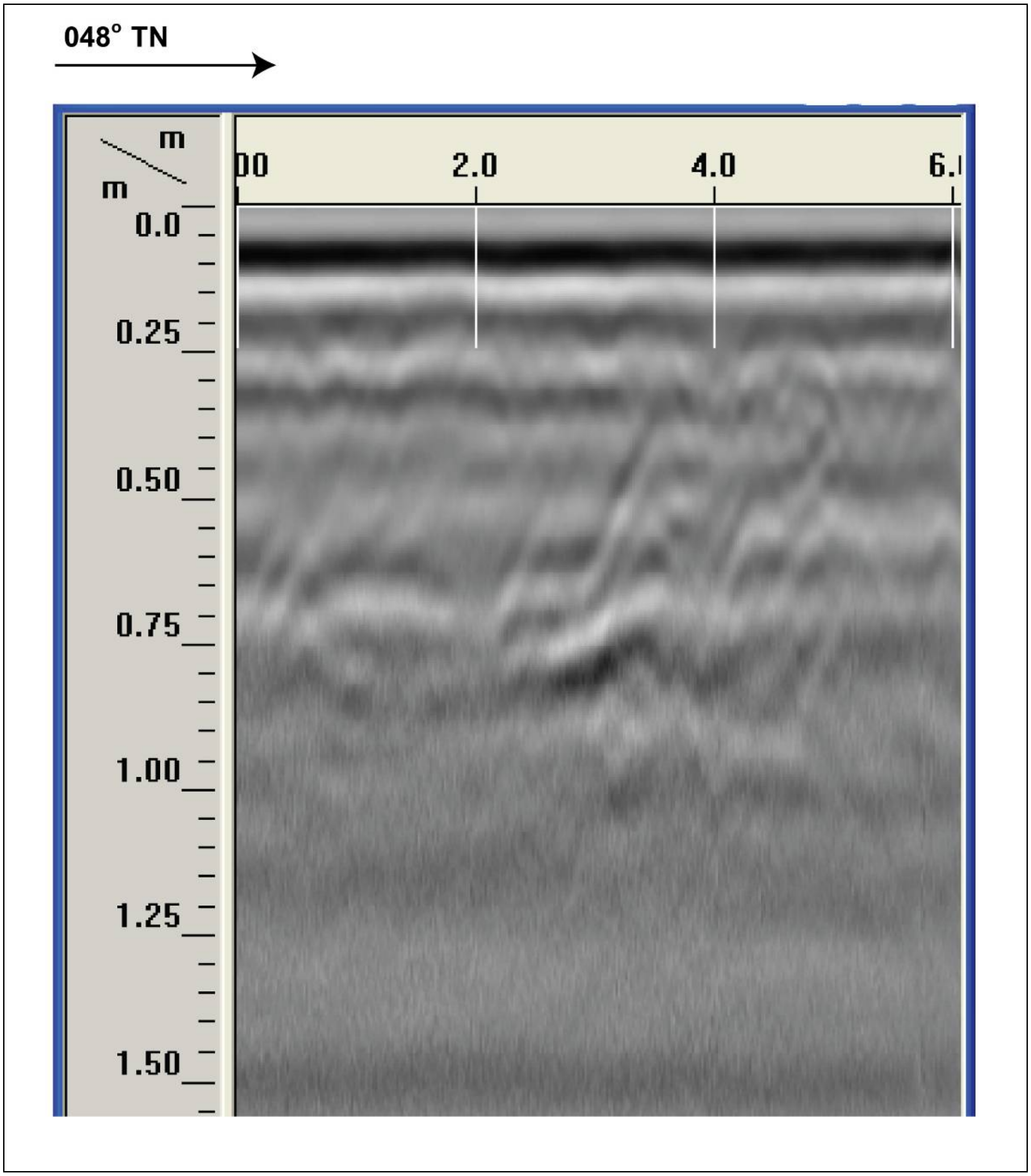

Figure 54. GPR profile collected at Survey Area 7

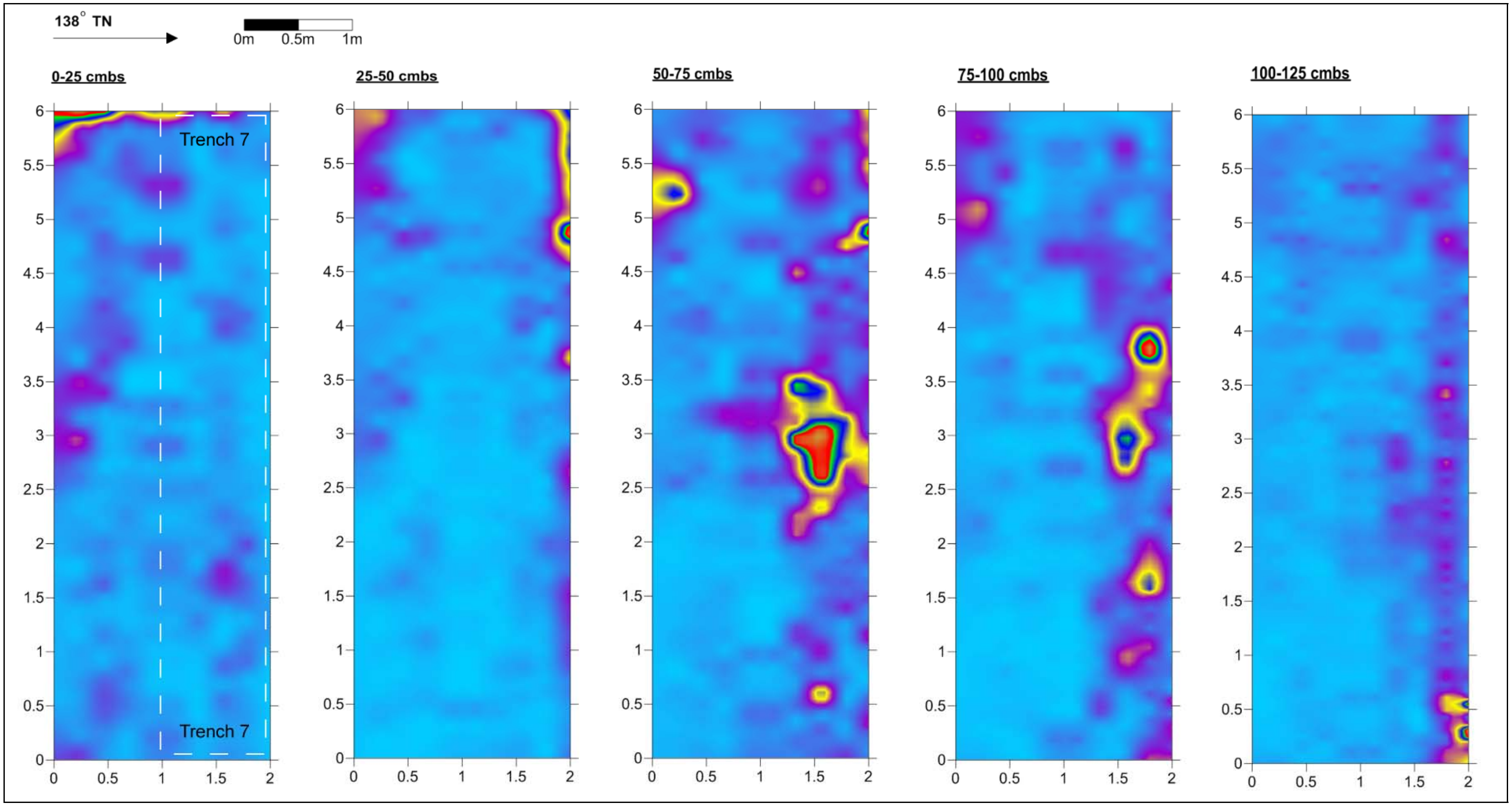

Figure 55. Horizontal slice maps collected at Survey Area 7

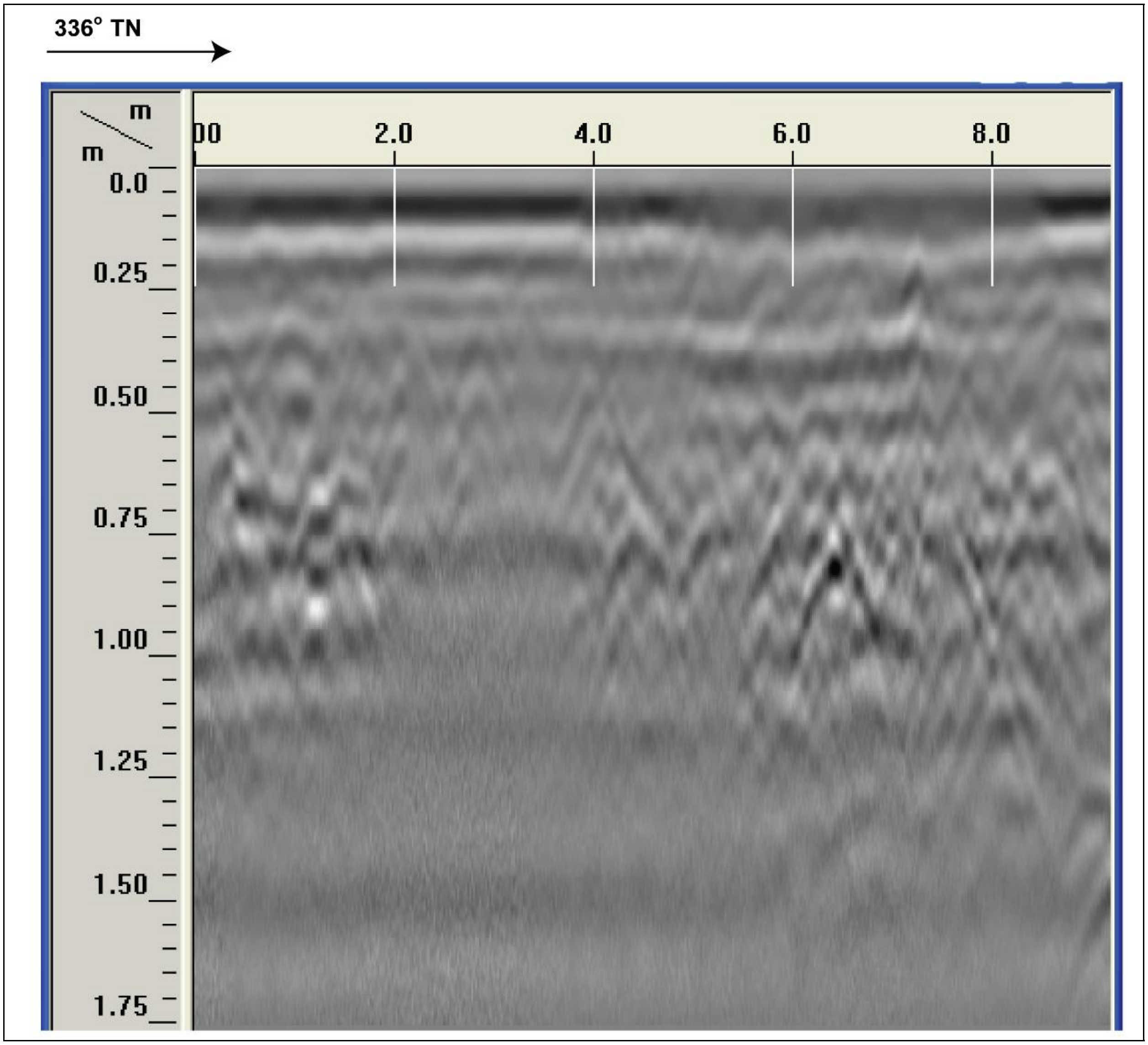

Figure 56. GPR depth profile collected at Survey Area 8

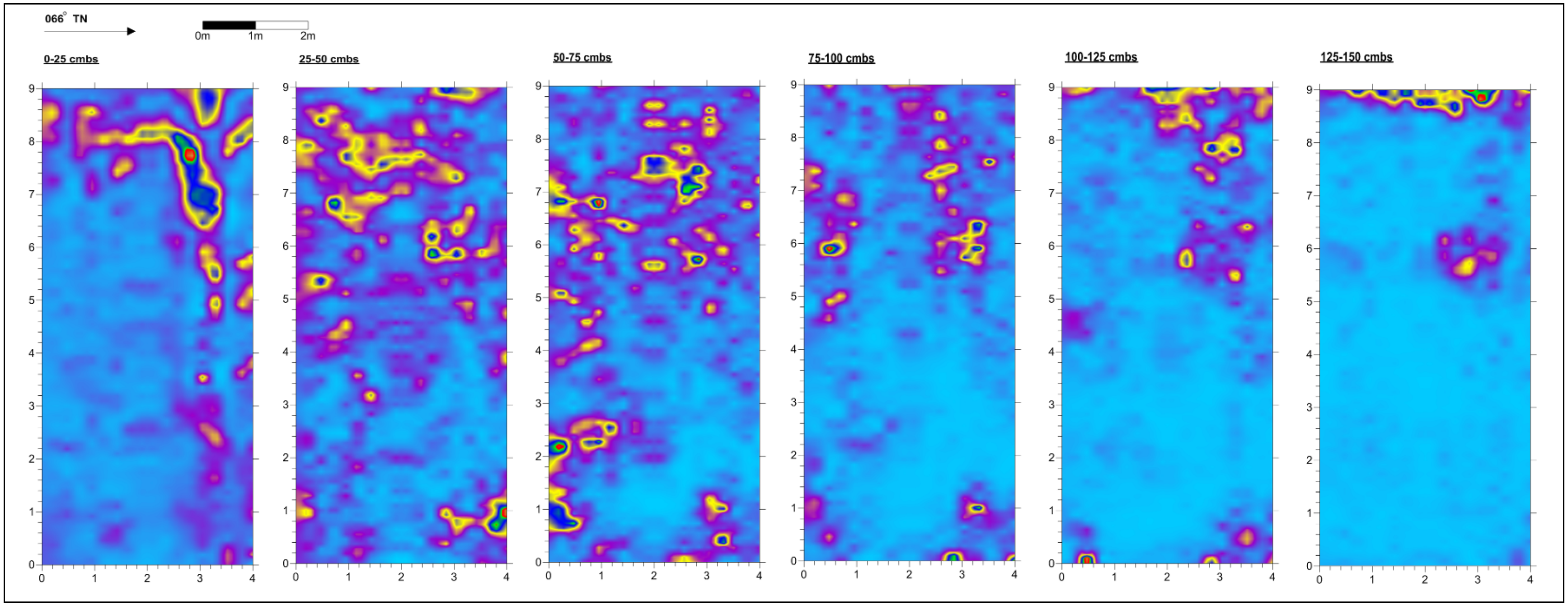

Figure 57. Horizontal slice maps collected at Survey Area 8

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.9 Survey Area 9

Survey Area 9 was located near the southern boundary of the project area, within an existing asphalt roadway (see Figure 41). The survey area measured approximately 4 m by 2 m, and involved of the collection of nine, 4 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 9 identified extensive horizontal banding within the western half of the survey area (Figure 58). This banding is indicative of changes in stratigraphy, and indicates that there may be extensive imported fill deposits in this area.

Horizontal slice maps collected from Survey Area 9 also show some type of subsurface deposits within the western half of the survey area (Figure 59). A concrete median is located along the western edge of the survey area, thus the horizontal banding and anomaly clusters shown in the profile and slice maps may be associated with ground stabilization (i.e., filling) for the median construction.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.10 Survey Area 10

Survey Area 10 was located near the eastern boundary of the project area, within a flagstone-paved walkway fronting Kalia Road (see Figure 41). The survey area measured approximately 4 m by 2 m, and involved of the collection of nine, 4 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 10 indicate the presence of concrete just below the surface within the entire survey area (Figure 60). Based on the profile data the concrete appears to be at least 40 cm thick. No anomalies were observed beneath the concrete; however, the thickness of the concrete could have attenuated the radar signal obscuring any anomalies that may be present.

A review of horizontal slice maps corroborates the data from the depth profiles, indicating numerous linear groupings of anomalies commonly associated with rebar set into concrete (Figure 61).

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.11 Survey Area 11

Survey Area 11 was located in the middle eastern portion of the project area, within a flagstone-paved walkway (see Figure 41). The survey area measured approximately 7 m by 2 m, and involved of the collection of nine, 7 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 11 indicate the presence of concrete just below the surface within the entire survey area (Figure 62). Based on the profile data the concrete appears to be at least 30 cm thick. Two anomalies were observed beneath the concrete and may correspond to subsurface utility lines.

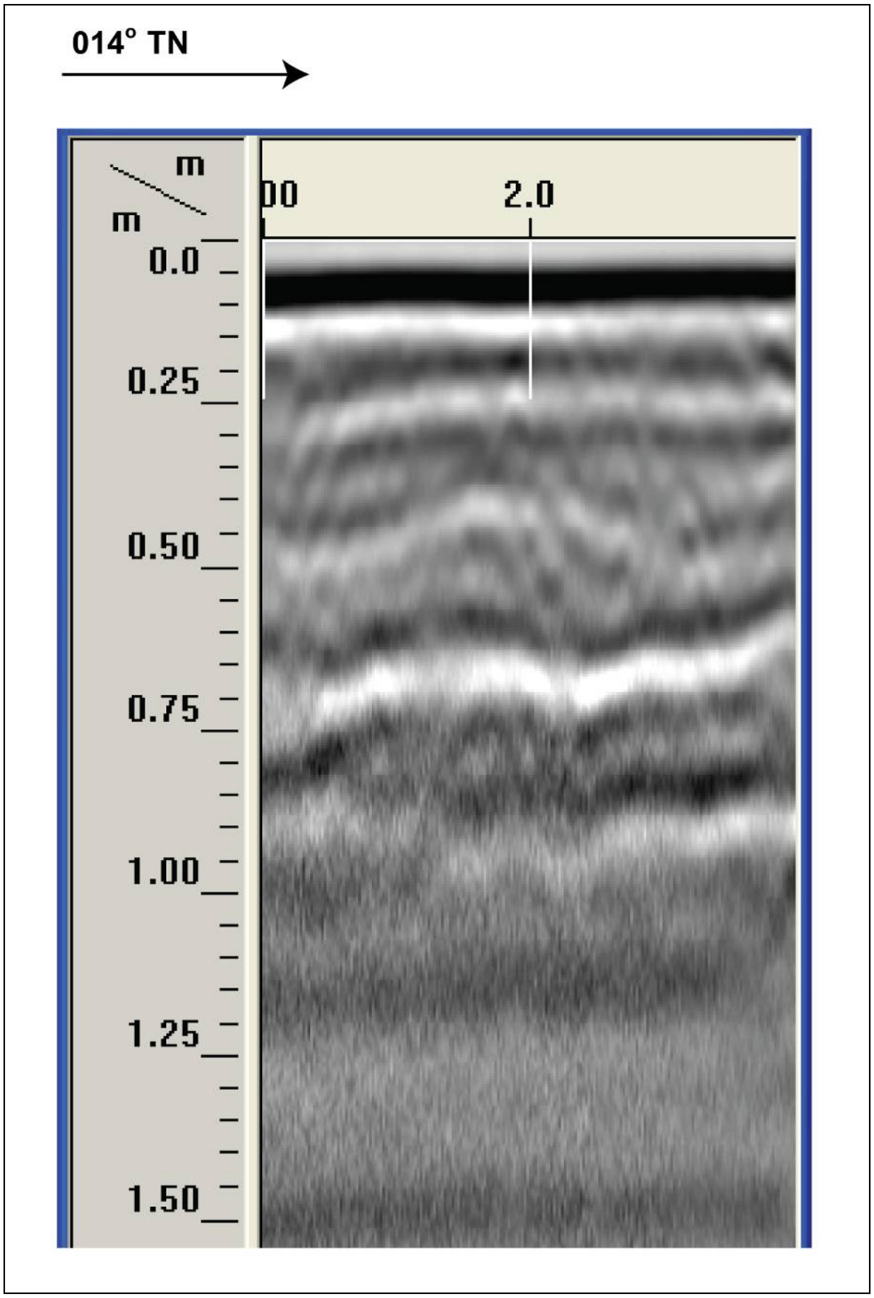

Figure 58. GPR depth profile collected at Survey Area 9

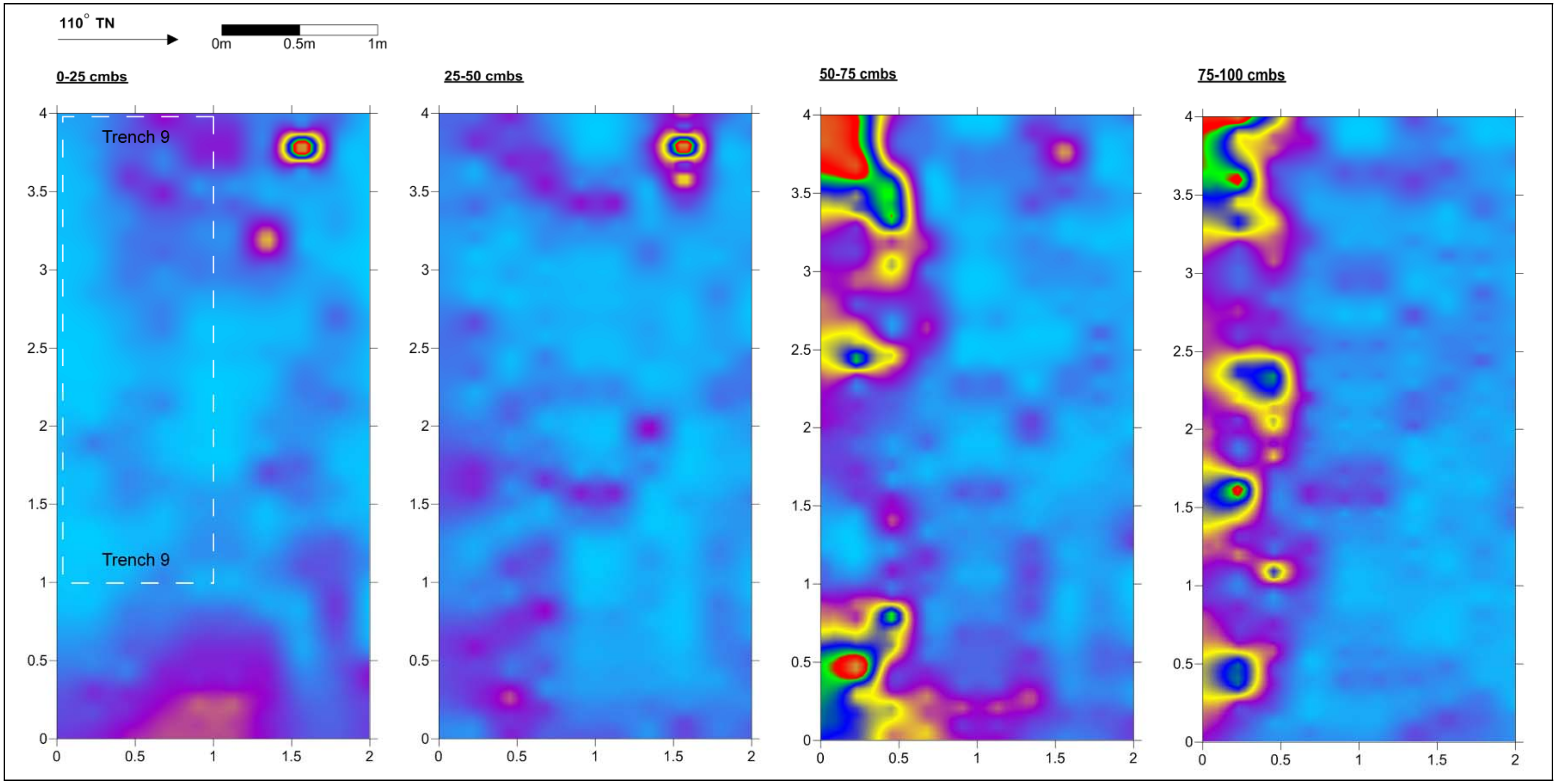

Figure 59. Horizontal slice maps collected at Survey Area 9

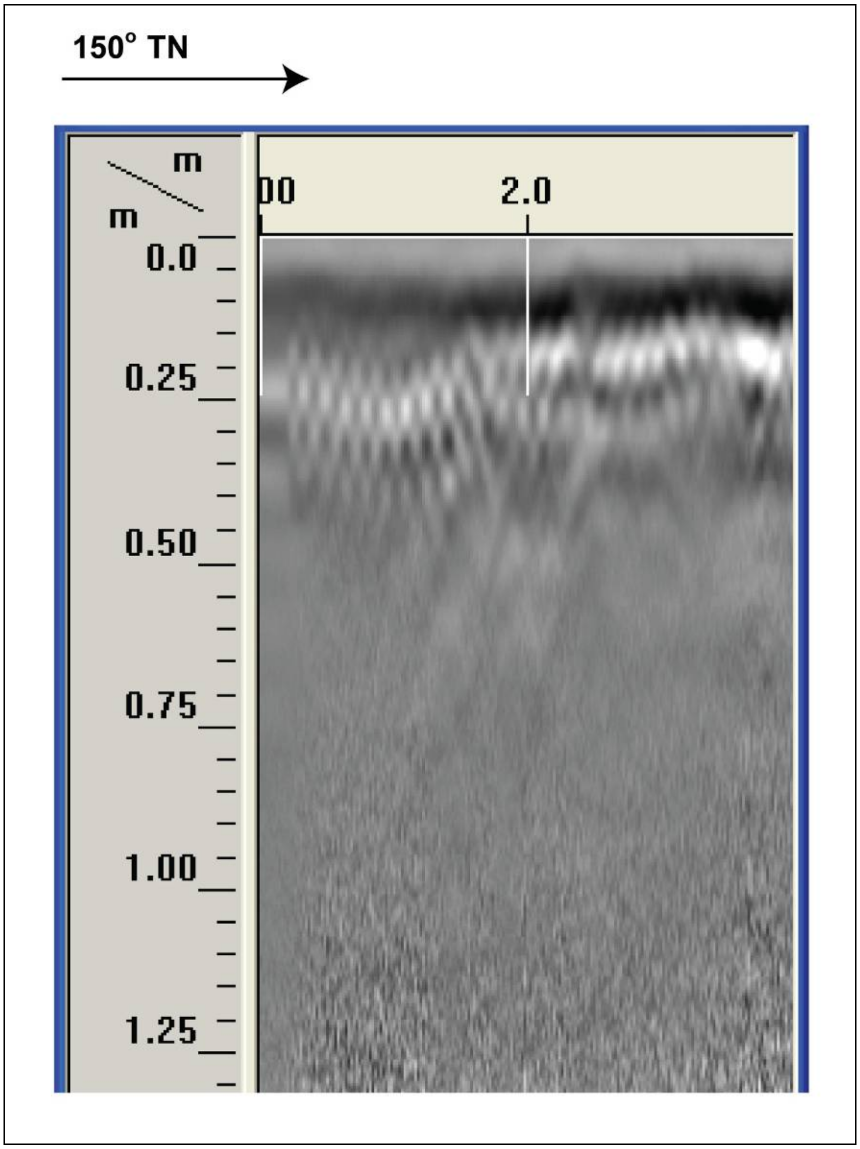

Figure 60. GPR depth profile collected at Survey Area 10

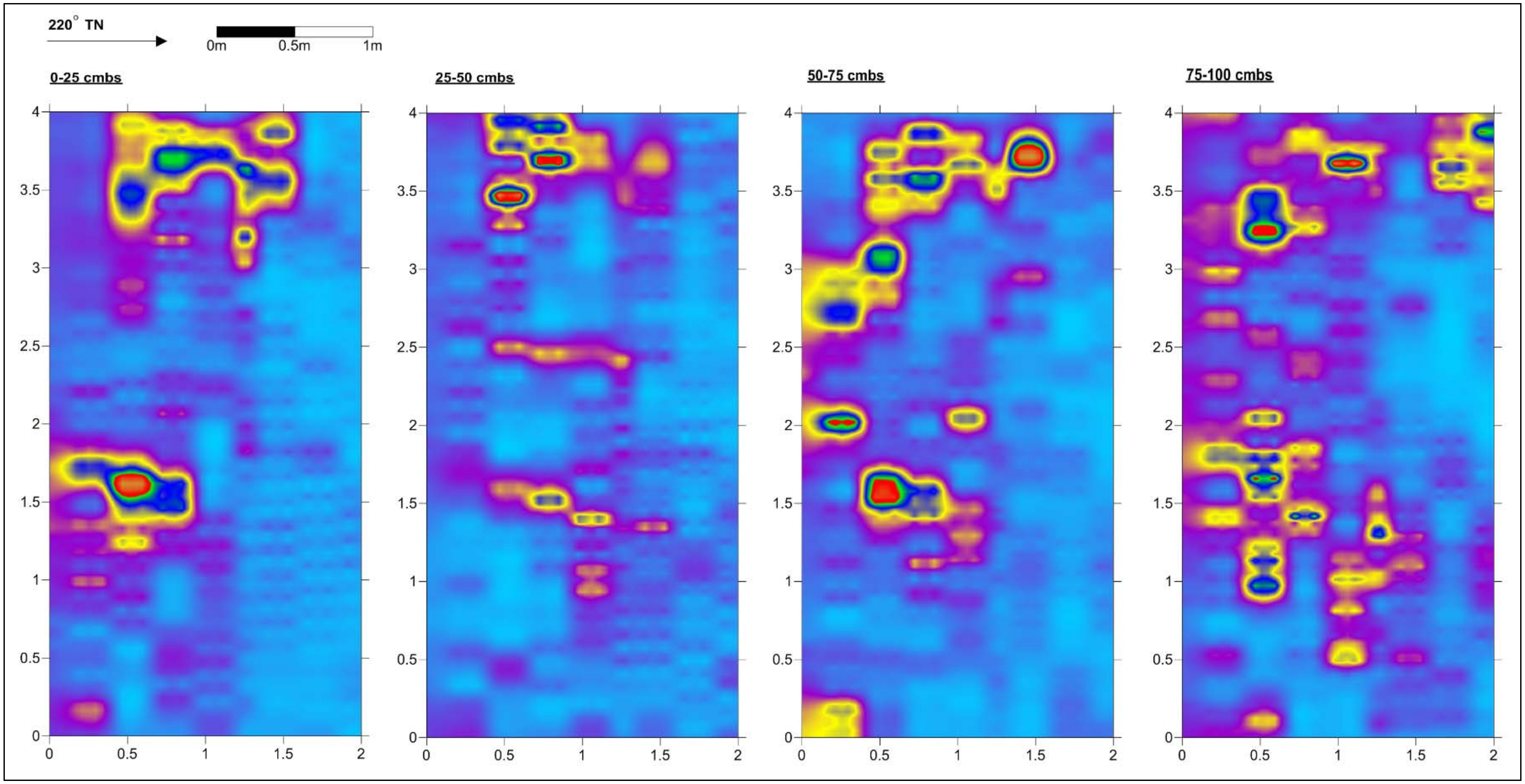

Figure 61. Horizontal slice maps collected at Survey Area 10

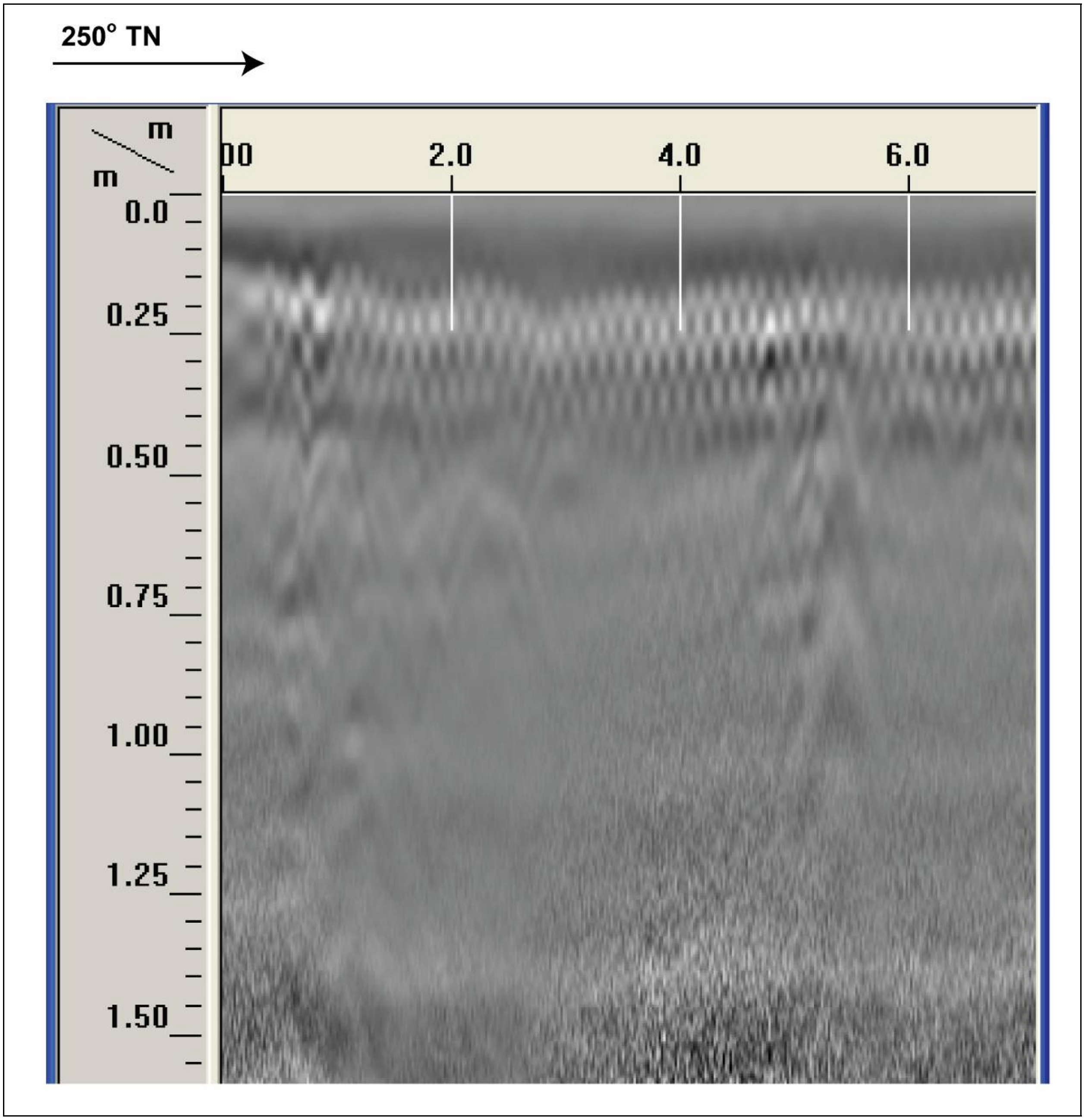

Figure 62. GPR depth profile collected at Survey Area 11

A review of horizontal slice maps corroborates the data from the depth profiles, indicating numerous linear groupings of anomalies commonly associated with rebar set into concrete (Figure 63). A linear anomaly, likely a utility line, and an isolated and very pronounced anomaly, possibly a basalt boulder, are also shown.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.12 Survey Area 12

Survey Area 12 was located roughly in the middle of the project area, within a flagstone-paved walkway (see Figure 41). The survey area measured approximately 6 m by 1.5 m, and involved of the collection of nine, 6 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 12 indicate extensive subsurface disturbance within the entire survey area (Figure 64). A prominent anomaly at 50 cmbs likely represents a utility line associated with the subsurface disturbance.

A review of horizontal slice maps corroborates the data from the depth profiles, indicating numerous amorphous groupings of anomalies likely associated with subsurface disturbance (Figure 65). Two linear anomalies are also shown crossing though the survey area, likely associated with utility lines.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

4.2.2.13 Survey Area 13

Survey Area 13 was located roughly in the middle of the project area, within a concrete walkway (see Figure 41). The survey area measured approximately 6 m by 2.5 m, and involved of the collection of 11, 6 m long transects spaced 25 cm apart.

GPR depth profiles collected at Survey Area 13 identified large concentrations of subsurface anomalies throughout the entire survey area (Figure 66). The anomalies were present from 0 to 150 cmbs and likely represent extensive subsurface disturbances associated with backfilled machine excavations.

Horizontal slice maps collected from Survey Area 13 indicated a long linear anomaly running through the length of the survey area (Figure 67). This may correspond to a seam in the concrete surface in which the survey area is situated. Additionally numerous linear groupings of anomalies commonly associated with rebar set into concrete were observed throughout the survey area.

Subsurface testing is recommended to ground truth the initial GPR analysis and to provide additional data for more accurate interpretation.

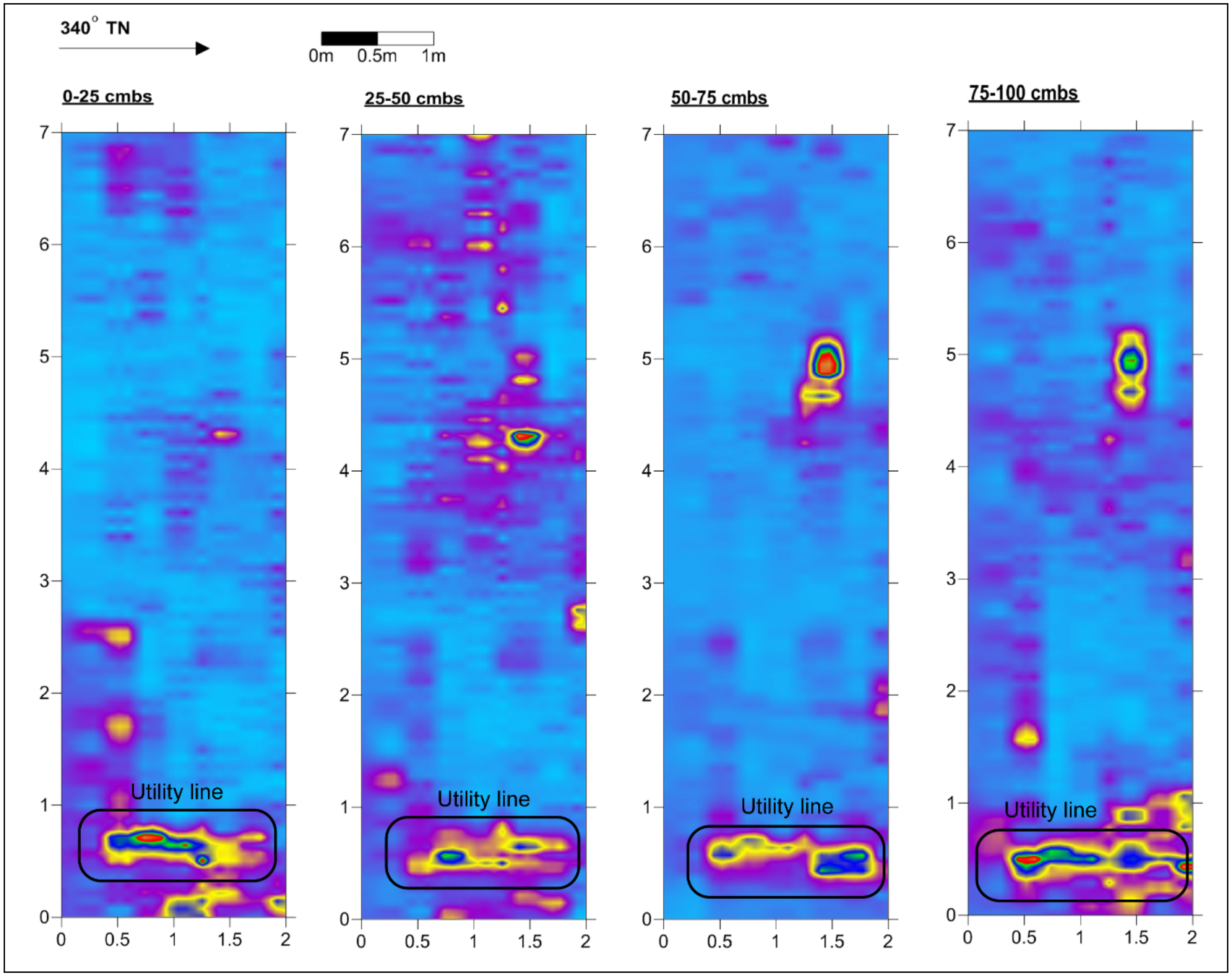

Figure 63. Horizontal slice maps collected at Survey Area 11

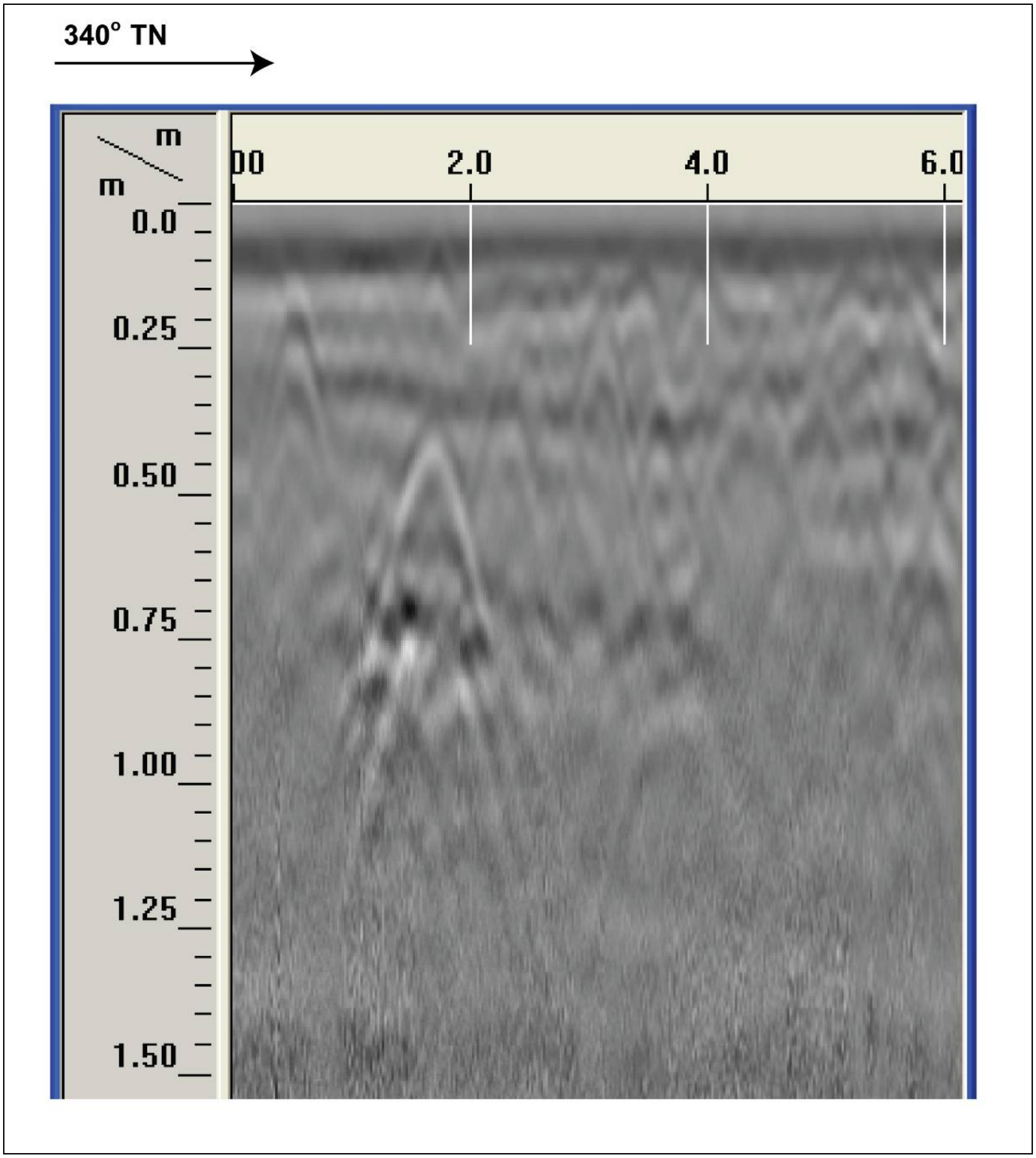

Figure 64. GPR depth profile collected at Survey Area 12

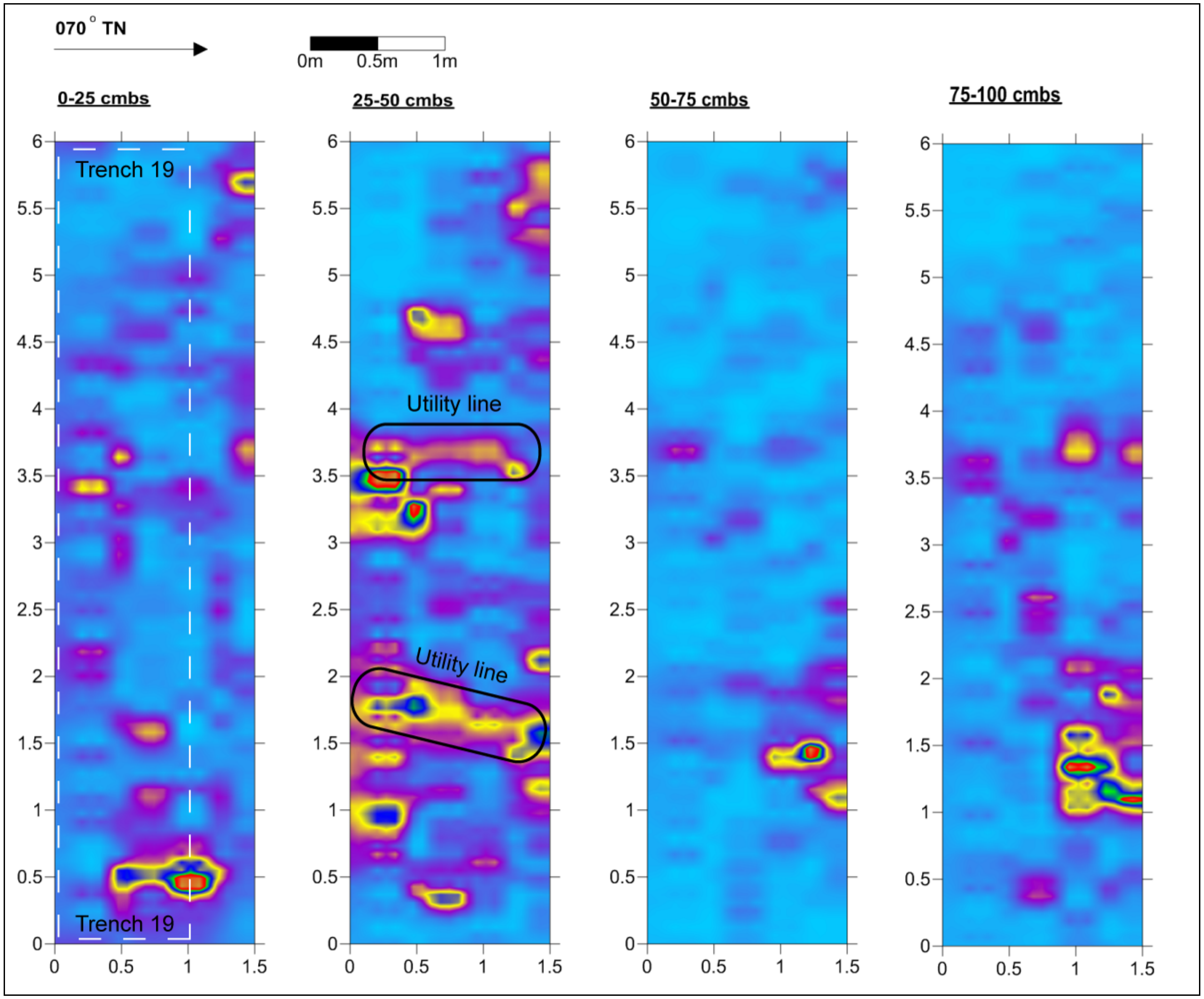

Figure 65. Horizontal slice maps collected at Survey Area 12

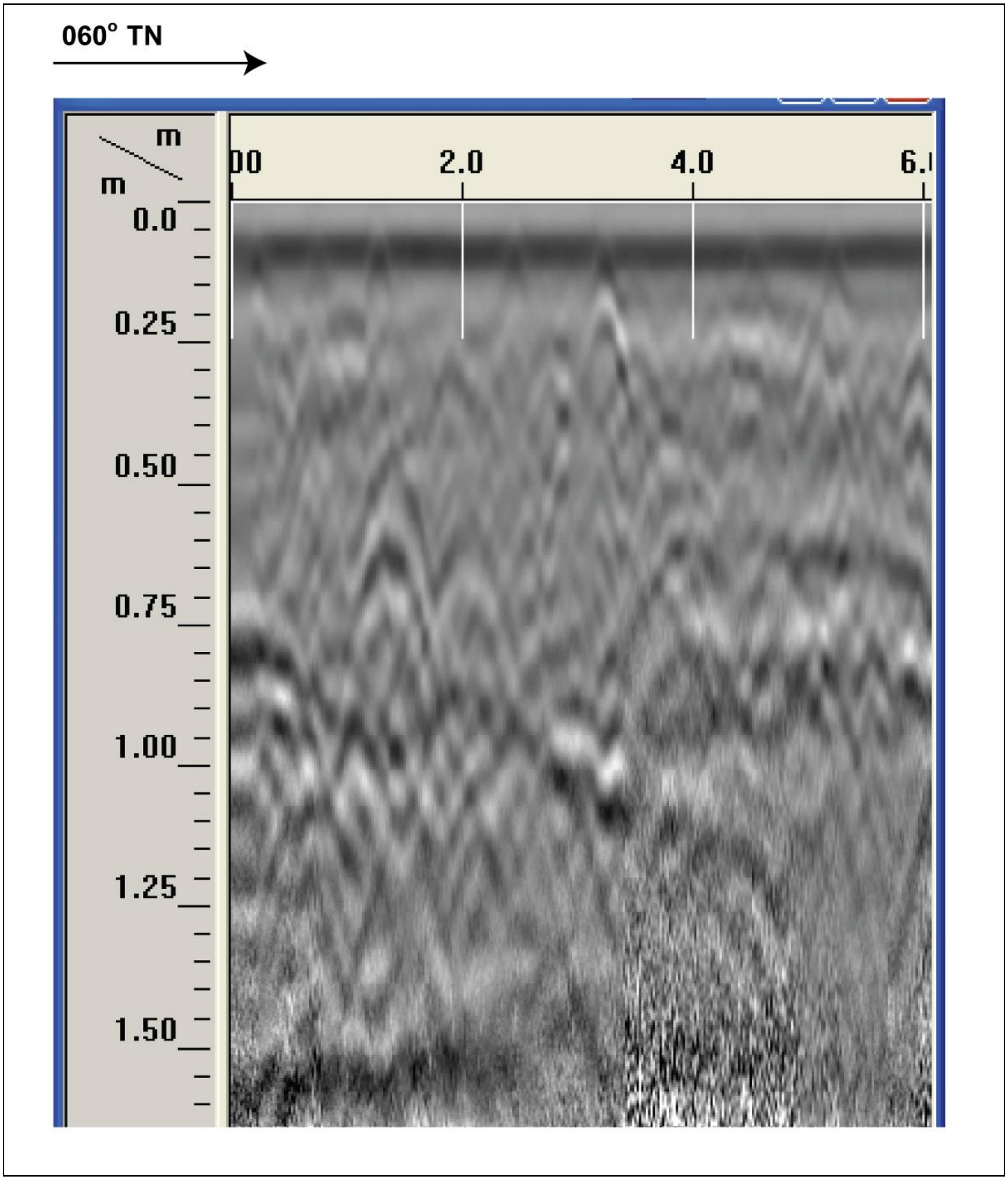

Figure 66. GPR depth profile collected at Survey Area 13

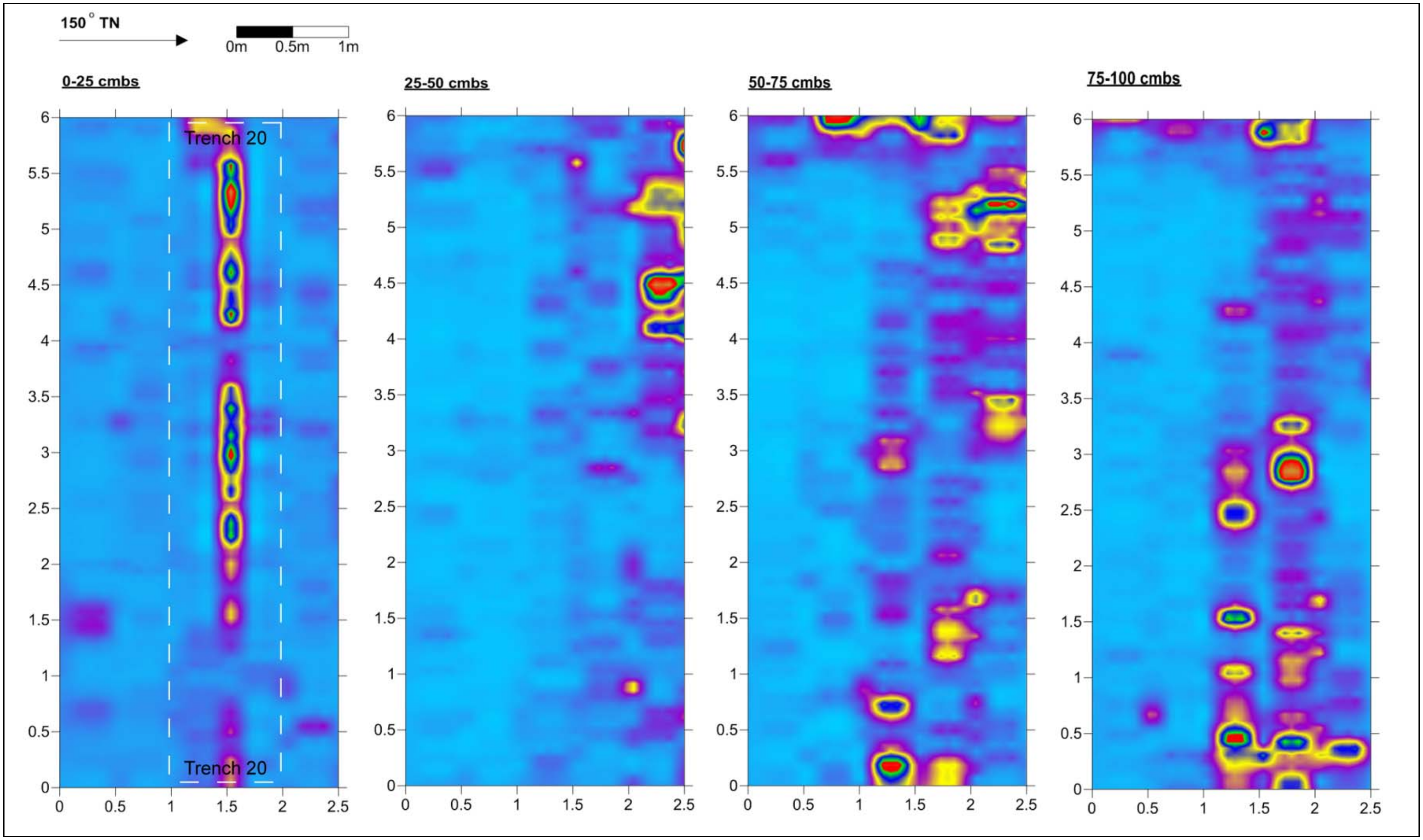

Figure 67. Horizontal slice maps collected at Survey Area 13

4.3 Results of Subsurface Testing

Subsurface testing, conducted between November 29, 2010 and December 21, 2010, consisted of the proposed excavation of 20 test trenches within the project area. Test trench locations were determined in coordination with project proponents to provide coverage of areas of proposed subsurface disturbance (See Section 2.1.3.1). Test trenches were labeled sequentially from Trench 1 to Trench 20 and are depicted on a site plan map and aerial photograph of the project area (Figure 68 and Figure 69).

A total of 19 of the 20 test trenches were successfully excavated to beneath the water table. Trench 9 could not be excavated due to the presence of multiple buried utility lines that extended through the trench as documented in the adjacent Trench 4. Test trenches generally measured 6.0 m long by 0.8 m wide, but in many instances these dimensions were slightly modified on the basis of toning conducted by ControlPoint Surveying, Inc. and GPR results (provided in Section 4.2). The depth of test trenches ranged from 1.0 m to 2.8 m with an average depth of 1.5 m below ground surface. The average depth of the water table was recorded at 1.37 m below ground surface and continued to rise following trench documentation. In total, trench excavation comprised approximately 74.2 m^2 of surface area within the project area.

Concrete blocks, asphalt surfaces, utility lines, and modern (less than 50 year old) construction debris were observed at or near the water table throughout the project area. Historic artifacts including glass bottles and fragments, ceramic fragments, cut/processed faunal remains, and assorted household items generally dating to the early twentieth century were also identified in several excavations throughout the project area at or near the water table. Analysis of the historic artifacts and faunal remains that were collected within the project area is presented in Section 5.

A buried A-horizon was observed within Trench 3, 4, 10, 11, 12, 15, 19, and 20 immediately beneath fill sediment (see Figure 68). In general, the buried A-horizon was observed to be discontinuous and truncated suggesting a high degree of previous disturbance. Artifacts or cultural content within the buried A-horizon were sparse. A glass soda bottle fragment that was collected from the buried A-horizon observed within Trench 3 dates the layer to post-1902 (see Section 5.1, Historic Artifact Analysis). Additionally, the buried A-horizon within Trench 3 and Trench 12 was partially underlain by an asphalt surface in the northern portion of each trench suggesting temporal modernity. In Trench 11, pieces of asphalt and wood fragments were observed within the buried A-horizon. In Trench 15, the buried A-horizon was observed overlying previously disturbed strata containing cinder blocks and concrete foundation remnants. In Trench 20, several small, undulating pits and one possible backfilled trench outline were observed extending from the base of the buried A-horizon. Field observations indicate that these undulating pits minimally contain infrequent charcoal flecking that was determined to be too small for wood taxa identification. An analysis of bulk sediment samples that were collected from the buried A-horizon within Trench 4, 12, 19, and 20 is presented in Section 5.3.

The buried A-horizon has been determined to be a previously disturbed post-contact land surface with associated pit features and numerous post-contact artifacts. The buried A-horizon that was documented as part of the current archaeological inventory survey was considered to be closely related, both characteristically and geographically, to SIHP# 50-80-14-2870, originally

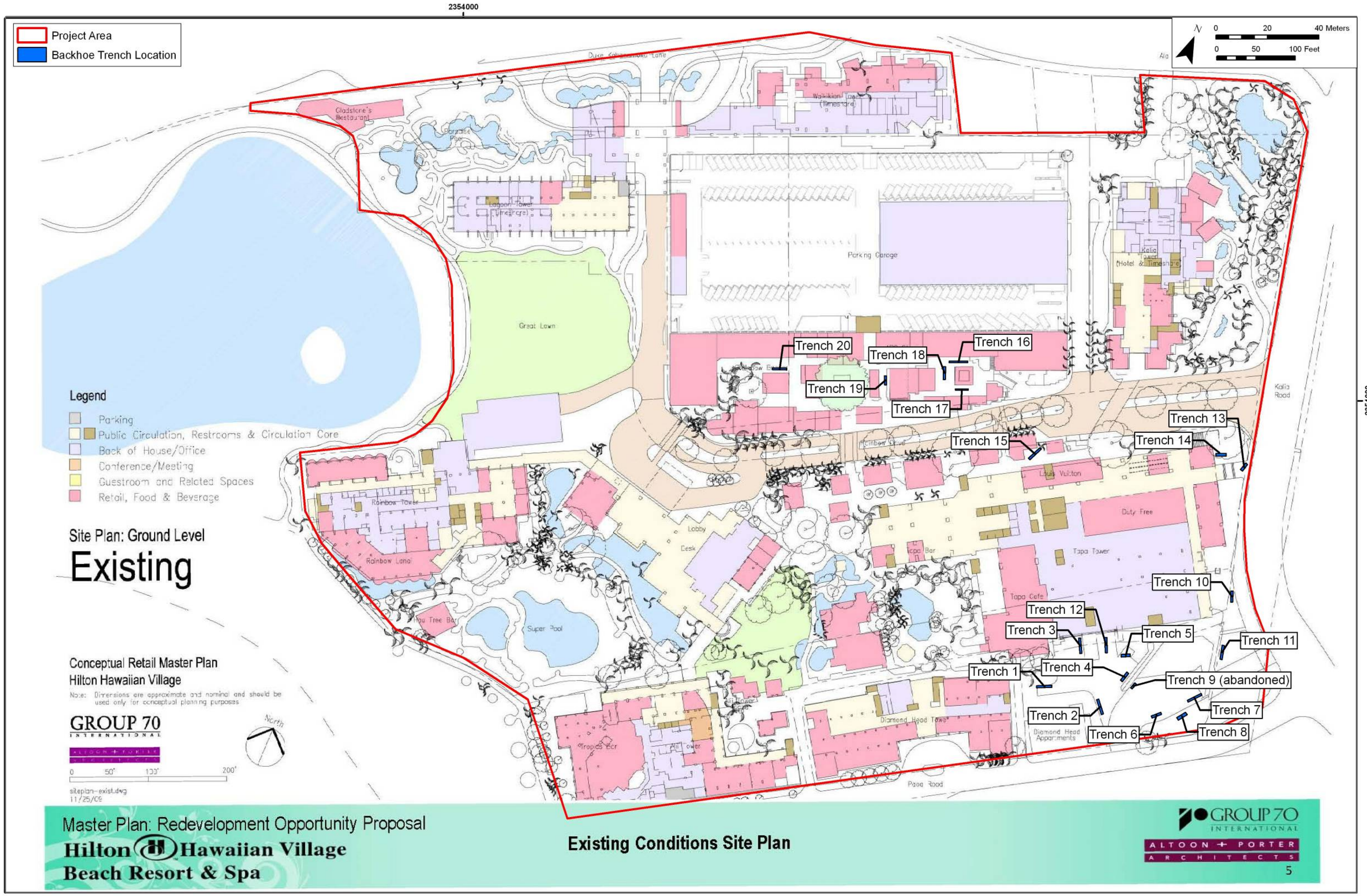

Figure 68. Site plan of existing conditions within the project area (source: Group 70 International, Inc. 2010) showing backhoe trench locations

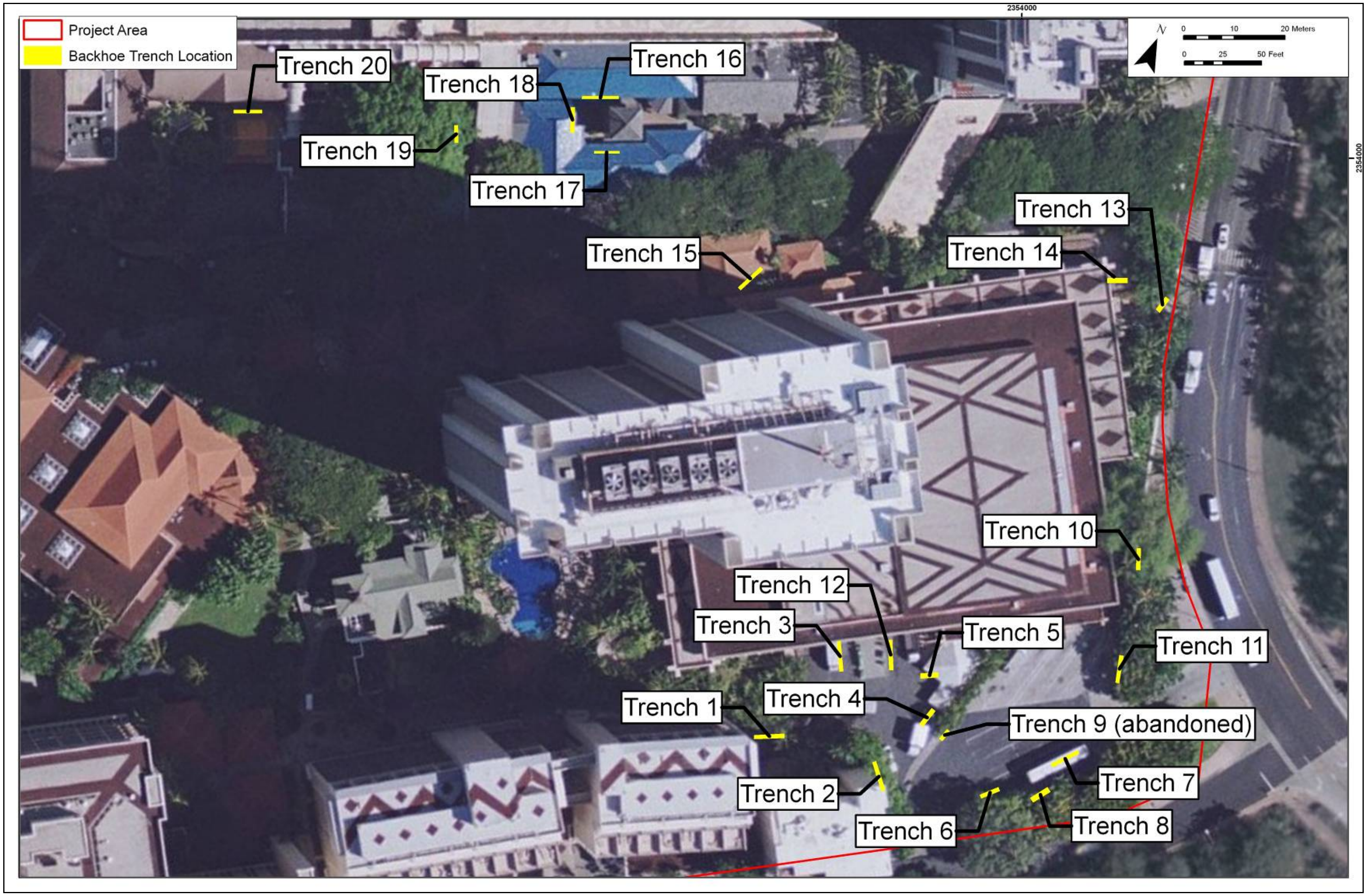

Figure 69. Aerial photograph showing backhoe trench locations (source: Google Earth 2010)

described by Neller (1980) as consisting of three post-contact human burials and several pit features that likely originated from a buried former land surface (Figure 70). Additional fieldwork conducted by Hurlbett et al. (1992) also identified similar pit features and previously disturbed sediment layers consisting of numerous pre- and post-contact artifacts that were assigned to SIHP# 50-80-14-2870 (see Figure 70). Consequently, the buried A-horizon that was documented during the present fieldwork has been assigned SIHP# 50-80-14-2870 (see Figure 70). A complete description of SIHP 350-80-14-2870 is present in Section 4.6 below.

4.4 Stratigraphic Summary

In general, stratigraphy within the project area consisted of the present resort infrastructure-related ground surface overlying a variable series of relatively thick, often compacted fill, a discontinuous, previously disturbed possible A-horizon, and previously disturbed or *in situ* sand and sandy loam to the water table.

The modern ground surface varied by location within the project area. Trenches 1 to 7, 9, and 12, located within the bus loading area, consisted of an asphalt surface overlying base course material composed primarily of various basalt gravels. Trenches 8, 10, 11, and 14, located within planters or landscaped areas along the eastern edge of the project area, consisted of a predominately organic, modern A-horizon surface overlying landscaping fill. Trenches 13, 15, 19, and 20, located within walkways or entryways throughout the resort property, consisted of flagstone and concrete or textured concrete overlying varying compacted fill layers. Trenches 16 to 18, located within the Rainbow Bazaar, consisted of a raised surface of wood decking supported by joists overlying fine, unconsolidated termite barrier gravel.

Fill strata observed within the project area varied by composition and thickness. Fill sediments were predominately composed of common construction-grade materials including fine- to medium-sized basalt gravels and pebble- to cobble-sized crushed coral within a sediment matrix that was composed of varying amounts of sands, silts, or clays. Fill sediments within the project area extended to an average depth of 1.19 m below ground surface with a depth range of 0.5 m to 2.52 m below surface. Comparatively, the average depth of the water table was recorded at 1.37 m below ground surface. Fill sediment was observed extending beneath the water table within Trench 2, 7 and 8.

As previously mentioned, a possible buried A-horizon was observed within Trench 3, 4, 10, 11, 12, 15, 19, and 20 immediately beneath fill sediment. The possible A-horizon was comprised of a variable sediment matrix of silty or sandy clay, sandy or clay loam, or silty sand with few to common roots and rootlets and minimal cultural content. The possible A-horizon was observed to be previously disturbed. Disturbances included upper boundary truncation, intrusion of overlying fill sediment, utility line trenching, and building foundations. Disturbances to the possible A-horizon suggest that the stratum was potentially displaced, leveled, and in some cases, redeposited, throughout the project area during construction activities. The possible A-horizon was then overlain by compacted fill sediment. Historic artifacts that were identified within the possible buried A-horizon indicate that the stratum post-dates 1902, and the presence of an asphalt surface located partially beneath the stratum in Trench 3 suggests temporal modernity.

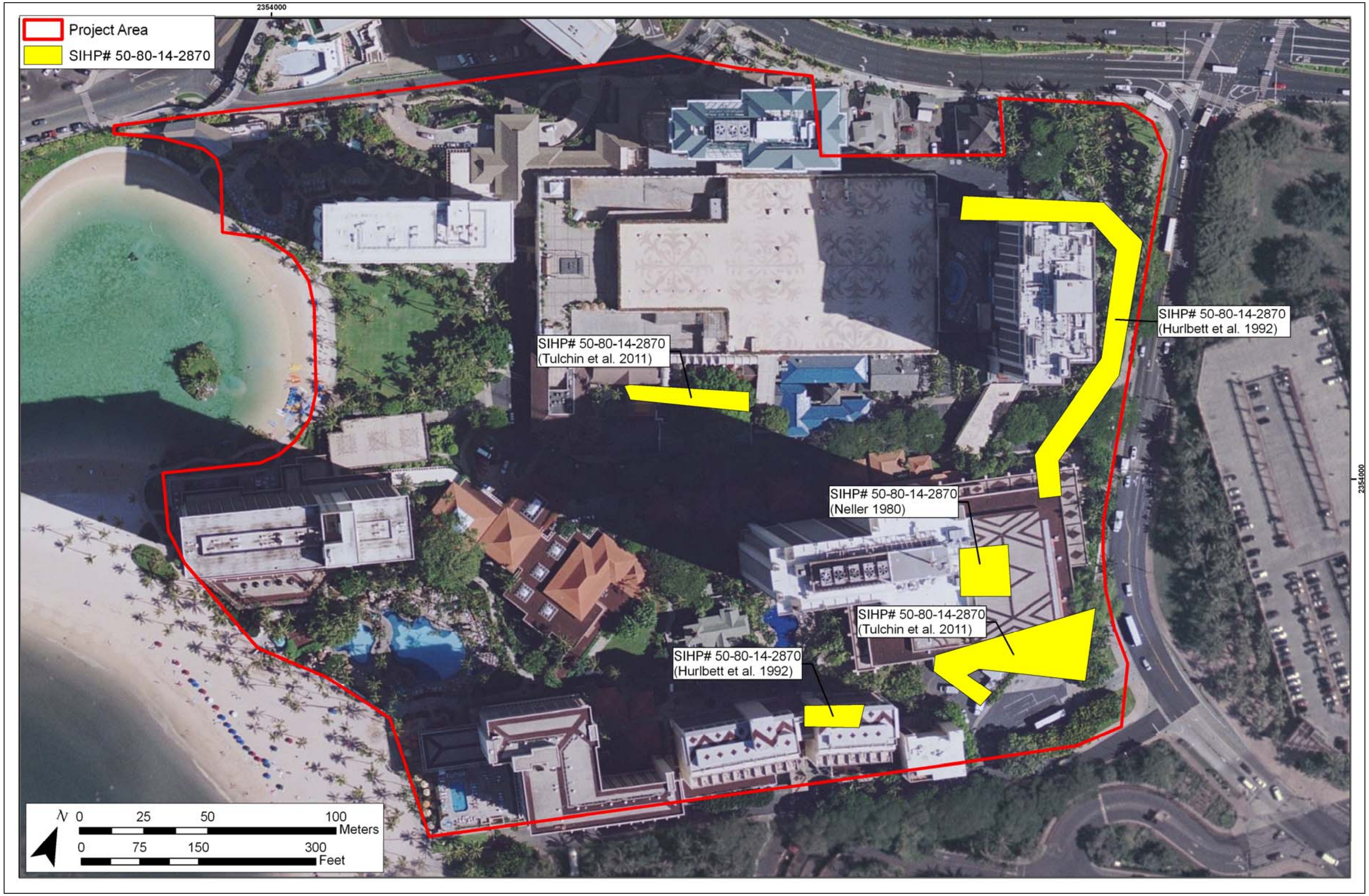

Figure 70. Aerial photograph (source: Google Earth 2010) showing the location of SIHP# 50-80-14-2870 as documented by present and previous archaeological studies

The deepest strata that were identified during the present fieldwork consisted of previously disturbed or in situ sand and sandy loam. Previously disturbed sand and sandy loam strata were evidenced by the presence of construction-related debris, cinder block and concrete foundation remnants, dispersed historic and modern artifacts, butchered faunal bone, and utility lines. In situ strata consisted of naturally deposited Jaucas sand at or near the water table.

4.5 Backhoe Test Trench Documentation

4.5.1 Test Trench 1

Test Trench 1, located within the fenced nursery and landscaping area in the western end of the bus loading area, was oriented in an approximate NE-SW direction and measured 6.0 m long by 0.9 m wide with a maximum depth or base of excavation (BOE) at 140 cm below the surface (cmbs) (Figure 71 to Figure 73 and Table 8). Groundwater was observed at 133 cmbs. The stratigraphy of Test Trench 1 consisted of asphalt (Stratum I) and crushed basalt gravel base course (Stratum II) overlying several strata of deposited fill consisting of gravelly sandy loam fill (Stratum III), sandy clay fill (Stratum IV), termite deterrent sand fill (Stratum V), redeposited coralline sand (Stratum VI), compacted alluvial clay (Stratum VII), and naturally deposited Jaucas sand (Stratum VIII). The maximum thickness of naturally deposited sediments above the water table was 41 cm. Cultural materials observed during excavation of Stratum VIII of Test Trench 1 consisted of glass bottle fragments and ceramic tile pieces.

Figure 71. Overview of Trench 1, view to southwest

Figure 72. Profile view of Trench 1, view to south

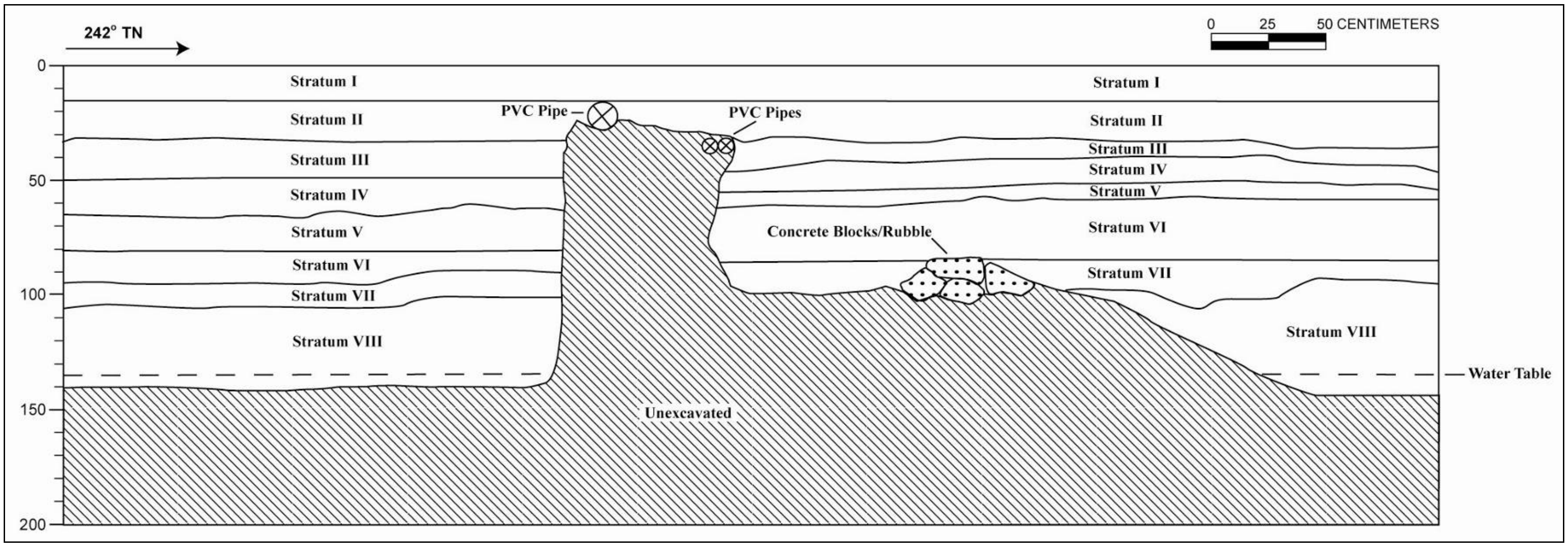

Figure 73. Trench 1 stratigraphic profile, south wall

Table 8. Strata observed within Test Trench 1

Stratum	Depth (cmbs)	Description of Sediment
I	0-15	Asphalt
II	15-35	Fill; 10YR 3/1, very dark gray; gravelly sand, contains 80% subangular basalt gravel; structureless (massive); dry, loose consistency; no cementation; non-plastic; mixed origin; very abrupt, smooth lower boundary; few medium roots observed
III	30-50	Fill; 10YR 4/1, dark gray; gravelly sandy loam; weak, fine crumb structure; moist, firm consistency; no cementation; slightly plastic; mixed origin; diffuse, wavy lower boundary; no roots observed
IV	40-65	Fill; 10YR 4/3, brown; sandy clay, contains 50% crushed coral gravel; weak, fine crumb structure; moist, friable consistency; no cementation; slightly plastic; mixed origin; clear, smooth and broken/discontinuous lower boundary; no roots observed
V	50-80	Fill; 10YR 4/1, dark gray; sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; clear, smooth lower boundary; no roots observed; termite deterrent sand deposit
VI	60-80	Fill; 10YR 5/4, yellowish brown; loamy sand, contains 50% crushed coral gravel; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; clear, smooth lower boundary; no roots observed; redeposited coralline sand
VII	85-105	Fill; 10YR 3/3 dark brown; sandy clay, contains < 5% coralline sand; moderate, medium crumb structure; moist, firm consistency; no cementation; plastic; mixed origin; clear, wavy lower boundary; no roots observed; compacted clay
VIII	92-140 (BOE)	10YR 6/4, light yellowish brown; medium-grain sand; structureless (single-grain); moist, loose consistency; no cementation; marine origin; no roots observed; natural Jaucas sand

4.5.2 Test Trench 2

Test Trench 2, located near the entranceway for the loading dock area in the eastern portion of the project area, was oriented in a SE-NW direction and measured 6.0 m long by 0.8 m wide with a maximum depth of 130 cmbs (Figure 74 to Figure 76 and Table 9). Groundwater was observed at 115 cmbs. The stratigraphy of Test Trench 2 consisted of asphalt (Stratum I) and crushed basalt base course (Stratum II) overlying redeposited loamy sand fill (Stratum III), sandy clay fill (Stratum IV), redeposited sand fill (Stratum V), and sandy clay fill (Stratum VI). The maximum thickness of naturally deposited sediments above the water table was 35 cm. Cultural materials observed during excavation of Stratum V of Test Trench 2 consisted of glass bottles, clothing remnants, and foundation structure remains.

Figure 74. Overview of Trench 2, view to northwest

Figure 75. Profile view of Trench 2, view to southwest

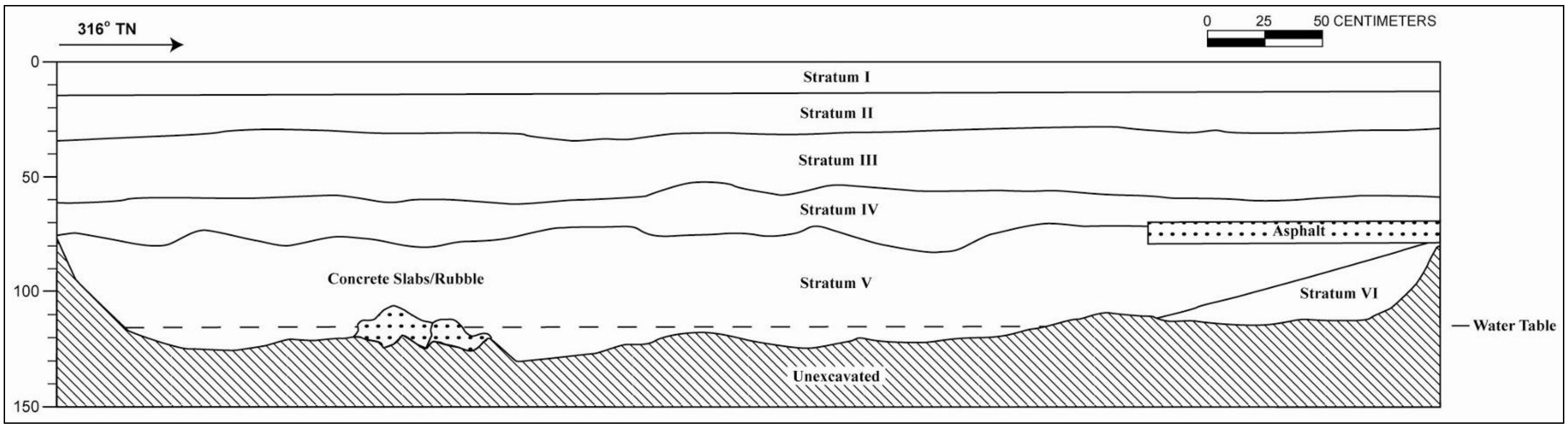

Figure 76. Trench 2 stratigraphic profile, southwest wall

Table 9. Strata observed within Test Trench 2

Stratum	Depth (cmbs)	Description of Sediment
I	0-15	Asphalt
II	15-30	Fill; 10YR 3/1, very dark gray; gravelly sand, contains 80% subangular basalt gravel; structureless (massive); dry, loose consistency; no cementation; non-plastic; mixed origin; very abrupt, smooth lower boundary; no roots observed
III	30-60	Fill; 10YR 6/2, light brownish gray; loamy sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; clear, smooth lower boundary; no roots observed; redeposited sand
IV	52-83	Fill; 7.5YR 3/1, very dark brown; sandy clay, contains asphalt and sparse basalt/coral gravels; weak, fine crumb structure; moist, friable consistency; no cementation; slightly plastic; mixed origin; clear, irregular lower boundary; no roots observed
V	70-130 (BOE)	Fill; 10YR 6/3, pale brown; medium-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; no roots observed; redeposited sand
VI	80-115 (BOE)	Fill; 7.5YR 3/2, dark brown; sandy clay; weak, fine crumb structure; moist, firm consistency; no cementation; plastic; terrestrial origin; no roots observed

4.5.3 Test Trench 3

Test Trench 3, located within the loading dock area in the eastern portion of the project area, was oriented in an approximate SE-NW direction and measured 6.0 m long by 0.8 m wide with a maximum depth of 130 cmbs (Figure 77 to Figure 79 and Table 10). Groundwater was observed at 120 cmbs. The stratigraphy of Test Trench 3 consisted of asphalt (Stratum I) and select gravel basalt base course (Stratum II) overlying crushed coral fill (Stratum III), sandy clay fill (Stratum IV), a buried A-horizon (Stratum V), and natural Jaucas sand (Stratum VI). The maximum thickness of naturally deposited sediments above the water table was 20 cm. Cultural materials observed during excavation of Strata V and VI of Test Trench 3 consisted of faunal skeletal fragments, glass bottles, glass and ceramic fragments, metal pieces, and sparse charcoal flecking.

Figure 77. Overview of Trench 3, view to northwest

Figure 78. Profile view of Trench 3, view to west

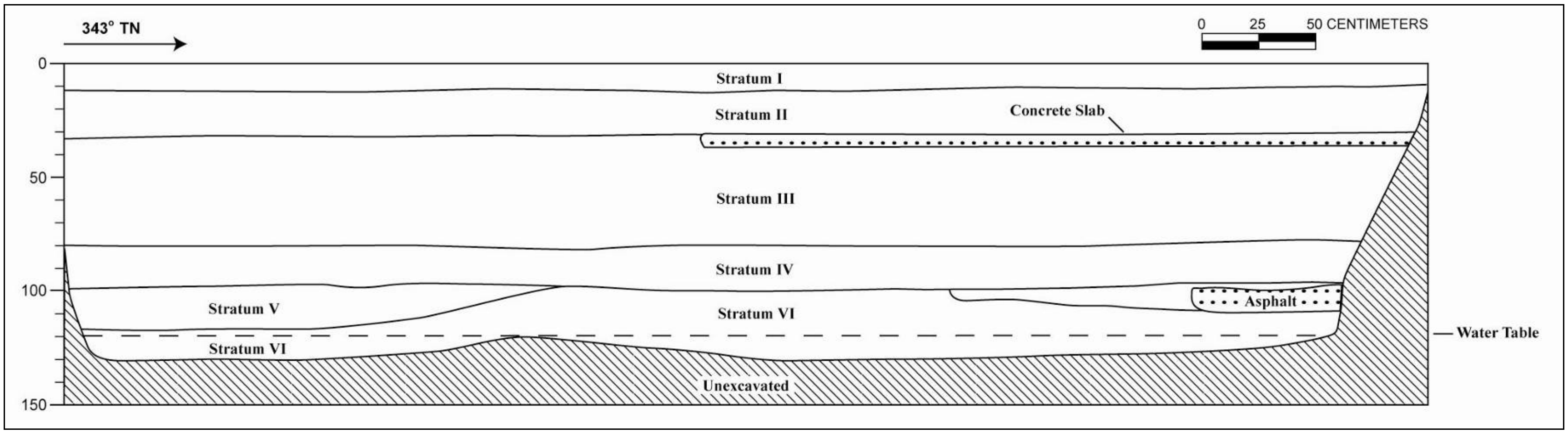

Figure 79. Trench 3 stratigraphic profile, west wall (note: asphalt surface partially beneath Stratum V, possible buried A-horizon)

Table 10. Strata observed within Test Trench 3

Stratum	Depth (cmbs)	Description of Sediment
I	0-12	Asphalt
II	12-32	Fill; 5YR 3/2, dark reddish brown; gravelly sand; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed; select gravelly basalt base course
III	32-80	Fill; 2.5Y 6/1, gray; silty sand with crushed coral gravel inclusions; structureless (massive); wet, non-sticky consistency; no cementation; non-plastic; mixed origin; clear, smooth lower boundary; no roots observed
IV	80-100	Fill; 10YR 3/3, dark brown; sandy clay; weak, fine crumb structure; moist, friable consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed
V	100-118	A-horizon; 10YR 4/3, brown; medium-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; abrupt, broken/discontinuous lower boundary; no roots observed
VI	100-130 (BOE)	10YR 6/4, light yellowish brown; medium-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; no roots observed; natural Jaucas sand

4.5.4 Test Trench 4

Test Trench 4, located within the luggage depot area in the eastern portion of the project area, was oriented in an approximate N-S direction and measured 4.0 m long by 0.95 m wide with a maximum depth of 135 cmbs (Figure 80 to Figure 82, and Table 11). Groundwater was observed at 120 cmbs. The stratigraphy of Test Trench 4 consisted of asphalt (Stratum I) and crushed basalt gravel base course (Stratum II) overlying crushed coral fill (Stratum III), gravelly sand (Stratum IV), a buried A-horizon (Stratum V), and Jaucas sand (Stratum VI). The maximum thickness of naturally deposited sediments above the water table was 35 cm. Cultural materials observed during excavation of Stratum V of Test Trench 4 consisted of glass bottle fragments and charcoal flecking. A bulk sediment sample was collected from Stratum V for laboratory processing and is described further in Section 5.3 below.

Figure 80. Overview of Trench 4, view to southwest

Figure 81. Profile view of Trench 4, view to south

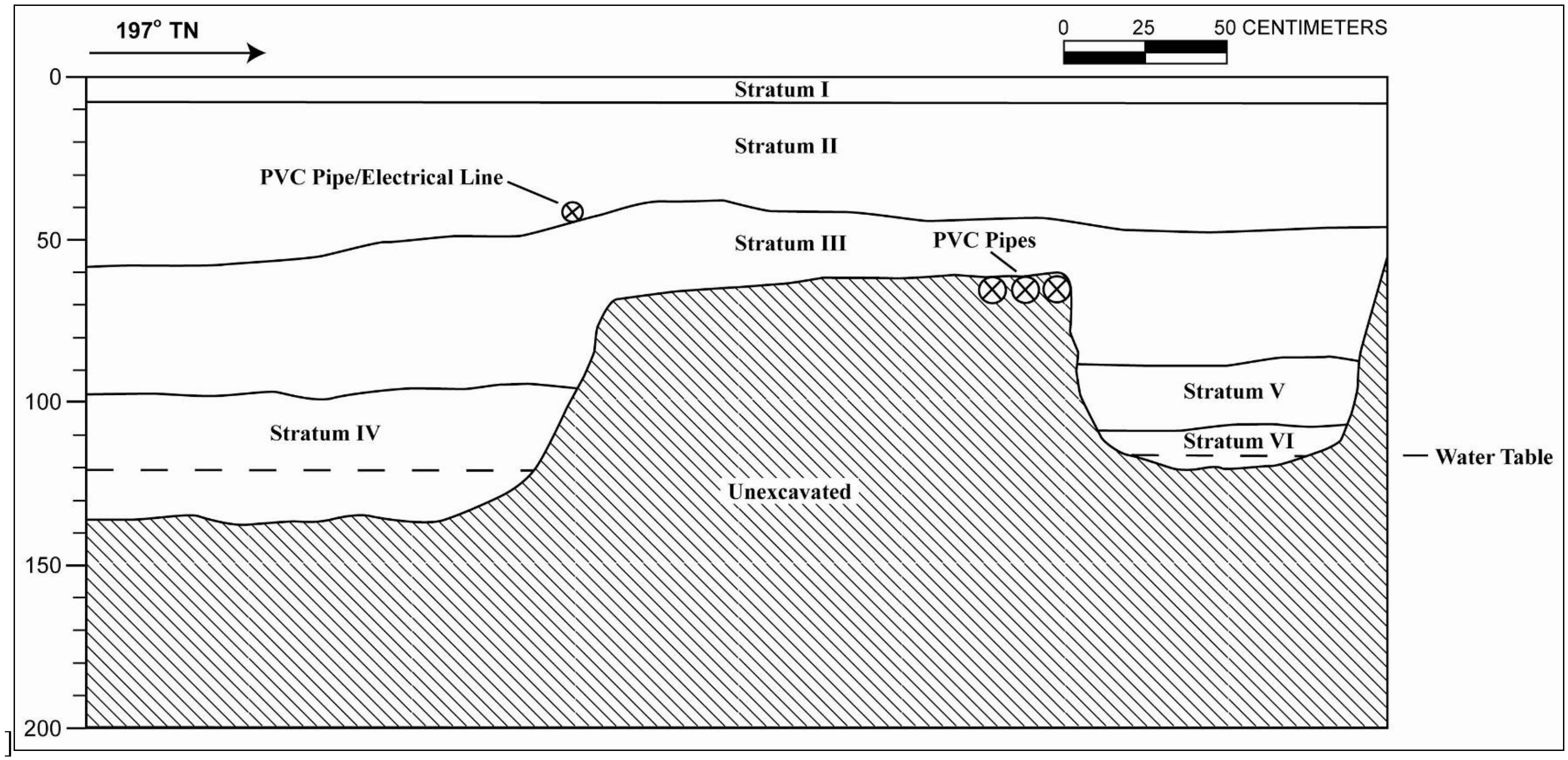

Figure 82. Trench 4 stratigraphic profile, south wall

Table 11. Strata observed within Test Trench 4

Stratum	Depth (cmbs)	Description of Sediment
I	0-7	Asphalt
II	7-57	Fill; 2.5Y 4/1, dark gray; gravelly sand, contains 80% subangular basalt gravel; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; very abrupt, wavy lower boundary; no roots observed
III	37-97	Fill; 10YR 4/3, brown; gravelly sand, contains 70% crushed coral; structureless (massive); moist, friable consistency; no cementation; non-plastic; mixed origin; clear, smooth lower boundary; no roots observed
IV	93-135	Fill; 10YR 4/3, brown; gravelly sand, contains 10% crushed coral gravel; weak, fine crumb structure; moist, friable consistency; no cementation; slightly plastic; mixed origin; clear, irregular lower boundary; no roots observed
V	85-107	A-horizon; 10YR 3/1, very dark gray; silty clay; moderate, fine crumb structure; moist, extremely firm consistency; no cementation; plastic; mixed origin; abrupt, broken/discontinuous lower boundary; no roots observed
VI	105-120 (BOE)	10YR 5/4, yellowish brown; medium-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; no roots observed; Jaucas sand

4.5.5 Test Trench 5

Test Trench 5, located within the luggage depot area in the eastern portion of the project area, was oriented in an approximate NE-SW direction and measured 3.5 m long by 1.0 m wide with a maximum depth of 130 cmbs (Figure 83 to Figure 85 and Table 12). Groundwater was observed at 125 cmbs. The stratigraphy of Test Trench 5 consisted of asphalt (Stratum I) and crushed basalt gravel base course (Stratum II) overlying gravelly sand fill (Stratum III), an additional crushed basalt gravel base course (Stratum IV), crushed coral fill (Stratum V), clay fill (Stratum VI), and disturbed sand (Stratum VII). The maximum thickness of naturally deposited sediments above the water table was 5 cm. Pieces of PVC plastic were observed in Stratum VII of Test Trench 5.

Figure 83. Overview of Trench 5, view to southwest

Figure 84. Profile view of Trench 5, view to south

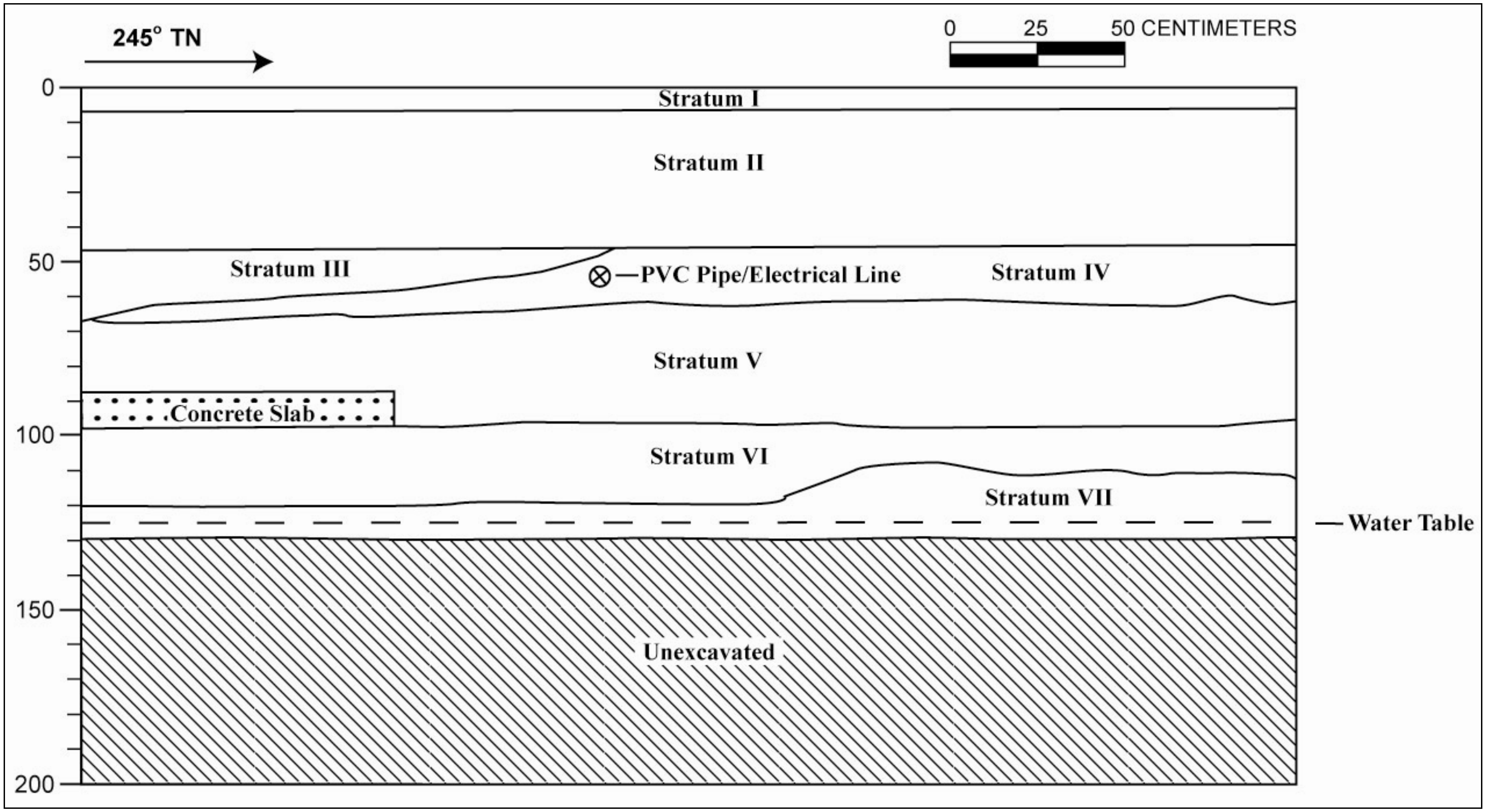

Figure 85. Trench 5 stratigraphic profile, south wall

Table 12. Strata observed within Test Trench 5

Stratum	Depth (cmbs)	Description of Sediment
I	0-7	Asphalt
II	7-47	Fill; 2.5Y 4/1, dark gray; gravelly sand, contains 80% subangular basalt gravel; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed
III	47-67	Fill; 5YR 3/2, dark reddish brown; gravelly sand; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed
IV	47-67	Fill; 2.5Y 4/1, dark gray; gravelly sand, contains 80% subangular basalt gravel; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed
V	65-97	Fill; 10YR 4/3, brown; gravelly sand, contains 70% angular crushed coral; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed
VI	97-120	Fill; 7.5YR 3/3, dark brown; clay; weak, medium blocky structure; moist, extremely firm consistency; no cementation; plastic; terrestrial origin; clear, smooth lower boundary; no roots observed; partially contaminated and stained with a band of 10YR 2/1, black, by fuel or oil
VII	120-130 (BOE)	10YR 5/4, yellowish brown; medium-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; no roots observed; disturbed sand

4.5.6 Test Trench 6

Test Trench 6, located within the bus loading lot in the eastern portion of the project area, was oriented in a SW-NE direction and measured 4.0 m long by 0.95 m wide with a maximum depth of 105 cmbs (Figure 86 to Figure 88 and Table 13). Groundwater was observed at 90 cmbs. The stratigraphy of Test Trench 6 consisted of asphalt (Stratum I) and select basalt gravel base course (Stratum II) overlying gravelly sand fill (Stratum III), natural Jaucas sand (Stratum IV), and gleyed Jaucas sand (Stratum V). The maximum thickness of naturally deposited sediments above the water table was 45 cm. No cultural material was encountered in Test Trench 6.

Figure 86. Overview of Trench 6, view to southwest

Figure 87. Profile view of Trench 6, view to west

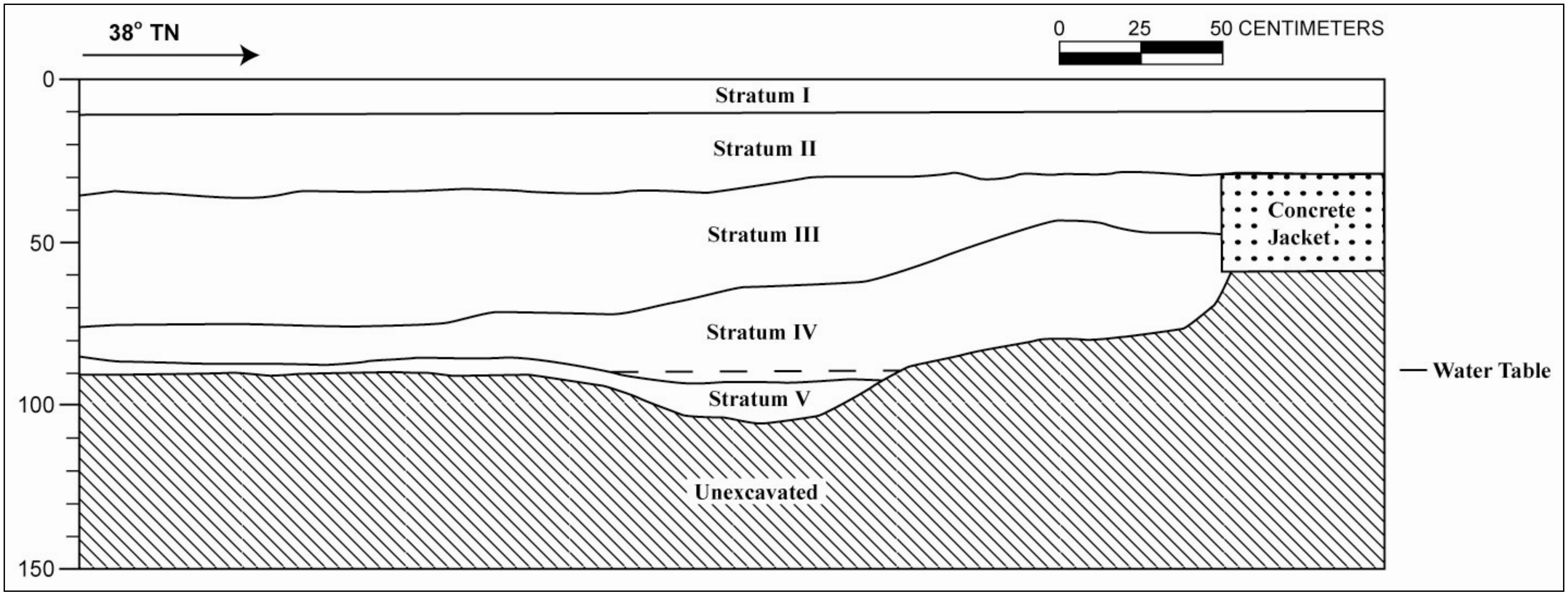

Figure 88. Trench 6 stratigraphic profile, west wall

Table 13. Strata observed within Test Trench 6

Stratum	Depth (cmbs)	Description of Sediment
I	0-12	Asphalt
II	12-35	Fill; 5YR 3/2, dark reddish brown; gravelly sand; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; diffuse, smooth lower boundary; no roots observed; select basalt gravel base course
III	30-75	Fill; 10YR 4/1, dark gray; gravelly sand, contains 80% subangular basalt gravel; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; very abrupt, smooth lower boundary; no roots observed
IV	45-95	10YR 8/3, very pale brown; medium-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; diffuse, smooth lower boundary; no roots observed; natural Jaucas sand
V	85-105 (BOE)	GLEY2 6/10B, bluish gray; sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; no roots observed; gleyed Jaucas sand

4.5.7 Test Trench 7

Test Trench 7, located near the right-of-way lane of the bus loading lot in the eastern portion of the project area, was oriented in an approximate NE-SW direction and measured 6.0 m long by 0.83 m wide with a maximum depth of 105 cmbs (Figure 89 to Figure 91 and Table 14). Groundwater was observed at 100 cmbs. The stratigraphy of Test Trench 7 consisted of asphalt (Stratum I) and select basalt gravel base course (Stratum II) overlying gravelly sand fill (Strata III and IV). No naturally deposited sediments were present above the water table (indicating historic disturbance to below the water table). No cultural material was encountered in Test Trench 7.

Figure 89. Overview of Trench 7, view to northwest

Figure 90. Profile view of Trench 7, view to west

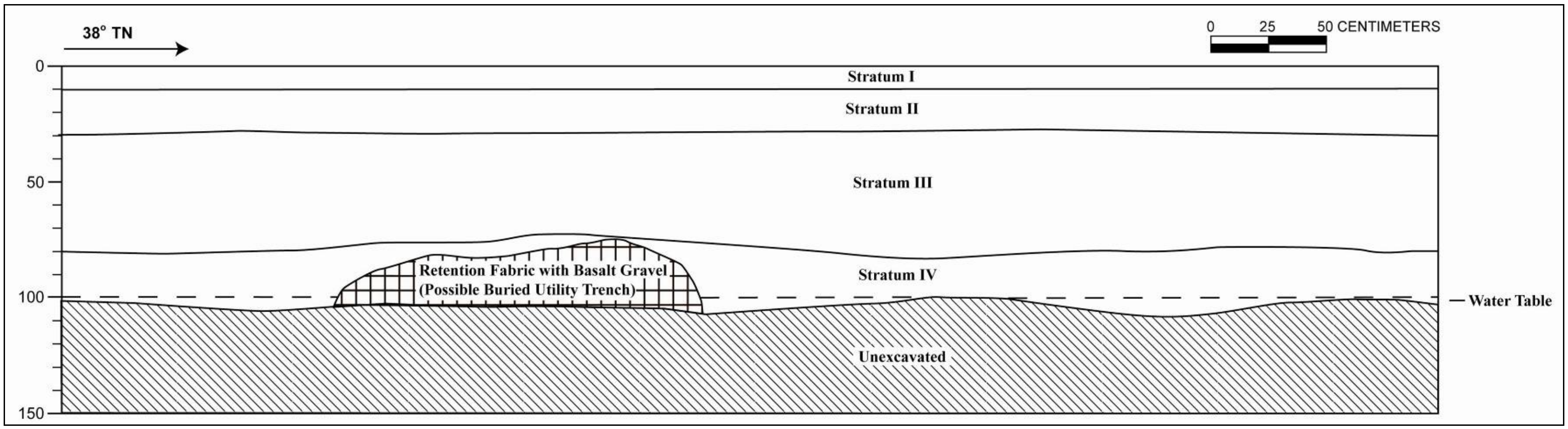

Figure 91. Trench 7 stratigraphic profile, west wall

Table 14. Strata observed within Test Trench 7

Stratum	Depth (cmbs)	Description of Sediment
I	0-10	Asphalt
II	10-30	Fill; 5YR 3/2, dark reddish brown; gravelly sand; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; diffuse, smooth lower boundary; no roots observed; select basalt gravel base course
III	30-80	Fill; 10YR 4/1, dark gray; gravelly sand, contains 80% subangular basalt gravel; structureless (massive); moist, very friable consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; few medium roots observed
IV	76-105 (BOE)	Fill; 10YR 6/2, light brownish gray; gravelly sand, contains 85% angular basalt cobbles and pebbles; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; mixed origin; no roots observed

4.5.8 Test Trench 8

Test Trench 8, located within the landscape adjacent to the right-of-way of the bus loading lot in the eastern portion of the project area, was oriented in an approximate NE-SW direction and measured 4.0 m long by 1.1 m wide with a maximum depth of 127 cmbs (Figure 92 to Figure 94 and Table 13). Groundwater was observed at 110 cmbs. The stratigraphy of Test Trench 8 consisted of clay loam landscaped topsoil (Stratum I) overlying disturbed sand (Stratum II). No naturally deposited sediments were present above the water table (indicating historic disturbance to below the water table). No cultural material was encountered in Test Trench 8.

Figure 92. Overview of Trench 8, view to southwest

Figure 93. Profile view of Trench 8, view to south

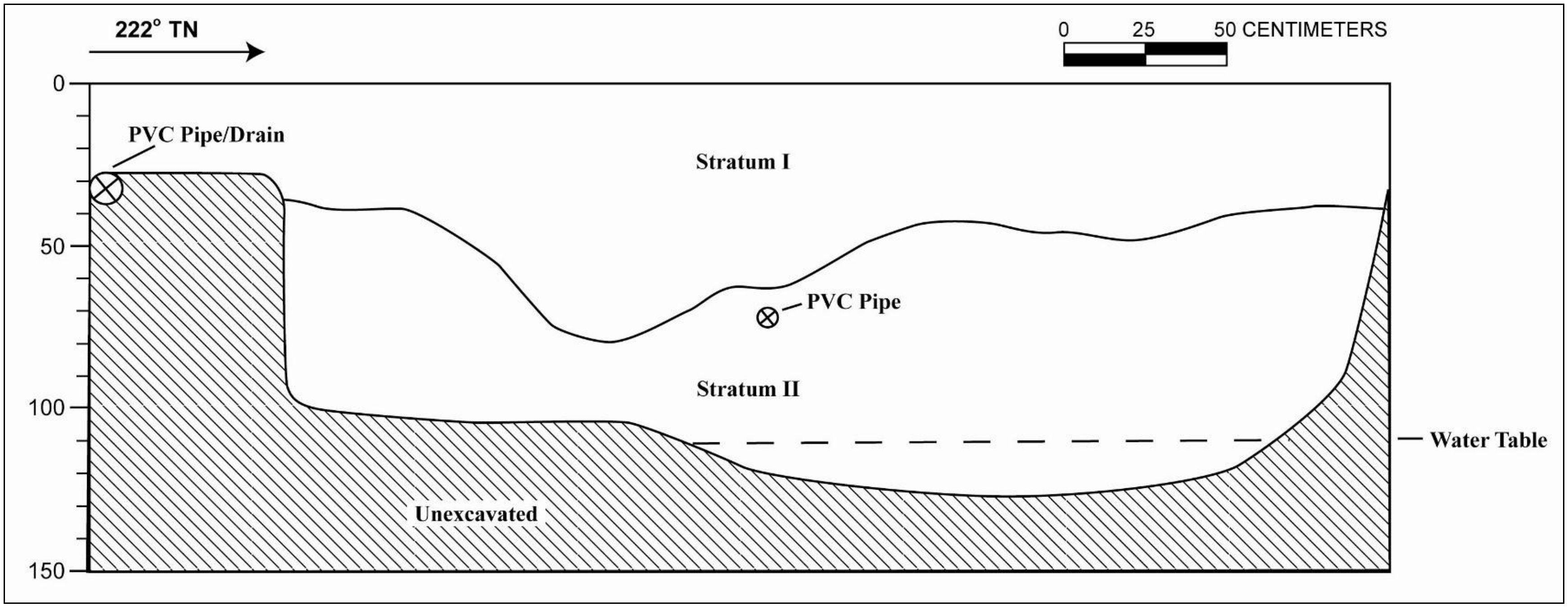

Figure 94. Trench 8 stratigraphic profile, south wall

Table 15. Strata observed within Test Trench 8

Stratum	Depth (cmbs)	Description of Sediment
I	0-80	Fill; 7.5YR 2.5/2, very dark brown; clay loam; weak, fine to medium crumb structure; moist, very friable consistency; slightly plastic, terrestrial origin; abrupt, wavy lower boundary; abundant coarse to very coarse roots and root balls from palm trees; landscaped topsoil
II	35-127 (BOE)	10YR 3/2, very dark grayish brown, mottled with 50% fine 10YR 8/2 very pale brown; fine-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; mixed origin; fine to medium roots common; disturbed sand

4.5.9 Test Trench 9

Test Trench 9 was proposed to be located within the bus loading lot in the eastern portion of the project area. Excavation of the trench was abandoned after documentation of multiple utility lines in the adjacent Test Trench 4 and Test Trench 6 were observed to cross directly through the proposed Test Trench 9 location.

4.5.10 Test Trench 10

Test Trench 10, located within the landscape adjacent to the sidewalk on Kālia Road in the eastern portion of the project area, was oriented in an approximate SE-NW direction and measured 4.3 m long by 0.85 m wide with a maximum depth of 152 cmbs (Figure 95 to Figure 97 and Table 16). Groundwater was observed at 145 cmbs. The stratigraphy of Test Trench 10 consisted of clay loam landscaped topsoil (Stratum I) overlying coarse sand fill (Stratum II), an irregular clay loam deposit (Stratum III), gravelly sand fill (Stratum IV), loamy sand fill (Strata V and VI), a previously disturbed buried A-horizon (Stratum VII), and natural Jaucas sand (Stratum VIII). No cultural material was encountered in Test Trench 10.

Figure 95. Overview of Trench 10, view to northwest

Figure 96. Profile view of Trench 10, view to west

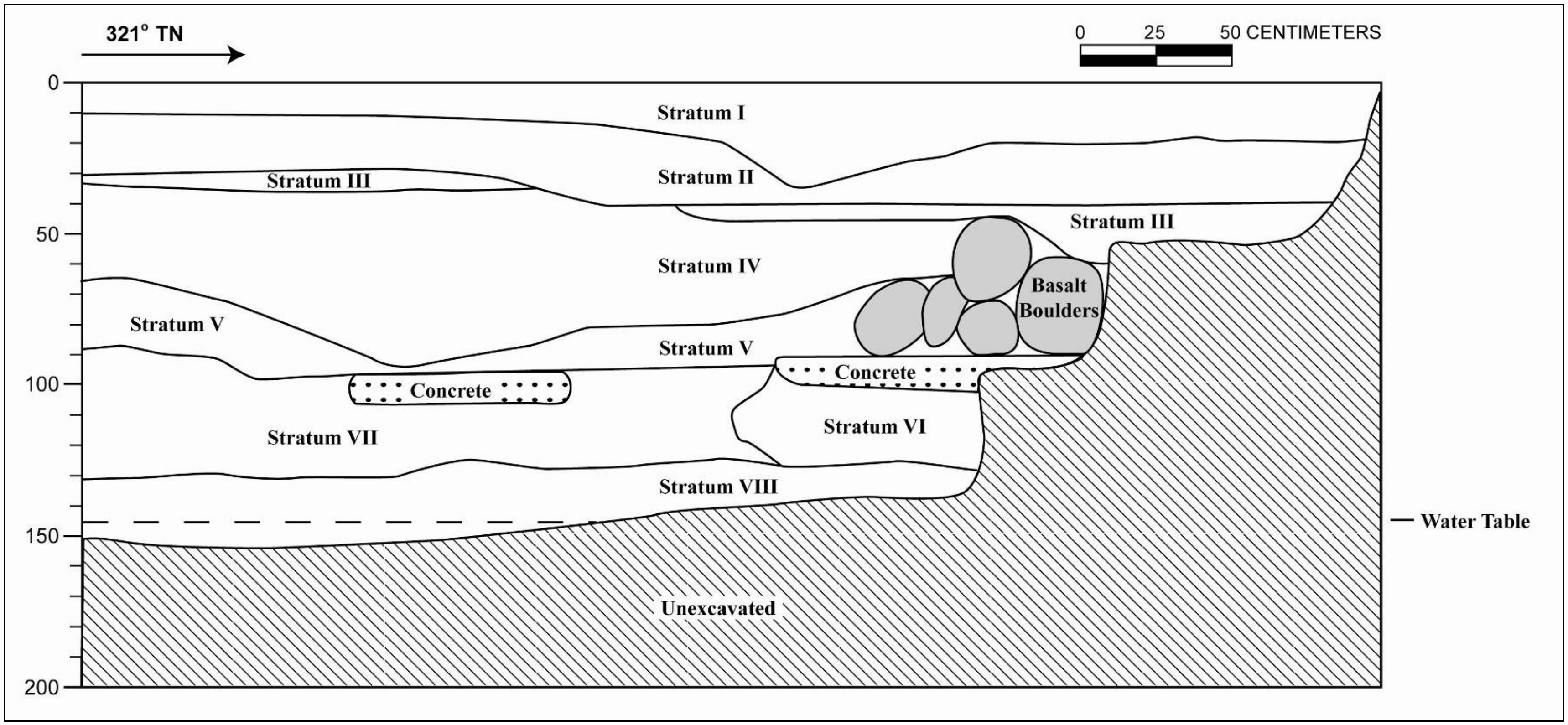

Figure 97. Trench 10 stratigraphic profile, west wall

Table 16. Strata observed within Test Trench 10

Stratum	Depth (cmbs)	Description of Sediment
I	0-35	Fill; 10YR 3/3, dark brown, mottled with 10% fine 10YR 8/2, very pale brown; sandy clay loam; weak, fine to medium crumb structure; moist, very friable consistency; no cementation; slightly plastic; mixed origin; clear, smooth lower boundary; many fine to coarse roots; landscaped topsoil
II	10-40	Fill; 10YR 6/3, pale brown, mottled with 50% fine to coarse 10YR 5/1, gray; coarse-grain sand; weak, fine to medium granular structure; moist, loose consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; few medium roots
III	30-60	Fill; 7.5YR 3/3, dark brown; clay loam; weak, fine to coarse blocky structure; moist, very friable consistency; no cementation; slightly plastic; terrestrial origin; abrupt, irregular lower boundary; coarse roots common; thin, irregular deposit
IV	35-95	Fill; 10YR 4/3, brown, mottled with 50% coarse 10YR 8/2 very pale brown; gravelly sand; weak, fine to coarse granular structure; moist, loose consistency; no cementation; non-plastic; marine origin; abrupt, broken/discontinuous lower boundary; few fine roots
V	65-97	Fill; 10YR 3/3, dark brown; loamy sand; weak, fine granular structure; moist, loose consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed
VI	92-128	Fill; 10YR 3/3, dark brown; loamy sand; weak, fine granular structure; moist, loose consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed
VII	87-130	A-horizon; 10YR 3/3, dark brown; clay loam; weak, fine to medium blocky structure; moist, friable consistency; no cementation; slightly plastic; terrestrial origin; abrupt, smooth lower boundary; no roots observed; previously disturbed
VIII	125-152 (BOE)	10YR 8/2, very pale brown; fine-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; no roots observed; natural Jaucas sand

4.5.11 Test Trench 11

Test Trench 11, located within the landscape near the waiting area for the bus loading lot in the eastern portion of the project area, was oriented in an approximate S-N direction and measured 5.5 m long by 0.8 m wide with a maximum depth of 135 cmbs (Figure 98 to Figure 100 and Table 17). Groundwater was observed at 120 cmbs. The stratigraphy of Test Trench 11 consisted of clay loam landscaped topsoil (Stratum I) overlying a previously disturbed buried A-horizon (Stratum II), and natural Jaucas sand (Stratum III). No cultural material was encountered in Test Trench 11.

Figure 98. Overview of Trench 11, view to northwest

Figure 99. Profile view of Trench 11, view to west

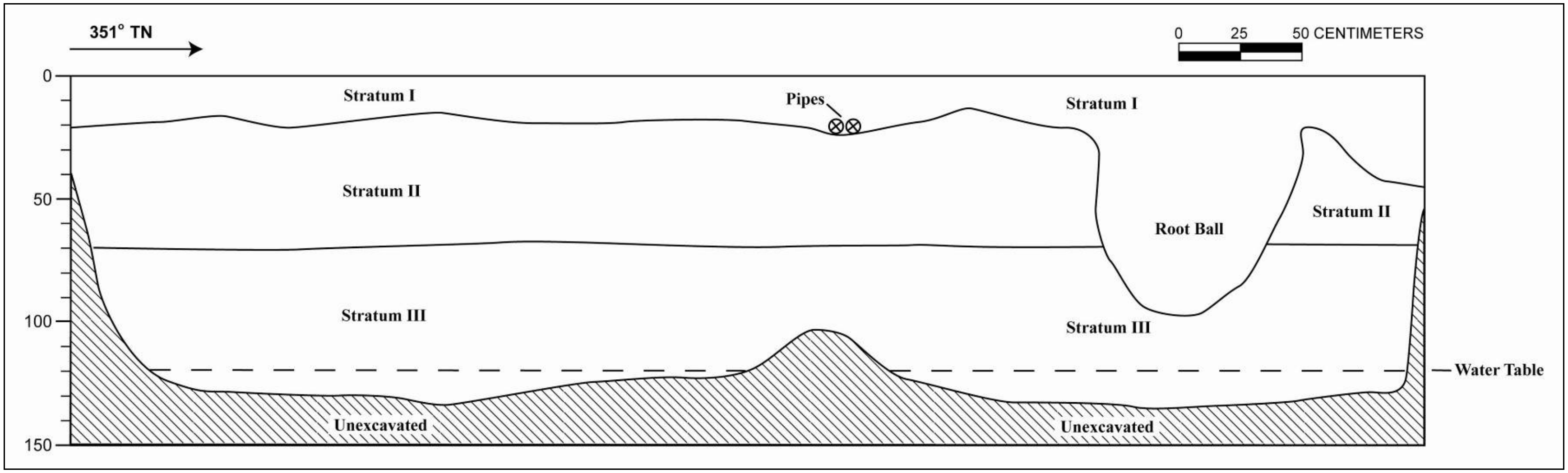

Figure 100. Trench 11 stratigraphic profile, west wall

Table 17. Strata observed within Test Trench 11

Stratum	Depth (cmbs)	Description of Sediment
I	0-100	Fill; 2.5YR 3/3, dark reddish brown; clay loam; weak, fine crumb structure; moist, friable consistency; no cementation; plastic; terrestrial origin; diffuse, smooth lower boundary; many medium roots; landscaped topsoil
II	25-70	A-horizon; 10YR 6/4, light brownish yellow; silty sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; clear, smooth lower boundary; fine to medium roots common; previously disturbed
III	70-135 (BOE)	10YR 7/4, very pale brown; fine-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; few fine roots; natural Jaucas sand

4.5.12 Test Trench 12

Test Trench 12, located within the loading dock area in the eastern portion of the project area, was oriented in an approximate SE-NW direction and measured 6.0 m long by 0.85 m wide with a maximum depth of 130 cmbs (Figure 101 to Figure 103 and Table 18). Groundwater was observed at 125 cmbs. The stratigraphy of Test Trench 12 consisted of asphalt (Stratum I) and basalt gravel base course (Stratum II) overlying crushed coral fill (Stratum III), redeposited silty sand fill (Stratum IV), an A-horizon (Stratum V), and natural Jaucas sand (Stratum VI). The maximum thickness of naturally deposited sediments above the water table was 20 cm. Cultural materials observed during excavation of Strata III and IV of Test Trench 12 consisted of modern construction material, and Stratum V contained modern lumber and asphalt.

Figure 101. Overview of Trench 12, view to southwest

Figure 102. Profile view of Trench 12, view to west (note: asphalt surface beneath Stratum V, possible buried A-horizon)

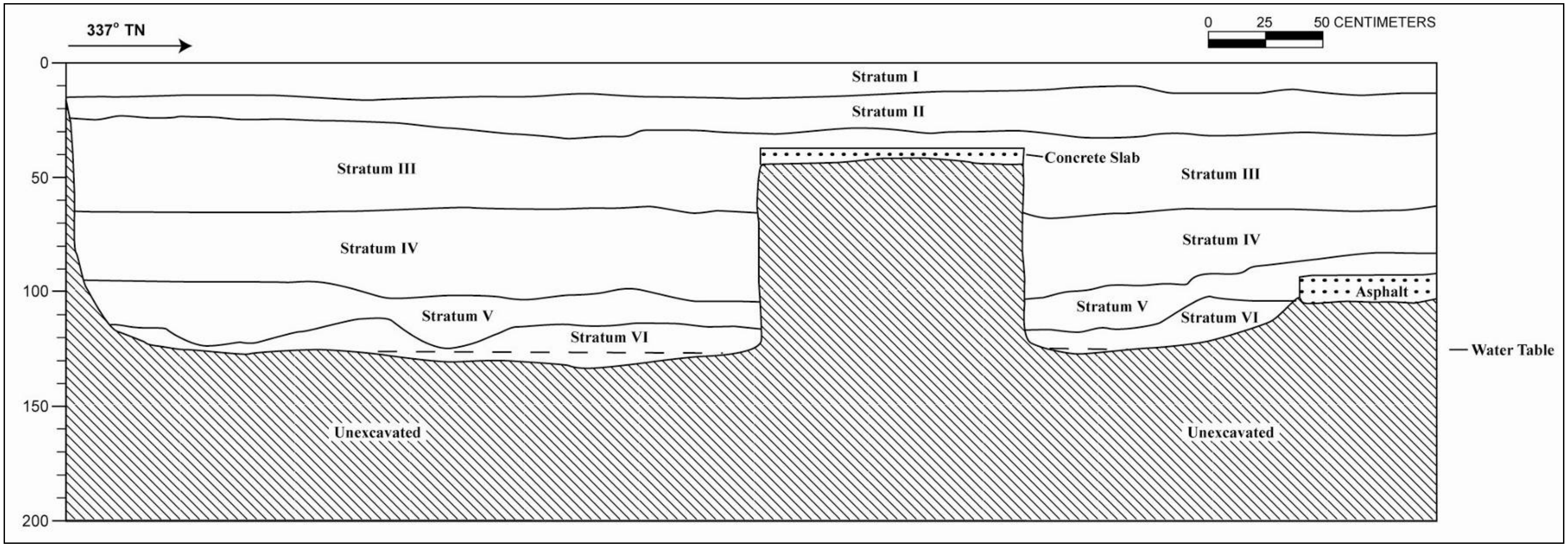

Figure 103. Trench 12 stratigraphic profile, west wall (note: asphalt surface beneath Stratum V, possible buried A-horizon)

Table 18. Strata observed within Test Trench 12

Stratum	Depth (cmbs)	Description of Sediment
I	0-15	Asphalt
II	15-35	Fill; 10YR 3/1, very dark gray; gravelly sand, contains 80% subangular basalt gravel; structureless (massive); dry, loose consistency; non-plastic; no cementation; mixed origin; very abrupt, smooth lower boundary; no roots observed
III	25-65	Fill; 2.5Y 4/3, olive; gravelly sandy loam, contains 90% crushed coral; weak, very fine crumb structure; moist, friable consistency; no cementation; non-plastic; mixed origin; clear, smooth lower boundary; no roots observed
IV	65-105	Fill; 10YR 5/4, yellowish brown; medium-grain silty sand, contains 5% coral; structureless (single-grain); moist, friable consistency; no cementation; non-plastic; marine origin; abrupt, smooth lower boundary; no roots observed; redeposited sand
V	85-125	A-horizon; 10YR 3/1, very dark gray; sandy clay; moderate, medium blocky structure; moist, firm consistency; no cementation; plastic; mixed origin; clear, wavy lower boundary; no roots observed
VI	105-130 (BOE)	10YR 7/2, light gray; fine- to medium-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; no roots observed; natural Jaucas sand

4.5.13 Test Trench 13

Test Trench 13, located within the walkway of the Kālia Road pedestrian entrance in the northeastern portion of the project area, was oriented in an approximate N-S direction and measured 3.25 m long by 1.0 m wide with a maximum depth of 100 cmbs (Figure 104 to Figure 106 and Table 19). Groundwater was observed at 95 cmbs. The stratigraphy of Test Trench 13 consisted of a concrete and flagstone cap (Stratum I) overlying basalt gravel utility fill (Stratum II), sandy loam fill (Stratum III) and natural Jaucas sand (Stratum IV). No cultural materials were observed in Test Trench 13.

Figure 104. Overview of Trench 13, view to southeast

Figure 105. Profile view of Trench 13, view to east

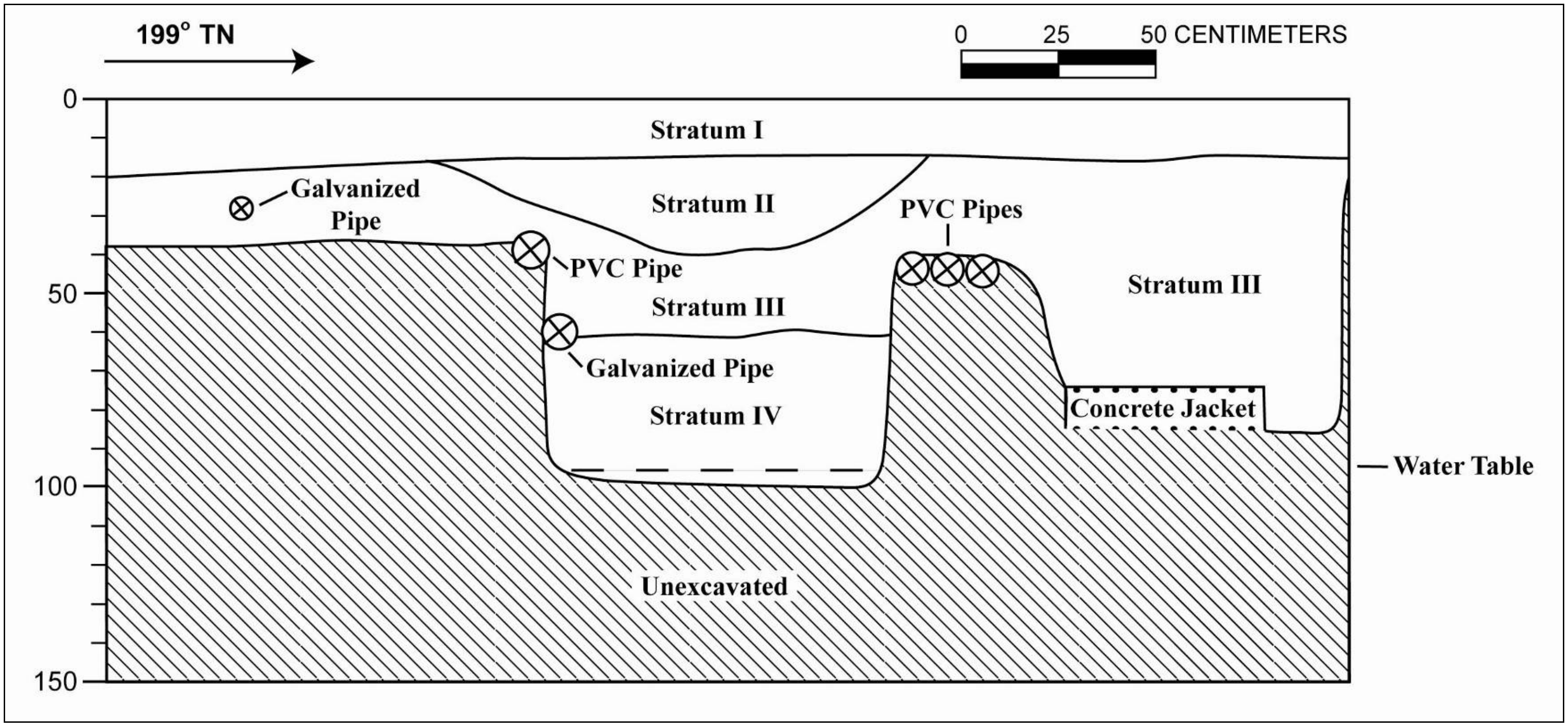

Figure 106. Trench 13 stratigraphic profile, east wall

Table 19. Strata observed within Test Trench 13

Stratum	Depth (cmbs)	Description of Sediment
I	0-20	Concrete cap with flagstone
II	16-40	Fill; 10YR 3/1, very dark gray; basalt gravel cobbles; strong, coarse, granular structure; moist, extremely firm consistency; non-plastic; indurated cementation; terrestrial origin; clear, smooth and broken lower boundary; no roots observed; basalt gravel utility excavation fill
III	15-60	Fill; 10YR 3/3, dark brown; sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; no cementation; mixed origin; clear, smooth lower boundary; no roots observed
IV	60-100 (BOE)	10YR 8/3, very pale brown; fine-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; no roots observed; natural Jaucas sand

4.5.14 Test Trench 14

Test Trench 14, located within the landscape *mauka* (north) of the walkway of the Kālia Road pedestrian entrance in the northeastern portion of the project area, was oriented in an approximate NE-SW direction and measured 4.0 m long by 1.0 m wide with a maximum depth of 275 cm below the datum (cmbd) (Figure 107 to Figure 109 and Table 20). Groundwater was observed at 270 cmbd. The stratigraphy of Test Trench 14 consisted of clay loam landscaped topsoil (Stratum I) overlying sandy clay fill (Stratum II), sandy loam fill (Strata III and IV), termite deterrent sand fill (Stratum V), sandy gravel fill (Stratum VI), sandy loam fill (Stratum VII), loamy sand fill (Strata VIII and IX), and natural Jaucas sand (Stratum X). No cultural materials were observed in Test Trench 14.

Figure 107. Overview of Trench 14, view to northwest

Figure 108. Profile view of Trench 14, view to southeast

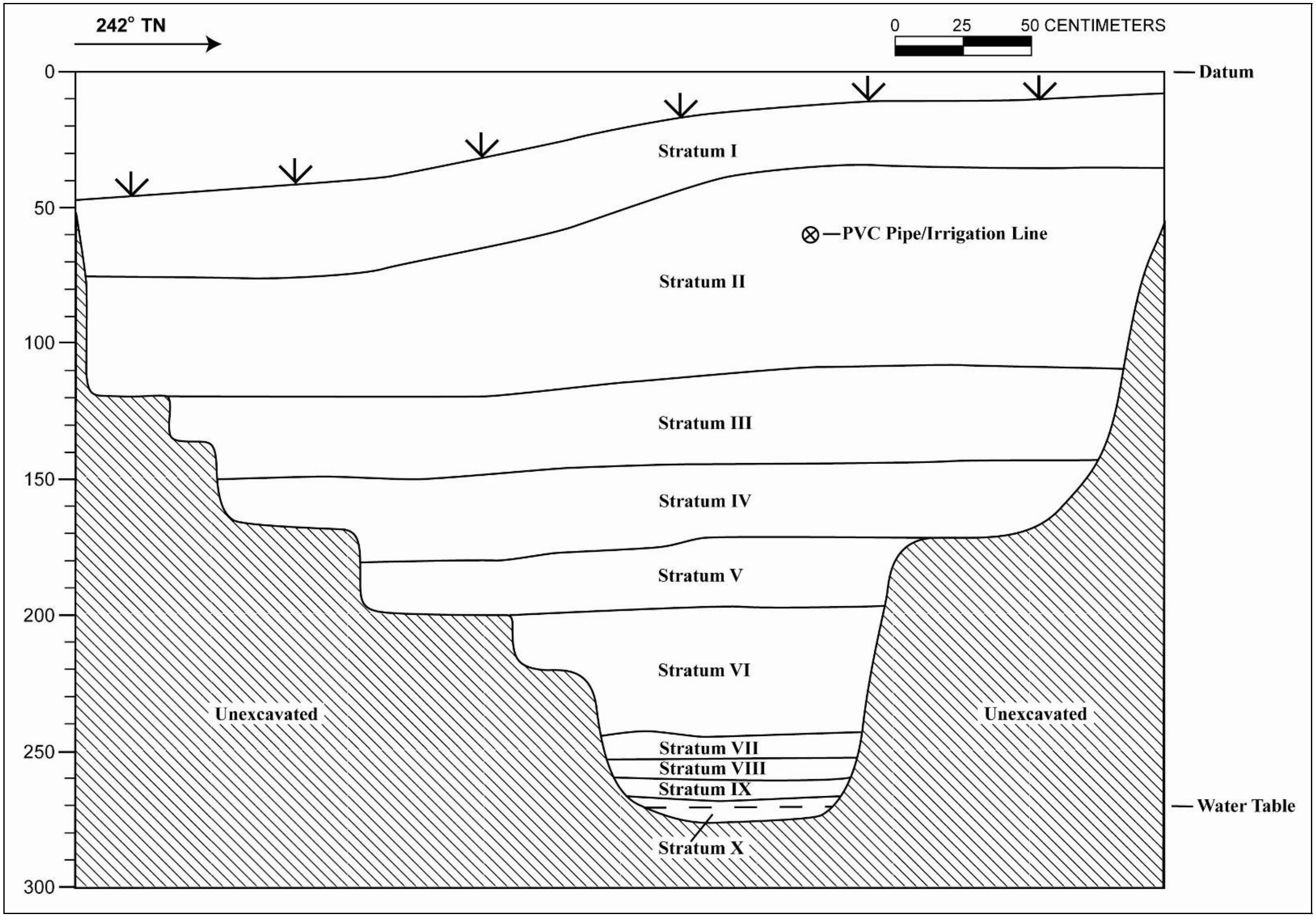

Figure 109. Trench 14 stratigraphic profile, southeast wall

Table 20. Strata observed within Test Trench 14

Stratum	Depth (cmbd)	Description of Sediment
I	10-75	Fill; 7.5YR 2.5/3, very dark brown; clay loam; weak, fine to medium crumb structure; moist, very friable consistency; no cementation; slightly plastic; terrestrial origin; very abrupt, smooth lower boundary; fine to medium roots common; landscaped topsoil
II	35-120	Fill; 10YR 6/1, gray; sandy clay; weak, fine to medium crumb structure; moist, friable consistency; no cementation; slightly plastic; terrestrial origin; abrupt, smooth lower boundary; few medium roots; construction grade compacted fill deposit
III	110-150	Fill; 10YR 6/3, pale brown, mottled with 40% medium to coarse 10YR 3/1, white; sandy loam; weak, fine to medium crumb structure; moist, loose consistency; no cementation; non-plastic; mixed origin; diffuse, smooth lower boundary; few fine roots; gravelly and cobbly construction grade compacted fill deposit
IV	143-180	Fill; 10YR 4/4, dark yellowish brown, mottled with 25% fine to coarse 10YR 8/1 white; sandy loam; weak, fine to medium crumb structure; moist, loose consistency; no cementation; non-plastic; mixed origin; very abrupt, smooth lower boundary; cobbly construction grade compacted fill
V	170-200	Fill; GLEY1 2.5/N, black; fine sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; terrestrial origin; abrupt, smooth lower boundary; no roots observed; old termite deterrent sand deposit observed in other parts of property
VI	195-244	Fill; 2.5Y 4/1, dark gray; gravelly sand; moderate, medium blocky structure; moist, loose consistency; no cementation; non-plastic; terrestrial origin; abrupt, smooth lower boundary; no roots observed; S4C gravel fill
VII	244-252	Fill; 10YR 3/1, very dark gray; sandy loam, contains medium to coarse gravel; weak, fine crumb structure; moist, very friable; slightly plastic; mixed origin; clear, smooth lower boundary; no roots observed
VIII	252-260	10YR 3/4, dark yellowish brown; loamy sand; weak, fine granular structure; moist, very friable; no cementation; non-plastic; mixed origin; clear, smooth lower boundary; no roots observed
IX	260-268	10YR 3/2, very dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; abrupt, smooth lower boundary; no roots observed
X	266-275 (BOE)	2.5Y 6/3, light yellowish brown; sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; no roots observed; natural Jaucas sand

4.5.15 Test Trench 15

Test Trench 15, located in the walkway behind the Louis Vuitton store in the eastern central portion of the project area, was oriented in a SW-NE direction, was oriented in an approximate NE-SW direction and measured 6.0 m long by 0.8 m wide with a maximum depth of 175 cmbs (Figure 110 to Figure 112 and Table 21). Groundwater was observed at 165 cmbs. The stratigraphy of Test Trench 15 consisted of asphalt topped with flagstone (Stratum I) overlying silty sand fill (Stratum II), a deposit of gravelly coarse-grain sand (S4C gravel) fill (Stratum III), several strata of redeposited sand fill (Strata IV, V, VI), a previously disturbed A-horizon (Stratum VII), previously disturbed sandy clay (Stratum VIII), sandy loam fill (Stratum IX), and Jaucas sand (Stratum X). Cultural material observed during excavation of Stratum VII of Test Trench 15 consisted of faunal remains, metal nails, ceramic and glass fragments, and cinder blocks remnant of a foundation. A fragmented ceramic plate and a glass bottle were encountered in Stratum X.

Figure 110. Overview of Trench 15, view to southwest

Figure 111. Profile view of Trench 15, view to west

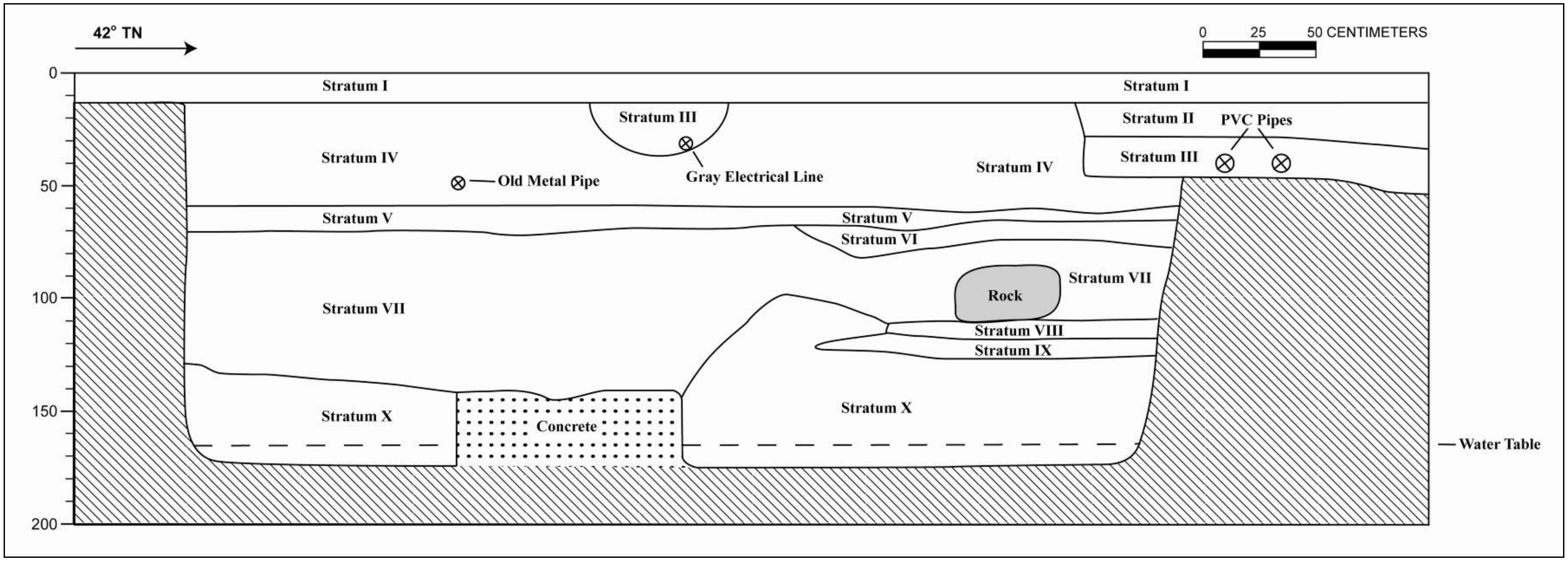

Figure 112. Trench 15 stratigraphic profile, west wall

Table 21. Strata observed within Test Trench 15

Stratum	Depth (cmbs)	Description of Sediment
I	0-12	Asphalt with flagstone
II	12-35	Fill; 10YR 3/3, dark brown; silty sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; clear, wavy and broken/discontinuous lower boundary; few fine to medium roots; specks of blue tarp are visible within matrix
III	12-55	Fill; 10YR 2/1, black; gravelly coarse-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; very abrupt, broken/discontinuous lower boundary; no roots observed; S4C gravel fill
IV	12-62	Fill; 10YR 7/3, very pale brown; fine-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; diffuse, smooth lower boundary; few fine roots; disturbed sand
V	60-70	Fill; 7.5YR 5/4, brown; gravelly sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; diffuse, smooth and broken/discontinuous lower boundary; no roots observed
VI	61-72	Fill; 10YR 4/3, brown; sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; diffuse, smooth lower boundary; no roots observed
VII	62-145	A-Horizon; 10YR 3/2, very dark grayish brown; silty sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; clear, wavy lower boundary; few fine to medium roots; previously disturbed
VIII	110-120	7.5YR 3/4, dark brown; sandy clay; weak, fine crumb structure; moist, loose consistency; no cementation; slightly plastic; terrestrial origin; clear, broken/discontinuous lower boundary; no roots observed; previously disturbed
IX	115-131	10YR 2/1, black; sandy loam, contains 95% subangular basalt gravel and cobbles covered in tar; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; broken/discontinuous lower boundary; previously disturbed
X	99-175 (BOE)	10YR 8/3, very pale brown; fine-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; no roots observed; disturbed Jaucas sand; previously disturbed

4.5.16 Test Trench 16

Test Trench 16, located within the deck area of the Rainbow Bazaar in the central portion of the project area, was oriented in a NE-SW direction and measured 7.2 m long by 0.6 m wide with a maximum depth of 170 cm below the surface of the wooden deck (Figure 113 to Figure 115 and Table 22). Groundwater was observed at 165 cmbs. The stratigraphy of Test Trench 16 consisted of a wooden deck with support joists and a concrete foundation overlying termite deterrent sand (Stratum I), sandy loam fill (Strata II and III), and natural Jaucas sand (Stratum IV). No cultural material was observed in Test Trench 16.

Figure 113. Overview of Trench 16, view to southwest

Figure 114. Profile view of Trench 16, view to south

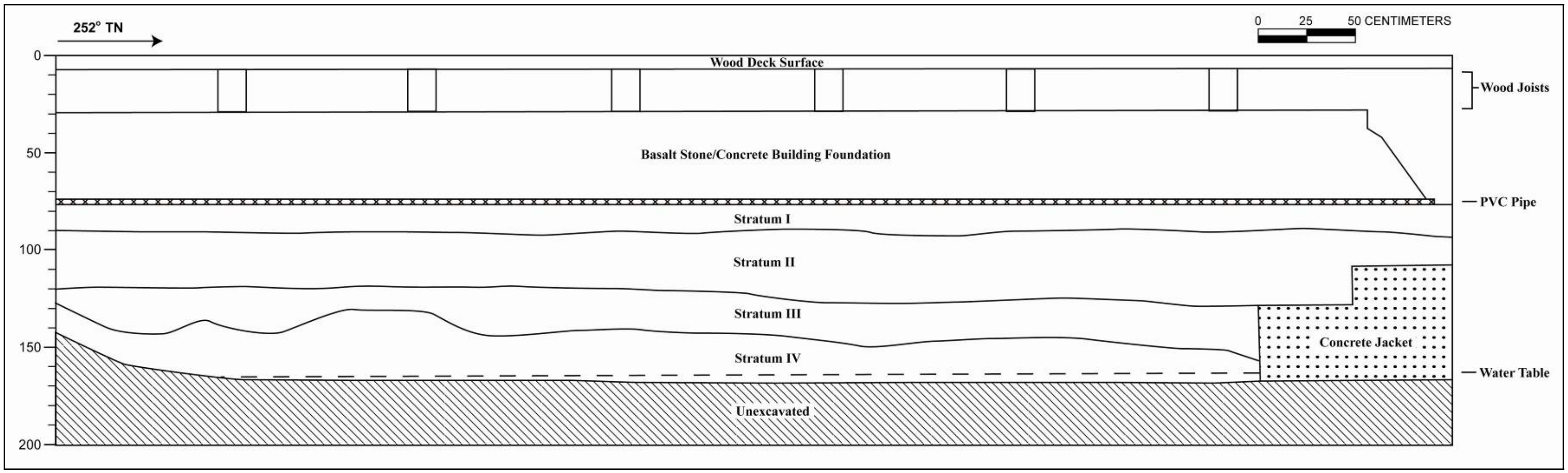

Figure 115. Trench 16 stratigraphic profile, south wall

Table 22. Strata observed within Test Trench 16

Stratum	Depth (cmbs)	Description of Sediment
I	78-95	Fill; 2.5Y 3/1, very dark gray; coarse-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; terrestrial origin; very abrupt, smooth lower boundary; no roots observed; basalt sand deposited for termite control
II	90-130	Fill; 10YR 4/3, brown; gravelly sandy loam; weak, fine to medium blocky structure; moist, loose consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; no roots observed;
III	117-155	Fill; 10YR 2/2, very dark brown; sandy loam; weak, fine to medium blocky structure; moist, friable consistency; no cementation; non-plastic; mixed origin; very abrupt, wavy lower boundary; no roots observed
IV	130-170 (BOE)	2.5Y 7/3, pale yellow; fine-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; no roots observed; natural Jaucas sand

4.5.17 Test Trench 17

Test Trench 17, located within the deck area of the Rainbow Bazaar in the central portion of the project area, was oriented in a NE-SW direction and measured 5.0 m long by 0.5 m wide with a maximum depth of 175 cm below the surface of the wooden deck (Figure 116 to Figure 118 and Table 23). Groundwater was observed at 175 cmbs at the base of excavation. The stratigraphy of Test Trench 17 consisted of a wooden deck with support joists and joist supports overlying termite deterrent sand (Stratum I), clay loam fill (Stratum II), sandy loam fill (Stratum III), and natural Jaucas sand (Stratum IV). A possible carved soapstone pipe bowl fragment (see Figure 132) was recovered from a depth of 165 – 175 cmbs in Stratum IV of Test Trench 17. Two relatively non-descript dinnerware ceramic fragments were also recovered from this same level of Stratum IV.

Figure 116. Overview of Trench 17, view to southwest

Figure 117. Profile view of Trench 17, view to south

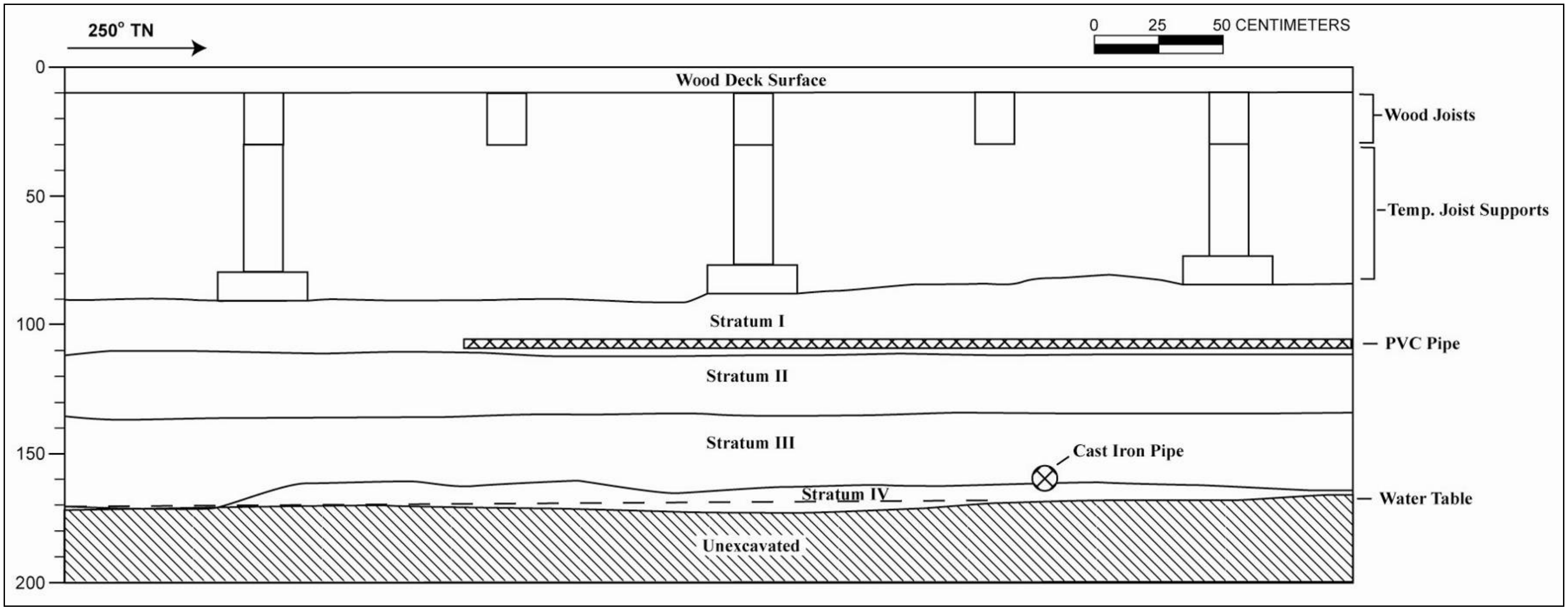

Figure 118. Trench 17 stratigraphic profile, south wall

Table 23. Strata observed within Test Trench 17

Stratum	Depth (cmbs)	Description of Sediment
I	80-112	Fill; 2.5Y 3/1, very dark gray; coarse-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; terrestrial origin; very abrupt, smooth lower boundary; no roots observed; basalt sand deposited for termite control
II	110-135	Fill; 7.5YR 3/3, dark brown, mottled with 50% fine 2.5Y 3/1 very dark gray; clay loam, contains 30% coral; weak, medium to coarse blocky structure; moist, friable consistency; no cementation; slightly plastic; terrestrial origin; abrupt, smooth lower boundary; no roots observed
III	133-170	Fill; 10YR 3/2, very dark grayish brown; sandy loam; weak, fine to medium blocky structure; moist, friable consistency; no cementation; non-plastic; mixed origin; abrupt, wavy lower boundary; no roots observed
IV	159-175 (BOE)	10YR 7/3, very pale brown; fine-grain sand; structureless (single-grain); wet, non-sticky consistency; no cementation; non-plastic; marine origin; no roots observed; natural Jaucas sand

4.5.18 Test Trench 18

Test Trench 18, located within the deck area of the Rainbow Bazaar in the central portion of the project area, was oriented in a SE-NW direction and measured 5.0 m long by 0.8 m wide with a maximum depth of 170 cm below the surface of the wooden deck (Figure 119 to Figure 121 and Table 24). Groundwater was observed at 165 cmbs. The stratigraphy of Test Trench 18 consisted of a wooden deck with support joists and a concrete pond feature overlying termite deterrent sand (Stratum I), sandy clay fill (Stratum II), silty clay fill (Stratum III), and disturbed Jaucas sand (Stratum IV). Cultural material observed during excavation of Stratum IV of Test Trench18 consisted of faunal remains, ceramic fragments, and metal pieces.

Figure 119. Overview of Trench 18, view to northwest

Figure 120. Profile view of Trench 18, view to west

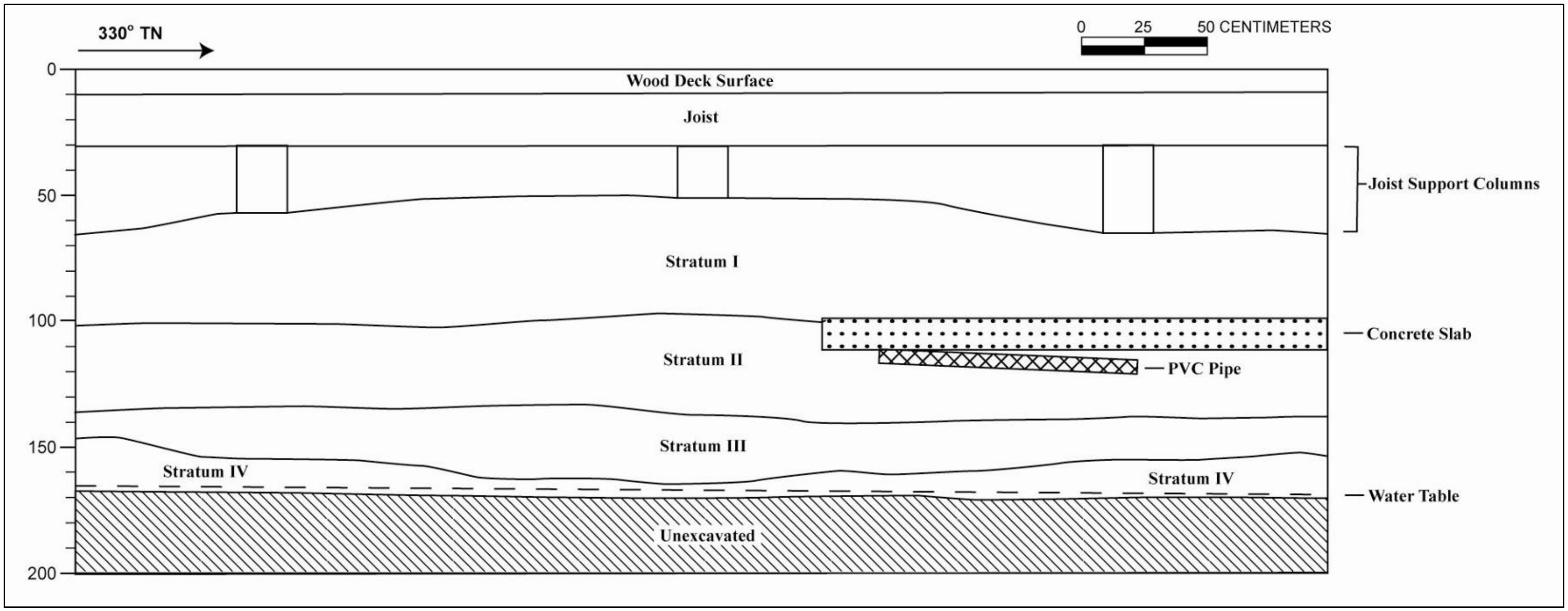

Figure 121. Trench 18 stratigraphic profile, west wall

Table 24. Strata observed within Test Trench 18

Stratum	Depth (cmbs)	Description of Sediment
I	50-100	Fill; 2.5Y 3/1, very dark gray; gravelly sand; structureless (massive); moist, loose consistency; no cementation; non-plastic; terrestrial origin; clear, smooth lower boundary; no roots observed; basalt sand deposited for termite control
II	100-140	Fill; 5YR 3/2, dark reddish brown; sandy clay, contains coral and gravel; weak, fine crumb structure; moist, friable consistency; no cementation; slightly plastic; mixed origin; clear, smooth lower boundary; no roots observed
III	140-160	Fill; 7.5YR 3/1, very dark gray; silty clay; moderate, fine crumb structure; moist, friable to firm consistency; no cementation; slightly plastic; mixed origin; clear, smooth lower boundary; no roots observed
IV	145-165 (BOE)	10YR 7/3, very pale brown; coarse-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; no roots observed; disturbed sand

4.5.19 Test Trench 19

Test Trench 19, located in the Rainbow Bazaar near the ABC store in the central portion of the project area, was oriented in a SE-NW direction and measured 3.5 m long by 0.75 m wide with a maximum depth of 118 cmbs (Figure 122 to Figure 124 and Table 25). Groundwater was observed at 115 cmbs. The stratigraphy of Test Trench 19 consisted of asphalt topped with flagstone (Stratum I) overlying crushed basalt base course (Stratum II), a previous asphalt surface (Stratum III), sandy loam fill (Stratum IV), a buried A-horizon (Stratum V), and natural Jaucas sand (Stratum VI). Faunal remains were observed during excavation of Stratum V of Test Trench 19.

Figure 122. Overview of Trench 19, view to northwest

Figure 123. Profile view of Trench 19, view to west

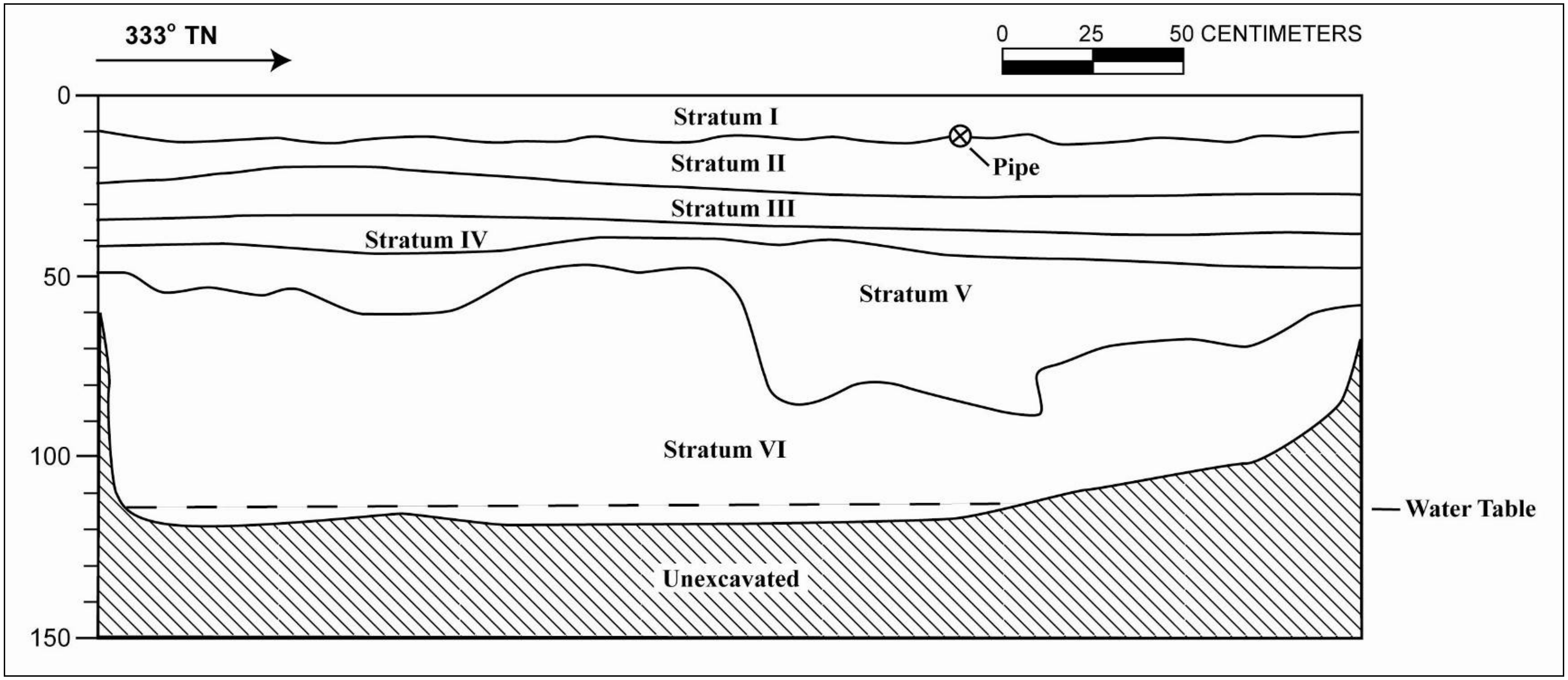

Figure 124. Trench 19 stratigraphic profile, west wall

Table 25. Strata observed within Test Trench 19

Stratum	Depth (cmbs)	Description of Sediment
I	0-15	Asphalt with flagstones
II	10-30	Fill; 10YR 3/2, very dark grayish brown; gravelly sandy loam, contains 70% crushed basalt gravel; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; abrupt, smooth lower boundary; fine to medium roots common; base course
III	20-40	Previous asphalt surface; yellow paint visible on portion
IV	32-50	Fill; 10YR 5/8, yellowish brown; sandy loam, contains 60% crushed coral; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; clear, wavy lower boundary; fine to medium roots common; gravelly base course
V	40-90	A-horizon; 10YR 2/2, very dark brown; sandy clay; weak, fine crumb structure; moist, very friable consistency; no cementation; slightly plastic; mixed origin; abrupt, wavy lower boundary; fine to medium roots common
VI	47-120 (BOE)	10YR 8/3, very pale brown; fine-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; fine to medium roots common; natural Jaucas sand

4.5.20 Test Trench 20

Test Trench 20, located in the Rainbow Bazaar in the central portion of the project area, was oriented in a SW-NE direction and measured 5.6 m long by 0.7 m wide with a maximum depth of 130 cmbs (Figure 125 to Figure 127 and Table 26). Groundwater was observed at 125 cmbs. The stratigraphy of Test Trench 20 consisted of concrete (Stratum I) overlying silty sand fill (Stratum II), crushed coral fill (Stratum III), a buried A-horizon (Stratum IV), and natural Jaucas sand (Stratum V). Faunal remains were observed in Strata II and V of Test Trench 20. Cultural material observed during excavation of Stratum IV consisted of metal nails, plastic and electrical parts, and ceramic fragments.

Figure 125. Overview of Trench 20, view to west

Figure 126. Profile view of Trench 20, view to northwest

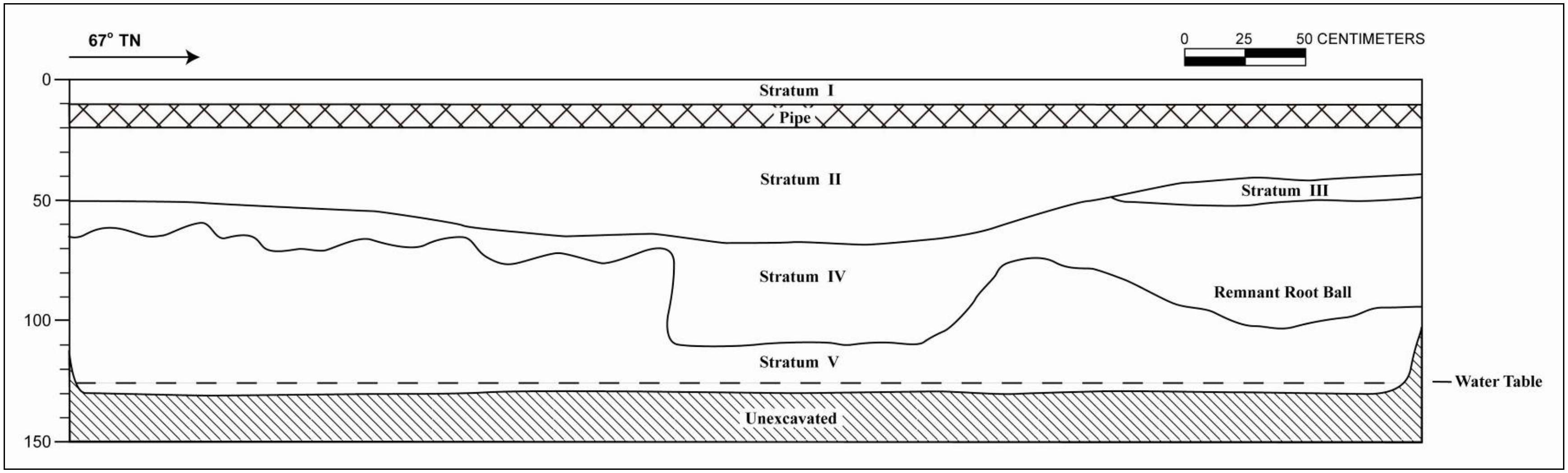

Figure 127. Trench 20 stratigraphic profile, northwest wall

Table 26. Strata observed within Test Trench 20

Stratum	Depth (cmbs)	Description of Sediment
I	0-10	Concrete
II	20-67	Fill; 10YR 4/3, brown; sandy loam; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; diffuse, smooth lower boundary; few fine roots
III	42-53	Fill; 10YR 8/2, very pale brown; silty sand, contains 95% crushed coral, gravels and small pebbles; structureless (massive); moist, very firm; no cementation; non-plastic; marine origin; clear, smooth and broken/discontinuous lower boundary
IV	50-111	10YR 3/2, very dark grayish brown; sandy loam; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; mixed origin; very abrupt, irregular lower boundary; possible buried A-horizon
V	70-130 (BOE)	10YR 8/3, very pale brown; fine-grain sand; structureless (single-grain); moist, loose consistency; no cementation; non-plastic; marine origin; natural Jaucas sand

4.6 Historic Property Description

4.6.1 SIHP# 50-80-14-2870

Site Type: Buried Culturally-enriched A-horizon (cultural layer)
No. of Features: Minimally 3 Features
Functional Interpretation: Activity Area/Burial
Probable Age: Post-contact
Overall Dimensions: Discontinuous portions within a 220.0 m N/S by 203.0 m E/W area
Topography: Level
Elevation: 3.3 ft (1 m) AMSL
Location: TMK [1] 2-6-008:001, 007, 019, 020, and 038 & 2-6-009:009, 011-013
Description:

SIHP 50-80-14-2870 was used by Earl Neller to designate three post-contact burials and numerous pit features containing historic refuse (Neller 1980). While Neller designates no site boundaries per se, he associates this historic property with all features in an approximately 3000 square foot area (Neller 1980:11, 22, 23, & 31) in the northeast portion of the Hilton Hawaiian Village Campus under his purview at the time (see Figure 70). The Hurlbett et al. (1992) archaeological monitoring report describes “15 horizontal features” widely distributed over the Hilton Hawaiian Village campus as well as artifacts, midden and miscellaneous objects recovered from disturbed deposits (see Figure 70). The pit features that were identified by

Hurlbett et al. (1992) lack feature-specific information and could not be geographically located, and therefore were not assigned alphabetical feature designations.

A buried A-horizon, which was observed during the present study (Tulchin et al. 2011) within Trench 3, 4, 10, 11, 12, 15, 19, and 20, was also assigned to SIHP# 50-80-14-2870. In general, the buried A-horizon was observed to be discontinuous and truncated suggesting a high degree of previous disturbance. Artifacts or cultural content within the buried A-horizon were sparse. A glass soda bottle fragment that was collected from the buried A-horizon observed within Trench 3 dated the layer to post-1902 (see Section 5.1, Historic Artifact Analysis). Additionally, the buried A-horizon within Trench 3 and Trench 12 was partially underlain by an asphalt surface in the northern portion of each trench suggesting temporal modernity. In Trench 11, pieces of asphalt and wood fragments were observed within the buried A-horizon. In Trench 15, the buried A-horizon was observed overlying previously disturbed strata containing cinder blocks and concrete foundation remnants. In Trench 20, several small, undulating pits and one possible backfilled trench outline were observed extending from the base of the buried A-horizon. Field observations indicate that these undulating pits minimally contain infrequent charcoal flecking that was determined to be too small for wood taxa identification.

SIHP# 50-80-14-2870 is a buried, culturally-enriched A-horizon (cultural layer) previously associated with three post-contact human burials that functioned as a post-contact activity area. The expression of this cultural layer is often weak and the layer is discontinuous.

The Neller study assigns no significance evaluation to SIHP# 50-80-14-2870. The Hurlbett et al. (1992:35) archaeological monitoring report concluded that: “Based on the findings of the current study, the project area [equated with the Hilton Hawaiian Village campus] (including Site 2870) is felt to be significant solely for information content…” The findings documented here do not lead us to suggest any change to the significance assessment recommended previously. It is our understanding that this historic property was previously determined as significant solely for information content, which in terms of the criteria used by the Hawai‘i State Register of Historic Places (HAR 13-284-6) would be criterion D - Historic property has yielded or may be likely to yield information important in prehistory or history.

Section 5 Results of Laboratory Analysis

5.1 Historic Artifact Analysis

The Hilton Hawaiian Village artifact assemblage consists of 50 glass bottle or bottle fragments, 27 ceramic fragments, 11 stone fragments, 1 soapstone fragment, and one plastic fragment, with a total weight of 3,808 grams. A catalog of all artifacts collected is included as Appendix D.

5.1.1 Glass Bottles Analysis

All terminology used to describe bottle traits and all bottle dating information on glass manufacturing techniques was taken from the U.S. Dept. Interior, Bureau of Land Management (BLM) and Society of Historic Archaeology (SHA) “Historic Glass Bottle Identification and Information Website” (http://www.sha.org/bottle/). Research on historic artifacts focused on the function and manufacturing dates of the items, using reference texts to identify glass manufacturers’ marks on bottles and company histories of the brands identified (i.e. Elliott 1971; Elliott and Gould 1988; Fike 1987; Millar 1988; Munsey 1970; Toulouse 1972; Zumwalt 1980).

The earliest glass bottles were free-blown, without the use of any molds. After bottles were free-blown, the bottles were attached at the base to a pontil rod so that the worker could detach the bottle from the blowpipe in the neck area and finish the lip of the bottle by hand. When the bottle was finished, the pontil rod was removed, but it left a scar on the base of the bottle called a pontil mark. By 1800, some bottle manufacturers were beginning to blow the base and a portion of the body into a wooden or metal mold; thus, a pontil rod was no longer necessary. By 1850, most bottles were mold blown; these bottles do not have pontil marks. None of the Hilton Hawaiian bottles have a pontil mark, or other characteristic of free-blown bottles, which means the glass bottles all date after 1850.

Although bottles were blown in molds after 1850, the lip of the bottle was still finished by hand. Beginning in the 1800s, additional glass was applied (“applied finish”) around the lip as a bead or collar, usually to stabilize the lip or to provide a protuberance for some type of metal closure. A finishing or lipping tool then was used to form the lip and collar of the bottle. Beginning in the 1870s, the technique changed and the lip to the neck portion of the bottle were re-fired (without adding additional glass), and the lip was finished with a lipping tool (“tooled finish”). These techniques were quickly adopted, and by the 1890s, most bottles had tooled finishes.

In 1898, semi-automatic machines, where the air was blown by a machine, were introduced; this was used mainly for wide-mouthed bottles. In 1905, a machine was invented that blew the bottle from the base to the lip. This was known as the Automatic Bottle Machine (ABM), and it was so much more efficient and cheaper than the old methods, that by 1920, most of the American bottle manufacturers had switched to this new technique. All bottles made by these machines have side seams that extend from the base to, and over, the lip, as the lip is completely finished by the machine.

The glass bottle assemblage represents a minimum of 19 bottles: 4 soda bottles, 4 spirits (whiskey, beer, ale, etc.) bottles, 2 beverage (spirits, soda, mineral water, etc.) bottles, 2 condiment (Worcestershire sauce) bottles, 5 medicine bottles, 1 cosmetic bottle, and 2 bottles of unknown function (Table 27 and Figure 128). None of the bottles were made before 1850, when bottles were still completely free-blown. No bottles with lips have an applied finish, indicating the bottles post-date the 1870s. Seven bottles have information on manufacturing techniques, two were blown in a mold and have tooled lips, which usually date from 1870-1920, one bottle was made either in a semi-automatic or automatic bottle machine and dates to 1890-1920, and four were blown in a automatic bottle machine, which means they post-date 1905.

The brand information can narrow the dates for four bottles: the Fountain Mineral and Soda Works bottle with a tooled lip dates from 1902-1911 based on the company history; an ABM Hawaii Beverages bottle has a date code of 1962; the Pond's Extract bottle with an ABM lip probably dates before 1920, when this witch hazel product was phased out by the Pond's company; and, a beer bottle (possibly Pabst) had a glass manufacturer mark that dates the bottle to 1900-1929, or 1900-1920 for alcoholic beverages, which were not manufactured during prohibition. Thus, we have at least four bottles that date to the first two decades of the 20th century, and one bottle dates to 1962.

5.1.2 Ceramic Analysis

Research on ceramic artifacts focused on the manufacturing dates of the items, using reference texts to identify ceramic marks and the potteries that they identify (i.e., Burton and Hobson 1919; Cushion and Honey 1996; Godden 1964; Lehner 1978, 1988).

The ceramic assemblage represents a minimum of 14 dinnerware vessels: 5 porcelain dishes (at least 3 plates and 1 bowl), 4 whiteware dishes (at least 1 plate), one whiteware handle, 1 whiteware lid, and 3 stoneware jars.

One complete whiteware plate is a "calendar" plate; a novelty or souvenir that was often hung on the wall, rather than used as dinnerware (Figure 129). This plate is for "1914", "Compliments of Lin Sing Kee, Honolulu, T. H." who was probably the shop owner who sold the plate. The plate was collected from Stratum X of Trench 15.

A porcelain plate fragment has a pottery mark on the back for "Homer Laughlin/ American Beauty." Homer Laughlin is a large pottery company in Ohio, established in 1871 (Figure 130). It introduced the "American Beauty" shape (not pattern) in 1899, but discontinued the line sometime between 1908 and 1916. The pottery mark on the back dates to around the turn of the century. The porcelain fragment was collected from Stratum V-VI of Trench 3.

The ceramic assemblage also includes fragments of three tiles, possibly for a bathroom or decorative floor/wall. Three of the fragments connect to one another, one from Trench 1, Stratum III, and one from Trench 2, Stratum V, indicating the widespread scatter of the historic trash. Together, the words "TRADE/ GLADDING/ M…" are embossed on one side (Figure 131). This is probably the mark of the tile/pipe company "Gladding, McBean" of Lincoln, California, which was established in 1875; it is still in business today.

Table 27. Glass bottle summary table

Provenience	Type	Color	Brand	Date
T-1, Str. III	soda	colorless	Hawaii Beverages	1962
T-2, Str. V	condiment	aqua	Lea & Perrins Worcestershire	1898-1920
T-3, Str. V-VI	soda	colorless	Fountain . . . Works	1902-1911
T-15, Str. X	condiment	aqua	Holbrook & Co. Worcestershire	1908-ca. 1920
T-15, Str. X	cosmetic	aqua	unknown	post-1850
T-15, Str. X	medicine	aqua	unknown	post-1850
T-15, Str. X	medicine	aqua	Pond’s Extract	1906-1920 ca.
T-15, Str. X	medicine	aqua	Fletcher’s Castoria	post 1905
T-15, Str. X	soda	lt. green	unknown	post 1905
T-15, Str. X	beverage	lt. blue	unknown	post 1850
T-15, Str. X	soda	colorless	unknown	post 1905 ca.
T-15, Str. X	beverage	colorless	unknown	post 1850
T-15, Str. X	medicine	colorless	poss. Pond’s Extract	post 1905 ca.
T-15, Str. X	medicine	colorless	unknown	post 1905 ca.
T-15, Str. X	unknown	colorless w/ paint	unknown	Unknown
T-15, Str. X	spirits	amber	unknown	post 1850
T-15, Str. X	beer	amber	poss. Pabst beer	1900-1920
T-15, Str. X	beer/spirits	amber	unknown	1870-1920
T-20, Str. IV	unknown	colorless	unknown	--

Figure 128. Representative photograph of glass bottles that were collected within the project area

Figure 129. A 1914 “calendar” plate collected from Stratum X of Trench 15

Figure 130. Homer Laughlin porcelain plate fragment collected from Stratum V-VI of Trench 3

Figure 131. Ceramic tile fragments collected from Stratum III of Trench 1 (at left) and Stratum V of Trench 2 (at right)

5.1.3 Other Material

There are other construction artifacts in the assemblage: three heavily corroded wire nails and 11 fragments of stoneware tile, which seem to be thin sawn fragments of sandstone, shale, and other sedimentary rocks. These were probably used for some decorative floor treatment. Machine made wire nails were first made in 1850 and came to dominate the nail industry by 1890 to the present (IMACS 1992)

The remaining two items are a possible carved soapstone pipe bowl fragment and a plastic strip, like from hair barrette (Figure 132).

5.1.4 Summary of Historic Artifact Analysis

In summary, there are several glass and ceramic artifacts in the Hilton Hawaiian Village assemblage that date definitely to the first two decades of the twentieth century, and one artifact that dates to 1962. There is no definite material that dates any earlier than ca. 1890. The assemblage seems to be composed of general residential trash, rather than commercial or industrial refuse. There is also some evidence for a widespread scatter of the trash, rather than a concentration, as two tile fragments from two different trenches and two different strata refit to make one tile.

5.2 Faunal Analysis

The faunal assemblage is composed of 202.4 grams of bone from six trenches (Table 28). The bones were identified according to species if possible, using the CSH mammal bone collection and standard reference texts (Olsen 1964; Schmid 1972; Sisson 1914). Two trenches have bones from *Gallus gallus*, the domestic chicken. In modern times, most chickens are killed from 6-12 weeks old, which means the epiphyses on many bones are not fully fused. Both of the chicken bones from the assemblage have unfused epiphyses, indicating that they were probably killed for food consumption. The same is true of the pig (*Sus scrofa*), which today usually is killed at 9-12 months old, meaning that many of the bones are not fully developed. There are five pig bones in the assemblage, representing small specimens; one pelvis fragment (pubis) is very light and porous, probably from a young animal. One of the pig bones has butchering marks from a knife or other tool used to cut (de-flesh) the meat from the bone shaft.

There are six bones consistent with a medium to large mammal, probably pig or cow bones. Two are large long bone shaft fragments, probably cow (*Bos taurus*) based on their size. Four of these bones have butchering marks, with chop marks (i.e. ax or cleaver marks), sawn ends, and de-fleshing cuts. Thus, the mammal bones all seem to represent food remains.

The assemblage also has one fish bone (spine) and 12 bone fragments of one small bird (smaller than a chicken). These bird bones are probably not associated with food consumption.

5.3 Bulk Sample Analysis

During subsurface testing, six bulk sediment samples, totaling 8.51 kg of sediment were collected from the possible buried A-horizon observed in four test trenches (Test Trench 4, 12,

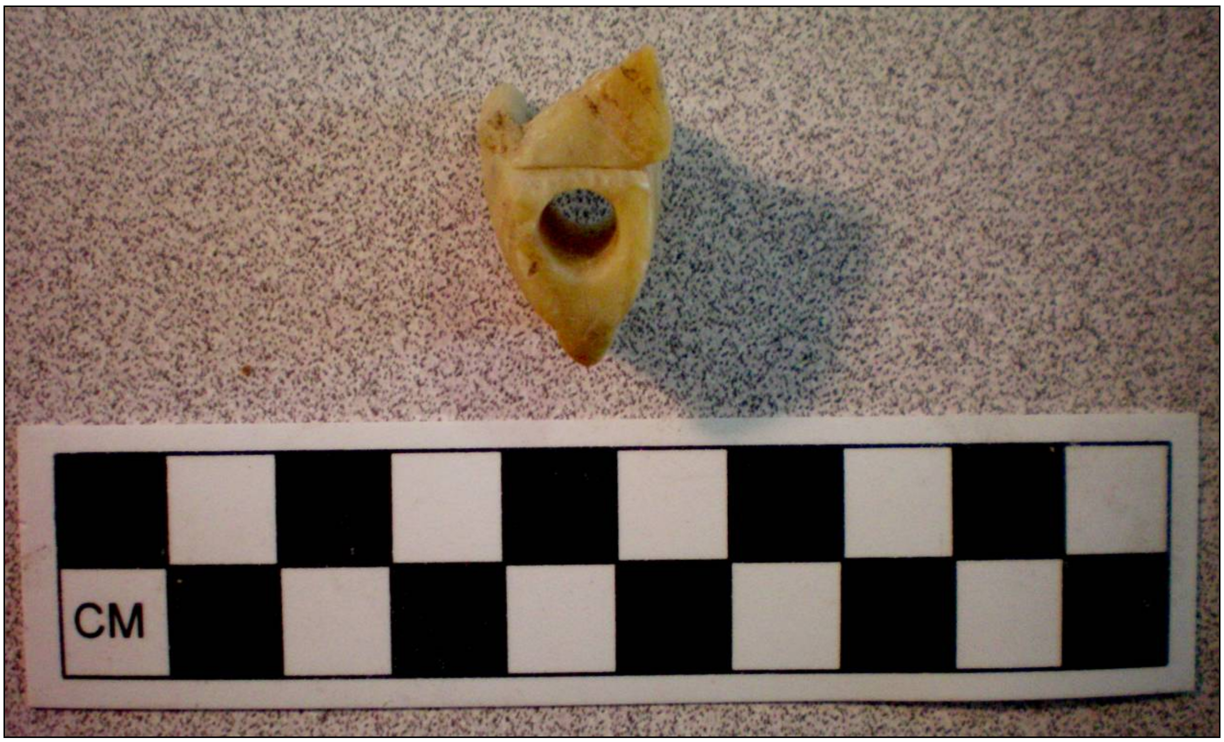

Figure 132. Possible carved soapstone pipe bowl fragment collected from Stratum IV of Trench 17

Table 28. Summary of faunal skeletal material collected during excavation within the project area

Trench	Stratum	Depth (cm)	Element	Portion	Length (cm)	Width (cm)	Wt. (g)	Species	Comments
2	V	70-130	Ulna-Right	Proximal end & shaft frag.	6.5	0.5	1.8	*Gallus gallus* - chicken	Distal epiphysis not fused - chicken less than a year old
2	V	70-130	Ulna	Shaft frag.	6.0	1.7	7.6	*Sus scrofa* - pig	
3	V-VI	100-130	Long bone	Shaft (2 frags.)	9.0	4.0	96.7	Med.- Lg. mammal (probably *Bos taurus* - cow, based on size)	Butchering marks: sawn on one end; de-fleshing cuts on shaft
3	V-VI	100-130	Rib	Med. frag.	4.8	2.0	8.2	Med.- Lg. mammal	Butchering marks: sawn on both ends
3	V-VI	100-130	Long bone	Shaft frag.	6.5	3.5	19.5	Med.- Lg. mammal (probably *Bos taurus* - cow, based on size)	Butchering marks: sawn horizontally across shaft on both sides (steak cut)
3	V-VI	100-130	Unknown	Sm. frag.	1.2	0.9	0.2	Mammal	
3	V-VI	100-130	Fin spine		3.5	1.0	0.2	Bony fish	
3	V-VI	100-130	5 elements	See Comments	--	--	2	Small bird	Not food remains: 12 fragments with at least 5 elements represented; right humerus, right ulna, right scapula, right pelvis frag., right distal tibiotarsus
15	VII	62-145	Ischium-Left	Fragment	5.5	4.6	13.7	*Sus scrofa* - pig	
15	VII	62-145	Pubis	Fragment	5.6	2.8	1.9	*Sus scrofa* - pig	Probably from same pelvis as above; bone is porous, as from a young animal
15	VII	62-145	Unknown	Sm. frags. (2)	--	--	0.4	Mammal	

Trench	Stratum	Depth (cm)	Element	Portion	Length (cm)	Width (cm)	Wt. (g)	Species	Comments
16	IV	130-170	Cranial	Sm. frag.	1.6	1.0	0.4	Med.- Lg. mammal	Too flat to be human
18	IV	140-165	Long bone	Shaft frag.	10.5	1.7	18.1	*Sus scrofa* - pig	Butchering marks: cut (de-fleshing) marks on shaft
20	IV	50-111	Long bone	Shaft frag.	5.2	2.3	6.1	Med.- Lg. mammal	Butchering marks: chop mark on one end
20	II (NE)	20-67	Humerus-Left	Complete	7.0	1.6	2.8	*Galllus gallus* - chicken	Epiphysis not fused - young chicken
20	IV	50-111	Long bone	Shaft frag.	5.7	2.2	16.7	Med.- Lg. mammal	May be from same bone as above
20	V (NE)	70-130	Tibia-Left	Proximal frag.	4.0	3.5	6.1	*Sus scrofa* - pig	

19 and 20). These samples were first examined within the CSH laboratory for individual charcoal fragments that were large enough to be submitted for wood taxa identification and radiocarbon analysis. The remainder of the sediment matrix of each bulk samples was dry-screened through a 1/16-inch mesh screen. Material recovered from the bulk sample analysis included bottle glass fragments, red clay brick pieces, a torn piece of clear plastic sheet material, charcoal, and faunal remains (Table 29). As no artifacts were cataloged from Test Trenches 4, 12, or 19, the presence of historic and modern material within these areas provides further evidence of the widespread dispersal of household and construction debris throughout the project area and the temporal modernity of the buried A-horizon (SIHP# 5080-14-2870) documented therein.

Although charcoal flecking was observed within portions of the buried A horizon screening of bulk samples failed to find appropriate samples for wood taxa identification and radiocarbon analysis. Additionally it should be noted that no discrete features or pre-Contact artifacts were identified leading us to believe that no pre-Contact discrete deposits are resent in the areas tested. Historic artifacts were used to provide temporal data.

Table 29. Material identified within bulk sediment samples collected from the buried A-horizon

Trench	Stratum	Depth (cm)	Bulk Sample Weight (kg)	Content
4	V	90-107	1.45	1 Amber-colored glass fragment (1.2 g) 1 Colorless glass fragment (0.1 g)
12	V	110-120	1.1 kg	1 clear plastic sheeting piece (0.1 g) 1 wood lumber fragment (1.9 g)
19	V	60-70	1.61 kg	20-30 red brick fragments (14.2 g)
20	IV	55-65	1.25	40-50 charcoal fragments with adhered sediment matrix (23.7 g)
20	IV	65-75	1.5 kg	5 charcoal fragments (1.1 g)
20	IV	85-95	1.70	3 Faunal bone fragments (1.4 g)

Section 6 Summary and Mitigation Recommendations

6.1 Summary and Interpretation

The Archaeological Inventory Survey work reported here followed an *Archaeological Inventory Survey Plan for the Hilton Hawaiian Village Master Plan Improvements Project, Waikīkī Ahupua‘a, Kona District, O‘ahu Island, TMK: [1] 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 & [1] 2-6-009:001-007, 009-013* (Tulchin, Shideler & Hammatt 2010) reviewed and accepted by the State Historic Preservation Division in an HRS 6E-42 Historic Preservation Review dated November 15, 2010 (Log No. 2010.3328, Doc No. 1011MV07).

The field work component of this archaeological inventory survey was accomplished between November 29, 2010 and December 21, 2010 by CSH archaeologists, Trevor Yucha, B.S., Jon Tulchin, B.A., Nifae Hunkin, B.A., Josephine Paolello, M.S., Ena Sroat, B.A., Douglas Borthwick, B.A. and David W. Shideler M.A. This effort required approximately 50 person-days to complete. All fieldwork was carried out under the supervision of Hallett H. Hammatt, Ph.D. (principal investigator). Archaeological fieldwork consisted of an initial ground penetrating radar survey and subsequent subsurface excavation of 19 test trenches within the project area.

A ground penetrating radar (GPR) survey was conducted within the project area prior to subsurface testing in an attempt to define the local stratigraphy and to prospect for buried cultural deposits. GPR survey corresponded with locations previously selected for subsurface testing (Tulchin et al. 2010). Thirteen of the 20 proposed test locations were surveyed (GPR Survey Area 1-13) with the remaining seven trench locations being inaccessible for GPR survey due to access limitation.

In general, the GPR survey was successful as subsurface anomalies were able to be accurately located and maximum depth “visibility” (i.e. radar wave penetration) reached approximately 100 cm below the surface. Identified subsurface anomalies within the project area were of varying size, distribution, and prominence. The distribution and prominence of the observed subsurface anomalies within the project area indicated extensive subsurface disturbance in the form of backfilled machine excavations, utility lines, and buried concrete slabs. Anomalies associated with subsurface cultural deposits were not observed, and may have been obscured by more prominent anomalies associated with the prior development of the project area.

Prior to the final layout and saw-cutting of test trenches within the project area, GPR survey data was used in order to identify the approximate location of subsurface utility lines and other anomalies within each GPR survey area. In several instances, test trenches were relocated slightly or resized in order to avoid significant subsurface utilities and maximize subsurface survey coverage. Due to the volume of subsurface infrastructure within the project area, several potential utility lines and indicated areas of subsurface disturbance were unavoidable. In trenches where GPR survey data indicated potential utilities lines, excavation proceeded with extreme caution and, in some cases, hand-digging was employed as a safety measure. The use of GPR survey data as an indicator of buried infrastructure resulted in minimal damage to subsurface utility lines.

Subsurface testing anticipated the proposed excavation of 20 test trenches within the project area. A total of 19 of the 20 test trenches were successfully excavated to beneath the water table. Trench 9 could not be excavated due to the presence of multiple buried utility lines that extended through the trench as documented in the adjacent Trench 4.

In general, stratigraphy within the project area consisted of the present resort infrastructure-related ground surface overlying a variable series of relatively thick, often compacted fill layers, a discontinuous, previously disturbed A-horizon, and a previously disturbed or in situ sand and sandy loam to the water table.

The water table was notably closer to the present ground surface in the eastern corner of the Hilton lands (Time Share Tower 1 location) in the location of trenches 1 to 8 and trenches 11 to 12) than had been anticipated. These ten test trenches encountered the water table at depths ranging from 90 cmbs to 133 cmbs with a mean depth to the water table of 116 cm (3'10"). This is in contrast to Neller's documentation of the area just to the north (see Figure 32 to Figure 35) in which deposits appeared to be five feet thick (152 cmbs) and the water table is not to be seen. It was apparent that the natural ground surface in this eastern corner of the Hilton lands had been sheared off but the extent of the removal of the natural ground surface above the water table in this area is unclear. The relatively high water table and the thickness of the layers of fill resulted in a thin or absent deposit of natural sediments above the water table in this area. The thickness of naturally deposited sediments above the water table varied between 0 (no natural sediments above the water table) to 50 cm. with an average thickness of 25 cm (less than 10 inches). It is thus perhaps no surprise that the in situ cultural finds in this area were minimal.

The buried A-horizon (SIHP# 50-80-14-2870) was observed within Trench 3, 4, 10, 11, 12, 15, 19, and 20 immediately beneath fill sediment. The analysis of bulk sediment samples that were collected from the A-horizon documented the presence of fragmentary historic and modern debris including plastic sheet material, red clay brick pieces, and bottle glass fragments..

Concrete blocks, asphalt surfaces, utility lines, and modern (less than 50 year old) construction debris were observed at or near the water table throughout the project area. Historic artifacts and faunal remains were also identified in several excavations throughout the project area at or near the water table.

The artifact assemblage consisted of 50 glass bottle or bottle fragments, 27 ceramic fragments, 11 stone fragments, 1 soapstone fragment, and one plastic fragment, with a total weight of 3,808 grams. The faunal assemblage consisted of 202.4 grams of skeletal remains, the majority of which possessed butchering marks, a characteristic of food remains. Several glass and ceramic artifacts in the artifact assemblage date to the first two decades of the twentieth century, and one artifact dates to 1962. There is no definite material that dates any earlier than ca. 1890. The assemblage seems to be composed of general residential trash, rather than commercial or industrial refuse. There is also some evidence for a widespread scatter of the trash, rather than a concentration, as two tile fragments from two different trenches and two different strata refit to make one tile.

The findings of the current archaeological inventory survey indicate that while it seems likely that portions of the project area were used or inhabited by pre-contact and traditional Hawaiian populations, evidence of this land use appears to have been destroyed or displaced during historic or modern development. No traditional Hawaiian or pre-contact skeletal remains or cultural material were identified during the current fieldwork.

A series of historic maps from the late 19th to mid 20th century has illustrated the dramatic changes that occurred within the project area as Western commercial interests supplanted the traditional Hawaiian way of life. The dispersion of historic artifacts within the project area suggests that the majority of *in situ* historic-era deposits have been destroyed or displaced by modern development. The buried A-horizon (SIHP# 50-80-14-2870) that was identified throughout portions of the project area is likely the remnant of a stable post-contact land surface, but appears to be significantly disturbed and discontinuous.

6.2 Mitigation Recommendations

The present archaeological inventory survey study has characterized the nature of the sediments above the water table within the areas of proposed construction and developed data on the likely nature, density and distribution of finds in these areas.

6.2.1 Archaeological Data Recovery Program

In consultation with the SHPD/DLNR (SHPD/DLNR review of a previously submitted draft study, April 15, 2011; Log No. 2011.0520, Doc No 1104MV02) a data recovery program (to begin with a data recovery plan to be submitted for the review and approval of SHPD/DLNR) will be undertaken within Improvement Area 2 and in the immediate vicinity of the proposed Timeshare Tower 2 (see Figure 4). This is an area proposed for substantial subsurface impact associated with the proposed Timeshare Tower 2. Historic maps, in particular a map of Land Court Application 264 (see Figure 14) illustrate relatively rapid shoreline accretion in this immediate area in the late 1800s (see Figure 40, based on the Land Court Application 264 map and data).

The archaeological data recovery plan will present research goals and hypotheses related to additional analysis of the buried, culturally-enriched A-horizon (SIHP# 50-80-14-2870) that was documented within Improvement Area 2 (Trench 20) during the present archaeological inventory survey. Additional subsurface testing within Improvement Area 2, in the vicinity of Trench 20, will be performed in order to further document, sample, and analyze SIHP# 50-80-14-2870 and any other buried cultural deposits that may be encountered. One research foci will be evaluating finds in relationship to the indicated shoreline accretion in this immediate area in the late 1800s. A modest program of subsurface testing (2 to 4 test trenches) is envisioned with the locations of these data recovery test excavations taking into consideration specific areas of proposed ground disturbance. Any Native Hawaiian burials as may be encountered during this data recovery would be previously identified burials. This data recovery report would need to be approved prior to construction in the immediate vicinity.

6.2.2 Archaeological Monitoring Program

In consultation with SHPD/DLNR, CSH recommends a program of on-site archaeological monitoring program be implemented for all construction activities related to the current project. A qualified archaeological monitor will remain on-site during all new ground disturbance activities. Archaeological monitoring will facilitate the identification and proper treatment of any historic properties that might be encountered during project construction activities.

Based on the archaeological inventory survey results it seems unlikely that there would be much in the way of in situ cultural finds in the eastern corner of the Hilton lands (due to the high water table and relatively thick fill) but it is certainly possible that previously disturbed cultural deposits (possibly including previously disturbed human skeletal remains) remain in this area.

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Appendix A Fishponds of Waikīkī

Names and spelling follow *Hawaiian Fishpond Study Islands of Oʻahu, Molokaʻi and Hawaiʻi* (Bishop Museum 1989: III 8-9)

Waikīkī Fishponds	Comments
Kaipuni	2 ponds, Class III*, Type III**
Kapaʻakea	Class III, Type III
Kapuʻuʻiki	Class III, Type III
Kuwili	Class III, Type III
Maalahia	Class III, Type III
Opu	Class III, Type III
Opukaala	Class III, Type III
Paweo	2 ponds, Class III, Type III
Halemauliolaliko	Class III, Type III
Haliʻi	Class III, Type III
Huaʻiki	Class III, Type III
Hueu	Class III, Type III
Kaʻaimano	2 ponds, Class III, Type III
Kahapuna	Class III, Type III
Kahiamoi	Class III, Type III
Kaihikapu	2 ponds, Class III, Type III
Kaʻili-o-ʻolelo	Class III, Type III
Kaʻilipaka	Class III, Type III
Kalokoloa	Class III, Type III
Kalokomoʻo	Class III, Type III
Kamau	Class III, Type III
Kaohai	2 ponds, Class III, Type III
Kapaʻahao	Class III, Type III
Kapaeli	Class III, Type III
Kapaweo	2 ponds, Class III, Type III
Kauamoa	3 ponds, Class III, Type III

Waikīkī Fishponds	**Comments**
Kawao	Class III, Type III
Kealia	4 ponds, Class III, Type III
Kihewa-Loko	Class III, Type III
Kuakamakau	Class III, Type III
Kuhanapili	Class III, Type III
Puhalahala	Class III, Type III
Waikapu‘u	Class III, Type III
Malamahuhina	Class III, Type III

* Class III = *No visible surface remains but location known* (Bishop Museum 1989: III-3)

** Type III = *Loko Wai: An inland freshwater fishpond which is usually either a natural lake or swamp, which can contain ditches connected to a river, stream, or the sea, and which can contain sluice grates* (Bishop Museum 1989: I-1 and I-2)

Appendix B LCA Documentation

Waihona `Aina
Your ultimate resource for hawaiian history and land use

Articles | Information | Samples | Gallery | About Us | Contact Us

Mahele Database | Boundary Commission | Land Grants | Royal Patents | Review Cart & Checkout

DOCUMENT DELIVERY

Mahele Database Documents
Number: 01775

Claim Number:	**01775**
Claimant:	**Pawa**
Other claimant:	
Other name:	Paoa
Island:	**Oahu**
District:	**Kona**
Ahupuaa:	**Waikiki**
Ili:	**Kalia**

Apana:	**1**	Awarded:	**1**
Loi:		FR:	
Plus:		NR:	**250v3**
Mala Taro:		FT:	**181v3**
Kula:		NT:	**509v3,75v10**
House lot:	**1**	RP:	**7033**
Kihapai/Pakanu:		Number of Royal Patents:	**1**
Salt lands:		Koele/Poalima:	**No**
Wauke:		Loko:	**No**
Olona:		Lokoia:	**No**
Noni:		Fishing Rights:	**No**
Hala:		Sea/Shore/Dunes:	**No**
Sweet Potatoes:		Auwai/Ditch:	**No**
Irish Potatoes:		Other Edifice:	**No**
Bananas:		Spring/Well:	**No**
Breadfruit:		Pigpen:	**No**
Coconut:		Road/Path:	**No**
Coffee:		Burial/Graveyard:	**No**
Oranges:		Wall/Fence:	**No**
Bitter Melon/Gourd:		Stream/Muliwai/River:	**No**
Sugar Cane:		Pali:	**No**
Tobacco:		Disease:	**No**

http://www.waihona.com/purchase.asp 2/11/2010

Koa/Kou Trees:		Claimant Died:	**No**
Other Plants:		Other Trees:	
Other Mammals:	**No**	Miscellaneous:	**section of ditch**

No. 1775, Pawa
N.R. 250v3

To the Land Commissioners, Greetings: I hereby state my claim for a section of irrigation ditch. I do not know its length - perhaps it is two fathoms more or less. The length of my interest at this place is from /the time of/ Kaahumanu I, which was when my people acquired this place, and until this day when I am telling you, no one has objected at this place where I live. The house lot where I live is on the north of the government fence at Kalia. Some planted trees grow there - five hau and four hala. There is a well which is used jointly.
With thanks,
PAWA X, his mark
Waikiki, Oahu, December 16, 1847
M.K. Trut, witness

F.T. 181v3
No. 1775, Pawa

Kalaione, sworn, This land is in Pinaio, Waititi, house lot, 1 house, no fence.

Mauka, Government road
Waialae, Government yard
Makai, sea
Honolulu, Str [stream].

Claimant received this land from Kaahumanu I and has ever since held it undisputed.

Alapai, sworn, confirmed the testimony above.

N.T. 509v3
No. 1775, Pawa, October 30, 1849

Kalaeone, sworn, I have seen his land at Piinaio in Waikiki - 1 house lot

Mauka by government road
Waialae by government lot
Makai by stream
Honolulu by stream.

Kaahumanu I had given him his land and no one has ever objected to this day.

Alapai, sworn, Our testimonies are similar. No one has objected.

See pg. 75, Vol. X

N.T. 75v10
No. 1775, Pawa (from page 509, Vol. 3), 18 November 1851

Kalaeone, sworn, I have seen this section of Pawa in Kalia in Waikiki, a Pauku ditch of stream taro.

Mauka, Government land
Waialae, Nihopuu's land

Makai, S. Kuluwailehua's land, Keino's land
Ewa, Nakoko's land.

Land to Pawa from his mother, Makuahine. Makuahine had received it from Naliikipi after the death of Kinau in 1839, because Makuahine is Naliikipi's sister. Makuahine had bequested it permanently to Pawa, their son. Makuahine, Pawa's parent has died and Pawa has been living there to the present time peacefully.

Section one claim has been done on 30 October 1849, it is the house lot. Work on the taro land section is being done today.

[Award 1775; R.P. 7033; Kalia Waikiki Kona; 2 ap.; 3.22 Acs; R.P. is to Paoa]

HELU 7033

Palapala Sila Nui

A KE ALII, MAMULI O KA OLELO A KA POE HOONA KULEANA.

No ka Mea, Ua hooholo na Luna Hoona i na kumu kuleana aina i ka olelo, he kuleana oiaio ko

Paoa Kuleana Helu 1775.

ma ke **Ano Alodio** iloko o kahi i oleloia malalo.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o **Kalakaua,** ke Alii Nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la nona iho, a no kona mau hope Alii, a ua haawi aku oia, ma ke **Ano Alodio** ia Paoa i kela wahi a pau loa ma Kalia, Waikiki Kona ma ka Mokupuni o Oahu penei na mokuna:

Aina ma Kalia Waikiki Oahu

Ap. 1. Kahale. Ke Hoomaka ma ke kumu Hem. o ka uapo kahiko, aoao makai ma ka lihi Hem. o ke kahawai Piinaio a e holo.

Hem. 2° Hik. 2.28 ma ke alanui kahiko, alaila

" 59.30 Hem 737 pauku e pili ana me ka apana aina o ke aupuni. Pela aku 80 pauku i kahakai, alaila hoi hou ma ke kihi i hoomaka ai.

Hem 59.30 Hem 70 pauku me

Akau 60° " 106 "

Hem 43° " 460 " a me

Hem 66° " 4 kaul, a hiki i kahakai, malaila aku ma kahakai, a hiki i ka hope o ka holo mua ana a puni keia. Eia ka ili. 1 70/100 Eka.

Apana 2 Pauku kahawai Kalo. E hoomaka ma ke kihi Hikina mauka o keia pauku kahawai, a e holo Hem 45° 45' Hem 133 pauku e pili ana me aupuni, a me Nihopuu a hiki i ke alanui o ka pa, alaila

Ak. 35° Hem 364 pauku, me

" 43° " 330 "

" 55° " 2 kaul, a me

" 62° " 253 pauku e pili ana me kaaina a me ka aina o S. Kaluaaikehua a me Naboko, a hiki i ka kihi hau ma ka aoao, alaila

Ak. 35° Hik 106 pauku me Naboko a hiki i ka pa ma ka aoao mauka, alaila holo kihi i hoomaka ai.

Number: 02511

Claim Number:	**02511**
Claimant:	**Alapai**
Other claimant:	
Other name:	
Island:	**Oahu**
District:	**Kona**
Ahupuaa:	**Waikiki**
Ili:	**Kalia**

Apana:	**1**	Awarded:	**1**
Loi:		FR:	
Plus:		NR:	**531v5**
Mala Taro:		FT:	**489v14**
Kula:		NT:	
House lot:		RP:	**3441**
Kihapai/Pakanu:		Number of Royal Patents:	**1**
Salt lands:		Koele/Poalima:	**No**
Wauke:		Loko:	**No**
Olona:		Lokoia:	**No**
Noni:		Fishing Rights:	**No**
Hala:		Sea/Shore/Dunes:	**Yes**
Sweet Potatoes:		Auwai/Ditch:	**No**
Irish Potatoes:		Other Edifice:	**No**
Bananas:		Spring/Well:	**No**
Breadfruit:		Pigpen:	**No**
Coconut:	1	Road/Path:	**Yes**
Coffee:		Burial/Graveyard:	**No**
Oranges:		Wall/Fence:	**Yes**
Bitter Melon/Gourd:		Stream/Muliwai/River:	**No**
Sugar Cane:		Pali:	**No**
Tobacco:		Disease:	**No**

http://www.waihona.com/purchase.asp 2/11/2010

Koa/Kou Trees:		Claimant Died:	**No**
Other Plants:		Other Trees:	
Other Mammals:	**No**	Miscellaneous:	**coconut grove,government road**

No. 2511, Alapai
N.R. 531v3

I, the one whose name is below, hereby state my claim for a coconut grove and a house site. The boundaries of the grove are: on the east is the small pond and the house of Umi, on the north is the Government road, and the government wall, and on the west the government wall also, and an unused place, and on the south is an unused place. That is my claim which is hereby stated.
I am, respectfully,
ALAPAI X, his mark

F.T. 489v14
No. 2511, Alapai, claimant

Kanemakua, sworn says, the land of claimant is an Uluniu called Kaneumanuhou in Kalia, Waikiki, Oahu. It is bounded:

Mauka by the public road
Kekaha by the house of Umi
Makai by the sea shore
Honolulul by pa aupuni of Kalia.

Claimant inherited the land from his father, Kahanaumaikai from the time of Kamehameha. He has held it in quiet.

Kamaea, sworn says, the above testimony is true, and is also his own.

[Award 2511, R.P. 3441; Kalia Waikiki Kona; 1 ap.; 4.6 Acs]

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(675)

HELU 3441

PALAPALA SILA NUI,

A KE ALII, MAMULI O KA OLELO A KA POE HOONA KULEANA.

NO KA MEA, ua hooholo na Luna Hoona i na kumu kuleana aina i ka olelo, he kuleana oiaio ko Alapai Kuleana Helu 2511 ma ke **Ano Alodio** iloko o kahi i oleloia malalo.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawai' Pae Aina, i na kanaka a pau, i keia la nona iho, a no kona mau hope alii, ua haawii aku oia ma ke **Ano Alodio** ia Alapai i kela wahi a pau loa ma Kalia Waikiki Kona ma ka mokupuni o Oahu penei na mokuna,

E hoomaka ma ke kihi Kom o keia aina ma kahakai e pili ana me ka Aina o ke Aupuni a e holo Ak 48 Hik 857 Kh e pili ana me Aupuni a hiki i ka Auwai Alaila Hem 15 Hik 407 Kh me Hem 24 Hik 334 Kh pili ana me Auwai o Kaihikapu no Aupuni Alaila Hem 52°30' Kom 165 Kh me Aupuni a hiki i ko Umi Alaila Ak 22 Kom 3½ Kh me Hem 54 Kom 56 pauk me Hem 13 Hik 126 Kaul me Hem 43 Kom 142 Kh me Hem 43 Hik 2 Kh e pili ana me Umi a hiki i ko Kauao Alaila Hem 52 30 Kom 389 Kh me ko Makoko no Kauao a hiki i kahaone alaila ma kahaone e holo a hiki i kahi mua

Atoeka

Appendix C Traditional Source Data Pertaining to Human Burials in Waikīkī

Written accounts document human sacrifice in Waikīkī and epics of death from fighting in the wars of Kahekili and Kamehameha in Waikīkī,.

Accounts of Human Sacrifice at Waikīkī

Kauwā Sacrifice in Waikīkī

Hawaiian authors in the nineteenth and twentieth century's have emphasized that victims for sacrifice were "criminals," "wrongdoers," or "individuals who had broken *tabu*, or rendered themselves obnoxious to the chiefs" (Kanahele 1995:116). Another major category of human sacrifice victims were the "*kauwā*." Pukui (Pukui and Elbert 1981:128) translates *kauwā* as "Untouchable, outcast, pariah: a cast which lived apart and was drawn on for sacrificial victims."

Waikīkī was famous for the drowning of *kauwā* with the same formulaic phrase '*Moe mālie i ke kai o ko haku*' ('Lie still in the waters of your superior') used for *kauwā* drowning at Kawailumalumaʻi, Kewalo and Kualoa. An account of sacrificial drowning of *kauwā* at Waikīkī appeared in the Hawaiian language Newspaper *Ka Loea Kālaiʻāina*:

> *A penei naʻe i kauwā loa [sic. "loaʻa"] ai. Aia a manaʻo ke Aliʻi Nui (Mōʻī) e ʻauʻau kai i Waikīkī Eia ka nīnau a ke Aliʻi Nui i ke aliʻi ma lalo iho ona, "Pehea āu mau wahi lepo kanu o Puʻu Kuʻua? ʻAʻole paha he mau wahi pōhuli?"*
> *Eia ka pane a ke aliʻi ma lalo iho ona, "He Pōhuli nō. ʻO ke kauoha ia akula nō ia e kiʻi.*
>
> *ʻOiai ko kāne me ka wahine e nanea ana me nā keiki, a hiki ʻana ke kiʻi i mau keiki. ʻO ke kū aʻela nō ia o ka makuakāne a lawe ʻana i kāna mau keiki a hiki i Waikīkī.*
>
> *Aia hoʻi a hiki i ka wā a ke Aliʻi e hele ai i ka ʻauʻau kai, a laila, hoouna ʻia mai ke kahu e kiʻi mai i ua keiki a lawe aku ia ma kahi pāpaʻu o ke kai, ma kahi a ke Aliʻi nui e hele kū ʻana, a laila kau nā lima o ka Mōʻī i luna o kahi keiki a me kahi keiki, ma nāʻāʻī o nā keiki a paʻa ai.*
>
> *ʻO ka hua ʻōlelo ma ka waha o ke Aliʻi nui e ʻōlelo ai, "ʻAʻole pau kuʻu loa! ʻAʻole pau kuʻu loa!" ʻOiai ʻo ia e ʻau ana me ka paʻa nō o nā lima i nā keiki a hiki i ka umauma ke kai o ke aliʻi.*
>
> *Ua lana aʻela nā keiki i luna o ka ʻilikai, aia ke alo i lalo. Eia hoʻi ka ʻōlelo a ka makuakāne ma kula aku nei, "Moe mālie i ke kai o ko Haku," a pēlā aku.*
> *ʻO ke kai o Waikīkī ke kai i ʻōlelo ʻia he kai lumalumaʻi kanaka o ka lua, aia i Kualoa.*

Translation:

> When the ruling chief wished to go to Waikīkī for sea bathing he asked the chief just below him in rank, “How are my planting places at Pu‘u Ku‘ua, [a place in the Wai‘anae Range famous as a *kauwā* residence and place of mixed caste] have they not produced young suckers?” The chief next to him answered, “There are some suckers,” and sent someone for them. When the men, women and children least expected it, the messenger came to get some of the children. The father stood up and took his sons to Waikīkī.
>
> Then, when the ruling chief went sea bathing, he sent an attendant to get the boys and take them to a shallow place where the ruling chief would come. Then the ruler placed a hand on each of the boys, holding them by the necks. The words he uttered were, “My height has not been reached! My height has not been reached!” He advanced and held onto the boys until the sea was up to his chest. The boys floated on the water face down. The father on shore called out, “Lie still in the sea of your Lord,” and so on.
>
> The Sea of Waikīkī is said to have been used to kill men in and the other place is Kualoa.

No specific location at Waikīkī is indicated as the sacrificial site (but see the following discussion of “Sacrifice at the Kapaemahu Stones”).

Sacrifice at the Kapaemāhū Stones (Wizard Stones/Healing Stones)

In 1905 ex-governor Archibald S. Cleghorn encountered human skeletal remains under one of the Waikīkī Kapaemāhū Stones. While erecting a new beach cottage “at his beach place on the Diamond Head side of the Hustace residence and close to the Moana Hotel” (in the vicinity of the present police sub-station on the *makai* side of Kalākaua Ave) Mr. Cleghorn saw fit to move at least two large, anomalous stones that are generally known today as two of the “Wizard (*Kūpua*) stones” or the “Waikīkī Healing Stones”

It is generally agreed that the four large Kapaemāhū Stones (placed in their present position in 1980) were initially moved some distance by Native Hawaiians – perhaps from a location in Kaimukī to coastal Waikīkī in pre-contact times. Of long-standing these stones are associated with four wizards (“*kūpua*” – traditionally named Kapaemāhū, Kahalao, Kapuni, and Kinohi) who were associated with a foreign land typically identified as the Society Islands. Accounts often emphasize that *mana* from these *kūpua* was imparted to the stones. Accounts often suggest a timeframe for the transport of the stones of AD 1200 to 1500.

Certain finds under one of the stones are described in an article in the *Pacific Commercial Advertiser* of February 23, 1905 (page 5) under the title “Sacrificial Stone Idols and Skeleton: Interesting Find by Ex-Gov. Cleghorn on Waikiki Beach lots---Relics of a Barbarian Past Uncovered” as follows:

> When the ten ton stone was raised Mr. Cleghorn made his most important discovery. The remains of a skeleton were found buried under the great rock. But few bones had been left by Time. There was a jaw bone with all the teeth intact and perfect. Dr. Maya the physician, to whom it was shown, and Dr. Whitney, the

> dentist, pronounce the teeth those of a young woman perhaps 17 years of age….It is the opinion of Mr. Cleghorn that the young woman was the victim of a sacrificial rite….Close to the bones Mr. Cleghorn discovered four or five very crude idols… (*Pacific Commercial Advertiser*, February 23, 1905, page 5)

By the time of the 1907 *Thrum's Hawaiian Annual* the account had been amplified by James H. Boyd to the point that the bones were associated with "a lovely, virtuous, young chiefess."

It seems not unlikely that Mr. Cleghorn was correct and that the human skeletal remains he observed were indeed a sacrifice associated with the original placement of the Kapaemāhū Stones in Waikīkī. The youth of the individual seems probable with a logical inference that the dentist Dr. Whitney (referred to above) noted the absence of the third molars (which typically erupt between the ages of 17 and 21) and that the dental observation was the basis for the age assessment reported. The gender determination seems less certain especially as it appears to have been based on a physician's assessment of a portion of a mandible of a sub adult. Based on the limited information we cannot rule out that the individual was "a lovely, virtuous, young chiefess", as was soon to be reported, but it may also relate to the tradition of *kauwā* sacrifice reported for the immediate vicinity (discussed above).

In the somewhat garish 1905 report of the "sacrificial stone" it is posited that certain "deep stains about the rim which no washing would remove …[may have been] caused by the blood of sacrificed victims" – suggesting a possible pattern or continuation of human sacrifice at the Kapaemāhū Stones. The norm for formal Hawaiian human sacrifice however was to avoid blood.

A possible *kauwā* sacrifice connection to the Kapaemāhū boulder interment is suggested in certain ancillary observations Mr. Cleghorn reports for the shallows in the immediate vicinity:

> Mr. Cleghorn states that it is a curious thing that the bottom along that section is almost free from coral. There appears to be a half moon section .there which has no coral stones to amount to anything. Mr. Cleghorn is of the opinion that Kamehameha put a great many of his people to work there removing the coral so that he might have a clean sandy ocean bed beneath the surface of the water where he had chosen to enjoy his baths and watch the aquatic sports of his subjects. (*Pacific Commercial Advertiser*, February 23, 1905, page 5)

We just note in passing the possibility that some preparation of a formal place in the shallows for the ruling chief's wading and drowning of *kauwā* sacrifice would appear commensurate with the *Ka Loea Kālai'āina* account cited above.

***Heiau* of Human Sacrifice**

Much uncertainty also remains regarding the exact location of the four Waikīkī *heiau* (temples) associated with human sacrifice. Papa‘ena‘ena, certainly the most famous, was located at the foot of Diamond Head Crater in the environs of the present Hawai‘i School for Girls. Papa‘ena‘ena Heiau is traditionally associated with Kamehameha I who was said to have visited the *heiau* before setting off to battle for Ni‘ihau and Kaua‘i in 1804. Five years later, according to John Papa ‘Ī‘ī, Kamehameha placed at Papa‘ena‘ena the remains of an adulterer - "all prepared in the customary manner of that time" (‘Ī‘ī 1959:50-51). This would have been one of the last human sacrifices in the kingdom.

Regarding the death of the famous prophet Kaʻōpulupulu by Kahahana, Thrum writes, "After a while the body of the priest was placed on a double canoe and brought to Waikīkī and placed high in the coconut trees at Kukaeunahi [sic, Kukaunahi?] the place of the temple, for several ten-day periods (*he mau anahulu*) without decomposition and falling off of the flesh to the sands of Waikīkī." (Note: Kahahana's place of residence at Waikīkī was Ulukou, the present site of the Moana Hotel, which was built in 1901. The closest and most likely *heiau* would appear to be the Helumoa Heiau formerly located on or very near the grounds of the Royal Hawaiian Hotel.)

The historical basis of the numerous accounts of human sacrifice (or near sacrifice) at Waikīkī is uncertain. The *heiau* associated with sacrifice are summarized in the following Table.

Table of Sites Associated With Human Sacrifice in Waikīkī

Place Name	Location	Grounds for believing associated with human sacrifice	Source
Papaʻenaʻena Heiau (Lēʻahi)	Waikīkī at or near La Pietra and the Hawaiʻi School for Girls	"*Heiau poʻokanaka*"	Thrum 1906:44
Kapua Heiau	Waikīkī in the vicinity of the Natatorium	"*Heiau poʻokanaka*", place of sacrifice of Kaolohaka	Thrum 1906:44
Helumoa Heiau	ʻĀpuakēhau, Waikīkī at or near the Royal Hawaiian Hotel	*Heiau poʻokanaka*, the place of sacrifice of Kauhi Kama" the defeated *mōʻī* of Maui in his raid on Oʻahu about 1610, in the reign of Kaihikapu	Thrum 1906:44
Shallow sea of Waikīkī	Waikīkī location uncertain	Account of *kauwā* drowning	*Ka Loea Kalaiaina*, July 8,1899
Kapaemāhū Stones aka "Wizard (*Kūpua*) Stones" or the "Waikīkī Healing Stones"	Vicinity of the present police sub-station (in 1905 they were slightly *ʻEwa* of their present location)	Association with human skeletal remains interred under a ten-ton boulder and opinions of Archibald S. Cleghorn and others	*Pacific Commercial Advertiser*, February 23, 1905, page 5
Kūpalaha Heiau	Waikīkī in the vicinity of the zoo entrance	Account of near sacrifice of Kapoʻi	Kamakau 1991:23

The closest of the *heiau* to the present project is Helumoa Heiau, which is not well documented in the literature. We know of no maps showing the location of Helumoa Heiau. Thomas Thrum (1906:44) relates that it was a "place of sacrifice" going back at least as far as A.D. 1610. The Maui chief Kauhiakama was said to have been sacrificed at Helumoa Heiau by the Oʻahu chief Kaʻihikapu (Hibbard and Franzen 1986:5). Thomas Thrum (1927:34) would later note: "This temple was long ago demolished, not a stone being left to mark the site, which was doubtlessly near, if not *the* [italics in original] actual spot now graced by the new Royal Hawaiian Hotel." Additional data supporting this site as a major place of human sacrifice is provided in Pukui et al.'s (1974:44) comments regarding the origin and meaning of the place name "Helumoa": "Old land division near the Royal Hawaiian Hotel at Helu-moa Street, Waikīkī, and site of a *heiau* where Ka-hahana was sacrificed. Lit. chicken scratch. (Chickens scratched to find maggots in the victim's body)." We conclude the former location of the *heiau* was quite close to the Royal Hawaiian Hotel. The prominent point just on the Sheraton side of the Royal Hawaiian Hotel appears likely for its commanding position and view planes.

Accounts of Battles at Waikīkī

Kahekili's Invasion of O‘ahu Circa 1783

In 1867, Samuel M. Kamakau wrote the following account of the invasion of the island of O‘ahu by the Maui ruling chief, Kahekili:

> *I ka pae ‘ana o Kahekili a me nā ‘au wa‘a kaua o nā li‘i o Maui, ma Waikīkī, e noho ana nō ka Mō‘ī Kahahana ma Kawānanakoa, ma Nu‘uanu, ma uka o Honolulu. I ka lohe ‘ana o Kahahana, ua hiki mai ‘o Kahekili me nā ‘au wa‘a i lako i nā mea kaua. Ua piha ho‘i mai Ka‘alāwai a hiki i Kawehewehe ka pa‘a i nā wa‘a kaua o Kahekili mai Maui, Moloka‘i a me Lāna‘i mai, no laila, maka‘u honua ‘ ēwale ihola nō ‘o Kahahana, a ho‘ākoakoa a‘ela i kona po‘e ali‘i a me nā koa . . . ‘ewalu ko lākou nui i hele i ke kaua. Ua komo loa kēia po‘e ‘ewalu i loko o ‘Āpuakēhau, i laila kahi i kaua ai me ke koa launa ‘ole, a ua ho‘opuni ‘ia mai lākou a puni e nā koa o Maui, a laila, wāhi a‘ela k‘ia po‘e ‘ewalu i loko o ka puoko o ke kaua , a nahā a‘ela ka po‘e i ho‘opuni ai iā lākou nei. I ko lākou luli ‘ana a‘e na‘e e ho‘i mai, ua piha loa ‘o mua i nā koa, ‘a‘ohe wahi ka‘awale o Kawehewehe, e hiolo ana nā pololã e like me nā paka ua, akā, ‘a‘ohe na‘e he wahi mea a pō‘ino ‘o kēia po‘e ‘ahi kananā, akā, ‘o kēlā po‘e koa o Maui ua pau i ka make. I ka hiki ‘ana i kuāuna o Punalu‘u, e iho mai ai i Luahinewai, e hiki mai ai i nā niu a Kuakuaaka . . . ‘Ekolu ho‘ouka kaua ‘ana o nā ‘ao‘ao ‘elua, a ua make like nō.*
>
> *I ka malama o Ianuari 1, o ka A. D. 1783, ua ‘ākoakoa nā ali‘i a me nā pūkaua, nā pū‘ali a me nā koa o Kahekili, a māhele ‘ia ihola ‘elua po‘e kaua. Māhele 1. ‘O Kahekili ka pūkaua. Māhele 2. ‘O Hūeu ka pūkaua. ‘O kā Hū‘eu po‘e kaua, ma uka o Kānelāau a me Kapapakōlea, ma uka o Pūowaina. ‘O ka māhele mua, ma luna o Hekili a hiki i Kahēhuna a me ‘Auwaiolimu. ‘O Kaheiki ke kahua kaua.. . . Lilo ihola ke aupuni o O‘ahu a me Moloka‘i . . . (Kū‘oko‘a*, 3/30/1867)
>
> Kahahana, [ruling chief of O‘ahu] who was then living at Kawānanakoa in Nu‘uanu, back of Honolulu, was filled with consternation when he heard that Kahekili had come with a fleet of war canoes that reached from Ka‘alāwai to Kawehewehe, and he rallied his warriors about him [but] eight of the warriors . . . went to ‘Āpuakēhau and fought against the whole host, and when they found themselves surrounded by the Maui warriors they broke through the front lines, only to find their way of retreat bristling with more warriors and no way to turn in all of Kawehewehe. Spears fell upon them like rain, but it was they who slew the warriors of Maui. At the border of Punalu‘u, on the way down to Luahinewai and the cocoanut grove of Kuakuaaka [there was fighting] . . . Three times both sides attacked, and three times both were defeated. In January 1783, a decisive battle

> was fought with Kaheiki as the battlefield. Kahekili’s forces were divided into two companies, one under Hū‘eu’s leadership stationed at Kānelā‘au and Kapapakōlea back of Pūowaina and the other under his own command stationed from above Hekili to Kahēhuna and ‘Auwaiolimu . . . thus O‘ahu and Molokai were taken . . . [Kamakau 1992:135-137].

The account makes reference to fighting at “Kawehewehe.” Kawehewehe is understood as the name of the beach on the ‘Ewa side of the Royal Hawaiian Hotel and Diamond Head of the Hale-kūlani Hotel:

> . . . just east of the Hale-kū-lani Hotel, Waikīkī, Honolulu. The sick were bathed here as treatment. The patient might wear a seaweed (limu-kala) lei and leave it in the water as a request that his sins be forgiven, the lei being a symbol. Lit., the removal [Pukui et al. 1974:99].

Fornander’s (1919:289) account of “The Story of Kahahana” relates that Maui chief Kahekili’s army was encamped at ‘Āpuakēhau, where they were organizing and preparing to march inland. The O‘ahu forces first attacked “the Maui troops collected at the heiau”, and “a fight commenced to which Hawaiian legends record no parallel” (Fornander 1919:289) A reconstruction of Kamakau’s account of Kahekili’s attack (Figure 60) definitely suggests battle casualties in Waikīkī. Intense fighting and mortality are indicated in the immediate vicinity of the Royal Hawaiian and Hale-kū-lani resorts.

Account of the Invasion of Kamehameha Circa 1795

In 1867, Samuel M. Kamakau wrote the following account of the invasion of the island of O‘ahu by the ruling chief, Kamehameha:

> *Holo akula ho‘i ka ‘au wa‘a kaua o Kamehameha a pae i Waikīkī, a ua pani ‘ia mai Wai‘alae a Waikīkī e nā ‘au wa‘a kaua o Kamehameha.*
>
> *‘O Kalanikūpule ho‘i a me kona mau ali‘i, e noho ana lākou ma Nu‘uanu, Kanoneakapueo, Kahapa‘akai, Luakaha, Kawānakoa, Kaukahōkū, Kapaeli, Kaumuohena a me Pū‘iwa nā kahua kaua. (Kū‘oko‘a,* June 8,1867)

Translation

> Kamehameha’s war fleet sailed to Waikīkī where it landed and the beaches from Wai‘alae to Waikīkī were covered with the war canoes of Kamehameha.
>
> Kalanikūpule and his chiefs were stationed at Nu‘uanu, Kanoneakapueo, Kahapa‘akai, Luakaha, Kawānakoa, Kaukahōkū, Kapaeli, Kaumuohena a me Pū‘iwa, the battlefields (where the main fighting took place).

This account emphasizes that the main fighting started in the uplands but fighting at Waikīkī is probable.

Another historical account of the famous battle of Nu‘uanu in which Kamehameha I unifies the islands, is given in *He Buke ‘Oia‘i‘o Kū‘auhau Ali‘i*. The “Battle of Nu‘uanu” chant was examined in the hopes it would provide clues as to the locations where fighting occurred and locations of possible burials as a result of the battle.

The chant is prefaced by the following explanation: [This is] "A chant of the battle of Nuʻuanu waged by Kamehameha the Great in the month of April, 1795. Composed by Kalaʻikūahulu and transcribed by G. M. Keola, Dec. 15, 1880."

Kalaʻikūahulu, was a skilled orator, genealogist and *kahuna* (priest) during the time of Kamehameha. He was also selected to be a member of Kamehameha's advisory council (Kamakau 1992:173, 175). Samuel Kamakau (1992:394), noted historian, writes "Kalaʻikūahulu was the composer who glorified the names of the chiefs of Hawaiʻi in chant."

A very brief analysis of the chant is provided here. The chant is divided into two parts, Māhele 1 and Māhele 2. The chant basically sets up the sequence of the Nuʻuanu Battle and gives a vivid description of the intensity of the fighting that occurred. Part 2 of the chant basically chronicles the story from the time Kamehameha's war fleet leaves the shores of Molokaʻi (after its conquest), crosses the Molokaʻi Channel, and enters the *papa* (reef flats) off of Oʻahu. From the chant, we know that Lopakapū, Kamehameha's cannon is on board one of the canoes, as is his war god, Kūkaʻilimoku. Poetic references are made to Kamehameha, comparing him to the long, sharp spines of the *wana*, the *nohu* — a poisonous fish, the *palani* known for its sharp barb which snags and the *kōkala kū* — the porcupine fish whose body is covered with long spines that inflict pain. In the chant, Kamehameha is declared the victor even before he has landed on the sands of Kākuhihewa, at Hononunu (the site of the War Memorial) in Waikīkī.

From the locations of the place names listed in the chant, it seems that indeed, as Kamakau wrote (*Kūʻokoʻa,* June 8, 1867), the coastline was covered with Kamehameha's war fleet from Waiʻalae Bay to Waikīkī and on to Kou (Honolulu Harbor). Very quickly, the battle moves out of Waikīkī toward Kou (downtown Honolulu) and up toward Pūowaina (Punchbowl). Kamehameha splits his troops into two divisions. One moving up toward Pūowaina and Nuʻuanu and the other going through Makiki and coming around the back side of Pūowaina. The chant creates a vivid picture of the intensity and fierceness of the fighting that occurred. A description is given of the general populace fleeing wildly through the taro fields in Makiki. The battle intensifies at Kānelāʻau, on the east slopes of Punchbowl, where Kalanikūpule's forces are trapped and surrounded. Kamehameha has the advantage of his canon, Lopaka, commanded by Hūʻeo (Isaac Davis). The Oʻahu battalions are forced to flee. Some escape the heat of the battle and try to make their way back toward Waikīkī, probably in a last ditch effort to escape via canoe, while others flee toward ʻEwa. However, the majority of the forces head toward Nuʻuanu and the *pali* with Kamehameha's men in fast pursuit.

Line 94 of the chant is perplexing in that it makes mention of "numerous [people] being killed at Kuamoʻo" (*make lehulehu i Kuamoʻo*). It is not clear whether this is a reference to Kuamoʻo, Oʻahu, Kuamoʻo on Hawaiʻi or possibly an obscure reference to a different Kuamoʻo location in close proximity to the place names mentioned in the chant. The locality of Kuamoʻo on Oʻahu is spoken of by Kamakau in relation to the 1794 battle of Kukiʻiahu, between Kaʻeokūlani of Maui and Kalanikūpule of Oʻahu. Mention is made of, "The heights of Kuamoʻo, Kalauao, and Aiea" and that Kaʻeo's men were "cut off . . . between Kalauao and Kuamoʻo (Kamakau 1992:169). This Kuamoʻo is clearly the one located in the ʻEwa District, far outside the boundaries where the Nuʻuanu battle took place. The famous battle of Kuamoʻo at Kailua,

Figure 133. Reconstruction of Kahekili's invasion of O'ahu circa 1783

Kona took place in 1819, after Kamehameha's death, over the upheaval of the *'ai kapu* (the religious taboo system). It seems odd that a chant written to commemorate Kamehameha and the Nu'uanu battle would make reference to a battle that occurred 24 years later and after the death of Kamehameha. It is even more odd to find a reference to either of the Kuamo'o battles within the sequence of Waikīkī place names given. The chant is clearly recounting the various place names in their order along the coast of Waikīkī. Regardless, both known Kuamo'o locations are nowhere near the vicinity of Waikīkī or the Punchbowl-Nu'uanu areas. The present day Kuamo'o Street in Waikīkī, situated between Kūhiō Avenue and Ala Wai Boulevard, is said to have been named for Mary Kuamoʻo Kaʻoanaʻena, the sister of Kekuaokalani who was killed at the Kuamoʻo battle of 1819 (Pukui et al. 1974:119).

Line 144 once again mentions the place name Kuamoʻo and is prefaced by the preceding line: "The people of Oʻahu ask, who is this facing us? Who is the warrior at Kuamoʻo?" The chant seems to be referring to a specific place name within the area of the battle zone but, this cannot be for certain. Research into place names and 19th century maps did not reveal any additional information regarding another "Kuamoʻo location" on Oʻahu.

In summary, the primary reason for studying this Nuʻuanu Battle chant was to find clues to where the fighting occurred and to then determine areas containing possible burials related to this particular war. From the chant, it is clear that the battle moved out of Waikīkī proper very quickly. Although there were skirmishes along the way, the main fighting and loss of life is understood to have occurred near the eastern slopes of Punchbowl and ended at Nuʻuanu Pali.

The only archaeological find associated with these wars of conquest is a mass burial find (SIHP citation of 50-80-14-4570:8 for what Carlson et al. 1994" call "Burial Area 6") located just southeast of the intersection of Paoa Place and Kālia Road. The 27 to 34 individuals appear to have been all males 12-15 to at least 50 years old with perimortum trauma identified on 21 individuals. The study concludes this was a hasty, mass interment and "may well represent the remains of Hawaiian warriors who died in one of the battles of the interisland wars of conquest which occurred during the reign of King Kamehameha I." (Carlson et al. 1994:70).

Analysis

The vast majority of the Waikīkī deceased were the common people. Withington (1953:16), probably referring to the *ʻokuʻu* plague (circa 1804), says,

> A few years of peace settled over the Islands. Kamehameha and other warring chiefs took this opportunity to re-establish their forces, which had been greatly reduced through war and disease. A terrible epidemic of measles had attacked the people of the islands. It is claimed that more than three hundred bodies were carried out to sea from Waikīkī in one day.

While many of the Waikīkī burials likely accumulated slowly over centuries, other burials are likely related to such early and rapid depopulation by introduced diseases.

Social rank seems to have had profound influences on places available for disposal. A king's body, or those of his attendants, could be placed within the district of the king's authority. Many geographical features were available. Fewer were available to lesser chiefs and their attendants, who were presumably limited to their own districts. The number of geographical features available for disposal seems to have decreased as rank decreased. Disposal for members of an extended family living in an *ʻili* (land division within an *ahupuaʻa*) was restricted to those geographical features located within the land unit, whether broken lava flats, lava tubes, earth plains, or sand dunes (Bowen 1961:21).

Bowen (1961:21) notes that most Hawaiians in the pre-contact period belonged to the *makaʻāinana* or commoner class and their bones were usually buried in no other area than their particular *ʻili*; this particular practice is reflected in a Hawaiian term for one's natal locality - *kulāiwi* meaning "plain of one's bones" (Cleghorn 1987:41).

Burials are commonly reported from clean, consolidated sand deposits and beach burial was clearly a common method of interment practiced by Hawaiians (Cleghorn 1987:42). One of the earliest references to Hawaiian burial customs was made by Urey Lisiansky (1814:122), who visited Hawaiʻi in June 1804. He notes: "The poor are buried anywhere along the beach . . . "

Commenting on the nature of burial areas and body positions used in burial, Ellis (1827:361-363) says: "The common people committed their dead to the earth in a most singular manner." The body was flexed, bound with cord, wrapped in a coarse mat, and buried one or two days after death. Graves were ". . . either simply pits dug in the earth, or large enclosures . . . Occasionally they buried their dead in sequestered places at a short distance from their habitations, but frequently in their gardens and sometimes in their houses. Their graves were not deep and the bodies were usually placed in them in a sitting posture" (Bowen 1961:142). Ellis observed an important point that has also been noted by archaeologists; the probability of burials within or in very close proximity to Land Commission Award house lot claims is significantly greater than is typical away from such house lot claims. This indicates a heightened probability of burials in portions of the present study area particularly in the eastern half of the project area.

Regarding the Castle burials, at the east end of Waikīkī, Bowen states, "Concerning the circumstances of burial, Emerson says: 'From the absence of fractures and marks of violence in the bones I have examined, such as might have been caused in battle, I am inclined to think that the site where they were found was at one time a Hawaiian cemetery" (1961: 149). Indeed it seems likely that most of the remains thus far documented relate to common mortuary practices. The mass burial find (SIHP 50-80-14-4570:8) mentioned above is a notable exception.

Appendix D Master Catalog of Artifacts

Trench	Stratum	Depth (cm)	Material	Identification	Portion	Ht. (cm)	Diam. (cm)	Wt. (g)	Color	Description
1	III		Glass	Bottle - Soda	Body/base frag.	5.5	5.5	102.3	Colorless	Cylindrical base and body; bottle with flutes and stippling ; embossed on base: "PROP. OR C. C. BOTT. CO. HON. LTD./MADE IN JAPAN"; embossed in base center: "10 T K" over "62"; the number 62 is for the date of bottle manufacture - 1962; the bottle is similar to a picture of a soda called "Hawaii Beverages" (Millar 1988:33)
1	III		Glass	Bottle	Body frag.	7.2	3.0	31.6	Colorless	Possibly from same bottle as above
1	III		Ceramic	Tile	Rim/body frag.	7.8	5.0	45.1	--	Whiteware tile; green glaze on one side and on rim; embossed on unglazed side: "TRADE/ GLADDING / M…"; mark probably for Gladding, McBean, established in Lincoln, CA in 1875 and still in operation today (Gladding, McBean 2010); this sherd connects to the tile in TR-2 Str. V
1	III		Stone	Tile	Fragments (6)	--	--	13.7	Various	Small thin fragments of cut (sawn) sedimentary stones (sandstone, shale, etc.) and some conglomerate material, used for decorative construction; 1 green, 1 grayish-green, 2 gray,1 black, and 1 red
2	V	70-130	Glass	Bottle - Condiment	Base to collar	18.0	5.3	232.1	Aqua	Cylindrical base and body; 2-pc. cup mold; semi-automatic or automatic bottle machine; club sauce finish; embossed on base: "JD/S/T 11"; on shoulder: "WORCESTERSHIRE SAUCE"; "LEA & PERRINS" on body, vertical orientation; Lea & Perrins established in the 1830s; imported to America by John Duncan & Sons in 1838-40; embossed "J D S" in 1877; switched from applied lip to semi-automatic or automatic bottle machine in 1890; embossing replaced by paper label in 1920s (Zumwalt 1980:269-271); thus, this bottle dates from 1890-1920
2	V	70-130	Ceramics	Tile	Body frag.	5.0	3.8	14.8	--	Whiteware tile; green glaze on one side; connects to T-1 Str. III sherd
2	V	70-130	Ceramics	Dinnerware	Base/body frag.	3.7	3.5	13.2	--	Whiteware dish (probably a plate); white glaze on both sides
2	V	70-130	Ceramics	Dinnerware	Body frag.	2.5	1.0	0.9	--	Whiteware dish; white glaze on both sides; may be part of same dish as above
2	V	70-130	Stone	Tile	Fragments (4)	--	--	6.9	Various	Small thin fragments of cut (sawn) sedimentary stone
2	V	70-130	Metal	Nail	Complete	6.7	1.0	6.2	--	Wire Nail
2	V	70-130	Plastic	Unknown	Fragment	5.7	7.0	2.0	Pearl	Curved plastic item; may be a strap or part of a hair barrette
3	V-VI		Glass	Bottle - Soda	Complete	27.0	5.7	420.3	Colorless	Cylindrical base and body; 2-pc. cup mold; tooled lip; crown top finish; embossed: "493" on base; "THIS BOTTLE NOT SOLD" on heel; "FOUNTAIN MINERAL AND SODA WORKS/ HONOLULU/ R R", with a picture of a hula girl and two fishermen (?); bottle dated to ca. 1908 by Elliot & Gould (1988:94) based on lip finish, base numbers, and soda works history; the Fountain Works was established in 1902; the name changed to the Rycroft Fountain Works in 1911 (Elliott 1971:30)
3	V-VI		Ceramic	Dinnerware	Body/rim (in 3 frags.)	16.6	10.6	78.8	--	Porcelain plate; white glaze on both sides; no decoration on fragments; inked stamp on bottom "HOMER LAUGHLIN/ American Beauty"; American Beauty is a shape name rather than a pattern and was introduced by HL in 1899; specific pottery mark was used for dinnerware around 1900 (Lehner 1988:247); American Beauty was still made in 1908, but is not found in the 1916 catalog (Page et al. 2003:35)
15	VII		Metal	Nail	Complete	6.4	0.7	6.0	--	Heavily corroded wire nail

Trench	Stratum	Depth (cm)	Material	Identification	Portion	Ht. (cm)	Diam. (cm)	Wt. (g)	Color	Description
15	X	165	Ceramic	Dinnerware	Complete (in 4 fragments)	20.8	20.8	408.4	--	Whiteware plate with white glaze on both sides; stamped patterns on top; monthly calendars, blue flowers with green 4-leaf clovers, "1914" in center; "Compliments of Lin Sing Kee/ HONOLULU/ T.H." at bottom; "CARNATION/ McNicol" in script on base. The plate was made either by the D. E. McNicol Pottery (1892-1920) or the Patrick McNicol pottery (1886-1920s) in East Liverpool, OH (Lehner 1978:50)
15	X	165	Glass	Bottle - Condiment	Body/base (in 3 frags.)	10.0	4.3	123.9	Aqua	Cylindrical base and body; 2-pc. cup mold; embossed "J" on base; "...OLBROOK & Co"; (for Holbrook & Co. Worcestershire Sauce); Holbrook & Co., Birmingham, England was established in 1908 (Zumwalt 1980:245) and were still in business in 1991 (Odell 2001)
15	X	165	Glass	Bottle - Cosmetic	Body/base (in 2 frags.)	6.2	5.5 x 3.3	39.9	Aqua	Rectangular bottle; 2-pc. cup mold; painted swirls on body; embossed "13" on base
15	X	165	Glass	Bottle - Medicine	Body	2.5	6.5	7.1	Aqua	Rectangular bottle; fragment of side panel
15	X	165	Glass	Bottle - Medicine	Base to Lip (in 3 frags.)	13.6	5.5 x 4.4	79.1	Aqua	Oval bottle; double collar finish; 2-pc. cup mold; ABM; "1846" embossed on base; marking found on "Pond's Extract"; Pond's Extract, first commercial witch hazel product, was invented in 1846; Pond's company incorporated in 1914; bottle prob. 1900-1920; cheaper witch hazel products sold around 1910 and Pond's switched to cold creams
15	X	165	Glass	Bottle - Medicine	Complete	14.7	4.7 x 2.2	128.5	Aqua	Rectangular bottle; 2-pc. cup mold; ABM offset seam; Owens Suction scar on base; embossed: "4" on base; "CASTORIA" on body side; "Chas. H. Fletcher's" in script on other body side; Fletcher's Castoria was introduced in the early 1890s (Fike 1987:162)
15	X	165	Glass	Bottle - Soda	Complete	23.9	6.4	393.2	Lt. Green	Cylindrical bottle; 2-pc. cup mold; crown top; ABM
15	X	165	Glass	Bottle	Body frag.	7.5	7.0	41.3	Lt. Blue	Curved glass piece
15	X	165	Glass	Bottle	Body frag.	5.0	6.3	35.8	Lt. Blue	Similar to above; possibly from same bottle
15	X	165	Glass	Bottle	Body frag.	3.5	8.2	$24.0	Lt. Blue	Similar to above; possibly from same bottle
15	X	165	Glass	Bottle - Soda	Base to collar	19.2	5.3	261.5	Colorless	Cylindrical bottle; 2-pc. cup mold; probably ABM
15	X	165	Glass	Bottle - Beverage	Base frag.	2.0	6.6	62.9	Colorless	Cylindrical bottle; 2-pc. Post mold; embossed "1" on base
15	X	165	Glass	Bottle - Medicine	Complete	3.4	9.5	68.9	Colorless	Cylindrical bottle; patent lip; turn mold
15	X	165	Glass	Bottle - Medicine	Body frags. (2)	4.0	3.0	12.5	Colorless	Curved bottle glass; two pieces fit together; embossed "…EXTRA…"; probably EXTRACT, a word found on numerous embossed patent medicines; may be part of a Pond's Extract bottle (but not part of the aqua bottle above)
15	X	165	Glass	Bottle	Body frag.	5.5	1.7	6.5	Colorless	Thickness and glass clarity similar to above "Extract" bottle
15	X	165	Glass	Bottle	Body frag.	4.8	2.0	3.2	Colorless	Curved bottle glass; white paint (?) on inside of glass
15	X	165	Glass	Bottle	Body frag.	0.9	0.9	0.4	Colorless	Curved bottle glass; white paint (?) on inside of glass
15	X	165	Glass	Bottle	Body frag.	0.4	1.2	0.3	Colorless	Curved bottle glass; white paint (?) on inside of glass
15	X	165	Glass	Bottle	Body/base frag.	10.6	7.8	323.1	Amber	Cylindrical bottle; 2-pc. Post mold; embossed "2709" on base; note: 1 of 3 amber bottles in this provenience
15	X	165	Glass	Bottle - Beer	Body/base frags. (6)	14.4	5.5	233.5	Amber	Cylindrical bottle; 2-pc. cup mold; embossed "...EE " in double circle on body [probably, Milwaukee]; "W F…MIL.." on base [likely "W F & S/ MILW" for William Franzen & Son, Milwaukee, WI. Mark used from 1900-1929 (Toulouse 1971:536); bottled Milwaukee beer]; very similar to Pabst beer bottle; note: 1 of 3 amber bottles in this provenience

Trench	Stratum	Depth (cm)	Material	Identification	Portion	Ht. (cm)	Diam. (cm)	Wt. (g)	Color	Description
15	X	165	Glass	Bottle - Beer	Body/base frag.	7.5	4.5	32.8	Amber	Cylindrical bottle; note: 1 of 3 amber bottles from this provenience
15	X	165	Glass	Bottle - Beer	Lip-Collar frag.	5.5	2.3	47.6	Amber	Brandy finish; tooled lip; may be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	6.2	3.0	16.3	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	3.0	2.2	3.6	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	4.0	2.6	8.2	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	4.2	2.5	5.6	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	8.0	3.0	22.1	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	8.0	3.0	21.6	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	3.2	1.9	3.5	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	3.2	1.1	3.4	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	5.5	2.2	10.0	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	5.0	4.0	15.7	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	7.0	3.0	13.6	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	5.3	2.3	8.3	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Glass	Bottle	Body frag.	9.5	5.3	37.2	Amber	May be part of one of the three amber bottles from this provenience
15	X	165	Ceramic	Dinnerware	Handle frag.	4.3	1.8	20.0	--	Whiteware handle; white glaze on all sides; brown stem pattern painted under the glaze
15	X	165	Ceramic	Dinnerware	Body/base frag.	8.0	5.2	30.3	--	Porcelain dish (probably a plate); white glaze on top and bottom; green leaf pattern painted under the glaze around the rim
15	X	165	Ceramic	Dinnerware	Body/base frag.	4.5	2.0	9.9	--	Porcelain dish; part of same dish as above
15	X	165	Ceramic	Dinnerware	Body/base frag.	2.5	2.0	4.5	--	Porcelain dish; part of same dish as above
15	X	165	Ceramic	Dinnerware	Body frag.	4.0	3.5	7.8	--	Porcelain dish; white glaze on both sides; green leaf painted above glaze
15	X	165	Ceramic	Dinnerware	Rim/body frag.	3.7	2.6	4.8	--	Porcelain dish (probably a bowl); white glaze on top and bottom; gold rim applied along rim above glaze on interior side; gold swirls on exterior side
15	X	165	Ceramic	Storage Jar	Rim/body frag.	5.4	5.0	32.5	--	Stoneware jar
15	X	165	Stone	Tile	Fragment	5.0	2.5	10.7	--	Small thin fragments of cut (sawn) sedimentary stone; two attached layers, one brown stone, over a black shale
17	IV	165-175	Ceramic	Dinnerware	Rim/body frag.	4.5	3.0	25.5	--	Whiteware dish lid on all sides; white glaze; green transfer print with blue flowers; grid pattern along rim
17	IV	165-175	Ceramic	Dinnerware	Base frag.	3.5	2.0	6.5	--	Whiteware dish; white glaze on both sides; Stamped mark on bottom: "…DEEN/84706..."
17	IV	165-175	Soapstone	Pipe	Bowl frag.	2.5	1.0	5.9	Whitish/ yellow	Carved pipe bowl; machine-bored hole, 0.6 cm. in diameter
18	IV	140-165	Ceramic	Dinnerware	Rim/body frag.	5.7	2.6	11.0	--	Whiteware dish (possibly a bowl); flow blue (sharp edges) pattern
18	IV	140-165	Ceramic	Dinnerware	Rim/body frag.	3.7	3.0	3.2	--	Porcelain dish; white glaze on both sides; painted pattern below the glaze; yellow flowers with green leaves, thin gold line and thick blue line along rim
18	IV	140-165	Ceramic	Storage Jar	Body frag.	3.0	2.5	21.3	--	Stoneware jar; gray body with black glaze on portions
18	IV	140-165	Ceramic	Storage Jar	Body frag.	5.5	4.5	5.2	--	Stoneware fragment; gray body with black glaze on portion; probably from same vessel as above
20	IV		Glass	Bottle	Body fragment	4.5	2.0	8.0	Colorless	Curved glass fragment

Trench	Stratum	Depth (cm)	Material	Identification	Portion	Ht. (cm)	Diam. (cm)	Wt. (g)	Color	Description
20	IV		Ceramic	Tile	Interior frag.	3.0	2.0	6.4	--	Whiteware tile; white glaze on one side
20	IV		Ceramic	Tile	Interior frags. (2)	3.5	2.0	8.0	--	Whiteware tile; yellow glaze on one side; embossed "RAM…" on unglazed side
20	IV		Metal	Nail	Complete	--	6.6	9.6	--	Very corroded, but probably a wire nail

Appendix E State Historic Preservation Division Comment Letter of April 19, 2010

LINDA LINGLE
GOVERNOR OF HAWAII

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
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

April 19, 2010

LOG NO: 2010.1789
DOC. NO: 1004PC008

MEMORANDUM

TO: Brian Kawika Cruz, Cultural Researcher
Momi Wheeler, Cultural Researcher
Cultural Surveys Hawai'i, P.O. Box 1114, Kailua,Hawai'i 96734

FROM: Phyllis Coochie Cayan, History and Culture Branch Chief

Subject: Cultural Impact Assessment (CIA) for the Proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project, Waikiki Ahupua'a, Honolulu (Kona) District, O'ahu Island. Multiple TMK.

Mahalo for the opportunity to comment on a cultural impact assessment for the proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project in Waikiki covering multiple TMKs within the hotel's property located at the ‘ewa end of Waikiki bounded by Kahanamoku Street to the northwest, Ala Moana Boulevard to the north, Kalia Road to the northeast, Paoa Lane to the southeast, and Waikiki Beach and the Pacific Ocean to the west and south.

The project area is highly developed for its hotel activities and there have been inadvertent burials found when work was done as part of the upgrade of the roads, the adjacent buildings and the current hotel plan. The department is concerned that there may be more unseen and/or unknown cultural resources as this was a rich cultural area prior to the hotel industry when large Hawaiian families (i.e., Kahanamoku, Paoa, Harbottle) populated the area especially the Paoa-Kahanamoku family compound that use to be in the area of Paoa Lane.

Part of SHPD's cultural concerns would be any inadvertent burials exposed from ground disturbances at the proposed project area as well as any ceremonial use, all access and gathering rights to the ocean including surfing, fishing, and other recreational uses. The SHPD archaeology comments will be separate from this letter.

Some folks who may have been helpful or able to refer others are:

• Nalani Olds		Phone: 808.261.1171
• Van Diamond	1523-F Halekula Way, Honolulu, 96822	Phone: 808.943-8674
• Betsy Paoa Cullen	95-168 Kahela Street Mililani, 96789	Phone: 808-623-4994
• Nanette Napoleon	Email: nanetten@hawaii.rr.com	Phone: 808-261-0705
• Cy Bridges	P.O. Box 94 Hauula, 96717	Phone: 808-293-3066

Any questions, please call me at 808-692-8015 or via email Phyllis.L.Cayan@hawaii.gov

C: Nancy McMahon, State Archaeologist
All referrals with mailing information above

Appendix F Office of Hawaiian Affairs Comment Letter of April 28 2010

PHONE (808) 594-1888 FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD10/4932

April 28, 2010

Brian Kawika Cruz, CSH Cultural Researcher
Momi Wheeler, CSH Cultural Researcher
Cultural Research Specialist
Cultural Surveys Hawai‘i, Inc.
P.O. Box 1114
Kailua, Hawai‘i 96734

RE: Cultural Impact Assessment consultation
Hilton Hawaiian Village Resort Master Plan Improvement Project
Waikīkī Ahupua‘a, Kona District, O‘ahu
Tax Map Key: Multiple

Aloha e Mr. Cruz and Ms. Wheeler:

The Office of Hawaiian Affairs (OHA) is in receipt of your April 9, 2010 letter initiating consultation and seeking comments ahead of a cultural impact assessment (assessment) for the Hilton Hawaiian Village Resort and Spa Master Plan Improvement Project. Based on the information contained in your letter, the area of interest is within the Hilton Hawaiian Village's approximate 22 acre property and is expected to be completed within 10 years. Your letter also mentions the improvements will include: Improvements to the main entry, the streetscape along Kalia road, Tapa pool, and Tapa Café; major renovations to the Front Desk area and Rainbow Drive; developments of a new Super Pool and new Hau Tree Bar, and two new timeshare towers to include 550 timeshare units; and finally, repositioning and redeveloping retail space and retail outlets.

As your firm has an extensive work history in Waikīkī, we are sure you are familiar with the mo‘olelo associated to this area, cultural practices that have occurred, and families who have ancestral ties to the assessment area. The Kahanamoku, Paoa, and the Harbottle ‘ohana originally resided from this area and may be able to share mo‘olelo and cultural practices related to their lineage.

OHA notes that the Waikīkī area has been known to yield many unmarked Native Hawaiian burial sites. We therefore request the applicant's assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during project activities, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Brian Kawika Cruz
Momi Wheeler
Cultural Surveys Hawai`i
April 28, 2010
Page 2 of 2

Also, please note that Native Hawaiian traditional and customary gathering, access and use rights should not be restricted, except as necessary to ensure safety. If such-related restrictions are put in place, alternate access routes must be provided.

Thank you for initiating consultation at this early stage and we look forward to the opportunity to review the completed assessment. Should you have any questions, please contact Kathryn Keala at 594-0272 or kathyk@oha.org.

‘O wau iho nō me ka ‘oia‘i‘o,

Clyde W. Nāmu‘o
Chief Executive Officer

APPENDIX G

Cultural Impact Assessment for the Hilton Hawaiian Village,
Waikīkī Ahupuaʻa, Kona District, Oʻahu Island
TMK: [1] 2-6-008: 001-003, 005, 007, 012, 019-021, 023, 024,
027, 034, 038 and [1] 2-6-009: 001-007, 009-013

Cultural Surveys Hawaii, Inc.

September 2010

Cultural Impact Assessment for the Hilton Hawaiian Village, Waikīkī Ahupua‘a, Kona District, O‘ahu Island TMK: [1] 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 and [1] 2-6-009:001-007, 009-013

Prepared for

Group 70 International, Inc.

Prepared by

Brian Kawika Cruz, B.A.

Christopher M. Monahan, Ph.D.

and

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.

Kailua, Hawai‘i

(Job Code: WAIKIKI 48)

September 2010

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Prefatory Remarks on Language and Style

A Note about Hawaiian and other non-English Words:

Cultural Surveys Hawaiʻi (CSH) recognizes that the Hawaiian language is an official language of the State of Hawaiʻi, it is important to daily life, and using it is essential to conveying a sense of place and identity. In consideration of a broad range of readers, CSH follows the conventional use of italics to identify and highlight all non-English (i.e., Hawaiian and foreign language) words in this report unless citing from a previous document that does not italicize them. CSH parenthetically translates or defines in the text the non-English words at first mention, and the commonly-used non-English words and their translations are also listed in the *Glossary of Hawaiian Words* (Appendix A) for reference. However, translations of Hawaiian and other non-English words for plants and animals mentioned by community participants are referenced separately (see explanation below).

A Note about Plant and Animal Names:

When community participants mention specific plants and animals by Hawaiian, other non-English, or common names, CSH provides their possible scientific names (Genus and species) in the *Common and Scientific Names of Plants and Animals Mentioned by Community Participants* (Appendix B). CSH derives these possible names from authoritative sources, but since the community participants only name the organisms and do not taxonomically identify them, CSH cannot positively ascertain their scientific identifications. CSH does not attempt in this report to verify the possible scientific names of plants and animals in previously published documents; however, citations of previously published works that include both common and scientific names of plants and animals appear as in the original texts.

Management Summary

Reference	Cultural Impact Assessment for the Hilton Hawaiian Village, Waikīkī Ahupua‘a, Kona District, O‘ahu Island, TMK: [1] 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 and 2-6-009:001-007, 009-013 (Cruz et al. 2010)
Date	September 2010
Project Number	Cultural Surveys Hawai‘i, Inc. (CSH) Project Number: WAIKIKI 48
Project Location	The Project area consists of the Hilton Hawaiian Village Beach Resort and Spa complex, located along the coast of Waikīkī. The Project area is bounded by Kālia Road to the east, Paoa Place to the south, Duke Kahanamoku Lagoon to the west, and Ala Moana Boulevard to the north. The Project area is depicted on the U.S. Geological Survey 7.5-Minute Series Topographic Map, Honolulu Quadrangle (1998) (see Figure 1).
Land Jurisdiction	Private, Hilton Hawaiian Village LLC
Agencies	State of Hawai‘i Department of Land and Natural Resources / State Historic Preservation Division (DLNR / SHPD); State Office of Environmental Quality Control (OEQC)
Project Description	The proposed Project involves the redevelopment of the existing Hilton Hawaiian Village Beach Resort and Spa complex (see Appendix C: Hilton Hawaiian Village Master Plan). This would involve the demolition of existing structures, the construction of new structures, and the renovation of existing structures. Associated ground disturbance will involve excavations related to the Project area’s redevelopment, to include: structural footing installation, utility installation, swimming pool expansion, and landscaping. Surface grading is also anticipated for roadway improvements and parking area installation.
Project Acreage	Approximately 22.24 acres
Area of Potential Effect (APE)	The Area of Potential Effect (APE) for this Cultural Impact Assessment (CIA) includes the approximately 22.24-acre Project area in the context *ahupua‘a* (land division usually extending from the uplands to the sea) of Waikīkī, Kona Moku (District), and other places on O‘ahu and beyond that are traditionally associated with or connected to the Project area.

Document Purpose	The Project requires compliance with the State of Hawai‘i environmental review process (Hawai‘i Revised Statutes [HRS] Chapter 343), which requires consideration of a proposed Project’s effect on cultural practices and resources. At the request of Group 70 International, Inc., CSH is conducting this draft CIA. Through document research and ongoing cultural consultation efforts, this report provides preliminary information pertinent to the assessment of the proposed Projects’ impacts to cultural practices and resources (per the *Office of Environmental Quality Control’s Guidelines for Assessing Cultural Impacts*) which may include Traditional Cultural Properties (TCP) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places, in accordance with Hawai‘i State Historic Preservation Statute (Chapter 6E) guidelines for significance criteria (HAR §13-284) under Criterion E. The document is intended to support the Project’s environmental review and may also serve to support the Project’s historic preservation review under HRS Chapter 6E-42 and Hawai‘i Administrative Rules (HAR) Chapter 13-284.
Community Consultation	CSH attempted to contact Hawaiian organizations, agencies, community members and all of the recognized cultural and lineal descendants of Waikīkī Ahupua‘a in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and the vicinity. The organizations consulted include the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), the O‘ahu Island Burial Council (OIBC), and community and cultural organizations including Hui Mālama I Nā Kūpuna O Hawai‘i Nei and the Waikīkī Hawaiian Civic Club.
Results of Background Research	Background research of the Project area indicates: 1. The Project area is located in the Kālia portion of Waikīkī Ahupua‘a. Kālia, meaning “waited for,” is a name used for the central portion of Mānoa Stream and the name of the coastal area where the Pi‘inaio Stream once emptied into the ocean adjacent to the proposed Project area. 2. Large portions of Waikīkī were once part of a wide marshland—including areas along the *mauka* (towards the mountain) border of the current Project area and inland from there. The name Waikīkī (water spurting from many sources) likely refers to the swampy land of pre-Contact Waikīkī, where water from the upland valleys gushed forth from underground. 3. Several royal residences and other chiefly residential compounds were once located just southeast of the current

	Project area, in the area of ʻĀpuakēhau Stream and the old land division of Helumoa. 4. Kālia is associated with a traditional fishing technique used to catch schools of mullet. The fishermen of Kālia became known as human fishnets. 5. The old land division of Helumoa (chicken scratch) is associated with oral-historical accounts of the legendary rooster Kaʻau-helu-moa, the historical figure Kaʻopulupulu and human sacrifices at the *heiau* (place of worship, shrine) of ʻĀpuakēhau. 6. Fishponds are one the most important traditional resources associated with the Project area. Many named and unnamed fishponds were once located immediately inland of the Project area, including Kaihikapu, Kuwili, Kaipuni (1 and 2), Paweo (1 and 2) and Kapuuiki. 7. There are no *heiau* or other religious sites in the current Project area; the closest *heiau* to the Project area was the famous Helumoa Heiau (current spot of the Royal Hawaiian Hotel). 8. The Wizard Stones of Kapaemāhū, currently located at Kūhiō Beach in Waikīkī, are named after four healers from Tahiti: Kapaemāhū, Kahaloa, Kapuni and Kinohi. 9. During the first decade of the twentieth century, the U.S. War Department acquired more than 70 acres in the Kālia portion of Waikīkī for the establishment of a military reservation called Fort DeRussy, located immediately adjacent to the Project area to the east. 10. During the 1920s, Waikīkī's landscape was transformed by the construction of the Ala Wai Drainage Canal which resulted in the draining and filling in of the remaining ponds and irrigated fields of Waikīkī. 11. After the bombing of Pearl Harbor on December 7, 1941, development plans for Waikīkī as a tourist destination were put on hold. 12. By the mid-1950s, there were more than 50 hotels and apartment buildings from the Kālia area to the Diamond Head end of Kapiʻolani Park. By this time, the population of Waikīkī included 11,000 permanent residents living in 4,000 single dwellings and apartment buildings. 13. In 1980, two sets of human remains and one additional isolated femur were inadvertently discovered during construction activities in the southeastern corner of the subject property

	between Hilton Hawaiian Village Road, Kālia Road and Paoa Place. State archaeologists determined the remains were of Hawaiian ethnicity and post-Contact (historic-era) origin. The remains were removed from their original resting place and reburied on the subject parcel. The general location of the reinterment site is in the southeastern corner of the parcel. A more specific understanding of the location of the reinterment site is known by the owner of the Hilton Hawaiian Village, former staff of the SHPD, former members of the O‘ahu Island Burial Council (OIBC) and descendents, as memorialized in a 1991 reburial agreement between the State Historic Preservation Officer and the landowner. CSH is conducting an archaeological inventory survey for the subject Project that will provide more specific details on the location of the existing reburial site, as appropriate and relevant to the subject Project.
Results of Community Consultation	CSH attempted to contact 123 community members (government agency or community organization representatives, or individuals such as residents, cultural and lineal descendents, and cultural practitioners) for this draft CIA report; of those, ten responded and five participated in formal interviews for more in-depth contributions to the CIA. Presented below are salient themes and concerns arranged from general Waikīkī, narrowed down to Kālia, then to the Project area that emerged from participants' interviews regarding the proposed Project: 1. The vast ocean and freshwater resources of Waikīkī's past was expressed by *kūpuna* (elders) Anna Cazimero and Sylvia Krewson-Reck. Mrs. Cazimero states gathering various ocean resources including: *wana*, *limu līpe‘epe‘e*, *hā‘uke‘uke* and *upāpalu* along the shores of Waikīkī (see Appendix B for common and scientific plant and animal names mentioned by community participants). Mrs. Krewson-Reck states the existence of fishponds located in the Waikīkī during her youth. Today, the fishponds of Waikīkī have been filled-in and *limu* (seaweed) and other ocean resource gathering have all but ceased to exist in Waikīkī. 2. Waikīkī was once the home of the Lālani Hawaiian Village, developed by *‘ukulele* maker George P. Mossman in 1932 to demonstrate traditional Hawaiian music, crafts and *lū‘au* (Hawaiian feast). Mrs. Krewson-Reck was a student of the Lālani Hawaiian Village school system and learned to dance *hula* there. 3. Ala Moana Park, west of the Project area, was once the location of "Squatter's Ville," a salvage yard that attracted needy people who scavenged the area for items to sell and use. Mr. Paoa

	states that it is very similar to what is presently known as "recycling." 4. Mr. Van Horn Diamond states that at the Honolulu Zoo, there is a burial marker honoring approximately 100 *iwi kūpuna* (ancestral remains) discovered along Kalākaua Avenue during underground construction work. Cultural descendants of the *iwi kūpuna* currently care for the burial site and continue to have traditional ceremonies in remembrance of their ancestors. 5. According to Mr. Van Horn Diamond, many of the street names in Waikīkī were named for the *aliʻi* class. The street he grew up on in Waikīkī called Kānekapōlei was named after one of Kamehameha I's wives. 6. The Kodak Hula Show was created in 1937 by Fritz Herman to create an opportunity for tourist to photograph *hula* dancers in the daytime. Mrs. Anna Cazimero has been a member of the Kodak Hula Show for over 60 years. She played various instruments including stand-up bass, guitar and *ʻukulele* during her career in Waikīkī. She states how hot it was performing under the sun at Sans Souci Beach, the original location of the show. 7. Mrs. Sylvia Krewson-Reck states watching famed Hawaiian Slack Key musician Gabby Pahinui perform shows at the Niumalu Hotel in Waikīkī, site of the present day Hilton Hawaiian Village. She states that Gabby's show was a music and dance show and that she would go on dates there to dance to the music. 8. On April 1, 1946, a *tsunami* generated from a magnitude 7.1 earthquake in the Aleutian Islands in Alaska struck the Hawaiian Islands killing 159 people. Most of the destruction was in the town of Hilo on Hawaiʻi Island. Mr. Paoa states that on that day in Waikīkī, ocean surge caused by the *tsunami* wrecked all the boats in the Ala Wai Harbor. 9. Due to the massive amounts of development in Waikīkī, Mr. Paoa has no more *aloha* (love) for Kālia and Waikīkī. He understands that changes are inevitable but feels hurt seeing all the drastic changes in Kālia. 10. Mrs. Sylvia Krewson-Reck is concerned about the proposed Project blocking sacred *mauka/makai* (towards the mountain/towards the sea) views, which are part of the beautiful landscape of the Waikīkī area. She emphatically states "Please stop blocking the views!"

	11. During the Māhele of 1848, Mr. Clarke Paoa's great grandfather was awarded a parcel of land on the western border of the Project area. Land Commission Award (LCA) 1775 was awarded to Mr. Pawa or Paoa and included one house lot with no fence and one Royal Patent. The document further states that the parcel of land was given to Mr. Pawa from Kaʻahumanu, favorite wife of Kamehameha I. 12. Mr. Clarence Medeiros, Jr. supports the proposed Project and believes it will create more jobs. However, he anticipates that inadvertent archaeological discoveries will be found during construction of this Project.
Recommendations	Based on information gathered from the community consultation effort as well as archaeological and archival research presented in this report, the evidence indicates that the proposed Project may have a negative impact on burials that may be discovered during construction. A good faith effort to address the following recommendations would help mitigate potentially adverse effects the proposed Project may have on Hawaiian cultural practices, beliefs and resources in and near the Project area: 1. The Project may have a direct impact on as-yet undiscovered burials located in subsurface contexts in the subject property. CSH recommends that personnel involved in development activities in the Project area should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural and/or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law. 2. CSH recommends that, in the event of discoveries of *iwi kūpuna* during Project construction, recognized cultural and lineal descendants should be notified and consulted on matters of burial treatment. CSH recommends recognized cultural and lineal descendants shall be granted access rights to conduct traditional and customary burial practices. 3. In recognition of the Project proponent's proactive approach to conducting an archaeological inventory survey guided by an archaeological inventory survey plan, CSH recommends that all possible options for burial treatment—including preserve in-place—be considered should *iwi kūpuna* be discovered during the subject Project.

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Section 1 Introduction

1.1 Project Background

At the request of Group 70 International, Inc., Cultural Surveys Hawaii, Inc. (CSH) conducted a Cultural Impact Assessment (CIA) for the Hilton Hawaiian Village located in Waikīkī Ahupua‘a, Kona District, O‘ahu Island, TMK: (1) 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 and (1) 2-6-009:001-007, 009-013. The Project area, which consists of portions of the Hilton Hawaiian Village Beach Resort and Spa complex, is bounded by Kālia Road to the east, Paoa Place to the south, Duke Kahanamoku Lagoon to the west, and Ala Moana Boulevard to the north. The Project area is depicted on a U.S. Geological Survey (USGS) topographic map (Figure 1), a TMK (Tax Map Key) map (Figure 2), and an aerial photograph (Figure 3).

The proposed Project involves the redevelopment of the existing Hilton Hawaiian Village Beach Resort and Spa complex (Figure 4; see Appendix C: Hilton Hawaiian Village Master Plan), including the demolition of existing structures, the construction of new structures, and the renovation of existing structures. Associated ground disturbance will involve excavation for structural footing installation, utility installation, swimming pool expansion, and landscaping. Surface grading is also anticipated for roadway improvements and parking area installation.

The Project's area of potential effects (APE) is defined as the entire approximately 22.24-acre Project area, within the larger context of Waikīkī Ahupua‘a and adjacent lands. The APE also includes the Project area's relationship with the rest of the *moku* (district) of Kona and other places on the island of O‘ahu as these relate to Hawaiian beliefs (e.g., *mo‘olelo*, or oral-historical accounts, and *wahi pana*, or storied places), resources and practices associated with the Project area.

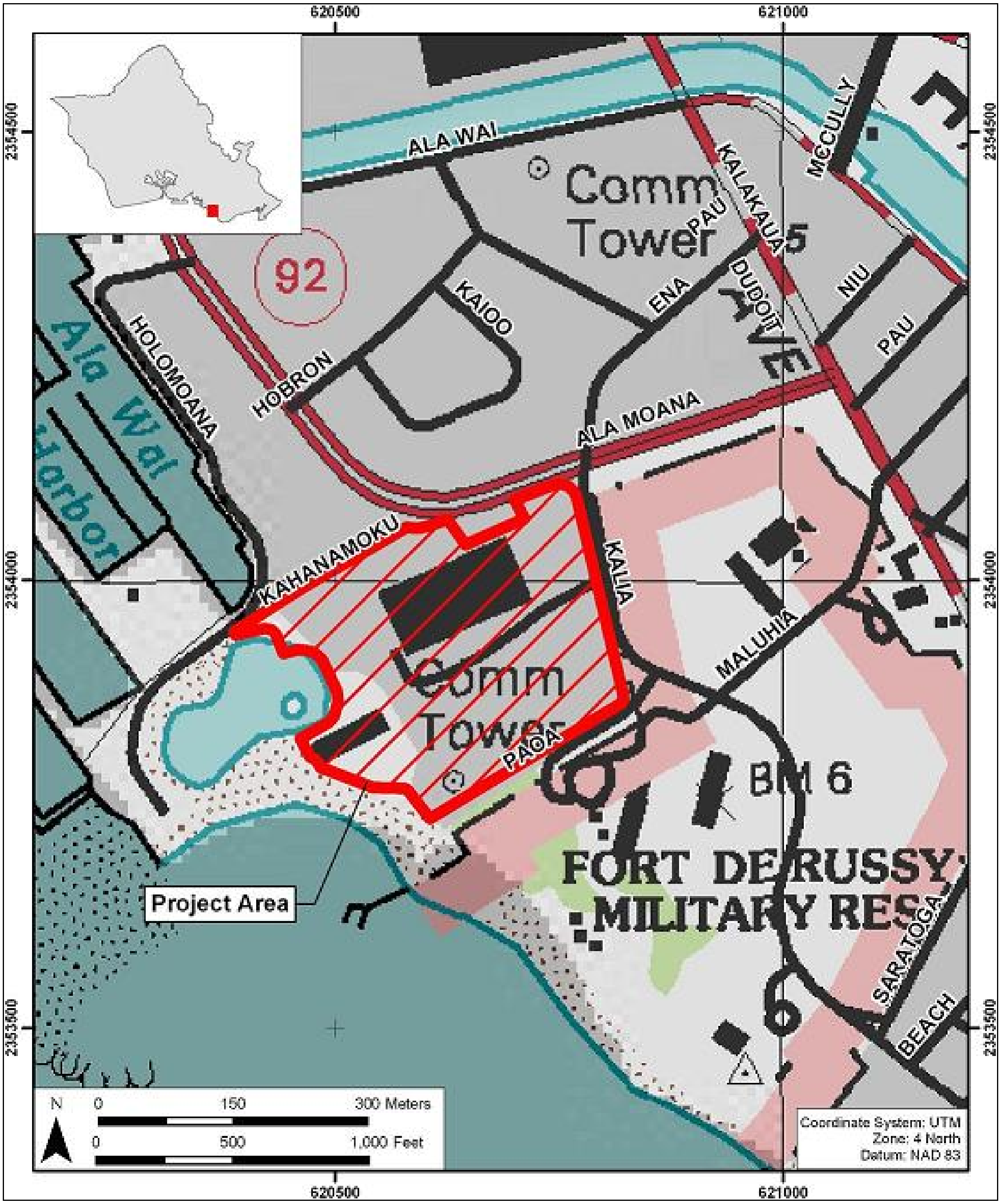

Figure 1. U.S. Geological Survey (USGS) 7.5 Minute Series topographic map, Honolulu (1998) Quadrangle, showing the location of the Project area

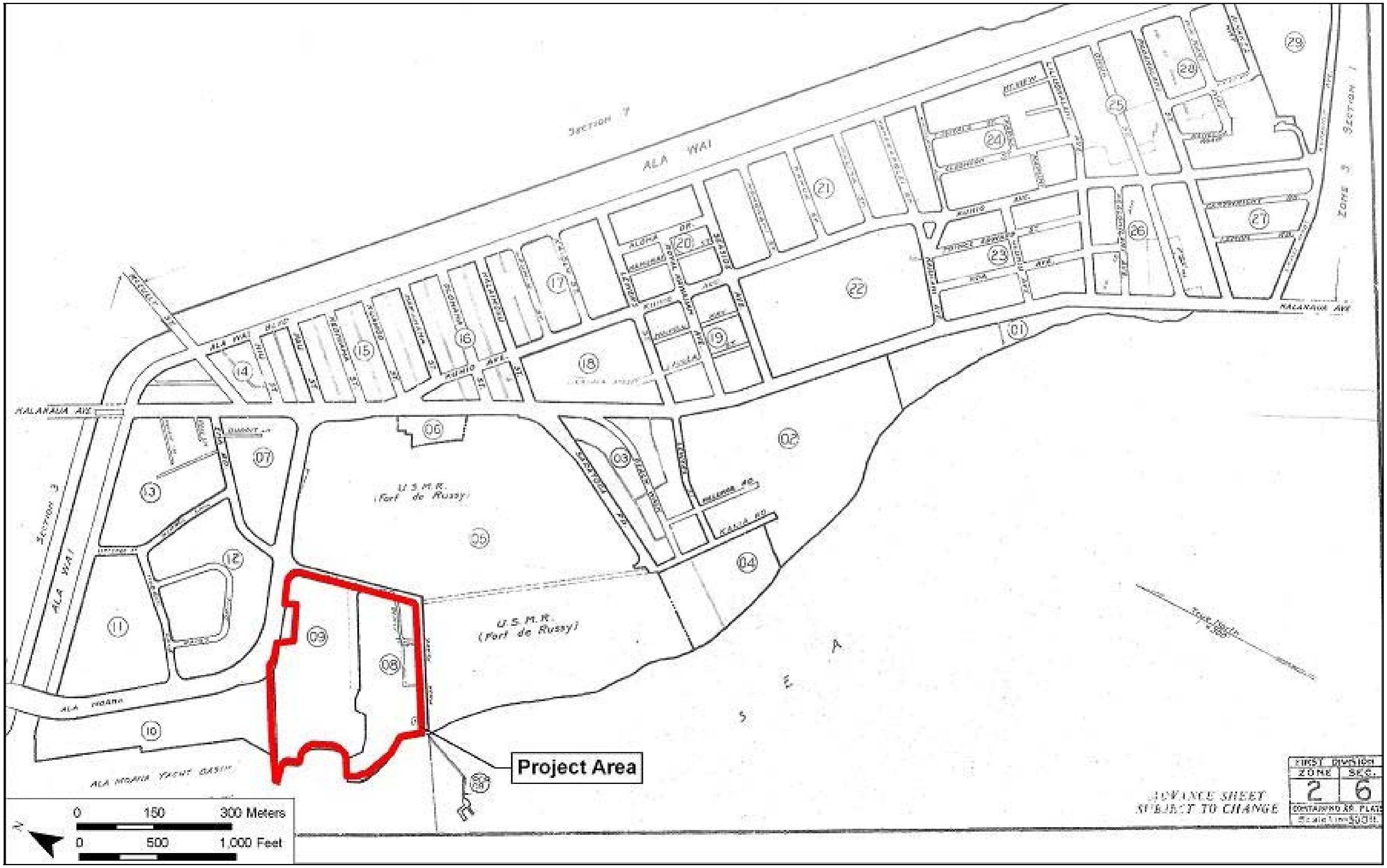

Figure 2. TMK: [1] 2-6 showing the location of the Project area

Figure 3. Aerial Photograph, showing the location of the Project area (source: Google Earth 2010)

Figure 4. Hilton Hawaiian Village site plan showing locations of proposed redevelopment (Group 70 International, Inc. 2010)

1.2 Document Purpose

The Project requires compliance with the State of Hawai‘i environmental review process [Hawai‘i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed Project's effects on cultural practices. CSH is conducting this CIA at the request of Group 70 International, Inc. Through document research and ongoing cultural consultation efforts this draft report provides preliminary information pertinent to the assessment of the proposed Project's impacts to cultural practices and resources (per the *Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts*), which may include Traditional Cultural Properties (TCP) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places, in accordance with Hawai‘i State Historic Preservation Statute (Chapter 6E) guidelines for significance criteria (HAR §13–284–6) under Criterion E which states to be significant an historic property shall:

> Have an important value to the Native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

The document is intended to support the Project's environmental review and may also serve to support the Project's historic preservation review under HRS Chapter 6E–42 and Hawai‘i Administrative Rules Chapter 13–284.

1.3 Scope of Work

The scope of work for this CIA includes:

1. Examination of cultural and historical resources, including Land Commission documents, historic maps, and previous research reports, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources or agricultural pursuits as may be indicated in the historic record.
2. Review of previous archaeological work at and near the subject parcel that may be relevant to reconstructions of traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
3. Consultation and interviews with knowledgeable parties regarding cultural and natural resources and practices at or near the parcel; present and past uses of the parcel; and/or other practices, uses, or traditions associated with the parcel and environs.
4. Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

1.4 Environmental Setting

1.4.1 Natural Environment

The Project area is situated along the southeastern coast of O‘ahu. The Honolulu leeward coastal plain is stratified with late-Pleistocene coral reef substrate overlaid with calcareous marine beach sand, terrigenous sediments, and/or stream-fed alluvial deposits (Armstrong 1973:36). Terrigenous sediments are formed and deposited on land, or are materials derived from land mixed with purely marine material. The modern Honolulu shoreline configuration is primarily the result of three factors: the rising sea level following the end of the Pleistocene (Stearns 1978); the 1.5–2.0 meter-high stand of the sea during the mid to late Holocene; and pre- and post-Contact human landscape modification. The Project area receives between 23 and 31 inches (600 and 800 millimeters) of rainfall per year (Giambelluca et al. 1986), and has no naturally occurring vegetation.

Lands within the Project area are relatively level with an elevation of three ft. above mean sea level (amsl). According to U.S. Department of Agriculture (USDA) soil survey data, sediments within the Project area consist almost exclusively of Jaucas Sand (JaC), with small pockets of Fill Land (FL) and Beaches (BS) located along the western edge (Foote et al. 1972) (Figure 5). As discussed in more detail below (see Section 3.7), Jaucas sands have been shown to contain many unmarked burials from pre-Contact and early historic times throughout Waikīkī and elsewhere on O‘ahu and other islands. The following is a synopsis of each soil series:

> Jaucas series consists of excessively drained, calcareous soils that occur as narrow strips on coastal plains, adjacent to the ocean…developed in wind and water deposited sand from coral and seashells…used for pasture, sugarcane, truck crops, alfalfa, recreational areas, wildlife habitat, and urban development. (Foote et al. 1972)
>
> Fill is described as a land type occurring mostly near Pearl Harbor and in Honolulu, adjacent to the ocean. It consists of areas filled with material dredged from the ocean or hauled from nearby areas, garbage, and general material from other sources. (Foote et al. 1972)
>
> Beaches occur as sandy, gravelly, or cobbly areas...washed and rewashed by ocean waves. Beaches mainly consist of light colored sands derived from coral and seashells. Beaches have no value for farming...but are highly suitable for recreational uses and resort development. (Foote et al. 1972)

1.4.2 Built Environment

The entire Project area has been artificially modified as a result of resort development. High- and low-rise buildings are present throughout the Project area, as well as concrete and asphalt paved roads and walkways. Landscaped trees and hedges are also present throughout the Project area.

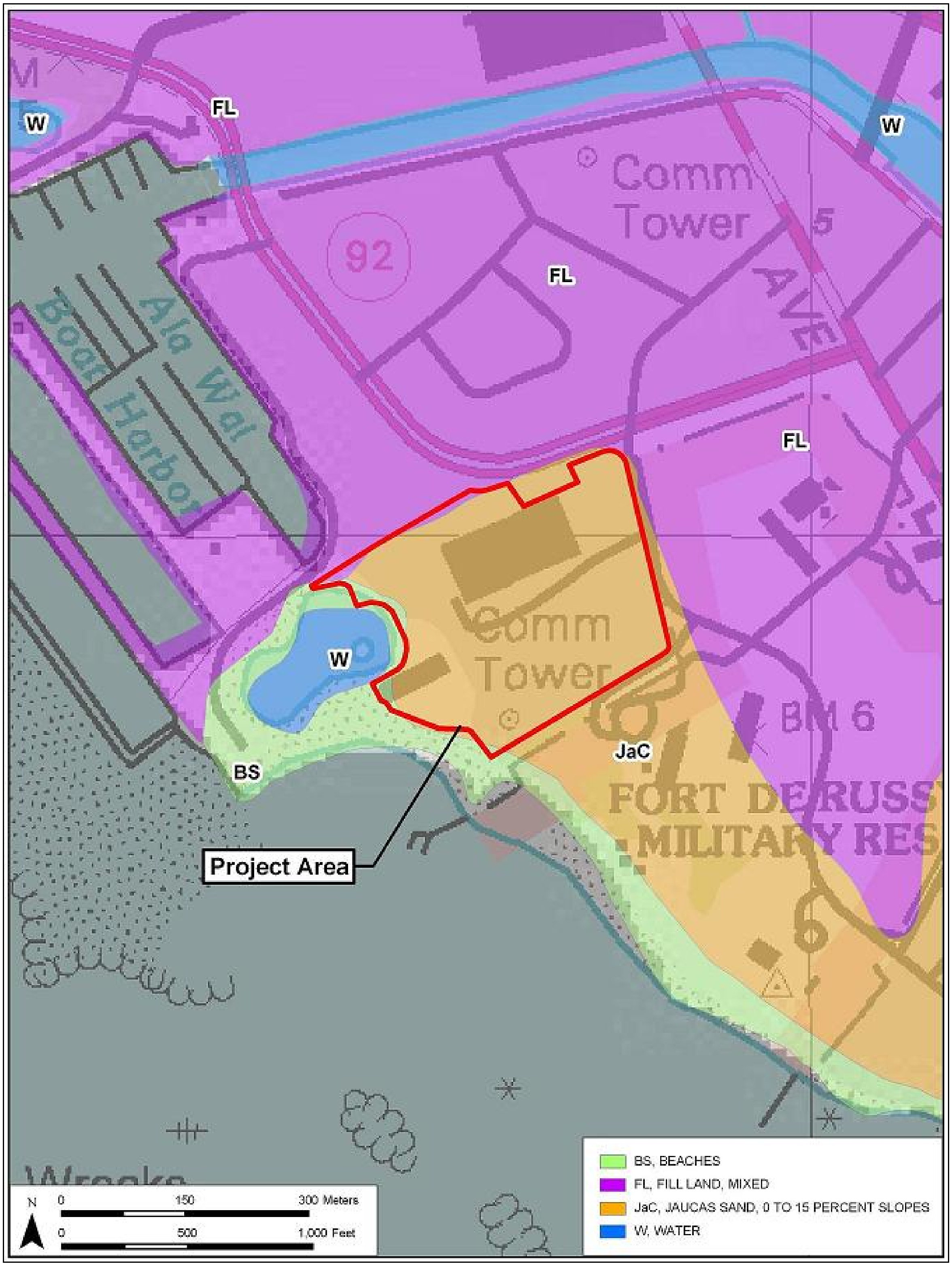

Figure 5. Overlay of the Soil Survey of the State of Hawai‘i (Foote et al. 1972), indicating soil types within the Project area

Section 2 Methods

2.1 Archival Research

Historical documents, maps and existing archaeological information pertaining to Waikīkī Ahupua'a, Kona Moku and the Project area vicinity—including Honolulu—were researched at the CSH library and other archives including the University of Hawai'i at Mānoa's Hamilton Library, the State Historic Preservation Division (SHPD) library, the Hawai'i State Archives, the State Land Survey Division, and the archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and photographs and primary and secondary historical sources. Information on Land Commission Awards (LCAs) was accessed through Waihona 'Aina Corporation's Māhele Data Base (www.waihona.com) as well as a selection of CSH library references.

The definitive source for Hawaiian place names is Pukui et al.'s (1974) *Place Names of Hawai'i*, but additional place-name translations and interpretations were also gleaned from Soehren's "Hawaiian Place Names" database on the internet (http//www.ulukau.org), historical maps, Land Commission documents available at the Hawai'i State Archives or on the internet at www.waihona.com, and from other place-name texts such as Clark (1977) and Thrum (1922). Some place names in this report—discussed in the next section—were also gathered from U.S. Geological Survey 7.5-Minute Series topographic maps.

For cultural studies, research for the Traditional Background section centered on Hawaiian activities including: religious and ceremonial knowledge and practices; traditional subsistence land use and settlement patterns; gathering practices and agricultural pursuits; as well as Hawaiian place names and *mo'olelo*, *mele* (songs), *oli* (chants), *'ōlelo no'eau* (proverbs) and more. For the Historic Background section research focused on land transformation, development and population changes beginning in the early post–European Contact era to the present day (see Scope of Work above).

2.2 Community Consultation

2.2.1 Sampling and Recruitment

A combination of qualitative methods, including purposive, snowball, and expert (or judgment) sampling, were used to identify and invite potential participants to the study. These methods are used for intensive case studies, such as CIAs, to recruit people that are hard to identify, or are members of elite groups (Bernard 2006:190). Our purpose is not to establish a representative or random sample. It is to "identify specific groups of people who either possess characteristics or live in circumstances relevant to the social phenomenon being studied….This approach to sampling allows the researcher deliberately to include a wide range of types of informants and also to select key informants with access to important sources of knowledge" (Mays and Pope 1995:110).

We began with purposive sampling informed by referrals from known specialists and relevant agencies. For example, we contacted the SHPD, the Office of Hawaiian Affairs (OHA), O'ahu

Island Burial Council (OIBC), and community and cultural organizations in and around Waikīkī for their brief response/review of the Project and to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and vicinity, cultural and lineal descendants, and other appropriate community representatives and members. Based on their in-depth knowledge and experiences, these key respondents then referred CSH to additional potential participants who were added to the pool of invited participants. This is snowball sampling, a chain referral method that entails asking a few key individuals (including agency and organization representatives) to provide their comments and referrals to other locally recognized experts or stakeholders who would be likely candidates for the study (Bernard 2006:192). CSH also employs expert or judgment sampling which involves assembling a group of people with recognized experience and expertise in a specific area (Bernard 2006:189–191). CSH maintains a database that draws on over two decades of established relationships with community consultants: cultural practitioners and specialists, community representatives and cultural and lineal descendants. The names of new potential contacts were also provided by colleagues at CSH and from the researchers’ familiarity with people who live in or around the Project area. Researchers often attend public forums (e.g., Neighborhood Board, Burial Council and Civic Club meetings) in or near the Project area to scope for participants. Please refer to Table 4, Section 6, for a complete list of individuals and organizations contacted for this CIA.

CSH focuses on obtaining in-depth information with a high level of validity from a targeted group of relevant stakeholders and local experts. Our qualitative methods do not aim to survey an entire population or subgroup. A depth of understanding about complex issues cannot be gained through comprehensive surveying. Our qualitative methodologies do not include quantitative (statistical) analyses, yet they are recognized as rigorous and thorough. Bernard (2006:25) describes the qualitative methods as “a kind of measurement, an integral part of the complex whole that comprises scientific research.” Depending on the size and complexity of the Project, CSH reports include in-depth contributions from about one-third of all participating respondents. Typically this means three to 12 interviews.

2.2.2 Informed Consent Protocol

An informed consent process was conducted as follows: (1) before beginning the interview the CSH researcher explained to the participant how the consent process works, the Project purpose, the intent of the study and how his/her information will be used; (2) the researcher gave him/her a copy of the Authorization and Release Form to read and sign (Appendix D); (3) if the person agreed to participate by way of signing the consent form *or* by providing oral consent, the researcher started the interview; (4) the interviewee received a copy of the Authorization and Release Form for his/her records, while the original is stored at CSH; (5) after the interview was summarized at CSH (and possibly transcribed in full), the study participant was afforded an opportunity to review the interview notes (or transcription) and summary and to make any corrections, deletions or additions to the substance of their testimony/oral history interview; this was accomplished primarily via phone, post or email follow-up and secondarily by in-person visits; (6) participants received the final approved interview, photographs and the audio-recording and/or transcripts their interview if it was recorded. They were also given information on how to view the draft report on the OEQC website and offered a hardcopy of the report once the report is a public document.

2.2.3 Interview Techniques

To assist in discussion of natural and cultural resources and cultural practices specific to the Project area, CSH initiated "talk story" sessions with (unstructured and semi-structured interviews as described by Bernard 2006) asking questions from the following broad categories: gathering practices and resources, burials, trails, historic properties and *wahi pana.* The interview protocol is tailored to the specific natural and cultural features of the landscape in the Project area identified through archival research and community consultation. These interviews and oral histories supplement and provide depth to consultations from government agencies and community organizations that may provide brief responses, reviews and/or referrals gathered via phone, email and occasionally face-to-face commentary.

2.2.3.1 In-depth Interviews and Oral Histories

Interviews were conducted initially at a place of the study participant's choosing (usually at the participant's home or at a public meeting place) and/or—whenever feasible—during site visits to the Project area. Generally, CSH's preference is to interview a participant individually or in small groups (two–four); occasionally participants are interviewed in focus groups (six–eight). Following the consent protocol outlined above, interviews may be recorded on tape or a digital audio device and in handwritten notes, and the participant photographed. The interview typically lasts one to four hours, and records the "who, what, when and where" of the interview. In addition to questions outlined above, the interviewee is asked to provided biographical information (e.g., connection to the Project area, genealogy, professional and volunteer affiliations, etc.).

2.2.3.2 Field Interviews

Field interviews are conducted with individuals or in focus groups comprised of *kūpuna* (elders) and *kamaʻāina* (Native born) who have a similar experience or background (e.g., the members of an area club, elders, fishermen, *hula* dancers) who are physically able and interested in visiting the Project area. In some cases, field visits are preceded by an off-site interview to gather basic biographical, affiliation and other information about the participant. Initially, CSH researchers try to visit the Project area to become familiar with the land and recognized (or potential) cultural places and historic properties in preparation for field interviews. All field activities are performed in a manner so as to minimize impact to the natural and cultural environment in the Project area. Where appropriate, Hawaiian protocol may be used before going on to the Project area and may include the offering of *hoʻokupu* (offering, gift), *pule* (prayer) and *oli*. All participants on field visits are asked to respect the integrity of natural and cultural features of the landscape and not remove any cultural artifacts or other resources from the area.

2.3 Compensation and Contributions to Community

Many individuals and communities have generously worked with CSH over the years to identify and document the rich natural and cultural resources of these islands for cultural impact, ethno–historical and, more recently, TCP studies. CSH makes every effort to provide some form of compensation to individuals and communities who contribute to cultural studies. This is done in a variety of ways: individual interview participants are compensated for their time in the form of a small honorarium and/or other *makana* (gift); community organization representatives (who may not be allowed to receive a gift) are asked if they would like a donation to a Hawaiian charter school or nonprofit of their choice to be made anonymously or in the name of the individual or organization participating in the study; contributors are provided their transcripts, interview summaries, photographs and—when possible—a copy of the CIA report; CSH is working to identify a public repository for all cultural studies that will allow easy access to current and past reports; CSH staff do volunteer work for community initiatives that serve to preserve and protect historic and cultural resources (for example in, Lānaʻi, Waimānalo, and Kahoʻolawe). Generally our goal is to provide educational opportunities to students through internships, share our knowledge of historic preservation and cultural resources and the State and Federal laws that guide the historic preservation process, and through involvement in an ongoing working group of public and private stakeholders collaborating to improve and strengthen the Chapter 343 environmental review process.

Section 3 Traditional Background

3.1 Overview

The historic land division of Waikīkī extends on the west from the land called Kou (old name for Honolulu) to Diamond Head in a strip along the coast. In modern times, the area identified as Waikīkī generally extends from Kalākaua Avenue on the west, from King Street/Waiʻalae Avenue on the *mauka* side, to Diamond Head on the east side, and to the sea coast on the *makai* (towards the sea) side. A distinction is sometimes made between Waikīkī Kai, the coastal area on the *makai* side of the Ala Wai Canal—within which the current Project area is located, and Waikīkī Waena (middle Waikīkī), the *mauka* lands between King Street/Waiʻalae Avenue and Ala Wai Boulevard.

Large portions of Waikīkī were once part of a wide marshland—including areas along the *mauka* border of the current Project area and inland from there, which extended as far east as the volcanic craters of Lēʻahi (Diamond Head) and the Kaimukī dome (where the present day Kaimukī fire station is built). This marshy area was once about three miles long and one mile wide, enclosing approximately 2,000 acres (Kanahele 1995:5–6).

Before the historic era, when the coastline was extended seaward by land-reclamation projects and major filling events, the *makai* half of the current Project area was under water. From the middle portion of the Project area extending inland appears to have been a low sand berm fronting an expansive wetland just inland of the *mauka* border of the current Project area. Although archaeological evidence has thus far only yielded post-Contact artifacts and features (including burials), this low sand berm, which was stabilized and built up in the early twentieth century using introduced fill, may have been used in pre-Contact times for short-term habitation sites and/or burials (Land Commission documents indicate at least two house lots, a coconut grove, *hala* [pandanus], *hau* [beach hibiscus], and some irrigated taro in this area).

Historic maps shows numerous inland fishponds immediately northeast of the Project area, which is located in the *ʻili* (land section, next in importance to *ahupuaʻa* and usually a subdivision of an *ahupuaʻa*) of Kālia, including Kaihikapu, Kaipuni and Paweo among others. Prior to the formalization of these fishponds, which would have required extensive social organization and management, it is likely that the area immediately inland of the current Project area was part of a vast natural wetland habitat for shorebirds, fish and other estuary resources.

Several royal residences (e.g., Kamehameha I and Kamehameha V) and other residential compounds belonging to various *aliʻi* (chiefly classes) were once located just southeast of the current Project area, in the area of ʻĀpuakēhau and Helumoa (currently the Royal Hawaiian Hotel), and extending further to the southeast.

3.2 Place Names

In general, Hawaiian place names convey a wide variety of information about the relationships between people, landscapes and other natural and cultural resources. Place names may also express cultural, historical and / or spiritual values and concepts important to Hawaiian world views. It is common for places and landscape features to have multiple names, some of which may only be known to certain *‘ohana* (families) or even certain individuals within *‘ohana*, and many of which have been lost, forgotten and/or kept secret through time. Place names may also convey *kaona* (hidden meaning/s) and / or *huna* (secret) information that may even have political or subversive undertones.

Before the introduction of writing to the islands, when cultural information was exclusively preserved and perpetuated orally, Hawaiians gave names to everything in their environment, including garden plots and *‘auwai* (ditch, canal), house sites, intangible phenomena such as meteorological and atmospheric effects (e.g., rain and wind), *pōhaku* (rocks), *pūnāwai* (fresh-water springs), and many others (cf. Handy and Handy 1972; Pukui et al. 1974; Pukui 1983; Sterling and Summers 1978; Soehren 2010). Place name definitions provided in quotations are taken directly from the authoritative Pukui et al. (1974) unless stated otherwise.

Waikīkī Kai was once divided into smaller *‘ili* lands, including Kālia (within which the Project area is located), Keōmuku, Helumoa, Kaluaokau, Hamohamo, Uluniu, Kapuni, Kekio, Ulukou, Kāneloa, Kapua, and Kaluahole (listed generally from west to east).

The name **Waikīkī**, which means “water spurting from many sources,” is appropriate to the character of the intact watershed system of pre-Contact Waikīkī, where water from the valleys of Mānoa and Pālolo gushed forth from underground. Before the construction of the Ala Wai Canal, these streams did not merge until deep within Waikīkī. As they entered the flat Waikīkī Plain, the names of the streams changed: Mānoa became the Kālia and the Pālolo became the Pāhoa. They joined near Hamohamo (now an area *mauka* of the Kapahulu Library) and then divided into three new streams, the Kuekaunahi, ‘Āpuakēhau, and Pi‘inaio—which once flowed along the northern boundary of the Project area into the sea as a wide delta. The land between these three streams was called **Waikolu**, meaning “three waters” (Kanahele 1995:7–8).

Kālia, meaning “waited for,” is a name used for the central portion of Mānoa Stream and the name of the coastal area where the Pi‘inaio Stream emptied into the ocean. The exact meaning of **Pi‘inaio** is unknown, but *pi‘ina* means “climb or ascend” (Pukui and Elbert 1986:327). The stream’s mouth was on the western end of the Waikīkī Coast, where the Ala Moana Shopping Center is now located, *‘ewa* (west) of Duke Kahanamoku Beach and Lagoon. A stream that runs below the S-shaped condominium on the opposite side of the canal follows the approximate course of the historic Pi‘inaio (Acson 1983:9).

Kawehewehe, located immediately southeast of the current Project area, sometimes synonymous with the mouth of the old ‘Āpuakēhau Stream and also the name of the reef entrance and channel at what is known today as Grey’s Beach (just east of the contemporary Halekūlani Hotel), translates as “the removal,” which appears to refer to the water’s famous healing powers for removing sickness and forgiving of sins (Pukui et al. 1974:99).

As described in detail below (Section 3.5), historic maps and documents indicate that Kālia was once home to numerous fishponds, including **Kaihikapu, Kaipuni**, **Paweo**, **Kuwili** and **Kapuuiki**. Kaihikapu (or Ka‘ihikapu) translates as “the taboo sacredness.” Kaipuni is not translated by Pukui et al. (1974) nor by other common sources cited above; however, the literal meaning of the words *kai* (ocean water) *puni* (one possible meaning is “surround”) are suggestive of an inland fishpond. Pukui et al. (1974:182) have a Kaua‘i entry for Paweo (or Pāweo), translated as “turn aside.” Kuwili (or Kūwili) translates as “stand swirling.” Kapuuiki is not translated by Pukui et al. (1974) or by other common sources cited above; however, the literal meaning of the words is something like "the little hill."

Helumoa, an old land division in the location of the Royal Hawaiian Hotel, translates as "chicken scratch," a reference to *moʻolelo* about the bodies of sacrificial victims being pecked over for maggots (see next section below). **ʻĀpuakēhau**, literally "basket [of] dew," was the old stream outlet at the present Royal Hawaiian Hotel. Pukui et al. (1974:13) believe it was probably named for a rain. This place was once also known as **Ulukou** (literally "*kou* tree grove").

3.3 Moʻolelo Associated with Specific Place Names

3.3.1 Kālia

The seaweed called *limu ʻeleʻele* was plentiful near the stream's outlet. A Hawaiian saying talks about this pleasant portion of the coast (Pukui 1983:186):

Ke kai wawalo leo leʻa o Kālia	The pleasing, echoing sea of Kālia.

Kālia is also a place where *ʻalamihi* crabs were once plentiful, leading to a play on the word *ʻala-mihi* (path of repentance), indicating someone who is in a repentant mood (Pukui 1983:110):

Hoʻi i Kālia ka ʻai ʻalamihi.	Gone to Kālia to eat ʻalamihi crabs.

Kālia was also known for a fishing technique used to catch schools of mullet. When a school of mullet appeared, a bag net was set and the men swam out in a row, surrounded the fish, and slapped the water together and kicked their feet, thus driving the frightened fish into the opening of their bag net. The fishermen of Kālia became known as human fishnets (Pukui 1983:150):

Ka iʻa pīkoi kānaka o Kālia;	The fish caught by the men of Kālia;
he kānaka ka pīkoi,	men are the floaters,
he kānaka ka pōhaku.	men are the sinkers.

Kālia is also mentioned in a story about a woman who left her husband and children on Kīpahulu, Maui to go away with a man of Oʻahu. Her husband missed her and went to see a *kahuna* (priest) who was skilled in *hana aloha* (sorcery for love making potions with herbs, prayers and even hypnosis). The *kahuna* told the man to find a container with a lid and then speak into it of his love for his wife. The *kahuna* then uttered an incantation into the container, closed it, and threw it into the sea. The wife was fishing one morning at Kālia, Oʻahu, and saw the container. She opened the lid, and was possessed by a great longing to return to her husband. She walked until she found a canoe to take her home (Pukui 1983:158):

Ka makani kāʻili aloha o	The love-snatching wind
o Kīpahulu.	of Kīpahulu

3.3.2 Kawehewehe

ʻĀpuakēhau Stream has sometimes been referred to as the *muliwai* (river mouth) of Kawehewehe. The place name Kawehewehe, cited by ʻĪʻī (1959:93) and in the Māhele records, is also of note. It does not only identify a land area in Waikīkī; according to Hawaiian scholars, it also names:

> [The] Reef entrance and channel off Grey’s Beach, just east of the Hale-kū-lani Hotel, Wai-kīkī, Honolulu. The sick were bathed here as treatment. The patient might wear a seaweed (*limu-kala*) lei and leave it in the water as a request that his sins be forgiven, the lei being a symbol. *Lit*., the removal. (Pukui et al. 1974:99)

The *līpōa* seaweed of Waikīkī, especially at Kawehewehe, was so fragrant that one could smell it while standing on the shore. It was often mentioned in *mo‘olelo* about Waikīkī, including the following saying (Pukui 1983:246):

Na līpoa ‘ala	The fragrant *līpōa*
O Kawehewehe.	of Kawehewehe.

3.3.3 Helumoa, ‘Āpuakēhau and Ulukou

There is a large body of oral-historical information about royal residences and other residential compounds belonging to various *ali‘i.* According to Martha Beckwith (1940:383), by the end of the fourteenth century Waikīkī had become “the ruling seat of the chiefs of O‘ahu.” Ma‘ilikukahi, the first *mō‘ī* (island-wide chief) of O‘ahu, moved the capital of the islands from ‘Ewa and Waialua to Waikīkī in this period. About AD 1350, he constructed a *heiau* (place of worship, shrine) at Helumoa for the Makahiki festival. Two idols, the long god and the short god, were carried on a circuit of the islands, each carried in the opposite direction and meeting again at Kualoa on the windward coast of O‘ahu. The pre-eminence of Waikīkī continued into the eighteenth century and is confirmed by the decision of Kamehameha, in the midst of unifying control of the islands, to reside there after wresting control of O‘ahu by defeating the island’s chief, Kalanikūpule. The nineteenth-century Hawaiian historian John Papa ‘Ī‘ī (1959:17), himself a member of the *ali‘i*, described the king’s Waikīkī residence:

> Kamehameha’s houses were at Puaaliilii, makai of the old road, and extended as far as the west side of the sands of Apuakehau. Within it was Helumoa, where Kaahumanu *ma* went to while away the time. The king built a stone house there, enclosed by a fence . . . (‘Ī‘ī 1959:17)

‘Ī‘ī further noted that the “. . . place had long been a residence of chiefs. It is said that it had been Kekuapoi’s home, through her husband Kahahana, since the time of Kahekili” (‘Ī‘ī 1959:17). Kamehameha lived here from 1795 to 1809. Puaaliilii has two meanings: *pua ali‘il‘i‘i* means “flower of the exalted royalty.” With the glottal stop in a different position, the name *pua‘a li‘ili‘i* means “little pig.” Since the pig was a sacred animal, both meanings may be correct since both could refer to a royal residence (Acson 1983:19).

Before Kamehameha’s victory at Nu‘uanu which led to his conquest of O‘ahu, he had promised the *mo‘o* (water spirit) goddess Kihawahine that he would build her a special dwelling called a *hala puaniu*, a place at which offerings of bananas, coconuts, and *‘awa* (kava) were kept to deify a deceased person and make him or her into a *mo‘o* or goddess (Pukui and Elbert 1986:347; Kanahele 1995:92):

> Walinuʻu, Walimanoanoa, and Kalamainuʻu were *ʻaumakua* [deified ancestor] with many bodies. A certain chiefess of the island of Maui named Kihawahine was transfigured into (*kakuʻai ʻia iloko o*) Kalamainuʻu, and she became a goddess with the body of a *moʻo*. Kihawahine was a famous *moʻo*, perhaps because she had been a chiefess and an ancestor of chiefs, and had been born a real human being. But when she was transfigured she turned into an *ʻeʻepa*, a *moʻo*. She was deified by the chiefs of Maui and Hawaii with kapus, with the setting up of kapu sticks (*puloʻuloʻu*), and with the kapus of the chiefess Kihawahine. . . . when Kamehameha added her to his gods, she was one of his gods that united the kingdom from Hawaii to Kauai. He said: "If you take (*ʻai*) Oahu, I will build a house for your *akua* in the calm of Waikiki—a *puaniu* house for Kalamainuʻu, the *akua* of Kihawahine." (Kamakau 1991:85)

There are many references to royal residences for this portion of Waikīkī. ʻĀpuakēhau Stream is one of the two branches of the united Mānoa-Pālolo Stream which once flowed past taro patches and fishponds. The mouth of the stream once emptied out into the ocean at the present location of the east side of the Outrigger Hotel and the west side of the (Sheraton) Moana Hotel. Land on the west side of the stream was known as Kahaloa, "the long place," and on the east, Ulukou, "the kou tree grove." The stream carved a small channel in the seabed where it emptied out in the ocean, creating a special surf, called the "Cornucopia," due to the shape of the breaking waves (Clark 1977:55).

The village of Waikīkī probably centered around the mouth of ʻĀpuakēhau Stream, near the present Royal Hawaiian Hotel. There was a *heiau* and an athletic field in the village called ʻĀpuakēhau on the land known as Helumoa. The athletic field was called Kahuamokomoko, meaning a "sports field for boxing." It was probably used for other types of games also such as the *maika* game where stone were rolled to hit a target. Several of the stones used in this game, called *ʻulu maika*, have been uncovered in this area (Acson 1983:20).

Chiefs who lived at Ulukou included Kahekili, ruler of Maui, who lived his final days here in 1794; Kamehameha I who lived in a grass shack and later a lava stone house between 1795 and 1809; Kamehameha V, who called his thatch-roofed stone house Kealohilani, meaning "the royal brightness"; and King Kalākaua, who called his home Keʻelanihakoi (Acson 1983:21). Princess Kaʻiulani had a residence on the eastern side of ʻĀpuakēhau. This area was called ʻAuʻaukai by the Hawaiians, which means "to bathe in the sea." Her home was called ʻĀinahau (*hau* tree land) around the turn of the century when her mother Princess Likelike and her father Governor Archibald Cleghorn lived there.

3.3.3.1 The Legend of Kawelo

In the "Legend of Kawelo," two boys are born on the same day, Kawelo-lei-makua, called Kawelo, the great nephew of the king of Kauaʻi, and Kawelo-aikanaka, called ʻAikanaka, the grandson of the king. Kawelo's older brothers and his parents soon moved from Kauaʻi to live at Waikīkī in Oʻahu near the ruling chief of Oʻahu, Kakuhihewa. The older brothers of Kawelo often challenged a famous wrestler living with Kakuhihewa, but they could never beat him.

> *A he mea mau i na kaikuaana o Kawelo ka heenalu, i ka nalu o Kalehuawehe, a pau ka heenalu, hoi aku la a ka muliwai o Apuakehau auau, a pau, hoi aku la a ka*

hale mokomoko, aole nae he hina o ke kanaka o Kakuhihewa i na kaikuaana o Kawelo.

The brothers of Kawelo were great surf riders, and they often went to ride the surf at Kalehuawehe [near the present Seaside Hotel in Waikīkī]. After the surf ride they would go to the stream of Apuakehau and wash, and from there they would go to the shed where the wrestling bouts were held and test their skill with Kakuhihewa's strong man; but in all their trials they never once were able to throw him. (Fornander 1918:4)

When the king of Kauaʻi died, ʻAikanaka became the new king. The grandparents, who longed to see their other children, traveled with Kawelo to Oʻahu, to Ulukou in Waikīkī, near the mouth of the stream ʻĀpuakēhau, where his elder brother and parents had been living. His grandparents later took him just inland of the coast. While Kawelo was working in the fields, he heard some shouting from the beach, and asked his grandparents, "What is that shouting down yonder?" (Fornander 1918:5). The grandparents answered that his older brothers had just finished surfing and must have challenged the king's strong man. The shouting indicated one of them must have been thrown. Next day, Kawelo went down to the beach, went surfing with his brothers, and then bathed in the freshwater stream of ʻĀpuakēhau. He challenged the strong man to a match, even though his brothers mocked him, saying "Are you strong enough to meet that man? If we whose bones are older cannot throw him, how much less are the chances of yourself, a mere youngster?" (Fornander 1918:6). The strong man, impressed by Kawelo's courage, said:

"Ina wau e kahea penei, 'Kahewahewa, he ua!' alaila, kulai kaua." Hai aku la no hoi o Kawelo i kana olelo hooulu, penei: "Kanepuaa! Ke nahu nei! Alia! Alia i oki ka aina o Kahewahewa, he ua!"

"If I should call out 'Kahewahewa, it is raining,' then we begin." Kawelo then replied in a mocking way: "Kanepuaa, he is biting, wait awhile, wait awhile. Don't cut the land of Kahewahewa, it is raining." (Fornander 1918:6)

Kawelo won the match, shaming his older brothers so much that they returned to Kauaʻi. In another version (Thrum 1923:154), the strong man was from Halemano [central Oʻahu], and was killed by a mighty blow from Kawelo. The man's body was given to the king of Oʻahu, and was carried as a sacrifice to the gods to a *heiau* in Lualualei, Waiʻanae.

3.3.3.2 Legend of Halemano

In the Legend of the hero, Halemano, Ulukou in Waikīkī is mentioned as the residence of ʻAikanaka, who later also became the king of Oʻahu:

A noho iho la o Kamalalawalu me Halemano, ia wa ua kaulana kau ka maikai o Kamalalawalu a lohe o Aikanaka, ke 'lii nui o Oahu nei, e noho ana ma Ulukou i Waikiki.

Kamalalawalu lived with Halemano as husband and wife, and the fame of the beauty of Kamalalawalu was soon spread all over Oahu until it came to the ears of

> Aikanaka, the king of Oahu, who was living at Ulukou in Waikiki. (Fornander 1919:238)

3.3.3.3 Legend of ʻŌlohe

ʻĀpuakēhau is mentioned in another legend as the home of the cruel chief ʻŌlohe, a master of the *lua* wrestling. The defeat of this chief led to the naming of the area now covered by Kapiʻolani Park as Ka-lua-ʻŌlohe, or "the *lua* fighting of ʻŌlohe" (Pukui et al. 1974:79):

> Loheloa came from Waipio on a huge log. He came first to Makapuu and then to Keauau Point, now called Leahi. He saw a strange glow like a ball of fire there. He asked for the chief Olohe and was told that the light was his.
>
> He saw some fishermen who told him to go away for he was scaring the fish. He called to Ku and Hina to bring them a school of fish which they did. The natives were grateful. He lifted his huge canoe and rested one end at Haula and the other at Namahana, against the hill. He told the people that he wanted to wrestle with their chief Olohe, a dogman who lived at Apuakehau, Waikiki. A messenger came to tell the chief who accepted the challenge. In the meantime the men were busy catching fish brought to them by Loheloa. A messenger was sent to bring Loheloa to the chief and Loheloa suggested that they wrestle in the open where they can be seen. He would bet his bones and his canoe on himself.
>
> Olohe and Loheloa fought on the field now known as Kapiolani Park. Olohe punched and raised a gale that flattened the ilima bushes. Loheloa slapped his ear hard enough to throw him in the air. The place he fell is called Kalua-Olohe (Olohe's pit) to this day. Loheloa won and the people shouted with joy over the defeat and death of their cruel chief. (Hainakolo, *Hawaii Holomua*, July 21, 1912, Oahu Place Names, cited in Sterling and Summers 1978:279)

3.3.3.4 Kaʻopulupulu

Thomas Thrum (1998:203–214) recounts the legend of the *kahuna nui* (highest priest), of Oʻahu, Kaʻopulupulu, who lived in Waimea, Oʻahu. He had a son named Kahulupue, who he taught all the traditions and rituals of the priestly caste. At this time, the ruler (*aliʻi amoku*) of Oʻahu was Kumuhana, a cruel chief who terrorized his people and would not listen to the counsel of his priest, Kahulupue. Kumuhana was finally driven off the island by the people and the lesser chiefs. When Kahekili, the king of Maui, heard this news, he sent his foster son, Kahahana (brother of Kumuhana), to rule Oʻahu in Kumuhana's place (ca. 1773). Kahahana chose a grove of coconut and *kou* trees, called Ulukou, located on the Waikīkī coast as his place of residence, and many *aliʻi* gathered in that place around him. One day, Kahahana sent a messenger to Kaʻopulupulu to attend him at Ulukou, who traveled from his home in Waimea and was greeted by the retainers of the king when he reached the mouth of the stream ʻĀpuakēhau. At first Kahahana valued the wisdom of the priest, but after several years, Kahahana began to be as cruel to the people as his predecessor, Kumuhana. In protest, the priest Kaʻopulupulu left Waikīkī to return to his home in Waimea, where he tattooed his knees, a sign that Kahahana had turned a deaf ear to his advice. This angered the king, who sent messengers to order Kaʻopulupulu and his son, Kahulupue, to come to Waiʻanae, where Kahahana then resided.

At Waiʻanae, the two men were placed into a special grass hut, one tied to the end post and one tied to the corner post. The next day, Kahahana ordered his men to torture the son, stabbing his eyes and stoning him while his father watched. When Kaʻopulupulu saw this, he commanded his son to flee into the sea, saying these words (Pukui 1983:44), which contained a prophecy:

E nui ke aho, e kuʻu keiki,	Take a deep breath, my son, and
a moe i ke kai, no ke kai la	lay yourself in the sea, for then
hoʻi ka ʻāina.	the land shall belong to the sea.

Kaʻopulupulu was taken by the soldiers to Puʻuloa (Pearl Harbor), at ʻEwa, and slain before the king. His body was put into a canoe and taken to Waikīkī, where it was placed high in the coconut trees at Kukaeunahi (at the *heiau* of Helumoa), so that the flesh would decompose and fall to the sand. When the king of Maui, Kahekili heard this news he grieved for Kaʻopulupulu and turned against his foster son. With his warriors, he set out over the sea for Waikīkī to take back the rulership of Oʻahu under his own authority. This fulfilled the prophecy of Kaʻopulupulu. According to S. M. Kamakau and David Malo, this saying was also in keeping with a prophecy by Kekiopilo presaging the arrival of the islands by Westerners, which would lead to "the foreigners possess[ing] the land" (Thrum 1998:214).

Helumoa means "chicken scratch." In one version, this name refers to the legendary rooster Kaʻau-helu-moa that lived up in Pālolo Valley and came down to this land and scratched for food. According the Legend of Kaʻopulupulu, the name refers to chickens scratching to find the maggots that fell from victims placed in the trees who were human sacrifices at the *heiau* of ʻĀpuakēhau (Pukui et al. 1974:44):

> The seer, together with the body of the son, was brought to Waikiki, to the coconut grove at the place called Helu-moa. There he was slain and the two bodies hung upon coconut trees. The place was named from the scratching of the chickens about the place where the maggots fell from the bodies of the two men.
>
> Before his death, Kaʻopulupulu uttered this prophecy: -"At the place where my body hangs and its fat flows, chiefs and commoners shall be slain and here shall be the chief-destroying sands of Kakuhihewa." These words were fulfilled soon after, when Kahekili, ruling chief of Maui, conquered the island. But the bitter result did not end there. They were again fulfilled in the time of Kamehameha when, after he had conquered Oahu at the battle of Nuuanu, he went back to Waikiki with his followers and many were stricken with the disease called *okuu* [probably cholera] and many died. (Green and Pukui 1936:122–123)

The sand of Helumoa was known as *Ke oneʻai aliʻi o Kakuhihewa* (The Chief Devouring Sand of Kakuhihewa) because of the curse placed by the prophet Kaʻopulupulu. When Kaʻopulupulu was brought with his son, Kahulupue, to be executed at Waikīkī, he cursed the place where his body-grease (*hinu*) should drip upon the sand. This curse was upon the chiefs and the people (Hibbard and Franzen 1986:5).

This curse continued to have an effect for the descendants of Kamehameha. Kamehameha II died in England. From the warning of this curse by the *kahuna*, Luau-nui-a-lepokapo, Kauikeaouli, Kamehameha II, transferred the seat of the government from Oʻahu to Lahaina in 1938. He later reconsidered moving back to Oʻahu. His *kahuna* counseled him:

> "O chief! This land of Oahu of Lua is made bitter by the fat of the man of god and his words lie like a squirming maggot for Kakuhihewa. If you listen to those who ask that the government be taken back to Oahu, it will become a maggot which will consume your race." (Green and Pukui 1936:123)

However, Kauikeaouli ignored the advice, and the prophecy was fulfilled by the smallpox epidemic of 1852–3.

3.4 Subsistence and Settlement

As stated above, nearly half of the Project area was under water prior to historic times when land-reclamation projects and filling episodes extended the coastline to its current configuration. In pre-Contact times, the Project area may have been used for short-term habitation sites and/or burials. Later, in historic times, Land Commission documents indicate at least two house lots, a coconut grove, *hala*, *hau*, and some irrigated taro in this area.

A 1901 study by the U.S. Commission of Fish and Fisheries (Bowers 1902:361–362) indicated the ocean fisheries of Kālia were established in Kamehameha III's 1839 Declaration of Rights as *kapu* (taboo), a function undoubtedly of their quality and abundance as well as their proximity to the royal and chiefly residences of Waikīkī at this time.

3.5 Fishponds

Fishponds are one the most important traditional resources associated with the Project area. Many named and unnamed fishponds (Figure 6) were once located immediately inland of the Project area. A 1901 study by the U.S. Commission of Fish and Fisheries (Bowers 1902) listed ten extant fishponds in Kālia: Kaihikapu, Kuwili, Kaipuni (1 and 2), Paweo (1 and 2), Kapuuiki, and three unnamed ponds.

The fame of Kālia's fishponds is attested to in a *moʻolelo* recounted by John Papa ʻĪʻī (in Wyban 1992) that deals with prohibitions against wasting food:

> Once Kinopu gave a tribute of fish to Kamehameha's son Kinau, at Moehonua's fishpond in Kalia. While Kinau and his wife Kahukuhaakoi (Wahine-pio) were going to Waikiki from Honolulu, the sea came into the pond and fishes of every kind entered the sluice gate. Kinopu ordered the keepers of the pond to lower fish nets and the result was a catch so large that a great heap of fish lay spoiling upon the bank of a pond.
>
> The news of the huge catch reached Kamehameha, who was then with Kalanimoku, war leader and officer of the king's guard. The king said nothing at the time, but sat with bowed head and downcast eyes, apparently disapproving of such reckless waste. (Wyban 1992:87)

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Figure 6. View from Kālia fishpond towards Diamond Head circa 1890 (photograph courtesy of Bishop Museum Archives)

3.6 Heiau and Other Religious Sites

There are no *heiau* or other religious sites in the Project area, which has been thoroughly developed over the past several decades. The closest *heiau* to the Project area was the famous Helumoa Heiau, located near the current spot of the Royal Hawaiian Hotel. This sacrificial *heiau* was where Ka'opulupulu—the last O'ahu-born Kahuna Nui of O'ahu—was laid after being slain in Wai'anae by Kahahana (or Kahāhana). Eventually, Kahahana, himself, was also sacrificed at Helumoa Heiau by Kahekili's invading army from Maui (Thrum 1904:112–113).

3.6.1 The Wizard Stones of Kapaemāhū at Waikīkī

This ancient legend tells of the Wizard Stones of Kapaemāhū at Waikīkī (Figure 7). These stones were unearthed in the late 1800s on the Waikīkī premises of the Cleghorn family, Governor A. Cleghorn, his wife Princess Likelike, and their daughter Princess Ka'iulani. According to Thrum (1907) the legend begins in the land of Tahiti:

> From the land of Moaulanuiakea (Tahiti) there came to Hawaii long before the reign of King Kakuihewa [Kakuhihewa], four soothsayers from the Court of the Tahitian King. Their names were: Kapaemahu, Kahaloa, Kapuni and Kinohi. They were received as became their station, and their tall stature, courteous ways and kindly manners made them soon loved by the Hawaiian people. The attractiveness of their fine physique and gentle demeanor was overshadowed by their low, soft speech which endeared them to all with whom they came in contact. They were unsexed by nature, and their habits coincided with their feminine appearance, although manly in stature and general bearing. After a long tour of the islands this quartette of favorites of the gods settled at Ulukou, Waikiki, near the site of the present Moana Hotel.
>
> The wizards or soothsayers proved to be adepts in the science of healing, and many wonderful cures by the laying on of sands are reported to have been effected by them, so that their fame spread all over this island (Oahu), as the ancients say, "from headland to headland," Their wisdom and skill was shown by many acts which gave them prestige among the people.
>
> In course of time, knowing that their days among their Hawaiian friends were drawing to a close, they caused their desire for recognition for past services to be remembered in some tangible form, or manner, so that those who might come after, could see the appreciation of those who had been succored and relieved of pain and suffering by their ministrations during their sojourn among them. As an enduring reminder, the wizards agreed among themselves that the people should be asked to erect four monumental tablets, two to be placed on the ground of the habitation, and two at their usual bathing place in the sea. They gave their decision to the people as a voice from the gods, and instructed that the stones be gathered from the vicinity of the historic "bell rock," at Kaimuki, on the Waialae road.

> The night of “Kane” was the time indicated for the commencement of the work of transportation and thousands responded to aid in the labor. Four large selected rocks, weighing several tons each, were taken to the beach lot at Ulukou, Waikiki, two of which were placed in position where their house stood, and the other two were placed in their bathing place in the sea. The Chief of the wizards, Kapaemahu, had his stone so named, and with incantations and ceremonies transferred his withcraft [witchcraft] powers thereto, and sacrifice was offered of a lovely, virtuous young chiefess, and her body placed beneath the stone. Idols indicating the hermaphrodite sex of the wizards were also placed under each stone and tradition tells that the incantations, prayers and fastings lasted one full moon. Tradition further states, as is related in the old-time meles of that period, that, after the ceremonies which included the transfer of all their powers, by each of the wizards to the stones thus placed, that they vanished, and were seen no more, but the rocks having lately been discovered they have been exhumed from their bed of sand and placed in position in the locality found, as tangible evidence of a Hawaiian tale. (Thrum 1907:139–141)

Today the stones are located at Kūhiō Beach Park east of the Project area.

3.7 Burials

As described in more detail below (see Section 5.3), areas immediately inland and adjacent to the Project area have yielded a large number of burials from both pre-Contact and early historic times. Many archaeological studies have documented burials in both Jaucas sand deposits and in more terrigenous sediments throughout Waikīkī.

Two burials and one additional isolated femur have been discovered to date within the current Project area. In 1980, during construction of the Tapa Tower at Hilton Hawaiian Village in the southeastern corner of the subject parcel, these burials—determined by the SHPD to be Native Hawaiian individuals from post-Contact (historic-era) times—were removed and relocated to a reburial site on the resort grounds. The general location of the reinterment site is in the southeastern corner of the parcel. A more specific understanding of the location of the reinterment site is known by the owner of the Hilton Hawaiian Village, former staff of the SHPD, former members of the Oʻahu Island Burial Council (OIBC) and descendents, as memorialized in a 1991 reburial agreement between the State Historic Preservation Officer and the landowner.

3.8 Trails

In *Fragments of Hawaiian History*, John Papa ʻĪʻī described the “Honolulu trails of about 1810” (ʻĪʻī 1959:89), including the trail from Honolulu to Waikīkī (Figure 8):

> The trail from Kawaiahao which led to lower Waikiki went along Kaananiau, into the coconut grove at Pawaa, the coconut grove of Kuakuaka, then down to Piinaio; along the upper side of Kahanaumaikai’s coconut grove, along the border of Kaihikapu pond, into Kawehewehe; then through the center of Helumoa of Puaaliilii, down to the mouth of the Apuakehau stream; along the sandy beach of

Ulukou to Kapuni, where the surfs roll in; thence to the stream of Kuekaunahi; to Waiaula . . . (‘Ī‘ī 1959:92)

Figure 7. Kapaemāhū, also known as the Wizard Stones, are located on Kūhiō Beach, east of the Project area (photograph courtesy of Alexa Jacinto 2010)

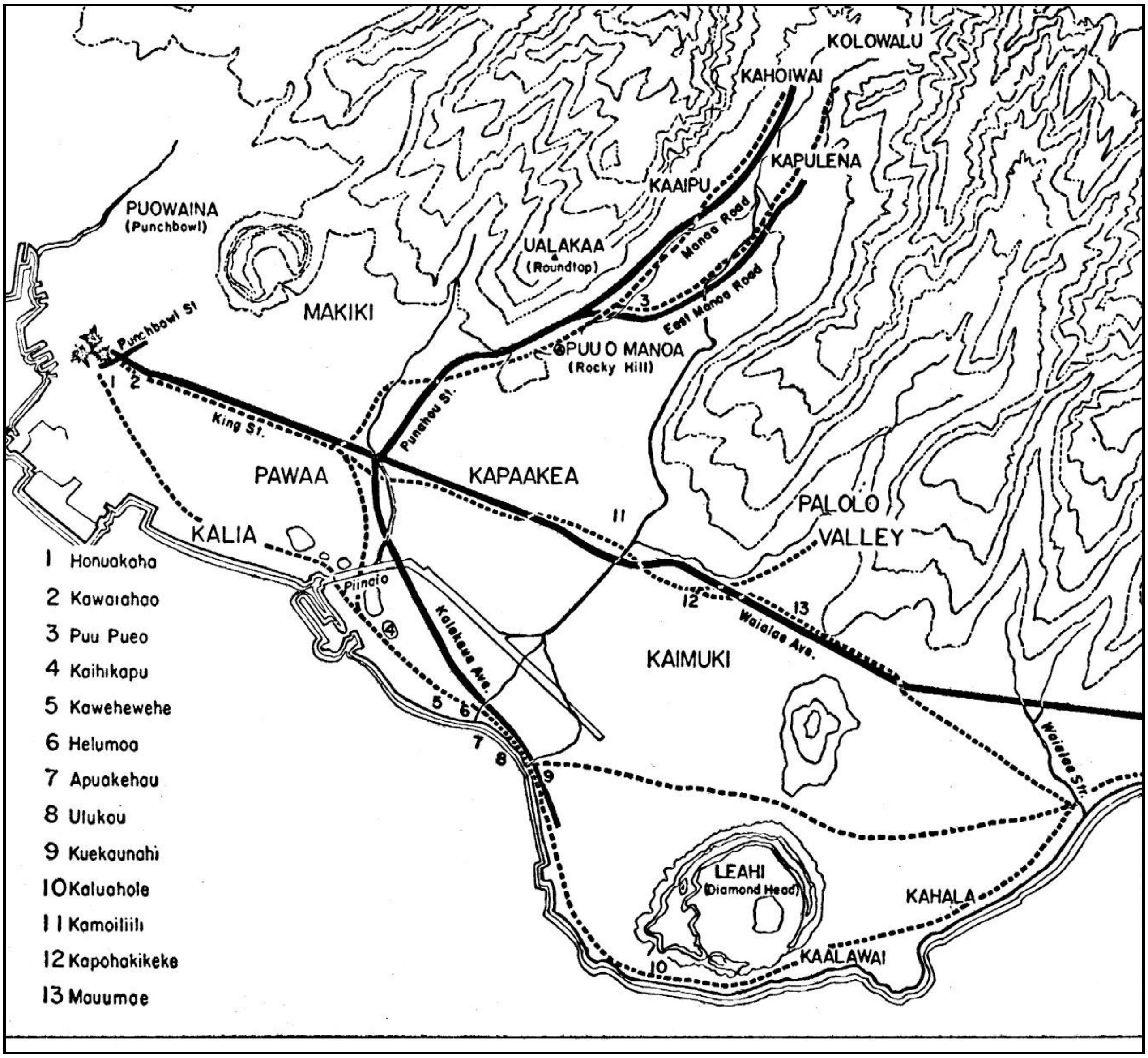

Figure 8. Trails on the southwest coast of Oʻahu ca. 1810 (Sketch by Gerald Ober; reprinted in ʻĪʻī 1959:93; not to scale), showing locations of some place names in Waikīkī; note, the trail traverses through the approximate location of the current Project area

Section 4 Historical Background

4.1 Late Pre-Contact / Early Historic Period

Waikīkī, by the time of the arrival of Europeans in the Hawaiian Islands during the late eighteenth century, had long been a center of population and political power on O'ahu. According to Martha Beckwith (1940), by the end of the fourteenth century, Waikīkī had become "the ruling seat of the chiefs of O'ahu." The preeminence of Waikīkī continued into the eighteenth century and is betokened by Kamehameha's decision to reside there upon wresting control of O'ahu by defeating the island's chief, Kalanikūpule. The nineteenth-century Hawaiian historian John Papa 'Ī'ī, himself a member of the *ali'i*, described the king's Waikīkī residence:

> Kamehameha's houses were at Puaaliilii, makai of the old road, and extended as far as the west side of the sands of Apuakehau. Within it was Helumoa, where Kaahumanu *ma* went to while away the time. The king built a stone house there, enclosed by a fence. . .('Ī'ī 1959:17)

'Ī'ī (1959:17) further noted that the "place had long been a residence of chiefs. It is said that it had been Kekuapoi's home, through her husband Kahahana, since the time of Kahekili."

Chiefly residences, however, were only one element of a complex of features which were able to sustain a large population that characterized Waikīkī up to pre-Contact times. Beginning in the fifteenth century, a vast system of irrigated taro fields was constructed, extending across the littoral plain from Waikīkī to lower Mānoa and Pālolo valleys. This field system - an impressive feat of engineering of which is traditionally attributed to the chief Kalamakua - took advantage of streams descending from Makiki, Mānoa and Pālolo valleys which also provided ample fresh water for the Hawaiians living in the *ahupua'a* (land division usually extending from the uplands to the sea). Water was also available from springs in nearby Mō'ili'ili and Punahou. Closer to the Waikīkī shoreline, coconut groves and fishponds dotted the landscape. A sizeable population developed amidst this Hawaiian-engineered abundance. Captain George Vancouver, arriving at "Whyteete" in 1792, captured something of this profusion in his journals:

> On shores, the villages appeared numerous, large, and in good repair; and the surrounding country pleasingly interspersed with deep, though not extensive valleys; which, with the plains near the sea-side, presented a high degree of cultivation and fertility.
>
> [Our] guides led us to the northward through the village, to an exceedingly well-made causeway, about twelve feet broad, with a ditch on each side.
>
> This opened our view to a spacious plain, which, in the immediate vicinity of the village, had the appearance of the open common fields in England; but, on advancing, the major part appeared to be divided into fields of irregular shape and figure, which were separated from each other by low stone walls, and were in a very high state of cultivation. These several portions of land were planted with the eddo or *taro* root, in different stages of inundation; none being perfectly dry, and some from three to six or seven inches under water. The causeway led us near a

> mile from the beach, at the end of which was the water we were in quest of. It was a rivulet five or six feet wide, and about two or three feet deep, well banked up, and nearly motionless; some small rills only, finding a passage through the dams that checked the sluggish stream, by which a constant supply was afforded to the *taro* plantations.
>
> [We] found the plain in a high state of cultivation, mostly under immediate crops of *taro*; and abounding with a variety of wild fowl, chiefly of the duck kind...The sides of the hills, which were at some distance, seemed rocky and barren; the intermediate vallies, which were all inhabited, produced some large trees, and made a pleasing appearance. The plain, however, if we may judge from the labour bestowed on their cultivation, seemed to afford the principal proportion of the different vegetable productions on which the inhabitants depend for their subsistence. (Vancouver 1798:161–164)

Further details of the exuberant life that must have characterized the Hawaiians use of the lands that included the *ahupua‘a* of Waikīkī are given by Archibald Menzies, a naturalist accompanying Vancouver’s expedition:

> The verge of the shore was planted with a large grove of cocoanut palms, affording a delightful shade to the scattered habitations of the natives. Some of those near the beach were raised a few feet from the ground upon a kind of stage, so as to admit the surf to wash underneath them. We pursued a pleasing path back to the plantation, which was nearly level and very extensive, and laid out with great neatness into little fields planted with taro, yams, sweet potatoes and the cloth plant. These, in many cases, were divided by little banks on which grew the sugar cane and a species of *Draecena* without the aid of much cultivation, and the whole was watered in a most ingenious manner by dividing the general stream into little aqueducts leading in various directions so as to be able to supply the most distant fields at pleasure, and the soil seemed to repay the labour and industry of these people by the luxuriancy of its productions. Here and there we met with ponds of considerable size, and besides being well stocked with fish, they swarmed with water fowl of various kinds such as ducks, coots, water hens, bitterns, plovers and curlews. (Menzies 1920:23–24)

However, the traditional Hawaiian focus on Waikīkī as a center of chiefly and agricultural activities on southeastern O‘ahu was soon to change - disrupted by the same Euro-American Contact which produced the first documentation (including the records cited above) of that traditional life. The *ahupua‘a* of Honolulu - with the only sheltered harbor on O‘ahu - became the center for trade with visiting foreign vessels, drawing increasing numbers of Hawaiians away from their traditional environments. The shift in pre-eminence is illustrated by the fact that Kamehameha moved his residence from Waikīkī to Honolulu. Indeed, by 1828, Levi Chamberlain describing a journey into Waikīkī would note:

> Our path led us along the borders of extensive plats of marshy ground, having raised banks on one or more sides, and which were once filled with water, and replenished abundantly with esculent fish; but now overgrown with tall rushes

> waving in the wind. The land all around for several miles has the appearance of having once been under cultivation. I entered into conversation with the natives respecting this present neglected state. They ascribed it to the decrease of population. (Chamberlain 1957:26)

Tragically, the depopulation of Waikīkī was not simply a result of the attractions of Honolulu (where, by the 1820s, the population was estimated at 6,000 to 7,000) but also of the European diseases that had devastating effects upon the Hawaiian populace.

4.2 Mid- to late-1800s

As the nineteenth century progressed, Waikīkī was becoming a popular site among foreigners – mostly American – who had settled on Oʻahu. An 1865 article in the *Pacific Commercial Advertiser* mentioned a small community that had developed along the beach. The area continued to be popular with the *aliʻi* and several notables had residences there. A visitor to Oʻahu in 1873 described Waikīkī as “a hamlet of plain cottages, whither the people of Honolulu go to revel in bathing clothes, mosquitoes, and solitude, at odd times of the year” (Bliss 1873).

Other developments during the second half of the nineteenth century, a prelude of changes that would dramatically alter the landscape of Waikīkī during the twentieth century – include the improvement of the road connecting Waikīkī to Honolulu (the route of the present Kalākaua Ave.), the building of a tram line between the two areas, and the opening of Kapiʻolani Park on June 11, 1877. Traditional land-uses in Waikīkī were abandoned or modified. By the end of the nineteenth century most of the fishponds that had previously proliferated had been neglected and allowed to deteriorate. The remaining taro fields were planted in rice to supply the growing numbers of immigrant laborers imported from China and Japan, and for shipment to the west coast of the United States (Coulter and Chun 1937).

As the sugar industry throughout the Hawaiian kingdom expanded in the second half of the nineteenth century, the need for increased numbers of field laborers prompted passage of contract labor laws. In 1852, the first Chinese contract laborers arrived in the islands. Upon completion of their contracts, a number of the immigrants remained in the islands, many becoming merchants or rice farmers. As was happening in other locales in the 1880s, groups of Chinese began leasing and buying (from the Hawaiians of Waikīkī) former taro lands for conversion to rice farming (Coulter and Chun 1937). By 1892, Waikīkī had 542 acres planted in rice, representing almost 12% of the total 4,659 acres planted in rice on Oʻahu.

4.2.1 The Māhele

The Organic Acts of 1845 and 1846 initiated the process of the Māhele, the division of Hawaiian lands, which introduced private property into Hawaiian society. In 1848, the crown and the *aliʻi* received their land titles. Some of the common people (*makaʻāinana*) received their *kuleana* (Native land rights) awards in 1850. It is through records for Land Commission Awards (LCAs) generated during the Māhele that the first specific documentation of life in Hawaiʻi, as it had evolved up to the mid-nineteenth century come to light. Although many Hawaiians did not submit or follow through on claims for their lands, the distribution of LCAs can provide insight into patterns of residence and agriculture. Many of these patterns of residence and agriculture probably had existed for centuries past. By examining the patterns of *kuleana* LCA parcels in the vicinity of the survey area, insight can be gained to the likely intensity and nature of Hawaiian activity in the area.

A review of a 1881 Hawaiian Government survey map by S.E. Bishop (Registered Map No. 1398) indicates two LCAs within the study area (LCA 1775 and LCA 2511) (Figure 9). Documentation from the LCAs was reviewed in an attempt to shed light on land use patterns within and near the study area during the mid-nineteenth century (Table 1 and Appendix E). LCA documentation indicates that traditional Hawaiian habitation and agriculture (both wetland and dry land) was occurring within *mauka* portions of the study area during the mid-nineteenth century.

The 1881 map (see Figure 9) also shows what appears to be a house site belonging to Umi immediately east of the Project area. The extensive complex of fishponds located inland of the current Project area was awarded to Kekūanaō‘a, husband to Kamehameha I's daughter, Kīna‘u, Governor of O‘ahu and a member of Ka‘ahumanu's inner circle. Much of the middle *mauka* portion of the current Project area was once Government land that was eventually sold as Land Grants to H. Widemann (H.A. Widdeman in Figure 9) in 1877 (Grant 3167 or 3162) and W.L. Green in 1862 (Grant 2869).

Table 1. Land Commission Awards Located Within of the Study Area

Land Claim #	Claimant	‘Ili	Land Use	Comments
1775-1	Pawa or Paoa	Kālia	house lot, *hala*, *hau,* irrigation ditch, taro land	LCA describes the boundaries of the parcel as a government road (currently Kālia Rd.) to the east, a stream (Pi‘inaio) to the north and west, and a government lot to the south (Grant 3167 [or 3162 in some documents]—text text).
2511	Alapai	Kālia	Coconut grove, house lot	LCA describes the boundaries of the parcel as a pond (Paweo I) and house to the east (shown on Reg. Map 1398—see Figure 9—as belonging to Umi), a Government road to the north, a government wall to the west (between it and Grant 2869) and unused land to the south.

A closer look at the LCAs within the current Project area shows that Paoa or Pawa originally obtained the land from the time of Kaʻahumanu (who is interestingly referred to as "Kaahumanu I" in LCA 1775). Paoa or Pawa also note the presence of a shared well on the property. Kalaeone, testifying on behalf of Pawa, refers to Pawa's irrigation ditch as a "Pauku ditch of stream taro." According to Pukui and Elbert (1986), the term *paukū* is a land division term referring to small, dividing feature. Pawa lists the names of his neighbors at the time of the Māhele as Nihopuu, S. Kuluwailehua, Keino and Nakoko, who received the nearby LCA 1409-1.

4.3 1900s

During the first decade of the twentieth century, the U.S. War Department acquired more than 70 acres in the Kālia portion of Waikīkī for the establishment of a military reservation called Fort DeRussy, named in honor of Brig. Gen. R.E. DeRussy of the Army Corps of Engineers.

> On 12 November 1908, a detachment of the 1st Battalion of Engineers from Fort Mason, California, occupied the new post...
>
> Between 1909 and 1911 the engineers were primarily occupied with mapping the island of Oʻahu. At DeRussy other activities also had to be attended to - especially the filling of a portion of the fishponds which covered most of the Fort. This task fell to the Quartermaster Corps, and they accomplished it through the use of an hydraulic dredger which pumped fill from the ocean continuously for nearly a year in order to build up an area on which permanent structures could be built. Thus the Army began the transformation of Waikīkī from wetlands to solid ground. (Hibbard and Franzen 1986:79)

During the 1920s Waikīkī landscape would be transformed when the construction of the Ala Wai Drainage Canal – begun in 1921 and completed in 1928 – resulted in the draining and filling in of the remaining ponds and irrigated fields of Waikīkī. The canal was one element of a plan to urbanize Waikīkī and the surrounding districts:

> The [Honolulu city] planning commission began by submitting street layout plans for a Waikīkī reclamation district. In January 1922 a Waikīkī improvement commission resubmitted these plans to the board of supervisors, which, in turn, approved them a year later. From this grew a wider plan that eventually reached the Kapahulu, Mōʻiliʻili, and McCully districts, as well as lower Makiki and Mānoa.
>
> The standard plan for new neighborhoods, with allowances for local terrain, was to be that of a grid, with 80-foot-wide streets crossing 70-foot-wide avenues at right angles so as to leave blocks of house lots about 260 by 620 feet. Allowing for a 10-foot-wide sidewalk and a 10-foot right-of-way [alley] down the center of each block, there would be twenty house lots, each about 60 by 120 feet, in each block. (Johnson 1991:311)

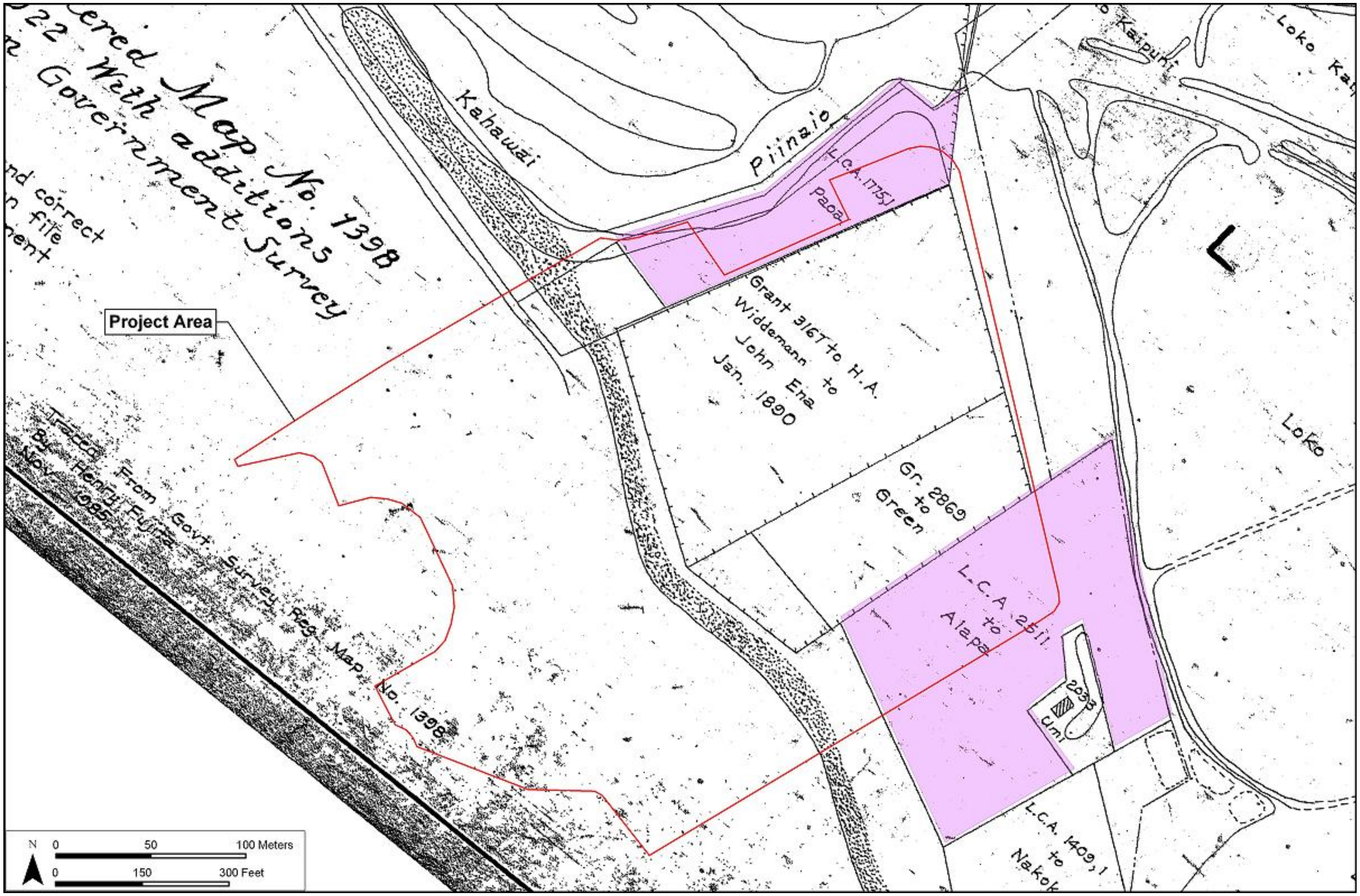

Figure 9. Portion of 1881 map of Waikīkī by S.E. Bishop showing the locations of LCAs and Land Grants within and near the Project area (Reg. Map No. 1398, Hawai‘i Land Survey Division)

Newly created land tracts following the Ala Wai Canal's construction (Figure 10) spurred a rush to development in the 1930's. An article in the Honolulu Star-Bulletin in 1938 extolled the area's progress:

> The expansion of apartment and private residence construction is no secret. Examination of building permits will show that more projects have been completed during the past year, and more are now underway in this area, than in any other section of the territory.
>
> These developments are being made by island residents who have recognized the fact that Waikīkī presents the unparalleled possibility for safe investment with excellent return. (Newton 1939:10)

The entrance of the United States into World War II following the Japanese bombing of Pearl Harbor on December 7, 1941 put on hold plans for the development of Waikīkī as a tourist destination. Until the war's end in 1945, the tourist trade was non-existent "...since the Navy controlled travel to and from Hawai‘i and did not allow pleasure trips" (Brown 1989: 141). For the duration of the war, Waikīkī was transformed into a recreation area for military personnel.

> It was not the same Waikīkī as before the war, though; barbed wire barricades now lined its sands, and there were other changes too. Fort DeRussy became a huge recreation center, with a dance hall called Maluhia that attracted thousands of men at a time. The Moana Hotel continued to function, but many other establishments and private homes in the area were taken over by the military. (Brown 1989:141)

By the mid-1950s there were more than 50 hotels and apartment buildings from the Kālia area to the Diamond Head end of Kapi‘olani Park. The Waikīkī population, by the mid-1950s, was not limited to transient tourists but included 11,000 permanent residents living in 4,000 single dwellings and apartments in stucco or frame buildings. Figure 11 and Figure 12 show aerial views of Waikīkī during the early 1960s.

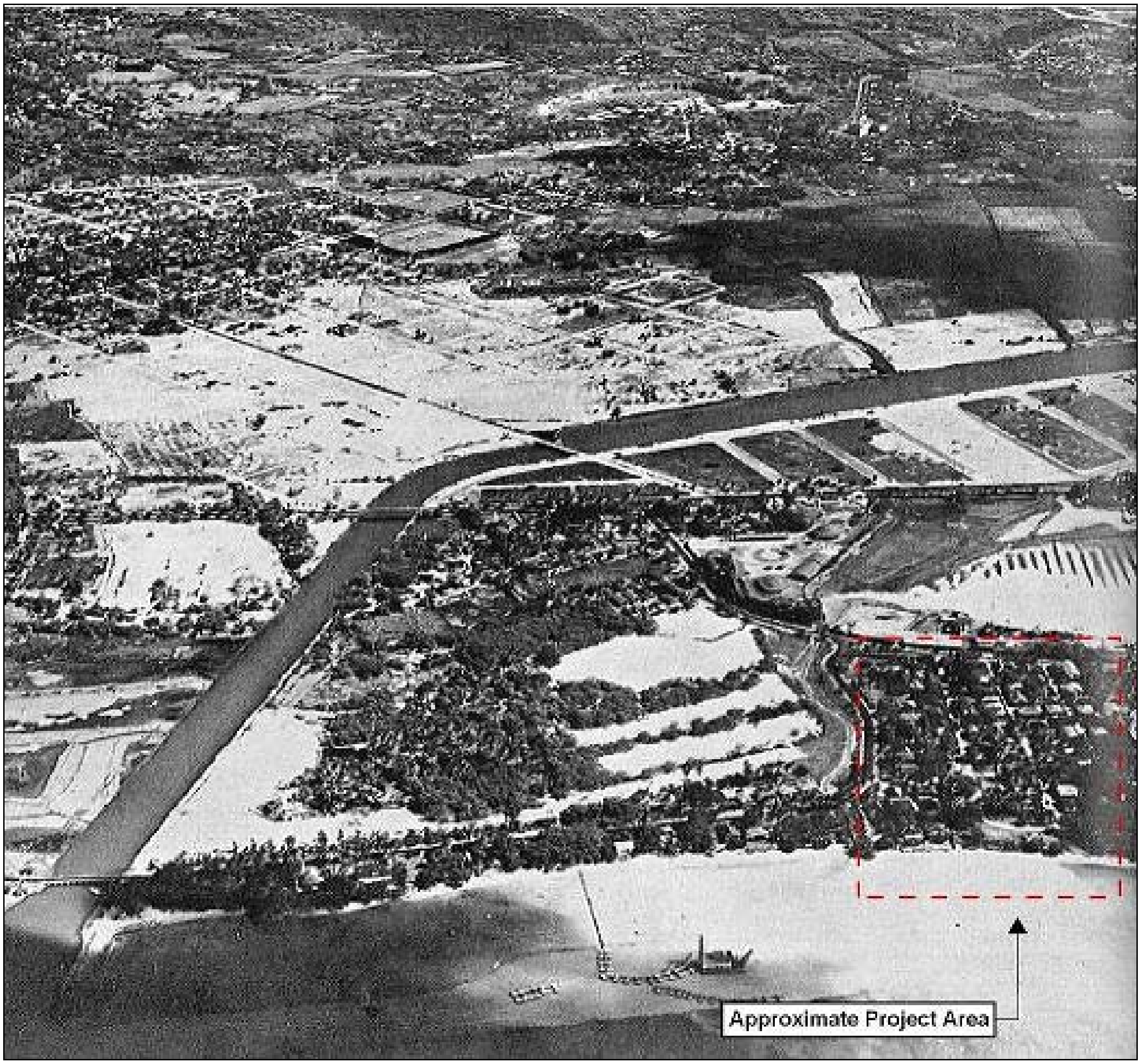

Figure 10. 1927 photograph of the Ala Wai Canal (photograph courtesy of the Bishop Museum Archives)

Figure 11. 1961 Photograph of Waikīkī from Kālia (photograph courtesy of *Honolulu Advertiser* Archives)

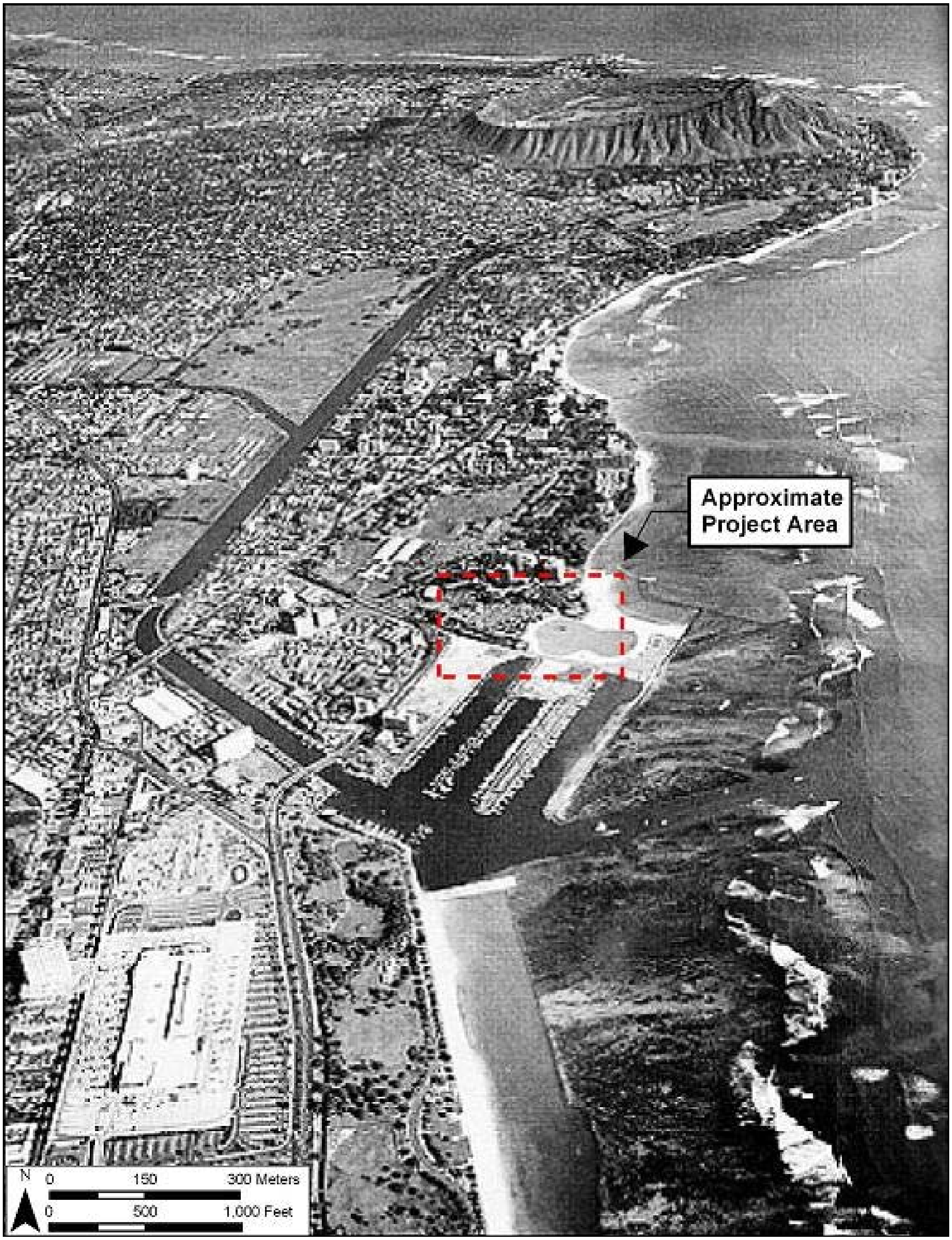

Figure 12. 1961 photograph of Waikīkī from Ala Moana Shopping Center (photograph courtesy of *Honolulu Star-Bulletin* Archives)

4.4 Historic Maps

A series of historic maps from 1887 to 1955 illustrate the dramatic changes that occurred within the study area as Western commercial interests supplanted the traditional Native Hawaiian way of life. Of note is the artificial extension of the coastline and successive waves of resort development.

An 1887 Hawaiian Government Survey map of Honolulu indicates that approximately half of the study area was once situated within coastal tidal flats, likely submerged by the ocean (Figure 13). A complex of fish ponds is indicated just *mauka* (northeast) of the study area, and a stream is shown running along the northern edge of the study area.

An 1897 map of Honolulu by M.D. Monsarrat still indicates approximately half of the study area situated within coastal tidal flats; however, now a pier appears to have been constructed along the coast (Figure 14). Also of note are the presence of roads that have been constructed along the east and north boundaries of the study area. Pi‘inaio Stream appears to have been rerouted due to the recent road construction.

A 1910 U.S. Engineers map of Waikīkī indicates that the coastline along the southwestern portion of the study area has been artificially extended into the ocean (Figure 15). Roads and dwellings are now indicated within the study area. The fishpond complex to the northeast of the study area appears to have been filled-in, replaced by what appears to be agricultural furrows.

A 1913 map of Land Court Application 264 illustrates the multiple episodes of shoreline accretion within the study area spanning from 1862 to 1908 (Figure 16).

A 1914 Sanborn Fire Insurance Map indicates that the structures within the study area are associated with resort and residential development (Figure 17). A hotel, boarding houses, and associated cottages are indicated within the study area.

A 1919 War Department topographic map shows extensive development, in the form of roads and dwellings, both within and in the immediate vicinity of the study area (Figure 18). Additionally, a large pier is shown extending from the southwestern portion of the study area in to ocean. Of note is the absence of any remnant of aquaculture or agriculture in the immediate area. Also all that remains of Pi‘inaio Stream is a small wetland area.

A 1927-28 USGS topographic map indicates extensive development within and in the vicinity of the study area (Figure 19). Almost the entire study area has been filled in with dwellings. All ponds and marsh lands have been filled-in and drained, likely associated with the construction of the Ala Wai Canal which is now indicated to the north and east of the study area.

A 1927 Sanborn Fire Insurance map provides details on the dwellings present within the study area during this time period (Figure 20). This map indicates that a majority of the structures are associated with either the Niumalu Hotel or residential dwellings and apartments.

A 1943 War Department topographic map shows little change within the study area from the late 1920s (Figure 21). However, is appears that the coastline has been slightly expanded within the northwestern portion of the study area.

A 1953 Army Map Service topographic map shows development along the coastline of the study area (Figure 22). A pier is shown jutting out from the southwestern edge of the study area Just north of the pier, the coastline appears to have been modified for the creation of a small boat harbor, likely used to drop off passengers to the resort. Construction of the boat harbor probably entailed extensive dredging and the fortification of the coastline with some sort of retaining walls. Also of note is the development of a yacht harbor just northwest of the study area.

A 1955 Sanborn Fire Insurance map shows the fist iteration of the resort development currently known as the Hilton Hawaiian Village (Figure 23). Here the resort is just called the "Hawaiian Village," as primary development was under the direction of Henry Kaiser, Conrad Hilton would not be involved until the 1960s. It appears that many of the dwellings observed in previous maps have been demolished for the installation of parking areas and to clear land for future resort expansion.

A 1978 aerial photograph shows the coastline expanded beyond the boundaries of the study area (Figure 24). A lagoon and beach are now present along the western boundary of the study area, an area that was once situated within the ocean. Large structures associated with the Hilton Hawaiian Village resort are present throughout the study area.

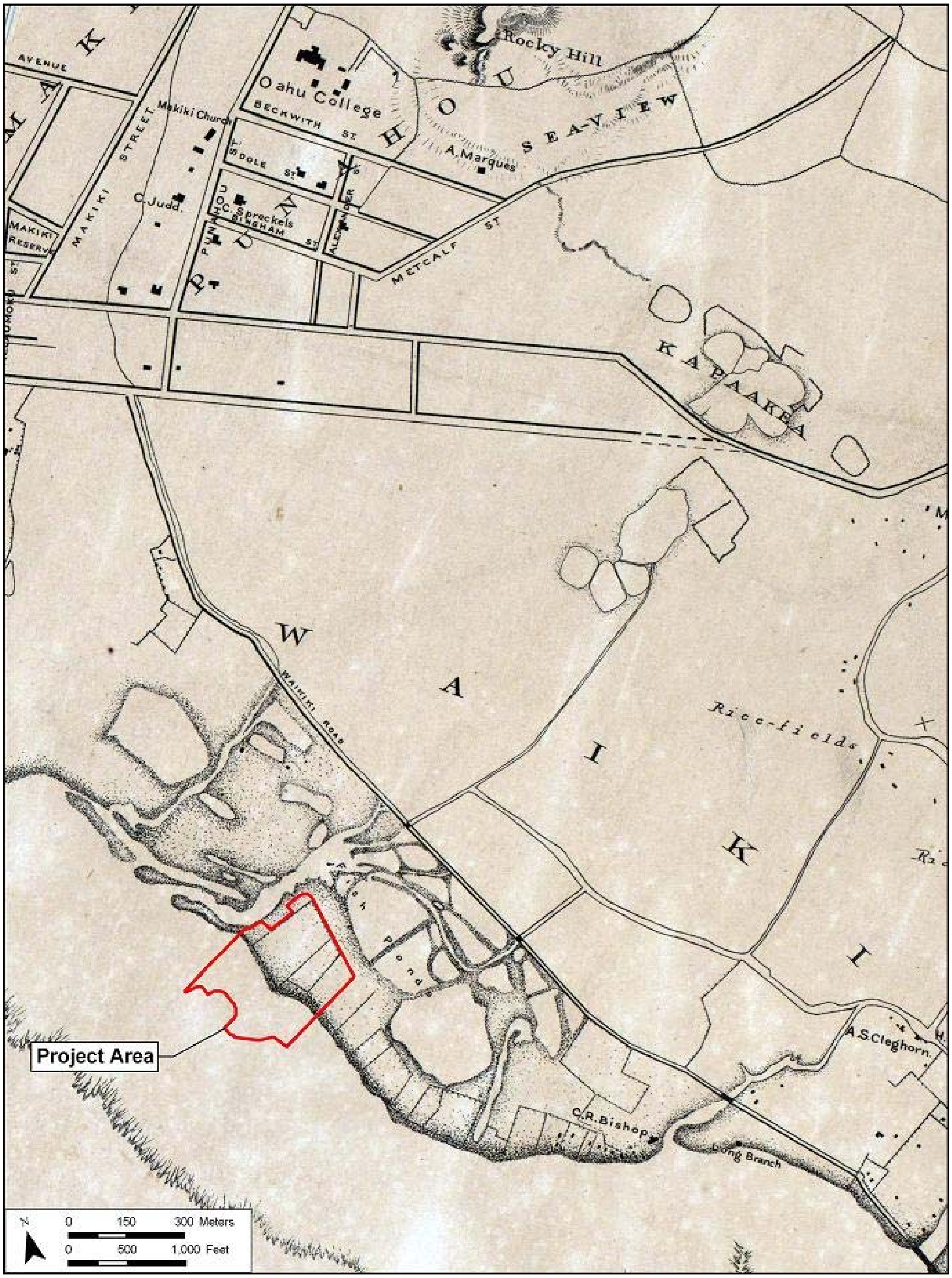

Figure 13. Portion of 1887 Hawaiian Government Survey map of Honolulu by W.A. Wall, showing the location of the Project area (Library of Congress, Geography and Map Division, Washington, D.C.)

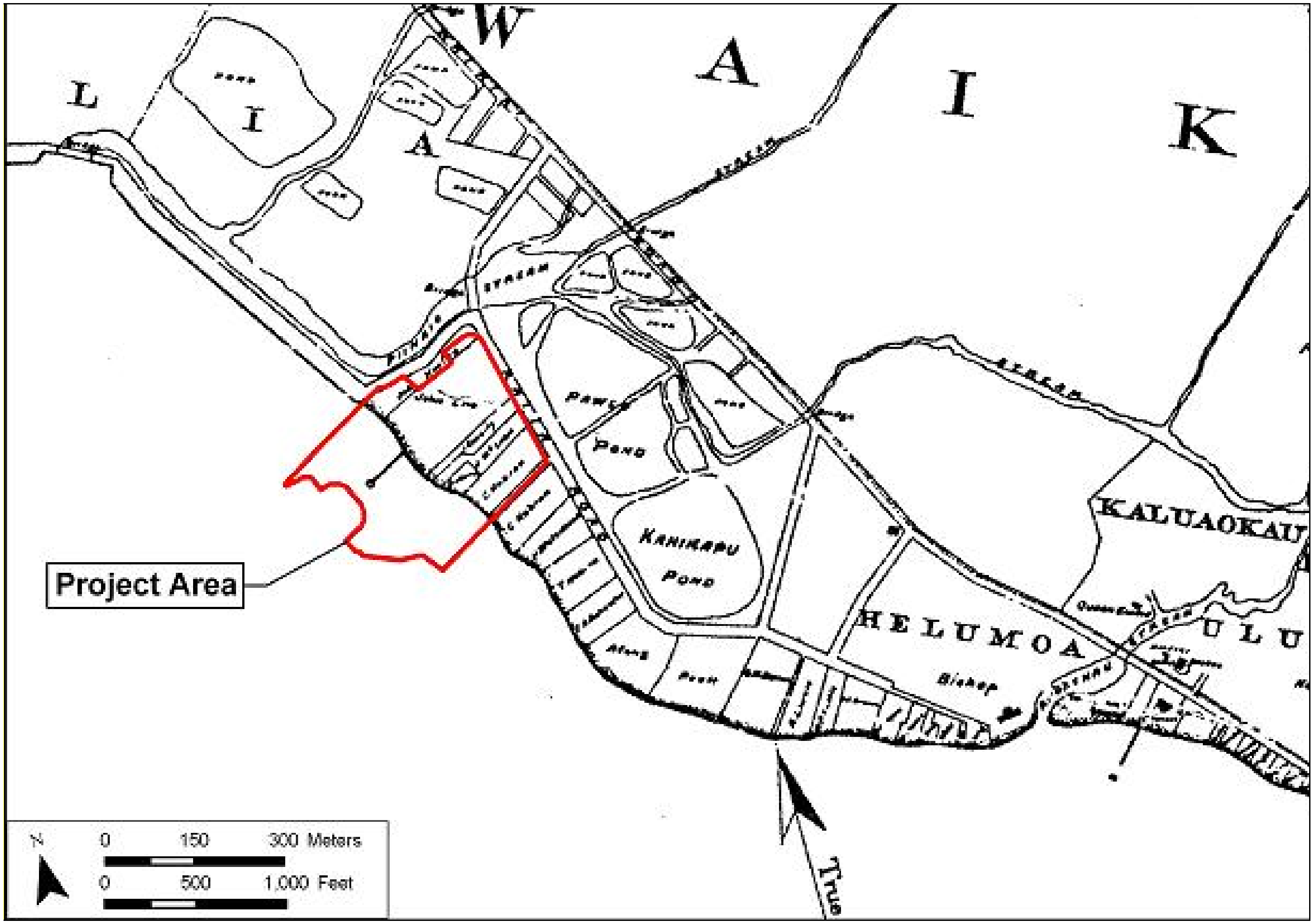

Figure 14. Portion of 1897 M.D. Monsarrat map of Honolulu with location of Project area indicate (Reg. Map No. 1910, Hawai‘i Land Survey Division)

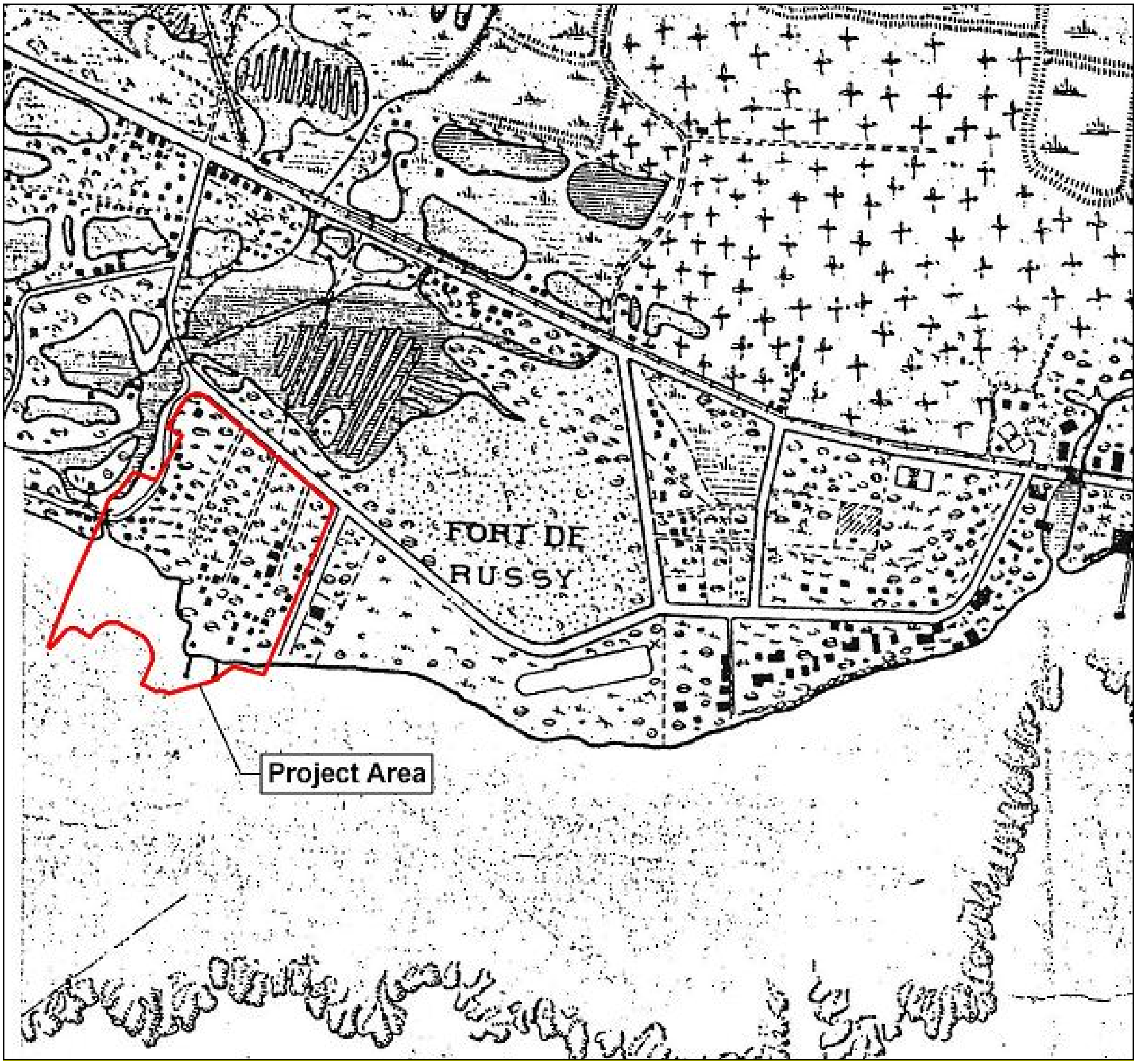

Figure 15. Portion of 1910 U.S. Army Engineer District Honolulu map of Waikīkī with location of Project area indicated (U.S. Army Engineer District Honolulu)

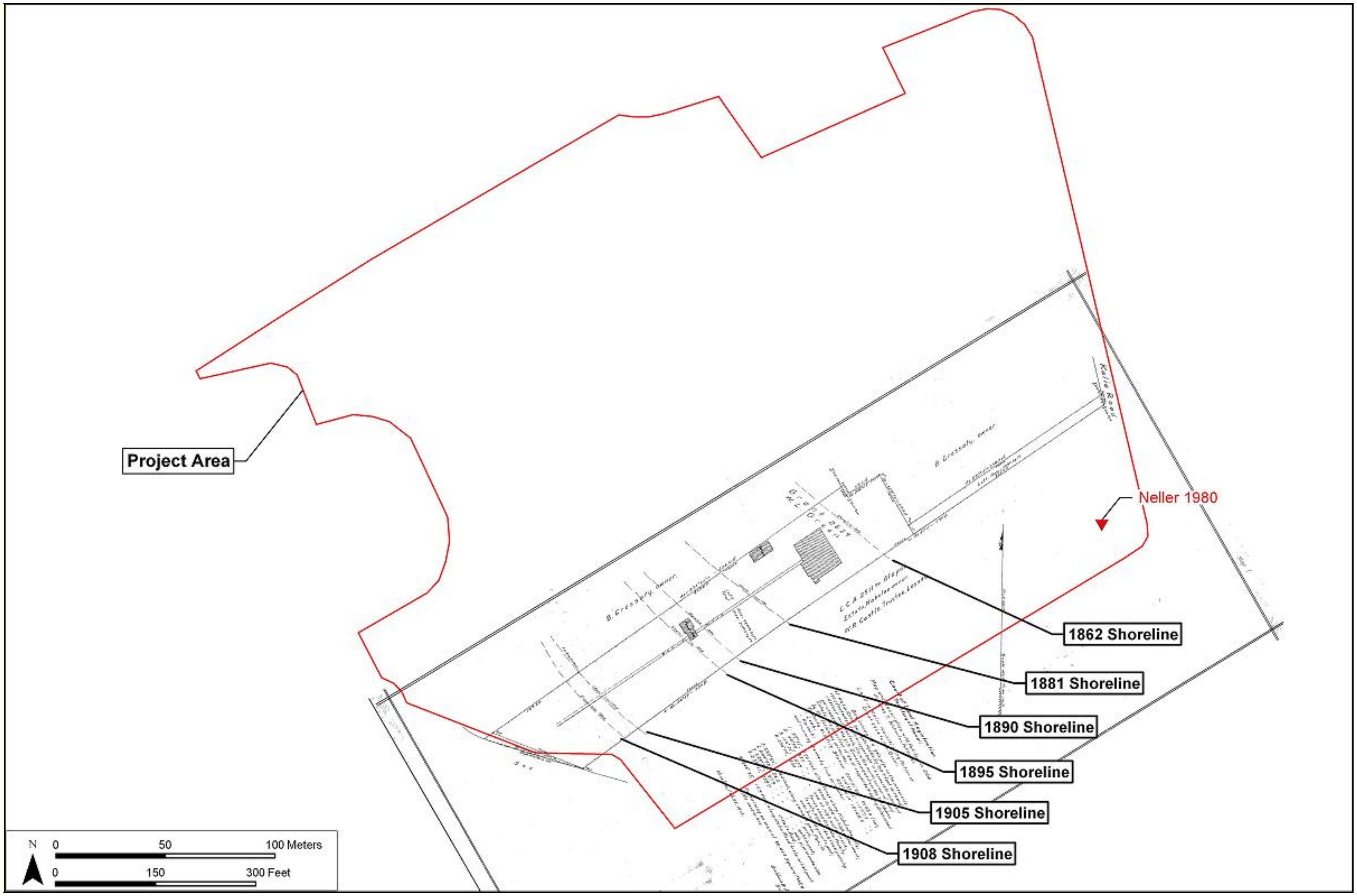

Figure 16. Portion of 1913 map of Land Court Application 264 illustrating shoreline accretion within the Project area from 1862 to 1908 (Hawai‘i Land Survey Division)

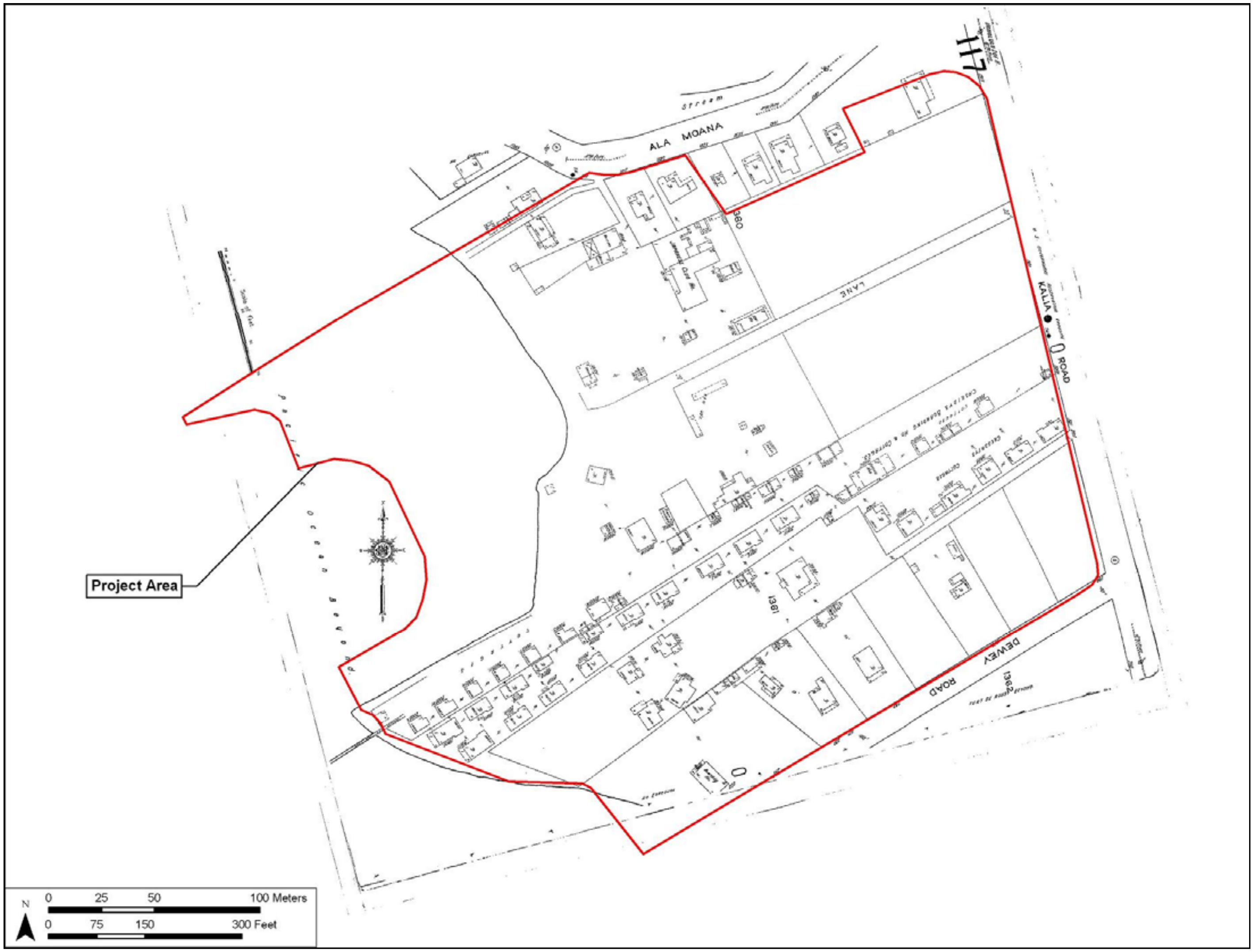

Figure 17. 1914 Sanborn Fire Insurance Map, Sheet 117, with location of study area indicated (UH Hamilton Library)

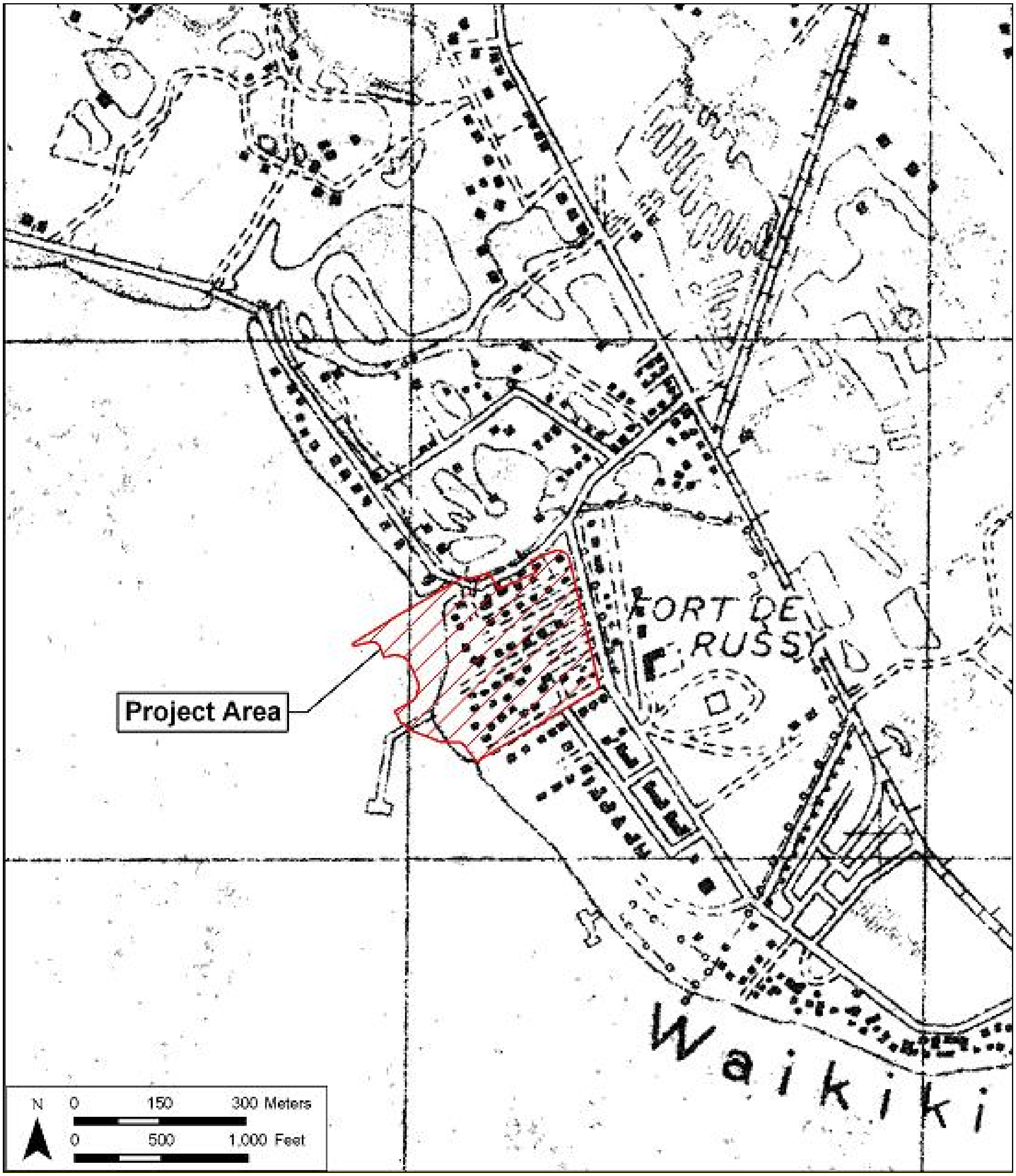

Figure 18. 1919 War Department topographic map, Honolulu Quadrangle, with location of study area indicated (USGS Information Services)

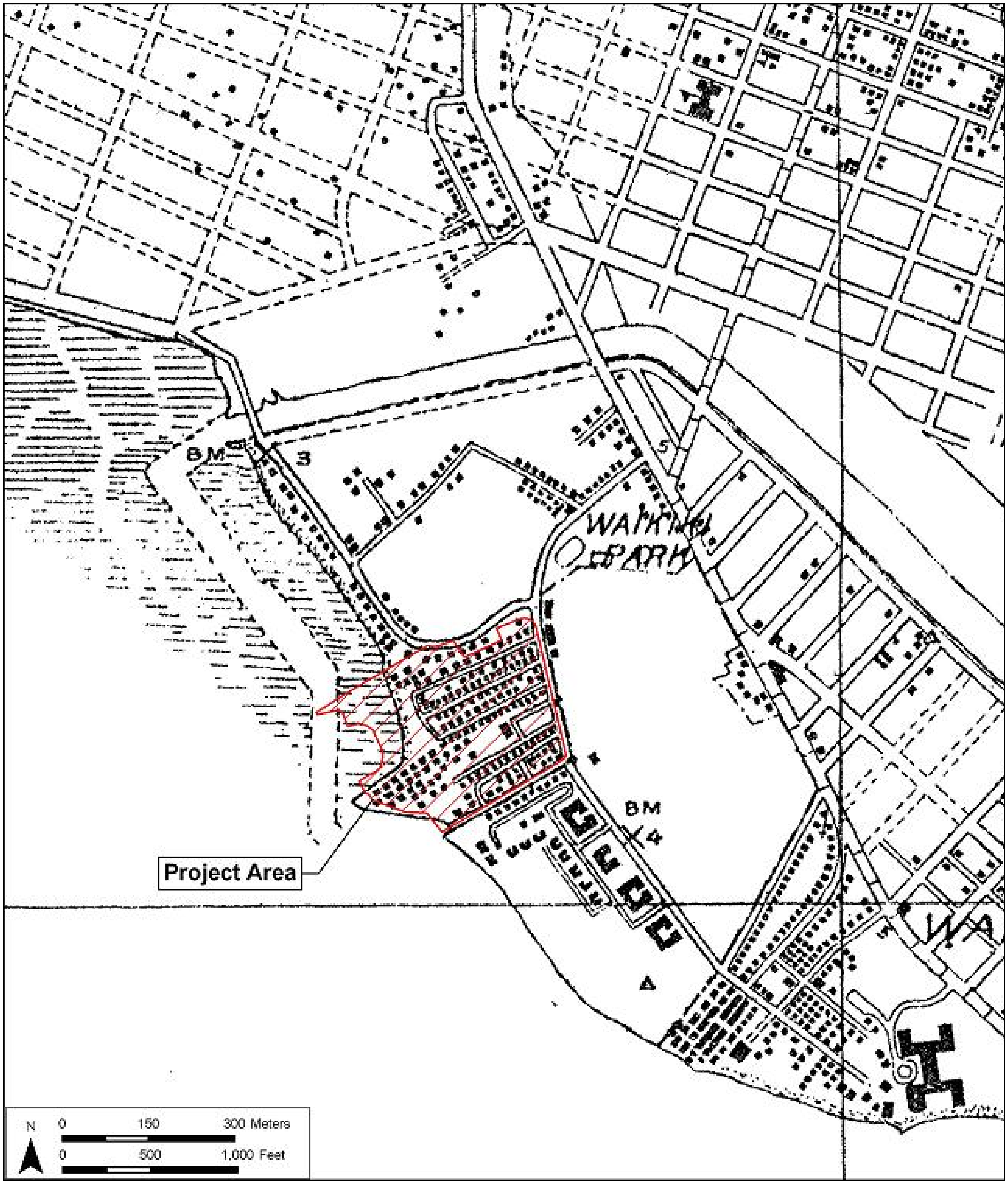

Figure 19. 1927-28 USGS topographic map, Honolulu Quadrangle, with location of study area indicated (USGS Information Services)

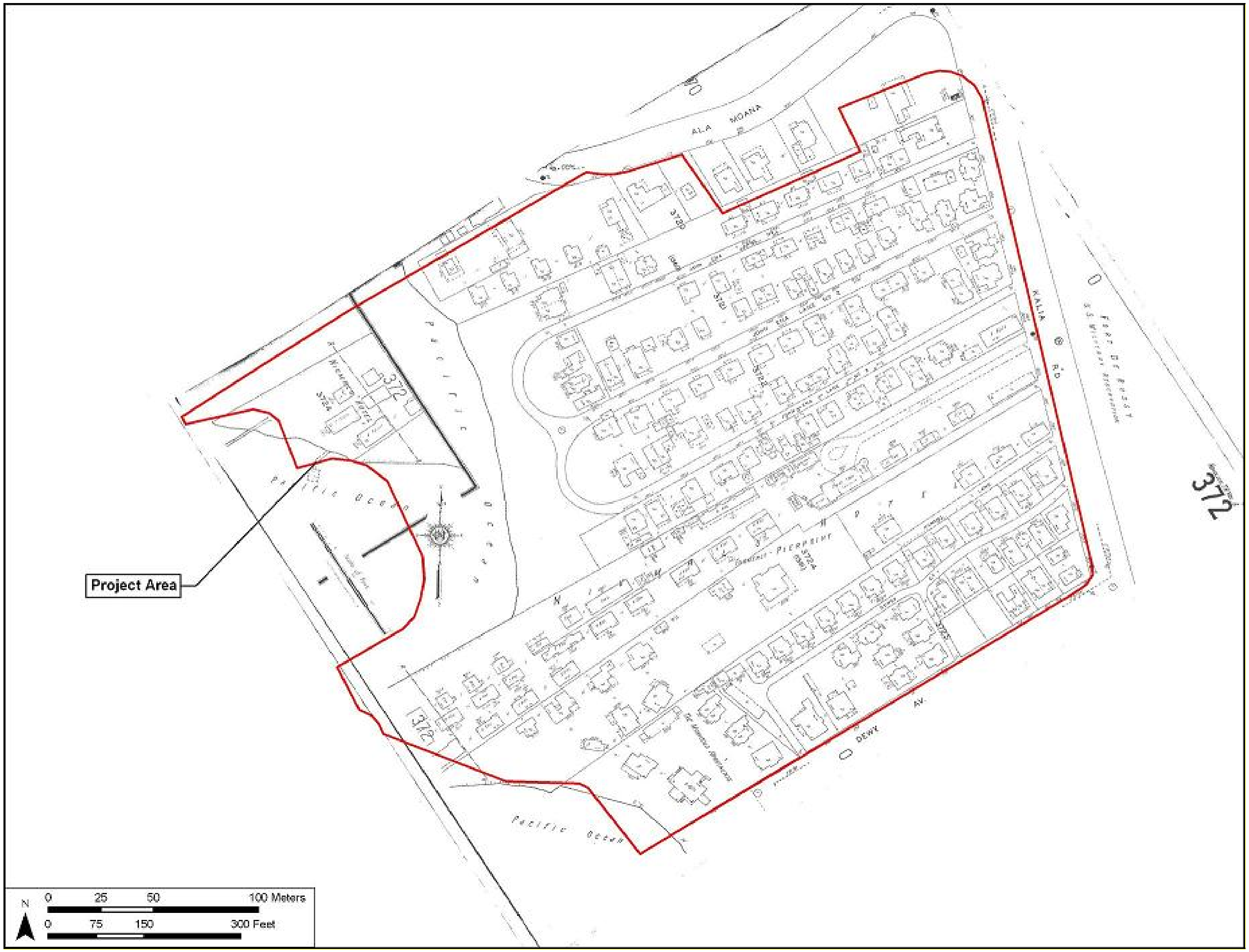

Figure 20. 1927 Sanborn Fire Insurance Map, Sheet 372, with location of study area indicated (UH Hamilton Library)

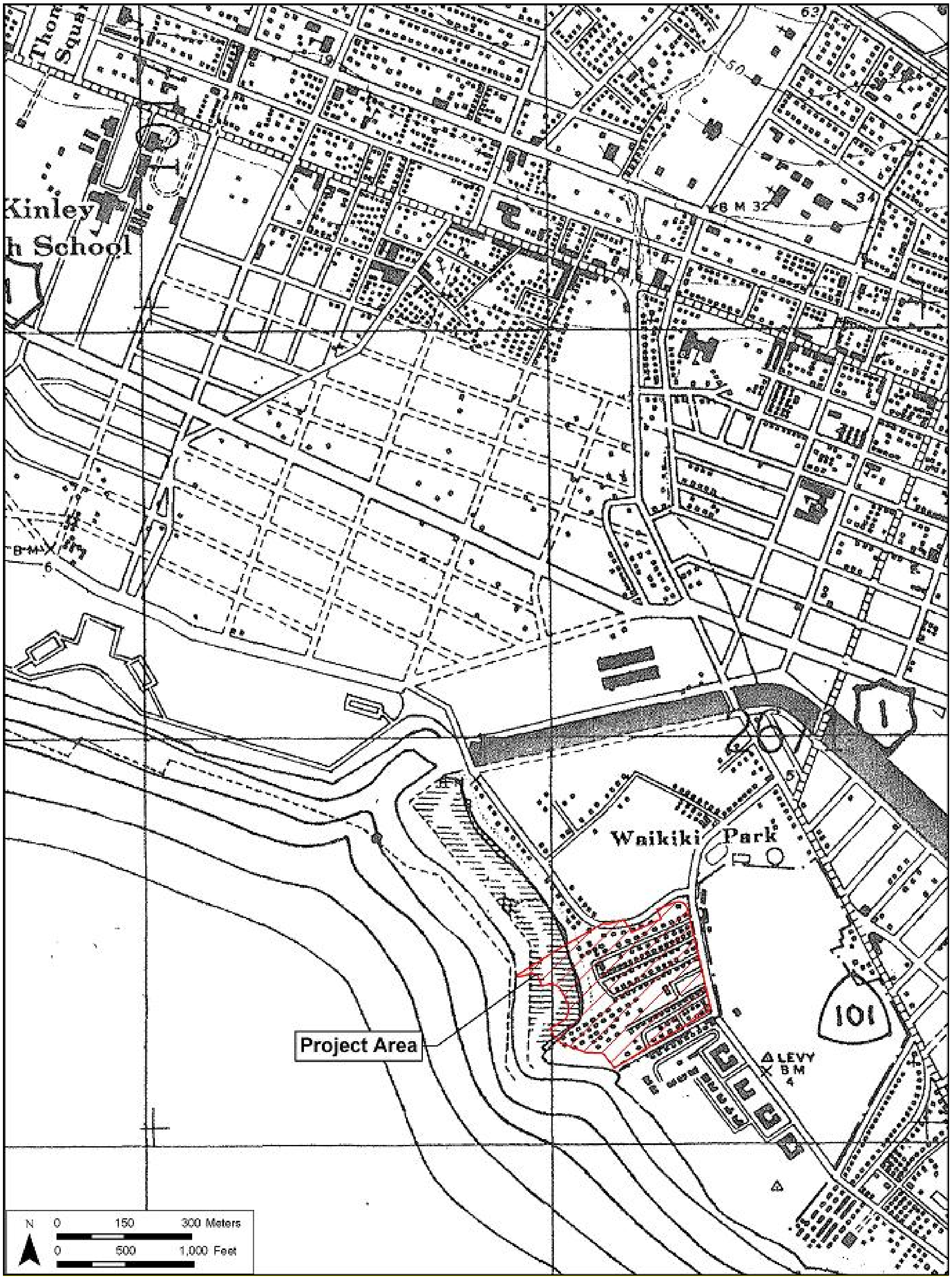

Figure 21. 1943 War Department topographic map, Honolulu Quadrangle, with location of study area indicated (USGS Information Services)

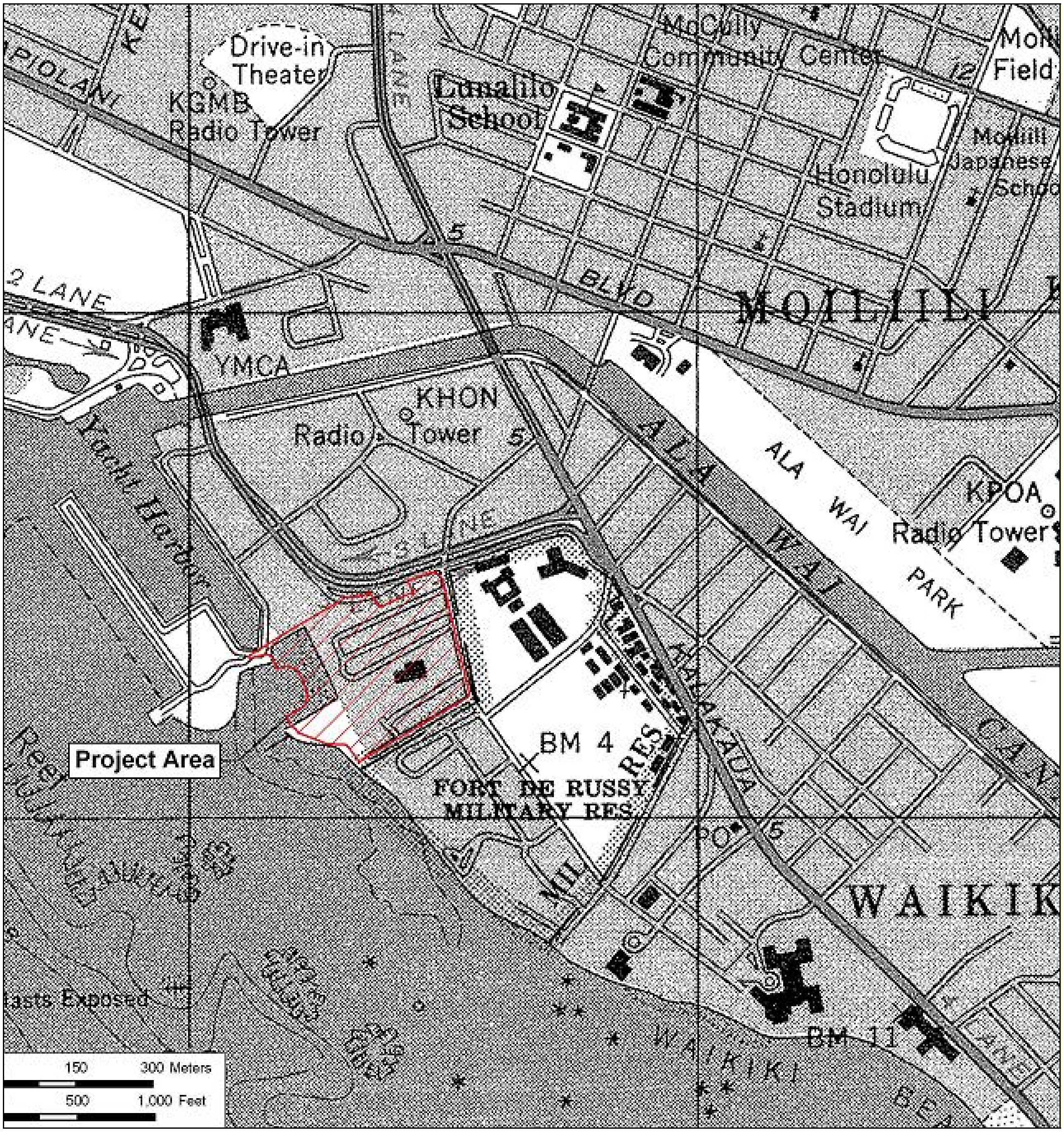

Figure 22. 1953 Army Map Service topographic map, Honolulu Quadrangle, with location of Project area indicated (USGS Information Services)

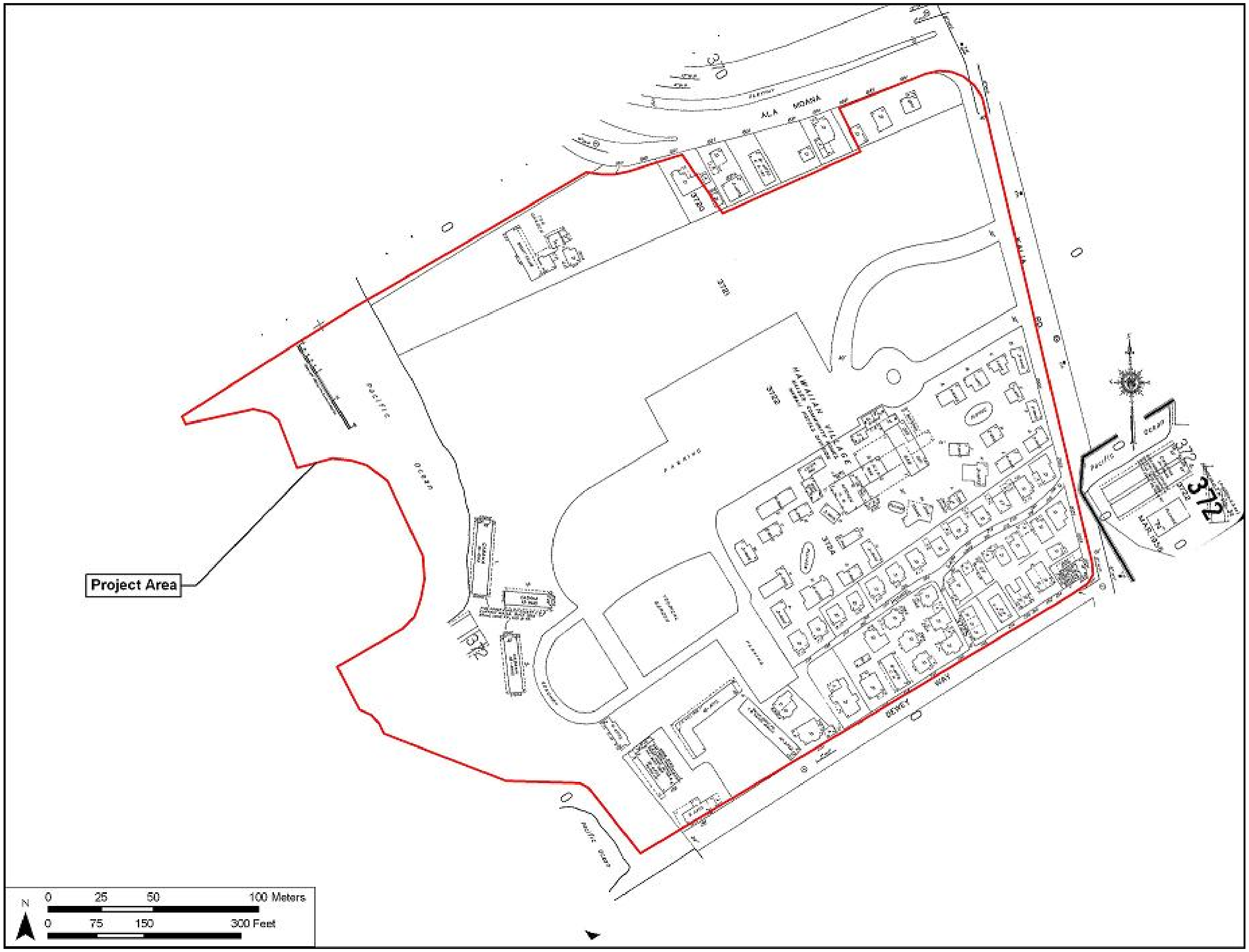

Figure 23. 1955 Sanborn Fire Insurance Map, Sheet 372, with location of study area indicated (UH Hamilton Library)

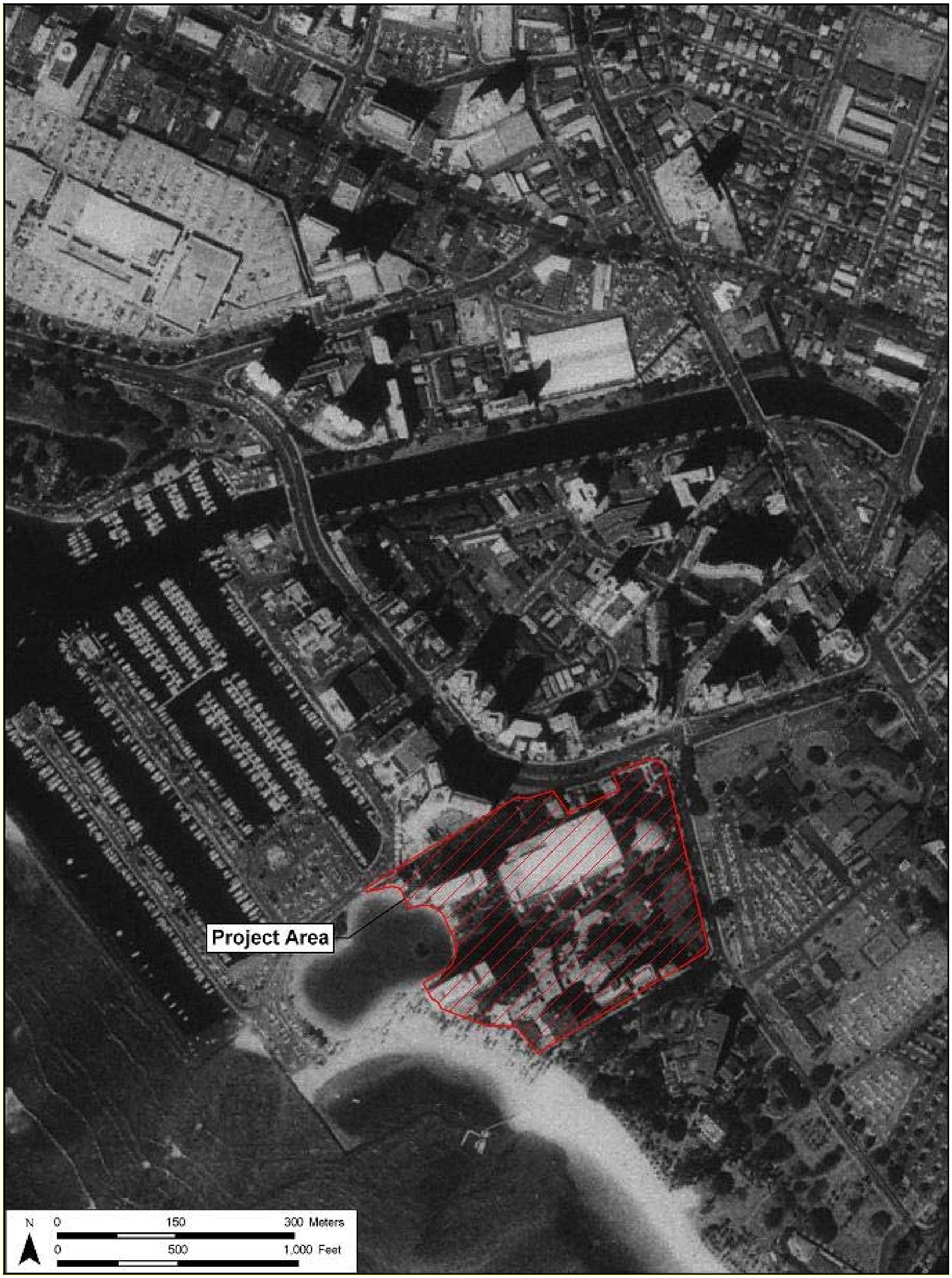

Figure 24. 1978 aerial photograph showing the location of the Project area (USGS orthophoto quadrangle)

Section 5 Archaeological Research

5.1 Overview

The main objectives of this section are (1) to establish a pre-Contact and early historic-era context for traditional land use and resource management in the Project area by providing an overview of relevant archaeological research, and (2) to provide a basic summary of archaeological evidence within and immediately adjacent to the Project area. This is not an exhaustive review of all previous archaeological research in Waikīkī Ahupua‘a, which is beyond the scope and purpose of this report. CSH's companion Archaeological Literature Review and Field Inspection (Tulchin et al. 2010) contains additional details not included here. The main focus of this section is on reviewing previously-identified archaeological resources that are within or near the current Project area.

The urban, highly developed landscape along the Waikīkī coast was already developed by the 1970s when historic preservation legislation went into effect. As a result, most development took place without prior archaeological investigations. However, during the last 20 years or so many buildings and associated infrastructures have been rebuilt and there have been numerous municipal utility line improvements. These recent developments have been accompanied by archaeological investigations that have documented numerous archaeological remains preserved beneath Waikīkī's modern land surface. A large number of burials and previously-disturbed human skeletal remains have been documented; other resources commonly encountered in subsurface contexts include pre- and post-Contact cultural layers, fishpond sediments, and the remains of extensive wetland agriculture. These resources are typically encountered beneath the extensive fill layers related to land reclamation activities related to urban development and expansion of the coastline.

5.2 Archaeological Research in the Vicinity of the Project Area

Archaeological studies in the vicinity of the current study area are shown in Figure 25 and briefly summarized in Table 2. The following is an overview of studies that have yielded significant results.

Freeman et al.'s (2005) inventory survey for the Ala Wai Gateway project bounded by Ala Wai and Ala Moana boulevards, Hobron Lane, and Līpe‘epe‘e Street identified four historic properties during subsurface testing: (1) State Inventory of Historic Property (SIHP) #50-80-14-6700, a set of previously-disturbed human skeletal remains in fill sediments; (2) SIHP #50-80-14-6701, a historic coffin burial; (3) SIHP #50-80-14-6702, a buried land surface containing evidence of both pre- and post-Contact habitation; and (4) SIHP #50-80-14-6703, buried alluvial sediment associated with a buried fishpond.

Archaeological monitoring for the Ala Wai Gateway project conducted by Tulchin and Hammatt (2009) documented two sets of previously-disturbed human skeletal remains. The first set consisted of additional skeletal fragments associated with SIHP #50-80-14-6700, previously identified by Freeman et al. (2005). The second set (SIHP #50-80-14-7057) was newly identified. Due to the fragmentary nature of both sets of remains, age and ethnicity could not be determined. In general, the stratigraphy consisted of varying layers of imported fill associated with historic and modern development overlying naturally deposited marine sand and clays indicative of the marsh environment that preceded the land reclamation and subsequent development of the area.

Perzinski et al. (1999) identified two human burials (SIHP #50-80-14-5744) near the intersection of Ena Road and Kalākaua Avenue during excavation for the first phase of the Waikīkī Anti-Crime Lighting Improvements Project. Both sets of remains, which were not associated with any cultural materials, appeared to be pre-Contact (possibly early post-Contact) Native Hawaiian burials.

Bell and McDermott's (2006) archaeological inventory survey for the Allure Waikiki Development Project between Ala Wai Boulevard, Kalākaua Avenue, and 'Ena Road identified three historic properties: SIHP #50-80-14-6873 and SIHP #50-80-14-6875, consisting of isolated traditional Hawaiian burials found in sand deposits, and SIHP #50-80-14-6874, a subsurface cultural layer of pre-Contact and post-Contact origin.

Jones and Hammatt's (2004) archaeological monitoring for the Waikīkī Anti-Crime Street Lighting Improvement Project on the *mauka* side of Kalākaua Avenue from Ala Wai Boulevard to Pau Street did not identify significant cultural deposits; however, some pond or *lo'i* (irrigated terrace for taro) sediments were noted near the intersection of Kalākaua Avenue and McCully Street.

Bush et al.'s (2002) archaeological monitoring for the Waikīkī Anti-Crime Street Lighting Improvement Project along portions of Kalākaua Avenue identified four sets of human remains: one (SIHP #50-80-14-5864) on Kalākaua Avenue, just before Dukes Lane; another (Feature C of a previously identified burial site SIHP #50-80-14-5856) at the intersection of Kalākaua and Ka'iulani Avenues; and two more at the intersection of Kalākaua Avenue and Kealohilani, near an area of concentrated burials assigned SIHP #50-80-14-5860. In addition to human remains, pre-Contact deposits, historic and modern rubbish concentrations, and pond sediments were also observed.

Davis' (1989) subsurface testing at Fort DeRussy documented substantial prehistoric, historic and modern subsurface archaeological deposits including buried fishpond sediments, *'auwai* sediments, midden- and artifact-enriched sediments, structural remains such as post holes and fire pits, and historic trash pits.

Davis' (1991) archaeological monitoring at Fort DeRussy Military Reservation at the corner of Ala Moana Boulevard and Kalākaua Avenue did not identify archaeological remains; however, based on the excavations conducted where intact deposits and features (dating to the fifteenth century A.D.) were previously noted, it was concluded that nearly continuous, intact prehistoric and early historic cultural deposits underlie the entire area between Battery Randolph and the beach.

Streck (1992) reported the remains of one post-Contact individual (SIHP #50-80-14-9550) between a probable nineteenth century and pre-Contact cultural deposit at the *mauka* end of the Kuroda Parade Ground at Fort DeRussy.

Simons et al.'s (1995) data recovery excavations at Fort DeRussy focused on three previously identified historic properties: Loko Paweo I (SIHP #50-80-14-4574), Loko Paweo II (SIHP #50-

80-14-4576), and SIHP #50-80-14-4579, a subsurface cultural layer associated with LCA 1785 containing one set of fragmented skeletal remains. In addition, a newly identified *‘auwai* system was discovered (SIHP #50-80-14-4970).

Denham and Pantaleo’s (1997a) archaeological monitoring along the Kālia Road Realignment Project at Fort DeRussy Military Reservation identified 10 subsurface features and nine burials organized into three sites: SIHP #50-80-14-4574, consisting of fishpond sediments (Loko Paweo I), three historic trash pits, and two burials (authors did not determine the burial’s age); SIHP #50-80-14-4570, consisting of a historic trash pit, four fire pits, an ash lens, and an unknown number of human burials (in six distinct locations) found in the sand dunes near the Kālia fishponds; and SIHP #50-80-14-4966, consisting of pre-Contact features and burials representing at least five individuals found in the Koko Head portion of the reservation. The historic trash pits contained various artifacts of which manufacture dates ranged from the early nineteenth century through the mid-twentieth century.

Denham and Pantaleo’s (1997b) data recovery at Fort DeRussy investigated five previously identified sites: one site (SIHP #50-80-14-4570) was characterized by such features as a firepit, coral rock concentration, and postholes. An *‘auwai* and bund system (SIHP #50-80-14-4970) revealed two channels, three bunds, and a charcoal stain. Another site (SIHP #50-80-14-4579) revealed a number of features related to permanent historic occupation and possible intermittent prehistoric use, such as five fire pits, two historic middens, and a human burial. In addition, three fishponds, Loko Paweo I (SIHP #50-80-14-4570, Loko Ka‘ihikapu (SIHP #50-80-14-4575), and Loko Paweo II (SIHP #50-80-14-4576), were identified (Denham and Pantaleo 1997b).

McMahon (1994) reported on an inadvertent burial (SIHP #50-80-14-4890) discovered during excavation for a water line at the intersection of Kalākaua Avenue and Kuamo‘o Street (just *mauka* of Fort DeRussy). No other cultural remains were found in association with the burial. These remains represented a single individual, and ethnicity was not determined (McMahon 1994).

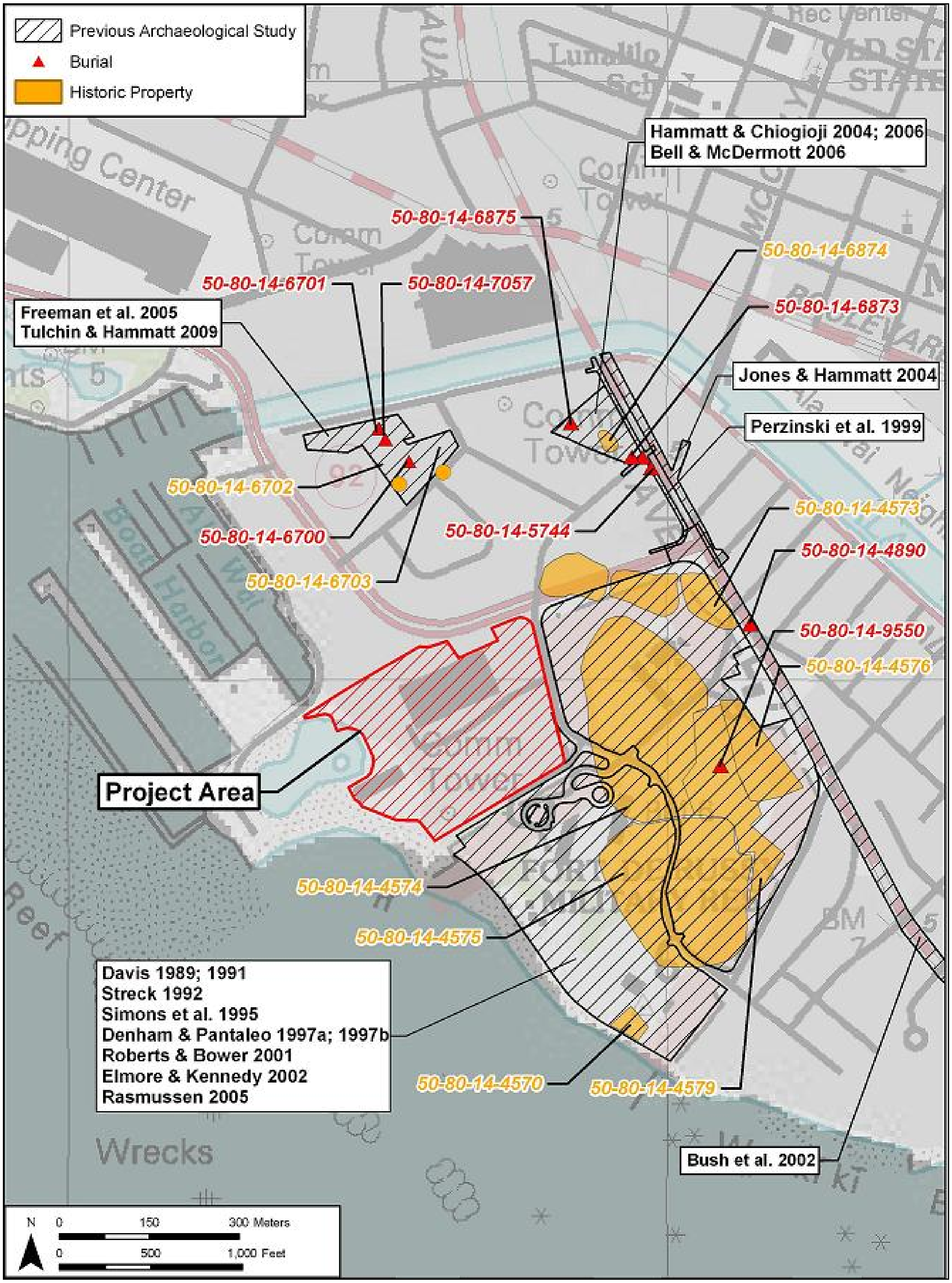

Figure 25. Previous archaeological investigations in the vicinity of the study area

Table 2. Previous Archaeological Studies in the Vicinity of the Study Area

Author	SIHP #50-80-14	Report Description and Findings
Bell and McDermott 2006	-6873, -6875, -6874	Inventory survey. Three historic properties documented: SIHP #50-80-14-6873 and SIHP #50-80-14-6875, consisting of isolated traditional Hawaiian burials; and SIHP #50-80-14-6874 a subsurface cultural layer of pre-Contact and post-Contact origin.
Bush et al. 2002	-5856, -5860, -5864	Monitoring. Four sets of human remains were inadvertently encountered during excavation. Pre-Contact deposits, historic and modern rubbish concentrations, and pond sediments were also noted.
Davis 1989	-4570, -4573 thru -4577	Archaeological reconnaissance. Fishponds and other subsurface features observed. Sites -4573 thru -4577 are fishponds, 4570 is a remnant cultural deposit.
Davis 1991	NA	Monitoring. No historic properties observed.
Denham and Pantaleo 1997a	-4570 ; -4574; -4966	Monitoring. Three historic properties observed: SIHP #50-80-14-4574, consisting of fishpond sediments (Loko Paweo I), three historic trash pits, and two burials; SIHP #50-80-14-4570 consisting of a historic trash pit, four fire pits, an ash lens, and an unknown number of human burials; and SIHP #50-80-14-4966 comprised of pre-Contact features and burials representing at least five individuals found in the Diamond Head portion of the reservation.
Denham and Pantaleo 1997b	-4570; -4575; -4576; -4579; -4970	Data recovery. Five previously identified sites investigated.
Elmore and Kennedy 2002	NA	Monitoring. No historic properties observed.
Freeman et al. 2005	-6700, -6701, -6702, -6703	Inventory survey. Four historic properties identified: 1.) SIHP #50-80-14-6700 a set of previously-disturbed human skeletal remains; 2.) SIHP #50-80-14-6701, a historic coffin burial; 3.) SIHP #50-80-14-6702, a culturally-enriched buried A horizon containing evidence of both pre- and post-Contact habitation; and 4.) SIHP #50-80-14-6703, buried alluvial sediment associated with a buried fishpond.
Hammatt and Chiogioji 2004	NA	Archaeological literature review and field check. Based on background research, there is the potential for subsurface archaeological remains.

Author	SIHP #50-80-14	Report Description and Findings
Hammatt and Chiogioji 2006	NA	Archaeological literature review and field check. Based on background research, there is the potential for subsurface archaeological remains.
Jones and Hammatt 2004	NA	Monitoring. No historic properties observed.
McMahon 1994	-4890	Inadvertent burial discovery.
Perzinski et al. 1999	-5744	Monitoring. Two pre-Contact or early post-Contact Native Hawaiian burials observed (SIHP #50-80-14-5744.
Rasmussen 2005	NA	Monitoring. No historic properties observed.
Roberts and Bower 2001	NA	Monitoring. No historic properties observed.
Simons et al. 1995	-4574, -4576, -4579, -4970	Data recovery. Three previously identified historic properties encountered: Loko Paweo I (SIHP #50-80-14-4574), Loko Paweo II (SIHP #50-80-14-4576), and SIHP #50-80-14-4579, a subsurface cultural layer associated with LCA 1785 and containing one set of fragmented skeletal remains. A newly identified *‘auwai* system was also discovered (SIHP #50-80-14-4970).
Streck 1992	-9550	Data recovery. One post-Contact burial identified (SIHP #50-80-14-9550)
Tulchin and Hammatt 2009	-6700, -7057	Monitoring. Two historic properties identified: additional skeletal fragments associated with SIHP #50-80-14-6700, previously identified (Freeman et al. 2005); SIHP #50-80-14-7057, previously-disturbed human skeletal remains.

5.3 Archaeological Research in the Current Project Area

Archaeological studies conducted within the current study area are shown in Figure 26 and listed in Table 3. The following is a summary of these archaeological studies.

In 1977, the Bishop Museum conducted an archaeological reconnaissance survey of the southeastern corner of the Hilton Hawaiian Village grounds (Sinoto 1977). No historic properties were identified on the ground surface; however, Sinoto 1977:1) recommended all construction excavation within the survey area be monitored by an archaeologist given the probable presence of subsurface cultural deposits, human burials and/or filled-in fishponds.

In 1980, two sets of human remains and one isolated femur were inadvertently discovered during construction activities within this same southeastern corner of the Hilton Hawaiian Village property (Neller 1980). All of these remains were disturbed by construction activities, and were removed from their primary burial context before State archaeologists could document their stratigraphic provenience. The general location of the reinterment site is in the southeastern corner of the parcel. A more specific understanding of the location of the reinterment site is known by the owner of the Hilton Hawaiian Village, former staff of the SHPD, former members of the O‘ahu Island Burial Council (OIBC) and descendents, as memorialized in a 1991 reburial agreement between the State Historic Preservation Officer and the landowner. All three sets of remains were of Hawaiian ethnicity and post-Contact origin (Neller 1980). The burials were determined to be post-1850 in age based on a reconstruction of historic period shorelines (Neller 1980). The burials were assigned as SIHP #50-80-14-2780. In addition to these burials, three subsurface pit features pre-dating the construction of the Ala Wai Canal were also observed. Two of the features had an undetermined function; however, Neller (1980) suggested that they may have been filled-in irrigation ditches. A “coffee bean” sinker, used for octopus lures, was collected from the pit fill of one of these possible ditches. The sinker was constructed of pink granite, an imported material which dated the traditional-style Hawaiian artifact to the post-Contact period. The third pit feature was a trash pit dated to the late 1890s.

Hurlbett et al.’s (1992) archaeological monitoring of mechanical loop excavations at the Hilton Hawaiian Village described a total of 15 pit features, 12 of which consisted of post-Contact trash pits; three were interpreted as historic to modern filled-in trenches. A total of 3,819 artifacts were collected from the Project area both within subsurface pit features and throughout non-feature sediments, which were interpreted as previously-disturbed fill layers. All of the artifacts collected from the trash pits were dated to the late nineteenth and early twentieth centuries. The pit features were incorporated into SIHP #50-80-14-2780, previously identified by Neller in 1980.

More specific details, trench location maps and data from the results of Hurlbett et al.’s (1992) study are included in CSH’s companion Archaeological Literature Review and Field Inspection (Tulchin et al. 2010). In general, the documented stratigraphy for the Hilton Hawaiian Village property consisted of multiple fill layers (consisting predominantly of disturbed sand with smaller portions of Ala Wai dredge material and crushed coral) overlying a culturally sterile sand layer, which was determined to be associated with the historic filling of the coral reef for artificial shoreline/beach expansion. Naturally deposited sediments were observed near the eastern edge of the current study area. Limestone bedrock, possibly associated with formerly exposed tidal flats, was observed in the western half of the study area.

Corbin’s (2001) subsurface archaeological inventory survey for a northern strip of the current study area consisted of the excavation of 21 backhoe trenches (see Tulchin et al. 2010 for details). In general, the stratigraphic sequence consisted of imported fill layers overlying disturbed sand deposits. Observed disturbances were associated with prior development of the area (e.g., subsurface utilities and prior building demolition and construction). No historic properties or significant cultural deposits were observed.

Putzi and Cleghorn’s (2002) archaeological monitoring of sewer connections in the northern portion of the current study area (and within Ala Moana Boulevard and Kalākaua Avenue) documented five pit features (designated SIHP #50-80-14-6399) excavated from a dark sand layer determined to be fill material associated with prior land reclamation of the area down into an underlying layer of sterile sand. Observed stratigraphy within the current study area consisted of imported and disturbed fill layers overlying naturally deposited, culturally sterile sand. Natural deposits were observed from 100-160 cmbs (centimeters below surface). The coral shelf was encounter at 240 cmbs. Excavations east of the current Project area uncovered remnants of the Loko Kaipuni complex (SIHP #50-80-14-4573). Documented fishpond remnants consisted primarily of a gray clay sediment layer located approximately 120 cmbs.

Jourdane and Dye’s (2006) archaeological monitoring for the construction of the Best Bridal Wedding Chapel at the Hilton Hawaiian Village documented no historic properties. Documented stratigraphy consisted of imported fill layers (consisting of sand deposits of varying color and consistency) overlying coralline beach sand, which was encountered at approximately one meter below the existing surface.

Recently, CSH (Tulchin et al. 2010) conducted an Archaeological Literature Review and Field Inspection of the current Project area. In addition to reviewing previous relevant archaeological work and results, the authors produced an archaeological sensitivity model that divides the Project area into low, medium and high probability areas for encountering significant archaeological deposits in subsurface context (Figure 27). The model suggests the *makai* half of the current Project area has little potential for significant cultural deposits. The *mauka* half of the current Project area, on the other hand, likely contains some historic-era features, such as trash pits, and possibly burials.

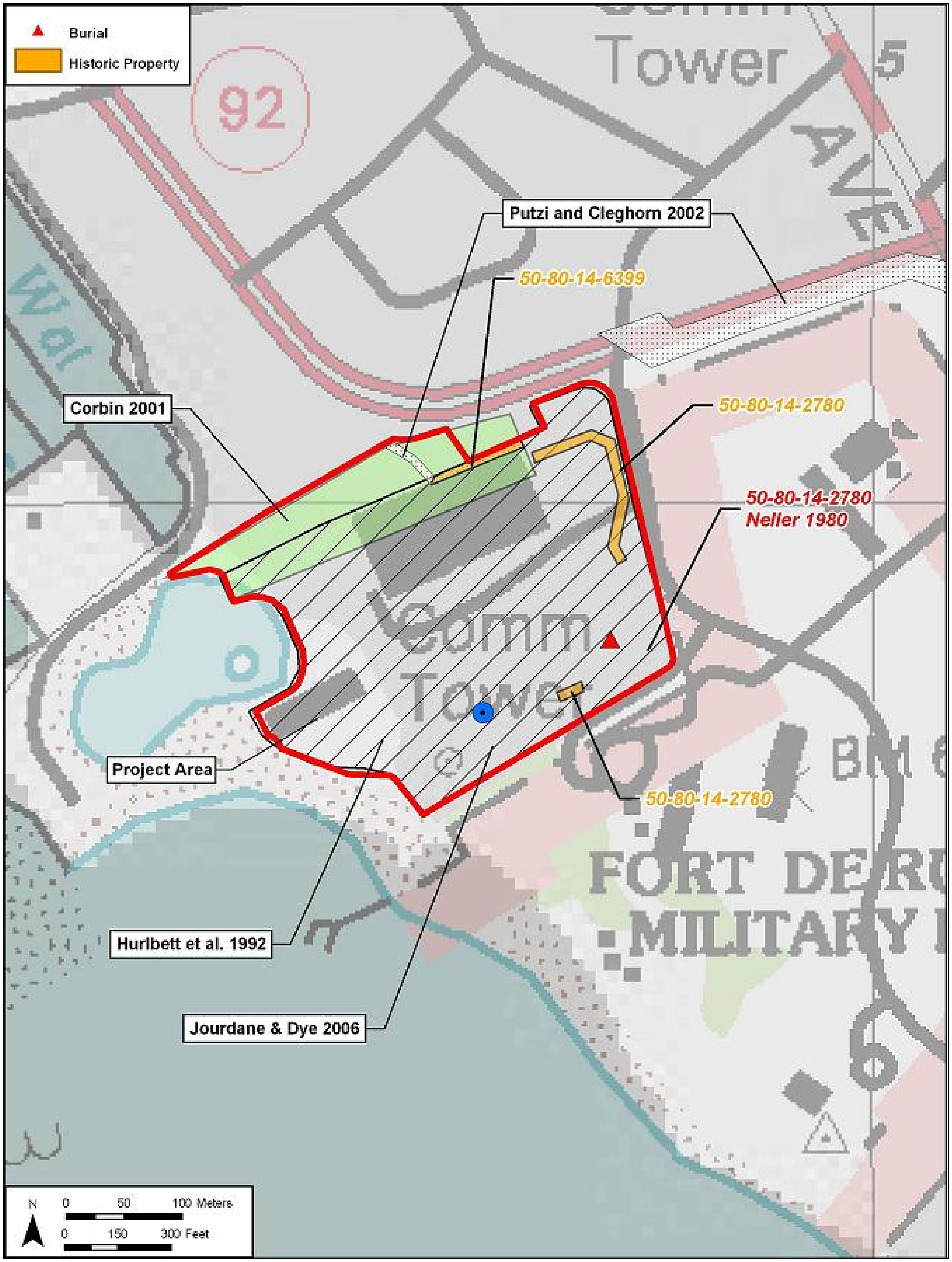

Figure 26. Previous archaeological investigations conducted within the study area

Table 3. Previous Archaeological Studies Conducted Within the Study Area

Author	SIHP #50-80-14	Report Description and Findings
Corbin 2001	NA	Stratigraphic sequence consisted of imported fill layers (asphalt, clay loam, crushed coral fill) overlying disturbed sand deposits.
Hurlbett et al. 1992	-2780	15 subsurface pit features associated with post-Contact trash disposal observed. Features were incorporated into SIHP #50-80-14-2780 previously identified by Neller (1980).
Jourdane and Dye 2006	NA	No historic properties observed. Documented stratigraphy consisted of imported fill layers overlying naturally deposited coralline beach sand. Naturally deposited sediments were observed at approximately 1 m below the existing surface.
Neller 1980	-2780	Two post-Contact burials and one isolated femur, and three subsurface pit features documented.
Putzi and Cleghorn 2002	-4573, -6399	Five post-Contact pit features documented within the current study area (SIHP #50-80-14-6399). Remnants of the Loko Kaipuni complex (SIHP #50-80-14-4573) documented east of study area.
Sinoto 1977	NA	No historic properties identified during the surface reconnaissance, however it was noted that the presence of subsurface cultural deposits in the form of human burials and filled-in fishponds were likely.

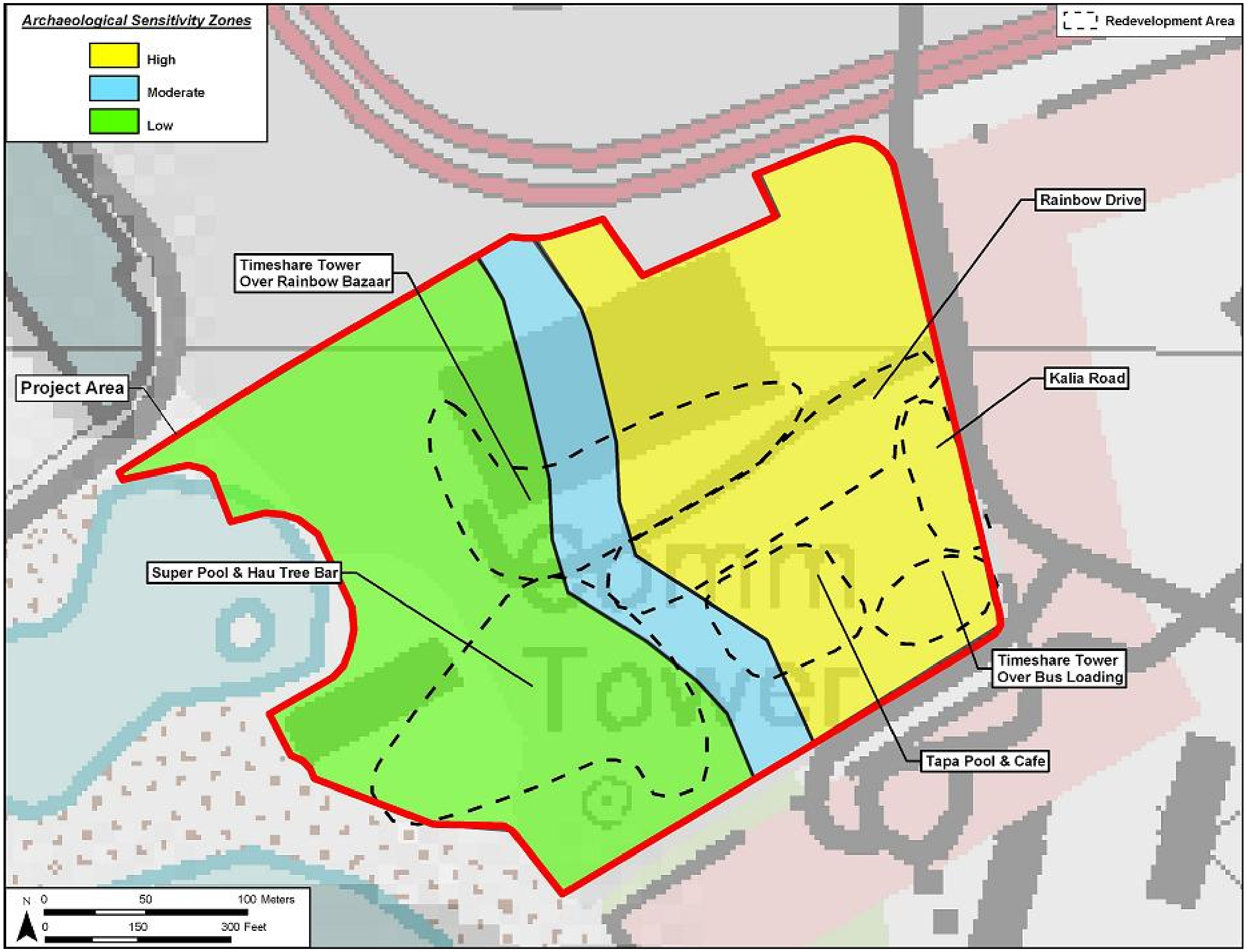

Figure 27. Archaeological sensitivity model for the current Project area showing proposed redevelopment areas (dashed lines) (Tulchin et al. 2010)

Section 6 Community Consultation

Throughout the course of this CIA, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, individuals and all of the recognized cultural and lineal descendants of Waikīkī Ahupua‘a in order to identify those who might have knowledge of and/or concerns about cultural resources and practices specifically related to the Project area. The community consultation effort was made by letter, email, telephone and in person. In the majority of cases, letters along with a map and an aerial photograph of the Project area were mailed with the following text:

> At the request of Group 70 International, Cultural Surveys Hawai‘i Inc. (CSH) is conducting a Cultural Impact Assessment (CIA) for the proposed Hilton Hawaiian Village Resort and Spa’s Village Master Plan Improvements Project, Waikīkī Ahupua‘a, Honolulu (Kona) District, O‘ahu Island, Multiple TMK.
>
> The Village Master Plan Improvements Project, within the Hilton Hawaiian Village’s approximate 22.24-acre property, is located at the ‘ewa end of Waikīkī (see attached maps). The resort is bounded and accessed by Kahanamoku Street to the northwest, Ala Moana Boulevard to the north, Kālia Road to the northeast, Paoa Lane to the southeast, and Waikīkī Beach and the Pacific Ocean to the west and south.
>
> The Village Master Plan Improvements Project is expected to be completed within 10 years and includes the following:
>
> - An improved streetscape, to include retail outlets, along Kālia Road to enhance the shopping and pedestrian experience for hotel guests, visitors and local residents alike
> - Retention of at least 50 percent open space throughout the Village’s 22-oceanfront acres to maintain and enhance the inviting, park-like setting
> - Repositioning and redeveloping retail space to meet expectations of today and tomorrow’s sophisticated shoppers
> - Improved Main Entry and renovation of Rainbow Drive
> - Major renovation of the open-air Front Desk area
> - Development of the new Super Pool and new Hau Tree Bar
> - Improvements to the Tapa Pool and Tapa Café
> - Development of two new timeshare towers that will mean an additional estimated 550 timeshare units within the Village, one tower will be located over the existing bus loading area and the second will be built over a newly redeveloped Rainbow Bazaar.
>
> The purpose of the CIA is to gather information about the Project area and its surroundings through research and interviews with individuals that are knowledgeable about this area in order to assess potential impacts to the cultural resources, cultural practices and beliefs identified as a result of the planned Project. We are seeking your *kōkua* and guidance regarding the following aspects of our study:

- **General history and present and past land use of the Project area. Although the redevelopment will be within the boundaries as stated above, this study will include the entire *ahupua‘a* of Waikīkī.**
- **Knowledge of cultural sites which may be impacted by future development of the Project area - for example, historic sites, archaeological sites, and burials.**
- **Knowledge of traditional gathering practices in the Project area, both past and ongoing.**
- **Cultural associations of the Project area, such as legends and traditional uses.**
- **Referrals of *kūpuna* or elders and *kama‘āina* who might be willing to share their cultural knowledge of the Project area and the surrounding *ahupua‘a* lands.**
- **Due to the sensitive nature regarding past encounters with *iwi kūpuna* or ancestral remains discovered and reinterred on the Hilton Hawaiian Village property, *mana‘o* regarding *iwi kūpuna* and the existing reinterment site will be greatly appreciated.**
- **Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the Project area.**

6.1 Community Consultation Effort

Several attempts were made by mail, email and telephone to contact individuals, organizations, and agencies apposite to the subject CIA. The summary of consultations is presented in Table 4.

Table 4. Summary of Community Consultation

Name	Affiliation, Background	Comments
Agard, Louis	Kahea Environmental Alliance. Former fisherman	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Ahlo, Charles	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Ailā, William	Hui Mālama I Nā Kūpuna ‘O Hawai‘i Nei	CSH sent community outreach letter and figures on April 9, 2010. Mr. Ailā responded on April 12, 2010 suggesting that a complete archeological survey be conducted before any design or construction occurs so that any inadvertent *kūpuna* discoveries can be avoided by construction-related activities.
Among, Les A.	Waikīkī Neighborhood Board Sub-district 1-Chair	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.

Name	Affiliation, Background	Comments
Apaka, Jeff	Waikīkī Neighborhood Board Sub-district 2-Chair	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Arcalas, Cara	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned to CSH on April 13, 2010.
Ayau, Halealoha	Hui Mālama I Nā Kūpuna o Hawaiʻi Nei, Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Bates, Cline	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Bates, Keʻala	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Battle, Cherie Kahealani Keohokālole	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Becket, Jan	Hawaiian historian, author and photographer	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Bissen, Tony	Cultural Historian, Moana Surfrider Hotel	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Blaisdell, Dr. Kekuni	Hawaiian community activist	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Boyd, Manu	Cultural Director, Royal Hawaiian Shopping Center	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Bridges, Cy	Native Hawaiian Hospitality Association president	Recommended by SHPD, CSH contacted Mr. Bridges on June 28, 2010. Mr. Bridges stated that he did not have knowledge of the Project area.
Brown, Desoto	Bishop Museum Archivist	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Cayan, Phyllis, “Coochie”	History and Culture Branch Chief, SHPD	CSH sent community outreach letter and figures on April 9, 2010. See SHPD response below in Figure 28.
Cazimero, Anna Kaʻolelo Machado	Waikīkī musician and *kupuna* (elder)	CSH Sent letter on June 21, 2010. See complete interview in Section 7 below.

Name	Affiliation, Background	Comments
Cullen, Betsy Paoa	Waikīkī/Kālia *kupuna*	CSH sent community outreach letter and figures on August 17, 2010.
Del Toro, Benjamin	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Del Toro, Daniel	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Del Toro, Rachel	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Del Toro, Samuel	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Diamond, Van Horn	Waikīkī cultural descendant, former OIBC Chair	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010. See complete interview in Section 7 below.
Downing, George	Save Our Surf Organization, Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Falemei, Hina Wong	OIBC Vice Chair, Hālau Lōkahi Hawaiian Immersion School *kumu*	CSH sent community outreach letter and figures on April 9 and May 25, 2010.
Finley, Bob	Waikīkī Neighborhood Board Sub-district 9-Chair	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Gomes, Phoebe	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Gomes, Robin	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Gora, Amelia K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 25, 2010.
Grace, Nadine	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Harris, Cy K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Hatchie, Andrew	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.

Name	Affiliation, Background	Comments
Hukiku, Clarence Moses	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Ka‘awakauo, Emma	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kahanamoku, Samuel A.	Waikīkī/Kālia *kupuna*	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Kaleikini, Ali‘ikaua	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kaleikini, Kala	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kaleikini, No‘eau	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kaleikini, Paulette	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kam, Thelma	Cultural Director, Sheraton Waikīkī	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana‘āina, Betty	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana‘āina, Kīhei	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana‘āina, Luther	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana‘āina, Michelle	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana‘āina, Noelani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana‘āina, Regina	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana‘āina, Vicky	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keana‘āina, Wilsam	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kekaula, Ashford	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Kekaula, Mary K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keli‘inoi, Kalahikiola	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keli‘inoi, Moani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keli‘ipa‘akaua, Chase	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keli‘ipa‘akaua, Justin	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Adrian K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Dennis Ka‘imina‘auao	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Emalia E.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, James Hoapili	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Jeanine Leikeonaona	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Joseph Moses Keaweaheulu	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Keohokālole, Lori Lani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kihikihi, Kauna	Waikīkī cultural historian, E Noa Tours	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kini, Debbie (Norman)	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kini, Nalani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Koko, Kanaloa	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Krewson-Reck, Sylvia	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, 2010. See complete interview in Section 7 below.
Kruse, T. Kehaulani	OIBC	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Kuhea, Kealoha	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 25, 2010.
Kuloloio, Manuel	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Lew, Haumea	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Lindsey, Keola	OHA	CSH sent community outreach letter and figures on April 9, 2010. See OHA response below in Figure 29.
Lopes, Kamahaʻo	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Lopes, Leinaʻala (Moses-Hukiku)	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Lopes, Puahone Kini	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Luka, Alika	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Mamac, Violet L. Medeiros	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
McDonald, Ruby Keanaʻāina	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jr., Clarence	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010. See complete interview in Section 7 below.
Medeiros, Sr., Clarence	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Medeiros, David	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jacob L.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jaimison K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jayla A.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Jim	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Kareen K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Lincoln K.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Medeiros, Roland	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Miller, ʻIhilani Silva	Entertainer, Sheraton Moana Surfrider	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Naguwa, Joan	Executive Director, Waikīkī Community Center	CSH sent community outreach letter and figures on April 9, May 3 and May 25, 2010.
Nāmuʻo, Clyde	Administrator, OHA	CSH sent community outreach letter and figures on April 9, 2010. See OHA response below in Figure 29.
Napoleon, Nanette	Hawaiian historian, writer and researcher	Recommended by SHPD, CSH contacted Ms. Napoleon on June 28, 2010. Ms. Napoleon stated that she did not have knowledge of the Project area.
Nobrega, Malia	President, Waikīkī Hawaiian Civic Club	CSH sent community outreach letter and figures on April 9, May 3 and May 25, 2010.
Norman, Carolyn	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 4 and May 25, 2010.
Norman, Eileen	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Norman, Kaleo	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Norman, Keli‘inui	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Norman, Theodore	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Olds, Nalani	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Paglinawan, Richard	Queen Emma Trust, Lua expert	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Paoa, Clarke	Waikīkī/Kālia *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010. See complete interview in Section 7 below.
Papa, Jr., Richard Likeke	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Pascua, Bruce H.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Peters, David	Queen Lili‘uokalani Trustee	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Rash, Regina	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Rochlen, Lillian Kenuenue Kaeo	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Roy, Corbett	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Shirai, Jacqueline	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9 and May 25, 2010.
Shirai, Jr., Thomas T.	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9 and May 25, 2010.
Souza, William D.	Royal Order of Kamehameha, Kūhiō Chapter	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Spinney, Charles	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

Name	Affiliation, Background	Comments
Sterling, Joanne Kahanamoku	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, 2010. See tribute in Section 7.3.
Suzuki, Ashley	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Suzuki, Kimberly	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Takaki, Miles	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Takaki, Moses	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Takaki, Tracy	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Takizawa, Lorna Medeiros	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 17, 2010.
Theone, Nicole Gulia	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, 2010. Letter and figures were returned on April 13, 2010.
Wagner, Pat (Low)	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Waikīkī Community Center Kūpuna	*Kupuna* center	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Williams, Evern	Waikīkī *kupuna*	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.
Yokooji, Dayleen	Waikīkī cultural descendant	CSH sent community outreach letter and figures on April 9, May 3 and May 24, 2010.

6.2 Written Responses

The SHPD stated the following in writing to CSH regarding the proposed Project in a letter dated April 19, 2010 (Figure 28): (1) although the Project area has been extensively developed, burials have been documented in and near the proposed Project area and other, as-yet undocumented burials may be discovered during construction; (2) additional cultural resources may still be present in subsurface contexts, particularly resources associated with Native Hawaiian families known to have lived in and near the Project area in historic times, including the Kahanamoku, Paoa and Harbottle ʻOhana; (3) the Paoa-Kahanamoku family compound used to be located in the area of Paoa Lane; (4) the SHPD-History and Culture Branch is concerned that all potential access and gathering rights to the Project area be maintained for ceremonial and other uses (e.g., surfing, fishing and other recreation): (5) Nalani Olds, Van Diamond, Betsy Paoa Cullen, Nanette Napolean and Cy Bridges should be contact for their *manaʻo* (thoughts, ideas).

The OHA stated the following in writing to CSH regarding the proposed Project in a letter dated April 28, 2010 (Figure 29): (1) the area was once home to the Kahanamoku, Paoa and Harbottle ʻOhana, who have ancestral connections to lands in and near the Project area; (2) these families may be able to share knowledge about cultural resources and *moʻolelo* associated with the Project area; (3) many burials have been documented in and near the proposed Project area and, if additional burials or other significant cultural resources are found during construction, CSH will stop work, inform the proper agencies and follow applicable law; (4) Native Hawaiian traditional and customary gathering, access and use rights should not be restricted; if safety issues preclude any of these, alternative access routes should be provided.

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

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

April 19, 2010

LOG NO: 2010.1789
DOC. NO: 1004PC008

MEMORANDUM

TO: Brian Kawika Cruz, Cultural Researcher
Momi Wheeler, Cultural Researcher
Cultural Surveys Hawai'i, P.O. Box 1114, Kailua,Hawai'i 96734

FROM: Phyllis Coochie Cayan, History and Culture Branch Chief

Phyllis Coochie Cayan

Subject: Cultural Impact Assessment (CIA) for the Proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project, Waikiki Ahupua'a, Honolulu (Kona) District, O'ahu Island. Multiple TMK.

Mahalo for the opportunity to comment on a cultural impact assessment for the proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project in Waikiki covering multiple TMKs within the hotel's property located at the 'ewa end of Waikiki bounded by Kahanamoku Street to the northwest, Ala Moana Boulevard to the north, Kalia Road to the northeast, Paoa Lane to the southeast, and Waikiki Beach and the Pacific Ocean to the west and south.

The project area is highly developed for its hotel activities and there have been inadvertent burials found when work was done as part of the upgrade of the roads, the adjacent buildings and the current hotel plan. The department is concerned that there may be more unseen and/or unknown cultural resources as this was a rich cultural area prior to the hotel industry when large Hawaiian families (i.e., Kahanamoku, Paoa, Harbottle) populated the area especially the Paoa-Kahanamoku family compound that use to be in the area of Paoa Lane.

Part of SHPD's cultural concerns would be any inadvertent burials exposed from ground disturbances at the proposed project area as well as any ceremonial use, all access and gathering rights to the ocean including surfing, fishing, and other recreational uses. The SHPD archaeology comments will be separate from this letter.

Some folks who may have been helpful or able to refer others are:

• Nalani Olds		Phone: 808.261.1171
• Van Diamond	1523-F Halekula Way, Honolulu, 96822	Phone: 808.943-8674
• Betsy Paoa Cullen	95-168 Kahela Street Mililani, 96789	Phone: 808-623-4994
• Nanette Napoleon	Email: nanetten@hawaii.rr.com	Phone: 808-261-0705
• Cy Bridges	P.O. Box 94 Hauula, 96717	Phone: 808-293-3066

Any questions, please call me at 808-692-8015 or via email Phyllis.L.Cayan@hawaii.gov

C: Nancy McMahon, State Archaeologist
All referrals with mailing information above

Figure 28. SHPD response letter dated April 19, 2010

PHONE (808) 594-1888 FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD10/4932

April 28, 2010

Brian Kawika Cruz, CSH Cultural Researcher
Momi Wheeler, CSH Cultural Researcher
Cultural Research Specialist
Cultural Surveys Hawai'i, Inc.
P.O. Box 1114
Kailua, Hawai'i 96734

RE: Cultural Impact Assessment consultation
Hilton Hawaiian Village Resort Master Plan Improvement Project
Waikīkī Ahupua'a, Kona District, O'ahu
Tax Map Key: Multiple

Aloha e Mr. Cruz and Ms. Wheeler:

The Office of Hawaiian Affairs (OHA) is in receipt of your April 9, 2010 letter initiating consultation and seeking comments ahead of a cultural impact assessment (assessment) for the Hilton Hawaiian Village Resort and Spa Master Plan Improvement Project. Based on the information contained in your letter, the area of interest is within the Hilton Hawaiian Village's approximate 22 acre property and is expected to be completed within 10 years. Your letter also mentions the improvements will include: Improvements to the main entry, the streetscape along Kalia road, Tapa pool, and Tapa Café; major renovations to the Front Desk area and Rainbow Drive; developments of a new Super Pool and new Hau Tree Bar, and two new timeshare towers to include 550 timeshare units; and finally, repositioning and redeveloping retail space and retail outlets.

As your firm has an extensive work history in Waikīkī, we are sure you are familiar with the mo'olelo associated to this area, cultural practices that have occurred, and families who have ancestral ties to the assessment area. The Kahanamoku, Paoa, and the Harbottle 'ohana originally resided from this area and may be able to share mo'olelo and cultural practices related to their lineage.

OHA notes that the Waikīkī area has been known to yield many unmarked Native Hawaiian burial sites. We therefore request the applicant's assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during project activities, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Brian Kawika Cruz
Momi Wheeler
Cultural Surveys Hawai`i
April 28, 2010
Page 2 of 2

Also, please note that Native Hawaiian traditional and customary gathering, access and use rights should not be restricted, except as necessary to ensure safety. If such-related restrictions are put in place, alternate access routes must be provided.

Thank you for initiating consultation at this early stage and we look forward to the opportunity to review the completed assessment. Should you have any questions, please contact Kathryn Keala at 594-0272 or kathyk@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

Figure 29. OHA response letter dated April 28, 2010

Section 7 Summaries of Kama‘āina “Talk-Story” Interviews

7.1 Overview

Kama‘āina and *kūpuna* with knowledge of the proposed Project and Project area participated in “talk-story” sessions for this CIA. Interviews for this study were conducted in May/June, 2010. CSH attempted to contact 123 individuals for this CIA (see Table 4); ten individuals responded and five of these *kūpuna* and/or *kama‘āina* participated in formal “talk-story” interviews for more in-depth contributions to the CIA. CSH initiated the “talk-story” sessions with questions from the following five broad categories: Traditional and Customary Resources and Practices, Religious and Spiritual Resources and Practices, Freshwater and Marine Resources and Practices, Burials, Trails and Cultural and Historic Properties. Brief backgrounds of participants’ “talk-story” sessions and their comments and concerns about the proposed Project area are presented below.

7.2 Acknowledgements

The authors and researchers of this report extend our deep appreciation to everyone who took time to speak and share their *mana‘o* with CSH whether in “talk-story” interviews or brief consultations, including contacts who opted *not* to contribute to the current CIA, but nevertheless spent time explaining their position on the proposed projects. We request that if these interviews are used in future documents, the words of contributors are reproduced accurately and not in any way altered, and that if large excerpts from interviews are used, report preparers obtain the express written consent of the interviewee/s.

7.3 Tribute to Aunty Jo-Anne Kahanamoku Sterling

CSH had the distinct honor and pleasure of interviewing Aunty Jo-Anne Kahanamoku Sterling for past CIA projects, including the proposed Hilton Hawaiian Village Resort and Spa’s Village Master Plan Improvements Project. Aunty Kahanamoku Sterling kindly invited CSH into her home on May 27, 2010 in Kailua-Kona to share her *mana‘o* regarding this Project. The always gracious *kupuna* shared *mo‘olelo* with CSH on a variety of topics ranging from her early childhood in Kālia, to gathering *limu* in Waikīkī, and to her days on the renowned voyaging canoe Hōkūle‘a. Sadly, on June 11, 2010, Aunty Kahanamoku Sterling passed away at the age of 80 in Kailua-Kona, the same day CSH was scheduled to be at her home to go over transcripts of her May 27 interview. She indicated to CSH prior to the scheduled meeting on June 11 that she wasn’t feeling well. CSH planned to reschedule that meeting until Aunty Kahanamoku Sterling was feeling better. Later that day in June, she passed away. Aunty Kahanamoku Sterling never had a chance to approve her interview for this report and out of respect for her and her *‘ohana*, the transcripts for her interview and a photograph taken of her during the May 27, 2010 interview have been sent to her family as a piece of remembrance and a small documentation of her legacy. CSH mourns the loss of Aunty Kahanamoku Sterling – our friend, our aunty, our *kumu* (teacher) and the embodiment of a Hawaiian cultural practitioner. CSH is working with Aunty Kahanamoku Sterling’s *‘ohana* to ascertain whether it is permissible or appropriate for the interview conducted at her home on May 27, 2010 to be included in the final version of the current CIA.

7.4 Anna Ka‘olelo Machado Cazimero

Mrs. Anna Ka‘olelo Machado Cazimero, a retired musician and Waikīkī *kupuna*, was interviewed by CSH on June 21, 2010 at the Lunalilo Home Adult Day Care Center in Hawai‘i Kai. She was born to parents Manuel Ka‘olelo and Sarah Koleka Kuhaupi‘o on August 28, 1920 in Kailua-Kona on the island of Hawai‘i.

Mrs. Cazimero spent her early childhood in Kailua-Kona in an area called Hōlualoa Makai. She explained that there were two areas of Hōlualoa, one called Hōlualoa Makai, located in the coastal area of Kailua-Kona, and the other Hōlualoa Mauka, located in the uplands of Kailua-Kona. Today there is no Hōlualoa Makai. During her teens and early adulthood, Mrs. Cazimero spent some of her time sorting coffee beans at the Kona Coffee Mill in Kailua-Kona. She noted that little children went to work with their parents because there were no babysitters, so children at a very young age also worked at odd tasks and were paid a small amount by the coffee companies. At times, she also worked in the fields picking coffee beans for what she considered small pay but still financially worthwhile because things were much cheaper back then.

Mrs. Cazimero explained that her family’s home in Hōlualoa, like other homes of Hawaiian families in the area, usually had some instrument in the house like a guitar or *‘ukulele*. At an early age, Mrs. Cazimero learned to play the various musical instruments at her home, although she insists she had no formal training. She learned to sing and to play the instruments by “ear,” a method of learning and practicing music by listening to a song and replicating the melody on an instrument or by voice without actually knowing what chords are that are being played. To help her learn and understand the Hawaiian songs that were being played by other musicians, her family spoke both Hawaiian and English. By the time she was in her early twenties, Mrs. Cazimero had acquired more than enough musical talent to join the musicians union. She began playing music and singing professionally soon after.

At the age of 20, Mrs. Cazimero relocated to O‘ahu to seek job opportunities in the musical industry in Waikīkī. She recalled catching a ride on a cattle ship that frequently traveled between islands for five dollars, an activity affordable to and commonly practiced by local people. The two cattle ships she recalled were the *Humu‘ula* and the *Hawai‘i*. During the trips on the cattle ships, where everyone slept on deck with the cattle, Mrs. Cazimero recalled playing music, the practice of *kanikapila* (to play music together), aboard the ship with other musicians. She states that the atmosphere on the deck of the ship was like a big party and lots of fun.

One of her first gigs was playing for the Kodak Hula Show in Waikīkī. The Kodak Hula Show officially began March 7, 1937 in Waikīkī. It was created by Fritz Herman, then vice-president and manager of Kodak Hawai‘i, to create an opportunity for tourist to photograph *hula* dancers in the daytime. Mrs. Cazimero was part of the Kodak Hula Show at Sans Souci Beach near the Natatorium in Waikīkī.

Mrs. Cazimero continued to play for the Kodak Hula Show until it finally ended in 2002 after a 65 year run in the islands. Instruments played by Mrs. Cazimero include *‘ukulele*, guitar and the stand-up bass; as well as vocals. She recalled that the show, held during daylight hours, was in an outdoor setting in the sun that was hot for the show’s cast.

During her early stint in Waikīkī with the Kodak Hula Show, Mrs. Cazimero was residing at 411e Kapahulu Avenue, minutes from the Waikīkī Beach. She recalled the December 7, 1941 bombing of Pearl Harbor by Japan, and how soon after, blackout laws were imposed by the U.S. military. She continued by sharing that no light was allowed to escape her house during the evening time or a night watchman would come to the house and reprimand her family for violations of the war-imposed blackout laws.

Soon after the historic attack on Pearl Harbor, Mrs. Cazimero found herself working at the Pearl Harbor Naval Yard building ammunition for the war effort of the U.S. military. She explained that she would take the bus early in the morning from Waikīkī and make her way to Pearl Harbor. Once there, she would board a ferry to get to Ford Island. In the factory where she worked, it was required that she have on her at all times her government-issued gas mask or she would not be allowed to work. The U.S. military was concerned for a chemical attack in the islands by Japan, so Mrs. Cazimero made sure she had her gas mask everyday she went to work at Pearl Harbor.

During the time she resided in Waikīkī, Mrs. Cazimero recalled gathering *limu* (seaweed) and catching fish along Waikīkī’s shores. The type of *limu* she collected was *limu līpe‘epe‘e* (see Appendix B for common and scientific plant and animal names mentioned by community participants), a much-desired edible red seaweed found near-shore in basaltic rocks and coral reefs throughout the Hawaiian islands. She recalled picking only enough *limu* for her family’s next meal and not over picking because the practice was to pick only as much as would be consumed for one meal. She noted that all practitioners knew that the ocean was an icebox that would hold the *limu* until the next meal, so picking more than was needed made no sense. She says this particular type of *limu* went well with all kinds of dishes.

Mrs. Cazimero recalled catching *‘upāpalu* in Waikīkī, a type of cardinal fish. *‘Upāpalu* is usually caught at night when the moon is bright, thus earning the nickname “moonfish” and its length is commonly three to five inches. This fish was eaten either raw or cooked, and was a favorite of her mother-in-law at the time, Mrs. Amelia Machado, with whom she lived. Mrs. Cazimero also used to gather *wana*, sea urchin varieties with sharp pointed spikes, and *hā‘uke‘uke*, a type of shingle urchin used for both food and medicine.

One story shared by Mrs. Cazimero involved a dream she had about being given a gift by the sea. The day after she had the dream, she went to Sans Souci Beach to pick *limu*. The area, also known as Kaimana Beach, was during Mrs. Cazimero’s time, a narrow strip of rocky sand with a wide reef where local residents gathered octopus, *limu*, and other seafood. She typically wore *tabis*, (*tabi* is a Japanese shoe that can be used to walk on reefs) and a wide-brimmed hat secured with a string tied under her chin. That day, while she was out on the reef, a strong wind came and blew her hat off. It flipped over and landed on the shallow reef and a fish (an *uhu*) jumped into her hat. Immediately she stopped gathering *limu*, picked up her hat with the fish in it, and went home. She gave the fish to her mother-in-law and told her about the dream. Her mother-in-law cooked the fish and they had it for dinner. She later told Mrs. Cazimero that the fish was a gift from the ocean and that the gift came for a reason, so she should be mindful that something else would likely happen. Several days later, Mrs. Cazimero went to the beach again to pick *limu*, but when she entered the water she found that the bottom of her feet hurt, so she went back on shore and discovered that the soles of her feet were cracking. She went to the doctor, who took some tests. Shortly afterward he determined that Mrs. Cazimero had become allergic to salt water. After that, she stopped going to the beach to gather *limu* and other seafood.

Now residing in Hawai‘i Kai at the Lunalilo Home Adult Day Care Center with other *kūpuna*, Mrs. Cazimero expressed her enjoyment of sharing her life stories with CSH. She spent over 50 years of her life in Waikīkī. She has worked with numerous musicians throughout her career such as Bill Lincoln, Van Horn Diamond, Lena Machado and John Alameida. Mrs. Cazimero was part of a group called the Diamond Head Trio, which included herself, Richard Wells and Doreen Lindsey. Her late husband, Bill Cazimero, is the father of the famous Hawaiian musical duo *The Brothers Cazimero*.

When Mrs. Cazimero was asked about the proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project, she responded that she did not have any problem with the proposed Project.

7.5 Clarence Medeiros, Jr.

CSH met with Mr. Clarence Medeiros, Jr. on April 15, 2010, in Kainaliu, Hawai‘i. He graciously gave his permission to use a previous interview regarding Waikīkī and the proposed redevelopment of the Diamond Head Tower for this proposed Project, the Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project in the Waikīkī Ahupua‘a. In addition to his previous statement, Mr. Medeiros also provided several comments directly related to the current Hilton Project.

CSH first interviewed Mr. Medeiros, Jr. on October 20, 2008. Born in 1952 in South Kona, Mr. Medeiros has four different connections to Waikīkī, each one meticulously documented by him. A war veteran who served in the U.S. Army from 1969 to 1972 with a tour of duty in Vietnam from 1970 to 1971, Mr. Medeiros owns a coffee, taro, and macadamia nut farm on Hawai‘i Island. Mr. Medeiros has been married to his wife Nellie for 40 years and they have two children: Jacob, 36, and Kareen, 38.

The importance of Hawaiian genealogy to traditional Hawaiians cannot be underestimated. For many *Kānaka maoli* (Native Hawaiians), ancestors' names have *mana* (supernatural or divine power). For Mr. Medeiros, the interest in his genealogy was piqued when as a young boy, when he came across a picture of his grandmother, Violet Leihulu Mokuohai Parker. Grandma Violet was tall, fair and had green eyes. Inside, however, she was pure Hawaiian.

During the April 15, 2010 interview, Mr. Medeiros noted that his Portuguese side comes from Waikīkī, one of the four genealogical connections to the area which he elaborated in the previous interview. He has a cousin who also plays music in the area since 2000.

For years now, Mr. Medeiros has carefully researched his genealogy. When he takes his vacations, he travels to the countryside of China, Portugal, and Germany as well as all over the United States to find family. First he locates them on paper, and then he tracks them down. "I'm successful, because there are a lot of records out there," he said. "The hardest record is Hawaiian, because it wasn't written for *maka‘āinana* (commoner)." However, because Mr. Medeiros' ancestors had ties to the *aliʻi*, there are documents with their names which he has been able to use in constructing his family tree.

Describing the long process of research and hard work to identify his ancestors, Mr. Medeiros stated:

> People when they take vacations, they visit a country on their list. My list is different. So when I go to a country, I look for my ethnicity. I base my vacations on my ethnicity. That makes it exciting. So I do all this research long before I go, and I have to learn the basic language, and when I go there, I hunt them down to where they live and reside. The preparation is a lot: church and government records, immigration records, passport information, ships' manifests, health and vital records. I get maps, get tapes to study the language. Maps to know the street and to break it down, zero in on the grid.

Mr. Medeiros acknowledged that he has been exposed to about six languages during different times of his life, but stressed modestly that his knowledge during those times was just enough "to get by." The languages he is familiar with include Hawaiian (he grew up with parents that were fluent in the language and his grandson was a student at Ke Kula o Ehunuikaimalino); German (he learned the language as a soldier stationed in Frankfurt and Hanau); Japanese (he learned some of the language from his Japanese-born brother-in-law who came into the family unable to speak fluent English); and Chinese and Portuguese (he learned these languages for his trips so he could "converse" when travelling and searching for his family roots).

The first connection Mr. Medeiros has with Waikīkī is through his great-great-great grandfather, Samuel Puhalahua. Regarding the first connection, Mr. Medeiros documented that LCA 1268 was awarded to Nakai. A land commission award, it involved 1.60 acres and 23/100 acres in Waikīkī *waena* (middle), not at the beach area of Waikīkī Ahupuaʻa. The land consisted of a *loʻi*. Nakai conveyed the land to William Smith who later conveyed it to Naomi Nakuapa Puhalahua, the wife of Kuwalu Puhalahua. Kuwalu, the father of Samuel Puhalahua, was Mr. Medeiros' great-great-great-great grandfather.

Samuel Puhalahua married Kanika and they had a son named John Mokuohai Puhalahua, the great-great-grandfather of Mr. Medeiros. Mr. Puhalahua married a half-English, half-Hawaiian woman named Kaehamalaole Elemakule Clark. They had one child, Abigail Mokuohai, who is the great-grandmother of Mr. Medeiros. Abigail married William Parker, Jr. and they had two children, one of them was Violet Leihulu Mokuohai Parker, who was the grandmother of Mr. Medeiros.

Mr. Medeiros grew up learning about his grandmother through stories from his parents, *kupuna*, and from his grand-uncle, the famed canoe carver Charles Mokuohai Parker, the brother of Grandma Violet. Grand-uncle Charles made canoes for canoe clubs throughout the islands. He resided in Keʻei *mauka* on Hawaiʻi Island and he taught his nephew, Clarence A. Medeiros, Sr., the father of Mr. Medeiros, to carve canoes. Because he was Clarence, Sr.'s first-born son, Mr. Medeiros accompanied his father everywhere. He was present when his father learned how to carve canoes, and in between watching and helping, he also learned. Grand-uncle Charles made *ahupuaʻa* stone walls and cattle pens in ranches and shared Hawaiian history, culture and stories with his nephew Clarence, Sr. and Clarence, Jr. Grand-uncle Charles was frequently invited to blessing ceremonies in Waikīkī because he was the builder of many strong and beautiful canoes. He also owned the Royal Poi Factory in Keʻei and farmed his own 20 plus-acre taro patch. In addition, grand-uncle Charles owned a store at Kauhako Bay close to where his great-grandfather, Henry Clarke, had a store back in the 1860s. Mr. Medeiros noted that Kauhako Bay is incorrectly called Hoʻokena Beach – the beach area is actually located in the *ahupuaʻa* of Kauhako and Hoʻokena is the *ahupuaʻa* to the north.

According to Mr. Medeiros, Grandma Violet was so pretty that she was called "Lily of the Valley" by friends and relatives. She married Frank C. Medeiros, and they had eight children. She died at the age of 43, a few months after the 1950 lava flow in South Kona. Speaking about the lava flow, Mr. Medeiros described how three fingers of lava flowed down the inhabited areas. The first lava flow, which crossed the *ahupuaʻa* of Honokua and Pāhoehoe 1, crossed Highway 11 shortly after 12:30 a.m. Grandma Violet and Grandpa Frank owned a building that housed a gas station and a post office where Grandma Violet was the postmistress. They also owned a home, farm and ranch which were destroyed by the hot lava along with the gas station and post office. The lava flow also ruined the Lincoln coffee factory and some homes.

The next day, the father of Mr. Medeiros, Clarence Medeiros Sr., Cecil Walker, and Gilbert Medeiros, tied strips of rubber from old tires onto their shoes and sprinted on the still-hot lava to help release animals owned by the Magoon family and others as well as to help rescue families who were trapped between the two flows. Shortly after, the second lava flow crossed the *ahupuaʻa* of Pāhoehoe. Bruised, dazed and bleeding, people hurried toward the cliffs in order to evacuate to waiting boats. The third flow hit the *ahupuaʻa* of Kaʻapuna. It destroyed the Ohia Lodge that was owned by Mr. Redfearn, whose wife was a relative of Mr. Medeiros' mother. Mr. Medeiros and other relatives believe that it was against this backdrop of stress and anxiety caused by the lava flow that led to the death of Grandma Violet a few months later.

The second connection Mr. Medeiros has to Waikīkī is from his mother's side of the family. His great-grandfather, Zen (a.k.a. Zane), was Chinese and arrived in Hawaiʻi in 1888. He lived in Waikīkī working with relatives planting rice and taro and working in the Sun/Soong family stores. His full name was Zen Man Sing and his mother's maiden name was Sun/Soong. Great-grandfather Zen later came to Kailua-Kona and lived in Hoʻokena and Kalihiki. There he met Mr. Medeiros' great-grandmother, Kaaumoana Niau. From this union, Mr. Medeiros' grandma, Annie, was born. Grandma Annie married her first husband, Charles Hua, the grandfather of Mr. Medeiros. After his death, Annie married Charles Weeks.

Regarding the third connection to Waikīkī, Mr. Medeiros narrated that his grand-aunt Miriam Peleuli Crowingburg Amalu owned several parcels of choice land in Waikīkī. She and Mr. Medeiros shared the same bloodline through a relative named Kameeiamoku. Miriam was a close friend and relative of Queen Liliʻuokalani and often visited the palace to see the queen. She later had her properties auctioned off and conveyed to others. It was from Miriam's grandson that some properties were conveyed to Mr. Medeiros. These properties included 1¼ of an acre in Hoʻokena Beach and 300-plus acres in Waiea on Hawaiʻi Island.

Mr. Medeiros continues to hunt and use this very land. In his spare time, he tends to the preservation of the Ala Kahakai trail in South Kona, which he believes to have been built in the 1600s, and the Ala Loa Trail in Hoʻokena built in the 1800s, which was constructed for hoof animals and wheel traffic.

His fourth connection to the *ahupua‘a* of Waikīkī is from the Portuguese side of his family. From 1958 to 1959, Mr. Medeiros went to school in O‘ahu. He first lived with his great-grandmother Mary Costa Pimental. Great-grandma Mary was married three times: her first marriage was to Marion Medeiros, whose son was Frank Medeiros. Frank Medeiros had married Grandma Violet, who was a direct descendant of Samuel Puhalahua who owned land in the middle part of Waikīkī (see above).

Great-grandma Mary’s maiden name was “Pacheco” and she came from a Portuguese-Italian background. During the year he visited and lived with them in their home on Birch St., Mr. Medeiros would watch his great-grandpa by marriage, Frank Pimental, play *bocci* (ancient game stemming from the Roman Empire which resembled bowling) along with other elderly men. He and great-grandma Mary would bake bread every Thursday. All the great-aunts would converge to help with the baking of bread and *malassadas* (sweet doughnuts originating from a Portuguese colony), and they would hug and squeeze their eight-year-old great-nephew until he was blue.

Recalling the differences between his Hawaiian and Portuguese sides of the family, Mr. Medeiros said:

> What was fascinating to me, when we first moved there, is that my father would have to ask her [great-grandma Mary] to make rice for him and me. She would say, “That for the two ‘*kanaks* [*kanaka* or person].’”

With his great-grandma, he lived a Portuguese life, a Catholic life, where making rice was a big deal. “My dad would make *poi* (cooked taro), and they would be surprised to see *poi* in the ice box,” Mr. Medeiros said.

While his father worked for the survey of the Wilson Tunnel, he went to Lanakila School in Kalihi. His father also worked part-time for former Mayor Frank Fasi as a truck driver. Mr. Medeiros remembered old landmarks of Honolulu during his time there, like the old Honolulu Stadium and Ft. DeRussy where his great-grandpa played *bocci*. In Kalihi, there was a wigwam store that is no longer there. The remaining eight months of that year, Mr. Medeiros lived with his father’s half-sister who was also named Violet. Her neighbors were relatives of Mr. Medeiros’ mother. Kalihi had a river, and there he used to catch tilapia with relatives and friends.

When asked what he thinks about the proposed improvements at the Hilton Hawaiian Village Resort and Spa on April 15, 2010, Mr. Medeiros states: “I think it is okay. We need the jobs, and if they can make it [the Hilton buildings] stronger, that’s a plus.” Regarding cultural resources in the area, Mr. Medeiros notes that there is a “good chance” of inadvertent finds. This is due to the history of the Project area.

7.6 Clarke Paoa

CSH conducted an interview with Mr. Robert Clarke Paoa on June 15, 2010. Mr. Paoa was born in Kālia in Waikīkī (where the Ilikai Hotel is today) in 1937. He was raised by his parents Malcolm and Ellen Clarke Paoa on their family land just south of the current Project area. Mr. Paoa worked for the Federal Government National Guard. Today he resides in Moanalua Gardens and is a member of the Moanalua Gardens Community Association.

Mr. Paoa specifically commented:

> The family land was obtained during the Māhele of 1848. My Grandfather's name was Henry Hoʻolae Paoa. His father, my great grandfather who went by the name of Paoa, was awarded that land in 1848. Later King David Kalākaua reconveyed the land to Paoa again 1877. We do not know why. It was a legal document. I have not been able to find it. My father and mother purchased the lot *makai* of us from my father's family. The fourth lot down from us was owned by Nainoa Thompson's family the Harbottles. His mother is still alive and his father recently passed. Duke Kahanamoku owned his land but rented it out.
>
> My family and others used to fish in the ocean and gather *limu*. We did not trust fishing in the canal. The Japanese used to fish in the canal for mullet. You see, when war broke out in the 1940s that stopped any kind of cultural practices. When the war came there was black outs, rules and curfew in which it stopped the normal lifestyle.
>
> I am not too familiar with the families in the study area although I do remember the Keaweamahi and the Palimoʻo names and one of the beach boys at that time we called "Tough Bill." His name was George William Keaweamahi and yes, he was tough. If you look in the books written about the old beach boys of Waikīkī he is featured in there.

Mr. Paoa described an area in Kālia known as "Squatter's Ville":

> There were a lot of Hawaiians living in there at that time. The area used to have a nickname "Squatter's Ville," due to many displaced Hawaiians at that time. The area referred to as "Squatter's Ville" was where Ala Moana Park is now. My father told me it used to be an open dump used by the City where they burned all the trash and garbage. Like many dumps it attracted needy people who scavenged the area for items to sell and use. Today we call it "recycling" so the name came about. The area where I was born, present Ilikai Hotel, was owned by the Hobron Estate I believe. In 1940 my parents purchased a house and lot from my Dad's family, the Paoas. This is where the current Kobe Steak House is today. We lived there from 1940 to 1968 then my parents leased it out and moved to Pearl City.
>
> In the 1950s or 1951, where the Kobe's Steak House is today, the road in front of our house [Beach Road, now Ala Moana Boulevard] was changed from two lanes to four lanes. The road work took our entire front yard.
>
> My family was buried where the Princess Kaʻiulani Hotel is today. There was a church there, a branch of Kawaihaʻo Church. The church had a piece of land and plots for different families. Most of the Hawaiians from this area were buried there. They later reinterred them at the Kawaihaʻo Church. Richard Paglinawan can tell you more about that.
>
> It is really too late to interview the elders of that period most of them have passed away. There was man by the name of Warren Nishimoto from the University of

> Hawaiʻi that I worked with before. I led him to families of that period and he did all the oral histories of this area. Some of the names were my Uncle and Aunty Fred Paoa and Mary Paoa Clarke and Rebecca Kahale Kapule. If you can find the oral histories that Warren conducted they will tell you of this area.
>
> I don't remember any sites like *heiau* in this area. There was no pond during my time. It was all filled in. They did build the KHON radio tower in 1947 which is no longer there (looking east of the Project area).

Growing up in the Kālia area, Mr. Paoa recalled an area in Kālia formerly named the "Dog Patch":

> The area that forms part of the Hawaiian Village now had three lanes running from Kālia Rd to the beach and the area had dozens of homes. Originally the area had a lot of *haole* (foreigner) families and over the years they were replaced by locals…part Hawaiians, Portuguese, Chinese, Japanese and a mix of many races. It seems that sometime in the late 1930s, a part Hawaiian lady living nearby referred to the area as the "Dog Patch." I don't know if you ever read the comics… they had a comic strip of Lil Abner who lived in Dog Patch. This was a close nit community despite having fights and disputes and a few bad characters. When WWII came, a lot of single *haole* men who were defense workers moved into the area. Wild drinking parties became common with a lot of loose women who visited. After the war the defense workers moved out and Dog Patch once again flourished! In the mid 1950s Henry Kaiser purchased the area from the ʻEna Estate and began the building of the Hawaiian Village. Many of the former residents still meet at funerals, parties and reunions to celebrate the good old days of Dog Patch. I was a bit too young to know that was going on there until after the war.

Mr. Paoa shared the following passage regarding the April 1, 1946 tsunami generated by a magnitude 7.1 earthquake in the Aleutian Islands that struck the Hawaiian Islands killing 159 people:

> I was 8 years old in 1945; this is how I remember it looking like. I remember the 1946 tidal wave wrecked all the boats in the canal. The canal just rose up and broke all the boats. The buildings were called the Ala Wai Terraces if I remember correctly, but maybe that is the names of the hotels in the Project area today. You will have to check on that.

Mr. Paoa was asked by CSH about the proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project. Mr. Paoa replied with the following:

> I have no more *aloha* for Kālia and Waikīkī as there's been too much change. I realize that change must come but for me it really hurts seeing such drastic changes. No more old landmarks left and the old timers have passed on or moved away.

7.7 Van Horn Diamond

Mr. Van Horn Diamond was interviewed by CSH on June 21, 2010 in Honolulu. He was born and raised in Waikīkī. Mr. Diamond served six years on the Oʻahu Island Burial Council and is the former OIBC chairperson. His family's residence was on Kānekapōlei Street in Waikīkī. Mr. Diamond adds that most of the place names in Waikīkī, including the street names, were associated with Kamehameha I or the *aliʻi* class in general. Kānekapōlei was one of Kamehameha I's wives.

Mr. Diamond was asked about his mother's occupation during his youth:

> My mom was a schoolteacher and played music. My grandmother had a *hula* troupe and her sister had a *hula* troupe. My grandmother's *hula* troupe was the Honolulu Girls. They called it glee clubs at the time. Her sister's one was the Royal Hawaiian Girls Glee Club. The Royal Hawaiian Girls Glee Club was the ones that maintained and performed at the Kodak Hula show all these years.

Mr. Diamond stated this about his childhood home on Kānekapōlei Street:

> It was pretty much urbanized by then. When I was growing up there was a fence line. On the other side of the fence were date trees. And the other side of the fig trees there were bachelors' quarters, Filipino workers for the hotels. And the community shower and there were these banyan trees. That was Supervisor's Road. And where the parking lot is, it connects to Kānekapōlei, that part of the parking lot, there was a platform. It could've been… Now, in retrospect, it could've been a platform for *iwi*, for whatever. What I saw there was, they had like, rotted out, badminton net kind of situation. And they had backboard for basketball. That's all there was. But thinking about it now, it could've been a platform. And the banyan tree was right there.

Mr. Diamond spoke about the electric buses that would run from Waikīkī to Kalihi:

> Where we lived, I go the ball game, I walk home. Cheaper than riding the bus. Take too long the bus. Gotta get on the bus in front of the stadium, go all the way to Pāwaʻa, where Cinerama was, get off there, get on another bus and we'd get on the bus that came from Mānoa, then it'd take you down around by Fisherman's Wharf and come all the way and then up along the Ala Wai. Or take the bus that went right down through Waikīkī and ended up by the Moana Hotel, Moana Surfrider, then walk home. Too long! So we just got off, walk down.

Musicians in Waikīkī during the 1940s and 1950s were unionized already. Mr. Diamond shared some insight into what it was like for his mother being a musician in the union:

> There was a union, but they didn't pay that much attention to it. Some were unionized, some were not. My mom got kicked out of the union because she wouldn't stop playing for her mother. She knew who the union president was and one day she was playing at the Royal Hawaiian Hotel on arrival day, or boat day and the union president showed up. He was wondering what she was doing. She

> said, “Oh, I got kicked out of the union.” So he got her back in. She got back in after she saw him.

Mr. Diamond was asked about *iwi kūpuna* (ancestral remains) in the Waikīkī area that he may have knowledge of:

> Well you know that there’s a memorial situated right in front of the zoo? There’s one right there, in front of the zoo. If you look at it, you’ll see it’s built behind a gate. There’s about, there’s probably about 100 [*iwi kūpuna*]. They’re from all of Waikīkī. There were families that were identified as cultural descendants that took responsibility of the *iwi kūpuna*. Some of the remains that popped up toward the end in the contemporary time, if you recall Mayor Harris, he ran the pipeline along Kalākaua Avenue to upgrade the water line. When he upgraded the water line, they encountered remains; practically all of those remains that were encountered are in that memorial. Can’t miss it, it’s right there. There’s the walk up and got Ghandi’s statue and all that stuff. Right in front of Ghandi’s statue, there’s this memorial. It’s right behind the kiosk, the thing that stands at the intersection at the corner. In back of that you see that there’s a gate and a circular thing, which is the memorial.

Mr. Diamond explained how he became a member and chairperson of the O‘ahu Island Burial Council:

> It all started by accident. Nalani Olds [Waikīkī *kūpuna*] had lineal ties to *iwi* found at Mōkapu [in He‘eia, Kāne‘ohe]. She’s probably the closest one to being a lineal descendant of all the claimants under Federal legislation. And she didn’t want to go alone to a particular meeting so I went as encouragement. As a result of that meeting, several of us who were also tied to Nalani, we all got involved in the repatriation of the *iwi* and we all filed claims to the *iwi* separately. So we got our respective families, so our families are now culturally affiliated with Mōkapu. Since 1999, Mōkapu is the largest single inventory on Oahu of *iwi kūpuna*. So they [*iwi kūpuna*] were repatriated to the families. There were roughly 20 of us families in 1999 that filed claims. They’re [*iwi kūpuna*] still waiting to be buried. So, as a result of Mōkapu, I got involved with the *iwi* situation in Waikīkī. Then, all of a sudden, I got asked to serve on the OIBC. So I said, “I guess so.” I was on for maybe a year, and they needed a chairman. And you know it’s rough if you don’t vote for yourself and you still get to be chairman.

Mr. Diamond continued explaining the role of cultural and lineal descendants for *iwi kūpuna*:

> You see, most of these remains that are found, they’re not necessarily from the family who had land commission awards, they’re from the larger land areas. Like the *iwi* that was found along Kalākaua Avenue, it doesn’t necessarily mean they were from Waikīkī. It just means they were found in Waikīkī. They could’ve come from the sand when they first dug that sand the first time, which was hard. So the state and the feds have different criteria. They’re similar, but different. The feds have, well first of all, you establish yourself as a Native Hawaiian

> organization. Then you identify yourself as being culturally affiliated to the land. If you're lineal, you have to identify the lineal is associated to a particular *iwi*. So that's how the federal works. So there are very many lineal descendents under federal law. The state criteria for descendant recognition one is similar, they have two categories, they actually have three categories, the one that's most pronounced is the lineal and then cultural. Cultural is if you are associated to the area where the *iwi* is found. The third category is a Native Hawaiian organization. And the only one that can file that claim right now is Hui Mālama and OHA because they're listed by the law. My interpretation of how the law works is that they qualify as a Native Hawaiian organization. The Attorney General has interpreted that you have to be specified by the law itself. Because there's nobody that can give you the recognition. I'm saying that the Burial Council can give recognition. Cause the Burial Councils are utilized to give recognition for lineal and cultural descendents. Therefore, they should be able to give recognition for community based organizations. But the Attorney General said no. The Burial Council has no recourse because it doesn't have its own attorney. The Attorney is the Attorney General. They're just caught, so they have to go… It's not bad. There's some people, I call them the crazies…

Mr. Diamond was asked by CSH about the proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project. Mr. Diamond replied with the following:

> I would be very careful regarding this Project because I believe they will discover *iwi kūpuna* for this Project. I just hope they are prepared for that.

7.8 Sylvia Krewson-Reck

CSH Interviewed Mrs. Sylvia Krewson-Reck at her home in Kahaluʻu on the windward side of Oʻahu on March 23, 2010. Aunt Sylvia, as she is affectionately known, was born in 1929. When she was seven years old she and her family moved to Oʻahu to a small home in Kalihi Valley. She grew up in the Waikīkī area beginning at the age of eight. Two years later, she and her siblings were put into the custody of the St. Mary's Orphanage on King Street in Mōʻiliʻili, where they spent the next five years:

> …we were placed in the St. Mary's Orphanage; we attended Lunalilo School in Honolulu. We still had visits from our parents every now and then but we continued to stay at St Mary's. I was lucky enough to be named "Princess Oʻahu" on May 1, 1941 for Lunalilo School…I don't know how that happened but there I was, "Princess Oʻahu" with the flowers and all on May Day.
>
> I remember riding the trolley from the orphanage into Waikīkī. As we rode on McCully Street heading towards Waikīkī, on the left hand side or the Diamond Head side of McCully Street, were all these fishponds and *loʻi* [Figure 30 and Figure 31]. Didn't have all the buildings like now. It was taro and fishponds but I guess they all got filled in.

In 1932, George P. Mossman, an *ʻukulele* maker, opened Lālani Hawaiian Village in Waikīkī to demonstrate traditional Hawaiian music, crafts and *lūʻau* (Hawaiian feast). After spending five years at St. Mary's, Aunt Sylvia attended the Lālani Hawaiian Village in Waikīkī, at the corner of Kalākaua Avenue and Kapahulu Boulevard:

> I became a student at Lālani Hawaiian Village. That's where I started learning about the Hawaiian culture. It was right near the beach in Waikīkī. I believe the person that ran the village was George Mossman. He even created a place in the village that I believe was a *heiau*. Lālani had a very Hawaiian cultural feel to the place. I danced *hula* there. Our *hālau* [*hula* group] was called "Hoʻo Naʻauao Hawaiʻi o Mokīmana." It means "Spread Knowledge of Hawaiʻi." My *kumu hula* was Pualani and Leilani Mossman, they were wonderful people.

While Aunt Sylvia attended Lālani Hawaiian Village, she recalled that sometimes her parents took her to play at Waikīkī beach:

> When my father used to take us kids with him, he would bring us to the beach at Waikīkī. He would hang out at this bar called the Tavern. It was right on the beach, so he'd be at the bar and us kids would be on the beach. So we basically grew up on Waikīkī beach. All the old timers were there. Folks like George Downing and there was this one gentleman named Joseph Kaopuiki [Figure 32]. His nick name was "Scooter Boy." He was known at that time as the surfer who rode the biggest wave on the North Shore. Everyone knew him. He was Cherokee Hawaiian. He was a really close friend of mine, he was a little older than me but we were really close. He would take me tandem surfing all the time. We were best friends but he never made a move on me, I'll never forget that [smiling as she said that]. I think he respected me too much. He was such a good man…quiet…and very respectful.
>
> Anyway, while we were at the beach and my dad was at the Tavern, there was this guy named Richard Kauhi. He was a musician upstairs at the Tavern. He played the piano and sang. He was so good. When I hear his songs now, it brings back those memories, he died very young.

Aunt Sylvia elaborated about the Hawaiian music scene in Waikīkī when she was growing up:

> At night in Waikīkī, there were all these Hawaiian music entertainers. It was before Don Ho's time. Under this big Banyan tree at Kūhiō Beach, was the Kalima Brothers. They used to play for the crowds and there was this bucket that was passed around for people to put money in for the brothers. They were really great musicians. At night, you could hear the music and people would follow the music and that's where the party was.
>
> Gabby Pahinui was also playing. His gig was at this hotel called Niumalu Hotel. He played with Pua Alameida, I remember they were good. It was before Gabby was big time. They played at this dinner and dance place. I used to go there on dates and dance away to their music.

After the illegal overthrow of the Hawaiian Kingdom in 1893, members of the Royal Hawaiian Band visited Ellen Wright Prendergast, a close friend of Queen Liliʻuokalani, and expressed their unhappiness with the takeover of the Hawaiian Kingdom. At her father's home in Kapālama, Ms. Prendergast put the band member's feelings into the song "*Kaulana Nā Pua*," or "Famous are the Children." Today, this song continues to be symbolic of the Hawaiian independence movement. Aunt Sylvia shared a story of Ms. Prendergast during her childhood years:

> I had a classmate and her name was Lorna Prendergast. One day we were invited to go to her home in Kapālama and hang out and play music. When we were in her home, we were talking and stuff and there was a woman in the kitchen. She came out to us and brought us juice or something. Lorna introduced the woman as her grandma Ellen. She was very nice to us and they had a piano in which we played and sang songs. This was in 1947.
>
> One day about ten years ago, I recalled that day in 1947 and it was then that I realized that Lorna's grandmother was Ellen Wright Prendergast, the woman who wrote *Kaulana Nā Pua*. On that day at Lorna's house, we never heard of that song so we just played on the piano and had fun.

Aunt Sylvia was asked by CSH about the proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project and emphatically she replied with the following: "Please stop blocking the views!" She further added that the views she is referring to are the sacred *mauka*/*makai* views that are part of the beautiful landscape of the Waikīkī area.

Figure 30. Photograph of trolley on Waikīkī Road circa 1940 described by Mrs. Krewson-Reck in her interview (photograph courtesy Hawaiʻi State Archives)

Figure 31. View of Diamond Head from McCully Street showing fields of *lo‘i kalo* circa 1940 described by Mrs. Krewson-Reck in her interview (photograph courtesy of Kamehameha Schools’ Baker Collection 1826–1940)

Figure 32. Photograph of Aunt Sylvia Krewson-Reck with Joseph "Scooter Boy" Kaopuiki circa 1945 (photograph courtesy of Aunt Sylvia Krewson-Reck)

Section 8 Cultural Landscape of the Project Area

8.1 Overview

Discussions of specific aspects of traditional Hawaiian culture as they may relate to the Project area are presented below. This section examines cultural resources and practices identified within or in proximity to the subject Project area in the broader context of the encompassing Waikīkī Ahupua‘a landscape. Excerpts from “talk-story” sessions from past and the present cultural studies are incorporated throughout this section where applicable.

8.2 Wahi Pana and Mo‘olelo

There is a large body of oral-historical information about royal residences and other residential compounds belonging to various *ali‘i.* According to Martha Beckwith (1940:383), by the end of the fourteenth century Waikīkī had become “the ruling seat of the chiefs of O‘ahu.” Ma‘ilikukahi, the first *mō‘ī* of O‘ahu, moved the capital of the islands from ‘Ewa and Waialua to Waikīkī in this period. About A.D. 1350, he constructed a *heiau* at Helumoa for the Makahiki festival. Two idols, the long god and the short god, were carried on a circuit of the islands, each carried in the opposite direction and meeting again at Kualoa on the windward coast of O‘ahu. The pre-eminence of Waikīkī continued into the eighteenth century and is confirmed by the decision of Kamehameha, in the midst of unifying control of the islands, to reside there after wresting control of O‘ahu by defeating the island’s chief, Kalanikūpule. Kamehameha’s houses were located near Āpuakēhau Stream in an area in Waikīkī called Pualiilii (Puali‘ili‘i) (‘Ī‘ī 1959:17).

Āpuakēhau Stream is also associated with the “Legend of Kawelo.” This *mo‘olelo* is about two boys born on the same day, Kawelo-lei-makua, called Kawelo, the great nephew of the king of Kaua‘i, and Kawelo-aikanaka, called ‘Aikanaka, the grandson of the king. Kawelo’s older brothers and his parents soon moved from Kaua‘i to live at Waikīkī near the ruling chief of O‘ahu, Kakuhihewa. The older brothers of Kawelo often challenged a famous wrestler living with Kakuhihewa, but they could never beat him. When Kawelo’s older brothers returned from surfing at Kalehuawehe in Waikīkī, they would wash off at Āpuakēhau Stream, from there they would go to the shed where the wrestling bouts were held and test their skill with Kakuhihewa’s strong man. In all their trials, Kaweolo’s brothers were unable to throw him.

While Kawelo was working in the fields, he heard some shouting from the beach, and asked his grandparents, “What is that shouting down yonder?” (Fornander 1918:5). The grandparents answered that his older brothers had just finished surfing and must have challenged the king’s strong man. The shouting indicated one of them must have been thrown. Next day, Kawelo went down to the beach, went surfing with his brothers, and then bathed in the freshwater stream of ‘Āpuakēhau. He challenged the strong man to a match, even though his brothers mocked him, saying “Are you strong enough to meet that man? If we whose bones are older cannot throw him, how much less are the chances of yourself, a mere youngster?” (Fornander 1918:6).

Kawelo won the match, shaming his older brothers so much that they returned to Kaua‘i. In another version (Thrum 1923:154), the strong man was from Halemano [central O‘ahu], and was killed by a mighty blow from Kawelo. The man's body was given to the king of O'ahu, and was carried as a sacrifice to the gods to a *heiau* in Lualualei, Wai'anae.

One story shared by Mrs. Anna Ka'olelo Machado Cazimero involved a dream she had about being given a gift by the sea. The day after she had the dream she went to Sans Souci Beach to pick *limu*. The area, also known as Kaimana Beach, was during Mrs. Cazimero's time, a narrow strip of rocky sand with a wide reef where local residents gathered octopus, *limu*, and other seafood. She typically wore *tabis*, (*tabi* is a Japanese shoe that can be used to walk on reefs) and a wide-brimmed hat secured with a string tied under her chin. That day, while she was out on the reef, a strong wind came and blew her hat off. It flipped over and landed on the shallow reef and a fish (an *uhu*) jumped into her hat. Immediately she stopped gathering *limu*, picked up her hat with the fish in it, and went home. She gave the fish to her mother-in-law and told her about the dream. Her mother-in-law cooked the fish and they had it for dinner. She later told Mrs. Cazimero that the fish was a gift from the ocean and that the gift came for a reason, so she should be mindful that something else would likely happen. Several days later, Mrs. Cazimero went to the beach again to pick *limu*, but when she entered the water she found that the bottom of her feet hurt, so she went back on shore and discovered that the soles of her feet were cracking. She went to the doctor, who took some tests. Shortly afterward he determined that Mrs. Cazimero had become allergic to salt water. After that, she stopped going to the beach to gather *limu* and other seafood.

8.3 Plant Gathering and Cultivation

Beginning in the fifteenth century, a vast system of irrigated taro fields was constructed, extending across the littoral plain from Waikīkī to lower Mānoa and Pālolo valleys. This field system - an impressive feat of engineering the design of which is traditionally attributed to the chief Kalamakua - took advantage of streams descending from Makiki, Mānoa and Pālolo valleys which also provided ample fresh water for the Hawaiians living in the *ahupua'a*. Water was also available from springs in nearby Mō'ili'ili and Punahou. Closer to the Waikīkī shoreline, coconut groves and fishponds dotted the landscape. A sizeable population developed amidst this Hawaiian-engineered abundance. Captain George Vancouver, arriving at "Whyteete" in 1792, states the abundance of taro fields in the Waikīkī and the overall high state of cultivation by the Native Hawaiians. Vancouver further mentions the similarities between the spacious plains of Waikīkī and the open common fields of England (Vancouver 1798:161-164)

Community participant Mrs. Sylvia Krewson-Reck stated the existence of large tracts of land used for *lo'i* and fishponds along McCully Street during her youth:

> I remember riding the trolley from the orphanage into Waikīkī. As we rode on McCully Street heading towards Waikīkī, on the left hand side or the Diamond Head side of McCully Street, were all these fishponds and *lo'i*. Didn't have all the buildings like now. It was taro and fishponds but I guess they all got filled in.

8.4 Marine and Freshwater Gathering and Cultivation

Fishponds are one the most important traditional resources associated with the Project area. Many named and unnamed fishponds were once located immediately inland of the Project area.

A 1901 study by the U.S. Commission of Fish and Fisheries (Bowers 1902) listed ten extant fishponds in Kālia: Kaihikapu, Kuwili, Kaipuni (1 and 2), Paweo (1 and 2), Kapuuiki, and three unnamed ponds.

The fame of Kālia’s fishponds is attested to in a *mo‘olelo* recounted by John Papa ‘Ī‘ī (in Wyban 1992) that deals with prohibitions against wasting food:

> Once Kinopu gave a tribute of fish to Kamehameha’s son Kinau, at Moehonua’s fishpond in Kalia. While Kinau and his wife Kahukuhaakoi (Wahine-pio) were going to Waikiki from Honolulu, the sea came into the pond and fishes of every kind entered the sluice gate. Kinopu ordered the keepers of the pond to lower fish nets and the result was a catch so large that a great heap of fish lay spoiling upon the bank of a pond.
>
> The news of the huge catch reached Kamehameha, who was then with Kalanimoku, war leader and officer of the king’s guard. The king said nothing at the time, but sat with bowed head and downcast eyes, apparently disapproving of such reckless waste. (Wyban 1992:87)

Community participant Mrs. Anna Ka‘olelo Machado Cazimero expressed gathering various ocean resources in Waikīkī. She stated that she gathered *limu līpe‘epe‘e* while she lived in Waikīkī. She recalled picking only enough *limu* for her family’s next meal and not over picking because the practice was to pick only as much as would be consumed for one meal. She noted that all practitioners knew that the ocean was an icebox that would hold the *limu* until the next meal, so picking more than was needed made no sense. She says this particular type of *limu* went well with all kinds of dishes. Mrs. Cazimero also gathered *‘upāpalu*, *wana* and *hā‘uke‘uke* along the shores of Waikīkī.

8.5 Burials

A total of three burials have been discovered to date within the current Project area. In 1980, during construction of the Tapa Tower at Hilton Hawaiian Village in the southeastern corner of the subject parcel, three burials—determined by the SHPD to be Native Hawaiian individuals from post-Contact times—were removed and relocated to a reburial site on the resort grounds. There is a relatively high probably that additional, as-yet undiscovered burials from historic times are located on the property in subsurface contexts.

Community participant Mr. Van Horn Diamond discussed other burials in Waikīkī. He states that at the Honolulu Zoo, there is a memorial honoring approximately 100 *iwi kūpuna* discovered during a waterline replacement project near the zoo. Mr. Diamond continued that the burial site is located in a gated area next to the Ghandi statue at the Honolulu Zoo. Recognized cultural descendants of the *iwi kūpuna* assumed responsibility of the burial site and continue to practice traditional memorial services there. Mr. Diamond expressed that there is a strong possibility that more *iwi kūpuna* will be discovered during the Hilton Hawaiian Village Resort and Spa’s Village Master Plan Improvements Project. Community participant Mr. Clarence Medeiros, Jr. states that there is a good chance of inadvertent archaeological discoveries during construction based on the history of the Project area.

8.6 Cultural and Historic Features

There are no *heiau* or other religious sites in the current Project area, which has been thoroughly developed over the past several decades. The closest *heiau* to the Project area was the famous Helumoa Heiau, located near the current spot of the Royal Hawaiian Hotel. This sacrificial *heiau* was where Ka‘opulupulu—the last O‘ahu-born Kahuna Nui of O‘ahu—was laid after being slain in Wai‘anae by Kahahana (or Kahāhana). Eventually, Kahahana, himself, was also sacrificed at Helumoa Heiau by Kahekili’s invading army from Maui.

In *Fragments of Hawaiian History*, John Papa ‘Ī‘ī described the “Honolulu trails of about 1810” (‘Ī‘ī 1959: 89), including the trail from Honolulu to Waikīkī:

> The trail from Kawaiahao which led to lower Waikiki went along Kaananiau, into the coconut grove at Pawaa, the coconut grove of Kuakuaka, then down to Piinaio; along the upper side of Kahanaumaikai’s coconut grove, along the border of Kaihikapu pond, into Kawehewehe; then through the center of Helumoa of Puaaliilii, down to the mouth of the Apuakehau stream; along the sandy beach of Ulukou to Kapuni, where the surfs roll in; thence to the stream of Kuekaunahi; to Waiaula . . . (‘Ī‘ī 1959:92)

Kapaemāhū is a set of four stones, also known as the Wizard Stones, located on the western end of Kūhiō Beach in Waikīkī. Each of the four stones was named after “sooth-sayers” or wizards from the ancient lands of Moaulanuiakea, now known as Tahiti. The four wizards were Kapaemāhū, Kahaloa, Kapuni and Kinohi and after touring the Hawaiian Islands and healing numerous people, settled at Ulukou near the Moana Hotel in Waikīkī in the fifteenth century. Upon their departure from the Hawaiian Islands, they transferred their healing powers and sorcery to the stones for the Hawaiian people to remember them by (Thrum 1907:139–141).

Section 9 Summary and Recommendations

At the request of Group 70 International, Inc., Cultural Surveys Hawaii, Inc. (CSH) conducted a Cultural Impact Assessment (CIA) for the Hilton Hawaiian Village located in Waikīkī Ahupuaʻa, Kona District, Oʻahu Island, TMK: (1) 2-6-008:001-003, 005, 007, 012, 019-021, 023, 024, 027, 034, 038 and (1) 2-6-009:001-007, 009-013. The Project area, which consists of portions of the Hilton Hawaiian Village Beach Resort and Spa complex, is bounded by Kālia Road to the east, Paoa Place to the south, Duke Kahanamoku Lagoon to the west, and Ala Moana Boulevard to the north.

The proposed Project involves the redevelopment of the existing Hilton Hawaiian Village Beach Resort and Spa complex (see Appendix C: Hilton Hawaiian Village Master Plan), including the demolition of existing structures, the construction of new structures, and the renovation of existing structures. Associated ground disturbance will involve excavation for structural footing installation, utility installation, swimming pool expansion, and landscaping. Surface grading is also anticipated for roadway improvements and parking area installation.

The Project's area of potential effects (APE) is defined as the entire approximately 22.24-acre Project area, within the larger context of Waikīkī Ahupuaʻa and adjacent lands. The APE also includes the Project area's relationship with the rest of the *moku* of Kona and other places on the island of Oʻahu as these relate to Hawaiian beliefs (e.g., *moʻolelo*, and *wahi pana*, resources and practices associated with the Project area.

9.1 Results of Background Research

Background research of the Project area indicates:

1. The Project area is located in the Kālia portion of Waikīkī Ahupuaʻa. Kālia, meaning "waited for," is a name used for the central portion of Mānoa Stream and the name of the coastal area where the Piʻinaio Stream once emptied into the ocean adjacent to the proposed Project area.
2. Large portions of Waikīkī were once part of a wide marshland—including areas along the *mauka* border of the current Project area and inland from there. The name Waikīkī (water spurting from many sources) likely refers to the swampy land of pre-Contact Waikīkī, where water from the upland valleys gushed forth from underground.
3. Several royal residences and other chiefly residential compounds were once located just southeast of the current Project area, in the area of ʻĀpuakēhau Stream and the old land division of Helumoa.
4. Kālia is associated with a traditional fishing technique used to catch schools of mullet. The fishermen of Kālia became known as human fishnets.
5. The old land division of Helumoa (chicken scratch) is associated with oral-historical accounts of the legendary rooster Kaʻau-helu-moa, the historical figure Kaʻopulupulu and human sacrifices at the *heiau* of ʻĀpuakēhau.

6. Fishponds are one the most important traditional resources associated with the Project area. Many named and unnamed fishponds were once located immediately inland of the Project area, including Kaihikapu, Kuwili, Kaipuni (1 and 2), Paweo (1 and 2) and Kapuuiki.
7. There are no *heiau* or other religious sites in the current Project area; the closest *heiau* to the Project area was the famous Helumoa Heiau (current spot of the Royal Hawaiian Hotel).
8. The Wizard Stones of Kapaemāhū, currently located at Kūhiō Beach in Waikīkī, are named after four healers from Tahiti: Kapaemāhū, Kahaloa, Kapuni and Kinohi.
9. During the first decade of the twentieth century, the U.S. War Department acquired more than 70 acres in the Kālia portion of Waikīkī for the establishment of a military reservation called Fort DeRussy, located immediately adjacent to the Project area to the east.
10. During the 1920s, Waikīkī's landscape was transformed by the construction of the Ala Wai Drainage Canal which resulted in the draining and filling in of the remaining ponds and irrigated fields of Waikīkī.
11. After the bombing of Pearl Harbor on December 7, 1941, development plans for Waikīkī as a tourist destination were put on hold.
12. By the mid-1950s, there were more than 50 hotels and apartment buildings from the Kālia area to the Diamond Head end of Kapiʻolani Park. By this time, the population of Waikīkī included 11,000 permanent residents living in 4,000 single dwellings and apartment buildings.
13. In 1980, two sets of human remains and one additional isolated femur were inadvertently discovered during construction activities in the southeastern corner of the subject property between Hilton Hawaiian Village Road, Kālia Road and Paoa Place. State archaeologists determined the remains were of Hawaiian ethnicity and post-Contact (historic-era) origin. The remains were removed from their original resting place and reburied on the subject parcel. The general location of the reinterment site is in the southeastern corner of the parcel. A more specific understanding of the location of the reinterment site is known by the owner of the Hilton Hawaiian Village, former staff of the SHPD, former members of the Oʻahu Island Burial Council (OIBC) and descendents, as memorialized in a 1991 reburial agreement between the State Historic Preservation Officer and the landowner. CSH is conducting an archaeological inventory survey for the subject Project that will provide more specific details on the location of the existing reburial site, as appropriate and relevant to the subject Project.

9.2 Results of Community Consultation

CSH attempted to contact 123 community members (government agency or community organization representatives, or individuals such as residents, cultural and lineal descendents, and cultural practitioners) for this draft CIA report; of those, ten responded and five participated in formal interviews for more in-depth contributions to the CIA. Presented below are salient themes and concerns arranged from general Waikīkī, narrowed down to Kālia, then to the Project area that emerged from participants' interviews regarding the proposed Project:

1. The vast ocean and freshwater resources of Waikīkī's past was expressed by *kūpuna* Anna Cazimero and Sylvia Krewson-Reck. Mrs. Cazimero states gathering various ocean resources including: *wana*, *limu līpe‘epe‘e*, *hā‘uke‘uke* and *upāpalu* along the shores of Waikīkī (see Appendix B for common and scientific plant and animal names mentioned by community participants). Mrs. Krewson-Reck states the existence of fishponds located in the Waikīkī during her youth. Today, the fishponds of Waikīkī have been filled-in and *limu* and other ocean resource gathering have all but ceased to exist in Waikīkī.
2. Waikīkī was once the home of the Lālani Hawaiian Village, developed by *‘ukulele* maker George P. Mossman in 1932 to demonstrate traditional Hawaiian music, crafts and *lū‘au*. Mrs. Krewson-Reck was a student of the Lālani Hawaiian Village school system and learned to dance *hula* there.
3. Ala Moana Park, west of the Project area, was once the location of "Squatter's Ville," a salvage yard that attracted needy people who scavenged the area for items to sell and use. Mr. Paoa states that it is very similar to what is presently known as "recycling."
4. Mr. Van Horn Diamond states that at the Honolulu Zoo, there is a burial marker honoring approximately 100 *iwi kūpuna* discovered along Kalākaua Avenue during underground construction work. Cultural descendants of the *iwi kūpuna* currently care for the burial site and continue to have traditional ceremonies in remembrance of their ancestors.
5. According to Mr. Van Horn Diamond, many of the street names in Waikīkī were named for the *ali‘i* class. The street he grew up on in Waikīkī called Kānekapōlei was named after one of Kamehameha I's wives.
6. The Kodak Hula Show was created in 1937 by Fritz Herman to create an opportunity for tourist to photograph *hula* dancers in the daytime. Mrs. Anna Cazimero has been a member of the Kodak Hula Show for over 60 years. She played various instruments including stand-up bass, guitar and *‘ukulele* during her career in Waikīkī. She states how hot it was performing under the sun at Sans Souci Beach, the original location of the show.
7. Mrs. Sylvia Krewson-Reck states watching famed Hawaiian Slack Key musician Gabby Pahinui perform shows at the Niumalu Hotel in Waikīkī, site of the present day Hilton Hawaiian Village. She states that Gabby's show was a music and dance show and that she would go on dates there to dance to the music.
8. On April 1, 1946, a *tsunami* generated from a magnitude 7.1 earthquake in the Aleutian Islands in Alaska struck the Hawaiian Islands killing 159 people. Most of the destruction was in the town of Hilo on Hawai‘i Island. Mr. Paoa states that on that day in Waikīkī, ocean surge caused by the *tsunami* wrecked all the boats in the Ala Wai Harbor.

9. Due to the massive amounts of development in Waikīkī, Mr. Paoa has no more *aloha* for Kālia and Waikīkī. He understands that changes are inevitable but feels hurt seeing all the drastic changes in Kālia.
10. Mrs. Sylvia Krewson-Reck is concerned about the proposed Project blocking sacred *mauka/makai* (towards the mountain/towards the sea) views, which are part of the beautiful landscape of the Waikīkī area. She emphatically states "Please stop blocking the views!"
11. During the Māhele of 1848, Mr. Clarke Paoa's great grandfather was awarded a parcel of land on the western border of the Project area. Land Commission Award (LCA) 1775 was awarded to Mr. Pawa or Paoa and included one house lot with no fence and one Royal Patent. The document further states that the parcel of land was given to Mr. Pawa from Kaʻahumanu, favorite wife of Kamehameha I.
12. Mr. Clarence Medeiros, Jr. supports the proposed Project and believes it will create more jobs. However, he anticipates that inadvertent archaeological discoveries will be found during construction of this Project.

9.3 Cultural Impacts and Recommendations

Based on information gathered from the community consultation effort as well as archaeological and archival research presented in this report, the evidence indicates that the proposed Project may have a negative impact on burials that may be discovered during construction. A good faith effort to address the following recommendations would help mitigate potentially adverse effects the proposed Project may have on Hawaiian cultural practices, beliefs and resources in and near the Project area:

1. The Project may have a direct impact on as-yet undiscovered burials located in subsurface contexts in the subject property. CSH recommends that personnel involved in development activities in the Project area should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural and/or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law.
2. CSH recommends that, in the event of inadvertent discoveries of *iwi kūpuna* during Project construction, recognized cultural and lineal descendants of the *iwi kūpuna* should be informed and consulted regarding the care for and handling of the ancestral remains. CSH recommends recognized cultural and lineal descendants should be granted access to the *iwi kūpuna* for traditional ceremonial practices.
3. In recognition of the Project proponent's proactive approach to conducting an archaeological inventory survey guided by an archaeological inventory survey plan, CSH recommends that all possible options for burial treatment—including preserve in-place—be considered should *iwi kūpuna* be discovered during the subject Project.

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Appendix A Glossary of Hawaiian Words

To highlight the various and complex meanings of Hawaiian words, the complete translations from Pukui and Elbert (1986) are used unless otherwise noted. In some cases, alternate translations may resonate stronger with Hawaiians today; these are placed prior to the Pukui and Elbert (1986) translations and marked with "(common)."

Diacritical markings used in the Hawaiian words are the ʻokina and the kahakō. The *ʻokina*, or glottal stop, is only found between two vowels or at the beginning of a word that starts with a vowel. A break in speech is created between the sounds of the two vowels. The pronunciation of the *ʻokina* is similar to saying "oh-oh." The *ʻokina* is written as a backwards apostrophe. The *kahakō* is only found above a vowel. It stresses or elongates a vowel sound from one beat to two beats. The *kahakō* is written as a line above a vowel.

Hawaiian Word	English Translation
ahupuaʻa	Land division usually extending from the uplands to the sea, so called because the boundary was marked by a heap (*ahu*) of stones surmounted by an image of a pig (*puaʻa*), or because a pig or other tribute was laid on the altar as tax to the chief.
aliʻi	Chief, chiefess, officer, ruler, monarch, peer, headman, noble, aristocrat, king, queen, commander.
ʻaumakua	Family of personal gods, deified ancestors who might assume the shape of sharks, owls, hawks (etc…). A symbiotic relationship existed; mortals did not harm or eat *ʻaumakua*, and *ʻaumakua* warned and reprimanded mortals in dreams, visions, and calls.
ʻauwai	Ditch, canal
hala	Pandanus or screw pine.
hālau	Long house, hula group (common).
haole	Foreigner, white person (common).
hau	Beach Hibiscus.
heiau	Place of worship, shrine; some *heiau* were elaborately constructed stone platforms, others simple earth terraces. Many are preserved today.
huna	Secret.
ʻili	Land section, next in importance to *ahupuaʻa* and usually a subdivision of an *ahupuaʻa*.

iwi kūpuna	Ancestral bone remains (common).
kahuna	Priest, sorcerer, magician, wizard, minister, expert in any profession. *Kāhuna*—plural of *kahuna*. *Kahuna nui* – high priest.
kamaʻāina	Native-born, one born in a place, host; native plant; acquainted, familiar, Lit., land child.
kānaka maoli	Native Hawaiians.
kanikapila	To play music together (common).
kaona	Hidden meaning.
kapu	Taboo, prohibition; special privilege or exemption from ordinary taboo; sacredness; prohibited, forbidden; sacred, holy, consecrated; no trespassing, keep out.
kuleana	Native land rights (common), right, privilege, concern, responsibility, title, business, property, estate, portion, jurisdiction, authority, liability, interest, claim, ownership, tenure, affair, province.
kumu	Teacher, source.
kupuna	Elder (common), grandparent, ancestor, relative or close friend of the grandparent's generation, grandaunt, granduncle. *Kūpuna*—plural of *kupuna*.
limu	Seaweed.
loʻi	Irrigated terrace, especially for taro, but also for rice; paddy.
lūʻau	Hawaiian feast (common), young taro tops.
makai	Ocean, seaward (common).
makaʻāinana	Commoner.
makana	Gift, present.
mauka	Inland.
mana	Supernatural or divine power.
manaʻo	Thoughts, ideas, beliefs, opinions, theories.
mele	Song, anthem, or chant of any kind; poem, poetry; to sing, chant.

mōʻī	King, island wide chief (common).
moku	District, island, islet, section.
moʻo	Water spirit, lizard (common).
moʻolelo	Story, tale, myth, history, tradition, literature, legend, journal, log, yarn, fable, essay, chronicle, record, article; minutes, as of a meeting. (From *moʻo ʻōlelo*, succession of talk; all stories were oral, not written).
muliwai	River mouth.
nā	Plural definite article. *Nā lani*, the chiefs.
ʻōlelo noʻeau	Proverb, wise saying, traditional saying.
oli	Chant that was not danced to, especially with prolonged phrases chanted in one breath, often with a trill at the end of each phrase; to chant thus.
pule	Prayer.
pōhaku	Rock, stone.
poi	Cooked taro (common), made from cooked taro corms, pounded and thinned with water.
ʻukulele	Stringed instrument brought to Hawaiʻi by the Portuguese.
waena	Middle, between.
wahi pana	Storied place (common). Legendary place.

Appendix B Common and Scientific Names for Plants and Animals Mentioned by Community Participants

Common Names		Possible Scientific Names		Source
Hawaiian	**Other**	**Genus**	**Species**	
ʻawa	kawa	*Piper*	*methysticum*	Wagner et al. 1999
hāʻukeʻuke	sea urchin	*Colobocentrotus*	*atratus*	Pukui and Elbert 1986
kalo	taro	*Colocasia esculenta*	*esculenta*	Wagner et al. 1999
limu līpeʻepeʻe	seaweed, red	*Laurencia*	*parvipapillata*	Pukui and Elbert 1986
uhu	Parrotfish	Multiple genera and species in the family Scaridae		Hoover 1993
ʻupāpalu	cardinal fish	*Apogon*	*spp.*	Pukui and Elbert 1986
wana	sea urchin	*Diadema*	*paucispinum*	Pukui and Elbert 1986

Appendix C Authorization and Release Form

Cultural Surveys Hawaiʻi, Inc.
Archaeological and Cultural Impact Studies
Hallett H. Hammatt, Ph.D., President

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Job code: WAIKIKI 48 **bcruz@culturalsurveys.com** **www.culturalsurveys.com**

AUTHORIZATION AND RELEASE FORM

Cultural Surveys Hawaiʻi (CSH) appreciates the generosity of the *kūpuna* and *kamaʻāina* who are sharing their knowledge of cultural and historic properties, and experiences of past and present cultural practices in the proposed Hilton Hawaiian Village Resort and Spa's Village Master Plan Improvements Project, Waikīkī Ahupuaʻa, (Honolulu) Kona District, Oʻahu, Hawaiʻi, Multiple TMK.

We understand our responsibility in respecting the wishes and concerns of the interviewees participating in our study. Here are the procedures we promise to follow:

1. The interview will not be tape-recorded without your knowledge and explicit permission.
2. If recorded, you will have the opportunity to review the written transcript of our interview with you. At that time you may make any additions, deletions or corrections you wish.
3. If recorded, you will be given a copy of the interview notes for your records.
4. You will be given a copy of this release form for your records.
5. You will be given any photographs taken of you during the interview.

For your protection, we need your written confirmation that:

1. You consent to the use of the complete transcript and/or interview quotes for reports on cultural sites and practices, historic documentation, and/or academic purposes.
2. You agree that the interview shall be made available to the public.
3. If a photograph is taken during the interview, you consent to the photograph being included in any report/s or publication/s generated by this cultural study.

I, ______________________________, agree to the procedures outlined above and, by my
(Please print your name here)
signature, give my consent and release for this interview to be used as specified.

____
(Signature)

____
(Date)

Appendix D 2LCA Documentation

Articles | Information | Samples | Gallery | About Us | Contact Us

Mahele Database | Boundary Commission | Land Grants | Royal Patents | Review Cart & Checkout

DOCUMENT DELIVERY

Mahele Database Documents

Number: 01775

Claim Number:	**01775**
Claimant:	**Pawa**
Other claimant:	
Other name:	Paoa
Island:	**Oahu**
District:	**Kona**
Ahupuaa:	**Waikiki**
Ili:	**Kalia**

Apana:	**1**	Awarded:	**1**
Loi:		FR:	
Plus:		NR:	**250v3**
Mala Taro:		FT:	**181v3**
Kula:		NT:	**509v3,75v10**
House lot:	**1**	RP:	**7033**
Kihapai/Pakanu:		Number of Royal Patents:	**1**
Salt lands:		Koele/Poalima:	**No**
Wauke:		Loko:	**No**
Olona:		Lokoia:	**No**
Noni:		Fishing Rights:	**No**
Hala:		Sea/Shore/Dunes:	**No**
Sweet Potatoes:		Auwai/Ditch:	**No**
Irish Potatoes:		Other Edifice:	**No**
Bananas:		Spring/Well:	**No**
Breadfruit:		Pigpen:	**No**
Coconut:		Road/Path:	**No**
Coffee:		Burial/Graveyard:	**No**
Oranges:		Wall/Fence:	**No**
Bitter Melon/Gourd:		Stream/Muliwai/River:	**No**
Sugar Cane:		Pali:	**No**
Tobacco:		Disease:	**No**

http://www.waihona.com/purchase.asp 2/11/2010

Koa/Kou Trees:		Claimant Died:	No
Other Plants:		Other Trees:	
Other Mammals:	No	Miscellaneous:	section of ditch

No. 1775, Pawa
N.R. 250v3

To the Land Commissioners, Greetings: I hereby state my claim for a section of irrigation ditch. I do not know its length - perhaps it is two fathoms more or less. The length of my interest at this place is from /the time of/ Kaahumanu I, which was when my people acquired this place, and until this day when I am telling you, no one has objected at this place where I live. The house lot where I live is on the north of the government fence at Kalia. Some planted trees grow there - five hau and four hala. There is a well which is used jointly.
With thanks,
PAWA X, his mark
Waikiki, Oahu, December 16, 1847
M.K. Trut, witness

F.T. 181v3
No. 1775, Pawa

Kalaione, sworn, This land is in Pinaio, Waititi, house lot, 1 house, no fence.

Mauka, Government road
Waialae, Government yard
Makai, sea
Honolulu, Str [stream].

Claimant received this land from Kaahumanu I and has ever since held it undisputed.

Alapai, sworn, confirmed the testimony above.

N.T. 509v3
No. 1775, Pawa, October 30, 1849

Kalaeone, sworn, I have seen his land at Piinaio in Waikiki - 1 house lot

Mauka by government road
Waialae by government lot
Makai by stream
Honolulu by stream.

Kaahumanu I had given him his land and no one has ever objected to this day.

Alapai, sworn, Our testimonies are similar. No one has objected.

See pg. 75, Vol. X

N.T. 75v10
No. 1775, Pawa (from page 509, Vol. 3), 18 November 1851

Kalaeone, sworn, I have seen this section of Pawa in Kalia in Waikiki, a Pauku ditch of stream taro.

Mauka, Government land
Waialae, Nihopuu's land

Makai, S. Kuluwailehua's land, Keino's land
Ewa, Nakoko's land.

Land to Pawa from his mother, Makuahine. Makuahine had received it from Naliikipi after the death of Kinau in 1839, because Makuahine is Naliikipi's sister. Makuahine had bequested it permanently to Pawa, their son. Makuahine, Pawa's parent has died and Pawa has been living there to the present time peacefully.

Section one claim has been done on 30 October 1849, it is the house lot. Work on the taro land section is being done today.

[Award 1775; R.P. 7033; Kalia Waikiki Kona; 2 ap.; 3.22 Acs; R.P. is to Paoa]

Number: 02511

Claim Number:	**02511**
Claimant:	**Alapai**
Other claimant:	
Other name:	
Island:	**Oahu**
District:	**Kona**
Ahupuaa:	**Waikiki**
Ili:	**Kalia**

Apana:	**1**	Awarded:	**1**
Loi:		FR:	
Plus:		NR:	**531v5**
Mala Taro:		FT:	**489v14**
Kula:		NT:	
House lot:		RP:	**3441**
Kihapai/Pakanu:		Number of Royal Patents:	**1**
Salt lands:		Koele/Poalima:	**No**
Wauke:		Loko:	**No**
Olona:		Lokoia:	**No**
Noni:		Fishing Rights:	**No**
Hala:		Sea/Shore/Dunes:	**Yes**
Sweet Potatoes:		Auwai/Ditch:	**No**
Irish Potatoes:		Other Edifice:	**No**
Bananas:		Spring/Well:	**No**
Breadfruit:		Pigpen:	**No**
Coconut:	1	Road/Path:	**Yes**
Coffee:		Burial/Graveyard:	**No**
Oranges:		Wall/Fence:	**Yes**
Bitter Melon/Gourd:		Stream/Muliwai/River:	**No**
Sugar Cane:		Pali:	**No**
Tobacco:		Disease:	**No**

http://www.waihona.com/purchase.asp 2/11/2010

Koa/Kou Trees:		Claimant Died:	**No**
Other Plants:		Other Trees:	
Other Mammals:	**No**	Miscellaneous:	**coconut grove,government road**

No. 2511, Alapai
N.R. 531v3

I, the one whose name is below, hereby state my claim for a coconut grove and a house site. The boundaries of the grove are: on the east is the small pond and the house of Umi, on the north is the Government road, and the government wall, and on the west the government wall also, and an unused place, and on the south is an unused place. That is my claim which is hereby stated.
I am, respectfully,
ALAPAI X, his mark

F.T. 489v14
No. 2511, Alapai, claimant

Kanemakua, sworn says, the land of claimant is an Uluniu called Kaneumanuhou in Kalia, Waikiki, Oahu. It is bounded:

Mauka by the public road
Kekaha by the house of Umi
Makai by the sea shore
Honolulul by pa aupuni of Kalia.

Claimant inherited the land from his father, Kahanaumaikai from the time of Kamehameha. He has held it in quiet.

Kamaea, sworn says, the above testimony is true, and is also his own.

[Award 2511, R.P. 3441; Kalia Waikiki Kona; 1 ap.; 4.6 Acs]

APPENDIX H

Acoustic Study for the Hilton Hawaiian Village Master Plan Entitlements Project Honolulu, Hawai'i

Y. Ebisu & Associates

October 2010

ACOUSTIC STUDY FOR THE HILTON HAWAIIAN VILLAGE MASTER PLAN ENTITLEMENTS PROJECT HONOLULU, HAWAII

Prepared for:

GROUP 70 INTERNATIONAL

Prepared by:

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OCTOBER 2010

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CHAPTER I. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed Hilton Hawaiian Village Master Plan Entitlements (HHV MPE) Project in Waikiki (see FIGURE 1) were evaluated for their potential impacts and their relationship to current FHA/HUD noise standards. The traffic noise level increases along the access roadways to and from the project site were calculated. No significant increases in traffic noise are predicted to occur along Ala Moana Boulevard, Kalia Road, and Ena Road as a result of project plus non-project traffic following project build-out by CY 2022. Traffic noise from Ala Moana Boulevard and Kalia Road will continue to control background ambient noise levels in the project environs, with traffic noise levels exceeding 70 DNL at existing and future resort units which front Ala Moana Boulevard. Along Kalia Road, future traffic noise levels are expected to exceed 65 DNL. Mitigation of the high traffic noise levels will be required at the new resort units in the proposed Timeshare Sequel 1 Building, and will be available in the form of closure and air conditioning of the proposed units.

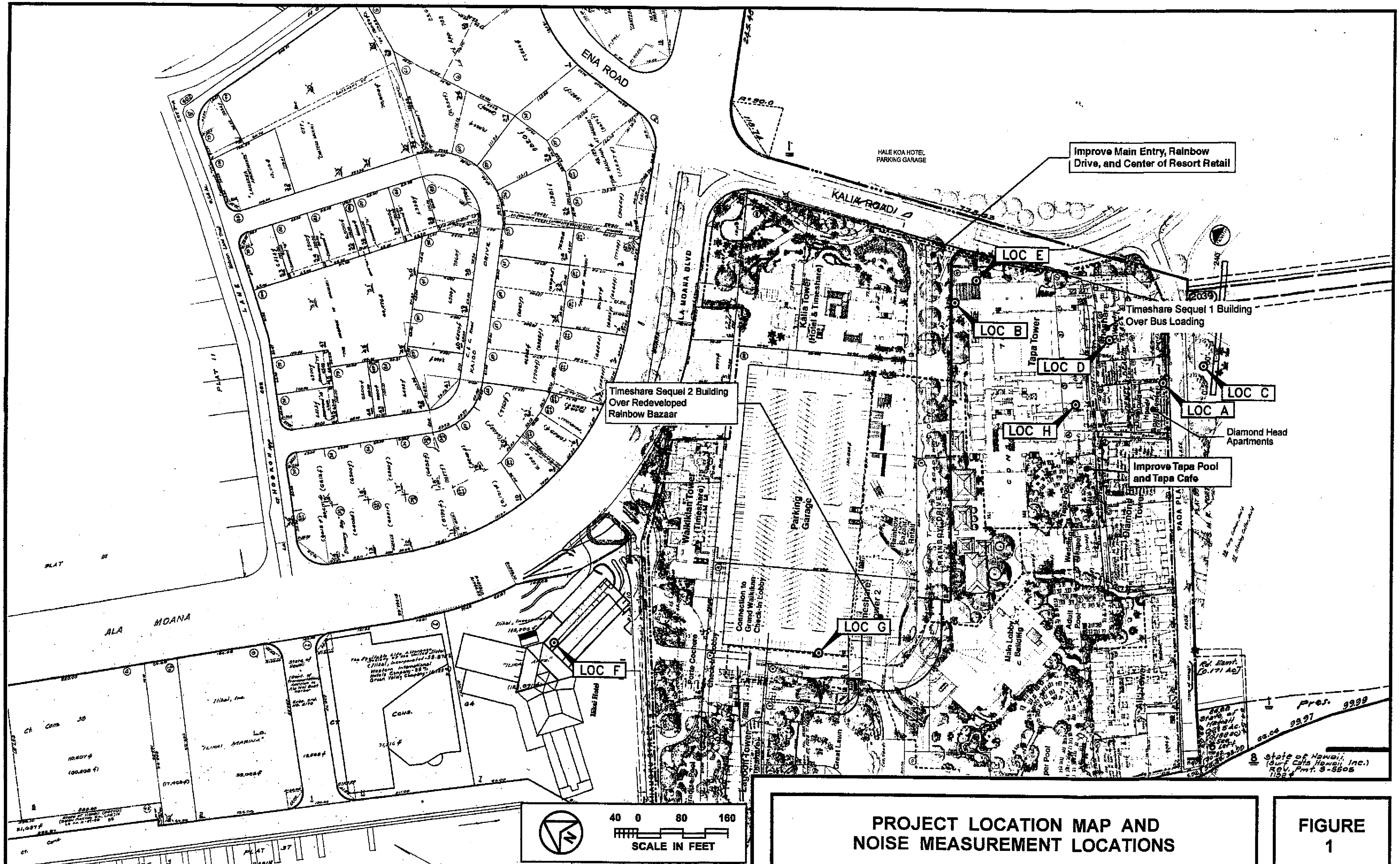
Project traffic will add less than 1.0 DNL additional unit of noise along Ala Moana Boulevard, Kalia Road, and Ena Road under the Build Alternative in the project environs. These levels of traffic noise increases resulting from project generated traffic are not considered to be significant.

Larger increases in traffic noise levels are predicted to occur along Paoa Place and Rainbow Drive at Kalia Road under the Build Alternative. Total noise levels along the mauka section of Rainbow Drive will be controlled (or dominated) by traffic noise from Kalia Road well as by other background noise sources within the hotel property. Along the makai section of Rainbow Drive, traffic noise will remain relatively low due to the very low vehicle speeds used along that roadway.

The largest increases in traffic noise of approximately 2.9 DNL units are expected along Paoa Place at the intersection with Kalia Road, which tour buses, tour vans, limousines, and delivery trucks use to enter the hotel's Receiving Dock and Group and Tour Drop Areas. Most of these vehicles currently exit the area to Kalia Road using the driveway on the Ewa side of the Paoa Place intersection.

The aircraft noise component should not exceed the Hawaii State Department of Transportation, Airports Division, recommended planning level of 60 DNL for residences and resort units. Mitigation of aircraft noise levels is not required for the planned units in the Timeshare Buildings, but will be available in the form of closure and air conditioning of the planned resort units.

An increase in noise levels of approximately 3 dB is expected in the hotel Receiving Dock and Group and Tour Drop Areas under the Build Alternative. The planned addition of a cover over the two areas will help to mitigate noise levels at the proposed Timeshare Sequel 1 Tower building, but leakage of noise via ventilation



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

openings could cause adverse noise impacts at the adjacent Diamond Head Apartments building. Noise mitigation measures for minimizing these impacts are recommended.

The existing luau and dinner show on the roof of the hotel Parking Garage will cause relatively high sound levels at the proposed guest units of the proposed Timeshare Sequel 2 Tower building and 2 Bedroom makai wing facing the Great Lawn. Special sound attenuation measures are recommended for guest units which face the dinner show stage. The inclusion of disclosure and other provisions within the sales documents for these units are also recommended to minimize risks of owner dissatisfaction and complaints associated with the high sound levels expected from the luau and dinner show.

Unavoidable, but temporary, noise impacts may occur during construction of the proposed project, particularly during the demolition and excavation activities on the project site. Because construction activities are predicted to be audible within the project site and at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. The use of drilling and cast-in-place piles for the new buildings of the project are recommended to minimize risks of potential noise and vibration impacts on the surrounding area during the construction phase. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases, but the use of quiet equipment is recommended as a standard mitigation measure. The implementation of Hawaii State Department of Health permit procedures and curfew periods for construction activities is also expected for this project.

CHAPTER II. PURPOSE

The primary objective of this study was to describe the existing and future traffic noise environment in the environs of the proposed HHV MPE Project in Waikiki on the island of Oahu. Traffic noise level increases and impacts associated with the proposed development were to be determined within the project site as well as along the public roadways which are expected to service the project traffic. A specific objective was to determine future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases.

Potential noise impacts from the existing luau and dinner show on the roof of the Parking Garage and the noise from the vehicular movements in the hotel's Receiving Dock and Group and Tour Drop Areas were also evaluated. Assessments of possible future impacts from short term construction noise at the project site were also included as noise study objectives. Recommendations for minimizing identified noise impacts were also to be provided as required.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies (such as FHA/HUD) to assess environmental noise is the Day-Night Average Sound Level (DNL or Ldn). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. A more complete list of noise descriptors is provided in APPENDIX B to this report.

TABLE 1, derived from Reference 1, presents current federal noise standards and acceptability criteria for residential land uses. Land use compatibility guidelines for various levels of environmental noise as measured by the DNL descriptor system are shown in FIGURE 2. As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences and resort units which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. In the project area, traffic noise levels associated with Ala Moana Boulevard and Kalia Road are greater than 70 and 65 DNL, respectively, along their Rights-of-Way due to the large volume of traffic on those major thoroughfares.

For purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 DNL or less is considered acceptable for residences. This standard is applied nationally (Reference 2), including Hawaii. Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, and as recommended in Reference 3, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 DNL are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

On the island of Oahu, the State Department of Health (DOH) regulates noise

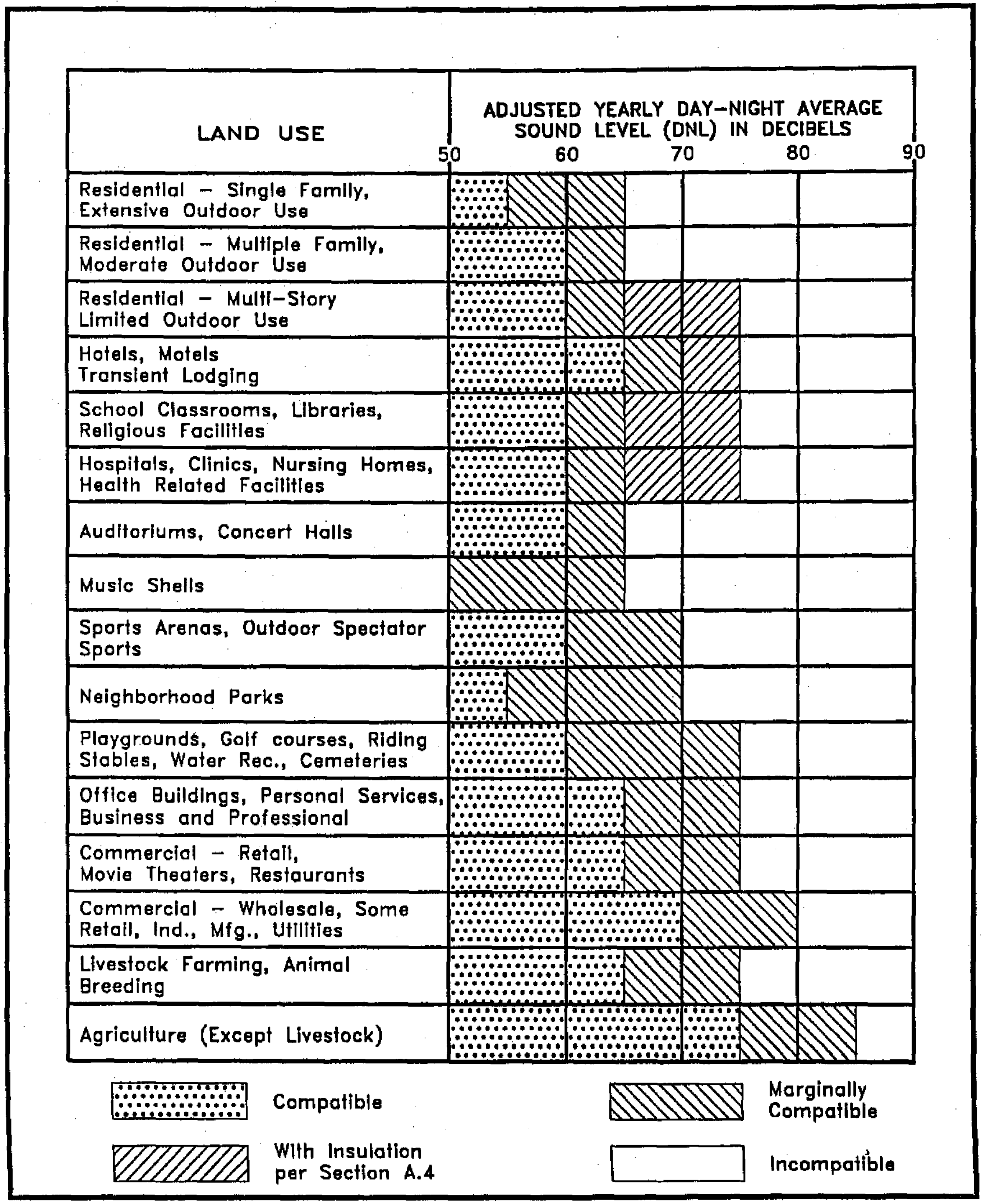
TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.



LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY-NIGHT AVERAGE SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED.
(Source: American National Standards Institute S12.9-1998/Part 5)

FIGURE 2

from fixed mechanical equipment and construction activities. State DOH noise regulations are expressed in maximum allowable noise limits rather than DNL (see Reference 4). The Honolulu Liquor Commission responds to complaints regarding excessive noise during functions such as luau shows, and uses limits which are identical to those of the State DOH noise regulations. Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for single family residential lands equate to approximately 55 DNL. For multifamily residential, commercial, and resort lands, the State DOH noise limits equate to approximately 60 DNL. For light and heavy industrial lands, the State DOH noise limits equate to approximately 76 DNL, respectively. Construction activities, which are typically noisier than the State DOH noise limits, are regulated through the issuance of permits for allowing excessive construction noise during limited time periods.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic and background ambient noise levels were measured at 8 locations (A through H) in the project environs to provide a basis for describing the existing noise environment in the project environs. The locations of the measurement sites are shown in FIGURE 1. Location A was at the entry to the Diamond Head Apartments on Paoa Place; Location B was alongside Rainbow Drive near Kalia Road; Location C was alongside Paoa Place near the entrance to the hotel's Receiving Dock and Group and Tour Drop Areas; Location D was on the walkway between the hotel's bus parking and baggage handling areas; Location E was along Kalia Road at the second floor lanai of the Tapa Retail Arcade; Location F was on the 25th floor lanai of the Ilikai Hotel facing Ala Moana Boulevard; Location G was on the roof of the hotel Parking Garage near the proposed Timeshare Sequel 2 Building; and Location H was on the 23rd floor lanai of the Tapa Tower facing Kalia Road.

Traffic and background ambient noise measurements were performed during the months of July and August of 2010. Traffic noise measurements were obtained at Locations B, C, E, F and H. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used. The traffic noise measurement results at Locations B, C, E, F, and H, and the comparisons of the measured traffic noise levels with computer model predictions of existing traffic noise levels are summarized in TABLE 2. At Locations B and C, traffic noise levels were relatively low and background noise levels were relatively high, as shown in FIGURES 3 and 4, respectively. A minimum background noise level of approximately 60 dB was present at Location B, and tour bus idling noise, which varied between 64 and 73 dB, was present at Location C during the traffic noise measurements.

Traffic noise calculations for the existing conditions as well as noise predictions for the Year 2022 were performed using the Federal Highway Administration (FHWA) Traffic Noise Model (Reference 5). Traffic data entered into the noise prediction model were: roadway and receiver locations; hourly traffic volumes, average vehicle speeds; estimates of traffic mix; and "Pavement" propagation loss factor. The traffic data and forecasts for the project (Reference 6), plus the published traffic counts along Ala Moana Boulevard (References 7 and 8) were the primary sources of data inputs to the model. APPENDIX C summarizes the AM and PM peak hour traffic volumes for CY 2010 and 2022 which were used to model existing and future traffic noise along the streets surrounding the project site. For existing and future traffic along the streets surrounding the project site, it was assumed that the average noise levels, or Leq(h), during the PM peak traffic hour were approximately 2.3 dB less than the 24-hour DNL along those roadways. This assumption was based on the traffic counts from References 7 and 8 (see FIGURE 5) as well as the traffic noise measurement data from Location F (see FIGURE 6).

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level and elevated receptors with and without the

TABLE 2

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
B. 50 FT from the center-line of Rainbow Drive (7/20/10)	1443 TO 1543	20	325	6	2	63.4 (1)	55.7
C. 50 FT from the center-line of Paoa Place (7/20/10)	1549 TO 1649	20	104	8	15	63.3 (2)	56.2
A. At entrance walkway to Diamond Head Apts. (7/22/10)	1441 TO 1538	N/A	N/A	N/A	N/A	65.8	N/A
D. At curb beween Tour Bus Loading/Unloading area and Purser Sta. (7/22/10)	1441 TO 1541	N/A	N/A	N/A	N/A	66.6	N/A
E. 78 FT from the center-line of Kalia Road (7/22/10)	1551 TO 1651	30	1,105	25	138	66.8	66.8
F. 291 FT from the center-line of Ala Moana Blvd. (7/26/10)	1600 TO 1700	37	2,172	50	162	67.7	67.5

TABLE 2 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	Hourly Traffic Volume M.TRUCK	Hourly Traffic Volume H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
F. 291 FT from the center-line of Ala Moana Blvd. (7/27/10)	0700 TO 0800	37	2,231	85	68	66.0	66.4
G. On roof of Parking Garage near makai-D.H. corner during Luau Show. (7/26/10)	1755 TO 2030	N/A	N/A	N/A	N/A	71.0	N/A
G. On roof of Parking Garage near makai-D.H. corner during housekeeping. (7/26/10)	2030 TO 2115	N/A	N/A	N/A	N/A	66.4	N/A
G. On roof of Parking Garage near makai-D.H. corner after housekeeping. (7/26-27/10)	2115 TO 0610	N/A	N/A	N/A	N/A	54.0	N/A
D. At curb beween Tour Bus Loading/Unloading area and Purser Sta. (7/30/10)	0730 TO 0830	N/A	N/A	N/A	N/A	73.8	N/A
G. On roof of Parking Garage near makai-D.H. corner during daytime. (8/16/10)	1043 TO 1100	N/A	N/A	N/A	N/A	57.8	N/A

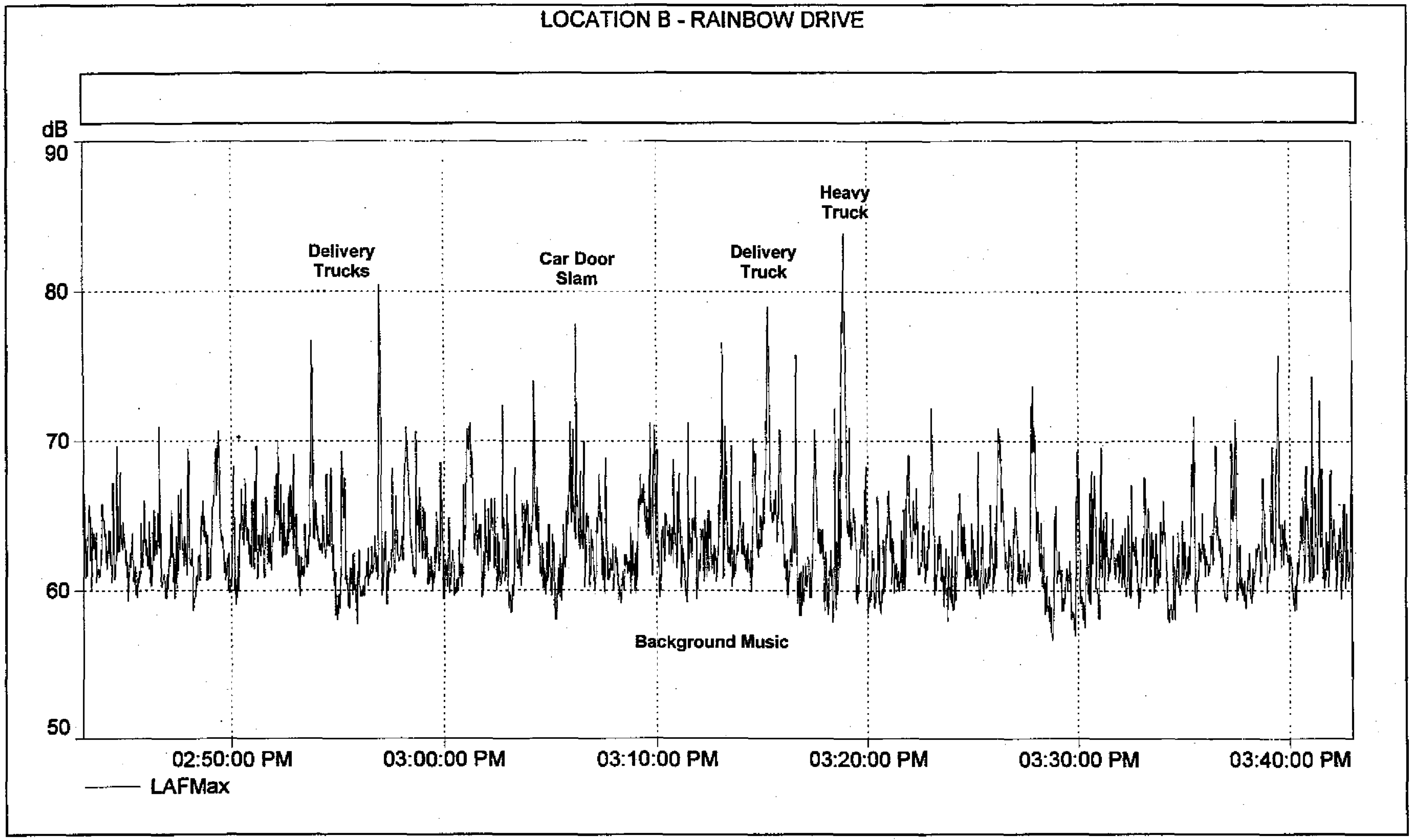
TABLE 2 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	-------- Hourly Traffic Volume --------			Measured Leq (dB)	Predicted Leq (dB)
			AUTO	M.TRUCK	H.TRUCK		
G. On roof of Parking Garage near makai-D.H. corner during daytime. (8/16/10)	1100 TO 1200	N/A	N/A	N/A	N/A	58.6	N/A
H. 351 FT from the center-line of Kalia Road. (8/16/10)	1600 TO 1700	30	1,010	39	121	64.2 (3)	60.9
H. 351 FT from the center-line of Kalia Road. (8/17/10)	0700 TO 0800	30	706	45	40	64.4 (4) 62.4 (5)	58.8

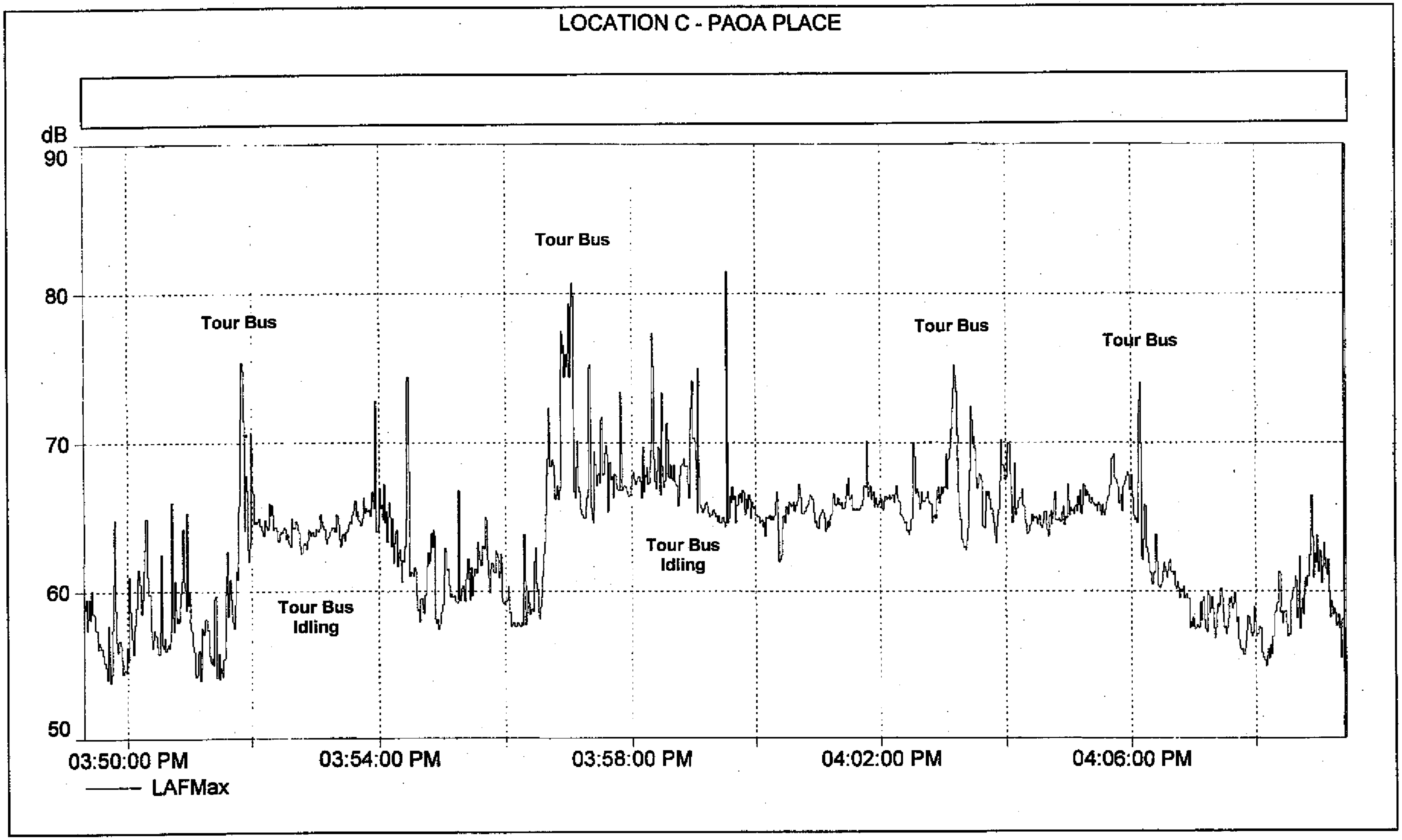
Notes:

(1) Measured noise levels were controlled by sources other than traffic along Rainbow Drive.
(2) Measured noise levels were controlled by sources in Tour Bus Loading Area.
(3) Measured noise levels at Location H include noise from vehicles in hotel's Receiving Dock and Tour and Group Drop Area.
(4) Measured noise level with police sirens.
(5) Measured noise level without police sirens.



MEASURED TRAFFIC AND BACKGROUND NOISE LEVELS AT 50 FT SETBACK DISTANCE FROM THE CENTERLINE OF RAINBOW DRIVE AT LOCATION "B" (JULY 20, 2010)

FIGURE 3



MEASURED TRAFFIC AND BACKGROUND NOISE LEVELS AT 50 FT SETBACK DISTANCE FROM THE CENTERLINE OF PAOA PLACE AT LOCATION "C" (JULY 20, 2010)

FIGURE 4

FIGURE 5

HOURLY VARIATIONS OF TRAFFIC NOISE AT 291 FT SLANT DISTANCE FROM THE CENTERLINE OF ALA MOANA BOULEVARD AT THE ILIKAI HOTEL (AUGUST 12, 2009)

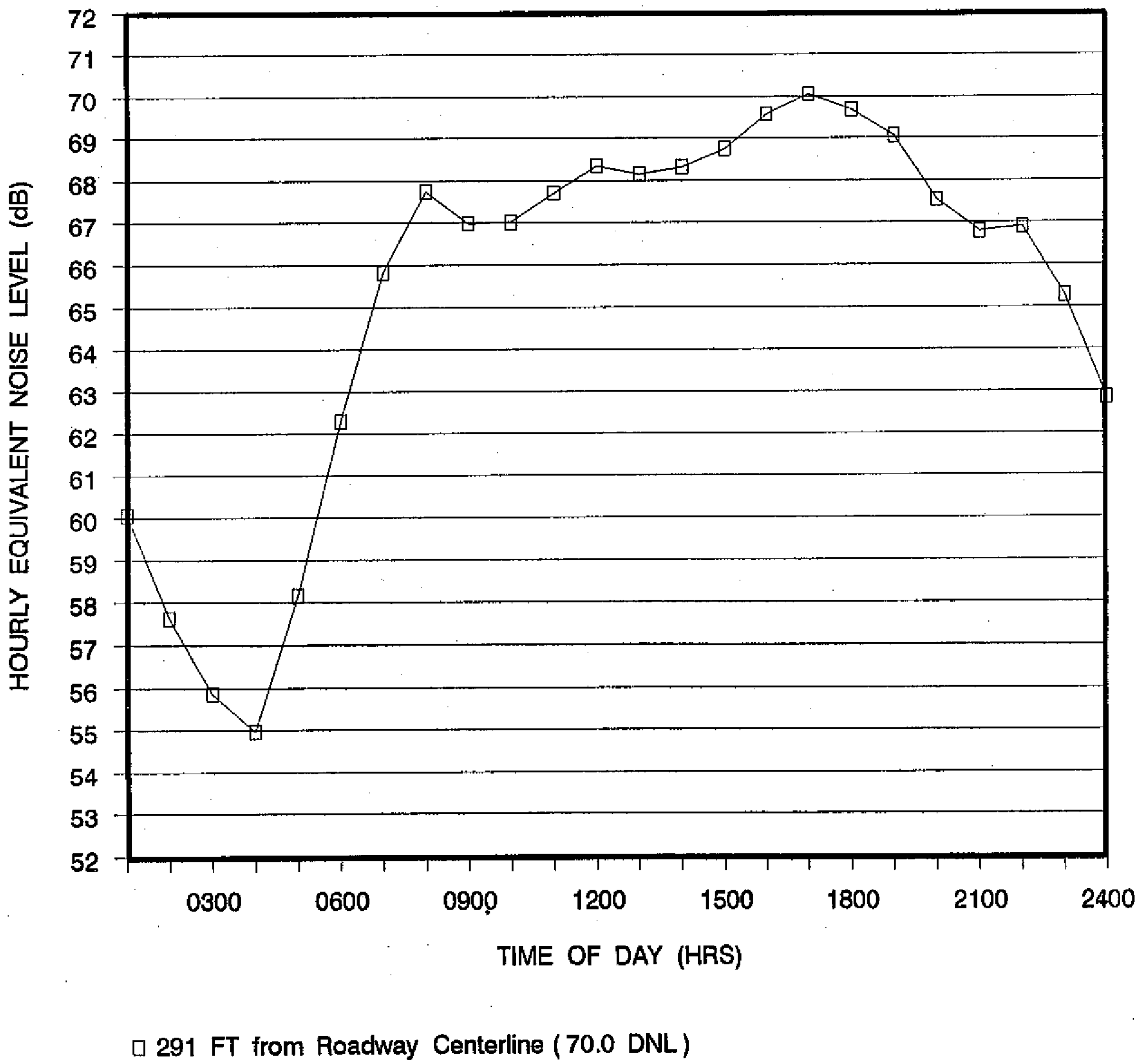
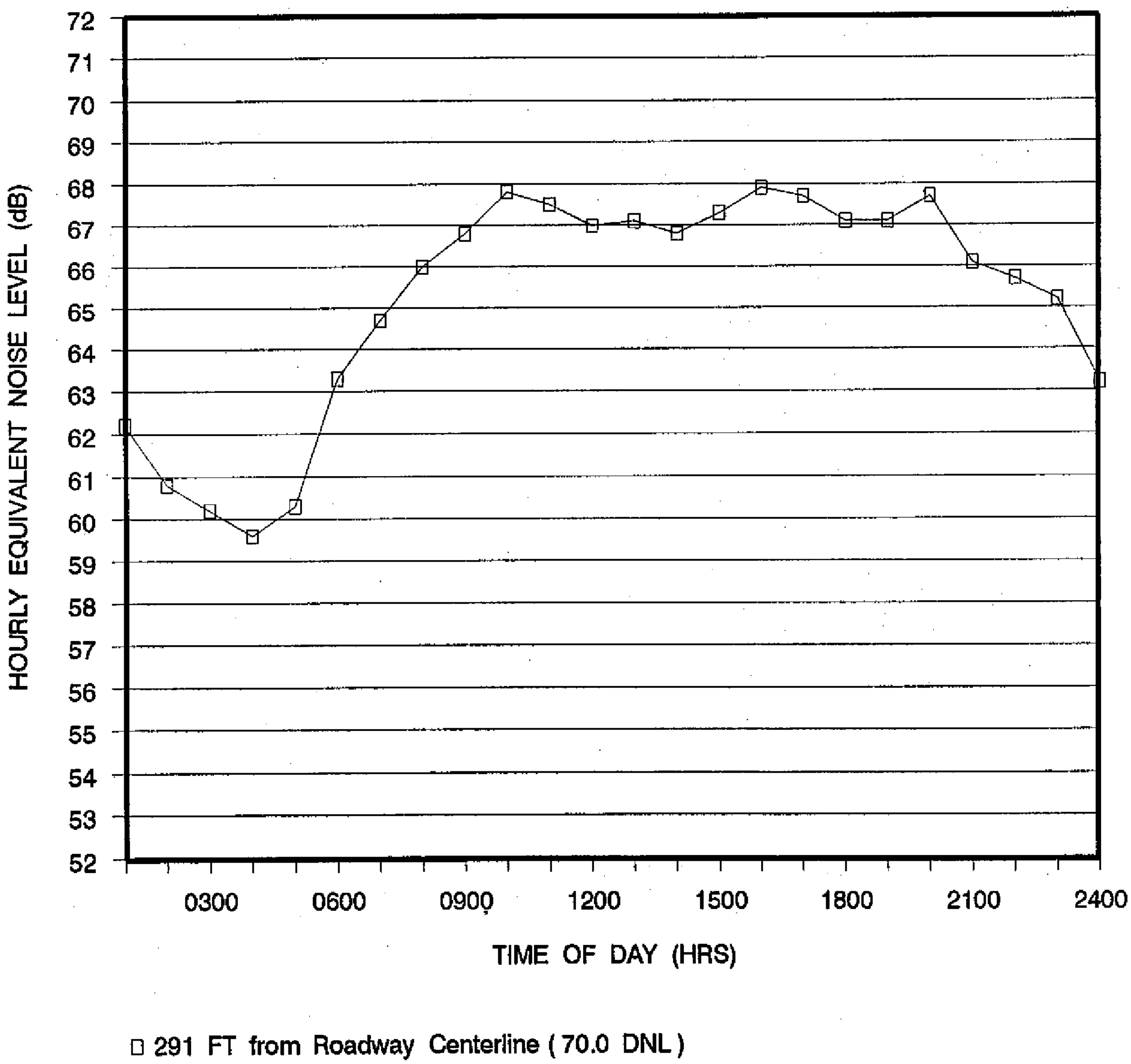


FIGURE 6

MEASURED TRAFFIC NOISE LEVELS AT 291 FT SLANT DISTANCE FROM THE CENTERLINE OF ALA MOANA BOULEVARD AT LOCATION "F" (JULY 26 – 27, 2010)



benefit of shielding from the proposed two Timeshare Tower Buildings. Traffic noise levels were also calculated for future conditions with (Build Alternative) and without (No Build Alternative) the proposed project. The forecasted changes in traffic noise levels over existing levels were calculated with and without the project, and noise impact risks evaluated. The relative contributions of non-project and project traffic to the total noise levels were also calculated, and an evaluation of possible traffic noise impacts was made.

FIGURE 7 presents the measured hourly variations in noise levels at Location H. In addition to the traffic noise measurements at Location H, background noise levels during a luau show at the roof of the hotel's Parking Garage and during loading and unloading operations at the hotel's Receiving Dock and Group and Tour Drop Areas were obtained at Locations A, D, and G. The measured average noise levels at Locations A, D, G, and H are shown in TABLE 2, FIGURE 7, and FIGURE 8. The results of these measurements plus the results of the traffic noise measurements and predictions were used to describe the existing noise levels in the project environs, and to determine if the units of the proposed Timeshare buildings are located in areas with acceptable noise levels of 65 DNL or less. Recommendations for acoustical treatments to the exterior envelopes of the two Timeshare buildings were also provided to reduce interior sound levels from traffic, luau show music, and Receiving Dock and Group and Tour Drop Area noise.

Calculations of average exterior and interior noise levels from construction activities were performed for typical naturally ventilated and air conditioned dwellings. Predicted noise levels were compared with existing background ambient noise levels, and the potential for noise impacts was assessed.

FIGURE 7

MEASURED TRAFFIC NOISE LEVELS AT 351 FT SLANT DISTANCE FROM THE CENTERLINE OF KALIA ROAD AT LOCATION "H" (AUGUST 16 – 17, 2010)

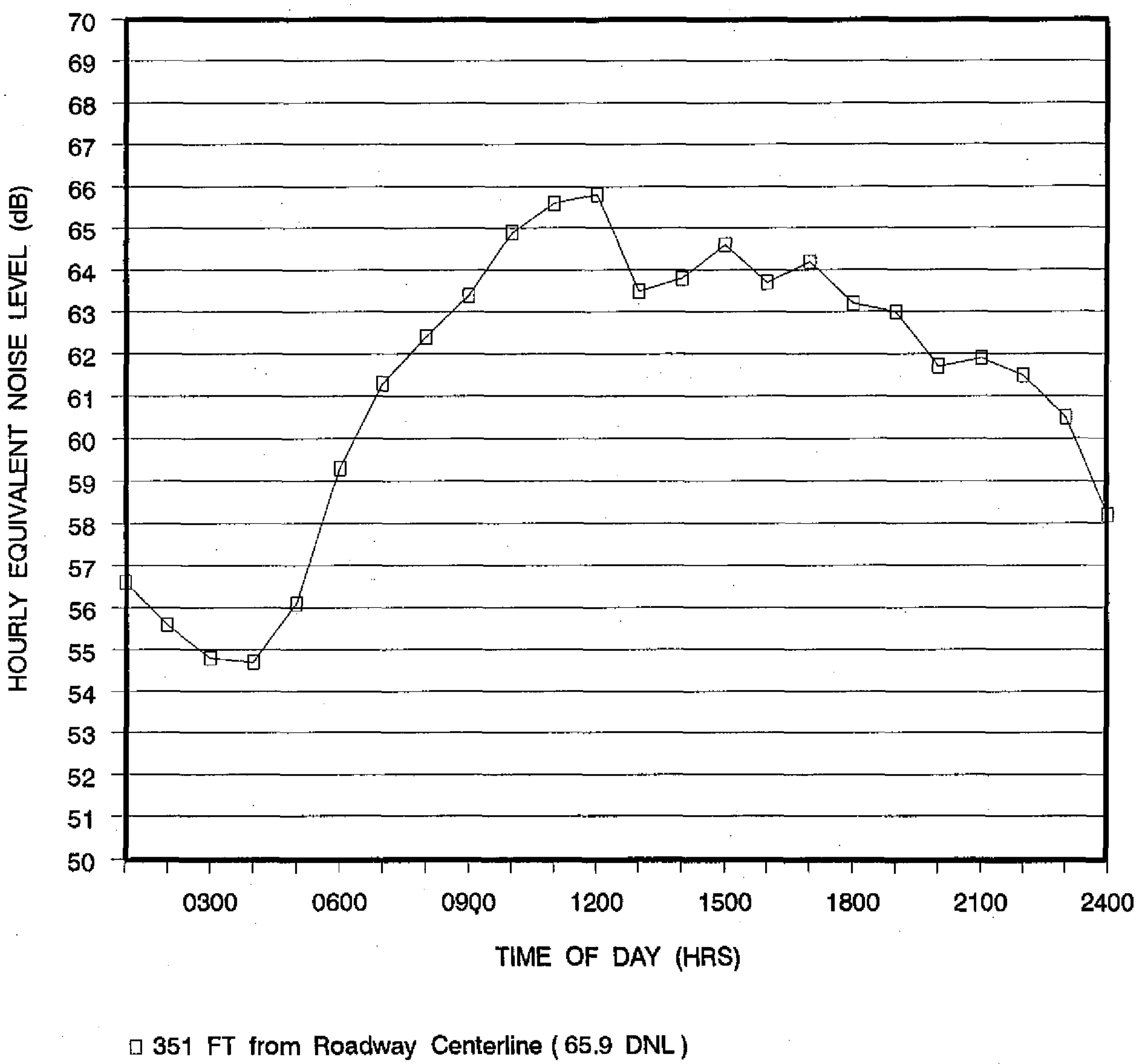
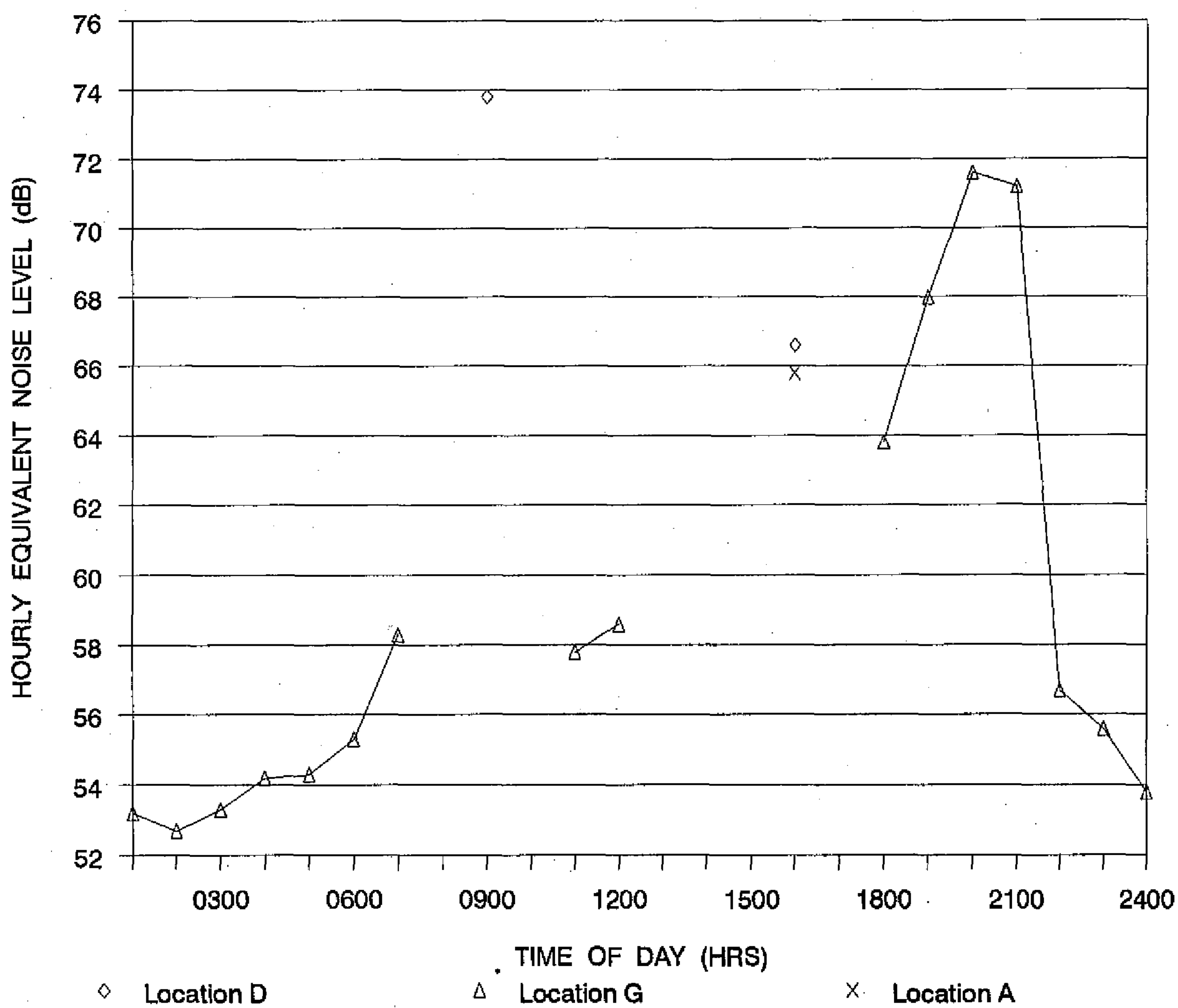


FIGURE 8

MEASURED BACKGROUND NOISE LEVELS AT LOCATIONS "A," "D," AND "G" (JULY AND AUGUST 2010)



V. EXISTING ACOUSTICAL ENVIRONMENT

Major contributors to the existing background ambient noise levels within the project area are: traffic along Ala Moana Boulevard and Kalia Road, the evening luau and dinner show on the roof of the hotel Parking Garage; and tour buses, vans, and delivery trucks operating at the hotel Receiving Dock and Group and Tour Drop Areas. Traffic and background noise measurements were obtained at eight locations (A through H) in the project environs in July and August 2010. These measurement locations are shown in FIGURE 1.

The traffic noise contributions from Ala Moana Boulevard were measured at Location F, and the results of these measurements are shown in TABLE 2 and FIGURE 6. The measured pm peak hour traffic noise levels shown in FIGURE 6 were less than the calculated hourly values of traffic noise along Ala Moana Boulevard for 2009 shown in FIGURE 5, primarily because the traffic volumes obtained in 2009 (Reference 7) were approximately double those reported in 2010 (Reference 6). Based on the measurement and noise modeling results at Location F, it was concluded that existing traffic noise levels of 70 DNL occur at approximately 291 FT slant distance from the centerline of Ala Moana Boulevard. It was also concluded that 70 DNL could be exceeded at all buildings within 209 feet setback distance from Ala Moana Boulevard under unobstructed line-of-sight conditions.

The traffic noise contributions from Kalia Road were measured at Locations E and H, and the results of these measurements are shown in TABLE 2 and FIGURE 7. Based on the measurement and noise modeling results at Locations E and H, it was concluded that existing traffic noise levels of 63 DNL occur at approximately 351 FT slant distance from the centerline of Kalia Road. It was also concluded that 65 DNL could be exceeded at all buildings within 192 feet setback distance from Kalia Road under unobstructed line-of-sight conditions.

Results of calculations of existing (CY 2010) traffic noise levels at reference distances of 50, 60, 100, and 200 feet from the centerlines of the roadways in the project environs are shown in TABLES 3 and 4. Calculations at 60 feet instead of 50 feet from the centerline of Ala Moana Boulevard were required due to the large width of the boulevard. Also shown in TABLES 3 and 4 are the average vehicle speeds and mixes assumed in modeling the existing traffic noise levels. The results of the calculations are shown for ground level receptors without noise shielding effects from nearby buildings. As indicated in TABLES 3 and 4, the existing noise levels in the project environs are highest along Ala Moana Boulevard, and lowest along Rainbow Drive and Ena Road. Existing traffic noise levels exceed 65 DNL at 100 feet setback distance from Ala Moana Boulevard and Kalia Road. Traffic noise levels along Kalia Road are less than those along Ala Moana Boulevard, but are relatively high due to the large number of tour buses which use that roadway. Tour buses, vans, as well as delivery trucks use Kalia Road and Paoa Place to enter the hotel's Receiving Dock and Group and Tour Drop Areas. The tour buses and vans exit the hotel's drop area via a

TABLE 3

EXISTING (CY 2010) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	******* VOLUMES (VPH) ********* AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Ala Moana Blvd. - Ewa of Project	37	3,162	2,944	57	161	75.1 *	71.9	68.4
Ala Moana Blvd. - Fronting Project	37	2,384	2,172	50	162	74.5 *	71.2	67.8
Ala Moana Blvd. - D.H. of Project	37	1,656	1,609	25	22	70.8 *	67.5	64.1
Ena Road - At Ala Moana Boulevard	25	390	384	4	2	56.7	53.7	50.4
Kalia Road - At Ala Moana Boulevard	30	1,475	1,323	27	125	69.2	65.6	62.5
Rainbow Drive - At Kalia Road	20	455	444	9	2	56.2	53.4	50.3
Kalia Road - D.H. of Rainbow Dr.	30	1,148	999	23	126	68.8	65.3	62.1
Kalia Road - Ewa of Paoa Place	30	1,140	992	23	125	68.8	65.2	62.1
Paoa Place at Kalia Road	20	105	86	6	13	58.6	55.1	52.1
Kalia Road - D.H. of Paoa Place	30	1,097	1,020	22	55	66.6	63.1	59.9

Notes:

1. Traffic noise levels calculated for ground level receptors.
2. Hard ground and unobstructed field-of-view conditions assumed.
3. * Calculated at 60 FT distance from centerline instead of 50 FT.

TABLE 4

EXISTING CONDITIONS; YEAR 2010; PM PEAK HR. LEQ AND DNL SETBACK DISTANCES

ROADWAY SEGMENT	SPEED (MPH)	VEHICLE MIX (%A/%MT/%HT)	TOTAL VPH	Leq @ 100' (dB)	DIST. (FT) FROM CENTERLINE 65 DNL	70 DNL	75 DNL
Ala Moana Blvd. - Ewa of Project	37	(93.1 / 1.8 / 5.1)	3,162	71.9	664	237	85
Ala Moana Blvd. - Fronting Project	37	(91.1 / 2.1 / 6.8)	2,384	71.2	598	209	73
Ala Moana Blvd. - D.H. of Project	37	(97.2 / 1.5 / 1.3)	1,656	67.5	275	96	33
Ena Road - At Ala Moana Boulevard	25	(98.5 / 1.0 / 0.5)	390	53.7	14	< 12	< 12
Kalia Road - At Ala Moana Boulevard	30	(89.7 / 1.8 / 8.5)	1,475	65.6	192	62	20
Rainbow Drive - At Kalia Road	20	(97.5 / 2.0 / 0.5)	455	53.4	12	< 12	< 12
Kalia Road - D.H. of Rainbow Dr.	30	(87.0 / 2.0 / 11.0)	1,148	65.3	177	59	20
Kalia Road - Ewa of Paoa Place	30	(87.0 / 2.0 / 11.0)	1,140	65.2	176	57	18
Paoa Place at Kalia Road	20	(82.0 / 6.0 / 12.0)	105	55.1	17	< 12	< 12
Kalia Road - D.H. of Paoa Place	30	(93.0/ 2.0 / 5.0)	1,097	63.1	109	36	12

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) Setback distances are for ground level receptors with unobstructed fields-of-view.
(3) "Pavement" or hard ground conditions assumed along all roadways.

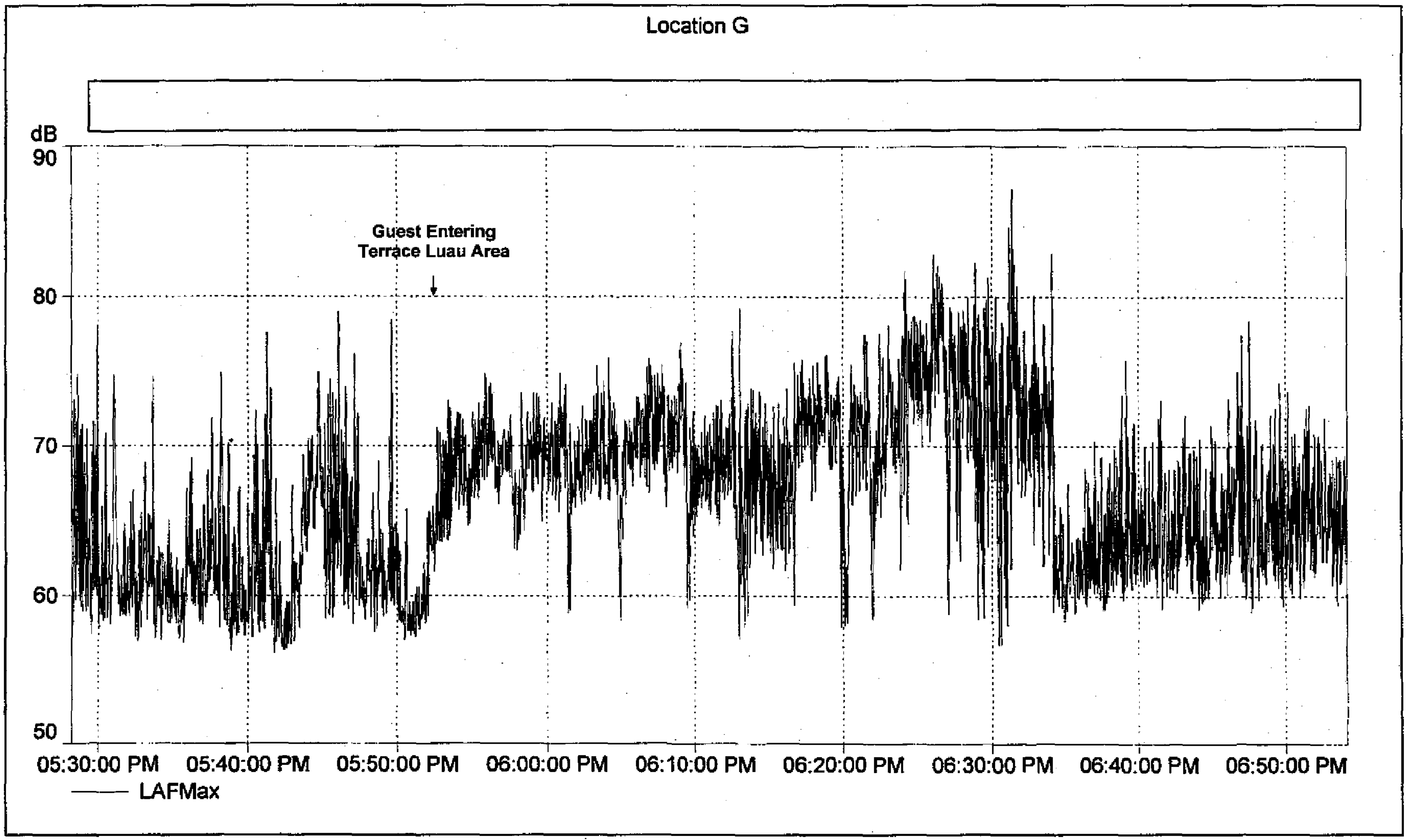
separate exit driveway located to the north of Paoa Place to enter Kalia Road.

At receptor locations which are shielded from Ala Moana Boulevard's and Kalia Road's traffic noise by buildings, such as at Location G, existing background ambient noise levels are lower due to the noise shielding effects of the buildings. Noise reductions of 5 to 20 dBA can be expected from these noise shielding effects. Due to the presence of local traffic and non-traffic noise sources which are located on the makai side of the Ilikai and the Hilton Hawaiian Village buildings, existing background ambient noise levels at these shielded locations range between 55 and 66 DNL. These noise sources which are located on the makai side of the high rise buildings include: local traffic along Rainbow Drive; fixed machinery and equipment on the grounds of the Ilikai and Hilton Hawaiian Village; and maintenance equipment on the grounds of the Hilton Hawaiian Village. In addition, the sounds from the outdoor luau and dinner show control the background noise levels during the evenings at locations which overlook the Parking Garage rooftop function area and Location G.

FIGURE 8 depicts the hourly variations in the measured average sound levels at Location G during the evening, nighttime, and early morning periods. Typical background noise levels during the quietest night and early morning periods were 53 dB at Location G. During the daytime, existing background noise levels at Location G are estimated to be 59 dB, and increase to levels of 61 to 72 dB during the evening outdoor luau and dinner show. Without the luau and dinner show, existing background noise levels at Location G were estimated to be 62 DNL, and with the luau and dinner show, existing background noise levels at Location G were estimated to be 65 DNL. Typical sound levels recorded at Location G before, during, and following a luau show are shown in FIGURE 9.

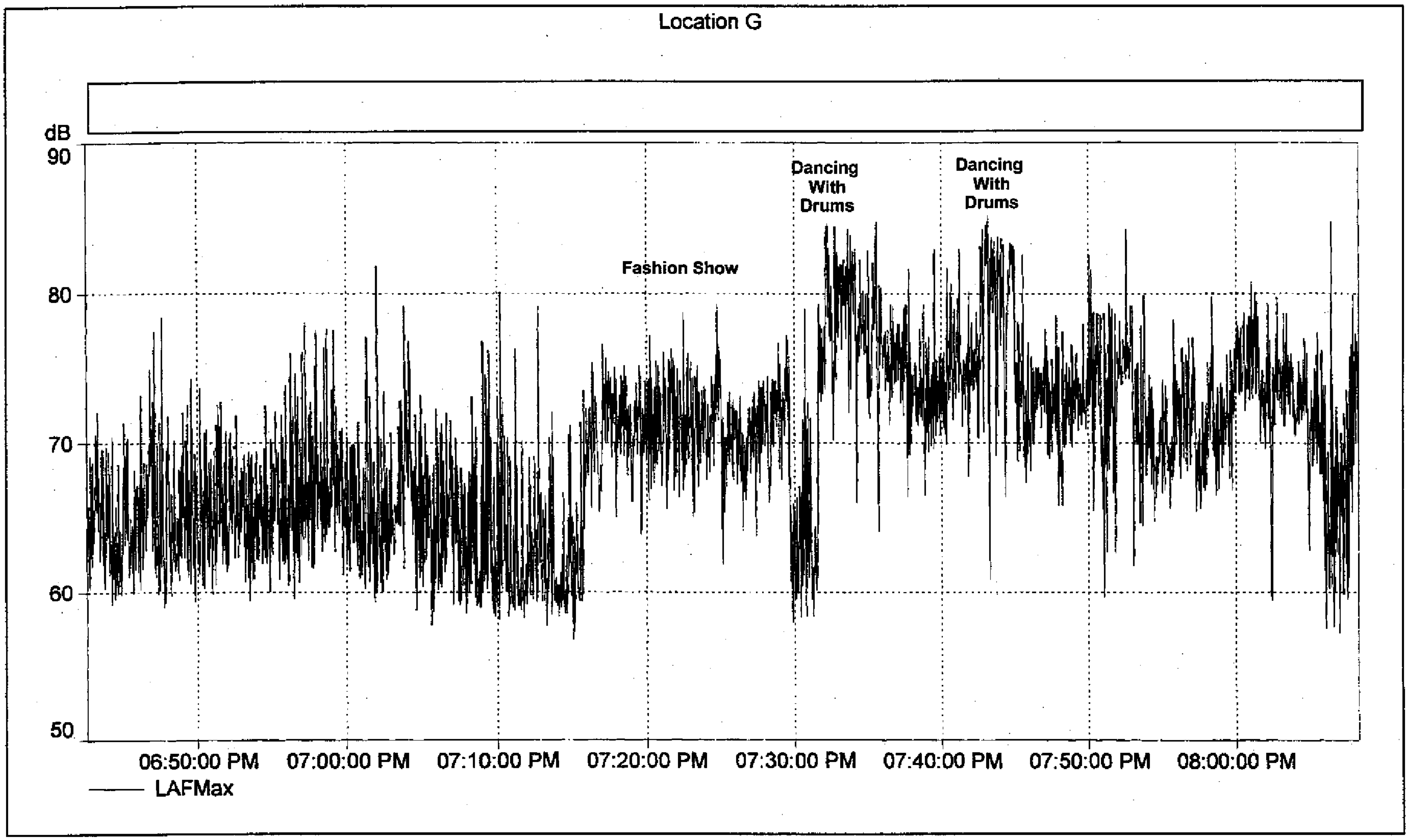
The maximum noise levels from offshore aircraft are typically between 65 and 70 dB. The loudest aircraft noise events are typically associated with departures by interisland jet cargo and military jet aircraft, or with flybys by helicopters. Aircraft noise events are audible above the background ambient noise. However, aircraft noise levels at the project site do not exceed 60 DNL, which is the level above which the Hawaii State Department of Transportation, Airports Division, considers to be unacceptable for residences and resorts. The most recently published airport noise contours for Honolulu International Airport indicate that the project site is located beyond (or outside) the 55 DNL contour for the Year 2008. This correlates with the measured aircraft noise data and the Year 2010 estimate of 50 to 55 DNL for aircraft noise at the project site.

Existing background noise levels near the hotel's Receiving Dock and Group and Tour Drop Areas were measured at Locations A and D where shown in FIGURE 1. The measurement results are shown in TABLE 2, and FIGURES 8, 10, 11, and 12. At Location D, measured averaged noise levels ranged from 67 to 74 dB. The higher value of 74 dB was considered to be typical during the peak tour bus loading/unloading period.



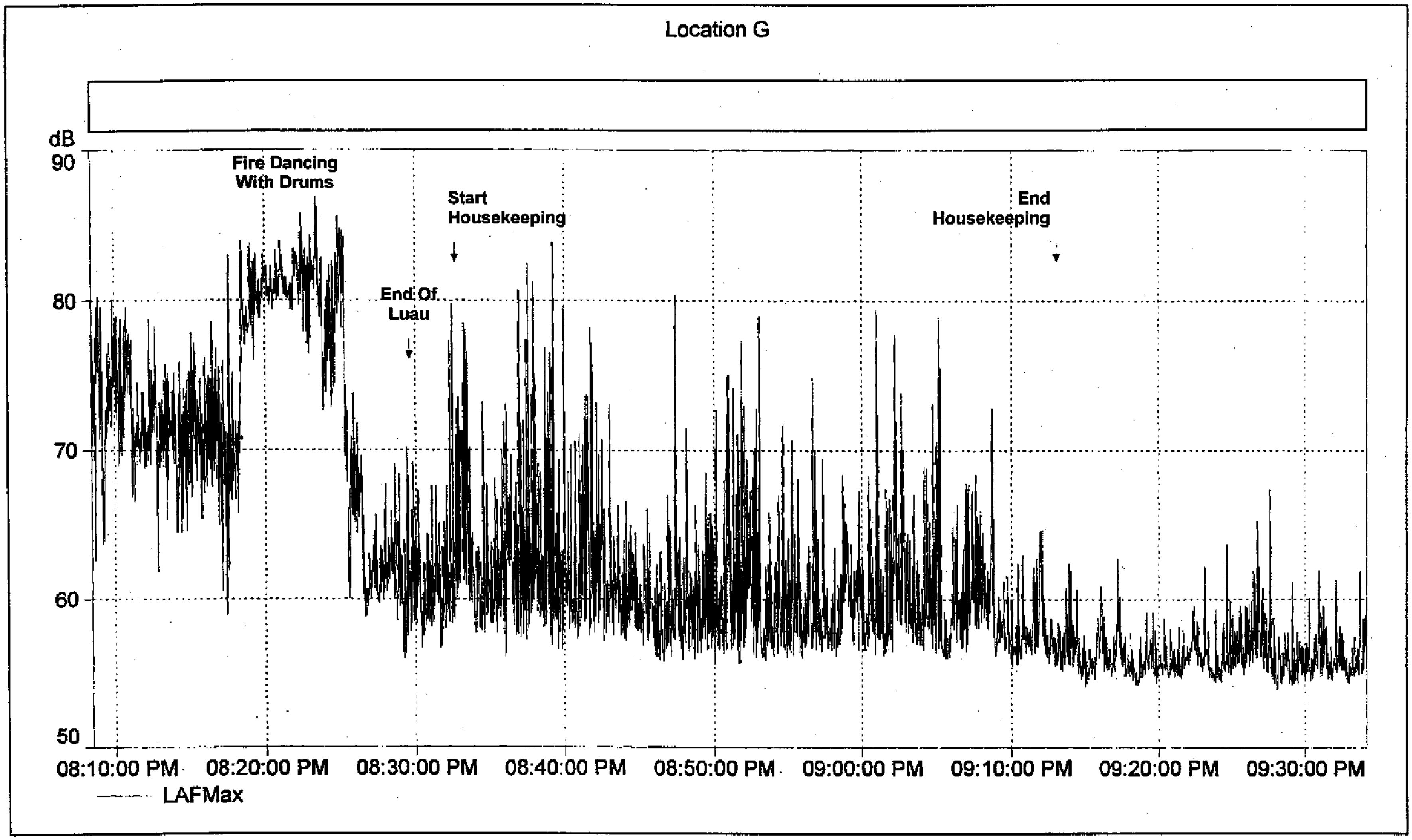
MAXIMUM SOUND LEVELS VS. TIME MEASURED AT LOCATION "G" (7/26/10; 1728 TO 2130 HOURS)

FIGURE 9



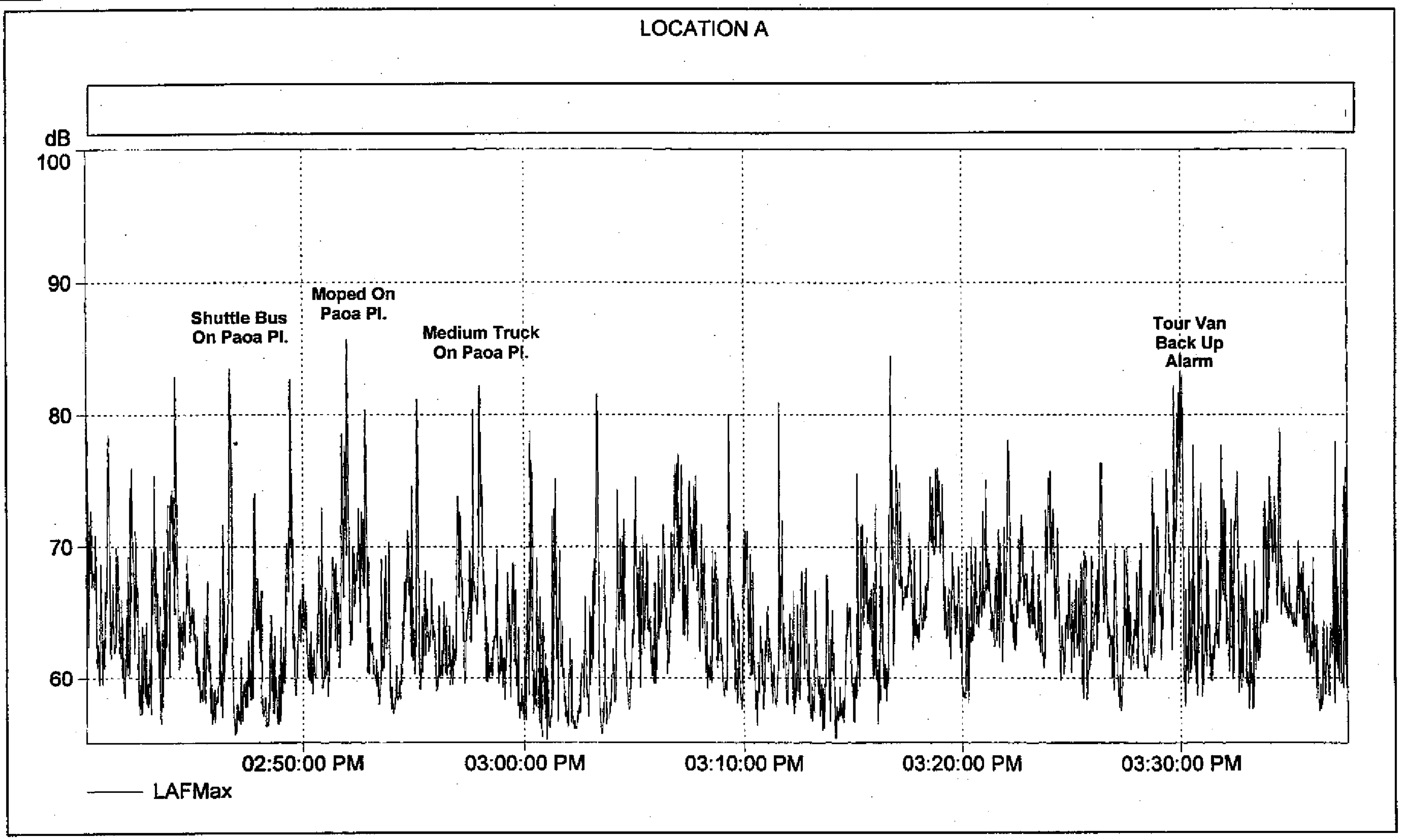
MAXIMUM SOUND LEVELS VS. TIME MEASURED AT LOCATION "G" (7/26/10; 1728 TO 2130 HOURS)

FIGURE 9 (CONT.)



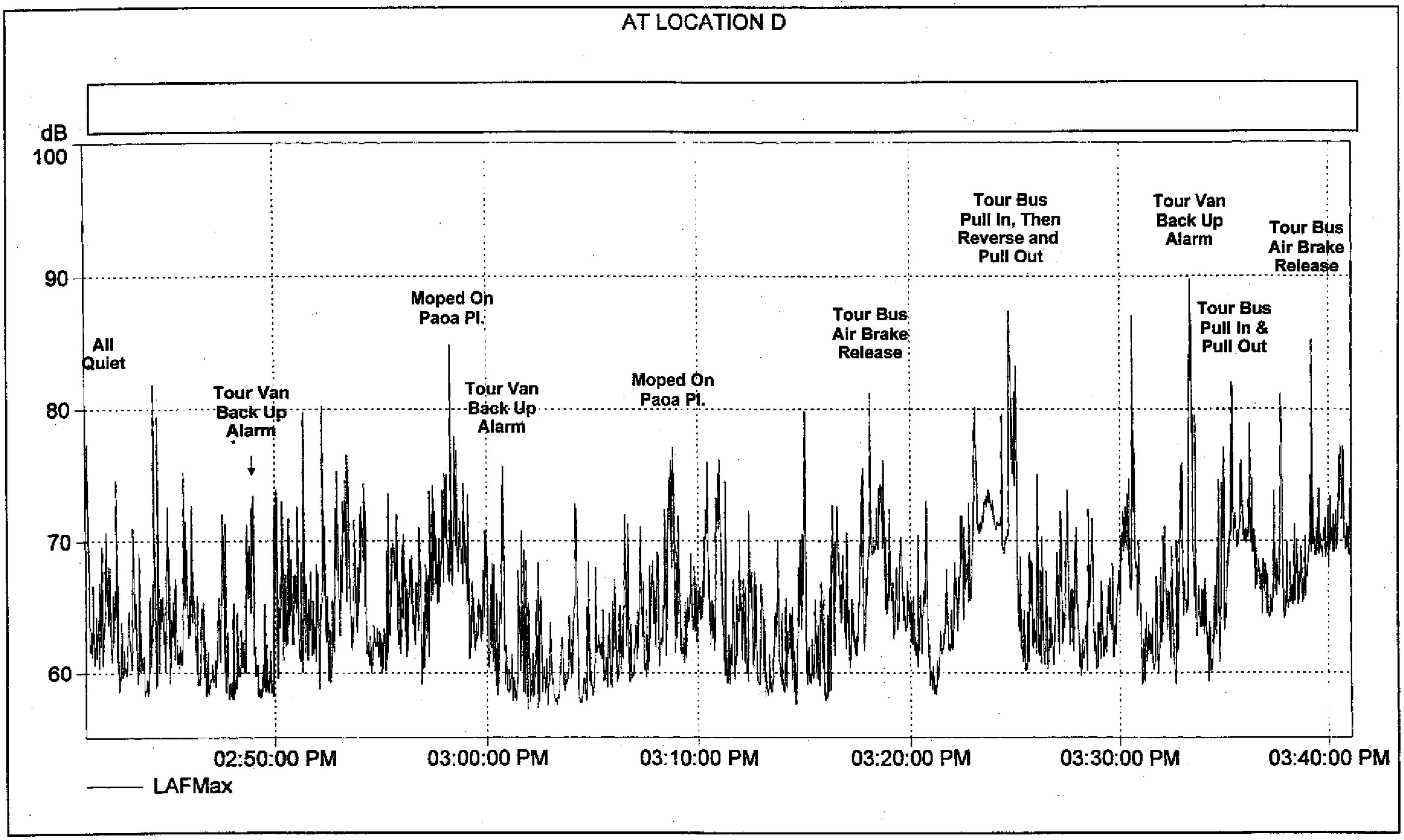
MAXIMUM SOUND LEVELS VS. TIME MEASURED AT LOCATION "G" (7/26/10; 1728 TO 2130 HOURS)

FIGURE 9 (CONT.)



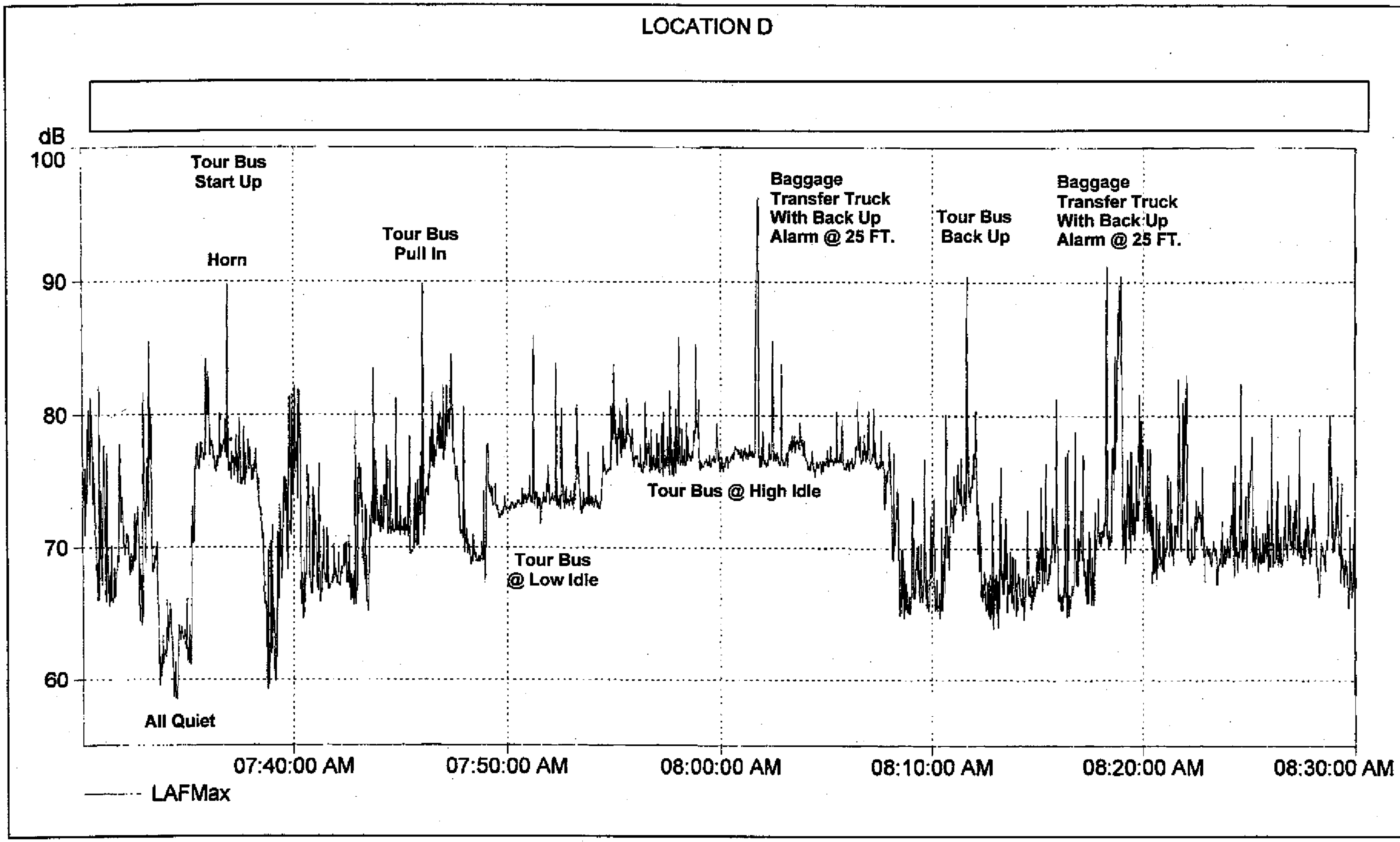
MAXIMUM SOUND LEVELS VS. TIME MEASURED AT LOCATION "A" (7/22/10; 1440 TO 1540 HOURS)

FIGURE 10



MAXIMUM SOUND LEVELS VS. TIME MEASURED AT LOCATION "D" (7/22/10; 1440 TO 1540 HOURS)

FIGURE 11



MAXIMUM SOUND LEVELS VS. TIME MEASURED AT LOCATION "D" (7/30/10; 0730 TO 0830 HOURS)

FIGURE 12

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 6 for CY 2022 with and without the proposed project. The future projections of non-project and project traffic volumes for the No Build and Build Alternatives are shown in APPENDIX C. The Base Year modeling assumptions regarding average vehicle speeds and mixes, and "Pavement" propagation loss factor were also used to model the future traffic noise levels.

TABLES 5 and 6 contain the CY 2022 traffic volumes, average vehicle speeds, vehicle mixes, and noise levels for the Build Alternative. TABLE 6 contains the CY 2022 setback distances to the 65, 70, and 75 DNL contours for ground level receptors with unobstructed fields-of-view to the roadways.

The dominant traffic noise source in the project area will continue to be traffic noise from Ala Moana Boulevard. The predicted increases in traffic noise levels for the various roadways from project and non-project traffic are shown in TABLE 7. Increases in traffic noise levels along Ala Moana Boulevard by CY 2022 are expected to be 0.0 dB under the No Build Alternative and range between 0.2 to 0.4 dB under the Build Alternative. Significant increases in traffic noise levels along Ala Moana Boulevard are not expected to result from the HHV MPE Project. Similar conclusions were possible for future traffic noise along Ena Road and Kalia Road, where future traffic noise increases associated with the HHV MPE Project were predicted to be 0.8 dB or less for the Build Alternative.

The larger (1.1 to 2.9 dB) increases in traffic noise attributable to the HHV MPE Project are predicted to occur along Rainbow Drive near the Kalia Road intersection, and along Paoa Place near the Kalia Road intersection. These predicted increases are relatively large because existing traffic noise levels along these two roadways are relatively low. Because of the relatively low noise levels during CY 2010 along Rainbow Drive and Paoa Place near the Kalia Road intersections, traffic noise levels from these two roadways will not approach those associated with Ala Moana Boulevard or Kalia Road in spite of the increases anticipated. In addition, because the existing traffic noise levels along these two roadways are well below the levels of other background noise sources (see TABLE 2, FIGURE 3, and FIGURE 4), future traffic noise levels along these two roadways are expected to remain below the level of other background noise sources.

TABLE 8 presents the existing and future traffic noise levels at various receptor locations in the project environs, which are shown in FIGURE 13. Locations which front Ala Moana Boulevard (F, #1, and #2) will experience relatively high noise levels above 65 DNL, due to existing and future traffic along Ala Moana Boulevard. Receptors at Locations #6 and #2 which front Kalia Road will also experience high noise levels above 65 DNL due to existing and future traffic along Kalia Road. At the interior

TABLE 5

FUTURE (CY 2022) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (PM PEAK HOUR, WITH THE PROJECT)

LOCATION	SPEED (MPH)	TOTAL VPH	******* VOLUMES (VPH) ********* AUTOS	M TRUCKS	H TRUCKS	50' Leq		100' Leq	200' Leq
Ala Moana Blvd. - Ewa of Project	37	3,388	3,154	61	173	75.5	*	72.2	68.8
Ala Moana Blvd. - Fronting Project	37	2,596	2,364	55	177	74.9	*	71.6	68.2
Ala Moana Blvd. - D.H. of Project	37	1,731	1,682	26	23	71.0	*	67.7	64.3
Ena Road - At Ala Moana Boulevard	25	448	442	4	2	57.2		54.2	50.9
Kalia Road - At Ala Moana Boulevard	30	1,753	1,572	32	149	69.9		66.4	63.2
Rainbow Drive - At Kalia Road	20	561	547	11	3	57.7		54.5	51.4
Kalia Road - D.H. of Rainbow Dr.	30	1,342	1,167	27	148	69.5		66.0	62.8
Kalia Road - Ewa of Paoa Place	30	1,248	1,086	25	137	69.2		65.7	62.5
Paoa Place at Kalia Road	20	220	181	13	26	60.9		58.0	55.1
Kalia Road - D.H. of Paoa Place	30	1,114	1,036	22	56	66.7		63.2	60.0

Notes:

1. Traffic noise levels calculated for ground level receptors.
2. Hard ground and unobstructed field-of-view conditions assumed.
3. * Calculated at 60 FT distance from centerline instead of 50 FT.

TABLE 6

FUTURE CONDITIONS WITH PROJECT; YEAR 2022; PM PEAK HR. LEQ AND DNL SETBACK DISTANCES

ROADWAY SEGMENT	SPEED (MPH)	VEHICLE MIX (%A/%MT/%HT)	TOTAL VPH	Leq @ 100' (dB)	DIST. (FT) FROM CENTERLINE 65 DNL	70 DNL	75 DNL
Ala Moana Blvd. - Ewa of Project	37	(93.1 / 1.8 / 5.1)	3,388	72.2	739	258	90
Ala Moana Blvd. - Fronting Project	37	(91.1 / 2.1 / 6.8)	2,596	71.6	651	227	79
Ala Moana Blvd. - D.H. of Project	37	(97.2 / 1.5 / 1.3)	1,731	67.7	286	100	35
Ena Road - At Ala Moana Boulevard	25	(98.5 / 1.0 / 0.5)	448	54.2	16	< 12	< 12
Kalia Road - At Ala Moana Boulevard	30	(89.7 / 1.8 / 8.5)	1,753	66.4	226	75	25
Rainbow Drive - At Kalia Road	20	(97.5 / 2.0 / 0.5)	561	54.5	16	< 12	< 12
Kalia Road - D.H. of Rainbow Dr.	30	(87.0 / 2.0 / 11.0)	1,342	66.0	207	69	23
Kalia Road - Ewa of Paoa Place	30	(87.0 / 2.0 / 11.0)	1,248	65.7	194	64	21
Paoa Place at Kalia Road	20	(82.0 / 6.0 / 12.0)	220	58.0	33	< 12	< 12
Kalia Road - D.H. of Paoa Place	30	(93.0/ 2.0 / 5.0)	1,114	63.2	112	37	12

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) Setback distances are for ground level receptors with unobstructed fields-of-view.
(3) "Pavement" or hard ground conditions assumed along all roadways.

TABLE 7

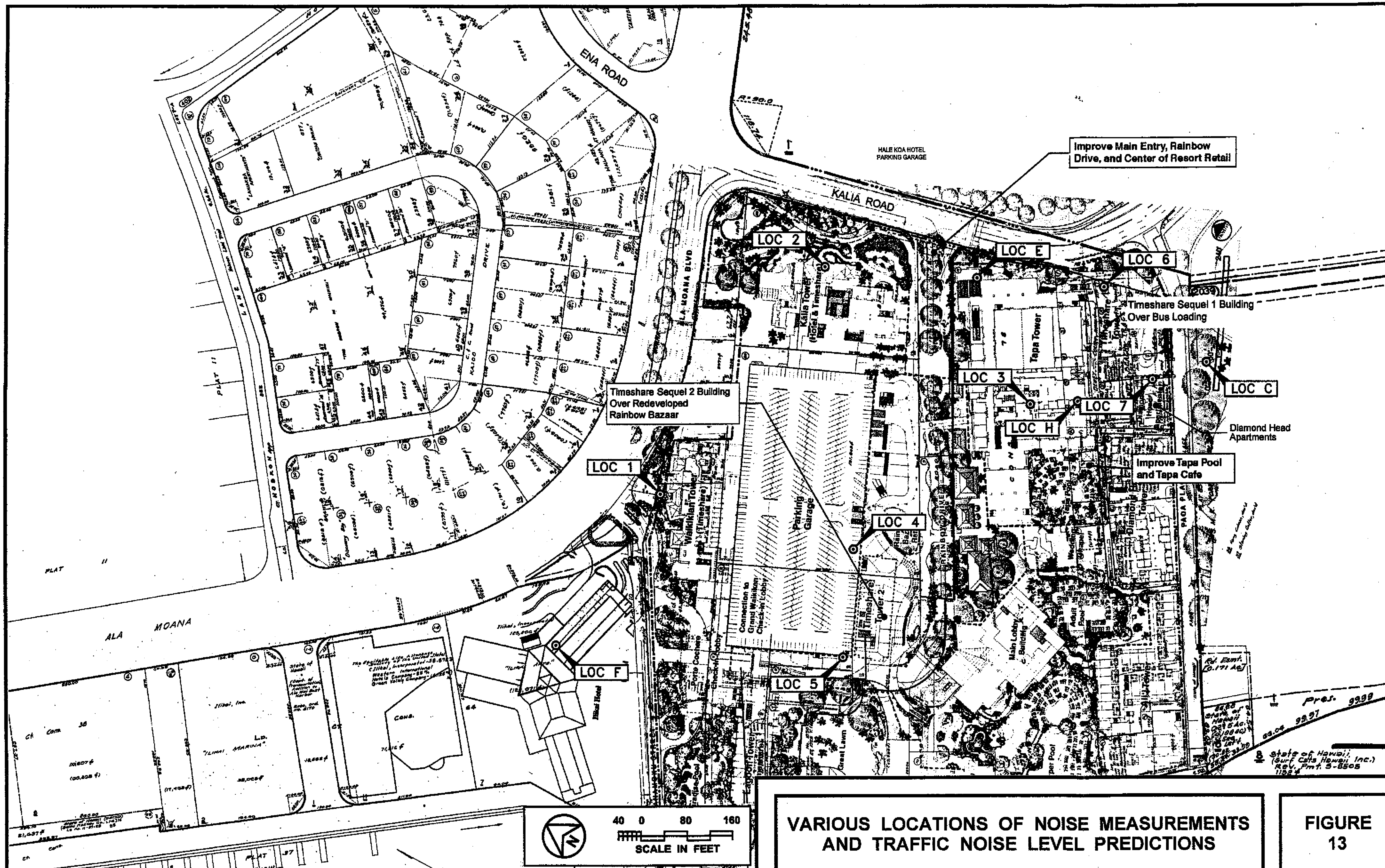
CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2022) (PM PEAK HOUR LEQ)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Ala Moana Blvd. - Ewa of Project	0.0	0.3
Ala Moana Blvd. - Fronting Project	0.0	0.4
Ala Moana Blvd. - D.H. of Project	0.0	0.2
Ena Road - At Ala Moana Boulevard	0.2	0.3
Kalia Road - At Ala Moana Boulevard	0.0	0.8
Rainbow Drive - At Kalia Road	0.0	1.1
Kalia Road - D.H. of Rainbow Dr.	0.0	0.7
Kalia Road - Ewa of Paoa Place	0.0	0.5
Paoa Place at Kalia Road	0.0	2.9
Kalia Road - D.H. of Paoa Place	0.0	0.1

TABLE 8

EXISTING AND FUTURE TRAFFIC NOISE LEVELS
(FUTURE NO BUILD AND BUILD CONDITIONS)

RECEPTOR LOCATION	SETBACK DIST. FROM EXIST. C/L	RECEPTOR EAR ELEVATION	EXISTING (CY 2010) DNL	FUTURE (CY 2022) LEVELS NO BUILD DNL	BUILD DNL
Location C	50 FT from Paoa Lane	5 FT Above Ground	63	63	61
Location E	78 FT from Kalia Road	21 FT Above Ground	69	69	70
Location F	173 FT from Ala Moana Blvd.	234 FT Above Ground	70	70	70
Location H	264 FT from Kalia Road	231 FT Above Ground	63	63	63
Location 1	104 FT from Ala Moana Blvd.	90 FT Above Ground	73	73	74
Location 2	134 FT from Kalia Road	90 FT Above Ground	68	68	69
Location 3	284 FT from Kalia Road	90 FT Above Ground	61	61	61
Location 4	606 FT from Kalia Road	90 FT Above Ground	57	57	57
Location 5	797 FT from Kalia Road	90 FT Above Ground	55	55	52
Location 6	88 FT from Kalia Road	90 FT Above Ground	68	68	68
Location 7	270 FT from Kalia Road	50 FT Above Ground	63	63	60



VARIOUS LOCATIONS OF NOISE MEASUREMENTS AND TRAFFIC NOISE LEVEL PREDICTIONS

FIGURE 13

receptor locations on the HHV site (#3, #4, #5, and #7), existing and future traffic noise levels are less than 65 DNL. In general, traffic noise levels on the HHV site will tend to decrease with increasing distances from Ala Moana Boulevard and Kalia Road.

Future sound levels associated with the evening luau and dinner show were assumed to remain the same as existing levels. During the daytime, future background noise levels at Location G are estimated to remain at 59 dBA, and increase to levels of 61 to 72 dB during the evening outdoor luau and dinner show. Without the luau and dinner show, existing background noise levels at Location G are expected to remain at 62 DNL, and with the luau and dinner show, future background noise levels at Location G were estimated to be 65 DNL. The assumed future sound levels at Location G before, during, and following a luau show were assumed to be similar to those shown in FIGURE 9. At the proposed new Timeshare Sequel 2 Tower on the Diamond Head side of the hotel Parking Garage, future traffic noise levels are expected to be less than 65 DNL (see TABLE 8, Locations #4 and #5). The sound level contributions from the luau and dinner show at this proposed new Timeshare Sequel 2 Tower Building are expected to be less than 61 DNL, so total background levels at these proposed tower units are predicted to be approximately 62 DNL. At the proposed 2 Bedroom guest units of the makai wing of the Timeshare Sequel 2 Building, sound levels associated with the luau and dinner show are expected to be much higher (in the order of 70 DNL) due to their shorter distances from the musicians and stage. These levels are quite high, and may result in conflicts between the show and the hotel guests.

The future noise levels at the hotel's Receiving Dock and Group and Tour Drop Areas without the HHV MPE Project are expected to remain the same as existing noise levels, and increase by approximately 3 dB with the HHV MPE project. The future noise events (back up alarms, bus idling, bus braking, and bus startup) will tend to occur approximately twice as often as existing conditions, which will cause the average noise levels in the hotel's Receiving Dock and Group and Tour Drop Areas to increase by 3 dB. The actual maximum noise levels of the intermittent noise events will remain at approximately the same levels, but will occur approximately twice as often as existing conditions.

Aircraft noise levels over the project site should not change significantly between CY 2010 and 2022, and should remain below the noise compatibility threshold level of 60 DNL used by the Hawaii State Department of Transportation, Airports Division for hotel properties. Because existing aircraft noise levels are relatively low at 50 to 55 DNL over the project site, it is unlikely that they will increase to the 60 DNL level by the 2022 time frame.

CHAPTER VII. DISCUSSION OF PROJECT-RELATED NOISE IMPACTS AND POSSIBLE MITIGATION MEASURES

Traffic Noise. Future traffic noise levels at the proposed Timeshare Sequel 1 Building fronting Kalia Road are expected to exceed 65 DNL. For the guest units in this proposed tower building, noise mitigation measures are recommended. Closure and air conditioning of the units in the building is an effective noise mitigation measure for this project. A minimum of 30 to 35 dB of exterior-to-interior noise reduction is recommended for those units which have unobstructed lines-of-sight to Kalia Road. Due to the noise contributions expected from the hotel's Receiving Dock and Group and Tour Drop Areas, additional exterior-to-interior noise reduction measures may be required if noise leakage from the Receiving Dock and Group and Tour Drop Areas via any ventilation openings is excessive.

The second proposed Timeshare Sequel 2 Building located next to the hotel Parking Garage should not require special noise mitigation measures for traffic noise since future traffic noise levels at this building should be less than 65 DNL. However, closure and air conditioning of the units in this tower building will probably be required due to the proximity of the building to the evening luau and dinner show.

Noise impacts from project related traffic along the roadways which are expected to service the project traffic are not expected due to the relatively low levels of project related traffic noise when compared to the noise levels of non-project related traffic and other noise sources. Project related traffic noise increases are expected to be largest in the Receiving Dock and Group and Tour Drop Areas, and future noise impacts are possible at the Diamond Head Apartments due to their proximity to the hotel's Receiving Dock and Group and Tour Drop Areas. With the added contribution of noise from tour bus, van, and truck movements in the Receiving Dock and Group and Tour Drop Areas, future background noise levels at the lower floors of the Diamond Head Apartment units which face the loading area could range from 65 to 70 DNL. Noise mitigation measures in the form of closure and air conditioning is recommended for these dwelling units.

Receiving Dock and Group and Tour Drop Area Noise. Figures 11 and 12 depict the noise levels measured at the existing Group and Tour Drop Area during the off-peak and peak operating periods. The frequency of high noise level events shown in the figures is expected to double by 2022 with the project. The proposed Timeshare Sequel 1 Building fronting Kalia Road is located above the planned Group and Tour Drop Area, and special acoustical treatments will be required to minimize reverberant sound buildup in the drop area. Also, special acoustical treatments to the exterior windows of the guest suites may also be required to attenuate Group and Tour Drop Area noise levels to acceptable levels within the guest suites. Closure and air conditioning of the guest suites will probably be mandatory because of high traffic noise levels. The following noise mitigation measures are recommended to minimize potential noise impacts from the Receiving Dock and Group and Tour Drop Areas:

1. Initiate a long range program to encourage tourist transportation and delivery truck operators at the hotel to switch over from the use of high pitched, backup alarms to the use of broadband noise backup alarms. The audible noise from the broadband noise backup alarms are less intrusive (particularly at the longer distances) because their energy is not concentrated at a single high frequency where other background noise levels tend to be low. These backup alarms are also available with features to utilize lower alarm emission levels during the quieter periods.

2. The exterior glass windows (or sliding lanai doors) of the HHV guest suites (as well as at the adjacent Diamond Head Apartments) will be the acoustical weak links in attenuating the noise from the loading areas. The use of double panes of glazing, with as much as 4" airspace between the panes, may be required at units if exterior noise levels exceed 85 dB. Therefore, special acoustical design considerations should be included in the construction of the new Timeshare Sequel 1 Building fronting Kalia Road.

3. Assistance with noise mitigation measures at the Diamond Head Apartments should be considered in order to reduce the potential noise impacts associated with the increase in activities at the hotel's Receiving Dock and Group and Tour Drop Areas.

Luau and Dinner Show Music. The use of the roof of the hotel Parking Garage for the evening luau and dinner show is a continuation of an existing function, and the amplified music and announcements during the show will continue to be audible at the adjacent buildings. While the music and other amplified sounds during the evening luau and dinner show is not expected to cause total background noise levels to exceed 65 DNL at the proposed Timeshare Sequel 2's Diamond Head Tower next to the Parking Garage, the sound levels from the show will exceed the Honolulu Liquor Commission limit of 60 dBA at the Ewa face of the proposed tower building. The potential sound levels at the exterior face of the proposed tower building are approximately 6 dB less than those shown in FIGURE 9, and are high enough that complaints may occur from guests at the proposed tower building. At the makai wing of 2 Bedroom units which face the Great Lawn, sound levels could be 10 to 15 dB greater than those shown in FIGURE 9 due to the shorter distances to the stage and musicians' shack. At these high levels, risks of complaints and conflicts between the show and the occupants of the 2 Bedroom units are considered to be high. Therefore, full disclosure of the sound levels from the show to potential owners of the new units as well as the use of other mitigating provisions in the sales documents are recommended for the proposed Timeshare Sequel 2 Building next to the Parking Garage. Special sound attenuation measures (in addition to closure and air conditioning) will also be required for the makai 2 Bedroom Wing.

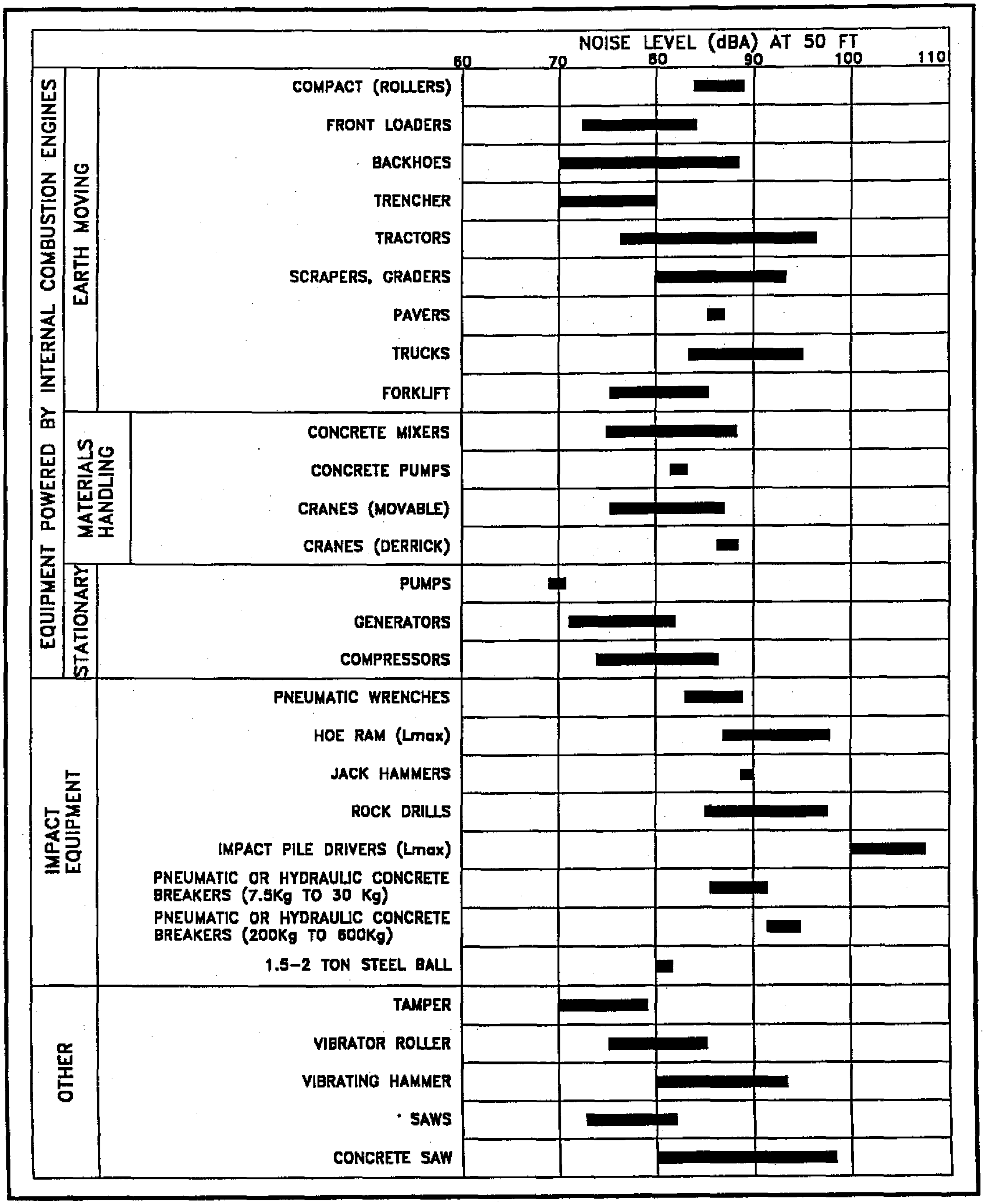
General Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. The total time period for construction is unknown, but it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. FIGURE 14 depicts the range of noise levels of various types of construction equipment when measured at 50 FT distance from the equipment. Typical levels of exterior noise from construction activity (excluding pile driving activity) at various distances from the job site are shown in FIGURE 15. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in FIGURE 15, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure.

FIGURE 15 is useful for predicting exterior noise levels at short distances (within 100 FT) from the work when visual line of sight exists between the construction equipment and the receptor. Direct line-of-sight distances from the construction equipment to existing resort buildings will range from 40 FT to 400 FT, with corresponding average noise levels of 88 to 66 dB (plus or minus 5 dB). For receptors along a cross-street, the construction noise level vs. distance curve of FIGURE 15 should be reduced by approximately 8 dB when the work is occurring at the intersection with the cross street, and should be reduced by 15 dBA when work is occurring at least 100 FT from the intersection (and the visual line-of-sight is blocked by intervening buildings). Typical levels of construction noise inside naturally ventilated and air conditioned structures are approximately 10 and 20 dB less, respectively, than the levels shown in FIGURE 15.

The existing guest units in the Lagoon Tower, Kalia Tower, Diamond Head Tower, Tapa Tower, and Diamond Head Apartments buildings are predicted to experience the highest noise levels during construction activities due to their proximity to the various construction sites. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work, the general availability of closure and air conditioning for noise mitigation at most of the noise sensitive units, and due to the administrative controls available for regulation of construction noise. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the various construction sites.

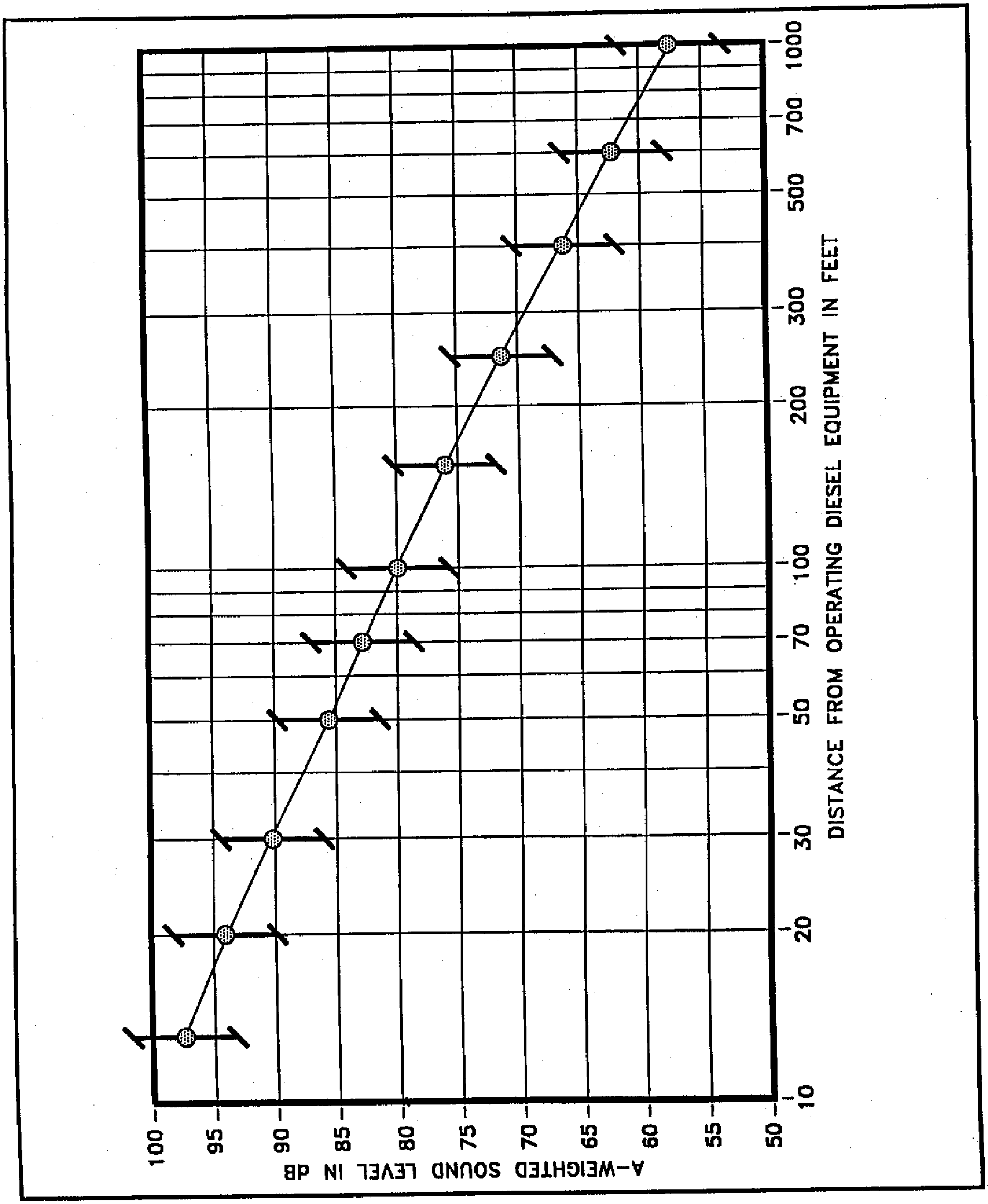
Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site. If feasible, the use of cast-in-place piles should be used to avoid the higher potential for adverse noise and vibration impacts from impact pile drivers.

Severe noise impacts are not expected to occur inside air conditioned structures which are beyond 70 to 450 FT of the project construction site. Inside naturally ventilated structures, interior noise levels (with windows or doors opened) are estimated to range between 73 to 55 dB at 70 FT to 450 FT distances from the construction site.



RANGES OF CONSTRUCTION EQUIPMENT NOISE LEVELS

FIGURE 14

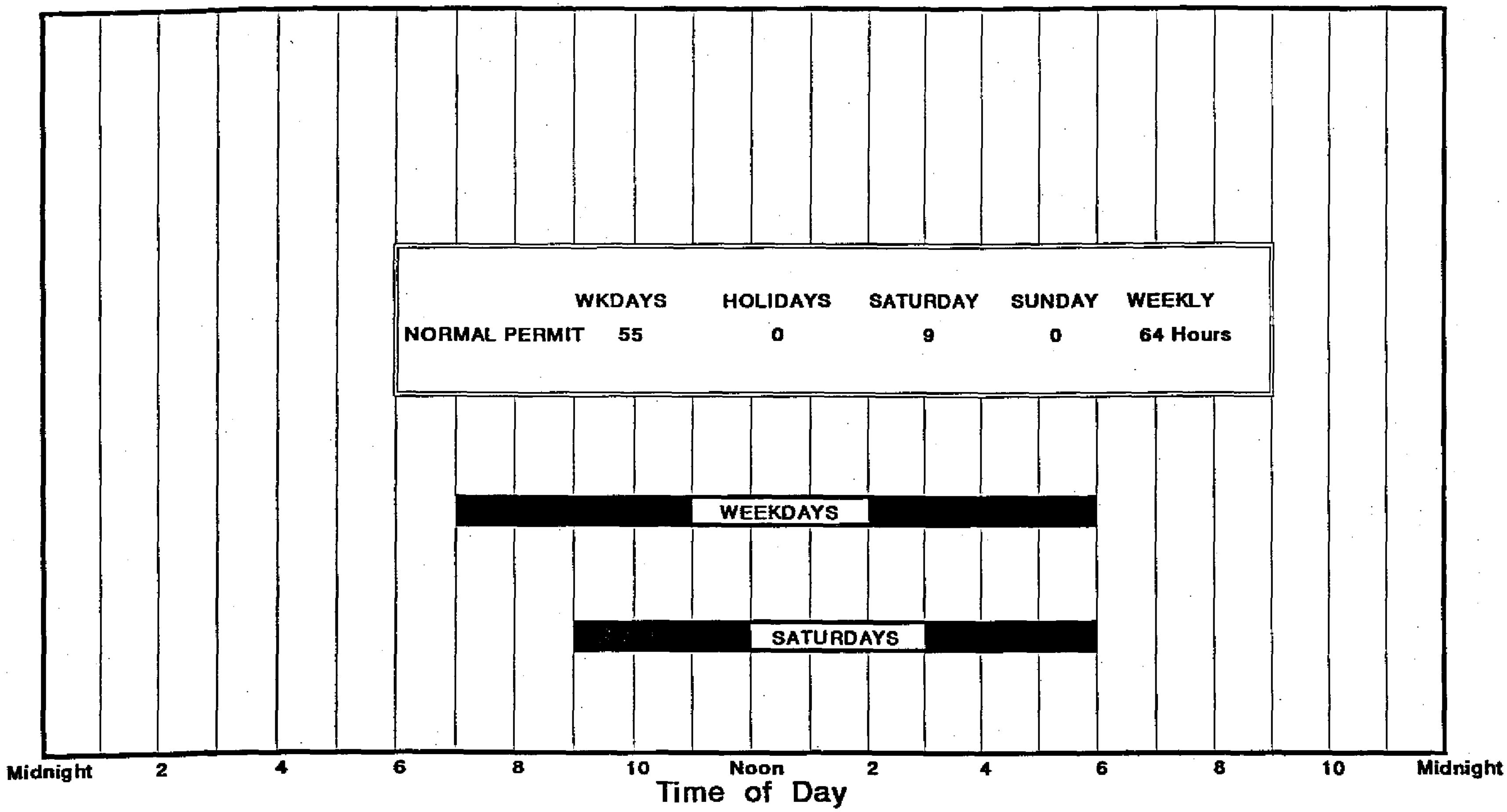


ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 15

Closure of all doors and windows facing the construction site would generally reduce interior noise levels by an additional 5 to 10 dB. If impact piles drivers are used, the interior noise levels listed above would increase by 15 dB during pile driving operations.

The incorporation of State Department of Health construction noise limits and curfew times, which are applicable throughout the State of Hawaii (Reference 4), is another noise mitigation measure which is normally applied to construction activities. FIGURE 16 depicts the normally permitted hours of construction. Noisy construction activities are not allowed on Sundays and holidays, during the early morning, and during the late evening and nighttime periods under the DOH permit procedures.



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE 16

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, l979.

(3) "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety;" Environmental Protection Agency (EPA 550/9-74-004); March 1974.

(4) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(5) "FHWA Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(6) Existing and Future AM and PM Peak Hour Traffic Turning Movements for the Hilton Hawaiian Village Master Plan Entitlement Project; Wilson Okamoto Corporation; Downloaded on July 16, 2010.

(7) 24-Hour Traffic Counts, Station B72009200871, Ala Moana Boulevard At Beginning of Curbed Median; August 12, 2009; Hawaii State Department of Transportation.

(8) 24-Hour Traffic Counts, Station B72009200908, Ala Moana Boulevard Between Kalia Road and Kalakaua Avenue; August 12, 2009; Hawaii State Department of Transportation.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

	TERM	SYMBOL
1.	A-Weighted Sound Level	L_A
2.	A-Weighted Sound Power Level	L_{WA}
3.	Maximum A-Weighted Sound Level	L_{max}
4.	Peak A-Weighted Sound Level	L_{Apk}
5.	Level Exceeded x% of the Time	L_x
6.	Equivalent Sound Level	L_{eq}
7.	Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8.	Day Sound Level	L_d
9.	Night Sound Level	L_n
10.	Day-Night Sound Level	L_{dn}
11.	Yearly Day-Night Sound Level	$L_{dn(Y)}$
12.	Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level Over Time(T)[4]	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND FUTURE YEAR TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2010 *****		CY 2022 (NO BUILD)		CY 2022 (BUILD)	
	AM VPH	PM VPH	AM VPH	PM VPH	AM VPH	PM VPH
Ala Moana Blvd. - Northwest (EB)	940	1,510	941	1,515	1,035	1,620
Ala Moana Blvd. - Northwest (WB)	1,498	1,652	1,551	1,678	1,632	1,768
Two-Way	2,438	3,162	2,492	3,193	2,667	3,388
Ala Moana Blvd. - Middle (EB)	852	1,270	852	1,270	942	1,373
Ala Moana Blvd. - Middle (WB)	1,034	1,115	1,070	1,133	1,150	1,224
Two-Way	1,885	2,384	1,921	2,402	2,092	2,596
Ala Moana Blvd. - East (EB)	641	828	641	828	790	859
Ala Moana Blvd. - East (WB)	736	828	736	828	1,061	872
Two-Way	1,377	1,656	1,377	1,656	1,851	1,731
Ena Road At Ala Moana Blvd. (SB)	128	159	164	177	184	196
Ena Road At Ala Moana Blvd. (NB)	116	231	116	231	126	252
Two-Way	244	390	280	408	310	448
Kalia Road At Ala Moana Blvd. (SB)	477	798	477	798	630	948
Kalia Road At Ala Moana Blvd. (NB)	494	677	494	677	590	805
Two-Way	971	1,475	971	1,475	1,220	1,753
Kalia Road D.H. of Rainbow Dr. (SB)	321	591	321	591	425	696
Kalia Road D.H. of Rainbow Dr. (NB)	379	557	379	557	448	646
Two-Way	700	1,148	700	1,148	873	1,342
Rainbow Drive At Kalia Rd. (EB)	166	184	166	184	206	240
Rainbow Drive At Kalia Rd. (WB)	207	271	207	271	269	321
Two-Way	373	455	373	455	475	561
Kalia Road Ewa of Paoa Pl. (SB)	346	603	346	603	327	602
Kalia Road Ewa of Paoa Pl. (NB)	359	537	359	537	448	646
Two-Way	705	1,140	705	1,140	775	1,248
Kalia Road D.H. of Paoa Pl. (SB)	290	575	290	575	296	586
Kalia Road D.H. of Paoa Pl. (NB)	355	522	355	522	362	528
Two-Way	645	1,097	645	1,097	658	1,114
Paoa Place At Kalia Rd. (EB)	27	46	27	46	134	161
Paoa Place At Kalia Rd. (WB)	79	59	79	59	79	59
Two-Way	106	105	106	105	213	220

APPENDIX I

Hazardous Materials Pre-Assessment Summary
Hilton Hawaiian Village Master Plan

ENPRO Environmental

July 2010

Hazardous Materials Pre-Assessment Summary

Hilton Hawaiian Village Master Plan

2005 Kalia Road

Honolulu, Hawaii

Prepared for:

Group 70 International
925 Bethel Street
Fifth Floor
Honolulu, Hawaii 96813

Prepared by:

ENPRO Environmental
151 Hekili Street, Suite 210
Kailua, Hawaii 96734
808.262.0909 (t)

ENPRO Project Number: 102-00024-HAZ
Date of Report: July 21, 2010
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PROJECT OVERVIEW:

ENPRO Environmental was retained by Group 70 International to survey and inventory hazardous materials at the Hilton Hawaiian Village, located at 2005 Kalia Road in Honolulu, Hawaii. Materials surveyed included suspect asbestos-containing material (ACM), suspect lead-containing and lead-based paint (LBP), and two underground storage tanks (USTs). No samples were collected of suspect ACM or suspect LBP. Suspect materials for each Master Plan Component (or "Zone"), as defined by the Master Plan: Redevelopment Opportunity Proposal prepared by Group 70 International, were inventoried for future assessment.

Prior to demolition or renovation which may disturb suspect materials, samples must be collected and analyzed for asbestos or lead content. Alternatively, materials may be presumed to be asbestos or lead containing, and treated as such. The resultant report should be considered in conjunction with any previous hazardous materials investigation reports and any previous remediation activities completed for the project site.

At the request of the Client, the inspection process did not include the Zones P, Q, and R and several areas in other zones which were inaccessible at the time of the investigation or not included in the scope of work.

This investigation is limited to the structures and aboveground portions of the subject property only. ENPRO's inspector conducted the inspections at the project site between April 21, 2010 and April 26, 2010.

Document review at the State of Hawaii Department of Health (DOH) regarding the USTs was conducted on May 17, 2010.

OBSERVATIONS AND MATERIALS INVENTORY:

1. USTs:

Two USTs were identified at the property during the inspection and in a Phase I Environmental Site Assessment dated October 24, 2007 and prepared by EMG. The location of the USTs is the tour bus parking area on the east corner of the property. The area is designated as "Zone H" in the Master Plan.

The DOH Solid and Hazardous Waste Branch UST Section Facility ID number for this site is 9-100818. Requests were sent to the DOH Solid and Hazardous Waste Branch UST Section and to the DOH Hazard Evaluation and Emergency Response

(HEER) Office, and governmental records concerning the USTs at the site were reviewed.

REGULATORY REQUIREMENTS:

The two USTs in Zone H are not regulated under the federal UST program. Prior to removing the USTs, Hilton Hawaiian Village must notify the City and County of Honolulu Fire Department. When the tanks are removed from the ground, if evidence of a release is observed, it must be reported to the DOH HEER Office and soil and ground water sampling should be conducted to delineate the extent of the release and to determine proper measures for remediation.

ENPRO further recommends that a minimum of two soil samples be collected from underneath each of the USTs and analyzed for total petroleum hydrocarbons (TPH) as diesel and associated metal contaminants regardless of whether evidence of a release is observed. The tank removal should be performed by a professional tank removal contractor and all tank removal activities should be documented by an environmental consultant.

2. Suspect Asbestos Containing Material:

ENPRO inspected “Zones” A through O for suspect asbestos containing material (ACM) and for suspect lead-containing or lead based paint (LBP).

Suspect ACM was identified in all fourteen zones inspected. Suspect ACM identified included grout and cement, plaster, skim coat, paint, drywall and joint compound, ceiling panels, duct insulation and tape, cove base and mastic, ceiling panels, vinyl floor tiles and mastic, carpet and mastic, wood flooring mastic, vinyl flooring and mastic, vinyl wainscot and mastic, mirror mastic, sink coating, spray-on fire-proofing, spray-on ceiling insulation, window sealant, toilet sealant, sink mastic/sealant, pool tile grout, pool caulking, gaskets, pipe insulation, roofing material, and roofing patch.

REGULATORY REQUIREMENTS:

Prior to the disturbance of any of the above identified suspect asbestos containing materials, the materials should be sampled by a State of Hawaii certified asbestos inspector and analyzed by a NVLAP (National Voluntary Laboratory Accreditation Program) accredited laboratory. Bulk samples of homogenous materials may be collected in accordance with DOH and EPA requirements. Bulk samples should be analyzed by polarized light microscopy using EPA Method 600/M4-82-020.

The removal of regulated asbestos containing building material (RACM) is required prior to demolition. All RACM must be removed by a specialty licensed contractor (C-19) adhering to contract specifications developed and based on the results of the inspection and assessment, and EPA, OSHA, and State of Hawaii DOH regulations. Each owner or operator of a demolition or renovation activity shall provide the Department of Health with a separate written notification of intention to demolish or renovate at least 10 working days before the work is to begin, and update the notice as necessary.

Notification to the State of Hawaii, Department of Health is required for all demolition projects in Hawaii. Requirements for asbestos occur when a cumulative threshold limit of 160 square feet, 260 linear feet of pipe insulation and/or 35 cubic feet is exceeded.

3. Suspect Lead Based and Lead Containing Paint

Suspect LBP and lead-containing paint (paint with a lead content less than 0.5% by weight) were identified in all fourteen zones inspected. Suspect LBP and lead-containing paint included interior and exterior paints.

REGULATORY REQUIREMENTS:

For structures constructed prior to 1978, specialized lead-based paint training is required for all renovators/painters who disturb greater than six square feet of interior painted surfaces or greater than twenty square feet of exterior painted surfaces. If an assessment has not been conducted to determine if lead based paint (LBP) is present in a pre-1978 structure, the paint may be presumed by the contractor to be LBP, and all requirements apply. Affected areas may be sampled and tested by a certified lead inspector and if no LBP is present, these regulations do not apply.

LBP is defined as 1.0 mg/cm^2 or 0.5% lead content by weight. Paint containing lead at less than 0.5% by weight is generally referred to as “lead-containing paint” and is not included in the above regulation. However, if the property is to undergo renovation or demolition, OSHA regulations apply to abatement workers. For structures constructed in 1978 or later which do not fall under the regulation of the United States Housing and Urban Development (HUD) department, lead paint is only a regulatory concern for abatement workers per OSHA requirements and for disposal acceptance at municipal landfill facilities.

Prior to the disturbance of any of the above identified suspect LBP containing materials, the materials should be tested by a State of Hawaii certified Lead Based Paint inspector using an EPA approved method. If paint chip samples are collected, the samples should be analyzed by a NVLAP (National Voluntary Laboratory Accreditation Program) accredited laboratory. Bulk samples of homogenous materials may be collected in accordance with DOH and EPA requirements.. Alternatively, any or all of the above identified suspect LBP containing materials may be presumed to be LBP containing and handled as such by the remediation contractor.

Additionally, demolition debris shall need to be sampled and tested (using TCLP analytical procedures) to meet municipal disposal site acceptance criteria. Other than demolition considerations, no other regulations apply.

4. Other Hazardous Materials

Hazardous materials not included in this survey report include mercury, PCBs, and hazardous chemicals and petroleum products. Mercury can be found in fluorescent light tubes among other things. All fluorescent light tubes are considered to be mercury-containing. When lamps are taken out of service and intended to be discarded, they become regulated Universal Waste. PCBs can be found in fluorescent light ballasts, electrical transformers, and hydraulic lift mechanisms. During removal, identify PCB vs. non-PCB ballasts per label identification. Leaking PCB ballasts require special handling and disposal. All other ballasts meet the definition of a non-regulated Small Capacitor and therefore do not have specialized disposal requirements.

APPENDIX J

Traffic Impact Report for the Hilton Hawaiian Village Renovations

Wilson Okamoto Corporation

September 2010

Traffic Impact Report

Hilton Hawaiian Village

Prepared for:
Group 70 International

Prepared by:
Wilson Okamoto Corporation

September 2010

TRAFFIC IMPACT REPORT

FOR THE

HILTON HAWAIIAN VILLAGE RENOVATIONS

Prepared for:

Group 70 International
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Honolulu, HI 96813

Prepared by:

Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
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WOC Ref: 8088-01

September 2010

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I. INTRODUCTION

A. Purpose of Study

The purpose of this study is to identify and assess the traffic impacts resulting from the proposed renovation of the existing Hilton Hawaiian Village located adjacent to Kalia Road in Waikiki on the island of Oahu. The proposed project entails improvements to Rainbow Drive and existing retail and pool areas, as well as, the construction of two new timeshare towers.

B. Scope of Study

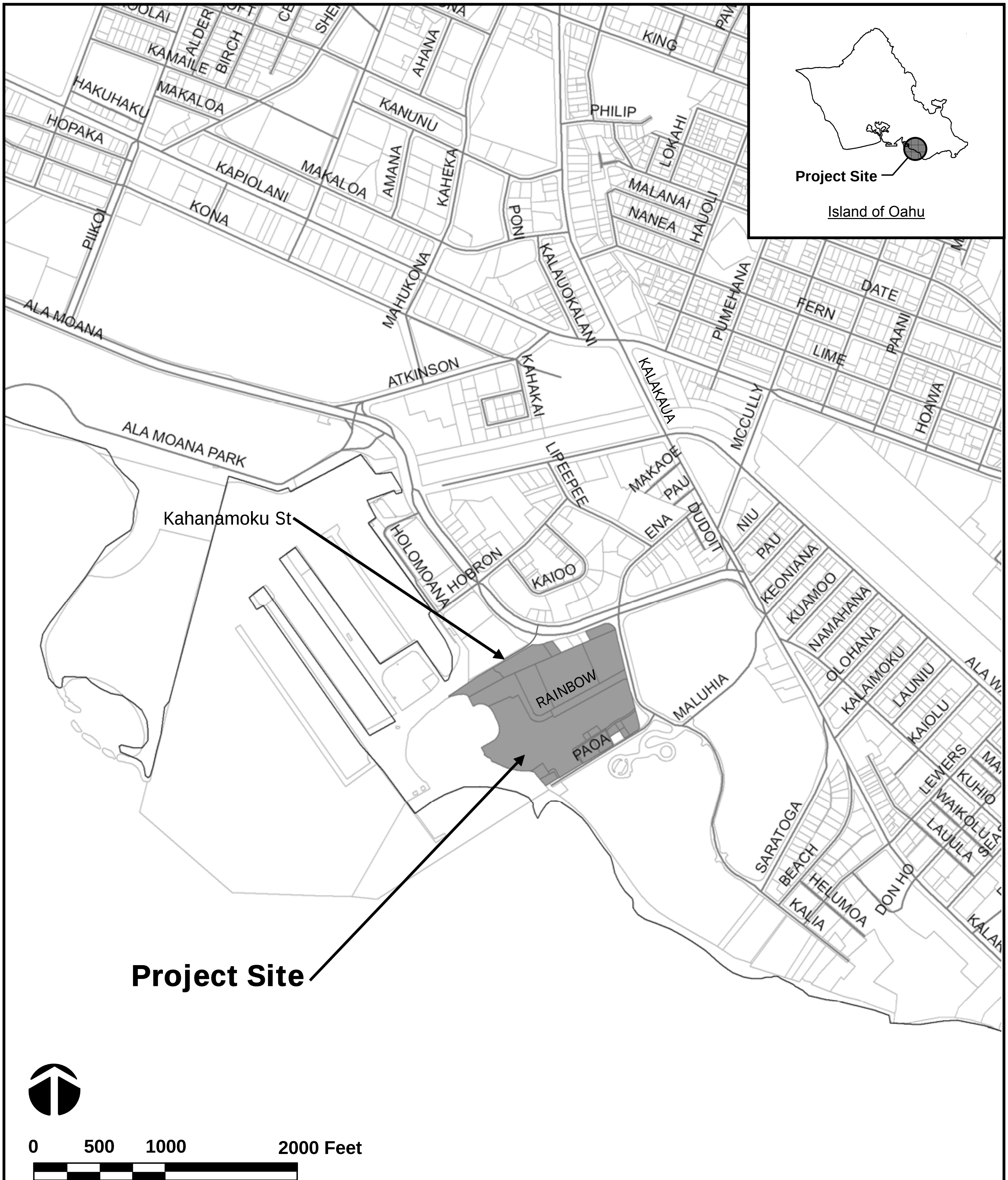
This report presents the findings and conclusions of the traffic study, the scope of which includes:

1. Description of the proposed project.
2. Evaluation of existing roadway and traffic operations in the vicinity.
3. Analysis of future roadway and traffic conditions without the proposed project.
4. Analysis and development of trip generation characteristics for the proposed project.
5. Superimposing site-generated traffic over future traffic conditions.
6. The identification and analysis of traffic impacts resulting from the proposed project.
7. Recommendations of improvements, if appropriate, that would mitigate the traffic impacts resulting from the proposed project.

II. PROJECT DESCRIPTION

A. Location

The existing Hilton Hawaiian Village is located adjacent to Kalia Road between Ala Moana Boulevard and Paoa Place in Waikiki on the island of Oahu (See Figure 1). Access to the Hilton Hawaiian Villages' main parking garage is provided via Rainbow Drive off Kalia Road and Kahanamoku Street off Ala Moana Boulevard while access to the towers and bus loading area on the south side of the resort are provided via Paoa Place and an exit driveway off Kalia Road.



WILSON OKAMOTO CORPORATION
ENGINEERS - PLANNERS

HILTON HAWAIIAN VILLAGE

LOCATION AND VICINITY MAP

FIGURE 1

B. Project Characteristics

The existing Hilton Hawaiian Village includes ~2,900 hotel rooms and ~650 timeshare units located in 7 towers, over 90 shops and 20 restaurants, over 150,000 square feet of indoor/outdoor banquet and meeting space, and other amenities such as pool areas, botanical gardens, and a parking garage (see Figure 2). The proposed project entails the following:

- Improvements to the main entry and Rainbow Drive
- Improvements to the retail areas along Kalia Road and the south side of Rainbow Drive
- Improvements to the existing Rainbow Bazaar retail area to create a new timeshare tower with 2 floors of retail and approximately 250 units. Parking for the new timeshare units will be accommodated in the existing parking garage.
- Improvements to the main lobby, Super Pool, and Hau Tree Bar
- Improvements to the Tapa Pool and Tapa Café
- Development of a new timeshare tower over the existing bus loading area adjacent to Paoa Place with approximately 300 units. Parking for the new timeshare units will be provided within the new tower.

The proposed renovation is expected to be completed by the Year 2022 with access to the parking garage for the Hilton Hawaiian Village continuing to be provided via Rainbow Drive off Kalia Road and Kahanamoku Street off Ala Moana Boulevard. Access for the new timeshare tower near Paoa Place will be provided via a new right-turn-in entrance driveway along Kalia Road and new exit driveway along Paoa Place that will be shared with the bus loading area. In conjunction with the proposed project, the existing exit driveway off Kalia Road that currently serves the bus loading area will be replaced by a shared exit driveway off Paoa Place and a new bus pullout will be provided along Kalia Road. Figures 3 and 4 show the proposed site plans.

III. EXISTING TRAFFIC CONDITIONS

A. Area Roadway System

The existing Hilton Hawaiian Village is located adjacent to Kalia Road between Ala Moana Boulevard and Paoa Place. In the vicinity of the resort, Ala Moana Boulevard is a predominantly six-lane, two-way State of Hawaii roadway that, with Kalakaua Avenue, provides access to and from Waikiki. Northwest of the resort,

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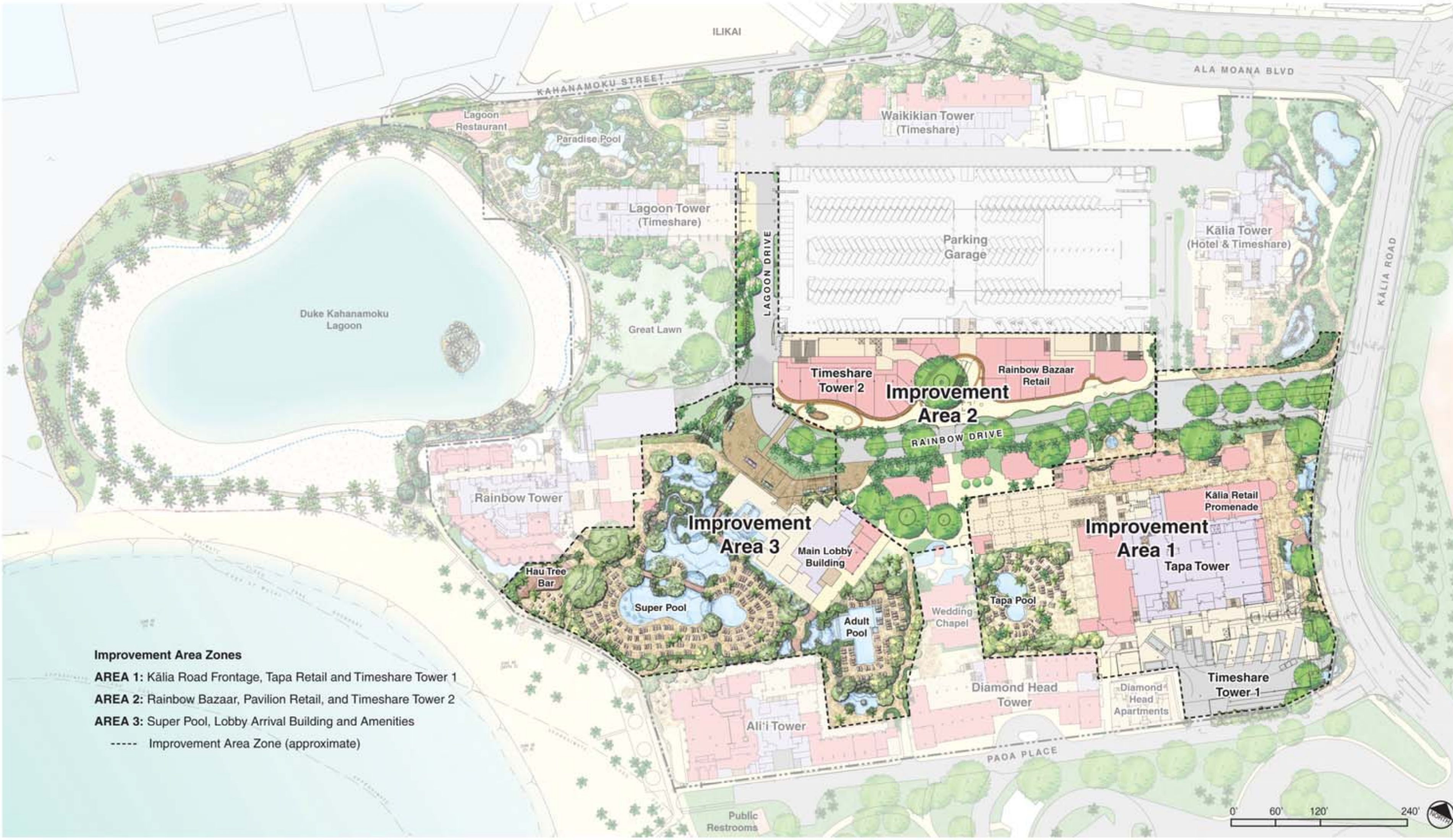
HILTON HAWAIIAN VILLAGE

EXISTING SITE PLAN

FIGURE 2



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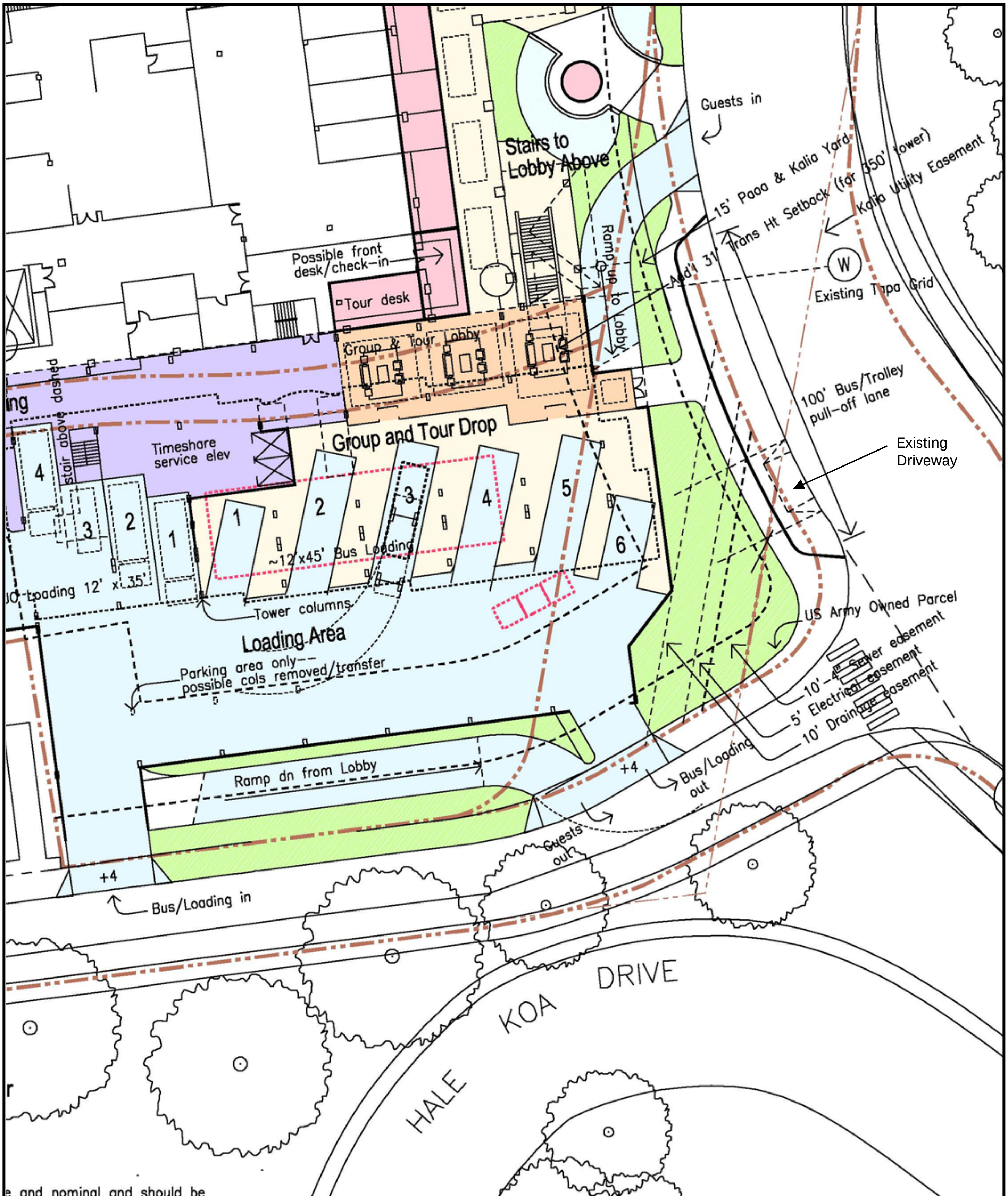
HILTON HAWAIIAN VILLAGE

PROPOSED SITE PLAN

FIGURE 3



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HILTON HAWAIIAN VILLAGE

PROPOSED DRIVEWAY MODIFICATIONS

FIGURE 4

Ala Moana Boulevard intersects Hobron Lane. At this signalized intersection, both approaches of Ala Moana Boulevard have exclusive left-turn lanes, two through lanes, and a shared through and right-turn lane. Hobron Lane is a predominantly two-lane, two-way roadway between Ena Road and Holomoana Street. At the intersection with Ala Moana Boulevard, the northbound approach of Hobron Lane has an exclusive left-turn lane and one lane that serves all traffic movements while the southbound approach has a shared left-turn and through lane and an exclusive right-turn lane.

Southeast of the intersection with Hobron Lane, Ala Moana Boulevard intersects Kahanamoku Street. At this signalized T-intersection, the eastbound approach of Ala Moana Boulevard has three through lanes and a shared through and right-turn lane while the westbound approach has an exclusive left-turn lane and three through lanes. Kahanamoku Street is a predominantly two-lane, two-way roadway that provides access to the Hilton Hawaiian Village and other commercial uses along its alignment. At the intersection with Ala Moana Boulevard, the Kahanamoku Street approach has exclusive left-turn and right-turn lanes.

East of the intersection with Kahanamoku Street, Ala Moana Boulevard intersects Kalia Road and Ena Road. At this signalized intersection, the eastbound approach of Ala Moana Boulevard has and exclusive left-turn lane, two through lanes, and two right-turn lanes while the westbound approach has an exclusive left-turn lane, two through lanes, and a shared through and right-turn lane. Kalia Road is a two-way roadway that serves as a connector roadway between Ala Moana Boulevard and Lewers Street. At the intersection with Ala Moana Boulevard and Ena Road, the northbound approach of Kalia Road has an exclusive left-turn lane, a shared left-turn and through lane, and an exclusive right-turn lane. The southbound approach of the intersection is comprised of Ena Road, a predominantly two-lane, two-way roadway between Kalakaua Avenue and Ala Moana Boulevard. At the intersection with Ala Moana Boulevard and Kalia Road, the southbound approach of Ena Road has one lane that serves all traffic movements.

Further east, the two directions of traffic along Ala Moana Boulevard split and intersect Kalakaua Avenue in two locations. At the northern intersection, the westbound departure lanes of Ala Moana Boulevard intersect Kalakaua Avenue and Niu Street. At this signalized intersection, Ala Moana Boulevard has three departure lanes. Kalakaua Avenue is a one-way (southbound) City and County of Honolulu roadway that with Ala Wai Boulevard forms a couplet system that provides access through Waikiki. At the intersection with Ala Moana Boulevard and Niu Street, the southbound approach of Kalakaua Avenue has three through lanes and a shared through and right-turn lane while the northbound approach has one through lane. Niu Street is a one-way (westbound) connector roadway between Ala Wai Boulevard and Kalakaua Avenue. At the intersection with Kalakaua Avenue and Ala Moana Boulevard, the westbound approach of Niu Street has a shared left-turn and through lane and two through lanes.

South of the intersection with Niu Street, the eastbound direction of traffic along Ala Moana Boulevard and Kalakaua Avenue intersect Pau Street. At this signalized intersection, the Ala Moana Boulevard approach has a shared through and right-turn lane and an exclusive right-turn lane while Kalakaua Avenue has four through lanes one the southbound approach and a shared through and right-turn lane on the northbound approach. Pau Street is a predominantly one-lane (eastbound) connector roadway between Kalakaua Avenue and Ala Wai Boulevard. At the intersection with Ala Moana Boulevard and Kalakaua Avenue, Pau Street has one eastbound departure lane.

South of the intersection with Ala Moana Boulevard and Ena Road, Kalia Road intersects Rainbow Drive. At this signalized T-intersection, the northbound approach of Kalia Road has a shared left-turn and through lane, and two through lanes while the southbound approach has one through lane and a shared through and right-turn lane. Rainbow Drive is a two-way private roadway generally oriented in the east-west direction that serves as an access roadway for the Hilton Hawaiian Village. At the intersection with Kalia Road, the Rainbow Drive approach has two left-turn lanes and one right-turn lane.

Southeast of the intersection with Rainbow Drive, Kalia Road intersects Paoa Place. At this unsignalized T-intersection, the northbound approach of Kalia Road has one lane that serves left-turn and through traffic movements while the southbound approach has two through lanes and a shared through and right-turn lane. Paoa Place is a two-lane, two-way roadway generally oriented in the east-west direction. At the intersection with Kalia Road, the Paoa Place approach has one lane that serves left-turn and right-turn traffic movements.

Further southwest, Kalia Road intersects Maluhia Road. At this signalized intersection, both approaches of Kalia Road have exclusive turning lanes and one through lane. Maluhia Road primarily serves as the access road for the Hale Koa Hotel and its parking garage. At the intersection with Kalia Road, both approaches of Maluhia Road have a shared left-turn and through lanes, and exclusive right-turn lanes.

South of the intersection with Maluhia Road, Kalia Road intersects Saratoga Road. At this unsignalized T-intersection, the northbound approach of Kalia Road has one through lane and an exclusive right-turn lane while the southbound approach has a shared left-turn and through lane. Saratoga Road is generally oriented in the east-west direction and serves as a connector roadway between Kalakaua Avenue and Kalia Road. At the intersection with Kalia Road, the Saratoga Road approach has one lane that serves right-turn traffic movements only. In addition, a second departure lane is provided along Saratoga Road east of the intersection so that right-turning vehicles from Kalia Road can proceed freely through the intersection.

B. Traffic Volumes and Conditions

1. General

a. Field Investigation

The field investigations were conducted during October 2009, February-March 2010, and June 2010, and consisted of manual turning movement count surveys and traffic flow assessments during the morning peak hours of 6:30 AM and 9:00 AM, and between the afternoon peak hours of 3:30 PM and 6:00 PM at the following intersections:

- Ala Moana Boulevard and Hobron Lane
- Ala Moana Boulevard and Kahanamoku Street
- Ala Moana Boulevard, Kalia Road, and Ena Road
- Ala Moana Boulevard, Kalakaua Avenue, and Niu Street
- Ala Moana Boulevard, Kalakaua Avenue, and Pau Street
- Kalia Road and Rainbow Drive
- Kalia Road and Paoa Place
- Kalia Road and Maluhia Road
- Kalia Road and Saratoga Road

In addition, surveys were conducted at the porte cochere for the Waikikian Hotel and the driveway for the Hilton bus loading area to evaluate operations at these locations. Appendix A includes the existing traffic count data.

b. Capacity Analysis Methodology

The highway capacity analysis performed in this study is based upon procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2000, and the "Synchro", developed by Trafficware. The analysis is based on the concept of Level of Service (LOS).

LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F"; LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" representing unacceptable or potentially congested traffic operating conditions.

"Volume-to-Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the roadway carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at or near capacity. A v/c ratio of greater than 1.00 generally indicates that the traffic demand exceeds the road's carrying capacity. The LOS definitions are included in Appendix B.

2. Existing Peak Hour Traffic

a. General

Figures 5 and 6 show the existing AM and PM peak period traffic volumes and traffic operating conditions. The AM peak hour of traffic generally occurs between the hours of 7:00 AM and 8:00 AM. During the afternoon, the PM peak hour of traffic generally occurs between the hours of 4:00 PM and 5:00 PM. Although the peak hours of traffic generally occur around the same time periods at each of the study intersections, the absolute commuter peak hour time periods for each intersection may differ slightly as shown in Table 1.

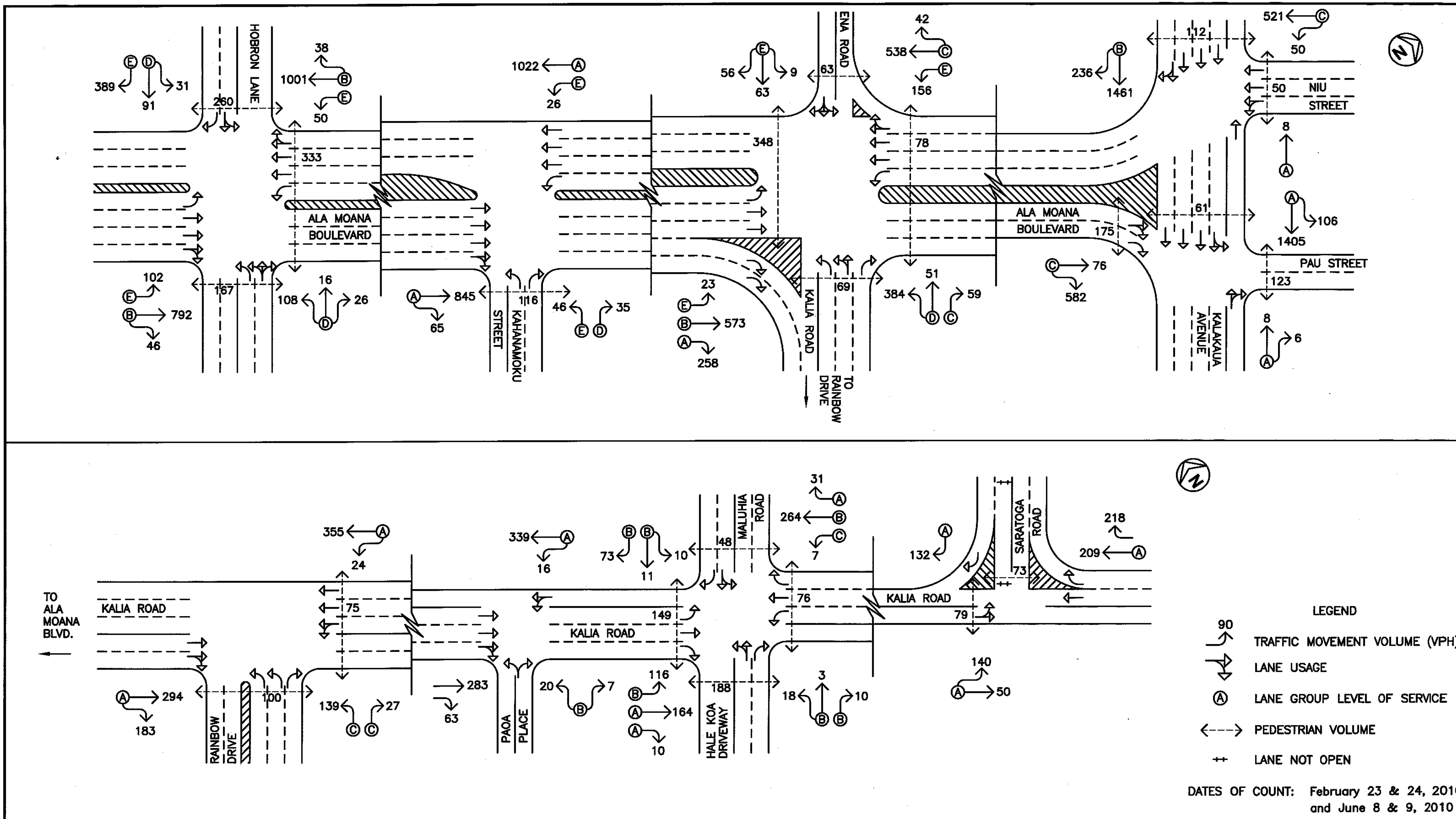
Table 1: Peak Hours of Traffic

Intersection	AM Peak	PM Peak
Ala Moana Blvd/ Hobron Ln	7:15 – 8:15 AM	3:30 – 4:30 PM
Ala Moana Blvd/ Kahanamoku St	7:15 – 8:15 AM	4:00 – 5:00 PM
Ala Moana Blvd/ Kalia Rd/Ena Rd	7:30 – 8:30 AM	5:00 – 6:00 PM
Ala Moana Blvd/ Kalakaua Ave/Niu St	7:45 – 8:45 AM	5:00 – 6:00 PM
Ala Moana Blvd/ Kalakaua Ave/Pau St	8:00 – 9:00 AM	5:00 – 6:00 PM
Kalia Rd/Rainbow Dr	6:45 – 7:45 AM	4:00 – 5:00 PM
Kalia Rd/Paoa Pl	6:45 – 7:45 AM	4:00 – 5:00 PM
Kalia Rd/Maluhia Rd	7:00 – 8:00 AM	4:00 – 5:00 PM
Kalia Rd/Saratoga Rd	7:00 – 8:00 AM	3:45 – 4:45 PM

The analysis is based on the above absolute commuter peak hour time periods for each intersection to identify the traffic impacts resulting from the proposed project. LOS calculations are included in Appendix C.

b. Ala Moana Boulevard and Hobron Lane

At the intersection with Hobron Lane, Ala Moana Boulevard carries 959 vehicles eastbound and 1,089 vehicles westbound during



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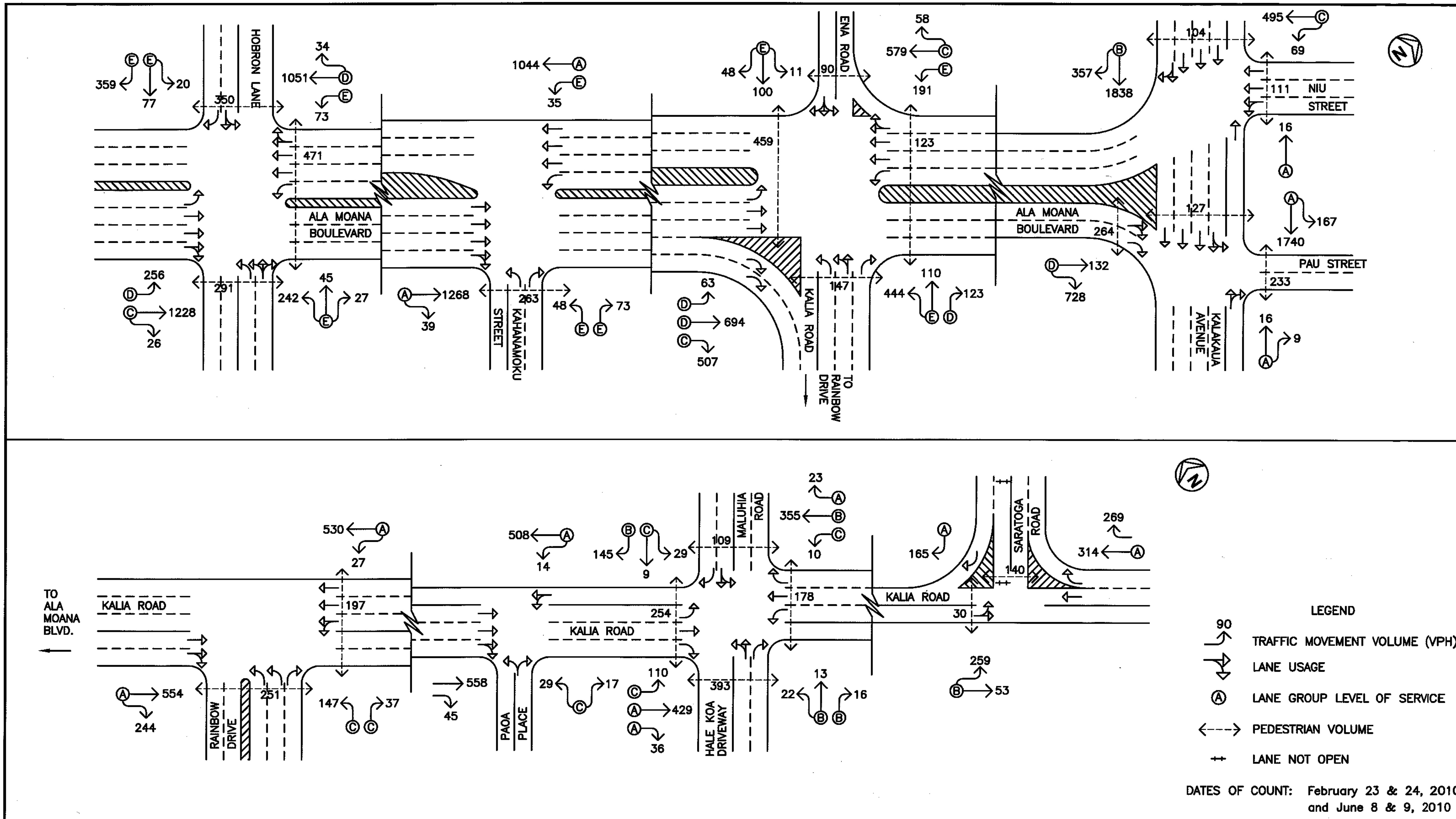
HILTON HAWAIIAN VILLAGE

EXISTING AM PEAK HOUR OF TRAFFIC

FIGURE 5



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EXISTING PM PEAK HOUR OF TRAFFIC

FIGURE 6

the AM peak period. During the PM peak period, the overall traffic volume is higher with 1,535 vehicles traveling eastbound and 1,193 vehicles traveling westbound. On the eastbound approach of Ala Moana Boulevard, the left-turn traffic movement operates at LOS "E" and LOS "D" during the AM and PM peak periods, respectively, while the through and right-turn traffic movement operates at LOS "B" and LOS "C" during the AM and PM peak periods, respectively. On the westbound approach, the left-turn traffic movement operates at LOS "E" during both peak periods while the through and right-turn traffic movement operates at LOS "B" and LOS "D" during the AM and PM peak periods, respectively. Vehicular queues formed periodically on the Ala Moana Boulevard approaches with the most significant queuing occurring during the PM peak period. During this period, average queue lengths of 15-17 vehicles were observed on both approaches with westbound queues occasionally extending through the upstream intersection with Kahanamoku Street. Most of these queues cleared the intersection after each traffic signal cycle change, but occasionally vehicles had to wait for more than one traffic signal cycle length.

The Hobron Lane approaches of the intersection carry 140 vehicles northbound and 510 vehicles southbound during the AM peak period. During the PM peak period, the overall traffic volume is higher with 314 vehicles travelling northbound and 456 vehicles traveling southbound. The northbound approach and the left-turn and through traffic movement on the southbound approach operate at LOS "D" and LOS "E" during both peak periods while the southbound right-turn traffic movement operates at LOS "E" during both peak periods. Vehicular queues formed periodically on the Hobron Lane approaches of the intersection with the most significant queuing occurring on the southbound approach. Average queue lengths of 5-7 vehicles were observed during both peak periods. However, these queues cleared the intersection after each traffic signal cycle change.

Pedestrian crossings are provided at this intersection across the westbound approach of Ala Moana Boulevard and both approaches of Hobron Lane. During the AM peak period, 333 pedestrians were observed crossing Ala Moana Boulevard while 167 pedestrians and 260 pedestrians were observed crossing the northbound and southbound approaches of Hobron Lane, respectively. During the PM peak period, 471 pedestrians were observed crossing Ala Moana Boulevard while 291 pedestrians and 350 pedestrians were observed crossing the northbound and southbound approaches of Hobron Lane, respectively.

c. Ala Moana Boulevard and Kahanamoku Street

At the intersection with Hobron Lane, Ala Moana Boulevard carries 910 vehicles eastbound and 1,048 vehicles westbound during the AM peak period. During the PM peak period, the overall traffic volume is higher with 1,307 vehicles traveling eastbound and 1,079 vehicles traveling westbound. The eastbound approach of Ala Moana Boulevard, as well as, the through traffic movement on the westbound approach operate at LOS "A" during both peak periods while the westbound left-turn traffic movement operates at LOS "E" during both peak periods. Vehicular queues formed periodically on the Ala Moana Boulevard approaches with the most significant queuing occurring during the PM peak period. During this period, average queue lengths of 5-7 vehicles were observed on both approaches with eastbound queues from the downstream intersection with Kalia Road/Ena Road and westbound queues from the downstream intersection with Hobron Lane occasionally extending the intersection. Most of these queues cleared the intersection after each traffic signal cycle change, but occasionally vehicles had to wait for more than one traffic signal cycle length.

The Kahanamoku Street approach of the intersection carries 81 vehicles and 121 vehicles northbound during the AM and PM peak periods, respectively. The left-turn traffic movement on this approach operates at LOS "E" during both peak periods while the right-turn traffic movement operates at LOS "D" and LOS "E" during the AM and PM peak periods, respectively. Vehicular queues formed periodically on the Kahanamoku Street approach of the intersection with average queue lengths of 2-3 vehicles observed during both peak periods. Most of these queues cleared the intersection after each traffic signal cycle change.

Pedestrian crossings are provided at this intersection across Kahanamoku Street approach. During the AM peak period, 116 pedestrians were observed crossing Kahanamoku Street while 263 pedestrians were observed during the PM peak period.

d. Ala Moana Boulevard, Kalia Road, and Ena Road

At the intersection with Kalia Road and Ena Road, Ala Moana Boulevard carries 871 vehicles eastbound and 736 vehicles westbound during the AM peak period. During the PM peak period, traffic volumes are higher with 1,284 vehicles traveling eastbound and 828 vehicles traveling westbound. On the eastbound approach of Ala Moana Boulevard, the left-turn traffic movement operates at LOS "E" and LOS "D" during the AM and PM peak periods, respectively, the through traffic movement operates at LOS "B" and LOS "D" during the AM and PM peak periods, respectively, and the right-turn traffic movement operates at LOS "A" and LOS "C" during the AM and PM peak periods, respectively. On the westbound approach, the left-turn traffic movement operates at LOS "E" during both peak periods while the through and right-turn traffic movement operates at LOS "C" during both peak periods. Vehicular queues formed periodically on the Ala Moana Boulevard approaches with the most significant queuing occurring on the eastbound approach during the PM peak period. During this period, average queue lengths of 10-15 vehicles were observed on this approach with queues occasionally extending through the upstream intersection with Kahanamoku Street. Most of these queues cleared the intersection after each traffic signal cycle change, but occasionally vehicles had to wait for more than one traffic signal cycle length.

The Kalia Road approach of the intersection carries 494 vehicles and 677 vehicles northbound during the AM and PM peak periods, respectively. The northbound left-turn and through traffic movement operates at LOS "D" and LOS "E" during the AM and PM peak periods, respectively, while the right-turn traffic movement operates at LOS "C" and LOS "D" during the AM and PM peak periods, respectively. Vehicular queues formed periodically on the Kalia Road approach of the intersection with the most significant queuing occurring during the PM peak period. During this period, average queue lengths of 6-8 vehicles were observed with queues occasionally extending through the upstream intersection with Rainbow Drive. Most of these queues cleared the intersection after each traffic signal cycle change.

The southbound approach of the intersection is comprised of Ena Lane which carries 128 vehicles and 159 vehicles southbound during the AM and PM peak periods, respectively. The Ena Road approach operates at LOS "E" during both peak periods. Vehicular queues formed periodically on the Ena Road approach of the intersection with average queue lengths of 3-5 vehicles observed during both peak periods. Most of these queues were observed to clear the intersection after each traffic signal cycle change.

Pedestrian crossings are provided at this intersection across all approaches of the intersection. During the AM peak period, 348 pedestrians and 78 pedestrians were observed crossing the eastbound and westbound approaches of Ala Moana Boulevard, respectively, while 63 pedestrians and 69 pedestrians were observed crossing the northbound and southbound approaches, respectively. During the PM peak period, 459 pedestrians and 123 pedestrians were observed crossing the eastbound and westbound approaches of Ala Moana Boulevard, respectively, while 147 pedestrians and 90 pedestrians were observed crossing the northbound and southbound approaches, respectively.

e. Ala Moana Boulevard, Kalakaua Avenue, and Niu Street

At the intersection with Ala Moana Boulevard and Niu Street, Kalakaua Avenue carries 8 vehicles northbound and 1,697 vehicles southbound during the AM peak period. During the PM peak period, the traffic volume is higher with 16 vehicles traveling northbound and 2,195 vehicles traveling southbound. The northbound approach of Kalakaua Avenue operates at LOS "A" during both peak periods while the southbound approach operates at LOS "B" during both peak periods. Vehicular queues formed periodically on the Kalakaua Avenue approach with the most significant queuing occurring during the PM peak period. During this period, average queue lengths of 5-7 vehicles were observed with queues from the downstream intersection with Pau Street periodically extending through this intersection, as well as, the upstream intersection with McCully Street. Most of these queues cleared the intersection after each traffic signal cycle change.

The Niu Street approach of the intersection carries 571 vehicles and 564 vehicles westbound during the AM and PM peak periods, respectively. This approach operates at LOS "C" during both peak periods. Vehicular queues formed periodically on the Niu Street approach of the intersection with average queue lengths of 1-2 vehicles observed during both peak periods. These queues were observed to clear the intersection after each traffic signal cycle change.

Pedestrian crossings are provided at this intersection across the southbound approach of Kalakaua Avenue and the Niu Street approach. During the AM peak period, 112 pedestrians were observed crossing Kalakaua Avenue while 50 pedestrians were observed crossing Niu Street. During the PM peak period, 104 pedestrians were observed crossing Kalakaua Avenue while 111 pedestrians were observed crossing Niu Street.

f. Ala Moana Boulevard, Kalakaua Avenue, and Pau Street

At the intersection with Kalakaua Avenue and Pau Street, Ala Moana Boulevard carries 658 vehicles eastbound. During the PM peak period, the traffic volume is higher with 860 vehicles traveling eastbound. This approach operates at LOS "C" and LOS "D" during the AM and PM peak periods, respectively. Vehicular queues formed periodically on the Ala Moana Boulevard approach with the most significant queuing occurring during the PM peak period. During this period, average queue lengths of 10-15 vehicles were observed on this approach. Most of these queues cleared the intersection after each traffic signal cycle change, but occasionally vehicles had to wait for more than one traffic signal cycle length.

The Kalakaua Avenue approach of the intersection carries 14 vehicles northbound and 1,511 vehicles southbound during the AM peak period. During the PM peak period, traffic volumes are higher with 25 vehicles traveling northbound and 1,907 vehicles traveling southbound. Both approaches of Kalakaua Avenue operate at LOS "A" during both peak periods. Vehicular queues formed periodically on the Hobron Lane approaches of the intersection with the most significant queuing occurring on the southbound approach. Vehicular queues formed periodically on the Kalakaua Avenue approach of the intersection with the most significant queuing occurring during the PM peak period. During this period, average queue lengths of 3-5 vehicles were observed with queues occasionally extending through the upstream intersections with Pau Street and McCully Street. Most of these queues cleared the intersection after each traffic signal cycle change.

Pedestrian crossings are provided at this intersection across the southbound approach of Kalakaua Avenue, as well as, the Ala Moana Boulevard and Pau Street approaches. During the AM peak period, 175 pedestrians were observed crossing Ala Moana Boulevard, 61 pedestrians were observed crossing Kalakaua Avenue, and 123 pedestrians were observed crossing Pau Street. During the PM peak period, 264 pedestrians were observed crossing Ala Moana Boulevard, 127 pedestrians were observed crossing Kalakaua Avenue, and 233 pedestrian were observed crossing Pau Street.

g. Kalia Road and Rainbow Drive

At the intersection with Rainbow Drive, Kalia Road carries 379 vehicles northbound and 477 vehicles southbound. During the PM peak period, traffic volumes are higher with 557 vehicles traveling northbound and 798 vehicles traveling southbound. Both approaches of Kalia Road operate at LOS "A" during both peak periods. Vehicular queues formed periodically on the Kalia Road approaches with the most significant queuing occurring during the PM peak period. During this period, average queue lengths of 4-6 vehicles were observed on both approaches with northbound queues from the downstream intersection with Ala Moana Boulevard occasionally extending through the intersection. Most of these queues cleared the intersection after each traffic signal cycle change.

The Rainbow Drive approach of the intersection carries 166 vehicles and 184 vehicles eastbound during the AM and PM peak periods, respectively. The traffic movements on this approach operate at LOS "C" during both peak periods. Vehicular queues formed periodically on the Rainbow Drive approach with average queue lengths of 2-3 vehicles observed during both peak periods. Most of these queues were observed to clear the intersection after each traffic signal cycle change.

Pedestrian crossings are provided at this intersection across the northbound approach of Kalia Road and the Rainbow Drive approach. During the AM peak period, 75 pedestrians were observed crossing Kalia Road while 100 pedestrians were observed crossing Rainbow Drive. During the PM peak period, 197 pedestrians were observed crossing Kalia Road while 251 pedestrians were observed crossing Rainbow Drive.

h. Kalia Road and Paoa Place

At the intersection with Paoa Place, Kalia Road carries 355 vehicles northbound and 346 vehicles southbound. During the PM peak period, traffic volumes are higher with 522 vehicles traveling northbound and 603 vehicles traveling southbound. The critical traffic movement on the Kalia Road approaches is the northbound left-turn and through traffic movement which operates at LOS "A" during both peak periods.

The Paoa Place approach of the intersection carries 27 vehicles and 46 vehicles eastbound during the AM and PM peak periods, respectively. This approach operates at LOS "B" and LOS "C" during the AM and PM peak periods, respectively.

i. Kalia Road and Maluhia Road

At the intersection with Maluhia Road, Kalia Road carries 302 vehicles northbound and 290 vehicles southbound. During the PM peak period, traffic volumes are higher with 388 vehicles traveling northbound and 575 vehicles traveling southbound. On the northbound approach of Kalia Road, the left-turn traffic movement operates at LOS "C" during both peak periods, the through traffic movement operates at LOS "B" during both peak periods, and the right-turn traffic movement operates at LOS "A" during both peak periods. On the southbound approach, the left-turn traffic movement operates at LOS "B" and LOS "C" during the AM and PM peak periods, respectively, while the through and right-turn traffic movements operate at LOS "A" during both peak periods. Vehicular queues formed periodically on the Kalia Road approaches with average queue lengths of 3-5 vehicles observed on both approaches during both peak periods. These queues were observed to clear the intersection after each traffic signal cycle change.

The Maluhia Road approaches of the intersection carry 31 vehicles eastbound and 94 vehicles westbound during the AM peak period. During the PM peak periods, traffic volumes are higher with 51 vehicles traveling eastbound and 183 vehicles traveling westbound. The traffic movements on both approaches operate at LOS "B" during both peak periods with the exception of the westbound left-turn and through traffic movement which operates at LOS "C" during the PM peak period. Vehicular queues formed periodically on the Maluhia Road approaches with average queue lengths of 2-3 vehicles observed on both approaches during both peak periods. These queues were observed to clear the intersection after each traffic signal cycle change.

Pedestrian crossings are provided at this intersection across both roadways. During the AM peak period, 76 pedestrians and 149 pedestrians were observed crossing the northbound and southbound approaches of Kalia Road, respectively, while 188 pedestrians and 48 pedestrians were observed crossing the eastbound and westbound approaches of Maluhia Road, respectively. During the PM peak period, 178 pedestrians and 254 pedestrians were observed crossing the northbound and southbound approaches of Kalia Road, respectively, while 393 pedestrians and 109 pedestrians were observed crossing the eastbound and westbound approaches of Maluhia Road, respectively.

j. Kalia Road and Saratoga Road

At the intersection with Saratoga Road, Kalia Road carries 427 vehicles northbound and 190 vehicles southbound. During the PM peak period, traffic volumes are higher with 583 vehicles traveling northbound and 312 vehicles traveling southbound. The northbound approach of Kalia Road operates at LOS "A" during both peak periods while the southbound approach operates at LOS "A" and LOS "B" during the AM and PM peak periods, respectively. Vehicular queues formed periodically on the Kalia Road approaches with the most significant queuing occurring during the PM peak period. During this period, average queue lengths of 3-5 vehicles were observed on both approaches.

The Saratoga Road approach of the intersection carries 132 vehicles and 165 vehicles westbound during the AM and PM peak periods, respectively. This approach operates at LOS "A" during both peak periods.

Pedestrian crossings are provided at this intersection across the southbound approach of Kalia Road and the Saratoga Road approach. During the AM peak period, 79 pedestrians were observed crossing Kalia Road while 73 pedestrians were observed crossing Saratoga Road. During the PM peak period, 30 pedestrians were observed crossing Kalia Road while 140 pedestrians were observed crossing Saratoga Road.

C. Public Transportation System

Convenient access to the public transportation system ("The Bus") in the vicinity of the Hilton Hawaiian Village is currently provided via bus stops along both sides of Kalia Road near the intersections with Paoa Place and Maluhia Road. These bus stops are served by a number of routes which include the following:

- E (CountryExpress!)
- 8
- 19
- 20
- 23
- 24
- 42
- 98
- 201 (Express)
- 202 (Express)
- 203 (Express)

IV. PROJECTED TRAFFIC CONDITIONS

A. Site-Generated Traffic

1. Trip Generation Methodology

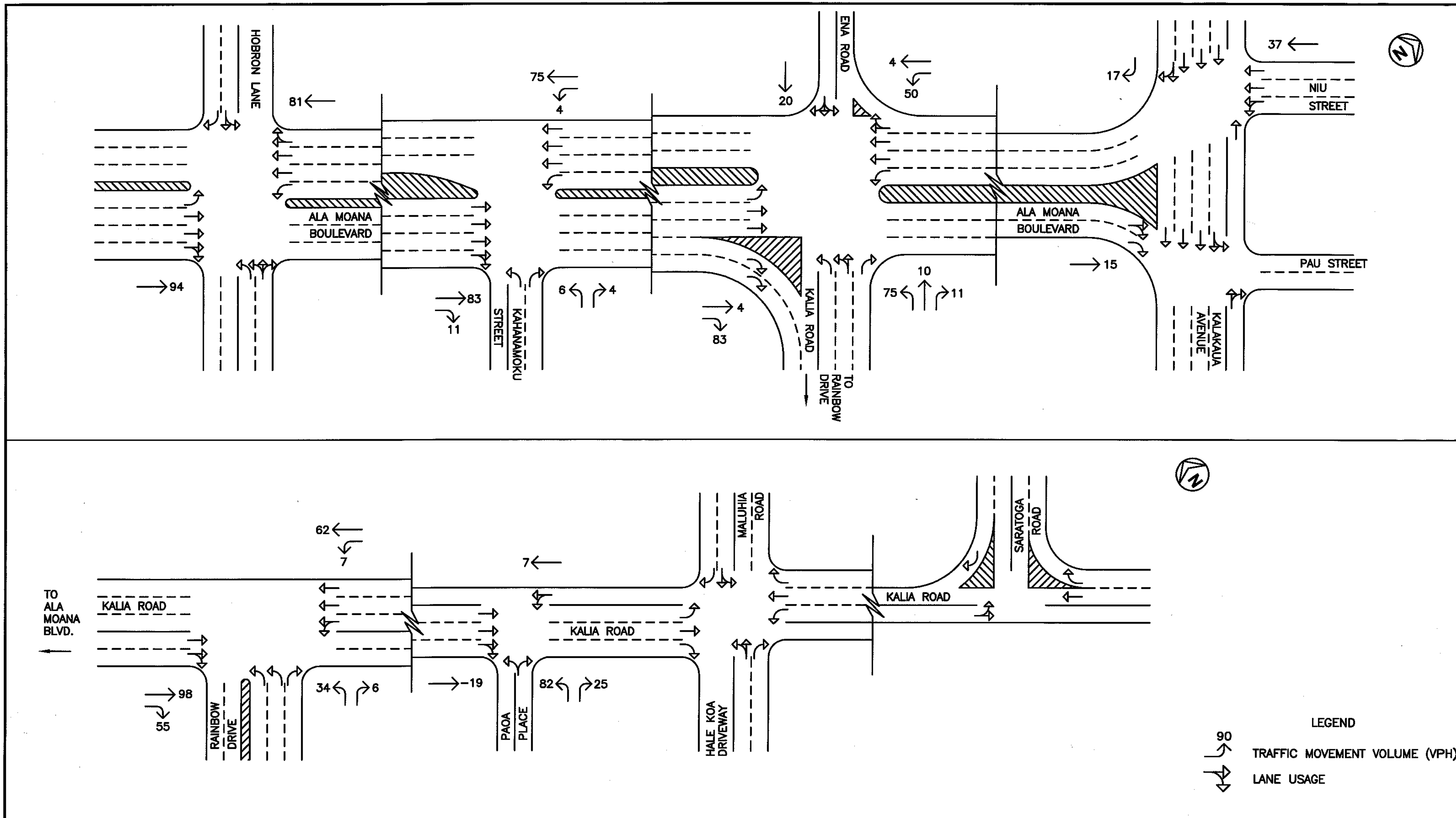
The trip generation methodology used in this study is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 8th Edition," 2008. The ITE trip generation rates are developed empirically by correlating the vehicle trip generation data with various land use characteristics such as the number of vehicle trips generated per unit. The proposed project entails renovations to or replacement of existing retail facilities, and the construction of two new timeshare towers. As such, the only new trips anticipated to be generated by this project are associated with the new timeshare units. For the purpose of this report, the proposed timeshare units were assumed to be hotel rooms since they will be placed into a rental pool when not occupied by the owners. Table 2 summarizes the project site trip generation characteristics applied to the AM and PM peak periods of traffic.

Table 2: Peak Hour Trip Generation

HOTEL (TOWER OVER RAINBOW BAZAAR) INDEPENDENT VARIABLE: Rooms = 250		
		PROJECTED TRIP ENDS
AM PEAK	ENTER	77
	EXIT	50
	TOTAL	127
PM PEAK	ENTER	78
	EXIT	70
	TOTAL	148
HOTEL (TOWER OFF PAOA PLACE) INDEPENDENT VARIABLE: Rooms = 300		
		PROJECTED TRIP ENDS
AM PEAK	ENTER	98
	EXIT	62
	TOTAL	160
PM PEAK	ENTER	94
	EXIT	83
	TOTAL	177

2. Trip Distribution

Figures 7 and 8 show the distribution of site-generated vehicular trips at the study intersections during the AM and PM peak hours of traffic. Parking for the new timeshare tower over the former Rainbow Bazaar will be provided in the existing parking garage at the Hilton Hawaiian Village. As such, the distribution of site-generated vehicles between Kahanamoku Street and Rainbow Drive accesses to the Hilton Hawaiian Village were assumed to remain similar to existing conditions. As such, approximately 20% were assumed to utilize the Kahanamoku Street access while 80% were assumed to utilize the Rainbow Drive Access. The site-generated vehicles utilizing the Kahanamoku Street access were assumed to be traveling to/from Ala Moana Boulevard. At the intersection with Ala Moana Boulevard, the directional distribution was assumed to remain similar to existing conditions. As such, 71.4% of entering vehicles are assumed to be headed eastbound during the



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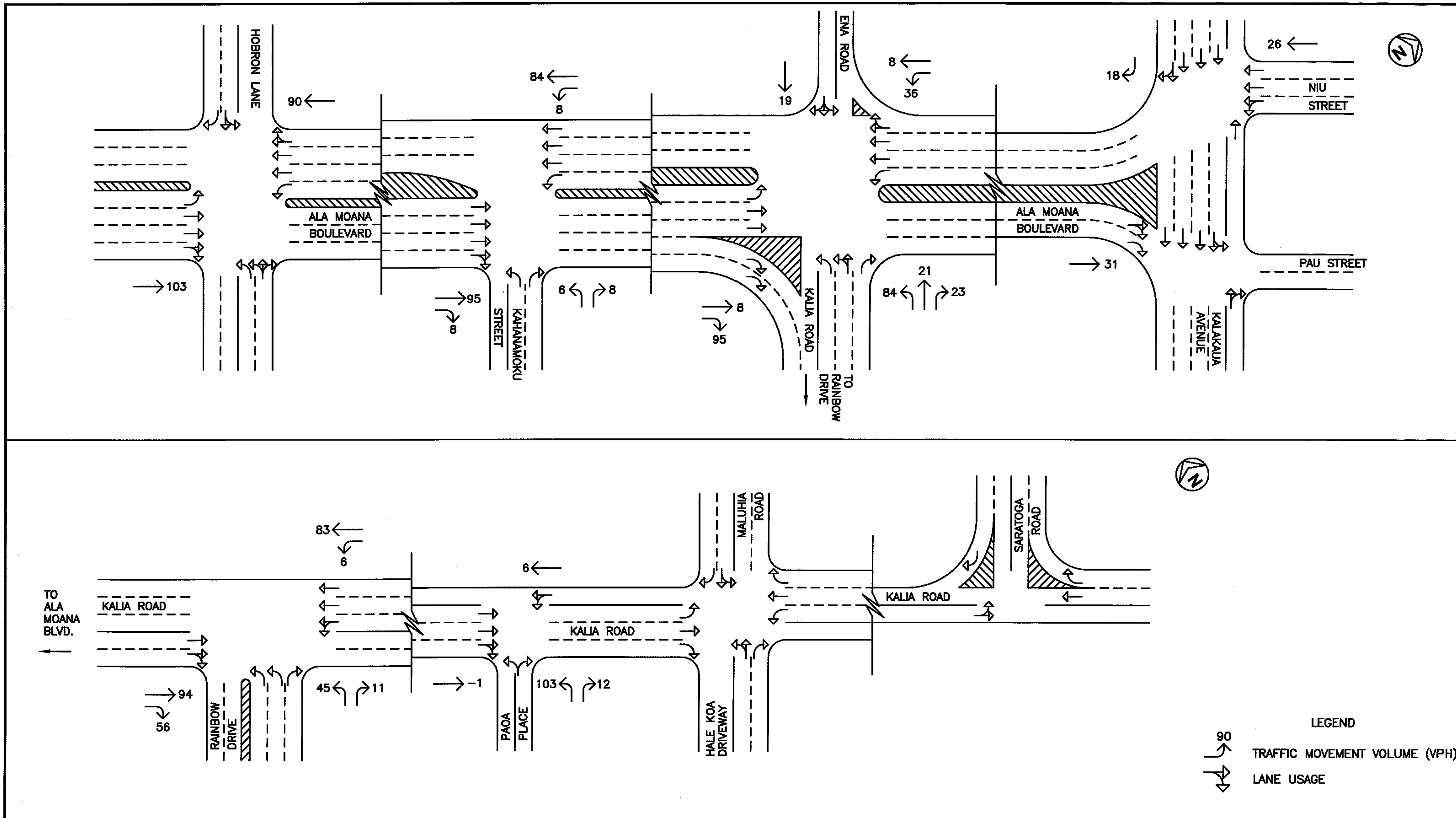
DISTRIBUTION OF SITE-GENERATED VEHICLES - AM PEAK HOUR OF TRAFFIC

FIGURE 7



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DISTRIBUTION OF SITE-GENERATED VEHICLES - PM PEAK HOUR OF TRAFFIC

FIGURE 8

AM peak period while 28.6% are assumed to be headed westbound. Similarly, 43.2% of exiting vehicles were assumed to be headed eastbound while 56.8% were assumed to be headed westbound. During the PM peak period, 52.7% of entering vehicles are assumed to be headed eastbound while 47.3% are assumed to be headed westbound. Similarly, 60.3% of exiting vehicles were assumed to be headed eastbound while 39.7% were assumed to be headed westbound. At the adjacent intersections along Ala Moana Boulevard, all site-generated vehicles were assumed to be traveling straight through the intersections with the exception of the intersection with Kalakaua Avenue and Niu Street. At this intersection, the directional distribution of entering vehicles was assumed to remain similar to existing conditions.

The directional distribution of site-generated vehicles utilizing Rainbow Drive was assumed to remain similar to existing conditions. As such, 11.6% of entering vehicles are assumed to be headed northbound during the AM peak period while 88.4% are assumed to be headed southbound. Similarly, 83.8% of exiting vehicles were assumed to be headed northbound while 16.1% were assumed to be headed southbound. During the PM peak period, 10.0% of entering vehicles are assumed to be headed northbound while 90.0% are assumed to be headed southbound. Similarly, 79.9% of exiting vehicles were assumed to headed northbound while 20.1% were assumed to be headed southbound. For site-generated vehicles headed to/from the north, the distribution of site-generated vehicles at the intersection with Ala Moana Boulevard and Ena Road was assumed to remain similar to existing conditions. At the adjacent intersections along Ala Moana Boulevard, all site-generated vehicles were assumed to be traveling straight through the intersections with the exception of the intersection with Kalakaua Avenue and Niu Street. At this intersection, the directional distribution of entering vehicles was assumed to remain similar to existing conditions. For site-generated vehicles headed to/from the south, the vehicles were assumed to be headed to/from Saratoga Road.

Access to the new timeshare tower adjacent to Paoa Place will be provided via a right-turn-in entrance driveway off Kalia Road and an exit driveway off Paoa Place. As such, all site-generated vehicles were assumed to be headed to/from Ala Moana Boulevard and the distribution of site-generated vehicles at the intersection with Ala Moana Boulevard and Ena Road was assumed to remain similar to existing conditions. At the adjacent intersections along Ala Moana Boulevard, all site-generated vehicles were assumed to be traveling straight through the intersections with the exception of the intersection with Kalakaua Avenue and Niu Street. At this intersection, the directional distribution of entering vehicles was assumed to remain similar to existing conditions.

In conjunction with the proposed project, the existing exit driveway for the bus loading area adjacent to Paoa Place will be replaced by an exit driveway off Paoa Place. As such, the vehicles currently exiting the bus loading are expected to access Kalia Road via Paoa Place. The direction distribution of these vehicles at the intersection of Kalia Road and Paoa Place is expected to remain similar to the existing distribution at the existing exit driveway along Kalia Road.

B. Other Considerations

There have been a number of new developments in Waikiki in the vicinity of the Hilton Hawaiian Village in recent years including the Waikiki Beach Walk and Watermark. Two of the developments in the vicinity are still under construction, but are expected to be completed by the Year 2022. The first development is the Waikiki Allure condominium located adjacent to Kalakaua Avenue north of Ena Road. This development will include 315 residential condominium units and a restaurant. As detailed in the "Traffic Impact Report for the Waikiki Allure Condominium," the development is expected to generate 130 trips and 213 trips during the AM and PM peak periods, respectively. The trips associated with the Waikiki Allure condominium were incorporated with the Year 2022 without project conditions to account for the additional traffic generated by this development.

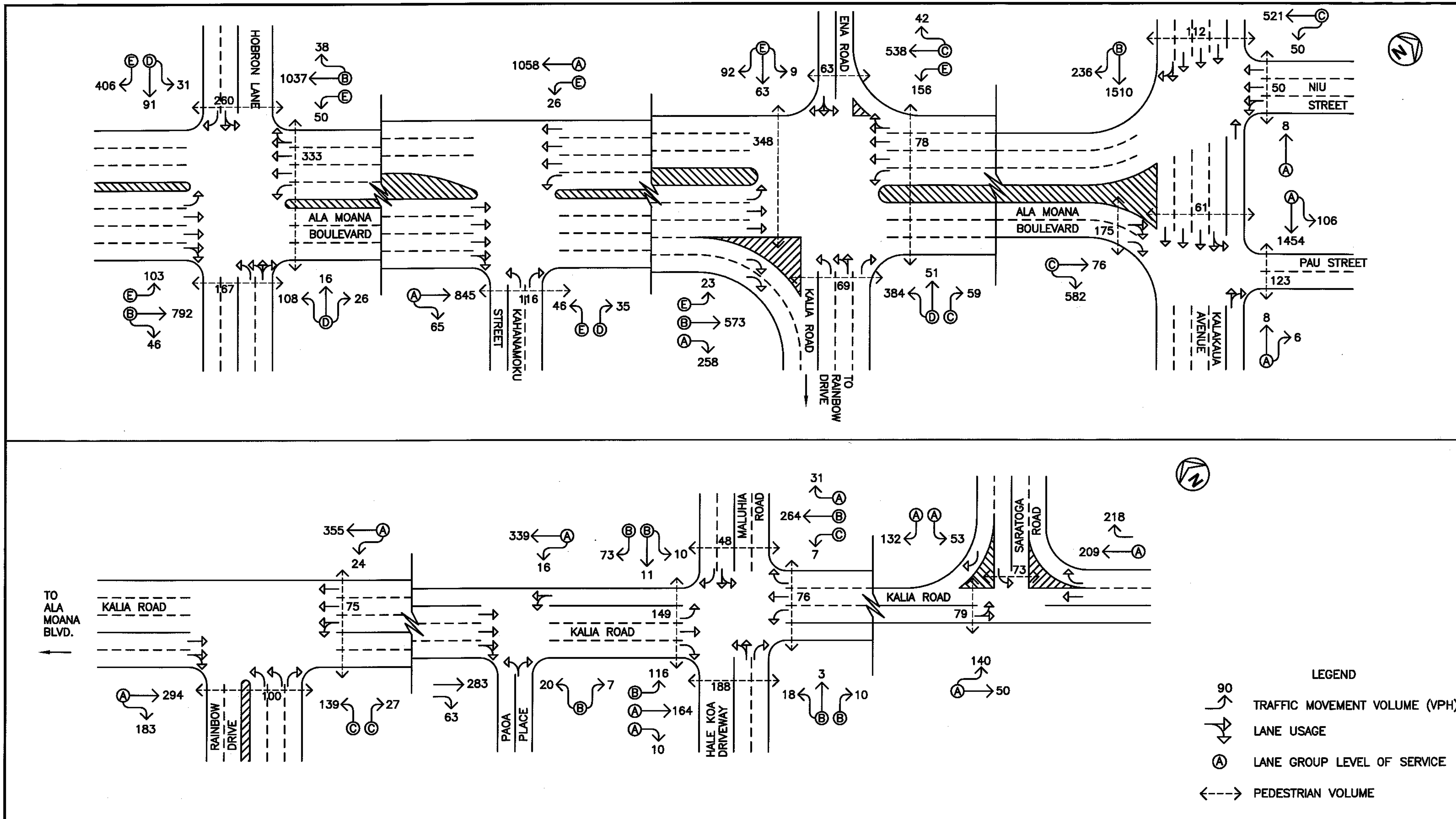
The second development is the Trump International Hotel and Tower (formerly referred to as the "Beach Walk Waikiki"). The majority of the development is completed and occupied. The only outstanding major item for the project is the completion of the traffic signal system at the adjacent intersection of Kalia Road and Saratoga Road. Currently, the Kalia Road approaches of the intersection are stop-controlled with vehicles in the right-turn lane along Saratoga Road required to yield to northbound vehicles along Kalia Road. Once the traffic signal system is completed, vehicles on the Saratoga Road approach of the intersection will also be allowed to turn left onto southbound Kalia Road. As such, the inclusion of this additional traffic movement at the intersection of Kalia Road and Saratoga Road was incorporated into the Year 2022 without project conditions in accordance with the "Traffic Impact Report for the Beach Walk Waikiki."

C. Total Traffic Volumes Without Project

The projected year 2022 AM and PM peak period traffic volumes and operating conditions without the proposed Hilton Hawaiian Village renovations are shown in Figures 9 and 10, and summarized in Table 3. The existing levels of service are included for comparison purposes. LOS calculations are included in Appendix D.

Table 3: Existing and Projected (Without Project) LOS Traffic Operating Conditions

Intersection	Critical Traffic Movement		AM		PM	
			Exist	Year 2022 w/out Proj	Exist	Year 2022 w/out Proj
Ala Moana Blvd/ Hobron Ln	Eastbound	LT	E	E	D	D
		TH-RT	B	B	C	C
	Westbound	LT	E	E	E	E
		TH-RT	B	B	D	D
	Northbound	LT-TH-RT	D	D	E	E
	Southbound	LT-TH	D	D	E	E
		RT	E	E	E	E



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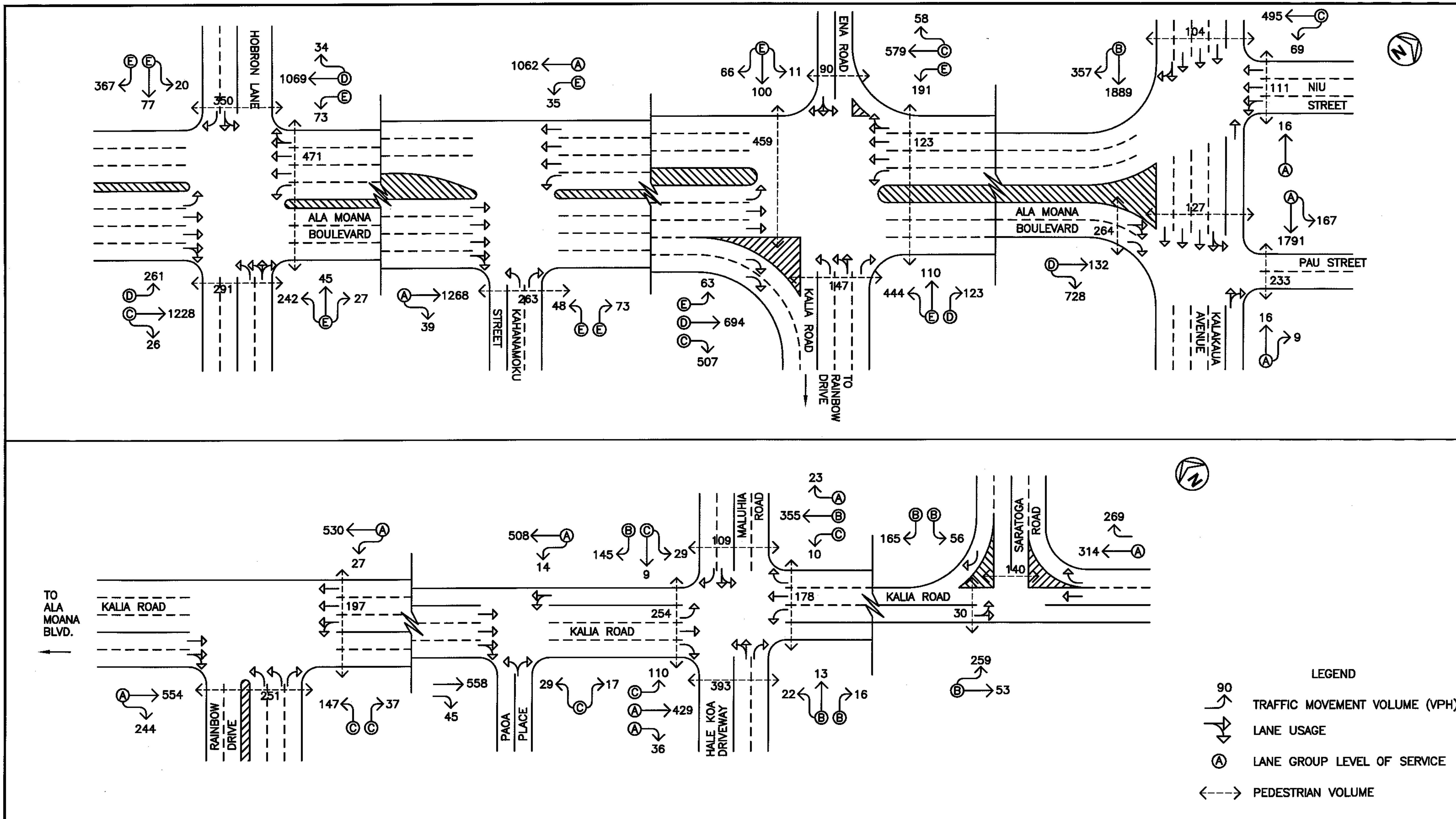
YEAR 2022 AM PEAK HOUR OF TRAFFIC WITHOUT PROJECT

FIGURE 9



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YEAR 2022 PM PEAK HOUR OF TRAFFIC WITHOUT PROJECT

FIGURE 10

Table 3: Existing and Projected (Without Project)
LOS Traffic Operating Conditions (Cont'd)

Intersection	Critical Traffic Movement		AM Exist	AM Year 2022 w/out Proj	PM Exist	PM Year 2022 w/out Proj
Ala Moana Blvd/ Kahanamoku St	Eastbound	TH-RT	A	A	A	A
	Westbound	LT	E	E	E	E
		TH	A	A	A	A
	Northbound	LT	E	E	E	E
		RT	D	D	E	E
Ala Moana Blvd/ Kalia Rd/Ena Rd	Eastbound	LT	E	E	D	E
		TH	B	B	D	D
		RT	A	A	C	C
	Westbound	LT	E	E	E	E
		TH-RT	C	C	C	C
	Northbound	LT-TH	D	D	E	E
		RT	C	C	D	D
	Southbound	LT-TH-RT	E	E	E	E
Ala Moana Blvd/ Kalakaua Ave/ Niu St	Westbound	LT-TH	C	C	C	C
	Northbound	TH	A	A	A	A
	Southbound	TH-RT	B	B	B	B
Ala Moana Blvd/ Kalakaua Ave/ Pau St	Eastbound	TH-RT	C	C	D	D
	Northbound	TH-RT	A	A	A	A
	Southbound	LT-TH	A	A	A	A
Kalia Rd/ Rainbow Dr	Eastbound	LT	C	C	C	C
		RT	C	C	C	C
	Northbound	LT-TH	A	A	A	A
	Southbound	TH-RT	A	A	A	A
Kalia Rd/Paoa Pl	Eastbound	LT-RT	B	B	C	C
	Northbound	LT-TH	A	A	A	A
Kalia Rd/ Maluhia Rd	Eastbound	LT-TH	B	B	B	B
		RT	B	B	B	B
	Westbound	LT-TH	B	B	C	C
		RT	B	B	B	B

Table 3: Existing and Projected (Without Project) LOS Traffic Operating Conditions (Cont'd)

Intersection	Critical Traffic Movement		AM		PM	
			Exist	Year 2022 w/out Proj	Exist	Year 2022 w/out Proj
Kalia Rd/ Maluhia Rd (Cont'd)	Northbound	LT	C	C	C	C
		TH	B	B	B	B
		RT	A	A	A	A
	Southbound	LT	B	B	C	C
		TH	A	A	A	A
		RT	A	A	A	A
Kalia Rd/ Saratoga Rd*	Westbound	LT	-	A	-	B
		RT	A	A	A	B
	Northbound	TH	A	A	A	A
	Southbound	LT-TH	A	A	B	A

*Traffic signal system installed and left-turn lane added to westbound approach.

Under Year 2022 without project conditions, traffic operations are expected, in general, to remain similar to existing conditions. The eastbound left-turn traffic movement at the intersection of Ala Moana Boulevard with Kalia Road and Ena Road is expected to deteriorate from LOS "D" to LOS "E" during the PM peak period. The remaining traffic movements at this intersection, as well as, the other study intersection are expected to operate at levels of service similar to existing conditions during both peak periods with the exception of the intersection of Kalia Road with Saratoga Road. After the installation of a traffic signal system and addition of a left-turn lane on the westbound approach of Saratoga Road, the Kalia Road approaches are expected to operate at LOS "A" during both peak periods while the traffic movements on the westbound approach are expected to operate at LOS "A" during the AM peak period and LOS "B" during the PM peak period.

D. Total Traffic Volumes With Project

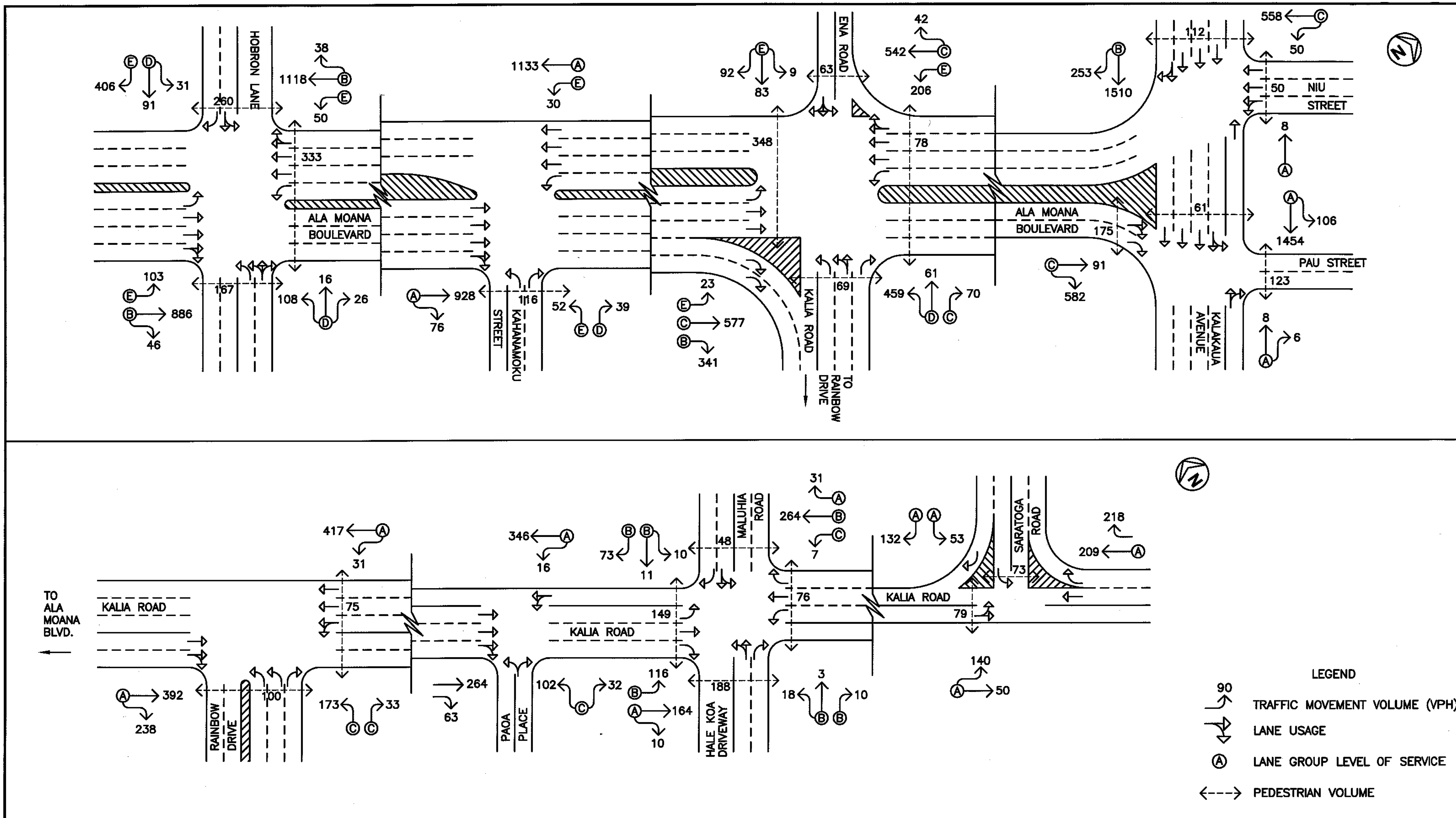
Figures 11 and 12 show the Year 2022 cumulative AM and PM peak hour traffic conditions resulting from the completion of other developments in the vicinity and the proposed renovations at the Hilton Hawaiian Village. The cumulative volumes consist of site- generated traffic superimposed over Year 2022 projected traffic demands. The traffic impacts resulting from the proposed project are addressed in the following section.

V. TRAFFIC IMPACT ANALYSIS

The Year 2022 cumulative AM and PM peak hour traffic conditions with the proposed renovations at the Hilton Hawaiian Village are summarized in Table 4. The segment of Kalia Road between Rainbow Drive and Maluhia Road is assumed to be modified to provide two lanes in each direction (see Figures 13 and 14). These modifications are expected to alleviate the existing queuing resulting from northbound buses entering and exiting the bus pullout along Kalia Road, as well as, the minimize the impact of vehicles turning into Paoa Place on the through traffic along Kalia Road. The existing and projected Year 2022 (Without Project) operating conditions are provided for comparison purposes. LOS calculations are included in Appendix E.

Table 4: Existing and Projected (Without and With Project) LOS Traffic Operating Conditions

Intersection	Critical Traffic Movement		AM			PM		
			Exist	Year 2022		Exist	Year 2022	
				w/out Proj	w/ Proj		w/out Proj	w/ Proj
Ala Moana Blvd/ Hobron Ln	EB	LT	E	E	E	D	D	E
		TH-RT	B	B	B	C	C	B
	WB	LT	E	E	E	E	E	E
		TH-RT	B	B	B	D	D	D
	NB	LT-TH-RT	D	D	D	E	E	E
	SB	LT-TH	D	D	D	E	E	E
		RT	E	E	E	E	E	E

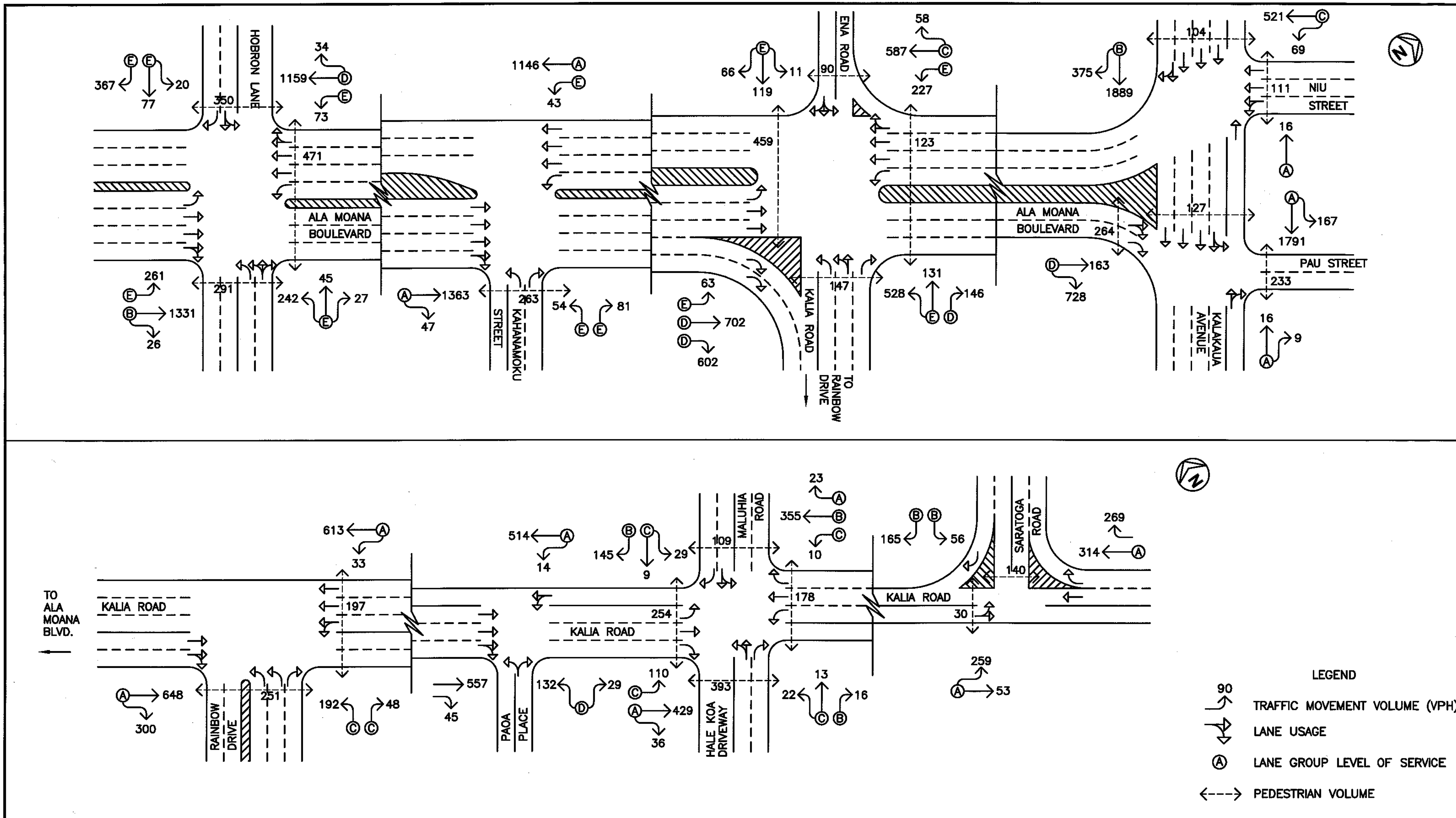


WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

HILTON HAWAIIAN VILLAGE

YEAR 2022 AM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 11

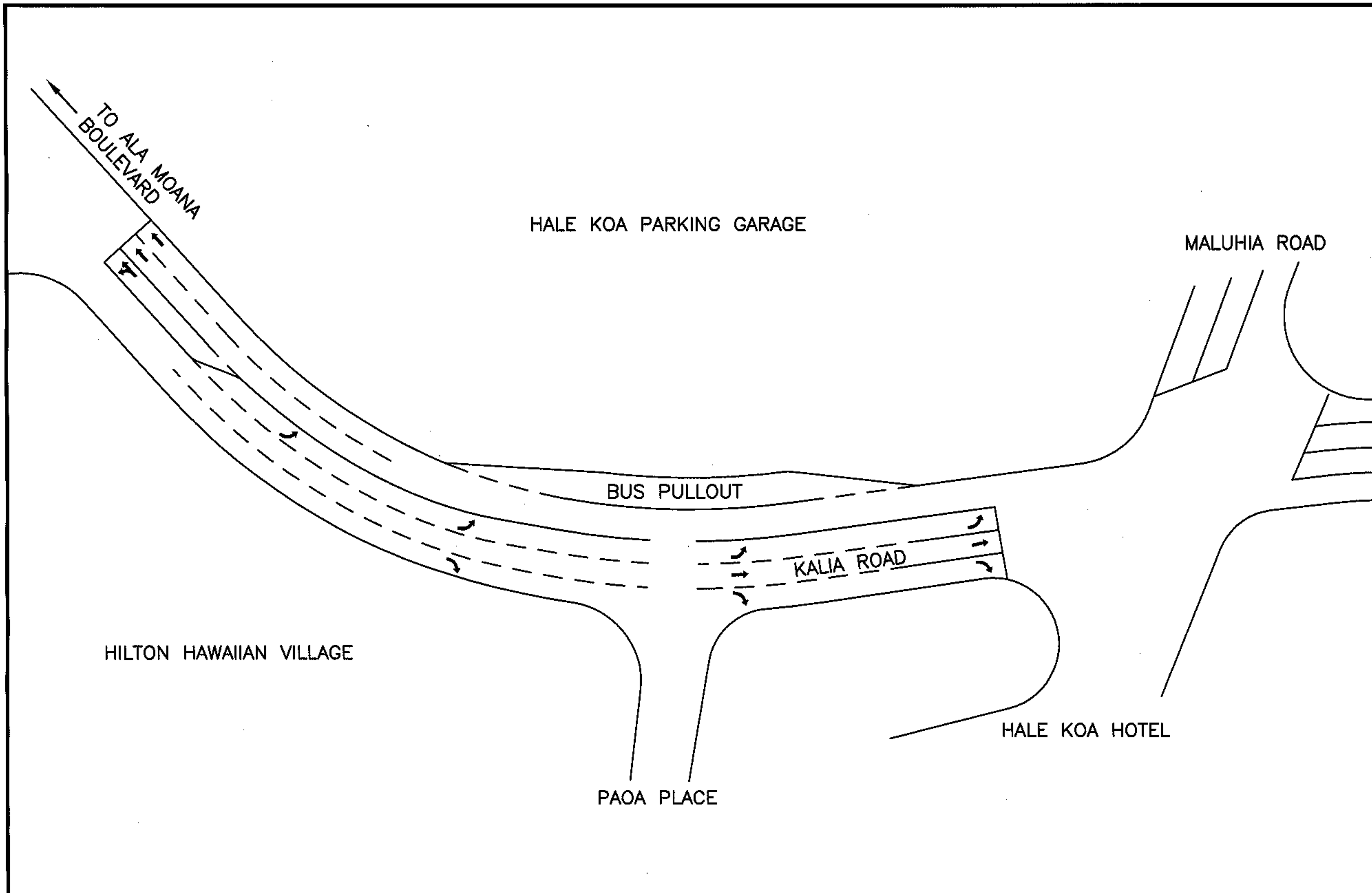


WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

HILTON HAWAIIAN VILLAGE

YEAR 2022 PM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 12



WILSON OKAMOTO CORPORATION
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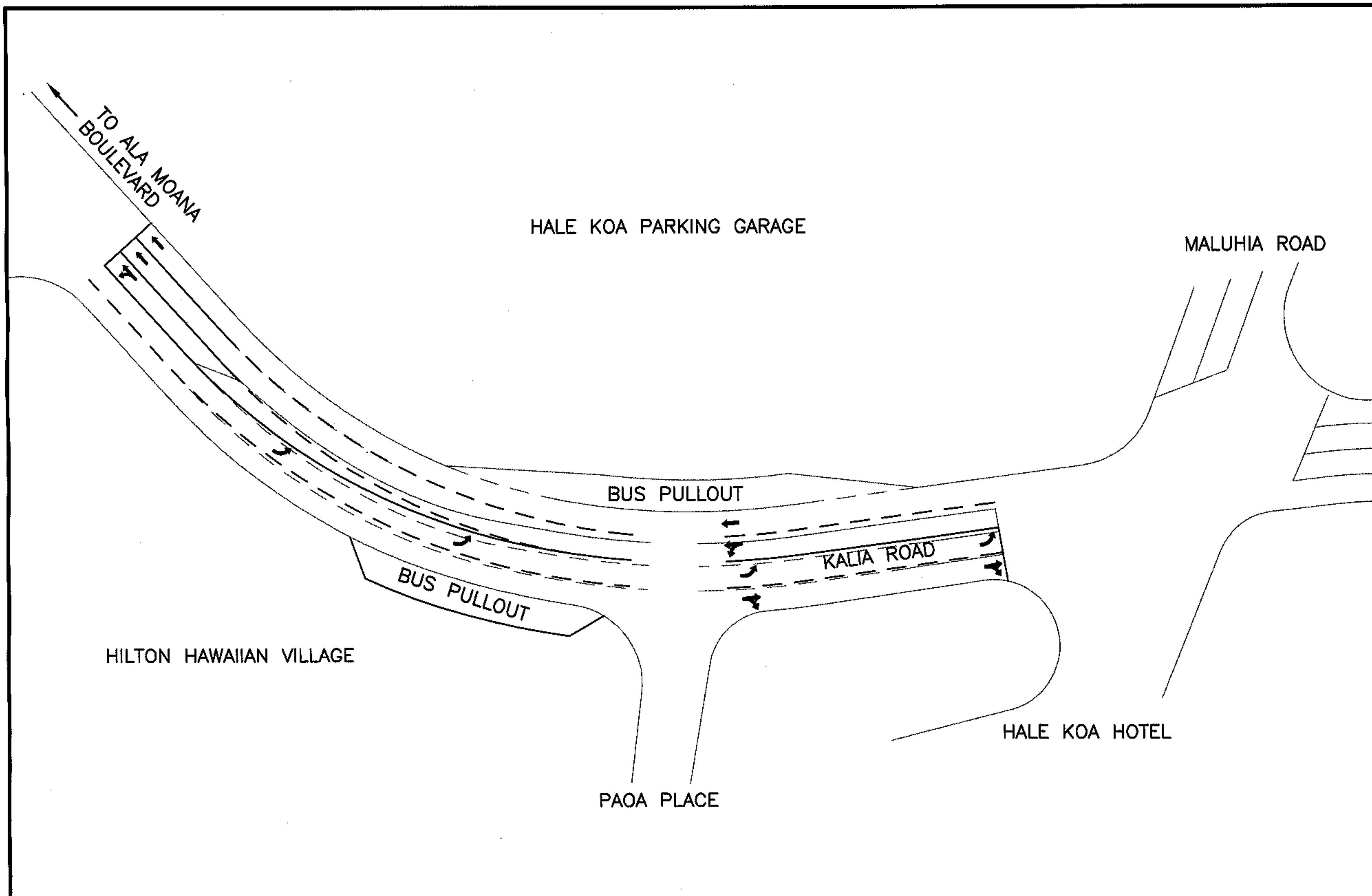
HILTON HAWAIIAN VILLAGE

EXISTING ROADWAY CONFIGURATION

FIGURE 13



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HILTON HAWAIIAN VILLAGE

PROPOSED ROADWAY CONFIGURATION (CONCEPUTAL)

FIGURE 14

Table 4: Existing and Projected (Without and With Project) LOS Traffic Operating Conditions

Intersection	Critical Traffic Movement		AM			PM		
			Exist	Year 2022		Exist	Year 2022	
				w/out Proj	w/ Proj		w/out Proj	w/ Proj
Ala Moana Blvd/ Kahanamoku St	EB	TH-RT	A	A	A	A	A	A
	WB	LT	E	E	E	E	E	E
		TH	A	A	A	A	A	A
	NB	LT	E	E	E	E	E	E
		RT	D	D	D	E	E	E
Ala Moana Blvd/ Kalia Rd/Ena Rd	EB	LT	E	E	E	D	E	E
		TH	B	B	C	D	D	D
		RT	A	A	B	C	C	D
	WB	LT	E	E	E	E	E	E
		TH-RT	C	C	C	C	C	C
	NB	LT-TH	D	D	D	E	E	E
		RT	C	C	C	D	D	D
	SB	LT-TH-RT	E	E	E	E	E	E
Ala Moana Blvd/ Kalakaua Ave/ Niu St	WB	LT-TH	C	C	C	C	C	C
	NB	TH	A	A	A	A	A	A
	SB	TH-RT	B	B	B	B	B	B
Ala Moana Blvd/ Kalakaua Ave/ Pau St	EB	TH-RT	C	C	C	D	D	D
	NB	TH-RT	A	A	A	A	A	A
	SB	LT-TH	A	A	A	A	A	A
Kalia Rd/ Rainbow Dr	EB	LT	C	C	C	C	C	C
		RT	C	C	C	C	C	C
	NB	LT-TH	A	A	A	A	A	A
	SB	TH-RT	A	A	A	A	A	A
Kalia Rd/ Paoa Pl*	EB	LT-RT	B	B	C	C	C	D
	NB	LT-TH	A	A	A	A	A	A
Kalia Rd/ Maluhia Rd*	EB	LT-TH	B	B	B	B	B	C
		RT	B	B	B	B	B	B
	WB	LT-TH	B	B	B	C	C	C
		RT	B	B	B	B	B	B

*Intersection modifications implemented.

Table 4: Existing and Projected (Without and With Project) LOS Traffic Operating Conditions (Cont'd)

Intersection	Critical Traffic Movement		AM			PM		
			Exist	Year 2022		Exist	Year 2022	
				w/out Proj	w/ Proj		w/out Proj	w/ Proj
Kalia/Maluhia Rd* (Cont'd)	NB	LT	C	C	C	C	C	C
		TH	B	B	B	B	B	B
		RT	A	A	A	A	A	A
	SB	LT	B	B	B	C	C	C
		TH	A	A	A	A	A	A
		RT	A	A		A	A	
Kalia Rd/ Saratoga Rd	WB	LT	-	A	A	-	B	B
		RT	A	A	A	A	B	B
	NB	TH	A	A	A	A	A	A
	SB	LT-TH	A	A	A	B	A	A

*Intersection modifications implemented.

Traffic operations under Year 2022 with project conditions are expected, in general, to remain similar to Year 2022 without project conditions during both peak periods. The traffic movements at the study intersections along Ala Moana Boulevard are expected to continue operating at LOS "E" or better during both peak periods with the exception of the intersections along Kalakaua Avenue. The traffic movements at the intersections of Kalakaua Avenue and Ala Moana Boulevard with Niu Street and Pau Street are expected to continue operating at LOS "C" or better during the AM peak period and LOS "C" and LOS "D" or better, respectively, during the PM peak period. Along Kalia Road, the traffic movements at the intersections with Rainbow Drive and Maluhia Road are expected to continue operating at LOS "C" or better during both peak periods while those at the intersection with Saratoga Road are expected to continue operating at LOS "A" during the AM peak period and LOS "B" or better during the PM peak period. At the intersection of Kalia Road with Paoa Place, the traffic movements are expected to operate at LOS "C" or better during the AM peak period and LOS "D" or better during the PM peak period despite the addition of site-generated traffic to the intersection primarily due to the recommended improvements along Kalia Road to provide two lanes in each direction and the elimination of the exit driveway the exit driveway along Kalia Road for the bus loading area.

Although Year 2022 with project conditions are expected to remain similar to without project conditions, the existing Hilton Hawaiian Village is located in a densely developed area with a high volume of pedestrian and vehicular traffic, and traffic operations along the adjacent Ala Moana Boulevard are currently congested. As such, a traffic management plan is recommended for the Hilton Hawaiian Village to minimize conflicts with traffic associated with the resort.

VI. RECOMMENDATIONS

Based on the analysis of the traffic data, the following are the recommendations of this study associated with the implementation of the proposed renovations at the Hilton Hawaiian Village:

1. Maintain sufficient sight distance for motorists to safely enter and exit all driveways and roadways.

2. Maintain adequate on-site loading and off-loading service areas and prohibit off-site loading operations.

3. Maintain adequate turn-around area for service, delivery, and refuse collection vehicles to maneuver on the project site to avoid vehicle-reversing maneuvers onto public roadways.

4. Maintain sufficient turning radii at all driveways and roadways to avoid or minimize vehicle encroachments to oncoming traffic lanes.

5. Channelize the right-turn-in entrance driveway for the new timeshare tower near Paoa Place to ensure adherence to the turning movement restrictions at that driveway.

6. Provide adequate sight distance at the exit driveway along Paoa Place to ensure that exiting vehicles from the new timeshare tower are able to see exiting vehicles from the bus loading area and vice versa.

7. Modify the segment of Kalia Road between Rainbow Drive and Maluhia Road to provide two through lanes in each direction near Paoa Place (see Figures 13 and 14). The actual dimensions and layout of these modifications will be determined during the design phase of the project.

8. Prepare a Traffic Management Plan (TMP) for the Hilton Hawaiian Village that includes traffic circulation, parking, loading, and traffic demand management strategies.

9. Prepare a Construction Management Plan (CMP) for the Hilton Hawaiian Village which includes discussions regarding the anticipated construction schedule and phasing, as well as, traffic circulation, traffic control, parking, and conflicts with public transportation during the construction period.

VII. CONCLUSION

The existing Hilton Hawaiian Village resort includes ~2,900 hotel rooms and ~650 timeshare units located in 7 towers, over 90 shops and 20 restaurants, over 150,000 square feet of indoor/outdoor banquet and meeting space, and other amenities such as pool areas, botanical gardens, and a parking garage. The proposed project entails the renovation of the resort's main entry and lobby, Rainbow Drive, and some of the existing retail and pool areas, as well as, construction of two new timeshare towers. The planned renovations are not expected to have a significant impact on traffic operations in the project vicinity primarily due to the implementation of the recommended improvements along Kalia Road to provide two lanes in each direction near Paoa Place and the elimination of the existing exit driveway along Kalia Road for the bus loading area. Although traffic operations in the vicinity of the resort are expected to remain similar to without project conditions, the preparation of a traffic management plan for the entire resort to manage daily and special events traffic, and a construction management plan for the proposed project are recommended to minimize conflicts with traffic along the surrounding roadways during construction activities.

APPENDIX A

EXISTING TRAFFIC COUNT DATA

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5677,D4-5671
Counted By:TO, RJ
Weather:Clear

File Name : AlaKah AM
Site Code : 00000001
Start Date : 3/3/2010
Page No : 1

Groups Printed- Unshifted

	Southbound	Ala Moana Blvd. Westbound					Kahanamoku Street Northbound					Ala Moana Blvd. Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:30 AM	0	3	147	0	0	150	12	0	8	16	36	0	132	8	0	140	326
06:45 AM	0	4	185	0	0	189	12	0	11	20	43	0	181	15	0	196	428
Total	0	7	332	0	0	339	24	0	19	36	79	0	313	23	0	336	754
07:00 AM	0	6	236	0	0	242	10	0	4	23	37	0	152	18	0	170	449
07:15 AM	0	8	273	0	0	281	14	0	10	34	58	0	237	25	0	262	601
07:30 AM	0	4	247	0	0	251	16	0	7	18	41	0	192	12	0	204	496
07:45 AM	0	6	235	0	0	241	6	0	8	26	40	0	198	17	0	215	496
Total	0	24	991	0	0	1015	46	0	29	101	176	0	779	72	0	851	2042
08:00 AM	0	8	267	0	0	275	10	0	10	38	58	0	218	11	0	229	562
08:15 AM	0	8	184	0	0	192	6	0	17	24	47	0	199	8	0	207	446
Grand Total	0	47	1774	0	0	1821	86	0	75	199	360	0	1509	114	0	1623	3804
Apprch %		2.6	97.4	0	0		23.9	0	20.8	55.3		0	93	7	0		
Total %	0	1.2	46.6	0	0	47.9	2.3	0	2	5.2	9.5	0	39.7	3	0	42.7	

	Southbound	Ala Moana Blvd. Westbound				Kahanamoku Street Northbound				Ala Moana Blvd. Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:15 AM														
07:15 AM	0	**8**	**273**	0	**281**	14	0	**10**	**24**	0	**237**	**25**	**262**	**567**
07:30 AM	0	4	247	0	251	**16**	0	7	23	0	192	12	204	478
07:45 AM	0	6	235	0	241	6	0	8	14	0	198	17	215	470
08:00 AM	0	8	267	0	275	10	0	10	20	0	218	11	229	524
Total Volume	0	26	1022	0	1048	46	0	35	81	0	845	65	910	2039
% App. Total		2.5	97.5	0		56.8	0	43.2		0	92.9	7.1		
PHF	.000	.813	.936	.000	.932	.719	.000	.875	.844	.000	.891	.650	.868	.899

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5671, D4-5677
Counted By:TO, RJ
Weather:Clear

File Name : AlaKah PM
Site Code : 00000001
Start Date : 3/3/2010
Page No : 1

Groups Printed- Unshifted

	Southbound	Ala Moana Blvd. Westbound					Kahanamoku Street Northbound					Ala Moana Blvd. Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	9	281	0	0	290	21	0	19	54	94	0	324	10	0	334	718
04:15 PM	0	12	283	0	0	295	12	0	18	75	105	0	305	13	0	318	718
04:30 PM	0	5	269	0	0	274	7	0	19	67	93	0	346	8	0	354	721
04:45 PM	0	9	211	0	0	220	8	0	17	67	92	0	293	8	0	301	613
Total	0	35	1044	0	0	1079	48	0	73	263	384	0	1268	39	0	1307	2770
05:00 PM	0	6	225	0	0	231	12	0	8	77	97	0	306	9	0	315	643
05:15 PM	0	12	264	0	0	276	11	0	18	93	122	0	322	6	0	328	726
05:30 PM	0	13	241	0	0	254	16	0	16	74	106	0	333	9	0	342	702
05:45 PM	0	9	191	0	0	200	12	0	13	69	94	0	364	17	0	381	675
Total	0	40	921	0	0	961	51	0	55	313	419	0	1325	41	0	1366	2746
Grand Total	0	75	1965	0	0	2040	99	0	128	576	803	0	2593	80	0	2673	5516
Apprch %		3.7	96.3	0	0		12.3	0	15.9	71.7		0	97	3	0		
Total %	0	1.4	35.6	0	0	37	1.8	0	2.3	10.4	14.6	0	47	1.5	0	48.5	

	Southbound	Ala Moana Blvd. Westbound				Kahanamoku Street Northbound				Ala Moana Blvd. Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 04:00 PM														
04:00 PM	0	9	281	0	290	**21**	0	**19**	**40**	0	324	10	334	**664**
04:15 PM	0	**12**	**283**	0	**295**	12	0	18	30	0	305	**13**	318	643
04:30 PM	0	5	269	0	274	7	0	19	26	0	**346**	8	**354**	654
04:45 PM	0	9	211	0	220	8	0	17	25	0	293	8	301	546
Total Volume	0	35	1044	0	1079	48	0	73	121	0	1268	39	1307	2507
% App. Total		3.2	96.8	0		39.7	0	60.3		0	97	3		
PHF	.000	.729	.922	.000	.914	.571	.000	.961	.756	.000	.916	.750	.923	.944

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-3888, D4-5673
Counted By:GC, BR
Weather:Clear

File Name : AlaKaliaEna AM
Site Code : 00000002
Start Date : 3/3/2010
Page No : 1

Groups Printed- Unshifted

	Ena Road Southbound					Ala Moana Blvd. Westbound					Kalia Road Northbound					Ala Moana Blvd. Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:30 AM	0	15	4	5	24	21	38	5	8	72	32	4	6	9	51	16	90	45	59	210	357
06:45 AM	0	11	9	14	34	51	72	6	14	143	56	7	20	10	93	12	106	54	92	264	534
Total	0	26	13	19	58	72	110	11	22	215	88	11	26	19	144	28	196	99	151	474	891
07:00 AM	1	4	2	14	21	37	117	6	9	169	100	10	26	12	148	12	126	43	69	250	588
07:15 AM	0	6	4	18	28	47	148	5	2	202	104	11	19	9	143	6	98	64	70	238	611
07:30 AM	1	9	8	11	29	48	150	4	9	211	91	7	17	18	133	8	139	44	78	269	642
07:45 AM	0	15	11	3	29	51	165	8	6	230	85	9	17	8	119	3	117	44	81	245	623
Total	2	34	25	46	107	183	580	23	26	812	380	37	79	47	543	29	480	195	298	1002	2464
08:00 AM	1	10	2	18	31	51	154	11	7	223	63	14	22	3	102	17	111	46	88	262	618
08:15 AM	0	10	6	28	44	41	103	8	20	172	90	8	28	16	142	6	143	48	131	328	686
Grand Total	3	80	46	111	240	347	947	53	75	1422	621	70	155	85	931	80	930	388	668	2066	4659
Apprch %	1.2	33.3	19.2	46.2		24.4	66.6	3.7	5.3		66.7	7.5	16.6	9.1		3.9	45	18.8	32.3		
Total %	0.1	1.7	1	2.4	5.2	7.4	20.3	1.1	1.6	30.5	13.3	1.5	3.3	1.8	20	1.7	20	8.3	14.3	44.3	

	Ena Road Southbound					Ala Moana Blvd. Westbound					Kalia Road Northbound					Ala Moana Blvd. Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	**1**	9	8	11	29	48	150	4	9	211	**91**	7	17	**18**	133	8	139	44	78	269	642
07:45 AM	0	**15**	**11**	3	29	**51**	**165**	8	6	**230**	85	9	17	8	119	3	117	44	81	245	623
08:00 AM	1	10	2	18	31	51	154	**11**	7	223	63	**14**	22	3	102	**17**	111	46	88	262	618
08:15 AM	0	10	6	**28**	**44**	41	103	8	**20**	172	90	8	**28**	16	**142**	6	**143**	**48**	**131**	**328**	**686**
Total Volume	2	44	27	60	133	191	572	31	42	836	329	38	84	45	496	34	510	182	378	1104	2569
% App. Total	1.5	33.1	20.3	45.1		22.8	68.4	3.7	5		66.3	7.7	16.9	9.1		3.1	46.2	16.5	34.2		
PHF	.500	.733	.614	.536	.756	.936	.867	.705	.525	.909	.904	.679	.750	.625	.873	.500	.892	.948	.721	.841	.936

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-3888, D4-5673
Counted By:GC, MM
Weather:Clear

File Name : AlaKaliaEna PM
Site Code : 00000002
Start Date : 3/3/2010
Page No : 1

Groups Printed- Unshifted

	Ena Road Southbound					Ala Moana Blvd. Westbound					Kalia Road Northbound					Ala Moana Blvd. Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	2	12	9	26	49	43	127	7	11	188	139	23	44	17	223	22	144	126	91	383	843
04:15 PM	0	16	10	24	50	38	132	10	4	184	124	38	47	25	234	14	175	134	96	419	887
04:30 PM	3	16	22	34	75	36	122	9	15	182	106	21	42	22	191	17	150	122	74	363	811
04:45 PM	3	7	9	23	42	42	161	10	6	219	122	17	32	20	191	14	165	120	99	398	850
Total	8	51	50	107	216	159	542	36	36	773	491	99	165	84	839	67	634	502	360	1563	3391
05:00 PM	2	10	9	40	61	26	120	9	15	170	105	33	35	29	202	23	217	121	97	458	891
05:15 PM	4	9	15	50	78	24	142	14	14	194	85	19	37	21	162	22	177	114	114	427	861
05:30 PM	1	7	8	33	49	40	124	12	21	197	134	22	36	15	207	18	184	128	96	426	879
05:45 PM	0	16	7	12	35	43	105	10	22	180	84	26	31	40	181	10	169	150	116	445	841
Total	7	42	39	135	223	133	491	45	72	741	408	100	139	105	752	73	747	513	423	1756	3472
Grand Total	15	93	89	242	439	292	1033	81	108	1514	899	199	304	189	1591	140	1381	1015	783	3319	6863
Apprch %	3.4	21.2	20.3	55.1		19.3	68.2	5.4	7.1		56.5	12.5	19.1	11.9		4.2	41.6	30.6	23.6		
Total %	0.2	1.4	1.3	3.5	6.4	4.3	15.1	1.2	1.6	22.1	13.1	2.9	4.4	2.8	23.2	2	20.1	14.8	11.4	48.4	

	Ena Road Southbound					Ala Moana Blvd. Westbound					Kalia Road Northbound					Ala Moana Blvd. Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	3	7	9	23	42	**42**	**161**	10	6	**219**	122	17	32	20	191	14	165	120	99	398	850
05:00 PM	2	**10**	9	40	61	26	120	9	15	170	105	**33**	35	**29**	202	**23**	**217**	121	97	**458**	**891**
05:15 PM	**4**	9	**15**	**50**	**78**	24	142	**14**	14	194	85	19	**37**	21	162	22	177	114	**114**	427	861
05:30 PM	1	7	8	33	49	40	124	12	**21**	197	**134**	22	36	15	**207**	18	184	**128**	96	426	879
Total Volume	10	33	41	146	230	132	547	45	56	780	446	91	140	85	762	77	743	483	406	1709	3481
% App. Total	4.3	14.3	17.8	63.5		16.9	70.1	5.8	7.2		58.5	11.9	18.4	11.2		4.5	43.5	28.3	23.8		
PHF	.625	.825	.683	.730	.737	.786	.849	.804	.667	.890	.832	.689	.946	.733	.920	.837	.856	.943	.890	.933	.977

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5674, D4-5671
Counted By:AR, KT
Weather:Clear

File Name : KalRain AM
Site Code : 00000003
Start Date : 10/29/2009
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Westbound	Kalia Road Northbound					Rainbow drive Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:30 AM	0	65	42	0	107	0	8	63	0	22	93	18	0	7	31	56	256
06:45 AM	0	67	57	0	124	0	9	57	0	17	83	45	0	9	25	79	286
Total	0	132	99	0	231	0	17	120	0	39	176	63	0	16	56	135	542
07:00 AM	0	60	42	0	102	0	6	99	0	32	137	30	0	1	20	51	290
07:15 AM	0	72	37	0	109	0	2	70	0	12	84	25	0	9	24	58	251
07:30 AM	0	99	50	0	149	0	6	82	0	14	102	24	0	8	31	63	314
07:45 AM	0	81	49	0	130	0	4	63	0	15	82	16	0	4	35	55	267
Total	0	312	178	0	490	0	18	314	0	73	405	95	0	22	110	227	1122
08:00 AM	0	77	39	0	116	0	4	78	0	21	103	26	0	5	42	73	292
08:15 AM	0	80	32	0	112	0	2	63	0	16	81	19	0	5	38	62	255
Grand Total	0	601	348	0	949	0	41	575	0	149	765	203	0	48	246	497	2211
Apprch %	0	63.3	36.7	0			5.4	75.2	0	19.5		40.8	0	9.7	49.5		
Total %	0	27.2	15.7	0	42.9	0	1.9	26	0	6.7	34.6	9.2	0	2.2	11.1	22.5	

	Kalia Road Southbound				Westbound	Kalia Road Northbound				Rainbow drive Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 06:45 AM														
06:45 AM	0	67	**57**	124	0	**9**	57	0	66	**45**	0	**9**	**54**	244
07:00 AM	0	60	42	102	0	6	**99**	0	**105**	30	0	1	31	238
07:15 AM	0	72	37	109	0	2	70	0	72	25	0	9	34	215
07:30 AM	0	**99**	50	**149**	0	6	82	0	88	24	0	8	32	**269**
Total Volume	0	298	186	484	0	23	308	0	331	124	0	27	151	966
% App. Total	0	61.6	38.4			6.9	93.1	0		82.1	0	17.9		
PHF	.000	.753	.816	.812	.000	.639	.778	.000	.788	.689	.000	.750	.699	.898

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5674, D4-5671
Counted By:AR, KP
Weather:Clear

File Name : KalRain PM
Site Code : 00000003
Start Date : 10/29/2009
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Westbound	Kalia Road Northbound					Rainbow Drive Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	125	53	0	178	0	5	161	0	78	244	69	0	12	49	130	552
04:15 PM	0	147	56	0	203	0	5	152	0	51	208	47	0	7	67	121	532
04:30 PM	0	116	46	0	162	0	11	138	0	31	180	41	0	8	66	115	457
04:45 PM	0	119	49	0	168	0	4	131	0	37	172	25	0	8	69	102	442
Total	0	507	204	0	711	0	25	582	0	197	804	182	0	35	251	468	1983
05:00 PM	0	111	40	0	151	0	13	122	0	30	165	52	0	9	61	122	438
05:15 PM	0	101	40	0	141	0	8	111	0	55	174	53	0	12	62	127	442
05:30 PM	0	125	48	0	173	0	5	115	0	28	148	47	0	5	78	130	451
05:45 PM	0	143	48	0	191	0	11	96	0	7	114	45	0	15	70	130	435
Total	0	480	176	0	656	0	37	444	0	120	601	197	0	41	271	509	1766
Grand Total	0	987	380	0	1367	0	62	1026	0	317	1405	379	0	76	522	977	3749
Apprch %	0	72.2	27.8	0			4.4	73	0	22.6		38.8	0	7.8	53.4		
Total %	0	26.3	10.1	0	36.5	0	1.7	27.4	0	8.5	37.5	10.1	0	2	13.9	26.1	

	Kalia Road Southbound				Westbound	Kalia Road Northbound				Rainbow Drive Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 04:00 PM														
04:00 PM	0	125	53	**178**	0	5	**161**	0	**166**	**69**	0	**12**	**81**	**425**
04:15 PM	0	**147**	**56**	**203**	0	5	152	0	157	47	0	7	54	414
04:30 PM	0	116	46	162	0	**11**	138	0	149	41	0	8	49	360
04:45 PM	0	119	49	168	0	4	131	0	135	25	0	8	33	336
Total Volume	0	507	204	711	0	25	582	0	607	182	0	35	217	1535
% App. Total	0	71.3	28.7			4.1	95.9	0		83.9	0	16.1		
PHF	.000	.862	.911	.876	.000	.568	.904	.000	.914	.659	.000	.729	.670	.903

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5671
Counted By:DY
Weather:Clear

File Name : KalRain AM 6-8-10
Site Code : 00000002
Start Date : 6/8/2010
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Westbound	Kalia Road Northbound					Rainbow Drive Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:30 AM	0	0	36	0	36	0	0	0	0	14	14	31	0	2	22	55	105
06:45 AM	0	0	32	0	32	0	5	0	0	10	15	39	0	5	17	61	108
Total	0	0	68	0	68	0	5	0	0	24	29	70	0	7	39	116	213
07:00 AM	0	0	36	0	36	0	4	0	0	19	23	51	0	7	35	93	152
07:15 AM	0	0	55	0	55	0	2	0	0	7	9	53	0	2	27	82	146
07:30 AM	0	0	42	0	42	0	3	0	0	8	11	41	0	3	22	66	119
07:45 AM	0	0	32	0	32	0	6	0	0	17	23	47	0	6	38	91	146
Total	0	0	165	0	165	0	15	0	0	51	66	192	0	18	122	332	563
08:00 AM	0	0	35	0	35	0	8	0	0	14	22	41	0	6	36	83	140
08:15 AM	0	0	35	0	35	0	5	0	0	12	17	37	0	14	27	78	130
Grand Total	0	0	303	0	303	0	33	0	0	101	134	340	0	45	224	609	1046
Apprch %	0	0	100	0			24.6	0	0	75.4		55.8	0	7.4	36.8		
Total %	0	0	29	0	29	0	3.2	0	0	9.7	12.8	32.5	0	4.3	21.4	58.2	

	Kalia Road Southbound				Westbound	Kalia Road Northbound				Rainbow Drive Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:00 AM														
07:00 AM	0	0	36	36	0	4	0	0	4	51	0	**7**	**58**	98
07:15 AM	0	0	**55**	**55**	0	2	0	0	2	**53**	0	2	55	**112**
07:30 AM	0	0	42	42	0	3	0	0	3	41	0	3	44	89
07:45 AM	0	0	32	32	0	**6**	0	0	**6**	47	0	6	53	91
Total Volume	0	0	165	165	0	15	0	0	15	192	0	18	210	390
% App. Total	0	0	100			100	0	0		91.4	0	8.6		
PHF	.000	.000	.750	.750	.000	.625	.000	.000	.625	.906	.000	.643	.905	.871

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5671
Counted By:DY
Weather:Clear

File Name : KalRain PM 6-8-10
Site Code : 00000002
Start Date : 6/8/2010
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Westbound	Kalia Road Northbound					Rainbow Drive Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	42	0	42	0	10	0	0	58	68	67	0	9	70	146	256
04:15 PM	0	0	51	0	51	0	9	0	0	35	44	52	0	10	85	147	242
04:30 PM	0	0	50	0	50	0	8	0	0	54	62	24	0	15	53	92	204
04:45 PM	0	0	46	0	46	0	8	0	0	49	57	27	0	8	60	95	198
Total	0	0	189	0	189	0	35	0	0	196	231	170	0	42	268	480	900
05:00 PM	0	0	63	0	63	0	5	0	0	39	44	34	0	12	80	126	233
05:15 PM	0	0	67	0	67	0	10	0	0	43	53	50	0	18	57	125	245
05:30 PM	0	0	53	0	53	0	8	0	0	44	52	40	0	10	59	109	214
05:45 PM	0	0	55	0	55	0	6	0	0	48	54	35	0	8	95	138	247
Total	0	0	238	0	238	0	29	0	0	174	203	159	0	48	291	498	939
Grand Total	0	0	427	0	427	0	64	0	0	370	434	329	0	90	559	978	1839
Apprch %	0	0	100	0			14.7	0	0	85.3		33.6	0	9.2	57.2		
Total %	0	0	23.2	0	23.2	0	3.5	0	0	20.1	23.6	17.9	0	4.9	30.4	53.2	

	Kalia Road Southbound				Westbound	Kalia Road Northbound				Rainbow Drive Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 05:00 PM														
05:00 PM	0	0	63	63	0	5	0	0	5	34	0	12	46	114
05:15 PM	0	0	**67**	**67**	0	**10**	0	0	**10**	**50**	0	**18**	**68**	**145**
05:30 PM	0	0	53	53	0	8	0	0	8	40	0	10	50	111
05:45 PM	0	0	55	55	0	6	0	0	6	35	0	8	43	104
Total Volume	0	0	238	238	0	29	0	0	29	159	0	48	207	474
% App. Total	0	0	100			100	0	0		76.8	0	23.2		
PHF	.000	.000	.888	.888	.000	.725	.000	.000	.725	.795	.000	.667	.761	.817

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5673
Counted By:JY
Weather:Clear

File Name : KaliaPaoa 6-8-10 AM
Site Code : 00000001
Start Date : 6/8/2010
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Westbound	Kalia Road Northbound					Paoa Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:30 AM	0	0	10	0	10	0	2	0	0	0	2	2	0	1	34	37	49
06:45 AM	0	0	12	0	12	0	5	0	0	0	5	7	1	1	24	33	50
Total	0	0	22	0	22	0	7	0	0	0	7	9	1	2	58	70	99
07:00 AM	0	0	10	0	10	0	1	0	0	0	1	1	0	1	30	32	43
07:15 AM	0	0	22	0	22	0	1	0	0	0	1	7	0	3	16	26	49
07:30 AM	0	0	19	0	19	0	9	0	0	0	9	5	0	2	17	24	52
07:45 AM	0	0	11	0	11	0	7	0	0	0	7	7	0	6	18	31	49
Total	0	0	62	0	62	0	18	0	0	0	18	20	0	12	81	113	193
08:00 AM	0	0	15	0	15	0	4	0	0	0	4	3	0	3	20	26	45
08:15 AM	0	0	17	0	17	0	5	0	0	0	5	3	0	2	6	11	33
Grand Total	0	0	116	0	116	0	34	0	0	0	34	35	1	19	165	220	370
Apprch %	0	0	100	0			100	0	0	0		15.9	0.5	8.6	75		
Total %	0	0	31.4	0	31.4	0	9.2	0	0	0	9.2	9.5	0.3	5.1	44.6	59.5	

	Kalia Road Southbound				Westbound	Kalia Road Northbound				Paoa Road Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:15 AM														
07:15 AM	0	0	**22**	**22**	0	1	0	0	1	**7**	0	3	10	33
07:30 AM	0	0	19	19	0	**9**	0	0	**9**	5	0	2	7	**35**
07:45 AM	0	0	11	11	0	7	0	0	7	7	0	**6**	**13**	31
08:00 AM	0	0	15	15	0	4	0	0	4	3	0	3	6	25
Total Volume	0	0	67	67	0	21	0	0	21	22	0	14	36	124
% App. Total	0	0	100			100	0	0		61.1	0	38.9		
PHF	.000	.000	.761	.761	.000	.583	.000	.000	.583	.786	.000	.583	.692	.886

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5673
Counted By:JY
Weather:Clear

File Name : KaliaPaoa 6-8-10 PM
Site Code : 00000001
Start Date : 6/8/2010
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Westbound	Kalia Road Northbound					Paoa Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	2	13	0	15	0	4	0	0	0	4	13	0	3	35	51	70
04:15 PM	0	0	15	0	15	0	3	0	0	0	3	7	0	2	61	70	88
04:30 PM	0	0	10	0	10	0	4	0	0	0	4	5	0	4	31	40	54
04:45 PM	0	0	7	0	7	0	3	0	0	0	3	4	0	8	54	66	76
Total	0	2	45	0	47	0	14	0	0	0	14	29	0	17	181	227	288
05:00 PM	0	0	6	0	6	0	0	0	0	0	0	8	0	5	78	91	97
05:15 PM	0	0	3	0	3	0	6	0	0	0	6	4	0	2	33	39	48
05:30 PM	0	0	10	0	10	0	2	0	0	0	2	7	0	1	24	32	44
05:45 PM	0	0	6	0	6	0	2	0	0	0	2	2	0	3	28	33	41
Total	0	0	25	0	25	0	10	0	0	0	10	21	0	11	163	195	230
Grand Total	0	2	70	0	72	0	24	0	0	0	24	50	0	28	344	422	518
Apprch %	0	2.8	97.2	0			100	0	0	0		11.8	0	6.6	81.5		
Total %	0	0.4	13.5	0	13.9	0	4.6	0	0	0	4.6	9.7	0	5.4	66.4	81.5	

	Kalia Road Southbound				Westbound	Kalia Road Northbound				Paoa Road Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 04:00 PM														
04:00 PM	0	**2**	13	**15**	0	**4**	0	0	**4**	**13**	0	3	**16**	**35**
04:15 PM	0	0	**15**	15	0	3	0	0	3	7	0	2	9	27
04:30 PM	0	0	10	10	0	4	0	0	4	5	0	4	9	23
04:45 PM	0	0	7	7	0	3	0	0	3	4	0	**8**	12	22
Total Volume	0	2	45	47	0	14	0	0	14	29	0	17	46	107
% App. Total	0	4.3	95.7			100	0	0		63	0	37		
PHF	.000	.250	.750	.783	.000	.875	.000	.000	.875	.558	.000	.531	.719	.764

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676, D4-5675
Counted By:PA, ZW
Weather:Clear

File Name : KalMal AM
Site Code : 00000004
Start Date : 10/29/2009
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Maluhia Road Westbound					Kalia Road Northbound					Maluhia Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:30 AM	27	31	2	20	80	3	6	17	7	33	1	46	7	23	77	6	2	0	31	39	229
06:45 AM	26	39	3	44	112	3	4	17	23	47	2	42	3	31	78	3	0	2	61	66	303
Total	53	70	5	64	192	6	10	34	30	80	3	88	10	54	155	9	2	2	92	105	532
07:00 AM	27	29	2	29	87	2	4	25	15	46	3	81	12	23	119	4	2	3	32	41	293
07:15 AM	23	38	2	34	97	3	2	10	13	28	1	77	6	20	104	6	1	1	56	64	293
07:30 AM	38	54	4	32	128	1	1	15	10	27	1	69	7	20	97	6	0	3	42	51	303
07:45 AM	28	43	2	54	127	4	4	25	10	43	2	48	6	13	69	3	0	3	58	64	303
Total	116	164	10	149	439	10	11	75	48	144	7	275	31	76	389	19	3	10	188	220	1192
08:00 AM	32	41	1	13	87	0	5	16	13	34	1	70	4	20	95	4	0	5	45	54	270
08:15 AM	20	38	5	37	100	2	2	13	14	31	1	50	4	12	67	9	1	2	33	45	243
Grand Total	221	313	21	263	818	18	28	138	105	289	12	483	49	162	706	41	6	19	358	424	2237
Apprch %	27	38.3	2.6	32.2		6.2	9.7	47.8	36.3		1.7	68.4	6.9	22.9		9.7	1.4	4.5	84.4		
Total %	9.9	14	0.9	11.8	36.6	0.8	1.3	6.2	4.7	12.9	0.5	21.6	2.2	7.2	31.6	1.8	0.3	0.8	16	19	

	Kalia Road Southbound				Maluhia Road Westbound				Kalia Road Northbound				Maluhia Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	27	29	2	58	2	**4**	**25**	31	**3**	**81**	**12**	**96**	4	**2**	**3**	**9**	194
07:15 AM	23	38	2	63	3	2	10	15	1	77	6	84	**6**	1	1	8	170
07:30 AM	**38**	**54**	**4**	**96**	1	1	15	17	1	69	7	77	6	0	3	9	**199**
07:45 AM	28	43	2	73	**4**	4	25	**33**	2	48	6	56	3	0	3	6	168
Total Volume	116	164	10	290	10	11	75	96	7	275	31	313	19	3	10	32	731
% App. Total	40	56.6	3.4		10.4	11.5	78.1		2.2	87.9	9.9		59.4	9.4	31.2		
PHF	.763	.759	.625	.755	.625	.688	.750	.727	.583	.849	.646	.815	.792	.375	.833	.889	.918

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676, D4-5675
Counted By:LE, TO
Weather:Clear

File Name : KalMal PM
Site Code : 00000004
Start Date : 10/29/2009
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Maluhia Road Westbound					Kalia Road Northbound					Maluhia Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	21	106	9	76	212	8	2	43	38	91	4	113	4	52	173	7	2	5	108	122	598
04:15 PM	33	97	9	61	200	7	3	36	30	76	4	106	4	37	151	7	5	2	99	113	540
04:30 PM	17	87	7	79	190	7	4	47	27	85	0	89	9	54	152	5	3	6	96	110	537
04:45 PM	28	93	7	38	166	7	0	39	14	60	2	93	6	35	136	6	3	3	90	102	464
Total	99	383	32	254	768	29	9	165	109	312	10	401	23	178	612	25	13	16	393	447	2139
05:00 PM	23	82	6	57	168	3	4	28	40	75	0	93	3	27	123	2	3	1	98	104	470
05:15 PM	17	82	10	80	189	8	5	25	28	66	3	82	4	24	113	3	6	3	105	117	485
05:30 PM	23	87	8	47	165	2	1	24	17	44	3	99	1	39	142	8	5	6	97	116	467
05:45 PM	15	128	5	57	205	4	1	22	31	58	0	82	6	31	119	2	2	2	96	102	484
Total	78	379	29	241	727	17	11	99	116	243	6	356	14	121	497	15	16	12	396	439	1906
Grand Total	177	762	61	495	1495	46	20	264	225	555	16	757	37	299	1109	40	29	28	789	886	4045
Apprch %	11.8	51	4.1	33.1		8.3	3.6	47.6	40.5		1.4	68.3	3.3	27		4.5	3.3	3.2	89.1		
Total %	4.4	18.8	1.5	12.2	37	1.1	0.5	6.5	5.6	13.7	0.4	18.7	0.9	7.4	27.4	1	0.7	0.7	19.5	21.9	

	Kalia Road Southbound				Maluhia Road Westbound				Kalia Road Northbound				Maluhia Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	21	**106**	**9**	136	**8**	2	43	53	**4**	**113**	4	**121**	**7**	2	5	**14**	**324**
04:15 PM	**33**	97	9	**139**	7	3	36	46	4	106	4	114	7	**5**	2	14	313
04:30 PM	17	87	7	111	7	**4**	**47**	**58**	0	89	**9**	98	5	3	**6**	14	281
04:45 PM	28	93	7	128	7	0	39	46	2	93	6	101	6	3	3	12	287
Total Volume	99	383	32	514	29	9	165	203	10	401	23	434	25	13	16	54	1205
% App. Total	19.3	74.5	6.2		14.3	4.4	81.3		2.3	92.4	5.3		46.3	24.1	29.6		
PHF	.750	.903	.889	.924	.906	.563	.878	.875	.625	.887	.639	.897	.893	.650	.667	.964	.930

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-3891, D4--5672
Counted By:DY, JY
Weather:Clear

File Name : KalSara AM
Site Code : 00000001
Start Date : 6/9/2010
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Saratoga Road Westbound					Kalia Road Northbound					Eastbound	
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Int. Total
06:00 AM	19	5	0	16	40	0	0	17	9	26	0	12	25	0	37	0	103
06:15 AM	23	8	0	17	48	0	0	21	9	30	0	19	26	0	45	0	123
06:30 AM	23	4	0	14	41	0	0	19	19	38	0	25	30	0	55	0	134
06:45 AM	22	9	0	18	49	0	0	37	8	45	0	38	49	0	87	0	181
Total	87	26	0	65	178	0	0	94	45	139	0	94	130	0	224	0	541
07:00 AM	30	13	0	9	52	0	0	33	11	44	0	61	48	0	109	0	205
07:15 AM	37	15	0	19	71	0	0	29	21	50	0	54	57	0	111	0	232
07:30 AM	32	9	0	31	72	0	0	41	36	77	0	42	57	0	99	0	248
07:45 AM	41	13	0	14	68	0	0	29	7	36	0	52	56	0	108	0	212
Total	140	50	0	73	263	0	0	132	75	207	0	209	218	0	427	0	897
08:00 AM	37	20	0	18	75	0	0	37	18	55	0	38	47	0	85	0	215
08:15 AM	24	8	0	16	48	0	0	28	12	40	0	32	51	0	83	0	171
08:30 AM	21	13	0	8	42	0	0	32	18	50	0	42	60	0	102	0	194
08:45 AM	15	8	0	9	32	0	0	28	16	44	0	39	49	0	88	0	164
Total	97	49	0	51	197	0	0	125	64	189	0	151	207	0	358	0	744
Grand Total	324	125	0	189	638	0	0	351	184	535	0	454	555	0	1009	0	2182
Apprch %	50.8	19.6	0	29.6		0	0	65.6	34.4		0	45	55	0			
Total %	14.8	5.7	0	8.7	29.2	0	0	16.1	8.4	24.5	0	20.8	25.4	0	46.2	0	

	Kalia Road Southbound				Saratoga Road Westbound				Kalia Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:00 AM														
07:00 AM	30	13	0	43	0	0	33	33	0	**61**	48	109	0	185
07:15 AM	37	**15**	0	52	0	0	29	29	0	54	**57**	**111**	0	**192**
07:30 AM	32	9	0	41	0	0	**41**	**41**	0	42	57	99	0	181
07:45 AM	**41**	13	0	**54**	0	0	29	29	0	52	56	108	0	191
Total Volume	140	50	0	190	0	0	132	132	0	209	218	427	0	749
% App. Total	73.7	26.3	0		0	0	100		0	48.9	51.1			
PHF	.854	.833	.000	.880	.000	.000	.805	.805	.000	.857	.956	.962	.000	.975

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

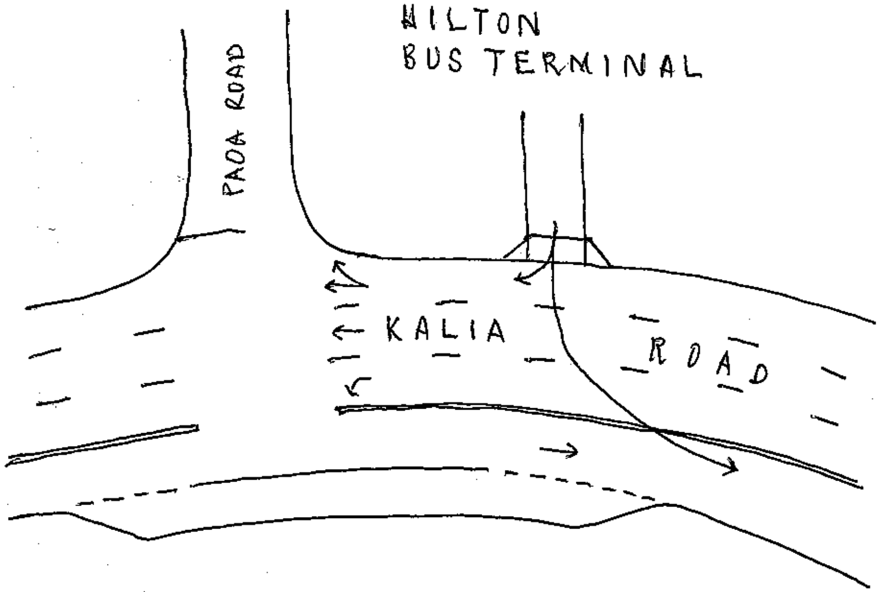
Counter:D4-5672, D4-3891
Counted By:DY, JY
Weather:Clear

File Name : KalSara PM
Site Code : 00000001
Start Date : 6/9/2010
Page No : 1

Groups Printed- Unshifted

	Kalia Road Southbound					Saratoga Road Westbound					Kalia Road Northbound					Eastbound	
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Int. Total
03:00 PM	70	16	0	29	115	0	0	40	30	70	0	74	73	0	147	0	332
03:15 PM	60	28	0	21	109	0	0	44	18	62	0	66	61	0	127	0	298
03:30 PM	64	16	0	23	103	0	0	42	27	69	0	69	57	0	126	0	298
03:45 PM	72	15	0	15	102	0	0	46	38	84	0	73	57	0	130	0	316
Total	266	75	0	88	429	0	0	172	113	285	0	282	248	0	530	0	1244
04:00 PM	59	13	0	23	95	0	0	45	27	72	0	91	70	0	161	0	328
04:15 PM	62	9	0	15	86	0	0	40	25	65	0	78	71	0	149	0	300
04:30 PM	66	16	0	15	97	0	0	34	37	71	0	72	71	0	143	0	311
04:45 PM	46	9	0	10	65	0	0	39	39	78	0	60	44	0	104	0	247
Total	233	47	0	63	343	0	0	158	128	286	0	301	256	0	557	0	1186
05:00 PM	61	16	0	12	89	0	0	34	48	82	0	63	66	0	129	0	300
05:15 PM	48	15	0	4	67	0	0	29	41	70	0	61	73	0	134	0	271
05:30 PM	62	14	0	6	82	0	0	32	16	48	0	56	56	0	112	0	242
05:45 PM	43	10	0	8	61	0	0	35	35	70	0	62	49	0	111	0	242
Total	214	55	0	30	299	0	0	130	140	270	0	242	244	0	486	0	1055
Grand Total	713	177	0	181	1071	0	0	460	381	841	0	825	748	0	1573	0	3485
Apprch %	66.6	16.5	0	16.9		0	0	54.7	45.3		0	52.4	47.6	0			
Total %	20.5	5.1	0	5.2	30.7	0	0	13.2	10.9	24.1	0	23.7	21.5	0	45.1	0	

	Kalia Road Southbound				Saratoga Road Westbound				Kalia Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 03:45 PM														
03:45 PM	**72**	15	0	**87**	0	0	**46**	**46**	0	73	57	130	0	263
04:00 PM	59	13	0	72	0	0	45	45	0	**91**	70	**161**	0	**278**
04:15 PM	62	9	0	71	0	0	40	40	0	78	**71**	149	0	260
04:30 PM	66	**16**	0	82	0	0	34	34	0	72	71	143	0	259
Total Volume	259	53	0	312	0	0	165	165	0	314	269	583	0	1060
% App. Total	83	17	0		0	0	100		0	53.9	46.1			
PHF	.899	.828	.000	.897	.000	.000	.897	.897	.000	.863	.947	.905	.000	.953



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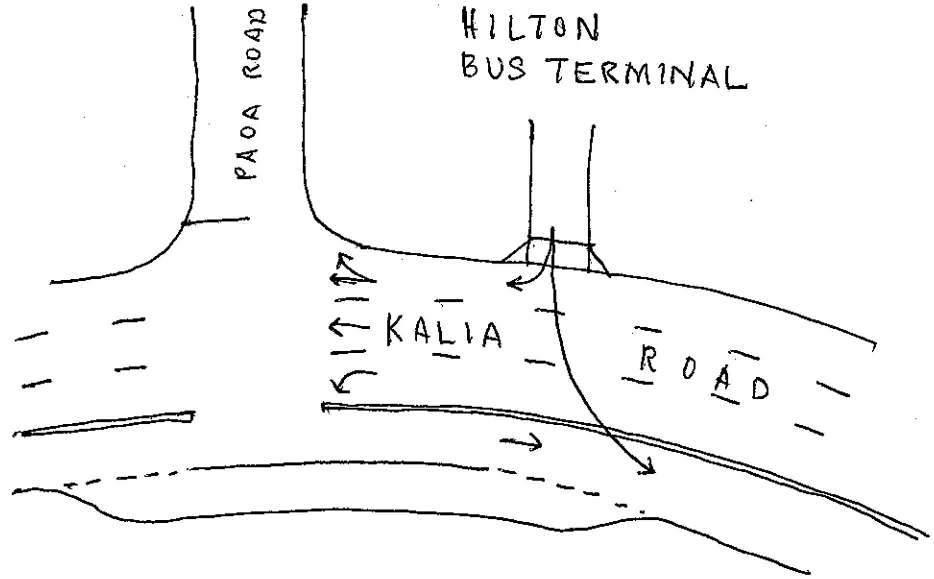
6:30AM	2	2
6:45AM	9	5
7:00AM	2	6
7:15AM	5	3
7:30AM	9	6
7:45AM	3	6
8:00AM	3	8
8:15AM	11	4



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4:00PM	3	4
4:15PM	0	5
4:30PM	4	7
4:45PM	5	4
5:00PM	1	2
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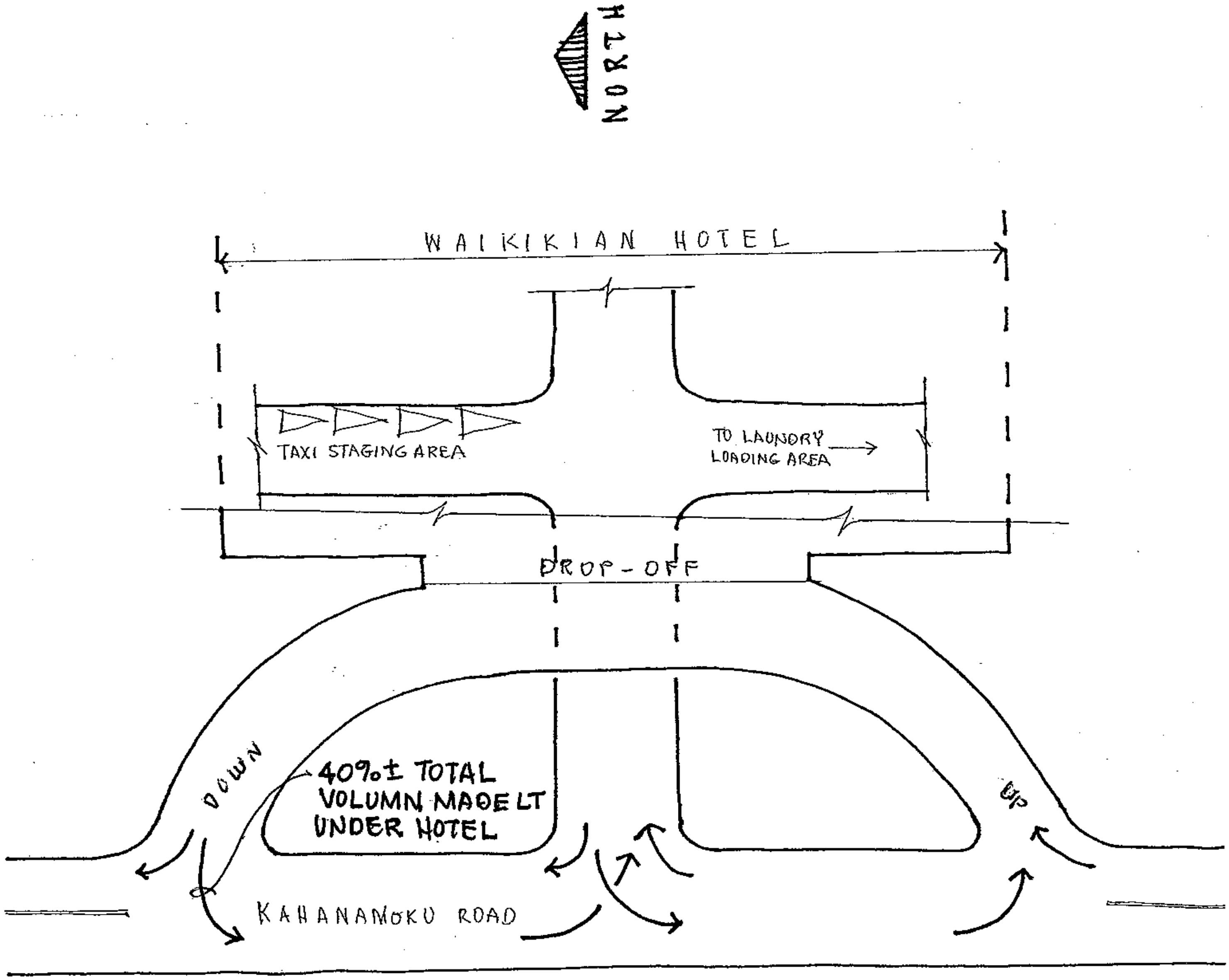
5:30PM	5	2
5:45PM	3	3



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4:00PM	5	5
4:15PM	7	4
4:30PM	9	1
4:45PM	12	3
5:00PM	6	9
5:15PM	4	10
5:30PM	7	6
5:45PM	4	5

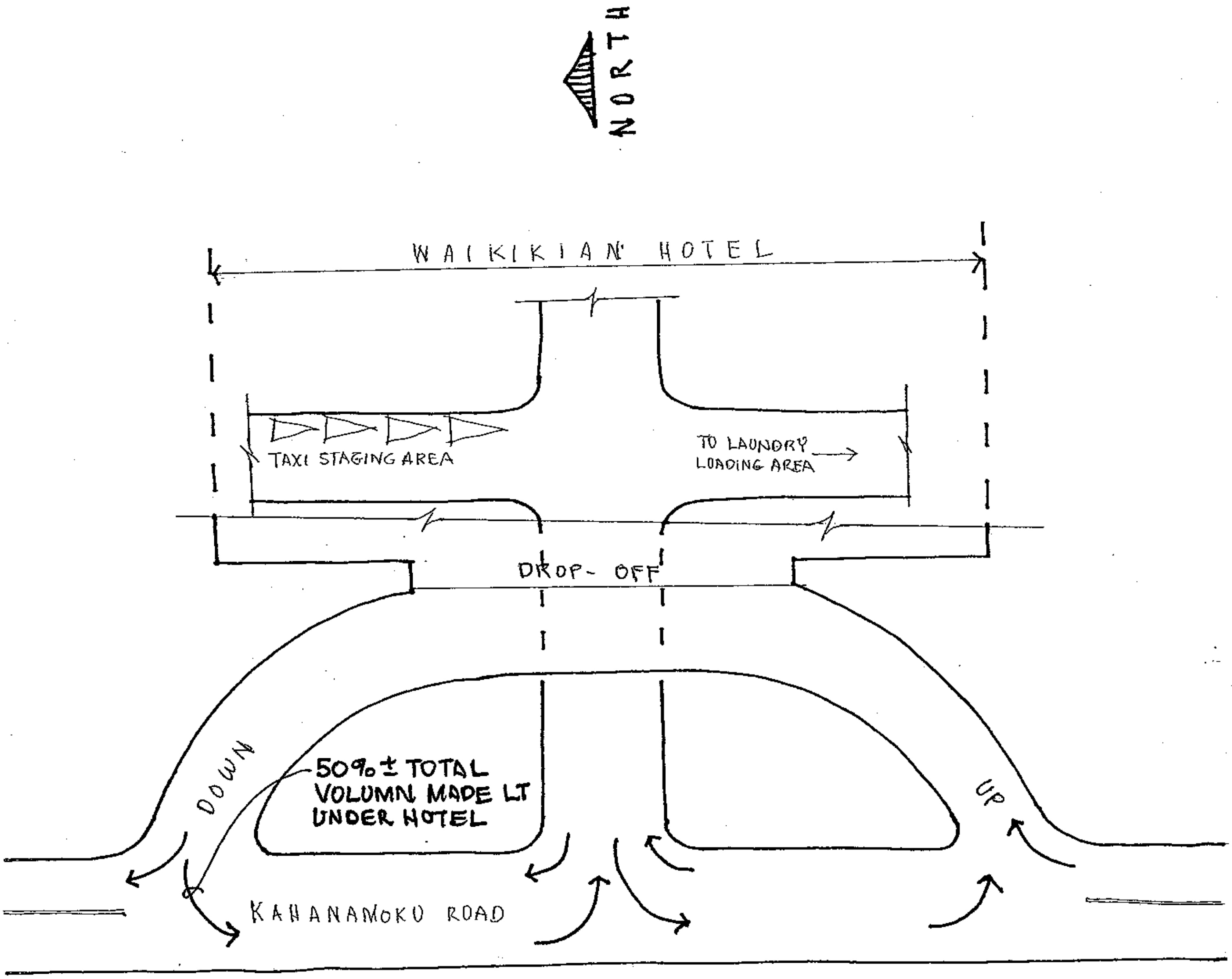
DATE	↗	↙	↘	↖
4:00PM	13	26	12	5
4:15PM	20	20	8	4
4:30PM	14	11	4	5
4:45PM	12	10	6	2
5:00PM	21	12	16	4
5:15PM	23	19	8	2
5:30PM	13	18	11	4
5:45PM	20	14	4	2

DATE	↗	↖
4:00PM	7	2
4:15PM	8	2
4:30PM	7	4
4:45PM	9	4
5:00PM	8	3
5:15PM	6	3
5:30PM	10	2
5:45PM	9	3

QUEUEING:

4:09 PM ALA MOANA TO NORTH DRIVEWAY - 6 CARS (NB)

4:16 & 5:17PM - ALA MOANA TO CENTER DRIVEWAY - 10 CARS (NB)



DATE	↙	↘
6:30AM	4	6
6:45AM	1	0
7:00AM	1	1
7:15AM	7	5
7:30AM	4	0
7:45AM	4	1
8:00AM	8	5
8:15AM	12	0

DATE	↗	↙	↘	↖
6:30AM	23	9	4	3
6:45AM	24	14	2	2
7:00AM	23	17	5	2
7:15AM	23	18	9	2
7:30AM	20	18	6	3
7:45AM	13	11	10	2
8:00AM	8	12	6	4
8:15AM	1	7	9	2

DATE	↗	↖
6:30AM	8	1
6:45AM	2	0
7:00AM	2	0
7:15AM	11	1
7:30AM	4	1
7:45AM	7	1
8:00AM	12	0
8:15AM	12	0

QUEUEING:

7:44AM ALA MOANA TO CENTER DRIVEWAY – 10 CARS (NB)
8:29AM ALA MOANA TO NORTH DRIVEWAY – 6 CARS (NB)

Wilbur Smith Associates

421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

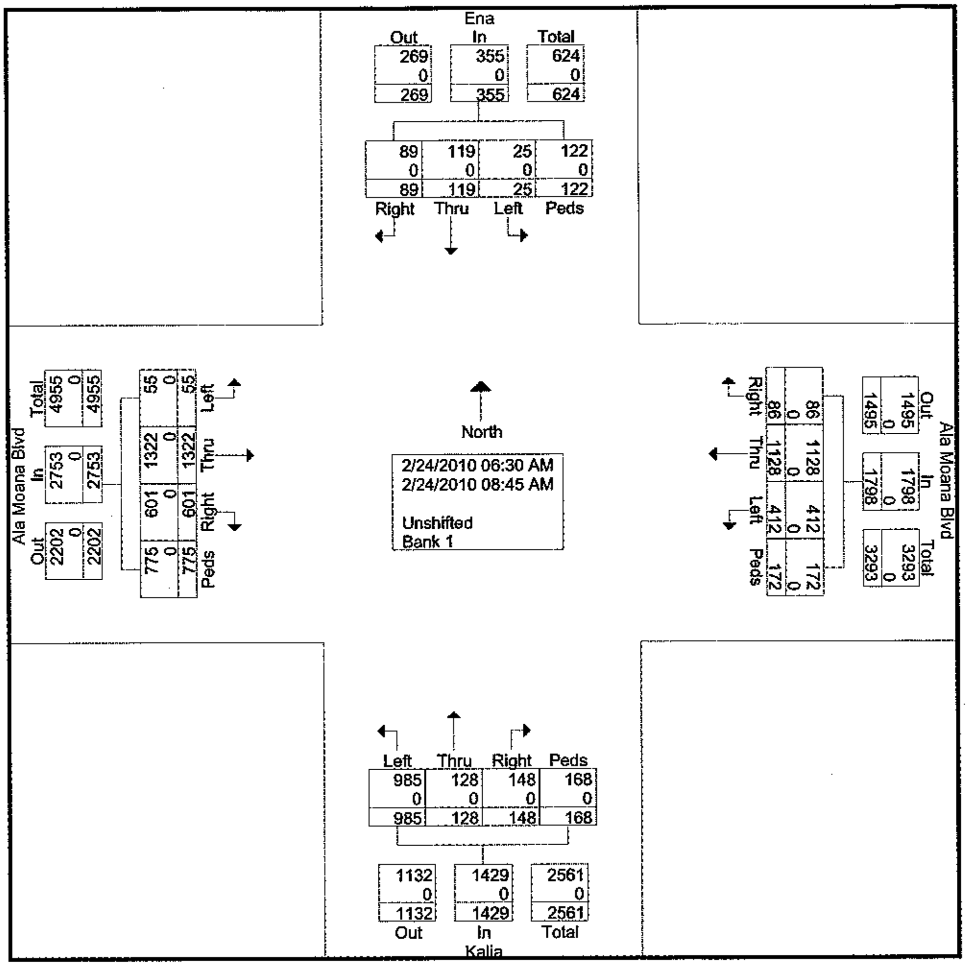
File Name : AMB Kalia Ena AM
Site Code : 00000000
Start Date : 2/24/2010
Page No : 1

Groups Printed- Unshifted - Bank 1

	Ena From North					Ala Moana Blvd From East					Kalia From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:30 AM	5	10	1	0	16	7	87	38	8	140	8	6	68	8	90	42	88	4	41	175	421
06:45 AM	8	15	4	7	34	5	75	39	12	131	12	14	77	18	121	54	84	2	72	212	498
Total	13	25	5	7	50	12	162	77	20	271	20	20	145	26	211	96	172	6	113	387	919
07:00 AM	7	12	3	2	24	6	120	46	10	182	9	13	168	9	199	80	148	6	33	267	672
07:15 AM	5	14	4	16	39	6	114	44	13	177	16	13	102	9	140	47	122	10	69	248	604
07:30 AM	17	22	0	18	57	10	140	38	21	209	22	14	122	12	170	79	157	3	83	322	758
07:45 AM	19	12	6	14	51	10	124	41	24	199	16	13	104	15	148	55	151	9	106	321	719
Total	48	60	13	50	171	32	498	169	68	767	63	53	496	45	657	261	578	28	291	1158	2753
08:00 AM	9	16	2	15	42	6	149	45	14	214	16	14	104	25	159	59	120	7	78	264	679
08:15 AM	11	12	1	16	40	16	125	30	19	190	11	16	94	17	138	61	145	4	81	291	659
08:30 AM	4	3	2	15	24	12	102	52	17	183	19	17	83	21	140	75	164	3	112	354	701
08:45 AM	4	3	2	19	28	8	92	39	34	173	19	8	63	34	124	49	143	7	100	299	624
Total	28	34	7	65	134	42	468	166	84	760	65	55	344	97	561	244	572	21	371	1208	2663
Grand Total	89	119	25	122	355	86	1128	412	172	1798	148	128	985	168	1429	601	1322	55	775	2753	6335
Apprch %	25.1	33.5	7	34.4		4.8	62.7	22.9	9.6		10.4	9	68.9	11.8		21.8	48	2	28.2		
Total %	1.4	1.9	0.4	1.9	5.6	1.4	17.8	6.5	2.7	28.4	2.3	2	15.5	2.7	22.6	9.5	20.9	0.9	12.2	43.5	
Unshifted	89	119	25	122	355	86	1128	412	172	1798	148	128	985	168	1429	601	1322	55	775	2753	6335
% Unshifted	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wilbur Smith Associates
421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : AMB Kalia Ena AM
Site Code : 00000000
Start Date : 2/24/2010
Page No : 2

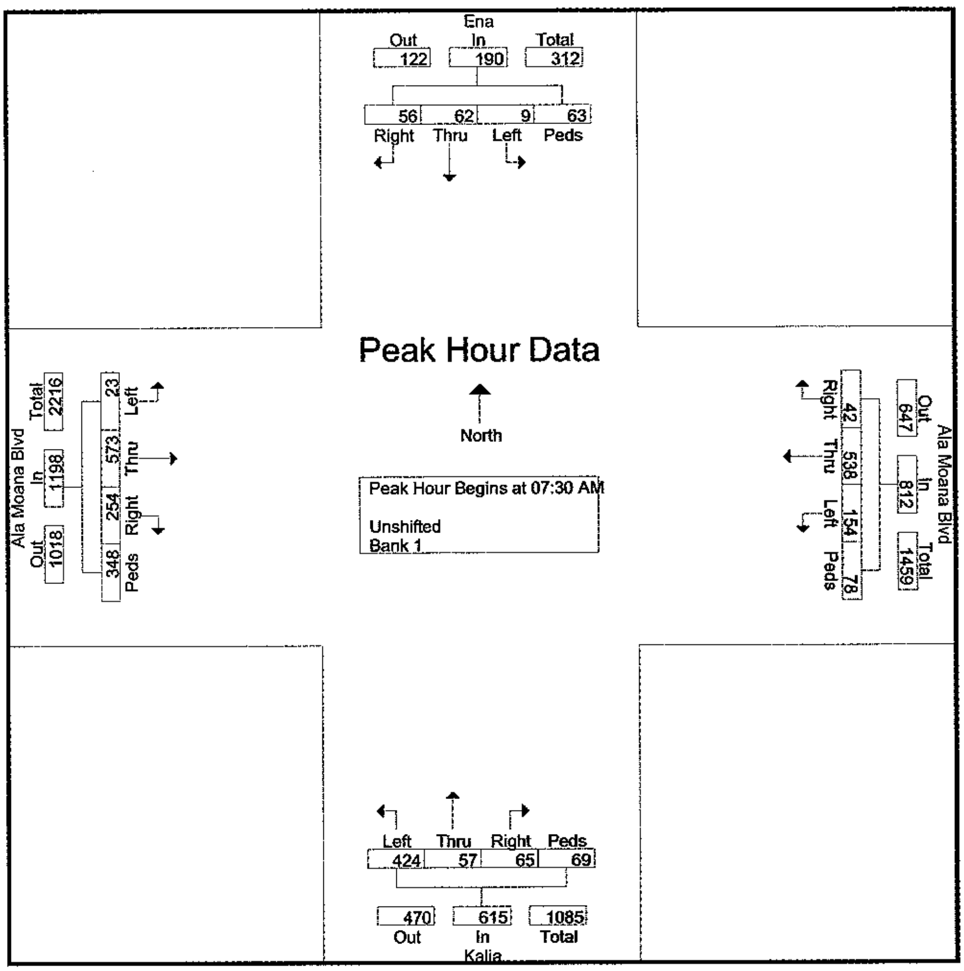


Wilbur Smith Associates

421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : AMB Kalia Ena AM
Site Code : 00000000
Start Date : 2/24/2010
Page No : 3

	Ena From North					Ala Moana Blvd From East					Kalia From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	17	**22**	0	**18**	**57**	10	140	38	21	209	**22**	14	**122**	12	**170**	**79**	**157**	3	83	**322**	**758**
07:45 AM	**19**	12	**6**	14	51	10	124	41	**24**	199	16	13	104	15	148	55	151	**9**	**106**	321	719
08:00 AM	9	16	2	15	42	6	**149**	**45**	14	**214**	16	14	104	**25**	159	59	120	7	78	264	679
08:15 AM	11	12	1	16	40	**16**	125	30	19	190	11	**16**	94	17	138	61	145	4	81	291	659
Total Volume	56	62	9	63	190	42	538	154	78	812	65	57	424	69	615	254	573	23	348	1198	2815
% App. Total	29.5	32.6	4.7	33.2		5.2	66.3	19	9.6		10.6	9.3	68.9	11.2		21.2	47.8	1.9	29		
PHF	.737	.705	.375	.875	.833	.656	.903	.856	.813	.949	.739	.891	.869	.690	.904	.804	.912	.639	.821	.930	.928



Wilbur Smith Associates

421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

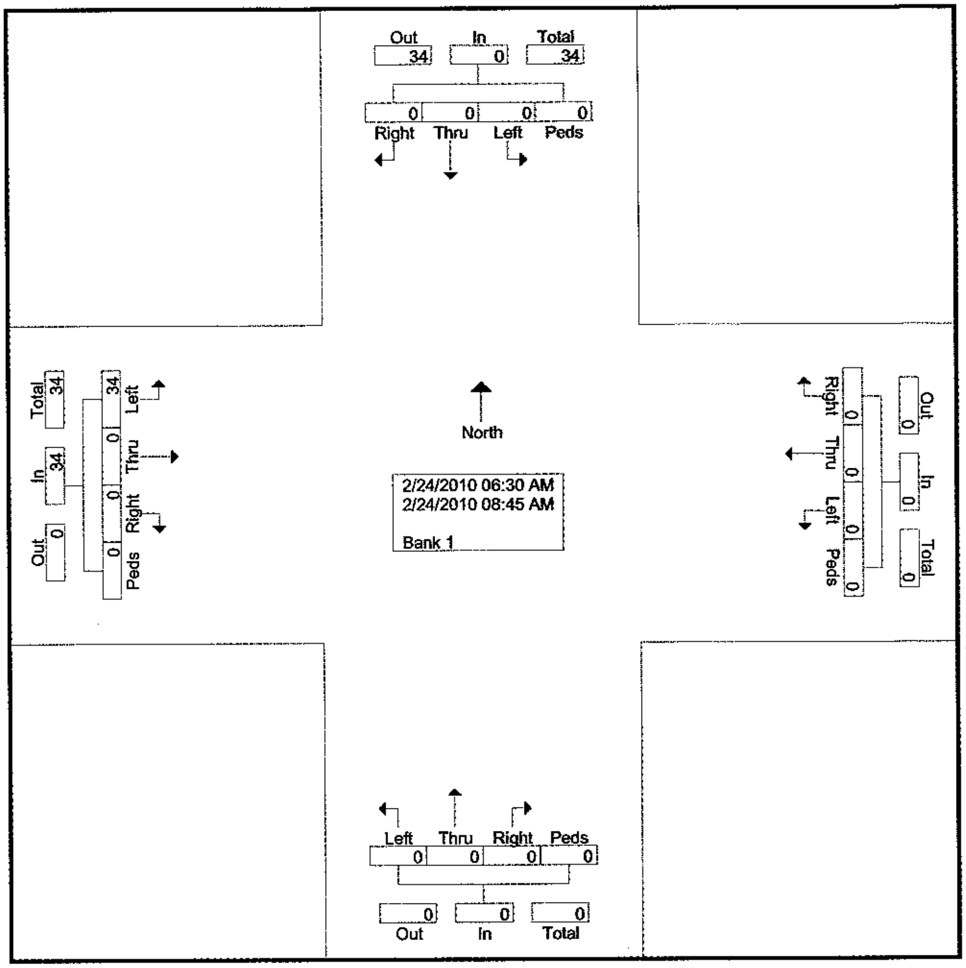
File Name : AMB Kalia AM
Site Code : 00000031
Start Date : 2/24/2010
Page No : 1

Groups Printed- Bank 1

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	7
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	4
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	4
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	12	12
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
*** BREAK ***																					
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	15	15
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0	34	34
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	100	0		
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100	

Wilbur Smith Associates
421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : AMB Kalia AM
Site Code : 00000031
Start Date : 2/24/2010
Page No : 2

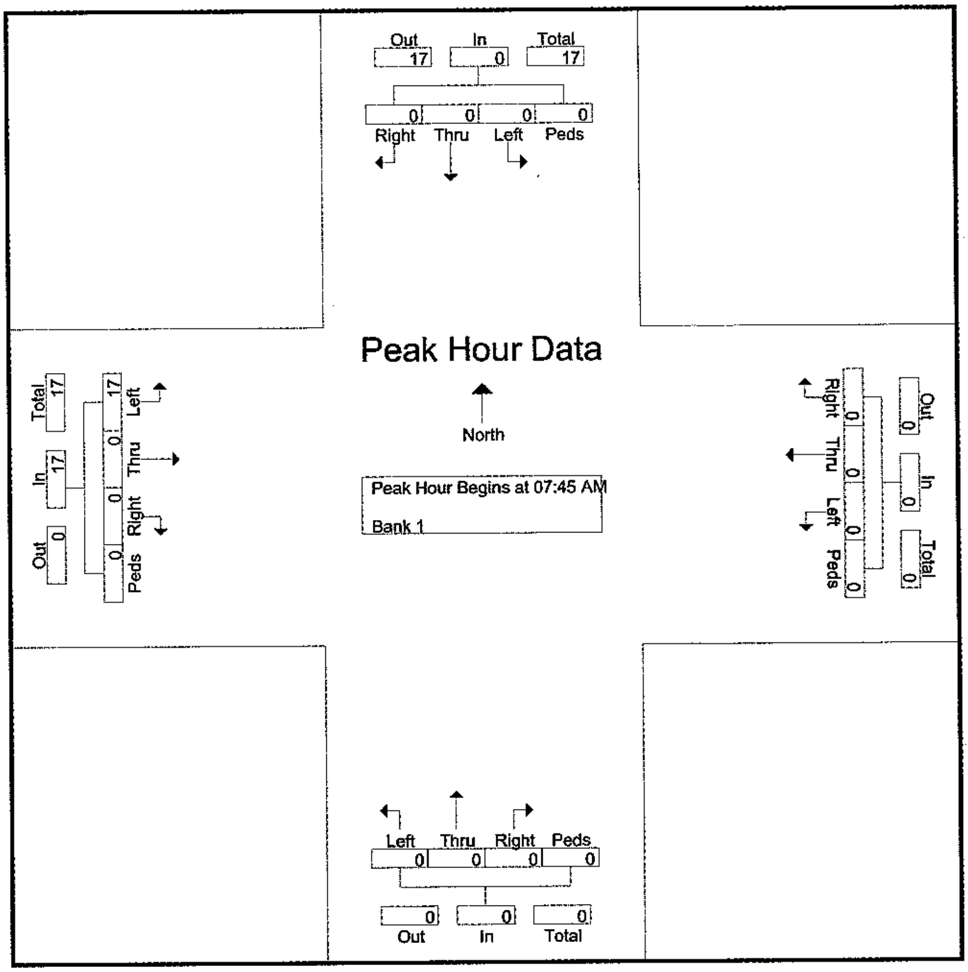


Wilbur Smith Associates

421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : AMB Kalia AM
Site Code : 00000031
Start Date : 2/24/2010
Page No : 3

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	17	17
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.850	.000	.850	.850



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421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : AMB Kalia Ena PM
Site Code : 00000031
Start Date : 2/24/2010
Page No : 1

Groups Printed- Unshifted - Bank 1

	Ena From North					Ala Moana Blvd From East					Kalia From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	20	20	3	5	48	1	124	46	51	222	29	31	129	23	212	112	181	14	70	377	859
03:45 PM	10	19	3	6	38	3	91	35	20	149	28	30	115	32	205	125	161	12	66	364	756
Total	30	39	6	11	86	4	215	81	71	371	57	61	244	55	417	237	342	26	136	741	1615
04:00 PM	11	12	4	12	39	9	133	38	27	207	34	32	147	23	236	144	210	23	84	461	943
04:15 PM	9	15	5	7	36	12	99	35	24	170	34	27	146	24	231	134	177	16	58	385	822
04:30 PM	11	20	0	7	38	12	122	51	37	222	19	20	105	23	167	135	170	17	92	414	841
04:45 PM	15	18	3	29	65	13	121	43	42	219	17	19	100	18	154	132	195	12	83	422	860
Total	46	65	12	55	178	46	475	167	130	818	104	98	498	88	788	545	752	68	317	1682	3466
05:00 PM	17	27	3	34	81	13	130	45	34	222	34	26	101	47	208	132	163	21	133	449	960
05:15 PM	12	30	3	20	65	14	180	61	35	290	24	21	70	37	152	144	186	9	78	417	924
05:30 PM	11	36	3	24	74	12	119	61	32	224	22	21	88	32	163	161	158	12	156	487	948
05:45 PM	8	26	2	12	48	19	150	57	22	248	15	18	86	31	150	162	187	21	92	462	908
Total	48	119	11	90	268	58	579	224	123	984	95	86	345	147	673	599	694	63	459	1815	3740
Grand Total	124	223	29	156	532	108	1269	472	324	2173	256	245	1087	290	1878	1381	1788	157	912	4238	8821
Apprch %	23.3	41.9	5.5	29.3		5	58.4	21.7	14.9		13.6	13	57.9	15.4		32.6	42.2	3.7	21.5		
Total %	1.4	2.5	0.3	1.8	6	1.2	14.4	5.4	3.7	24.6	2.9	2.8	12.3	3.3	21.3	15.7	20.3	1.8	10.3	48	
Unshifted	124	223	29	156	532	108	1269	472	324	2173	256	245	1087	290	1878	1381	1788	117	912	4198	8781
% Unshifted	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	74.5	100	99.1	99.5
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	40	40
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.5	0	0.9	0.5

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421 Fayetteville Street, Suite 1303
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File Name : AMB Kalia Ena PM
Site Code : 00000031
Start Date : 2/24/2010
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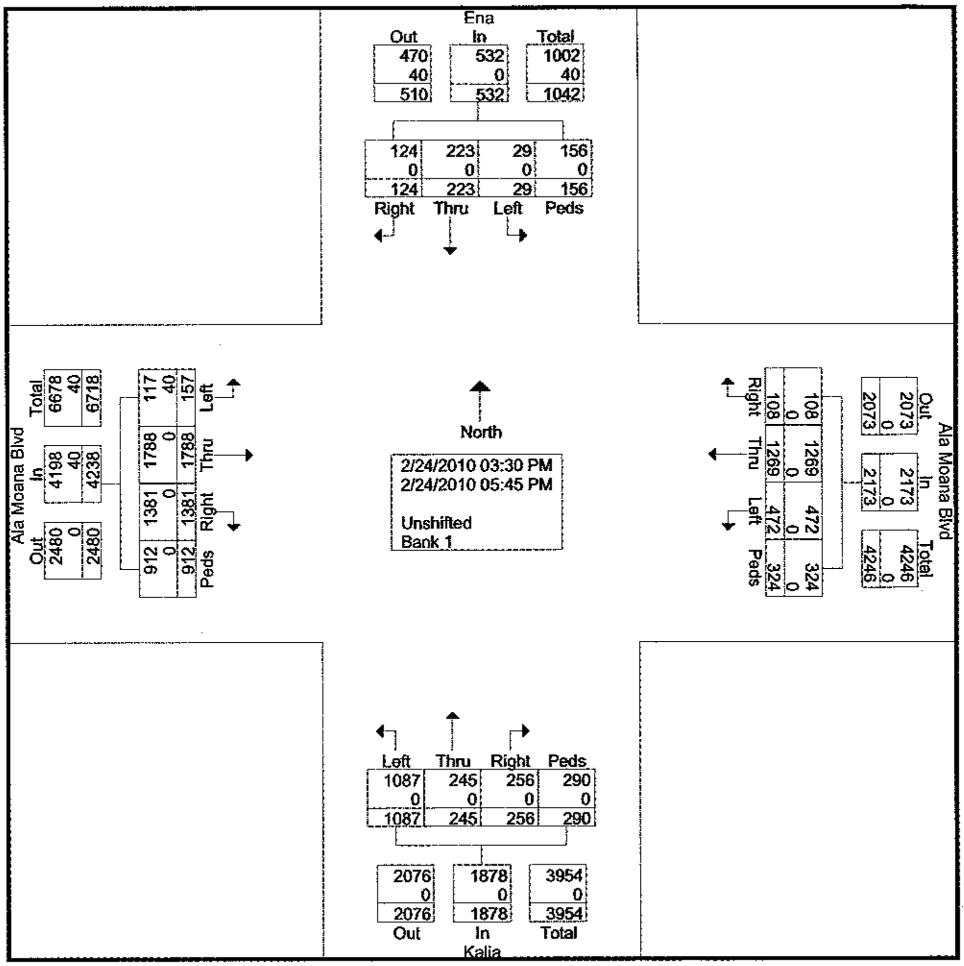

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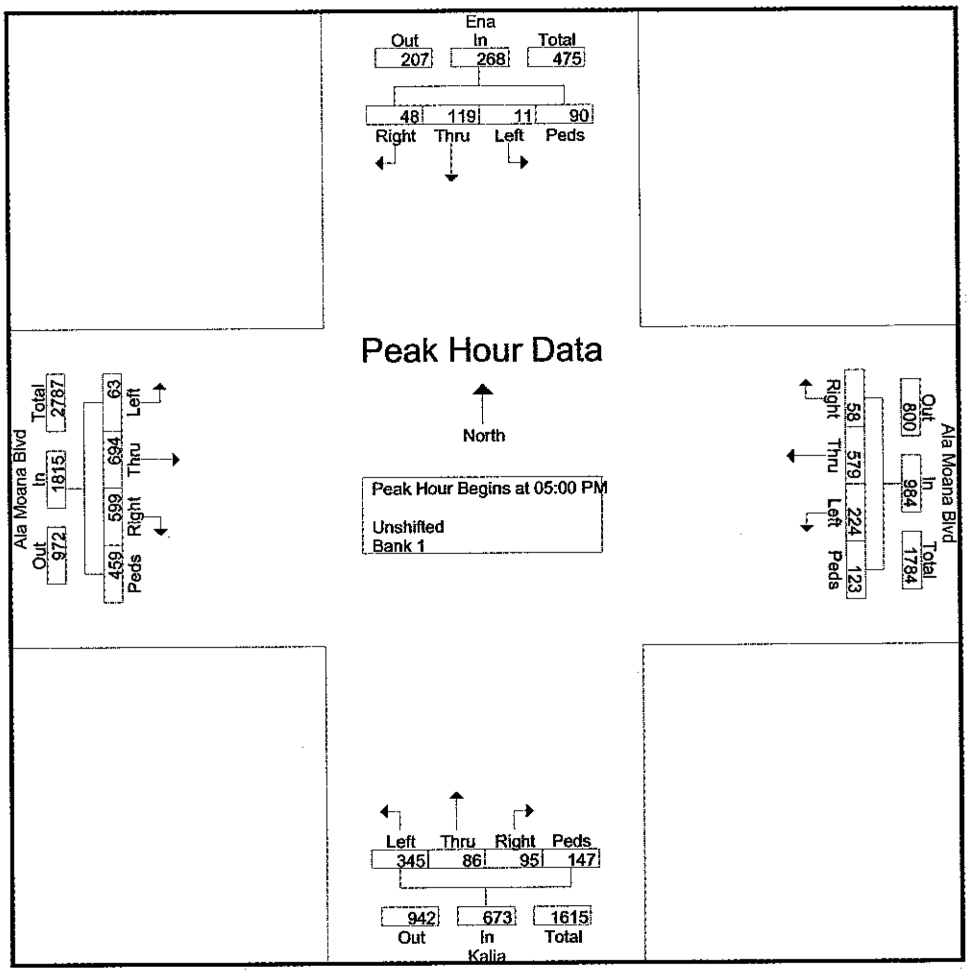
421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : AMB Kalia Ena PM
Site Code : 00000031
Start Date : 2/24/2010

	Ena From North					Ala Moana Blvd From East					Kalia From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	**17**	27	**3**	**34**	**81**	13	130	45	34	222	**34**	**26**	**101**	**47**	**208**	132	163	**21**	133	449	**960**
05:15 PM	12	30	**3**	20	65	14	**180**	**61**	**35**	**290**	24	21	70	37	152	144	186	9	78	417	924
05:30 PM	11	**36**	**3**	24	74	12	119	**61**	32	224	22	21	88	32	163	161	158	12	**156**	**487**	948
05:45 PM	8	26	2	12	48	**19**	150	57	22	248	15	18	86	31	150	**162**	**187**	21	92	462	908
Total Volume	48	119	11	90	268	58	579	224	123	984	95	86	345	147	673	599	694	63	459	1815	3740
% App. Total	17.9	44.4	4.1	33.6		5.9	58.8	22.8	12.5		14.1	12.8	51.3	21.8		33	38.2	3.5	25.3		
PHF	.706	.826	.917	.662	.827	.763	.804	.918	.879	.848	.699	.827	.854	.782	.809	.924	.928	.750	.736	.932	.974



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421 Fayetteville Street, Suite 1303
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File Name : AMB Kalia PM
Site Code : 00000031
Start Date : 2/24/2010
Page No : 1

Groups Printed- Bank 1

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	6
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	8
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	3
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	18	18
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	14	14
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	40	40
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	100	0		
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100	

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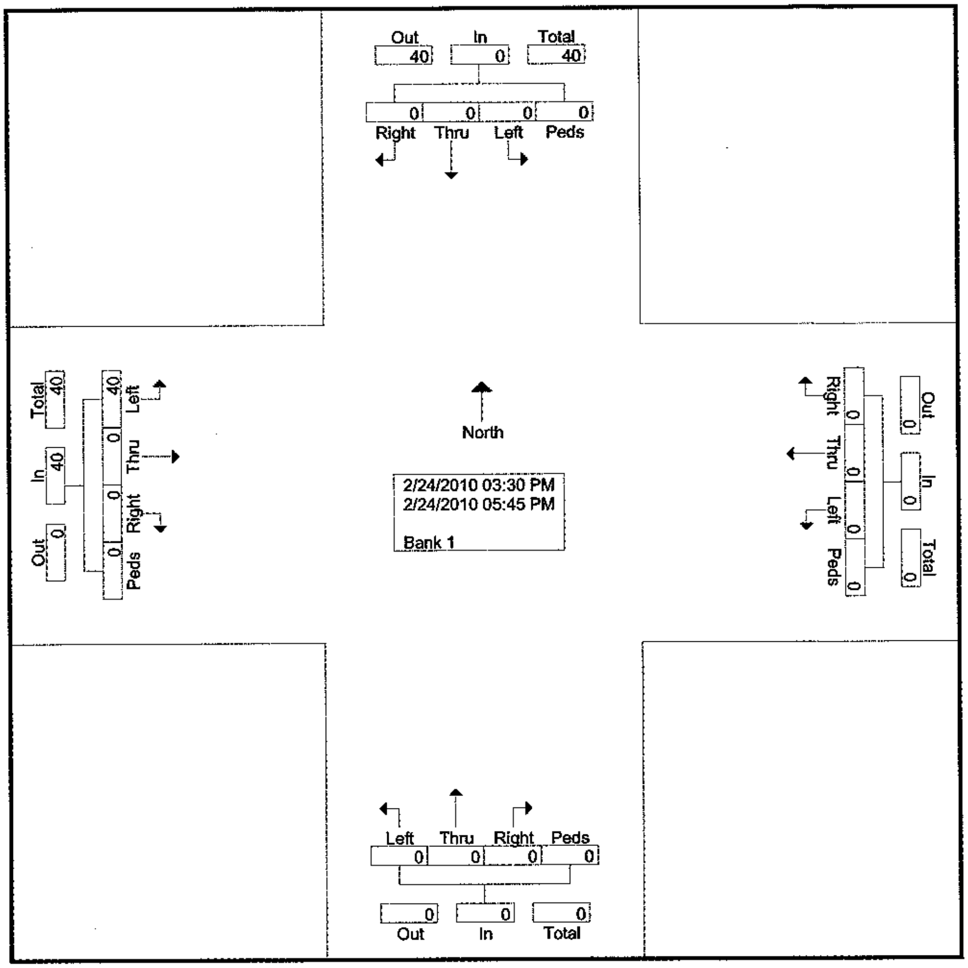
File Name : AMB Kalia PM
Site Code : 00000031
Start Date : 2/24/2010
Page No : 2



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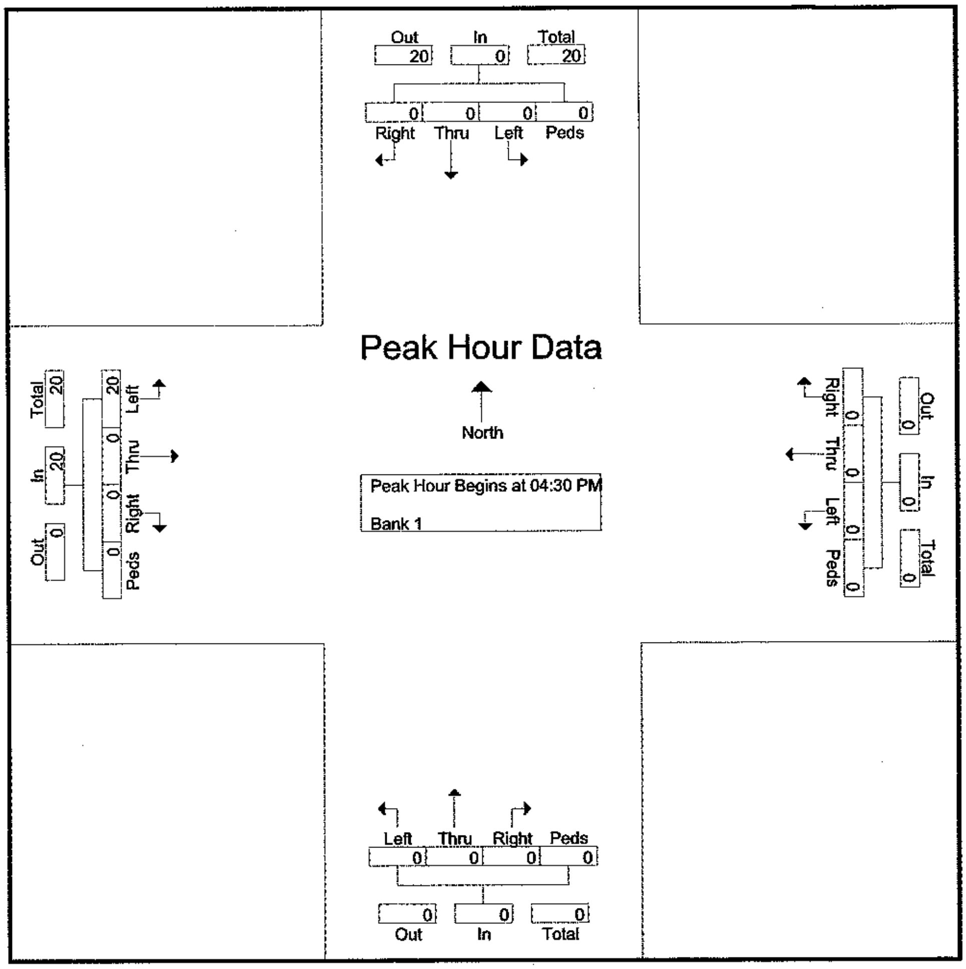
Raleigh, NC 27601

File Name : AMB Kalia PM
Site Code : 00000031
Start Date : 2/24/2010
Page No : 3

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20	20
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000			



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421 Fayetteville Street, Suite 1303
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File Name : Dewey AM
Site Code : 00000051
Start Date : 2/24/2010
Page No : 1

Groups Printed- Unshifted - Bank 1

	From North					Ala Moana Blvd From East					Dewey From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
11:45 AM	0	0	0	0	0	0	0	5	0	5	3	0	20	10	33	23	0	0	0	23	61
Total	0	0	0	0	0	0	0	5	0	5	3	0	20	10	33	23	0	0	0	23	61
12:00 PM	0	0	0	0	0	0	0	4	0	4	13	0	20	32	65	17	0	0	2	19	88
12:15 PM	0	0	0	0	0	0	0	6	0	6	17	0	14	32	63	22	0	0	0	22	91
12:30 PM	0	0	0	0	0	0	0	5	0	5	11	0	12	28	51	16	0	0	0	16	72
12:45 PM	0	0	0	0	0	0	0	10	0	10	13	0	9	42	64	21	0	0	0	21	95
Total	0	0	0	0	0	0	0	25	0	25	54	0	55	134	243	76	0	0	2	78	346
01:00 PM	0	0	0	0	0	0	0	14	0	14	12	0	9	18	39	9	0	0	2	11	64
01:15 PM	0	0	0	0	0	0	0	8	0	8	15	0	11	40	66	10	0	0	0	10	84
01:30 PM	0	0	0	0	0	0	0	8	0	8	16	0	17	60	93	14	0	0	0	14	115
Grand Total	0	0	0	0	0	0	0	60	0	60	100	0	112	262	474	132	0	0	4	136	670
Apprch %	0	0	0	0		0	0	100	0		21.1	0	23.6	55.3		97.1	0	0	2.9		
Total %	0	0	0	0	0	0	0	9	0	9	14.9	0	16.7	39.1	70.7	19.7	0	0	0.6	20.3	
Unshifted	0	0	0	0	0	0	0	60	0	60	100	0	112	262	474	132	0	0	4	136	670
% Unshifted	0	0	0	0	0	0	0	100	0	100	100	0	100	100	100	100	0	0	100	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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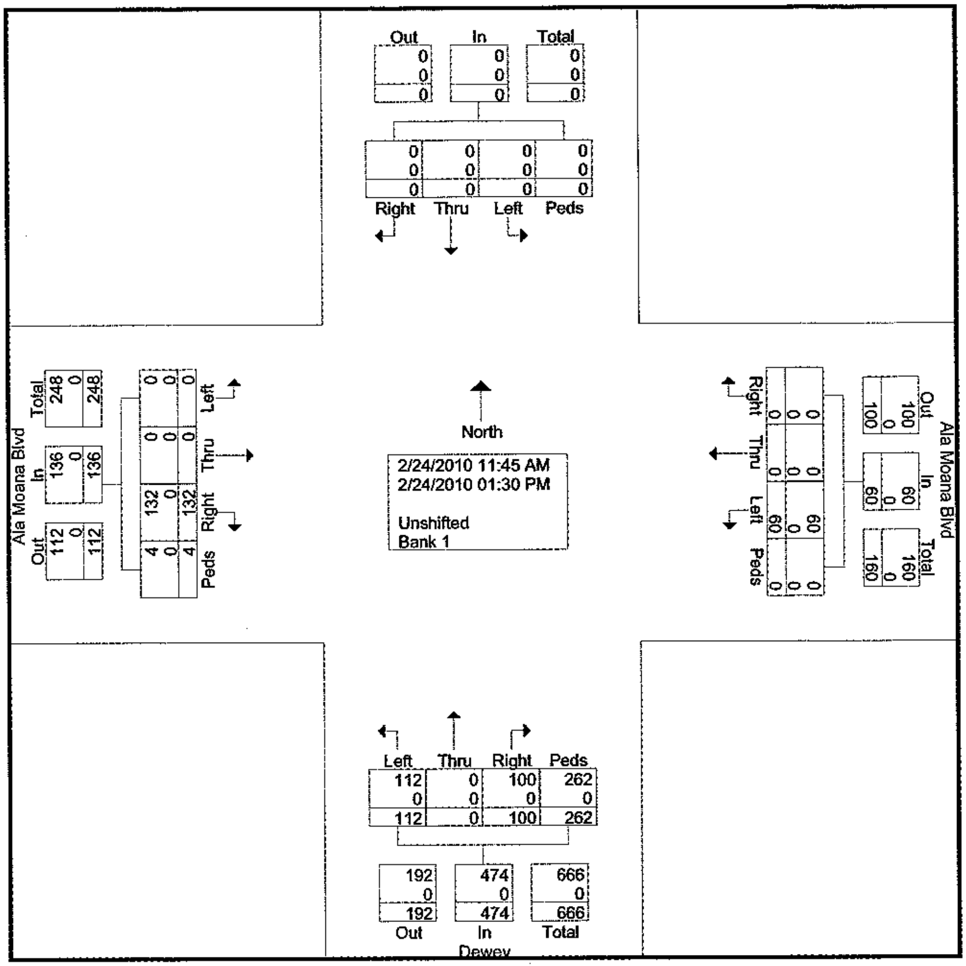
421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : Dewey AM
Site Code : 00000051
Start Date : 2/24/2010
Page No : 2



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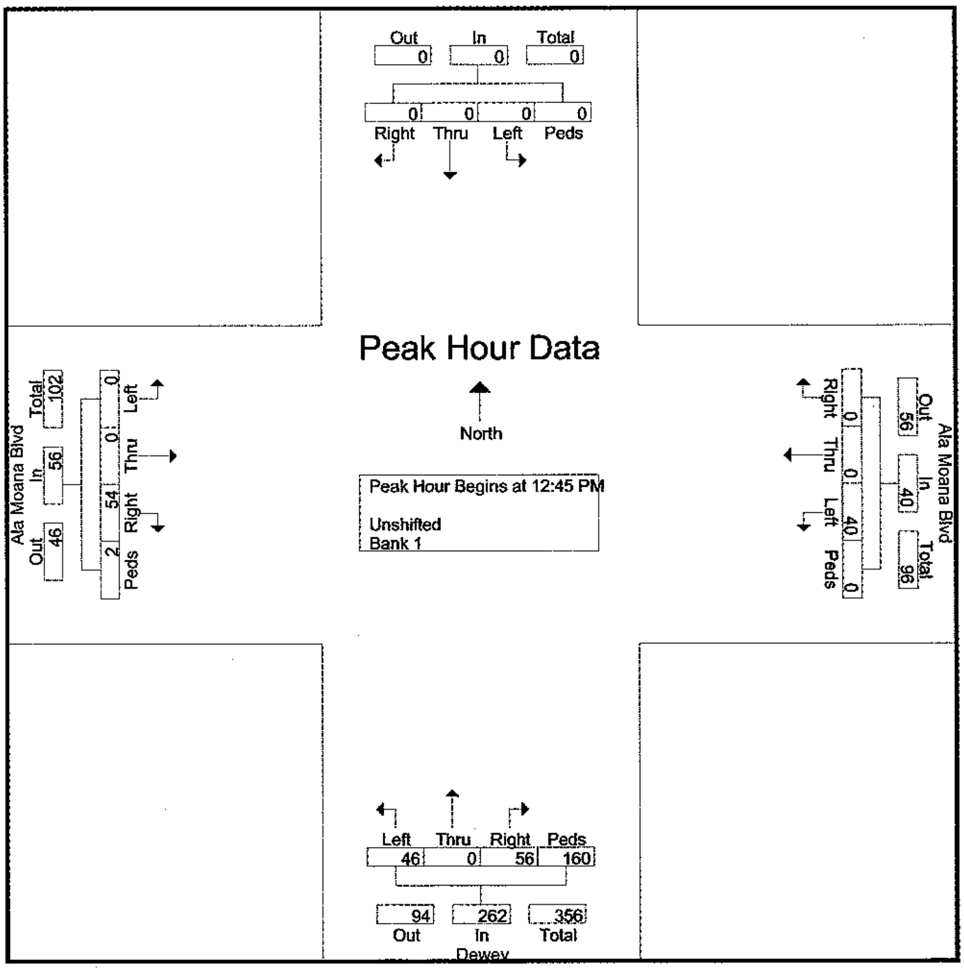
Raleigh, NC 27601

File Name : Dewey AM
Site Code : 00000051
Start Date : 2/24/2010
Page No : 3

	From North					Ala Moana Blvd From East					Dewey From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:45 AM to 01:30 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:45 PM																					
12:45 PM	0	0	0	0	0	0	0	10	0	10	13	0	9	42	64	**21**	0	0	0	**21**	95
01:00 PM	0	0	0	0	0	0	0	**14**	0	**14**	12	0	9	18	39	9	0	0	**2**	11	64
01:15 PM	0	0	0	0	0	0	0	8	0	8	15	0	11	40	66	10	0	0	0	10	84
01:30 PM	0	0	0	0	0	0	0	8	0	8	**16**	0	**17**	**60**	**93**	14	0	0	0	14	**115**
Total Volume	0	0	0	0	0	0	0	40	0	40	56	0	46	160	262	54	0	0	2	56	358
% App. Total	0	0	0	0		0	0	100	0		21.4	0	17.6	61.1		96.4	0	0	3.6		
PHF	.000	.000	.000	.000	.000	.000	.000	.714	.000	.714	.875	.000	.676	.667	.704	.643	.000	.000	.250	.667	.778



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421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : Dewey PM
Site Code : 00000051
Start Date : 2/24/2010
Page No : 1

Groups Printed- Unshifted - Bank 1

	From North					Ala Moana Blvd From East					Dewey From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
08:30 PM	0	0	0	0	0	0	0	8	0	8	17	0	10	69	96	26	0	0	0	26	130
08:45 PM	0	0	0	0	0	0	0	9	0	9	12	0	12	91	115	16	0	0	0	16	140
Total	0	0	0	0	0	0	0	17	0	17	29	0	22	160	211	42	0	0	0	42	270
09:00 PM	0	0	0	0	0	0	0	12	0	12	14	0	17	88	119	15	0	0	0	15	146
09:15 PM	0	0	0	0	0	0	0	10	0	10	22	0	15	66	103	14	0	0	0	14	127
09:30 PM	0	0	0	0	0	0	0	5	0	5	10	0	13	65	88	14	0	0	0	14	107
09:45 PM	0	0	0	0	0	0	0	11	0	11	19	0	12	61	92	21	0	0	0	21	124
Total	0	0	0	0	0	0	0	38	0	38	65	0	57	280	402	64	0	0	0	64	504
10:00 PM	0	0	0	0	0	0	0	6	0	6	14	0	11	86	111	16	0	0	0	16	133
10:15 PM	0	0	0	0	0	0	0	7	0	7	26	0	9	62	97	11	0	0	0	11	115
10:30 PM	0	0	0	0	0	0	0	7	0	7	16	0	12	67	95	15	0	0	0	15	117
10:45 PM	0	0	0	0	0	0	0	10	0	10	10	0	12	54	76	9	0	0	0	9	95
Total	0	0	0	0	0	0	0	30	0	30	66	0	44	269	379	51	0	0	0	51	460
Grand Total	0	0	0	0	0	0	0	85	0	85	160	0	123	709	992	157	0	0	0	157	1234
Apprch %	0	0	0	0		0	0	100	0		16.1	0	12.4	71.5		100	0	0	0		
Total %	0	0	0	0	0	0	0	6.9	0	6.9	13	0	10	57.5	80.4	12.7	0	0	0	12.7	
Unshifted	0	0	0	0	0	0	0	85	0	85	160	0	123	709	992	157	0	0	0	157	1234
% Unshifted	0	0	0	0	0	0	0	100	0	100	100	0	100	100	100	100	0	0	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : Dewey PM
Site Code : 00000051
Start Date : 2/24/2010
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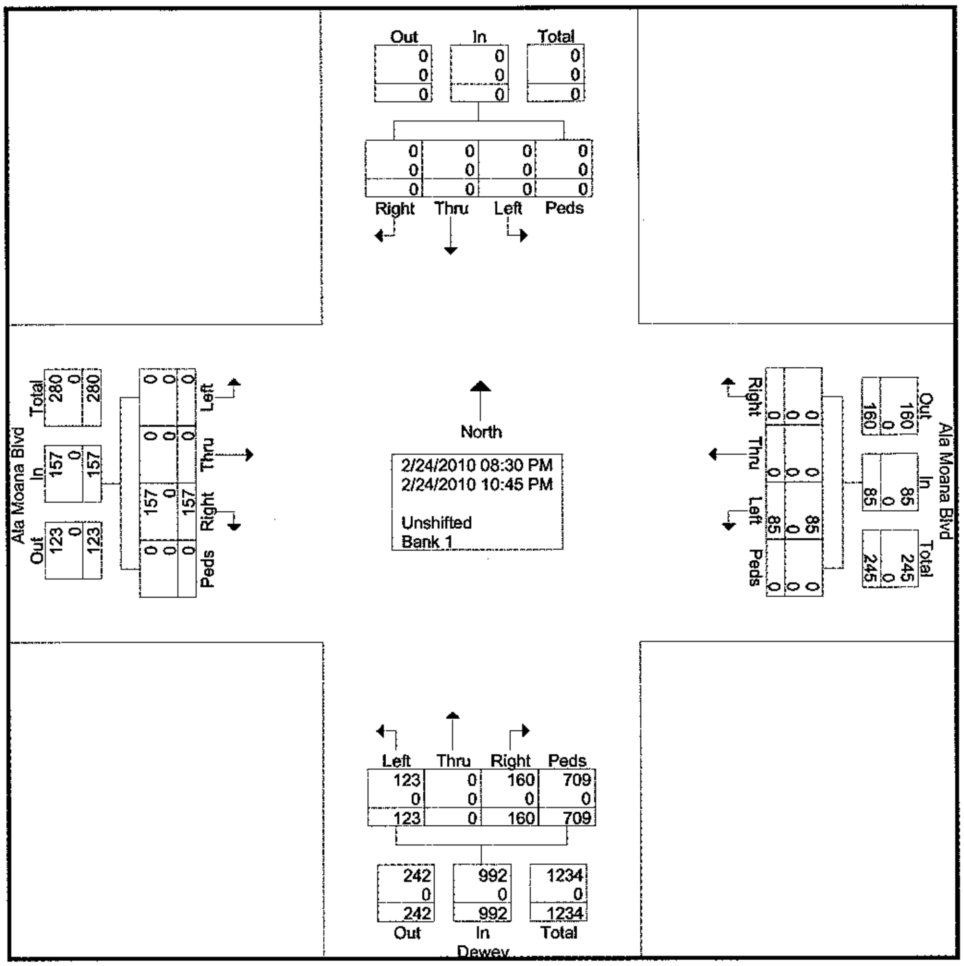

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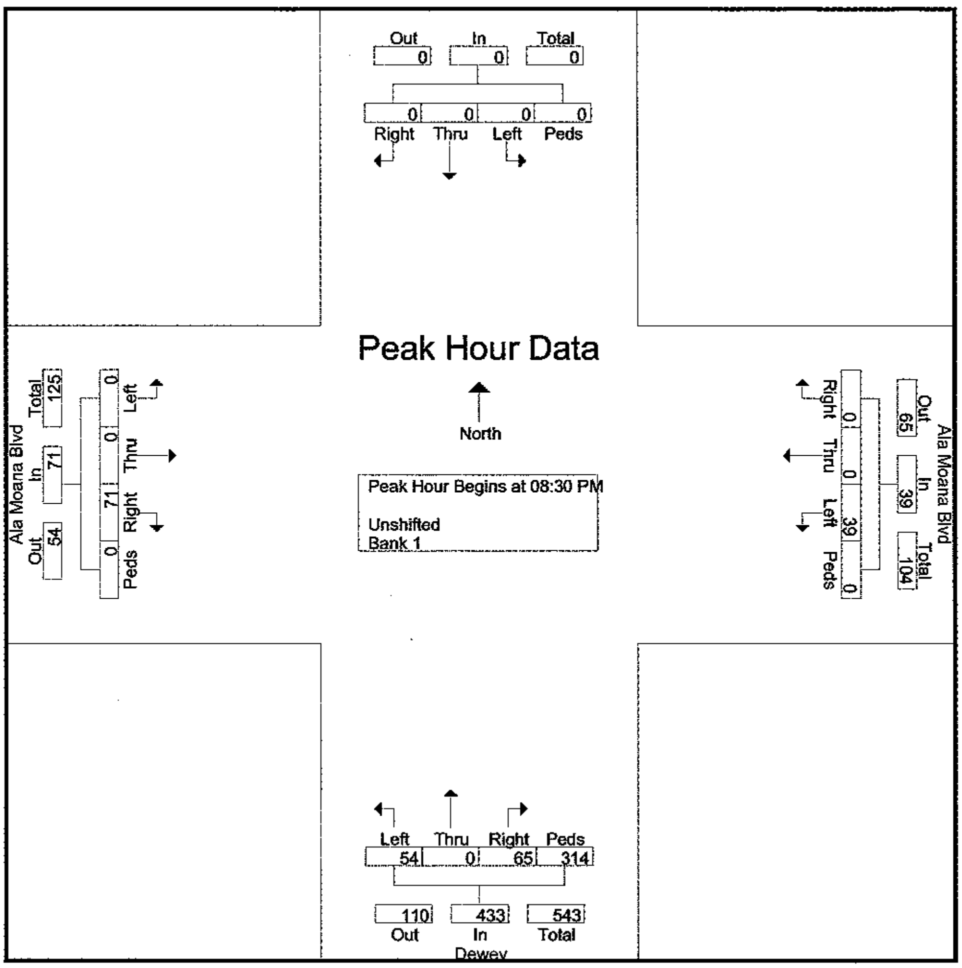
421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : Dewey PM
Site Code : 00000051
Start Date : 2/24/2010
Page No : 3

	From North					Ala Moana Blvd From East					Dewey From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 08:30 PM to 10:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 PM																					
08:30 PM	0	0	0	0	0	0	0	8	0	8	17	0	10	69	96	**26**	0	0	0	**26**	130
08:45 PM	0	0	0	0	0	0	0	9	0	9	12	0	12	**91**	115	16	0	0	0	16	140
09:00 PM	0	0	0	0	0	0	0	**12**	0	**12**	14	0	**17**	88	**119**	15	0	0	0	15	**146**
09:15 PM	0	0	0	0	0	0	0	10	0	10	**22**	0	15	66	103	14	0	0	0	14	127
Total Volume	0	0	0	0	0	0	0	39	0	39	65	0	54	314	433	71	0	0	0	71	543
% App. Total	0	0	0	0		0	0	100	0		15	0	12.5	72.5		100	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.813	.000	.813	.739	.000	.794	.863	.910	.683	.000	.000	.000	.683	.930



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File Name : Ala Moana_Hobron AM
Site Code : 00000021
Start Date : 2/23/2010
Page No : 1

Groups Printed- Unshifted - Bank 1

	Hobron From North					Ala Moana Blvd From East					Hobron From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:30 AM	77	13	4	31	125	6	177	5	12	200	6	4	16	12	38	27	187	14	1	229	592
06:45 AM	71	25	3	35	134	3	190	11	0	204	7	3	16	26	52	15	156	26	1	198	588
Total	148	38	7	66	259	9	367	16	12	404	13	7	32	38	90	42	343	40	2	427	1180
07:00 AM	96	13	7	32	148	6	240	7	40	293	6	1	28	32	67	23	202	20	0	245	753
07:15 AM	94	23	12	58	187	8	247	10	50	315	4	3	17	19	43	13	214	28	0	255	800
07:30 AM	105	25	8	69	207	8	263	16	89	376	8	2	32	47	89	12	189	26	0	227	899
07:45 AM	111	15	6	59	191	9	268	8	92	377	6	7	28	47	88	8	195	27	0	230	886
Total	406	76	33	218	733	31	1018	41	271	1361	24	13	105	145	287	56	800	101	0	957	3338
08:00 AM	79	28	5	74	186	13	223	16	102	354	8	4	31	54	97	13	194	21	0	228	865
08:15 AM	83	19	8	65	175	17	209	10	86	322	8	4	34	29	75	11	178	25	0	214	786
08:30 AM	106	20	5	80	211	14	189	10	99	312	7	8	32	37	84	10	246	27	0	283	890
08:45 AM	63	21	12	59	155	10	178	20	109	317	10	9	42	52	113	17	162	33	0	212	797
Total	331	88	30	278	727	54	799	56	396	1305	33	25	139	172	369	51	780	106	0	937	3338
Grand Total	885	202	70	562	1719	94	2184	113	679	3070	70	45	276	355	746	149	1923	247	2	2321	7856
Apprch %	51.5	11.8	4.1	32.7		3.1	71.1	3.7	22.1		9.4	6	37	47.6		6.4	82.9	10.6	0.1		
Total %	11.3	2.6	0.9	7.2	21.9	1.2	27.8	1.4	8.6	39.1	0.9	0.6	3.5	4.5	9.5	1.9	24.5	3.1	0	29.5	
Unshifted	885	202	70	562	1719	94	2184	113	679	3070	70	45	276	355	746	149	1923	247	2	2321	7856
% Unshifted	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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421 Fayetteville Street, Suite 1303
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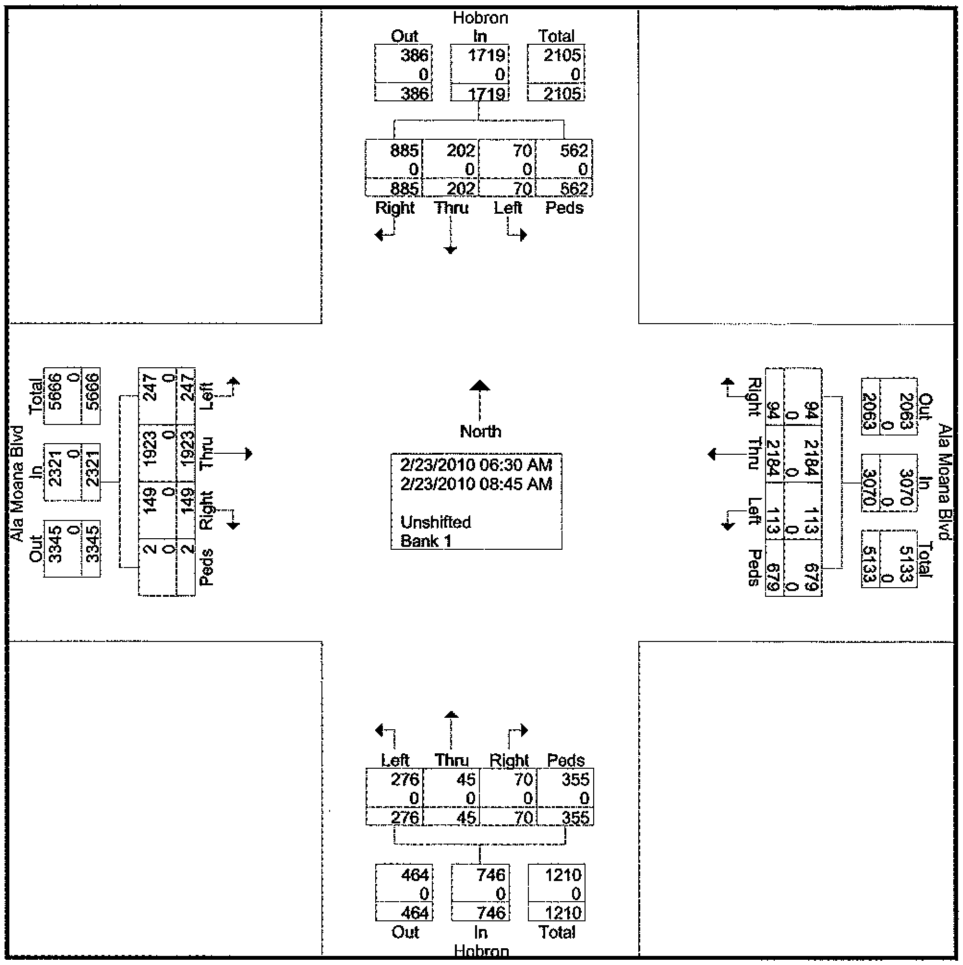
File Name : Ala Moana_Hobron AM
Site Code : 00000021
Start Date : 2/23/2010
Page No : 2



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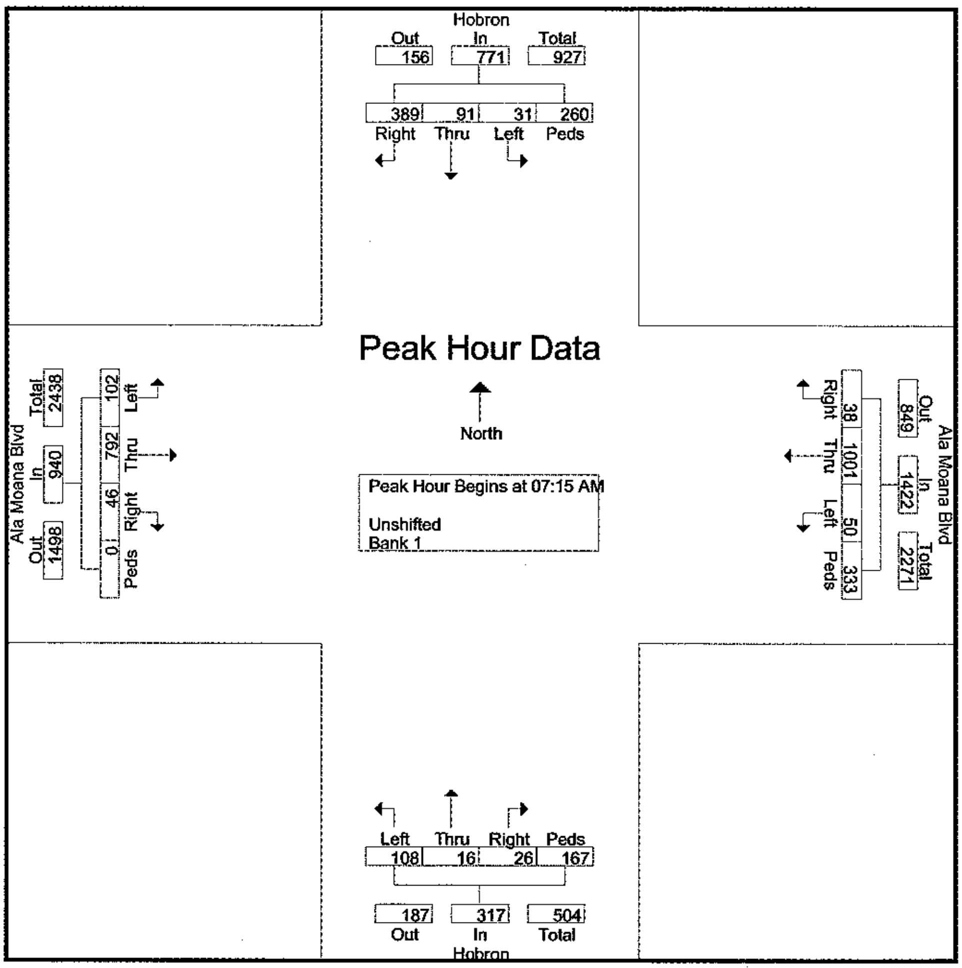
File Name : Ala Moana_Hobron AM
Site Code : 00000021
Start Date : 2/23/2010
Page No : 3

	Hobron From North					Ala Moana Blvd From East					Hobron From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	94	23	**12**	58	187	8	247	10	50	315	4	3	17	19	43	**13**	**214**	**28**	0	**255**	800
07:30 AM	105	25	8	69	**207**	8	263	**16**	89	376	**8**	2	**32**	47	89	12	189	26	0	227	**899**
07:45 AM	**111**	15	6	59	191	9	**268**	8	92	**377**	6	**7**	28	47	88	8	195	27	0	230	886
08:00 AM	79	**28**	5	**74**	186	**13**	223	16	**102**	354	8	4	31	**54**	**97**	13	194	21	0	228	865
Total Volume	389	91	31	260	771	38	1001	50	333	1422	26	16	108	167	317	46	792	102	0	940	3450
% App. Total	50.5	11.8	4	33.7		2.7	70.4	3.5	23.4		8.2	5	34.1	52.7		4.9	84.3	10.9	0		
PHF	.876	.813	.646	.878	.931	.731	.934	.781	.816	.943	.813	.571	.844	.773	.817	.885	.925	.911	.000	.922	.959



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File Name : AMB Hobron PM
Site Code : 00000022
Start Date : 2/23/2010
Page No : 1

Groups Printed- Unshifted - Bank 1

	Hobron From North					Ala Moana Blvd From East					Hobron From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	107	18	6	108	239	9	245	16	106	376	8	14	69	85	176	7	346	71	0	424	1215
03:45 PM	99	27	5	82	213	5	201	26	137	369	6	6	58	60	130	5	275	50	0	330	1042
Total	206	45	11	190	452	14	446	42	243	745	14	20	127	145	306	12	621	121	0	754	2257
04:00 PM	78	14	6	89	187	9	276	18	122	425	7	13	47	79	146	7	310	69	0	386	1144
04:15 PM	75	18	3	71	167	11	329	13	106	459	6	12	68	66	152	7	297	66	0	370	1148
04:30 PM	88	16	10	73	187	7	224	21	96	348	9	8	40	81	138	7	315	74	0	396	1069
04:45 PM	76	10	8	92	186	9	245	10	134	398	9	6	55	76	146	6	313	64	0	383	1113
Total	317	58	27	325	727	36	1074	62	458	1630	31	39	210	302	582	27	1235	273	0	1535	4474
05:00 PM	78	23	7	75	183	4	239	18	134	395	7	20	52	100	179	12	265	55	0	332	1089
05:15 PM	80	14	7	109	210	6	256	21	100	383	5	11	42	96	154	17	336	75	0	428	1175
05:30 PM	97	19	3	95	214	8	207	7	120	342	10	7	43	105	165	13	321	62	0	396	1117
05:45 PM	73	13	9	110	205	7	197	24	120	348	7	8	35	120	170	15	343	79	0	437	1160
Total	328	69	26	389	812	25	899	70	474	1468	29	46	172	421	668	57	1265	271	0	1593	4541
Grand Total	851	172	64	904	1991	75	2419	174	1175	3843	74	105	509	868	1556	96	3121	665	0	3882	11272
Apprch %	42.7	8.6	3.2	45.4		2	62.9	4.5	30.6		4.8	6.7	32.7	55.8		2.5	80.4	17.1	0		
Total %	7.5	1.5	0.6	8	17.7	0.7	21.5	1.5	10.4	34.1	0.7	0.9	4.5	7.7	13.8	0.9	27.7	5.9	0	34.4	
Unshifted	851	172	64	904	1991	75	2419	174	1175	3843	74	105	509	868	1556	96	3121	615	0	3832	11222
% Unshifted	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	92.5	0	98.7	99.6
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	50	50
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.5	0	1.3	0.4

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File Name : AMB Hobron PM
Site Code : 00000022
Start Date : 2/23/2010
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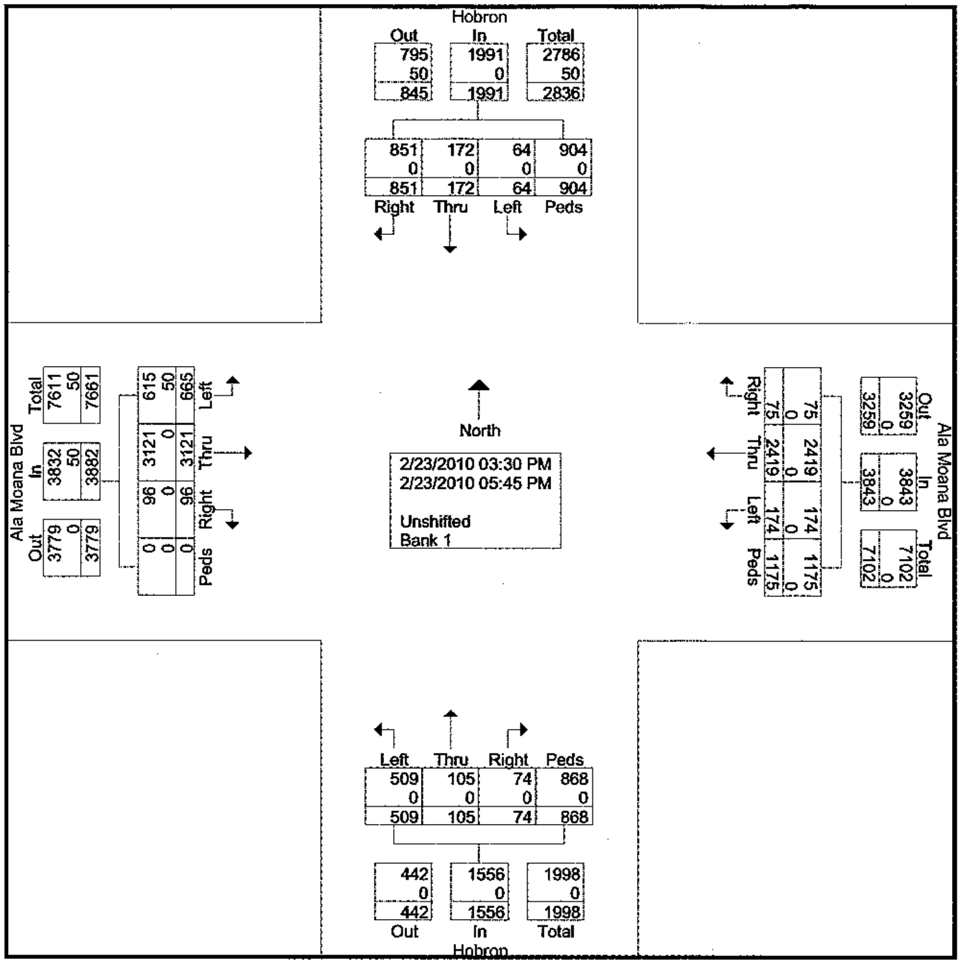

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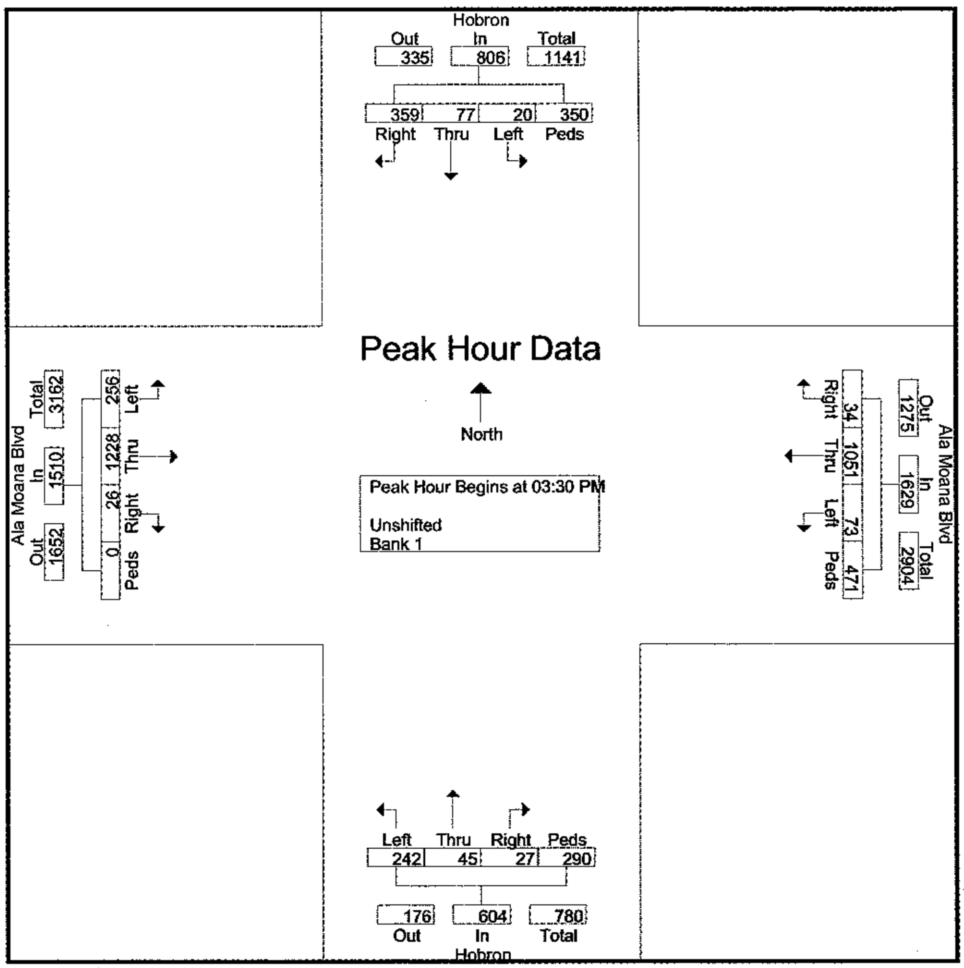
421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : AMB Hobron PM
Site Code : 00000022
Start Date : 2/23/2010

	Hobron From North					Ala Moana Blvd From East					Hobron From South					Ala Moana Blvd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**107**	18	**6**	**108**	**239**	9	245	16	106	376	**8**	**14**	**69**	**85**	**176**	**7**	**346**	**71**	0	**424**	**1215**
03:45 PM	99	**27**	5	82	213	5	201	**26**	**137**	369	6	6	58	60	130	5	275	50	0	330	1042
04:00 PM	78	14	6	89	187	9	276	18	122	425	7	13	47	79	146	7	310	69	0	386	1144
04:15 PM	75	18	3	71	167	**11**	**329**	13	106	**459**	6	12	68	66	152	7	297	66	0	370	1148
Total Volume	359	77	20	350	806	34	1051	73	471	1629	27	45	242	290	604	26	1228	256	0	1510	4549
% App. Total	44.5	9.6	2.5	43.4		2.1	64.5	4.5	28.9		4.5	7.5	40.1	48		1.7	81.3	17	0		
PHF	.839	.713	.833	.810	.843	.773	.799	.702	.859	.887	.844	.804	.877	.853	.858	.929	.887	.901	.000	.890	.936



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421 Fayetteville Street, Suite 1303
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File Name : AMB EB Hobron NB PM
Site Code : 00000022
Start Date : 2/23/2010
Page No : 1

Groups Printed- Bank 1

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	3
03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	4
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	7
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	7
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	6
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	25	25
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	4
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	6
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	7
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	4
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	21	21
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	50	50
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	100	0		
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100	

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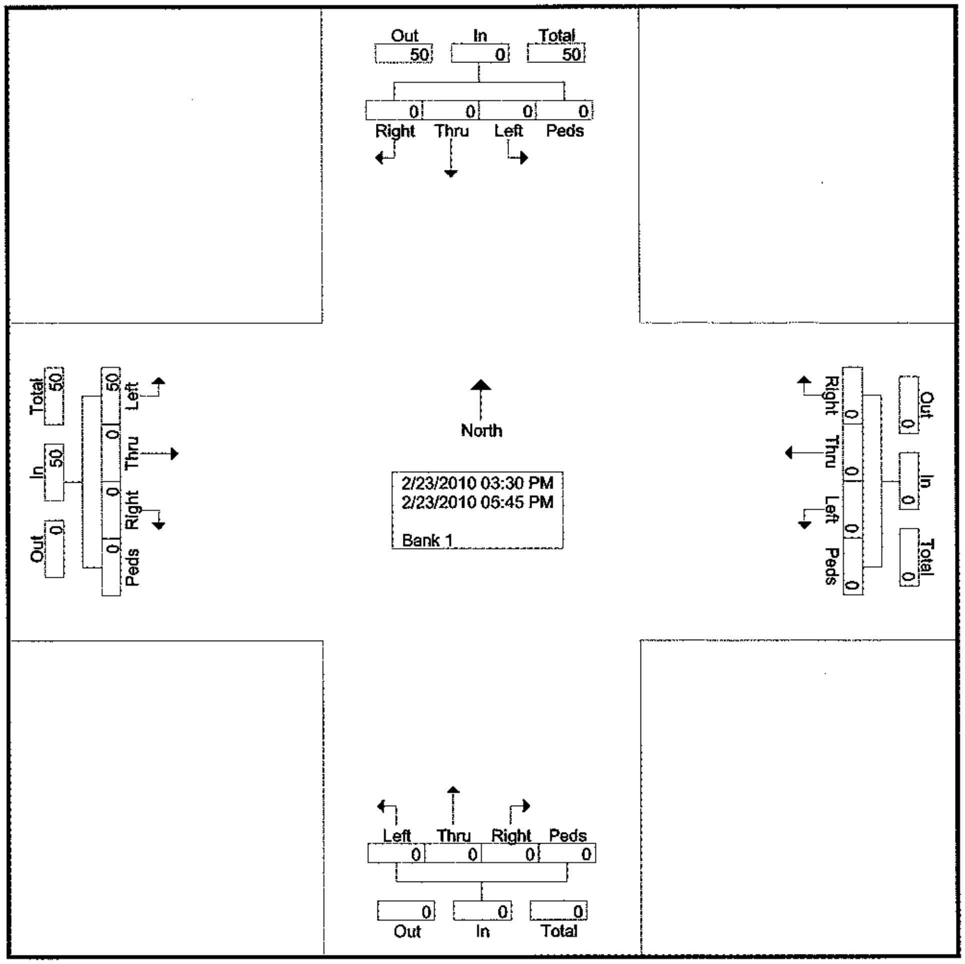
File Name : AMB EB Hobron NB PM
Site Code : 00000022
Start Date : 2/23/2010
Page No : 2



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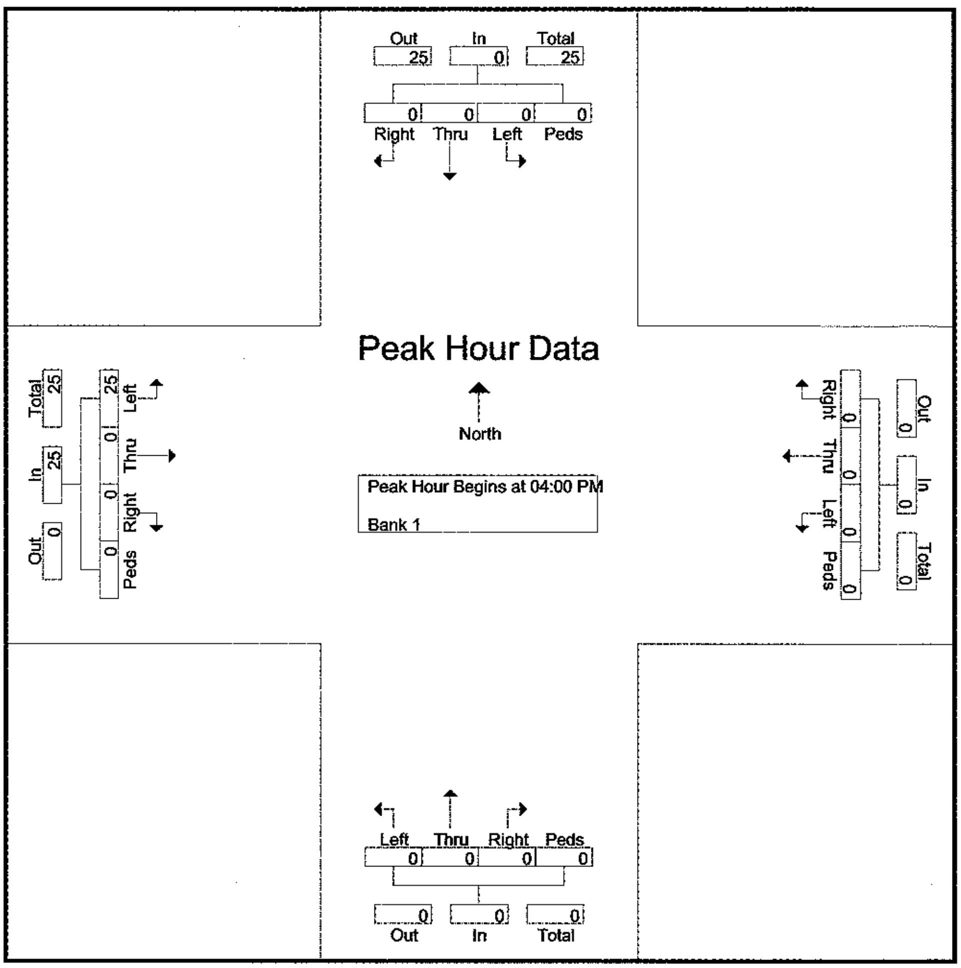
Raleigh, NC 27601

File Name : AMB EB Hobron NB PM
Site Code : 00000022
Start Date : 2/23/2010
Page No : 3

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	7
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	7
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	6
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	25	25
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.893	.000	.893	.893



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421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : Niu AM
Site Code : 00000041
Start Date : 2/24/2010
Page No : 1

Groups Printed- Unshifted - Bank 1

	Niu From North					Kalakaua Ave From East					From South					Kalakaua Ave From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
11:30 AM	0	84	6	2	92	0	0	0	0	0	0	0	0	0	0	52	255	0	5	312	404
11:45 AM	0	64	9	7	80	0	0	0	0	0	0	0	0	0	0	58	283	0	9	350	430
Total	0	148	15	9	172	0	0	0	0	0	0	0	0	0	0	110	538	0	14	662	834
12:00 PM	0	106	3	8	117	0	0	0	0	0	0	0	0	0	0	42	267	0	0	309	426
12:15 PM	0	139	8	13	160	0	0	0	0	0	0	0	0	0	0	49	316	0	26	391	551
12:30 PM	0	159	5	11	175	0	0	0	0	0	0	0	0	0	0	66	317	0	9	392	567
12:45 PM	0	161	7	14	182	0	0	0	0	0	0	0	0	0	0	52	386	0	46	484	666
Total	0	565	23	46	634	0	0	0	0	0	0	0	0	0	0	209	1286	0	81	1576	2210
01:00 PM	2	126	16	10	154	0	0	0	0	0	0	0	0	0	0	76	360	0	24	460	614
01:15 PM	0	133	13	21	167	0	0	0	0	0	0	0	0	0	0	51	333	0	20	404	571
01:30 PM	0	101	14	5	120	0	0	0	0	0	0	0	0	0	0	57	382	0	22	461	581
01:45 PM	0	100	22	21	143	0	0	0	0	0	0	0	0	0	0	53	408	0	35	496	639
Total	2	460	65	57	584	0	0	0	0	0	0	0	0	0	0	237	1483	0	101	1821	2405
Grand Total	2	1173	103	112	1390	0	0	0	0	0	0	0	0	0	0	556	3307	0	196	4059	5449
Apprch %	0.1	84.4	7.4	8.1		0	0	0	0		0	0	0	0		13.7	81.5	0	4.8		
Total %	0	21.5	1.9	2.1	25.5	0	0	0	0	0	0	0	0	0	0	10.2	60.7	0	3.6	74.5	
Unshifted	2	1173	103	112	1390	0	0	0	0	0	0	0	0	0	0	556	3307	0	196	4059	5449
% Unshifted	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	100	100	0	100	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : Niu AM
Site Code : 00000041
Start Date : 2/24/2010
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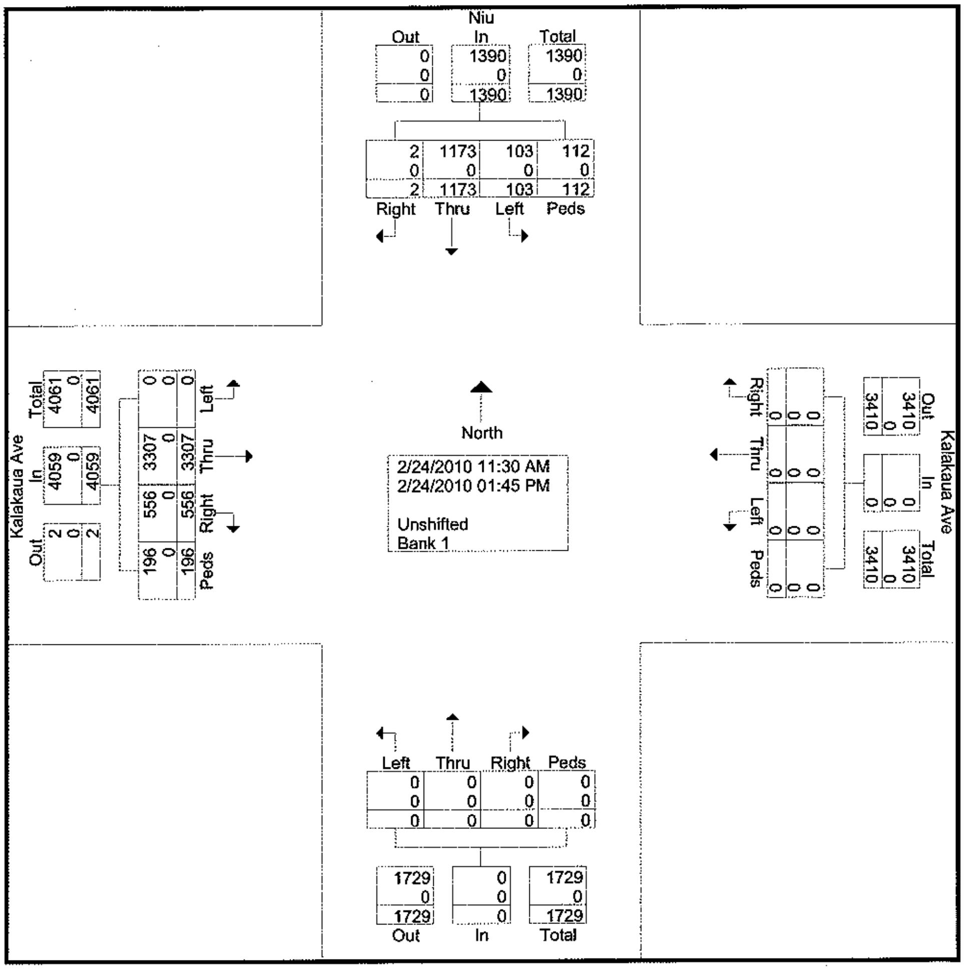

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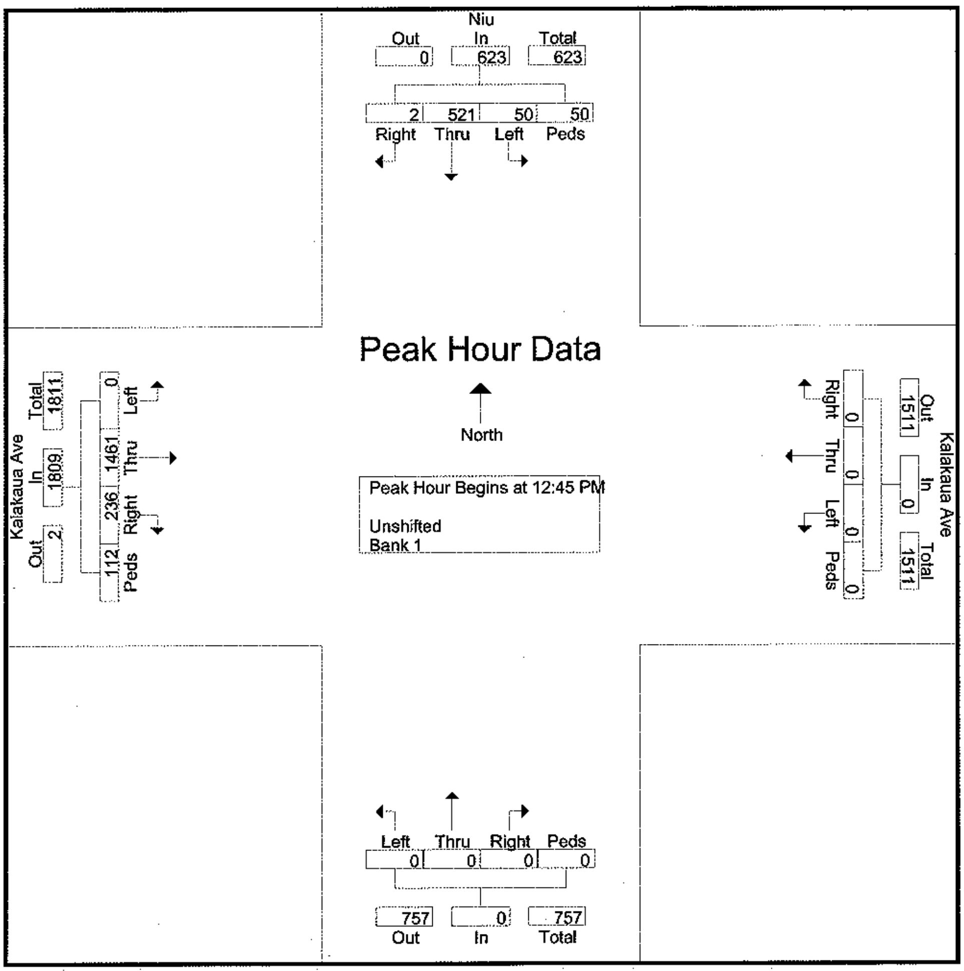
421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : Niu AM
Site Code : 00000041
Start Date : 2/24/2010

	Niu From North					Kalakaua Ave From East					From South					Kalakaua Ave From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 01:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:45 PM																					
12:45 PM	0	**161**	7	14	**182**	0	0	0	0	0	0	0	0	0	0	52	**386**	0	**46**	**484**	**666**
01:00 PM	**2**	126	**16**	10	154	0	0	0	0	0	0	0	0	0	0	**76**	360	0	24	460	614
01:15 PM	0	133	13	**21**	167	0	0	0	0	0	0	0	0	0	0	51	333	0	20	404	571
01:30 PM	0	101	14	5	120	0	0	0	0	0	0	0	0	0	0	57	382	0	22	461	581
Total Volume	2	521	50	50	623	0	0	0	0	0	0	0	0	0	0	236	1461	0	112	1809	2432
% App. Total	0.3	83.6	8	8		0	0	0	0		0	0	0	0		13	80.8	0	6.2		
PHF	.250	.809	.781	.595	.856	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.776	.946	.000	.609	.934	.913



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421 Fayetteville Street, Suite 1303
Raleigh, NC 27601

File Name : Niu PM
Site Code : 00000041
Start Date : 2/24/2010
Page No : 1

Groups Printed- Unshifted - Bank 1

	Niu From North					From East					Kalakaua From South					Kalakaua From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
08:30 PM	0	105	18	23	146	0	0	0	0	0	0	0	0	0	0	67	380	0	19	466	612
08:45 PM	0	112	12	14	138	0	0	0	0	0	0	0	0	0	0	59	441	0	20	520	658
Total	0	217	30	37	284	0	0	0	0	0	0	0	0	0	0	126	821	0	39	986	1270
09:00 PM	0	131	24	8	163	0	0	0	0	0	0	0	0	0	0	52	391	0	14	457	620
09:15 PM	0	100	20	22	142	0	0	0	0	0	0	0	0	0	0	62	399	0	15	476	618
09:30 PM	0	101	9	25	135	0	0	0	0	0	0	0	0	0	0	69	449	0	21	539	674
09:45 PM	0	119	20	14	153	0	0	0	0	0	0	0	0	0	0	59	475	0	27	561	714
Total	0	451	73	69	593	0	0	0	0	0	0	0	0	0	0	242	1714	0	77	2033	2626
10:00 PM	1	117	15	23	156	0	0	0	0	0	0	0	0	0	0	93	452	0	13	558	714
10:15 PM	0	139	18	30	187	0	0	0	0	0	0	0	0	0	0	79	437	0	36	552	739
10:30 PM	0	115	22	25	162	0	0	0	0	0	0	0	0	0	0	98	490	0	34	622	784
10:45 PM	0	124	14	33	171	0	0	0	0	0	0	0	0	0	0	87	459	0	21	567	738
Total	1	495	69	111	676	0	0	0	0	0	0	0	0	0	0	357	1838	0	104	2299	2975
Grand Total	1	1163	172	217	1553	0	0	0	0	0	0	0	0	0	0	725	4373	0	220	5318	6871
Apprch %	0.1	74.9	11.1	14		0	0	0	0		0	0	0	0		13.6	82.2	0	4.1		
Total %	0	16.9	2.5	3.2	22.6	0	0	0	0	0	0	0	0	0	0	10.6	63.6	0	3.2	77.4	
Unshifted	1	1163	172	217	1553	0	0	0	0	0	0	0	0	0	0	725	4373	0	220	5318	6871
% Unshifted	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	100	100	0	100	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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File Name : Niu PM
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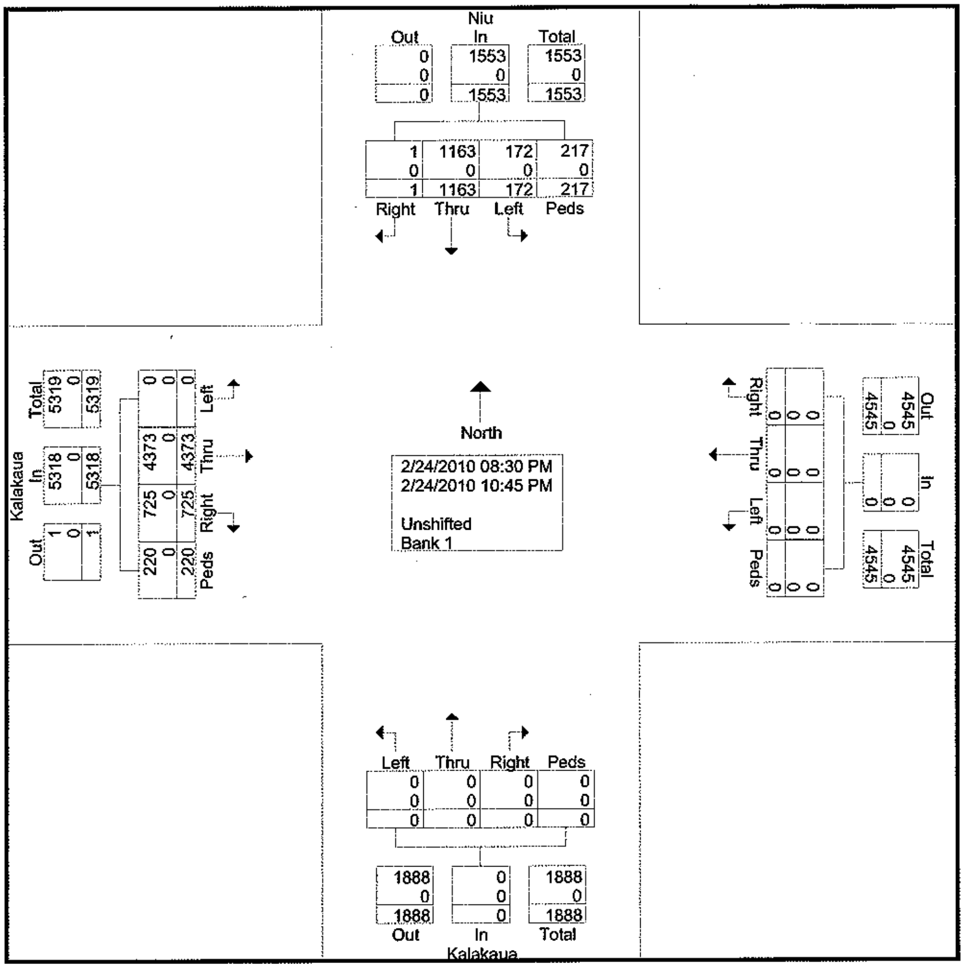

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File Name : Niu PM
Site Code : 00000041
Start Date : 2/24/2010
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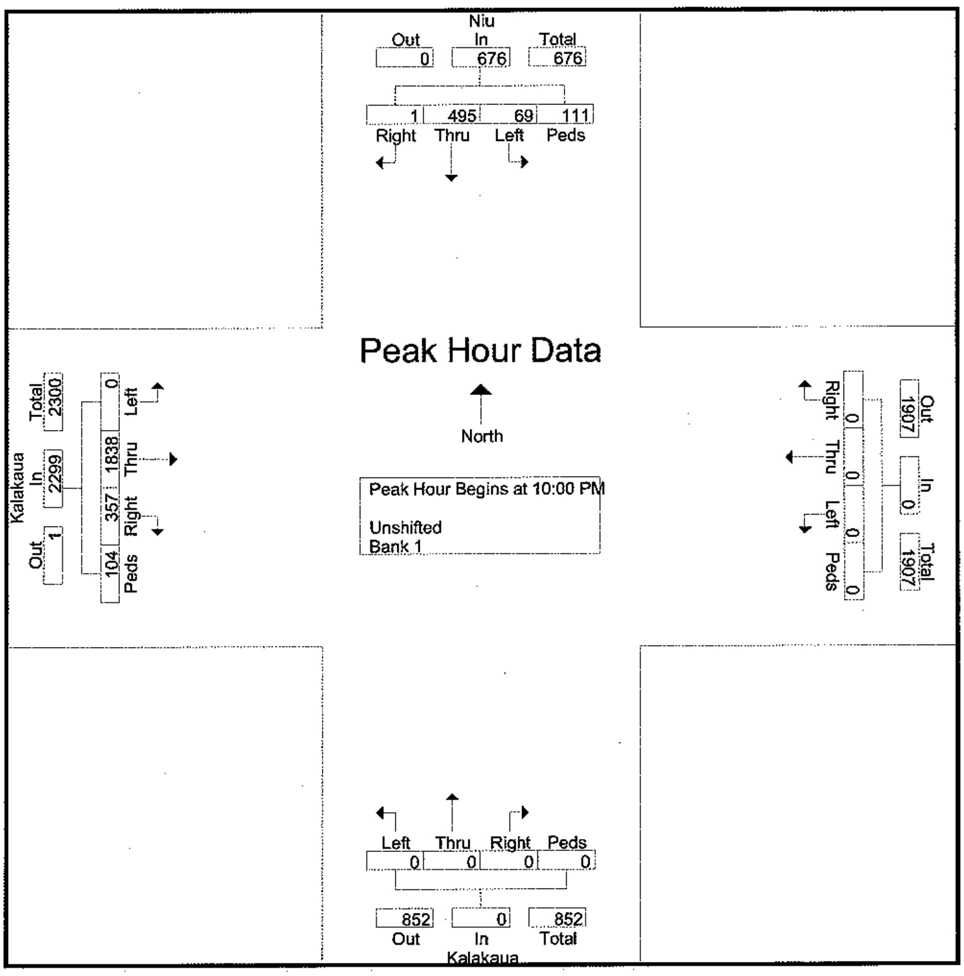
	Niu From North					From East					Kalakaua From South					Kalakaua From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 08:30 PM to 10:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 10:00 PM																					
10:00 PM	**1**	117	15	23	156	0	0	0	0	0	0	0	0	0	0	93	452	0	13	558	714
10:15 PM	0	**139**	18	30	**187**	0	0	0	0	0	0	0	0	0	0	79	437	0	**36**	552	739
10:30 PM	0	115	**22**	25	162	0	0	0	0	0	0	0	0	0	0	**98**	**490**	0	34	**622**	**784**
10:45 PM	0	124	14	**33**	171	0	0	0	0	0	0	0	0	0	0	87	459	0	21	567	738
Total Volume	1	495	69	111	676	0	0	0	0	0	0	0	0	0	0	357	1838	0	104	2299	2975
% App. Total	0.1	73.2	10.2	16.4		0	0	0	0		0	0	0	0		15.5	79.9	0	4.5		
PHF	.250	.890	.784	.841	.904	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.911	.938	.000	.722	.924	.949



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File Name : Pau AM
Site Code : 00000042
Start Date : 2/24/2010
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Groups Printed- Unshifted - Bank 1

	Pau From North					Kalakaua Ave From East					Pau From South					Kalakaua Ave From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:30 AM	0	0	0	7	7	1	2	0	7	10	103	11	0	22	136	0	0	13	0	13	166
06:45 AM	0	0	0	20	20	2	4	0	13	19	91	6	0	32	129	0	0	11	0	11	179
Total	0	0	0	27	27	3	6	0	20	29	194	17	0	54	265	0	0	24	0	24	345
07:00 AM	0	0	0	9	9	3	2	0	10	15	115	19	0	25	159	1	0	14	0	15	198
07:15 AM	0	0	0	26	26	3	1	0	20	24	135	17	0	55	207	0	0	23	0	23	280
07:30 AM	0	0	0	29	29	1	5	0	17	23	166	20	1	46	233	0	0	23	0	23	308
07:45 AM	0	0	0	19	19	29	3	0	13	45	131	16	0	43	190	0	0	33	0	33	287
Total	0	0	0	83	83	36	11	0	60	107	547	72	1	169	789	1	0	93	0	94	1073
08:00 AM	0	0	0	26	26	0	2	0	9	11	127	21	0	30	178	0	0	34	0	34	249
08:15 AM	0	0	0	27	27	3	3	0	19	25	128	14	0	35	177	0	0	26	0	26	255
08:30 AM	0	0	0	32	32	2	2	0	12	16	172	19	0	55	246	0	0	27	0	27	321
08:45 AM	0	0	0	38	38	1	1	0	21	23	155	22	0	55	232	0	0	19	0	19	312
Total	0	0	0	123	123	6	8	0	61	75	582	76	0	175	833	0	0	106	0	106	1137
Grand Total	0	0	0	233	233	45	25	0	141	211	1323	165	1	398	1887	1	0	223	0	224	2555
Apprch %	0	0	0	100		21.3	11.8	0	66.8		70.1	8.7	0.1	21.1		0.4	0	99.6	0		
Total %	0	0	0	9.1	9.1	1.8	1	0	5.5	8.3	51.8	6.5	0	15.6	73.9	0	0	8.7	0	8.8	
Unshifted	0	0	0	233	233	45	25	0	141	211	1323	165	1	398	1887	1	0	223	0	224	2555
% Unshifted	0	0	0	100	100	100	100	0	100	100	100	100	100	100	100	100	0	100	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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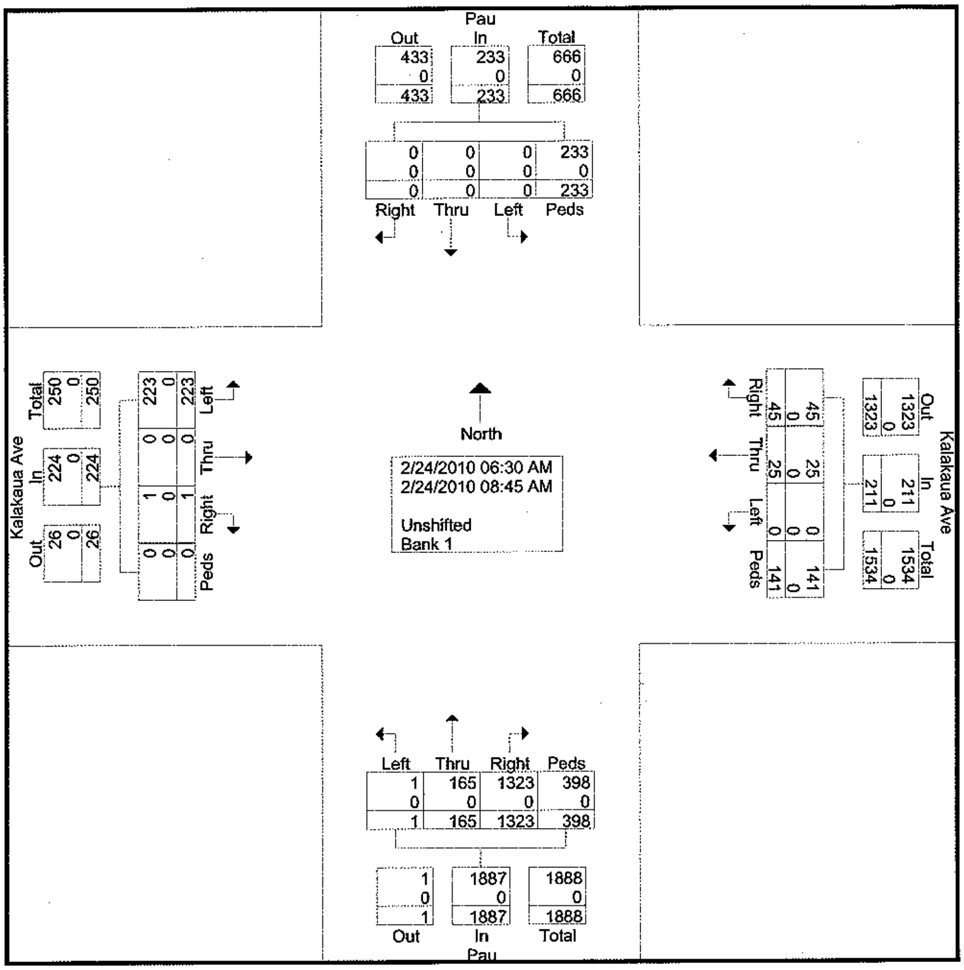

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Site Code : 00000042
Start Date : 2/24/2010
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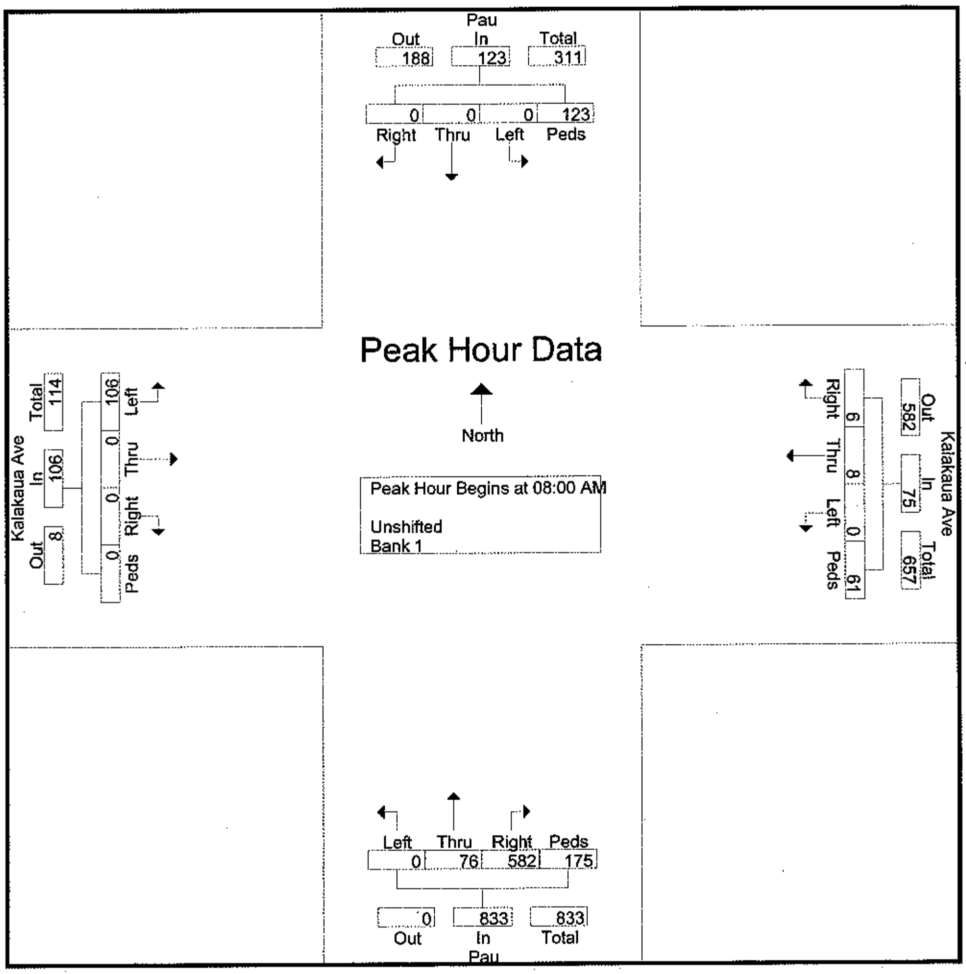
	Pau From North					Kalakaua Ave From East					Pau From South					Kalakaua Ave From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	0	0	26	26	0	2	0	9	11	127	21	0	30	178	0	0	**34**	0	**34**	249
08:15 AM	0	0	0	27	27	**3**	**3**	0	19	**25**	128	14	0	35	177	0	0	26	0	26	255
08:30 AM	0	0	0	32	32	2	2	0	12	16	**172**	19	0	**55**	**246**	0	0	27	0	27	**321**
08:45 AM	0	0	0	**38**	**38**	1	1	0	**21**	23	155	**22**	0	55	232	0	0	19	0	19	312
Total Volume	0	0	0	123	123	6	8	0	61	75	582	76	0	175	833	0	0	106	0	106	1137
% App. Total	0	0	0	100		8	10.7	0	81.3		69.9	9.1	0	21		0	0	100	0		
PHF	.000	.000	.000	.809	.809	.500	.667	.000	.726	.750	.846	.864	.000	.795	.847	.000	.000	.779	.000	.779	.886



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File Name : Pau PM
Site Code : 00000042
Start Date : 2/24/2010
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Groups Printed- Unshifted - Bank 1

	Pau From North					Kalakaua From East					From South					Kalakaua From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	0	53	53	2	2	0	20	24	162	41	0	66	269	0	0	31	0	31	377
03:45 PM	0	0	0	43	43	4	4	0	23	31	186	34	0	55	275	0	0	31	0	31	380
Total	0	0	0	96	96	6	6	0	43	55	348	75	0	121	544	0	0	62	0	62	757
04:00 PM	0	0	0	29	29	3	5	0	15	23	197	49	0	42	288	0	0	39	0	39	379
04:15 PM	0	0	0	43	43	3	3	0	23	29	185	44	0	71	300	0	0	37	0	37	409
04:30 PM	0	0	0	56	56	2	6	0	20	28	199	29	0	59	287	0	0	30	0	30	401
04:45 PM	0	0	0	36	36	4	6	0	17	27	163	34	0	53	250	0	0	55	0	55	368
Total	0	0	0	164	164	12	20	0	75	107	744	156	0	225	1125	0	0	161	0	161	1557
05:00 PM	0	0	0	57	57	1	4	0	35	40	194	44	0	73	311	0	0	36	0	36	444
05:15 PM	0	0	0	55	55	2	5	0	46	53	174	37	0	82	293	0	0	45	0	45	446
05:30 PM	0	0	0	61	61	4	3	0	19	26	190	28	0	50	268	0	0	46	0	46	401
05:45 PM	0	0	0	60	60	2	4	0	27	33	170	23	0	59	252	0	0	40	0	40	385
Total	0	0	0	233	233	9	16	0	127	152	728	132	0	264	1124	0	0	167	0	167	1676
Grand Total	0	0	0	493	493	27	42	0	245	314	1820	363	0	610	2793	0	0	390	0	390	3990
Apprch %	0	0	0	100		8.6	13.4	0	78		65.2	13	0	21.8		0	0	100	0		
Total %	0	0	0	12.4	12.4	0.7	1.1	0	6.1	7.9	45.6	9.1	0	15.3	70	0	0	9.8	0	9.8	
Unshifted	0	0	0	493	493	27	42	0	245	314	1820	363	0	610	2793	0	0	390	0	390	3990
% Unshifted	0	0	0	100	100	100	100	0	100	100	100	100	0	100	100	0	0	100	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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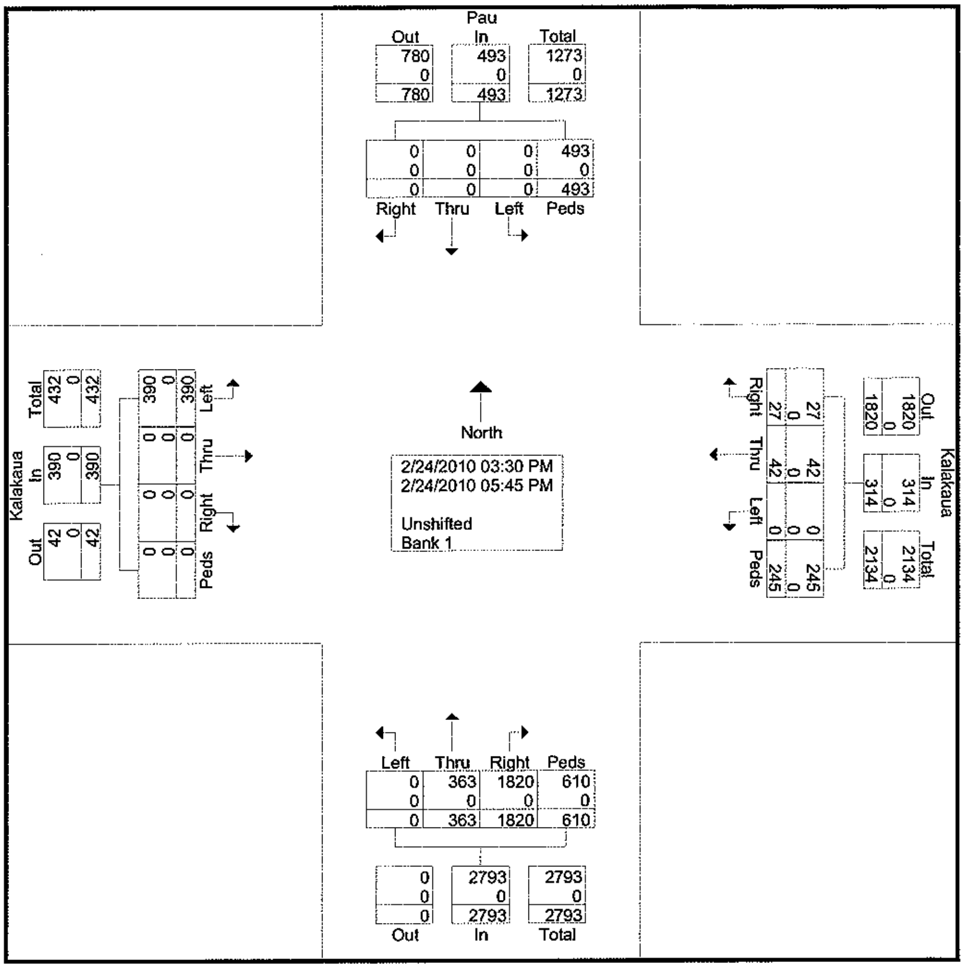

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File Name : Pau PM
Site Code : 00000042
Start Date : 2/24/2010
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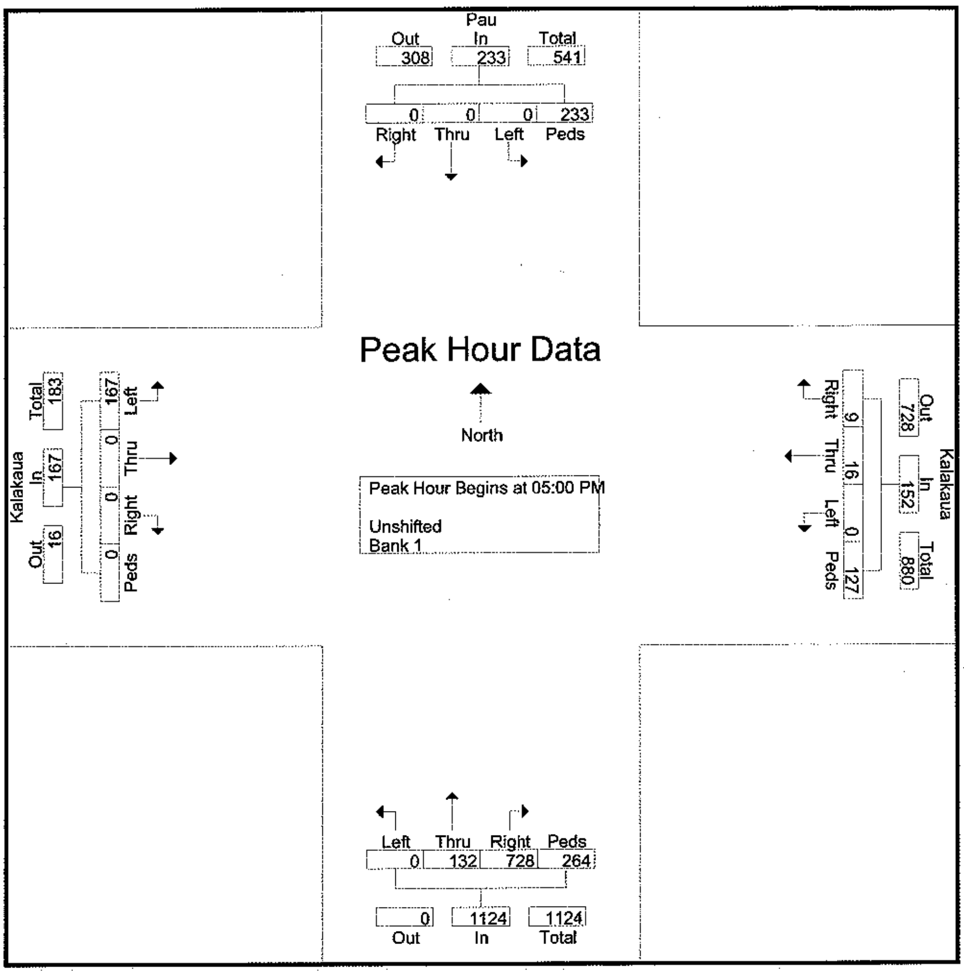
	Pau From North					Kalakaua From East					From South					Kalakaua From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	57	57	1	4	0	35	40	**194**	**44**	0	73	**311**	0	0	36	0	36	444
05:15 PM	0	0	0	55	55	2	**5**	0	**46**	**53**	174	37	0	**82**	293	0	0	45	0	45	**446**
05:30 PM	0	0	0	**61**	**61**	**4**	3	0	19	26	190	28	0	50	268	0	0	**46**	0	**46**	401
05:45 PM	0	0	0	60	60	2	4	0	27	33	170	23	0	59	252	0	0	40	0	40	385
Total Volume	0	0	0	233	233	9	16	0	127	152	728	132	0	264	1124	0	0	167	0	167	1676
% App. Total	0	0	0	100		5.9	10.5	0	83.6		64.8	11.7	0	23.5		0	0	100	0		
PHF	.000	.000	.000	.955	.955	.563	.800	.000	.690	.717	.938	.750	.000	.805	.904	.000	.000	.908	.000	.908	.939



APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average control delay per vehicle, typically a 15-min analysis period. The criteria are given in the following table.

Table 1: Level-of-Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec/veh)
A	≤10.0
B	>10.0 and ≤20.0
C	>20.0 and ≤35.0
D	>35.0 and ≤55.0
E	>55.0 and ≤80.0
F	>80.0

Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group.

Level of Service A describes operations with low control delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

Level of Service B describes operations with control delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

Level of Service C describes operations with control delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

Level of Service D describes operations with control delay greater than 35 and up to 55 sec per vehicle. At level of service D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

"Highway Capacity Manual," Transportation Research Board, 2000.

Level of Service E describes operation with control delay greater than 55 and up to 80 sec per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

Level of Service F describes operations with control delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

"Highway Capacity Manual," Transportation Research Board, 2000.

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service (LOS) criteria are given in Table 1. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in the queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. If the degree of saturation is greater than about 0.9, average control delay is significantly affected by the length of the analysis period.

Table 1: Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (Sec/Veh)
A	≤10.0
B	>10.0 and ≤15.0
C	>15.0 and ≤25.0
D	>25.0 and ≤35.0
E	>35.0 and ≤50.0
F	>50.0

"Highway Capacity Manual," Transportation Research Board, 2000.

APPENDIX C

CAPACITY ANALYSIS CALCULATIONS
EXISTING PEAK HOUR TRAFFIC ANALYSIS

HCM Signalized Intersection Capacity Analysis
2: Ala Moana Blvd & Hobron Road

6/23/2010

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰	↑↑↱		↰	↑↑↱		↰	↰↑↱			↰↑
Volume (vph)	19	102	792	46	50	1001	38	108	16	26	31	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0		5.0	5.0			5.0
Lane Util. Factor		1.00	0.91		1.00	0.91		0.95	0.95			1.00
Frpb, ped/bikes		1.00	0.97		1.00	0.98		1.00	0.86			1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00			1.00
Frt		1.00	0.99		1.00	0.99		1.00	0.95			1.00
Flt Protected		0.95	1.00		0.95	1.00		0.95	0.98			0.99
Satd. Flow (prot)		1770	4895		1770	4946		1681	1409			1840
Flt Permitted		0.95	1.00		0.95	1.00		0.95	0.98			0.99
Satd. Flow (perm)		1770	4895		1770	4946		1681	1409			1840
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.95	0.95	0.95	0.87	0.87	0.87	0.93	0.93
Adj. Flow (vph)	21	111	861	50	53	1054	40	124	18	30	33	98
RTOR Reduction (vph)	0	0	4	0	0	3	0	0	17	0	0	0
Lane Group Flow (vph)	0	132	907	0	53	1091	0	88	67	0	0	131
Confl. Peds. (#/hr)				167			260			333		
Turn Type	Prot	Prot			Prot			Split			Split	
Protected Phases	5	5	2		1	6		3	3		4	4
Permitted Phases												
Actuated Green, G (s)		13.7	61.3		7.4	55.0		11.6	11.6			19.7
Effective Green, g (s)		13.7	61.3		7.4	55.0		11.6	11.6			19.7
Actuated g/C Ratio		0.11	0.51		0.06	0.46		0.10	0.10			0.16
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0			5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	3.0			3.0
Lane Grp Cap (vph)		202	2501		109	2267		162	136			302
v/s Ratio Prot		c0.07	0.19		0.03	c0.22		c0.05	0.05			0.07
v/s Ratio Perm												
v/c Ratio		0.65	0.36		0.49	0.48		0.54	0.49			0.43
Uniform Delay, d1		50.9	17.6		54.5	22.6		51.7	51.4			45.1
Progression Factor		1.00	1.00		1.19	0.80		1.00	1.00			1.00
Incremental Delay, d2		7.4	0.4		3.3	0.7		3.7	2.8			1.0
Delay (s)		58.3	18.0		68.3	18.8		55.4	54.2			46.1
Level of Service		E	B		E	B		E	D			D
Approach Delay (s)			23.1			21.1			54.8			54.5
Approach LOS			C			C			D			D

Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	389
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.0
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.93
Adj. Flow (vph)	418
RTOR Reduction (vph)	230
Lane Group Flow (vph)	188
Confl. Peds. (#/hr)	
Turn Type	Perm
Protected Phases	
Permitted Phases	4
Actuated Green, G (s)	19.7
Effective Green, g (s)	19.7
Actuated g/C Ratio	0.16
Clearance Time (s)	5.0
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	260
v/s Ratio Prot	
v/s Ratio Perm	c0.12
v/c Ratio	0.72
Uniform Delay, d1	47.6
Progression Factor	1.00
Incremental Delay, d2	9.6
Delay (s)	57.1
Level of Service	E
Approach Delay (s)	
Approach LOS	

Intersection Summary

HCM Signalized Intersection Capacity Analysis
2: Ala Moana Blvd & Hobron Road

6/23/2010

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations		↰	↑↑↑↱			↰	↑↑↑↱		↰	✢		
Volume (vph)	25	256	1228	26	35	73	1051	34	242	45	27	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0			5.0	5.0		5.0	5.0		
Lane Util. Factor		1.00	0.91			1.00	0.91		0.95	0.95		
Frpb, ped/bikes		1.00	0.99			1.00	0.98		1.00	0.93		
Flpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	1.00		
Frt		1.00	1.00			1.00	1.00		1.00	0.97		
Flt Protected		0.95	1.00			0.95	1.00		0.95	0.97		
Satd. Flow (prot)		1770	5015			1770	4969		1681	1566		
Flt Permitted		0.95	1.00			0.95	1.00		0.95	0.97		
Satd. Flow (perm)		1770	5015			1770	4969		1681	1566		
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.82	0.82	0.82	0.82	0.86	0.86	0.86	0.87
Adj. Flow (vph)	28	288	1380	29	43	89	1282	41	281	52	31	23
RTOR Reduction (vph)	0	0	1	0	0	0	2	0	0	6	0	0
Lane Group Flow (vph)	0	316	1408	0	0	132	1321	0	183	175	0	0
Confl. Peds. (#/hr)				291				350			471	
Turn Type	Prot	Prot			Prot	Prot			Split			Split
Protected Phases	5	5	2		1	1	6		3	3		4
Permitted Phases												
Actuated Green, G (s)		28.8	68.2			14.4	53.8		21.1	21.1		
Effective Green, g (s)		28.8	68.2			14.4	53.8		21.1	21.1		
Actuated g/C Ratio		0.21	0.49			0.10	0.38		0.15	0.15		
Clearance Time (s)		5.0	5.0			5.0	5.0		5.0	5.0		
Vehicle Extension (s)		2.0	3.0			2.0	3.0		3.0	3.0		
Lane Grp Cap (vph)		364	2443			182	1910		253	236		
v/s Ratio Prot		c0.18	0.28			0.07	c0.27		0.11	c0.11		
v/s Ratio Perm												
v/c Ratio		0.87	0.58			0.73	0.69		0.72	0.74		
Uniform Delay, d1		53.8	25.6			60.9	36.1		56.7	56.8		
Progression Factor		0.66	0.91			0.93	0.97		1.00	1.00		
Incremental Delay, d2		14.7	0.8			11.3	2.1		9.8	11.8		
Delay (s)		50.4	23.9			67.7	37.2		66.5	68.7		
Level of Service		D	C			E	D		E	E		
Approach Delay (s)			28.8				40.0			67.6		
Approach LOS			C				D			E		

Intersection Summary			
HCM Average Control Delay	41.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	99.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	77	359
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	5.0
Lane Util. Factor	1.00	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	0.99	1.00
Satd. Flow (prot)	1844	1583
Flt Permitted	0.99	1.00
Satd. Flow (perm)	1844	1583
Peak-hour factor, PHF	0.87	0.87
Adj. Flow (vph)	89	413
RTOR Reduction (vph)	0	274
Lane Group Flow (vph)	112	139
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	4	
Permitted Phases		4
Actuated Green, G (s)	16.3	16.3
Effective Green, g (s)	16.3	16.3
Actuated g/C Ratio	0.12	0.12
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	3.0	3.0
Lane Grp Cap (vph)	215	184
v/s Ratio Prot	0.06	
v/s Ratio Perm		c0.09
v/c Ratio	0.52	0.76
Uniform Delay, d1	58.2	59.9
Progression Factor	1.00	1.00
Incremental Delay, d2	2.3	16.1
Delay (s)	60.4	76.0
Level of Service	E	E
Approach Delay (s)	72.7	
Approach LOS	E	

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑↱		↰	↑↑↑	↰	↱
Volume (vph)	845	65	26	1022	46	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	0.86		1.00	0.91	1.00	1.00
Frpb, ped/bikes	0.97		1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	6136		1770	5085	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	6136		1770	5085	1770	1583
Peak-hour factor, PHF	0.87	0.87	0.93	0.93	0.84	0.84
Adj. Flow (vph)	971	75	28	1099	55	42
RTOR Reduction (vph)	5	0	0	0	0	39
Lane Group Flow (vph)	1041	0	28	1099	55	3
Confl. Peds. (#/hr)		116				
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	91.9		5.1	102.0	8.0	8.0
Effective Green, g (s)	91.9		5.1	102.0	8.0	8.0
Actuated g/C Ratio	0.77		0.04	0.85	0.07	0.07
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	4699		75	4322	118	106
v/s Ratio Prot	0.17		0.02	c0.22	c0.03	
v/s Ratio Perm						0.00
v/c Ratio	0.22		0.37	0.25	0.47	0.03
Uniform Delay, d1	4.0		55.9	1.7	53.9	52.4
Progression Factor	0.65		0.97	0.47	1.00	1.00
Incremental Delay, d2	0.1		2.9	0.1	2.9	0.1
Delay (s)	2.7		57.2	0.9	56.8	52.5
Level of Service	A		E	A	E	D
Approach Delay (s)	2.7			2.3	54.9	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	4.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	34.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑↱		↰	↑↑↑	↰	↱
Volume (vph)	1268	39	35	1044	48	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	0.86		1.00	0.91	1.00	1.00
Frpb, ped/bikes	0.98		1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	6259		1770	5085	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	6259		1770	5085	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.91	0.91	0.76	0.76
Adj. Flow (vph)	1378	42	38	1147	63	96
RTOR Reduction (vph)	2	0	0	0	0	89
Lane Group Flow (vph)	1418	0	38	1147	63	7
Confl. Peds. (#/hr)		263				
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	107.3		7.3	119.6	10.4	10.4
Effective Green, g (s)	107.3		7.3	119.6	10.4	10.4
Actuated g/C Ratio	0.77		0.05	0.85	0.07	0.07
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	4797		92	4344	131	118
v/s Ratio Prot	c0.23		c0.02	0.23	c0.04	
v/s Ratio Perm						0.00
v/c Ratio	0.30		0.41	0.26	0.48	0.06
Uniform Delay, d1	4.9		64.3	1.9	62.2	60.3
Progression Factor	0.09		1.04	0.37	1.00	1.00
Incremental Delay, d2	0.1		2.5	0.1	2.8	0.2
Delay (s)	0.6		69.2	0.8	65.0	60.5
Level of Service	A		E	A	E	E
Approach Delay (s)	0.6			3.0	62.3	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBu	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	17	23	573	258	156	538	42	384	51	59	9	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0		5.0
Lane Util. Factor		1.00	0.95	0.88	1.00	0.91		0.95	0.95	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.98		1.00	1.00	0.82		0.83
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		0.94
Flt Protected		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		1.00
Satd. Flow (prot)		1770	3539	2787	1770	4937		1681	1704	1292		1441
Flt Permitted		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		1.00
Satd. Flow (perm)		1770	3539	2787	1770	4937		1681	1704	1292		1441
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.92	0.92	0.92	0.86	0.86	0.86	0.81	0.81
Adj. Flow (vph)	19	26	644	290	170	585	46	447	59	69	11	78
RTOR Reduction (vph)	0	0	0	99	0	7	0	0	0	55	0	24
Lane Group Flow (vph)	0	45	644	191	170	624	0	250	256	14	0	134
Confl. Peds. (#/hr)							63			78		
Turn Type	Prot	Prot		pt+ov	Prot			Split		Perm	Split	
Protected Phases	5	5	2	2 3	1	6		3	3		4	4
Permitted Phases										3		
Actuated Green, G (s)		6.5	44.1	68.3	16.2	53.8		24.2	24.2	24.2		15.5
Effective Green, g (s)		6.5	44.1	68.3	16.2	53.8		24.2	24.2	24.2		15.5
Actuated g/C Ratio		0.05	0.37	0.57	0.13	0.45		0.20	0.20	0.20		0.13
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0	5.0		5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0
Lane Grp Cap (vph)		96	1301	1586	239	2213		339	344	261		186
v/s Ratio Prot		0.03	c0.18	0.07	c0.10	0.13		0.15	c0.15			c0.09
v/s Ratio Perm										0.01		
v/c Ratio		0.47	0.50	0.12	0.71	0.28		0.74	0.74	0.05		0.72
Uniform Delay, d1		55.1	29.3	12.0	49.7	20.9		44.9	45.0	38.7		50.2
Progression Factor		1.28	0.46	0.10	1.00	1.00		0.93	0.93	0.90		1.00
Incremental Delay, d2		3.5	1.3	0.0	9.6	0.3		8.1	8.4	0.1		12.5
Delay (s)		73.9	14.9	1.3	59.2	21.2		50.0	50.4	34.8		62.6
Level of Service		E	B	A	E	C		D	D	C		E
Approach Delay (s)			13.6			29.3			48.4			62.6
Approach LOS			B			C			D			E

Intersection Summary			
HCM Average Control Delay	29.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	56
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.81
Adj. Flow (vph)	69
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	348
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	20	63	694	507	191	579	58	444	110	123	11	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0		5.0
Lane Util. Factor		1.00	0.95	0.88	1.00	0.91		0.95	0.95	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.98		1.00	1.00	0.72		0.89
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		0.96
Flt Protected		0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00		1.00
Satd. Flow (prot)		1770	3539	2787	1770	4894		1681	1718	1142		1579
Flt Permitted		0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00		1.00
Satd. Flow (perm)		1770	3539	2787	1770	4894		1681	1718	1142		1579
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.84	0.84	0.84	0.82	0.82	0.82	0.89	0.89
Adj. Flow (vph)	22	68	754	551	227	689	69	541	134	150	12	112
RTOR Reduction (vph)	0	0	0	46	0	7	0	0	0	117	0	12
Lane Group Flow (vph)	0	90	754	505	227	751	0	335	340	33	0	166
Confl. Peds. (#/hr)							90			123		
Turn Type	Prot	Prot		pt+ov	Prot			Split		Perm	Split	
Protected Phases	5	5	2	2 3	1	6		3	3		4	4
Permitted Phases										3		
Actuated Green, G (s)		12.4	47.4	78.6	21.9	56.9		31.2	31.2	31.2		19.5
Effective Green, g (s)		12.4	47.4	78.6	21.9	56.9		31.2	31.2	31.2		19.5
Actuated g/C Ratio		0.09	0.34	0.56	0.16	0.41		0.22	0.22	0.22		0.14
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0	5.0		5.0
Vehicle Extension (s)		3.0	3.0		2.0	3.0		2.0	2.0	2.0		2.5
Lane Grp Cap (vph)		157	1198	1565	277	1989		375	383	255		220
v/s Ratio Prot		0.05	c0.21	0.18	c0.13	0.15		c0.20	0.20			c0.11
v/s Ratio Perm										0.03		
v/c Ratio		0.57	0.63	0.32	0.82	0.38		0.89	0.89	0.13		0.75
Uniform Delay, d1		61.3	38.9	16.4	57.1	29.1		52.8	52.7	43.5		57.9
Progression Factor		0.79	0.86	2.08	0.97	1.04		0.94	0.94	0.92		1.00
Incremental Delay, d2		4.8	2.4	0.0	14.4	0.5		21.9	20.5	0.1		13.0
Delay (s)		53.5	35.9	34.3	70.1	30.7		71.7	70.3	40.3		71.0
Level of Service		D	D	C	E	C		E	E	D		E
Approach Delay (s)			36.4			39.8			65.4			71.0
Approach LOS			D			D			E			E

Intersection Summary			
HCM Average Control Delay	46.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	48
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.89
Adj. Flow (vph)	54
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	459
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

HCM Signalized Intersection Capacity Analysis
4: Niu Street & Kalakaua Ave

7/9/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰↑↑			↑			↑↑↑↱	
Volume (vph)	0	0	0	50	521	0	0	8	0	0	1461	236
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0			5.0			5.0	
Lane Util. Factor					0.91			1.00			0.86	
Frt					1.00			1.00			0.98	
Flt Protected					1.00			1.00			1.00	
Satd. Flow (prot)					5063			1863			6274	
Flt Permitted					1.00			1.00			1.00	
Satd. Flow (perm)					5063			1863			6274	
Peak-hour factor, PHF	0.92	0.92	0.92	0.85	0.85	0.85	0.67	0.67	0.67	0.97	0.97	0.97
Adj. Flow (vph)	0	0	0	59	613	0	0	12	0	0	1506	243
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	37	0
Lane Group Flow (vph)	0	0	0	0	672	0	0	12	0	0	1712	0
Turn Type				Perm								
Protected Phases					4			2			2	
Permitted Phases				4								
Actuated Green, G (s)					27.0			43.0			43.0	
Effective Green, g (s)					27.0			43.0			43.0	
Actuated g/C Ratio					0.34			0.54			0.54	
Clearance Time (s)					5.0			5.0			5.0	
Lane Grp Cap (vph)					1709			1001			3372	
v/s Ratio Prot								0.01			c0.27	
v/s Ratio Perm					0.13							
v/c Ratio					0.39			0.01			0.51	
Uniform Delay, d1					20.2			8.6			11.8	
Progression Factor					1.00			0.37			1.00	
Incremental Delay, d2					0.7			0.0			0.5	
Delay (s)					20.9			3.2			12.3	
Level of Service					C			A			B	
Approach Delay (s)		0.0			20.9			3.2			12.3	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Niu Street & Kalakaua Ave

7/9/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰↑↑			↑			↑↑↑↱	
Volume (vph)	0	0	0	69	495	0	0	16	0	0	1838	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0			5.0			5.0	
Lane Util. Factor					0.91			1.00			0.86	
Frt					1.00			1.00			0.98	
Flt Protected					0.99			1.00			1.00	
Satd. Flow (prot)					5054			1863			6251	
Flt Permitted					0.99			1.00			1.00	
Satd. Flow (perm)					5054			1863			6251	
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.80	0.80	0.80	0.93	0.93	0.93
Adj. Flow (vph)	0	0	0	77	550	0	0	20	0	0	1976	384
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	44	0
Lane Group Flow (vph)	0	0	0	0	627	0	0	20	0	0	2316	0
Turn Type				Perm								
Protected Phases					4			2			2	
Permitted Phases				4								
Actuated Green, G (s)					27.0			43.0			43.0	
Effective Green, g (s)					27.0			43.0			43.0	
Actuated g/C Ratio					0.34			0.54			0.54	
Clearance Time (s)					5.0			5.0			5.0	
Lane Grp Cap (vph)					1706			1001			3360	
v/s Ratio Prot								0.01			c0.37	
v/s Ratio Perm					0.12							
v/c Ratio					0.37			0.02			0.69	
Uniform Delay, d1					20.0			8.6			13.6	
Progression Factor					1.00			0.44			1.00	
Incremental Delay, d2					0.6			0.0			1.2	
Delay (s)					20.7			3.8			14.8	
Level of Service					C			A			B	
Approach Delay (s)		0.0			20.7			3.8			14.8	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	15.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Ala Moana Blvd & Kalakaua Ave

7/9/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱					↱			↰↑↑↑	
Volume (vph)	0	76	582	0	0	0	0	8	6	106	1405	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.95	0.95					1.00			0.86	
Frpb, ped/bikes		1.00	1.00					0.87			1.00	
Flpb, ped/bikes		1.00	1.00					1.00			0.98	
Frt		0.88	0.85					0.94			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		1565	1504					1523			6253	
Flt Permitted		1.00	1.00					1.00			0.91	
Satd. Flow (perm)		1565	1504					1523			5680	
Peak-hour factor, PHF	0.86	0.86	0.86	0.92	0.92	0.92	0.58	0.58	0.58	0.97	0.97	0.97
Adj. Flow (vph)	0	88	677	0	0	0	0	14	10	109	1448	0
RTOR Reduction (vph)	0	19	19	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	367	360	0	0	0	0	19	0	0	1557	0
Confl. Peds. (#/hr)									123	123		
Turn Type			Prot							Perm		
Protected Phases		8	8					6			6	
Permitted Phases										6		
Actuated Green, G (s)		27.0	27.0					43.0			43.0	
Effective Green, g (s)		27.0	27.0					43.0			43.0	
Actuated g/C Ratio		0.34	0.34					0.54			0.54	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		528	508					819			3053	
v/s Ratio Prot		0.23	c0.24					0.01				
v/s Ratio Perm											c0.27	
v/c Ratio		0.70	0.71					0.02			0.51	
Uniform Delay, d1		22.9	23.1					8.7			11.8	
Progression Factor		1.00	1.00					1.00			0.24	
Incremental Delay, d2		7.4	8.1					0.1			0.5	
Delay (s)		30.3	31.2					8.7			3.3	
Level of Service		C	C					A			A	
Approach Delay (s)		30.8			0.0			8.7			3.3	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	132	728	0	0	0	0	16	9	167	1740	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.95	0.95					1.00			0.86	
Frpb, ped/bikes		1.00	1.00					0.92			1.00	
Flpb, ped/bikes		1.00	1.00					1.00			0.98	
Frt		0.90	0.85					0.95			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		1584	1504					1626			6263	
Flt Permitted		1.00	1.00					1.00			0.90	
Satd. Flow (perm)		1584	1504					1626			5634	
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.89	0.89	0.89	0.91	0.91	0.91
Adj. Flow (vph)	0	147	809	0	0	0	0	18	10	184	1912	0
RTOR Reduction (vph)	0	5	5	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	482	464	0	0	0	0	23	0	0	2096	0
Confl. Peds. (#/hr)									233	233		
Turn Type			Prot							Perm		
Protected Phases		8	8					6			6	
Permitted Phases										6		
Actuated Green, G (s)		27.0	27.0					43.0			43.0	
Effective Green, g (s)		27.0	27.0					43.0			43.0	
Actuated g/C Ratio		0.34	0.34					0.54			0.54	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		535	508					874			3028	
v/s Ratio Prot		0.30	c0.31					0.01				
v/s Ratio Perm											c0.37	
v/c Ratio		0.90	0.91					0.03			0.69	
Uniform Delay, d1		25.2	25.4					8.7			13.6	
Progression Factor		1.00	1.00					1.00			0.22	
Incremental Delay, d2		20.8	23.3					0.1			1.0	
Delay (s)		46.0	48.7					8.7			3.9	
Level of Service		D	D					A			A	
Approach Delay (s)		47.3			0.0			8.7			3.9	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	139	27	24	355	294	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	0.97	1.00		0.91	0.95	
Frpb, ped/bikes	1.00	0.91		1.00	0.92	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.94	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3433	1433		5069	3075	
Flt Permitted	0.95	1.00		0.89	1.00	
Satd. Flow (perm)	3433	1433		4541	3075	
Peak-hour factor, PHF	0.70	0.70	0.79	0.79	0.81	0.81
Adj. Flow (vph)	199	39	30	449	363	226
RTOR Reduction (vph)	0	33	0	0	71	0
Lane Group Flow (vph)	199	6	0	479	518	0
Confl. Peds. (#/hr)		75				100
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	8.9	8.9		41.1	41.1	
Effective Green, g (s)	8.9	8.9		41.1	41.1	
Actuated g/C Ratio	0.15	0.15		0.68	0.68	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	509	213		3111	2106	
v/s Ratio Prot	c0.06				c0.17	
v/s Ratio Perm		0.00		0.11		
v/c Ratio	0.39	0.03		0.15	0.25	
Uniform Delay, d1	23.1	21.8		3.3	3.6	
Progression Factor	1.00	1.00		1.00	1.37	
Incremental Delay, d2	0.5	0.1		0.1	0.3	
Delay (s)	23.6	21.9		3.4	5.2	
Level of Service	C	C		A	A	
Approach Delay (s)	23.3			3.4	5.2	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	147	37	27	530	554	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	0.97	1.00		0.91	0.95	
Frpb, ped/bikes	1.00	0.73		1.00	0.84	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.95	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3433	1163		5073	2841	
Flt Permitted	0.95	1.00		0.88	1.00	
Satd. Flow (perm)	3433	1163		4458	2841	
Peak-hour factor, PHF	0.90	0.90	0.82	0.82	0.88	0.88
Adj. Flow (vph)	163	41	33	646	630	277
RTOR Reduction (vph)	0	36	0	0	49	0
Lane Group Flow (vph)	163	5	0	679	858	0
Confl. Peds. (#/hr)		197				251
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	8.7	8.7		51.3	51.3	
Effective Green, g (s)	8.7	8.7		51.3	51.3	
Actuated g/C Ratio	0.12	0.12		0.73	0.73	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	427	145		3267	2082	
v/s Ratio Prot	c0.05				c0.30	
v/s Ratio Perm		0.00		0.15		
v/c Ratio	0.38	0.04		0.21	0.41	
Uniform Delay, d1	28.2	27.0		2.9	3.6	
Progression Factor	1.00	1.00		1.00	1.54	
Incremental Delay, d2	0.6	0.1		0.1	0.5	
Delay (s)	28.7	27.1		3.1	6.0	
Level of Service	C	C		A	A	
Approach Delay (s)	28.4			3.1	6.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	283	63	16	339	20	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.79	0.79	0.68	0.68
Hourly flow rate (vph)	349	78	20	429	29	10
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	340			234		
pX, platoon unblocked					0.90	
vC, conflicting volume			427		858	155
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			427		786	155
tC, single (s)			4.1		*5.8	*5.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		92	99
cM capacity (veh/h)			1129		365	902

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1
Volume Total	140	140	148	449	40
Volume Left	0	0	0	20	29
Volume Right	0	0	78	0	10
cSH	1700	1700	1700	1129	431
Volume to Capacity	0.08	0.08	0.09	0.02	0.09
Queue Length 95th (ft)	0	0	0	1	8
Control Delay (s)	0.0	0.0	0.0	0.6	14.2
Lane LOS				A	B
Approach Delay (s)	0.0			0.6	14.2
Approach LOS					B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

* User Entered Value

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱			↰	Y	
Volume (veh/h)	558	45	14	508	29	17
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.91	0.91	0.72	0.72
Hourly flow rate (vph)	634	51	15	558	40	24
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	341			219		
pX, platoon unblocked					0.85	
vC, conflicting volume			685		1249	237
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			685		1203	237
tC, single (s)			4.1		*5.8	*5.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		81	97
cM capacity (veh/h)			904		208	819

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1
Volume Total	254	254	178	574	64
Volume Left	0	0	0	15	40
Volume Right	0	0	51	0	24
cSH	1700	1700	1700	904	288
Volume to Capacity	0.15	0.15	0.10	0.02	0.22
Queue Length 95th (ft)	0	0	0	1	21
Control Delay (s)	0.0	0.0	0.0	0.5	21.1
Lane LOS				A	C
Approach Delay (s)	0.0			0.5	21.1
Approach LOS					C

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	48.0%	ICU Level of Service	A
Analysis Period (min)	15		

* User Entered Value

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱		↰↑	↱		↰↑	↱
Volume (vph)	116	164	10	7	264	31	18	3	10	10	11	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.71	1.00	1.00	0.91		1.00	0.87		1.00	0.77
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		0.82	1.00		0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.98	1.00
Satd. Flow (prot)	1770	1863	1130	1770	1863	1444		1464	1381		1725	1217
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.73	1.00		0.83	1.00
Satd. Flow (perm)	1770	1863	1130	1770	1863	1444		1120	1381		1475	1217
Peak-hour factor, PHF	0.76	0.76	0.76	0.82	0.82	0.82	0.89	0.89	0.89	0.73	0.73	0.73
Adj. Flow (vph)	153	216	13	9	322	38	20	3	11	14	15	100
RTOR Reduction (vph)	0	0	6	0	0	23	0	0	10	0	0	87
Lane Group Flow (vph)	153	216	7	9	322	15	0	23	1	0	29	13
Confl. Peds. (#/hr)			188			48	149		76	76		149
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases			6			2	4		4	8		8
Actuated Green, G (s)	7.4	24.6	24.6	0.9	18.1	18.1		5.8	5.8		5.8	5.8
Effective Green, g (s)	7.4	24.6	24.6	0.9	18.1	18.1		5.8	5.8		5.8	5.8
Actuated g/C Ratio	0.16	0.53	0.53	0.02	0.39	0.39		0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	283	990	600	34	728	565		140	173		185	152
v/s Ratio Prot	c0.09	0.12		0.01	c0.17							
v/s Ratio Perm			0.01			0.01		c0.02	0.00		0.02	0.01
v/c Ratio	0.54	0.22	0.01	0.26	0.44	0.03		0.16	0.01		0.16	0.08
Uniform Delay, d1	17.9	5.8	5.1	22.4	10.4	8.7		18.1	17.7		18.1	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	2.1	0.1	0.0	4.1	0.4	0.0		0.6	0.0		0.4	0.2
Delay (s)	20.0	5.9	5.1	26.5	10.8	8.7		18.6	17.7		18.5	18.1
Level of Service	B	A	A	C	B	A		B	B		B	B
Approach Delay (s)		11.5			11.0			18.4			18.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	46.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	429	36	10	355	23	22	13	16	29	9	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.47	1.00	1.00	0.81		1.00	0.71		1.00	0.59
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		0.77	1.00		0.80	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.96	1.00
Satd. Flow (prot)	1770	1863	740	1770	1863	1286		1385	1118		1429	933
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.79	1.00		0.75	1.00
Satd. Flow (perm)	1770	1863	740	1770	1863	1286		1121	1118		1115	933
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.96	0.96	0.96	0.88	0.88	0.88
Adj. Flow (vph)	120	466	39	11	394	26	23	14	17	33	10	165
RTOR Reduction (vph)	0	0	18	0	0	15	0	0	15	0	0	141
Lane Group Flow (vph)	120	466	21	11	394	11	0	37	2	0	43	24
Confl. Peds. (#/hr)			393			109	254		178	178		254
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2		2	6		6
Actuated Green, G (s)	6.7	27.1	27.1	0.9	21.3	21.3		7.2	7.2		7.2	7.2
Effective Green, g (s)	6.7	27.1	27.1	0.9	21.3	21.3		7.2	7.2		7.2	7.2
Actuated g/C Ratio	0.13	0.54	0.54	0.02	0.42	0.42		0.14	0.14		0.14	0.14
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	236	1006	399	32	790	546		161	160		160	134
v/s Ratio Prot	c0.07	c0.25		0.01	0.21							
v/s Ratio Perm			0.03			0.01		0.03	0.00		c0.04	0.03
v/c Ratio	0.51	0.46	0.05	0.34	0.50	0.02		0.23	0.02		0.27	0.18
Uniform Delay, d1	20.2	7.1	5.5	24.4	10.6	8.4		19.0	18.5		19.2	18.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	1.7	0.3	0.1	6.3	0.5	0.0		0.7	0.0		0.9	0.6
Delay (s)	21.9	7.4	5.5	30.7	11.0	8.4		19.8	18.5		20.1	19.5
Level of Service	C	A	A	C	B	A		B	B		C	B
Approach Delay (s)		10.1			11.4			19.4			19.6	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	50.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↑	↱		↱
Sign Control		Stop	Stop		Yield	
Volume (vph)	140	50	209	218	0	132
Peak Hour Factor	0.90	0.90	0.91	0.91	0.90	0.90
Hourly flow rate (vph)	156	56	230	240	0	147

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total (vph)	211	230	240	147
Volume Left (vph)	156	0	0	0
Volume Right (vph)	0	0	240	147
Hadj (s)	0.18	0.03	-0.57	-0.57
Departure Headway (s)	4.3	4.1	3.2	3.2
Degree Utilization, x	0.25	0.26	0.21	0.13
Capacity (veh/h)	822	860	1122	1121
Control Delay (s)	8.7	8.6	7.1	6.7
Approach Delay (s)	8.7	7.8		6.7
Approach LOS	A	A		A

Intersection Summary			
Delay	7.9		
HCM Level of Service	A		
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↑	↱		↱
Sign Control		Stop	Stop		Yield	
Volume (vph)	259	53	314	269	0	165
Peak Hour Factor	0.88	0.88	0.96	0.96	0.81	0.81
Hourly flow rate (vph)	294	60	327	280	0	204

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total (vph)	355	327	280	204
Volume Left (vph)	294	0	0	0
Volume Right (vph)	0	0	280	204
Hadj (s)	0.20	0.03	-0.57	-0.57
Departure Headway (s)	4.4	4.3	3.2	3.2
Degree Utilization, x	0.43	0.39	0.25	0.18
Capacity (veh/h)	802	821	1112	1121
Control Delay (s)	10.8	10.0	7.3	6.9
Approach Delay (s)	10.8	8.7		6.9
Approach LOS	B	A		A

Intersection Summary			
Delay	9.0		
HCM Level of Service	A		
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D

CAPACITY ANALYSIS CALCULATIONS PROJECTED YEAR 2022 PEAK HOUR TRAFFIC ANALYSIS WITHOUT PROJECT

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰	↑↑↑↱		↰	↑↑↑↱		↰	↰↑↱			↰↑
Volume (vph)	19	103	792	46	50	1037	38	108	16	26	31	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0		5.0	5.0			5.0
Lane Util. Factor		1.00	0.91		1.00	0.91		0.95	0.95			1.00
Frpb, ped/bikes		1.00	0.97		1.00	0.98		1.00	0.86			1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00			1.00
Frt		1.00	0.99		1.00	0.99		1.00	0.95			1.00
Flt Protected		0.95	1.00		0.95	1.00		0.95	0.98			0.99
Satd. Flow (prot)		1770	4895		1770	4951		1681	1409			1840
Flt Permitted		0.95	1.00		0.95	1.00		0.95	0.98			0.99
Satd. Flow (perm)		1770	4895		1770	4951		1681	1409			1840
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.95	0.95	0.95	0.87	0.87	0.87	0.93	0.93
Adj. Flow (vph)	21	112	861	50	53	1092	40	124	18	30	33	98
RTOR Reduction (vph)	0	0	4	0	0	3	0	0	17	0	0	0
Lane Group Flow (vph)	0	133	907	0	53	1129	0	88	67	0	0	131
Confl. Peds. (#/hr)				167			260			333		
Turn Type	Prot	Prot			Prot			Split			Split	
Protected Phases	5	5	2		1	6		3	3		4	4
Permitted Phases												
Actuated Green, G (s)		13.5	60.3		7.3	54.1		11.6	11.6			20.8
Effective Green, g (s)		13.5	60.3		7.3	54.1		11.6	11.6			20.8
Actuated g/C Ratio		0.11	0.50		0.06	0.45		0.10	0.10			0.17
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0			5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	3.0			3.0
Lane Grp Cap (vph)		199	2460		108	2232		162	136			319
v/s Ratio Prot		c0.08	0.19		0.03	c0.23		c0.05	0.05			0.07
v/s Ratio Perm												
v/c Ratio		0.67	0.37		0.49	0.51		0.54	0.49			0.41
Uniform Delay, d1		51.1	18.2		54.6	23.4		51.7	51.4			44.1
Progression Factor		1.00	1.00		1.19	0.80		1.00	1.00			1.00
Incremental Delay, d2		8.2	0.4		3.4	0.8		3.7	2.8			0.9
Delay (s)		59.3	18.7		68.1	19.5		55.4	54.2			45.0
Level of Service		E	B		E	B		E	D			D
Approach Delay (s)			23.8			21.7			54.8			56.0
Approach LOS			C			C			D			E

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	406
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.0
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.93
Adj. Flow (vph)	437
RTOR Reduction (vph)	227
Lane Group Flow (vph)	210
Confl. Peds. (#/hr)	
Turn Type	Perm
Protected Phases	
Permitted Phases	4
Actuated Green, G (s)	20.8
Effective Green, g (s)	20.8
Actuated g/C Ratio	0.17
Clearance Time (s)	5.0
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	274
v/s Ratio Prot	
v/s Ratio Perm	c0.13
v/c Ratio	0.77
Uniform Delay, d1	47.3
Progression Factor	1.00
Incremental Delay, d2	12.0
Delay (s)	59.3
Level of Service	E
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Volume (vph)	25	261	1228	26	35	73	1069	34	242	45	27	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0			5.0	5.0		5.0	5.0		
Lane Util. Factor		1.00	0.91			1.00	0.91		0.95	0.95		
Frpb, ped/bikes		1.00	0.99			1.00	0.98		1.00	0.93		
Flpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	1.00		
Frt		1.00	1.00			1.00	1.00		1.00	0.97		
Flt Protected		0.95	1.00			0.95	1.00		0.95	0.97		
Satd. Flow (prot)		1770	5015			1770	4971		1681	1566		
Flt Permitted		0.95	1.00			0.95	1.00		0.95	0.97		
Satd. Flow (perm)		1770	5015			1770	4971		1681	1566		
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.82	0.82	0.82	0.82	0.86	0.86	0.86	0.87
Adj. Flow (vph)	28	293	1380	29	43	89	1304	41	281	52	31	23
RTOR Reduction (vph)	0	0	1	0	0	0	2	0	0	6	0	0
Lane Group Flow (vph)	0	321	1408	0	0	132	1343	0	183	175	0	0
Confl. Peds. (#/hr)				291				350			471	
Turn Type	Prot	Prot			Prot	Prot			Split			Split
Protected Phases	5	5	2		1	1	6		3	3		4
Permitted Phases												
Actuated Green, G (s)		29.2	67.8			14.4	53.0		21.1	21.1		
Effective Green, g (s)		29.2	67.8			14.4	53.0		21.1	21.1		
Actuated g/C Ratio		0.21	0.48			0.10	0.38		0.15	0.15		
Clearance Time (s)		5.0	5.0			5.0	5.0		5.0	5.0		
Vehicle Extension (s)		2.0	3.0			2.0	3.0		3.0	3.0		
Lane Grp Cap (vph)		369	2429			182	1882		253	236		
v/s Ratio Prot		c0.18	0.28			0.07	c0.27		0.11	c0.11		
v/s Ratio Perm												
v/c Ratio		0.87	0.58			0.73	0.71		0.72	0.74		
Uniform Delay, d1		53.6	25.9			60.9	37.0		56.7	56.8		
Progression Factor		0.66	0.91			0.95	0.98		1.00	1.00		
Incremental Delay, d2		14.7	0.8			11.3	2.3		9.8	11.8		
Delay (s)		50.0	24.3			69.2	38.5		66.5	68.7		
Level of Service		D	C			E	D		E	E		
Approach Delay (s)			29.1				41.2			67.6		
Approach LOS			C				D			E		

Intersection Summary			
HCM Average Control Delay	42.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	100.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	77	367
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	5.0
Lane Util. Factor	1.00	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	0.99	1.00
Satd. Flow (prot)	1844	1583
Flt Permitted	0.99	1.00
Satd. Flow (perm)	1844	1583
Peak-hour factor, PHF	0.87	0.87
Adj. Flow (vph)	89	422
RTOR Reduction (vph)	0	273
Lane Group Flow (vph)	112	149
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	4	
Permitted Phases		4
Actuated Green, G (s)	16.7	16.7
Effective Green, g (s)	16.7	16.7
Actuated g/C Ratio	0.12	0.12
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	3.0	3.0
Lane Grp Cap (vph)	220	189
v/s Ratio Prot	0.06	
v/s Ratio Perm		c0.09
v/c Ratio	0.51	0.79
Uniform Delay, d1	57.8	59.9
Progression Factor	1.00	1.00
Incremental Delay, d2	1.9	19.2
Delay (s)	59.7	79.2
Level of Service	E	E
Approach Delay (s)	75.1	
Approach LOS	E	

Intersection Summary

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑↱		↰	↑↑↑	↰	↱
Volume (vph)	845	65	26	1058	46	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	0.86		1.00	0.91	1.00	1.00
Frpb, ped/bikes	0.97		1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	6136		1770	5085	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	6136		1770	5085	1770	1583
Peak-hour factor, PHF	0.87	0.87	0.93	0.93	0.84	0.84
Adj. Flow (vph)	971	75	28	1138	55	42
RTOR Reduction (vph)	5	0	0	0	0	39
Lane Group Flow (vph)	1041	0	28	1138	55	3
Confl. Peds. (#/hr)		116				
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	91.9		5.1	102.0	8.0	8.0
Effective Green, g (s)	91.9		5.1	102.0	8.0	8.0
Actuated g/C Ratio	0.77		0.04	0.85	0.07	0.07
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	4699		75	4322	118	106
v/s Ratio Prot	0.17		0.02	c0.22	c0.03	
v/s Ratio Perm						0.00
v/c Ratio	0.22		0.37	0.26	0.47	0.03
Uniform Delay, d1	4.0		55.9	1.7	53.9	52.4
Progression Factor	0.72		0.97	0.45	1.00	1.00
Incremental Delay, d2	0.1		2.8	0.1	2.9	0.1
Delay (s)	3.0		56.8	0.9	56.8	52.5
Level of Service	A		E	A	E	D
Approach Delay (s)	3.0			2.3	54.9	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	4.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	34.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	tttt>		↰	↑↑↑	↰	↱
Volume (vph)	1268	39	35	1062	48	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	0.86		1.00	0.91	1.00	1.00
Frpb, ped/bikes	0.98		1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	6259		1770	5085	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	6259		1770	5085	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.91	0.91	0.76	0.76
Adj. Flow (vph)	1378	42	38	1167	63	96
RTOR Reduction (vph)	2	0	0	0	0	89
Lane Group Flow (vph)	1418	0	38	1167	63	7
Confl. Peds. (#/hr)		263				
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	107.3		7.3	119.6	10.4	10.4
Effective Green, g (s)	107.3		7.3	119.6	10.4	10.4
Actuated g/C Ratio	0.77		0.05	0.85	0.07	0.07
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	4797		92	4344	131	118
v/s Ratio Prot	c0.23		c0.02	0.23	c0.04	
v/s Ratio Perm						0.00
v/c Ratio	0.30		0.41	0.27	0.48	0.06
Uniform Delay, d1	4.9		64.3	1.9	62.2	60.3
Progression Factor	0.08		1.02	0.44	1.00	1.00
Incremental Delay, d2	0.1		2.4	0.1	2.8	0.2
Delay (s)	0.5		68.2	1.0	65.0	60.5
Level of Service	A		E	A	E	E
Approach Delay (s)	0.5			3.1	62.3	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	17	23	573	258	156	538	42	384	51	59	9	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0		5.0
Lane Util. Factor		1.00	0.95	0.88	1.00	0.91		0.95	0.95	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.98		1.00	1.00	0.82		0.88
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		0.92
Flt Protected		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		1.00
Satd. Flow (prot)		1770	3539	2787	1770	4937		1681	1704	1292		1510
Flt Permitted		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		1.00
Satd. Flow (perm)		1770	3539	2787	1770	4937		1681	1704	1292		1510
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.92	0.92	0.92	0.86	0.86	0.86	0.81	0.81
Adj. Flow (vph)	19	26	644	290	170	585	46	447	59	69	11	78
RTOR Reduction (vph)	0	0	0	128	0	7	0	0	0	56	0	40
Lane Group Flow (vph)	0	45	644	162	170	624	0	250	256	13	0	163
Confl. Peds. (#/hr)							63			78		
Turn Type	Prot	Prot		pt+ov	Prot			Split		Perm	Split	
Protected Phases	5	5	2	2 3	1	6		3	3		4	4
Permitted Phases										3		
Actuated Green, G (s)		6.3	43.9	67.2	15.9	53.5		23.3	23.3	23.3		16.9
Effective Green, g (s)		6.3	43.9	67.2	15.9	53.5		23.3	23.3	23.3		16.9
Actuated g/C Ratio		0.05	0.37	0.56	0.13	0.45		0.19	0.19	0.19		0.14
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0	5.0		5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0
Lane Grp Cap (vph)		93	1295	1561	235	2201		326	331	251		213
v/s Ratio Prot		0.03	c0.18	0.06	c0.10	0.13		0.15	c0.15			c0.11
v/s Ratio Perm										0.01		
v/c Ratio		0.48	0.50	0.10	0.72	0.28		0.77	0.77	0.05		0.76
Uniform Delay, d1		55.3	29.5	12.3	49.9	21.1		45.8	45.8	39.4		49.6
Progression Factor		1.25	0.47	0.21	1.00	1.00		0.92	0.93	0.87		1.00
Incremental Delay, d2		3.9	1.4	0.0	10.5	0.3		10.3	10.7	0.1		14.9
Delay (s)		72.7	15.1	2.6	60.4	21.4		52.6	53.1	34.2		64.6
Level of Service		E	B	A	E	C		D	D	C		E
Approach Delay (s)			14.1			29.7			50.6			64.6
Approach LOS			B			C			D			E

Intersection Summary			
HCM Average Control Delay	31.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	92
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.81
Adj. Flow (vph)	114
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	92
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	20	63	694	507	191	579	58	444	110	123	11	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0		5.0
Lane Util. Factor		1.00	0.95	0.88	1.00	0.91		0.95	0.95	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.98		1.00	1.00	0.72		0.86
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		0.95
Flt Protected		0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00		1.00
Satd. Flow (prot)		1770	3539	2787	1770	4894		1681	1718	1142		1517
Flt Permitted		0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00		1.00
Satd. Flow (perm)		1770	3539	2787	1770	4894		1681	1718	1142		1517
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.84	0.84	0.84	0.82	0.82	0.82	0.89	0.89
Adj. Flow (vph)	22	68	754	551	227	689	69	541	134	150	12	112
RTOR Reduction (vph)	0	0	0	47	0	7	0	0	0	117	0	17
Lane Group Flow (vph)	0	90	754	504	227	751	0	335	340	33	0	181
Confl. Peds. (#/hr)							90			123		
Turn Type	Prot	Prot		pt+ov	Prot			Split		Perm	Split	
Protected Phases	5	5	2	2 3	1	6		3	3		4	4
Permitted Phases										3		
Actuated Green, G (s)		11.8	46.0	77.2	21.4	55.6		31.2	31.2	31.2		21.4
Effective Green, g (s)		11.8	46.0	77.2	21.4	55.6		31.2	31.2	31.2		21.4
Actuated g/C Ratio		0.08	0.33	0.55	0.15	0.40		0.22	0.22	0.22		0.15
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0	5.0		5.0
Vehicle Extension (s)		3.0	3.0		2.0	3.0		2.0	2.0	2.0		2.5
Lane Grp Cap (vph)		149	1163	1537	271	1944		375	383	255		232
v/s Ratio Prot		0.05	c0.21	0.18	c0.13	0.15		c0.20	0.20			c0.12
v/s Ratio Perm										0.03		
v/c Ratio		0.60	0.65	0.33	0.84	0.39		0.89	0.89	0.13		0.78
Uniform Delay, d1		61.8	40.1	17.2	57.6	30.0		52.8	52.7	43.5		57.0
Progression Factor		0.83	0.82	1.97	1.00	1.00		0.95	0.95	0.92		1.00
Incremental Delay, d2		6.6	2.7	0.0	18.9	0.6		21.9	20.5	0.1		15.0
Delay (s)		57.7	35.7	33.8	76.5	30.6		72.2	70.8	40.4		72.1
Level of Service		E	D	C	E	C		E	E	D		E
Approach Delay (s)			36.4			41.2			65.8			72.1
Approach LOS			D			D			E			E

Intersection Summary			
HCM Average Control Delay	47.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	66
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.89
Adj. Flow (vph)	74
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	459
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰↑↑			↑			↑↑↑↱	
Volume (vph)	0	0	0	50	521	0	0	8	0	0	1510	236
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0			5.0			5.0	
Lane Util. Factor					0.91			1.00			0.86	
Frt					1.00			1.00			0.98	
Flt Protected					1.00			1.00			1.00	
Satd. Flow (prot)					5063			1863			6278	
Flt Permitted					1.00			1.00			1.00	
Satd. Flow (perm)					5063			1863			6278	
Peak-hour factor, PHF	0.92	0.92	0.92	0.85	0.85	0.85	0.67	0.67	0.67	0.97	0.97	0.97
Adj. Flow (vph)	0	0	0	59	613	0	0	12	0	0	1557	243
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	35	0
Lane Group Flow (vph)	0	0	0	0	672	0	0	12	0	0	1765	0
Turn Type				Perm								
Protected Phases					4			2			2	
Permitted Phases				4								
Actuated Green, G (s)					27.0			43.0			43.0	
Effective Green, g (s)					27.0			43.0			43.0	
Actuated g/C Ratio					0.34			0.54			0.54	
Clearance Time (s)					5.0			5.0			5.0	
Lane Grp Cap (vph)					1709			1001			3374	
v/s Ratio Prot								0.01			c0.28	
v/s Ratio Perm					0.13							
v/c Ratio					0.39			0.01			0.52	
Uniform Delay, d1					20.2			8.6			11.9	
Progression Factor					1.00			0.38			1.00	
Incremental Delay, d2					0.7			0.0			0.6	
Delay (s)					20.9			3.3			12.5	
Level of Service					C			A			B	
Approach Delay (s)		0.0			20.9			3.3			12.5	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰↑↑			↑			↑↑↑↱	
Volume (vph)	0	0	0	69	495	0	0	16	0	0	1889	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0			5.0			5.0	
Lane Util. Factor					0.91			1.00			0.86	
Frt					1.00			1.00			0.98	
Flt Protected					0.99			1.00			1.00	
Satd. Flow (prot)					5054			1863			6255	
Flt Permitted					0.99			1.00			1.00	
Satd. Flow (perm)					5054			1863			6255	
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.80	0.80	0.80	0.93	0.93	0.93
Adj. Flow (vph)	0	0	0	77	550	0	0	20	0	0	2031	384
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	43	0
Lane Group Flow (vph)	0	0	0	0	627	0	0	20	0	0	2372	0
Turn Type				Perm								
Protected Phases					4			2			2	
Permitted Phases				4								
Actuated Green, G (s)					27.0			43.0			43.0	
Effective Green, g (s)					27.0			43.0			43.0	
Actuated g/C Ratio					0.34			0.54			0.54	
Clearance Time (s)					5.0			5.0			5.0	
Lane Grp Cap (vph)					1706			1001			3362	
v/s Ratio Prot								0.01			c0.38	
v/s Ratio Perm					0.12							
v/c Ratio					0.37			0.02			0.71	
Uniform Delay, d1					20.0			8.6			13.8	
Progression Factor					1.00			0.44			1.00	
Incremental Delay, d2					0.6			0.0			1.3	
Delay (s)					20.7			3.8			15.1	
Level of Service					C			A			B	
Approach Delay (s)		0.0			20.7			3.8			15.1	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱	↱					↑↱			↰↑↑↑	
Volume (vph)	0	76	582	0	0	0	0	8	6	106	1454	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.95	0.95					1.00			0.86	
Frpb, ped/bikes		1.00	1.00					0.94			1.00	
Flpb, ped/bikes		1.00	1.00					1.00			0.99	
Frt		0.88	0.85					0.94			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		1565	1504					1661			6338	
Flt Permitted		1.00	1.00					1.00			0.91	
Satd. Flow (perm)		1565	1504					1661			5762	
Peak-hour factor, PHF	0.86	0.86	0.86	0.92	0.92	0.92	0.58	0.58	0.58	0.97	0.97	0.97
Adj. Flow (vph)	0	88	677	0	0	0	0	14	10	109	1499	0
RTOR Reduction (vph)	0	17	17	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	369	362	0	0	0	0	19	0	0	1608	0
Confl. Peds. (#/hr)									123	123		
Turn Type			Prot							Perm		
Protected Phases		8	8					6			6	
Permitted Phases										6		
Actuated Green, G (s)		27.0	27.0					43.0			43.0	
Effective Green, g (s)		27.0	27.0					43.0			43.0	
Actuated g/C Ratio		0.34	0.34					0.54			0.54	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		528	508					893			3097	
v/s Ratio Prot		0.24	c0.24					0.01				
v/s Ratio Perm											c0.28	
v/c Ratio		0.70	0.71					0.02			0.52	
Uniform Delay, d1		23.0	23.1					8.7			11.9	
Progression Factor		1.00	1.00					1.00			0.23	
Incremental Delay, d2		7.5	8.3					0.0			0.5	
Delay (s)		30.5	31.4					8.7			3.3	
Level of Service		C	C					A			A	
Approach Delay (s)		31.0			0.0			8.7			3.3	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	55.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	132	728	0	0	0	0	16	9	167	1791	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.95	0.95					1.00			0.86	
Frpb, ped/bikes		1.00	1.00					0.92			1.00	
Flpb, ped/bikes		1.00	1.00					1.00			0.98	
Frt		0.90	0.85					0.95			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		1584	1504					1626			6267	
Flt Permitted		1.00	1.00					1.00			0.90	
Satd. Flow (perm)		1584	1504					1626			5642	
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.89	0.89	0.89	0.91	0.91	0.91
Adj. Flow (vph)	0	147	809	0	0	0	0	18	10	184	1968	0
RTOR Reduction (vph)	0	5	5	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	482	464	0	0	0	0	23	0	0	2152	0
Confl. Peds. (#/hr)									233	233		
Turn Type			Prot							Perm		
Protected Phases		8	8					6			6	
Permitted Phases										6		
Actuated Green, G (s)		27.0	27.0					43.0			43.0	
Effective Green, g (s)		27.0	27.0					43.0			43.0	
Actuated g/C Ratio		0.34	0.34					0.54			0.54	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		535	508					874			3033	
v/s Ratio Prot		0.30	c0.31					0.01				
v/s Ratio Perm											c0.38	
v/c Ratio		0.90	0.91					0.03			0.71	
Uniform Delay, d1		25.2	25.4					8.7			13.8	
Progression Factor		1.00	1.00					1.00			0.21	
Incremental Delay, d2		20.9	23.5					0.1			1.0	
Delay (s)		46.2	48.9					8.7			4.0	
Level of Service		D	D					A			A	
Approach Delay (s)		47.5			0.0			8.7			4.0	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↰	↱		↰↑↑	↑↱	
Volume (vph)	139	27	24	355	294	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	0.97	1.00		0.91	0.95	
Frpb, ped/bikes	1.00	0.91		1.00	0.92	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.94	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3433	1433		5069	3075	
Flt Permitted	0.95	1.00		0.89	1.00	
Satd. Flow (perm)	3433	1433		4541	3075	
Peak-hour factor, PHF	0.70	0.70	0.79	0.79	0.81	0.81
Adj. Flow (vph)	199	39	30	449	363	226
RTOR Reduction (vph)	0	33	0	0	71	0
Lane Group Flow (vph)	199	6	0	479	518	0
Confl. Peds. (#/hr)		75				100
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	8.9	8.9		41.1	41.1	
Effective Green, g (s)	8.9	8.9		41.1	41.1	
Actuated g/C Ratio	0.15	0.15		0.68	0.68	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	509	213		3111	2106	
v/s Ratio Prot	c0.06				c0.17	
v/s Ratio Perm		0.00		0.11		
v/c Ratio	0.39	0.03		0.15	0.25	
Uniform Delay, d1	23.1	21.8		3.3	3.6	
Progression Factor	1.00	1.00		1.00	1.13	
Incremental Delay, d2	0.5	0.1		0.1	0.3	
Delay (s)	23.6	21.9		3.4	4.3	
Level of Service	C	C		A	A	
Approach Delay (s)	23.3			3.4	4.3	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↰	↱		↰↑↑	↑↱	
Volume (vph)	147	37	27	530	554	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	0.97	1.00		0.91	0.95	
Frpb, ped/bikes	1.00	0.73		1.00	0.84	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.95	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3433	1163		5073	2841	
Flt Permitted	0.95	1.00		0.88	1.00	
Satd. Flow (perm)	3433	1163		4458	2841	
Peak-hour factor, PHF	0.90	0.90	0.82	0.82	0.88	0.88
Adj. Flow (vph)	163	41	33	646	630	277
RTOR Reduction (vph)	0	36	0	0	49	0
Lane Group Flow (vph)	163	5	0	679	858	0
Confl. Peds. (#/hr)		197				251
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	8.7	8.7		51.3	51.3	
Effective Green, g (s)	8.7	8.7		51.3	51.3	
Actuated g/C Ratio	0.12	0.12		0.73	0.73	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	427	145		3267	2082	
v/s Ratio Prot	c0.05				c0.30	
v/s Ratio Perm		0.00		0.15		
v/c Ratio	0.38	0.04		0.21	0.41	
Uniform Delay, d1	28.2	27.0		2.9	3.6	
Progression Factor	1.00	1.00		1.00	1.53	
Incremental Delay, d2	0.6	0.1		0.1	0.5	
Delay (s)	28.7	27.1		3.1	6.0	
Level of Service	C	C		A	A	
Approach Delay (s)	28.4			3.1	6.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱			↰	Y	
Volume (veh/h)	283	63	16	339	20	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.79	0.79	0.68	0.68
Hourly flow rate (vph)	349	78	20	429	29	10
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	340			234		
pX, platoon unblocked					0.87	
vC, conflicting volume			427		858	155
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			427		765	155
tC, single (s)			4.1		*5.8	*5.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		92	99
cM capacity (veh/h)			1129		363	902

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1
Volume Total	140	140	148	449	40
Volume Left	0	0	0	20	29
Volume Right	0	0	78	0	10
cSH	1700	1700	1700	1129	430
Volume to Capacity	0.08	0.08	0.09	0.02	0.09
Queue Length 95th (ft)	0	0	0	1	8
Control Delay (s)	0.0	0.0	0.0	0.6	14.2
Lane LOS				A	B
Approach Delay (s)	0.0			0.6	14.2
Approach LOS					B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

* User Entered Value

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↰	Y	
Volume (veh/h)	558	45	14	508	29	17
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.91	0.91	0.72	0.72
Hourly flow rate (vph)	634	51	15	558	40	24
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	341			219		
pX, platoon unblocked					0.84	
vC, conflicting volume			685		1249	237
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			685		1202	237
tC, single (s)			4.1		*5.8	*5.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		81	97
cM capacity (veh/h)			904		208	819

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1
Volume Total	254	254	178	574	64
Volume Left	0	0	0	15	40
Volume Right	0	0	51	0	24
cSH	1700	1700	1700	904	287
Volume to Capacity	0.15	0.15	0.10	0.02	0.22
Queue Length 95th (ft)	0	0	0	1	21
Control Delay (s)	0.0	0.0	0.0	0.5	21.1
Lane LOS				A	C
Approach Delay (s)	0.0			0.5	21.1
Approach LOS					C

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	48.0%	ICU Level of Service	A
Analysis Period (min)	15		

* User Entered Value

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱		↰↑	↱		↰↑	↱
Volume (vph)	116	164	10	7	264	31	18	3	10	10	11	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.71	1.00	1.00	0.91		1.00	0.87		1.00	0.77
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		0.82	1.00		0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.98	1.00
Satd. Flow (prot)	1770	1863	1130	1770	1863	1444		1464	1381		1725	1217
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.73	1.00		0.83	1.00
Satd. Flow (perm)	1770	1863	1130	1770	1863	1444		1120	1381		1475	1217
Peak-hour factor, PHF	0.76	0.76	0.76	0.82	0.82	0.82	0.89	0.89	0.89	0.73	0.73	0.73
Adj. Flow (vph)	153	216	13	9	322	38	20	3	11	14	15	100
RTOR Reduction (vph)	0	0	6	0	0	23	0	0	10	0	0	87
Lane Group Flow (vph)	153	216	7	9	322	15	0	23	1	0	29	13
Confl. Peds. (#/hr)			188			48	149		76	76		149
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases			6			2	4		4	8		8
Actuated Green, G (s)	7.4	24.6	24.6	0.9	18.1	18.1		5.8	5.8		5.8	5.8
Effective Green, g (s)	7.4	24.6	24.6	0.9	18.1	18.1		5.8	5.8		5.8	5.8
Actuated g/C Ratio	0.16	0.53	0.53	0.02	0.39	0.39		0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	283	990	600	34	728	565		140	173		185	152
v/s Ratio Prot	c0.09	0.12		0.01	c0.17							
v/s Ratio Perm			0.01			0.01		c0.02	0.00		0.02	0.01
v/c Ratio	0.54	0.22	0.01	0.26	0.44	0.03		0.16	0.01		0.16	0.08
Uniform Delay, d1	17.9	5.8	5.1	22.4	10.4	8.7		18.1	17.7		18.1	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	2.1	0.1	0.0	4.1	0.4	0.0		0.6	0.0		0.4	0.2
Delay (s)	20.0	5.9	5.1	26.5	10.8	8.7		18.6	17.7		18.5	18.1
Level of Service	B	A	A	C	B	A		B	B		B	B
Approach Delay (s)		11.5			11.0			18.4			18.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	46.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱		↰↑	↱		↰↑	↱
Volume (vph)	110	429	36	10	355	23	22	13	16	29	9	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.47	1.00	1.00	0.81		1.00	0.71		1.00	0.59
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		0.77	1.00		0.80	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.96	1.00
Satd. Flow (prot)	1770	1863	740	1770	1863	1286		1385	1118		1429	933
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.79	1.00		0.75	1.00
Satd. Flow (perm)	1770	1863	740	1770	1863	1286		1121	1118		1115	933
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.96	0.96	0.96	0.88	0.88	0.88
Adj. Flow (vph)	120	466	39	11	394	26	23	14	17	33	10	165
RTOR Reduction (vph)	0	0	18	0	0	15	0	0	15	0	0	141
Lane Group Flow (vph)	120	466	21	11	394	11	0	37	2	0	43	24
Confl. Peds. (#/hr)			393			109	254		178	178		254
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2		2	6		6
Actuated Green, G (s)	6.7	27.1	27.1	0.9	21.3	21.3		7.2	7.2		7.2	7.2
Effective Green, g (s)	6.7	27.1	27.1	0.9	21.3	21.3		7.2	7.2		7.2	7.2
Actuated g/C Ratio	0.13	0.54	0.54	0.02	0.42	0.42		0.14	0.14		0.14	0.14
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	236	1006	399	32	790	546		161	160		160	134
v/s Ratio Prot	c0.07	c0.25		0.01	0.21							
v/s Ratio Perm			0.03			0.01		0.03	0.00		c0.04	0.03
v/c Ratio	0.51	0.46	0.05	0.34	0.50	0.02		0.23	0.02		0.27	0.18
Uniform Delay, d1	20.2	7.1	5.5	24.4	10.6	8.4		19.0	18.5		19.2	18.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	1.7	0.3	0.1	6.3	0.5	0.0		0.7	0.0		0.9	0.6
Delay (s)	21.9	7.4	5.5	30.7	11.0	8.4		19.8	18.5		20.1	19.5
Level of Service	C	A	A	C	B	A		B	B		C	B
Approach Delay (s)		10.1			11.4			19.4			19.6	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	50.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Kalia & Saratoga

9/13/2010

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	140	50	209	218	53	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes		0.98	1.00	1.00	1.00	1.00
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		0.96	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1766	1863	1530	1770	1583
Flt Permitted		0.64	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1179	1863	1530	1770	1583
Peak-hour factor, PHF	0.90	0.90	0.91	0.91	0.90	0.90
Adj. Flow (vph)	156	56	230	240	59	147
RTOR Reduction (vph)	0	0	0	0	0	113
Lane Group Flow (vph)	0	212	230	240	59	34
Confl. Peds. (#/hr)	73			73		
Turn Type	Perm			Free		Perm
Protected Phases		4	8		6	
Permitted Phases	4			Free		6
Actuated Green, G (s)		8.0	8.0	23.4	5.4	5.4
Effective Green, g (s)		8.0	8.0	23.4	5.4	5.4
Actuated g/C Ratio		0.34	0.34	1.00	0.23	0.23
Clearance Time (s)		5.0	5.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		403	637	1530	408	365
v/s Ratio Prot			0.12		0.03	
v/s Ratio Perm		c0.18		c0.16		0.02
v/c Ratio		0.53	0.36	0.16	0.14	0.09
Uniform Delay, d1		6.2	5.8	0.0	7.2	7.1
Progression Factor		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.2	0.4	0.2	0.2	0.1
Delay (s)		7.4	6.1	0.2	7.3	7.2
Level of Service		A	A	A	A	A
Approach Delay (s)		7.4	3.1		7.2	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	23.4	Sum of lost time (s)	5.0
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
	↗	→	←	↖	↘	↙
Lane Configurations		↰	↑	↱	↰	↱
Volume (vph)	259	53	314	269	56	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00	0.95	1.00	1.00
Flpb, ped/bikes		0.95	1.00	1.00	1.00	1.00
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		0.96	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1702	1863	1499	1770	1583
Flt Permitted		0.56	1.00	1.00	0.95	1.00
Satd. Flow (perm)		998	1863	1499	1770	1583
Peak-hour factor, PHF	0.88	0.88	0.96	0.96	0.81	0.81
Adj. Flow (vph)	294	60	327	280	69	204
RTOR Reduction (vph)	0	0	0	0	0	171
Lane Group Flow (vph)	0	354	327	280	69	33
Confl. Peds. (#/hr)	140			140		
Turn Type	Perm			Free		Perm
Protected Phases		4	8		6	
Permitted Phases	4			Free		6
Actuated Green, G (s)		19.5	19.5	35.1	5.6	5.6
Effective Green, g (s)		19.5	19.5	35.1	5.6	5.6
Actuated g/C Ratio		0.56	0.56	1.00	0.16	0.16
Clearance Time (s)		5.0	5.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		554	1035	1499	282	253
v/s Ratio Prot			0.18		0.04	
v/s Ratio Perm		c0.35		c0.19		0.02
v/c Ratio		0.64	0.32	0.19	0.24	0.13
Uniform Delay, d1		5.4	4.2	0.0	12.9	12.7
Progression Factor		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.4	0.2	0.3	0.5	0.2
Delay (s)		7.8	4.4	0.3	13.4	12.9
Level of Service		A	A	A	B	B
Approach Delay (s)		7.8	2.5		13.0	
Approach LOS		A	A		B	

Intersection Summary			
HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	35.1	Sum of lost time (s)	5.0
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX E

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2022 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰	↑↑↱		↰	↑↑↱		↰	↰↑↱			↰↑
Volume (vph)	19	103	886	46	50	1118	38	108	16	26	31	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0		5.0	5.0			5.0
Lane Util. Factor		1.00	0.91		1.00	0.91		0.95	0.95			1.00
Frpb, ped/bikes		1.00	0.97		1.00	0.98		1.00	0.86			1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00			1.00
Frt		1.00	0.99		1.00	1.00		1.00	0.95			1.00
Flt Protected		0.95	1.00		0.95	1.00		0.95	0.98			0.99
Satd. Flow (prot)		1770	4914		1770	4960		1681	1409			1840
Flt Permitted		0.95	1.00		0.95	1.00		0.95	0.98			0.99
Satd. Flow (perm)		1770	4914		1770	4960		1681	1409			1840
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.95	0.95	0.95	0.87	0.87	0.87	0.93	0.93
Adj. Flow (vph)	21	112	963	50	53	1177	40	124	18	30	33	98
RTOR Reduction (vph)	0	0	3	0	0	2	0	0	17	0	0	0
Lane Group Flow (vph)	0	133	1010	0	53	1215	0	88	67	0	0	131
Confl. Peds. (#/hr)				167			260			333		
Turn Type	Prot	Prot			Prot			Split			Split	
Protected Phases	5	5	2		1	6		3	3		4	4
Permitted Phases												
Actuated Green, G (s)		13.4	60.3		7.3	54.2		11.6	11.6			20.8
Effective Green, g (s)		13.4	60.3		7.3	54.2		11.6	11.6			20.8
Actuated g/C Ratio		0.11	0.50		0.06	0.45		0.10	0.10			0.17
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0			5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	3.0			3.0
Lane Grp Cap (vph)		198	2469		108	2240		162	136			319
v/s Ratio Prot		c0.08	0.21		0.03	c0.24		c0.05	0.05			0.07
v/s Ratio Perm												
v/c Ratio		0.67	0.41		0.49	0.54		0.54	0.49			0.41
Uniform Delay, d1		51.2	18.7		54.6	23.9		51.7	51.4			44.1
Progression Factor		1.00	1.00		1.33	0.46		1.00	1.00			1.00
Incremental Delay, d2		8.6	0.5		3.4	0.9		3.7	2.8			0.9
Delay (s)		59.8	19.2		76.0	11.9		55.4	54.2			45.0
Level of Service		E	B		E	B		E	D			D
Approach Delay (s)			23.9			14.5			54.8			56.0
Approach LOS			C			B			D			E

Intersection Summary			
HCM Average Control Delay	27.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	406
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.0
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.93
Adj. Flow (vph)	437
RTOR Reduction (vph)	227
Lane Group Flow (vph)	210
Confl. Peds. (#/hr)	
Turn Type	Perm
Protected Phases	
Permitted Phases	4
Actuated Green, G (s)	20.8
Effective Green, g (s)	20.8
Actuated g/C Ratio	0.17
Clearance Time (s)	5.0
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	274
v/s Ratio Prot	
v/s Ratio Perm	c0.13
v/c Ratio	0.77
Uniform Delay, d1	47.3
Progression Factor	1.00
Incremental Delay, d2	12.0
Delay (s)	59.3
Level of Service	E
Approach Delay (s)	
Approach LOS	

Intersection Summary

HCM Signalized Intersection Capacity Analysis
2: Ala Moana Blvd & Hobron Road

9/10/2010

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations		↰	↑↑↑↱			↰	↑↑↑↱		↰	↰↑↱		
Volume (vph)	25	261	1331	26	35	73	1159	34	242	45	27	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0			5.0	5.0		5.0	5.0		
Lane Util. Factor		1.00	0.91			1.00	0.91		0.95	0.95		
Frpb, ped/bikes		1.00	0.99			1.00	0.98		1.00	0.93		
Flpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	1.00		
Frt		1.00	1.00			1.00	1.00		1.00	0.97		
Flt Protected		0.95	1.00			0.95	1.00		0.95	0.97		
Satd. Flow (prot)		1770	5020			1770	4980		1681	1566		
Flt Permitted		0.95	1.00			0.95	1.00		0.95	0.97		
Satd. Flow (perm)		1770	5020			1770	4980		1681	1566		
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.82	0.82	0.82	0.82	0.86	0.86	0.86	0.87
Adj. Flow (vph)	28	293	1496	29	43	89	1413	41	281	52	31	23
RTOR Reduction (vph)	0	0	1	0	0	0	2	0	0	6	0	0
Lane Group Flow (vph)	0	321	1524	0	0	132	1452	0	183	175	0	0
Confl. Peds. (#/hr)				291				350			471	
Turn Type	Prot	Prot			Prot	Prot			Split			Split
Protected Phases	5	5	2		1	1	6		3	3		4
Permitted Phases												
Actuated Green, G (s)		30.0	68.2			14.0	52.2		21.1	21.1		
Effective Green, g (s)		30.0	68.2			14.0	52.2		21.1	21.1		
Actuated g/C Ratio		0.21	0.49			0.10	0.37		0.15	0.15		
Clearance Time (s)		5.0	5.0			5.0	5.0		5.0	5.0		
Vehicle Extension (s)		2.0	3.0			2.0	3.0		3.0	3.0		
Lane Grp Cap (vph)		379	2445			177	1857		253	236		
v/s Ratio Prot		c0.18	0.30			0.07	c0.29		0.11	c0.11		
v/s Ratio Perm												
v/c Ratio		0.85	0.62			0.75	0.78		0.72	0.74		
Uniform Delay, d1		52.8	26.4			61.3	38.9		56.7	56.8		
Progression Factor		1.05	0.65			1.02	1.03		1.00	1.00		
Incremental Delay, d2		12.3	0.9			13.6	3.3		9.8	11.8		
Delay (s)		67.6	18.1			76.2	43.3		66.5	68.7		
Level of Service		E	B			E	D		E	E		
Approach Delay (s)			26.7				46.1			67.6		
Approach LOS			C				D			E		

Intersection Summary			
HCM Average Control Delay	43.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	101.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	77	367
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	5.0
Lane Util. Factor	1.00	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	0.99	1.00
Satd. Flow (prot)	1844	1583
Flt Permitted	0.99	1.00
Satd. Flow (perm)	1844	1583
Peak-hour factor, PHF	0.87	0.87
Adj. Flow (vph)	89	422
RTOR Reduction (vph)	0	273
Lane Group Flow (vph)	112	149
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	4	
Permitted Phases		4
Actuated Green, G (s)	16.7	16.7
Effective Green, g (s)	16.7	16.7
Actuated g/C Ratio	0.12	0.12
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	3.0	3.0
Lane Grp Cap (vph)	220	189
v/s Ratio Prot	0.06	
v/s Ratio Perm		c0.09
v/c Ratio	0.51	0.79
Uniform Delay, d1	57.8	59.9
Progression Factor	1.00	1.00
Incremental Delay, d2	1.9	19.2
Delay (s)	59.7	79.2
Level of Service	E	E
Approach Delay (s)	75.1	
Approach LOS	E	

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑↱		↰	↑↑↑	↰	↱
Volume (vph)	928	76	30	1133	52	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	0.86		1.00	0.91	1.00	1.00
Frpb, ped/bikes	0.97		1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	6122		1770	5085	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	6122		1770	5085	1770	1583
Peak-hour factor, PHF	0.87	0.87	0.93	0.93	0.84	0.84
Adj. Flow (vph)	1067	87	32	1218	62	46
RTOR Reduction (vph)	6	0	0	0	0	43
Lane Group Flow (vph)	1148	0	32	1218	62	3
Confl. Peds. (#/hr)		116				
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	91.3		5.3	101.6	8.4	8.4
Effective Green, g (s)	91.3		5.3	101.6	8.4	8.4
Actuated g/C Ratio	0.76		0.04	0.85	0.07	0.07
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	4658		78	4305	124	111
v/s Ratio Prot	0.19		0.02	c0.24	c0.04	
v/s Ratio Perm						0.00
v/c Ratio	0.25		0.41	0.28	0.50	0.03
Uniform Delay, d1	4.2		55.8	1.9	53.8	52.0
Progression Factor	0.25		0.94	2.53	1.00	1.00
Incremental Delay, d2	0.1		3.0	0.1	3.1	0.1
Delay (s)	1.2		55.2	4.8	56.9	52.1
Level of Service	A		E	A	E	D
Approach Delay (s)	1.2			6.1	54.9	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	36.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑↱		↰	↑↑↑	↰	↱
Volume (vph)	1363	47	43	1146	54	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	0.86		1.00	0.91	1.00	1.00
Frpb, ped/bikes	0.98		1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	6241		1770	5085	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	6241		1770	5085	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.91	0.91	0.76	0.76
Adj. Flow (vph)	1482	51	47	1259	71	107
RTOR Reduction (vph)	2	0	0	0	0	99
Lane Group Flow (vph)	1531	0	47	1259	71	8
Confl. Peds. (#/hr)		263				
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	106.0		8.0	119.0	11.0	11.0
Effective Green, g (s)	106.0		8.0	119.0	11.0	11.0
Actuated g/C Ratio	0.76		0.06	0.85	0.08	0.08
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	4725		101	4322	139	124
v/s Ratio Prot	c0.25		c0.03	0.25	c0.04	
v/s Ratio Perm						0.01
v/c Ratio	0.32		0.47	0.29	0.51	0.07
Uniform Delay, d1	5.5		63.9	2.1	61.9	59.8
Progression Factor	0.06		1.08	0.59	1.00	1.00
Incremental Delay, d2	0.1		2.4	0.1	3.1	0.2
Delay (s)	0.5		71.7	1.4	65.1	60.0
Level of Service	A		E	A	E	E
Approach Delay (s)	0.5			3.9	62.0	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	5.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰	↑↑	↱↱	↰	↑↑↑↱		↰	↰↑	↱		↰↑↱
Volume (vph)	17	23	577	341	206	542	42	459	61	70	9	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0		5.0
Lane Util. Factor		1.00	0.95	0.88	1.00	0.91		0.95	0.95	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.98		1.00	1.00	0.82		0.89
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		0.93
Flt Protected		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		1.00
Satd. Flow (prot)		1770	3539	2787	1770	4938		1681	1704	1292		1545
Flt Permitted		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		1.00
Satd. Flow (perm)		1770	3539	2787	1770	4938		1681	1704	1292		1545
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.92	0.92	0.92	0.86	0.86	0.86	0.81	0.81
Adj. Flow (vph)	19	26	648	383	224	589	46	534	71	81	11	102
RTOR Reduction (vph)	0	0	0	135	0	7	0	0	0	63	0	31
Lane Group Flow (vph)	0	45	648	248	224	628	0	299	306	18	0	196
Confl. Peds. (#/hr)							63			78		
Turn Type	Prot	Prot		pt+ov	Prot			Split		Perm	Split	
Protected Phases	5	5	2	2 3	1	6		3	3		4	4
Permitted Phases										3		
Actuated Green, G (s)		6.3	36.6	62.6	18.8	49.1		26.0	26.0	26.0		18.6
Effective Green, g (s)		6.3	36.6	62.6	18.8	49.1		26.0	26.0	26.0		18.6
Actuated g/C Ratio		0.05	0.30	0.52	0.16	0.41		0.22	0.22	0.22		0.16
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0	5.0		5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0
Lane Grp Cap (vph)		93	1079	1454	277	2020		364	369	280		239
v/s Ratio Prot		0.03	c0.18	0.09	c0.13	0.13		0.18	c0.18			c0.13
v/s Ratio Perm										0.01		
v/c Ratio		0.48	0.60	0.17	0.81	0.31		0.82	0.83	0.06		0.82
Uniform Delay, d1		55.3	35.5	15.1	48.9	24.0		44.8	44.9	37.3		49.1
Progression Factor		1.29	0.71	1.25	1.00	1.00		0.87	0.87	0.89		1.00
Incremental Delay, d2		3.9	2.4	0.1	15.8	0.4		13.7	14.1	0.1		19.2
Delay (s)		74.9	27.8	18.9	64.6	24.4		52.8	53.3	33.4		68.3
Level of Service		E	C	B	E	C		D	D	C		E
Approach Delay (s)			26.6			34.9			50.7			68.3
Approach LOS			C			C			D			E

Intersection Summary			
HCM Average Control Delay	38.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	92
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.81
Adj. Flow (vph)	114
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	92
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

HCM Signalized Intersection Capacity Analysis
3: Ala Moana Blvd & Ena Road

9/8/2010

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	20	63	702	602	227	587	58	528	131	146	11	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0		5.0
Lane Util. Factor		1.00	0.95	0.88	1.00	0.91		0.95	0.95	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.96		1.00	1.00	0.84		0.84
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		0.95
Flt Protected		0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00		1.00
Satd. Flow (prot)		1770	3539	2787	1770	4834		1681	1718	1335		1485
Flt Permitted		0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00		1.00
Satd. Flow (perm)		1770	3539	2787	1770	4834		1681	1718	1335		1485
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.84	0.84	0.84	0.82	0.82	0.82	0.89	0.89
Adj. Flow (vph)	22	68	763	654	270	699	69	644	160	178	12	134
RTOR Reduction (vph)	0	0	0	63	0	8	0	0	0	125	0	13
Lane Group Flow (vph)	0	90	763	591	270	760	0	399	405	54	0	207
Confl. Peds. (#/hr)							90			123		
Turn Type	Prot	Prot		pt+ov	Prot			Split		Perm	Split	
Protected Phases	5	5	2	2 3	1	6		3	3		4	4
Permitted Phases										3		
Actuated Green, G (s)		11.7	37.3	77.3	24.7	50.3		35.0	35.0	35.0		23.0
Effective Green, g (s)		11.7	37.3	77.3	24.7	50.3		35.0	35.0	35.0		23.0
Actuated g/C Ratio		0.08	0.27	0.55	0.18	0.36		0.25	0.25	0.25		0.16
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0	5.0	5.0		5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0
Lane Grp Cap (vph)		148	943	1539	312	1737		420	430	334		244
v/s Ratio Prot		0.05	c0.22	0.21	c0.15	0.16		c0.24	0.24			c0.14
v/s Ratio Perm										0.04		
v/c Ratio		0.61	0.81	0.38	0.87	0.44		0.95	0.94	0.16		0.85
Uniform Delay, d1		61.9	48.0	17.8	56.0	34.1		51.6	51.5	41.0		56.8
Progression Factor		0.87	0.81	2.02	1.00	1.00		0.89	0.89	0.85		1.00
Incremental Delay, d2		6.7	7.2	0.2	21.3	0.8		31.0	28.7	0.2		22.8
Delay (s)		60.5	46.2	36.1	77.3	34.9		77.1	74.8	35.0		79.6
Level of Service		E	D	D	E	C		E	E	D		E
Approach Delay (s)			42.6			45.9			68.5			79.6
Approach LOS			D			D			E			E

Intersection Summary			
HCM Average Control Delay	52.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	66
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.89
Adj. Flow (vph)	74
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	459
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰↑↑			↑			↑↑↑↱	
Volume (vph)	0	0	0	50	558	0	0	8	0	0	1510	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0			5.0			5.0	
Lane Util. Factor					0.91			1.00			0.86	
Frt					1.00			1.00			0.98	
Flt Protected					1.00			1.00			1.00	
Satd. Flow (prot)					5064			1863			6270	
Flt Permitted					1.00			1.00			1.00	
Satd. Flow (perm)					5064			1863			6270	
Peak-hour factor, PHF	0.92	0.92	0.92	0.85	0.85	0.85	0.67	0.67	0.67	0.97	0.97	0.97
Adj. Flow (vph)	0	0	0	59	656	0	0	12	0	0	1557	261
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	38	0
Lane Group Flow (vph)	0	0	0	0	715	0	0	12	0	0	1780	0
Turn Type				Perm								
Protected Phases					4			2			2	
Permitted Phases				4								
Actuated Green, G (s)					27.0			43.0			43.0	
Effective Green, g (s)					27.0			43.0			43.0	
Actuated g/C Ratio					0.34			0.54			0.54	
Clearance Time (s)					5.0			5.0			5.0	
Lane Grp Cap (vph)					1709			1001			3370	
v/s Ratio Prot								0.01			c0.28	
v/s Ratio Perm					0.14							
v/c Ratio					0.42			0.01			0.53	
Uniform Delay, d1					20.4			8.6			11.9	
Progression Factor					1.00			0.38			1.00	
Incremental Delay, d2					0.8			0.0			0.6	
Delay (s)					21.2			3.3			12.5	
Level of Service					C			A			B	
Approach Delay (s)		0.0			21.2			3.3			12.5	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰↑↑			↑			↑↑↑↱	
Volume (vph)	0	0	0	69	521	0	0	16	0	0	1889	375
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0			5.0			5.0	
Lane Util. Factor					0.91			1.00			0.86	
Frt					1.00			1.00			0.98	
Flt Protected					0.99			1.00			1.00	
Satd. Flow (prot)					5056			1863			6249	
Flt Permitted					0.99			1.00			1.00	
Satd. Flow (perm)					5056			1863			6249	
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.80	0.80	0.80	0.93	0.93	0.93
Adj. Flow (vph)	0	0	0	77	579	0	0	20	0	0	2031	403
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	45	0
Lane Group Flow (vph)	0	0	0	0	656	0	0	20	0	0	2389	0
Turn Type				Perm								
Protected Phases					4			2			2	
Permitted Phases				4								
Actuated Green, G (s)					27.0			43.0			43.0	
Effective Green, g (s)					27.0			43.0			43.0	
Actuated g/C Ratio					0.34			0.54			0.54	
Clearance Time (s)					5.0			5.0			5.0	
Lane Grp Cap (vph)					1706			1001			3359	
v/s Ratio Prot								0.01			c0.38	
v/s Ratio Perm					0.13							
v/c Ratio					0.38			0.02			0.71	
Uniform Delay, d1					20.2			8.6			13.9	
Progression Factor					1.00			0.44			1.00	
Incremental Delay, d2					0.7			0.0			1.3	
Delay (s)					20.8			3.8			15.2	
Level of Service					C			A			B	
Approach Delay (s)		0.0			20.8			3.8			15.2	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱	↱					↑↱			↰↑↑↑	
Volume (vph)	0	91	582	0	0	0	0	8	6	106	1454	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.95	0.95					1.00			0.86	
Frpb, ped/bikes		1.00	1.00					0.94			1.00	
Flpb, ped/bikes		1.00	1.00					1.00			0.99	
Frt		0.89	0.85					0.94			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		1575	1504					1661			6338	
Flt Permitted		1.00	1.00					1.00			0.91	
Satd. Flow (perm)		1575	1504					1661			5762	
Peak-hour factor, PHF	0.86	0.86	0.86	0.92	0.92	0.92	0.58	0.58	0.58	0.97	0.97	0.97
Adj. Flow (vph)	0	106	677	0	0	0	0	14	10	109	1499	0
RTOR Reduction (vph)	0	17	17	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	380	369	0	0	0	0	19	0	0	1608	0
Confl. Peds. (#/hr)									123	123		
Turn Type			Prot							Perm		
Protected Phases		8	8					6			6	
Permitted Phases										6		
Actuated Green, G (s)		27.0	27.0					43.0			43.0	
Effective Green, g (s)		27.0	27.0					43.0			43.0	
Actuated g/C Ratio		0.34	0.34					0.54			0.54	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		532	508					893			3097	
v/s Ratio Prot		0.24	c0.25					0.01				
v/s Ratio Perm											c0.28	
v/c Ratio		0.72	0.73					0.02			0.52	
Uniform Delay, d1		23.1	23.3					8.7			11.9	
Progression Factor		1.00	1.00					1.00			0.23	
Incremental Delay, d2		8.0	8.8					0.0			0.5	
Delay (s)		31.1	32.1					8.7			3.3	
Level of Service		C	C					A			A	
Approach Delay (s)		31.6			0.0			8.7			3.3	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	55.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Ala Moana Blvd & Kalakaua Ave

9/10/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱	↱					↑↱			↰↑↑↑↑	
Volume (vph)	0	163	728	0	0	0	0	16	9	167	1791	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.95	0.95					1.00			0.86	
Frpb, ped/bikes		1.00	1.00					0.92			1.00	
Flpb, ped/bikes		1.00	1.00					1.00			0.98	
Frt		0.90	0.85					0.95			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		1598	1504					1626			6267	
Flt Permitted		1.00	1.00					1.00			0.90	
Satd. Flow (perm)		1598	1504					1626			5642	
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.89	0.89	0.89	0.91	0.91	0.91
Adj. Flow (vph)	0	181	809	0	0	0	0	18	10	184	1968	0
RTOR Reduction (vph)	0	5	5	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	508	472	0	0	0	0	23	0	0	2152	0
Confl. Peds. (#/hr)									233	233		
Turn Type			Prot							Perm		
Protected Phases		8	8					6			6	
Permitted Phases										6		
Actuated Green, G (s)		27.0	27.0					43.0			43.0	
Effective Green, g (s)		27.0	27.0					43.0			43.0	
Actuated g/C Ratio		0.34	0.34					0.54			0.54	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		539	508					874			3033	
v/s Ratio Prot		c0.32	0.31					0.01				
v/s Ratio Perm											c0.38	
v/c Ratio		0.94	0.93					0.03			0.71	
Uniform Delay, d1		25.8	25.6					8.7			13.8	
Progression Factor		1.00	1.00					1.00			0.21	
Incremental Delay, d2		27.0	25.8					0.1			1.0	
Delay (s)		52.7	51.4					8.7			4.0	
Level of Service		D	D					A			A	
Approach Delay (s)		52.1			0.0			8.7			4.0	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM Average Control Delay	19.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↰	↱		↰↑↑	↑↱	
Volume (vph)	173	33	31	417	392	238
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	0.97	1.00		0.91	0.95	
Frpb, ped/bikes	1.00	0.84		1.00	0.92	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.94	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3433	1333		5068	3082	
Flt Permitted	0.95	1.00		0.87	1.00	
Satd. Flow (perm)	3433	1333		4411	3082	
Peak-hour factor, PHF	0.70	0.70	0.79	0.79	0.81	0.81
Adj. Flow (vph)	247	47	39	528	484	294
RTOR Reduction (vph)	0	39	0	0	96	0
Lane Group Flow (vph)	247	8	0	567	682	0
Confl. Peds. (#/hr)		75				100
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	9.6	9.6		40.4	40.4	
Effective Green, g (s)	9.6	9.6		40.4	40.4	
Actuated g/C Ratio	0.16	0.16		0.67	0.67	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	549	213		2970	2075	
v/s Ratio Prot	c0.07				c0.22	
v/s Ratio Perm		0.01		0.13		
v/c Ratio	0.45	0.04		0.19	0.33	
Uniform Delay, d1	22.8	21.3		3.7	4.1	
Progression Factor	1.00	1.00		1.00	1.47	
Incremental Delay, d2	0.6	0.1		0.1	0.4	
Delay (s)	23.4	21.4		3.8	6.4	
Level of Service	C	C		A	A	
Approach Delay (s)	23.1			3.8	6.4	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↰	↱		↰↑↑	↑↱	
Volume (vph)	192	48	33	613	648	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	0.97	1.00		0.91	0.95	
Frpb, ped/bikes	1.00	0.73		1.00	0.84	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.95	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	3433	1163		5072	2817	
Flt Permitted	0.95	1.00		0.85	1.00	
Satd. Flow (perm)	3433	1163		4346	2817	
Peak-hour factor, PHF	0.90	0.90	0.82	0.82	0.88	0.88
Adj. Flow (vph)	213	53	40	748	736	341
RTOR Reduction (vph)	0	46	0	0	56	0
Lane Group Flow (vph)	213	7	0	788	1021	0
Confl. Peds. (#/hr)		197				251
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	9.6	9.6		50.4	50.4	
Effective Green, g (s)	9.6	9.6		50.4	50.4	
Actuated g/C Ratio	0.14	0.14		0.72	0.72	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	471	159		3129	2028	
v/s Ratio Prot	c0.06				c0.36	
v/s Ratio Perm		0.01		0.18		
v/c Ratio	0.45	0.05		0.25	0.50	
Uniform Delay, d1	27.8	26.2		3.4	4.3	
Progression Factor	1.00	1.00		1.00	1.09	
Incremental Delay, d2	0.7	0.1		0.2	0.8	
Delay (s)	28.5	26.3		3.5	5.5	
Level of Service	C	C		A	A	
Approach Delay (s)	28.0			3.5	5.5	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↱			↰↑	⅄	
Volume (veh/h)	264	63	16	346	102	32
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.79	0.79	0.68	0.68
Hourly flow rate (vph)	326	78	20	438	150	47
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	340			234		
pX, platoon unblocked						
vC, conflicting volume			404		624	202
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			404		624	202
tC, single (s)			4.1		*5.8	*5.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		69	94
cM capacity (veh/h)			1151		491	854

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	217	186	166	292	197
Volume Left	0	0	20	0	150
Volume Right	0	78	0	0	47
cSH	1700	1700	1151	1700	546
Volume to Capacity	0.13	0.11	0.02	0.17	0.36
Queue Length 95th (ft)	0	0	1	0	41
Control Delay (s)	0.0	0.0	1.1	0.0	15.3
Lane LOS			A		C
Approach Delay (s)	0.0		0.4		15.3
Approach LOS					C

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

* User Entered Value

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↱			↰↑	Y	
Volume (veh/h)	557	45	14	514	132	29
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.91	0.91	0.72	0.72
Hourly flow rate (vph)	633	51	15	565	183	40
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	341			219		
pX, platoon unblocked						
vC, conflicting volume			684		972	342
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			684		972	342
tC, single (s)			4.1		*5.8	*5.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		44	94
cM capacity (veh/h)			905		325	722

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	422	262	204	377	224
Volume Left	0	0	15	0	183
Volume Right	0	51	0	0	40
cSH	1700	1700	905	1700	361
Volume to Capacity	0.25	0.15	0.02	0.22	0.62
Queue Length 95th (ft)	0	0	1	0	99
Control Delay (s)	0.0	0.0	0.8	0.0	29.9
Lane LOS			A		D
Approach Delay (s)	0.0		0.3		29.9
Approach LOS					D

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

* User Entered Value

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	116	164	10	7	264	31	18	3	10	10	11	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.91		1.00	0.87		1.00	0.86
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.89	1.00		0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00		0.98	1.00
Satd. Flow (prot)	1770	1817		1770	1863	1445		1595	1383		1727	1366
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.73	1.00		0.83	1.00
Satd. Flow (perm)	1770	1817		1770	1863	1445		1220	1383		1476	1366
Peak-hour factor, PHF	0.76	0.76	0.76	0.82	0.82	0.82	0.89	0.89	0.89	0.73	0.73	0.73
Adj. Flow (vph)	153	216	13	9	322	38	20	3	11	14	15	100
RTOR Reduction (vph)	0	2	0	0	0	23	0	0	10	0	0	88
Lane Group Flow (vph)	153	227	0	9	322	15	0	23	1	0	29	12
Confl. Peds. (#/hr)			188			48	149		76	76		149
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	7.3	24.3		1.0	18.0	18.0		5.4	5.4		5.4	5.4
Effective Green, g (s)	7.3	24.3		1.0	18.0	18.0		5.4	5.4		5.4	5.4
Actuated g/C Ratio	0.16	0.53		0.02	0.39	0.39		0.12	0.12		0.12	0.12
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	283	966		39	734	569		144	163		174	161
v/s Ratio Prot	c0.09	0.12		0.01	c0.17							
v/s Ratio Perm						0.01		0.02	0.00		c0.02	0.01
v/c Ratio	0.54	0.23		0.23	0.44	0.03		0.16	0.01		0.17	0.07
Uniform Delay, d1	17.7	5.7		22.0	10.1	8.5		18.1	17.8		18.1	17.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	2.1	0.1		3.0	0.4	0.0		0.5	0.0		0.5	0.2
Delay (s)	19.8	5.9		25.0	10.6	8.5		18.6	17.8		18.6	18.1
Level of Service	B	A		C	B	A		B	B		B	B
Approach Delay (s)		11.4			10.7			18.4			18.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	45.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱		↰↑	↱		↰↑	↱
Volume (vph)	110	429	36	10	355	23	22	13	16	29	9	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.96		1.00	1.00	0.82		1.00	0.71		1.00	0.76
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.86	1.00		0.80	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		0.96	1.00
Satd. Flow (prot)	1770	1766		1770	1863	1292		1559	1128		1437	1201
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.79	1.00		0.75	1.00
Satd. Flow (perm)	1770	1766		1770	1863	1292		1262	1128		1121	1201
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.96	0.96	0.96	0.88	0.88	0.88
Adj. Flow (vph)	120	466	39	11	394	26	23	14	17	33	10	165
RTOR Reduction (vph)	0	3	0	0	0	15	0	0	15	0	0	144
Lane Group Flow (vph)	120	502	0	11	394	11	0	37	2	0	43	21
Confl. Peds. (#/hr)			393			109	254		178	178		254
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	6.9	27.1		0.8	21.0	21.0		6.2	6.2		6.2	6.2
Effective Green, g (s)	6.9	27.1		0.8	21.0	21.0		6.2	6.2		6.2	6.2
Actuated g/C Ratio	0.14	0.55		0.02	0.43	0.43		0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	249	975		29	797	553		159	142		142	152
v/s Ratio Prot	c0.07	c0.28		0.01	0.21							
v/s Ratio Perm						0.01		0.03	0.00		c0.04	0.02
v/c Ratio	0.48	0.51		0.38	0.49	0.02		0.23	0.02		0.30	0.14
Uniform Delay, d1	19.5	6.9		23.9	10.2	8.1		19.3	18.8		19.5	19.1
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	1.5	0.5		8.1	0.5	0.0		0.8	0.0		1.2	0.4
Delay (s)	20.9	7.3		32.0	10.7	8.1		20.1	18.8		20.7	19.5
Level of Service	C	A		C	B	A		C	B		C	B
Approach Delay (s)		10.0			11.1			19.7			19.7	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	49.1	Sum of lost time (s)	15.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Kalia & Saratoga

9/8/2010

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↑	↱	↰	↱
Volume (vph)	140	50	209	218	53	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes		0.98	1.00	1.00	1.00	1.00
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		0.96	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1766	1863	1530	1770	1583
Flt Permitted		0.64	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1179	1863	1530	1770	1583
Peak-hour factor, PHF	0.90	0.90	0.91	0.91	0.90	0.90
Adj. Flow (vph)	156	56	230	240	59	147
RTOR Reduction (vph)	0	0	0	0	0	113
Lane Group Flow (vph)	0	212	230	240	59	34
Confl. Peds. (#/hr)	73			73		
Turn Type	Perm			Free		Perm
Protected Phases		4	8		6	
Permitted Phases	4			Free		6
Actuated Green, G (s)		8.0	8.0	23.4	5.4	5.4
Effective Green, g (s)		8.0	8.0	23.4	5.4	5.4
Actuated g/C Ratio		0.34	0.34	1.00	0.23	0.23
Clearance Time (s)		5.0	5.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		403	637	1530	408	365
v/s Ratio Prot			0.12		0.03	
v/s Ratio Perm		c0.18		c0.16		0.02
v/c Ratio		0.53	0.36	0.16	0.14	0.09
Uniform Delay, d1		6.2	5.8	0.0	7.2	7.1
Progression Factor		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.2	0.4	0.2	0.2	0.1
Delay (s)		7.4	6.1	0.2	7.3	7.2
Level of Service		A	A	A	A	A
Approach Delay (s)		7.4	3.1		7.2	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	23.4	Sum of lost time (s)	5.0
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	259	53	314	269	56	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00	0.95	1.00	1.00
Flpb, ped/bikes		0.95	1.00	1.00	1.00	1.00
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		0.96	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1702	1863	1499	1770	1583
Flt Permitted		0.56	1.00	1.00	0.95	1.00
Satd. Flow (perm)		998	1863	1499	1770	1583
Peak-hour factor, PHF	0.88	0.88	0.96	0.96	0.81	0.81
Adj. Flow (vph)	294	60	327	280	69	204
RTOR Reduction (vph)	0	0	0	0	0	171
Lane Group Flow (vph)	0	354	327	280	69	33
Confl. Peds. (#/hr)	140			140		
Turn Type	Perm			Free		Perm
Protected Phases		4	8		6	
Permitted Phases	4			Free		6
Actuated Green, G (s)		19.5	19.5	35.1	5.6	5.6
Effective Green, g (s)		19.5	19.5	35.1	5.6	5.6
Actuated g/C Ratio		0.56	0.56	1.00	0.16	0.16
Clearance Time (s)		5.0	5.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		554	1035	1499	282	253
v/s Ratio Prot			0.18		0.04	
v/s Ratio Perm		c0.35		c0.19		0.02
v/c Ratio		0.64	0.32	0.19	0.24	0.13
Uniform Delay, d1		5.4	4.2	0.0	12.9	12.7
Progression Factor		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.4	0.2	0.3	0.5	0.2
Delay (s)		7.8	4.4	0.3	13.4	12.9
Level of Service		A	A	A	B	B
Approach Delay (s)		7.8	2.5		13.0	
Approach LOS		A	A		B	

Intersection Summary			
HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	35.1	Sum of lost time (s)	5.0
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX K

Parking & Loading Management Plan for the Hilton Hawaiian Village, An Evaluation and Study

Wilson Okamoto Corporation

October 2010
Revised March 2011

Parking & Loading Management Plan

Hilton Hawaiian Village

Prepared for:
Group 70 International

Prepared by:
Wilson Okamoto Corporation

October 2010
Revised March 2011

PARKING & LOADING MANAGEMENT PLAN

FOR THE

HILTON HAWAIIAN VILLAGE

An Evaluation and Study

Prepared for:
Group 70 International
925 Bethel Street, 5th Floor
Honolulu, HI 96813

Prepared by:

Wilson Okamoto Corporation
1907 South Beretania Street
Honolulu, Hawaii 96826
WOC Ref #8088-01

October 2010
Revised March 2011

FORWARD

The operational and management strategies identified in this report are offered as suggestions and may be considered for implementation should the need to improve parking and/or loading operations, and traffic circulation in the immediate vicinity arise. This document is intended to be a reference guide and includes basic implementation strategies that can be modified to service specific needs.

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LIST OF EXHIBITS

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I. INTRODUCTION

A. Purpose

The purpose of this plan is to identify supplemental ~~potential~~ parking and loading management strategies that can be implemented to relieve existing parking and loading operations, as well as, traffic circulation at the Hilton Hawaiian Village. The Hilton Hawaiian Village currently implements traffic management strategies as identified in “Hilton Hawaiian Village, Existing and Revised General Traffic Management Plan” dated August 2008. This document is intended to be used as reference specifically for the Hilton Hawaiian Village should management programs and other actions become necessary to alleviate adverse traffic operations.

B. Scope of Evaluation

This report presents the findings and conclusions of the parking management plan, the scope of which includes:

1. Description of the Hilton Hawaiian Village and its operations as they relate to parking and loading.

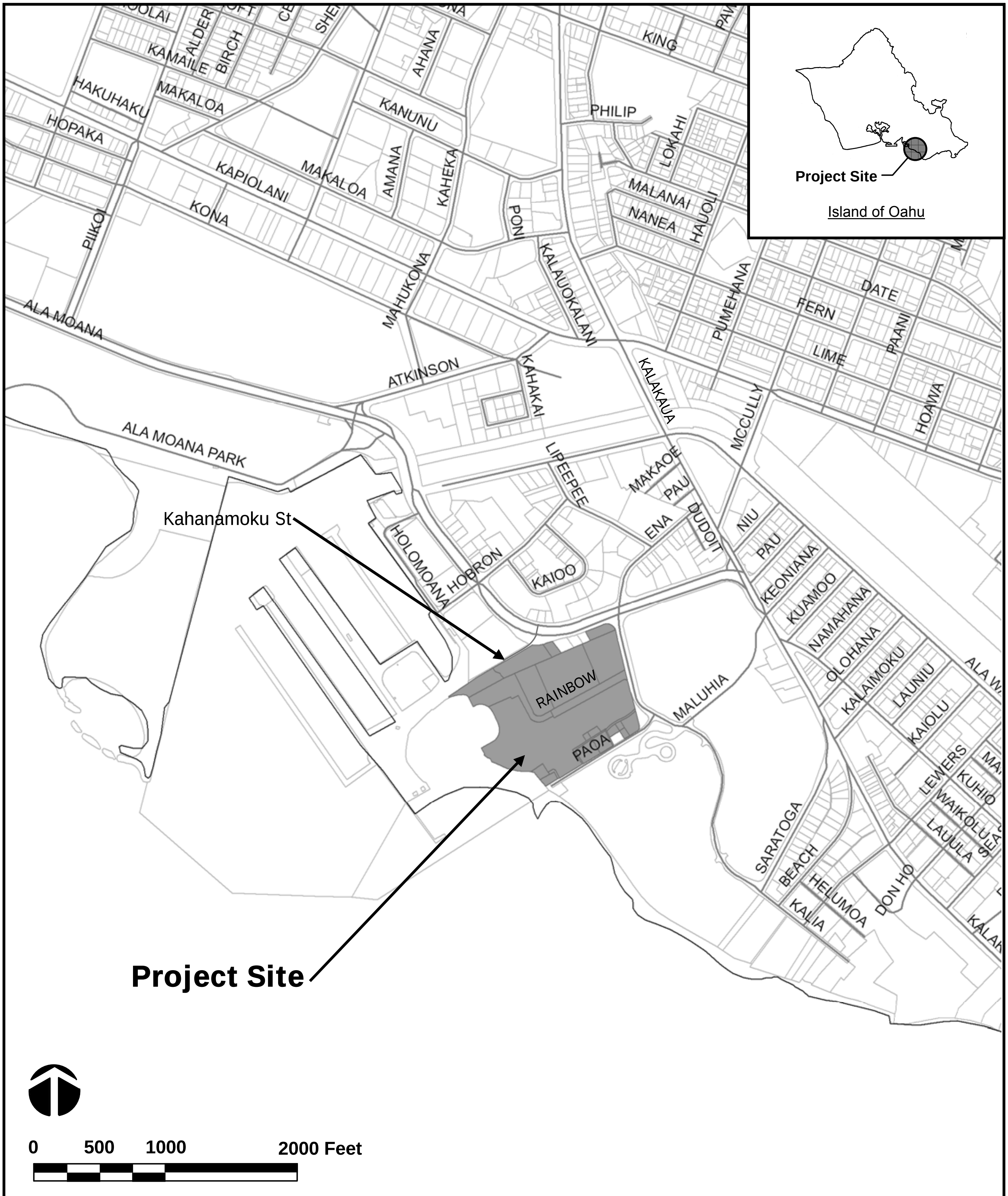
2. Formulation of parking and loading management strategies to reduce on-site parking and loading demands, as well as, traffic circulation in the vicinity.

II. HILTON HAWAIIAN VILLAGE DESCRIPTION

A. Area Roadway System

The Hilton Hawaiian Village is located adjacent to Ala Moana Boulevard and Kalia Road in Waikiki on the island of Oahu (see Figure 1). The resort is bounded by the Hale Koa Hotel to the south, Kalia Road to the east, and Ala Moana Boulevard and Kahanamoku Street to the north. The area roadway system surrounding the resort is comprised of a number of east-west oriented roadways which include Ala Moana Boulevard and two smaller access roadways, Rainbow Drive and Paoa Place, and north-south oriented connector roadways which include Kalia Road and one smaller access roadway, Kahanamoku Street.

Vehicular access for the Hilton Hawaiian Village is provided via Rainbow Drive, Paoa Place, and Kahanamoku Street. Rainbow Drive is a two-way private roadway generally oriented in the east-west direction while Paoa Place is a two-lane,



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HILTON HAWAIIAN VILLAGE

LOCATION AND VICINITY MAP

FIGURE

1

two-way roadway generally oriented in the east-west direction. Along the northwest edge of the resort, Kahanamoku Street is a predominantly two-lane, two-way roadway that also provides access to the other commercial uses along its alignment. Access to these three roadways is provided via Ala Moana Boulevard to the north and Kalia Road to the east. In the vicinity of the resort, Ala Moana Boulevard is a predominantly six-lane, two-way State of Hawaii roadway that, with Kalakaua Avenue, provides access to and from Waikiki, while Kalia Road is a two-way roadway that serves as a connector roadway between Ala Moana Boulevard and Lewers Street.

B. Project Characteristics and Function

The existing Hilton Hawaiian Village includes ~2,900 hotel rooms and ~650 timeshare units located in 7 towers, over 90 shops and 20 restaurants, over 150,000 square feet of indoor/outdoor banquet and meeting space, and other amenities such as pool areas, botanical gardens, and a parking garage (see Figure 2). The master plan for the report proposes improvements to the resort which include the following:

- Improvements to the main entry and Rainbow Drive
- Improvements to the retail areas along Kalia Road and the south side of Rainbow Drive
- Improvements to the existing Rainbow Bazaar retail area to create a new timeshare tower with 2 floors of retail and approximately 250 units. Parking for the new timeshare units will be accommodated in the existing parking garage.
- Improvements to the main lobby, Super Pool, and Hau Tree Bar
- Improvements to the Tapa Pool and Tapa Café
- Development of a new timeshare tower over the existing bus loading area adjacent to Paoa Place with approximately 300 units. Parking for the new timeshare units will be provided within the new tower.

Access to the parking garage for the Hilton Hawaiian Village will continue to be provided via Rainbow Drive off Kalia Road and Kahanamoku Street off Ala Moana Boulevard. Access for the new timeshare tower near Paoa Place will be provided via a new right-turn-in entrance driveway along Kalia Road and new exit driveway along Paoa Place that will be shared with the bus loading area. In conjunction with the proposed project, the existing exit driveway off Kalia Road that currently serves the bus loading area will be replaced by a shared exit driveway off Paoa Place and a new

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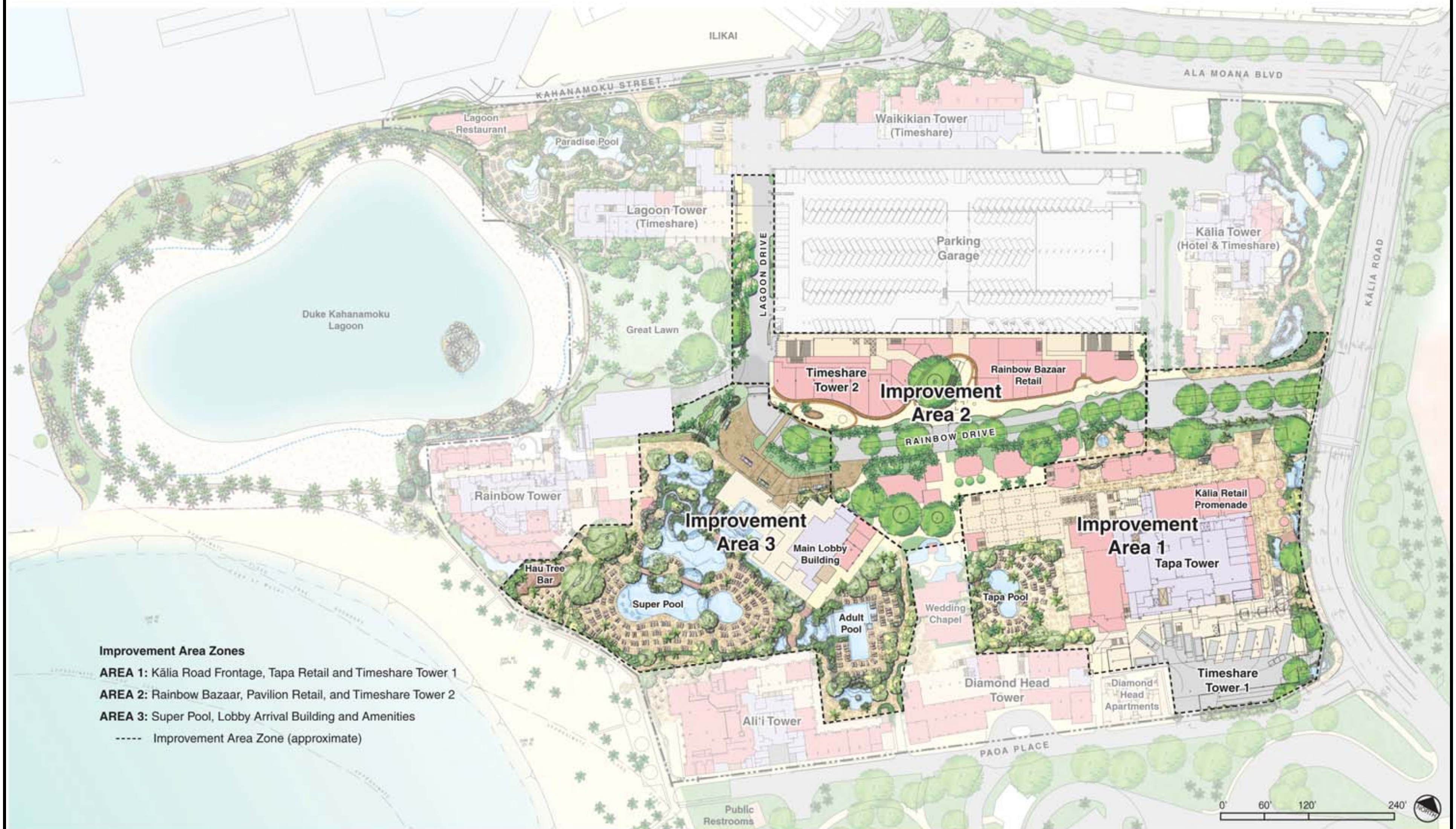
HILTON HAWAIIAN VILLAGE

EXISTING SITE PLAN

FIGURE 2



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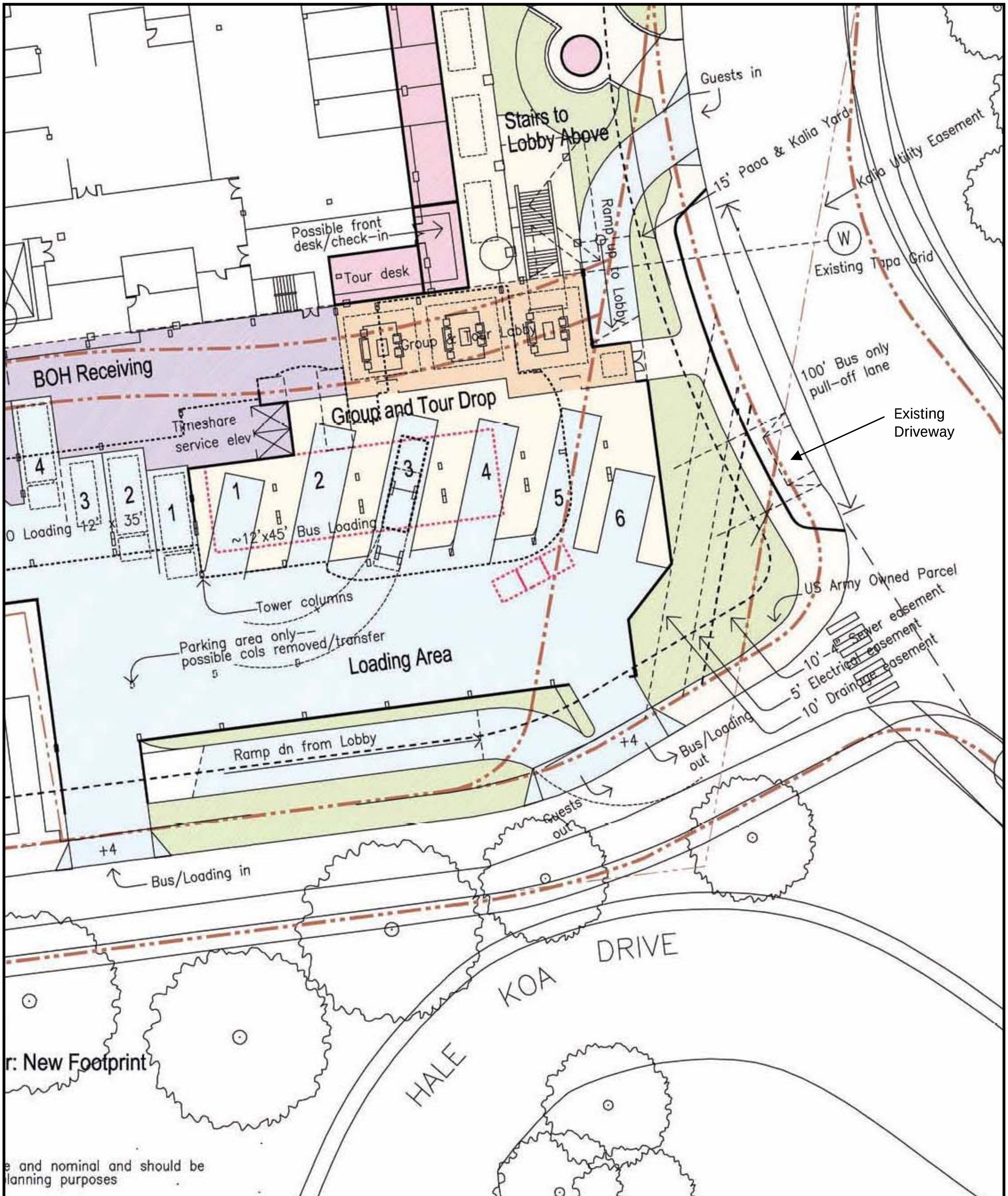
HILTON HAWAIIAN VILLAGE

PROPOSED SITE PLAN

FIGURE 3



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HILTON HAWAIIAN VILLAGE

PROPOSED DRIVEWAY MODIFICATIONS

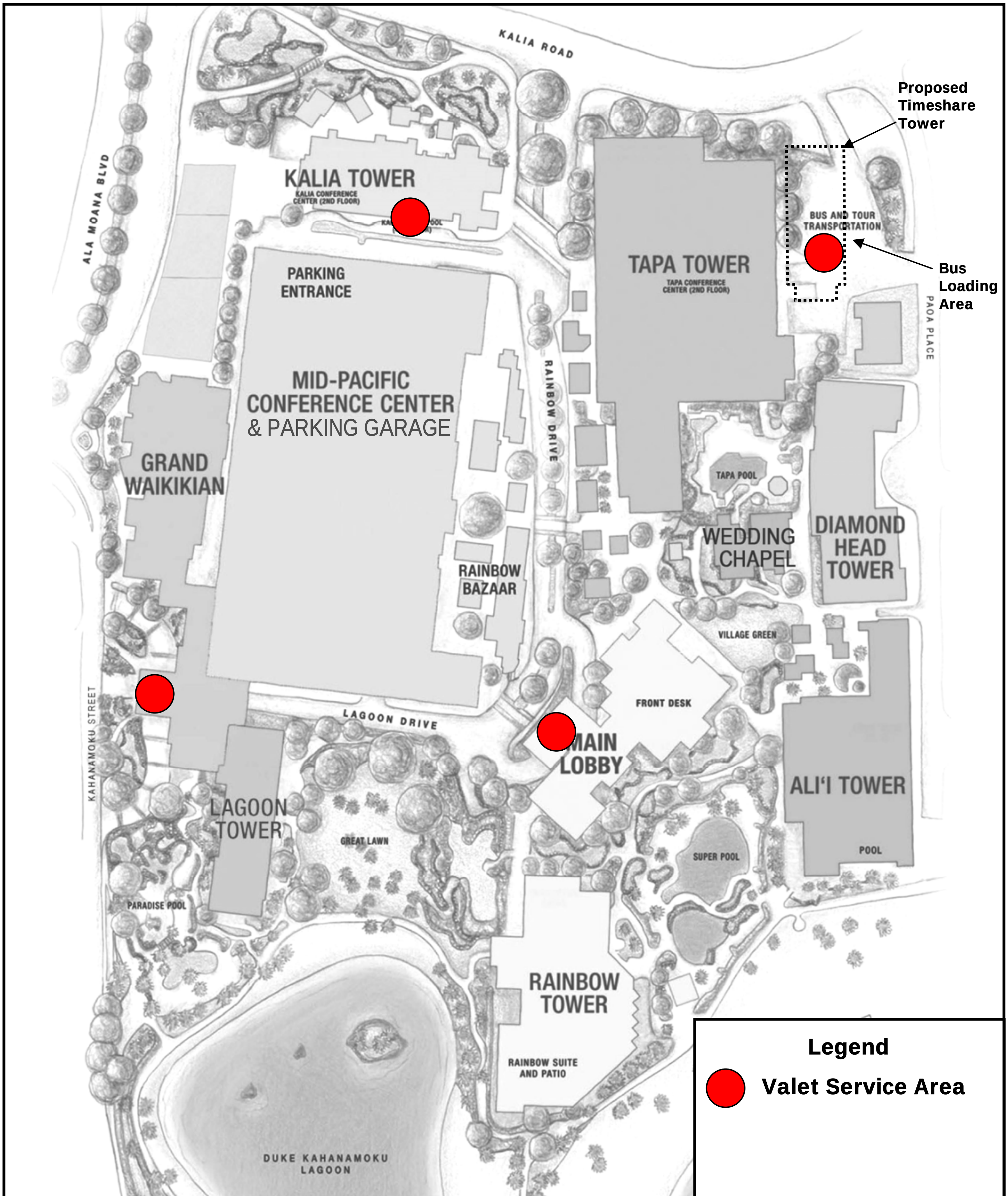
FIGURE 4

bus pullout will be provided along Kalia Road. Figures 3 and 4 show the proposed site plans.

C. Daily Traffic

The daily traffic generated by the Hilton Hawaiian Village consists of visitors, employees, and deliveries. Visitors to the resort can be divided into those who choose to drive and those utilizing some form of transit (i.e., taxi, bus, or trolley). Visitors who choose to drive can utilize the valet service provided at the Kalia Tower, Waikikian, main lobby and the new timeshare tower along Paoa Place, or self-park in the parking garage (see Figure 5). Visitors utilizing valet services at the Kalia Tower or main lobby would most likely utilize Rainbow Drive to access these areas while those utilizing the valet services at the Waikikian would most likely utilize Kahanamoku Street. The new timeshare tower planned near Paoa Place will also provide valet services and visitors would utilize Kalia Road to access these services. Since valet parking is located in the parking garage, valets from the Kalia Tower and the main lobby transport the vehicles to and from the parking structure via internal roadways while those from the Waikikian exit onto Kahanamoku Street and then utilize that roadway to access the connection to the parking garage. Valet parking for the new timeshare tower near Paoa Place will be located within that tower so valets utilize on-site connections to transport vehicles to and from the parking area. Visitors can also choose to travel to and from the resort via taxis, limousines, buses, or trolleys. Taxis and limousines are allowed to pick-up and drop-off at all of the porte cocheres while buses and trolleys pick-up and drop-off at the bus loading area near the Tapa Tower (see Figure 5).

The employees of the Hilton Hawaiian Village can be divided into shift employees or management staff. Shift employees staff the hotels 24-hours a day with shift changes occurring at 7:00 AM, 3:00 PM, and 11:00 PM while management staff typically works between 8:00 AM and 5:00 PM. Employees are allowed to park in the resort’s parking garage although a significant portion chooses to be either dropped-off/picked-up from the hotel or utilize public transit. Convenient access to the public transportation system (“The Bus”) in the vicinity of the Hilton Hawaiian



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HILTON HAWAIIAN VILLAGE

PARKING AND PASSENGER LOADING AREAS

FIGURE 5

Village is currently provided via bus stops along both sides of Kalia Road adjacent to the resort which are served by a number of routes that include the following:

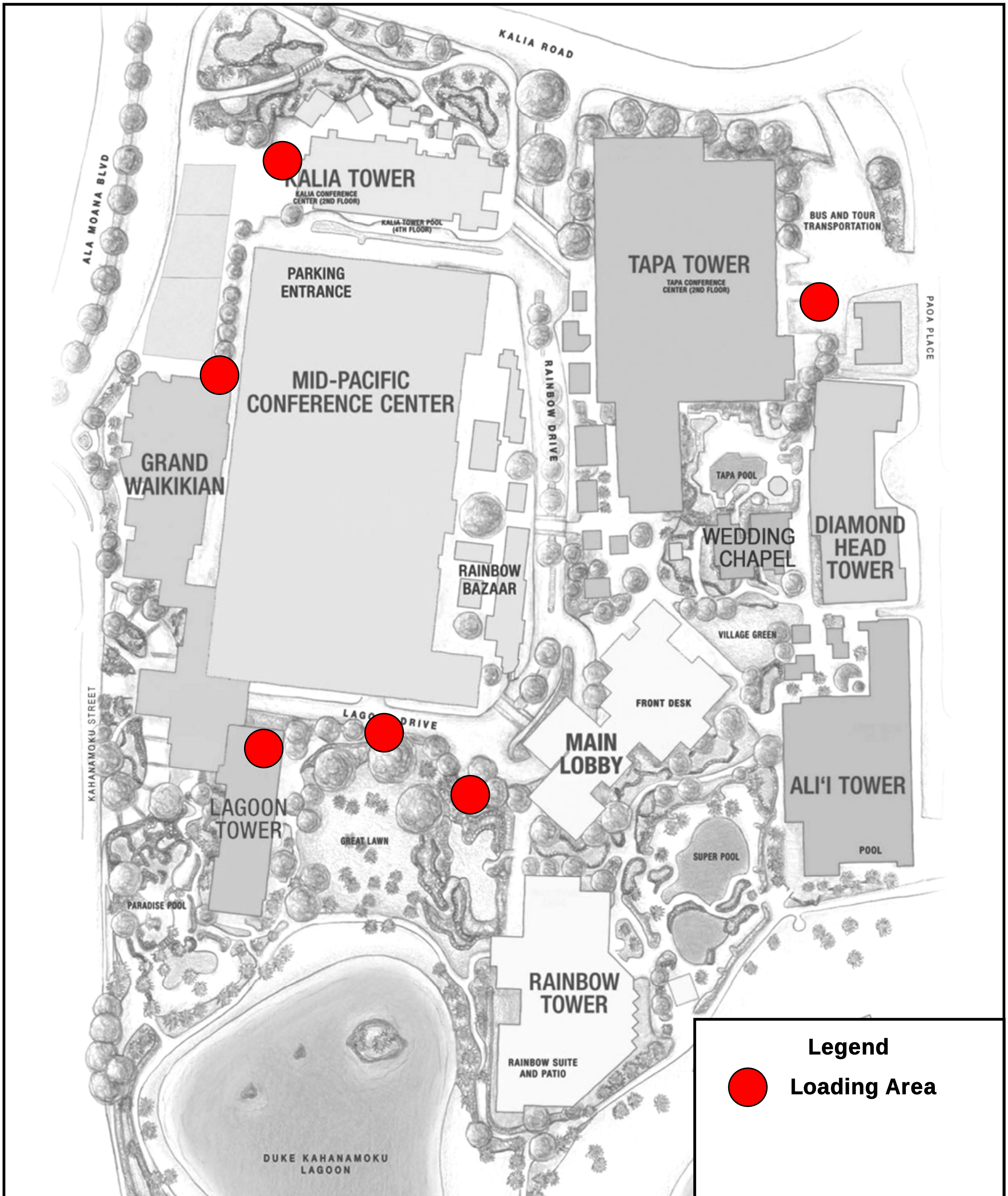
- E (CountryExpress!)
- 8
- 19
- 20
- 23
- 24
- 42
- 98
- 201 (Express)
- 202 (Express)
- 203 (Express)

Deliveries to the Hilton Hawaiian Village can be made at the loading areas provided at the Kalia Tower, Waikikian, Tapa Tower, Great Lawn, and Lagoon Tower (see Figure 6). Access to the loading areas at the Waikikian, Great Lawn, and Lagoon Tower is provided off Rainbow Drive via Kahanamoku Street or Kalia Road. The loading area at Kalia Tower can also be accessed via these routes, but an additional access point is also provided directly off Ala Moana Boulevard. However, this access is gated during the evening and early morning hours, opening at 10:00 AM each day. The loading area at the Tapa Tower is open daily from 8:00 AM although vehicles making deliveries to other areas within the resort can utilize this uncontrolled loading area prior to that time. Access to this loading area is provided via a driveway off Paoa Place.

III. PARKING MANAGEMENT PLAN

A. Parking Resources

Parking for the Hilton Hawaiian Village (HHV) is currently provided on-site within their parking garage which currently has a capacity of 1,844 vehicles. In conjunction with the proposed project, the capacity of the garage is expected to increase to 1,969 vehicles. ~~The parking garage includes a total of 1,785 available parking stalls: 374valet, 1,363 self-park, and 48 reserved stalls. In addition, there are stalls utilized by Hertz car rental andapproximatley 26 stalls that are currently being utilized for equipment storage.~~ A survey was conducted of the valet, self-park, and reserved stalls within the Hilton Hawaiian Village parking garage in 2010 on July 23rd (Friday) and 24th (Saturday) which recorded occupancy in the garage in 15-minute intervals. There are additional stalls within the garage, however, these stalls are either



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HILTON HAWAIIAN VILLAGE

LOADING AREAS FOR DELIVERIES

FIGURE 6

Figure 7: HHV Parking Garage Overall Occupancy

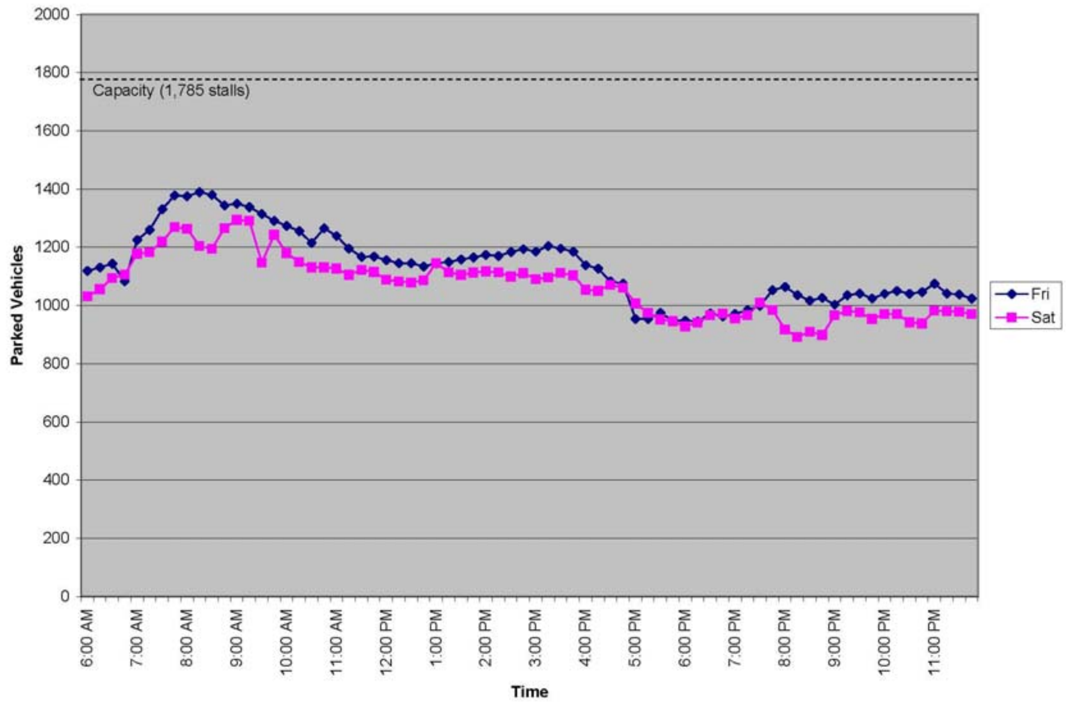


Figure 8: HHV Parking Garage Valet Parking Occupancy

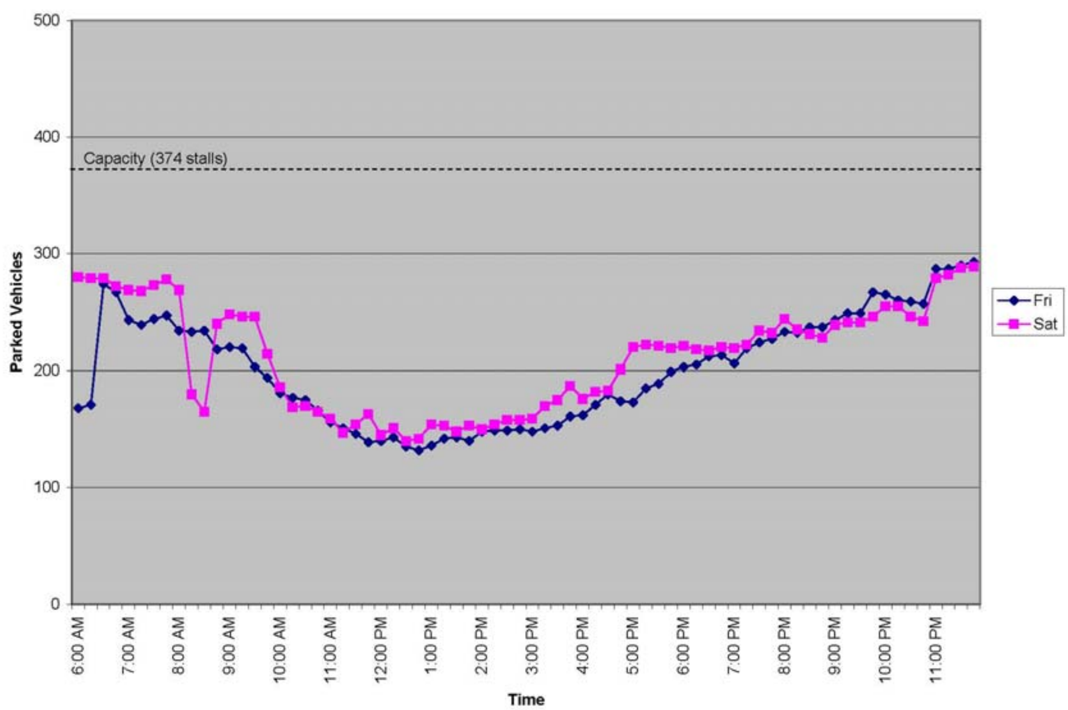


Figure 9: HHV Parking Garage Self-Parking Occupancy

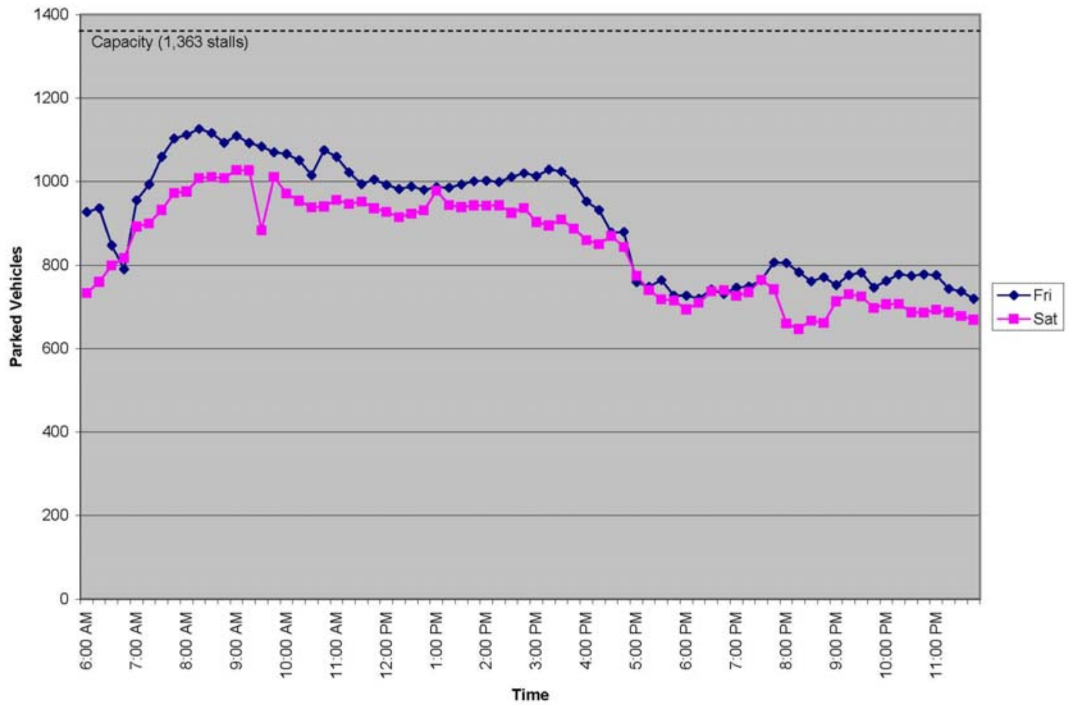
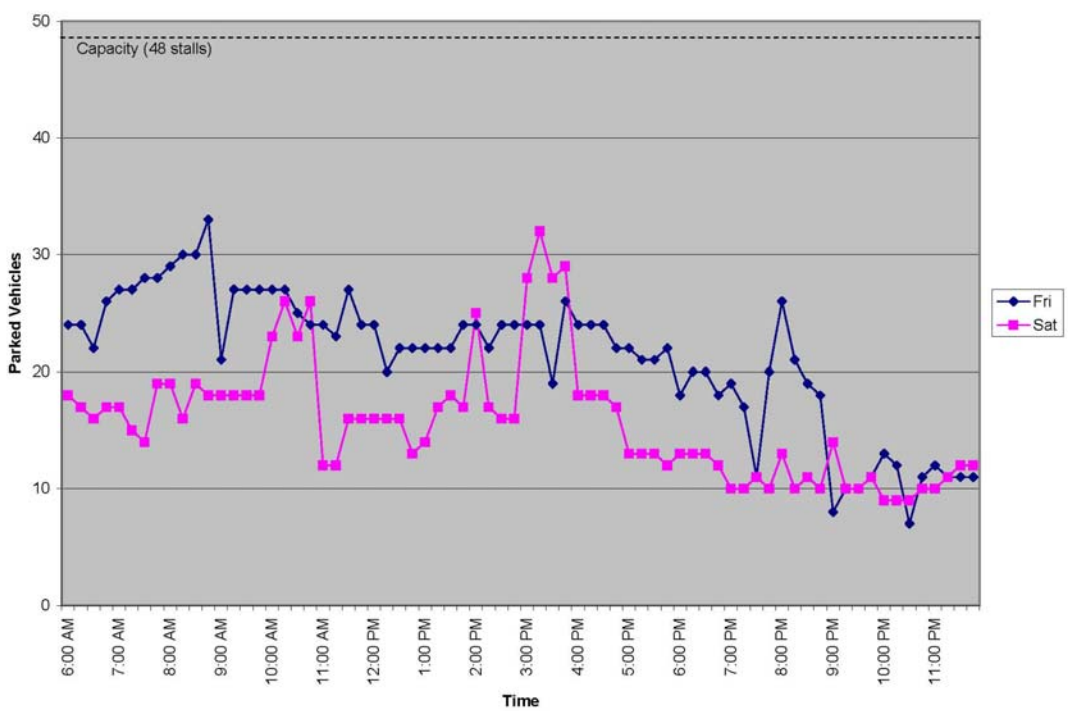


Figure 10: HHV Parking Garage Reserve Parking Occupancy



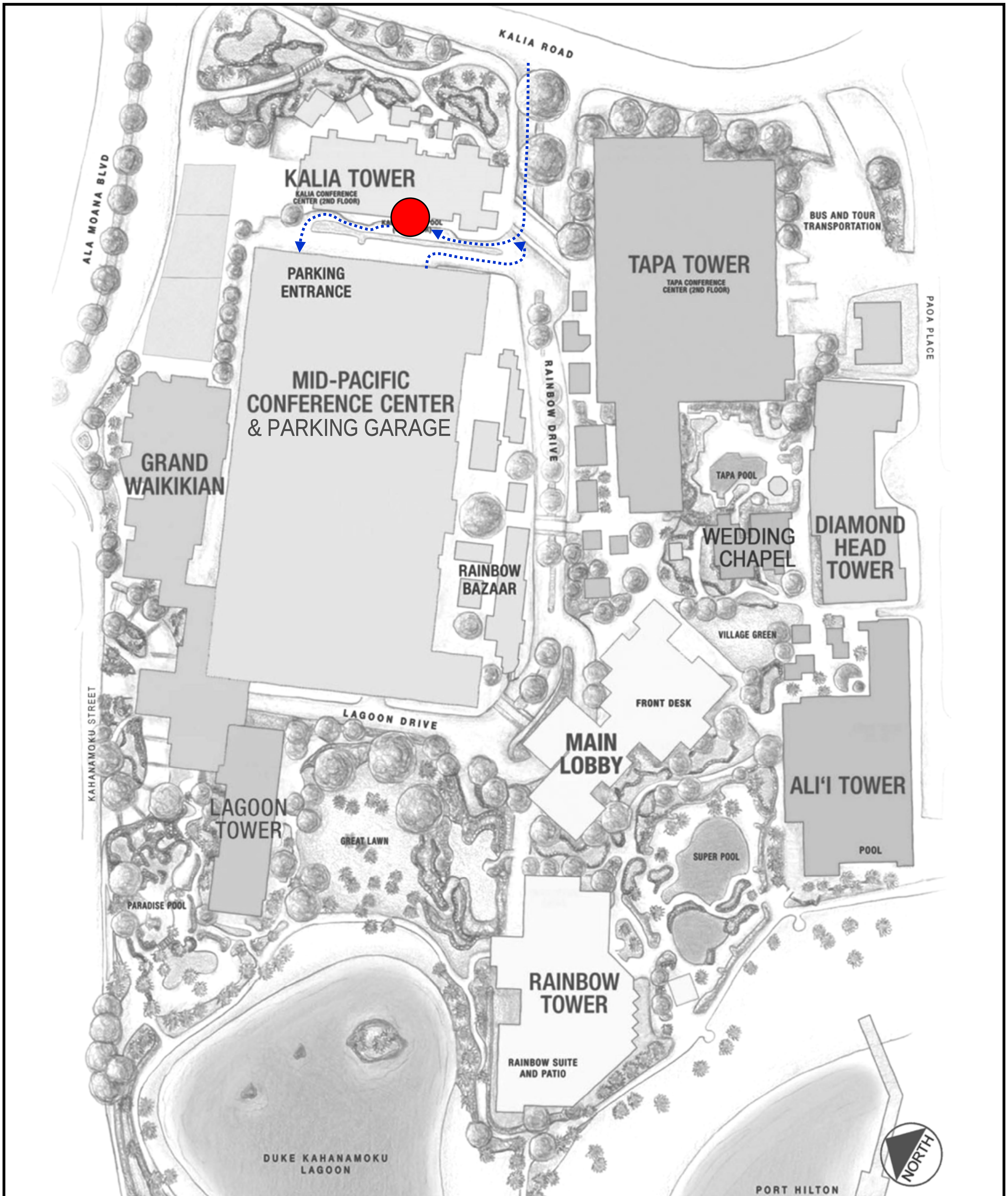
utilized by Hertz car rental or were temporarily being utilized for equipment storage. Figures 7 to 10 summarize the collected data which is also included in Appendix A.

During the survey, the overall peak occupancy of the parking garage, as well as, the peak occupancy of the self-parking and reserved stalls occurred during the mid-morning while the peak occupancy of the valet stalls occurred near midnight. The overall peak occupancy was approximately 78% on Friday and 73% on Saturday while the peak occupancy of the valet stalls was 78% on Friday and 77% on Saturday. The peak occupancy of the self-parking stalls was 83% on Friday and 75% on Saturday while the peak occupancy of the reserved stalls was 78% on Friday and 67% on Saturday.

B. Visitor Parking Management Strategies

1. Valet Parking

Valet services are provided for visitors at the Kalia Tower, Waikikian, or main lobby. Visitors utilizing the valet service at the Kalia Tower drop their vehicles off at the porte cochere for that tower and then valet personnel transport the vehicles directly to the parking garage across the access aisle (see Figure 11). Similarly, visitor utilizing the valet service at the Waikikian drop their vehicles off at the porte cochere for that building and then valet personnel utilize Kahanamoku Street to transport the vehicles to the parking garage (Figure 12). At the main lobby, visitors utilizing the valet service drop their vehicles off at the porte cochere where valets categorize them as either short-term or long-term parking. Vehicles that are only expected to park for a short period of time (short-term) are parked within the porte cochere if possible. Vehicles that are expected to park for longer periods of time (long-term) are typically transferred to the parking garage utilizing Rainbow Drive (see Figure 13). Valet services will also be provided at the new timeshare tower near Paoa Place. Visitors at this tower utilize Kalia Road to access the porte cochere for the tower. Valet personnel then utilize on-site connections to directly access the parking area within the tower (see Figure 14).



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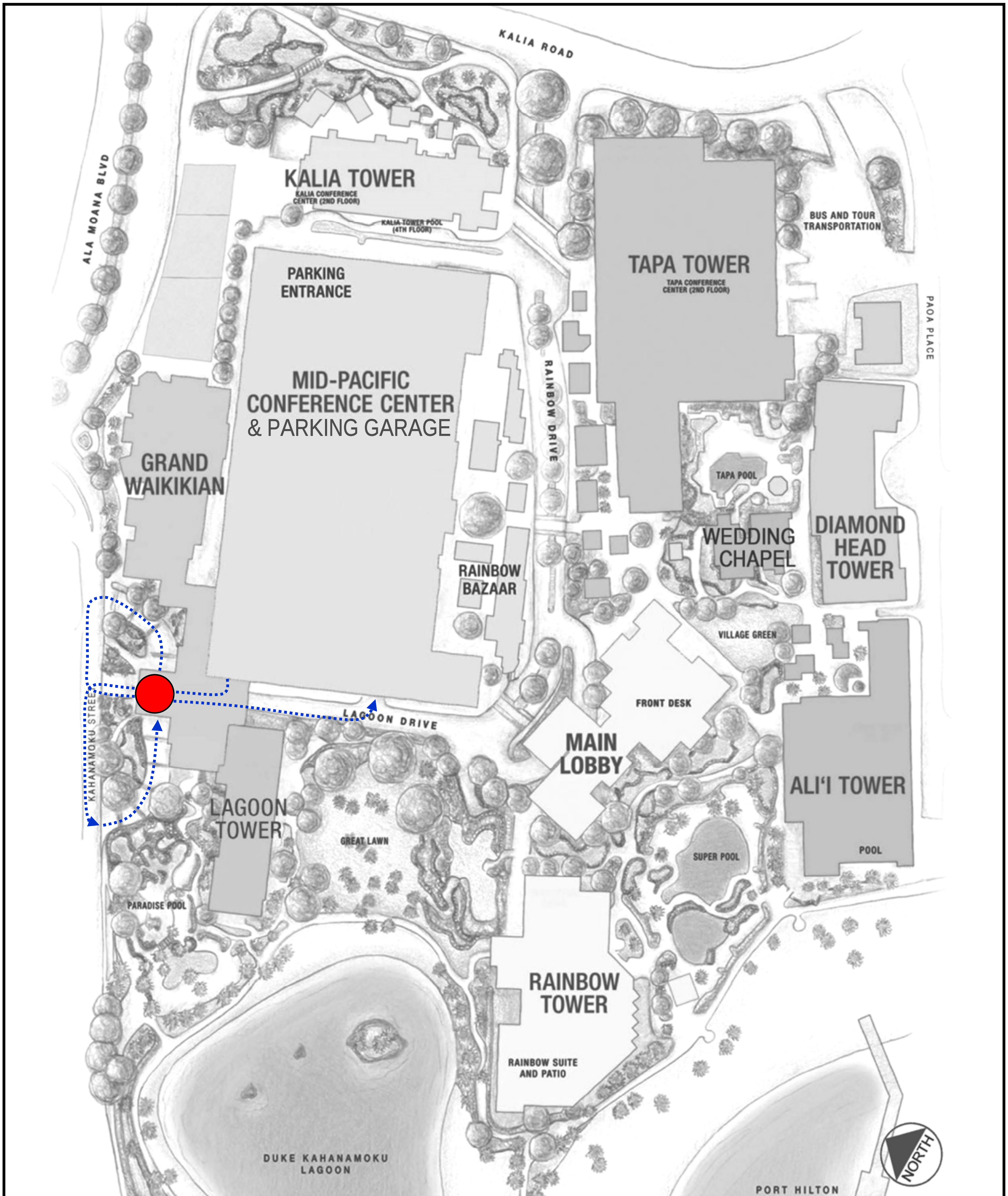
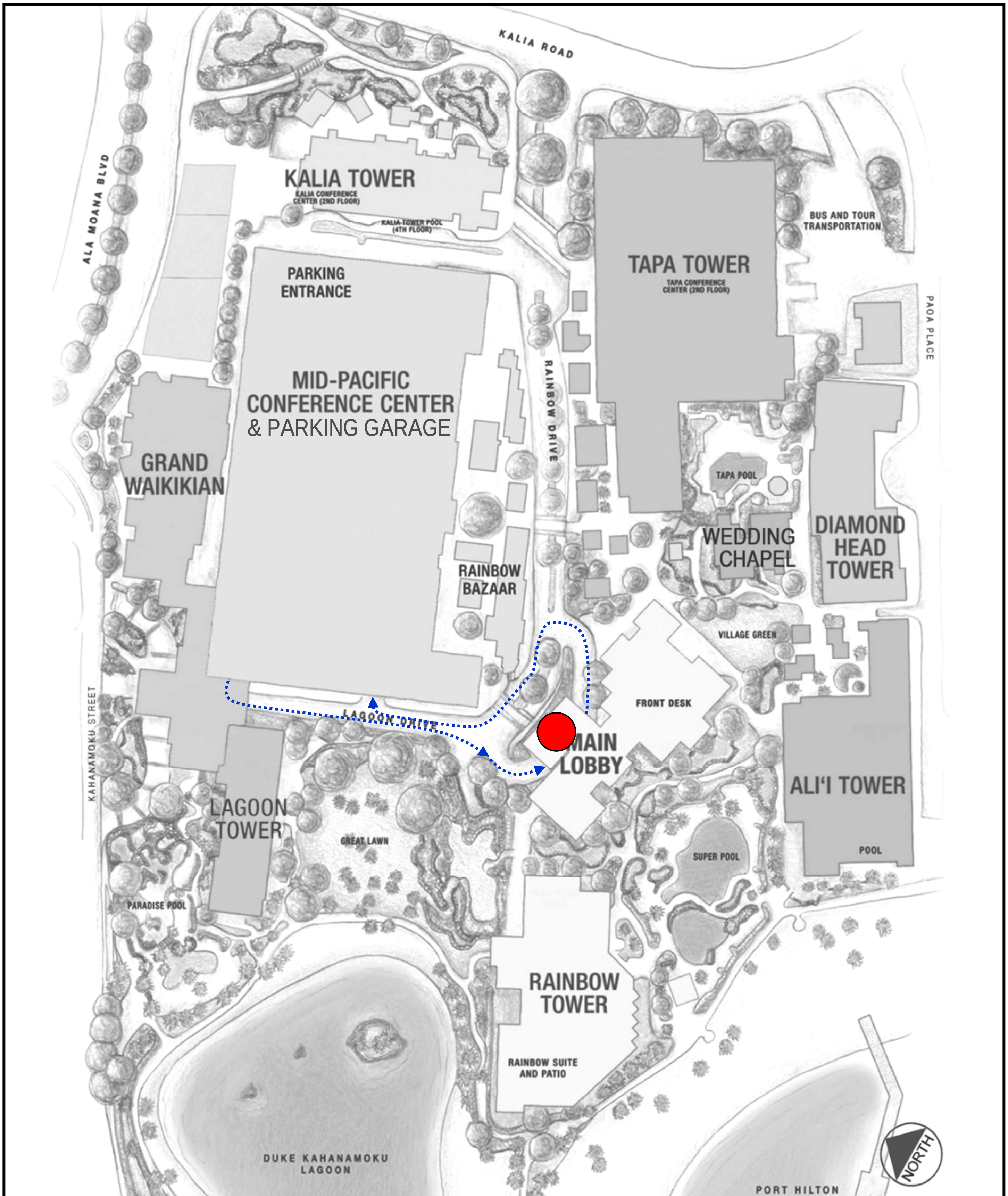
HILTON HAWAIIAN VILLAGE

KALIA TOWER VALET CIRCULATION

FIGURE 11



WILSON OKAMOTO CORPORATION ENGINEERS - PLANNERS	**HILTON HAWAIIAN VILLAGE** WAIKIKIAN VALET CIRCULATION	FIGURE 12



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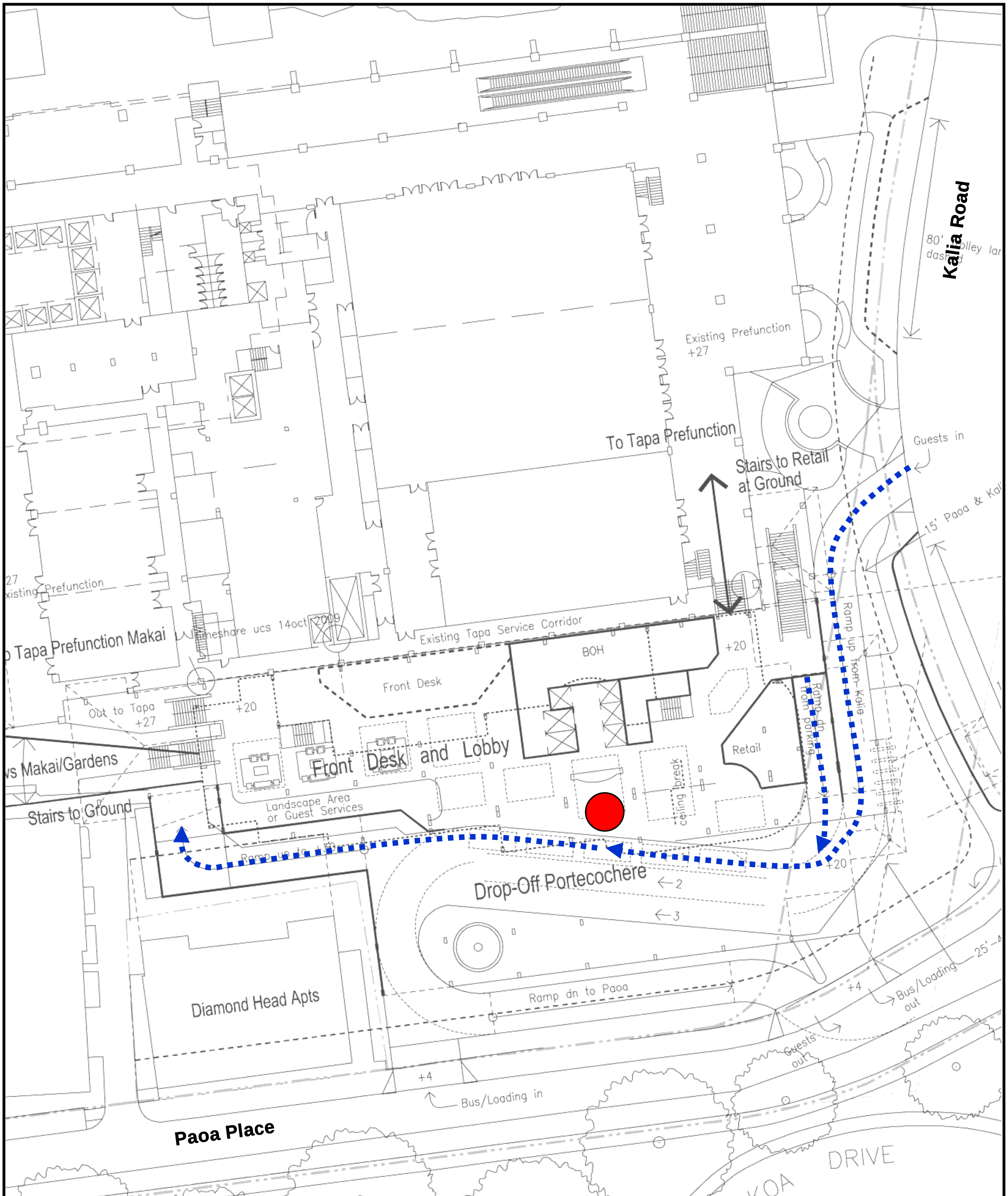
HILTON HAWAIIAN VILLAGE

MAIN LOBBY VALET CIRCULATION

FIGURE 13



HILTON HAWAIIAN VILLAGE

NEW TIMESHARE TOWER VALET CIRCULATION

FIGURE 14

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A survey was conducted of the existing porte cocheres at the Kalia Tower, Waikikian, and main lobby in 2010 on July 30th (Friday) and 31st (Saturday) to assess valet operations in these areas (see Appendix B for the collected data). At the Kalia Tower and Waikikian, valet personnel transferred vehicles from the porte cocheres to the parking garage in a timely manner thereby minimizing queuing within the valet area, as well as, onto the adjacent roadways. The maximum number of vehicles observed within the valet area at the Kalia Tower was 6 vehicles on the Friday and 10 vehicles on Saturday while the maximum number of vehicles observed within the valet area at the Waikikian was 18 vehicles on Friday and 20 vehicles on Saturday. Field observations indicate that in addition to vehicles accessing valet services, 2-3 taxis are staged within the Waikikian porte cochere with additional taxis staged along an access aisle adjacent to the parking structure. At the main lobby, the maximum number of vehicles observed within the valet area was 25 vehicles on Friday and 35 vehicles on Saturday. Valet personnel were observed parking some of the dropped-off vehicles within the porte cochere area and on Saturday evening, valet personnel were unable to transfer vehicles quickly enough to the parking garage resulting in queues extending onto Rainbow Drive. Field observations also indicate that 2-3 taxis are staged along the curbside near the Great Lawn waiting to serve visitors at the main lobby.

The Hilton Hawaiian Village could supplement their existing ~~implement the following~~ parking management strategies with the following to minimize congestion within the porte cocheres and queuing onto the adjacent roadways:

- Ensure that vehicles are not parked within the porte cochere blocking traffic flow through that area. All vehicles will be transferred to the various parking area regardless of the anticipated length of stay.

- Adequately staff of each of the valet service areas to minimize the dwell time of each vehicle within the various porte cocheres, especially at the main lobby where vehicle transfer times are longer.

- If necessary, assist vehicles exiting the valet service areas to maintain the flow of traffic through the porte cocheres and minimize queuing within the areas and onto the adjacent roadways.

2. Self-Parking

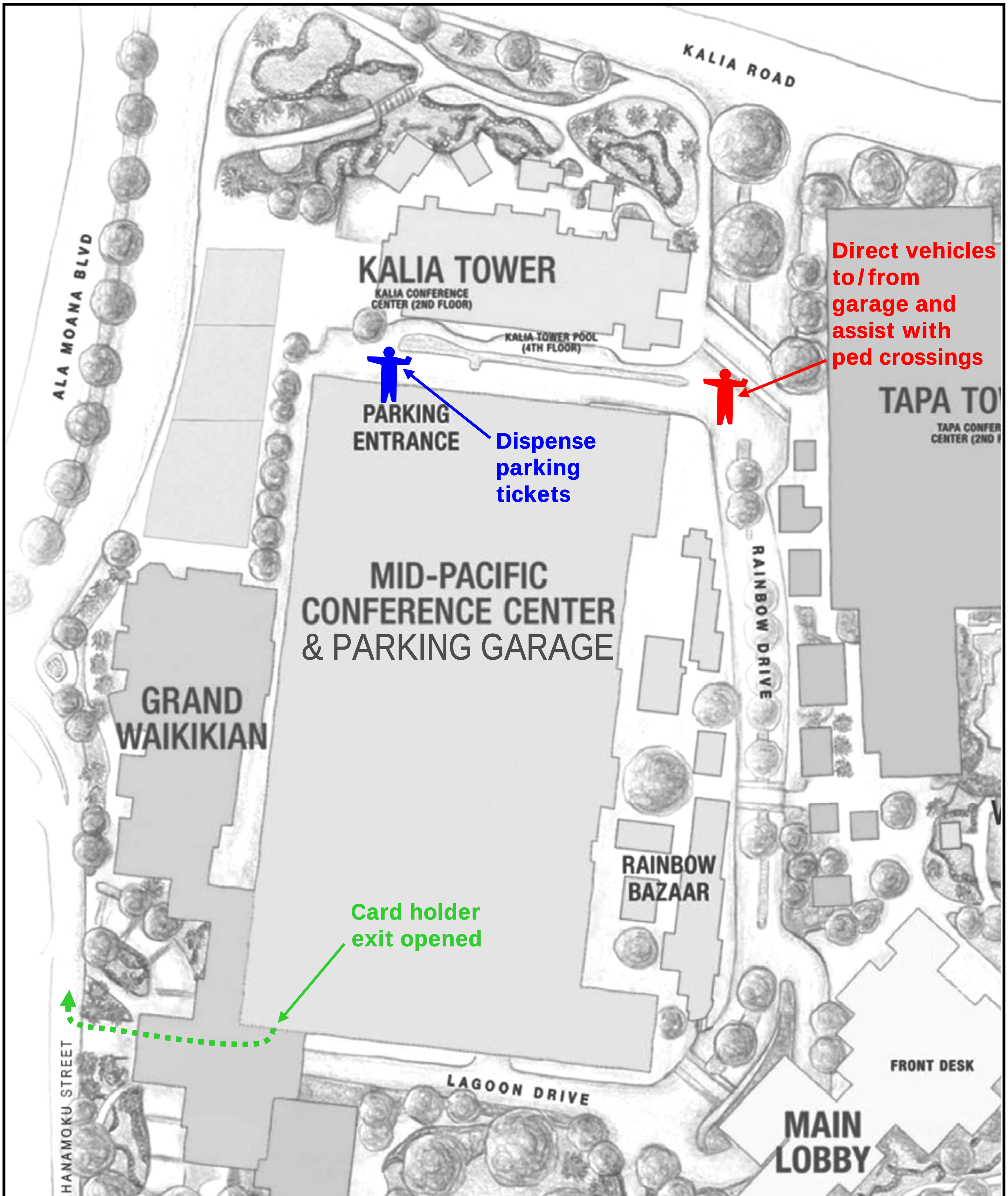
Visitors can choose to self-park their vehicles in the Hilton Hawaiian Village parking garage. When functions are held at the resort that are expected to generate a high volume of traffic, the following are the parking management strategies currently ~~are~~ implemented:

- Parking attendants are stationed at the intersection of the parking garage access roadway and Rainbow Drive to direct vehicles to the parking garage and to assist pedestrians crossing both roadways (see Figure 15).
- Parking attendants are stationed at the main entrance for the parking garage to dispense parking tickets for entering vehicles (see Figure 15).
- Parking attendants are stationed throughout the parking garage to direct vehicles to open parking stalls and minimize conflict between vehicles circulating through the garage (see Figure 16).
- The card holder exit from the parking garage near the Lagoon Tower is opened to allow vehicles to exit onto Kahanamoku Street without utilizing Rainbow Drive (see Figure 15).

In addition, the Hilton Hawaiian Village plans to relocate the existing pedestrian crossing along Rainbow Drive near the access to the parking garage (see Figure 17). Pedestrian traffic crossing Rainbow Drive currently conflicts with traffic headed between the Kalia Road and the parking garage. In conjunction with the initial phases of the master plan implementation, the crossing will be relocated further west to the opposite side of the intersection. However, this crossing is expected to be replaced by a pedestrian overpass during the latter phases of the master plan implementation.

C. Employee Parking Management Strategies

Employees are allowed to park in the Hilton Hawaiian Village's parking garage although a significant portion of them choose to be either dropped-off/picked-up from the hotel or utilize public transit. The Hilton Hawaiian Village could supplement their existing parking management strategies with the following ~~implement the following parking management startegies for their employees~~ to reduce their on-site parking demand:



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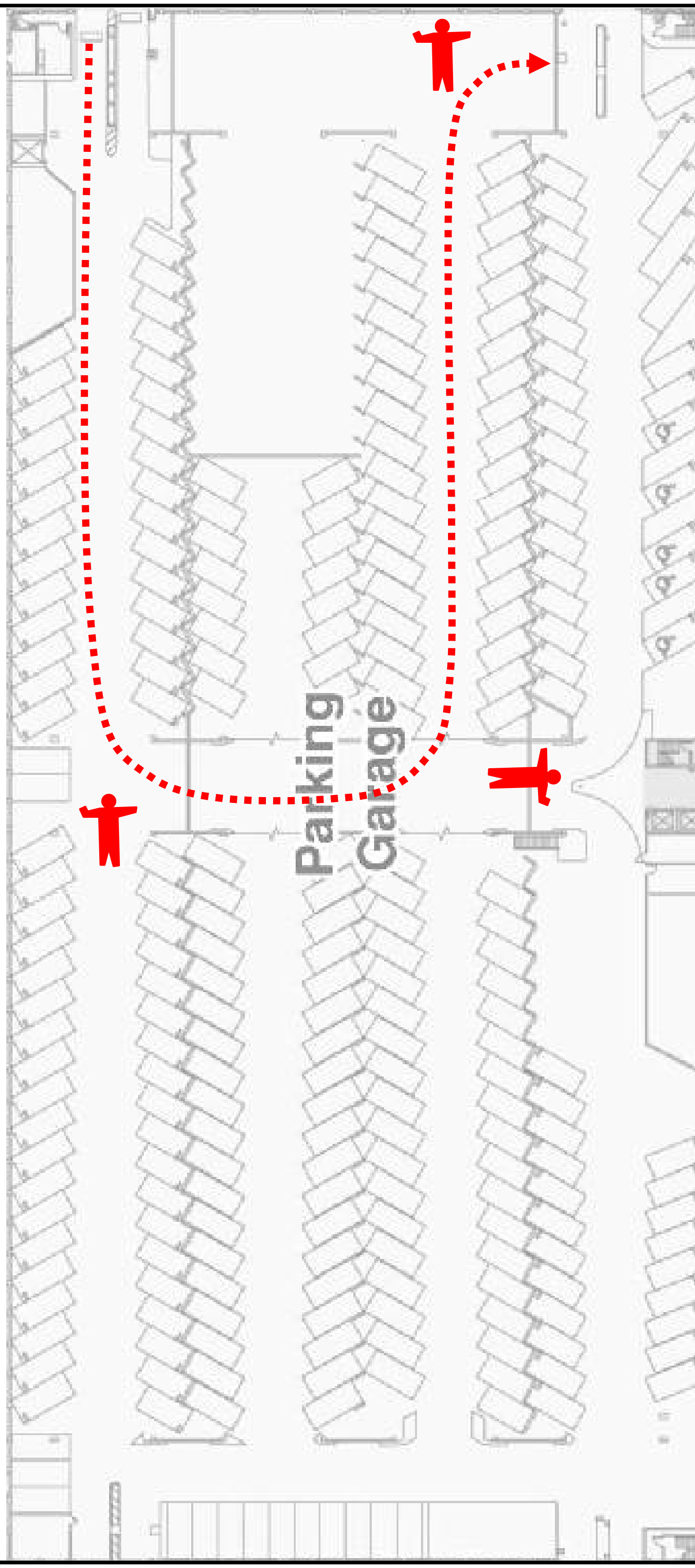
HILTON HAWAIIAN VILLAGE

SELF-PARKING MANAGEMENT PLAN

FIGURE 15



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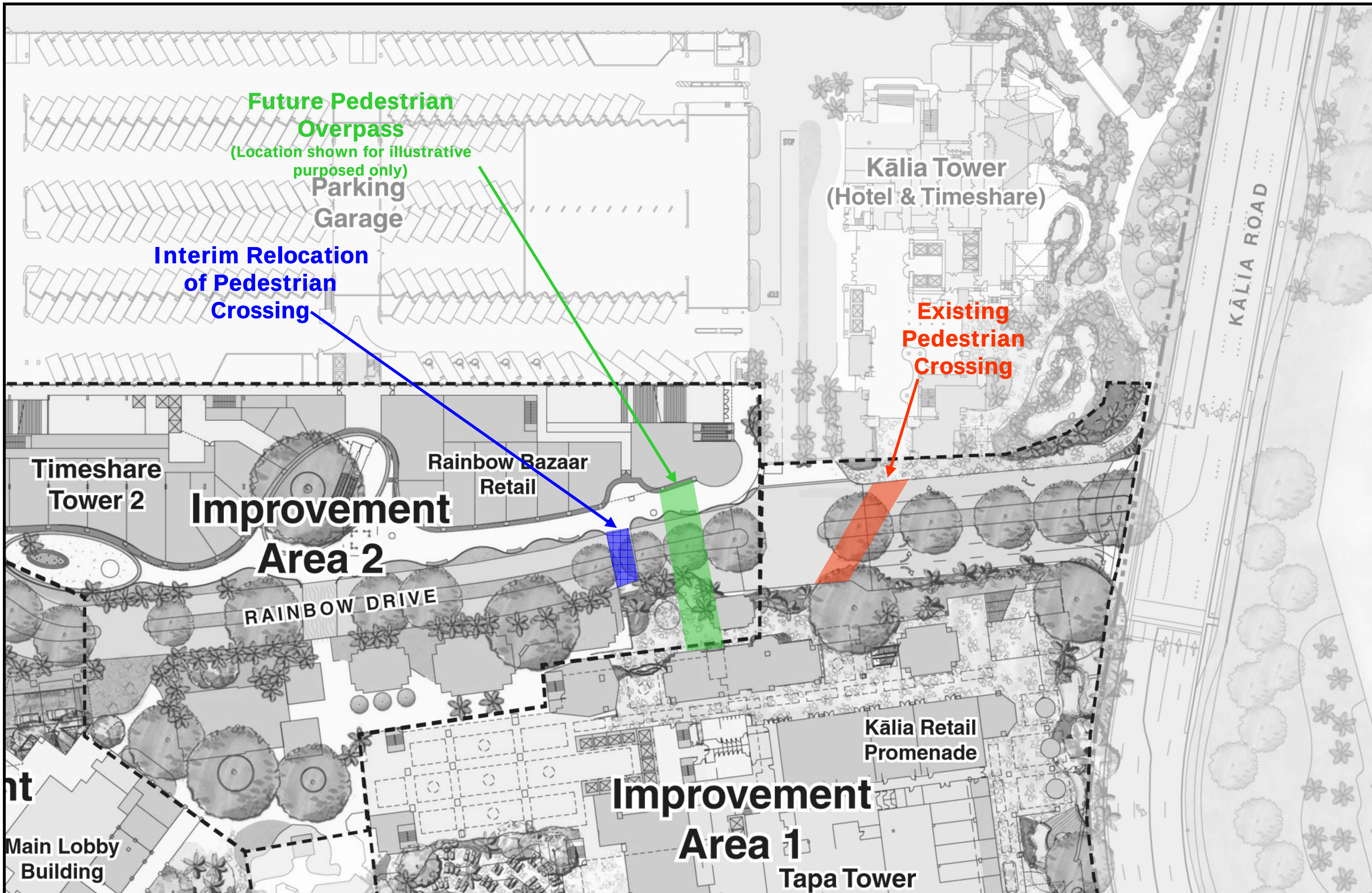
HILTON HAWAIIAN VILLAGE

SELF-PARKING MANAGEMENT PLAN

FIGURE 16



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HILTON HAWAIIAN VILLAGE

PROPOSED PEDESTRIAN CROSSING IMPROVEMENTS

FIGURE 17

- Implement a flexible work schedule program for management staff to minimize trips during peak periods of traffic that may include flexible work hours, staggered 4-day work weeks, and telecommuting.

- Establish a bus pass program to encourage employees to use public transit as a mode of travel. This initiative may be in the form of a subsidized program as an incentive to attract employees to use public transit as a mode of travel.

- Provide adequate and secure bicycling parking areas to encourage the use of alternative modes of travel.

- Encourage ride-sharing and establish a program to identify employees of same work shifts and similar travel routes that potentially may carpool together. Utilizing geographic demographics for their employees, the properties could coordinate the matching of employees desiring to participate in the ride-sharing program. The program could also include incentives for carpools such as the provision of parking subsidies and exclusion from parking lock-out periods.

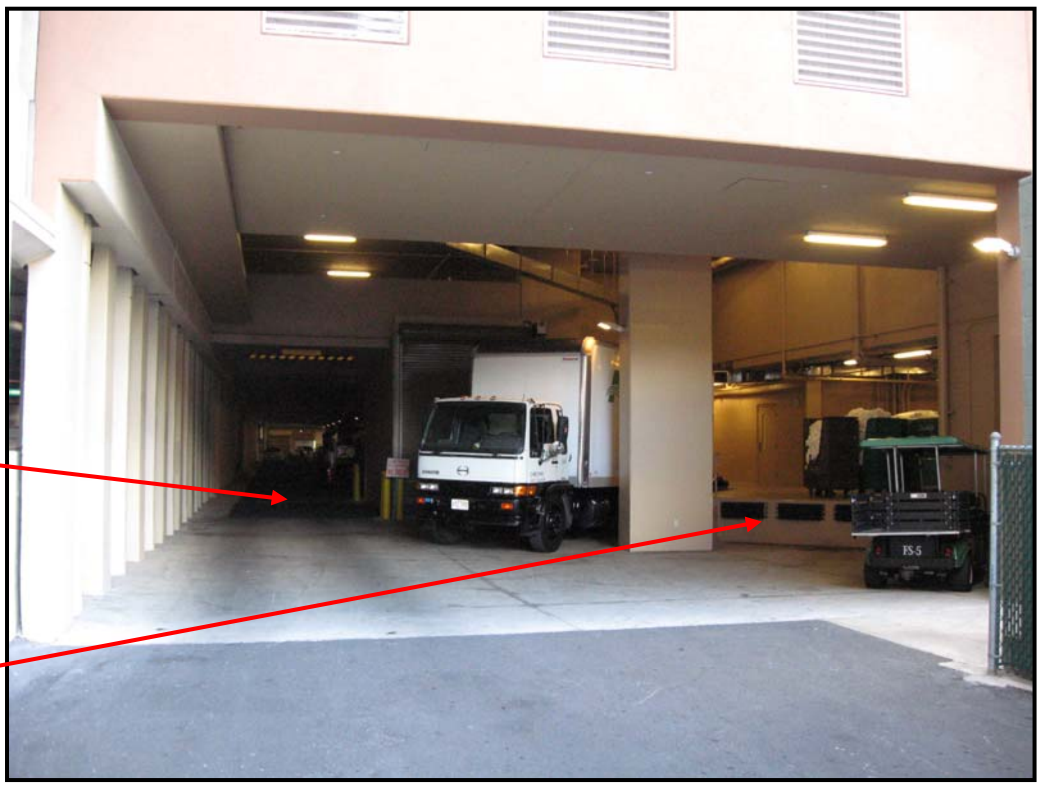
IV. LOADING MANAGEMENT PLAN

A. Delivery Operations

1. Resources

Deliveries to the Hilton Hawaiian Village can be made at the loading areas provided at the Kalia Tower, Waikikian, Tapa Tower, Great Lawn, and Lagoon Tower. The loading area at the Kalia Tower can accommodate two vehicles at the loading dock although vehicles utilize the area around the dock to make deliveries as well while the loading area at the Waikikian can accommodate only 2-3 vehicles without blocking the adjacent access aisle which is utilized by taxis staging at the resort (see Figure 18). The loading area at the Tapa Tower can currently accommodate up to five vehicles at the loading dock although vehicles utilize the area around the dock to make deliveries as well (see Figure 19). In conjunction with the development of the new timeshare tower over this loading area, the loading area will be reconfigured to provide spaces for six vehicles at the loading dock, but will reduce the available area around the dock for additional vehicle parking (see Figure 19). In addition, the existing two-way driveway along Paoa Place will be replaced by two one-way driveways. Vehicles will enter the site through

Kalia Tower Loading Area



Waikikian Loading Area

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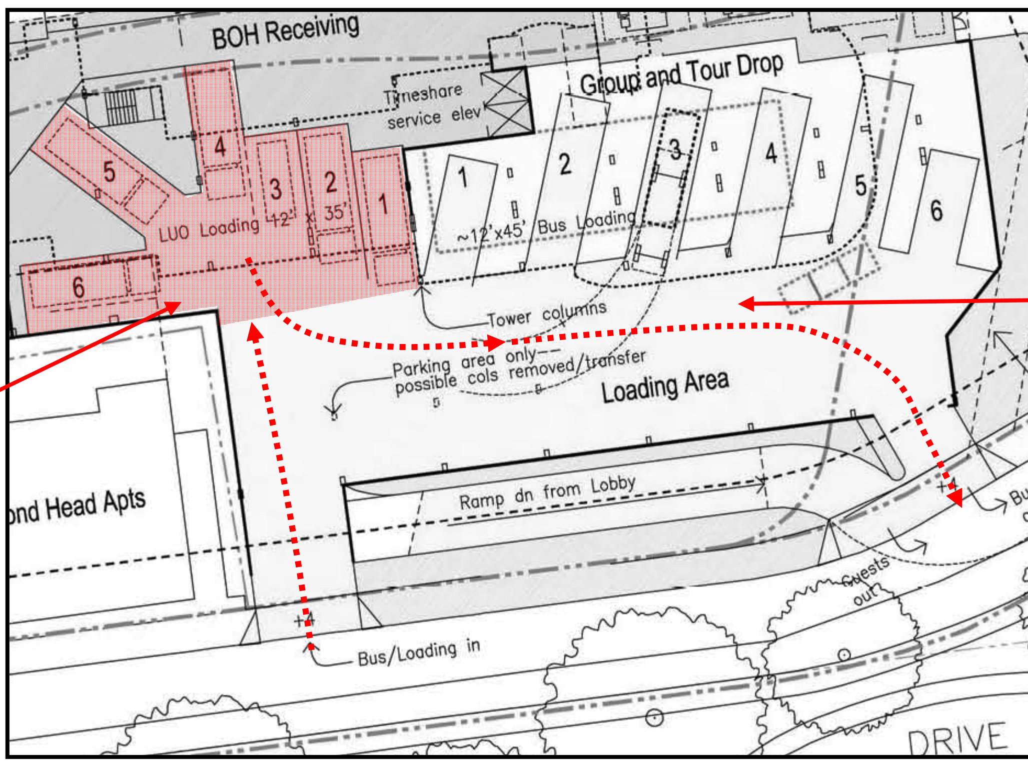
HILTON HAWAIIAN VILLAGE

KALIA TOWER AND WAIKIKIAN LOADING AREAS

FIGURE 18

Existing Loading Area



Proposed Loading Area Modifications

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HILTON HAWAIIAN VILLAGE

EXISTING AND PROPOSED MODIFICATIONS TO THE TAPA TOWER LOADING AREA

FIGURE 19

the west driveway to access the loading dock then travel through the bus loading area to access the shared exit driveway. Two loading areas are provided near the Great Lawn with the area near the loading dock able to accommodate only one vehicle while the curbside loading is able to accommodate up to 3 vehicles (see Figure 20). Finally, the loading area at the Lagoon Tower can accommodate one vehicle (see Figure 21).

A survey was conducted of the loading areas at the Kalia Tower, Waikikian, Tapa Tower, and the curbside loading area near the Great Lawn in 2010 on July 23rd (Friday) and 24th (Saturday) to assess loading operations in these areas (see Appendix C for the collected data). The survey focused on the more heavily utilized loading areas and, as such, the loading areas at the Lagoon Tower and loading dock near the Great Lawn were not included since they can only accommodate one vehicle at a time. At the Kalia Tower loading area, a maximum of 13 vehicles and 8 vehicles were observed utilizing the area on Friday and Saturday, respectively, with an average dwell time of 29 minutes on Friday and 34 minutes on Saturday. During the survey period, approximately 64% and 60% of the vehicles had dwell times less than 30 minutes on Friday and Saturday, respectively. However, there were a few vehicles observed with dwell times well in excess of 30 minutes. The maximum dwell time recorded within this loading area was 2 hours 14 minutes on Friday and 2 hours 45 minutes on Saturday. Field observations indicated that the area around the loading dock was heavily utilized with vehicles occasionally blocked in by other parked vehicles.

At the Waikikian loading area, a maximum of 4 vehicles and 2 vehicles were observed utilizing the area on Friday and Saturday, respectively, with an average dwell time of 28 minutes on Friday and 17 minutes on Saturday. During the survey period, approximately 67% and 100% of the vehicles had dwell times that were less than 30 minutes on Friday and Saturday, respectively. Field observations indicated that occasionally vehicles blocked the adjacent access aisle utilized by taxis for staging at the resort.

Curbside Loading Area

Loading Dock Area

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HILTON HAWAIIAN VILLAGE

GREAT LAWN LOADING AREAS

FIGURE 20

Loading
Dock
Access

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HILTON HAWAIIAN VILLAGE

LAGOON TOWER LOADING AREA

FIGURE
21

At the Tapa Tower loading area, a maximum of 10 vehicles and 8 vehicles were observed utilizing the area on Friday and Saturday, respectively, with an average dwell time of 18 minutes on Friday and 34 minutes on Saturday. During the survey period, approximately 83% and 86% of the vehicles had dwell times less than 30 minutes. However, there were a few vehicles observed with dwell times well in excess of 30 minutes. The maximum dwell time recorded within this loading area was 3 hours 2 minutes on Friday and on Saturday, there was a vehicle parked in the loading area for the entire survey period (11+ hours), as well as, a vehicle parked for at least 9 hours 46 minutes.

At the Great Lawn curbside loading area, a maximum of 3 vehicles were observed utilizing the area on Friday and on Saturday, only one vehicle was observed utilizing the loading area. An average dwell time of 38 minutes was observed on Friday with approximately 64% of the vehicles having dwell times less than 30 minutes. The maximum dwell time observed in this area on Friday was 2 hours 9 minutes.

2. Delivery Management Strategies

The Hilton Hawaiian Village could supplement their existing ~~implement the following~~ delivery management strategies with the following, especially for the Kalia Tower and Tapa Tower loading areas, to alleviate the existing congestion within these areas:

- Ensure that parking restrictions within the loading areas are enforced by security or designated personnel. Vehicles should not be allowed to block travel lanes or block other vehicles. In addition, only authorized vendors or delivery service provider should be allowed to park within the loading areas. Privately owned vehicles were observed parked within some of the loading areas. Any unauthorized or illegally parked vehicles should be towed at the vehicle driver's/owner's expense.

- Restrict dwell times within the loading areas to 30 minutes or less unless previously authorized by the resort. The loading area survey indicated that the majority of vehicles were able to make their deliveries within a 30-minute timeframe. Provide vendors and delivery service providers with information regarding the dwell time restrictions. Any vehicles parked for periods longer than 30 minutes should be towed at the vehicle driver's/ owner's expense.

- Position an attendant or security guard at the exit driveway during peak periods to assist exiting vehicles, as well as, minimize conflicts with other vehicles at the driveway and along Paoa Place (see Figure 22). In addition, the attendant or security guard could monitor the curbside along Paoa Place to prevent illegal parking by vendors or delivery services providers.

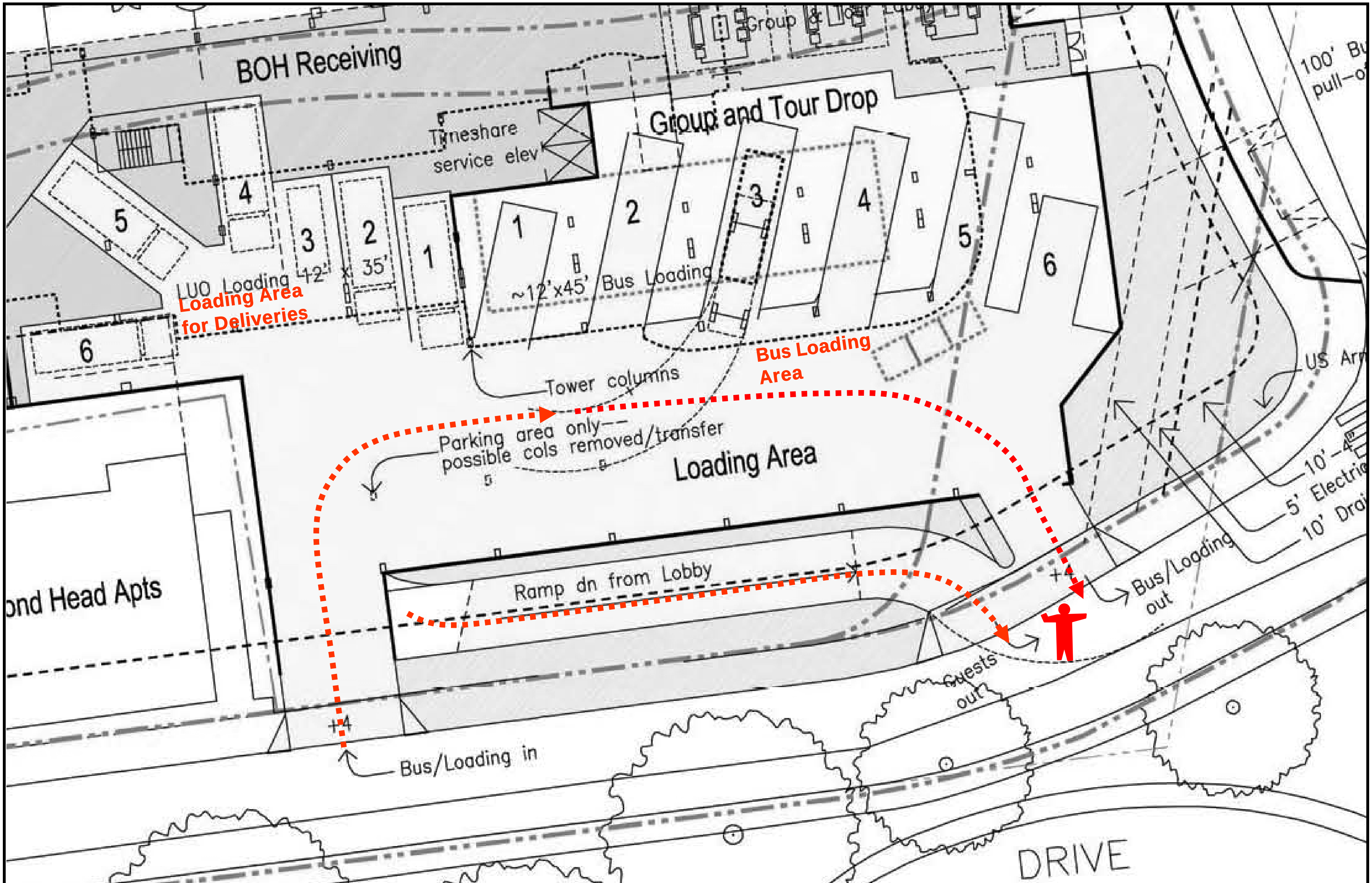
- Implement a Delivery Scheduling Program to assign delivery times to the vendors that service the resort. The Delivery Scheduling Program should be managed by a designated Loading Manager who would oversee operations at all of the loading areas via cameras installed within the loading areas or communicate with security personnel stationed at each of the loading areas. The following is a summary of the delivery management responsibilities of this manager:

  - Create and maintain a delivery schedule for the use of the loading areas. Use of the loading areas will be restricted to authorized vendors and delivery service providers only. Preference for use of the loading spaces shall be given to tenants and vendors participating in the scheduling program.
  - Provide vendors and delivery service providers with information regarding the purpose, use, and adherence to the Delivery Scheduling Program, as well as, vehicle positioning requirements and driver responsibilities.
  - Monitor the use of the loading areas to identify vendors or delivery companies not adhering to the Delivery Scheduling Program. Work with these vendors or delivery companies to inform them of the program and identify appropriate scheduled delivery times.
  - Monitor the use of the loading areas to identify peak delivery periods when delivery vehicles exceed the capacity of facilities and result in delivery vehicles stopped in improper areas to unload or await an open delivery spot.
  - Proactively work with tenants, vendors, and delivery companies to consolidate deliveries, as well as, schedule deliveries during off-peak periods (early morning or afternoon) to reduce the demand for loading facilities during the midday peak period.

B. Passenger Loading Operations

1. Resources

An on-site passenger loading area is provided at the Tapa Tower adjacent to the loading dock (referred to as the "bus loading area"). This



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HILTON HAWAIIAN VILLAGE

LOADING MANAGEMENT PLAN – TAPA TOWER

FIGURE 22

passenger loading area currently has five stalls for active passenger loading/unloading and can stage 4-5 additional vehicles while still maintaining a travel lane (see Figure 23). In conjunction with the development of the new timeshare tower over this area, the bus loading area will be reconfigured to provide six stalls for active passenger loading/ unloading, but will reduce the available staging area (see Figure 24).

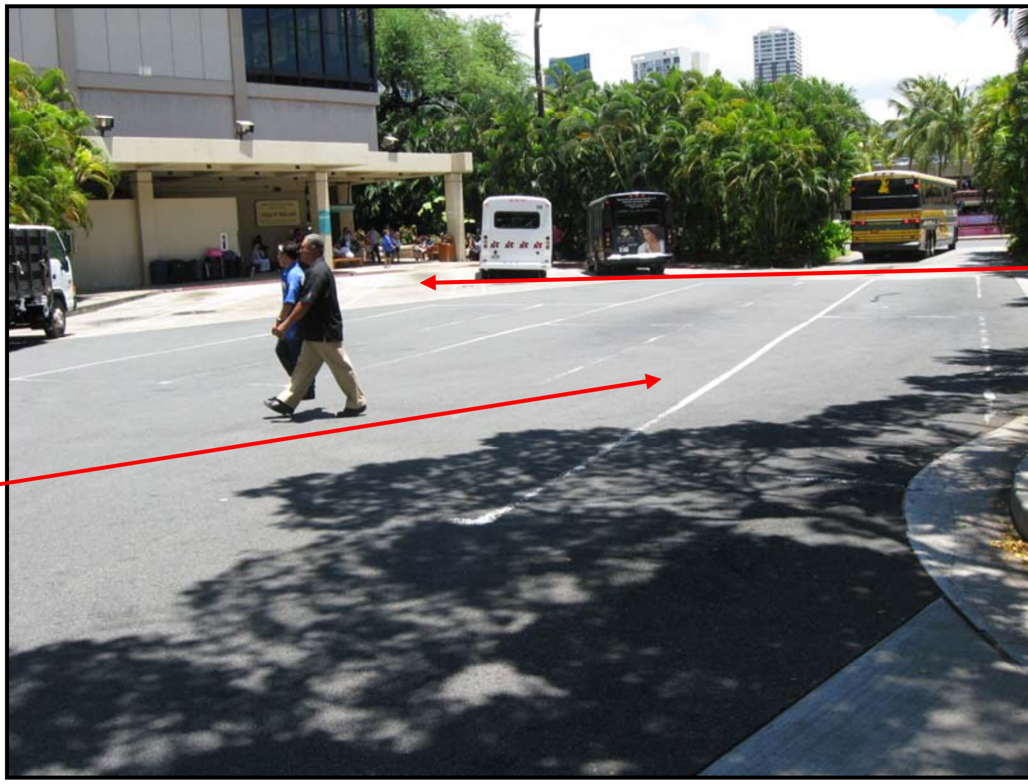
A survey was conducted of the bus loading area at the Kalia Tower in 2010 on July 30th (Friday) and 31st (Saturday) to assess passenger loading operations in this area (see Appendix D for the collected data). An average of 5 vehicles and a maximum of 12 vehicles was observed utilizing the area on both days. The average dwell time was approximately 6 minutes on both days with 95% and 96% of the vehicles having dwell times less than 20 minutes on Friday and Saturday, respectively. However, there were a few vehicles observed with dwell times well in excess of 20 minutes. The maximum dwell time recorded within this area was 1 hour 32 minutes on Friday and 48 minutes on Saturday.

2. Passenger Loading Management Strategies

The Hilton Hawaiian Village could implement the following passenger loading management strategies to alleviate the existing congestion within this area:

- Ensure that parking restrictions within the passenger loading area is enforced by security or designated personnel. Vehicles should not be allowed to block travel lanes or block other vehicles. In addition, only authorized service providers should be allowed to park within the passenger loading areas. Taxis and limousines were observed utilizing this area and should be redirected to the resort’s porte cocheres. Any unauthorized or illegally parked vehicles should be towed at the vehicle driver’s/owner’s expense

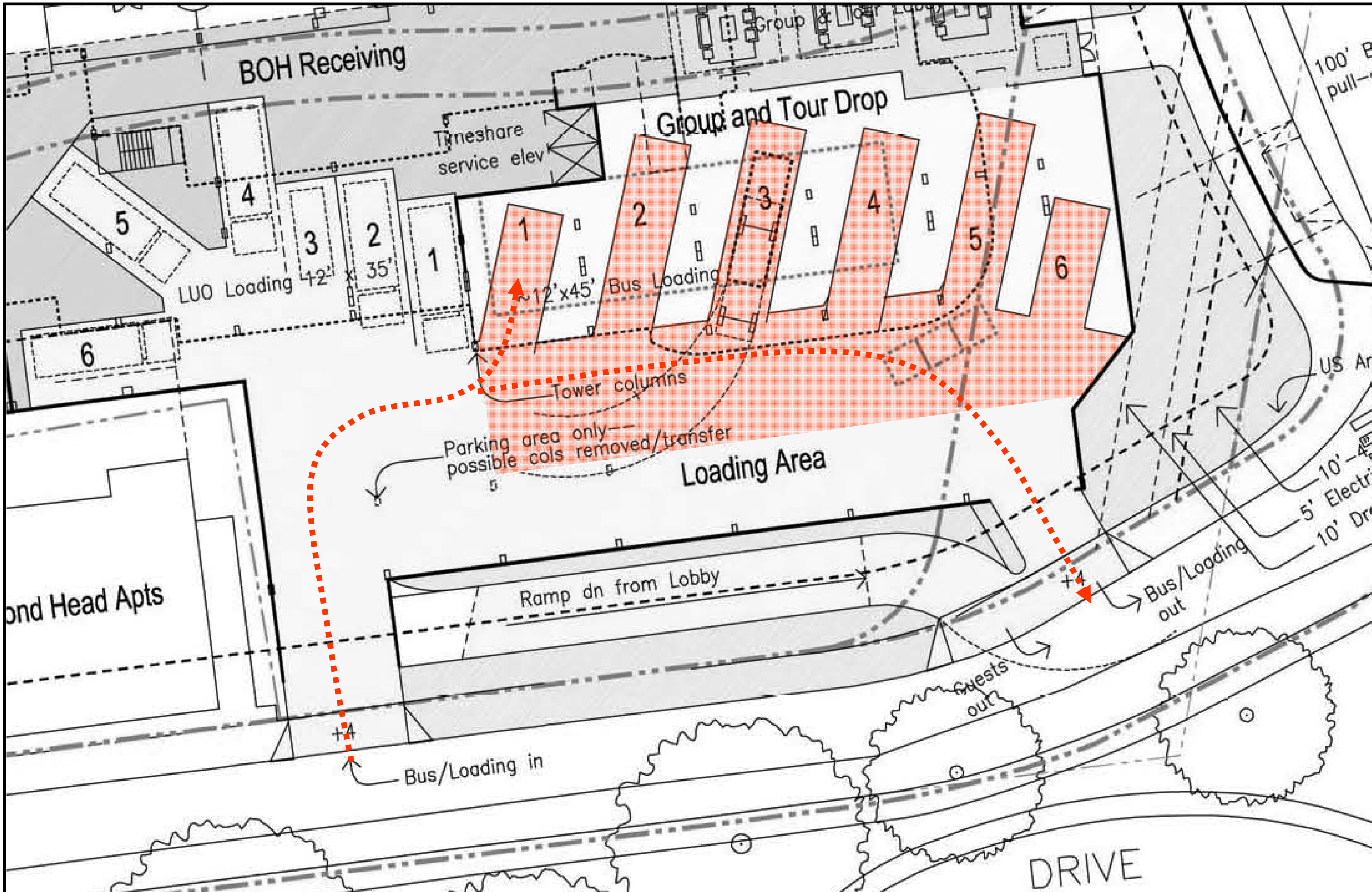
- Restrict active loading/unloading dwell times within the bus loading area to 20 minutes or less unless previously authorized by the resort. The bus loading area survey indicated that almost all of vehicles were able to load/unload within a 20-minute timeframe. Provide service providers with information regarding the dwell time restrictions. Any vehicles parked for periods longer than 20 minutes should be towed at the vehicle driver’s/ owner’s expense.



Bus Loading Area

Bus Loading Area During Peak Period

WILSON OKAMOTO CORPORATION ENGINEERS - PLANNERS	**HILTON HAWAIIAN VILLAGE** TAPA TOWER BUS LOADING AREA	FIGURE 23



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HILTON HAWAIIAN VILLAGE

PROPOSED MODIFICATIONS TO THE BUS LOADING AREA

FIGURE 24

- If there is sufficient space for vehicle staging within the bus loading area, restrict staging dwell times to 20 minutes or less unless previously authorized by the resort. The bus loading area survey indicated that almost all of vehicles were able to load/unload within a 20-minute timeframe so an active loading/unloading stall should become available during this timeframe. Any vehicles that arrive too early (more than 20 minutes prior) for their designated pick-up times must stage off-site.

- Position an attendant or security guard at the exit driveway during peak periods to assist exiting vehicles, as well as, minimize conflicts with other vehicles at the driveway and along Paoa Place. In addition, the attendant or security guard could monitor the curbside along Paoa Place to prevent illegal parking by services providers.

- Implement a Passenger Loading Scheduling Program to assign loading times to the vendors that service the resort. The Passenger Loading Scheduling Program should be managed by a designated Loading Manager. The following is a summary of the passenger loading management responsibilities of this manager:

  - Create and maintain a passenger loading schedule for the service providers at the resort. Preference for use of the passenger loading area shall be given to authorized providers participating in the scheduling program.
  - Provide service providers with information regarding the purpose, use, and adherence to the Passenger Loading Scheduling Program.
  - Proactively work with service providers to schedule appropriate loading times to minimize the dwell time of buses and trolleys within the passenger loading area.

V. CONCLUSION

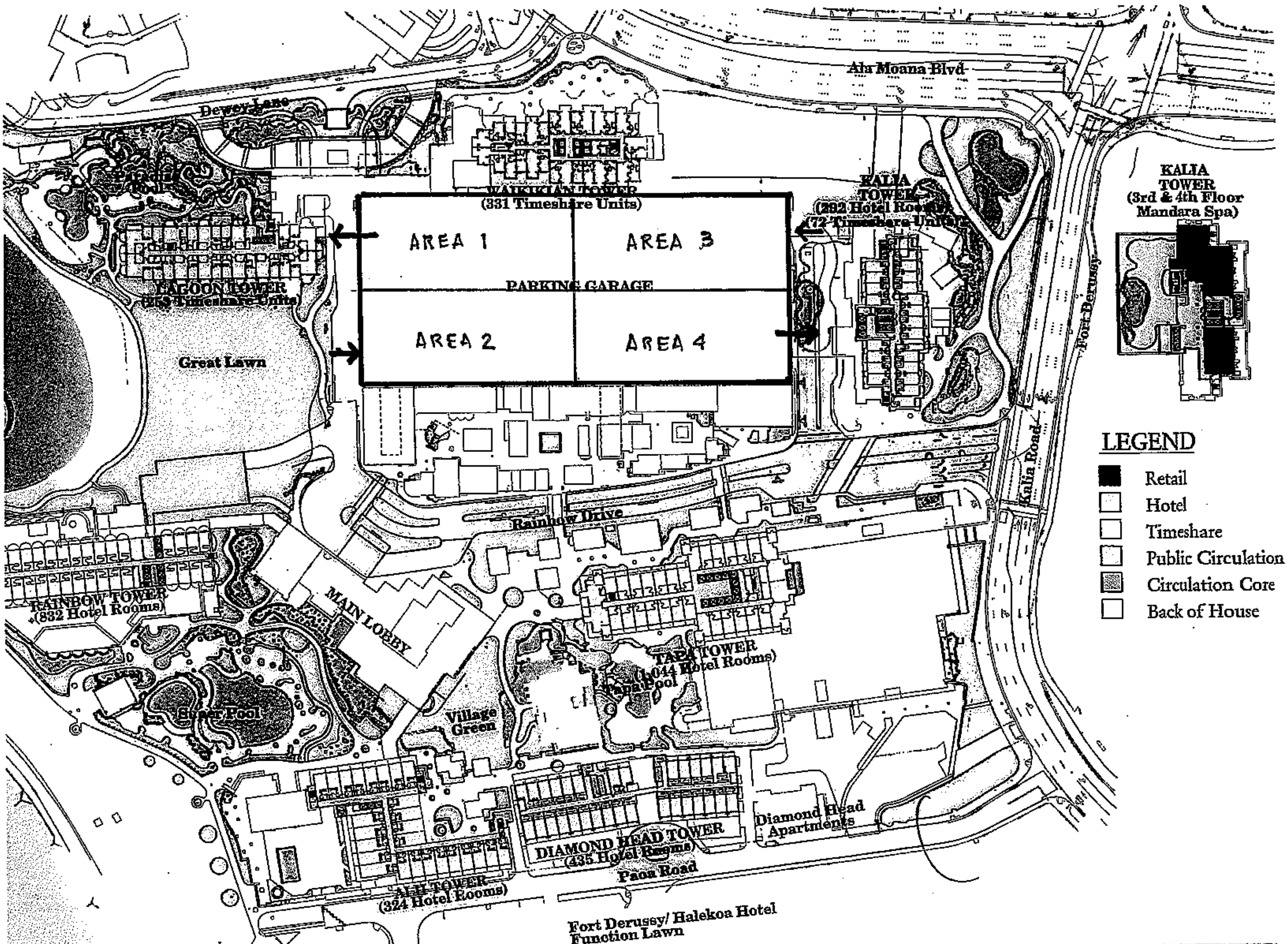
The existing Hilton Hawaiian Village resort includes hotel and timeshare units, shops, restaurants, banquet/meeting space, and other amenities such as pool areas, botanical gardens, and a parking garage. The master plan for the resort includes the renovation of the resort's main entry and lobby, Rainbow Drive, and some of the existing retail and pool areas, as well as, construction of two new timeshare towers. Surveys were conducted of the existing parking and loading operations within the resort which indicate that although most of the parking and loading areas operate smoothly, the loading areas at the Kalia Tower and Tapa Tower are currently congested. As such, the Hilton Hawaiian Village could implement parking and loading management strategies to alleviate the existing conditions and provide adequate capacity for their future plans. These strategies include the restriction of parking within the valet service areas, implementation of bus pass and ride-share programs to reduce on-site parking by employees, restriction of dwell times within the loading areas, and the implementation of scheduling programs for deliveries and passenger loading. In addition, parking and loading operating conditions at the resort should be monitored periodically, at least every three (3) years, and the parking and loading management plan updated based upon the results of this assessment.

Hilton Hawaiian Village Contact:

Jerry Gibson, Area Vice President
Hilton Hawaiian Village Beach Resort and Spa
2005 Kalia Road
Honolulu, HI 96815
Tel: (808) 949-4321

APPENDIX A

PARKING GARAGE SURVEY



ity Proposal
e

Existing Conditions Plan: Upper Guestrooms Towers Level

GROUP 70
ALTOON + PORTER ARCHITECTS

HILTON HAWAIIAN VILLAGE PARKING GARAGE SURVEY

Date: Friday, July 23, 2010

Interval	Area 1				Area 2			Area 3				Area 4			Totals
	Self Parking	Valet Parking	Reserved Parking	Hertz Rental	Self Parking	Valet Parking	Motorcycle/ Mopeds	Self Parking	ADA Stall	Valet Parking	Reserved Parking	Self Parking	ADA Stall	Reserved Parking	
6:00AM	259	34	1	17	229	94	15	186	0	40	3	251	2	20	1151
6:15AM	251	34	1	17	234	95	15	193	0	42	3	256	2	20	1163
6:30AM	136	138	1	17	241	95	13	202	0	41	2	266	2	19	1173
6:45AM	137	135	1	17	156	91	14	228	0	41	2	267	2	23	1114
7:00AM	172	115	1	14	261	88	16	235	0	40	3	285	2	23	1255
7:15AM	168	113	1	14	270	88	16	265	0	38	3	288	2	23	1289
7:30AM	200	121	1	15	280	85	19	282	0	38	4	295	2	23	1365
7:45AM	238	126	1	15	289	83	19	286	0	38	4	286	4	23	1412
8:00AM	237	113	1	15	297	81	20	285	0	40	5	289	4	23	1410
8:15AM	240	112	1	15	301	81	20	285	0	40	5	295	5	24	1424
8:30AM	239	110	1	14	299	81	22	284	0	43	5	289	5	24	1416
8:45AM	231	108	1	14	293	70	22	278	0	40	7	287	4	25	1380
9:00AM	233	108	1	14	296	72	21	280	0	40	8	288	12	12	1385
9:15AM	230	107	1	17	291	72	21	277	0	40	8	282	12	18	1376
9:30AM	232	96	1	14	279	65	20	277	1	42	8	283	12	18	1348
9:45AM	231	94	1	14	273	61	20	269	1	39	8	285	11	18	1325
10:00AM	226	91	1	12	283	52	22	263	1	38	8	281	12	18	1308
10:15AM	221	86	1	12	283	53	22	258	1	38	8	276	12	18	1289
10:30AM	209	73	1	12	285	65	21	252	1	37	8	256	12	16	1248
10:45AM	238	75	1	10	316	59	21	243	1	32	7	265	12	16	1296
11:00AM	244	74	1	10	310	53	21	237	1	29	7	255	12	16	1270
11:15AM	234	75	1	8	275	45	21	240	1	31	6	260	12	16	1225
11:30AM	235	72	1	8	265	43	22	233	1	31	8	248	12	18	1197
11:45AM	240	70	1	8	271	42	25	238	1	27	8	245	10	15	1201
12 Noon	236	71	1	8	265	44	22	237	0	25	8	244	10	15	1186
12:15PM	236	70	1	8	263	44	23	229	0	29	7	245	9	12	1176
12:30PM	235	64	1	8	273	41	25	221	0	30	7	248	11	14	1178
12:45PM	225	62	1	8	269	41	25	224	0	29	7	251	11	14	1167
1:00PM	225	67	0	8	278	39	26	219	0	30	6	256	9	16	1179
1:15PM	221	67	0	8	282	46	27	216	0	29	6	256	10	16	1184
1:30PM	221	67	0	8	284	47	28	219	0	29	6	260	9	16	1194
1:45PM	220	66	0	8	288	46	27	220	0	28	6	264	9	18	1200
2:00PM	199	71	0	8	297	49	27	228	0	28	6	269	9	18	1209
2:15PM	197	70	0	8	288	50	26	234	0	29	6	270	10	16	1204
2:30PM	197	70	0	8	293	51	33	235	0	28	6	276	10	18	1225
2:45PM	198	69	0	8	288	54	34	241	0	27	6	283	10	18	1236
3:00PM	197	67	0	8	286	54	34	240	0	27	6	280	10	18	1227
3:15PM	204	70	0	8	291	57	31	244	0	24	7	280	10	17	1243
3:30PM	193	73	0	11	294	56	31	246	0	24	7	281	10	12	1238
3:45PM	197	72	0	11	293	65	28	225	0	24	8	275	8	18	1224
4:00PM	191	74	0	11	277	64	29	215	0	24	7	261	8	17	1178
4:15PM	174	74	0	13	271	71	27	211	0	26	7	266	10	17	1167
4:30PM	160	82	0	12	270	71	26	187	0	27	7	254	7	17	1120
4:45PM	163	84	0	12	272	63	26	175	0	27	6	263	6	16	1113
5:00PM	120	80	1	10	229	67	26	149	0	26	7	252	9	14	990
5:15PM	114	89	1	10	231	70	26	145	0	26	6	249	9	14	990
5:30PM	107	88	1	10	249	75	25	155	0	26	6	244	9	14	1009
5:45PM	101	93	1	10	223	77	24	151	0	29	6	244	8	15	982

HILTON HAWAIIAN VILLAGE PARKING GARAGE SURVEY

Date: Friday, July 23, 2010

Interval	Area 1				Area 2			Area 3				Area 4			Totals
	Self Parking	Valet Parking	Reserved Parking	Hertz Rental	Self Parking	Valet Parking	Motorcycle/ Mopeds	Self Parking	ADA Stall	Valet Parking	Reserved Parking	Self Parking	ADA Stall	Reserved Parking	
6:00PM	105	95	1	11	235	80	27	150	0	28	6	230	7	11	986
6:15PM	88	98	1	11	234	83	27	145	0	24	4	244	9	15	983
6:30PM	93	98	1	11	235	90	27	153	0	24	4	251	9	15	1011
6:45PM	90	99	1	12	232	89	26	156	1	25	3	243	9	14	1000
7:00PM	96	86	1	12	238	96	26	161	1	24	3	242	8	15	1009
7:15PM	93	97	1	12	234	95	27	162	1	27	3	250	8	13	1023
7:30PM	99	97	1	14	238	100	27	161	1	27	3	256	9	7	1040
7:45PM	95	98	1	13	262	102	30	178	1	27	3	263	7	16	1096
8:00PM	103	105	1	16	246	102	31	181	1	26	3	263	11	22	1111
8:15PM	103	102	1	18	237	101	30	180	1	29	1	253	9	19	1084
8:30PM	99	102	1	20	237	105	29	177	1	30	1	239	8	17	1066
8:45PM	95	102	1	19	239	106	30	178	1	29	1	249	9	16	1075
9:00PM	92	106	1	14	237	108	31	172	1	29	1	241	9	6	1048
9:15PM	96	109	1	20	237	107	30	172	1	33	1	261	9	8	1085
9:30PM	94	108	1	20	239	108	29	178	1	33	1	261	9	8	1090
9:45PM	94	117	1	20	241	113	27	175	1	37	1	228	7	9	1071
10:00PM	100	116	1	21	243	112	26	174	1	37	1	238	6	11	1087
10:15PM	100	112	1	21	245	111	27	177	1	37	1	249	6	10	1098
10:30PM	100	112	1	21	239	114	26	164	1	33	0	264	6	6	1087
10:45PM	99	111	1	21	237	113	26	174	1	33	0	260	7	10	1093
11:00PM	103	128	1	19	227	119	23	174	1	40	1	264	7	10	1117
11:15PM	98	126	1	20	225	121	23	171	1	40	1	243	5	9	1084
11:30PM	88	128	1	20	224	123	22	169	1	39	1	250	5	9	1080
11:45PM	85	130	1	20	210	120	19	172	1	43	1	246	5	9	1062

HILTON HAWAIIAN VILLAGE PARKING GARAGE SURVEY
Date: Saturday, July 24, 2010

Interval	Area 1				Area 2			Area 3				Area 4			Totals
	Self Parking	Valet Parking	Reserved Parking	Hertz Rental	Self Parking	Valet Parking	Motorcycle/ Mopeds	Self Parking	ADA Stall	Valet Parking	Reserved Parking	Self Parking	ADA Stall	Reserved Parking	
6:00AM	100	131	1	20	225	115	17	150	0	34	6	253	5	11	1068
6:15AM	98	131	1	20	228	115	19	163	0	33	6	265	6	10	1095
6:30AM	97	131	1	20	237	115	19	204	0	33	5	254	7	10	1133
6:45AM	91	130	1	19	239	109	20	212	0	33	5	268	7	11	1145
7:00AM	113	126	1	18	242	109	20	255	0	34	5	276	6	11	1216
7:15AM	110	126	1	18	268	110	22	235	0	32	4	281	6	10	1223
7:30AM	125	125	1	17	274	108	23	231	0	40	4	295	7	9	1259
7:45AM	132	124	1	17	278	108	22	256	0	46	4	300	7	14	1309
8:00AM	143	124	1	17	282	105	25	243	0	40	6	302	6	12	1306
8:15AM	164	118	1	16	284	24	24	253	0	38	6	300	7	9	1244
8:30AM	172	112	1	15	282	24	24	260	0	29	9	290	7	9	1234
8:45AM	175	108	1	15	284	97	25	251	0	35	8	291	7	9	1306
9:00AM	189	113	1	15	287	100	26	251	0	35	8	294	7	9	1335
9:15AM	187	112	1	16	290	99	26	247	0	35	8	296	7	9	1333
9:30AM	178	110	1	16	191	100	6	215	0	36	8	292	7	9	1169
9:45AM	182	98	1	14	289	80	26	240	0	36	8	294	6	9	1283
10:00AM	182	75	1	13	264	77	26	243	0	34	5	274	8	17	1219
10:15AM	178	65	1	12	258	70	28	241	0	34	5	268	9	20	1189
10:30AM	173	66	1	9	258	69	28	237	0	35	5	262	8	17	1168
10:45AM	174	60	1	9	256	69	28	243	0	36	6	257	10	19	1168
11:00AM	175	61	1	9	248	65	29	238	0	33	6	286	9	5	1165
11:15AM	170	50	1	9	246	67	29	230	0	30	6	291	9	5	1143
11:30AM	176	55	1	8	249	69	29	223	0	30	6	295	9	9	1159
11:45AM	176	64	1	7	253	71	27	201	0	28	6	297	9	9	1149
12 Noon	168	46	1	7	239	71	27	217	1	28	6	294	8	9	1122
12:15PM	166	50	1	6	240	72	28	213	1	29	6	287	8	9	1116
12:30PM	164	51	1	6	243	60	30	216	1	29	6	290	9	9	1115
12:45PM	162	52	1	6	249	60	30	218	1	30	3	292	9	9	1122
1:00PM	166	64	1	6	312	58	30	196	1	32	5	294	9	8	1182
1:15PM	167	64	1	6	265	59	31	207	1	30	8	297	7	8	1151
1:30PM	164	60	1	6	273	60	31	203	1	28	9	291	7	8	1142
1:45PM	164	63	1	7	279	61	32	206	1	29	8	287	6	8	1152
2:00PM	166	63	1	5	283	60	33	201	1	27	17	284	7	7	1155
2:15PM	165	64	0	5	270	65	32	211	1	25	9	291	5	8	1151
2:30PM	166	66	0	5	265	65	33	211	1	27	8	275	7	8	1137
2:45PM	166	62	0	5	261	68	31	212	1	28	8	290	7	8	1147
3:00PM	164	62	0	4	260	65	28	206	1	32	8	264	8	20	1122
3:15PM	156	72	0	7	257	66	29	213	0	32	9	261	8	23	1133
3:30PM	154	75	0	7	258	68	32	202	0	32	9	288	7	19	1151
3:45PM	155	85	0	8	258	71	32	200	0	31	8	267	7	21	1143
4:00PM	156	83	0	8	259	63	29	176	0	30	8	263	6	10	1091
4:15PM	156	87	0	8	255	65	30	175	0	30	8	258	6	10	1088
4:30PM	160	87	0	8	257	64	29	173	0	32	8	276	4	10	1108
4:45PM	159	88	0	8	243	79	29	172	0	34	7	265	4	10	1098
5:00PM	110	102	0	6	217	83	25	156	0	35	3	286	5	10	1038
5:15PM	109	104	0	7	216	83	30	150	0	35	3	260	5	10	1012
5:30PM	101	104	0	7	215	82	31	149	1	35	3	247	5	10	990
5:45PM	103	102	0	7	216	83	33	150	1	34	2	241	4	10	986

HILTON HAWAIIAN VILLAGE PARKING GARAGE SURVEY

Date: Saturday, July 24, 2010

Interval	Area 1				Area 2			Area 3				Area 4			Totals
	Self Parking	Valet Parking	Reserved Parking	Hertz Rental	Self Parking	Valet Parking	Motorcycle/ Mopeds	Self Parking	ADA Stall	Valet Parking	Reserved Parking	Self Parking	ADA Stall	Reserved Parking	
6:00PM	91	103	0	8	216	83	33	146	1	35	2	237	3	11	969
6:15PM	89	104	0	8	223	80	33	150	1	34	2	243	4	11	982
6:30PM	88	101	0	8	239	82	33	146	1	34	2	259	4	11	1008
6:45PM	86	103	0	8	239	83	33	148	1	34	2	262	4	10	1013
7:00PM	83	102	0	7	241	83	33	153	1	34	1	243	5	9	995
7:15PM	83	104	0	9	243	84	30	154	1	34	1	249	5	9	1006
7:30PM	81	107	0	9	226	93	30	165	1	34	1	287	5	10	1049
7:45PM	81	103	0	10	224	93	30	151	1	36	1	279	6	9	1024
8:00PM	88	101	0	11	170	95	30	144	1	48	1	252	5	12	958
8:15PM	85	101	0	11	166	94	29	141	1	40	1	249	5	9	932
8:30PM	84	100	0	11	169	95	29	150	1	36	1	259	4	10	949
8:45PM	84	98	0	11	168	95	28	148	1	35	1	256	4	9	938
9:00PM	86	107	0	13	221	95	28	150	0	37	1	252	4	13	1007
9:15PM	81	109	0	13	248	95	27	148	0	37	1	250	3	9	1021
9:30PM	80	107	0	13	239	96	27	152	0	38	1	251	3	9	1016
9:45PM	78	107	0	13	214	101	24	153	0	38	1	249	3	10	991
10:00PM	85	118	0	15	212	99	99	157	0	38	1	248	4	8	1084
10:15PM	85	117	0	15	213	100	100	157	0	38	1	248	4	8	1086
10:30PM	67	110	0	14	210	98	98	158	0	38	1	248	4	8	1054
10:45PM	66	107	0	14	209	97	97	158	0	38	1	249	4	9	1049
11:00PM	78	128	0	14	207	111	111	157	0	40	1	247	4	9	1107
11:15PM	78	128	0	14	205	115	115	157	0	39	1	243	4	10	1109
11:30PM	76	129	0	14	202	120	120	155	0	39	1	241	4	11	1112
11:45PM	74	130	0	14	201	120	120	151	0	39	1	239	4	11	1104

HILTON HAWAIIAN VILLAGE PARKING GARAGE SURVEY

Date: Friday, July 23, 2010

Interval	Kalia Tower Dwy		Lagoon Tower Dwy	
	Entering	Exiting	Entering	Exiting
6:00AM	23	0	11	15
6:15AM	31	6	13	10
6:30AM	60	6	19	16
6:45AM	59	7	18	11
7:00AM	61	12	27	24
7:15AM	55	10	23	27
7:30AM	30	4	24	17
7:45AM	16	9	20	21
8:00AM	38	7	13	18
8:15AM	17	5	9	19
8:30AM	18	11	9	20
8:45AM	13	7	12	29
9:00AM	12	7	4	23
9:15AM	16	10	8	19
9:30AM	16	14	9	22
9:45AM	15	12	7	25
10:00AM	9	11	17	35
10:15AM	9	14	4	26
10:30AM	11	16	12	22
10:45AM	14	10	10	18
11:00AM	9	20	9	25
11:15AM	9	14	10	28
11:30AM	10	24	21	20
11:45AM	14	19	15	8
12 Noon	13	25	15	19
12:15PM	6	16	11	11
12:30PM	18	19	9	10
12:45PM	17	10	17	13
1:00PM	18	15	19	23
1:15PM	11	8	13	9
1:30PM	19	18	25	9
1:45PM	21	9	24	7
2:00PM	17	23	21	31
2:15PM	27	15	26	15
2:30PM	27	31	29	16
2:45PM	25	25	17	9
3:00PM	21	30	18	22
3:15PM	23	21	9	18
3:30PM	30	41	26	13
3:45PM	11	33	20	22
4:00PM	20	49	23	43
4:15PM	14	28	22	23
4:30PM	16	51	25	11
4:45PM	24	37	20	18
5:00PM	18	61	22	29
5:15PM	25	25	19	11
5:30PM	19	23	9	13
5:45PM	16	22	34	16

HILTON HAWAIIAN VILLAGE PARKING GARAGE SURVEY

Date: Friday, July 23, 2010

Interval	Kalia Tower Dwy		Lagoon Tower Dwy	
	Entering	Exiting	Entering	Exiting
6:00PM	11	20	19	12
6:15PM	16	22	16	6
6:30PM	13	13	31	32
6:45PM	18	17	24	13
7:00PM	21	16	20	14
7:15PM	17	9	27	13
7:30PM	16	8	47	16
7:45PM	10	6	23	13
8:00PM	12	25	14	12
8:15PM	15	32	12	16
8:30PM	9	19	20	9
8:45PM	12	16	13	4
9:00PM	11	10	14	7
9:15PM	11	8	17	4
9:30PM	10	18	18	2
9:45PM	11	13	13	8
10:00PM	6	13	21	12
10:15PM	6	7	23	15
10:30PM	5	15	10	8
10:45PM	7	5	15	5
11:00PM	0	25	14	26
11:15PM	4	19	7	5
11:30PM	2	11	4	3
11:45PM	0	6	1	5

HILTON HAWAIIAN VILLAGE PARKING GARAGE SURVEY
Date: Saturday, July 24, 2010

Interval	Kalia Tower Dwy		Lagoon Tower Dwy	
	Entering	Exiting	Entering	Exiting
6:00AM	17	5	5	9
6:15AM	28	7	8	16
6:30AM	47	3	18	11
6:45AM	45	3	17	16
7:00AM	59	13	12	14
7:15AM	69	9	14	14
7:30AM	29	7	15	16
7:45AM	11	4	6	11
8:00AM	13	7	2	25
8:15AM	12	8	8	15
8:30AM	11	6	5	25
8:45AM	9	13	3	20
9:00AM	9	11	9	27
9:15AM	12	9	8	22
9:30AM	19	9	11	28
9:45AM	8	7	14	26
10:00AM	11	8	8	25
10:15AM	9	20	14	27
10:30AM	7	12	8	19
10:45AM	10	14	8	21
11:00AM	8	16	6	19
11:15AM	9	26	13	20
11:30AM	9	16	6	22
11:45AM	8	10	8	14
12 Noon	19	14	13	15
12:15PM	10	11	15	16
12:30PM	13	24	11	10
12:45PM	14	9	18	10
1:00PM	22	15	17	16
1:15PM	12	8	15	10
1:30PM	12	18	24	14
1:45PM	15	9	25	7
2:00PM	17	23	24	16
2:15PM	21	15	20	16
2:30PM	21	31	27	18
2:45PM	20	25	19	13
3:00PM	34	30	18	19
3:15PM	13	21	22	11
3:30PM	24	41	24	10
3:45PM	40	33	21	9
4:00PM	73	49	18	25
4:15PM	35	28	30	20
4:30PM	26	51	31	10
4:45PM	52	37	21	7
5:00PM	17	65	21	24
5:15PM	16	36	15	19
5:30PM	16	9	29	17
5:45PM	10	20	21	16

HILTON HAWAIIAN VILLAGE PARKING GARAGE SURVEY
Date: Saturday, July 24, 2010

Interval	Kalia Tower Dwy		Lagoon Tower Dwy	
	Entering	Exiting	Entering	Exiting
6:00PM	26	16	15	18
6:15PM	7	18	18	13
6:30PM	18	18	28	19
6:45PM	11	12	25	15
7:00PM	15	17	19	17
7:15PM	12	15	15	19
7:30PM	8	6	21	9
7:45PM	9	7	10	12
8:00PM	12	30	12	5
8:15PM	15	18	18	7
8:30PM	7	12	15	12
8:45PM	14	17	12	4
9:00PM	15	27	12	12
9:15PM	8	11	18	5
9:30PM	5	11	21	11
9:45PM	18	7	15	4
10:00PM	9	11	10	13
10:15PM	8	19	15	13
10:30PM	12	4	12	7
10:45PM	5	7	15	7
11:00PM	8	21	12	10
11:15PM	5	15	6	3
11:30PM	5	5	6	1
11:45PM	0	4	4	2

APPENDIX B

VALET SURVEY

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
6:00AM	1	2	0	11	11 Cars already parked within valet area	0	0	0	0		0	2	0	4	
6:05AM	0	4	0	13		0	0	0	0		0	0	0	4	
6:10AM	0	2	0	10		1	0	0	1		0	2	0	5	
6:15AM	0	1	0	9		0	0	0	0		1	0	0	6	
6:20AM	0	3	0	8		0	0	0	0		0	0	0	6	
6:25AM	2	2	0	9		0	0	0	0		0	0	0	5	
6:30AM	2	0	0	9		0	0	0	0		0	0	0	4	
6:35AM	4	0	0	10		0	0	0	0		0	0	0	3	
6:40AM	3	1	0	2		0	0	0	0		2	2	0	5	
6:45AM	2	1	0	2		1	0	0	1		2	1	0	7	
6:50AM	3	1	0	12		2	2	0	4		0	0	0	6	
6:55AM	5	0	0	14		1	0	0	1		0	0	0	6	
7:00AM	3	0	0	11		0	1	0	1		2	2	0	5	
7:05AM	3	1	0	12		1	1	0	2		0	1	0	7	
7:10AM	2	1	0	8		0	0	0	0		0	2	0	8	
7:15AM	0	0	0	7		1	0	0	1		3	2	0	8	
7:20AM	5	2	0	14		1	1	0	2		0	0	0	7	
7:25AM	2	1	0	10		1	2	0	3		2	1	0	8	
7:30AM	4	1	0	11		0	0	0	0		3	2	0	7	
7:35AM	1	0	0	11		0	0	0	0		0	1	0	7	
7:40AM	2	2	0	15		2	0	1	3		0	1	0	7	
7:45AM	6	3	1	2		0	0	0	0		2	0	0	7	
7:50AM	6	2	0	12		0	0	0	0		0	1	0	5	
7:55AM	2	0	0	10		2	0	0	2		2	4	0	5	
8:00AM	5	5	0	14		2	0	0	2		4	3	2	9	
8:05AM	5	1	0	2		1	1	0	2		3	0	0	8	
8:10AM	1	4	0	2		1	0	0	1		3	1	0	7	
8:15AM	1	3	0	9		0	0	0	0		1	0	1	8	
8:20AM	4	4	0	10		1	0	0	1		2	0	0	9	
8:25AM	1	1	1	6		3	0	0	3		2	0	0	8	
8:30AM	6	1	0	9		1	2	0	3		2	1	0	7	
8:35AM	0	5	0	12		1	2	0	3		4	0	0	10	
8:40AM	5	2	0	7		0	0	0	0		2	2	1	10	
8:45AM	5	0	0	9		0	1	0	1		3	0	0	10	
8:50AM	4	3	0	12		1	0	0	1		0	0	0	9	
8:55AM	0	5	0	2		0	0	0	0		3	0	2	14	
9:00AM	6	2	0	13		1	0	0	1		1	1	0	9	
9:05AM	5	2	0	11		0	0	0	0		2	1	0	11	
9:10AM	3	4	0	13		0	0	0	0		1	0	0	11	
9:15AM	2	3	0	14		0	0	0	0		3	1	0	10	
9:20AM	6	3	0	11		0	1	1	2		1	0	0	10	
9:25AM	8	2	0	17		1	0	0	1		1	0	0	9	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
9:30AM	7	2	0	19		1	0	0	1		2	0	0	10	
9:35AM	8	3	0	15		1	0	0	1		3	1	0	11	
9:40AM	5	2	0	15		2	0	0	2		2	1	0	8	
9:45AM	4	5	1	17		2	0	0	2		0	0	0	6	
9:50AM	3	4	0	13		0	0	0	0		1	1	0	8	
9:55AM	5	2	0	17		1	0	0	1		2	1	0	8	
10:00AM	8	2	0	17		2	1	0	3		0	0	0	7	
10:05AM	4	0	0	13		2	0	0	2		1	1	0	7	
10:10AM	4	6	0	7		3	0	0	3		4	1	0	8	
10:15AM	3	1	3	13		4	0	0	4		2	1	0	8	
10:20AM	1	1	0	12		3	0	0	3		3	1	1	6	
10:25AM	8	2	0	15		2	0	0	2		1	1	0	6	
10:30AM	9	6	0	10		2	0	0	2		2	3	3	8	
10:35AM	7	4	0	9		2	0	0	2		3	2	0	8	
10:40AM	5	2	0	10		1	1	1	3		5	3	0	10	
10:45AM	6	5	0	12		0	0	0	0		5	2	1	8	
10:50AM	10	4	0	16		0	0	0	0		3	1	0	2	
10:55AM	6	3	0	16		1	1	0	2		1	3	1	10	
11:00AM	7	3	4	17		2	0	0	2		2	2	0	14	
11:05AM	5	0	0	12		1	1	0	2		2	1	1	10	
11:10AM	7	0	0	12		2	0	0	2		2	2	0	9	
11:15AM	10	3	0	13		1	0	0	1		1	2	0	12	
11:20AM	5	0	0	10		1	0	0	1		5	2	4	9	
11:25AM	9	3	0	12		1	0	0	1		4	2	0	13	
11:30AM	5	1	0	9		4	0	0	4		1	2	0	11	
11:35AM	8	2	0	12		2	1	0	3		2	4	0	11	
11:40AM	2	1	0	13		1	1	0	2		3	3	0	13	
11:45AM	6	4	0	11		3	1	0	4		5	4	0	10	
11:50AM	4	3	1	15		0	1	0	1		3	2	1	12	
11:55AM	8	3	1	18		0	0	0	0		2	3	0	13	
12Noon	10	6	0	18		1	0	0	1		0	1	0	14	
12:05PM	10	3	0	17		2	1	0	3		2	4	0	12	
12:10PM	2	3	0	15		3	1	0	4		1	1	0	9	
12:15PM	4	4	0	12		2	0	0	2		3	3	0	9	
12:20PM	4	3	0	14		1	0	0	1		2	0	0	9	
12:25PM	8	3	2	12		0	0	0	0		2	1	0	10	
12:30PM	6	4	0	9		2	0	0	2		2	0	0	9	
12:35PM	5	3	0	8		2	0	0	2		0	1	0	7	
12:40PM	2	4	0	10		0	0	0	0		2	3	0	7	
12:45PM	1	1	0	7		0	0	0	0		1	2	0	6	
12:50PM	7	0	0	7		1	0	0	1		2	1	0	4	
12:55PM	4	5	0	13		1	0	0	1		1	3	0	3	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
1:00PM	4	2	2	7		5	0	0	5		4	3	0	4	
1:05PM	4	6	0	8		3	0	0	3		1	2	0	4	
1:10PM	2	0	0	5		4	0	0	4		4	2	0	3	
1:15PM	2	2	0	6		1	0	0	1		0	0	0	6	
1:20PM	4	3	0	5		1	0	0	1		1	0	0	6	
1:25PM	5	3	3	13		0	0	0	0		3	0	1	7	
1:30PM	3	2	0	7		1	0	0	1		3	1	0	7	
1:35PM	3	3	1	8		3	1	0	4		1	0	0	7	
1:40PM	4	3	1	10		2	0	0	2		2	2	0	7	
1:45PM	4	2	1	8		1	0	0	1		4	1	0	9	
1:50PM	2	1	0	6		0	0	0	0		1	1	0	9	
1:55PM	6	4	0	12		0	0	0	0		5	1	1	10	
2:00PM	2	2	0	9		0	0	0	0		5	4	0	18	
2:05PM	4	3	1	13		2	0	0	2		1	0	0	11	
2:10PM	4	5	0	14		0	0	0	0		0	1	0	8	
2:15PM	8	3	1	12		2	1	0	3		2	0	0	7	
2:20PM	4	5	0	10		1	1	0	2		6	3	0	11	
2:25PM	2	2	0	7		0	0	0	0		4	2	0	11	
2:30PM	4	2	0	8		2	0	0	2		4	0	0	15	
2:35PM	5	5	0	11		0	0	0	0		5	1	0	10	
2:40PM	2	1	0	6		0	0	0	0		2	0	0	13	
2:45PM	6	2	0	8		0	1	0	1		2	2	0	14	
2:50PM	5	2	0	13		2	3	0	5		3	3	1	12	
2:55PM	3	2	0	10		1	1	0	2		2	3	0	13	
3:00PM	8	2	0	9		1	2	0	3		6	0	0	13	
3:05PM	5	1	0	13		0	0	0	0		3	1	0	16	
3:10PM	8	0	1	9		1	0	0	1		3	1	0	12	
3:15PM	8	1	2	17		2	0	0	2		4	0	0	7	
3:20PM	5	2	0	14		2	0	0	2		2	0	0	7	
3:25PM	5	3	0	12		2	1	0	3		2	1	0	7	
3:30PM	6	5	0	14		3	0	0	3		3	2	0	7	
3:35PM	6	3	0	10		2	1	0	3		4	1	0	7	
3:40PM	4	2	0	11		0	0	0	0		5	1	0	8	
3:45PM	6	4	0	11		0	0	0	0		1	0	1	9	
3:50PM	3	0	0	13		0	0	0	0		3	2	0	10	
3:55PM	4	2	1	14		1	0	0	1		2	0	0	10	
4:00PM	3	1	0	12		1	0	0	1		3	0	0	11	
4:05PM	3	0	0	15		0	0	0	0		3	2	0	10	
4:10PM	4	0	0	14		1	0	0	1		3	1	1	10	
4:15PM	6	2	0	19		0	0	0	0		1	2	0	8	
4:20PM	6	2	0	17		1	0	0	1		2	4	0	9	
4:25PM	4	2	0	16		6	0	0	5		1	1	0	8	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
4:30PM	3	2	0	19		1	0	0	1		2	1	0	7	
4:35PM	5	3	0	18		0	0	1	1		4	2	0	7	
4:40PM	5	0	0	19		2	0	0	2		0	0	0	11	
4:45PM	3	2	0	20		3	0	0	3		1	2	0	5	
4:50PM	7	1	0	21		1	0	0	1		2	3	0	7	
4:55PM	9	2	2	20		1	0	0	1		3	1	0	7	
5:00PM	7	10	0	25	1 - Police Car	2	0	0	2		1	0	0	9	
5:05PM	4	4	0	21		2	1	0	3		2	0	0	9	
5:10PM	7	3	0	21		0	1	0	1		2	1	0	8	
5:15PM	5	2	0	19		0	0	0	0		4	3	0	10	
5:20PM	3	5	0	17		1	0	0	1		3	0	0	8	
5:25PM	4	3	0	18		0	0	0	0		1	1	0	10	
5:30PM	6	4	0	15		2	0	0	2		4	1	1	8	
5:35PM	9	4	0	23		1	0	0	1		2	2	0	5	
5:40PM	4	4	0	18		1	1	0	2		2	1	0	5	
5:45PM	7	6	1	24		1	2	0	3		2	1	0	4	
5:50PM	6	4	0	18		3	0	0	3		0	2	1	6	
5:55PM	10	6	0	22		1	1	0	2		4	2	0	6	
6:00PM	6	4	0	17		1	0	0	1		2	2	0	7	
6:05PM	9	1	0	16		1	0	0	1		4	4	1	6	
6:10PM	7	3	0	15		2	0	0	2		1	1	1	6	
6:15PM	2	4	0	13		3	1	1	5		0	1	0	6	
6:20PM	8	3	0	17		2	0	0	2		4	1	0	5	
6:25PM	7	4	0	16		3	0	0	3		1	0	0	6	
6:30PM	8	2	0	17		3	0	0	3		2	4	0	6	
6:35PM	8	2	0	15		1	0	0	1		3	0	0	8	
6:40PM	6	4	0	13		3	0	0	3		5	0	0	7	
6:45PM	5	3	0	12		2	0	0	2		0	0	0	11	
6:50PM	10	3	0	16		2	0	0	2		3	3	0	9	
6:55PM	7	4	1	18		2	0	0	2		4	3	0	6	
7:00PM	6	3	0	17		1	0	0	1		3	1	0	7	
7:05PM	8	3	0	17		1	0	0	1		2	3	0	7	
7:10PM	10	2	0	16		0	0	0	0		4	2	0	9	
7:15PM	7	5	0	18		0	0	0	0		3	4	0	10	
7:20PM	5	7	0	18		2	0	0	2		2	0	0	6	
7:25PM	8	2	0	14		0	0	0	0		4	0	0	7	
7:30PM	6	3	1	13		1	1	0	2		0	0	0	7	
7:35PM	3	7	0	14		0	0	0	0		3	2	0	4	
7:40PM	3	5	0	16		0	0	0	0		1	3	0	6	
7:45PM	6	4	0	15		0	0	0	0		1	0	0	9	
7:50PM	8	4	0	17		2	0	0	2		2	0	0	10	
7:55PM	7	5	0	16		0	1	0	1		5	2	0	8	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
8:00PM	4	2	0	15		0	0	0	0		5	1	0	5	
8:05PM	5	4	0	13		0	0	0	0		1	2	0	6	
8:10PM	3	4	1	14		0	0	0	0		1	0	0	7	
8:15PM	6	3	0	15		0	0	0	0		1	2	0	6	
8:20PM	2	6	0	8		1	1	0	2		1	0	0	7	
8:25PM	3	2	0	9		0	0	0	0		1	2	0	7	
8:30PM	3	2	0	12		0	0	0	0		2	2	0	8	
8:35PM	7	4	1	15		0	0	0	0		0	0	0	8	
8:40PM	6	2	0	14		0	0	0	0		3	2	0	7	
8:45PM	4	0	0	10		1	0	0	1		1	1	0	9	
8:50PM	3	1	0	12		1	0	0	1		3	0	0	6	
8:55PM	3	1	0	12		0	0	1	1		1	1	0	8	
9:00PM	3	2	0	12		2	0	1	3		0	1	0	5	
9:05PM	4	1	0	11		2	0	0	2		1	0	0	5	
9:10PM	4	3	0	9		0	0	0	0		1	1	0	4	
9:15PM	3	3	0	12		0	0	0	0		1	0	0	5	
9:20PM	5	0	0	10		0	0	0	0		0	3	0	4	
9:25PM	2	5	1	10		0	0	0	0		0	1	0	4	
9:30PM	3	2	0	10		2	0	0	2		1	0	0	4	
9:35PM	5	2	0	8		1	0	0	1		0	1	0	4	
9:40PM	5	5	2	12		0	0	0	0		1	1	0	4	
9:45PM	6	3	0	15		1	0	0	1		1	1	0	5	
9:50PM	9	2	1	13		1	0	0	1		2	1	0	5	
9:55PM	4	2	1	12		4	0	1	5		2	1	0	7	
10:00PM	6	4	2	13		2	2	0	4		2	1	0	5	
10:05PM	2	0	0	10		1	0	0	1		1	3	0	5	
10:10PM	5	2	0	8		0	0	0	0		2	1	0	4	
10:15PM	4	5	0	12		3	1	0	4		1	2	0	4	
10:20PM	7	3	1	12		3	0	0	3		3	0	0	6	
10:25PM	3	4	2	11		0	0	0	0		2	2	0	5	
10:30PM	6	2	0	13		1	0	0	1		2	1	0	6	
10:35PM	3	1	3	13		1	1	0	2		2	0	0	4	
10:40PM	1	3	0	11		0	0	0	0		2	1	0	4	
10:45PM	5	1	0	16		4	2	0	6		0	2	0	5	
10:50PM	5	1	0	17		2	3	0	5		1	1	0	4	
10:55PM	2	2	0	18		0	0	0	0		2	0	0	4	
11:00PM	1	2	0	12		1	0	0	1		1	0	0	1	
11:05PM	5	2	0	13		2	3	0	5		2	3	0	5	
11:10PM	2	2	0	14		1	1	0	2		1	1	0	2	
11:15PM	1	4	0	12		0	0	0	0		0	0	0	0	
11:20PM	3	2	0	13		0	0	0	0		0	0	0	0	
11:25PM	1	2	0	12		0	2	0	2		0	2	0	2	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
11:30PM	2	6	0	12		0	0	0	0		0	0	0	0	
11:35PM	1	1	0	10		0	0	0	0		0	0	0	0	
11:40PM	1	0	0	8		0	0	0	0		0	0	0	0	
11:45PM	0	2	0	8		0	0	0	0		0	0	0	0	
11:50PM	0	1	0	8		0	0	0	0		0	0	0	0	
11:55PM	1	0	0	8		0	0	0	0		0	0	0	0	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

Time	Main Valet					Kalia Valet					Waikikian Valet				
	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
6:00AM	3	2	0	8		2	1	0	3		0	1	1	5	
6:05AM	2	3	0	9		1	0	1	2		0	0	0	5	
6:10AM	2	1	0	8		1	0	0	1		1	1	0	6	
6:15AM	2	3	0	8		1	0	0	1		1	1	0	6	
6:20AM	1	2	0	8		1	2	0	3		0	0	0	5	
6:25AM	1	2	0	7		1	0	0	1		1	0	0	4	
6:30AM	0	1	0	8		0	1	0	1		1	1	0	4	
6:35AM	1	2	0	8		1	2	0	3		0	0	0	6	
6:40AM	0	3	0	8		1	1	0	2		1	1	0	4	
6:45AM	1	2	0	9		1	0	0	1		1	1	1	5	
6:50AM	0	3	0	9		0	1	0	1		2	1	0	2	
6:55AM	0	4	0	8		0	1	0	1		1	2	0	6	
7:00AM	1	2	0	9		1	0	1	2		1	2	1	6	
7:05AM	2	4	0	9		1	0	1	2		1	1	0	5	1 - Commercial Van (No Name)
7:10AM	1	2	0	8		1	0	0	1		1	1	0	5	
7:15AM	2	4	0	8		3	0	0	3		1	3	0	7	
7:20AM	2	3	0	9		2	1	0	3		2	4	0	6	
7:25AM	1	5	0	9		1	0	0	1		0	1	0	9	
7:30AM	1	1	0	10		1	1	0	2		2	2	0	5	
7:35AM	4	3	0	12		1	1	0	2		0	1	2	6	1 - Maui Divers Van 1 - Delivery Van (No Name)
7:40AM	4	2	0	12		1	0	0	1		1	1	1	7	
7:45AM	3	4	0	10		3	2	0	5		3	1	3	4	2 - Delivery Vans (No Name)
7:50AM	5	3	0	13		3	1	0	4		2	3	2	8	1 - Delivery Van
7:55AM	2	3	0	12		3	0	0	3		2	2	0	10	
8:00AM	3	2	1	15		1	2	0	3		4	4	0	6	
8:05AM	3	2	1	8		3	0	0	3		1	5	0	8	
8:10AM	2	5	0	9		4	3	0	7		1	1	2	2	
8:15AM	2	3	0	8		3	2	0	5		3	1	2	2	
8:20AM	1	5	0	8		2	3	0	5		2	5	1	2	
8:25AM	4	5	0	12		1	5	0	6		2	0	2	12	
8:30AM	3	2	0	10	1 - Loomis Armored Car	2	2	0	4		0	3	0	8	
8:35AM	4	4	0	9		0	0	0	0		2	3	0	8	
8:40AM	2	3	0	9		3	5	0	8		1	3	0	8	
8:45AM	1	2	0	9		3	2	0	5		3	2	0	10	
8:50AM	2	3	0	10		2	1	0	4		3	1	0	8	
8:55AM	1	5	0	9		3	2	0	4		3	2	1	7	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
9:00AM	4	5	1	10		3	1	0	4		1	3	0	9	
9:05AM	3	2	0	13		2	3	0	5		2	2	0	10	
9:10AM	5	1	0	11		4	3	0	7		3	3	0	10	
9:15AM	10	3	1	9		3	2	0	5		0	3	0	10	
9:20AM	5	4	1	13		4	2	0	5		4	7	1	6	
9:25AM	2	2	0	11		4	0	0	4		3	0	0	9	
9:30AM	4	5	0	2		2	2	0	4		5	2	0	7	
9:35AM	5	1	0	10		2	1	0	3		0	3	1	8	
9:40AM	4	2	0	8		1	1	0	2		4	2	0	8	
9:45AM	3	7	0	11		2	2	0	4		4	4	0	9	
9:50AM	7	4	0	10		2	2	0	4		13	5	0	17	
9:55AM	5	2	0	14		2	1	0	3		8	2	1	17	
10:00AM	12	3	0	14		2	1	1	4		4	2	1	20	
10:05AM	10	7	1	19		2	0	0	2		2	2	0	16	1 - Delivery Van
10:10AM	0	6	0	14		3	1	1	5		3	5	0	20	
10:15AM	7	4	0	15		4	2	1	7		4	5	1	15	
10:20AM	15	4	0	17		6	1	1	8		4	6	1	14	1 - Delivery Van
10:25AM	12	2	1	12		3	1	0	4		8	8	0	14	
10:30AM	7	9	0	15		4	1	0	5		5	7	0	12	
10:35AM	4	8	0	12		7	1	0	8		4	5	1	9	
10:40AM	6	3	0	16		3	1	0	4		2	4	1	9	
10:45AM	8	11	0	13		3	1	1	5		1	4	1	13	
10:50AM	5	5	0	13		3	2	1	6		3	3	1	11	
10:55AM	7	2	0	11		2	1	0	3		4	2	1	11	
11:00AM	7	5	1	14		0	1	0	1		4	2	0	12	
11:05AM	5	2	0	9		0	2	0	2		0	2	1	11	
11:10AM	12	4	0	17		1	0	0	1		1	9	1	3	
11:15AM	4	6	0	18		3	0	0	3		5	2	0	7	
11:20AM	9	11	0	20		3	0	0	3		0	2	0	8	
11:25AM	1	8	0	13		2	1	0	3		4	3	0	6	
11:30AM	2	2	0	13		3	1	0	4		2	7	0	10	
11:35AM	1	10	0	16		1	0	0	1		2	4	0	8	1 - Delivery Van
11:40AM	5	5	0	12		0	1	0	1		2	3	0	8	
11:45AM	6	4	0	14		0	0	0	0		3	6	0	10	
11:50AM	5	3	0	14		0	1	1	2		1	6	0	11	
11:55AM	5	0	0	13		2	0	0	2		1	2	0	10	
12Noon	5	4	0	13		1	0	0	1		0	0	0	11	
12:05PM	7	3	1	11		1	0	0	1		1	2	0	9	1 - Delivery Van
12:10PM	4	5	0	14		0	0	0	0		5	1	0	10	
12:15PM	6	2	0	12		0	0	0	0		0	2	0	8	
12:20PM	5	7	0	17		2	1	1	4		3	0	0	6	
12:25PM	4	3	0	15		3	1	0	4		3	2	0	5	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
12:30PM	5	5	0	11		2	0	0	2		3	0	0	8	
12:35PM	2	5	0	8		1	1	0	2		1	0	0	8	
12:40PM	0	3	0	7		0	0	0	0		4	2	0	7	
12:45PM	8	4	0	12		0	0	0	0		1	1	0	9	
12:50PM	3	4	0	11		1	0	0	1		1	1	0	5	
12:55PM	7	2	0	11		1	2	0	3		1	0	0	8	1 - Post Office Delivery Truck
1:00PM	6	3	0	11		0	0	0	0		1	1	0	7	
1:05PM	2	1	0	8		0	0	0	0		4	2	0	4	
1:10PM	3	1	0	7		0	0	0	0		0	1	0	6	
1:15PM	6	2	0	9		3	1	0	4		1	3	0	5	
1:20PM	6	5	0	13		1	2	0	3		1	3	0	7	
1:25PM	7	1	1	13	1 - Handyvan	2	1	0	3		3	1	0	7	
1:30PM	6	2	0	11		1	0	0	1		3	1	0	6	
1:35PM	10	3	0	19	Cars Beginning To Be Parked Within Valet Driveway	4	0	0	4		2	4	0	9	
1:40PM	6	9	2	16		5	0	0	5		4	2	0	7	
1:45PM	4	5	1	17		3	0	0	3		2	1	2	2	
1:50PM	4	1	1	14		3	0	0	3		4	3	0	10	
1:55PM	5	1	0	16		2	1	0	3		3	0	0	9	
2:00PM	9	3	0	16		4	1	0	5		1	4	0	8	
2:05PM	4	2	1	14		3	3	0	6		2	2	0	6	
2:10PM	5	2	0	12		5	2	0	7		3	1	0	7	
2:15PM	4	1	0	9		6	1	1	7		1	1	0	7	
2:20PM	16	3	0	17		5	0	0	5		2	1	0	6	
2:25PM	5	4	0	15		2	0	0	2		6	2	0	5	
2:30PM	5	2	0	16		5	4	0	9		3	1	0	8	
2:35PM	10	3	0	17		3	1	0	4		3	2	0	6	
2:40PM	4	2	0	12		2	2	2	6		8	4	0	6	
2:45PM	5	4	0	15		5	3	2	10		1	2	0	8	
2:50PM	8	3	0	13		6	3	2	2		0	1	0	8	
2:55PM	2	1	1	11		2	4	1	7		2	2	0	7	
3:00PM	6	5	1	9		3	1	0	4		3	0	0	7	
3:05PM	1	4	0	9		1	1	0	2		2	2	0	10	
3:10PM	6	3	0	11		2	1	0	3		4	0	0	10	
3:15PM	6	0	0	12		3	1	0	4		1	3	0	7	
3:20PM	1	1	0	8		4	2	1	7		1	0	0	6	
3:25PM	8	4	2	15		1	0	0	1		4	1	1	7	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

Time	Main Valet					Kalia Valet					Waikikian Valet				
	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
3:30PM	8	6	0	16		1	0	0	1		3	3	0	10	
3:35PM	5	3	0	10		2	0	0	2		4	1	0	9	
3:40PM	5	5	0	15		1	0	0	1		0	1	0	8	
3:45PM	6	6	0	16		3	0	0	3		4	4	0	8	
3:50PM	4	0	0	14		3	1	0	4		0	2	0	9	
3:55PM	2	4	1	12		2	1	0	3		4	2	0	6	
4:00PM	11	2	0	14		1	0	0	1		3	2	0	8	
4:05PM	5	4	0	17		0	0	0	0		5	1	0	8	
4:10PM	9	4	0	15		1	0	0	1		4	1	0	11	
4:15PM	4	4	0	14		2	1	0	3		2	0	0	10	
4:20PM	9	1	0	14		3	0	0	3		3	1	0	10	
4:25PM	5	9	0	13		3	0	0	3		0	0	0	9	
4:30PM	5	3	1	10		5	0	0	5		0	5	0	6	
4:35PM	9	4	0	9		3	0	0	3		0	4	0	6	
4:40PM	6	3	0	11		3	2	0	5		8	0	0	5	
4:45PM	8	2	0	10		4	1	0	5		11	3	0	11	
4:50PM	7	6	0	12		5	0	0	5		5	5	0	14	
4:55PM	7	1	0	10		2	1	0	3		2	3	0	11	
5:00PM	8	8	0	13	1 - Police Car	3	0	0	3		1	1	0	9	
5:05PM	8	3	1	11		1	0	0	1		1	0	0	6	
5:10PM	5	4	0	10		1	0	0	1		5	1	0	8	
5:15PM	12	2	0	16		1	0	0	1		6	4	0	12	
5:20PM	10	4	0	18		1	0	0	1		2	0	0	13	1 - Tow Truck
5:25PM	8	2	0	15		1	1	0	2		3	2	1	12	
5:30PM	7	2	3	13		1	0	0	1		4	1	0	12	
5:35PM	4	5	1	11		1	0	0	1		3	1	0	10	
5:40PM	4	2	0	7		1	0	0	1		3	1	0	10	
5:45PM	4	2	0	10		2	1	0	3		3	1	0	9	
5:50PM	6	3	0	14		3	1	0	4		4	1	0	4	
5:55PM	8	5	0	11		2	1	0	3		0	3	0	8	
6:00PM	6	5	0	9		2	1	0	3		1	2	0	5	
6:05PM	5	4	1	11		4	0	0	4		1	0	0	8	
6:10PM	6	3	0	9		2	0	0	2		1	4	0	8	
6:15PM	4	3	0	8		2	1	1	4		2	1	0	8	1 - delivery Van
6:20PM	6	6	0	7		0	0	1	1		0	1	0	12	
6:25PM	2	3	0	9		1	1	0	2		2	1	0	5	
6:30PM	5	5	1	11		2	0	0	2		2	0	0	7	
6:35PM	4	6	0	10		4	2	0	6		3	3	0	8	
6:40PM	7	3	1	10		2	1	0	3		1	2	0	8	
6:45PM	1	3	0	9		3	0	0	3		0	1	0	9	
6:50PM	2	4	0	8		3	2	0	5		5	3	0	7	
6:55PM	8	3	0	9		1	1	0	2		2	3	0	8	1 - Delivery Van

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
7:00PM	9	4	0	11		1	2	0	3		1	0	0	7	
7:05PM	2	5	0	11		0	0	0	0		2	1	1	7	
7:10PM	5	4	0	13		0	0	0	0		1	1	0	6	
7:15PM	8	4	0	12		3	1	0	4		2	0	1	7	
7:20PM	5	4	0	13		3	1	0	4		3	2	0	7	
7:25PM	7	3	1	15		3	1	0	4		2	0	0	9	
7:30PM	6	2	0	20		6	1	0	7		2	1	0	6	
7:35PM	7	4	0	16		6	1	0	7		3	0	0	6	
7:40PM	7	6	0	14		5	0	0	5		0	1	0	7	
7:45PM	3	3	0	14		2	0	0	2		1	1	0	5	
7:50PM	3	3	0	15		2	1	0	3		1	0	0	5	
7:55PM	4	4	0	14		3	0	0	3		0	1	0	4	
8:00PM	3	1	1	11		1	0	0	1		6	2	0	4	
8:05PM	8	2	0	13		0	0	0	0		2	3	0	7	
8:10PM	11	3	1	15		1	0	0	1		0	2	0	5	
8:15PM	7	3	0	26	Traffic within valet area extremely heavy, no movement at some periods, due to mixture of cars to be valeted which were parked blocking two lanes and heavy taxi requests by guests.	1	0	0	1		1	0	0	5	
8:20PM	8	3	0	27	Traffic on Rainbow Drive south bound queueing about 8-12 cars, waiting to make left turn into valet area.	1	1	0	2		1	4	0	5	
8:25PM	5	5	0	23		1	0	0	1		1	0	0	7	
8:30PM	4	3	0	19		0	0	0	0		5	2	0	5	
8:35PM	12	3	0	19		0	0	1	1		0	1	0	7	
8:40PM	5	4	0	18		3	0	1	4		1	2	0	6	
8:45PM	5	1	0	19		2	0	0	2		1	3	0	4	
8:50PM	3	3	1	20		0	3	0	3		1	1	0	4	
8:55PM	4	3	0	16		0	0	0	0		2	2	0	5	

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Saturday, July 31, 2010

	Main Valet					Kalia Valet					Waikikian Valet				
Time	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments	Private Vehicle	Taxi	Limousine	Queueing	Comments
9:00PM	19	11	0	22		1	0	0	1		1	5	0	5	
9:05PM	16	6	0	25		0	0	0	0		1	4	0	9	1 - Tour Van
9:10PM	17	8	0	27		2	0	0	2		4	0	0	5	
9:15PM	16	3	0	24		1	0	0	1		1	0	0	5	
9:20PM	18	5	0	29		0	0	0	0		4	0	0	6	
9:25PM	14	7	0	31		2	0	0	2		0	1	0	8	
9:30PM	10	7	0	24		2	0	0	2		0	0	0	7	
9:35PM	13	8	0	22		2	0	0	2		3	0	0	7	
9:40PM	11	5	0	19		0	0	0	0		0	1	0	7	
9:45PM	13	10	0	26		0	0	0	0		2	1	0	5	
9:50PM	13	4	0	20		0	0	0	0		1	1	0	7	
9:55PM	12	6	0	23		0	0	0	0		0	1	0	4	
10:00PM	12	6	1	20		0	0	0	0		0	0	0	4	
10:05PM	12	8	1	23		0	0	0	0		1	1	0	4	1 - Police Car #1114
10:10PM	12	7	1	25		0	1	0	1		0	1	0	5	
10:15PM	11	5	1	20		1	0	0	1		2	1	0	5	
10:20PM	12	5	0	20		1	1	0	2		5	3	0	6	
10:25PM	12	4	0	21		1	1	0	2		1	1	0	7	
10:30PM	13	0	0	16		2	1	0	3		0	0	0	5	
10:35PM	15	4	0	21		2	1	0	3		3	1	0	4	
10:40PM	13	5	0	24		3	2	0	5		1	1	0	4	
10:45PM	14	12	0	33		2	0	0	2		4	1	0	4	
10:50PM	17	13	1	35		4	0	0	4		1	0	0	6	
10:55PM	16	7	0	25		2	1	0	3		1	0	0	6	
11:00PM	13	5	0	19		1	1	0	2		1	0	0	6	
11:05PM	13	6	1	24		1	0	0	1		1	0	0	3	
11:10PM	12	7	1	21		1	0	0	1		0	0	0	3	
11:15PM	13	8	1	23		1	0	0	1		1	0	0	2	
11:20PM	13	7	0	21		2	0	0	2		1	0	0	3	
11:25PM	12	4	0	23		1	0	0	1		0	0	0	3	
11:30PM	13	4	0	18		1	0	0	1		0	0	0	2	
11:35PM	11	2	0	15		1	0	0	1		2	0	0	2	
11:40PM	14	3	0	18		1	0	0	1		0	0	0	2	
11:45PM	13	4	0	19		1	0	0	1		1	0	0	2	
11:50PM	12	4	1	21		1	0	0	1		1	0	0	3	
11:55PM	13	5	0	18		2	0	0	2		0	0	0	3	

APPENDIX C

LOADING AREA SURVEY

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Kalia Loading Dock			
	Vehicle Type			
Time	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
6:00 AM	So Ono 6:01 - 6:33	Paper Source Hawaii Inc. 6:03 - 6:14		
6:15 AM	Fresh Tropical Delights Hawaii 6:15 - 6:47 Wholesale Unlimited 6:21 - 7:15 Pacific Creations 6:22 - 6:32 Unnamed Vehicle 6:25 - 6:40	Hawaiian Sun 6:19 - 6:46 Johnson Brothers Hawaii 6:26 - 7:05		Pacific Creations parked in no parking zone. Unnamed vehicle and Wholesale Unlimited blocking street access gate.
6:30 AM				Private vehicles parked in no parking zone from 6:40
6:45 AM	Star Advertiser 6:48 - 6:59			
7:00 AM				
7:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Kalia Loading Dock			
	Vehicle Type			
Time	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
7:30 AM		Paradise Beverages 7:38 - 8:53 KYD 7:38 - 7:50 Honolulu Cookie Co. 7:40 - 7:59 Shimaya Shoten 7:42 - 7:53		7:45 Private vehicle parked next to green waste dumpster Paradise Beverages truck parks next to private vehicle and blocks half of loading zone area
7:45 AM				
8:00 AM	Unnamed Vehicle 8:03 - 8:20 Harley Davidson 8:05 -8:51 Private Vehicle 8:14 - 8:25			
8:15 AM		Aloha State Brokerage 8:21 - 8:40		
8:30 AM	Regal Foods 8:42 - 8:58	Triple F 8:30 - 9:05		Regal Food parked in no parking zone
8:45 AM		Commercial Plumbing 8:45 - 9:05		

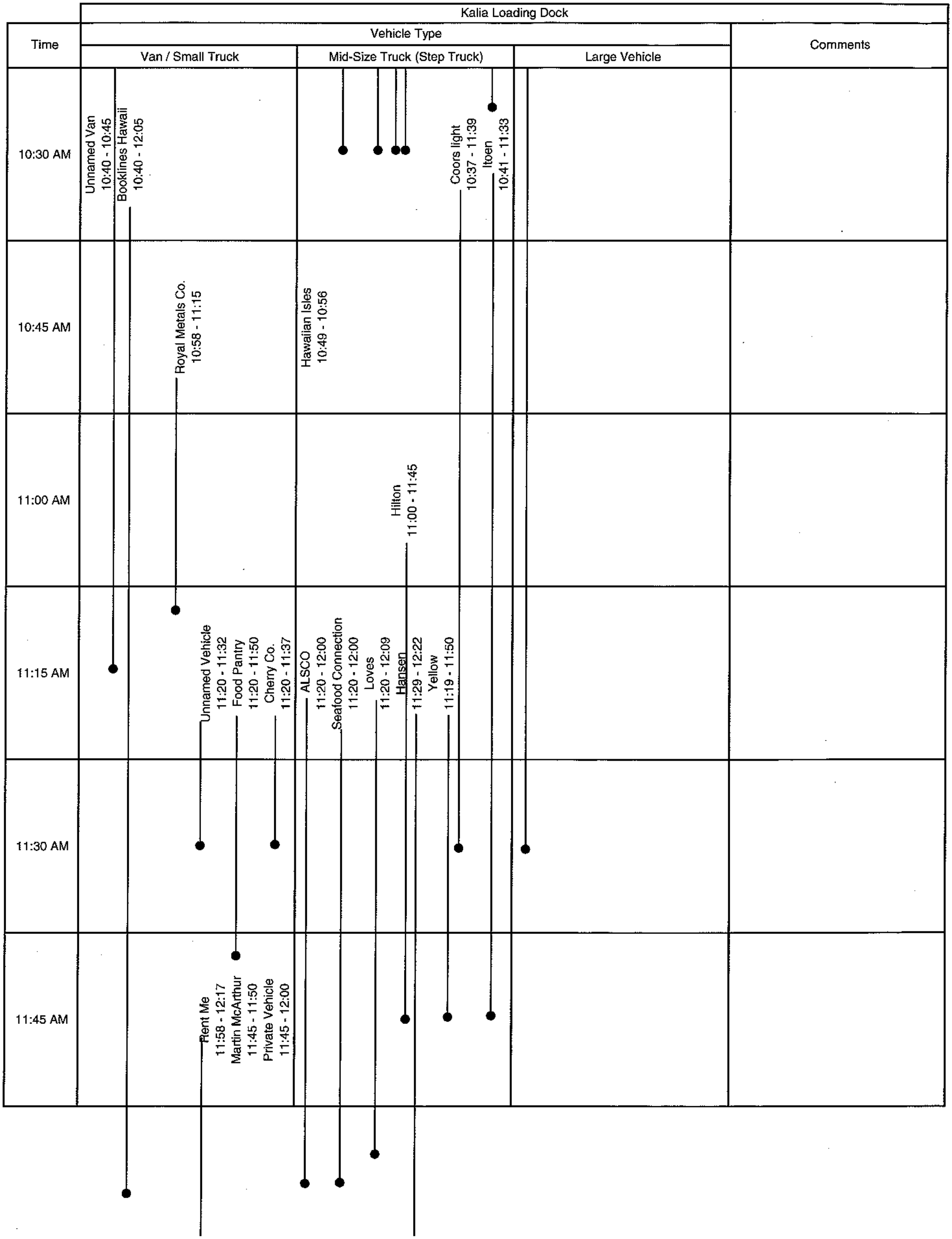
HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Kalia Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
9:00 AM	Alakai Mechanical 9:03 - 11:17	CCH 9:00 - 9:04; State Poultry Processors 9:00 - 9:15		State Poultry parked in no parking zone
9:15 AM	Unnamed Van 9:15 - 9:48			
9:30 AM	Govindas 9:35 - 9:46; Nippon Express 9:35 - 10:13	D. Otani Produce 9:32 - 10:41	Coca-Cola 9:41 - 11:35	Coca-Cola parked in no parking zone
9:45 AM	Unnamed Vehicle 9:49 - 9:55	True World Foods 9:50 - 10:01; Better Brands 9:54 - 10:40		Area around loading dock full. Vehicles blocked in.
10:00 AM	Harley Davidson 10:14- 10:24	Bud Light 10:01 - 10:04; Y. Hata 10:00 - 10:21; Y. Hata 10:12 - 10:33		Access gate to Ala Moana Blvd. Opened. Loading dock area full.
10:15 AM		DSR 10:25 - 10:28		DSR truck blocking driveway to taxi aisle

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010



HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Kalia Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
12:00 AM	Alert Alarm Hawaii 12:10 - 12:23	ALSCO 12:10 - 12:26		
12:15 AM	Unnamed Vehicle 12:15 - 12:21; Unnamed Vehicle 12:24 - 1:06	Young Laundry & Dry Cleaning 12:15 - 12:19; Southern Wine & Spirits 12:15 - 12:40		Alsco backs into Waikikian loading dock from Kalia Loading dock.
12:30 AM		Fresh Tropical 12:30 - 12:50; HFM 12:37 - 1:32		
12:45 AM		Pacific Isle Delivery 12:45 - 12:48; Odwalla 12:50 - 1:19		
1:00 PM	Unnamed Vehicle 1:02 - 1:30; Quality Air Conditioning 1:13 - 2:30	United Laundry Service 1:02 - 1:26		
1:15 PM	Unnamed Vehicle 1:18 - 1:26			

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Kalia Loading Dock – Vehicle Type: Van / Small Truck	Kalia Loading Dock – Vehicle Type: Mid-Size Truck (Step Truck)	Kalia Loading Dock – Vehicle Type: Large Vehicle	Comments
1:30 PM		Johnston Bros. 1:37 - 1:47		
1:45 PM		Young Laundry 1:45 - 1:50 Unnamed Vehicle 1:45 - 2:03		
2:00 PM		Meadow Gold 2:01 - 4:09		
2:15 PM	Unnamed Vehicle 2:20 - 2:48 21st Century Lighting 2:19 - 2:23	JFC 2:15 - 2:50		
2:30 PM	Unnamed Vehicle 2:30 - 2:46	Nishimoto Trading 2:37 - 3:03 Nishimoto Trading 2:44 - 3:16		Private vehicle parked by street entrance
2:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Kalia Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
3:00 PM		Unnamed Vehicle 3:00 - 3:12 Seafood Connection 3:11 - 3:18		
3:15 PM				
3:30 PM			Hawaiian Isles 3:31 - Undetermined	
3:45 PM				
4:00 PM	ALSCO 4:08 - 4:28			
4:15 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Kalia Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
4:30 PM		ALSCO 4:33 - Undetermined		
4:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Kalia Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
6:00 AM	The Pizza Shop 6:02 - 6:13			
6:15 AM				
6:30 AM				
6:45 AM	Fresh Tropical Delight 6:55 - 7:35; So Ono 6:58 - 7:18			
7:00 AM		Hawaiian Ice 7:05 - 7:13		
7:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Kalia Loading Dock			
	Vehicle Type			
Time	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
7:30 AM				
7:45 AM				
8:00 AM		Honolulu Cookie Company 8:12 - 8:40		Dekivery made to Waikikian and Coral Ballroom
8:15 AM				
8:30 AM				
8:45 AM				

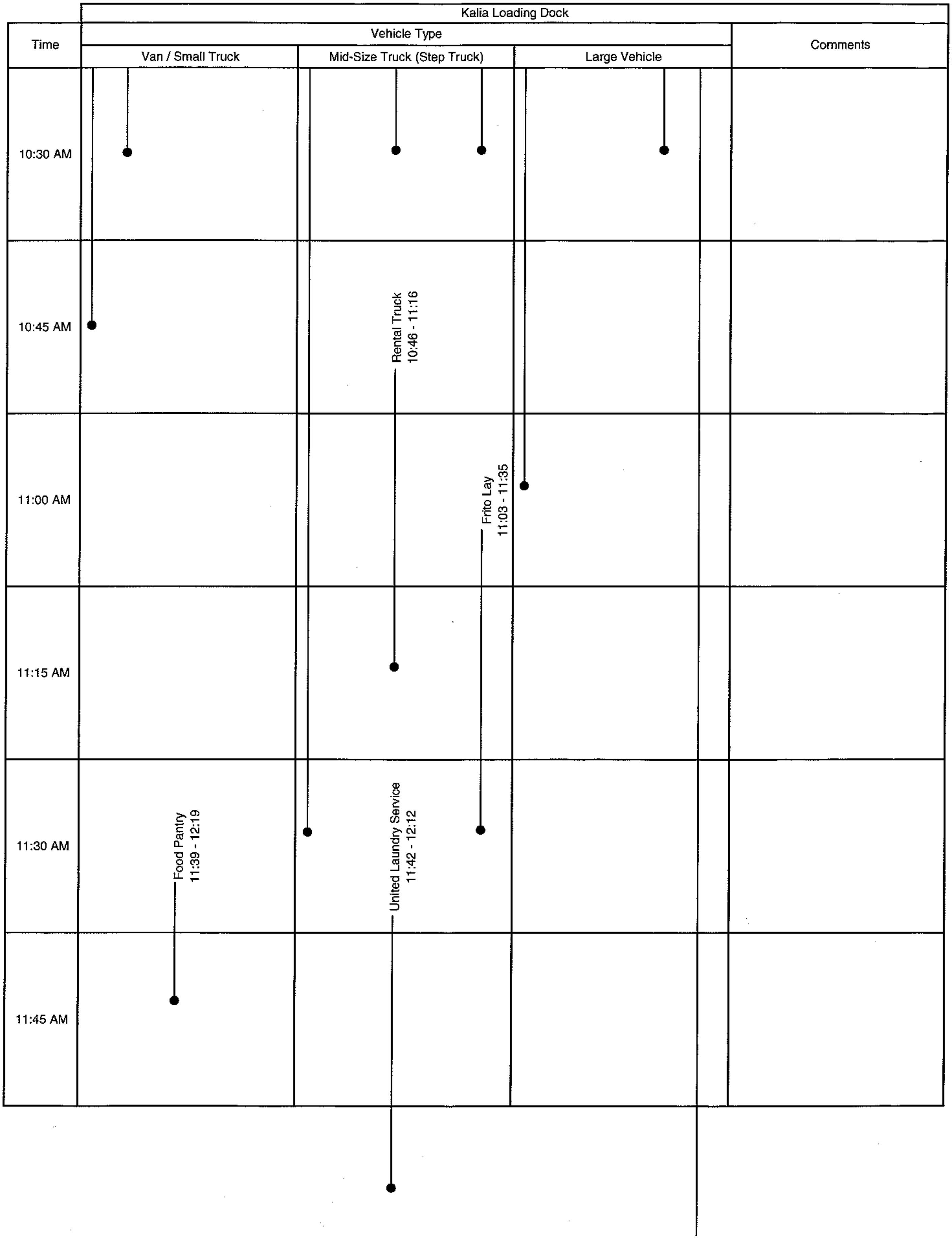
HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Kalia Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
9:00 AM				
9:15 AM		Frito Lay 9:20 -11:35		
9:30 AM	True World Foods 9:36 - 9:46	State Poultry Processors 9:39 - 9:55		
9:45 AM			Honolulu Disposal 9:48 - 10:02	Honolulu Disposal removing / replacing yard waste container
10:00 AM	Unmarked Van 10:12 - 10:52; ALSCO 10:14 - 10:38	D. Otani 10:01 - 10-33	Honolulu Disposal 10:02 - 10:13	
10:15 AM		Sun Noodle 10:20 - 10:27	Honolulu Disposal 10:16 - 10:33; Meadow Gold 10:23 - 1:08	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010



HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Kalia Loading Dock			
	Vehicle Type			
Time	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
12:00 PM	So Ono 12:06 - 12:34 So Ono 12:14 - 12:54			
12:15 PM		ALSCO 12:17 - 12:31		
12:30 PM				
12:45 PM		ALSCO 12:56 - 1:20		So Ono driver return to van at 12:36 but did not leave until 12:54
1:00 PM				
1:15 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Kalia Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
1:30 PM				
1:45 PM				
2:00 PM				
2:15 PM				
2:30 PM				
2:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Kalia Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
3:00 PM				
3:15 PM				
3:30 PM				
3:45 PM				
4:00 PM		ALSCO 4:02 - 4:27		
4:15 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Kalia Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
4:30 PM				
4:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Friday, July 30, 2010

	Waikikian Loading Dock			
	Vehicle Type			
Time	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
6:00 AM				
6:15 AM				
6:30 AM				Private vehicle parked at loading dock (No Loading / Unloading observed) 6:35 - 6:45
6:45 AM	Fresh Tropical Delight 6:47 - 6:59			
7:00 AM				
7:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
7:30 AM				
7:45 AM				
8:00 AM				
8:15 AM		Sweet Leilani Florist 8:26 - 9:58		
8:30 AM				Commercial Plumbing working near loading dock, blocking vehicles from using the area.
8:45 AM				Taxi's and Commercial Plumbing blocking road to loading dock. 8:45 - 8:56

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
9:00 AM				
9:15 AM				
9:30 AM				
9:45 AM				
10:00 AM				
10:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
10:30 AM		DSR 10:30 - 10:45; ALSCO 10:35 - 10:47		Trucks blocking Taxi lane
10:45 AM				Private Vehicle parked at loading dock 10:49 - 11:02
11:00 AM				
11:15 AM				
11:30 AM				
11:45 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Waikikian Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
12:00 PM	Unnamed Van 12:05 - 12:18	Euran Inc. 12:09 - 12:38		
12:15 PM	Unnamed Van 12:15 - 12:48	Electric Pencil 12:15 - 12:27		
12:30 PM		Unnamed Vehicle 12:42 - 1:22; ALSCO 12:30 - 12:45		
12:45 PM				
1:00 PM				
1:15 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
1:30 PM				
1:45 PM				
2:00 PM		COSTCO 2:01 - 2:34		
2:15 PM				
2:30 PM				
2:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
3:00 PM				
3:15 PM				
3:30 PM				
3:45 PM				
4:00 PM				
4:15 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
4:30 PM		ALSCO 4:34 - Undetermined		Private vehicle parked at loading dock
4:45 PM		↓		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
6:00 AM				
6:15 AM				
6:30 AM				
6:45 AM				
7:00 AM				
7:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
7:30 AM				
7:45 AM				
8:00 AM				
8:15 AM				
8:30 AM				8:34 - 3 Private cars parked along fence adjacent to loading dock
8:45 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
9:00 AM				
9:15 AM				9:18 - All private cars left
9:30 AM	Unmarked Truck 9:30 - 9:45	ALSCO 9:31 - 9:57		Unmarked truck picked-up broken vacuum cleaner
9:45 AM				
10:00 AM				
10:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
10:30 AM		ALSCO 10:35 - 10:45		
10:45 AM				
11:00 AM				
11:15 AM				
11:30 AM				
11:45 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

Time	Waikikian Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
12:00 PM				
12:15 PM				
12:30 PM		ALSCO 12:31 - 12:56		
12:45 PM				
1:00 PM				
1:15 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Saturday, July 31, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
1:30 PM				
1:45 PM				
2:00 PM				
2:15 PM				
2:30 PM				
2:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Saturday, July 31, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
3:00 PM				
3:15 PM				
3:30 PM				
3:45 PM				
4:00 PM				
4:15 PM		ALSCO 4:27 - 4:43		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Waikikian Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
4:30 PM				
4:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
6:00 AM		Unamed Vehicle Before 6:00-9:02 Unnamed Vehicle Before 6:00-8:45 Young Laundry Before 6:00-6:40		
6:15 AM		Touchdown Trucking 6:22 - 6:30 Young Laundry 6:24 - 6:55		
6:30 AM		Clearway 6:31 - 6:45 Nippon 6:33 - 6:35 BTS 6:37 - 6:40		
6:45 AM		Lapperts 6:47 - 6:50 Touchdown Trucking 6:50 - 7:35		
7:00 AM	Unnamed Vehicle 7:03 - 7:08	Touchdown Trucking 7:03 - 7:06		
7:15 AM		TF Tours 7:29 - 7:36 Touchdown Trucking 7:16 - 7:30		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
7:30 AM		ALSCO 7:33 - 7:58 Touchdown Trucking 7:42 - 7:57		ALSCO truck blocked until 7:36. TF Tours picked-up baggage then passengers.
7:45 AM		Armstrong 7:55 - 8:51		
8:00 AM	Unnamed Vehicle 8:08 - 8:22	BTS 8:00 - 8:02		Unnamed vehicle parked along driveway curb not loading dock area.
8:15 AM		BTS 8:17 - 8:32		
8:30 AM		Touchdown 8:35 - 8:57 Unnamed Vehicle 8:40 - 8:56	Coke Truck 8:41 - 8:55	Coke truck was too large to pull up to loading dock, parked on side of driveway.
8:45 AM		Kings Food Service 8:57 - 9:16 BTS 8:58 - 9:04		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Tapa Loading Dock			
	Vehicle Type			
Time	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
9:00 AM	Unnamed Vehicle 9:00 - 9:04	Honolulu Disposal 9:06 - 9:10 WDI 9:08 - 10:12 Touchdown Trucking 9:12-9:16 BTS 9:13 - 9:22		WDI parked on street, loading dock not opened.
9:15 AM		Meadow Gold 9:15 - 10:02 Unnamed Vehicle* 9:21 - 10:01 Unnamed Vehicle** 9:20 - 9:34 Touchdown Trucking 9:27 - 9:47 Touchdown Trucking 9:27 - 9:47 ALSCO 9:28 - 9:44		Honolulu Disposal blocking entrance to loading dock, left at 9:18 * Hilton Truck? **Parked in front of luggage area
9:30 AM		H&W 9:30 - 9:55 St. Germaine* 9:32 - 9:38 BTS 9:35 - 9:45 Unnamed Vehicle 9:37 - 10:16 Big Brothers Big Sisters 9:38 - 10:00 Touchdown Trucking 9:39 - 9:57 Johnson Brothers 9:40 - 9:59		* Loading dock full,parked alongside of driveway.
9:45 AM		HFM 9:50 - 10:11		HFM arrived at loading dock at 9:43 but could not park until 9:50
10:00 AM	Unnamed Vehicle 10:05 - 10:15	ALSCO 10:06 - 10:33 DSR 10:13 - 10:21		
10:15 AM		Unnamed Vehicle 10:29 - 11:09 BTS 10:23 - 10:25 Sun Noodle 10:23 - 10:33		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
10:30 AM		Unnamed Vehicle 10:30 - 11:11 Leilani Nursery 10:35 - 10:38 Touchdown Trucking 10:38 - 10:50 Touchdown Trucking 10:41 - 10:48		
10:45 AM	Unnamed Vehicle 10:48 - 10:51	Unnamed Vehicle 10:46 - 11:29 Tour Van 10:50 - 10:53 Finest Food 10:54 - 11:17		
11:00 AM	Unnamed Vehicle 11:00 - 11:09	Hawaiian Housewares 11:03 - 11:13 Lapperts 11:04 - 11:10 Touchdown Trucking 11:00 - 11:20 Unnamed Vehicle 11:06 - 11:15 TFS Tours 11:07 - 11:12 Touchdown Trucking 11:07 - 11:10		
11:15 AM	GEOC Tec. Waste Management 11:22 - 11:32	Island Pro 11:17 - 11:21 Unnamed Vehicle 11:22 - 11:37		
11:30 AM		Honolulu Disposal 11:34 - 11:54 Youngs Laundry 11:37 - 12:03 Baggage Transfer Service 11:43 - 11:45		
11:45 AM		Unnamed Vehicle 11:47 - 11:58 Unnamed Vehicle 11:48 - 11:53		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
12:00 PM	AST&T 12:06 - 12:10	Touchdown Trucking 12:07 - 12:18 Unnamed Vehicle 12:09 - 12:28 Bud Light 12:08 - 1:13 Hawaiian Ice 12:12 - 12:13		
12:15 PM		Unnamed Vehicle 12:28 - 12:35 ALSCO 12:25 - 1:05		
12:30 PM	Electric Pencil 12:40 - 12:46 HPD 12:40 - 12:48	BTS 12:32 - 12:35 BTS 12:32 - 12:35 Unnamed Vehicle 12:35 - 1:14 Odwalla 12:36 - 12:48		
12:45 PM	Unnamed Vehicle 12:53 - 12:59 Charley's Taxi 12:53 - 12:56	Unnamed Vehicle 12:47 - 12:59 Touchdown Trucking 12:50 - 12:54 Touchdown Trucking 12:59 - 1:05 Touchdown Trucking 12:59 - 1:05		
1:00 PM		Paradise Beverages 1:09 - 1:20		
1:15 PM		Armstrong 1:15 - 1:24 Premium Inc. 1:18 - 1:52 Unnmaed Vehicle 1:18 - 1:20 Honolulu Disposal Service 1:25 - 1:42 BTS 1:23 - 1:25		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Tapa Loading Dock			
	Vehicle Type			
Time	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
1:30 PM	Obun Hawaii Group 1:34 - 1:43	Unnamed Vehicle Vehicle 1:33 - 1:42		
1:45 PM	Unnamed Vehicle 1:55 - 2:01			
2:00 PM		Unnamed Vehicle 2:03 - 2:36		
2:15 PM		Galleria 2:21 - 2:35 Unnamed Vehicle 2:23 - 2:37		
2:30 PM	Fresh Island Fish 2:32 - 2:49 Unnamed Vehicle 2:33 - 2:36			
2:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
3:00 PM	Finest 3:02 - 3:14 HPD 3:03 - 3:08			
3:15 PM		Unnamed Vehicle 3:28 - 3:47 Armstrong 3:29 - 3:46		
3:30 PM				
3:45 PM	Unnamed Vehicle 3:55 - 4:09	Unnamed Vehicle 3:46 - 3:58		
4:00 PM				
4:15 PM	Unnamed Vehicle 4:24 - 4:51	Unnamed Vehicle 4:22 - Undetermined Unnamed Vehicle 4:25 - 4:36 ALSCO 4:28 - Undetermined		

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Friday, July 30, 2010

	Tapa Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
4:30 PM				
4:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

Time	Tapa Loading Dock – Vehicle Type: Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
6:00 AM		Flatbed truck parked at loading dock prior to count. ECO Feed Truck 6:10 - 6:23; 6-Unman Olsen 6:13 - 6:15		Flatbed parked for duration of survey
6:15 AM				
6:30 AM		Senator Tour Bus 6:30 - 6:32; Touchdown Trucking 6:32 - 6:53; Youngs Laundry and Dry Cleaning 6:37 - 7:13		
6:45 AM	Touchdown Van #1 6:56 - 7:00			
7:00 AM	Touchdown Van #2 7:10 - 7:15; Touchdown Van #3 7:14 - 7:20	Unnamed Truck 7:14 arrive; Touchdown Truck 7:06 - 7:15		Unnamed truck parked for remainder of survey
7:15 AM	The Handy Van Shuttle 7:25 - 8:10			

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Saturday, July 31, 2010

	Tapa Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
7:30 AM				
7:45 AM	Baggage Transfer Service 7:54 - 8:14			
8:00 AM		Touchdown Trucking 8:00 - 8:10		
8:15 AM		Touchdown Trucking 8:18 - 8:23 Honolulu Service Disposal 8:15 - 8:25		
8:30 AM		Unnamed Truck 8:30 - 8:32 Unnamed Truck 8:33 - 8:50 BTS 8:33 - 8:37		
8:45 AM		BTS 8:45 - 9:06 Touchdown Trucking 8:47 - 9:17		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Tapa Loading Dock			
	Vehicle Type			
Time	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	Comments
9:00 AM		BTS 9:00 - 9:17 Touchdown Trucking 9:10 - 9:15		
9:15 AM	Unnamed Van 9:25 - 9:37 Tour Van 9:27 - 9:37	Touchdown Trucking 9:15- 9:25 Touchdown Trucking 9:15 - 9:27 UNID 9:26 - 9:30		
9:30 AM	Unnamed Truck 9:38 - 9:51	BTS 9:30 - 9:34 Touchdown Trucking 9:38 - 9:51 Ryder 9:40 - 9:45 Touchdown Trucking 9:40 - 9:45		
9:45 AM	St. Germaine 9:53 - 10:00 Unnamed Delivery Van 9:59 -11:03	Touchdown Trucking 9:45 - 9:50 HDS 9:47 - 10:00 Touchdown Trucking 9:50 - 10:12 Tourbus 9:58 - 10:04		
10:00 AM		ALSCO 10:06 - 11:02 BTS 10:12 - 10:17		
10:15 AM	Ilima Shuttle 10:29 - 10:31			

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
10:30 AM		Unnamed Shuttle 10:42 - 10:44 ALSCO 10:40 - 10:58		
10:45 AM		Touchdown Trucking 10:45 - 10:48		
11:00 AM	Baggage Trans Service 11:00 - 11:14 No name Van 11:03 - 11:18			
11:15 AM	Touchdown Trucking 11:25 - 11:32			
11:30 AM				
11:45 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
12:00 PM	Unnamed Delivery Truck 12:00 - 12:26 Unnamed Delivery Truck 12:04 - 12:20	BTS 12:00 - 12:02		
12:15 PM		BTS 12:15 - 12:18		
12:30 PM		Unnamed Truck 12:34 - 12:38		White truck is a baggage cargo truck.
12:45 PM	Touchdown Trucking 12:50 - 12:53 ALSCO 12:55 - 2:00	ALSCO Truck 12:54 - 1:18		ALSCO Truck couldn't start - towed away
1:00 PM		Tow Truck 1:00 - 1:18 ALSCO Truck 1:00 - 2:00		
1:15 PM	Unnamed Truck 1:15 - 1:20 DFS Galleria 1:20 - 1:30	BTS 1:15 - 1:22		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Tapa Loading Dock			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
1:30 PM	Unnamed Truck 1:38 - 1:50	Touchdown Trucking 1:30 - 1:37		
1:45 PM				
2:00 PM	Unnamed Delivery Truck 2:07 Arrive			Delivery truck parked for remainder of survey
2:15 PM		ALSCO Truck 2:20 - 2:31		
2:30 PM				
2:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
3:00 PM	Unnamed Delivery Truck 3:11 - 3:22	ALSCO 3:02 - 3:10 ALSCO 3:07 - 4:05		
3:15 PM	Superb Sushi 3:22 - 3:27			
3:30 PM				
3:45 PM	UNID Truck 3:55 - 4:00			
4:00 PM				
4:15 PM		Unnamed Delivery Truck 4:22 - Undetermined		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

Time	Tapa Loading Dock			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
4:30 PM		↓		
4:45 PM		↓		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Great Lawn Loading			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
6:00 AM				
6:15 AM				
6:30 AM			Pepsi Truck 6:44 - 7:12	
6:45 AM				
7:00 AM				
7:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Great Lawn Loading			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
7:30 AM				
7:45 AM				
8:00 AM				2 - Private Vehicles in Loading / Unloading 8:00 - 8:10
8:15 AM				
8:30 AM		Bud Light Truck 8:30 - 8:41		1 - Private Vehicle in Loading / Unloading 8:30 - 8:37
8:45 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Great Lawn Loading			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
9:00 AM	Unnamed Van 9:08 - 9:15			Limousine parked in loading zone 9:05 - 9:12
9:15 AM				
9:30 AM				
9:45 AM				
10:00 AM	DSC 10:09 - 10:41			
10:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Great Lawn Loading			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
10:30 AM		Premium Incorporated 10:33 - 10:43		
10:45 AM				
11:00 AM				
11:15 AM				
11:30 AM				
11:45 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Friday, July 30, 2010

	Great Lawn Loading			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
12:00 PM		Armstrong Produce 12:10 - 12:27		
12:15 PM				
12:30 PM				
12:45 PM				
1:00 PM				
1:15 PM	Unnamed Vehicle 1:22 - 3:31			

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Friday, July 30, 2010

	Great Lawn Loading			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
1:30 PM	Unnamed Vehicle 1:30 - 3:31			
1:45 PM				
2:00 PM	FEDEX Van 2:09 - 3:01			
2:15 PM				
2:30 PM				
2:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

Time	Great Lawn Loading			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
3:00 PM				
3:15 PM	Unnamed Truck 3:21 - 3:27			
3:30 PM				
3:45 PM				
4:00 PM				Private Vehicle in loading / unloading 4:03 - 4:18
4:15 PM			Budweiser Truck 4:25 - 4:35	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Friday, July 30, 2010

	Great Lawn Loading			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
4:30 PM				
4:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Great Lawn Loading Area			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
6:00 AM				
6:15 AM				
6:30 AM				
6:45 AM				
7:00 AM				
7:15 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Great Lawn Loading Area			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
7:30 AM				
7:45 AM				
8:00 AM				
8:15 AM				
8:30 AM				
8:45 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Great Lawn Loading Area			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
9:00 AM				
9:15 AM				2 private vehicles parked at loading zone
9:30 AM				1st private vehicle left
9:45 AM				
10:00 AM				
10:15 AM				2nd private vehicle left

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Saturday, July 31, 2010

	Great Lawn Loading Area			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
10:30 AM		ALSCO Truck 10:35 - 10:45		
10:45 AM				
11:00 AM				
11:15 AM				
11:30 AM				
11:45 AM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY
Date: Saturday, July 31, 2010

Time	Great Lawn Loading Area			
	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
12:00 PM				
12:15 PM				
12:30 PM				
12:45 PM				
1:00 PM				
1:15 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Great Lawn Loading Area			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
1:30 PM				
1:45 PM				
2:00 PM				
2:15 PM				
2:30 PM				
2:45 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Great Lawn Loading Area			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
3:00 PM				
3:15 PM				
3:30 PM				
3:45 PM				
4:00 PM				
4:15 PM				

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Date: Saturday, July 31, 2010

	Great Lawn Loading Area			
Time	Vehicle Type			Comments
	Van / Small Truck	Mid-Size Truck (Step Truck)	Large Vehicle	
4:30 PM				
4:45 PM				

APPENDIX D

PASSENGER LOADING SURVEY

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
6:00AM	ET (5), DHT (5), TACHI (4)		
6:05AM	IRUKU (2), OAHU (2), ET (8)	RH (12)	
6:10AM		RH (13)	
6:15AM	VIP (2), NN, KTO (2)	RS (12), PA (6)	
6:20AM	OLE (12), TACHI (3)		
6:25AM	KAI (1), KATO (1), NICE (17)		
6:30AM	NIP (2), KO (1), SPEEDI (2)		
6:35AM	OLE (1), NIP (1), NN (2), PA (4)		
6:40AM	RHV (19)		
6:45AM	ST (10), PACSKY (14), ST (8), TAXI (19), ST (8)		
6:50AM	WAKE (6)	PA (6)	
6:55AM	HKGOLF (3), HAWN, FIRE, SURF (4)	PA (5)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
7:00AM	MD (5), TOP (3), RHV (2), VIP (1)	TPT (21), PA (31)	
7:05AM	PAV (74), TACHI (9), ST (3), TQ (7), HST (2), OAHU (1)		
7:10AM	TELL (2)	PA (13), TPT (17)	
7:15AM	NN (1), NN, ET (5), ET (5), ET (9), ALO (1)	TPT (4)	
7:20AM	SB (4), RHV	PA (5), PA (47), SS (5), SS (11)	
7:25AM	ST	PA (54), PA (11), PA 8)	
7:30AM	HIS, TAXI, SPH, PCC (6), DUK (2)	KUALOA (2), SS (18)	
7:35AM	TF (4), MAK (5), VIP (3), NN (12)	KNT (11)	
7:40AM	VIPT (1), ET (5), STH (2)	RS (5)	
7:45AM	ST (3), ST (4), MT (8)	TPT (6)	
7:50AM	NN (2), NN (1), SA (6)		
7:55AM	NN (5), NICE (2), SURF (3)	RH (5)	
8:00AM	ALL (4), VIPT (2), ST (2), ET (2)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
8:05AM	MD (1)	TPT (5)	
8:10AM	SURF (5)	PH (28)	
8:15AM	TACHI (3)	PA (22)	
8:20AM	SH (14), HAN (2), TQ (4), EH (3), NN (5)		
8:25AM	NN (3), PAV (11), VIP (5), TAXI (1)		
8:30AM	SH (14), TACHI (5), WAKE (2), TJ (3), NN (5)		
8:35AM	EH (2), RHV (11), NN (1), MD (2)		
8:40AM	LL (8)	PA (13), SS (23)	
8:45AM	TQ (4), KAI	RH (1), PA (20)	
8:50AM	MD (1), ST (7)	PA (11)	
8:55AM	OAHU (1), HST (9), SA (8), ALL (1), GT (2)		
9:00AM	NN (5), HST (5), BWT (3), KAI (2)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
9:05AM	MUS (1), BWT (5), KO (7), RHV (4)	PA (21)	
9:10AM	SB (1), NN (20)	PA (9), IL (15), PS (10)	
9:15AM	PAV (56), MD (2), VIP (3), ALPHA (3), ET (13)		
9:20AM	VIP (24)		
9:25AM	TT, OAHU (3), MAKANI (4)	RH (1)	
9:30AM	BWT (3), RH (4), ET (1), TQ (7)	PD (2)	
9:35AM	RHV, OLE, OAHU (1), TACHI (8)	TPT (41), DM (1)	
9:40AM	SEA (11)	RH (2)	
9:45AM	NICE (3), ST (2), NIP (13), SEE (20)	TPT (6)	
9:50AM	ST (4), ST (4), PAV		
9:55AM	HON SC (10), OLE (2), SKY (2), ST (2), TT (1)		
10:00AM	ENT (1), TAXI (1), ISL (5), TOP (2), NICE (9)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
10:05AM	MD (1)		
10:10AM	ET (19), WS (3), WS (3)	PA (8), RH (8), PD (8), PA (5)	
10:15AM	ST, SA (4), AA	RH (10)	
10:20AM	ET, MAK (3), ZZ (5), SB (11), KO (1), WAKE (1), ET (1)		
10:25AM	SPH (6), HIS (2), PAV (1), RHV (6)		
10:30AM		TPT (9), PA (14)	
10:35AM	ST (5), ALL (3)	RH (1), TPT (13)	
10:40AM	TOP (3), ST (4)		
10:45AM	HON SC (4), ST (4), ST (7), KO (4), ET (2), ATS (3)		
10:50AM	ST (4), RHV (13)		
10:55AM			
11:00PM	ET (21), ST (16), HAPA (2), OFS (2), RHV (11), ST (7), TFT (6), UNC (3)	RH (5)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type: Van / Mini Bus	Vehicle Type: Buses	Comments
11:05PM	HST (1), ID (1), ST (8), ST (6), PD (6)		
11:10PM	TQ (7)		
11:15PM	NNV (8)		
11:20PM	RID (4), HIS (2)		
11:25PM	PD (1), TAXI (1), TELL (2), SS (2), SH (15)	RH (2)	
11:30PM	AT (6), E CORP (1), MKH (3), TOT (4)		
11:35PM	ET (5)		
11:40PM	SURF SCH (5), TOMMY'S (5)		
11:45PM	SHA (26), RH (5), JOKI (5)	PD (5)	
11:50PM	SCREAMER (1), HST (7)	RH (10)	
11:55PM		TP (5)	
12Noon	MB (6), FIRE-SURF (4)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
12:05PM	MAK (1), PCC (6), NN (8), ATS (2), VIP (8), TAXI (4)	PA (4)	
12:10PM	BLUE (1), TAXI (3), ISL (1)	PD (1)	
12:15PM	TACHI, ILI (2)	PA (8)	
12:20PM	SPEEDI (1), ILI (2)	RH (2), TPT (1), PD (1), PD (2)	
12:25PM	KO (2), HAPA (1), NN (2), OAHU (1)		
12:30PM	ET (1)	RH (2)	
12:35PM	HST (1), MUS (2), NN (2), ILI (3)	SS (2)	
12:40PM	TAXI (3)	PD (3), RH (1), TPT (3)	
12:45PM	WAI (20), DUKE (1), OAHU (1)		
12:50PM	VIP (2), HON SC (1), ET (1), RHV (2)	TPT (1), PD (3)	
12:55PM	VIP (9), HL (2), SPEEDI (1), SB (1), RH (12)		
1:00PM	BLUE (1), VIP (1), INU (1), SA	RH (5), RH (1)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
1:05PM	MD OFS		
1:10PM	NN (1) DUK (1) PAC-SKY		
1:15PM	ST (5) ET (1)		
1:20PM	RHV (3) ST (4) PAV (1) HK-GOLF (1) HIS (6)	RH (1) PD (1)	
1:25PM	ST (3) STAR (1)	RS (1)	
1:30PM	TAXI (6) NICE REL (6) HAPA (2)	RH (3) RH (10)	
1:35PM	ILI (3) REL TAXI (4) NN (4)	PD (1)	
1:40PM	HIS (2) ST (5) KUU (3)		
1:45PM	ILI (2) WAKE (2) HON SC (3) HAPA (3)		
1:50PM	VIP (2) ET (5) RHV (4) TAXI (1) VIP (4) ST (14)	RH (8)	
1:55PM		SS (10)	
2:00PM	HTT (1) OAHU (2) MD (2)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
2:05PM			
2:10PM	TTS (2) MAK (7)		
2:15PM	OAHU (1) HIS (4) HIS (5) HST (2) BLOT (2) HAPA (1)	PA (2)	
2:20PM	NN (1) TQ (1) VIP		
2:25PM	SO PAC ST (3) SB (7) TAXI (1)	RH (1)	
2:30PM	RHV (4) RHV (4) TACHI (1)	RH (4)	
2:35PM	SPEEDI (2) TOMMY'S (1) HAS	PA (2)	
2:40PM	SA VIP (2)	PA (46)	
2:45PM	HIS (1) KAI (1) ET		
2:50PM	VIP (2)		
2:55PM	ST (8) HIS (6) RS (2) ALPHA (2)		
3:00PM	ALOHA-GOLF (2) VIP (3)	PA (19)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
3:05PM	SEA (1) SH (1)	RS (92)	
3:10PM	MD VIP (51)	RH (3)	
3:15PM	SH (1)		
3:20PM	HIS (1)	PA (1)	
3:25PM		RH (2)	
3:30PM	MAK RHV (3) RHV (7) NN		
3:35PM	ILI (2)		
3:40PM	RHV (3) NN	TELL (2) SS (2)	
3:45PM		RH (3)	
3:50PM	DHT (2) VIP (2) BLUE (4)	PA (17)	
3:55PM	HON SC REL (1) NN NN DHT (1)	RH (24)	
4:00PM	MUS (2) ET (2)	LLB (5) PHC (3) RH (34)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Friday, July 30, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
4:05PM		RS (40)	
4:10PM		RH (10) RH (3)	
4:15PM	NN ST (7) RHV (7) NN (6)	TPT (12)	
4:20PM			
4:25PM	TAXI (11)		
4:30PM			
4:35PM			
4:40PM		PD (1)	
4:45PM		RH (5)	
4:50PM	NN (1)		
4:55PM	ST NN		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
6:00AM	RHV (1), ET (8), TACHI (8), TACHI (3)	SS (4)	
6:05AM			
6:10AM	ET (6)	RH (12), RH (9)	
6:15AM	ET (3)		
6:20AM			
6:25AM	NN (6), ET (16), REL (2), ST (18), ATS (2), ILI (16)		
6:30AM	NICE (3)		
6:35AM	PAV (3)		
6:40AM	ST (4), ST (5)		
6:45AM	TAXI (4), KATO (5), SEE (5), HUM (10), KO (1)	PA (3)	
6:50AM	RHV (11), ST (4), KO (9)	RH (11)	
6:55AM	DHT (4), TACHI (6), KATO (3), MD (5), TF (12), HST (10)	PA (7)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
7:00AM	KAI (3)		Handi Van in loading zone
7:05AM	TQ (5), WAI (3), VIP (1)		
7:10AM	RHV (16)	PA (9), PA (16)	
7:15AM	ET (4), NN, NN (17)	TPT (6)	
7:20AM	TT (13), NN (2), KUA (2), MAK (3)	RH (14)	
7:25AM	SHA (3), KUA (16), HIS (9), VIP (9)		
7:30AM	NEL (6), ISL (2), REL (3)	PA (10)	
7:35AM	ST (7), RIO (7), MD, TF (4), SA (4)	IL (1)	
7:40AM	NICE (11), KOS (5)	TPT (4)	
7:45AM	SPH (1), ST (23), MAH (39)	PA (28), TPT (13)	
7:50AM	NN (9), MD (2), NN (2), NN (8)		
7:55AM	TAXI (4), NN (2)		
8:00AM	AQUA (1), RHV (9), ST (4), SCUBA (3), OAHU (7), HST (3), GTI (11)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
8:05AM	OAHU (8), PAV (4)		Handi-van leaves at 8:05 fromloading dock area
8:10AM	MD (2), HST (7), GTI (3), HAS (1), ET (2)	RS (26)	
8:15AM	TWO (2), SH (27), SHA (1), HAN (5)	LL (6), DM (16)	
8:20AN	808 (5), HTT (3), NIP (5)		
8:25AM	ET (8), ILV (6), NN (1)	PA (4)	
8:30AM	TAXI (5), RHV (8), ST (9), MAK (6)	PA (17)	
8:35AM	TACHI (3), HON SC (7), NN		
8:40AM	BWT (1), OLE (4), NN	RS (25)	
8:45AM	PAV (2), ST (3)	PA (9), SS (22)	
8:50AM	HIS (4), ILV (6), CO (7), KO (24), DOLP (1)	PA (19), RH (2)	
8:55AM	GIRL (3), VIPT (1), NN (17)	SS (5)	Congestion on Kalia. Cannot depart loading area at driveway.
9:00AM	ST (1), HST (7), VIP (5), ST (16)	PA (1)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
9:05AM	MUSA (2), RHV (2), PA (7)	PA (2)	
9:10AM	BIKE (2), ASTT (5), ILV (7)	PA (9), RS (4)	
9:15AM	ST (8)	SS (9)	
9:20AM	VIP (2), AMBU-LANCE (23)		
9:25AM	BIKE (3), OAHU (6), EO (3), RHV (10), ILV (7), ILV (5), ET (4), TT (7)	TPT (9), RH (8)	
9:30AM	FIRE (4), SPEEDI (6), PAV (6), REL (6), TQ (4)	PD (4)	
9:35AM	ILV (22), VIP (1), TAXI (7), TT (6), TACHI (3)	PA (3)	
9:40AM	ST (5), HON SC (1), RHV (3)	RH (3), TPT (45)	
9:45AM	VIP (5), ET (1), NICE (6)	PA (9)	
9:50AM	HIS (3), SKY (3), ST (8)	PA (21), PA (21), RH (2)	
9:55AM	TOP (3), HST (13), MAK (1)	PD (17)	
10:00AM	NN (2), KPT (12)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
10:05AM	REL (1), MD (1), TF (2), VIP (4), WAKE (11), ET (11), ST (1)		
10:10AM	MD		
10:15AM	NN (1)		
10:20AM	ST (2), SO PAC (5), TAXI (2), VIP (3), RH	TPT (15), RH (9)	
10:25AM	SA (3), ST (2), PARADISE (16)		
10:30AM	KUU (10), NICE (1), ST (2), ET (2)	PA	
10:35AM	NN (1)		
10:40AM	HOLO (1)		
10:45AM	HON SC (2), VIP (1), ET (1), KO (6), NN (5), HIS (6)	TPT (5), RH (7)	
10:50AM	ST (5), KAI (4), EXEC (2)	PH (1)	
10:55AM	TF (7), ROBERTS (5), ILIMA (7), HIS (4)		
11:00PM	VIP (5), VIP (5), TF (6)	PH (2), RH (3)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
11:05PM	ST (6), ENT (2), MKH (3), ALPHA (4), HI (1)	TP (1), TP (6)	
11:10PM	HIS (3), TQ (7), SCREAMER (10)		
11:15PM	EWS (1), ALL (7), PTT (4)		
11:20PM	NAV (11), HIS (4), ST (10)	RS (5)	
11:25PM	KOS (2), SH (3)		
11:30PM	MD (2), NN (14), ST (4), ST (5)		
11:35PM	RS (5), SCREAMER (11), HIS (4)	RH (6)	
11:40PM	TACHI (5), ST (2), ET (4), TOURNET (5), TPM (3)	RH (9), TP (8)	
11:45PM	RH (6), RH (6)	PH (8), PH (3), RH (5)	
11:50PM	TP (6), NELSON (2), TF (4)		
11:55PM	VIP (7), NEL (3), NEL (5), LLT (10), TF (5), OAHU (3)		
12Noon	NN (2)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
12:05PM	LL (5), MD, MD, COSMO (4), VIP (1), TTS (1), TAXI	PD (2)	
12:10PM	ST (4), RHV (5)	RH (16), PA (3)	
12:15PM	RHV (3), RHV (3), BIKE (5)	TPT (2), SS (48), PD (2)	
12:20PM	NN (8)	TPT, RH (2)	
12:25PM	ILV (2), OLE (4), NN (4)		
12:30PM	ET, SCUBA (1), KO (5)	RH, TPT (1), PH (1)	
12:35PM	VIP (2), OAHU (4), HIS (5), ILV, HIS (7)	PD (1)	
12:40PM	NS (4), SO PAC (1)	SS (1)	
12:45PM	SPEEDI (1), KUU (1), NN (12)	RS (11)	
12:50PM	NICE (1), SKY (7), IRU (1), NELSON, GIRLS (1)		
12:55PM	WAI (2), KO, SPEEDI (4), NN (2), NN (5)		
1:00PM	SA (1), HIS (2), MD (2)		

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
1:05PM	ILV (1) HST (1) NICE (1)		
1:10PM	OAHU (1) ALPHA (3)		
1:15PM	ET (3) MAH (5) VIP (6) RHV (4)	RH (3)	
1:20PM	TT (1)		
1:25PM	HAPA NN (3)	KNT (21)	
1:30PM	VIPT (3) RHV (4)	VIPB (3) TPT VIP (9)	
1:35PM	TACHI (1) NN (2) HON SC (4)	RH (2)	
1:40PM	KUUB (2) DUKE'S (1) ET (4) KATO (1)	RH (1)	
1:45PM	RHV (4)		
1:50PM	HON SC (7)		
1:55PM	FIRE (4) WAI (3)		
2:00PM	RHV (8) HIS (2)	RH (1)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
2:05PM	KATO (1) RHV (1) VIP (3)		
2:10PM	OAHU (3) ILV (2) OLE (2)	PA (2)	
2:15PM	HAPA (3)	RH (3)	
2:20PM	TAXI (4) MAH (7)		
2:25PM	TOURNET (11)	PH (3)	
2:30PM	MD (1) PTT (1) VIP (40) SPEEDI (4)	RH (5)	
2:35PM	SPEEDI (1)		
2:40PM	BIKE (1)		
2:45PM	TOURNET (5)	RH (4)	
2:50PM	HON SC (1) HIS (6)		
2:55PM	NN (2) VIP (2) HST (1)		
3:00PM	RHV (14) RIO (1)	IL (5)	

HILTON HAWAIIAN VILLAGE LOADING SURVEY

Saturday, July 31, 2010

Bus Terminal

Time	Vehicle Type		Comments
	Van / Mini Bus	Buses	
3:05PM	MD SH (2)	RH (3) DM (2)	
3:10PM	SH		
3:15PM	IGS (3)		
3:20PM	NICE (3) SPEEDI (2)		
3:25PM	REL (9) HST (8) REL (1) ENTERPRISE (1)		
3:30PM	DISC (1) ST (1)	RH (1) RH (2)	
3:35PM	MAK (1) VIP (2) HIS (1)		
3:40PM	RHV (2) NN (2) NN (1) AR (24)		
3:45PM	ILV (2) TAXI (4)		
3:50PM	DOLPH (1) MUSA ILV (4) SA (1)	PD (3)	
3:55PM	RHV (2) LL (6) VIPT (2) HST (9) RHV (8)		
4:00PM	NN (2) ST (4)		

During the survey, the overall peak occupancy of the parking garage, as well as, the peak occupancy of the self-parking and reserved stalls occurred during the mid-morning while the peak occupancy of the valet stalls occurred near midnight. The overall peak occupancy was approximately 78% on Friday and 73% on Saturday while the peak occupancy of the valet stalls was 78% on Friday and 77% on Saturday. The peak occupancy of the self-parking stalls was 83% on Friday and 75% on Saturday while the peak occupancy of the reserved stalls was 78% on Friday and 67% on Saturday.

B. Visitor Parking Management Strategies

1. Valet Parking

Valet services are provided for visitors at the Kalia Tower, Waikikian, or main lobby. Visitors utilizing the valet service at the Kalia Tower drop their vehicles off at the porte cochere for that tower and then valet personnel transport the vehicles directly to the parking garage across the access aisle (see Figure 11). Similarly, visitor utilizing the valet service at the Waikikian drop their vehicles off at the porte cochere for that building and then valet personnel utilize Kahanamoku Street to transport the vehicles to the parking garage (Figure 12). At the main lobby, visitors utilizing the valet service drop their vehicles off at the porte cochere where valets categorize them as either short-term or long-term parking. Vehicles that are only expected to park for a short period of time (short-term) are parked within the porte cochere if possible. Vehicles that are expected to park for longer periods of time (long-term) are typically transferred to the parking garage utilizing Rainbow Drive (see Figure 13). Valet services will also be provided at the new timeshare tower near Paoa Place. Visitors at this tower utilize Kalia Road to access the porte cochere for the tower. Valet personnel then utilize on-site connections to directly access the parking area within the tower (see Figure 14).

A survey was conducted of the existing porte cocheres at the Kalia Tower, Waikikian, and main lobby in 2010 on July 30th (Friday) and 31st (Saturday) to assess valet operations in these areas (see Appendix B for the collected data). At the Kalia Tower and Waikikian, valet personnel

APPENDIX L

Preliminary Engineering Report for Hilton Hawaiian Village Master Plan

Belt Collins Associates

March 2011 ~~September 2010~~

HILTON HAWAIIAN VILLAGE
MASTER PLAN ENTITLEMENTS
PRELIMINARY ENGINEERING REPORT

Hilton Hawaiian Village Beach Resort & Spa
2005 Kalia Road
Waikiki, Honolulu, Hawaii 96815
Tax Map Keys:
2-6-05: 1 (portion)
2-6-08: 1, 2, 3, 5, 7, 12, 19, 20, 21, 23, 24, 27, 31, 34, 37 & 38 and
2-6-09: 1, 2, 3, 7, 9, 10, 11, 12 & 13

Prepared by:

Belt Collins Hawaii Ltd.
2153 North King Street, Suite 200
Honolulu, Hawaii 96819

BELT COLLINS

March 2011

ALAN M. KATO
LICENSED PROFESSIONAL ENGINEER
No. 7552-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME
OR UNDER MY SUPERVISION

April 30, 2012
EXPIRATION DATE OF THE LICENSE

1. Purpose

The purpose of this Preliminary Engineering Report (PER) is to address existing conditions, potential impacts and mitigation for water supply, wastewater, roadways, solid waste, gas and electrical/communications requirements in support of the Environmental Impact Statement (EIS) and the Shoreline Management Area (SMA) Use Permit, and the Planned Development Report (PDR) Permit for the Hilton Hawaiian Village (HHV) master plan improvements

2. Master Plan Improvements

The following is a summary of the master plan improvements:

- New Timeshare Tower with 300 guest rooms/suites over the bus loading area adjacent to the Tapa Tower.
- New Timeshare Tower with 250 guest rooms/suites over the south-west end of the Rainbow Bazaar.
- Redevelopment of the Rainbow Bazaar.
- Improve the retail and streetscape along Kalia Road
- Improve the Main Entry, Rainbow Drive and the center resort retail area.
- Improve the Tapa Pool and Tapa Café.
- Improve the Front Desk, develop a new Super Pool and new Hau Tree Bar.

3. Infrastructure

3.1. Water Supply

3.1.1. Existing Conditions

The Honolulu Board of Water Supply (BWS) provides potable water for most of Oahu, including the HHV. The HHV area BWS water system consists of a 12-inch diameter main along the north side of Ala Moana Boulevard, a 4-inch diameter service line along the south side of Ala Moana Boulevard, an 8-inch diameter main in Kalia Road, a 12-inch diameter water main along Kahanamoku Street, and an 8-inch diameter main that reduces to a 4-inch diameter service line within Paoa Place. Fire hydrants are located along the north side of Ala Moana Boulevard and Kalia Road, spaced approximately 300-feet apart. Fire hydrants are located along Kahanamoku Street, spaced approximately 250-feet apart. See Figure 1 – Water System, following the text of this report.

Multiple meters provide potable water and fire water service the HHV campus. The primary potable water service connection is from the 12-inch diameter main in Ala Moana Boulevard through two (2) 4-inch turbine meters with a secondary connection to the 8-inch diameter main in Kalia Road fronting Kalia Tower through two (2) 6-inch compound meters. During a site visit on April 6, 2010, Mr. John Clarke, Hilton's Director of Property Operations indicated that one of the meters at each connection was previously shut at the valve by the Board of Water Supply, therefore only two (2) of the four (4) meters are in operation. An 8-inch diameter potable water line traverses around the HHV campus between the two service connections, from the north side of Kalia Tower and the parking garage, along Lagoon Drive, to the north side of the Diamond Head Tower and along Kalia Road within the campus. A separate water line is connected to the 12-inch diameter water main in Kahanamoku Street that services the Grand Waikikian. The water consumption for the HHV campus during 2009 was 356,816,000 gallons or approximately 0.978 million gallons per day (mgd).

Fire water service is from the 12-inch diameter main in Ala Moana Boulevard with a secondary connection to the 8-inch diameter main in Kalia Road fronting Tapa Tower. A 6-inch diameter fire water line is looped completely around the campus, adjacent to the potable water line. Within the HHV campus fire hydrants are connected to the 8-inch diameter potable water line along Lagoon Drive, at the lobby and at the south corner of Diamond Head Tower next to Paoa Place.

3.1.2. Probable Impacts

The increase in water usage from the master plan improvements is shown in Table 1. Water usage is anticipated to increase by approximately 0.194 mgd, or approximately 20 percent above the current 0.978 mgd HHV water use. The BWS indicated that "the existing water system is presently adequate to accommodate the proposed development" in their letter dated May 5, 2010.

Table 1: Additional Water Usage

Type of Use	No. of Units	Use Rate[1]	Expected Usage
Hotel Rooms[2]	550 Rooms	350 gal/unit-day	192,500 gpd
Retail & Offices	14,790 sf	120 gal/1,000 sf-day	1,775 gpd
Total			194,275 gpd 0.194 mgd

1. Board of Water Supply, Water System Standards, 2002, Table 100-18.
2. Time share rooms.

There is adequate pipeline infrastructure around and within the HHV campus to support the proposed master planned improvements. For the new timeshare tower over the bus loading area, a new potable water line with a compound meter and fire water line connection with a detector check meter can either be connected to the 12-inch diameter water line in

Kalia Road or to the 8-inch water line in Paoa Place. For the new timeshare tower over the Rainbow Bazaar, the water services can be submetered and connected to the 12-inch diameter water line in Lagoon Drive. An alternate connection and submetering for the timeshare tower over the Rainbow Bazaar would be to the 8-inch diameter water line and 6-inch diameter fire line in Lagoon Drive.

3.2. Wastewater

3.2.1. Existing Conditions

The City and County of Honolulu (City) sewer system around the HHV campus consists of 18- and 12-inch diameter sewer lines along Ala Moana Boulevard, which connect to a 24-inch diameter sewer line (1960) at the Kalia Road intersection, a 12-inch diameter sewer line in Kalia Road, 8- and 12-inch diameter sewer lines in Kahanamoku Street, and a sewer line in Paoa Place that varies in size from 8- to 10-inch in diameter. See Figure 2 – Sewer System, following the text of this report. Wastewater from the campus flows in the north direction, toward the Ala Moana Boulevard and Kalia Road intersection. The 24-inch diameter sewer line (1960), a second 24-inch diameter sewer line (2004) in Ala Moana Boulevard and a 16-inch diameter sewer line that traverses through the Fort DeRussy property convey area wastewater by gravity flow to a sewage pump station located on Kalakaua Avenue adjacent to Fort DeRussy. The station pumps the collected flows to the City's sewage pump station at Ala Moana Beach Park for eventual conveyance to the Sand Island Treatment Plant, where it is treated and discharged through a deep ocean outfall.

The majority of the wastewater from the HHV property flows in a 15-inch diameter sewer line to a manhole along the 24-inch diameter sewer line at the intersection of Ala Moana Bouleard and Kalia Road. The 15-inch diameter sewer line also conveys wastewater from a portion of Alii Tower, the Lobby, Rainbow Tower, Lagoon Tower, the Grand Waikikian Tower, Rainbow Bazaar, the Mid-Pacific Conference Center, a portion of the parking garage and Kalia Tower.

Wastewater from the majority of Tapa Tower and a portion of the parking garage flows in a 12-inch diameter sewer line in Rainbow Drive which connects to the 12-inch diameter sewer line in Kalia Road. At the Ala Moana Boulevard end of Kalia Road, the 12-inch diameter sewer line connects to the 16-inch diameter sewer line through the Fort DeRussy property. The remainder of the Tapa Tower wastewater flows in a 6-inch diameter sewer lateral connecting into a manhole along the 12-inch diameter sewer line in Kalia Road.

Wastewater from a portion of Alii Tower, Diamond Head Tower and the Diamond Head Apartments flows into the 8-/10-inch diameter sewer line in Paoa Place and into the 12-inch diameter sewer line in Kalia Road.

There are no sewer line connections from the HHV campus to the sewer line in Kahanamoku Street.

3.2.2. Probable Impacts

The increase in wastewater generated from the master plan improvements is shown in Table 2. Wastewater is anticipated to increase by approximately 0.124 mgd.

Table 2: Additional Wastewater Generation

Type of Use	No. of Units	Generation Rate[1]	Expected Generation
Hotel Rooms[2]	550 Rooms	224 gal/unit-day	123,200 gpd
Retail & Offices	14,790 sf	0.074 gal/sf-day	1,087 gpd
Total			124,287 gpd 0.124 mgd

1. City and County of Honolulu, Design Standards of the Department of Wastewater Management, Volume I, July, 1993, Chapter 20, Design of Sewers.
2. Time share rooms.

Wastewater from the tower over the bus depot area would discharge to the sewer line in Kalia Road. Wastewater from the tower over the Rainbow Bazaar would discharge to either the 15-inch diameter sewer line in Lagoon Drive or the sewer line through the parking garage and then to the 15-inch diameter sewer line at the Ala Moana Boulevard and Kalia Road intersection. In response to the Site Development Division Master Application Form for sewer connection, the City Department of Planning and Permitting Wastewater Branch, provided three (3) options for consideration: 1) Connect the Kalia Road 12-inch diameter sewer line to the 24-inch diameter sewer line (1960) and relieve approximately 615 linear feet of the Kalia Road 12-inch diameter sewer line and 1,600 linear feet of the 24-inch diameter sewer line (1960), 2) Connect the Kalia Road 12-inch diameter sewer line to the 24-inch diameter sewer line (2004) and relieve approximately 615 linear feet of the Kalia Road 12-inch diameter sewer line, or 3) Add wastewater flows from both towers to the 15-inch diameter sewer line at the Ala Moana Boulevard and Kalia Road intersection. The City indicated their preference to discontinue use of the 16-inch diameter sewer line through the Fort DeRussy property.

<u>Option 1.</u> Discussions with the City on behalf of HHV have been on-going regarding installation of a new 18-inch diameter sewer line in Kalia Road connecting to the 24-inch diameter sewer line (1960) to replace the existing 12-inch diameter sewer line in Kalia Road. The new 18-inch

diameter sewer line would be rerouted in a proposed easement at the corner of Kalia Road and Paoa Place, which is currently a remnant City parcel. The new 18-inch diameter sewer line would be located along the east side of the parcel to avoid the footing of the proposed new tower. Approximate order of magnitude cost for approximately 915 linear feet of new 18-inch diameter sewer line in Kalia Road from Paoa Place to the 24-inch diameter sewer line (1960) is $2,800,000. This new 18-inch diameter sewer line will allow the City to discontinue the use of the 16-inch diameter sewer line through the Fort DeRussy property.

~~In lieu of the Option 1 relief of the 24-inch diameter sewer line (1960), an alternate relief sewer line option at the Ala Moana Boulevard and Kalia Road intersection has been proposed to the City for their consideration. The proposed option is to transfer flow to the 24-inch diameter sewer line (1960) upstream from the 15-inch diameter HHV sewer line connection via approximately 200 linear feet of new 24-inch diameter sewer line connecting to the 24-inch diameter sewer line (2004). Approximate order of magnitude cost for the 200 linear feet of 24-inch diameter sewer diversion line is $800,000.~~

~~Discussions with the City are continuing, as the City is evaluating the alternate relief sewer line option with consideration for future area growth.~~

<u>Option 2.</u> Option 2 is infeasible, since the 24-inch diameter sewer line (1960) and the 24-inch diameter sewer line (2004) are at approximately the same depth. As such, the Kalia Road sewer line cannot cross the 1960 line to connect to the 2004 sewer line.

<u>Option 3.</u> Option 3 would require a sewage pump station at the tower over the bus depot area and a force main to convey wastewater to the 15-inch diameter sewer line at the Ala Moana Boulevard and Kalia Road intersection. From an operational standpoint, a sewer pump station is undesirable due to maintenance requirements and potential system failures.

Summary of sewer line improvement costs are presented in Table 3.

Table 3: Summary of Sewer Line Improvement Costs

Sewer Line Improvement	Cost
Required Sewer Line Improvements	
• 915 LF of 18-inch diameter Sewer Line in Kalia Road	$2,800,000
Relief Sewer Line Option (Under Discussion with the City)	
• ~~200 LF of 24-inch diameter Sewer Line at Ala Moana Boulevard and Kalia Road Intersection~~Options Under Discussions with the City	~~$800,000~~Undetermined

Discussions with the City are continuing to formulate a relief sewer improvement to accommodate the modest additional demand from the HHV Master Plan improvements that is economically viable for the project.

3.3. Drainage

3.3.1. Existing Conditions

A 5' x 3' box drain on the north side of Ala Moana Boulevard, which originates at the Kalia Road intersection and conveys storm water in the west direction provides the main conduit for drainage around the HHV campus. The drainage system along Kalia Road consists of an 18-inch diameter drain line from Paoa Place extending to the north side of the Rainbow Drive intersection, where the drain system increases to two 18-inch diameter drain lines and extends to the Ala Moana Boulevard intersection. At the Ala Moana Boulevard intersection, the Kalia Road drainage system increases to a 24-inch diameter drain line which connects to the 5' x 3' box drain in Ala Moana Boulevard. Catch basins along Ala Moana Boulevard and Kalia Road capture the roadway storm water runoff for conveyance through the pipes and box drain. See Figure 3 – Drainage System, following the text of this report.

Storm water runoff from approximately half of the north-east side of Paoa Place is captured in a catch basin near the intersection of Kalia Road and conveyed through the 18-inch diameter drain line along Kalia Road to Ala Moana Boulevard. Storm water runoff from the south-west half of Paoa Place is captured in inlets and conveyed through a 6-inch diameter drain line to the south-west end of Paoa Place, where the runoff flows through a 3' x 1' concrete box drain, to a 15-inch diameter drain line, and discharges to the ocean at Port Hilton. A catch basin on Kalia Road, just north of Paoa Place, captures storm water for conveyance through an 18-inch diameter drain line across Paoa Place and connects to a 36-inch diameter drain line that runs along the south-east side of Paoa Place.

A 5' x 3' concrete box drain along the north side of Kahanamoku Street extends from the north side of Ala Moana Boulevard and discharges to the Ala Wai Yacht Harbor.

The majority of the storm water runoff from approximately two-thirds of the north-west side of the HHV campus, shown as Basin 1 on figure 3, is captured by inlets and catch basins and flows through pipes to three (3) storm water quality chambers in the Great Lawn. Storm water runoff from a portion of the area around the Tapa Tower retail shops is captured and pumped through a 14-inch diameter force main to the storm water quality chambers in the Great Lawn. From the Great Lawn, storm water is pumped through a 30-inch diameter force main to the Ala Wai Yacht Harbor. Storm water runoff from the areas around Alii Tower, Diamond Head Tower and the south side half of the Super Pool, shown as Basin 2 on Figure 3, is captured in inlets and gravity flows in pipes to a 15-inch diameter drain line that discharges to the ocean at Port Hilton. Storm water runoff from the north-east side of the HHV campus, shown as Basin 3 on Figure 3, is either disposed directly into seepage wells/dry wells or captured in inlets and gravity flows through pipes to seepage wells/dry wells. Storm water runoff from a portion of the Tapa Tower roof is pumped to a series of seepage wells/dry wells located in the Tapa Bus loading area.

Historically, drainage problems have been reported along Kalia Road and Paoa Place. A recent survey of the drainage system along Kalia Road and Paoa Place noted that the catch basins are filled with dirt and several of the storm drain manholes near the Ala Moana Boulevard end of the drain line(s) are also filled with dirt and water. The drainage system, filled with dirt and debris, would cause flooding along Kalia Road and Paoa Place. To mitigate the flooding problems along Kalia Road from impacting the HHV, Rainbow Drive was raised at the pedestrian crossing between Kalia and Tapa Towers. The raised pedestrian crossing created a berm which mitigated storm water from flowing into the HHV and flooding Rainbow Drive.

3.3.2. Probable Impacts

The proposed master planned improvements will have some impacts on drainage within the HHV campus. Storm water runoff is anticipated to decrease slightly in Basin 1 due to a decrease in pavement areas. Storm water runoff is anticipated to increase slightly in Basins 2 and 3, due to an increase in building and pavement areas. Table 4 summaries the storm water runoff flows (Q) for the existing and developed conditions.

Table 4: Runoff Summary

Drainage Basin	Drainage Direction or Outlet	Existing Q	Developed Q	Net Q Change [1]
1	Ala Wai Yacht Harbor	64.07 cfs	63.96 cfs	-0.11 cfs
2	Port Hilton	15.94 cfs	16.08 cfs	0.14 cfs
3	On-site Seepage/Dry Wells	21.83 cfs	22.27 cfs	0.44 cfs
Total		101.84 cfs	102.31 cfs	0.47 cfs

1. Net = Developed – Existing
2. Assumes that drainage patterns for proposed improvements are the same as existing.

No mitigation measures are required for Basin 1 due to an estimated decrease of approximately 0.11 cubic feet per second (cfs) of runoff from the basin.

Storm water runoff from Basin 2 into Port Hilton is estimated to increase by approximately 0.14 cfs. No flood control mitigation measures are required because the Port Hilton outfall is open coastal water. However, water quality treatment is required to mitigate the effects of the storm water runoff. Water quality treatment mitigation measures which can be implemented include bioretention basins, permeable pavements, or hydrodynamic separator/filter units (e.g. Vortech, Aquaswirl, or CDS system). Bioretention basins and permeable pavements are low impact development (LID) strategies which are used to retain storm water runoff on site. Bioretention areas are depressed landscaped areas for storm water runoff storage, infiltration, and evapotranspiration. Permeable pavements allow storm water runoff to infiltrate into the ground and prevent concentrated runoff flow. Use, location and sizing of bioretention basins and permeable pavements would be determined with the detailed design of the area. Hydrodynamic separator/filter units are proprietary storm water quality units which filter out trash, sediments, grease and oils. Storm water quality units vary in size based on the manufacturer. For Basin 2, a storm water quality unit sized to accommodate approximately 1.26 cfs of flow-through runoff, would be about the size of a standard manhole. A storm water quality unit can be located south of the Super Pool, to treat the storm water runoff prior to flowing off the campus. An order of magnitude construction cost for a storm water quality chamber is $70,000. The actual amount of runoff treatment required would be based on the final design of the Super Pool improvements.

Storm water runoff from Basin 3 is estimated to increase by approximately 0.44 cfs due to the increase in hardscape and building areas for the new timeshare tower over the Tapa bus loading area. The existing runoff from the bus loading area flows into seepage wells/dry wells and percolates into the ground. It is estimated that three 8-foot diameter by 7.5-feet deep seepage wells would need to be installed to mitigate the additional runoff. Onsite percolation testing would be required to determine the actual number of seepage wells. Runoff into the seepage wells does not discharge into the ocean or other receiving waters, therefore water quality treatment is not required. An order of magnitude construction cost for the three seepage wells is $30,000.

The existing seepage wells/dry wells in the bus loading area would be displaced by the proposed new timeshare tower improvements. An order of magnitude construction cost to remove the existing twelve seepage wells/dry wells is $60,000. An estimated twenty-three new 8-foot diameter by 7.5-feet deep seepage wells would be required to replace the twelve seepage wells/dry wells. An order of magnitude construction cost for the new seepage wells is $230,000. Alternatively, percolation chambers with 6,800-cubic-feet of storage volume could replace the twelve seepage/dry wells. An order of magnitude construction cost for the percolation chambers is $350,000. Onsite percolation testing would be required to determine the actual number and volume of seepage wells or percolation chambers.

The new seepage wells and/or percolation chambers in the bus loading area will help mitigate the flooding problems along Kalia Road and Paoa Place by containing storm water runoff on site. However, to mitigate area flooding, the catch basins and drain lines in Kalia Road and Paoa Place should be cleaned of dirt and debris and the drainage system maintained by the City and the State for the systems under their jurisdiction, respectively.

Summary of drainage improvement costs are presented in Table 5.

Table 5: Summary of Drainage Improvement Costs

Drainage Improvement	Cost
New Storm Water Quality Chamber	$70,000
Three New Seepage Wells	$30,000
Total New Drainage Improvements	**$100,000**
Remove 12 Existing Seepage Wells/Dry Wells	$60,000
23 Replacement Seepage Wells or Percolation Chambers (6,800 cubic feet)	$230,000 to $350,000
Total Replacement Drainage Improvements New Timeshare Tower at Tapa Bus Loading Area	**$290,000 to $410,000**
Total Drainage Improvements	**$390,000 to $510,000**

3.4. Roadways

3.4.1. Existing Conditions

Kahanamoku Street, Ala Moana Boulevard, Kalia Road and Paoa Place bound the HHV on the west, north, east and south sides of the campus, respectively. Kahanamoku Street and Paoa Place are owned by the City. Ala Moana Boulevard is owned by the State Department of Transportation (DOT). Kalia Road from Ala Moana Boulevard to 173.71 feet in the south direction is State DOT owned, and from 173.71 feet to Paoa Place is City owned. See Figure 4 – Roadways, following the text of this report.

Access to the HHV main parking garage is via Rainbow Drive from Kalia Road and via Lagoon Drive from Kahanamoku Street.

3.4.2. Probable Impacts

The probable impacts to the area roadways are detailed in the Traffic Impact Report. No major improvements are required to mitigate the impacts of additional traffic on the area roads.

3.5. Solid Waste

3.5.1. Existing Conditions

Solid waste at the HHV is compacted onsite, then collected by Oahu Waste Services, a private contractor, and hauled to the City's H-Power waste to energy plant, the City's Waimanalo Gulch landfill, the privately owned PVT Landfill in Nanakuli and various recycling facilities. Eco-Feed Incorporated, a private food waste recycling contractor, collects and hauls food waste from the HHV. In 2009, approximately 5,442 tons of waste was collected from the HHV campus, including 1,700 tons of recyclables. Recyclables collected included cardboard, glass, newspapers, aluminum, paper, metals, greenwaste and food. Table 6 provides a breakdown of the disposition of the waste from the HHV. Approximately 99.6% of all material generated from the HHV is either recycled or converted to energy at the City's H-Power Plant.

Table 6: 2009 Solid Waste Disposition

Disposition of Material	Tons	Percent
H-Power Plant (City)	3,718	68.3%
Recycling	1,700	31.3%
Landfill (City and Private)	24	0.4%
Total	5,442	100%

3.5.2. Probable Impacts

The increase in solid waste generation from the master plan improvements is shown in Table 7. Solid waste generation is anticipated to increase by approximately 1.15 tons per day, or approximately 8 percent above the current total HHV solid waste generation rate of approximately 14.9 tons per day. The projected increase in solid waste of 421 tons per year constitutes less than 0.05 percent of the 783,013 tons per year of solid waste produced on Oahu that is either sent to the City's H-Power Plant or to the Waimanalo Gulch Landfill.

Table 7: Additional Solid Waste Generation

Type of Use	No. of Units	Use Rate[1]	Expected Generation
Hotel Rooms[2]	550 Rooms	3.5 lbs/room-day	1,925 lbs/day
Retail & Offices	14,790 sf	0.026 lbs/sf-day	385 lbs/day
Restaurant	--	5 lbs/meal	0 lbs/day
Total			2,310 lbs/day 1.15 tons/day 421 tons/year

1. Source: Wimberly, Allison, Tong and Goo. November 2001. Waikikian Development Plan Final EIS. Based on historical records from the HHV.
2. Time share rooms.

The City has a permit to operate and expand the Waimanalo Gulch Landfill with the State of Hawaii Department of Health. The City has started construction of the expansion of the H-Power Plant, with projected completion in May 2012. The H-Power Plant expansion will increase the processing capacity by 50-percent. The increase in waste generated from the HHV improvements will not have a significant impact on the City's waste stream and disposal with the expansion of the City's landfill and the expansion of the City's H-Power Plant.

3.6. Gas

3.6.1. Existing Conditions

The HHV uses natural gas for cooking, hot-water heating and outdoor illumination. The total gas used on the HHV campus in 2009 was 1,116,052 therms.

The Gas Company has existing gas lines around the HHV campus within Ala Moana Boulevard, Kalia Road, Paoa Place and Kahanamoku Street and within the campus itself. A 4-inch diameter gas line extends along the north and east sides of Ala Moana Boulevard and Kalia Road, respectively. A 2-inch diameter gas line extends along Paoa Place and Kahanamoku Street. The Gas Company gas lines within the HHV campus are interconnected with the gas lines along Kalia Road, Paoa Place and Kahanamoku Street. The primary gas service to the HHV campus is through a 4-inch diameter gas line connection from Kalia Road, on the north end of Kalia Tower. This 4-inch diameter gas line extends around Kalia Tower and reduces to a 2-inch diameter gas line through the Rainbow Bazaar and a 1-1/4-inch diameter gas line along the north end of the Parking Structure. A 2-inch diameter gas line along Lagoon Drive from Kahanamoku Street connects to the 1-1/4-inch diameter gas line along the Parking Structure and extends around the lobby area and traverses between the Diamond Head and Alii Towers to connect to the 2-inch diameter gas line in Paoa Place. A separate 4-inch diameter gas line services the Tapa Tower from Kalia Road at the Tapa Tower bus loading area. Gas Company meters are located at the towers, restaurants and various locations throughout the campus for the tiki torches. See Figure 5 – Gas System, following the text of this report.

3.6.2. Probable Impacts

The Gas Company has adequate pipeline infrastructure around and within the HHV campus to support the proposed master planned improvements. The Gas Company will relocate the 4-inch diameter gas line in the bus loading area to the Tapa Tower when the proposed new timeshare tower is constructed over the bus loading area. For the new timeshare tower over the Rainbow Bazaar, the Gas Company can either serve it from the 2-inch diameter gas line within the Rainbow Bazaar or from the 2-inch diameter gas line in Lagoon Drive. The Gas Company will install gas meters at both timeshare towers. Coordination with the Gas Company during the design of the Super Pool expansion will allow the Gas Company to relocate the 2-inch diameter gas line in areas of conflict with the Super Pool. No major impacts or infrastructure improvements are anticipated to the gas infrastructure system with the proposed master planned improvements.

3.7. Electrical

3.7.1. Existing Conditions

Hawaiian Electric Company (HECO) presently serves the HHV campus from HECO's Ena Substation which is located on Ena Road across from the Hobron Lane intersection. HECO has indicated that although their existing Ena Substation is loaded to 30MVA, there are no plans to upgrade the substation. HECO has three service connection points to the HHV campus: at the intersection of Kahanamoku Street and Ala Moana Boulevard; at the service alley connection to Ala Moana Boulevard near the Kalia Tower; and along Kalia Road fronting the Tapa Tower. The Kahanamoku Street service connection serves the HGVC Waikikian Tower and the Lagoon Pump Station. The HECO ductline in the service alley serves the switchgear room constructed in the parking structure below the Coral Ballroom and serves the Diamond Head and Kalia Towers. A separate ductline in the service alley behind the parking structure serves the Lagoon Tower. The Kalia Road service connection serves the Tapa Tower. There are also two existing HHV-owned 12.47 kV tie-circuits between the Coral Ballroom switchgear room and a switchgear room in the Tapa Tower.

3.7.2 Probable Impacts

HECO has indicated that the proposed timeshare towers will be served from the circuits originating in the Ena Substation and has also indicated that the existing infrastructure in Ala Moana Boulevard and Kalia Road do not require upgrading. Ducts and circuits from the HECO ductline in Kalia Road need to be extended to provide service to the timeshare tower over the Tapa bus loading area or the existing switchgear in the Tapa Tower must be modified to accommodate the additional circuit breakers required to service the new tower. The latter may be infeasible due to the space constraints of the existing electrical room. Since the timeshare tower will be under the jurisdiction of Hilton Grand Vacations Club (HGVC), a separate electrical service connection, similar to the Waikikian Tower may be warranted.

HECO indicated that for the timeshare tower over the Rainbow Bazaar, ducts and circuits would need to be extended either to the handhole on Ala Moana Boulevard across from Kahanamoku Street or to the stub-outs in the service alley behind the Coral Ballroom parking structure that were constructed under the recent (2003) HHV Infrastructure Improvements project. It may be possible to tie into the switchgear provided under the aforementioned improvement project, however, HECO would need to confirm if the circuits have sufficient capacity. Since this timeshare tower will be under the jurisdication of HGVC, the separate electrical service connection may be warranted.

At the intersection of Kalia Road and Paoa Place, the existing HECO infrastructure that serves the Hale Koa Hotel and the Diamond Head Apartments remains in a remnant City-owned parcel that was created when the Federal Government re-aligned Kalia Road into its present location. The HECO infrastructure is located parallel to the existing Kalia Road right-of-way and is within the proposed footprint of the timeshare tower over the Tapa bus loading area. A bypass duct and manhole system must be constructed to allow HECO to relocate the circuits in the existing infrastructure away from the tower foundation. The proposed alignment for the relocated ductline would lie within a utility and access easement in favor of the City that will abut the Federal right-of-way in Kalia Road.

See Table 8 for a summary of the electrical infrastructure improvement costs.

Other than during construction of the ductlines mentioned in the previous paragraphs, no major impacts or infrastructure improvements are anticipated to the electrical infrastructure system with the proposed master planned improvements.

3.8. Communications

3.8.1. Existing Conditions

Hawaiian Telcom (HTCO) presently serves the HHV campus from HTCO's Punahou Central Office located on Young Street near McCully Street. HTCO's main ductlines and cables are located along Ala Moana Boulevard. Oceanic Time Warner Cable (OTWC) facilities, in many cases, are collocated with HTCO's duct system. Since the completion of the Kalia Road Re-alignment project by the Federal Government, there have been on-going discussions regarding the jurisdiction and ownership of the duct system on Kalia Road. The Kalia Road Realignment Site Improvements and Utilities Package #1 drawings indicate that the communications ductlines were constructed on the north-east side of Kalia Road within Federal property. HTCO and OTWC have three service connection points to the HHV campus: at the intersection of Kahanamoku Street and Ala Moana Boulevard; at the service alley connection to Ala Moana Boulevard near the Kalia Tower; and along Kalia Road fronting the Tapa Tower. This latter service connection, as well as the communications lines along Paoa Place, are served from the cables within the communications ductline on Federal property outside the Kalia Road right-of-way. The Kahanamoku Street service connection serves the HGVC Waikikian Tower. The communications ductline in the service alley serves the Kalia Towers. A separate ductline in the service alley serves the Coral Ballroom and through it, the Lagoon Tower. The Kalia Road service connection serves the Tapa and the Diamond Head Towers.

3.8.2. Probable Impacts

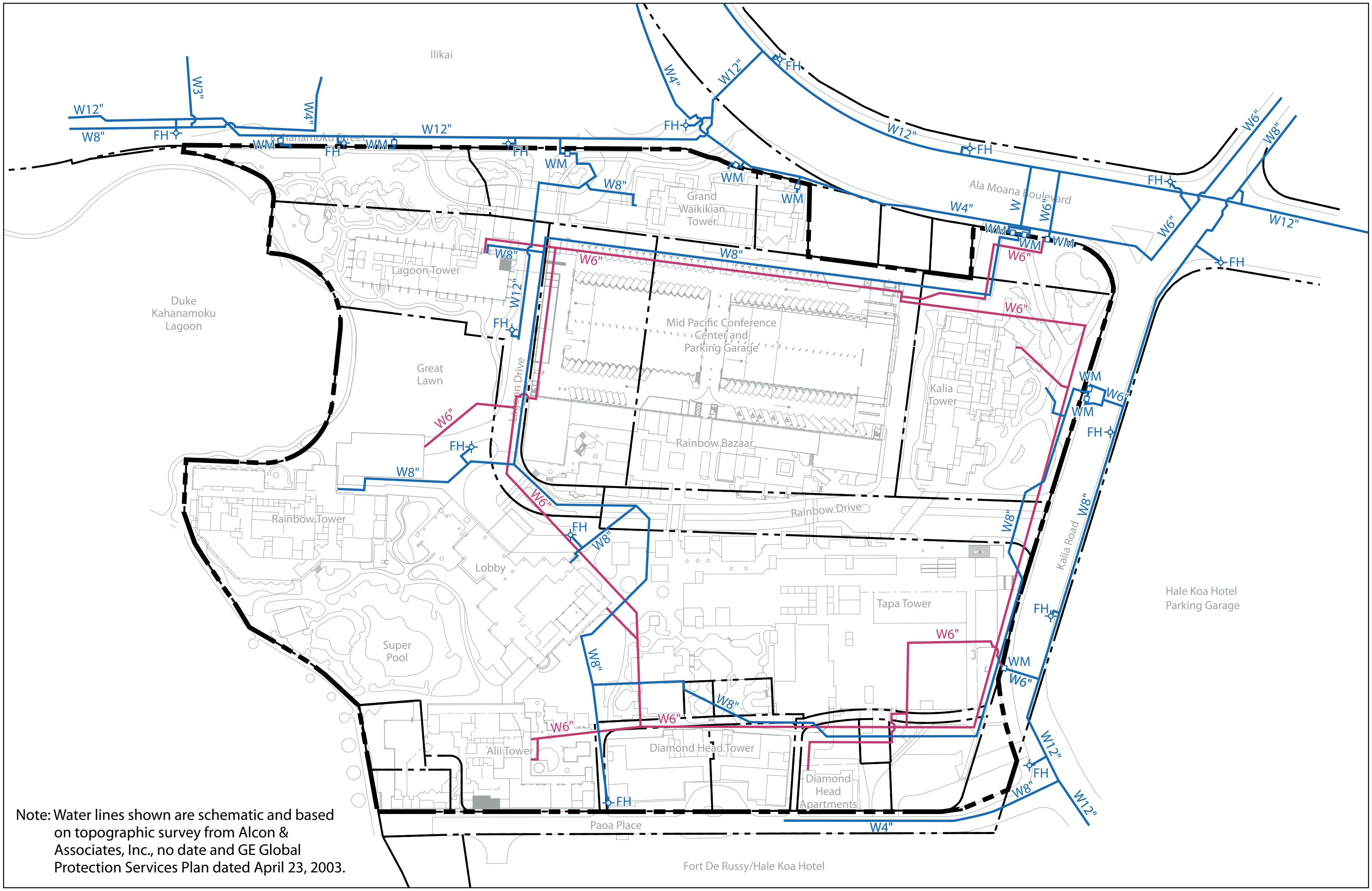
New communications infrastructure must be constructed from Kahanamoku Street along Lagoon Drive to the timeshare tower over the Rainbow Bazaar. For the timeshare tower over the Tapa bus loading area, new communications infrastructure must be constructed from the existing HTCO and OTWC infrastructure on Ala Moana Boulevard within the Kalia Road right-of-way. This construction is proposed to avoid connecting to the disputed communications ductline on the north-east side of Kalia Road fronting the Hale Koa Hotel parking structure. The existing communication infrastructure in Ala Moana Boulevard does not require upgrades. See Table 8 for a summary of the communication infrastructure improvement costs.

Other than during construction of the ductlines mentioned in the previous paragraphs, no major impacts or infrastructure improvements are anticipated to the communications infrastructure system with the proposed master planned improvements.

Table 8: Summary of Electrical/Communication Improvement Costs

Electric/Communications Improvement	Cost
New Elec/Comm Service to Timeshare Tower over Rainbow Bazaar	$500,000
New Elec/Comm Service to Timeshare Tower At Tapa Tower Bus Loading Area	$750,000
Total New Elec/Comm Service Improvements	**$1,250,000**
Bypass HECO Ductline for New Timeshare Tower at Tapa Bus Loading Area	$400,000
Bypass HTCO and OTWC Ductlines for New Timeshare Tower at Tapa Bus Loading Area	$100,000
Total Elec/Comm Improvements	**$1,750,000**

FIGURES



Note: Water lines shown are schematic and based on topographic survey from Alcon & Associates, Inc., no date and GE Global Protection Services Plan dated April 23, 2003.

LEGEND

- W8" Water Line
- W6" Fire Water Line (On Site)
- WM Water Meter
- FH Fire Hydrant

BELT COLLINS

NORTH

0 50 100 200
SCALE IN FEET

Figure 1
WATER SYSTEM

Hilton Hawaiian Village Preliminary Engineering Report
August 2010

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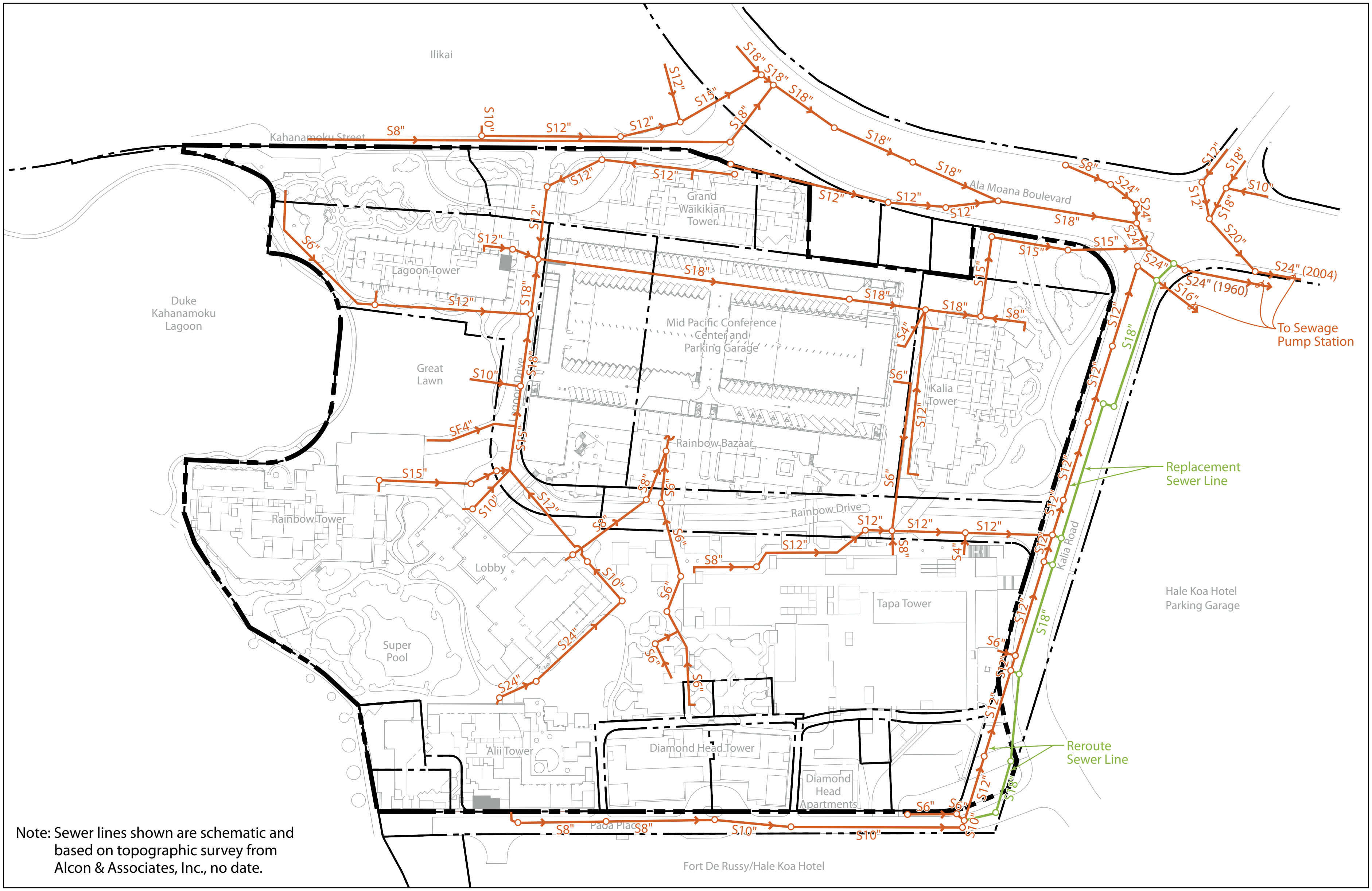

Note: Sewer lines shown are schematic and based on topographic survey from Alcon & Associates, Inc., no date.

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LEGEND

- S12" Sewer Line/Size/Direction
- Sewer Manhole
- S12" New Sewer Line/Size Direction
- New Sewer Manhole

* Relief Sewer Line Option under discussion with the City.

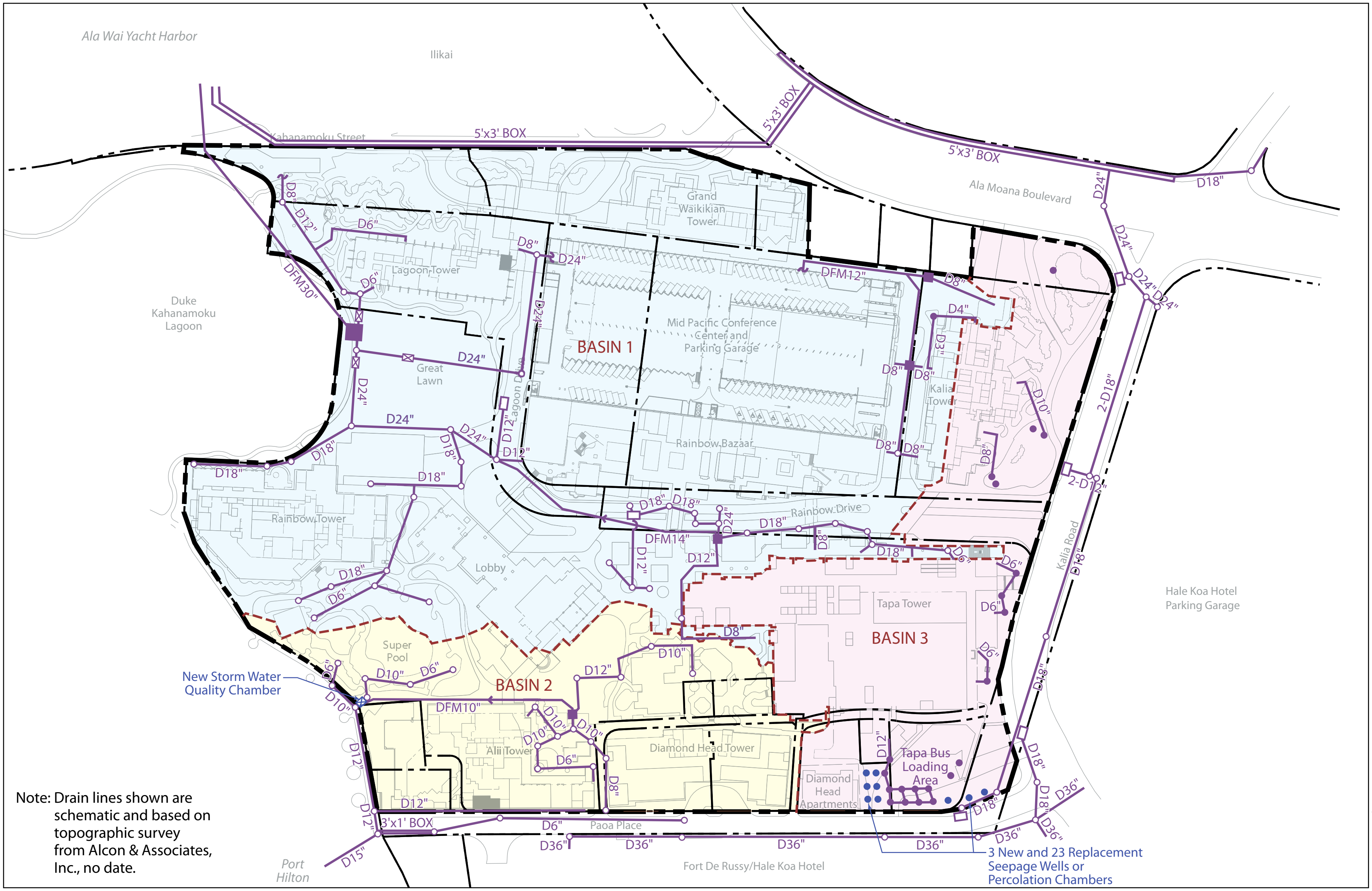
BELT COLLINS

NORTH

0 50 100 200
SCALE IN FEET

Figure 2
SEWER SYSTEM

Hilton Hawaiian Village Preliminary Engineering Report
February 2011



Note: Drain lines shown are schematic and based on topographic survey from Alcon & Associates, Inc., no date.

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LEGEND

D18"	Drain Line
DFM12"	Drain Force Main
○	Drain Manhole/Inlet
□	Catch Basin
- - -	Drainage Basin
●	Seepage Well/Dry Well
■	Pump Station
⊠	Storm Water Quality Chamber
⊠	New Storm Water Quality Chamber
●	New Seepage Well

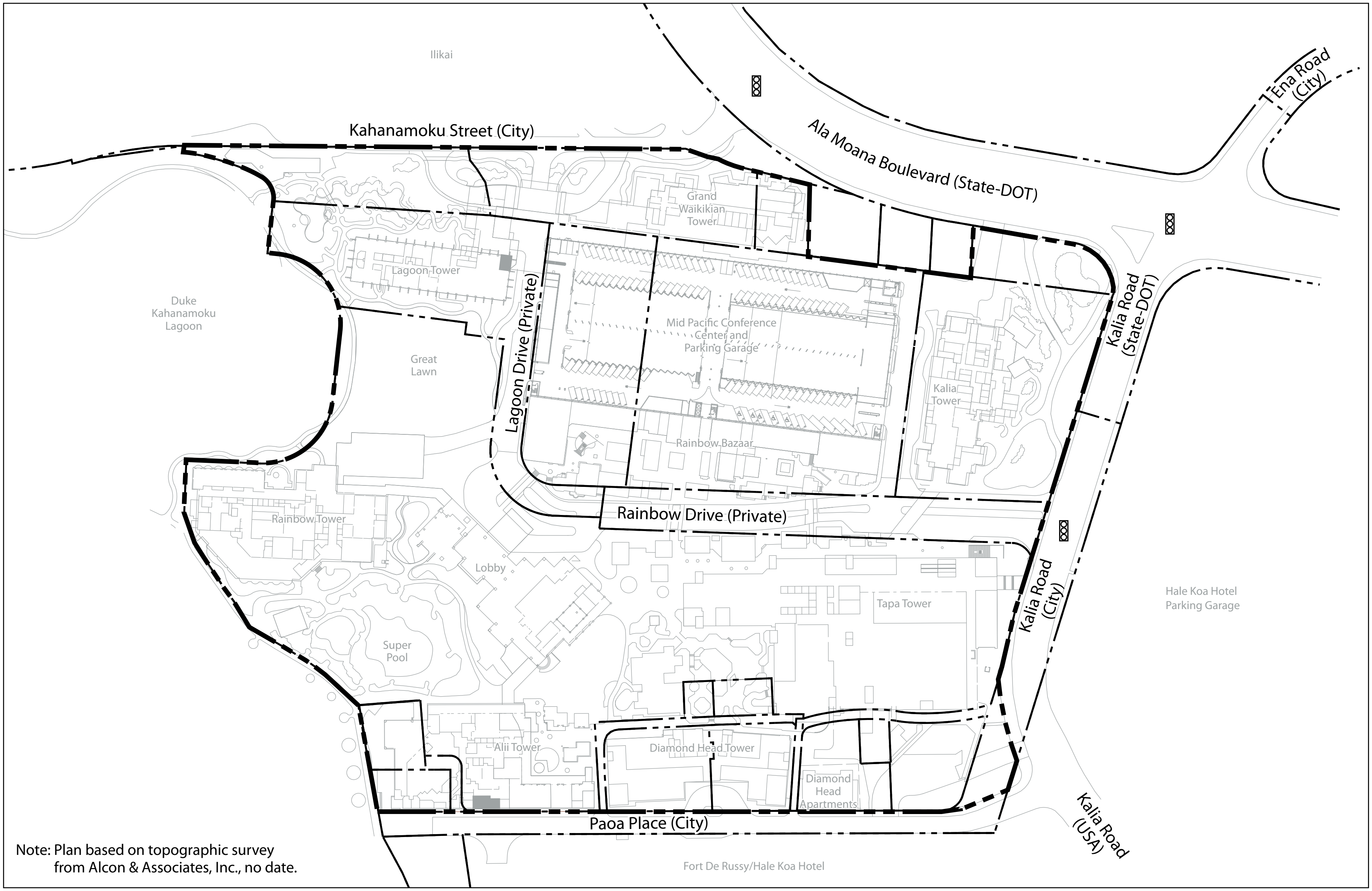
BELT COLLINS

NORTH

0 50 100 200
SCALE IN FEET

Figure 3
DRAINAGE SYSTEM

Hilton Hawaiian Village
Preliminary Engineering Report
February 2011



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BELT COLLINS

NORTH

0 50 100 200
SCALE IN FEET

LEGEND

Signalized Intersection

Figure 4
ROADWAYS

Hilton Hawaiian Village Preliminary Engineering Report
August 2010

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NORTH

0 50 100 200

SCALE IN FEET

LEGEND

G2" Gas Line

Figure 5
GAS SYSTEM

Hilton Hawaiian Village Preliminary Engineering Report
August 2010

APPENDIX A

WATER SUPPLY

PROJECT:	Hilton Hawaiian Village	JOB NO:	2010.33.0600
CLIENT:	Group 70	DATE:	27-Aug-10
SUBJECT:	Water	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Reports\Water\[Water.xls]2009 Water		

2009 Water

Account	January	February	March	April	May	June	July	August	September	October	November	December	Total
Hilton													
Meter #05154021	3,587,000	2,478,000	3,251,000	2,622,000	3,477,000	6,478,000	5,919,000	7,178,000	7,767,000	5,095,000	5,875,000	5,091,000	58,818,000
Meter #01129009	22,508,000	21,104,000	16,903,000	19,421,000	22,379,000	20,227,000	21,657,000	21,299,000	24,004,000	19,078,000	24,094,000	21,347,000	254,021,000
Meter #07030097								285,000	84,000	91,000		85,000	545,000
Grand Waikikian	2,312,000	3,079,000	3,666,000	3,654,000	3,252,000	3,638,000	4,054,000	4,803,000	3,572,000	4,347,000	3,420,000	3,635,000	43,432,000
TOTAL	28,407,000	26,661,000	23,820,000	25,697,000	29,108,000	30,343,000	31,630,000	33,565,000	35,427,000	28,611,000	33,389,000	30,158,000	356,816,000

2009 Total Water Use	356,816,000	gallons
	356.816	million gallons
2009 Average Daily Use	977,578	gallons
	0.978	million gallons

Notes:
1. Meter #05154021 also includes meter #05154022.
2. Meter #001129009 also includes meter #04120002.
3. Grand Waikikian includes three meters (#05182063, #07030107 & #08070077) for the building, a restroom, pool and landscaping.

PROJECT:	Hilton Hawaiian Village	JOB NO:	2010.33.0600
CLIENT:	Group 70	DATE:	13-Sep-10
SUBJECT:	Project Water Usage	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Reports\Water\[Water.xls]Project V		

Additional Water Usage

Type of Use	No. of Units	Use Rate		Expected Use	
Hotel Rooms	550	350	gallons/unit-day	192,500	gal/day
Retail & Offices	14,790	0.120	gallons/sf-day	1,775	gal/day
Total				194,275 0.194	gal/day mgd

Notes:

1. Use rate from Board of Water Supply, Water System Standards, 2002, Table 100-18, Domestic Consumption Guidelines
   350 gallons/unit for Oahu Resort
   120 gals/1000 sq ft for Oahu Commercial/Residential Mix
2. Hotel Rooms = Timeshare Rooms.

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

RECEIVED
2010 MAY 10 PM 1: 4
BELT COLLINS HAWAII

May 5, 2010

Mapes, A.
Terry, M.
Agena, L.
Palesh, C.
Abe, R.
Ancheta, C.
Billingsley, W.
Chan, V.
Chong, L.
Chung, J.
Cunningham, B.
Grilho, K.
Hamura, S.
Kanashiro, C.
✓ Kato, A.
Klein, S.
Kondo, C.
Lee, L.
Len, C.
Matsunaga, R.
Miyashiro, E.
Onuma, T.
Rasa, B.
Rivera, A.
Tamashiro, E.
Young, J.

Job No._____

MUFI HANNEMANN, Mayor

RANDALL Y. S. CHUNG, Chairman
SAMUEL T. HATA
WILLIAM K. MAHOE
THERESIA C. McMURDO
ADAM C. WONG

JEOFFREY S. CUDIAMAT, Ex-Officio
BRENNON T. MORIOKA, Ex-Officio

WAYNE M. HASHIRO, P.E.
Manager and Chief Engineer

DEAN A. NAKANO
Deputy Manager

Mr. Alan Kato
Belt Collins Hawaii, Limited
2153 North King Street, Suite 200
Honolulu, Hawaii 96819

Dear Mr. Kato:

Subject: Your Letter Dated April 21, 2010 Requesting the Availability of Water to the Proposed Hilton Hawaiian Village Master Plan Improvements, 2005 Kalia Road TMK: 2-6-5: 1 (por) 2-6-8: 1, 3, 5, 7, 12, 19, 20, 21, 23, 24, 27, 31, 34, 37 & 38 and 2-6-9: 1, 2, 3, 7, 9, 10, 11, 12 & 13

Thank you for your letter on the proposed Master Plan for Hilton Hawaiian Village resort located at 2005 Kalia Road.

The existing water system is presently adequate to accommodate the proposed development. However, please be advised that this information is based upon current data and, therefore, the Board of Water Supply reserves the right to change any position or information stated herein up until the final approval of your building permit application. The final decision on the availability of water will be confirmed when the building permit application is submitted for approval.

When water is made available, the applicant will be required to pay our Water System Facilities Charges for resource development, transmission and daily storage.

The on-site fire protection requirements should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

PAUL S. KIKUCHI
Chief Financial Officer
Customer Care Division

APPENDIX B

WASTEWATER

PROJECT:	Hilton Hawaiian Village	JOB NO:	2010.33.0600
CLIENT:	Group 70	DATE:	13-Sep-10
SUBJECT:	Project Wastewater Generation	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Reports\Sewer\[Sewer.xls]Project W		

Additional Wastewater Generation

Type of Use	No. of Units	Generation Rate		Expected Generation	
Hotel Rooms	550	224	gallons/unit-day	123,200	gal/day
Retail & Offices	14,790	0.074	gallons/sf-day	1,087	gal/day
Total				124,287 0.124	gal/day mgd

Notes:

1. Generation rate from Department of Wastewater Management, City and County of Honolulu, Design Standards of the Department of Wastewater Management, Volume I, July, 1993, Chapter 20, Design of Sewers

Average Daily per Capita Flow:	80	gallons	
Density:	2.8	persons per apartment unit	
Hotel Room Generation Rate:	(80 gallons/person-day) x (2.8 persons/unit)		
	224	gallons/unit-day	
Retail & Offices:	40	capita/acre	use neighborhood business, as it
	(40 cpa x 80 gal/person) =		correlates to water use.
	3,200	gallons/acre	
	0.0735	gallons/sf-day	

2. Hotel Rooms = Timeshare Rooms.

BELT COLLINS

PROJECT:	Hilton Hawaiian Village	JOB NO:	2010.33.0600
CLIENT:	Group 70 Int.	DATE:	2-Jul-10
SUBJECT:	Kalia Road Sewer Line	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Calculatio		

Proposed Kalia Road Sewer Line

Existing Sewer Line = 12 Inch

Proposed Sewer Line Reroute:

914 Linear Feet

12" at Paoa Place	Inv =	-2.34	Soffitt =	-1.34
24" at Ala Moana Blvd	Inv =	-5.23	Soffitt =	-3.23

Flow in line with New Tower at Tapa Bus Depot =	2.13	mgd	per City
	3.30	cfs	

Future Developments: Add 50 to 350 Units

Average Daily Flow = 224 gallons/unit-day per DWWM Standards

Average Wastewater Flow

50 Units	Flow =	50 x 224 =	11,200	gpd	0.011	mgd
350 Units	Flow =	350 x 224 =	78,400	gpd	0.078	mgd

Flowing Factor = 5 per DWWM Standards

Maximum Wastewater Flow

50 Units	Flow =	0.011 x 5 =	0.055	mgd
350 Units	Flow =	0.078 x 5 =	0.39	mgd

Flow in line with Future Improvements

Flow in line with 50 Future Units =	2.13 + 0.055 =	2.19	mgd	3.399	cfs
Flow in line with 350 Future Units =	2.13 + 0.39 =	2.52	mgd	3.899	cfs

New Line

Length = 914 feet

Match Soffits

15" Line:	Up Inv =	-1.34 - 1.25 =	-2.59	
	Down Inv =	-3.23 - 1.25 =	-4.48	
	Slope =	[-2.59-(-)4.48]/914 =		0.002068
	Full Flow =	2.57	cfs	<-- Inadequate Capacity
18" Line:	Up Inv =	-1.34 - 1.5 =	-2.84	
	Down Inv =	-3.23 - 1.5 =	-4.73	
	Slope =	[-2.84-(-)4.73]/914 =		0.002068
	Full Flow =	4.17	cfs	<-- New 18" Line has capacity for new Tapa Bus Depot Tower + 350 Future Units

Note: Computations subject to invert confirmation from topographic survey.

BELT COLLINS

PROJECT:	Hilton Hawaiian Village PER	JOB NO:	2010.33.0600
CLIENT:	Group 70 Int.	DATE:	28-Aug-10
SUBJECT:	Sewer Realignment Options	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Cost Estimates\[Cost Estimate Sewer.xls]Ka		

Description	Quantity	Units	Unit Cost	Total	
Kalia Road - 18" Sewer Line					
Demolish and Remove 12" Sewer Line	250	LF	$100	$25,000	
Demolish and Remove Sewer Manole	2	Each	$5,000	$10,000	
Rechannelize Existing Sewer Manhole	4	Each	$1,000	$4,000	
Connect Existing Sewer Line/Manhole	7	Each	$1,000	$7,000	
Trench Excavation, Backfill, Shoring, Restoration	915	LF	$600	$549,000	
18" Sewer Line	915	LF	$85	$77,775	
Sewer Manhole	10	Each	$15,000	$150,000	
Dewatering	1	LS	$300,000	$300,000	
Traffic Control	1	LS	$200,000	$200,000	
Relocation of Existing Utilities	1	LS	$915,000	$915,000	
SUBTOTAL				$2,237,775	
25% Contingency				$559,444	
TOTAL				$2,797,219	
SAY				$2,800,000	$3,060 per LF
Ala Moana Boulevard and Kalia Road Intersection 24" Relief Sewer Line					
Rechannelize Existing Sewer Manhole	1	Each	$1,000	$1,000	
Connect Existing Sewer Line/Manhole	2	Each	$1,000	$2,000	
Trench Excavation, Backfill, Shoring, Restoration	200	LF	$700	$140,000	
24" Sewer Line	200	LF	$150	$30,000	
Sewer Manhole	3	Each	$15,000	$45,000	
Dewatering	1	LS	$120,000	$120,000	
Traffic Control	1	LS	$80,000	$80,000	
Relocation of Existing Utilities	1	LS	$200,000	$200,000	
SUBTOTAL				$618,000	
25% Contingency				$154,500	
TOTAL				$772,500	
SAY				$800,000	$4,000 per LF

Cost Based on:
1) 5 Months of Construction for Kalia Road and 2 Months of Construction for Ala Moana and Kalia Road Intersection
2) Dewatering Unit Cost of $60,000/month
3) Traffic Control Unit Cost of $40,000/month
4) Relocation of Utilities of $1,000/LF

APPENDIX C

DRAINAGE

PROJECT:	Hilton Hawaiian Village Master Plan	JOB NO:	2010330600
CLIENT:	Group 70 International	DATE:	27-Aug-10
SUBJECT:	Drainage Calculations	BY:	cca
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Calculations\Drainage\[drainage calc.xls]Sheet1		

Table 1: Existing Condition Runoff Calculations

Basin	Sub-basin[1] (Weighted C)	Ground Cover	Drainage Destination	Area (sf)	Area[2] (ac)	C[3]	Tc[4] (min)	CF[5]	i[6] (in)	I[7] (in/hr)	Q[8] (cfs)
1	Super Pool	Grass / Landscape	Ala Wai Yacht Harbor	11,505	0.26	0.50	5.0	2.8	2.00	5.60	0.74
	Super Pool	Pool / Pond	Ala Wai Yacht Harbor	11,258	0.26	0.00	5.0	2.8	2.00	5.60	0.00
	Super Pool	Bldg Roof / Pavement	Ala Wai Yacht Harbor	19,526	0.45	0.95	5.0	2.8	2.00	5.60	2.38
	Non-Super Pool	Composite	Ala Wai Yacht Harbor	557,701	12.80	0.85	5.0	2.8	2.00	5.60	60.94
	Total			599,990	13.77						64.07
2	Super Pool	Grass / Landscape	Port Hilton	19,914	0.46	0.50	5.0	2.8	2.00	5.60	1.28
	Super Pool	Pool / Pond	Port Hilton	11,587	0.27	0.00	5.0	2.8	2.00	5.60	0.00
	Super Pool	Bldg Roof / Pavement	Port Hilton	28,054	0.64	0.95	5.0	2.8	2.00	5.60	3.43
	Non-Super Pool	Composite	Port Hilton	102,769	2.36	0.85	5.0	2.8	2.00	5.60	11.23
	Total			162,324	3.73						15.94
3	Timeshare Sequel 1 Tower	Grass / Landscape	Seepage / Dry Wells	9,567	0.22	0.50	5.0	2.8	2.00	5.60	0.61
	Timeshare Sequel 1 Tower	Pool / Pond	Seepage / Dry Wells	0	0.00	0.00	5.0	2.8	2.00	5.60	0.00
	Timeshare Sequel 1 Tower	Bldg Roof / Pavement	Seepage / Dry Wells	27,214	0.62	0.95	5.0	2.8	2.00	5.60	3.32
	Non-Timeshare Sequel 1 Tower	Composite	Seepage / Dry Wells	163,700	3.76	0.85	5.0	2.8	2.00	5.60	17.89
	Total			200,481	4.60						21.83

Table 2: Developed Condition Runoff Calculations

Basin	Sub-basin[1] (Weighted C)	Ground Cover	Drainage Destination	Area (sf)	Area[2] (ac)	C[3]	Tc[4] (min)	CF[5]	i[6] (in)	I[7] (in/hr)	Q[8] (cfs)
1	Super Pool	Grass / Landscape	Ala Wai Yacht Harbor	10,965	0.25	0.50	5.0	2.8	2.00	5.60	0.70
	Super Pool	Pool / Pond	Ala Wai Yacht Harbor	12,359	0.28	0.00	5.0	2.8	2.00	5.60	0.00
	Super Pool	Bldg Roof / Pavement	Ala Wai Yacht Harbor	18,965	0.44	0.95	5.0	2.8	2.00	5.60	2.32
	Non-Super Pool	Composite	Ala Wai Yacht Harbor	557,701	12.80	0.85	5.0	2.8	2.00	5.60	60.94
	Total			599,990	13.77						63.96
2	Super Pool	Grass / Landscape	Port Hilton	11,469	0.26	0.50	5.0	2.8	2.00	5.60	0.74
	Super Pool	Pool / Pond	Port Hilton	14,396	0.33	0.00	5.0	2.8	2.00	5.60	0.00
	Super Pool	Bldg Roof / Pavement	Port Hilton	33,690	0.77	0.95	5.0	2.8	2.00	5.60	4.11
	Non-Super Pool	Composite	Port Hilton	102,769	2.36	0.85	5.0	2.8	2.00	5.60	11.23
	Total			162,324	3.73						16.08
3	Timeshare Sequel 1 Tower	Grass / Landscape	Seepage / Dry Wells	1,711	0.04	0.50	5.0	2.8	2.00	5.60	0.11
	Timeshare Sequel 1 Tower	Pool / Pond	Seepage / Dry Wells	67	0.00	0.00	5.0	2.8	2.00	5.60	0.00
	Timeshare Sequel 1 Tower	Bldg Roof / Pavement	Seepage / Dry Wells	35,003	0.80	0.95	5.0	2.8	2.00	5.60	4.27
	Non-Timeshare Sequel 1 Tower	Composite	Seepage / Dry Wells	163,700	3.76	0.85	5.0	2.8	2.00	5.60	17.89
	Total			200,481	4.60						22.27

NOTES:

1. Ground cover of existing and developed conditions analyzed for Super Pool area and Timeshare Sequel 1 Tower area (Tapa Tower bus loading area) to calculate weighted runoff coefficient (C). Ground cover of existing and developed conditions for the remainder of the site considered similar.
2. Sub-basin drainage area (A) in acres.
3. Runoff coefficient (C) for Super Pool area and Timeshare Sequel 1 Tower area based on weighted composite of surfaces, where C is 0.95 for paved surfaces and 0.5 for landscaped/grassed surfaces. C is 0 for pool/pond areas, runoff from these areas is backwashed to sewage system. For remainder of the site, C is 0.85, based on C&C of Honolulu Storm Drainage Standards, Table 2 for hotel-apartment areas.
4. Use minimum time of concentration (Tc) of 5 minutes.
5. Correction factor (CF) is from Plate 4 in C&C of Honolulu Storm Drainage Standards.
6. Rainfall intensity (i) of 10-year, 1-hr rainfall event is from Plate 1 in C&C of Honolulu Storm Drainage Standards.
7. Design rainfall intensity (I) = CF x i
8. Runoff flow rate (Q) = C x I x A

Table 3: Runoff Summary

Basin	Discharge Point	Existing (cfs)	Developed (cfs)	Net Change (cfs)
1	Ala Wai Yacht Harbor	64.07	63.96	-0.11
2	Port Hilton	15.94	16.08	0.14
3	Seepage / Dry Wells	21.83	22.27	0.44
Total		101.84	102.31	0.47

Basin 1 has net decrease in runoff, so no runoff quantity or water quality treatment is required.
Basin 2 has net increase in runoff, but does not require runoff quantity treatment because the final receiving waters are open coastal waters. Water quality treatment is required.
Basin 3 has net increase in runoff, so runoff quantity treatment (storage) is required. Water quality treatment is not required because basin discharges into seepage wells, not the ocean or other receiving waters.

Water Quality Requirement Calculations

Basin: 2 (Entire)

Detention Based Water Quality Control

	C	Design Storm (in)	Area (ac)	WQ Volume (cf)
Detention Facility	0.88	1.0	3.73	11,907

Flow-Through Based Water Quality Control

	C	Design Storm (in)	Area (ac)	WQ Flow (cfs)
Flow-Through Facility	0.85	0.4	3.73	1.26

Storage Requirement Calculations

Basin: 3

Runoff Volume (V) = 1/2 * Q (cfs) * 60 sec * 60 min

Existing Condition		Developed Condition	
Q =	21.83 CFS	Q =	22.27 CFS
V =	39,294 CF	V =	40,086 CF
Net Increase in Volume =	792 CF		

Storage Facility	Diameter (ft)	Depth (ft)	Volume of Each (cf)	Quantity Required
Seepage Well	8.0	6.0	301.6	2.63

← Three (3) 8-ft-diameter seepage wells required to accommodate net increase in runoff from Timeshare Sequel 1 Tower

Existing Drainage System - Tapa Bus Loading Area

Storage Facility	Diameter (ft)	Depth (ft)	Volume of Each (cf)	Quantity Existing	Total Volume (cf)
Seepage/Dry Well	6.0	20.0	565.5	12.00	6,786

Options for Replacing Existing Seepage/Dry Wells - Tapa Bus Loading Area

Storage Facility	Diameter (ft)	Depth (ft)	Volume of Each (cf)	Quantity Required
Seepage Well	8.0	6.0	301.6	22.50
Percolation Chamber	--	--	6,786	--

Note: Storage requirement calculations based on no percolation. Quantities based on providing adequate storage volume to accommodate the runoff.
Onsite percolation testing required to determine actual quantity of seepage wells or percolation chambers required.

Table 4: Ground Cover Summary

Basin	Sub-basin (Weighted C)	Ground Cover	Drainage Destination	Existing Area (sf)	Proposed Area (sf)	Net Area
1	Super Pool	Grass / Landscape	Ala Wai Yacht Harbor	11,505	10,965	-540
	Super Pool	Pool / Pond	Ala Wai Yacht Harbor	11,258	12,359	1,101
	Super Pool	Bldg Roof / Pavement	Ala Wai Yacht Harbor	19,526	18,965	-561
	Non-Super Pool	Composite	Ala Wai Yacht Harbor	557,701	557,701	0
	Total			599,990	599,990	
2	Super Pool	Grass / Landscape	Port Hilton	19,914	11,469	-8,445
	Super Pool	Pool / Pond	Port Hilton	11,587	14,396	2,809
	Super Pool	Bldg Roof / Pavement	Port Hilton	28,054	33,690	5,636
	Non-Super Pool	Composite	Port Hilton	102,769	102,769	0
	Total			162,324	162,324	
3	Timeshare Sequel 1 Tower	Grass / Landscape	Seepage / Dry Wells	9,567	1,711	-7,856
	Timeshare Sequel 1 Tower	Pool / Pond	Seepage / Dry Wells	0	67	67
	Timeshare Sequel 1 Tower	Bldg Roof / Pavement	Seepage / Dry Wells	27,214	35,003	7,789
	Non-Timeshare Sequel 1 Tower	Composite	Seepage / Dry Wells	163,700	163,700	0
	Total			200,481	200,481	

BELT COLLINS

PROJECT:	Hilton Hawaiian Village Master Plan	JOB NO:	2010330600
CLIENT:	Group 70 International	DATE:	27-Aug-10
SUBJECT:	Drainage Calculations	BY:	cca
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Calculations\Drainage\[drainage calc.xls]check pool reqt		

Check Additional Landscape Needed in Basin 2 Super Pool Area for Zero Net Discharge

Table 1: Existing Condition Runoff Calculations

Basin	Sub-basin (Weighted C)	Ground Cover	Drainage Destination	Area (sf)	Area (ac)	C	Tc (min)	CF	i (1-hr)	I (in/hr)	Q (cfs)
2	Super Pool	Grass / Landscape	Port Hilton	19,914	0.46	0.50	5.0	2.8	2.00	5.60	1.28
	Super Pool	Pool / Pond	Port Hilton	11,587	0.27	0.00	5.0	2.8	2.00	5.60	0.00
	Super Pool	Bldg Roof / Pavement	Port Hilton	28,054	0.64	0.95	5.0	2.8	2.00	5.60	3.43
	Non-Super Pool	Composite	Port Hilton	102,769	2.36	0.85	5.0	2.8	2.00	5.60	11.23
	Total			162,324	3.73						15.94

Table 2: Developed Condition Runoff Calculations

Basin	Sub-basin (Weighted C)	Ground Cover	Drainage Destination	Area (sf)	Area (ac)	C	Tc (min)	CF	i (1-hr)	I (in/hr)	Q (cfs)
2	Super Pool	Grass / Landscape	Port Hilton	13,922	0.32	0.50	5.0	2.8	2.00	5.60	0.89
	Super Pool	Pool / Pond	Port Hilton	14,396	0.33	0.00	5.0	2.8	2.00	5.60	0.00
	Super Pool	Bldg Roof / Pavement	Port Hilton	31,237	0.72	0.95	5.0	2.8	2.00	5.60	3.81
	Non-Super Pool	Composite	Port Hilton	102,769	2.36	0.85	5.0	2.8	2.00	5.60	11.23
	Total			162,324	3.73						15.94

Additional landscape area required to provide zero net runoff = 2,453 SF = 21.4% of current landscaping shown

Table 3: Discharge Summary

Basin	Discharge Point	Existing (cfs)	Developed (cfs)	Net Change (cfs)
2	Port Hilton	15.94	15.94	0.00

PROJECT:	Hilton Hawaiian Village Master Plan	JOB NO:	2010330600
CLIENT:	Group 70 International	DATE:	27-Aug-10
SUBJECT:	Drainage Calculations	BY:	cca
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Calculations\Drainage\[drainage calc.xls]check pool reqt		

Check Additional Water Feature Area Needed in Basin 2 Super Pool Area for Zero Net Discharge

Table 1: Existing Condition Runoff Calculations

Basin	Sub-basin[1] (Weighted C)	Ground Cover	Drainage Destination	Area (sf)	Area (ac)	C	Tc (min)	CF	i (1-hr)	I (in/hr)	Q (cfs)
2	Super Pool	Grass / Landscape	Port Hilton	19,914	0.46	0.50	5.0	2.8	2.00	5.60	1.28
	Super Pool	Pool / Pond	Port Hilton	11,587	0.27	0.00	5.0	2.8	2.00	5.60	0.00
	Super Pool	Bldg Roof / Pavement	Port Hilton	28,054	0.64	0.95	5.0	2.8	2.00	5.60	3.43
	Non-Super Pool	Composite	Port Hilton	102,769	2.36	0.85	5.0	2.8	2.00	5.60	11.23
	Total			162,324	3.73						15.94

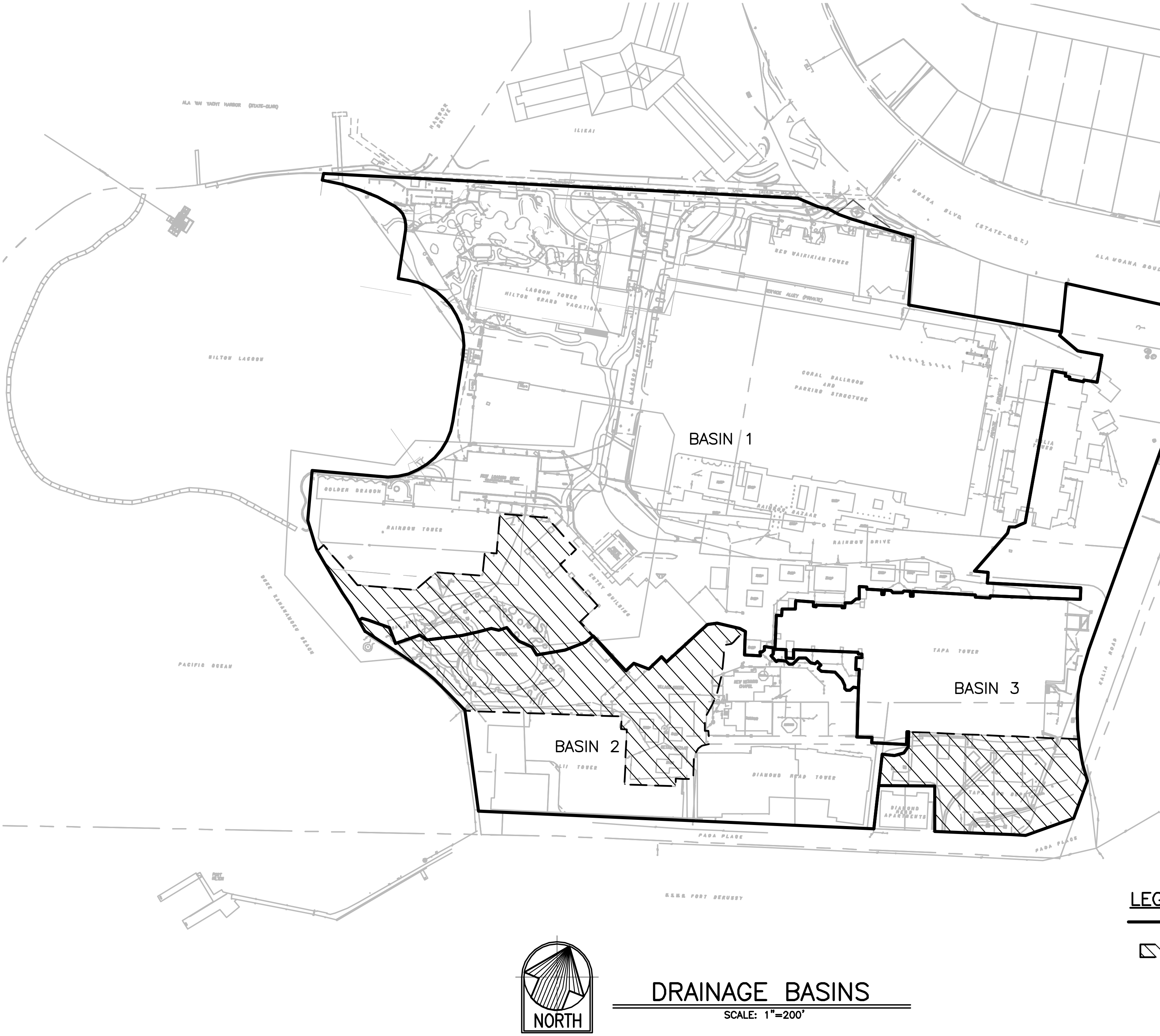
Table 2: Developed Condition Runoff Calculations

Basin	Sub-basin[1] (Weighted C)	Ground Cover	Drainage Destination	Area (sf)	Area (ac)	C	Tc (min)	CF	i (1-hr)	I (in/hr)	Q (cfs)
2	Super Pool	Grass / Landscape	Port Hilton	11,469	0.26	0.50	5.0	2.8	2.00	5.60	0.74
	Super Pool	Pool / Pond	Port Hilton	15,558	0.36	0.00	5.0	2.8	2.00	5.60	0.00
	Super Pool	Bldg Roof / Pavement	Port Hilton	32,528	0.75	0.95	5.0	2.8	2.00	5.60	3.97
	Non-Super Pool	Composite	Port Hilton	102,769	2.36	0.85	5.0	2.8	2.00	5.60	11.23
	Total			162,324	3.73						15.94

Additional pool area required to provide zero net runoff = 1,162 SF = 8.1% of current pool/pond shown

Table 3: Discharge Summary

Basin	Discharge Point	Existing (cfs)	Developed (cfs)	Net Change (cfs)
2	Port Hilton	15.94	15.94	0.00



LEGEND:

DRAINAGE BASIN

SUPER POOL/TIMESHARE SEQUEL 1 TOWER SUB-BASIN (WEIGHTED C)

DRAINAGE BASINS

SCALE: 1"=200'

APPENDIX D

ROADWAYS

(Not Used)

APPENDIX E

SOLID WASTE

BELT COLLINS

PROJECT:	Hilton Hawaiian Village	JOB NO:	2010.33.0600
CLIENT:	Group 70	DATE:	27-Aug-10
SUBJECT:	Waste	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Reports\Refuse\[Refuse.xls]Project Waste		

2009 General Waste Tonnage

Account	January	February	March	April	May	June	July	August	September	October	November	December	Total
Tapa	108.96	98.77	92.29	93.51	124.92	131.67	137.99	136.91	107.57	124.93	120.14	110.79	1388.45
Kalia	41.8	45.61	46.59	48.87	48.75	49.7	54.49	45.93	41	41.82	29.15	43.76	537.47
Rainbow	97.48	91.65	100.95	107.3	119.28	103.1	113.7	103.7	85.75	97.07	80.36	84.24	1184.58
Hilton	25.6	25.63	22.91	33.99	20.06	38.95	36.41	28.07	30.26	34.21	21.39	21.19	338.67
Kobe										3.2			3.2
Grand Vacation (6377)	34.01	34.38	22	25.62	23.02	24.2	27.83	30.07	20.86	21.74	23.15	24.57	311.45
Grand Vacation (6379)		2.89	14.92	23.4	20.62	22.51	26.33	24.26	17.74	16.76	19.87	23.08	212.38
TOTAL	307.85	298.93	299.66	332.69	356.65	370.13	396.75	368.94	303.18	339.73	294.06	307.63	3976.2

2009 Recyclables - Cardboard, Glass, Aluminum, Paper

Material	January	February	March	April	May	June	July	August	September	October	November	December	Total
Recyclables	11.54	15.03	14.5	14.26	13.04	15.47	14.78	14.26	12.86	16.45	12.94	14.44	169.57
TOTAL	319.39	313.96	314.16	346.95	369.69	385.6	411.53	383.2	316.04	356.18	307	322.07	4145.77

Food Waste 108 tons/month Eco-Feed Incorporated, a food waste recycler

	Year	Monthly	Daily
Total Waste (tons)	5,441.77	453.5	14.9

Recycle Material	Year	Monthly	
C,G,A,P	169.57	14.1	Cardboard, Glass, Aluminum and Paper
Other - non food	234.60	19.5	To Hawaiian Earth Products, Schnitzer Steel, Refrigerant Recycling (5.9% of General Waste)
Food	1296.00	108.0	To Eco-Feed Incorporated, to their pig farm in Waianae
Total	1700.17	141.7	

Material Disposition	Year	Monthly	Percent Total
H-Power	3,717.75	309.8	68.32%
Landfill	23.86	2.0	0.44%
Recycle	1700.17	141.7	31.24%
Total	5,441.77	453.5	100.0%

2009 City and County of Honolulu - Waste Tonnage

H-Power	607,301
Waimanalo Gulch	175,712
Total	783,013

BELT COLLINS

PROJECT:	Hilton Hawaiian Village	JOB NO:	2010.33.0600
CLIENT:	Group 70	DATE:	27-Aug-10
SUBJECT:	Disposal of Waste	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Reports\Refuse\[Refuse		

Haul

Location	Tons	Percentage	Percentage	
H-Power via Transfer Station	2775.79	83.4%	93.5%	
H-Power	337.05	10.1%		City's Waste to Energy Conversion Facility.
Hawaiian Earth Products	147.48	4.4%	5.9%	Private greenwaste recycling facility
Schnitzer Steel	28.33	0.9%		Private metal recycling facility.
Refrigerant Recycling	19.71	0.6%		Private recycling facility for refrigeration liquids.
PVT Landfill	18.89	0.6%	0.6%	Private landfill for construction/demolition debris.
Waimanalo Gulch Landfill	1.00	0.0%		City and County Landfill.
Total	3328.25	100.0%	100.0%	

Notes:
1. 2009 Data from Honolulu Disposal Service Inc., the private contractor that disposes of waste from the Hilton Hawaiian Village.
2. Disposal to the City's Waimanalo Gulch Landfill when HPOWER is closed for maintenance.

PROJECT:	Hilton Hawaiian Village	JOB NO:	2010.33.0600
CLIENT:	Group 70	DATE:	13-Sep-10
SUBJECT:	Project Waste Generation	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Reports\Refuse\[Refuse.xls]Project V		

Solid Waste Generation

Type of Use	No. of Units	Use Rate		Expected Generation	
Hotel Rooms	550	3.5	lbs/room-day	1,925	lbs/day
Retail & Offices	14,790	0.026	lbs/sf-day	385	lbs/day
Restaurant	--	5	lbs/meal	0	lbs/day
Total				2,310 1.15 421	lbs/day tons/day tons/year

Notes:
1. Use rate from Wimberly, Allison, Tong and Goo. November 2001. Waikikian Development Plan Final EIS.
   Based on historical records from the HHV.
2. Hotel Rooms = Timeshare Rooms

APPENDIX F

GAS

PROJECT:	Hilton Hawaiian Village	JOB NO:	2010.33.0600
CLIENT:	Group 70	DATE:	4-Sep-10
SUBJECT:	Gas	BY:	A. Kato
FILE:	M:\HHV\2010330600 Master Plan Entitlements PER\Design\Reports\Gas\Gas.xls		

Gas Useage - 2009 (therms)

GASCo Account	January	February	March	April	May	June	July	August	September	October	November	December	Total
Hilton Schedule 60	14464.97	14259.79	14374.88	14203.34	13683.49	18275.57	16990.05	15360.85	16157.42	14703.26	15640.63	17116.91	185231.16
Hilton Schedule 91	60345.5	0	131204.46	69425.82	68053.21	75632.09	83801.85	86169.23	77628.88	76373.03	79655.03	79988.94	888278.04
HGVC Heater/Tikis	3026.5	2539.35	4155.61	3563.7	2562.87	2009.7	1427.41	1242.17	1609.35	1031.8	1078.12	1939.66	26186.24
HGVC pool/restaurant	0	1270.37	2323.57	2520.84	1850.12	1060.52	901.3	866.89	930.49	814.79	806.52	3010.87	16356.28
TOTAL	77836.97	18069.51	152058.52	89713.7	86149.69	96977.88	103120.61	103639.14	96326.14	92922.88	97180.3	102056.38	1116051.72

Total Gas Useage for 2009 = 1,116,051.7 therms

BELT COLLINS

MEETING SUMMARY

PROJECT: Hilton Hawaiian Village	BCH JOB NUMBER: 2010.33.0600
MEETING LOCATION: Belt Collins Hawaii Conference Room 1	DATE & TIME: April 14, 2010 9:00 – 9:30 am
SUBJECT: Gas System	ATTENDEES: Ms. Sharon Shigemoto, The Gas Company Mr. Richard Louis, The Gas Company Mr. Alan Kato - BCH

The meeting with the Gas Company was requested to discuss the proposed master plan improvements at the Hilton Hawaiian Village (HHV) and determine whether there are any gas infrastructure upgrades required to service the campus.

The master plan development map was provided to the Gas Company for reference. A summary of the improvements include the following:

- Tapa Bus Depot timeshare tower: 300 timeshare units
- Rainbow Bazaar timeshare tower: 250 timeshare units
- Redeveloped Retail: 14,359 square feet of additional retail space
- Pool Expansion: (area undetermined at this time)

The Gas Company has lines through the HHV campus which they service and maintain up to the gas meters. The Gas Company provided a map of their lines through the HHV. Gas meters are provided at the towers and the individual tenants (restaurants), the primary lines through the HHV campus are 2-inch in size.

The Gas Company indicated that they have been having problems with their line around the wedding chapel area, in the super pool expansion area. If construction in the area proceeds, the Gas Company would like to reroute their line in the area.

A 4-inch gas line services the main boilers in the Tapa Towers off of Kalia Road. The 4-inch line will have to be rerouted for the new timeshare tower over the Tapa Bus Depot. The Gas Company would complete the reroute at their cost and provide a service connection for the new timeshare tower.

The Gas Company indicated that based on the anticipated loading, no gas infrastructure improvements would be required. The Gas Company can provide the service connections and meters for the proposed developments from the existing gas infrastructure.

APPENDIX M

Socio Economic Context: Hilton Hawaiian Village Master Plan Improvements

John M. Knox & Associates, Inc.

July 2010

J·M·K JOHN M. KNOX & ASSOCIATES, INC.

Socio-Economic Context:

Hilton Hawaiian Village Master Plan Improvements

July 12, 2010

Prepared for:
Hilton Hawaiian Village and Group 70 International

Prepared by:
John M. Knox & Associates, Inc.

1001 Bishop St., Suite 1542 ▪ Honolulu, HI 96813 USA ▪ Phone (808) 523-1352 ▪ Fax (808) 523-1353 ▪
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1.0 EXISTING SOCIAL MILIEU

Waikīkī is a densely populated square mile of land on the south shore of the island of O'ahu. For purposes of this report, the Study Area is the Waikīkī Neighborhood Board No. 9 area, comprised of six census tracts: 18.01, 18.02, 19.01, 19.02, 20.1, and 20.2. This area is bounded by the Pacific Ocean to the south, the Ala Wai Boat Harbor to the west, Ala Wai Canal to the north, and Kapahulu Avenue to the east.[1]

Waikīkī is both a residential and resort community where visitors and residents interact as they carry on their respective activities. From the resident perspective, Waikīkī serves a number of social and/or socio-economic functions, including:

- Job center (and a primary economic engine for the island);
- Residential area for people valuing an urban, largely apartment-based lifestyle;
- Ocean recreation sites and indoor restaurant/entertainment facilities; and
- Venues for local wedding parties, conferences, and other large events. (The Hilton Hawaiian Village is particularly known for this function.)

1.1 Population, Housing, and Demographic Characteristics as of 2000

The U.S. Bureau Census reported the population of O'ahu at 875,670 in 2000, increasing slightly (by about 3.4%) to 905,034 by 2008. Waikīkī had a resident population of 19,723 in 2000, which amounted to about 2.3% of the total O'ahu population at that time. (No more recent Census estimates are available for Waikīkī's population.) Waikīkī's resident population of about 20,000 compares with an average daily visitor population of about 72,000 and 56,000 Waikīkī visitor industry jobs (see subsequent Section 2.1.3)

Table 1.1 compares Waikīkī to O'ahu (the City and County of Honolulu) as a whole. Waikīkī's population was generally older; has a racial mix with proportionately more Caucasians and fewer Asians and Native Hawaiian or Pacific Islanders. Proportionately, homeownership rates were lower, and vacancy rates greater (with many of the vacant units "held for occasional use" – e.g., timeshares or second homes). Waikīkī residents are almost all apartment-dwellers; half are single occupants; and few children live there.

Additionally (not shown in table), the 2000 Census indicates the median household income for Waikīkī census tracts ranged from $25,865 to $37,018, significantly lower than the median household income of $51,914 for O'ahu. Waikīkī residents were much more likely than islandwide residents to have been born in another state (40% vs. 22%) or to have been foreign-born (38% vs. 19%), particularly Japanese. They were less likely to have been living in the same house five years previously (40% vs. 56%).

[1] It should be noted that this definition excludes some areas to the Diamond Head side of Kapahulu Ave. often considered to be part of Waikīkī – the Honolulu Zoo, the Waikīkī Shell performing area, Kapi'olani Park, the Waikīkī Aquarium, and several smaller stand-alone hotels. These are part of Census Tract 17, and the principal residential areas of C.T. 17 include Diamond Head homes subsumed in Neighborhood Area #5, Diamond Head/Kapahulu/St. Louis Heights.

Table 1.1 Waikīkī Vs. O‘ahu Population and Demographics, 2000

	Waikīkī	O‘ahu
Total Population	**19,723**	**875,670**
Age		
Under 5 Years (% of total population)	3.5%	6.5%
5-17 Years	6.0%	17.3%
18-64 Years	72.1%	62.7%
65 Years and Over	18.4%	13.4%
Median Age	**42.2 yr.**	**35.7 yr.**
Race		
White alone (% of total population)	44.0%	21.2%
Asian alone	39.0%	46.2%
Native Hawaiian and other Pacific Islander alone	5.0%	8.8%
Other race alone	4.0%	3.7%
Two or more races	8.0%	20.1%
Housing Occupancy and Tenure		
Total Housing Units	**18,370**	**315,988**
Occupied Units	62.0%	90.7%
By Owner (% of all occupied units)	33.5%	49.5%
By Renter	66.5%	41.2 %
Single Occupancy (% of all occupied units)	51.2%	21.6%
Multi-Person Occupancy	48.8%	78.4%
Vacant Units	38.0%	9.3%
For rent (% of all vacant units)	47.3%	41.3%
For sale only	1.7%	8.7%
For seasonal, recreational, or occasional use	42.9%	23.2%
Other Vacant	8.1%	26.8%
Household Type		
Total Occupied Households	**11,397**	**286,450**
Family households	35.9%	71.8%
Married-couple family (% of all family households)	76.6%	75.9%
With own children under 18 (% of all married)	*24.8%*	*45.1%*
No own children under 18	*75.2%*	*54.9%*
Other family (% of all family households)	23.4%	24.1%
Male householder, no wife present (% of all other family)	*32.9%*	*29.0%*
Female householder, no husband present	*67.1%*	*71.0%*
Nonfamily households	64.1%	28.2%
Living in Buildings with 2+ Units	**97.9%**	**42.6%**
Average Persons per Households	**1.72**	**2.95**

Source: US Census Bureau. 2000 Decennial Census. (SF1 100 Percent Data for most; SF3 sample data for units in structure)

1.2 Trends Over Time

It should be noted that the foregoing Table 1.1 as well as the following Census data pertain to the *full-time* Waikīkī residential population. Waikīkī also has a substantial *part-time* residential population, about which less can be authoritatively stated because of lack of Census statistics. However, they are believed to be significantly older and more affluent than the full-time population.

1.2.1 Population Trends

Census data reveal similar patterns of growth for the populations of Waikīkī and O‘ahu since the 1960’s, with sharp growth rate increases in the 1960’s through the 1980’s, then slowing down or leveling off in the 1990’s (Table 1.2). However, while Waikīkī’s residential population grew faster than the overall O‘ahu population from 1970 to 1990, it essentially stopped growing after 1990.

Table 1.2 Population Trends, 1960-2000

Total Population	1960	1970	1980	1990	2000
Waikīkī	11,075	13,124	17,384	19,768	19,723
Percent Growth	*N/A*	*18.50%*	*32.45%*	*13.71%*	*-0.23%*
O‘ahu	500,409	629,176	762,565	836,231	875,670
Percent Growth	*N/A*	*25.73%*	*21.20%*	*9.66%*	*4.72%*

While both populations (Waikīkī and islandwide) are simultaneously getting older with time, Waikīkī’s population over the age of 65 has risen more quickly over the years. Waikīkī’s ethnic make-up has been comparatively made up of continuously more Caucasian residents than on O‘ahu. (See charts in Figure 1.1 and Figure 1.2 below.)

Figure 1.1 Waikīkī Population Level & Age Characteristics, 1960-2000

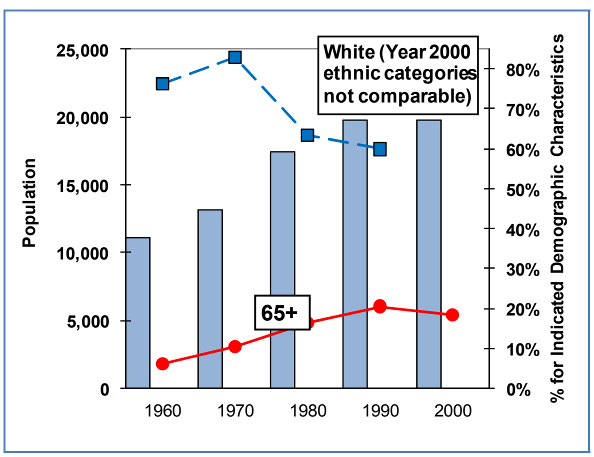
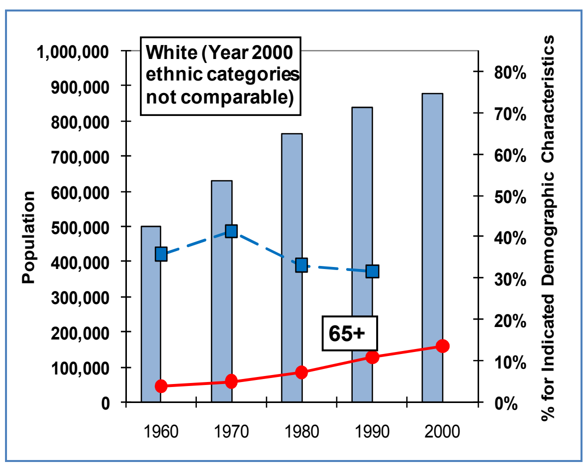


Figure 1.2 O‘ahu Population Level and Age Characteristics, 1960-2000



1.2.2 Housing and Household Characteristic Trends

Table 1.3 shows 40-year Census trends for occupied housing units, while Figure 1.3 and Figure 1.4 chart these numbers (vertical bars) and also show comparative trends for selected household characteristics.

A comparison of the growth percentages in Table 1.3 and the preceding Table 1.2 (population trends) indicates occupied housing units have generally grown faster than overall population in both Waikīkī and Oʻahu, reflecting declines in average household size. This discrepancy was particularly noticeable for Waikīkī in the 1960s and 1970s, when much of the earlier single-family housing stock was cleared and replaced by hotels or condo/apartment units.

Table 1.3 Occupied Housing Units, 1960-2000

Total Occupied Housing Units	1960	1970	1980	1990	2000
Waikīkī	5,200	6,830	9,852	11,408	11,397
Percent Growth	*N/A*	*31.35%*	*44.25%*	*15.79%*	*-0.10%*
Oʻahu	117,856	164,763	230,214	265,304	286,450
Percent Growth	*N/A*	*39.80%*	*39.72%*	*15.24%*	*7.97%*

The charts below (Figure 1.3 and Figure 1.4) show a steady rise in time for both Waikīkī and Oʻahu as a whole in rates of home ownership and single-person occupancy, though Waikīkī's much lower ownership rate and higher single-person rates reached almost their present levels by 1980 and grew only slightly thereafter till 2000.

Figure 1.3 Waikīkī Residential Household Characteristics,1960-2000

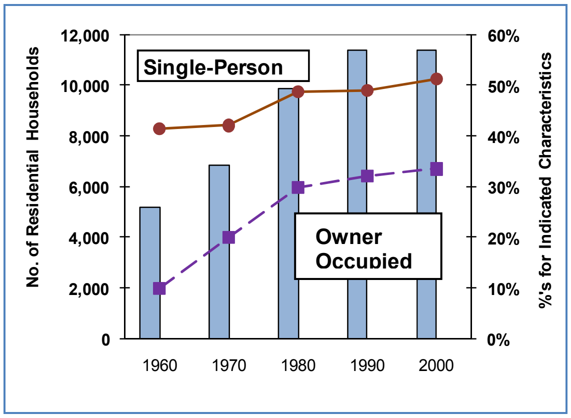
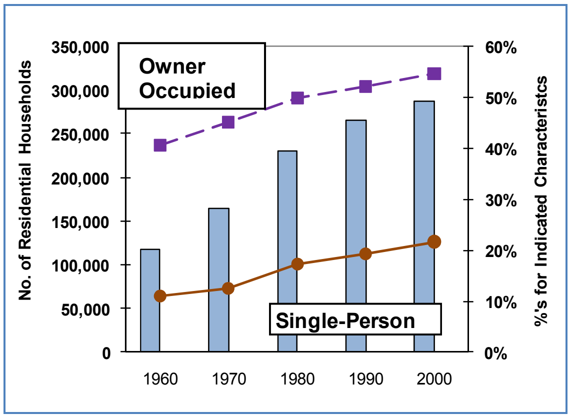


Figure 1.4 Oʻahu Residential Household Characteristics,1960-2000



2.0 LITERATURE REVIEW

Two types of secondary data (i.e., information from published sources) are reviewed in this chapter:

1. Relatively recent studies on Waikīkī's economic and social context;

2. Minutes of 2009 Waikīkī Neighborhood Board meetings, which provide a preliminary sense of issues important to the community.

2.1 Published Studies

2.1.1 Qualitative Interviews with Waikīkī Residents

In a 1997 report entitled *Living in Hawai'i: A Report on Interviews with 42 Waikīkī Residents*[2], University of Hawai'i Urban and Regional Planning professors Tom Dinell and Karl Kim describe the results of in-depth interviews with Waikīkī residents. The study aimed at pulling together Waikīkī residents' thoughts, ideas, and suggestions to provide a "sound and informative basis for planning". The interviews revealed things residents **liked** about Waikīkī, such as:

- Convenience (lots of facilities nearby; close proximity to everything)
- Beauty of the place (the ocean, clean air, and perfect weather)
- The people, the multiple cultures, and the excitement ("Waikīkī is alive!")

The study also listed certain things residents **did not like** about Waikīkī:

- Crime
- Noise at night
- Dangerous pedestrian environment
- Traffic
- Losing a sense of place; over-commercialization of Waikīkī

2.1.2 Quantitative Survey of Waikīkī Residents

A literature search turned up only one somewhat recent quantitative survey of the Waikīkī residential community, conducted by a University of Hawai'i Travel Industry Management professor and graduate student.

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[2] Dinell, Tom. Kim, Karl. (1997) *Living in Waikīkī: A Report on Interviews with 42 Waikīkī Residents*. Prepared for the City and County of Honolulu Planning Department.

Sheldon and Abenoja[3] (2000) formulated their mail-out survey based on six main questions:

1. What are the characteristics of the residents?
2. What is their affinity towards the destination?
3. What are residents' opinions of destination features?
4. What activities do they engage in within the destination?
5. What do they wish to see changed?
6. What are the differences of opinions among demographic subgroups?

After distributing a 12-question mail survey to nearly 1,000 randomly selected Waikīkī voters (though it should be noted this excluded a large portion of the Waikīkī district which does not or is not able to vote), Sheldon and Abenoja received just over 350 responses.

Survey results indicated Waikīkī residents believed more attention should be paid to ensuring convenient access to and from Waikīkī. Related circulation concerns included congestion, adequate means of transportation, and accessibility for pedestrians. According to the report, "Enhanced pedestrian environments help facilitate and encourage residents' involvement in the community as well as favorably affecting tourists' experiences."

Residents reported Waikīkī Beach as the feature they most valued about Waikīkī, followed by parks and public transportation. They ranked shopping malls as their least favorite feature.

Survey results showed that the pollution in and around the Ala Wai Canal, traffic congestion, and noise pollution ranked among residents' top three environmental concerns. Parks, open space, pedestrian walkways and landscaping were most mentioned as things which could improve the quality of life for Waikīkī residents.

Results showed that creating a sense of place specific to Waikīkī and recognizing the "Waikīkīan" culture was important for residents. This would involve seeking opportunities for entertainment and recreation tailored at least in part toward Waikīkī residents, rather than solely centered on the needs of the tourist population. The authors suggest that mature destinations should remain "true to their local identity, to preserve a refreshing, unique, and authentic tourist product for visitors." It suggests that in order to revitalize Waikīkī, strong emphasis must be placed on identifying its unique sense of place by:

- Providing better access to and from Waikīkī
- Enhancing the pedestrian experience

[3] Sheldon, Pauline J. Abenoja, Teresa. (2000) *Resident Attitudes in a Mature Destination: The Case of Waikīkī. Tourism Management*.22; 435-443.

- Increasing opportunities for entertainment and activities which would appeal to residents (entertainment and activities which would celebrate the local flavor for the benefit of the residents instead of being focused on the visitors)
- Maintaining public green areas
- Restoring significant historic places and structures
- Maintaining a high level of environmental beauty and quality
- Developing a cultural gathering place, where residents and tourists could celebrate Waikīkī's unique cultural heritage

The report concludes that Waikīkī residents generally hold a favorable impression of Waikīkī and Waikīkī visitors.

2.1.3 The Economic Contribution of Waikīkī

According to a 2003 Department of Business, Economic Development & Tourism (DBEDT) report[4] about the *Economic Contribution of Waikīkī* to the state's economy, Waikīkī tourism-related activities account for an estimated 8% of Hawai'i's Gross State Product (GSP). However, Waikīkī's role in the economy is far more significant than its GSP contribution alone. Although Maui's share of economic growth related to the tourism industry has increased over the past decades, Waikīkī remains the most important tourist destination in the State, with around 72,000 visitors per day.

Waikīkī accounts for 45% of the state's total yearly visitor units. DBEDT's input-output model generated an estimate that in 2002 visitor industry firms accounted for more than 122,000 jobs[5] statewide, with nearly half (an estimated 56,000) in Waikīkī. Jobs related either directly or indirectly to the visitor industry accounted for nearly 161,000[6] jobs statewide, with an estimated 73,000 jobs around the state due to activities in Waikīkī alone. The study also estimated that more than $432 million in tax revenue (a substantial portion from property taxes) are generated by the Waikīkī-based visitor industry.

The report conservatively estimates that $3.6 billion (or 46%) of tourism's statewide economic contribution comes from Waikīkī-based visitor activity. Waikīkī, according to the DBEDT study, is a significant asset to the state, as it directly and indirectly is associated with supporting around 11% of all the state's civilian jobs, as well as 12% of Hawai'i's state and local taxes.

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[4] State of Hawai'i. Department of Business, Economic Development & Tourism. (2003). *The Economic Contribution of Waikīkī*. DBEDT e-report. http://Hawai'i.gov/dbedt/info/economic/data_reports/e-reports/econ_Waikīkī.pdf. Note: DBEDT is currently updating this report, but the update was not available at the time of writing.

[5] Civilian jobs, inclusive of wage and salary jobs, plus self employed, but exclusive of non-civilian military jobs.

[6] Direct and indirect impact, but excluding induced.

2.2 Waikīkī Neighborhood Board Minutes (2009-2010)

Table 2.1 summarizes Waikīkī Neighborhood Board meeting minutes for the year 2009 and the first quarter of 2010. Many concerns and issues for Waikīkī residents – as indicated by resident testimony and Board discussion – could be categorized into seven broad areas:

- Maintenance & repairs of public infrastructure,
- Noise,
- Safety,
- Homelessness,
- Litter & cleanliness,
- Development & economy, and
- Parking and miscellaneous issues.

The issues in the table include both **very frequently mentioned** and **somewhat frequently mentioned** (omitting infrequently discussed spot issues).

Table 2.1 Waikīkī Neighborhood Board Regular Meeting Minutes: Issues and Concerns

Waikīkī NEIGHBORHOOD BOARD REGULAR MEETING MINUTES January 2009 - March 2010 "Very Frequently" Mentioned and "Somewhat Frequently" Mentioned Issues and Concerns		
Category	**Issue / Concern**	**Explanation / Comments**
VERY FREQUENTLY MENTIONED		
MAINTENANCE & REPAIRS	• Infrastructure maintenance (roads; potholes; street lights etc) • Water main breaks (flooding) • Empty lots throughout Waikīkī • Graffiti on Liliʻuokalani • Banyan tree needs cutting (Kaiolu and Kūhiō)	The community's main concerns relate to particular requests to the city, as well as to the time it takes the city to respond to or mitigate these requests. These complaints pertain to: non-functioning water fountains; sidewalk repairs (Kūhiō and Paoakalani); problems with traffic lights (traffic light at Kaiolu Street); pavilion tables and benches; showers at Waikīkī Beach; sidewalks along Cleghorn, maintenance of city buses; "deterioration of" Kalākaua Park (their words). There is also concern with the future of the Natatorium, and reports of accumulation of debris at the bridge near Ala Moana Park. Finally, frequent water main breaks create important traffic concerns, especially around Ala Wai as there is no other way out of Waikīkī.
NOISE	• Noise in general • Vehicular noise: mufflers and exhaust • Noise in the ʻIlikai area, as well as on Ena Road • Gun Shop on Kalākaua	Kalia Street at the intersection of Hobron Lane and Ena Road is frequently mentioned as a spot where noise seems to be a great problem. Truck reverse beeping noise, all vehicular sounds and the general street noise caused by loitering and street performers are among Waikīkī residents' main concerns. Although noise during the day is expected, residents take issue with loud sounds which carry on late into the night.
SAFETY	• Safety on sidewalks • Scooters riding on streets • Segways and 3-wheel mopeds riding and parking on sidewalk • Young kids on bikes on sidewalks • No bike lane into Waikīkī • Prostitution and crime	Most Waikīkī residents feel there should be no bikes, mopeds, segways etc. on sidewalks. Most feel that they would like to see more being done with regards to safety on Waikīkī sidewalks. Use of vehicles such as bicycles, scooters, skateboards, roller skates is already banned from Waikīkī sidewalks for pedestrian safety. Suggested solutions have included lower speed limits, issuing tickets, and even changing the law to ban all electric propulsion systems not designed to assist disabled persons.

Waikīkī NEIGHBORHOOD BOARD REGULAR MEETING MINUTES January 2009 - March 2010
"Very Frequently" Mentioned and "Somewhat Frequently" Mentioned Issues and Concerns

Category	Issue / Concern	Explanation / Comments
HOMELESSNESS	• Problems with campers: no one should be camping in the city parks, on Kalākaua Avenue or throughout Waikīkī • Homeless asleep on sidewalks • HPD not making arrests • No comfort stations • Park closures are difficult to enforce as it is difficult to issue citations	Waikīkī residents are concerned with the growing number of homeless people throughout Waikīkī. There are homeless people in city parks, on street benches, at city bus stops etc. The residents are concerned about their safety because of the increase in solicitation (prostitution, begging), the proliferation of drugs and alcohol, and increased waste. Witnesses at Board meetings believe this reflects badly on the city. Enforcement of illegal camping in city parks is difficult, as parks such as Kapi'olani Park have too many points of entry to enforce. HPD can't do much as there are laws prohibiting targeting a homeless person. Officers can only do what the law permits for an arrest to be made. It is often proposed that the city do more to house the homeless to get them off the streets, parks, and other public spaces.
LITTER & CLEANLINESS	• Street cleaning too infrequent • City parks need to be cleaned • Trash is not picked up daily • Trash dumping on sidewalk • Dog owners need to pick up after their dogs • "Ilikai and Ala Wai: debris, trash and littering • Homeless littering	The community is concerned with recurrent littering. They feel that limited trash pick-up attracts vermin, and is unsightly and unsanitary. They are also concerned with people picking out of garbage (trash diving).
SOMEWHAT FREQUENTLY MENTIONED		
DEVELOPMENT & ECONOMY	• Opposition to privatization/ commercialization of the Ala Wai Small Boat Harbor • Public Hula and torch lighting are no longer funded • City's Rail Transit System proposal • Visitor count still double digit down	Many of the concerns with regards to development at Neighborhood Board Meetings pertain specifically to the Ala Wai Small Boat Harbor. Waikīkī residents first and foremost want to be assured that the Boat Harbor will not become ""over-commercialized." Increased traffic congestion associated with the Harbor Improvements is also an important source of apprehension. With regards to the daily hula shows and torch lighting ceremonies in Waikīkī, residents feel they have been very popular with guests and should remain funded.

Waikīkī NEIGHBORHOOD BOARD REGULAR MEETING MINUTES January 2009 - March 2010 “Very Frequently” Mentioned and “Somewhat Frequently” Mentioned Issues and Concerns		
Category	**Issue / Concern**	**Explanation / Comments**
PARKING AND MISCELLANEOUS	• Parking problems and street use by construction vehicles • Rule for "No Dogs in City Parks" • Economy affecting amount of lifeguards around Waikīkī beach	According to numerous complaints, parking spots are being monopolized by construction work crews around Waikīkī. As a result, it is even more difficult to park on Ala Wai as well as at Hobron Lane, where multiple parking spaces were removed entirely without notice. Many residents feel the rule about "no dogs in City Parks" should be re-visited. Some concern was expressed with regards to the impact the economy is having on the reduced presence of lifeguards at Waikīkī Beaches.

APPENDIX N

Community Issue Interview Summary: Hilton Hawaiian Village Master Plan Improvements

John M. Knox & Associates, Inc.

July 2010

JOHN M. KNOX & ASSOCIATES, INC.

Community Issue Interview Summary:

Hilton Hawaiian Village Master Plan Improvements

July 12, 2010

Prepared for:
Hilton Hawaiian Village and Group 70 International

Prepared by:
John M. Knox & Associates, Inc.

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Purpose and Methods

As input to the Environmental Impact Statement (EIS) being prepared by Group 70 International for the Hilton Hawaiian Village's "Master Plan Improvements," John M. Knox & Associates, Inc. was asked to conduct and summarize a series of community interviews with Waikīkī or other stakeholders.

In May and early June 2010, we held 35 interview sessions with 42 interviewees – elected officials, Neighborhood Board members, other community organizations, visitor industry groups, and a few islandwide interest groups associated with building/construction. Interviewees were told their names would be listed but that nobody would be quoted by name. Although our list of interviewees (appended) also notes organizational affiliations, all spoke to us as individuals only.

Although discussions could be free-flowing and did not necessarily follow a script, we developed an interview guide that contained four broad types of questions:

(1) Positive and negative factors about life in Waikīkī;

(2) Overall issues specific to the project (including current perceptions of the project components and of Hilton management);

(3) Specific issues related to specific project elements (though we found that questions about *timeshare* generated the vast majority of responses); and

(4) Additional questions or final thoughts.

Pros and Cons of Life in Waikīkī

Resident values and reasons for liking or disliking their community provide important context for their assessment of new projects. This subject was briefly touched on in the "literature review" of a companion report for this project ("Socio-Economic Context"), and Table 1 provides an overview of additional or supporting perspectives. In many ways, the cited "positives" and "negatives" seem like two sides of the same coin – i.e., the standard worldwide challenges of maintaining the quality of life in a successful urban resort that is always susceptible to deterioration or loss of charm.

Table 1: Pros and Cons of Life in Waikīkī

From More to Less Frequently Mentioned			
	Positives about Waikīkī		**Negatives about Waikīkī**
Convenience	▪ Everything is within walking distance, walkability ▪ Proximity to restaurants and entertainment, bars, restaurants, parks, Ala Moana Center ▪ Where all the jobs are (live/work) ▪ Access to ocean, surf, swim, beach	Lack of Parking and Traffic	▪ Traffic congestion ▪ Parking is expensive, and comes at a premium ▪ Dirty (soot on lanais from trolleys and buses)
Beauty	▪ Ocean view – night is million dollar view ▪ Waikīkī is a prime area; aesthetically, it is O‘ahu at its best! ▪ Steady improvement (landscaping, sand replenishment, beach revitalization)	Noise	▪ From nightlife (bars letting out at 4 a.m., etc) ▪ Trucks, buses, cars, traffic, early morning trash collection, deliveries, crashing of containers, vehicles without mufflers etc.
Pace and Vibrancy	▪ Fast pace ▪ Diversity ▪ A fun, happening place! (Street performers, etc)	Home-lessness	▪ People sleeping at bus stops, urinating on walls, sleeping on benches, in parks
Weather	▪ Always warm, always sunny	Density	▪ Waikīkī can feel overcrowded, too many people ▪ Parts of Waikīkī feel too built-up and expensive ▪ Not enough parks and open spaces ▪ Blocked views
Community & Cultural Aspects	▪ Strong neighborliness in Waikīkī ▪ Safety ▪ Still small town feel ▪ Hawaiian sense, culture, influence ▪ Bus Service	Public Infrastructure and Maintenance	▪ Sewerage not adequately maintained ▪ Waikīkī could use more beautification, more flowers ▪ Lack of adequate public transportation
High-End Setting	▪ Hotel atmosphere ▪ Resort setting ▪ Glitz ▪ New designs	Lack of a Sense of Community for Residents	▪ Expensive and too high-end for residents ▪ Made for tourists; not always “local-friendly” ▪ Doesn’t provide services and amenities as other standard neighborhoods do ▪ Apartment living and part-time use interfere with sense of community in many condos
Safety and Livability	▪ Rent is reasonable ▪ Relatively low crime (especially violent crime)	Safety and Crime Issues	▪ Prostitution ▪ Drugs ▪ Pedestrian safety

Summary of Project-Specific Issues

As context for the issues raised about the project:

1. Prior to the interviews, most interviewees said, they were aware only of the proposed timeshare towers, not the wide range of other proposed improvements.

2. Because trust level is a critical factor in community response, we asked about the Hilton Hawaiian Village management reputation. Interviewees overwhelmingly praised the quality of past development, but had much more mixed replies in regard to Hilton's track record on community outreach. Neighbors with existing issues or complaints about existing Hilton operations were more negative; business representatives more positive.

3. On balance, we found that interviewees struck a more analytic and dispassionate tone than is often the case with development proposals. While certain issues have strong visceral impact, most people were able to find both pros and cons. (*This was not a survey, so we did not ask for a "vote" on the project, just the key issues raised*.)

Table 2 summarizes the issues from the interviews.

Summary of Comments About Vacation Ownership (Timeshares)

Follow-up probes on attitudes toward timeshares suggest residents are now much more familiar but not yet always more comfortable with them, especially in comparison to traditional hotel units. People in the visitor industry accept that economics rules out new hotel construction and that timeshares can complement existing hotel operations, but some residents say they do not yet fully understand or trust those arguments.

Table 2: Issues Raised by Proposed Project

From More to Less Frequently Mentioned			
	Project-Specific Issues -- Definite or Prospective POSITIVES		**Project-Specific Issues -- Definite or Prospective NEGATIVES**
Jobs, Economy & Tax Revenues	• More rooms/visitors = more business, more jobs, revenues for government • Continued revitalization of the industry • Encouragement of outside investment • Increased foot traffic filtering into nearby shops	**Traffic Access, Flow & Parking**	• Increase in trucks loading and unloading, taking up parking, and slowing traffic • Increase in traffic: slowing or encumbering pedestrian and vehicular traffic • Fears of construction workers taking up public parking • Number of additional Hilton parking spaces allotted for project seen as low
Beautification & Landscaping	• Excellent landscape, architecture, and *Hawaiiana* feeling • Kalia Road improvements will upgrade neighborhood • Improved entryway and opening up of front desk area • Creating clean visual space by moving the overhang to open it up • Responsible development: Improvement to local aging infrastructure, roads and sewers and beach	**Timeshare Towers: Density/Population**	• Infrastructure and Carrying Capacity: o More crowded and dense: Extra taxing on infrastructure • Too Many Buildings: o Not enough green, open space o Look and feel: fear that campus will feel too hemmed-in to preserve guest experience; 37-story tower too urban o Too many people in the Village, too crowded • Some ongoing discomfort with timeshares
Traffic Flow & Pedestrian Experience	• Improvements to the pedestrian experience, from public rights of way • Improvements to vehicular flow; easier to get through from Kalia • Improvements to parking and flow of traffic make it more convenient for local residents (and visitors) to get in & out • Flow through to front desk will enhance visitor experience	**Views**	• Obstructed views for nearby structures: View corridor to the ocean blocked • Blocked views affect the value of nearby units
Amenities & Property Values	• More and better pools • New stores and shops, restaurants etc. • The increased value of the Hilton adds to the value of surrounding area • More options for travelers and kamaʻāina	**Lack of Community Benefits**	• All or most benefits are internal, and for the visitors: No perceived real benefits for the public • Inside improvements and landscaping in the Tapa Tower will not be visible to people out there on street • Crosswalks are all solely within the facility • Pool only accessible to visitors/guests

Appendix: List of Interviewees

Name	Affiliation	Title, Position
Beach/Ocean Stakeholders		
Kenneth Chee	Ala Wai Boat Small Boat Harbor	Harbor Master
Edward Underwood	Department of Land and Natural Resources, Division of Boating and Ocean Recreation	Administrator
Janet Mandrill	Ala Wai Small Boat Harbor Makai Society	Tenant Public Liaison
Robbie Santanello	Hawai'i Yacht Club	Rear Commodore
Joseph "Nappy" Napoleon Hardy Spoehr	'Anuenue Canoe Club (joint interview with Mr. Spoehr) 'Ānuenue Canoe Club (joint interview with Mr. Napoleon)	President Board Member
Clyde Aikau	Pure Hawaiian Surf Academy (Hilton Beach Concession)	Owner
Earl Kāne	Hawai'i Hot Spots Surf School (Hilton Beach Concession)	Owner
General Waikīkī Residential Community and Public Officials		
Sen. Brickwood Galuteria (and Brenda Baker, Legislative Assistant)	Senate District 12 (contains Hilton Hawaiian Village)	State Senator
Major Greg Lefcourt	Waikīkī Police	Commanding Officer
Sheila Beckham	Waikīkī Health Center	Executive Director
Joan Naguwa	Waikīkī Community Center	Executive Director
Akane Takenaka	Luana Waikīkī Hawaiian Massage and Shiatsu (Japanese national)	President
Seiko Wang	Waikīkī Resident (Japanese national)	Nurse
Etsuyo Kila	Waikīkī Resident (Japanese national)	Planner
Perry White	Waikīkī Resident; former consulting planner on Hilton Lagoon Project	Planner
Jo-Ann Adams	Waikīkī Neighborhood Board, Subdistrict 1 (contains Hilton Hawaiian Village) Waikīkī Chateau Association of Apartment Owners Board (AOAO)	Subdistrict 1 Member Secretary
Jeff Merz	Waikīkī Neighborhood Board	Subdistrict 3 Member
(Residential Community, Neighbors and Public Officials In Close Proximity to the Hilton)		
Rep. Tom Brower (and Cynthia Nyross, Office Manager)	House District 23 (contains Hilton Hawaiian Village) Resident of 'Ena Road, above Hilton Hawaiian Village	State Representative
Lou Erteschik	Waikīkī Area Residents Association (WARA) Waikīkī Neighborhood Board Hawaiian Monarch Association of Apartment Owners (AOAO) Board Hawai'i's Thousand Friends	President Vice Chair (Subdistrict 2 member) Vice President Board of Directors

Name	Affiliation	Title, Position
Ray Gruntz	Waikīkī Neighborhood Board (recently resigned) ʻIlikai Association of Apartment Owners (AOAO) (recently resigned) Waikīkī Area Residents Association (WARA)	Former Subdistrict 1 Member Former Vice President Director
ʻIlikai Residents (Group Interview) Nancy Mueting Lavonne Wes Lila Tarsey	 ʻʻIlikai ʻIlikai ʻIlikai Association of Apartment Owners (AOAO) ʻIlikai ʻIlikai Marina	 Resident Resident Former Board Member Former Longtime Resident Current Resident
John Popovich	ʻIlikai Association of Apartment Owners (AOAO)	General Manager
David Sotonovich	ʻIlikai Marina	Resident Manager
Bruce Thompson	Hawaiian Property Management (managing Pōmaikaʻi Condominium)	Management Executive
Canterbury Place (Group Interview) Alethea Rebman Cathy Moszkowicz Darrel Martenson	 Canterbury Place, Association of Apartment Owners Canterbury Place, Association of Apartment Owners Canterbury Place, Association of Apartment Owners	 President Communications Chair Member
Clifton Johnson	Wailana Association of Apartment Owners (AOAO)	President, and resident
Visitor Industry and Wider Business/Labor Community		
David Uchiyama	Hawaiʻi Tourism Authority (HTA)	Marketing Director
Vicky Olsen	Hawaiʻi Army Museum Society	Executive Director
Rick Egged	Waikīkī Improvement Association (WIA)	President
Murray Towill	Hawai\`i Hotel & Lodging Association Hawaiʻi Hotel Industry Foundation	President Secretary
Jan Yamane	Waikīkī Business Improvement District	Executive Director
Kyle Chock	The Pacific Resource Partnership	Executive Director
William "Buzz" Hong	Hawaiʻi Building and Construction Trades Council	Executive Director
Karen Nakamura	Building Industry Association of Hawaiʻi	Chief Executive Officer (CEO)
Chris Forbes	Hale Koa Hotel	Marketing Director, F&B Director

APPENDIX O

<u>Economic and Fiscal Impact Assessment for the Hilton Hawaiian Village Master Plan, Island of O'ahu</u>

Mikiko Corporation

August 2010

MIKIKO
CORPORATION

ECONOMIC AND FISCAL IMPACT ASSESSMENT FOR THE HILTON HAWAIIAN VILLAGE MASTER PLAN

ISLAND OF OAHU

Prepared for:
Group 70 International, Inc.

FINAL REPORT

August 2010

Economic and Fiscal Impact Assessment for the Hilton Hawaiian Village Master Plan

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ECONOMIC AND FISCAL IMPACT ASSESSMENT FOR THE HILTON HAWAIIAN VILLAGE MASTER PLAN

Report Text

1 – Introduction and Executive Summary

This chapter relates the study background, objectives, approach, and principal conclusions of an economic and fiscal impact assessment prepared for the proposed Hilton Hawaiian Village Master Plan Improvements. The following chapters offer a more detailed explanation of the findings and analyses on which these conclusions are based.

Project and Study Background

The Master Plan (Exhibit 1-1)

Principals of the Hilton Hawaiian Village Beach Resort & Spa (Hilton) propose major renovations to their 22-acre resort complex located in Waikiki, Oahu. Hilton Hawaiian Village (the Village) currently consists of five hotel towers: the Tapa, Rainbow, Diamond Head, Alii and Kalia Towers; the Diamond Head Apartments; and two timeshare towers, the Grand Waikikian and the Lagoon Tower. The complex also includes more than 150,000 square feet of banquet and meeting spaces, 124,000 square feet of commercial areas, various outdoor areas, six swimming pools, and the recently renovated, publicly-owned Kahanamoku Lagoon, which is maintained by Hilton.

Hilton worked with Group 70 International, Inc. (Group 70) to articulate a Master Plan that encompasses:

- Construction of two timeshare towers:
  - Tower I – a 37-story, 300-unit tower to be built over the existing bus loading area in the mauka/Diamond Head area of the campus;
  - Tower II – a 23-story, 250-unit tower to be part of the redevelopment of the Rainbow Bazaar;
- Redeveloped, refreshed and/or new retail areas along Kalia Road, near the Tapa Tower and within the Rainbow Bazaar, with a net increase of 14,790 square feet of new retail space;
- Improvements to the streetscape along Kalia Road;
- Improvements to the main entry, Rainbow Drive and the center area of resort retail;
- Improvements to the existing front desk lobby and the Super Pool, Village Green and Hau Tree Bar; and

- Improvements to the Tapa Pool and Cafe.

The Master Plan is estimated to be built-out within approximately 12 years. Sell-out of the timeshare intervals could be completed by 2028.

Entitlement Requirements and Need for Report

Implementation of the Master Plan will require a Special Management Area (SMA) Use Permit and a Planned Development-Resort (PDR) Permit under requirements of the Waikiki Special District Ordinance. Group 70 is coordinating this entitlement effort, and has asked Mikiko Corporation (Mikiko) to prepare this assessment of the economic and fiscal impacts of the Master Plan. This report is expected to be included in an Environmental Impact Statement (EIS), and other documents that may be required to support the SMA/PDR entitlement process.

Economic and Fiscal Impact Approach

This economic and fiscal assessment is intended to assess the Project's impacts within the State of Hawaii (State) and the City and County of Honolulu (County). Impacts that are evaluated include:

- Economic impacts:
  - Expenditures by visitors attracted to Oahu;
  - Development-related employment;
  - Operations-related employment; and
  - Personal income deriving from development and operations.
- Population impacts:
  - Timeshare (or hotel) utilization patterns;
  - Average daily new visitor population; and
  - In-migrant resident population.
- Fiscal impacts:
  - Property tax and other County government revenues;
  - General excise tax, income tax, transient accommodations tax and other State government revenues;
  - County and State government operating expenditures; and
  - County and State net fiscal operating impacts.

State and County revenues and expenses estimated herein are based on the structure of tax collections and services reported as of the fiscal years ending June 30, 2009 (FY2009) for the County, and June 30, 2008 (FY2008) for the State. The impacts estimated would differ if governmental taxing and spending policies were to be materially altered.

All dollar amounts in this report are stated in 2010 dollars, and year references are to calendar years, unless otherwise stated.

Executive Summary

The Master Plan Evaluation

This economic and fiscal impact assessment is based in part on development, planning, market and other assumptions that were provided by Hilton, Group 70, and/or other Master Plan team consultants. It focuses on the timeshare and retail elements of the Master Plan, as follows:

Development Elements Assessed
2010 dollars

	Comment	Average annual inventory, 2011-2028[1]	Stabilization, 2028
Timeshare unit inventory	*Number of residences*		
Tower I	*Opens 3/2016*	217	300
Tower II	*Opens 12/2022*	97	250
Total		**314**	**550**
Commercial areas	*Net additional square feet GLA*	**9,320**	**14,790**

Sources: Hilton Grand Vacations Company, Group 70 International, Inc.

Projected Impacts[2]

The Project would generate significant, on-going economic and fiscal benefits for residents of Hawaii, as well as for the County and State governments. Development of facilities would generate employment and consequent income and taxes. In addition, by

[1] See discussion on next page of average annual measures, as reported herein.

[2] See Chapter 2 for study methodology and definitions of key terminology, such as “direct,” “indirect” and “induced” impacts.

attracting new visitors to Oahu, the Project is expected to support long-term impacts, including additional consumer expenditures, employment opportunities, personal income and government revenue enhancement.

Highlights of the Master Plan's impacts are summarized in the table on the next page. Impacts are reported in three ways, each with different applications:

- **Total, 2011-2028 –** This is the "study period" that is evaluated, extending from date of anticipated receipt of final discretionary approval, to sell-out of the last timeshare interval.

- **Average annual, 2011 to 2028 –** This is an average of the estimated values for each year within the study period. They are roughly 1/18th of the total numbers shown (with variation due to rounding of input factors.) However, these numbers may sometimes appear to understate impacts. For instance, since construction is estimated to be completed by 2022, the average in the period that also includes 2023 to 2028 would be less than what one would expect to observe in any given year during construction.

- **Stabilization, 2028+** - These figures reflect the annual impacts that can be expected to endure once all new development activity has been completed, new facilities have achieved a stable level of operations, and initial sales of the timeshare intervals have been completed. Thus, numbers in this column reflect no impacts from the substantial development activities and timeshare sales and marketing activities that would go on during the majority of the study period.

Summary of Projected Economic and Fiscal Impacts

2010 dollars, in millions except where noted

	Comment	Total 2011-2028[3]	Av. annual 2011-2028[3]	Stabilization 2028+[3]
Development costs[4]	***Net of contingencies, inflation, etc.*** *(see footnote below)*	$427.5	$23.7 ($35.6 during construction)	$0.0
FTE employment[5]:	***Direct, indirect and induced***			
Development-related	*Person-years in period*	6,100	340	0
Operations-related	*On-going*	N/A	910	530
Personal earnings[6]:	***Direct, indirect and induced***			
Development-related		$363.9	$20.2	$0.0
Operations-related		$990.3	$55.0	$20.2
Average earnings per FTE job[6]:	***Direct, indirect and induced***			
Development-related	*(not in millions)*	N/A	$59,000	$0
Operations-related		N/A	$60,000	$38,000
Employee benefits[7]:	***Direct benefits only***			
Development-related	*Info not available*	INA	INA	INA
Operations-related		$112.2	$6.2	$5.0

[3] See discussion of total, average annual and stabilized reporting periods, on preceding page.

[4] Figures differ from those that may be reported elsewhere (and appropriate in those contexts) since these exclude contingencies, escalation, costs of entitling the Project, insurance, bonds, public agency/PDR requirements, capitalized interest and those portions of project management, finance, tax, legal, furniture, fixture and equipment costs estimated to be spent out-of-State.

[5] FTE = Full-time equivalent, defined as 40 hours per week or 2,080 hours per year.

For operational positions, this jobs estimate is based on net new positions at the Resort attributable to the Master Plan. If all jobs to be supported at the redeveloped Rainbow Bazaar were considered (including those that may be lost when the current structures are demolished), the total jobs attributable to the new facilities could amount to some 1,370 FTE in an average year of the study period (2011-2028) or 980 FTE thereafter.

[6] Direct earnings based on wage data from State of Hawaii, Department of Labor and Industrial Relations and exclude tips, commissions (except timeshare sales commissions, which are included), bonuses and benefits. Indirect and induced earnings derived from State of Hawaii, Department of Business Economic Development and Tourism, 2008, Input-Output study, which defines earnings to include wage, salary and proprietary incomes, plus directors' fees and employer contributions to health insurance, less employee contributions to social insurance.

[7] Employer-paid contributions to FICA, FUTA, State unemployment insurance, pension plans, group insurance (including health care), employee meals and uniforms, other benefits as relevant. Excludes personal and vacation time, which are incorporated into the FTE salaries shown.

Summary of Projected Economic and Fiscal Impacts
2010 dollars, in millions except where noted, continued

	Comment	Total 2011-2028[8]	Av. annual 2011-2028[3]	Stabilization 2028+[3]
Visitor impacts:				
Average daily visitors		N/A	750	1,460
Total expenditures	*Direct, indirect and induced*	$1,954.5	$108.6	$212.9
In-migrant resident population:	***Direct, indirect and induced employees plus their dependents***			
To the County		N/A	100	50
To the State		N/A	40	20
Net additional government operating revenues[9]:	***Operating revenues less operating expenditures***			
For the County		$33.7	$1.9	$3.0
For the State		$161.4	$9.0	$7.7
Revenue/expenditure ratio[8]:	***For government operations***			
For the County		3.2	3.2	3.1
For the State		8.6	8.8	5.0

These summary findings are explained below. See the next chapter for definitions and discussions of special terms that may be used, and important study conditions.

- **Development costs –** Based on estimates provided by Project consultant Rider Levett Bucknall, total Project costs have been estimated at some $770 million. However, for purposes of this economic and fiscal impact assessment, only $427.5 million of the $770 million is considered. The lower number is used to exclude contingencies, escalation (since this analysis is presented in 2010 dollars), costs associated with obtaining entitlements for the Master Plan, potential out-of-State expenses and other items not appropriate to this particular impact assessment, as detailed in footnote 4 on the prior page.

[8] See discussion of total, average annual and stabilized reporting periods, on preceding page.

[9] Excludes conveyance taxes on timeshare sales; Gross Excise Tax (GET) on timeshare sales commissions; potential income taxes and GET on any operating entities or ground lease arrangements.

Over the 2011 to 2028 period, this could represent $24 million in development expenditures per year. However, since construction is projected to be completed by 2022, the average annual amounts expended on Oahu while construction is ongoing would be closer to $36 million.

- **Development employment –** The Master Plan is estimated to generate 6,100 total person-years of full-time equivalent (FTE) development-related jobs during its development, considering direct, indirect and induced impacts. This would represent an average of 340 FTE positions per year over the total study period, or about 510 per year during actual buildout.

  These jobs are expected to be associated with total annual personal earnings[10] (direct, indirect and induced impacts) of some $364 million, at an estimated average $59,000 per FTE job.

- **Operational employment –** During its development and selling period, the Master Plan is also estimated to generate some 910 FTE total jobs in an average year. Some of these would be related to the sales and marketing of the timeshare intervals, however, and most of those would not persist after sell-out. After 2028, the Project is estimated to support some 530 permanent, total FTE jobs.[11]

  Altogether, these total operations-related positions could be expected to generate some $990 million in personal earnings for Hawaii residents during the study period, or about $55 million per year. This represents an average compensation of about $60,000 per FTE position.

  After 2028, the Project is estimated to generate some $20 million in total payroll per year, or an average of about $38,000 per FTE job.

- **Visitor impacts –** Until 2016, there would be no new facilities to house new visitors, while from 2016 to 2028, the new timeshare units would be gradually sold to owners. During that sales period, Hilton Grand Vacations Company (HGVC) would operate some of the unsold intervals for hotel or marketing purposes.

  The majority of timeshare owners and hotel or marketing guests are expected to be from out-of-State and to constitute new visitors to the islands who would not have been accommodated elsewhere in Hawaii if the Project had not been developed.

  Averaging the years with no additional inventory with those of gradually increasing

[10] These development earnings are defined as wage, salary and proprietary income, plus director's fees and employer contributions to health insurance, less employee contributions to social insurance.

[11] These jobs estimates are based on net new positions at the Resort attributable to the Master Plan. If all jobs to be supported at the redeveloped Rainbow Bazaar were considered, including those that may be lost when the current structures are demolished, the total jobs attributable to the new facilities could amount to some 1,370 FTE in an average year of the study period (2011-2028) or 980 FTE thereafter.

occupancy of units, the Master Plan is anticipated to attract an average daily guest population of 750 new visitors from out-of-State during the study period. After 2028, when all 550 timeshare units are operational and sold out, the Project is projected to be associated with some 1,460 average daily guests.

During the study period, out-of-State owners and guests staying at the new timeshare towers are anticipated to generate $1.95 billion, or some $109 million per year, in total visitor expenditures. After 2028, with the timeshare intervals fully absorbed, the Project is expected to support ongoing, annual visitor expenditures amounting to some $213 million per year.

- **Resident population movements –** A very few of the jobs supported by the Master Plan, most likely professional or managerial positions, may create incentives for some neighbor islanders or mainland residents to move to Oahu. These and other indirect factors can be expected to result in perhaps 100 persons living on Oahu who might not otherwise have lived on the island (in-migration to the County) during the Project's development and sales period, and perhaps 50 once the Project is sold out after 2028. Within these totals, some 40 and 20 persons, respectively, might be persons who had previously lived out-of-State (in-migration to the State).

- **Net County fiscal impacts** - The Project could be expected to contribute some $34 million in net additional County revenues during its development and sales period, or an average of $1.9 million per year. Its contributions to the County are expected to stabilize at about $3 million per year after 2028.

  New County government revenues are estimated to represent around 3 times the new County government operating expenditures required to support the additional population that could be attracted to Oahu by the Project. The major contributor to these fiscal benefits would be the Project's net new real property taxes.

- **Net State fiscal impacts** - For the State, net additional operating revenues generated by the Project are estimated to total some $161 million during its buildout and sales, or about $9 million per year. After 2028, when construction is completed and all timeshare intervals sold, the State could continue to benefit from net additional revenues of about $8 million per year thereafter.

  These represent a revenue/expenditure ratio of nearly 9 during the study period, and 5 thereafter.

  The State fiscal benefits as estimated do not include the additional revenues that would be generated by conveyance taxes on timeshare interval sales, the Gross Excise Tax (GET) on timeshare sales commissions, and the potential income taxes and GET from any operating entities or ground lease arrangements. Such additional contributions could further increase the public benefits of the Master Plan.

Report Organization

The rest of the report is organized in three parts, as follows:

1) **Remainder of Report Text –** Further explanation of the study analyses and conclusions, including:

   - Study Parameters
   - Economic Impacts
   - Population Impacts
   - Fiscal Impacts

2) **Exhibits-** Detailed bases and findings on which the conclusions of the primary (timeshare) scenario are based.

3) **Appendices –** Report conditions and summary of findings on the alternate hotel development scenario.

2. Study Parameters

Special Considerations

Special considerations guide the analyses herein. These and other aspects of this study's analytical framework are set forth below.

- **Time frame and reporting periods –** The base study period extends from 2011 to 2028, an 18-year time frame that spans from preconstruction planning through Project buildout (by 2022) and then sell-out of the timeshare intervals by 2028. Reporting considers the total impacts in this period, the average annual impacts in this period, and a stabilized estimate for annual impacts in 2028 and beyond.

  The average annual figures should be interpreted with care. See the discussion in the executive summary of this report regarding interpretation of the impacts reported, particularly the average annual figures.

- **Commercial facilities** - The proposed commercial facilities are expected to attract spending from guests at the timeshare towers, other visitors to Oahu, as well as Oahu residents.

  It is likely that Oahu residents and visitors would have spent an equivalent amount on dining out and/or personal services whether or not the Project's commercial facilities were developed. Therefore, the impact of the commercial facilities for the County and State is estimated based on spending of the net additional visitors attracted to Oahu (those staying at the timeshare units) rather than on assessment of spending that may occur at the new or renovated commercial facilities per se.

- **Entitlement spending not considered –** Hilton's currently on-going entitlement process for the Hilton Hawaiian Village Master Plan is already generating economic and fiscal benefits by employing professionals and supporting various vendors around the State. However, since such benefits are not dependent on the outcome of the entitlement process, they are not enumerated in this analysis.

Definition of Terminology

Within this report, the following definitions apply:

- **Study period –** As discussed above, the base study period for this analysis is defined as 2011 to 2028, and this time span is referred to as "the study period" herein. The report also addresses the potential impacts of the Master Plan thereafter, in 2028+.

- **Direct impacts** - Those economic, population or other impacts attributable to persons or activities that are a direct result of the proposed development. For instance, direct employment impacts might include those involved in building the proposed facilities, such as construction workers, and those who would later work at them in their operations.

  Many, but not all of direct impacts can be expected to occur on-site. For instance, a portion of the construction budget is for architects and engineers. While such persons' employment might be temporarily dependent on contracts generated by the Master Plan, they may do the majority of their work from offices in Honolulu or elsewhere. Likewise, administrative and managerial staff located off-site would support construction professionals working on-site.

- **Indirect impacts** - Indirect impacts occur when the businesses or persons who are directly affected make expenditures for additional supplies or services. For instance, some of the additional retail spending by those newly attracted to Hawaii by the Project could be spent on eating out. These elevated dining out expenditures could indirectly increase demand for produce, seafood and meats from Hawaii farms, fishermen and/or ranching enterprises. The Master Plan would thus have indirectly supported new business opportunities for area providers of such goods and services.

- **Induced impacts** - Induced impacts occur throughout the community when those persons or companies that have benefited from the direct or indirect impacts of the Project spend their associated earnings on consumer goods and services. For instance, a construction worker may spend her earned wages to buy a new pair of shoes, or to pay for her child's day care. The farmer who sells produce to a restaurant at Hilton Hawaiian Village may use some of his profit to take his family out to the movies. The businesses and individuals impacted by such re-spending are said to enjoy induced economic impacts from the Project.

- **Total impacts** - Total impacts are defined as the sum of direct, indirect and induced impacts for any given variable.

- **Resident population -** Resident population refers to all those persons who habitually reside in a given area, whether or not they may have temporarily traveled away.

- **De facto population –** Total population that is physically present in an area at any given time. This would include residents and visitors who are present, and would exclude residents who are temporarily away.

- **Full-time equivalent** - This study measures employment in full-time equivalent (FTE) units. One full-time equivalent position is defined as 2,080 hours of employment (including paid vacation and sick leave) per year. This is equivalent to 40 hours per week, and may also be referred to as a "person-year" of employment. Two half-time jobs would be considered to together represent one FTE job.

The FTE concept is also be applied to residents and visitors. For instance, 52 visitors who each stay one week in Hawaii together constitute one FTE visitor to the State.

Development and Operating Assumptions

Assumptions regarding the scale, timing, and operations of the Project elements must be made in order to assess its impacts. This assessment utilizes the timelines and development programs provided by Hilton, Group 70 and others as noted. Operating assumptions are set forth in each exhibit and were generally provided by senior management of Hilton Hawaiian Village or HGVC; these assumptions reflect operating experiences at the Village and their judgments regarding conditions going forward.

Development Program (Exhibit 2-1)

The Project as evaluated encompasses 550 timeshare units in two towers and a net addition of 14,790 square feet of commercial areas. The net additional commercial areas reflect the demolition of the existing Rainbow Bazaar and a few other small, free-standing commercial buildings (totaling 58,910 square feet) and the development of 73,700 square feet of new areas, principally a redeveloped Rainbow Bazaar. Portions of the new Rainbow Bazaar will be located in the base of Timeshare Tower II.

The Master Plan also involves the renovation or refreshing of numerous other areas within the Village, including pedestrian and traffic zones, the Tapa Pool, the resort lobby, the Super Pool and many of the existing commercial areas that will not be demolished. While these aspects of the Master Plan are not specifically modeled in this analysis, their development costs are incorporated in the analysis and contribute to employment, income and various tax outcomes that may be anticipated to result from such local spending.

Project Timing (Exhibit 2-1)

Assuming entitlements are obtained on a timely basis, it is estimated that several of the refreshment projects would be completed by 2011, while timeshare Tower I is projected to be available for occupancy in March 2016 and Tower II by December 2022. All construction identified in the Master Plan is expected to be completed by 2022.

The Project involves marketing and sales of 28,600 timeshare intervals (52 weeks per unit), and these initial sales are anticipated to be accomplished by 2028.

Timeshare Owner Characteristics and Utilization (Exhibit 2-2)

As timeshare intervals are gradually sold, timeshare owners will become the principal occupants of the towers. However, during the marketing period, Hilton Grand Vacations would operate available intervals as hotel units and/or in marketing packages.

- **Origins –** Based on prior sales at the Village, 98% of timeshare owners are estimated to come from out-of-State, bringing new expenditures to the islands. The remainder is expected to be Oahu residents who would thus not directly contribute new expenditures to the local economy.

However, since these local residents are purchasing into a club concept that permits trades, it is likely that they will at least sometimes stay elsewhere, while their week on Oahu is filled by another visitor who may be from out-of-State. This analysis is conservative in that potential out-of-State revenues that thus derive indirectly from this local market segment are not modeled.

- **Occupancy –** HHV timeshare owners (or other interval owners they may have traded with) are estimated to occupy their interests 88% of the time, based on a projected range of 85% to 90% occupancy, at 3.1 persons per occupied unit.

- **Expenditures -** Maintenance fee revenues are estimated at $1,000 per year per interval, while food and beverage and other expenditures in the islands is estimated at $503 per occupied unit per day, based on average expenditure data obtained from the Hawaii Tourism Authority (HTA). This relatively high rate of spending reflects HGVC's assessment that some 75% of timeshare buyers will be from Japan.

Hotel and Marketing Guest Characteristics and Utilization (Exhibit 2-3)

- **Overview and occupancy –** The analysis assumes that the hotel and marketing use segments will phase out as the timeshare intervals are used; thus they are shown to generate only interim occupancy and revenues. Unsold units available for such uses are anticipated to be occupied some 65% of the time, with an average of 2.4 persons per occupied unit.

- **Origins -** While these market segments are expected to have a relatively smaller international component than the timeshare owner market, they are still anticipated to be 98% from out-of-State.

- **Expenditures -** HGVC estimates that the average achieved room rate for these two market segments is $210. Based on market-specific data from the HTA, their non-rooms expenditures are estimated at $212 per occupied unit per day.

Summary of Timeshare Tower Uses (Exhibit 2-4)

Considering all user markets, 260 units are expected to be occupied on an average day in the study period (this includes years of zero occupancy from 2011 to 2016), while 480 are expected to be occupied on an average day at Project stabilization after 2028.

On average, the timeshare towers could be expected to be housing 770 persons per day during the study period, and 1,490 after 2028. However, the Hawaii de facto population impact consists of a subset of this, representing only those average daily guests who originate from out-of-State. Oahu residents would already be present, and no neighbor island markets are anticipated. The de facto visitor impacts are estimated at 750 persons per day during the study period, and 1,460 per day, on average at stabilization in 2028 and beyond.

Direct gross revenues generated by the timeshare towers are projected at approximately $1 billion over the study period, or $59 million per year. After 2028, they are projected at about $116 million per year. These gross revenues include maintenance fees and rooms expenditures for all guests, regardless of their origins (since taxes and other fiscal benefits accrue from these), but only that share of other guest expenditures that is attributed to out-of-State residents.

3. Economic Impacts

The Master Plan may be expected to impact the State and County economies by:

- Attracting new Oahu residents and visitors who would pay local taxes, consume services and make new expenditures,
- Generating development activity, which supports expenditures for goods and services, and
- Creating and supporting jobs and business enterprises in its ongoing operations. The new jobs would in turn generate additional personal earnings in the County and throughout the State.

Visitor Expenditures (Exhibit 3-1)

Direct visitor expenditures in Hawaii attributable to the Project are anticipated to total some $1.0 billion over the study period, or $56 million per year. At stabilization, they may amount to $109 million per year. These are based on 77% of maintenance fee payments (the share estimated to be spent in Hawaii), all room revenues for hotel and marketing uses of the timeshare units, and other visitor expenditures deriving from out-of-State guests only.

Including the indirect and induced impacts, total visitor expenditures in Hawaii are estimated at $1.95 billion over the study period, or $109 million per year. By the time of sell-out and stabilized operations, however, total visitor contributions to the economy attributable to the Project could amount to $213 million per year.

Project Costs

Economic Multipliers (Exhibit 3-2)

The State of Hawaii, Department of Business Economic Development and Tourism (DBEDT) periodically evaluates the economic interdependencies of the various industries within the State, and their rates of job and personal earnings creation. The latest such study is dated August 2008 and entitled, “The 2005 State Input-Output Study for Hawaii.”

- **Final demand industry multipliers** show the relationship between input, or spending within any given industry category, and its resulting creation of jobs and earnings in other sectors of the State economy. These multipliers are used to estimate the direct employment effects of the construction and development activities planned for the Master Plan.

- **Direct-effect industry multipliers** show the relationship between direct jobs or earnings and the indirect and induced jobs or earnings[12] that they can be expected to subsequently support.

Development Costs (Exhibit 3-3)

Based on estimates provided by Rider Levett Bucknall (RLB), the Master Plan's development is expected to require some $427.5 million in development-related expenditures in Hawaii over the 18 years between 2011 and 2028, or $24 million per year.

This budget differs from those that may be reported for the Project elsewhere (and appropriate in those contexts) in that the $427.5 figure excludes contingencies, costs of entitling the Master Plan, insurance, bonds, public agency/PDR requirements, capitalized interest and those portions of project management, finance, tax, legal, furniture, fixture and equipment costs estimated to be spent out-of-State. Since the impact assessment conducted herein is presented in constant 2010 dollars, the $427.5 million figure used also excludes estimated escalation or inflation factors in the budgets that were estimated by RLB.

The development costs applied herein cover:

- **Professional services –** planning, architectural, engineering, landscape design, development management, legal, and similar services. Note that those services related to the effort to entitle the Master Plan have been excluded from this estimate, since they are not contingent on the entitlement.

- **Construction –** including demolition, infrastructure, site preparation, construction of the timeshare towers and commercial facilities, refurbishment and refreshment of the entryway, lobby, pools and other amenities as described previously, and retail and office tenant improvements.

- **Other –** including relocation of activities and services during construction, building permitting, land title services, general contractors' overhead and profits,

[12] Personal earnings are defined in the DBEDT study as wage and salary income plus proprietors' income, plus director's fees, plus employer contributions to health insurance, less personal contributions to social insurance (i.e., social security taxes). These criteria are also incorporated into assessments of the indirect and induced impacts. However, not below that direct wage estimates are derived from State of Hawaii wage and salary data that present are more narrow view of compensation.

administrative overhead, and similar, locally-spent "soft" expenditures incurred because of the Project's development.

Employment and Earnings

Development Employment (Exhibit 3-4)

During the study period, the Master Plan could directly generate some 2,700 person-years of development-related work, or nearly 150 in an average year (about 225 per year during the 12 years in which construction would take place.) These estimates include wage, salaried and proprietary employment opportunities supported by the Project's development. The majority of this work would occur on-site. However, some of this employment, such as the professional services and administrative positions, could be located off-site.

Considering also the indirect and induced employment opportunities that these direct impacts would support, the total impacts of the Project's development could represent 6,100 total person-years of development-related employment over the study period, an average of 340 per year between 2011 and 2028 (or about 510 per year during the approximately 12 years of construction activity ending in 2022.)

Personal Earnings from Development – Per Job and Family (Exhibit 3-5)

Considering the most recent State of Hawaii, Department of Labor and Industrial Relations (DLIR) data on average earnings in relevant occupational categories, the wages generated by the Project's direct development expenditures are estimated to average $73,000 per direct FTE position, or $59,000 considering the Project's total, more dispersed impacts. The direct earnings estimates exclude commissions, bonuses and benefits that may also accrue to these development-related employees.

Since most families in Hawaii include more than one job-holder, and many employees themselves hold more than one job, these position-specific salaries can be expected to be associated with higher average family incomes.[13] On average, those employed in positions directly supported by the Master Plan's development might be expected to have family incomes averaging about $139,000, while those associated with all jobs created through the Project's direct, indirect or induced effects might be expected to have family incomes averaging $112,000. These would represent 170% and 114% of the median family income for Honolulu County, respectively, based on the estimated median of $81,700 in FY 2010.[14]

[13] Ratio derived from the 2008 average annual wage in the Honolulu Metropolitan Statistical Area, as reported by the State Department of Labor & Industrial Relations, with adjustment to 2010 dollars based on consumer price index for Honolulu, and the FY 2010 median family income as reported for the Honolulu MSA, as noted below. See Exhibit 3-5 for further information.

[14] U.S. Department of Housing & Urban Development, HUD USER, as accessed July 27, 2010.

These family income estimates are hypothetical in that they assume other family earners are employed in similar wage-level positions as the subject Project employee.

Personal Earnings from Development – Total on Oahu (Exhibit 3-6)

Direct personal earnings associated with Hawaii-based positions could amount to some $198 million over the Project's development. Considering also the indirect and induced earnings, Hawaii workers could expect to enjoy a total of some $364 million in additional earnings over the Project's development.

On an annual basis, the direct earnings represent an average $11 million from 2011 to 2028, while total earnings could amount to about $20 million per year. The indirect and induced benefits could be expected to be supported throughout the State, with high concentration on Oahu.

Operational Employment (Exhibit 3-7)

In addition to its development-related positions, the Master Plan would create numerous long-term permanent jobs in its operations. Direct operational employment opportunities include:

- **Timeshare sales and marketing –** HGVC currently employs some 375 FTE personnel who market and sell the resort's existing timeshare products. Without new timeshare development at the Village, all but about 100 of these positions are expected to be phased out over the next several years. Development of the two towers as planned would enable the continuation of these positions.

  Once the second tower is sold out, HGVC estimates it would retain about 135 of these positions for ongoing timeshare resales and other marketing activities.

- **Timeshare operations –**Hilton Hawaiian Village provides staff to operate the timeshare units. These positions are principally in areas such as housekeeping, engineering and landscaping. They are estimated at 88 FTE positions over the study period, or some 154 FTE positions at stabilization and beyond.

- **Commercial and other operations –** Retail, restaurant and amenity facilities at the Village are expected to increase by some 52 FTE jobs during the study period, or nearly 70 at stabilization.

Together, the Project is expected to directly generate some 420 operational positions during the study period, of which about 270 could be considered permanent positions. The difference is attributed to the loss of 240 of the timeshare sales and marketing positions after sell-out, partially off-set by increasing permanent employment in other operations.

Including indirect and induced employment effects, the Project could be expected to support a total of some 910 FTE operational positions during its buildout and sell-out, and 530 thereafter.[15]

Personal Earnings from Operations - Total (Exhibit 3-8)

Direct wages and salaries paid to those employed in the Project's operations are expected to reach some $22 million per year during its sell-out period, and then decline to about $10 million per year in 2028 and beyond. These direct estimates exclude proprietary earnings, director's fees, commissions (except on timeshare interval sales, where commissions are included within the average compensation figure), tips, bonuses and benefits.

Including personal earnings associated with the indirect and induced positions, the Project could generate some $55 million per year during the study period, and $20 million in ongoing payroll within the State thereafter.

Employee Benefits (Exhibit 3-8)

Based on information provided by Hilton, HGVC and Retail Merchants of Hawaii, employer-sponsored employee benefits associated with the projected direct operational positions could amount to some $112.2 million over the study period, or $5.0 million per year on an ongoing basis thereafter. These expenditures include employer contributions to FICA, FUTA (Federal Insurance Contributions Act and Federal Unemployment Tax Act, respectively), State unemployment insurance, pension plans, group insurance including health care, employee meals and uniforms, as applicable.

These benefits are for direct employees of the Project only. They are not estimated for the equally numerous indirect and induced employees because anticipating the nature of those employment positions is problematic.

Personal Earnings from Operations – Per Job and Family (Exhibit 3-9)

The direct employment opportunities generated by the Master Plan could be expected to support average FTE wages of about $53,000 during the study period, or $37,000 at stabilization. Including the indirect and induced positions, the overall average FTE position might support an average wage of about $60,000 during the study period, or $38,000 thereafter.

As for development employment, these earnings per job are expected to be associated with higher average family incomes. Using the same methodology explained previously, the families that include a person employed through direct, indirect or induced employment impacts of the Master Plan might have average incomes of about $114,000

[15] These job estimates are based on net new positions at the Resort attributable to the Master Plan. If all jobs to be supported at the redeveloped Rainbow Bazaar were considered, including those that may be lost when the current structures are demolished, the total jobs attributable to the new facilities could amount to some 1,370 FTE in an average year of the study period (2011-2028) or 980 FTE thereafter.

during the study period, or $72,000 after stabilization. These family income benchmarks are again hypothetical as they assume that the secondary family income is at a similar wage level as the Project-related position.

4. Population Impacts

In-migrant Residents (Exhibit 4-1)

Some of those taking advantage of the construction and net new operational employment generated by the Project might move from other counties or states because of the job opportunity. These might include young householders who grew up in Hawaii but who had been living and working on the US mainland due to the lack of attractive career or living environments in Hawaii, or neighbor islanders who seek employment and lifestyle opportunities such as supported by the Project on Oahu. Other household members might also accompany such in-migrating workers.

- **Development employees** - Hawaii's labor market is considered to have sufficient supply and the required skills to satisfy most of the Project's development labor needs. A nominal 2% of FTE specialty staffing needs is assumed to come from the US mainland. Such persons might be temporarily resident in the islands during periods of the Project's development.

  Those moving or commuting between islands during the Project's development might fill another 1%. Together with those from out-of-State, this would represent 3% of development employees being temporary in-migrants to the County. However, this would still be a nominal number of development positions in any given year.

- **Operational employees –** Some 98% of the Project's operational employee needs are anticipated to be satisfied from within the State's and 95% from within Oahu's labor pool.

- **Dependents -** In-migrant dependents are estimated at an average of 0.2 per FTE in-migrant construction worker, since the position on which the "move" is based would be temporary. For operational employees, the dependent ratio is estimated at 1.0 per FTE in-migrant operational employee.

During its development and sales, the Project could attract some 100 FTE in-migrant residents who previously lived off-island. These persons represent in-migrants to the County and would include development and operational employees who move to Oahu from the neighbor islands or out-of-State because of employment opportunities generated by the Master Plan, as well as those dependents who may move with them. After 2028, when the Project's development is complete, in-migration might have accounted for 50 new County residents.

In-migrants to the State are a subset of in-migrants to the County, since they would exclude those persons moving between islands. During the study period, the Project is estimated to attract 40 such in-migrant residents in an average year; after stabilization, this count might settle at a nominal figure such as 20 new residents.

Average Daily Visitors (Exhibit 4-1)

Owners and visitors staying at the timeshare towers who normally live out-of-State would contribute to the de facto populations of the County and State. Because HGVC anticipates virtually no owners or visitors from the neighbor islands, the average daily visitor impact is the same for the County and the State. As shown previously in Exhibit 2-4, this is projected to amount to about 750 FTE visitors in an average year during the study period, or about 1,460 after stabilization in 2028.

Total Population Impact (Exhibit 4-1)

Combining the resident and visitor population impacts, the State's de facto population could be expected to increase by some 790 FTE persons on an average year during the Project's development and sales period, or 1,480 persons thereafter.

For the County, the analogous figures would be 850 FTE persons during the study period and 1,510 in 2028 and thereafter.

5. Fiscal Impacts

The Master Plan's fiscal impacts are estimated by comparing anticipated changes in government revenues to the government service costs associated with the additional population the Project could attract to the State and County.

Operating Revenues

Real Property Taxes (Exhibit 5-1)

For the County, the Project's most significant fiscal impact would be the higher real property taxes it would generate compared to those currently paid. Net new real property taxes are based on the County's FY 2011 rates in the hotel & resort zone, and for incremental changes in tax assessed building values as supported by the Project. While the higher building values driven by the Master Plan may also tend to increase land values, a conservative approach is taken in not anticipating land value changes.

Future assessed values will be based on the County assessors' estimates at a future time, and County standards of practice for establishing such values. However, for projection purposes, the following proxies are used:

- **Assessed values of the timeshare towers** are based on the FY2011 tax assessed building value per unit for the Grand Waikikian timeshare tower. The Waikikian is located within the Village, close to the Tower II site, and was completed in 2008. This results in an estimated assessed value for the two new towers of $230 million at stabilization.

- **Assessed values of the various other commercial improvements** are estimated based on the estimated $71 million in vertical construction costs as presented previously in Exhibit 3-3, less expenses associated with the pools, the Village Green, tenant improvement costs, and other non-real estate costs. This results in an estimated assessed value of about $43 million for these aspects of the Project, at stabilization.

Thus, the Project's improvements are estimated to have a building tax assessed value of about $274 million in at stabilization, or $165 million in an average year during its development and sales period.

County Real Property Tax Revenues (Exhibit 5-1)

Considering the estimated assessments and the current County real property taxation structure, the Master Plan could support potential new real property taxes of some $3.4 million at stabilization or $2.0 million in an average year during the study period.

However, since some 58,910 square feet of commercial buildings that are now supporting real property tax revenues are to be demolished at various times over the study period, those displaced tax revenues are deducted ratably.

On balance, the Master Plan is projected to supply the County with about $3.3 million in net additional real property tax revenues on an ongoing basis after 2028, or $2.0 million in an average year of the study period. Alternatively, the 18-year study period as a whole can be seen to generate some $36 million in net additional real property taxes for the County.

Total County Government Operating Revenues (Exhibit 5-2)

In addition to real property taxes, the County obtains liquid fuel, motor vehicle weight, and other license and permit fees and taxes from residents and businesses. Based on Honolulu County revenues reported by City and County of Honolulu for FY2009, these minor County taxes and fees amount to about $216 per resident, in 2010 dollars.

The County also receives a share of transient accommodations tax or transient occupancy tax (TAT/TOT) revenues collected by the State. Currently, this share represents 19.8% of total collections.

Honolulu County also receives a 0.5% “surcharge” on all Gross Excise Tax (GET) collected by the State.[16]

Added to the real property taxes discussed above, net new taxes earned by the County as a result of the Project’s development and operations are estimated at some $4.4 million in 2028 and beyond or $2.7 million per year during the study period. These additional revenues could also be expressed as a total of about $49 million over the study period as a whole.

State Government Operating Revenues (Exhibits 5-3 and 5-4)

Operating revenues accruing to the State government are expected to derive principally from:

- GET applied to the Master Plan’s development expenditures, the spending by its residents and employees who came from out-of-State, and the maintenance fees and operating expenses incurred by owners and guests at the timeshare towers;
- The TAT and TOT on room revenues and maintenance fees associated with operations of the timeshare towers, regardless of where guests come from;

[16] Under current State law, the City receives a 0.5% excise tax surcharge less a State government administrative charge of 10%, to fund the operating and capital costs of a new public transportation rail system. This surcharge is scheduled to sunset on January 1, 2023, but is assumed for these purposes to be renewed. See City & County of Honolulu, “Comprehensive Annual Financial Report, Fiscal Year Ended June 30, 2009,” December 30, 2009.

- Individual income taxes paid by the Project's employees, including both its development- and operations-related employees; and

- Specific excise, licenses, fees, fines and other payments to the State made by those who move to Hawaii because of the Project.

Assumptions on which the above sources are estimated are shown in Exhibit 5-3.

Exhibit 5-4 applies these assumptions and shows net new operating revenues for the State at some $10 million in 2028 and annually thereafter, $10 million in an average year during the study period, and $182 million over the 18-year study period as a whole.

These projected State tax revenues are considered a conservative estimate in that they do not consider a number of other sources of State revenue, such as:

- Potential income taxes from businesses such as operating entities and ground lessors,

- Personal income tax on gratuities, bonuses or other earnings by Project employees not accounted for herein,

- Conveyance taxes on the timeshare interval sales and GET on timeshare sales commissions, and

- Conveyance and GE taxes on the ongoing resales of timeshare intervals within the Project.

Operating Expenses

Per Capita Government Operating Expenditures (Exhibits 5-5 and 5-6)

Both State and County governments can be expected to incur additional operating expenses in supporting the in-migrants that are attracted by the Project. An analysis of the County's FY2009 operating expenditures, net of Federal and State grants, suggests that the County spends some $1,550 per FTE resident and $940 per FTE visitor, in 2010 dollars. These expenditures support functions ranging from public safety and highways to recreation, as well as County debt service and benefits for its employees.

A similar analysis of State government operating expenditures for FY2008 suggests that the State spends about $5,490 per year to support government operations on behalf of each FTE resident and $1,240 per FTE visitor, in 2010 dollars.

Additional County Government Operating Expenditures (Exhibit 5-7)

The per capita budgets derived above are applied to the counts of anticipated in-migrants to the County because of employment opportunities. This results in an estimated $1.4 million in additional County government operating expenditures in 2028 and beyond, $0.9 million per year during the study period, or about $16 million total over the study period.

Additional State Government Operating Expenditures (Exhibit 5-8)

Employing an analogous methodology, the State could be expected to require up to $1.9 million more per year to support the net additional residents the Project could eventually attract, by 2028 and beyond. During the study period, the additional State burden might amount to some $1.1 million per year, or about $21 million total.

Net Fiscal Benefits (Exhibit 5-9)

Comparing the net new government operating revenues and expenditures discussed above yields the projected net fiscal benefits for the County and State governments.

- **County government** operating revenues attributable to the Master Plan are anticipated to exceed the additional operating expenses in all of the periods evaluated. By 2028, net additional operating revenues could represent some $3.0 million per year, for a sustained revenue/expenditure ratio of about 3.

  During the study period, the revenue/expenditure ratio is expected to be similar, but the total amount of net additional County revenues could be less per year, owing to the gradual build-up of tax assessed values as development progresses. Average annual net additional County revenues are projected at $1.9 million per year during this period, or about $34 million for the period as a whole.

- **The State government's** projected operating revenues are expected to exceed its additional operating expenses at even more favorable ratios. Net additional revenues are projected to amount to $7.7 million per year in 2028 and beyond, or $9 million per year during the study period. Net additional State government operating revenues for the study period as a whole are estimated at some $161 million.

  The new revenues are expected to represent nearly 9 times the associated new State government operating expenditures throughout the study period, and about 5 times the expenditures in 2028 and beyond. The decline after 2028 is largely driven by the expiration of the many State tax revenues that derive from construction activity as well as the phase-out of many of the timeshare sales and marketing positions after Project sell out.

ECONOMIC AND FISCAL IMPACT ASSESSMENT FOR THE HILTON HAWAIIAN VILLAGE MASTER PLAN

Exhibits

Exihibit 1-1
Map of Master Plan Improvements

Source: Group 70 International, Inc., 2010.

Exhibit 2-1
Project Overview

	Unit	Basis/reference		Total 2011-2028	Av. annual 2011-2028	*Stabilization, 2028+*
Key developments:[1]						
Timeshare towers -		*52 intervals sold/residence*				
Tower I	*Residences*	*300*	*total, open 3/2016*			
Developed				300	17	0
Sold				300	17	0
Tower II	*Residences*	*250*	*total, open 12/2022*			
Developed				250	14	0
Sold				250	14	0
Total timeshare units	*Residences*					
Developed				550	31	0
Sold				550	31	0
Commercial areas -	*Square feet*	*Gross leasable or usable retail, office*				
Withdrawn from service		*and/or pre-function areas*		58,910	3,273	0
Added to service				73,700	4,094	0
Net new commercial areas				14,790	822	0
Average inventory within each period:						
Timeshare -						
Tower I	*Residences*	*300*	*total, open 3/2016*			
Average no. in timeshare use					187	300
Average no. held for marketing					15	0
Average no. in hotel use					15	0
Subtotal					217	300
Tower II	*Residences*	*250*	*total, open 12/2022*			
Average no. in timeshare use					61	250
Average no. held for marketing					18	0
Average no. in hotel use					18	0
Subtotal					97	250
Total units in use					314	550
Commercial areas	*Square feet*	*Net new, after demolitions*			9,320	14,790

1 Shows major income-generating developments. Master Plan also includes a new parking area under Tower I with 132 spaces, redevelopment and/or renovations of existing parking areas, pedestrian/traffic zones, the Tapa Pool, the resort lobby and front desk, the Super Pool and other amenities.

Sources: Hilton Worldwide, Inc., 2010; Rider Levett Bucknall, 2010; Group 70 International, Inc., 2010.

Exhibit 2-2
Timeshare Use Market Mix, Utilization and Revenues
2010 dollars, in millions unless specified

	Basis/reference (not in millions)		**Total 2011-2028**	**Av. annual 2011-2028**	**Stabilization, 2028+**
Units in timeshare use		*Exhibit 2-1, average in period*		248	550
Timeshare user mix (by no. residences):		*Hilton Grand Vacations Company*			
Oahu residents	*2%*	*of units sold (Exhibit 2-1)*		5	11
Out-of-State residents	*98%*	*of units sold (Exhibit 2-1)*		243	539
Total				248	550
Utilization pattern:		*Hilton Grand Vacations Company*			
Average daily occupied units	*88%*	*average occupancy*		218	484
Average daily guests -	*3.1*	*persons per occupied unit*			
Oahu residents	*2%*	*of average units in period (above)*		13	30
Out-of-State residents	*98%*	*of average units in period (above)*		657	1,460
Total, rounded				670	1,490
Timeshare intervals:					
Number of intervals sold in period	*52*	*intervals per residence*	28,600	1,589	-
Average no. intervals in operations			N/A	12,899	28,600
Revenues from timeshare operations:					
Maintenance fee	*$1,000*	*annual, per sold interval*	$232.2	$12.9	$28.6
F&B and other	*$503*	*per occupied unit per day, out-of-State markets only* [1]	$707.5	$39.3	$87.1
Total			$939.6	$52.2	$115.7

1 Relatively high spending reflects average per person per day spending as reported by the HTA and an expected buyer market mix that is approximately 75% Japanese.

Sources: Hilton Grand Vacations Company, 2010; State of Hawaii, Hawaii Tourism Authority, 2010.

Exhibit 2-3
Hotel and Marketing Use Market Mix, Utilization and Revenues
2010 dollars, in millions unless specified

	Basis/reference (not in millions)		Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
Units covered by analysis:	*Exhibit 2-1, average in period*				
Marketing use				33	0
Hotel use				33	0
Total				66	0
Utilization pattern:	*Based on mix of marketing and hotel uses*				
Average daily occupied units	*65%*	*average occupancy*		43	0
Average daily guests -	*2.4*	*persons per occupied room*			
Oahu residents	*2%*	*Similar to timeshare users*		2	0
Out-of-State residents	*98%*	*Similar to timeshare users*		98	0
Total, rounded				100	0
Projected revenues:	*Based on mix of marketing and hotel uses*				
Rooms	*$210*	*average daily rate (all markets)*	$59.0	$3.3	$0.0
Other	*$212*	*per occupied unit per day, out-of-State markets only* [1]	$58.2	$3.2	$0.0
Total			$117.2	$6.5	$0.0

1 Spending ratio is based on average per person per day expenditures as reported by the HTA and considers a market that is largely from the US mainland.

Sources: Hilton Grand Vacations Company, 2010; State of Hawaii, Hawaii Tourism Authority, 2010.

Exhibit 2-4
Summary of Timeshare, Hotel and Marketing Utilization
2010 dollars, in millions unless specified

	Basis/reference (not in millions)	Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
Units covered by analysis:	*Exhibits 2-2 and 2-3*			
Timeshare use			248	550
Marketing and hotel uses	*Temporary uses during sales period*		66	0
Total			314	550
Utilization pattern:	*Exhibits 2-2 and 2-3*			
Average daily occupied units -				
Timeshare use			218	484
Marketing and hotel uses			43	0
Total, rounded			**260**	**480**
Average daily guests -	*Out-of-State and local residents*			
Timeshare use	*Exhibit 2-2*		670	1,490
Marketing and hotel uses	*Exhibit 2-3*		100	0
Total, rounded			**770**	**1,490**
Visitor impact[1]	*98% of average daily guests, above*		**750**	**1,460**
Projected revenues:	*Direct gross revenues*[2]			
Maintenance fee	*Exhibit 2-2*	$232.2	$12.9	$28.6
Rooms	*Exhibit 2-3*	$59.0	$3.3	$0.0
Other	*Exhibits 2-2 and 2-3*	$765.7	$42.5	$87.1
Total		**$1,056.9**	**$58.7**	**$115.7**

1 Subset of average daily guests, representing only those who originate from out-of-State.

2 Maintenance fees and room revenues reflect direct expenditures made by timeshare owners and marketing/hotel use guests, including both local and out-of-State guests. Other spending reflects only that by out-of-State residents since food, beverage and other spending by the Oahu market segment is not an impact of the Project. See Exhibit 3-1 for evaluation of the share of these revenues that are considered net new to Hawaii.

Exhibit 3-1
Visitor Expenditures in Hawaii, Average Annual
2010 dollars, in millions unless specified

		Basis/reference (not in millions)	Total 2011-2028	Av. annual 2011-2028	*Stabilization* 2028+
Direct:					
Timeshare owner uses -		*Exhibit 2-2*			
Maintenance fees	*77%*	*est. spent in HI, per HGVC*	$178.8	$9.9	$22.0
F&B and other expenditures		*Out-of-State visitors only, non-accommodation*	$707.5	$39.3	$87.1
Subtotal, timeshare owner use			**$886.2**	**$49.2**	**$109.2**
Hotel and marketing uses -		*Exhibit 2-3*			
Rooms		*All visitors*	$59.0	$3.3	$0.0
F&B and other expenditures	*98%*	*Out-of-State visitors only, non-accommodation expenses*	$57.1	$3.2	$0.0
Subtotal, hotel use			**$116.1**	**$6.4**	**$0.0**
All visitor expenditures:					
Direct		*Owners plus transient users, as shown above*	$1,002.3	$55.7	$109.2
Indirect & induced	*0.95*	*multiplier* [1]	$952.2	$52.9	$103.7
Total			**$1,954.5**	**$108.6**	**$212.9**

1 Based on Type 2 multipliers for output in the accommodations, retail and eating and drinking industries (less 1.0), State of Hawaii, Department of Business, Economic Development and Tourism, Research and Economic Analysis Division, "The 2005 State Input-Output Study for Hawaii," August 2008.

Exhibit 3-2
Economic Multipliers Applied to Development Activities

FINAL DEMAND INDUSTRY MULTIPLIERS[1]	DBEDT industrial categories applied	Final demand multipliers per $1 million project cost: Jobs[2]	FTE factor[3]
Professional services	*#45-Legal services, #46-Architectural and engineering services*	9.45	0.80
Construction:			
Timeshare towers	*#14-Construction of other buildings*	6.09	0.89
Commercial facilities and tenant improvements	*#14-Construction of other buildings*	6.09	0.89
Infrastructure	*#15-Heavy & civil engineering construction*	8.00	0.89
Other costs	*#49-Other professional services, #50-management of companies and enterprises, #52-administrative and support services*	14.60	0.80

DIRECT-EFFECT INDUSTRY MULTIPLIERS[4]	DBEDT industrial categories applied	Indirect & induced multiplier per direct: FTE job	$ Earnings[5]
Professional services	*Same as above*	1.01	0.60
Construction:			
Timeshare towers	*Same as above*	1.43	0.92
Commercial facilities and tenant improvements	*Same as above*	1.43	0.92
Infrastructure	*Same as above*	1.14	0.97
Other	*Same as above*	0.94	0.71

1 Direct impacts of development expenditures based on multipliers derived from Input-Output Transactions Table, total output vs. total jobs in sector and earnings (for multipliers), from State of Hawaii, Department of Business, Economic Development & Tourism, Research and Economic Analysis Division, "The 2005 State Input-Output Study for Hawaii," August 2008, Detailed Tables.

2 The DBEDT multipliers produce estimates of total wage, salaried and proprietary jobs, both full- and part-time (not full-time equivalent); therefore adjustment factor from DLIR data applied (see following footnote).

3 Adjustment factor applied in addition to the jobs coefficient to estimate full-time equivalent jobs at 40 hours per week. Factor derived from the 35.6 average weekly hours reported worked in the natural resources, mining and construction industries and 31.8 in professional and business services industries for the State of Hawaii for January 2007 through August 2008, as reported by Hawaii Department of Labor and Industrial Relations, at www.hawaii.gov/labor/rs, "Experimental Series for All Employee Hours and earnings on Private Non-Farm Payrolls," as accessed October 9, 2008.

4 For indirect and induced impacts of respective direct impacts. Indirect and induced factors derived from Type 2 Direct-Effect total job/total job and earnings/earnings multipliers as shown in DBEDT, Ibid.

5 Indirect and induced earnings defined to include wage, salary and proprietary incomes, plus directors' fees and employer contributions to health insurance, less employee contributions to social insurance. Direct earnings are estimated based on wage data from the State of Hawaii, Department of Labor and Industrial Relations (see Exhibit 3-5.)

Exhibit 3-3
Estimated Development Costs
2010 dollars, in millions

	Basis/reference	Total 2011-2028	Av. annual 2011-2028	*Stabilization* 2028+
Professional services	*Local shares of planning, design, engineering, legal, project management budget estimates*	$56.3	$3.1	$0.0
Construction -	*Net of contingencies, etc. (see text)*			
Timeshare towers	*Vertical construction and tenant fitout; includes new parking facility under Tower I*	$247.8	$13.8	$0.0
HHV Retail Master Plan & Rainbow Bazaar Mauka	*Vertical and adhesive package construction, includes tenant fitout*	$71.4	$4.0	$0.0
Infrastructure	*Demolition, site development, parking renovations, utilities, etc.*	$23.4	$1.3	$0.0
Subtotal		$342.5	$19.0	$0.0
Other	*Relocation, land title (excl. legal), general contractor's overhead and profit, office costs*	$28.6	$1.6	$0.0
Total, rounded		**$427.5**	**$23.7**	**$0.0**

Note: Total differs from Project cost figures that may be presented elsewhere because, for these purposes, certain costs are excluded. See accompanying text for further information.

Source: Rider Levett Bucknall, 2010

Exhibit 3-4
Development Employment, FTE Jobs

	Basis/reference	Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
Total:				
Direct jobs -	*Exhibits 3-2 and 3-3*			
Professional services		423	23	0
Construction -				
Timeshare towers		1,342	75	0
HHV Retail Master Plan & Rainbow Bazaar Mauka		387	21	0
Infrastructure		167	9	0
Other		332	18	0
Subtotal direct jobs (rounded)		**2,700**	**147**	**0**
Indirect and induced jobs (rounded)[1]	*Exhibit 3-2*	3,400	190	0
Total jobs (rounded)		**6,100**	**340**	**0**

Note: FTE = Full time equivalent, defined as 40 hours per week or 2,080 hours per year.

1 Based on weighted average of jobs multipliers for each category, as shown on Exhibit 3-2.

Exhibit 3-5
Personal Earnings from Development - Per Job and Family
2010 dollars

	Basis/reference	Av. annual 2011-2028	Stabilization, 2028+
	DLIR, 2008, inflated to 2010$ at:[1] *2.2%*		
Average per new FTE job:	with FTE factors from Exhibit 3-2 applied		
Professional services		$82,300	$0.0
Construction -			
Timeshare towers		$74,400	$0.0
HHV Retail Master Plan & Rainbow		$74,400	$0.0
Infrastructure		$74,400	$0.0
Other		$65,400	$0.0
Weighted average, total direct jobs		**$73,200**	**$0.0**
Indirect and induced jobs		$49,000	$0.0
Average per total job		**$59,000**	$0.0
Estimated average family income[2]:	*1.9 times average wage (not in millions)*		
For direct job-holders		$139,000	NA
For indirect and induced job-holders		$93,000	NA
All Project-related job-holders		**$112,000**	NA
Percent of median income[3]:	*$81,700 median family income, FY2010*		
For direct job-holders		170%	NA
For indirect and induced job-holders		114%	NA
All Project-related job-holders		**137%**	NA

Note: Direct figures exclude commissions, bonuses and benefits, as applicable.

1 State of Hawaii, Department of Labor and Industrial Relations, "Employment and Wages of Workers Covered by Hawai`i Employment Security Law and Unemployment Compensation for Federal Employees Classified by Industry for Calendar Year 2008," on http://www.hiwi.org, as accessed July 27, 2010.

2 Ratio estimated from 2008 average annual wage in Honolulu Metropolitan Statistical Area, all occupations ($42,101), as provided by State of Hawaii, Department of Labor & Industrial Relations, with adjustment to 2010 dollars based on CPI-U, and median family income in Honolulu MSA as noted below. Reflects multiple job-holders within each family as well as multiple job-holding by individuals.

3 For FY2010, Honolulu Metropolitan Statistical Area, as provided by U.S. Department of Housing & Urban Development, HUD USER, as accessed July 27, 2010, at http://www.huduser.org/portal/datasets.

Exhibit 3-6
Personal Earnings from Development - Total
2010 dollars, in millions

	Basis/reference	Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
Direct earnings[1]:	*Exhibits 3-4 and 3-5*			
Professional services		$34.8	$1.9	$0.0
Construction -				
Timeshare towers		$99.9	$5.5	$0.0
HHV Retail Master Plan & Rainbow Bazaar Mauka		$28.8	$1.6	$0.0
Infrastructure		$12.4	$0.7	$0.0
Other		$21.7	$1.2	$0.0
Subtotal, direct		**$197.6**	**$11.0**	**$0.0**
Indirect and induced earnings[2]		$166.3	$9.2	$0.0
Total earnings		**$363.9**	**$20.2**	**$0.0**

Note: Direct figures exclude commissions, bonuses and benefits, as applicable.

1 Based on average industry wages shown in Exhibit 3-5 and projected total FTE jobs in Exhibit 3-4.

2 Weighted average of estimated direct earnings by industry as shown above, and respective multipliers shown in Exhibit 3-2. Indirect and induced earnings incorporate wage, salary and proprietary incomes, plus directors' fees and employer contributions to health insurance, less employee contributions to social insurance.

Exhibit 3-7
Operational Employment, FTE Jobs

		Basis/reference	Av. annual 2011-2028	Stabilization, 2028+
Direct jobs:				
Timeshare towers -		*Hilton Grand Vacations*		
Timeshare sales & marketing	*375*	*est. FTE positions to be maintained/created*	375	135
Less conserved TS marketing positions	*(100)*	*est. existing FTE positions that would endure even without the new towers*	(100)	(100)
Operations	*0.3*	*per unit in operations, including hotel visitor and owner users*	88	154
Subtotal			363	189
Commercial and other operations -		*Hilton Hawaiian Village*		
Commercial/office (net new)	*200*	*square feet GLA per FTE job*[1]	52	67
Parking, other	*10*	*Valet parkers, life guards, pool attendants, etc.*	8	10
Subtotal			60	77
Total direct jobs associated with Project, rounded			**420**	**270**
Indirect and induced -		*Multiplier and industry category applied*[2]		
Timeshare sales & marketing	*1.33*	*Real estate, and rentals & leasing industries*	366	47
Timeshare & hotel operations	*1.10*	*Accommodations industry*	97	169
Commercial & other operations	*0.52*	*Retail, and eating & drinking industries*	31	40
Subtotal, indirect & induced jobs, rounded			490	260
Total jobs			**910**	**530**

Note: FTE = Full time equivalent, defined as 40 hours per week or 2,080 hours per year.

1 Excludes GLA of small prefunction area within Rainbow Bazaar Mauka.

2 Based on Type 2 Direct-Effect Multipliers for employment ("Total job/total job," less 1.0 each) as shown in State of Hawaii, Department of Business and Economic Development, 2008, Ibid.

Exhibit 3-8
Personal Earnings and Employee Benefits from Operations - Total
2010 dollars, in millions except where noted

		Basis/reference (not in millions)	Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
PERSONAL EARNINGS:					
Direct earnings -		*Estimated average FTE salary:*			
Timeshare sales & marketing	*$62,800*	*Average compensation for Oahu (ARDA, 2007), applied to net new sales & marketing positions only, adjusted to 2010 dollars* [1]	$310.9	$17.3	$2.2
Timeshare operations	*$33,500*		$53.0	$2.9	$5.2
Commercial and other operations	*$33,900*	*Average Honolulu retail wage (DLIR, 2008), adjusted to FTE* [2]	$36.8	$2.0	$2.6
Subtotal, direct earnings			**$400.7**	**$22.3**	**$10.0**
Indirect and induced earnings -		*Multiplier and industry category* [3]			
Timeshare sales & marketing	*1.65*	*Real estate, and rentals & leasing industries*	$513.9	$28.5	$3.6
Timeshare & hotel operations	*0.86*	*Accommodations industry*	$45.8	$2.5	$4.5
Commercial and other operations	*0.81*	*Retail, and eating & drinking industries*	$29.9	$1.7	$2.1
Subtotal, indirect & induced			$589.6	$32.8	$10.2
Total personal earnings			**$990.3**	**$55.0**	**$20.2**
EMPLOYEE BENEFITS[4]:		*Employer contributions, direct effect only*	**$112.2**	**$6.2**	**$5.0**

Note: Direct figures exclude commissions, tips, bonuses and benefits, as applicable, with exceptions: (1) all include vacation and personal time off (as part of FTE estimate) and (2) commissions for timeshare unit sales, which are included in the average compensation figure shown.

1 Hospitality Advisors LLC for American Resort Development Association ("ARDA") Hawaii Chapter, "Analysis of the State of Hawai`i Timeshare Industry," August 15, 2008, pg. 68; State of Hawaii, Department of Labor and Industrial Relations, "Employment and Wages of Workers Covered by Hawai`i Employment Security Law and Unemployment Compensation for Federal Employees Classified by Industry for Calendar Year 2008," on http://www.hiwi.org, as accessed July 27, 2010.

2 Adjustment factor of 80% applied to estimate FTE salary.

3 Based on Type II Direct-Effect Multipliers for earnings ("Earnings/earnings," less 1.0 each) as shown in DBEDT, 2008, Ibid. Earnings defined in source to include wage, salary and proprietary incomes, plus directors' fees and employer contributions to health insurance, less employee contributions to social insurance.

4 Average direct benefits for operational employees, including employer contributions to FICA, FUTA, State unemployment insurance, pension plans, group insurance (including health care), employee meals and uniforms, as applicable. Excludes personal time off and vacation time, which are incorporated into the base salaries shown above. Bases provided by Hilton Hawaiian Village and Retail Merchants of Hawaii.

Exhibit 3-9
Personal Earnings from Operations - Per Job and Family
2010 dollars

	Basis/reference		Av. annual 2011-2028	Stabilization, 2028+
Average earnings per new FTE job:	*Exhibits 3-7 & 3-8, not in millions*			
Direct jobs			$53,000	$37,000
Indirect and induced jobs			$67,000	$39,000
Average per job			**$60,000**	**$38,000**
Estimated average family income[1]:	*1.9*	*times average wage; not in millions*		
For direct job-holders			$101,000	$70,000
For indirect and induced job-holders			$127,000	$74,000
All job-holders			**$114,000**	**$72,000**
Percent of median income[2]:	*$81,700*	*median family income, FY 2010*		
For direct job-holders			124%	86%
For indirect and induced job-holders			155%	91%
All job-holders			**140%**	**88%**

Note: Direct figures exclude commissions, tips, bonuses and benefits, as applicable; however, commissions for timeshare unit sales, which are included in the average compensation figure shown.

1 Assumes that additional family income sources are at similar wage rates as HHV employee's wage. Ratio estimated from 2008 average annual wage in Honolulu Metropolitan Statistical Area, all occupations ($42,101), as provided by State of Hawaii, Department of Labor & Industrial Relations, with adjustment to 2010 dollars based on CPI-U, and median family income in Honolulu MSA as noted below. Reflects multiple job-holders within each family as well as multiple job-holding by individuals.

2 Assumes that additional family income sources are at similar wage rates as Hilton Hawaiian Village employee's wage. U.S. Department of Housing & Urban Development, HUD USER.

Exhibit 4-1
Population Impacts

	Basis/reference	Av. annual 2011-2028	Stabilization, 2028+
In-migrant residents:			
To the State[1] -	*Subset of in-migrants to County*		
Development employees	*2% of av. annual jobs (Ex. 3-4)*	7	0
Operational employees	*2% of total jobs generated (Ex. 3-7)*	18	11
Dependents[2]	*Ratio of in-migrant employees*	20	11
In-migrants to State, rounded[3]		**40**	**20**
To the County[3] -	*Includes in-migrants to State*		
Development employees	*3% of av. annual jobs (Ex. 3-4)*	10	0
Operational employees	*5% of total jobs generated (Ex. 3-7)*	46	27
Dependents[2]	*Ratio of in-migrant employees*	48	27
In-migrants to County, rounded[3]		**100**	**50**
Average daily visitors	*From out-of-State only (Exhibit 2-4), considered new to County and State*	**750**	**1,460**
De facto population impacts:	*In-migrant residents plus average daily visitors*		
To the State[1] -	*Subset of County impacts*		
Residents		40	20
Visitors		750	1,460
Total		**790**	**1,480**
To the County[3] -	*Includes State impacts*		
Residents		100	50
Visitors		750	1,460
Total		**850**	**1,510**

Source: Ratios based on discussions with management of Hilton Grand Vacations Company and Hilton Hawaiian Village.

1 Subset of County in-migrants. See footnote 3, below.

2 In-migrant dependents estimated to average 0.2 per in-migrant development employee, and 1.0 per in-migrant operational employee.

3 In-migrants to the County include all those moving to the State plus any that may move between islands due to job opportunities at the Project.

Exhibit 5-1
Real Property Taxes Generated by Development
2010 dollars, in millions except as noted

	Basis/reference (not in millions)		Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
New developments:					
Estimated assessed values -	*Improvements only (no land)*				
Timeshare towers	*$419,000*	*per unit, based on Waikikian TAV*	N/A	$131.5	$230.5
HHV Retail Master Plan & Rainbow Bazaar Mauka	*Vertical development costs less pool, Village Green, adhesive package and tenant fitout (Ex 3-3)*		N/A	$33.3	$43.2
Total additional assessed values			**N/A**	**$164.8**	**$273.6**
New RPT revenues -	*FY 2011 rates per $1,000 net taxable value*				
Improved timeshare	*$12.40*	*Hotel & resort*	$29.3	$1.6	$2.9
HHV Retail Master Plan & Rainbow Bazaar Mauka	*$12.40*	*Hotel & resort*	$7.4	$0.4	$0.5
Total new tax revenues			**$36.8**	**$2.0**	**$3.4**
Less demolitions:					
Estimated assessed values[1] -					
Commercial areas to be demolished	*58,910*	*SF, valued at Rainbow Bazaar FY2011 TAV PSF: $60*	N/A	$2.5	$3.5
Associated RPT revenues -					
Displaced tax revenues	*$12.40*	*Hotel & resort*	$0.6	$0.0	$0.0
Estimated net additional RPT			**$36.2**	**$2.0**	**$3.3**

N/A - Not applicable.

1 Assessment value per square foot based on tax assessed building assessed value of the Rainbow Bazaar in FY2011 of $2.99 million. Rainbow Bazaar represents 87% of retail spaces to be demolished. Displaced tax revenues weighted by size and year of all anticipated demolitions.

Exhibit 5-2
Total Annual Revenues to County Government Attributable to Development & In-Migrant Population
2010 dollars, in millions, except as noted

	Basis/reference (not in millions)	Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
Bases for projection:				
FTE in-migrants to County -	*Exhibit 4-1*	*Total person-years*		
Employees and their dependents		*1,860*	*100*	*50*
Spending applicable to GET	*Exhibit 5-3*	*$2,285.7*	*$126.9*	*$198.9*
Estimated tax and other revenues:				
Net new property tax revenues	*Exhibit 5-1*	$36.2	$2.0	$3.3
Taxes and other revenue sources from in-migrant residents[1]	*Other than real property taxes* *$216 per person*	$0.4	$0.0	$0.0
Transient accommodations/ occupancy taxes[2]	*19.8% of total TAT/TOT collections (Ex. 5-3)*	$2.3	$0.1	$0.2
General excise tax[3]	*0.5% County surcharge on GET*	$10.3	$0.6	$0.9
Total new County revenues		**$49.2**	**$2.7**	**$4.4**

1 Includes fuel and motor vehicle weight taxes, plus licenses & permits, fines & forfeits and charges for services from the General, Highway, Highway Beautification, Bikeway, Hanauma Bay, Golf and Special Events Funds. Excludes public service company and public utility franchise taxes, investment earnings, unrestricted grants and contributions and other sources of revenues. See City and County of See City & County of Honolulu, "Comprehensive Annual Financial Report: Fiscal Year Ended June 30, 2009," December 30, 2009.

2 Based on Honolulu County share of 44.1% of the 44.8% of the TAT revenues that are distributed among the four counties, per State tax policies in effect as of July 2010.

3 Under current State law, the City receives a 0.5% excise tax surcharge less a State government administrative charge of 10%, to fund the operating and capital costs of a new public transportation rail system. This surcharge is scheduled to sunset on January 1, 2023, but is assumed for these purposes to be renewed. See City & County of Honolulu, 2009, Ibid.

Exhibit 5-3
Bases for Projecting State Government Revenues
2010 dollars, in millions, except as noted

	Basis/reference, not in millions		Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
For GET calculations:					
Project development costs -	*Exhibit 3-3*				
Professional services			$56.3	$3.1	$0.0
Construction and other			$371.1	$20.6	$0.0
Subtotal development cost			$427.5	$23.7	$0.0
In-migrant employees & dependents to State -			*Total person-years*		
Number persons	*Exhibit 4-1*		800	40	20
Estimated number households	*2.6 persons per household*		308	15	8
In-State spending by hhds[1]	*58% of average total earnings per development and operational family (Ex. 3-6 and 3-9)*		$20.2	$1.0	$0.3
Timeshare towers:	*Direct, indirect & induced on vis. expenditures*			$18.1	
Owner expenditures	*Out-of-state owners only, Exhibit 3-1*		$1,379.6	$76.6	$169.9
Maintenance fees collected	*Exhibit 2-2, no I&I impact applied*		$232.2	$12.9	$28.6
Hotel user revenues	*Out-of-State visitors only, Exhibit 3-1*		$226.3	$12.6	$0.0
Total spending applicable to GET			$2,285.7	$126.9	$198.9
TAT/TOT:					
Transient occupancy tax:	*$142 maintenance fee allocated per day*				
Taxable basis	*50% of above, applied to occupied days*		$102.2	$5.7	$12.6
TOT collected	*7.25% of taxable basis*		$7.4	$0.4	$0.9
Transient accommodations tax:					
Hotel room revenues	*Exhibit 2-3*		$59.0	$3.3	$0.0
TAT collected	*7.25% of room revenues[2]*		$4.3	$0.2	$0.0
For individual income taxes:	*Direct, indirect & induced earnings*				
Net new personal income earned -					
Development employment	*Exhibit 3-6*		$363.9	$20.2	$0.0
Operational employment	*Exhibit 3-8*		$990.3	$55.0	$20.2
Av. personal earnings/FTE job -					
Development employment	*Exhibit 3-6 (total personal earnings)*	*Not in millions >>*	$0	$59,000	$0
Operational employment	*Exhibit 3-9 (total personal earnings)*	*Not in millions >>*	$60,000	$60,000	$38,000
For other State taxes:			*Total person-years*		
FTE in-migrants to State	*Exhibit 4-1*		800	40	20

Note: Excludes conveyance taxes on timeshare sales; GET on timeshare sales commissions; potential income taxes and GET from any operating entities or ground lease arrangements.

1 U.S. Department of labor, Bureau of Labor Statistics, "Consumer Spending Patterns in Honolulu: 2001-02", released April 30, 2004 at www.bls.gov/ro9/cexhono.htm. Estimate uses study findings showing 77.6% of pre-tax income of household units was spent, of which 75.1% were on items likely subject to Hawaii Gross Excise Tax. Excludes spending on shelter (owned dwellings), cash contributions, personal insurance and pensions. Applied to estimated in-migrant households and average of personal earnings for operational employees, as shown. Excludes potential household income from other household members.

2 A 9.25% rate, enacted by Act 61, Session Laws of Hawaii 2009, Relating to Taxation, went into effect on July 1, 2010. However, this recent increase is currently scheduled to be repealed on June 30, 2015 with the TAT rate being reinstated thereafter back to 7.25%.

Exhibit 5-4
Projected State Government Revenues
2010 dollars, in millions, except as noted

	Basis/reference (not in millions)		Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
General excise taxes, on:		*County GET surcharges accounted for on Ex. 5-2*			
Development[1]			$11.9	$0.7	$0.0
Spending by in-migrants to State	*4.0%*	*of employee & dependent spending*	$0.8	$0.0	$0.0
Spending associated with TS towers	*4.0%*	*of operating revenues (unit sales not considered)*	$73.5	$4.1	$7.9
TAT and TOT, on:					
Owner and transient use revenues	*55.2%*	*State share of total collections*[2]	$6.4	$0.4	$0.5
Individual income taxes[3]:					
Development employees					
Estimated average family income		*Direct, indirect & induced, Exhibit 3-5, not in mils*	$112,000	$112,000	$0
Adjusted gross family income	*75%*	*of total family income , not in millions*	$84,000	$84,000	$0
Applicable tax rate on AGI			6.8%	6.8%	0.0%
Total income tax		*Tax rate applied to total MP earnings (Ex. 3-6)*	$24.8	$1.4	$0.0
Operational employees					
Estimated average family income		Direct, indirect & induced, Exhibit 3-9, not in mils	$114,000	$114,000	$72,000
Adjusted gross family income	*75%*	*of total family income, not in millions*	$85,500	$85,500	$54,000
Applicable tax rate on AGI		Adjusted gross income estimated at 75%	6.5%	6.5%	5.9%
Total income tax		*Based on number of FTE jobs, Exhibit 3-7*	$64.8	$3.6	$1.2
Other taxes and revenues from in-migrants[4]	*$257*	*per in-migrant shown in Exhibit 4-1*	$0.2	$0.0	$0.0
Total, additional revenues			**$182.5**	**$10.1**	**$9.6**

Note: Excludes conveyance taxes on timeshare sales; GET on timeshare sales commissions; potential income taxes and GET from any operating entities or ground lease arrangements.

1 Based on 4% on 100% of professional services and 60% of construction costs, plus a wholesale construction materials tax of 0.5% against 40% of construction costs.

2 Based on State tax policies as accessed August 2, 2001.

3 Based on average family incomes for all Project-related job holders as shown previously, and on 2009 Hawaii Tax Table, for married taxpayers filing joint returns. Adjusted Gross Incomes estimated as a percent of total average family earnings, considering potential deductions.

4 Based on total FY 2008 State tax revenue receipts as reported by State of Hawaii, "Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2008," statement of revenues, expenditures and changes in fund balances. Includes tobacco and liquor taxes, liquid fuel tax, and licenses and fees. Excludes fines & forfeitures, franchise tax, rental motor vehicle surcharge tax, public service companies tax, tax on premiums of insurance companies and other fees.

Exhibit 5-5
City and County of Honolulu Governmental Expenses
Net of Intergovernmental Revenues (State and Federal)
Fiscal Year July 1, 2008 to June 30, 2009

	Expenditures ($thousands)	Service population[1]	Expenditures (not in thousands) per: Resident	Visitor
Primary government:				
Governmental activities -				
General government	$444,701	900,700	$494	$0
Public safety	$372,843	936,500	$398	$398
Highways and streets	$51,916	936,500	$55	$55
Sanitation	$5,130	936,500	$5	$5
Human services	$83,647	900,700	$93	$0
Culture and recreation	$110,390	936,500	$118	$118
Utilities or other enterprises	$52,166	936,500	$56	$56
Debt service (principal and interest)	$83,048	936,500	$89	$89
Subtotal	$1,203,841		$1,308	$721
Business-type activities -				
Housing	$13,711	900,700	$15	$0
Sewer	$178,944	936,500	$191	$191
Solid waste	$154,158	936,500	$165	$165
Public transportation	$209,645	936,500	$224	$224
Subtotal	$556,458		$595	$580
Less: State & Federal contributions	($355,530)	936,500	($380)	($380)
Total, in FY09 dollars	**$1,404,769**		**$1,523**	**$921**
Total, rounded, in 2010 dollars, based on increase of[2]		2.1%	**$1,550**	**$940**

1 Averages of resident and de facto population estimates for July 1, 2008 and July 1, 2009, as obtained from U.S. Census Bureau, Population Division, reported by State of Hawai`i, Department of Business, Economic Development and Tourism.

2 Based on Honolulu CPI-U to 2009 ad DBEDT forecast to 2010, as reported by U.S. Department of Labor, Bureau of Labor Statistics at http://data.bls.gov, accessed July 2010, and State of Hawaii, Department of Business, Economic Development and Tourism, 2010.

Source: City and County of Honolulu, "Comprehensive Annual Financial Report: Fiscal Year Ended June 30, 2009," December 30, 2009, "Statement of Activities for the Fiscal Year Ended June 30, 2009."

Exhibit 5-6
State of Hawai`i Government Expenses
Net of Intergovernmental Revenues (Federal)
Fiscal Year July 1, 2007 to June 30, 2008

	Operating expenditures ($thousands)	Service population[1]	Expenditures (not in thousands) per: Resident	Visitor
Governmental activities:				
General government	$548,439	1,282,200	$428	$0
Public safety	$414,463	1,391,900	$298	$298
Highways	$490,754	1,391,900	$353	$353
Conservation of natural resources	$74,411	1,391,900	$53	$53
Health	$895,413	1,282,200	$698	$0
Welfare	$1,877,188	1,282,200	$1,464	$0
Lower education	$2,385,056	1,282,200	$1,860	$0
Higher education	$815,116	1,282,200	$636	$0
Other education	$23,206	1,282,200	$18	$0
Culture and recreation	$107,676	1,391,900	$77	$77
Urban redevelopment and housing	$187,861	1,282,200	$147	$0
Economic development and assistance	$157,421	1,282,200	$123	$0
Interest expense	$140,032	1,391,900	$101	$101
Less: Intergovernmental revenues	($1,807,376)	1,282,200	($1,410)	$0
Subtotal	$6,309,660		$4,846	$882
Business-type activities:				
Airports	$354,554	1,391,900	$255	$255
Harbors	$80,344	1,391,900	$58	$58
Unemployment compensation	$159,098	1,282,200	$124	$0
Nonmajor proprietary fund	$22,619	1,391,900	$16	$16
Less: Federal grants to Airports Division	($24,958)	1,391,900	($18)	($18)
Subtotal	$591,657		$435	$311
Total, in FY08 dollars	**$6,901,317**		**$5,280**	**$1,193**
Total, rounded, in 2010 dollars, based on increase of[2]		4.0%	**$5,490**	**$1,240**

Note: General government includes legislative expenses; line items may include debt service and employee benefit expenses within each. Excludes expenses of "Component Units" including the University of Hawaii, Housing and Community Development Corporation of Hawaii, Hawaii Health Systems Corporation and Hawaii Hurricane Relief Fund. The first three charge for services, and receive capital and operating grants and contributions.

1 Averages of resident and de facto population estimates for July 1, 2007 and July 1, 2008, as obtained from U.S. Census Bureau, Population Division, reported by State of Hawai`i, Department of Business, Economic Development and Tourism.

2 Based on Honolulu CPI-U to 2009 ad DBEDT forecast to 2010, as reported by U.S. Department of Labor, Bureau of Labor Statistics at http://data.bls.gov, accessed July 2010, and State of Hawaii, Department of Business, Economic Development and Tourism, 2010.

Source: State of Hawaii, Department of Accounting and General Services, "State of Hawaii: Comprehensive Annual Financial Report For the Fiscal Year Ended June 30, 2008," Summary Schedule of Changes in Net Assets (for expenses) and Statement of Revenues, Expenditures and Changes in Fund Balances and Net Assets (for intergovernmental expenses).

Exhibit 5-7
Annual County Government Expenditures Attributable to De Facto Population Increase
2010 dollars, in millions, except where noted

	Basis/reference (not in millions)			**Total 2011-2028**	**Av. annual 2011-2028**	**Stabilization, 2028+**
Bases for County projection -				*Total person-years*		
FTE in-migrants to County		*Exhibit 4-1*		*1,860*	*100*	*50*
Visitors from off-island		*Exhibit 4-1*		*13,500*	*750*	*1,460*
Annual expenditures -						
FTE in-migrants to County	*$1,550*	*per person, ref:*	*Exhibit 5-5*	$2.9	$0.2	$0.1
Visitors from off-island	*$940*	*per person, ref:*	*Exhibit 5-5*	$12.7	$0.7	$1.4
Subtotal new County expenditures				**$15.6**	**$0.9**	**$1.4**

Exhibit 5-8
Annual State Government Expenditures
Attributable to De Facto Population Increase
2010 dollars, in millions, except where noted

	Basis/reference (not in millions)			**Total 2011-2028**	**Av. annual 2011-2028**	**Stabilization, 2028+**
Bases for State projection -				*Total person-years*		
FTE in-migrants to State		*Exhibit 4-1*		*800*	*40*	*20*
Visitors from out-of-State		*Exhibit 4-1*		*13,500*	*750*	*1,460*
Annual expenditures -						
FTE in-migrants to State	*$5,490*	*per person, ref:*	*Exhibit 5-6*	$4.4	$0.2	$0.1
Visitors from out-of-State	*$1,240*	*per person, ref:*	*Exhibit 5-6*	$16.7	$0.9	$1.8
Subtotal new State expenditures				**$21.1**	**$1.1**	**$1.9**

Exhibit 5-9
County & State Government Revenue and Expenditure Comparison
2010 dollars, in millions

	Basis/reference	Total 2011-2028	Av. annual 2011-2028	Stabilization, 2028+
City and County of Honolulu:				
New revenues	*Exhibit 5-2*	$49.2	$2.7	$4.4
New expenditures	*Exhibit 5-7*	$15.6	$0.9	$1.4
Net additional revenues		$33.7	$1.9	$3.0
Revenue ÷ expenditure ratio[1]		**3.2**	**3.2**	**3.1**
State of Hawaii:				
New revenues[2]	*Exhibit 5-4*	$182.5	$10.1	$9.6
New expenditures	*Exhibit 5-8*	$21.1	$1.1	$1.9
Net additional revenues		$161.4	$9.0	$7.7
Revenue ÷ expenditure ratio[1]		**8.6**	**8.8**	**5.0**

N/A - Not applicable.

1 New revenues divided by new expenditures. Calculated where denominator (additional expenses) exceeds zero.

2 Excludes conveyance taxes on timeshare sales; GET on timeshare sales commissions; potential income taxes and GET from any operating entities or ground lease arrangements.

ECONOMIC AND FISCAL IMPACT ASSESSMENT FOR THE HILTON HAWAIIAN VILLAGE MASTER PLAN

Appendix

Appendix 1: Report Conditions

This assessment incorporates information provided by government agencies, Hilton World International, Inc. (Hilton Worldwide), Hilton Grand Vacations Company, (HGVC), Group 70 International, Inc. (Group 70), and other sources as cited in the exhibits. While attempts have been made to verify information used via multiple sources, it is not always possible to do so. Mikiko cannot guarantee the accuracy of all information upon which its assessments may be based.

Mikiko has no responsibility to update this report or any of the underlying data for events and circumstances occurring after August 2, 2010, the date of substantial completion of primary data collection.

This report is for the planning purposes of Hilton Worldwide, HGVC, Group 70 and their consultants, as well as for public disclosure of the nature of the Project pursuant to seeking State and County land entitlements. It is not intended to be used to solicit investment.