Volume II of II

Final Environmental Assessment (APPENDICES)

PROPOSED DOWNTOWN KIHEI PROJECT

TMK Nos. (2) 3-9-002:030, 076, 080, and 158

Prepared for:

The Krausz Companies, Inc.

Approving Agency:

Maui Planning Commission

March 2013

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VOLUME II OF II

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APPENDIX A.

Development Plans

Site Development Plan

August 30, 2012

NORTH

0' 50' 100' 150' 200' 250' 300'

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.

44 Montgomery St, Ste 3300, San Francisco, CA 94104 | Tel 1415732 5800

PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII

STOUTENBOROUGH INC

Architects and Planners

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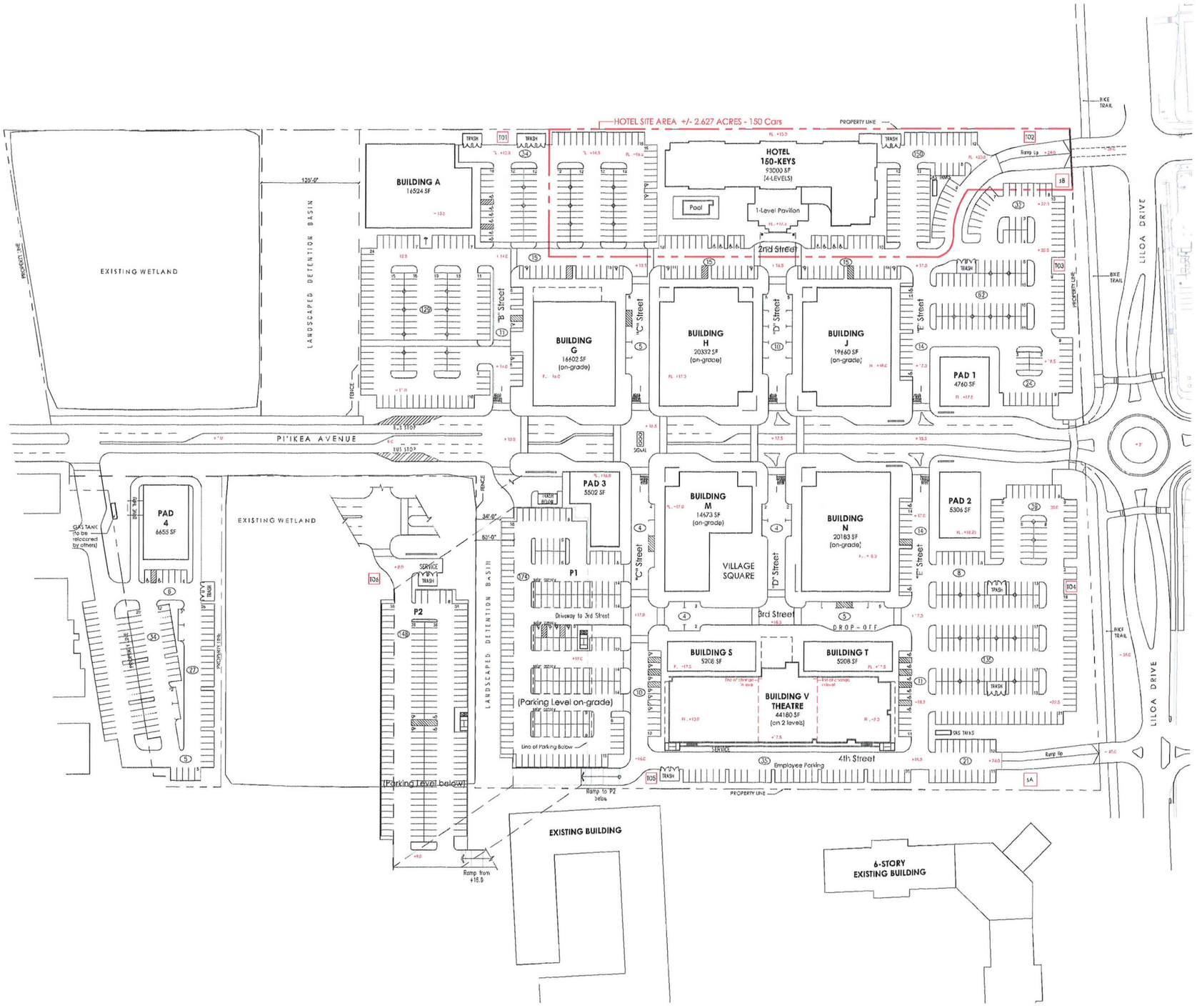

TABULATION SUMMARY

North Site Area	13.5 Acres		
Building Name	Building Area (sf)	Parking Required (Pursuant to Ordinance 3662 Bill No. 49 ; 2009)	Parking Provided
Ground Level			
Building A	16,524	33 cars @ 2 cars / 1000 sf	
Building G	16,602	33 "	
Building H	20,332	41 "	
Building J	19,660	39 "	
Pad 1	4,760	10 "	
Total Ground Level Bldg Area	**77,878 sf**	**156 cars**	
Second Level			
Building G (Mecical)	14,198	45 cars @ 3.2 cars / 1000 sf	
Building H	11,736	23 cars @ 2 cars / 1000 sf	
Building J	11,132	22 cars @ 2 cars / 1000 sf	
Total Second Level Bldg Area	**37,066 sf**	**91 cars**	
Hotel (4 Levels)			
150 Keys	93,000	150 cars @ 1 car / key	
Total Building Area	**93,000 sf**	**150 cars**	
Restaurant Allowance (Additional)			
10,000 sf of GLA		48 cars @ 8 cars / 1000 sf of dining area o 6000 sf*	
*1) **Total Restaurant & Medical Allowance**		**48 cars (additional)**	
Total Gross Leasable Area (North Side)	**207,944 sf**	**445 cars required**	**515 cars provided**

South Site Area	12.6 Acres		
Building Name	Building Area (sf)	Parking Required (Pursuant to Ordinance 3662 Bill No. 49 ; 2009)	Parking Provided
Ground Level			
Building M	14,673	29 cars @ 2 cars / 1000 sf	
Building N	20,183	40 "	
Pad 3	5,502	11 "	
Pad 2	5,306	11 "	
Building S	5,208	10 "	
Building T	5,208	10 "	
*2) Building V (Theatre)	44,180	245 cars @ 1 car / 6 seats	
Pad 4	6,655	40 cars @ 10 cars / 1000 sf of dining area o 3993 sf*	
Total Ground Level Bldg Area	**106,915 sf**	**398 cars**	
Second Level			
Building M (Office)	15,056	30 cars @ 2 cars / 1000 sf	
Building N (Service, Retail & Rest.)	20,183	40 "	
Total Second Level Bldg Area	**35,239 sf**	**70 cars**	
Restaurant Allowance (Additional)			
20,000 sf of GLA		96 cars @ 8 cars / 1000 sf of dining area o 12000 sf*	
Total Restaurant & Medical Allowance		**96 cars (additional)**	
Total Gross Leasable Area (South Side)	**142,154 sf**	**564 cars required**	**684 cars provided**
Total Project Area (North & South Sites)	**350,098 sf**	**1009 cars required**	**1199 cars provided 19 % over requirement**

* Note:

1) Dining Room area of restaurant is assumed at 60% of GLA
2) Theatre is 44180 sf on 2 levels at 30 sf / seat = 1472 seats @ 1 car / 6 seats

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HOTEL SITE AREA +/- 2.627 ACRES - 150 Cars

PROPERTY LINE

HOTEL
3 - UPPER LEVELS

BUILDING A

EXISTING WETLAND

2nd Street

"B" Street

"C" Street

"D" Street

"E" Street

BUILDING G
14198 SF

BUILDING H
11736 SF

BUILDING J
11132 SF

PAD 1

LILOA DRIVE

PI'IKEA AVENUE

PAD 4

EXISTING WETLAND

PAD 3

BUILDING M
15056 SF

BUILDING N
20183 SF

PAD 2

Solar Canopy

BLDG S

BLDG T

BUILDING V
THEATRE
THEATRE - 44180 SF (on 2 levels)

4th Street

NORTH

Second Level Plan on Site

August 30, 2012

0' 50' 100' 200' 300'

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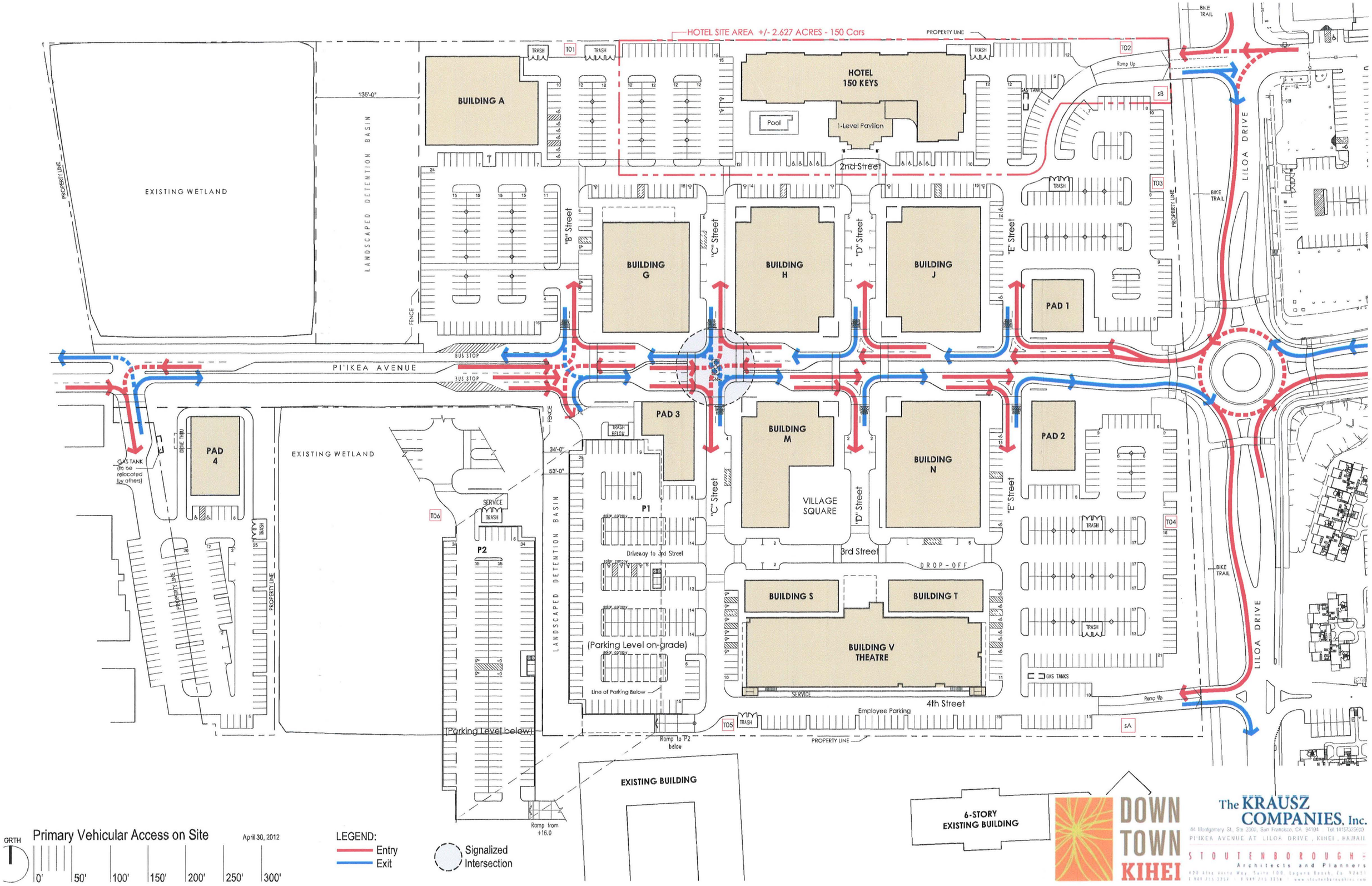
HOTEL SITE AREA +/- 2.627 ACRES - 150 Cars
PROPERTY LINE
BIKE TRAIL
HOTEL
150 KEYS
Pool
1-Level Pavilion
2nd Street
Ramp Up
GAS TANKS
BUILDING A
EXISTING WETLAND
LANDSCAPED DETENTION BASIN
135'-0"
FENCE
"B" Street
"C" Street
"D" Street
"E" Street
BUILDING G
BUILDING H
BUILDING J
PAD 1
LILOA DRIVE
PI'IKEA AVENUE
BUS STOP
PAD 3
BUILDING M
BUILDING N
PAD 2
VILLAGE SQUARE
PAD 4
GAS TANK (To be relocated by others)
DRIVE THRU
TRASH BELOW
34'-0"
53'-0"
P1
P2
SERVICE
TRASH
Driveway to 3rd Street
(Parking Level on-grade)
Line of Parking Below
(Parking Level below)
3rd Street
DROP-OFF
BUILDING S
BUILDING T
BUILDING V
THEATRE
4th Street
Employee Parking
Ramp to P2 below
Ramp from +16.0
EXISTING BUILDING
6-STORY
EXISTING BUILDING
TO1
TO2
TO3
TO4
TO5
TO6
sA
sB
NORTH
Primary Vehicular Access on Site
April 30, 2012
0'
50'
100'
150'
200'
250'
300'
LEGEND:
Entry
Exit
Signalized Intersection
DOWN TOWN KIHEI
The KRAUSZ COMPANIES, Inc.
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PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII
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View of Village Square towards Hotel

April 23, 2012

Key Plan

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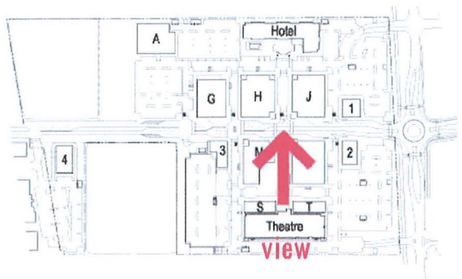
View along Pi'ikea Avenue towards Hotel

April 23, 2012



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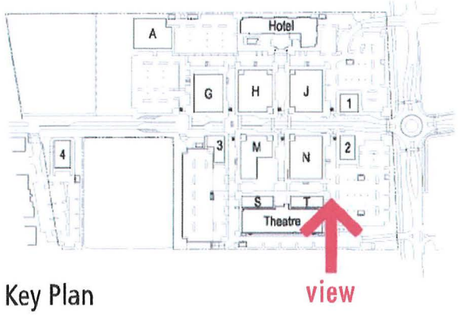
View of Shops from Parking Field

April 23, 2012



Key Plan

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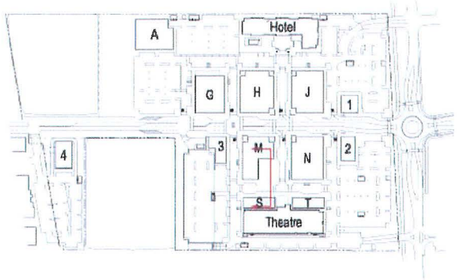
cascading pond



Key Plan

Section / Elevation - West

April 23, 2012

NORTH

0' 5' 10' 15' 20' 25'

DOWN TOWN KIHEI

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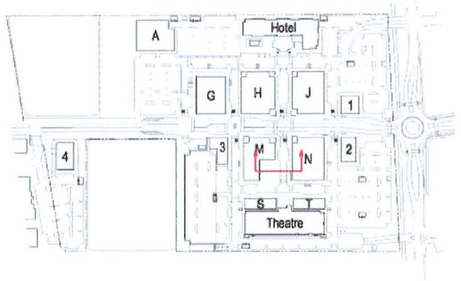

Key Plan

Section / Elevation - North

April 23, 2012

NORTH

0' 5' 10' 15' 20' 25'

DOWN TOWN KIHEI

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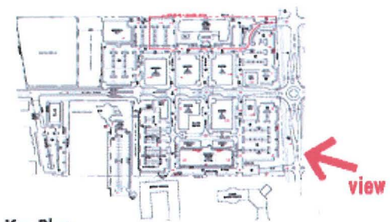
View from Bike Path along Liloa Avenue



Key Plan

NORTH

Site Section

0' 20' 40' 60' 80' 100' 120'

June 24, 2012

DOWN TOWN KIHEI

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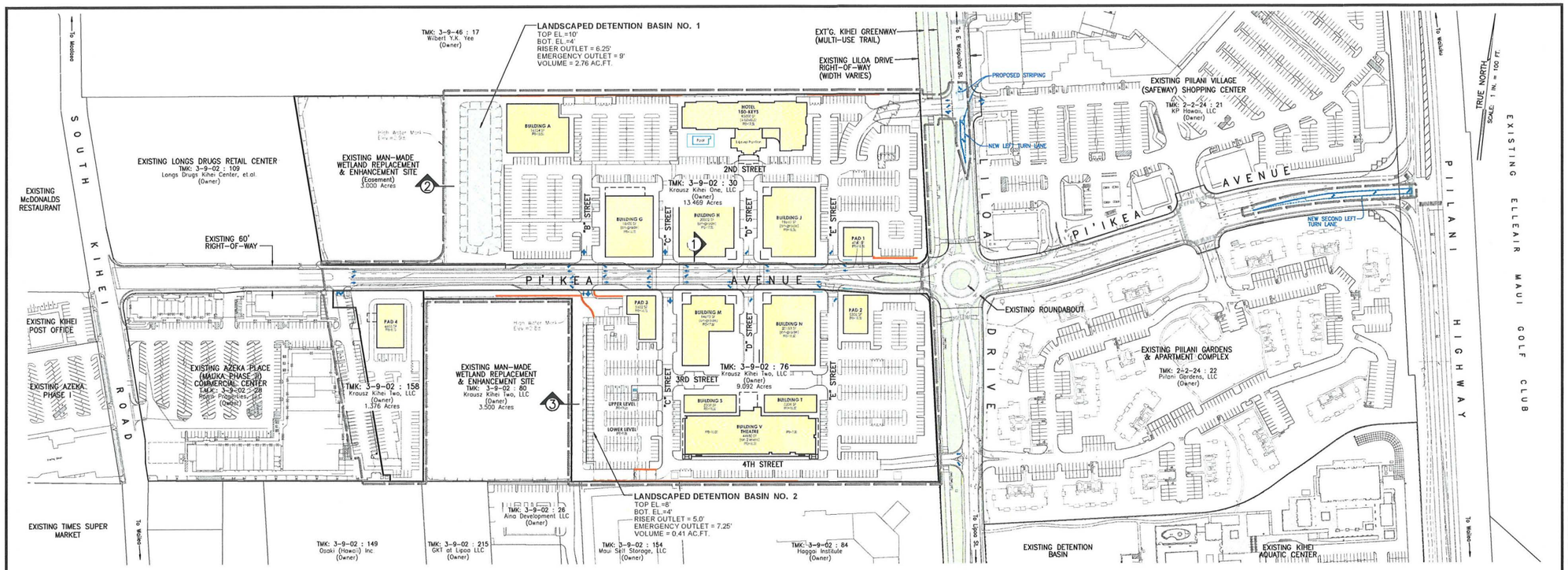
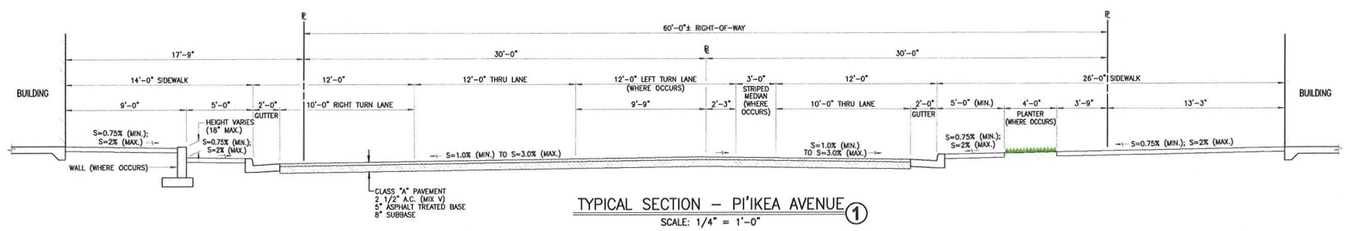
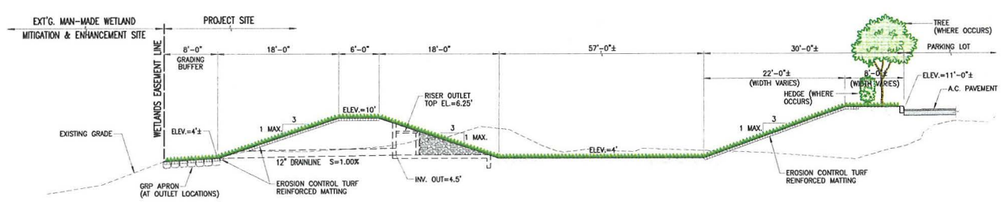




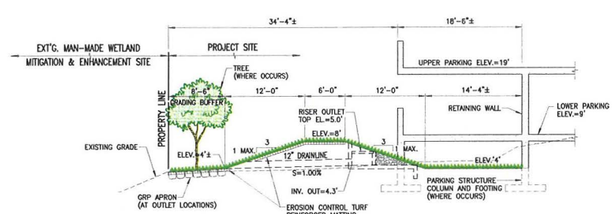
TYPICAL SECTION – PI'IKEA AVENUE (1)

SCALE: 1/4" = 1'-0"



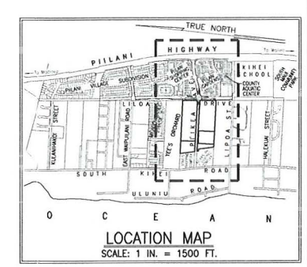
TYPICAL SECTION – NORTH DETENTION BASIN (2)

SCALE: 1/8" = 1'-0"



TYPICAL SECTION – SOUTH DETENTION BASIN (3)

SCALE: 1/8" = 1'-0"



LOCATION MAP

SCALE: 1 IN. = 1500 FT.

LEGEND:

- NEW PAVEMENT AREA
- PROPOSED BUILDINGS WITH I.D. AND SIZE
- PROPOSED OFFSITE ROADWAY IMPROVEMENTS
- PROPOSED RETAINING WALLS
- LIMITS OF PROJECT
- PAVEMENT ARROWS

No.	Date	Revision

Consultant:

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HAWAII, U.S.A.

Signature: License Expires April 30, 2014

DATE

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Project:

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The KRAUSZ COMPANIES, Inc.

(PLAN DATED APRIL 23, 2012
BASED ON STOUTENBOROUGH SITE)
T.M.K.: (2) 3-9-002 : 30, 76 & 80
PI'IKEA AVENUE / LILOA DRIVE
KIHEI, MAUI, HAWAII

WARREN S. UNEMORI, ENGR'G., INC.

WARREN S. UNEMORI, ENGINEERING, INC.
Civil & Structural Engineers
Land Surveyors
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Job: 06059.00
Issue Date: 4/27/2012
Proj. Engr: C.N.M.
Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:

CONCEPTUAL GENERAL SITE PLAN

Sheet:

C-1

Of:

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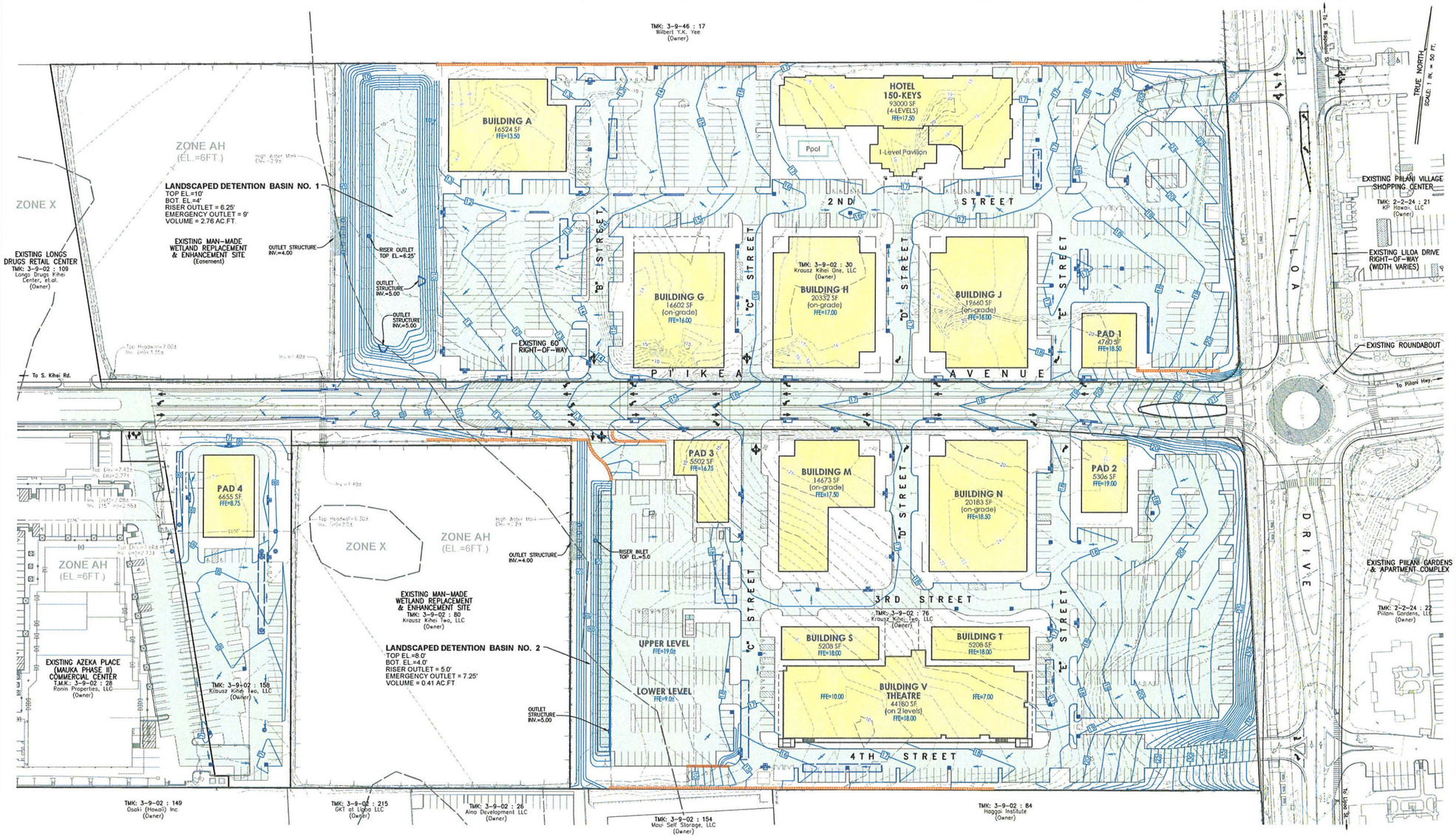


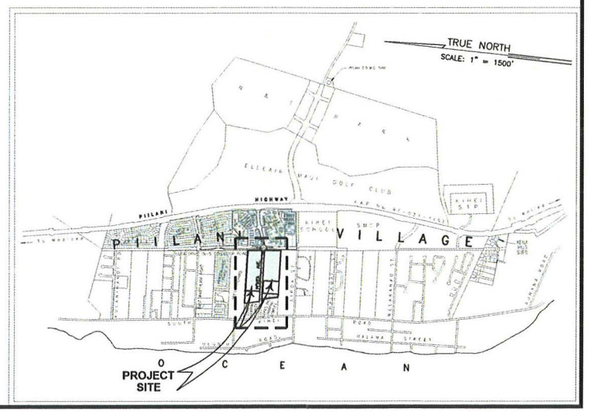
LEGEND:

- GRATED INLET CATCH BASIN
- CURB INLET CATCH BASIN
- DRAIN MANHOLE
- ROOF DOWNSPOUT (CONFIRM LOCATION AND SIZE WITH ARCHITECT PLANS)
- SLOTTED DRAIN PIPE
- DRAIN CLEANOUT TO GRADE
- SUBSURFACE DETENTION SYSTEM
- EXISTING SPOT ELEVATION
- EXISTING POWER POLE
- EXISTING POWER POLE W/ GUY WIRE
- EXISTING LIGHT POLE
- EXISTING TRANSFORMER
- EXISTING HANDHOLE OR HANDHOLE GROUP
- EXISTING SEWER MANHOLE
- EXISTING DRAIN MANHOLE
- EXISTING WATER METER W/ BACKFLOW PREVENTER
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXT'G. GRADES WITH ELEVATION
- CONCEPTUAL FINISH GRADE CONTOURS & BUILDING ELEVATIONS
- FEMA FLOOD INSURANCE RATE MAP ZONE
- TOP OF BANK
- BOTTOM OF BANK
- PROPOSED BUILDINGS WITH I.D. & SIZE
- NEW PAVEMENT AREA
- PROPOSED RETAINING WALLS
- FLOW DIRECTION
- F.F.E. FINISH FLOOR ELEVATION
- EXISTING TREES

EARTHWORK ANALYSIS

SITE	APPROXIMATE EARTHWORK QUANTITIES			GRADING AREA
	EXCAVATION	EMBANKMENT	NET	
NORTH PARCEL TMK: 3-9-02 : 30	23,000	34,000	11,000 (FILL)	*10.47 ACS.
SOUTH PARCEL TMK: 3-9-02 : 76	28,000	35,000	7,000 (FILL)	9.09 ACS.
WEST PARCEL TMK: 3-9-02 : 158	50	1,800	1,750 (FILL)	1.37 ACS.
PI'IKEA AVENUE	1,600	5,000	2,400 (FILL)	1.50 ACS.

*(EXCLUDES WETLAND AREA)



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Issue Date: 4/27/2012
Proj. Engr: C.N.M.
Drawn By: D.P.T.
Checked By: A.L.U.

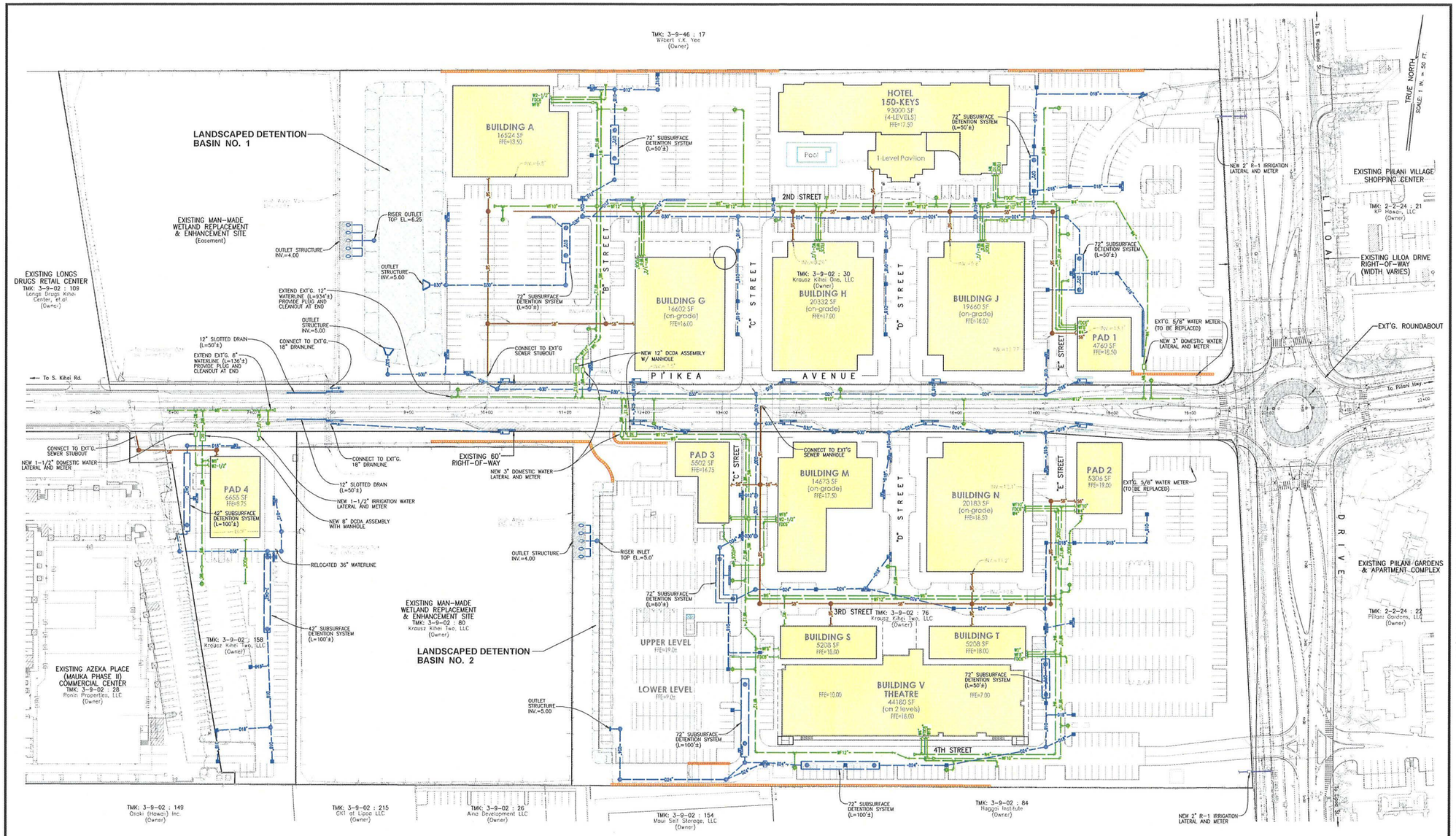
Sheet Title:

CONCEPTUAL SITE AND GRADING PLAN

Sheet:

C-2

Of:



LEGEND:

- GRATED INLET CATCH BASIN
- CURB INLET CATCH BASIN
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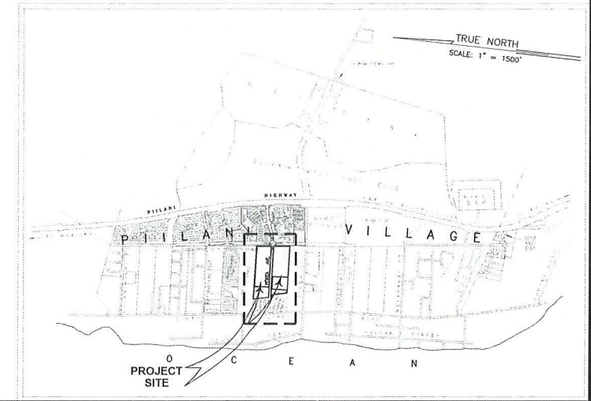
- ROOF DOWNSPOUT (CONFIRM LOCATION AND SIZE WITH ARCHITECT PLANS)
- SLOTTED DRAIN PIPE
- DRAIN CLEANOUT TO GRADE
- SUBSURFACE DETENTION SYSTEM
- DRAINLINE W/ SIZE
- GREASE TRAP
- SEWER MANHOLE
- SEWER CLEANOUT TO GRADE
- SEWERLINE W/ SIZE
- WATER METER
- DETECTOR CHECK ASSEMBLY
- WATER ARV MANHOLE
- WATER VALVE
- FIRE HYDRANT
- FIRE DEPT. CONNECTION
- WATERLINE FOR FIRE SERVICE W/ SIZE
- WATERLINE FOR DOMESTIC SERVICE W/ SIZE
- RECLAIMED WATERLINE W/ SIZE
- TRASH ENCLOSURE
- NEW PAVEMENT AREA
- PROPOSED BUILDINGS WITH I.D. AND SIZE
- PROPOSED RETAINING WALLS
- EXISTING SEWER FORCE MAIN W/ SIZE
- EXISTING IRRIGATION WATERLINE W/ SIZE
- EXISTING DRAINLINE W/ SIZE
- EXISTING SEWERLINE W/ SIZE
- EXISTING WATERLINE W/ SIZE
- EXISTING RECLAIMED WATERLINE W/ SIZE
- EXISTING POWER POLE W/ GUY WIRE
- EXISTING HANDHOLE OR HANDHOLE GROUP
- EXISTING SEWER MANHOLE
- EXISTING DRAIN MANHOLE
- EXISTING WATER METER W/ BACKFLOW PREVENTER
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT



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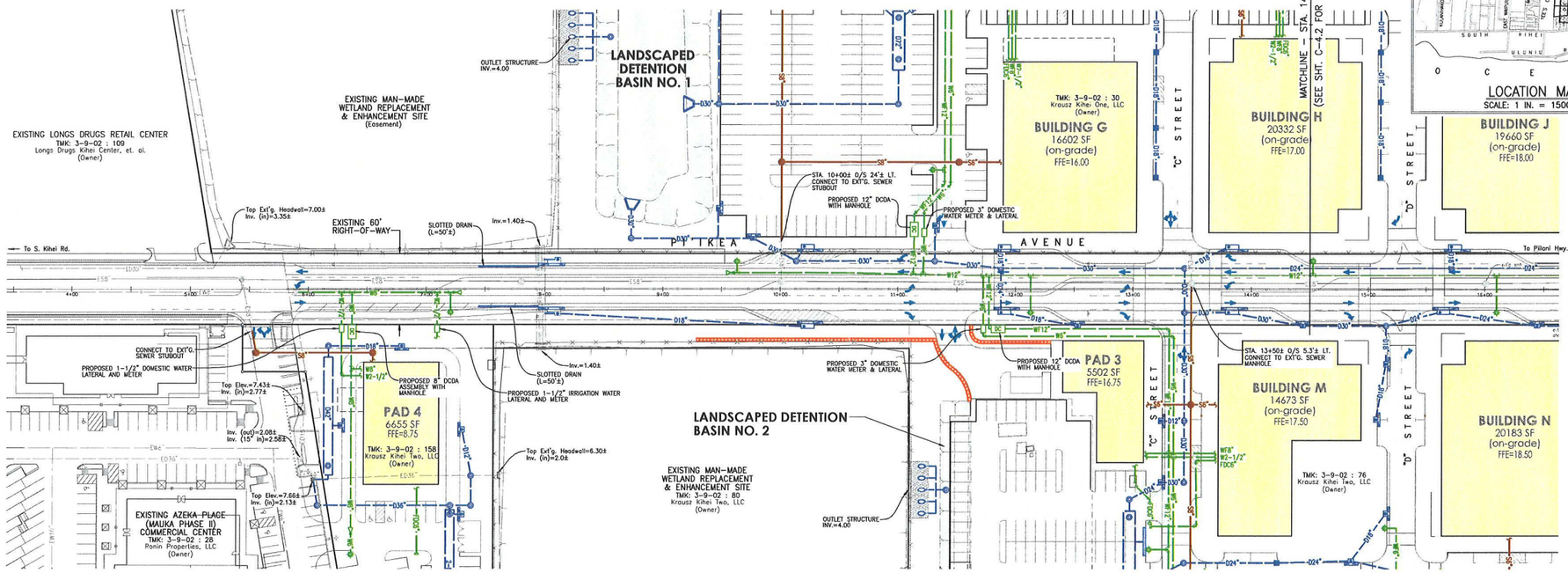
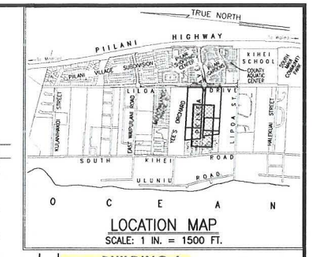
CONCEPTUAL UTILITY PLAN

Sheet:
C-3

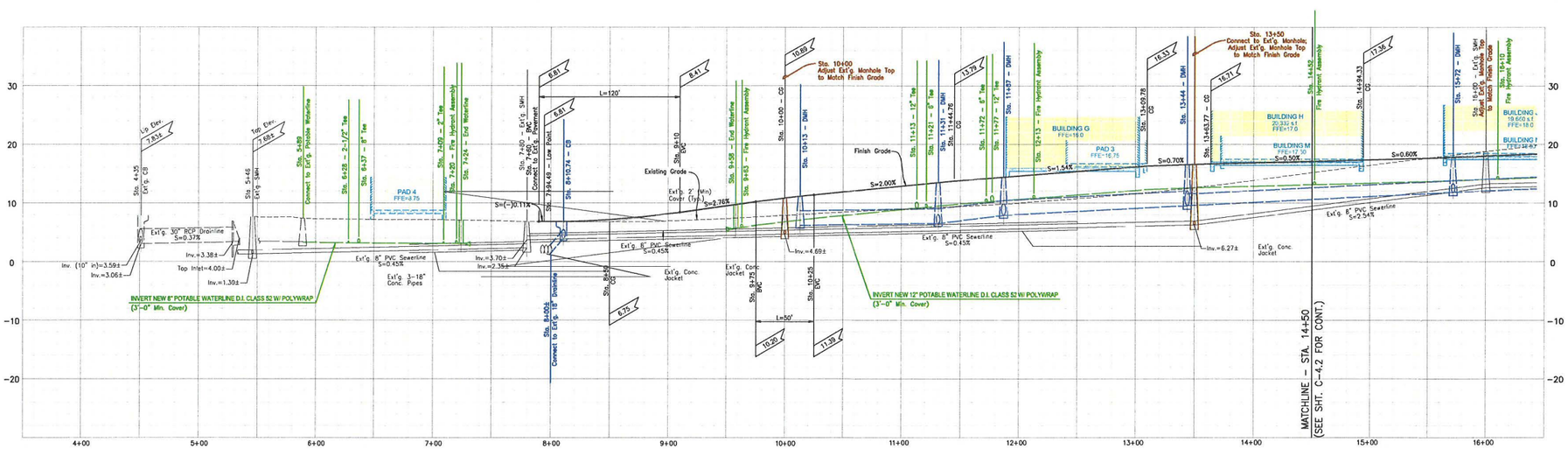
Of:



PLAN
Scale: 1 in. = 40 ft.



LOCATION MAP
SCALE: 1 IN. = 1500 FT.



PROFILE – PI'IKEA AVENUE RECONSTRUCTION
Scale: Horiz. 1" = 40'
Vert. 1" = 8'

LEGEND:

- GRATED INLET CATCH BASIN
- CURB INLET CATCH BASIN
- DRAIN MANHOLE
- ROOF DOWNSPOUT (CONFIRM LOCATION AND SIZE WITH ARCHITECT PLANS)
- SLOTTED DRAIN PIPE
- DRAIN CLEANOUT TO GRADE
- SUBSURFACE DETENTION SYSTEM
- D24" DRAINLINE W/ SIZE
- GREASE TRAP
- SEWER MANHOLE
- SEWER CLEANOUT TO GRADE
- 8" SEWERLINE W/ SIZE
- WATER METER
- DC DETECTOR CHECK ASSEMBLY
- WATER ARV MANHOLE
- WATER VALVE
- FIRE HYDRANT
- FIRE DEPT. CONNECTION
- W12" WATERLINE FOR FIRE SERVICE W/ SIZE
- W4" WATERLINE FOR DOMESTIC SERVICE W/ SIZE
- RW12" RECLAIMED WATERLINE W/ SIZE
- NEW PAVEMENT AREA
- PROPOSED BUILDINGS W/ NUMBER AND SIZE
- PROPOSED RETAINING WALLS
- PAVEMENT ARROWS
- ESFM8" EXISTING SEWER FORCE MAIN W/ SIZE
- EIRR8" EXISTING IRRIGATION WATERLINE W/ SIZE
- EDR24" EXISTING DRAINLINE W/ SIZE
- ES8" EXISTING SEWERLINE W/ SIZE
- EW8" EXISTING WATERLINE W/ SIZE
- ERW12" EXISTING RECLAIMED WATERLINE W/ SIZE
- EXISTING POWER POLE W/ GUY WIRE
- EXISTING HANDHOLE OR HANDHOLE GROUP
- EXISTING SEWER MANHOLE
- EXISTING DRAIN MANHOLE
- EXISTING WATER METER W/ BACKFLOW PREVENTER
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT

NOTE:

1. CONTRACTOR SHALL ADJUST ELEVATIONS OF ALL EXISTING WATER, SEWER, DRAIN, ELECTRICAL, LANDSCAPING AND CURBING TO MATCH REVISED ROADWAY PROFILE GRADES.
2. EXISTING INVERTS AS SHOWN ON THE PLANS ARE FROM AVAILABLE AS-BUILTS AND NEED TO BE VERIFIED IN THE FIELD.

No.	Date	Revision

Consultant:

CLIFFORD N. MOON
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NO. 6667-C
HAWAII, U.S.A.

License Expires: April 30, 2014
SIGNATURE DATE

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Project:

DOWNTOWN KIHEI
The KRAUSZ COMPANIES, Inc.

(PLAN DATED APRIL 23, 2012
BASED ON STOUTENBOROUGH SITE)
T.M.K.: (2) 3-9-002 : 30, 76 & 80
PI'IKEA AVENUE / LILOA DRIVE
KIHEI, MAUI, HAWAII

WARREN S. UNEMORI, ENGR'G., INC.

WARREN S. UNEMORI, ENGINEERING, INC.
Civil & Structural Engineers
Land Surveyors
2145 Wells Street
Suite 403
Wailuku, HI 96793

Job: 06059.00
Issue Date: 4/27/2012
Proj. Engr: C.N.M.
Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:
PLAN & PROFILE:
PI'IKEA AVE. RECONSTRUCTION

Sheet:
C-4.1

Of:

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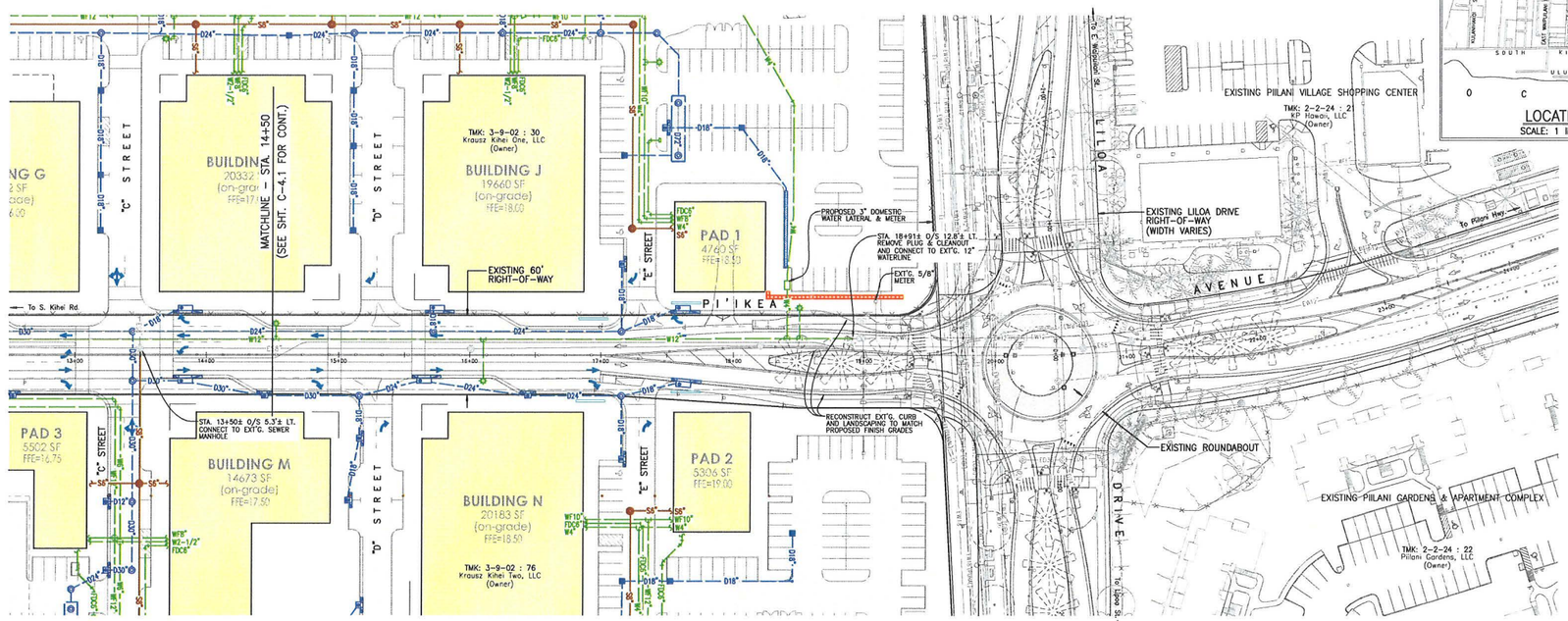
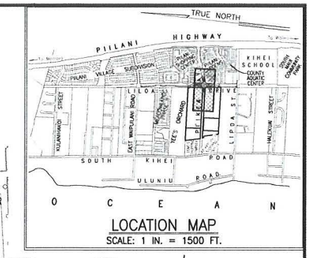
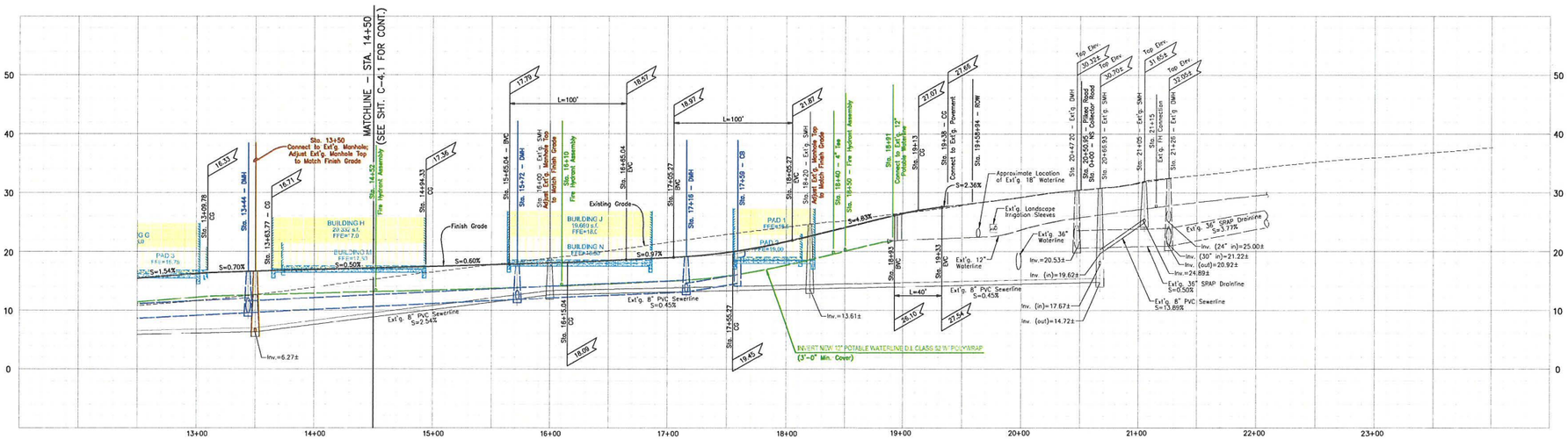


PLAN
Scale: 1 in. = 40 ft.



LOCATION MAP
SCALE: 1 IN. = 1500 FT.



PROFILE – PI'IKEA AVENUE RECONSTRUCTION
Scale: Horiz. 1" = 40'
Vert. 1" = 8'

LEGEND:

- GRATED INLET CATCH BASIN
- CURB INLET CATCH BASIN
- DRAIN MANHOLE
- ROOF DOWNSPOUT (CONFIRM LOCATION AND SIZE WITH ARCHITECT PLANS)
- SLOTTED DRAIN PIPE
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- SEWER CLEANOUT TO GRADE
- SEWERLINE W/ SIZE
- WATER METER
- DETECTOR CHECK ASSEMBLY
- WATER ARV MANHOLE
- WATER VALVE
- FIRE HYDRANT
- FIRE DEPT. CONNECTION
- WATERLINE FOR FIRE SERVICE W/ SIZE
- WATERLINE FOR DOMESTIC SERVICE W/ SIZE
- RECLAIMED WATERLINE W/ SIZE
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SIGNATURE DATE

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Project:

DOWNTOWN KIHEI
The KRAUSZ COMPANIES, Inc.

(PLAN DATED APRIL 23, 2012
BASED ON STOUTENBOROUGH SITE)
T.M.K.: (2) 3-9-002 : 30, 76 & 80
PI'IKEA AVENUE / LILOA DRIVE
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WARREN S. UNEMORI, ENGR'G., INC.

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Job: 06059.00
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Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:
PLAN & PROFILE:
PI'IKEA AVE. RECONSTRUCTION

Sheet:
C-4.2

Of:

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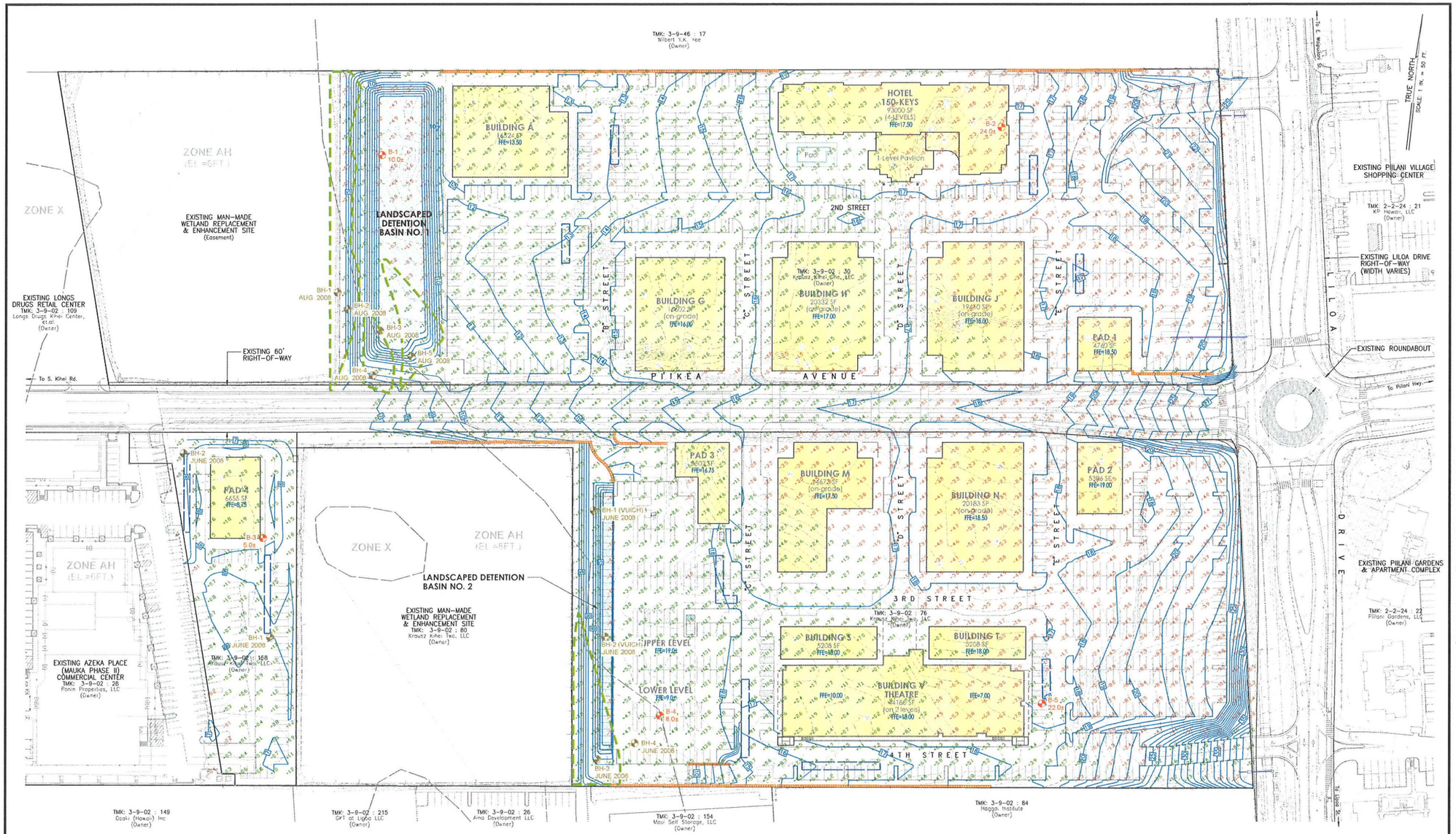

LEGEND:

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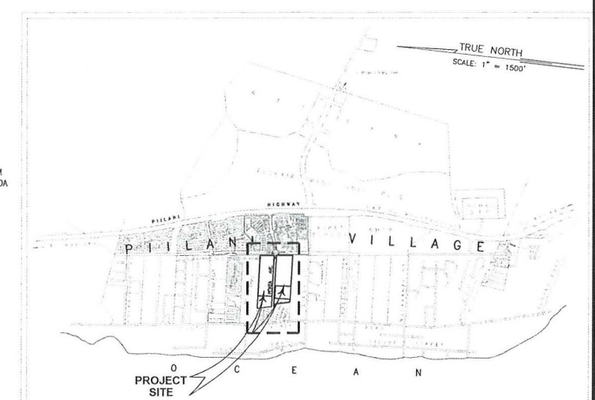
	EXTG. GRADES WITH ELEVATION
10	PROPOSED FUTURE FINISH GRADES FOR ONSITE IMPROVEMENTS
FFE	FINISH FLOOR ELEVATION
	FEMA FLOOD INSURANCE MAP ZONES
	PROPOSED RETAINING WALL
B-4 8.0±	BORING OR TEST PITS (WITH NUMBER AND APPROX.. ELEVATION (FROM THE "PRELIMINARY SUBSURFACE INVESTIGATION REPORT, PI'IKEA-LILOA COMMERCIAL MIXED-USE PROJECT", BY FEWELL GEOTECHNICAL ENGINEERING LTD.; DATED SEPTEMBER 30, 2005).
BH-4 JUNE 2008	BOREHOLE LOCATIONS (FROM THE "WETLANDS SURVEY-PIIKEA PROPERTY" CONDUCTED BY MALAMA ENVIRONMENTAL (MEV, LLC). DATED JUNE 13, 2008 AND AUGUST 27, 2008).
	APPROXIMATE LOCATION OF MARGINAL WETLAND CONDITIONS (FROM THE "WETLANDS SURVEY-PIIKEA PROPERTY" CONDUCTED BY MALAMA ENVIRONMENTAL (MEV, LLC), DATED JUNE 13, 2008 AND AUGUST 27, 2008).

EARTHWORK ANALYSIS

SITE	APPROXIMATE EARTHWORK QUANTITIES			GRADING AREA
	EXCAVATION	EMBANKMENT	NET	
NORTH PARCEL TMK: 3-9-02 : 30	23,000	34,000	11,000 (FILL)	*10.47 ACS.
SOUTH PARCEL TMK: 3-9-02 : 76	28,000	35,000	7,000 (FILL)	9.09 ACS.
WEST PARCEL TMK: 3-9-02 : 158	50	1,800	1,750 (FILL)	1.37 ACS.
PI'IKEA AVENUE	1,600	5,000	2,400 (FILL)	1.50 ACS.

*(EXCLUDES WETLAND AREA)



No.	Date	Revision

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Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:
EARTHWORK ANALYSIS

Sheet:
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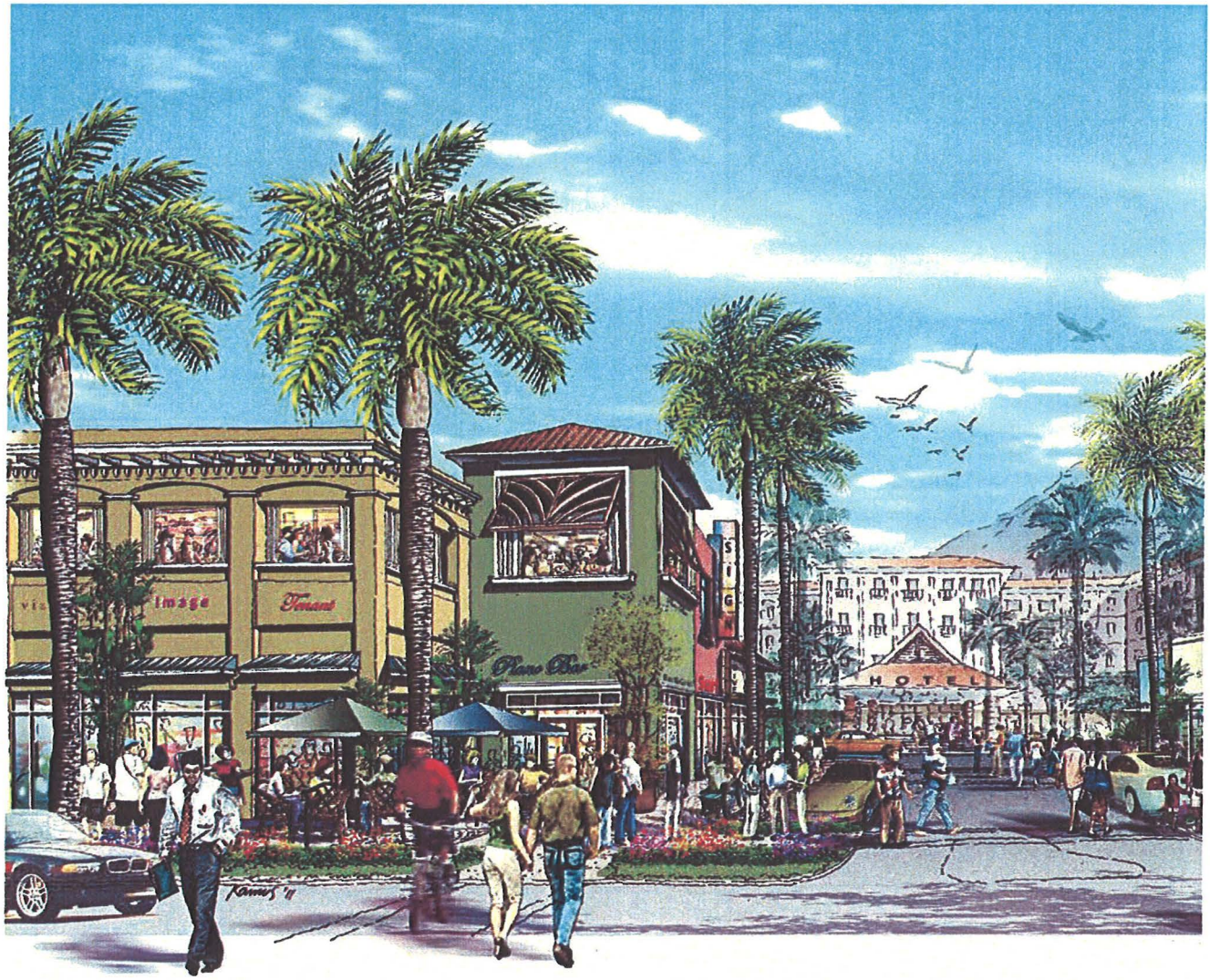
Of:

APPENDIX A-1.

Design Guidelines

DOWNTOWN KIHEI

DESIGN GUIDELINES



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*(11 x 17 Sheets)

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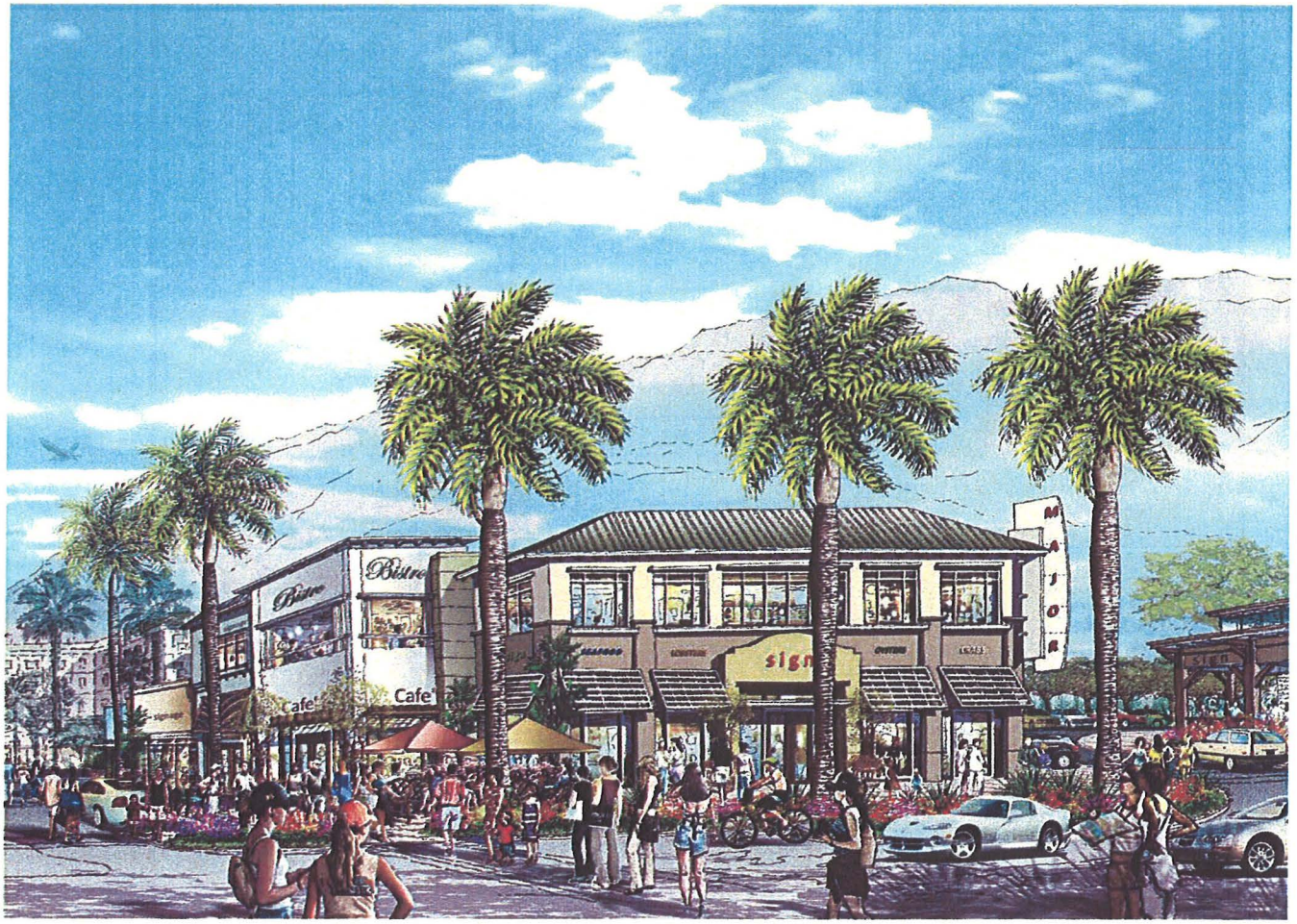
*(11 x 17 Sheets)

INTRODUCTION

Downtown Kihei is a development encompassing approximately 13.5 acres on the North Site Area and 12.6 acres on the South Site Area, with a total building square footage of approximately 350,000, and parking for approximately 1200 cars. These Development Guidelines are intended to establish and control the quality of design for Downtown Kihei. The Guidelines address the design aspects of the project, including site planning, landscape architecture, architecture of the buildings, traffic, water consumption, and exterior lighting. These guidelines are intended to enhance the coordination and organization of the site, while maintaining a compatible relationship with the community and adjoining developments.

All development on the site must comply with these Guidelines. In the event of any conflict between the County of Maui, County zoning code and these Guidelines, the County zoning shall prevail, except where these Development Guidelines are more restrictive.



GENERAL INFORMATION

The objective of the **site plan** is to establish a functional and attractive organization of the buildings, circulation corridors, parking and service areas that will enhance the identity and efficiency of the project.

The objective for the **landscape design** is to create a distinctive environment that compliments the site plan and building architecture, reinforces the vehicular roadways and pedestrian walkways, provides shade for pedestrian comfort and visual relief for the parking areas, screens service areas and maintains street continuity at points of ingress and egress to the project. The landscape design is intended to incorporate (where appropriate) native Hawaiian and drought-tolerant plant materials that have low-medium water use requirements.

Also the objective of the landscape design is to unify Downtown Kihei and integrate it into the existing community.

The **exterior lighting** objective is to create a safe and distinctive nighttime environment while limiting adverse impacts on surrounding development.

The **architectural design** intent is to create distinctive buildings appropriate to the endeavors and activities contemplated, while maintaining an overall character which is consistent with forms and materials found on the island of Maui.

SUSTAINABILITY

Downtown Kihei is being designed as a sustainable project and is registered with the US Green Building Council (USGBC). Sustainability, as it relates to the built environment and to the human condition, is the long-term maintenance of well being which has environmental, economic and social dimensions.

Downtown Kihei is defined by the USGBC as a sustainable project for the following reasons:

- Downtown Kihei is a mixed-use project. It houses commercial uses such as retail and restaurants as well as hotel, entertainment and office uses. Public access and community uses are also incorporated. This mix of uses reduces parking demand and provides for an efficient use of the site area – allowing for outdoor public spaces to be enjoyed by all.

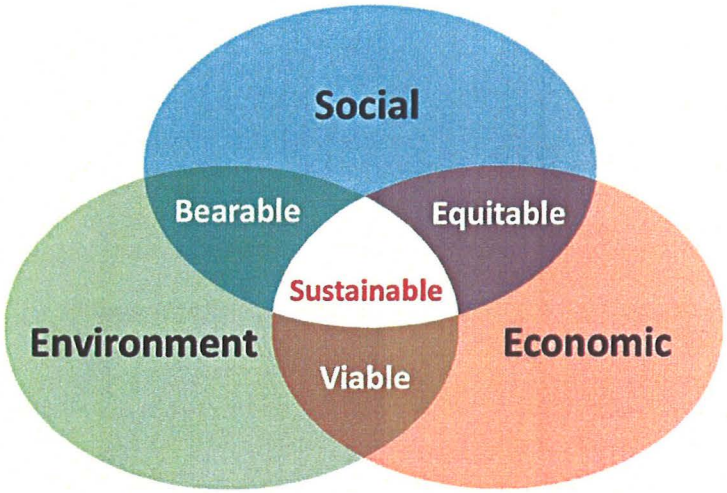
- The project is connected to the public bus transportation system and is designed to be a friendly environment for bicycle and pedestrian use while also providing electrical charging of low-emitting and fuel efficient vehicles on site.

- The project is designed with the intent to reduce water consumption by more than 20% over the Energy Policy Act of 1992.

- All buildings are designed to optimize energy performance and provide for on-site renewable energy.

- The project will be constructed with regional and recycled materials when possible.

Downtown Kihei embraces sustainable objectives by balancing economic realities with social and ecological consequences, providing a way of living that reduces consumption of resources per person.



SITE PLANNING

Parking Design Criteria

Purpose

To provide a sufficient number of stalls to accommodate the demands of Downtown Kihei. Off-street parking shall be provided in accordance with Maui County Code and these Development Guidelines.

Off-Street Parking Requirements

The shopping center will allow for parking and cross access in accordance with Chapter 19.36A, Maui County Code.

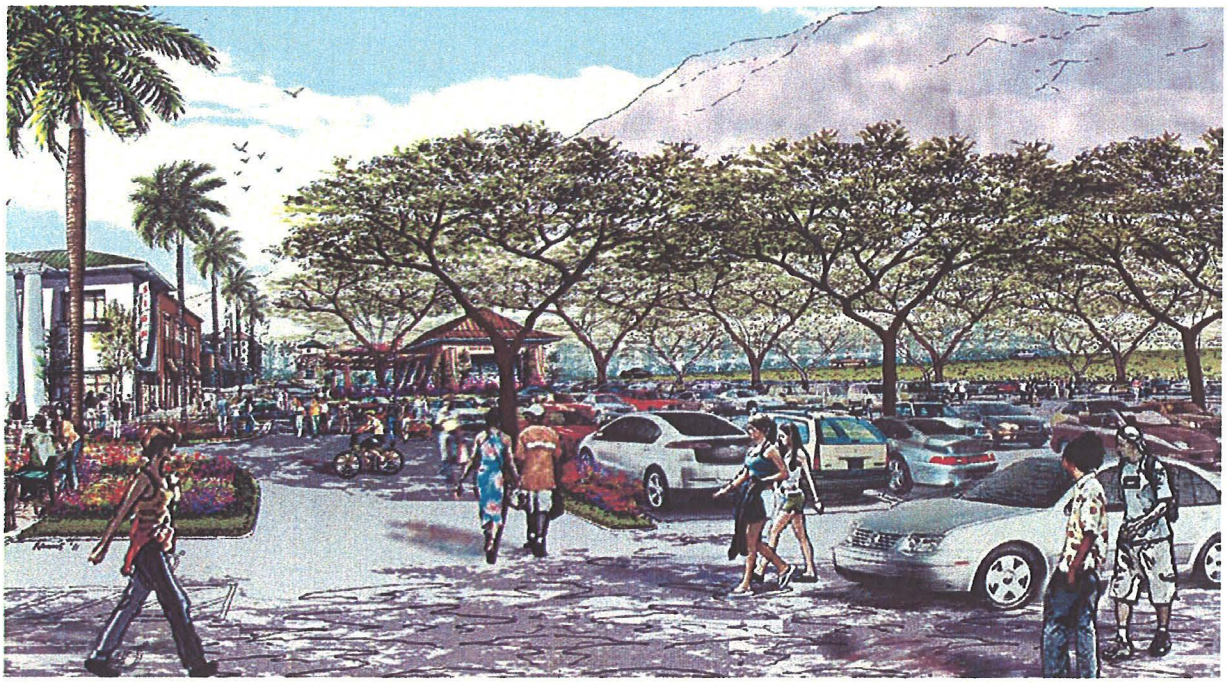
Handicap Parking

Parking design and requirements for handicapped parking shall follow the Americans with Disabilities Act (ADA) standards.

Employee Parking

Where employee parking is required by an employer it shall be identified as employee parking.

The size and location of parking shall follow Typical Off-Street Parking Drawing and Design Standards for County of Maui, Hawaii.



SITE PLANNING

Parking Design Criteria

Landscape Areas

Landscape guidelines for the parking lot area are set forth in the landscape section.

Truck Loading and Unloading Area

All uses which receive large amounts of good shall provide a loading and unloading area to handle the goods. The maximum size is 12' wide by 40' in length with 14' clearance in height.

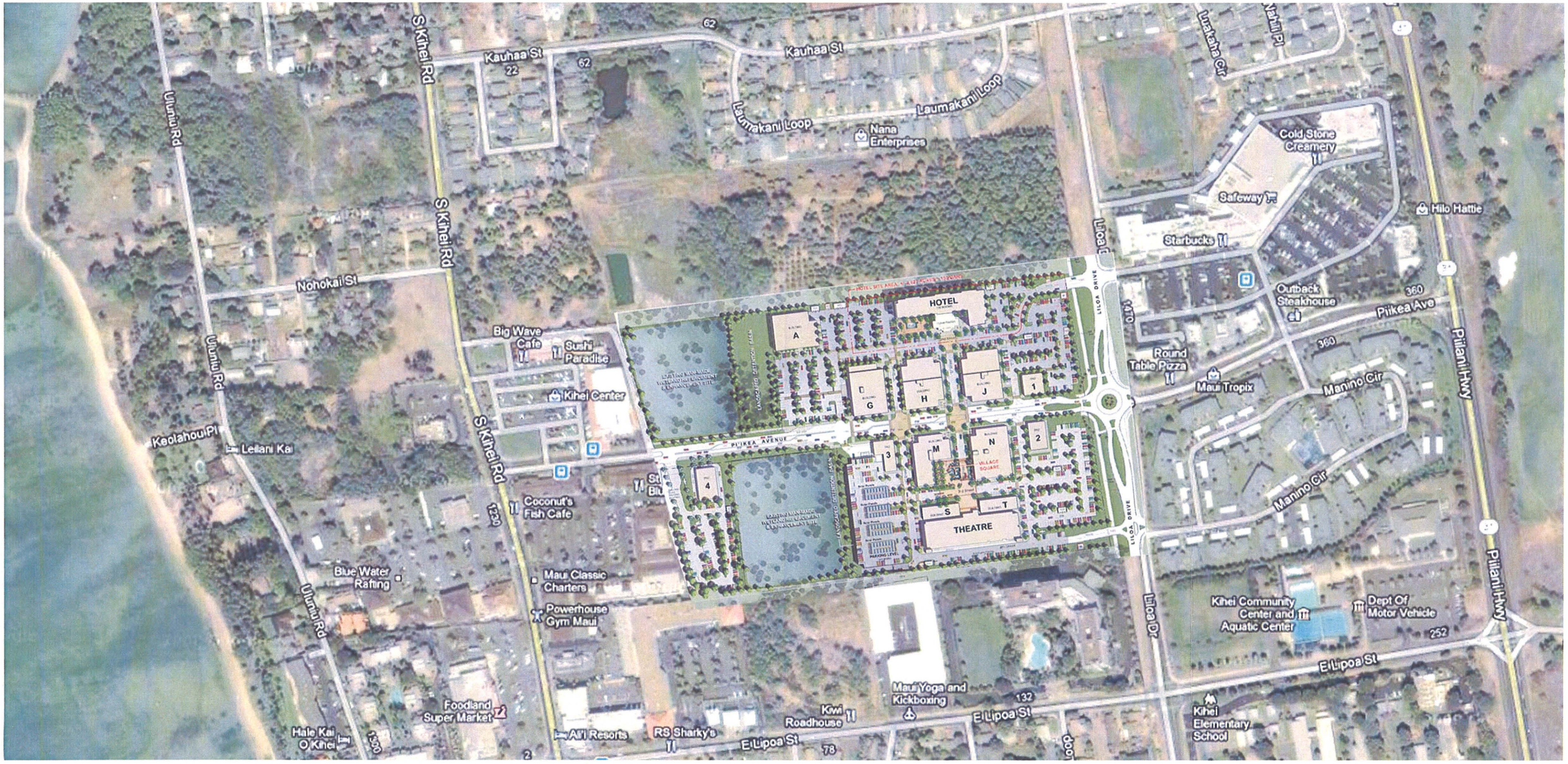
Passenger Loading Area

The area shall be located adjacent to the building and shall be designed in a way not to impede vehicular circulation. The minimum size is 8' wide by 36' in length.

Bicycles

Bicycle parking facilities shall be provided for each commercial use as follows:

Grocery, Medical, Retail and Service Uses	1 bicycle space for every 25 car spaces required
Restaurants/Bars	1 bicycle space for every 50 car spaces required



Vicinity Plan

December 20, 2012

NORTH

0' 100' 200' 400' 600' 800'

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.
44 Montgomery St., Ste 3300, San Francisco, CA 94104 : Tel.14157325600
PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII

STOUTENBOROUGH INC
Architects and Planners
420 Alta Vista Way, Suite 100, Laguna Beach, Ca 92651
T 949 715 3257 | F 949 715 3254 | www.stoutenboroughinc.com

Site Development Plan

November 2, 2012

NORTH

0' 50' 100' 150' 200' 250' 300'

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.

44 Montgomery St., Ste 3300, San Francisco, CA 94104 Tel 14157325602

P'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII

STOUTENBOROUGH LLP

Architects and Planners

420 Alta Vista Way, Suite 100, Laguna Beach, Ca 92651

T 949 715 3257 | F 949 715 3256 | www.stoutenborughllp.com

HOTEL SITE AREA +/- 2.627 ACRES - 150 Cars

PROPERTY LINE

EXISTING WETLAND

LANDSCAPED DETENTION BASIN

135'-0"

BUILDING A

HOTEL
150 KEYS

Pool

1-Level Pavilion

2nd Street

BUILDING G

BUILDING H

BUILDING J

PAD 1

"B" Street

"C" Street

"D" Street

"E" Street

PI'IKEA AVENUE

BUS STOP

PAD 3

BUILDING M

BUILDING N

PAD 2

VILLAGE SQUARE

3rd Street

DROP-OFF

BUILDING S

BUILDING T

BUILDING V
THEATRE

SERVICE

4th Street

Employee Parking

Ramp Up

LILOA DRIVE

BIKE TRAIL

GAS TANKS

TRASH

TO1

TO2

TO3

TO4

TO5

TO6

SA

SB

FENCE

PAD 4

DRIVE THRU

GAS TANK (to be relocated by others)

EXISTING WETLAND

34'-0"

53'-0"

P1

Driveway to 3rd Street

(Parking Level on-grade)

Line of Parking Below

P2

(Parking Level below)

Ramp to P2 below

Ramp from +16.0

EXISTING BUILDING

6-STORY
EXISTING BUILDING

NORTH

Primary Vehicular Access on Site

April 30, 2012

0' 50' 100' 150' 200' 250' 300'

LEGEND:

Entry

Exit

Signalized Intersection

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.

44 Montgomery St., Ste 3300, San Francisco, CA 94104 ; Tel 14157325660

PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII

STOUTENBOROUGH

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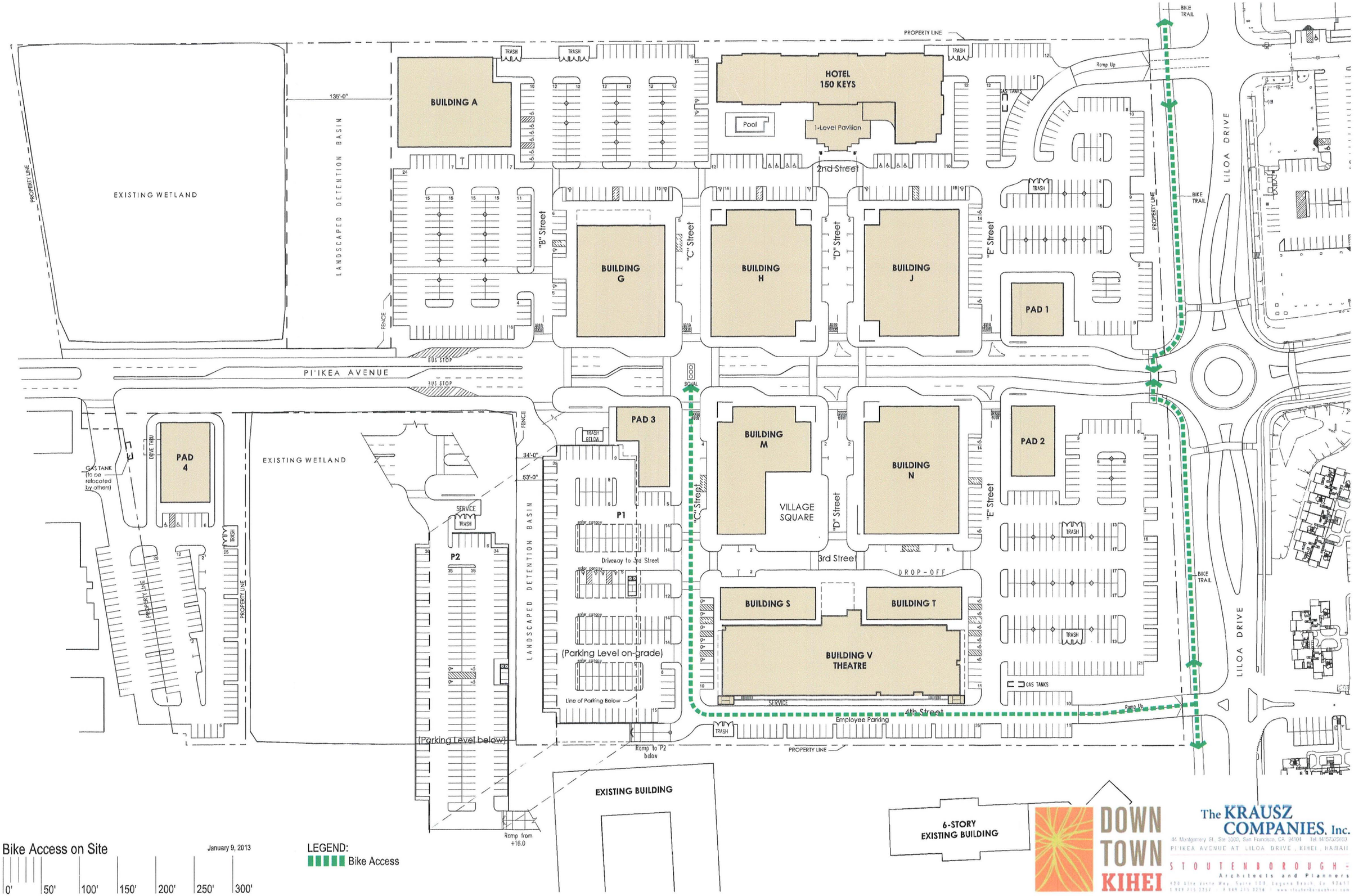
430 Alta Vista Way, Suite 100, Laguna Beach, Ca 92651

T 949 715 3257 | F 949 715 3256 | www.stoutenboroughinc.com


PROPERTY LINE
BIKE TRAIL
TRASH
HOTEL
150 KEYS
Pool
1-Level Pavilion
Ramp Up
GAS TANKS
BUILDING A
135'-0"
EXISTING WETLAND
LANDSCAPED DETENTION BASIN
2nd Street
"B" Street
"C" Street
"D" Street
"E" Street
BUILDING G
BUILDING H
BUILDING J
PAD 1
LILOA DRIVE
FENCE
BUS STOP
PI'IKEA AVENUE
SIGNAL
PAD 3
BUILDING M
BUILDING N
PAD 2
PAD 4
DRIVE THRU
GAS TANK (to be relocated by others)
34'-0"
53'-0"
TRASH BELOW
VILLAGE SQUARE
SERVICE
P1
P2
Driveway to 3rd Street
solar canopy
(Parking Level on-grade)
Line of Parking Below
(Parking Level below)
3rd Street
DROP-OFF
BUILDING S
BUILDING T
BUILDING V
THEATRE
4th Street
Employee Parking
Ramp to P2 below
Ramp from +16.0
EXISTING BUILDING
6-STORY EXISTING BUILDING
DOWN TOWN KIHEI
The KRAUSZ COMPANIES, Inc.
44 Montgomery St., Ste 3300, San Francisco, CA 94104 Tel 415.732.5600
PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII
STOUTENBOROUGH
Architects and Planners
NORTH
Bike Access on Site
January 9, 2013
0' 50' 100' 150' 200' 250' 300'
LEGEND:
Bike Access

LANDSCAPE

General

Shading Concept:

Parking fields shall be landscaped to comply with the Maui County Code and Development Guidelines, providing a ratio of 1 tree for every 5 parking stalls, dispersed at regular intervals throughout as much as possible (utility layouts, planter size/locations, and view planes may affect exact spacing).

Primary vehicular drives and major pedestrian circulation routes shall be articulated different from the parking field in order to reinforce the design theme.

Landscape enhancements at internal streets and pedestrian circulation routes may include any of the following:

- Ornamental tree and accent plantings
- Vertical tree plantings, Palms
- Trellises
- Specialty lighting with possible banners
- Use of reclaimed water

Landscape Guidelines:

In some areas, landscape might be enhanced to meet any of the following goals:

1. Screening of parking areas, service zones, trash enclosures and/or mechanical equipment.
2. Meeting parking lot shade requirements as previously noted under "Shading Concept".
3. Accenting main entry monuments or pole signage or walkways.
4. Framing views of building entrance or signage.
5. Re-routing traffic.
6. Specific plant material for erosion control.
7. A combination of ground cover and/or jute netting may be placed along slopes that exceed 3:1.
8. Specific shrubs and perennials hardy enough to survive the pedestrian and vehicular traffic and to soften the geometric design of the parking lot.
9. Weeds and brush will be removed throughout the year as necessary. If wildflower and other seeding mixes are used during the time the sites are undeveloped, the site shall be maintained in a neat appearance.
10. Turf may be used in lieu of, or in addition to, the ground covers listed in each zone.
11. Landscape should use drought and salt tolerant and non-invasive species.

LANDSCAPE
General

Trees and Palms:

Following are photos of trees and palms that could be considered for the parking lots (trees) and adjacent to the buildings (palms) for this project. Parking lot trees are selected for their medium mature size, adaptability to the Kihei growing conditions, maintenance requirements, ability to have their tree canopy "lifted" for favorable visibility of the project signage, and attractiveness. Most trees will require some degree of selective maintenance to achieve the desired effect. The use of fruit-bearing trees, such as Kou, will be restricted in the parking and other pedestrian uses.

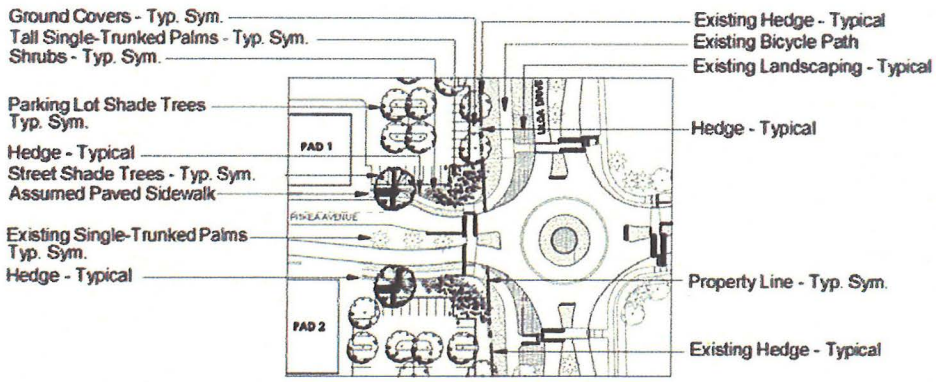
The palms are selected for the following characteristics: absence of large nuts/fruits, adaptability to Kihei growing environment, self-cleaning fronds (they still need to be manually removed but do not accumulate on the palm like date palms), height scale in relationship to the multi-level buildings, and attractiveness,

Besides the listed characteristics the final selection of either trees/palms may depend on quantity needed and availability.

Royal Palm: No large nut, self-cleaning, straight trunk, max. ht. 60 ft.

LANDSCAPE
Intersection

Lignum Vitae: Very attractive, slow growing and availability in large quantities.



CONCEPTUAL LANDSCAPE PLAN
KIHEI DOWNTOWN
PI'IKEA AVENUE/LILOA DRIVE INTERSECTION

No Scale

OBJECTIVE:
Create a landscape gateway element into the Kihei Downtown that allows unobstructed views and provides planting continuity at the roundabout intersection.

PRELIMINARY PLANT LIST

STREET SHADE TREES:
e.g.: Shower Tree
Hong Kong Orchid

SHADE TREES:
e.g.: Pink Tecoma
Tulipwood
Lignum Vitae

PALMS:
e.g.: Dwarf Date Palm

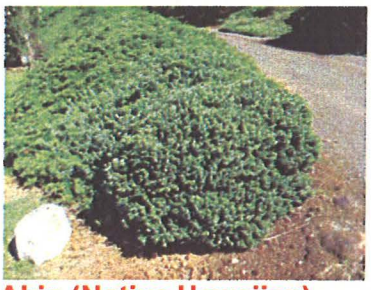
FLOWERING SHRUBS/HEDGE:
e.g.: Bougainvillea
Natal Plum
Hibiscus
Plumbago

TROPICAL SHRUBS:
e.g.: Philodendron
Monstera

NATIVE COASTAL PLANTS:
e.g.: Beach Naupaka
Pohinahina
'Akia
'Ulei

GROUNDCOVERS:
e.g.: Purple Tradescantia
'Ilima Papa
Golden Glory
Lantana

GRASSES:
e.g.: Hybrid Bermuda
El Toro Zoysia



Akia (Native Hawaiian)

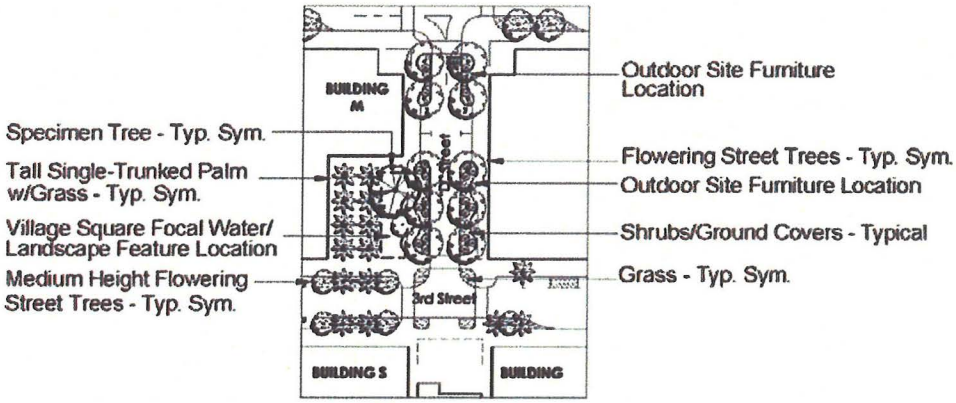
Lantana

LANDSCAPE
Village Square

Shower Tree

Foxtail Palm: No large nuts self-cleaning, straight trunk. max. ht. about 30 ft.

African Iris



CONCEPTUAL LANDSCAPE PLAN
KIHEI DOWNTOWN
VILLAGE SQUARE

No Scale

OBJECTIVE:
Create a landscape environment that is condusive to socializing and gathering, and is attractive, comfortable and safe. This area should be highly visible while providing shade, seating, and interest.

PRELIMINARY PLANT LIST

SPECIMEN TREES:
e.g.: Shower tree
Mahoganey

FLOWERING STREET TREES:
e.g.: Pink Tecoma
Tulipwood
Hong Kong Orchid
Plumeria

TALL SINGLE-TRUNKED PALMS:
e.g.: Royal Palm
Foxtail Palm

PALMS:
e.g.: Areca Palm
MacArthur Palm
Raphis Palm

TROPICAL SHRUBS:
e.g.: Zanadu Philodendron
Meyer Asparagus Fern

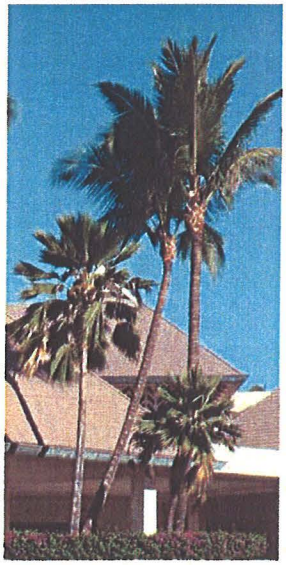
FLOWERING SHRUBS/HEDGE:
e.g: Bougainvillea
Dwarf Natal Plum
Hibiscus
Plumbago
African Iris
Philipine Ground Orchid

NATIVE PLANTS:
e.g.: Ahinahina
Pohinahina
'Akia
Kupukupu Fern
Kulu'i

GROUNDCOVERS:
e.g.: Mondo Grass
Blue Daze
Purple Tradescantia
Lantana

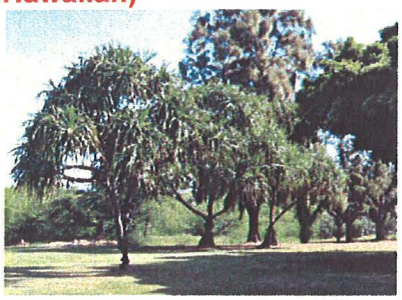
GRASSES:
e.g.: Hybrid Bermuda
El Toro Zoysia

LANDSCAPE
South Detention Basin

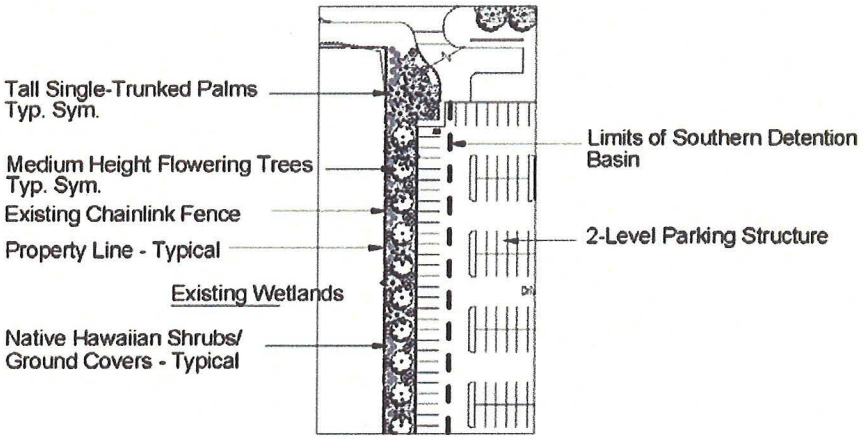


Coconut & Fiji Fan Palms: Coconut Palm: large nuts, trimmed regularly, max. ht. 100 ft. The Fiji Fan Palm: no large nuts, straight trunk, max. ht. 30 ft.

Koki'o ke'oke'o (Native Hawaiian)



Hala (Native Hawaiian)



CONCEPTUAL LANDSCAPE PLAN
KIHEI DOWNTOWN
SOUTH WETLANDS BOUNDARY

No Scale

OBJECTIVE:
Create a transitional landscape that bridges the wetlands and the built environment while reducing its overall visual impact. Planting incorporates the use of native Hawaiian plants and riparian vegetation.

PRELIMINARY PLANT LIST

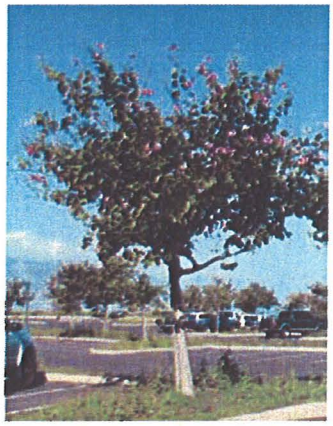
MEDIUM. HT. FLOWERING TREES:
e.g.: Alahe'e
Hao
Beach Heliotrope
Hala
Plumeria

TALL SINGLE-TRUNKED PALMS:
eg.: Coconut
Loulu

NATIVE PLANTS:
e.g.: Beach Naupaka
Pohinhina
'A'ali'i
Kulu'i
Koki'oke'oke'o
Mao Hau Hele
U'ulei
Naio

GROUNDCOVERS:
e.g.: Nehe
'Ilima Papa
Maiapio
Pa'u O Hi'iaka
'Aki'aki

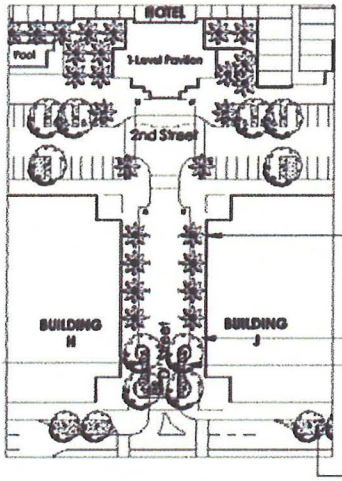
LANDSCAPE
Village Hotel



Hong Kong Orchid: Attractive flowers

Hong Kong Orchid Blossom

Hibiscus - Varieties



CONCEPTUAL LANDSCAPE PLAN
KIHEI DOWNTOWN
VILLAGE HOTEL

No Scale

OBJECTIVE:
Create a landscape reinforces the vehicular roadway, provides shade and visual relief, while complimenting the building architecture and frontages.

PRELIMINARY PLANT LIST

SHADE TREES:
e.g.: Pink Tecoma
Tulipwood
Hong Kong Orchid
Plumeria

TALL SINGLE-TRUNKED PALMS:
e.g.: Royal Palm

TALL SINGLE-TRUNKED PALMS:
e.g.: Areca Palm
Dwarf Date Palm
MacArthur Palm
Raphis Palm

FLOWERING SHRUBS/HEDGE:
e.g.: Bougainvillea
Dwarf Natal Plum
Hibiscus
Plumbago
African Iris
Philipine Ground Orchid

TROPICAL SHRUBS:
e.g.: Zanadu Philodendron
Meyer Asparagus Fern

NATIVE PLANTS:
e.g.: Pohinahina
'Akia
Kupukupu Fern

GROUNDCOVERS:
e.g.: Mondo Grass
Blue Daze
Purple Tradescantia
Golden Glory
Lantana

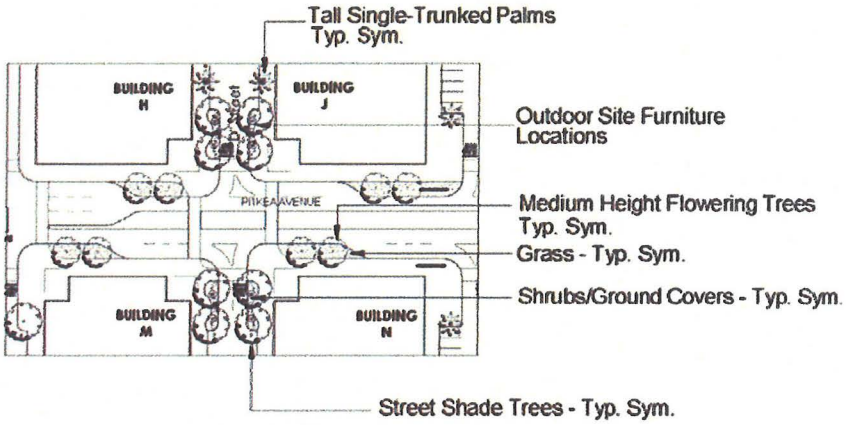
GRASSES:
e.g.: Hybrid Bermuda
El Toro Zoysia

LANDSCAPE
Pi'ikea Avenue

Pink Tecoma: Very adaptable to the Kihei growing environment.

Purple Tradescantia Flower

Purple Tradescantia (Groundcover)



CONCEPTUAL LANDSCAPE PLAN
KIHEI DOWNTOWN
PI'IKEA AVENUE
No Scale

OBJECTIVE:
Create a landscape reinforces the vehicular roadway, provides shade and visual relief, while complimenting the building architecture and frontages.

PRELIMINARY PLANT LIST

SHADE TREES:
e.g.: Pink Tecoma
Tulipwood
Lignum Vitae

MED. HT. FLOWERING TREES:
e.g.: Alahe'e
Plumeria
Kou Haole

TALL SINGLE-TRUNKED PALMS:
e.g.: Royal Palm

TROPICAL SHRUBS:
e.g.: Zanadu Philodendron
Meyer Asparagus Fern

GRASSES:
e.g.: El Toro Zoysia

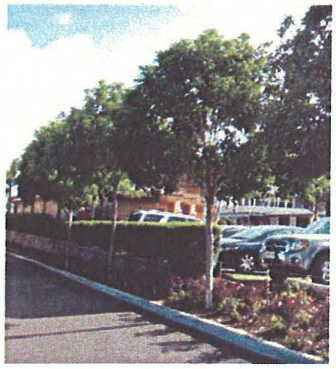
FLOWERING SHRUBS:
e.g.: Bougainvillea
Dwarf Natal Plum
Hibiscus
Blue Plumbago
African Iris
Phillipine Ground Orchid

NATIVE PLANTS:
e.g.: Ahinahina
Pohinahina
'Akia
Kupukupu Fern
Kulu'i

GROUNDCOVERS:
e.g.: Mondo Grass
Blue Daze
Purple Tradescantia
Lantana

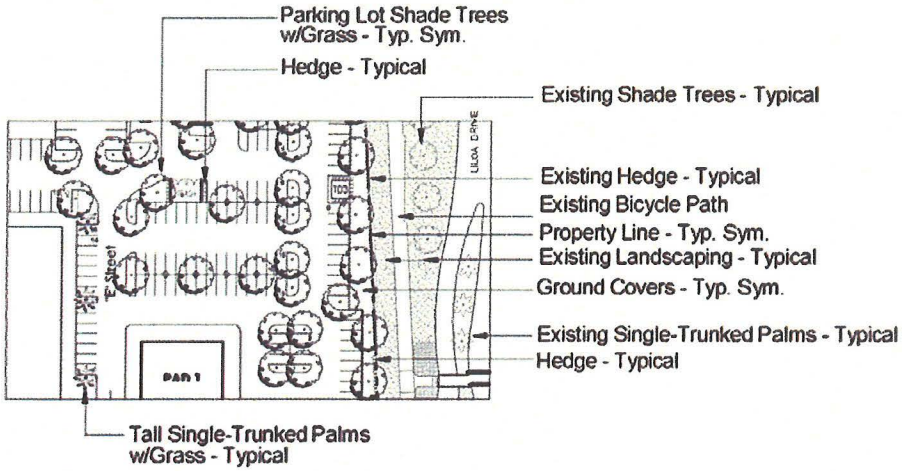
LANDSCAPE
Parking Liloa Drive

Bougainvillea - Varieties



Tulipwood: Availability if large quantities small fruits are not a problem.

Plumbago



CONCEPTUAL LANDSCAPE PLAN
KIHEI DOWNTOWN
PARKING FIELDS/LILOA DRIVE

No Scale

OBJECTIVE:
Create an attractive landscape environment that provides visual relief from the paved parking surfaces, reinforces the vehicular roadways, and screens the service and utility enclosures.

PRELIMINARY PLANT LIST

SHADE TREES:
e.g.: Pink Tecoma
Tulipwood
Hong Kong Orchid

TALL SINGLE-TRUNKED PALMS:
e.g.: Royal Palm

FLOWERING SHRUBS/HEDGE:
e.g.: Bougainvillea
Hibiscus
Plumbago

GROUNDCOVERS:
e.g.: Purple Tradescantia
'Ilima Papa
Golden Glory
Lantana

GRASSES:
e.g.: El Toro Zoysia
Hybrid Bermuda

LANDSCAPE

Irrigation Design Concept

Kihei is located on the leeward side of the island which naturally receives less rainfall than most of the rest of Maui and therefore it is necessary to provide a permanent irrigation system for the landscape planting areas for the proposed Downtown Kihei. It will be used to supplement the natural rainfall. Although drought-tolerant and Hawaiian native plants are being considered for the planting palette, a reliable water supply to the plants is essential to their health and survival. The Kihei Wastewater Treatment Plant will be the source of the reclaimed R-1 water that will be used in the landscape irrigation system. A water quality test of the reclaimed water will be conducted during the landscape design process to determine the appropriate plant types to specify that will be compatible with the test results. This reclaimed water line is located on Liloa Drive and is being used and has been successful in irrigating the landscape at the adjacent Piilani Commercial Shopping Center. This landscape irrigation system will be designed and adhere to all County of Maui, Department of Environmental Management, and State of Hawaii, Department of Health design standards and guidelines.

The water source is at a higher elevation than the project and the point of connection for the landscape irrigation system will be at the mauka end of the project site along Liloa Drive, which is also at the highest elevation for the project. Because the topography of the site slopes mauka to makai adequate water pressure for the efficient operation of the irrigation system should not be an issue of concern. If necessary, pressure regulating valves will be installed at intervals to assure an even range of available water pressure throughout the system. The water will then be distributed underground through designated and identified reclaimed water PVC pipes. The only surface piping, or tubing, will be drip irrigation lines with in-line emitters. And wherever possible, these drip lines will be covered with some kind of mulch materials, whether organic or synthetic. It will be a standard detail to have most of the planters that are not planted with some kind of groundcover or grass to have a layer of mulching installed to assist in retaining moisture and minimize loss through evaporation.

In addition to the planting areas throughout Downtown Kihei, the two detention basins located at the makai end of the property will have a permanent irrigation system as well to assure that it remains vegetated during drought conditions. This will provide a visually attractive green space between Downtown Kihei and the existing wetlands.

Irrigation controllers, either electric or solar-operated, will be used to operate the automatic irrigation system and effectively program their sequence and run time. These controllers will be coupled with rain sensing devices that will automatically disrupt the electrical impulse when the rainfall threshold is met and temporarily prevent the controller from operating the system. Although there is an abundance of reclaimed water available presently, it is still the philosophy of the developer to conserve water however possible.

Downtown Kihei will have a full-time landscape crew that will not only maintain the landscape planting but will also be responsible for the on-going maintenance and operation of the permanent irrigation system.

EXTERIOR LIGHTING

RECOMMENDED ILLUMINANCE

	Recommended Minimum Average Horizontal Illuminance Levels	Uniformity Ratio Avg/min
SIDEWALKS	0.5 fc	4
ROADS		
Pedestrian Roads (Local)	0.7 fc	6
Collector Roads	0.9 fc	4
PARKING LOTS	1.0 fc	5
INTERSECTIONS		
Local/Local	1.4 fc	6
Collector/Local	1.6 fc	4

*Notes:

-Lamp Standards- 75W LPS for internal road intersections and 125W LPS at intersections with major or minor collector roads.

-See IES *Table 6: Recommended Mainted Illuminance Levels for Pedestrian Ways (RP-33-99)* for sidewalks.

-See IES *Table 2: Illuminance Method-Recommended Values (RP-8-00)* for roads.

-See IES *Table 1: Recommended Maintained Illuminance Values for Parking Lots (RP-30-98)* for parking lots.

-See IES *Table 9: Recommended Illuminance for the Intersection of Continuously Lighted Urban Streets (RP-8-00)* for intersections

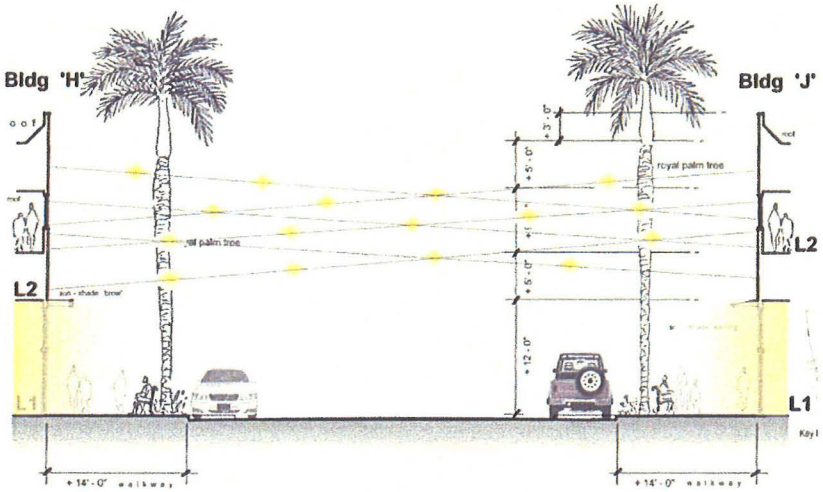
Maui County Code, Chapter 20.35 Outdoor Lighting shall be adhered to: "All new outdoor lighting shall be fully shielded, with limited exceptions. Fully shielded is defined as being constructed so that all of the light emitted by the fixtures is projected downward, below the horizontal plane of the lowest point of the fixture."

PERFORMANCE CRITERIA & LIST OF COMPONENTS

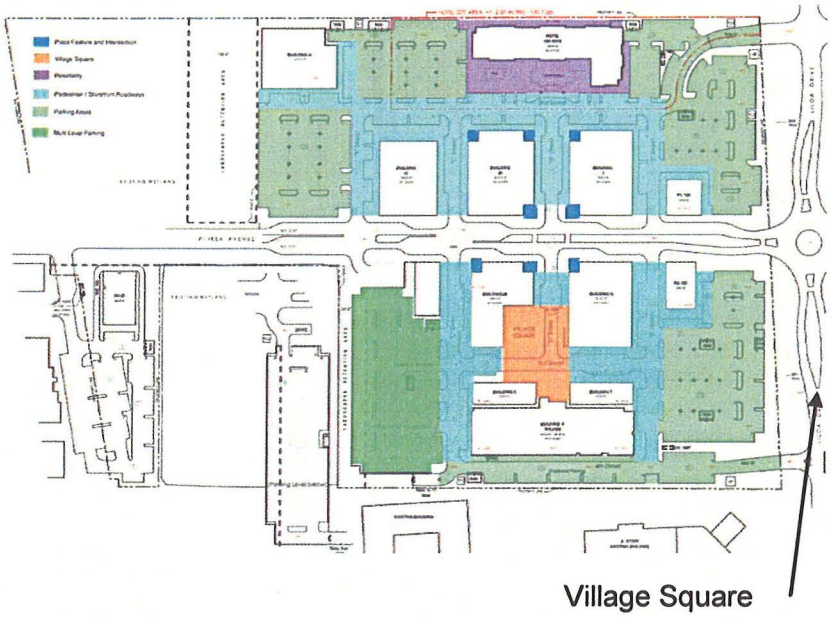
1. **Circulation**
   - a. Lighting Performance Criteria
     - i. 15o Cut off criteria
     - ii. Minimum Luminaire Efficacy Rating: 60
   - b. Roadway Lighting
     - i. 20' Fixture Mounting Height, Maximum
     - ii. Banner Arm
     - iii. Flag Arm
     - iv. Decorative Illuminated Component
   - c. Pedestrian Lighting
     - i. 20' Fixture Mounting Height, Maximum
     - ii. Banner Arm
     - iii. Flag Arm
   - d. Decorative Illuminated Component
   - e. Wall Mounted Pedestrian Luminaires
   - f. Service Circulation Lighting
     - i. Wall Mounted Luminaires
     - ii. Post Mounted Luminaires
2. **Nodes and Accent:**
   - **a.** Plaza Lighting
     - i. String Lighting
     - ii. Area Lighting mounted by cable, post, or wall
     - iii. Building Mounted Flood Lighting with Color Accents
     - iv. Under-bench Lighting
   - b. Landscape Lighting
     - i. Down Lighting only
     - ii. Tree mounted seasonal temp. lighting
     - iii. Bollard and Post
   - c. Sign Lighting
     - i. Retail Sign Lighting- Integral
     - ii. Entry Monument Lighting- Integral
   - d. Façade Lighting
     - i. Building mounted Down Lighting
     - ii. Back Illuminated windows
     - iii. Parapet Mounted Dome/Roof Lighting
     - v. Water Feature Lighting
3. **Photovoltaic Energy Systems**
   - e. Parking Structure
   - f. Open Parking
   - g. Roof top

EXTERIOR LIGHTING

Village Square



Cable Mounted LED Accent Light
***(Tokistar LED series)**



EXTERIOR LIGHTING

Façade Lighting

Facade Lighting: Back Illuminated Windows

EXTERIOR LIGHTING

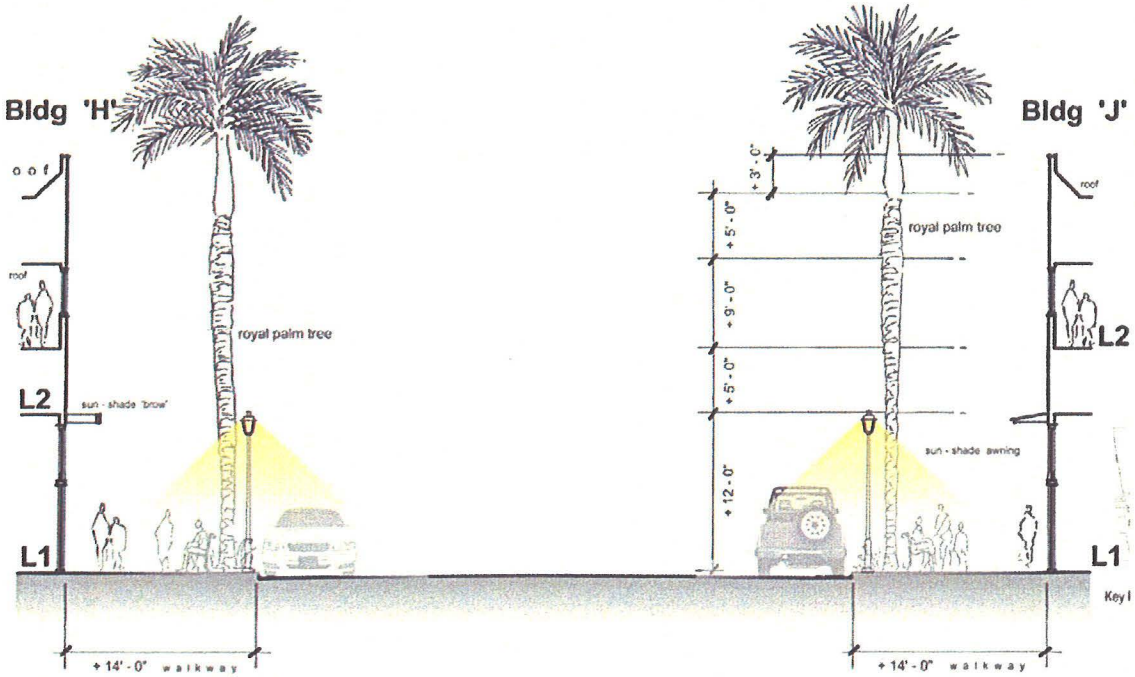
Façade Lighting

Facade Lighting: Building Mounted Down Lighting

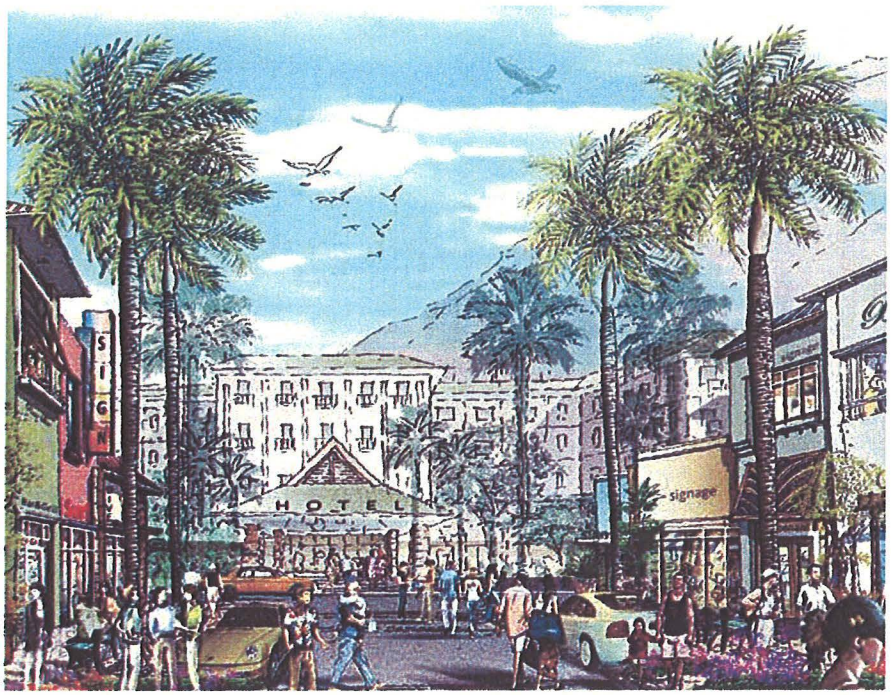
Facade Lighting: Trellis & Canopy Lighting

EXTERIOR LIGHTING

Street Lighting



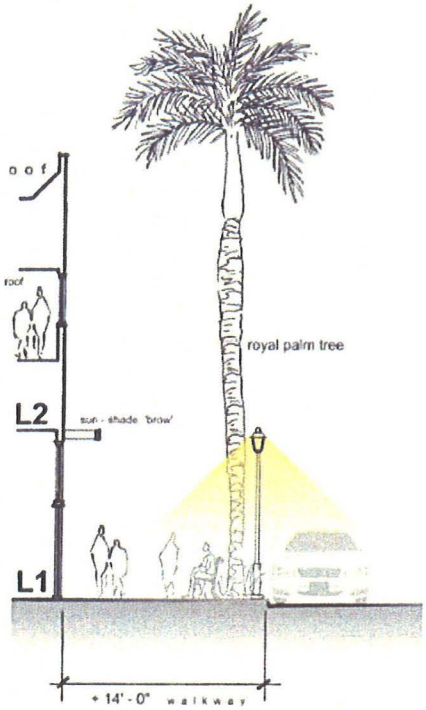
15 ft pole
(Neri Cut-off Lantern)



EXTERIOR LIGHTING

Pedestrian / Storefront Roadways

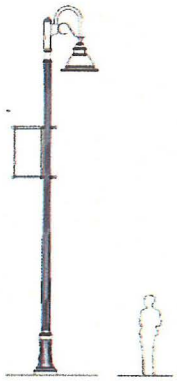
Bldg. N or J

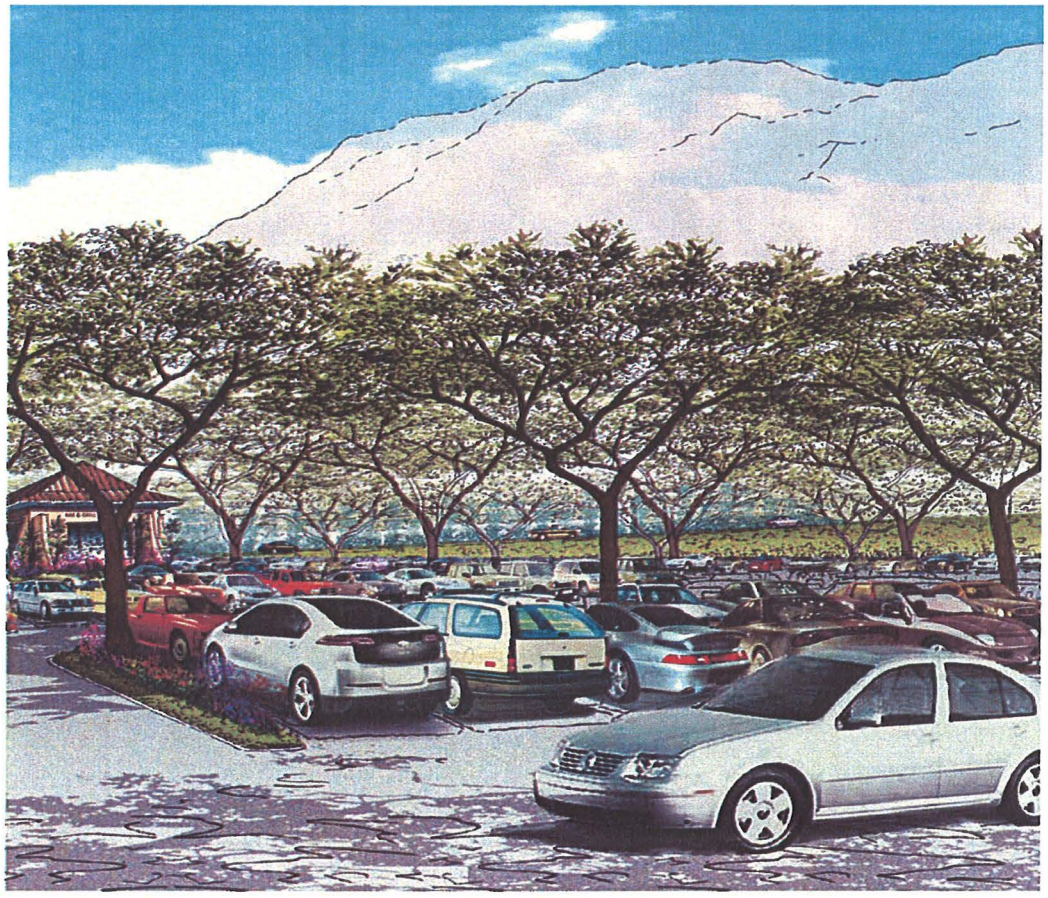


15 ft pole
(Neri Cut-off Lantern)

EXTERIOR LIGHTING

Parking Areas

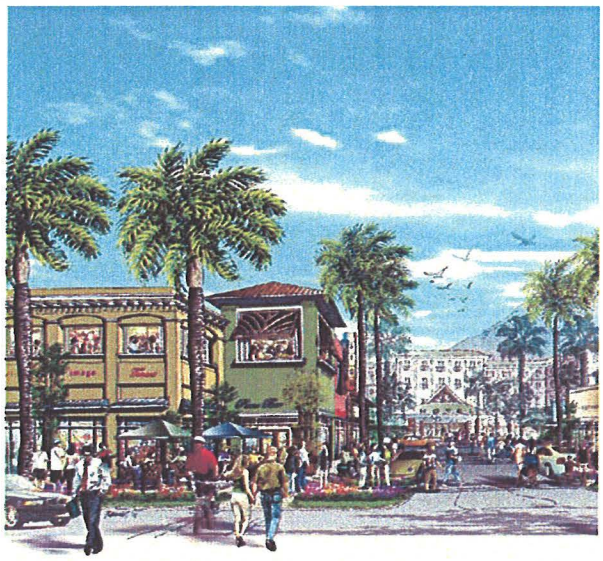




ARCHITECTURE
Design Guidelines

Architectural Design Concepts

The objective of the architectural design guidelines is to support building designs that include a variety of architectural styles that include contemporary interpretations of the character of Maui's early buildings. Examples that meet this objective are:

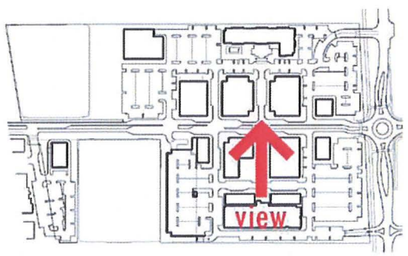


Variation in building forms such as recesses or projecting bays.

- Architectural details and façade details such as recessed windows, recessed or projecting balconies and lanais, projecting sills.
- Diversity of window size, shape or patterns that relate to interior function.
- Special treatment or designs at building entries, use of overhangs, awnings and canopies.
- To keep with traditional Hawaiian architecture, all rooftop overhangs shall be a minimum of 30 inches.
- Variation in the use of materials, patterns, surface relief, color and textures.
- Subdividing the building facade into smaller, more human scaled elements such as tighter and more frequent rhythm of column or bay spacing.
- Projecting pilaster, columns, bays cornices and roofs.
- Distinctive corner entry treatments.

View along Pi'ikea Avenue towards Hotel

December 10, 2012



Key Plan

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.
44 Montgomery St., Ste 3300, San Francisco, CA 94104 : Tel.14157325600
PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII

STOUTENBOROUGH INC
Architects and Planners
420 Alta Vista Way, Suite 100, Laguna Beach, Ca 92651
T 949 715 9257 | F 949 715 9256 | www.stoutenboroughinc.com

ARCHITECTURE

Design Guidelines (Continued)

Building Facades

Building Facades shall be visually interesting through the interplay of light and shadow, particularly those that face streets, plazas or public open space. The facades shall provide human scale and detail.

Examples that achieve the desired visual interest include variation in building facade, recessed entries, recessed or projected lanais, recessed or projected windows and variation in size and rhythm in spacing, canopies, roof overhangs, fascia detail, cornice details, exterior railing details and ornamentation.

Facades should respect traditional design principles allowing for the flexibility to interpret the guidelines in a contemporary context.

Blank Walls

Blank or completely solid walls within the project are not permitted, with the exception of the theater building, which must have some blank walls, due to the nature of its use.

Large surface blank walls of the theater should be detailed to break down the scale and appearance of monolithic walls.

Building Transparency

Transparent glazing shall be provided at the ground floor that insures the visibility of active uses. Glass without coatings or tints shall be used for retail glazing.

Provide transparent glazing at the upper levels to enhance the awareness of upper level activity as viewed from the street or public spaces.

Use of highly reflective, mirror faced glass is not permitted.

View of Village Square towards Hotel - 02

December 13, 2012

Key Plan

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc

44 Montgomery St., Ste 3300, San Francisco, CA 94104 : Tel.1415732560

PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWA

STOUTENBOROUGH

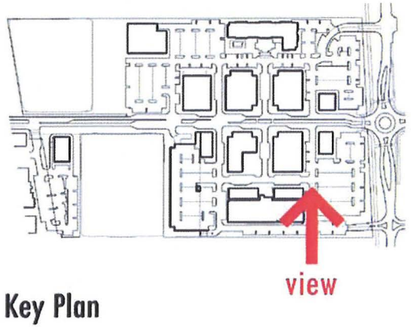
Architects and Planner

420 Alta Vista Way, Suite 100, Laguna Beach, Ca 9265

T 949 715 3257 : F 949 715 3256 | www.stoutenboroughinc.co

View of Shops from Parking Field

December 3, 2012



Key Plan

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.
44 Montgomery St., Ste 3300, San Francisco, CA 94104 : Tel. 14157325600
PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII

STOUTENBOROUGH LLC
Architects and Planners
426 Alta Vista Way, Suite 103, Laguna Beach, Ca 92651
T 949 715 3257 | F 949 715 3256 | www.stoutenboroughlcc.com

ARCHITECTURE

Design Guidelines (Continued)

Building Entries and Storefronts

Major entries to buildings on the ground floor shall be emphasized.

Building entries and storefronts shall be articulated with a variety of architectural design elements that create street level interest. Recessed entries, elaborate detailing, varied signage and graphics, inviting lighting at entries to retail shops, commercial spaces and restaurants are appropriate.

Single buildings with multiple storefronts, shall use a varied treatments including canopies, eyebrows and/or roof overhangs.

Roof overhangs, canopies, eyebrows, arcades and architectural ornamentation are additional elements that can be used to define and enhance building and storefront entries.

Outdoor Dining

Outdoor dining areas adjacent to the internal private streets are appropriate for restaurants, coffee shops and eateries. This activity allows for spontaneity, casual encounters and creates opportunities for people to interact.

Materials

Materials of quality that weather well, resist vandalism and require little maintenance are to be used.

Exterior building materials that are appropriate to the design intent are: stone, masonry, plaster, stucco and wood or metal siding.

A combination of these materials can be used to break-up building surfaces provided that it is consistent with the design guidelines and in keeping with the architectural character and style of the building.

Retaining Walls

All retaining walls shall be split-face block or veneered with real or simulated lava rock.

ARCHITECTURE

Design Guidelines (Continued)

Roofing Materials

Roofing materials include but are not limited to corrugated and standing seam metal, wood and metal shake, slate, tile, shingle and gravel over built-up roofing.

Exterior Colors

Exterior colors may be used in any combinations to reflect the architectural style and character of the building. Garish, iridescent and highly reflective colors are not permitted.

Lighting

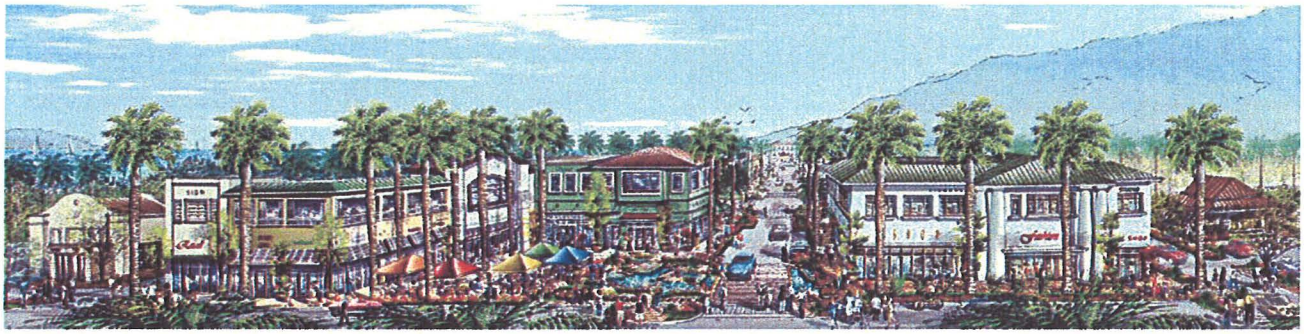
Building lighting in addition to signage lighting shall be provided to accentuate important architectural components such as building towers, cornices or ornamental details. Building lighting shall also be provided for safety and ease of access at building entries. Lighting shall be provided for all open spaces and shall complement the lighting scheme along the sidewalks.

Roof Design and Equipment

A variant of roof shapes and design shall be provided to create an interesting and varied skyline. This varied skyline should also incorporate a variety of roof parapet designs, cornice caps and details to add "human scale". The roof shall be designed in such a way as to reduce visual clutter of rooftop equipment seen from streets and major public open spaces/plazas.

All rooftop electrical and communication equipment such as dish antennae shall be screened from view from streets and major public open spaces/plazas.

Care should be taken to mitigate the impacts of noise and odors when neighboring residential uses are located near mechanical equipment.



ARCHITECTURE

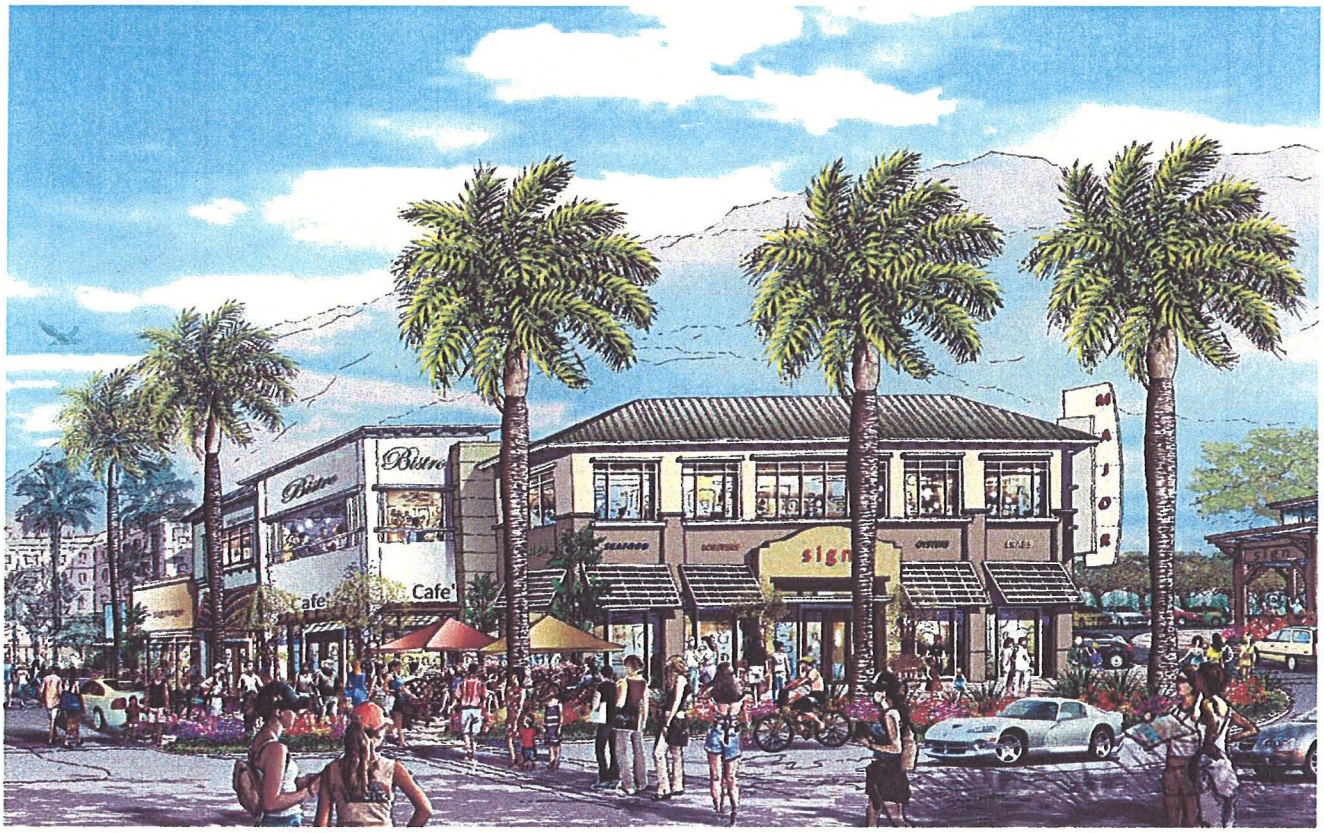
Building Walls

Parapets: Parapet heights are intended to screen roof-mounted equipment from adjacent roadways and properties to the extent reasonably possible given the grade differentials unique to this site. Changes in parapet height shall be used to enhance tenant entries, provide tenant identity, and articulated building elements.

Materials: All colors and materials shall be selected from the approved material legend. Wall finish materials may consist of concrete, masonry, cement plaster, or stone. Rustic building materials such as natural stone, veneer systems or textured stucco are permitted. Awnings shall be either metal or fabric. Glass shall be clear, light gray tinted, or spandrel glass.

Building Colors: Colors, materials, and finishes shall be coordinated on the exterior elevations of all buildings to maintain and promote continuity of the design themes while allowing for unique tenant presentations. Concrete, and plaster surfaces shall be painted. Metal surfaces shall be painted.

Accent Colors: Accent colors may be used to identify and differentiate each tenant's entry area. These colors may be used for signage, signage backdrops, metal wall system, canopies, building corners as well as for the modular articulation of the building.



ARCHITECTURE

Articulation

Buildings in all areas shall be articulated with three components.

Building Base Component: The lower area of the building façade shall be pedestrian scaled and consistent in thematic detail throughout the project. The height of this component shall be generally consistent.

Wall Articulation Component: This area above the building base shall have articulation generally consistent for each building. Color and material variations may provide each tenant with unique identities.

Tenant Entry Component: This component shall focus on each individual tenant's identity and will incorporate each tenant's brand and style while maintaining the architectural integrity of the project.

Natural Materials

Natural Stone Veneer
Flagstone
Metal Reveal
Wood
Brick Veneer
Architectural Metal Canopy / Trim
Fabric or Metal Awning
Decorative Metal Grille / Railing
Standing Seam Metal Roof
Slate Roof Tile
Concrete Roof Tile
Copper Accents
Siding and Shingles
Board & Bat Exterior
Split Face / Precision Concrete Masonry Units (CMU or Veneer)

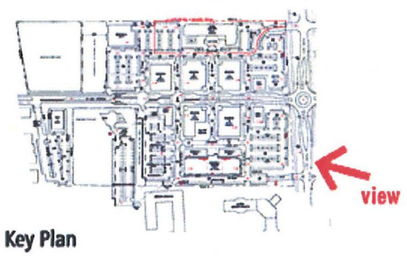
Other Materials

Precast Concrete Columns / Bases
Concrete Curbs
Manufactured Stone Veneer
E.I.F.S.
Concrete Walls Panels
Resin-based Painted Steel
Aluminum Storefront System
Clear Tempered Float Glass
Spandrel Glass
E.P.S. Molding / Cornice / Trim with Smooth Plaster Finish
Exterior Cement Plaster - Light Dash or with Smooth Steel Trowel Finish

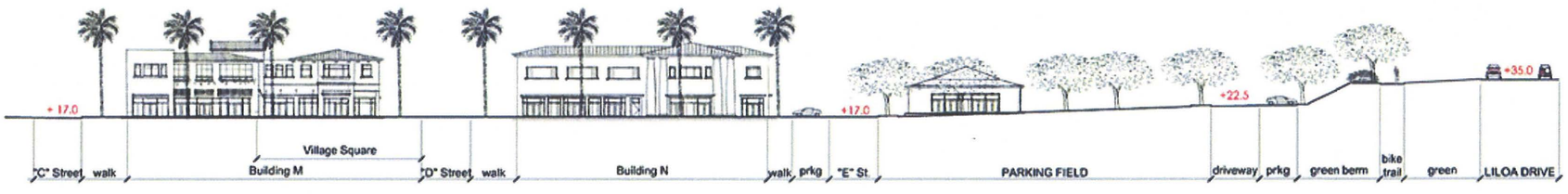
Materials Not Permitted

Reflective or Mirror-Faced Glass
Vinyl Coated Mesh
Red Brick

View from Bike Path along Liloa Avenue



Key Plan



NORTH

Site Section

0' 20' 40' 60' 80' 100' 120'

June 24, 201

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, In

44 Montgomery St., Ste 3300, San Francisco, CA 94104 · Tel: 415/397-3325

PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAW.

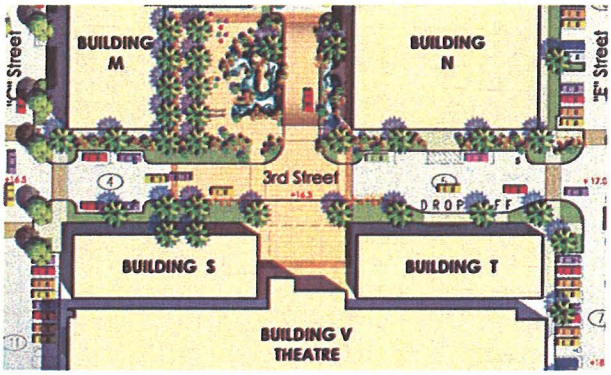
STOUTENBOROUGH Architects and Planners

ARCHITECTURE

The Village Square

The heart of Downtown Kihei is the Village Square. Designed as a flexible space 130 feet by 130 feet, the village square provides for a performance venue, childrens' play area, outdoor dining and public gathering areas.

Designed with a "outdoor living room" feel, the Village Square creates conversation areas with comfortable outdoor furniture. Shaded by a grove of Royal Palms, these areas allow for meeting and greeting friends, resting during shopping excursions, and watching one's children play on the sea turtles figurines and on the beach.



The Village thoughtfully represents Kihei. The name "Kihei" literally translates to "cape".

The large water feature is reminiscent of the local "loko i'a" (fishpond), with traditional lo'i kalo for the wetland taro beds (plantings that grow in the water) also featured within the pond.

Photo of native loko i'a

Photo of lo'i or taro patch.

Bar & Grill

Steak sushi

Tenant

signage

stage

outdoor dining

turtle sculpture

cascading pond

turtle sculpture

outdoor dining

0'

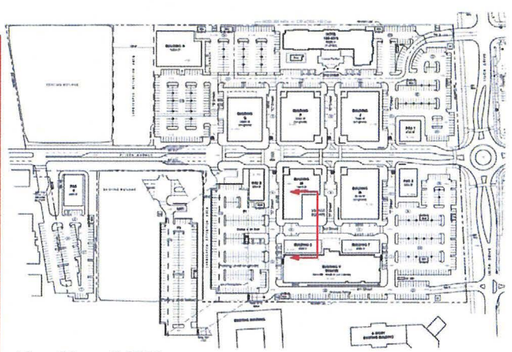
10'

25'

Partial Section / Elevation (Village Square)

December 12, 2011

Key Section / Elevation (NTS)



Key Plan (NTS)

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.

44 Montgomery St., Ste 3300, San Francisco, CA 94104 : Tel. 1.415.733.5500

PIIKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII

STOUTENBOROUGH

PLANNERS AND ARCHITECTS

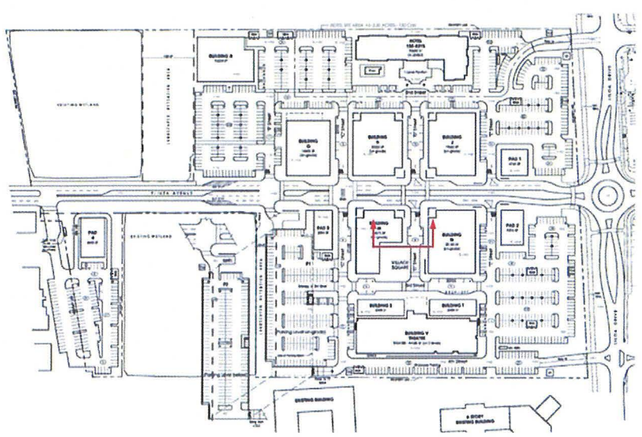
420 Alta Vista Way, Suite 100, Laguna Beach, Ca 92651

T 949.715.5253 | F 949.715.5256 | www.stoutenborough.com

North Section / Elevation (Village Square)

0' 10' 25'

December 5, 2012



Key Plan (NTS)

DOWN TOWN KIHEI

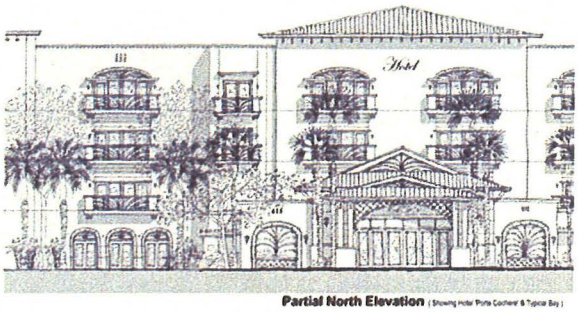
The KRAUSZ COMPANIES, Inc
44 Montgomery St., Ste 3300, San Francisco, CA 94104 : Tel. 14157325600
PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII

STOUTENBOROUGH
Architects and Planners
420 Alta Vista Way, Suite 100, Laguna Beach, Ca 92651
T 949 715 3237 | F 949 715 3256 | www.stoutenborough.com

ARCHITECTURE

The Hotel

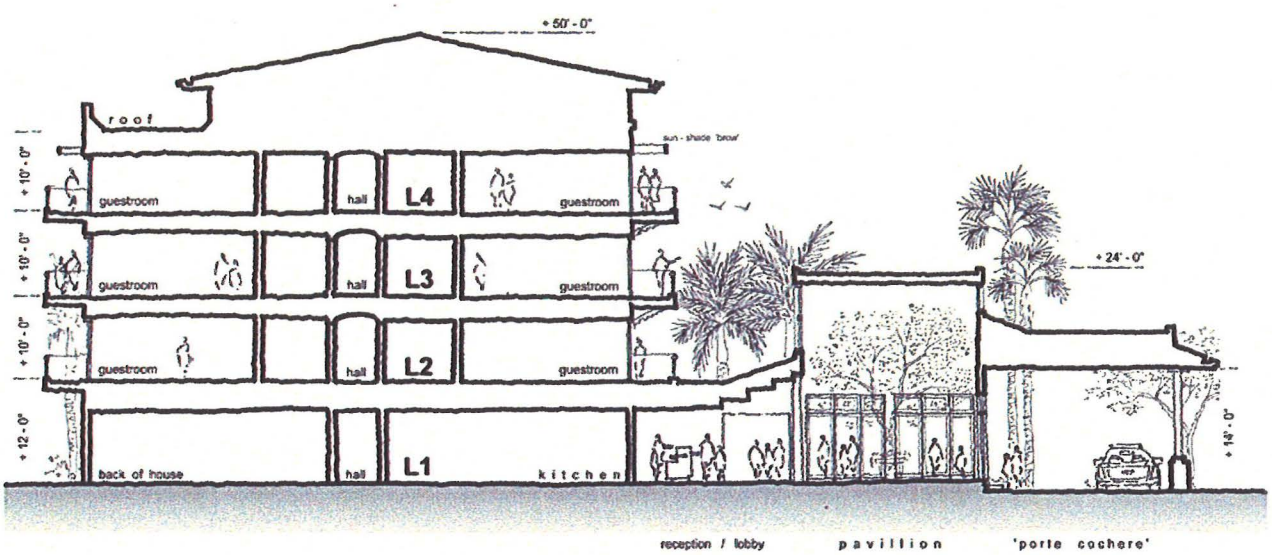
Integrated and visually anchoring the main street of Downtown Kihei is the four-level 150-room select-service hotel of approximately 93,000 sq. ft. gross building area. The entry with porte-cochere faces the retail / entertainment street scene that provides a walkable environment for guests. Parking for the hotel is provided at grade pursuant to Maui County "Ordinance 3662, Bill Number 49, 2009" on the hotel site area of approximately 2.63 acres.



Partial North Elevation (Showing note 'Porte Cochere' & Typical Bay)

Amenities for the Hotel facility may include a pool, lanais for each room, and gardens.

The maximum height of the hotel to the parapet is approximately 45 feet with allowable roof projections to 50 feet measured from finish grade. Any rooftop equipment will be shielded from view. Construction materials shall be selected from those outlined in Architectural materials section of these guidelines.



Section

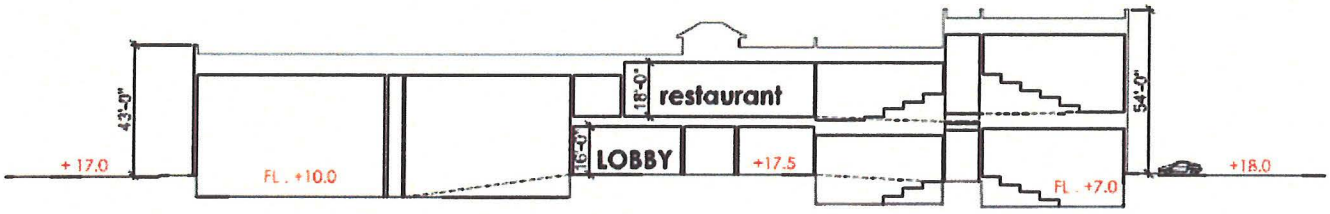
ARCHITECTURE

The Cinema

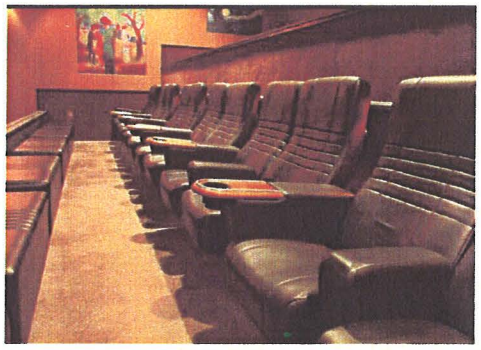
Facing the Village Square is Downtown Kihei's 10-screen cinema with approximately 1,500 seats. The facility will provide state-of-the-art film presentations requiring a building height of 45-55 feet measured from grade. Stadium seat auditoriums will range in size providing venues designed for families and areas for food and drink. Facing the Village and fronting the Cinema is one level of retail.

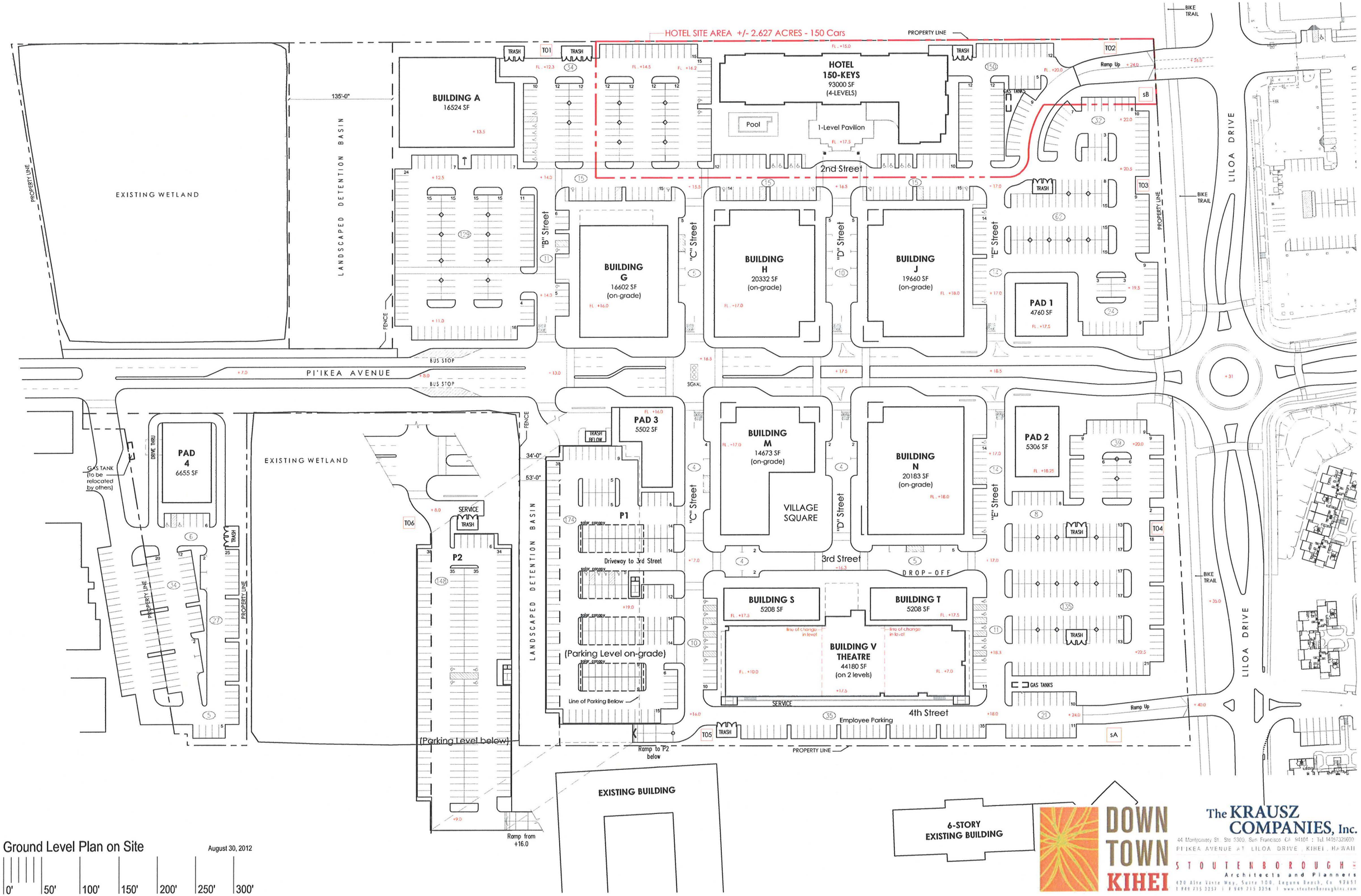
Outside and above the entry to the cinema lobby is a lanai overlooking activities below. Utilizing a water feature, the theater will include world-class video presentations that employ various projection technologies, engaging the Village Square in a unique way, leaving a lasting impression on visitors.

While integrating allowable materials found in the Architectural Building Facades and Materials section of these Design Guidelines, the primary structure will be steel and concrete block. Sufficient ADA parking is provided near this fully accessible venue.



Section




HOTEL SITE AREA +/- 2.627 ACRES - 150 Cars
PROPERTY LINE
BIKE TRAIL
HOTEL
150-KEYS
93000 SF
(4-LEVELS)
Pool
1-Level Pavilion
2nd Street
BUILDING A
16524 SF
EXISTING WETLAND
LANDSCAPED DETENTION BASIN
135'-0"
"B" Street
"C" Street
"D" Street
"E" Street
BUILDING G
16602 SF
(on-grade)
BUILDING H
20332 SF
(on-grade)
BUILDING J
19660 SF
(on-grade)
PAD 1
4760 SF
LILOA DRIVE
PI'IKEA AVENUE
BUS STOP
SIGNAL
PAD 3
5502 SF
BUILDING M
14673 SF
(on-grade)
VILLAGE SQUARE
BUILDING N
20183 SF
(on-grade)
PAD 2
5306 SF
PAD 4
6655 SF
DRIVE THRU
GAS TANK (To be relocated by others)
EXISTING WETLAND
34'-0"
53'-0"
SERVICE
P1
P2
Driveway to 3rd Street
(Parking Level on-grade)
Line of Parking Below
(Parking Level below)
Ramp from +16.0
Ramp to P2 below
3rd Street
DROP-OFF
BUILDING S
5208 SF
BUILDING T
5208 SF
BUILDING V
THEATRE
44180 SF
(on 2 levels)
4th Street
Employee Parking
Ramp Up
GAS TANKS
EXISTING BUILDING
6-STORY
EXISTING BUILDING
NORTH
Ground Level Plan on Site
August 30, 2012
0'
50'
100'
150'
200'
250'
300'
DOWN TOWN KIHEI
The KRAUSZ COMPANIES, Inc.
44 Montgomery St., Ste 3300, San Francisco, CA 94104 ; Tel 14157326600
PI'IKEA AVENUE AT LILOA DRIVE, KIHEI, HAWAII
STOUTENBOROUGH
Architects and Planners
430 Alta Vista Way, Suite 100, Laguna Beach, Ca 92651
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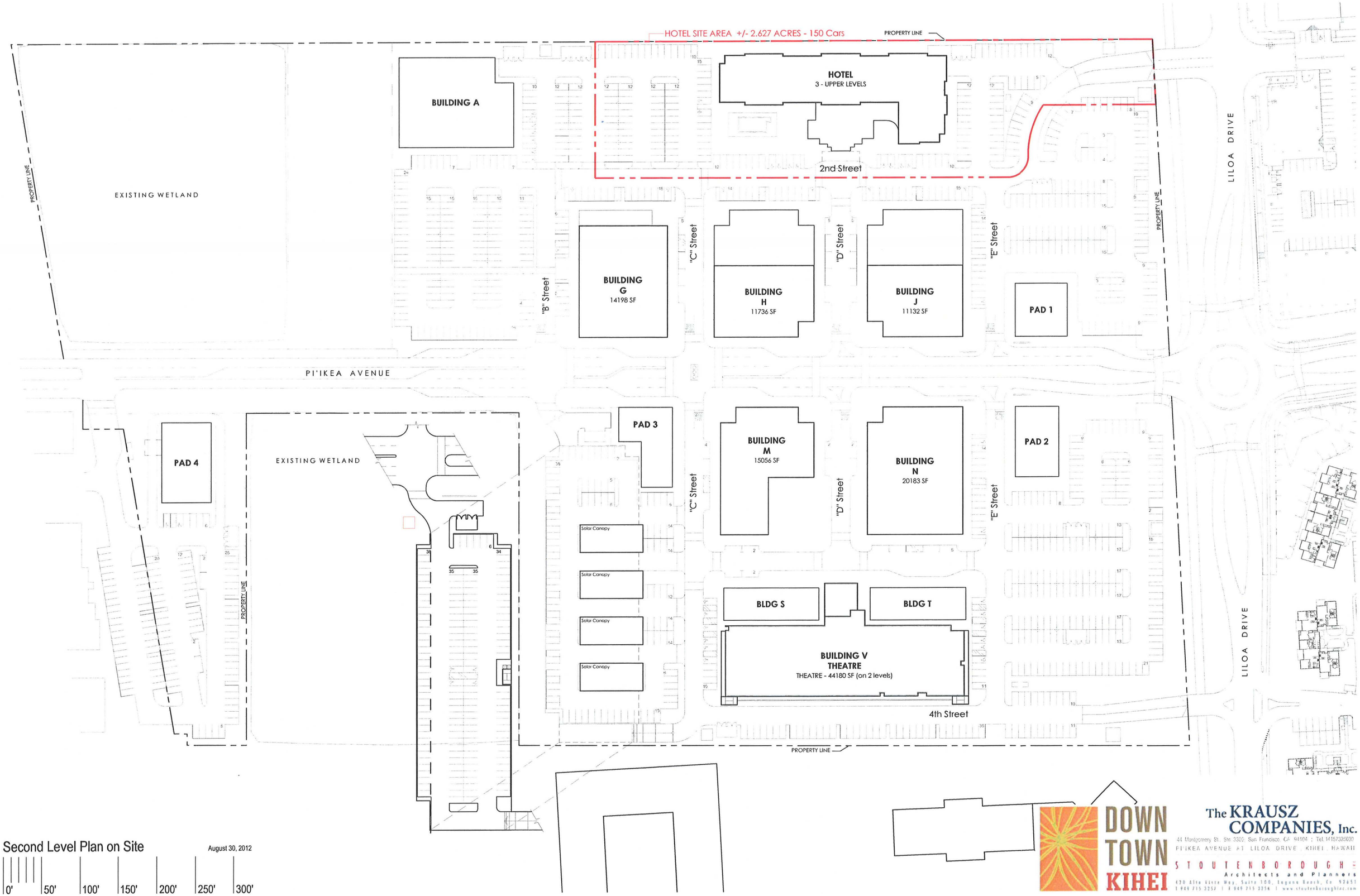

Second Level Plan on Site

August 30, 2012

DESIGN TEAM DIRECTORY

OWNER/DEVELOPER

The Krausz Companies, Inc.
44 Montgomery Street, Suite 3300
San Francisco, CA 94104
(415) 732-5600
Contact: David Pyle

ARCHITECT

Stoutenborough, Inc.
420 Alta Vista Way, Suite 100
Laguna Beach, CA 92651
(949) 715-3257
Contact: J Todd Stoutenborough, AIA, NCARB, LEED AP

LANDSCAPE ARCHITECT

Russel Y. Gushi, ASLA
44 S. Market Street
Wailuku, Maui, Hawaii 96793
(808) 242-6503
Contact: Russel Gushi

CIVIL & STRUCTURAL ENGINEER

Warren S. Unemori Engineering, Inc.
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii 96793
(808) 242-4403
Contact: Clifford Mukai, P.E.

LIGHTING CONSULTANT

Francis Krahe & Associates Inc.
304 S. Broadway, Suite 500
Los Angeles, CA 90013
(213) 617-0477
Contact: Francis Krahe, P.E.

TRAFFIC ENGINEER

Austin, Tsutsumi & Assoc., Inc.
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031
(808) 533-3646
Contact: Keith K. Niya, P.E.

PLANNER

Munekiyo & Hiraga, Inc.
305 S. High Street, Suite 104
Wailuku, Hawaii 96793
(808) 244-2015
Contact: Colleen Suyama

MECH / ELEC / PLUMB. ENGINEER

IDS Group, Inc.
810 Richards Street, Suite 503
Honolulu, HI 96813
(808) 330-7906
Contact: Robert Popov, P.E.

APPENDIX B.

Market Study

Summary Report to

The Krausz Companies, Inc.

Covering the

PROPOSED DOWNTOWN KIHEI MIXED-USE DEVELOPMENT

Piikea Avenue and Liloa Drive,
Kihei, Maui, Hawaii

As of August 5, 2011

JOHN CHILD & COMPANY
APPRAISERS & CONSULTANTS

JOHN CHILD & COMPANY
APPRAISERS & CONSULTANTS

August 27, 2012

Karen Char, MAI, CRE
Paul D. Cool, MAI, CRE
Shelly H. Tanaka

Mr. David Pyle
The Krausz Companies, Inc.
444 Montgomery Street, Suite 3300
San Francisco, California 94104

Dear Mr. Pyle:

Re: Proposed Downtown Kihei Mixed-Use Development

At your request, John Child & Company has provided real estate consulting services to assess the current and projected market support for the proposed Downtown Kihei mixed-use development. This letter summarizes our findings that are presented in the attached report.

STUDY BACKGROUND

Krausz Kihei One LLC and Krausz Kihei Two LLC, entities related to The Krausz Companies, Inc. (Krausz), own the fee simple interest in three unimproved parcels flanking Piikea Avenue at its intersection with Liloa Drive in Kihei, Maui, Hawaii. The three parcels are identified as tax map keys 3-9-02:30, 76, and 158 of the Second Taxation Division. About 3.5 acres of Parcel 30 are encumbered by wetlands. Consequently, the parcels have a net developable area of about 20.4 acres, shown as follows:

Net Developable Land Area

Parcel	Acres
30	9.969
76	9.092
158	1.376
Total	20.437

Krausz proposes a mixed-use "downtown" development on the three parcels. Its goals are to provide retail, office, and visitor accommodation units in a walkable and sustainable development. The development will include:

733 Bishop Street, Suite 2500 • Honolulu, Hawaii 96813
T 808.533.2951 • F 808.523.7672 • email:info@johnchild.com

- About 257,000ƒ of gross leasable area for retail, office, restaurant and entertainment uses, including a 44,000ƒ Cinetopia theatre with restaurant, wine bar and gourmet concession stands

- Four-story, 150-key select-service hotel with about 93,000ƒ of building area, including 1,500ƒ of meeting space

- Surface and decked parking areas, walkways, and other ancillary development components.

Under the Maui County zoning code, the parcels are zoned for single-family residential uses. The Kihei-Makena Community Plan classifies the wetlands area as Open Space and the balance of the parcels for Business/Commercial use. Finally, the parcels are within a Special Management Area. Consequently, the proposed mixed-use development will require certain changes to the existing land use designations.

Krausz has retained Munekiyo & Hiraga, a Maui-based land planning consultant, to assist with the land use entitlement process. As a part of the submissions to the Maui County agencies, certain market assessments of the proposed development may be necessary. In this regard you have asked us to assist you.

STUDY OBJECTIVE

The objective of our assistance is to assess the current and projected market support for the hotel and commercial components of the proposed Downtown Kihei mixed-use development.

INTENDED USE AND USER(S)

Our assistance is intended to be used by Krausz (Client), its consultants, and State and County agencies in matters relating to land use entitlements for the proposed Downtown Kihei mixed-use development. The Client has specifically agreed that our assistance is not intended for any other purpose or users and is not to be relied upon by any third parties for any purpose, whatsoever.

EFFECTIVE DATE OF ANALYSIS

The effective date of analysis is August 5, 2011.

REPORTING

This assignment is presented in a summary report, a format intended to comply with the reporting requirements set forth under Standards Rule 2-2(b) of the Uniform Standards of Professional Appraisal Practice.

This report contains summary discussions of the data, reasoning, and analyses used to project the market support for the hotel and commercial components of the proposed Downtown Kihei mixed-use development. Any data, reasoning, and analyses not presented in this report are available in our workfiles.

STUDY CONDITIONS

This report is subject to the study conditions that are presented in Section I of the accompanying report.

PROJECTED MARKET SUPPORT

The proposed Downtown Kihei mixed-use development is envisioned as a sustainable community integrating retail, office, entertainment, and hotel uses. Design elements create a pedestrian-friendly environment with open spaces that can accommodate open markets, entertainment and other community activities.

The development will be centrally located within the Kihei-Makena community and in close proximity to major employment, educational, shopping, recreational, and community support facilities. The development will have convenient ingress and egress via major traffic corridors through the region.

The estimated market support for the proposed Downtown Kihei mixed-use development are presented under the following subheadings.

Hotel Component

Based on the analyses presented in Section II, market support for new hotel development in Kihei is expected after 2013. Assuming a two-year planning and development period, demand would exist for the 150-room Downtown Kihei hotel upon completion.

Considering the competitive position of the Downtown Kihei development, the 150-room hotel is anticipated to capture a substantial share of the new room demand from out-of-state visitors. With a capture rate of at least 50% of the annual new visitor room demand, the 150-room hotel could be expected to achieve a stabilized occupancy between 2015 and 2016.

Demand from neighbor island residents and airline crew members has not been quantified. However, the hotel's central location and market orientation would appeal to these segments as well. Considering the potential demand from these markets, the projections of stabilized occupancy may be conservative.

Commercial Component

Based on the analyses presented in Section III, the additional retail space requirements within the Kihei-Makena area are estimated at about 172,000ƒ to 224,000ƒ between 2010 and 2015, and about 119,000ƒ to 159,000ƒ between 2015 and 2020.

The Downtown Kihei development could capture a 60% share of the additional retail space requirements. As a result, the 213,000ƒ of non-theatre commercial space planned for the center could be fully leased by around 2020, shown as follows:

Projected Market Support for the Downtown Kihei Commercial Component [1]

	Additional Space Requirement			Downtown Kihei Commercial Component			
				Per Period		Cumulative	
Period	Low	High	Capture rate	Low	High	Low	High
2010 – 2015	172,000 -	224,000	60%	103,000 -	134,000	103,000 -	134,000
2015 – 2020	119,000 -	159,000	60	71,000 -	95,000	174,000 -	229,000
2020 – 2025	121,000 -	158,000	60	73,000 -	95,000	247,000 -	324,000
2025 - 2030	116,000 -	153,000	60	70,000 -	92,000	317,000 -	416,000

* * * * *

[1] Excludes 44,000ƒ expected to be leased to Cinetopia.

We appreciate having the opportunity to assist you on this interesting assignment. Please contact us if you have questions.

Sincerely,

JOHN CHILD & COMPANY, INC.

Paul D. Cool, MAI, CRE
Vice President
Certified General Appraiser License No. 71
State of Hawaii
Expires December 31, 2013

Shelly H. Tanaka
Appraiser
Certified General Appraiser License No. 648
State of Hawaii
Expires December 31, 2013

CERTIFICATION

We certify, to the best of our knowledge and belief:

- Reported statements of fact are true and correct.
- Reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions and are our unbiased professional analyses, opinions, and conclusions.
- We have no present or prospective interest in the property that is the subject of this report, and we have no personal interest or bias with respect to the parties involved.
- We have provided real estate appraisal services relating to an ownership interest in the property that is the subject of this report within three years and have informed the client prior to acceptance of this assignment.
- Our engagement was not contingent upon developing or reporting predetermined results.
- Our compensation is not contingent on the reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value estimate, the attainment of a stipulated result, or the occurrence of a subsequent event and is not contingent on an action or event resulting from the analyses, opinions or conclusions in, or use of, this report.
- The reported analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Uniform Standards of Professional Appraisal Practice and the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute.
- The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives. It is also subject to the same review by the Counselors of Real Estate and the American Society of Appraisers.
- As of the date of this report, Paul D. Cool, MAI has completed the continuing education program for Designated Members of the Appraisal Institute.
- As of the date of this report, Shelly Tanaka has completed the Standards and Ethics Education Requirements for Associate Members of the Appraisal Institute.
- Paul D. Cool personally visited the real estate that is the subject of this report. Shelly Tanaka did not visit the real estate; however, she is familiar with the property and its environs.

JOHN CHILD & COMPANY, INC.

Paul D. Cool, MAI, CRE
Vice President
Certified General Appraiser License No. 71
State of Hawaii
Expires December 31, 2013

Shelly H. Tanaka
Appraiser
Certified General Appraiser License No. 648
State of Hawaii
Expires December 31, 2013

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CERTIFICATION
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Qualifications of John Child & Company, Inc.
Qualifications of Paul D. Cool, MAI, CRE
Qualifications of Shelly H. Tanaka

This section presents the study background, study objective, intended use and intended users, effective date of analysis, and study conditions.

STUDY BACKGROUND

Krausz Kihei One LLC and Krausz Kihei Two LLC, entities related to The Krausz Companies, Inc. (Krausz), own the fee simple interest in three unimproved parcels flanking Piikea Avenue at its intersection with Liloa Drive in Kihei, Maui, Hawaii, as shown in Exhibit I-A.

The three parcels are identified as tax map keys 3-9-02:30, 76, and 158 of the Second Taxation Division, as shown in Exhibit I-B. About 3.5 acres of Parcel 30 are encumbered by wetlands. Consequently, the parcels have a net developable area of about 20.4 acres, shown as follows:

Net Developable Land Area

Parcel	Acres
30	9.969
76	9.092
158	1.376
Total	20.437

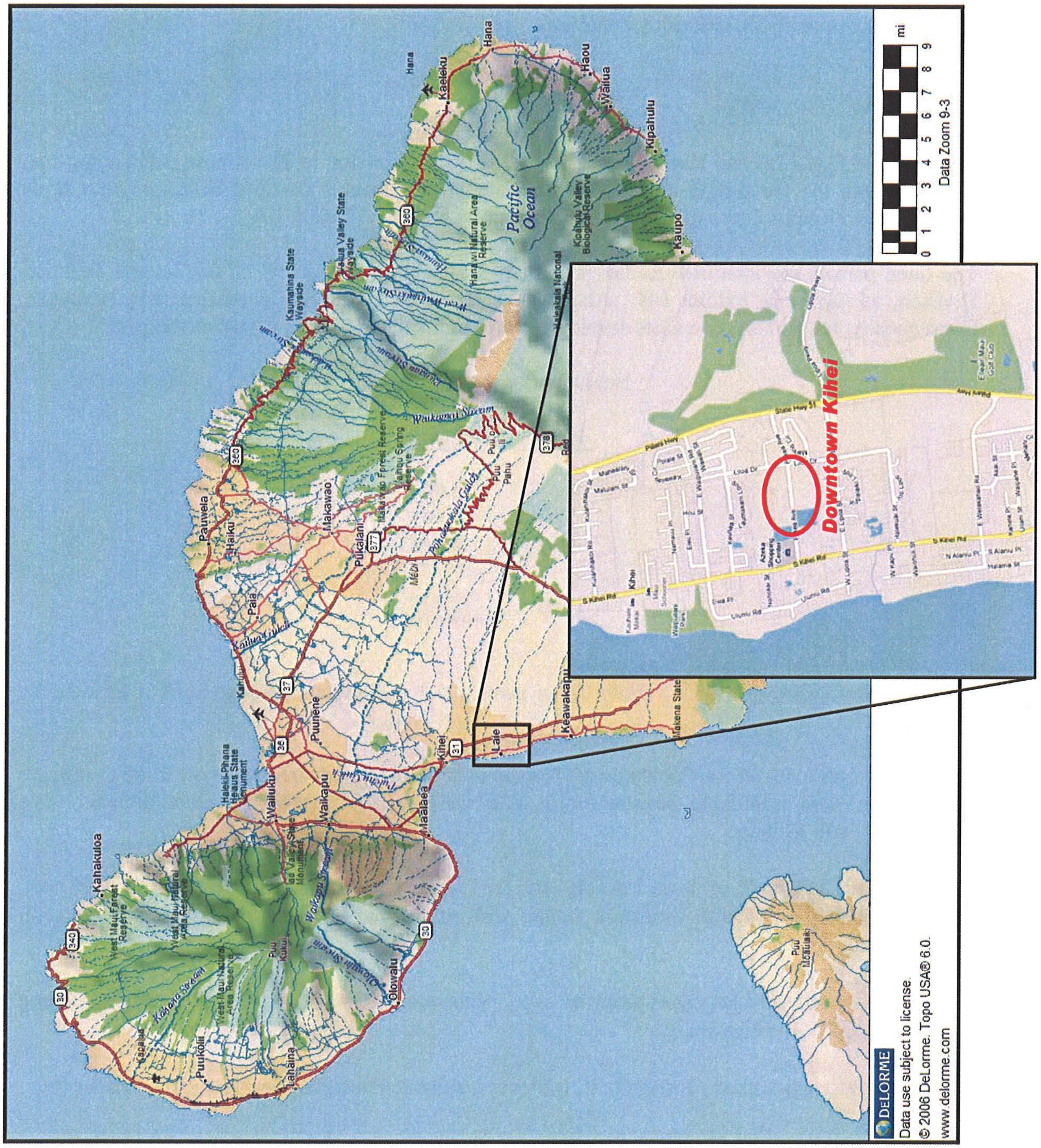
An aerial photograph of the Downtown Kihei parcels and surrounding neighborhood is included as Exhibit I-C.

Krausz proposes a mixed-use "downtown" development on the three parcels. Its goals are to provide retail, office, and affordable housing units in a walkable and sustainable development. The development will include:

- About 257,000ƒ of gross leasable area for retail, office, restaurant and entertainment uses, including a 44,000ƒ Cinetopia theatre with restaurant, wine bar and gourmet concession stands
- Four-story, 150-key select-service hotel with about 93,000ƒ of building area, including 1,500ƒ of meeting space
- Surface and decked parking areas, walkways, and other ancillary development components.

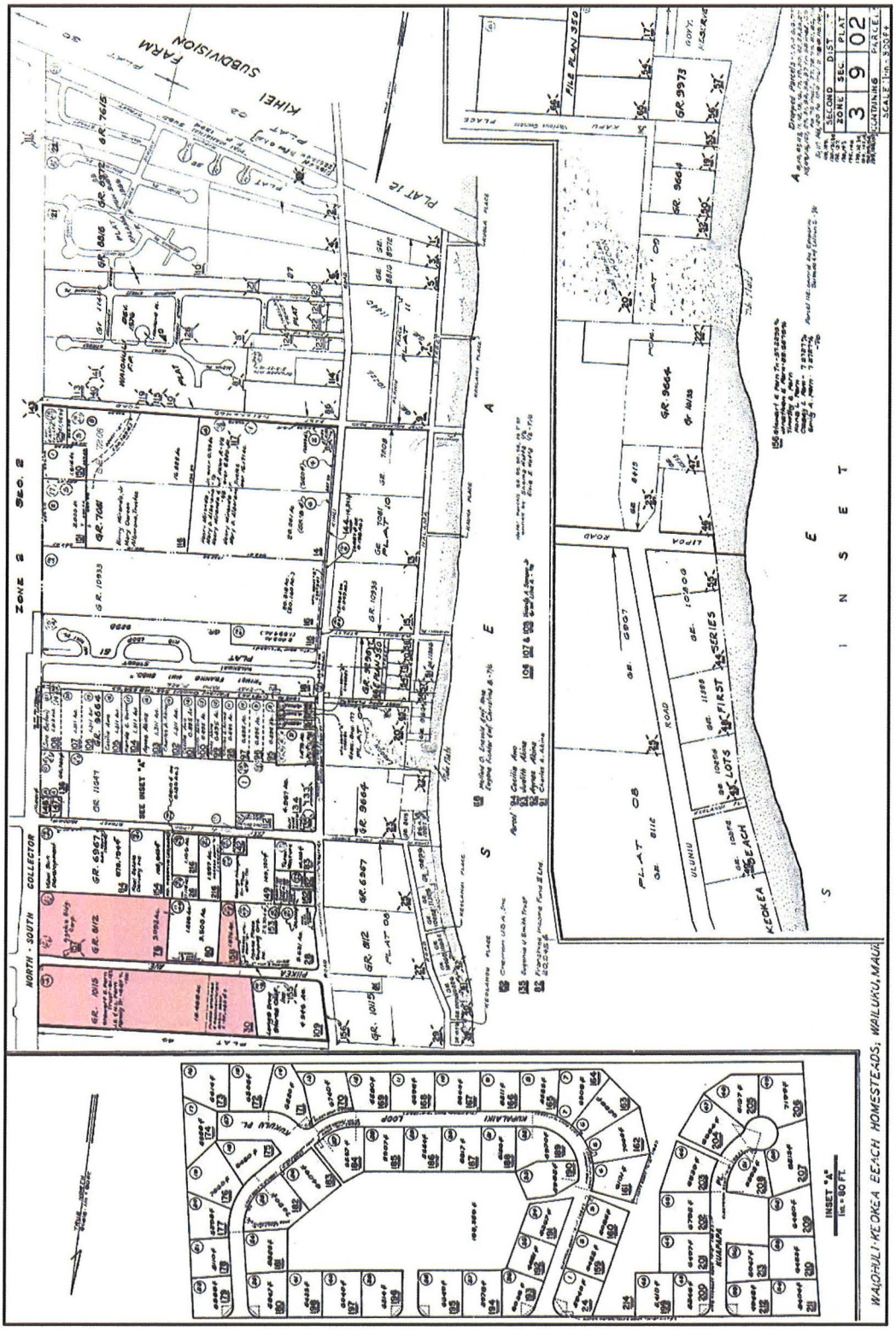
The conceptual site plan is included in Exhibit I-D. Selected conceptual renderings are included in Exhibit I-E.

LOCATION MAP OF DOWNTOWN KIHEI



Source: DeLorme, Topo USA®6.0, 2006 and Google Maps.

TAX MAP OF THE DOWNTOWN KIHEI PARCELS

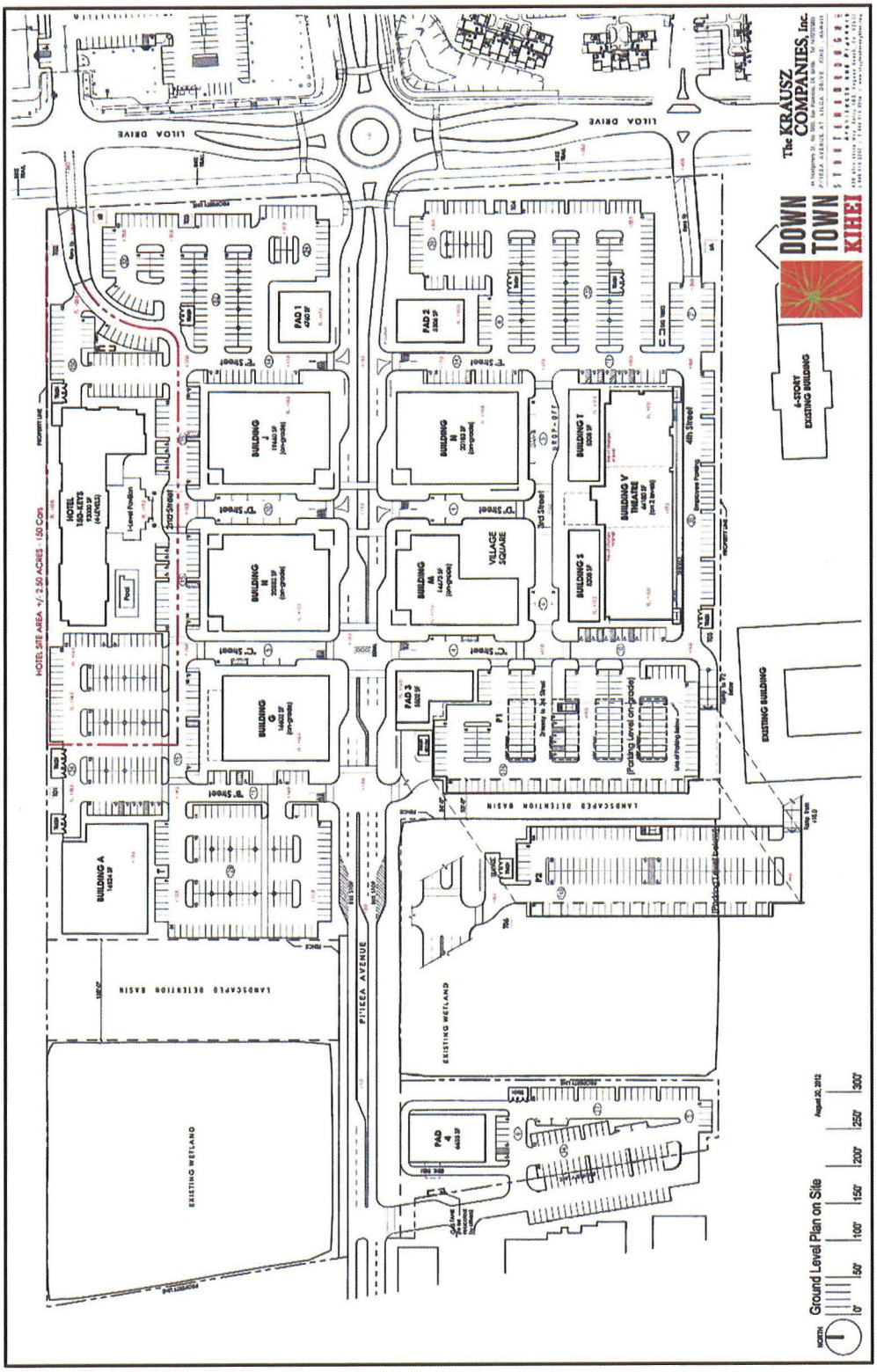


Source: Title Guaranty of Hawaii, Title Guaranty Express.

AERIAL PHOTOGRAPHS OF THE DOWNTOWN KIHEI PARCELS

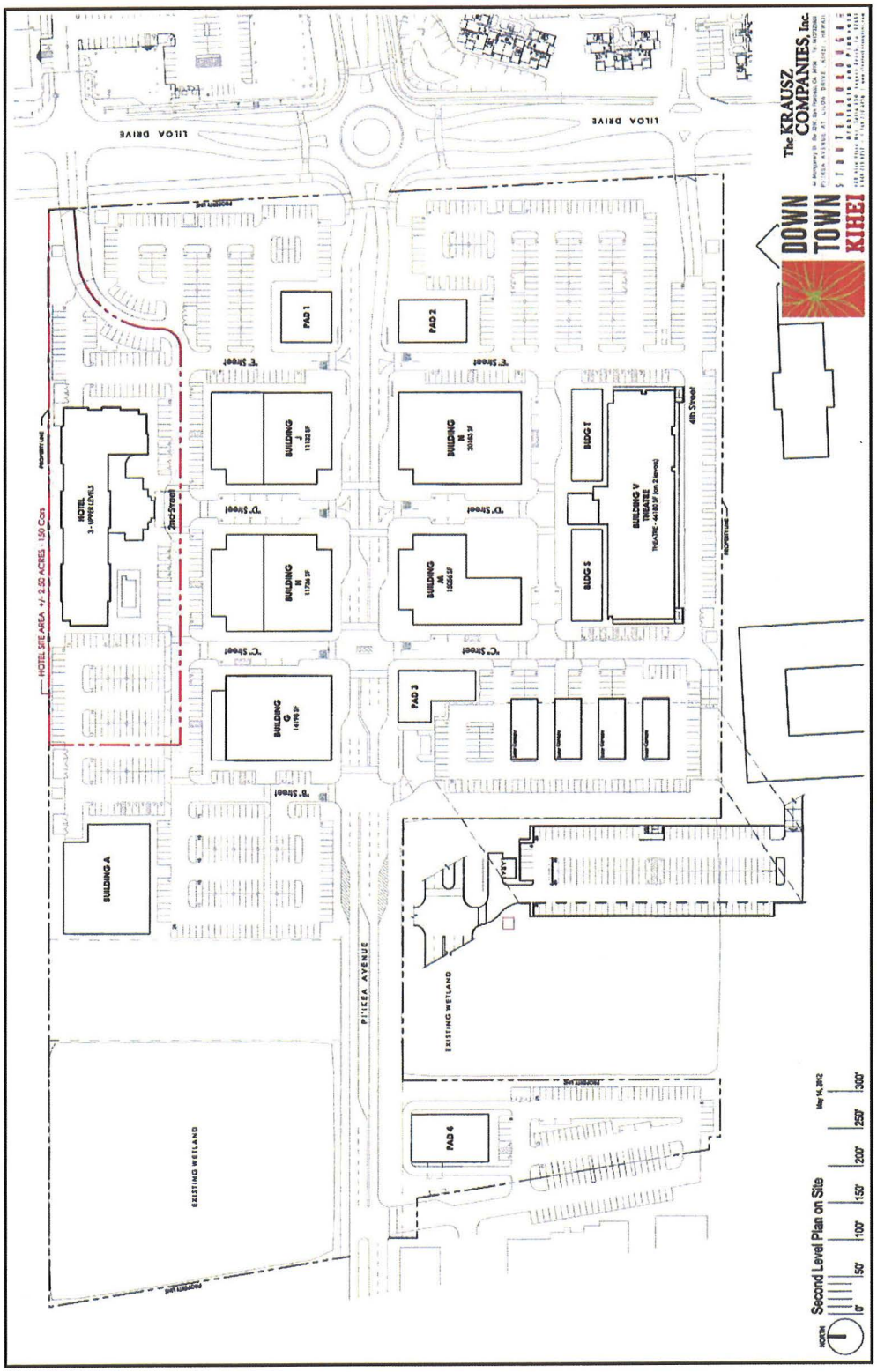
Source: The Krausz Companies, Inc.

CONCEPTUAL SITE PLAN FOR DOWNTOWN KIHEI



Source: Stoutenborough Inc. Architects and Planners.

CONCEPTUAL SITE PLAN FOR DOWNTOWN KIHEI



Source: Stoutenborough Inc. Architects and Planners.

TABULATION SUMMARY

North Site Area — **13.5 Acres**

	Building Name	Building Area (sf)	Parking Required (Pursuant to Ordinance 3662 Bill No. 49 ; 2009)	Parking Provided
Ground Level				
	Building A	16,524	33 cars @ 2 cars / 1000 sf	
	Building G	16,602	33 "	
	Building H	20,332	41 "	
	Building J	19,660	39 "	
	Pad 1	4,760	10 "	
	Total Ground Level Bldg Area	**77,878 sf**	**156 cars**	
Second Level				
	Building G (Medical)	14,198	45 cars @ 3.2 cars / 1000 sf	
	Building H	11,736	23 cars @ 2 cars / 1000 sf	
	Building J	11,132	22 cars @ 2 cars / 1000 sf	
	Total Second Level Bldg Area	**37,066 sf**	**91 cars**	
Hotel (4 Levels)				
	150 Keys	93,000	150 cars @ 1 car / key	
	Total Building Area	**93,000 sf**	**150 cars**	
Restaurant Allowance (Additional)				
	10,000 sf of GLA		48 cars @ 8 cars / 1000 sf of dining area o 6000 sf*	
*1)	**Total Restaurant & Medical Allowance**		**48 cars (additional)**	
Total Gross Leasable Area (North Side)		**207,944 sf**	**445 cars required**	**515 cars provided**

South Site Area — **12.6 Acres**

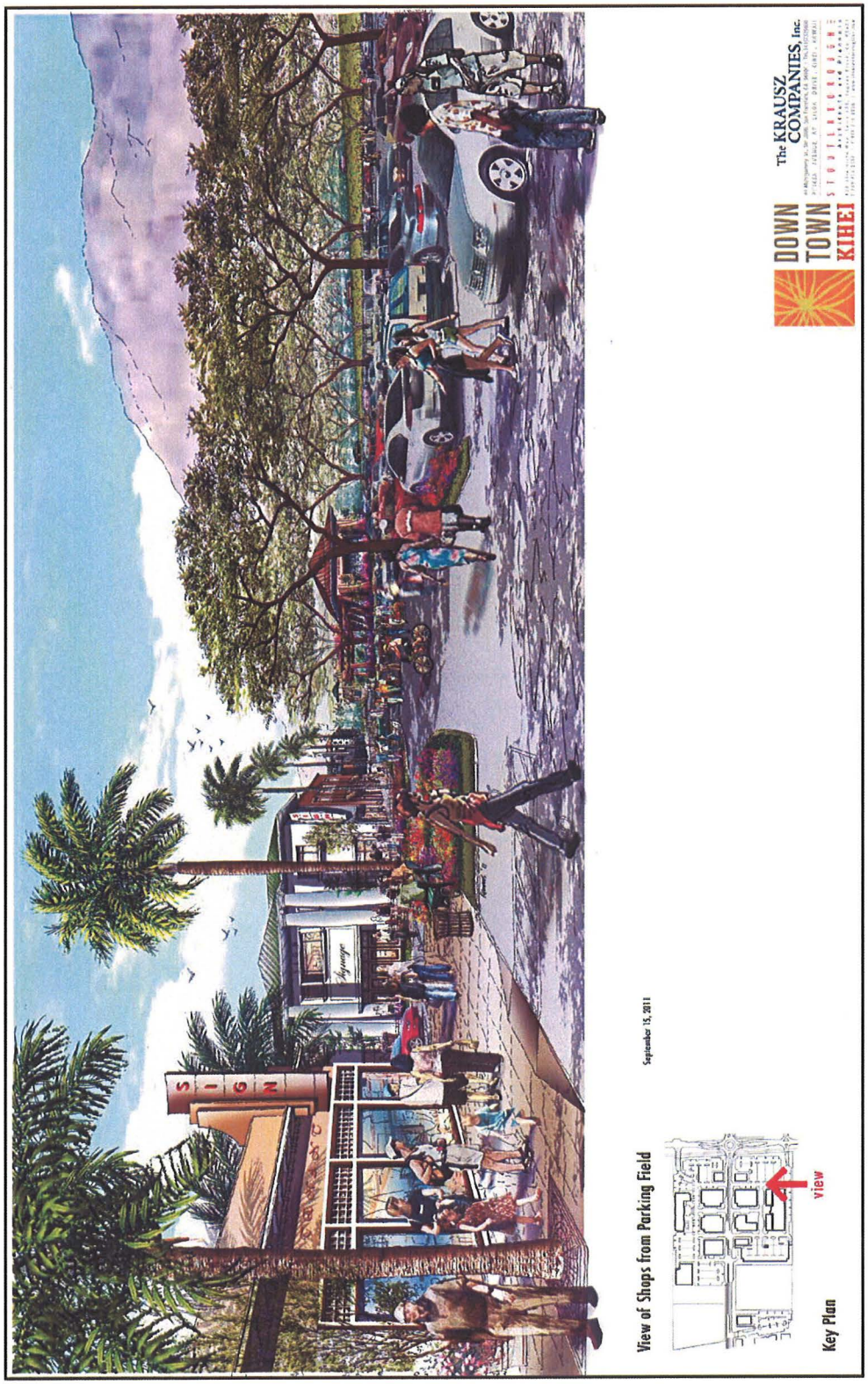
	Building Name	Building Area (sf)	Parking Required (Pursuant to Ordinance 3662 Bill No. 49 ; 2009)	Parking Provided
Ground Level				
	Building M	14,673	29 cars @ 2 cars / 1000 sf	
	Building N	20,183	40 "	
	Pad 3	5,502	11 "	
	Pad 2	5,306	11 "	
	Building S	5,208	10 "	
	Building T	5,208	10 "	
*2)	Building V (Theatre)	44,180	245 cars @ 1 car / 6 seats	
	Pad 4	6,655	40 cars @ 10 cars / 1000 sf of dining area o 3993 sf*	
	Total Ground Level Bldg Area	**106,915 sf**	**398 cars**	
Second Level				
	Building M (Office)	15,056	30 cars @ 2 cars / 1000 sf	
	Building N (Service, Retail & Rest.)	20,183	40 "	
	Total Second Level Bldg Area	**35,239 sf**	**70 cars**	
Restaurant Allowance (Additional)				
	20,000 sf of GLA		96 cars @ 8 cars / 1000 sf of dining area o 12000 sf*	
	Total Restaurant & Medical Allowance		**96 cars (additional)**	
Total Gross Leasable Area (South Side)		**142,154 sf**	**564 cars required**	**684 cars provided**

Total Project Area (North & South Sites)	**350,098 sf**	**1009 cars required**	**1199 cars provided** **19 % over requirement**

* Note:
1) Dining Room area of restaurant is assumed at 60% of GLA
2) Theatre is 44180 sf on 2 levels at 30 sf / seat = 1472 seats @ 1 car / 6 seats

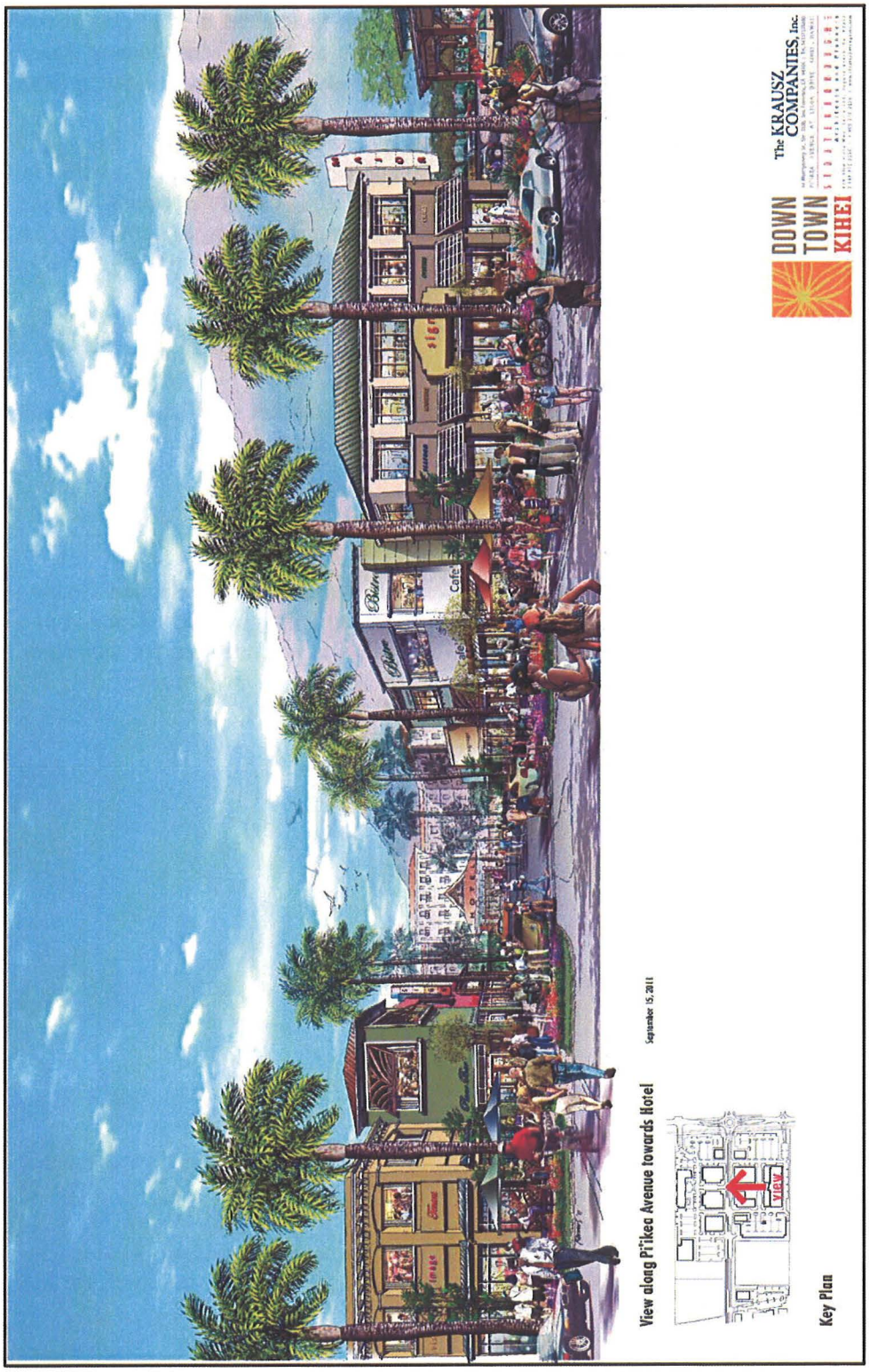
Source: Stoutenborough Inc. Architects and Planners.

CONCEPTUAL RENDERINGS OF DOWNTOWN KIHEI



Source: The Krausz Companies, Inc.

CONCEPTUAL RENDERINGS OF DOWNTOWN KIHEI



Source: The Krausz Companies, Inc.

Under the Maui County zoning code, the parcels are zoned for single-family residential uses. The Kihei-Makena Community Plan classifies the wetlands area as Open Space and the balance of the parcels for Business/Commercial use. Finally, the parcels are within a Special Management Area. Consequently, the proposed mixed-use development will require certain changes to the existing land use designations.

Krausz has retained Munekiyo & Hiraga, a Maui-based land planning consultant, to assist with the land use entitlement process. As a part of the submissions to the Maui County agencies, certain market assessments of the proposed development may be necessary. In this regard you have asked us to assist you.

STUDY OBJECTIVE

The objective of our assistance is to assess the current and projected market support for the hotel and commercial components of the proposed Downtown Kihei mixed-use development.

INTENDED USE AND USER(S)

Our assistance is intended to be used by Krausz (Client), its consultants, and State and County agencies in matters relating to land use entitlements for the proposed Downtown Kihei mixed-use development. The Client has specifically agreed that our assistance is not intended for any other purpose or users and is not to be relied upon by any third parties for any purpose, whatsoever.

EFFECTIVE DATE OF ANALYSIS

The effective date of analysis is August 5, 2011.

STUDY CONDITIONS

This report is subject to the following study conditions:

Basis of Analysis, Opinions, and Conclusions

The analysis, opinions, and conclusions of this report are based on informed judgment about market and economic conditions as of the effective date of the report.

The analyses, opinions, and conclusions of this report rely on data and information provided by others. The information is believed to be reliable; however, no responsibility is assumed for the accuracy of information provided by others.

The analysis, opinions, and conclusions assume:

1. No hidden or unapparent surface or subsurface conditions of the property, structures, soils, subsoils, geological formations, ground water, or drainage conditions exist that would render the property more or less valuable.

2. The client has provided us with all significant, relevant information covering the subject of this report.

No responsibility is assumed for matters legal in nature affecting the property or its title, which is assumed to be good and merchantable.

Properties in Hawaii typically include a reservation in favor of the State of Hawaii of all mineral and metallic mines. Our analyses, opinions, and conclusions assume these reservations do not have an impact on the value or use of the property.

Any drawings, maps, photographs, and similar exhibits accompanying this report are included to assist the reader in visualizing the property. No responsibility is assumed for the accuracy of these exhibits.

Legality of Improvements

This report assumes that any existing and/or proposed improvements comply with all applicable federal, state, and county regulations, laws and private covenants and restrictions unless specifically stated otherwise.

Hazardous Substances

Unless otherwise stated, the existence of hazardous substances (actual, alleged or threatened discharge, disposal, seepage, migration, release, growth, infestation, spread or escape of molds, mildews, fungi and/or spores, or any materials, goods or products containing, harboring or nurturing these substances) that could be present on the property, or other environmental conditions that could impact the property, were not brought to the attention of the appraisers nor observed during the site visit.

The appraisers are not trained or qualified to detect hazardous substances or conditions even if these hazards, or evidence of potential presence of these hazards, are visible on the property.

Therefore, this report assumes no hazardous substance or condition exists that would impact the analyses, opinions or conclusions. If a hazardous substance or condition exists, it could have a negative effect on the value of the property.

Archaeological or Historically Significant Conditions

The appraisers are not trained or qualified to recognize archaeological or historically significant conditions, even if these conditions are visible on the property.

Unless otherwise stated, archaeological or historically significant conditions that could be present on the property were not identified nor observed during the site visit. The report assumes no archaeological or historically significant condition exists that would impact the analyses, opinions or conclusions of this report. If an archaeological or historically significant condition exists, it could impact the use or value of the property and affect the results of this assignment.

Americans With Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) became effective January 26, 1992. Unless otherwise stated, this report was not based on any specific compliance survey and analysis of this property to determine whether or not it is in conformity with the various detailed requirements of the ADA. A survey of the property together with a detailed analysis of the requirements of the ADA could reveal that the property is not in compliance with one or more of the requirements of the ADA. If so, it could have a negative effect on the value of the property.

Terms of Assignment

We have no obligation to update our report because of events and transactions occurring subsequent to the effective date of the report.

Neither our fees nor payment were contingent upon the results of the report.

Reporting

This assignment is presented in a summary report, a format intended to comply with the reporting requirements set forth under Standards Rule 2-2(b) of the Uniform Standards of Professional Appraisal Practice.

This report contains summary discussions of the data, reasoning, and analyses used to project the market support for the proposed commercial, and hotel components of the Downtown Kihei mixed-use development. Any data, reasoning, and analyses not presented in this report are available in our workfiles.

Use of Report

This report is valid only if presented in whole, with the letter of transmittal and signed certification.

This report or any portion of this report may not be reproduced or published without the prior written consent of John Child & Company, and then only with proper qualification.

The contents of this report or portions of this report, the identity of the appraisers or any reference to John Child & Company, the Appraisal Institute, the Counselors of Real Estate, or the American Society of Appraisers, or to their respective designations may not be disseminated to the public through advertising media, public relations media, news media, sales media, or any other public means of communication.

Limitation on Liability

John Child & Company shall not be liable to Client or to any third party (including without limitation lenders and other persons to whom Client may show this report for the purposes of obtaining credit, insurance or any other benefit or promise) in the event that the use or value of the subject property is or becomes different from the use or value estimates, analyses, opinions or conclusions in this report unless it is established by clear and convincing evidence that John Child & Company acted in bad faith or willfully and recklessly failed to exercise an appropriate standard of care in the community while performing this assignment. In any event, John Child & Company's liability to Client or to any third party shall be limited to the amount of the fees to complete this assignment.

This report may not be shown to any third party without our consent and without receiving a written acknowledgement from any person to whom it is shown that such person has read, understands and agrees to be bound by the limitation of liability in this paragraph.

This section summarizes the market support for the proposed 150-room hotel in terms of the State visitor industry trends, Maui's visitor plant, projected demand for visitor rooms in Kihei, competitive supply, and projected market support for the Downtown Kihei hotel component.

VISITOR ARRIVALS

About 6.0 to 7.0 million people traveled to the State of Hawaii annually between 1990 and 2004. Visitor arrivals peaked at about 7.5 million between 2005 and 2007. However the global recession impacted travel, and arrivals fell sharply to about 6.4 million in 2009.

The State of Hawaii Department of Business, Economic Development, and Tourism (DBEDT) forecasts visitor arrivals to the State. Its long-range visitor projections through 2035 were prepared as of July 2009 when arrivals were at an all-time low. At that time, DBEDT projected arrivals would not reach 7.5 million visitors again until 2015.

However, the visitor market rebounded faster than expected, with Maui and Oahu leading the recovery. By the end of 2010, visitor arrivals topped 7.0 million people, or about a 9% increase over 2009. Year-to-date counts through June 2011 show the market remains robust with arrivals up 4.5% compared to the same period last year, as shown in Exhibit II-A.

DBEDT forecasts arrivals will continue to increase between 2% and 4% annually over the near-term. Based on its near-term forecast prepared at the end of June 2011, visitor arrivals to the State could reach 7.8 million by 2014, as shown in Exhibit II-B.

MAUI VISITOR MARKET

Direct flights to Kona and new resort development on Lanai and the Big Island of Hawaii have increased travel to these islands. However, Oahu and Maui continue to dominate the market.

Maui receives about 2.0 to 2.2 million visitors annually, or about 30% of all visitors to the State, as shown in Exhibit II-C. Characteristics of Maui's visitor market are summarized under the following subheadings.

Major Market Areas (MMAs)

The mainland U.S. accounts for about 80% of Maui's visitor market, or about 1.6 million people in 2010. Ten states account for about 71% of all U.S. visitors, with 44% from California and Washington alone, as shown in Exhibit II-D.

Canadian visitors are a growing segment and currently account for about 9.5% of all visitors to Maui, or nearly 200,000 visitors annually. Recent sales in Wailea Resort also show Canadians are a significant second-home market for luxury real estate on the island.

HISTORICAL VISITOR ARRIVALS, BY AIR
1990 - YTD June 2011

			Maui County				
Year	State	Oahu	Maui	Lanai	Molokai	Hawaii	Kauai
1990	6,723,531	5,139,558	2,235,701	46,052	103,477	1,127,373	1,228,850
1991	6,518,460	4,831,027	2,129,020	55,721	89,361	1,111,035	1,182,326
1992	6,473,669	4,864,160	2,267,020	79,242	115,684	1,139,978	881,730
1993	6,070,995	4,472,235	2,212,129	73,046	94,179	1,117,656	576,366
1994	6,364,674	4,629,736	2,288,809	78,012	79,135	1,079,535	860,719
1995	6,546,759	4,817,552	2,268,273	92,353	83,109	1,081,047	929,150
1996	6,723,141	4,903,884	2,260,454	94,292	77,470	1,163,700	975,436
1997	6,761,135	4,875,612	2,260,921	106,036	79,922	1,205,081	997,087
1998	6,595,790	4,601,834	2,243,912	97,434	75,245	1,340,767	1,078,400
1999	6,741,037	4,560,142	2,278,933	94,546	69,657	1,307,720	1,089,289
2000	6,948,595	4,719,244	2,246,254	87,661	64,558	1,267,966	1,074,821
2001	6,303,791	4,257,829	2,048,896	84,905	70,233	1,181,618	1,008,698
2002	6,389,058	4,276,077	2,073,051	80,875	75,134	1,243,313	1,005,898
2003	6,380,439	4,090,483	2,125,421	91,445	94,106	1,207,164	975,867
2004	6,912,094	4,464,551	2,155,561	73,382	72,084	1,281,156	1,020,915
2005	7,416,574	4,731,843	2,294,697	73,280	73,487	1,521,538	1,090,147
2006	7,528,106	4,688,117	2,446,590	94,269	86,336	1,614,408	1,204,132
2007	7,496,820	4,694,750	2,463,595	100,350	83,163	1,622,359	1,299,045
2008	6,713,436	4,193,685	2,075,800	80,867	68,883	1,321,277	1,030,647
2009	6,420,448	4,024,888	1,892,396	61,054	48,339	1,215,256	928,112
2010	6,982,425	4,328,849	2,092,069	68,884	50,253	1,290,859	964,724
YTD June:							
2010	3,353,160	2,045,977	1,011,226	33,343	24,235	628,696	466,313
2011	3,503,955	2,114,235	1,082,109	39,992	29,702	661,488	492,964
% change	4.5%	3.3%	7.0%	19.9%	22.6%	5.2%	5.7%

Notes:

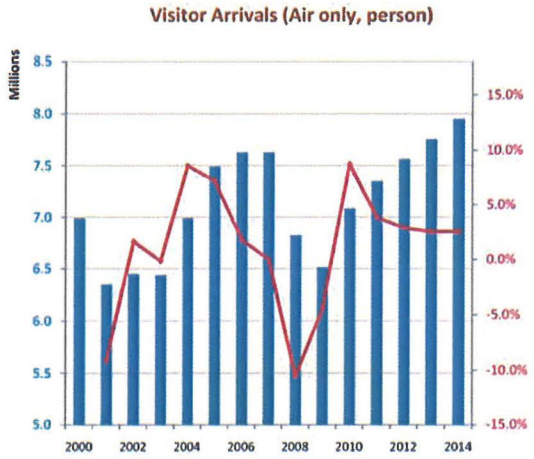
Figures exclude arrivals by cruise ship.

The sum of visitor arrivals by island is greater than the total arrivals to the State because people visit more than one island.

Source: Hawaii Tourism Authority, "2010 Annual Visitors Research Report" (HTA 2010 Report) and "June 2011 Island Highlights."

FORECAST STATE VISITOR ARRIVALS, DAYS, AND EXPENDITURES 2005 - 2014

DBEDT Forecasts (2Q 2011): Visitor Arrival



	Air only		Total	
	person	annual growth (%)	person	annual growth (%)
2005	7,416,574	7.3%	7,494,236	7.2%
2006	7,528,105	1.5%	7,628,117	1.8%
2007	7,496,820	-0.4%	7,627,819	0.0%
2008	6,713,436	-10.4%	6,822,912	-10.6%
2009	6,420,448	-4.4%	6,517,054	-4.5%
2010	6,982,572	8.8%	7,084,525	8.7%
2011	7,231,000	3.6%	7,354,000	3.8%
2012	7,442,000	2.9%	7,565,000	2.9%
2013	7,632,000	2.5%	7,755,000	2.5%
2014	7,827,000	2.6%	7,950,000	2.5%

DBEDT Forecasts (2Q 2011) : Visitor Days

	Air only		Total	
	days	annual growth (%)	days	annual growth (%)
2005	67,687,479	7.8%	68,241,986	7.7%
2006	69,145,854	2.2%	69,884,943	2.4%
2007	69,135,310	0.0%	70,074,573	0.3%
2008	63,130,133	-8.7%	63,857,377	-8.9%
2009	60,255,061	-4.6%	60,836,669	-4.7%
2010	65,596,761	8.9%	66,202,147	8.8%
2011	68,886,000	5.0%	69,597,000	5.1%
2012	70,701,000	2.6%	71,442,000	2.7%
2013	72,506,000	2.6%	73,247,000	2.5%
2014	74,404,000	2.6%	75,145,000	2.6%

Source: State of Hawaii Department of Business, Economic Development, and Tourism (DBEDT), "Quarterly Statistical and Economic Report, 2nd Quarter 2011" (2Q2011 QSER).

FORECAST STATE VISITOR ARRIVALS, DAYS, AND EXPENDITURES
2005 - 2014

DBEDT Forecasts (2Q 2011): Visitor Expenditure

	Air only		Total	
	$million	annual growth (%)	$million	annual growth (%)
2005	11,650	9.4%	11,904	9.6%
2006	12,243	5.1%	12,492	4.9%
2007	12,578	2.7%	12,811	2.6%
2008	11,182	-11.1%	11,398	-11.0%
2009	9,794	-12.4%	9,993	-12.3%
2010	11,383	16.2%	11,588	16.0%
2011	12,623	10.9%	12,837	10.8%
2012	13,317	5.5%	13,538	5.5%
2013	14,024	5.3%	14,250	5.3%
2014	14,643	4.4%	14,874	4.4%

Source: State of Hawaii Department of Business, Economic Development, and Tourism (DBEDT), "Quarterly Statistical and Economic Report, 2nd Quarter 2011" (2Q2011 QSER).

MARKET SHARE, BY ISLAND
1990 - 2010

Year	State	Oahu	Maui County			Hawaii	Kauai
			Maui	Lanai	Molokai		
Arrivals:							
1990	6,723,531	5,139,558	2,235,701	46,052	103,477	1,127,373	1,228,850
1995	6,546,759	4,817,552	2,268,273	92,353	83,109	1,081,047	929,150
2000	6,948,595	4,719,244	2,246,254	87,661	64,558	1,267,966	1,074,821
2005	7,416,574	4,731,843	2,294,697	73,280	73,487	1,521,538	1,090,147
2010	6,982,425	4,328,849	2,092,069	68,884	50,253	1,290,859	964,724
Market Share:							
1990	N/A	76.4%	33.3%	0.7%	1.5%	16.8%	18.3%
1995	N/A	73.6%	34.6%	1.4%	1.3%	16.5%	14.2%
2000	N/A	67.9%	32.3%	1.3%	0.9%	18.2%	15.5%
2005	N/A	63.8%	30.9%	1.0%	1.0%	20.5%	14.7%
2010	N/A	62.0%	30.0%	1.0%	0.7%	18.5%	13.8%

Source: HTA 2010 Report.

TOP U.S. MAINLAND MARKETS TO MAUI
2010

No.	State	Total	Percent of total [1]
1	California	562,804	34%
2	Washington	169,177	10
3	Oregon	86,533	5
4	Texas	84,105	5
5	Illinois	56,014	3
6	Arizona	51,665	3
7	Colorado	49,520	3
8	New York	43,435	3
9	Florida	30,039	2
10	Utah	27,230	2
Total top 10 states		1,160,522	71%

[1] Based on total U.S. visitors of 1,638,001 persons in 2010.

Source: HTA 2010 Report.

MAUI VISITOR ARRIVALS, BY COUNTRY
1990 - 2010

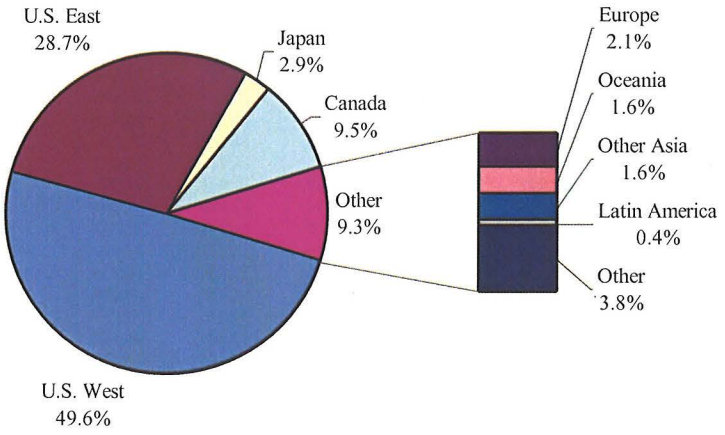
Year	U.S. West	U.S. East	Japan	Canada	Europe [1]	Oceania [2]	Other Asia [3]	Latin America	Other	Total
Arrivals (persons):										
1990	925,972	774,453	257,090	104,985	57,651	57,722	21,936	NA	35,892	2,235,701
1991	890,842	728,177	247,104	84,532	54,268	45,910	36,908	NA	41,280	2,129,020
1992	909,530	678,832	314,877	106,223	100,470	56,842	44,603	NA	55,644	2,267,020
1993	889,791	626,221	332,732	103,956	100,796	39,507	56,505	NA	62,621	2,212,129
1994	946,599	659,021	321,494	103,108	99,859	28,546	58,247	NA	71,935	2,288,809
1995	921,010	642,013	357,186	93,046	99,977	26,917	56,146	NA	71,978	2,268,273
1996	912,961	644,778	364,012	92,365	90,587	26,214	58,510	NA	71,027	2,260,454
1997	925,793	624,050	334,058	98,337	91,599	25,777	60,365	NA	100,943	2,260,921
1998	840,035	720,552	324,292	106,286	79,663	14,085	29,122	10,049	119,829	2,243,912
1999	898,354	776,418	250,941	121,747	75,418	21,718	32,567	7,670	94,100	2,278,933
2000	911,117	755,616	270,831	122,375	55,560	14,421	29,701	8,397	78,235	2,246,254
2001	881,929	689,978	228,910	102,888	36,976	12,953	19,104	5,657	70,502	2,048,896
2002	946,397	681,800	186,343	85,084	36,509	21,591	20,964	5,079	89,285	2,073,051
2003	1,035,283	721,445	123,135	95,013	36,716	20,851	20,140	5,511	67,329	2,125,421
2004	1,040,229	745,518	119,050	93,140	38,208	23,666	16,926	5,194	73,630	2,155,561
2005	1,124,292	797,089	104,212	106,175	38,205	22,278	15,219	5,518	81,709	2,294,697
2006	1,199,524	818,906	94,717	135,280	36,718	29,873	19,211	7,229	105,132	2,446,590
2007	1,210,399	797,781	80,430	172,425	38,484	37,591	25,557	8,135	92,793	2,463,595
2008	979,253	655,435	65,612	179,139	42,128	31,586	23,426	6,996	92,225	2,075,800
2009	931,078	570,831	55,646	170,754	39,012	26,599	22,677	6,412	69,389	1,892,396
2010	1,037,142	600,859	60,749	198,048	43,785	32,675	32,544	7,328	78,939	2,092,069
% of total arrivals:										
1990	41.4%	34.6%	11.5%	4.7%	2.6%	2.6%	1.0%	---	1.6%	100.0%
1991	41.8%	34.2%	11.6%	4.0%	2.5%	2.2%	1.7%	---	1.9%	100.0%
1992	40.1%	29.9%	13.9%	4.7%	4.4%	2.5%	2.0%	---	2.5%	100.0%
1993	40.2%	28.3%	15.0%	4.7%	4.6%	1.8%	2.6%	---	2.8%	100.0%
1994	41.4%	28.8%	14.0%	4.5%	4.4%	1.2%	2.5%	---	3.1%	100.0%
1995	40.6%	28.3%	15.7%	4.1%	4.4%	1.2%	2.5%	---	3.2%	100.0%
1996	40.4%	28.5%	16.1%	4.1%	4.0%	1.2%	2.6%	---	3.1%	100.0%
1997	40.9%	27.6%	14.8%	4.3%	4.1%	1.1%	2.7%	---	4.5%	100.0%
1998	37.4%	32.1%	14.5%	4.7%	3.6%	0.6%	1.3%	0.4%	5.3%	100.0%
1999	39.4%	34.1%	11.0%	5.3%	3.3%	1.0%	1.4%	0.3%	4.1%	100.0%
2000	40.6%	33.6%	12.1%	5.4%	2.5%	0.6%	1.3%	0.4%	3.5%	100.0%
2001	43.0%	33.7%	11.2%	5.0%	1.8%	0.6%	0.9%	0.3%	3.4%	100.0%
2002	45.7%	32.9%	9.0%	4.1%	1.8%	1.0%	1.0%	0.2%	4.3%	100.0%
2003	48.7%	33.9%	5.8%	4.5%	1.7%	1.0%	0.9%	0.3%	3.2%	100.0%
2004	48.3%	34.6%	5.5%	4.3%	1.8%	1.1%	0.8%	0.2%	3.4%	100.0%
2005	49.0%	34.7%	4.5%	4.6%	1.7%	1.0%	0.7%	0.2%	3.6%	100.0%
2006	49.0%	33.5%	3.9%	5.5%	1.5%	1.2%	0.8%	0.3%	4.3%	100.0%
2007	49.1%	32.4%	3.3%	7.0%	1.6%	1.5%	1.0%	0.3%	3.8%	100.0%
2008	47.2%	31.6%	3.2%	8.6%	2.0%	1.5%	1.1%	0.3%	4.4%	100.0%
2009	49.2%	30.2%	2.9%	9.0%	2.1%	1.4%	1.2%	0.3%	3.7%	100.0%
2010	49.6%	28.7%	2.9%	9.5%	2.1%	1.6%	1.6%	0.4%	3.8%	100.0%

[1] Includes Germany (37% in 2010), England (30%), France (10%), Switzerland (12%), and Italy (11%).
[2] Includes Australia (91% in 2010) and New Zealand (9%).
[3] Includes Korea (68% in 2010), China (21%), Taiwan (6%), Hong Kong (4%), and Singapore (2%).

Source: HTA 2010 Report.

In comparison, the number of Japanese visitors to Maui has declined. Japan now accounts for only 3% of all arrivals, down from about 16% in the mid-1990s, as shown in Exhibit II-E and as follows:

Visitor Arrivals to Maui Island, by Residence: 2010



Source: HTA 2010 Report.

Visitor Status and Travel Method

About 68% of Maui's visitors are repeat visitors with an average of 5.2 trips to the island. About 69% are true independent travelers, as follows:

2010 Arrivals, by Visitor Status and Travel Method

	State		Maui Island	
	Total	%	Total	%
Visit Status:				
First Timers	2,365,931	34%	678,442	32%
Repeaters	4,616,494	66	1,413,627	68
Total	6,982,425	100	2,092,069	100
Average number of trips	5.1		5.2	
Travel Method:				
Group Tour	653,060	9%	99,169	5%
Package	2,477,135	35	627,618	30
Group Tour & Package	546,830	8	76,059	4
True Independent	4,399,060	63	1,441,341	69

Source: HTA 2010 Report.

Purpose of Trip

The majority of visitors were on Maui for vacation. Winter and summer months (December through February, June through August) remain the busiest travel seasons.

About 8% of Maui's visitors planned to get married or honeymoon on Maui. MCI travel (meetings, conventions, corporate incentives) accounts for about 5.5% of arrivals, with the remainder citing friends and relatives, sporting events, or other business for the purpose of their trip, as follows:

2010 Arrivals, by Trip Purpose

	State		Maui Island	
	Total	%	Total	%
Pleasure:				
Honeymoon	497,278	7.1%	145,307	6.9%
Get Married	116,551	1.7	28,133	1.3
Pleasure/Vacation	5,231,129	74.9	1,724,777	82.4
Mtgs/Conventions/Incentive				
Conventions	225,083	3.2	66,620	3.2
Corporate Meetings	70,684	1.0	20,785	1.0
Incentive	86,094	1.2	27,984	1.3
Other Business	240,281	3.4	50,989	2.4
Visit Friends/Rel.	660,752	9.5	124,431	5.9
Gov't/Military	122,133	1.7	8,202	0.4
Attend School	21,312	0.3	3,778	0.2
Sports Events	95,207	1.4	16,684	0.8

Source: HTA 2010 Report.

Party Size and Length of Stay

The average party size on Maui was 2.15 people. The average length of stay for all Maui visitors was 8 days.

However, both vary depending on visitor origin. For example, visitors from Japan and other Asian countries are on Maui for only 3 days on average, compared to 7 to 9 days for U.S. and European visitors, as follows:

Average Party Size and Length of Stay for Maui's Visitors in 2010

	Average party size (persons)	Average length of stay on Maui (days)
Japan	2.73	3.24
Other Asia	2.53	3.31
Oceania	2.19	5.15
US East	1.87	7.39
Latin America	1.85	7.85
Europe	1.78	8.09
US West	2.04	8.46
Canada	2.18	10.65

Source: HTA 2010 Report.

Accommodations

In comparison to the rest of the state, Maui's visitor plant includes a larger proportion of hotel-condominiums or individual residential condominium units in vacation rental pools. As a result, nearly one-third of Maui's visitors planned to stay in a condominium, compared to only 18% for the State overall.

However, hotel properties still comprise the majority of Maui's visitor accommodations, and the majority of Maui's visitors (54%) planned to stay in a hotel sometime during their trip. About 13% planned to stay in a timeshare, as shown as follows:

2010 Visitor Arrivals, by Accommodations

	State		Maui Island	
	Total	%	Total	%
Hotel / condo / timeshare:				
Plan to stay in Hotel	4,364,269	62.5%	1,138,931	54.4%
Hotel only	3,831,737	54.9	884,127	42.3
Plan to stay in Condo	1,227,358	17.6	618,572	29.6
Condo only	967,050	13.8	487,217	23.3
Plan to stay in Timeshare	719,669	10.3	279,862	13.4
Timeshare only	554,270	7.9	209,616	10.0
Other:				
Rental house	322,423	4.6	76,078	3.6
Cruise ship	132,329	1.9	108,235	5.2
Friends/Relatives	697,832	10.0	139,045	6.6
Bed & Breakfast	63,955	0.9	23,886	1.1

Source: HTA 2010 Report.

Average Daily Visitor Census

The average daily census measures the number of visitors on Maui and is an indicator of the demand for hotel rooms. However, the census excludes neighbor island residents and airline crew members that also require overnight accommodations.

In 2010, the average daily visitor census for Maui Island was about 46,300 visitors, or about 26% of the State's average daily census. DBEDT forecasts the census for the State overall will increase by about 5% in 2011, and about 2.5% annually between 2012 and 2014. Its long-range forecast assumes lower growth rates of around 1.0% between 2015 through 2030.

Based on these growth rates, the average daily visitor census for Maui Island is projected to increase from about 46,300 in 2010 to about 53,000 in 2014 and 62,000 by 2030, as shown in Exhibit II-F.

VISITOR PLANT INVENTORY

The 2010 Visitor Plant Inventory, compiled by the State Hawaii Tourism Authority (HTA), shows there are about 19,000 visitor accommodation units on the island of Maui. Nearly three-fourths are hotel, condominium hotel, or timeshare units. About 15% are unaffiliated individual vacation units, as shown in Exhibit II-G and as follows:

PROJECTED AVERAGE DAILY CENSUS FOR THE STATE, MAUI COUNTY, AND MAUI ISLAND 1990 - 2030

Year	State	Maui County [1]	Maui Island	Maui Island as % of State
Average Daily Census				
Historical:				
1990	162,070	39,500	36,300	22.4%
1995	159,060	42,970	39,701	25.0%
2000	168,637	43,854	41,819	24.8%
2005	185,445	48,414	46,923	25.3%
2006	189,441	51,034	49,319	26.0%
2007	189,412	51,222	49,355	26.1%
2008	172,487	46,038	44,433	25.8%
2009	165,925	42,864	41,506	25.0%
2010	179,721	47,619	46,263	25.7%
Near-term forecast [2]:				
2011	188,729	50,013	49,013	26.0%
2012	193,172	51,191	50,167	26.0%
2013	198,647	52,641	51,589	26.0%
2014	203,847	54,019	52,939	26.0%
Long-term projections [3]:				
2015	208,273	54,984	53,884	25.9%
2020	219,670	58,213	57,048	26.0%
2025	229,829	61,135	59,912	26.1%
2030	238,135	63,344	62,077	26.1%
Average annual % change				
Historical:				
1990 - 1995	-0.4%	1.7%	1.8%	
1995 - 2000	1.2%	0.4%	1.0%	
2000 - 2005	1.9%	2.0%	2.3%	
2005 - 2010	-0.6%	-0.3%	-0.3%	
Near-term forecast:				
2010 - 2011	5.0%	5.0%	5.9%	
2011 - 2012	2.4%	2.4%	2.4%	
2012 - 2013	2.8%	2.8%	2.8%	
2014 - 2015	2.6%	2.6%	2.6%	
Long-term projections:				
2015 - 2020	1.1%	1.1%	1.1%	
2020 - 2025	0.9%	1.0%	1.0%	
2025 - 2030	0.7%	0.7%	0.7%	

[1] Includes islands of Maui, Lanai and Molokai.

[2] Based on DBEDT's forecast visitor days for the State (air only) as of June 2011. Assumes Maui County continues to comprise about 26.5% of the State census, and Maui Island represents about 98% of the County's census or about 26% of the State's census.

[3] Based on the June 2011 forecast through 2014 and long-term growth rates projected by DBEDT as of July 2009.

Source: John Child & Company, based on data from the HTA 2010 Report, DBEDT 2Q2011 QSER, and DBEDT "Population and Economic Projections for the State of Hawaii to 2035 – Revised, July 2009" (DBEDT 2035 Series).

SUMMARY OF MAUI'S VISITOR PLANT INVENTORY

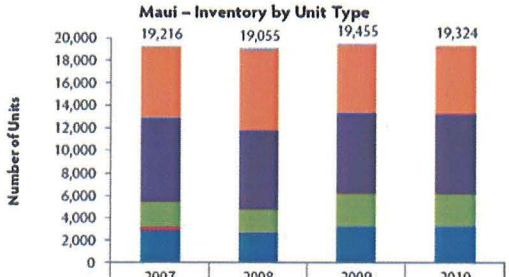
The overall number of lodging units on Maui declined by 0.7 percent over 2009, with reductions for most categories of properties [Figure 12].

Significant changes to Maui's visitor plant inventory include the closing of the Happy Valley Hale Maui hostel and the opening of Marriott's Maui Ocean Club Nāpili and Lahaina Towers. The Sands of Kahana reported a decrease of 76 timeshare units for 2010, and Aston Whaler on Kā'anapali reported 30 fewer condo hotel units in its rental pool.

The majority of Maui's visitor units were in the Luxury and Deluxe price classes due to the high-end properties in the luxury regions of Wailea and Lahaina - Kā'anapali - Nāpili - Kapalua.

Figure 12

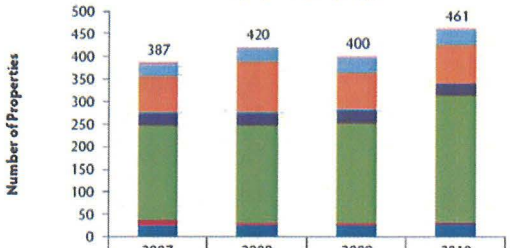
Maui – Inventory by Unit Type



	2007	2008	2009	2010
MAUI TOTAL	19,216	19,055	19,455	19,324
Apt/Hotel	17	14	14	0
B&B	114	110	105	91
Condo Hotel	6,170	7,071	5,931	5,941
Hostels	40	40	42	32
Hotel	7,458	7,033	7,130	7,129
IVU	2,195	2,021	2,901	2,831
Other	306	109	8	2
Timeshare	2,916	2,657	3,324	3,298

Figure 13

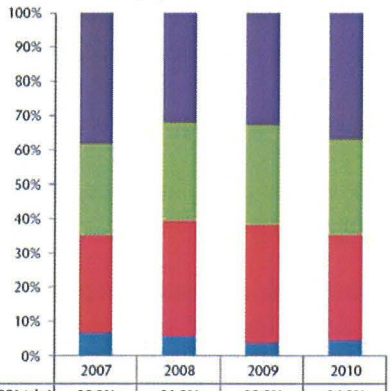
Maui – Inventory by Property Type



	2007	2008	2009	2010
MAUI TOTAL	387	420	400	461
Apt/Hotel	3	1	2	1
B&B	27	29	34	34
Condo Hotel	81	114	81	84
Hostels	3	3	3	2
Hotel	26	26	28	26
IVU	209	216	221	282
Other	12	5	5	3
Timeshare	26	26	26	29

Figure 14

Maui – Inventory by Price Class



	2007	2008	2009	2010
Luxury (over $500/night)	38.3%	31.8%	32.5%	36.8%
Deluxe ($251 to $500)	26.5%	28.7%	29.1%	27.9%
Standard ($101 to $250)	28.5%	33.8%	34.6%	30.7%
Budget (up to $100)	6.6%	5.6%	3.7%	4.6%

Source: HTA "2010 Visitor Plant Inventory."

Maui Visitor Plant Inventory: 2010

Property type	Units	% of Total
Apartment/hotel	0	0.0%
Bed and breakfast	91	0.5
Condo hotel	5,941	30.7
Hostels	32	0.2
Hotel	7,129	36.9
IVU [1]	2,831	14.7
Other	2	0.0
Timeshare	3,298	17.1
Total	19,324	100.0%

Source: HTA 2010 Visitor Plant Inventory.

Kihei Visitor Plant Inventory

Kihei's visitor plant is described under the following subheadings.

Number and Type of Accommodations

Kihei's visitor plant includes 74 properties with a total of 4,133 units, or about 21% of Maui's inventory.

Kihei includes a greater proportion of condominium hotel and individual vacation units (IVUs) compared to the rest of Maui. Condo-hotel and IVUs typically require a longer stay (e.g., five nights minimum) and are, therefore, not able to accommodate short-term stays that are more typical of Asian visitors to Maui, business travelers, or Hawaii residents.

Hotel rooms comprise only 16% of Kihei's visitor plant inventory, compared to 37% for Maui overall, as follows:

[1] Individual vacation units (IVUs) are predominantly condominium units with very limited service, often with only basic cleaning supplies provided.

2010 Visitor Plant Inventory, by Type

Type	Maui Units	Maui %	Kihei Units	Kihei %
Bed & Breakfast	91	0	16	0
Condo hotel	5,941	31	1,843	45
Hostels / other	34	0	0	0
Hotel	7,129	37	652	16
IVU	2,831	15	1,129	27
Timeshare	3,298	17	493	12
Total	19,324	100	4,133	100

Source: HTA 2010 Visitor Plant Inventory.

Kihei's visitor plant is relatively old with the majority of its properties built before 1980, as shown in Exhibit II-H.

Since 2000, new resort development in Kihei has been limited to 200 new timeshare units in the Worldmark at Kihei. The lack of suitable, zoned land has been, and will continue to be, the major constraint to new resort development in Kihei.

Class of Units

The majority of Kihei's visitor accommodations are located off-water, and most were originally built as residential condominiums. Therefore, they lack the amenities and services commonly found in full-service hotels, such as on-site restaurants, daily housekeeping services, spas, and concierge desks. As a result, only 20% of Kihei's inventory are in the "Deluxe" or "Luxury" category. These primarily include hotel units in the Maui Coast Hotel and Maui Hill timeshare project, and individual condominium units in oceanfront projects such as Sugar Beach Resort and Kamaole Sands.

About three-fourths of Kihei's visitor units are classified as "Standard" rooms. Daily room rates for this class range between $101 and $250. The mix of units by price class is shown in Exhibit II-I and summarized as follows:

KIHEI VISITOR UNITS, BY PROPERTY TYPE
2000 - 2010

No.	Property	Year opened	Number of Units 2000	2005	2010
Hotels					
1	Aloha Pualani	1978	6	5	5
2	Aston Maui Lu Resort	1958	120	120	120
3	Days Inn Maui Oceanfront Kihei	1972	88	71	87
4	Maui Coast Hotel	1991	265	265	265
5	Maui Sunseeker Resort	1971	4	5	17
6	Maui Sunset	1976	200	150	158
Total hotels			683	616	652
Timeshare					
7	Kamaole Beach Club	1983	37	37	31
8	Kapulanikai	1975	12	12	12
9	Leilani Kai Resort	1960	8	8	8
10	Maui Beach Resort	1989	-	45	48
11	Maui Hill	1981	129	131	136
12	Maui Schooner Resort	1990	58	58	58
13	Worldmark at Kihei	2001	-	200	200
Total timeshare			244	491	493
Condo hotel / IVUs:					
14	Kamaole Sands	1983	325	281	334
15	Maui Banyan	1990	150	150	253
16	Maui Vista	1979	145	145	225
17	Maui Kamaole	1989	150	202	191
18	Sugar Beach	1976	213	200	164
19	Kauhale Makai	1978	112	112	135
20	Kihei Kai Nani	1973	130	130	133
21	Mana Kai	1973	52	55	111
22	Kihei Akahi	1977	110	110	109
23	Luana Kai	1979	75	75	104
24	Menehune Shores	1976	91	109	100
25	Hale Pau Hana	1969	48	60	84
26	Kihei Surfside Resort	1976	69	79	79
27	Kihei Alii Kai	1979	73	74	78
28	Haleakala Shores	1975	15	76	74
29	Maui Suncoast Realty	Various	-	75	60
30	Kihei Beach Resort	1973	40	48	50
31	Kihei Bay Surf	1980	52	119	47
32	Kihei Bay Vista	1989/2003	17	-	40
33-68	All others [1]	1958-1982	751	769	601
Total condo hotels / IVUs			2,618	2,869	2,972
69-74	Bed & Breakfasts [2]	1993-2002	29	19	16
Total Kihei market area			3,574	3,995	4,133

[1] Includes 36 projects with fewer than 40 units each in 2010. The median year built for these projects is 1975.
[2] Includes 8 properties in 2010.

Source: HTA 2010 Visitor Plant Inventory.

KIHEI VISITOR PLANT INVENTORY, BY PRICE CLASS

2010

No.	Property	Number of Units: Budget < $100	Standard $101-250	Deluxe $251-500	Luxury $500+
Hotels					
1	Aloha Pualani	-	-	5	-
2	Aston Maui Lu Resort	-	120	-	-
3	Days Inn Maui Oceanfront Kihei	-	84	3	-
4	Maui Coast Hotel	-	151	114	-
5	Maui Sunseeker Resort	-	14	3	-
6	Maui Sunset	-	158	-	-
Total hotels		-	527	125	-
Timeshare					
7	Kamaole Beach Club	-	13	18	-
8	Kapulanikai	-	12	-	-
9	Leilani Kai Resort	-	8	-	-
10	Maui Beach Resort	-	1	47	-
11	Maui Hill	-	-	136	-
12	Maui Schooner Resort	-	58	-	-
13	Worldmark at Kihei	-	200	-	-
Total timeshare		-	292	201	-
Condo hotel / IVUs:					
14	Kamaole Sands	-	235	96	3
15	Maui Banyan	-	189	64	-
16	Maui Vista	-	225	-	-
17	Maui Kamaole	-	187	4	-
18	Sugar Beach	-	110	54	-
19	Kauhale Makai	-	135	-	-
20	Kihei Kai Nani	128	5	-	-
21	Mana Kai	-	57	54	-
22	Kihei Akahi	-	109	-	-
23	Luana Kai	-	104	-	-
24	Menehune Shores	-	100	-	-
25	Hale Pau Hana	-	4	80	-
26	Kihei Surfside Resort	-	79	-	-
27	Kihei Alii Kai	-	78	-	-
28	Haleakala Shores	-	74	-	-
29	Maui Suncoast Realty	-	60	-	-
30	Kihei Beach Resort	-	39	11	-
31	Kihei Bay Surf	47	-	-	-
32	Kihei Bay Vista	13	27	-	-
33-68	All others [1]	57	402	139	3
Total condo hotels / IVUs		245	2,219	502	6
69-74	Bed & Breakfasts [2]	8	8	-	-
Total Kihei market area		253	3,046	828	6

[1] Includes 36 projects with fewer than 40 units each in 2010. The median year built for these projects is 1975.
[2] Includes 8 properties in 2010.

Source: HTA 2010 Visitor Plant Inventory.

KIHEI VISITOR PLANT INVENTORY, BY PRICE CLASS
2010

No.	Property	Percent of Units: Budget < $100	Standard $101-250	Deluxe $251-500	Luxury $500+
Hotels					
1	Aloha Pualani	- %	- %	100 %	- %
2	Aston Maui Lu Resort	-	100	-	-
3	Days Inn Maui Oceanfront Kihei	-	97	3	-
4	Maui Coast Hotel	-	57	43	-
5	Maui Sunseeker Resort	-	82	18	-
6	Maui Sunset	-	100	-	-
Total hotels		-	81	19	-
Timeshare					
7	Kamaole Beach Club	-	42	58	-
8	Kapulanikai	-	100	-	-
9	Leilani Kai Resort	-	100	-	-
10	Maui Beach Resort	-	2	98	-
11	Maui Hill	-	-	100	-
12	Maui Schooner Resort	-	100	-	-
13	Worldmark at Kihei	-	100	-	-
Total timeshare		-	59	41	-
Condo hotel / IVUs:					
14	Kamaole Sands	-	70	29	1
15	Maui Banyan	-	75	25	-
16	Maui Vista	-	100	-	-
17	Maui Kamaole	-	98	2	-
18	Sugar Beach	-	67	33	-
19	Kauhale Makai	-	100	-	-
20	Kihei Kai Nani	96	4	-	-
21	Mana Kai	-	51	49	-
22	Kihei Akahi	-	100	-	-
23	Luana Kai	-	100	-	-
24	Menehune Shores	-	100	-	-
25	Hale Pau Hana	-	5	95	-
26	Kihei Surfside Resort	-	100	-	-
27	Kihei Alii Kai	-	100	-	-
28	Haleakala Shores	-	100	-	-
29	Maui Suncoast Realty	-	100	-	-
30	Kihei Beach Resort	-	78	22	-
31	Kihei Bay Surf	100	-	-	-
32	Kihei Bay Vista	33	68	-	-
33-68	All others [1]	9	67	23	0
Total condo hotels / IVUs		8	75	17	0
69-74	Bed & Breakfasts [2]	50	50	-	-
Total Kihei market area		6	74	20	0

[1] Includes 36 projects with fewer than 40 units each in 2010. The median year built for these projects is 1975.
[2] Includes 8 properties in 2010.

Source: HTA 2010 Visitor Plant Inventory.

2010 Visitor Plant Inventory, by Class

Class	Maui		Kihei	
	Units	%	Units	%
Budget (Up to $100)	889	15%	253	6%
Standard ($101 to $250)	5,932	31	3,046	74
Deluxe ($251 to $500)	5,391	28	828	20
Luxury (Over $500)	7,111	37	6	0
Total	19,324	100	4,133	100

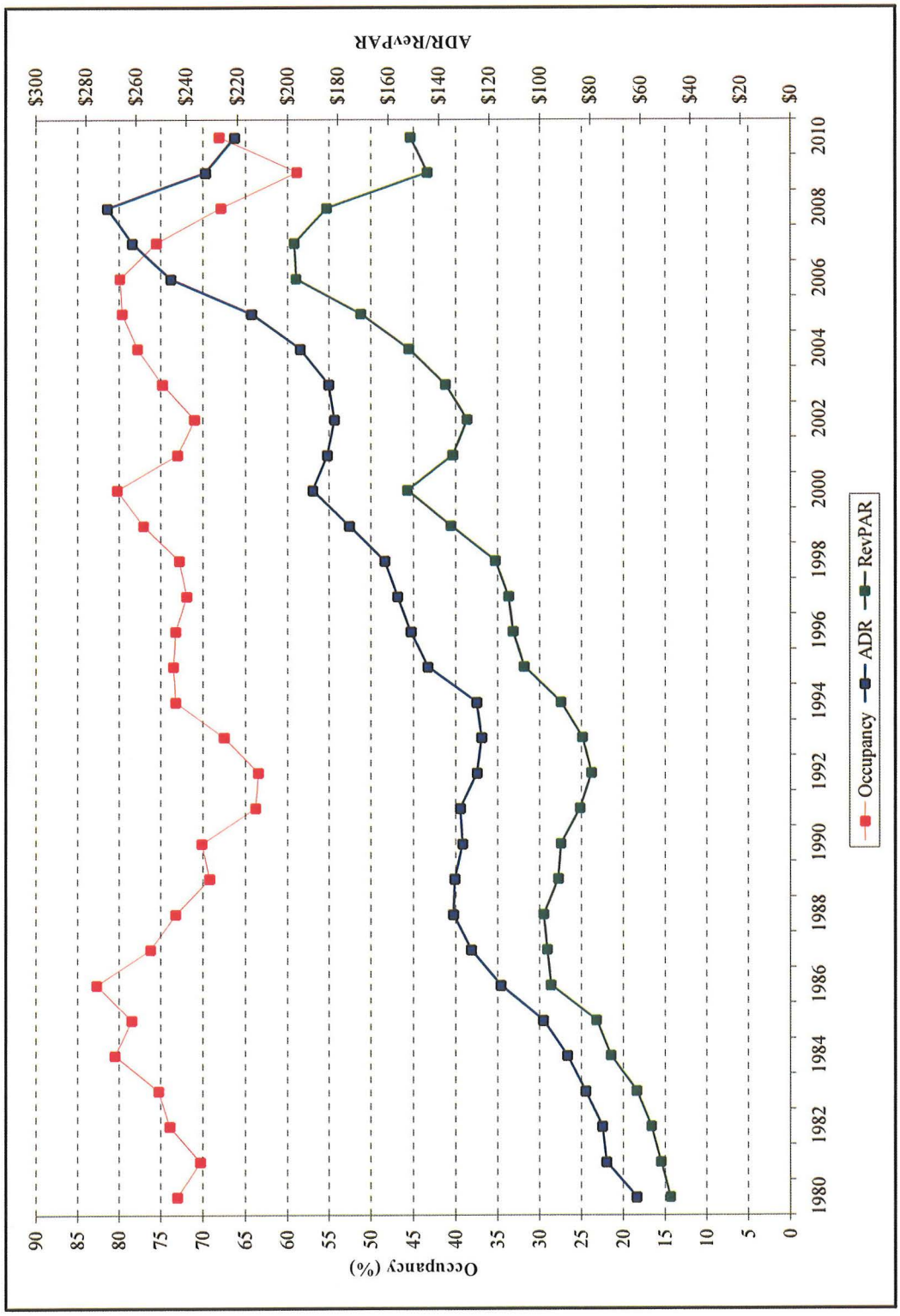
Source: HTA 2010 Visitor Plant Inventory.
Note: Columns do not foot because of rounding.

Occupancies and Rates

Since 1980, the average hotel occupancy rate on Maui has generally fluctuated between 70% and 77%. However, the average daily room rate has nearly quadrupled, from about $60 in 1980 to about $220 in 2010, as shown in Exhibit II-J.

Kihei has historically experienced lower occupancies compared to the rest of Maui. Since 2001, Kihei's occupancy rate has ranged from a low of 56% in 2009 to a high of 72% in 2005. The YTD occupancy rate as of November 2010 was 67%, as shown in Exhibit II-K.

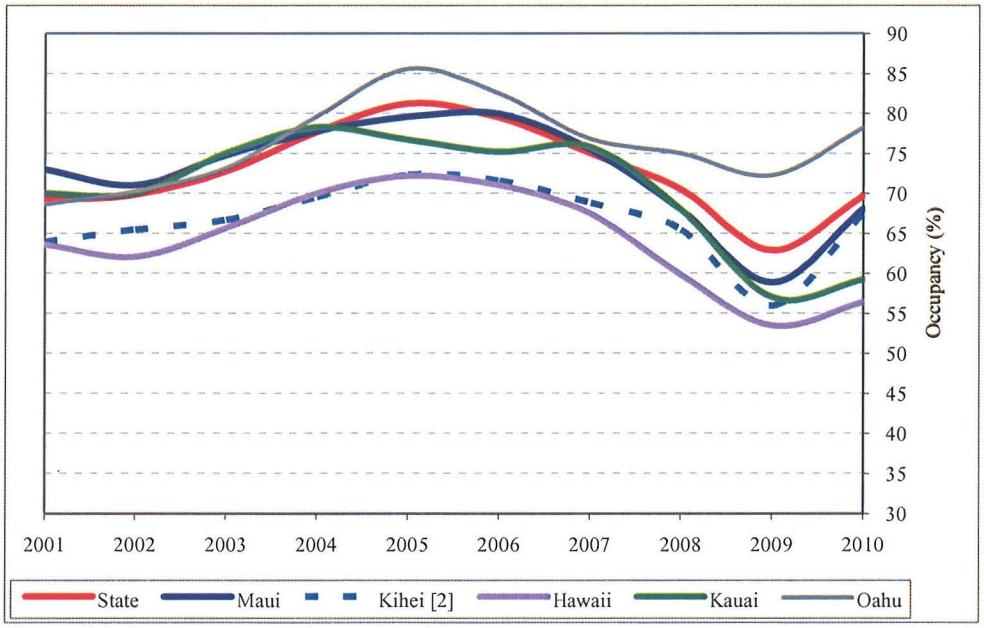
HISTORICAL OCCUPANCY, ROOM RATES, AND REVPAR FOR MAUI ISLAND 1980 - 2010



Source: Hawaii Tourism Authority, Smith Travel Research, and Hospitality Advisors, LLC.

HISTORICAL HOTEL OCCUPANCY RATES
2001 – 2010 [1]

Year	State	Oahu	Maui	Kihei [2]	Hawaii	Kauai
Average Hotel Occupancy Rate:						
2001	69.2 %	68.6 %	73.0 %	64.0 %	63.6 %	70.0 %
2002	69.8	70.3	71.0	65.5	62.1	70.0
2003	72.7	73.2	74.8	66.6	65.7	75.1
2004	77.7	79.7	77.8	69.6	70.0	78.3
2005	81.2	85.6	79.6	72.3	72.2	76.7
2006	79.5	82.5	79.9	71.6	71.0	75.2
2007	75.0	76.8	75.5	68.8	67.5	75.8
2008	70.5	75.0	67.9	65.5	59.8	67.9
2009	62.9	72.3	58.9	56.0	53.5	57.0
2010	69.7	78.2	68.1	67.4	56.4	59.2
Percent of State:						
2001	100.0 %	99.1 %	105.5 %	92.4 %	91.9 %	101.2 %
2002	100.0	100.7	101.7	93.8	89.0	100.3
2003	100.0	100.6	102.8	91.6	90.3	103.3
2004	100.0	102.6	100.1	89.5	90.1	100.8
2005	100.0	105.4	98.0	89.1	88.9	94.5
2006	100.0	103.8	100.5	90.1	89.3	94.6
2007	100.0	102.4	100.7	91.7	90.0	101.1
2008	100.0	106.4	96.3	92.9	84.8	96.3
2009	100.0	114.9	93.6	89.0	85.1	90.6
2010	100.0	112.2	97.7	96.7	80.9	84.9



[1] The 2010 figures for Kihei are as of YTD 11/10.
[2] The Kihei occupancy rates are based on responses by 13 hotels with a total of 1,387 rooms.

Source: Hawaii Tourism Authority, Smith Travel Research, and Hospitality Advisors, LLC.

Its room rates are also among the lowest in the State, the result of its large proportion of standard class properties. The average daily room rate for Kihei was $124 as of YTD 11/2010, as shown in Exhibit II-L. [1]

PROJECTED DEMAND FOR VISITOR ROOMS

The analysis used to project demand for the 150-room Downtown Kihei hotel is presented under the following subheadings.

Accommodated Demand

The current accommodated room demand is estimated based on the current occupancy rate and total available rooms.

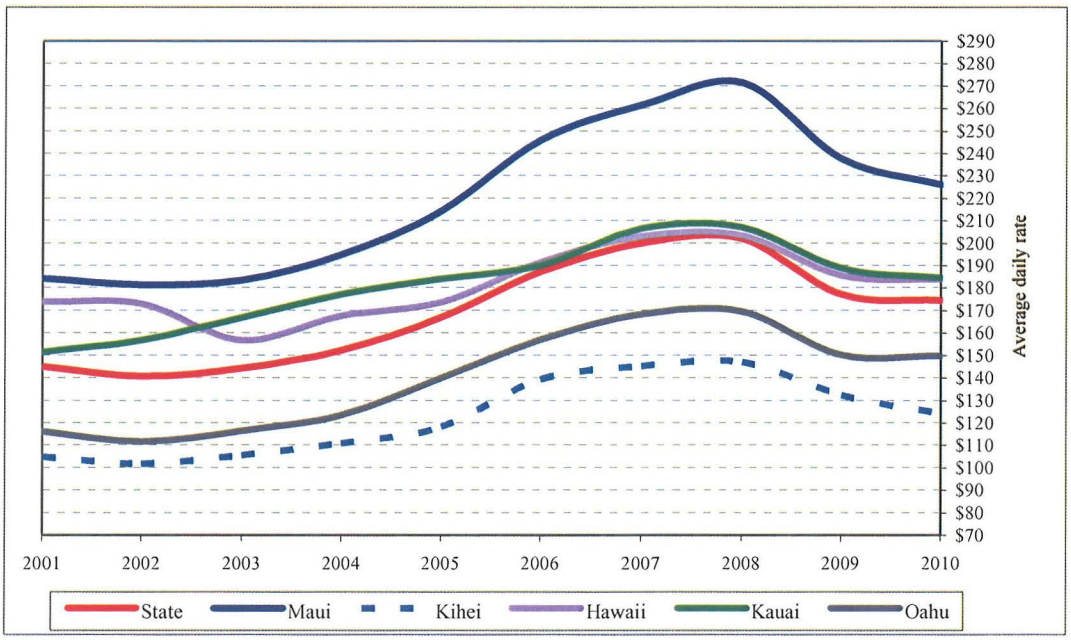
---

[1] Occupancy and room rate data for Kihei are based on information compiled by Smith Travel Research (STR) for 13 hotels and hotel condominiums with a combined 1,387 rooms, or about 34% of the existing visitor plant. Local or national hotel chains including Aston Hotels & Resorts and Coast Hotels manage 63% of the units included in the data set. The remaining 37% is managed by third-party property management companies or an association of owners, as follows:

Property	Chain affiliation	Opened	No. of rooms
Chain affiliation:			
Maui Banyan	Aston Hotels & Resorts	1990	150
Maui Hill	Aston Hotels & Resorts	1981	55
Maui Lu	Aston Hotels & Resorts	1960	120
Kamaole Sands	Castle Resorts	1983	195
Maui Coast Hotel	Coast Hotels	1991	265
Maui Oceanfront Resort	Days Inn	1973	87
Other			
Sugar Beach	---	1978	111
Kihei Akahi	---	1977	46
Hale Kai O Kihei	---	1969	17
Hale Kamaole	---	1976	39
Maui Kamaole	---	1988	141
Mana Kai Maui	---	1973	102
Hale Pau Hana	---	1969	59
Total			1,387

HOTEL AVERAGE ROOM RATES
2001 – 2010 [1]

Year	State	Oahu	Maui	Kihei [2]	Hawaii	Kauai
Average Daily Rate:						
2001	$144.88	$116.22	$184.13	$104.85	$173.78	$151.37
2002	140.54	111.46	181.25	101.61	172.80	156.78
2003	144.16	116.27	183.58	105.55	156.74	166.84
2004	152.17	123.34	194.96	110.87	167.51	177.21
2005	166.86	139.68	214.41	117.98	173.67	184.10
2006	187.19	157.02	246.08	139.33	191.50	189.94
2007	199.96	168.36	261.43	145.21	203.01	206.34
2008	201.85	169.44	271.39	146.92	203.30	206.94
2009	177.10	150.06	237.51	132.20	185.43	188.78
2010	174.33	149.67	226.07	124.04	183.63	184.52
Percent of State:						
2001	100.0 %	80.2 %	127.1 %	72.4 %	119.9 %	104.5 %
2002	100.0	79.3	129.0	72.3	123.0	111.6
2003	100.0	80.7	127.3	73.2	108.7	115.7
2004	100.0	81.1	128.1	72.9	110.1	116.5
2005	100.0	83.7	128.5	70.7	104.1	110.3
2006	100.0	83.9	131.5	74.4	102.3	101.5
2007	100.0	84.2	130.7	72.6	101.5	103.2
2008	100.0	83.9	134.5	72.8	100.7	102.5
2009	100.0	84.7	134.1	74.6	104.7	106.6
2010	100.0	85.9	129.7	71.2	105.3	105.8



[1] The 2010 figures for Kihei are as of YTD 11/10.
[2] Averages for Kihei are based on responses by 13 hotels with a total of 1,387 rooms.

Source: Hawaii Tourism Authority, Smith Travel Research and Hospitality Advisors, LLC.

For the eleven months ended November 2010, the average hotel occupancy rate in Kihei was 67%. The occupancy rate implies an accommodated room demand of about 2,769 rooms, as follows:

Accommodated Room Demand in Kihei: 2010

Existing supply (units)	4,133
Current occupancy	67% [1]
Accommodated room demand (units)	2,769

Projected Demand

Future demand is estimated based on the projected increase in the average daily visitor census. The study approach and method used to project room demand is summarized under the following subheadings.

Average Daily Census on Maui Island

The average daily census for Maui Island was previously projected to increase from about 46,300 visitors in 2010 to about 53,000 visitors by 2014, as previously shown in Exhibit II-F. The average daily census is allocated among the various visitor markets based on the historical distribution, as shown in Exhibit II-M.

Kihei-Makena Share of Average Daily Census

A portion of Maui's visitor census is allocated to Kihei-Makena based on its share of occupied visitor units, as follows:

- In 2010, HTA reports there were 19,324 visitor units on Maui. West Maui resorts included 10,909 units; other destinations that primarily include Kihei, Wailea, and Makena account for the balance, or 8,415 units.

- Based on the 2010 occupancy rate of 68.1%, an estimated 13,160 units on Maui were occupied. West Maui accounts for about 56.5% of the total, or about 7,429 units. Other Maui resorts comprise the balance, or about 43.5% of the total, as shown on page 1 of Exhibit II-N.

- The 3,102 hotel and condo hotel units in Kihei-Makena represent about 36.9% of the total 8,415 units reported for Other Maui. Including timeshare and individual vacation units, Kihei-Makena's supply totals 7,813 rooms, or about 92.8% of all Other Maui units.

[1] The YTD 2011 occupancy for Kihei is not available. However, based on the YTD performance for Maui Island and the state in general, Kihei's 2011 occupancy is projected to be at least 67% or better.

AVERAGE DAILY CENSUS TO MAUI, BY MARKET SEGMENT
1990 – 2030

	Average Daily Census (Persons)					Percent of Average Daily Census				
Year	U.S.	Japan	Canada	Other	Total	U.S.	Japan	Canada	Other	Total
Historical:										
1990	28,727	1,873	3,235	2,465	36,300	79.1%	5.2%	8.9%	6.8%	100.0%
1995	29,906	2,780	3,241	3,773	39,701	75.3%	7.0%	8.2%	9.5%	100.0%
2000	33,479	1,862	3,073	3,405	41,819	80.1%	4.5%	7.3%	8.1%	100.0%
2005	40,102	884	2,813	3,124	46,923	85.5%	1.9%	6.0%	6.7%	100.0%
2006	41,403	732	3,457	3,727	49,319	83.9%	1.5%	7.0%	7.6%	100.0%
2007	40,598	668	4,325	3,764	49,355	82.3%	1.4%	8.8%	7.6%	100.0%
2008	35,143	554	4,927	3,809	44,433	79.1%	1.2%	11.1%	8.6%	100.0%
2009	32,997	441	4,610	3,457	41,506	79.5%	1.1%	11.1%	8.3%	100.0%
2010	36,305	539	5,779	3,640	46,263	78.5%	1.2%	12.5%	7.9%	100.0%
Near-term forecast:										
2011	38,720	490	5,882	3,921	49,013	79.0%	1.0%	12.0%	8.0%	100.0%
2012	39,632	502	6,020	4,013	50,167	79.0%	1.0%	12.0%	8.0%	100.0%
2013	40,755	516	6,191	4,127	51,589	79.0%	1.0%	12.0%	8.0%	100.0%
2014	41,822	529	6,353	4,235	52,939	79.0%	1.0%	12.0%	8.0%	100.0%
Long-term projections:										
2015	42,569	539	6,466	4,311	53,885	79.0%	1.0%	12.0%	8.0%	100.0%
2020	45,068	570	6,846	4,564	57,048	79.0%	1.0%	12.0%	8.0%	100.0%
2025	47,330	599	7,189	4,793	59,911	79.0%	1.0%	12.0%	8.0%	100.0%
2030	49,041	621	7,449	4,966	62,077	79.0%	1.0%	12.0%	8.0%	100.0%

Source: John Child & Company, based on historical data and forecasts by HTA and DBEDT.

ESTIMATED MARKET SHARE OF VISITORS TO KIHEI-MAKENA BASED ON SHARE OF OCCUPIED VISITOR UNITS

	2007	2008	2009	2010
Number of visitor accommodation units:				
West Maui [1]	10,400	10,453	10,941	10,909
Other Maui				
Kihei-Makena				
Hotels and Condo Hotels	3,347	2,991	3,101	3,102
All other	4,720	4,880	4,782	4,711
Subtotal - Kihei-Makena	8,067	7,871	7,883	7,813
Elsewhere on Maui	749	731	631	602
Other Maui	8,816	8,602	8,514	8,415
Total visitor units	19,216	19,055	19,455	19,324
Occupancy rates [2]:				
West Maui	78.3%	69.0%	58.9%	68.1%
Other Maui	72.6%	66.6%	58.9%	68.1%
Maui Island	75.5%	67.9%	58.9%	68.1%
Occupied units:				
West Maui	8,143	7,213	6,444	7,429
Other Maui	6,400	5,729	5,015	5,731
Total	14,543	12,942	11,459	13,160
Share of occupied units:				
West Maui	56.0%	55.7%	56.2%	56.5%
Other Maui	44.0%	44.3%	43.8%	43.5%
Total	100.0%	100.0%	100.0%	100.0%

[1] Includes Kaanapali, Lahaina, Kapalua and Napili.
[2] Occupancy rates for West Maui and Other Maui are not available for 2009 and 2010. Therefore, the average for Maui Island is used.

Source: John Child & Company based on data provided by Hospitality Advisors LLC and HTA.

ESTIMATED MARKET SHARE OF VISITORS TO KIHEI-MAKENA BASED ON SHARE OF OCCUPIED VISITOR UNITS

	2007	2008	2009	2010
Estimated share of US, Canadian and Other visitors:				
Other Maui share of occupied units	44.0%	44.3%	43.8%	43.5%
All Kihei-Makena units as a percent of Other Maui units	91.5%	91.5%	92.6%	92.8%
Share of US, Canadian, and other visitors (product):	**40.3%**	**40.5%**	**40.6%**	**40.4%**
Estimated share of Japan visitors:				
Other Maui share of occupied units	44.0%	44.3%	43.8%	43.5%
Kihei-Makena Hotel and Condo-Hotel Units only, as a percent of Other Maui units	38.0%	34.8%	36.4%	36.9%
Share of Japan visitors (product):	**16.7%**	**15.4%**	**16.0%**	**16.0%**

Source: John Child & Company based on data provided by Hospitality Advisors LLC and HTA.

- Assuming Kihei-Makena could capture its fair share of 92.8% of the Other Maui demand, its share of the occupied room demand is estimated to be about 40%, as shown on page 2 of Exhibit II-N.

- The estimated demand includes longer-term vacation rentals that would not appeal to visitors from Japan that typically stay exclusively in hotels. Therefore, demand from the Japanese visitor market is estimated based on the ratio of hotel and hotel condo units as a percent of all Other Maui units, or 36.9%. Using this figure, Kihei-Makena's share of Japanese visitors is estimated to be about 15% (rounded down), as also shown on page 2 and summarized as follows:

Kihei-Makena Share of Average Daily Census

Japanese visitors	15%
All others	40%

Projected Average Daily Census for Kihei-Makena

The estimated capture rates for Kihei-Makena are applied to the projected average daily census for Maui Island to project the average daily census for Kihei-Makena, as shown in Exhibit II-O and summarized below:

Average Daily Census for Kihei-Makena

Year	Average daily census	Average annual increase
2010	18,371	---
2011	19,483	6.1%
2012	19,941	2.4
2013	20,506	2.8
2014	21,043	2.6
2015	21,419	1.8
2020	22,677	1.1
2025	23,815	1.0
2030	24,675	0.7

PROJECTED AVERAGE DAILY CENSUS FOR KIHEI-MAKENA
2010 – 2030

	Average Daily Census to Maui				Kihei-Makena Market Share		Kihei-Makena Share of Daily Census				
Year	US	Japan	Canada	Other	Non-Japan	Japan	US	Japan	Canada	Other	Total
Historical:											
2010	36,305	539	5,779	3,640	40%	15%	14,522	81	2,312	1,456	18,371
Near-term forecast:											
2011	38,720	490	5,882	3,921	40%	15%	15,488	74	2,353	1,568	19,483
2012	39,632	502	6,020	4,013	40%	15%	15,853	75	2,408	1,605	19,941
2013	40,755	516	6,191	4,127	40%	15%	16,302	77	2,476	1,651	20,506
2014	41,822	529	6,353	4,235	40%	15%	16,729	79	2,541	1,694	21,043
Long-term projections:											
2015	42,569	539	6,466	4,311	40%	15%	17,028	81	2,586	1,724	21,419
2020	45,068	570	6,846	4,564	40%	15%	18,027	86	2,738	1,826	22,677
2025	47,330	599	7,189	4,793	40%	15%	18,932	90	2,876	1,917	23,815
2030	49,041	621	7,449	4,966	40%	15%	19,616	93	2,980	1,986	24,675
Average annual % change											
Near-term:											
2010 - 2011											6.1%
2011 - 2012											2.4%
2012 - 2013											2.8%
2013 - 2014											2.6%
2014 - 2015											1.8%
Long-term:											
2015 - 2020											1.1%
2020 - 2025											1.0%
2025 - 2030											0.7%

Source: John Child & Company based on data provided by Hospitality Advisors LLC, DBEDT, and HTA.

Projected Room Demand

The projected growth in the Kihei-Makena visitor census is used to project the total room demand in Kihei. Based on the analysis, the annual room demand in Kihei is projected to increase from about 2,769 rooms in 2010 to about 3,229 rooms by 2015 and 3,418 rooms by 2020, as shown in Exhibit II-P and summarized as follows:

Projected Room Demand in Kihei: 2010 – 2020

Year	Annual room demand	Increase
2010	2,769	---
2015	3,229	460
2020	3,418	189

EXISTING AND PLANNED SUPPLY

New resort development on Maui has primarily occurred in the master-planned resorts of Kaanapali, Kapalua, and Wailea. In comparison, there has been no new resort development in Kihei since 2001. Future development in Kihei will continue to be constrained by the lack of zoned land available for development.

According to the 2010 Visitor Plant Inventory and pending applications with the Maui County Department of Planning, 2,959 hotel, timeshare, or hotel condominium units are planned on Maui. Of this total, only 456 units are proposed for Kihei, as follows:

PROJECTED ROOM DEMAND IN KIHEI
2010 - 2020

Year	Annual increase in census	Estimated annual room demand [1]	Existing supply	Occupancy at existing supply
Historical:				
2010	---	2,769	4,133	67%
Projected:				
2011	6.1%	2,937	4,133	71%
2012	2.4%	3,006	4,133	73%
2013	2.8%	3,091	4,133	75%
2014	2.6%	3,172	4,133	77%
2015	1.8%	3,229	4,133	78%
2016	1.1%	3,266	4,133	79%
2017	1.1%	3,303	4,133	80%
2018	1.1%	3,341	4,133	81%
2019	1.1%	3,379	4,133	82%
2020	1.1%	3,418	4,133	83%

[1] Based on the projected growth in the average daily census for Kihei-Makena, shown in Exhibit II-O.

Source: John Child & Company.

Planned Additions to Kihei Visitor Plant

Project	Type	Total units	Net new supply
Maui Lu	Timeshare	400	280 [1]
Kamaole Heights	Hotel condo	24	24
Nani Loa Hotel Condominiums [2]	Hotel condo	32	32
Maui Research and Technology Park	Hotel	N/A	N/A [3]
Total		456	336

The 400-room redevelopment of the Maui Lu Hotel received Special Management Area (SMA) approval in 2008. Marriott Vacation Club planned to purchase the hotel around this time and complete the redevelopment. However, the sale was cancelled as a result of the financial market crash and ensuing recession. The current owner has been unable to secure construction financing for the development, and plans are currently on hold. The owner will apply for an extension of time to begin construction; however, there are no plans to restart development in the near-term.

The development timetable for the remaining projects is also speculative. Most require SMA approval, a change in zoning, and/or a community plan amendment.

STABILIZED OCCUPANCY AND NEW ROOM DEMAND

With no additions to the existing visitor plant, the average hotel occupancy rate in Kihei is projected to increase to about 75% by 2013 and 80% by 2017, as previously shown in Exhibit II-P.

In comparison, hotel occupancies in Kihei reached 69% to 72% between 2005 and 2007 when visitor arrivals peaked. However, the historical occupancy has been hindered by Kihei's aging visitor plant and lack of short-term hotel properties.

In comparison, the annual occupancy rate for Maui Island reached 80% in 2005 and 2006 and has hovered around 75% since 1980. Based on the historical long-term trend for Maui Island overall, a stabilized occupancy rate of 75% is used to project the new room demand for Kihei.

[1] The 120-room Maui Lu hotel is planned for redevelopment with a 400-room timeshare project. The redevelopment would result in 280 new units.

[2] Not identified as a Planned Addition and New Development by the 2010 Visitor Plant Inventory; however, proposed on March 2009.

[3] A 60,000ƒ business hotel is included in the proposed master plan for the MRT Village Center. However, there is no timeline for development.

Based on the projected room demand, Kihei's existing visitor plant would reach 75% occupancy by 2013. At this time, the market would support development of an additional 108 rooms in 2014, and about 436 rooms by 2020, as shown in Exhibit II-Q and summarized as follows:

Projected New Room Demand in Kihei: 2010 – 2020

Year	Cumulative new room demand
2014	108
2015	184
2016	233
2017	282
2018	333
2019	384
2020	436

PROJECTED MARKET SUPPORT FOR THE DOWNTOWN KIHEI HOTEL

The evaluation of the competitive position of the Downtown Kihei hotel component and the estimated market support for the 150-room hotel are discussed under the following subheadings.

Competitive Position

The Downtown Kihei hotel will be centrally located in Kihei, an established visitor destination on Maui. With several of the island's best beaches, its appeal as a visitor destination is expected to continue.

However, its existing visitor plant is composed of smaller, budget hotel chains such as Aston, Days Inn, and Castle Resorts, and independently-owned condominiums that typically require longer stays. The majority are dated with limited amenities.

Other hotel chains such as Marriott, Hilton, or Embassy Suites do not have a presence in Kihei. Development land constraints will continue to be a significant barrier to entry.

PROJECTED NEW ROOM DEMAND IN KIHEI
2013 - 2020

Year	Projected accommodated (occupied) room demand	Increase in accommodated room demand	Stabilized occupancy	New Room Demand	
				Annual	Cumulative
2013*	3,091	---	---	---	---
2014	3,172	81	75%	108	108
2015	3,229	57	75%	76	184
2016	3,266	37	75%	49	233
2017	3,303	37	75%	49	282
2018	3,341	38	75%	51	333
2019	3,379	38	75%	51	384
2020	3,418	39	75%	52	436

* Year existing plant achieves stabilized occupancy of 75%.

Source: John Child & Company.

The hotel's convenient location near the Kahului Airport, and the various retail, restaurant, and entertainment venues that are planned for Downtown Kihei, would appeal to airline crew members staying overnight. Its proximity to major employment, educational, and recreational facilities including the Maui Research and Technology Park also makes it a convenient option for neighbor island residents traveling to Maui for business, sporting events, or weekend getaways. [1]

Projected Market Share and Occupancy

Considering the competitive position of the Downtown Kihei development, and limited plans for competing new development in Kihei, the 150-room hotel is expected to capture at least 50% of the annual new room demand projected after 2013. Assuming capture rates of 50% to 75%, the 150-room hotel would achieve a stabilized occupancy between 2015 and 2016, as shown in Exhibit II-R.

[1] In 2009, HTA estimates inter-island travel accounted for an additional 1.4 million trips to Maui. The number of neighbor island residents staying overnight on Maui is not tracked, and the actual room demand from Hawaii residents could not be quantified. However, neighbor island resident demand would augment the projected demand for the Downtown Kihei hotel component.

PROJECTED LEASE-UP AND OCCUPANCY FOR 150-ROOM DOWNTOWN KIHEI HOTEL COMPONENT

Year	Cumulative new room demand for Kihei	Projected Room Demand for Downtown Kihei Assuming Capture Rates of: 50%	75%	Projected Occupancy Rate for 150-Room Downtown Kihei Hotel 50%	75%
2014	108	54	81	36%	54%
2015	184	92	138	61%	92% *
2016	233	117	175	78% *	---
2017	282	141	---	---	---
2018	333	167	---	---	---
2019	384	---	---	---	---
2020	436	---	---	---	---

* Stabilized occupancy at 75% achieved.

Source: John Child & Company.

This section assesses the market support for the Downtown Kihei commercial component in terms of the current and projected demand, existing and planned supply, competitive advantages, and projected market support.

IDENTIFICATION OF MARKET AREA

Kihei is the primary commercial area for residents and visitors in South Maui. As a result, the market area for the commercial retail and office component in Downtown Kihei is defined as the area extending from Maalaea to Makena, as shown in Exhibit III-A.

The region is referred to as Kihei-Makena. It includes the following Census Designated Places and Census Tracts:

	Census Tracts	
Census Designated Places	2000	2010
Kihei and Maalaea	307	307.05 – 307.10
Wailea and Makena	303.02	303.03

RETAIL DEMAND

Demand for retail goods and services is assessed in terms of resident retail expenditures and visitor retail expenditures.

Resident Retail Expenditures

The analysis used to project resident retail expenditures is presented under the following subheadings.

Resident Population

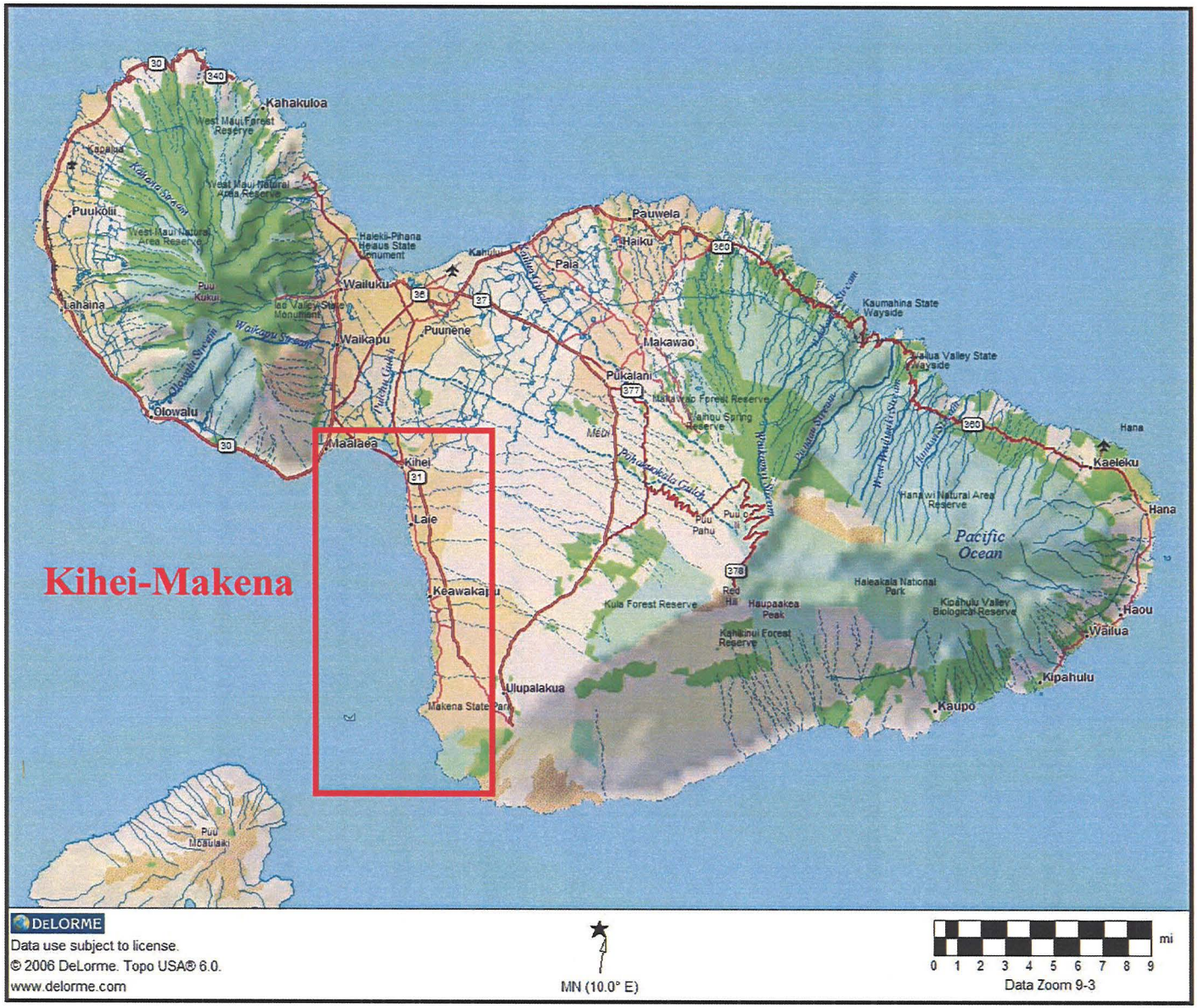
Maui County's resident population increased from about 71,000 persons in 1980 to 155,000 in 2010. The Kihei-Makena region represents about 17.6% of the County population and is currently home to about 27,300 residents.

DBEDT's long-range projections prepared as of July 2009 assume population growth rates of about 1.5% through 2015 and tapering off to about 1.1% by 2030. Using these growth rate assumptions, the Kihei-Makena resident population could total about 35,000 by 2030, as shown in Exhibit III-B.

Proposed Downtown Kihei Mixed-Use Development

MAP OF KIHEI-MAKENA AREA

Exhibit III-A



Source: DeLorme, Topo USA@6.0, 2006.

RESIDENT POPULATION, HOUSEHOLD, AND HOUSEHOLD SIZE
1980 – 2030 [1]

	Resident Population			Households		Household Size	
Year	Maui County	Kihei-Makena [2]	% of Maui County	Maui County	Kihei-Makena [2]	Maui County	Kihei-Makena
Historical:							
1980	70,991	7,262	10.2%	22,581	2,577	3.1	2.8
1990	100,504	15,374	15.3%	33,207	5,931	3.0	2.6
2000	128,241	22,913	17.9%	43,622	8,965	2.9	2.6
2010	154,924	27,270	17.6%	53,955	11,098	2.9	2.5
Projected: [3]							
2015	166,897	29,378	17.6%	57,551	11,846	2.9	2.5
2020	178,912	31,492	17.6%	61,694	12,802	2.9	2.5
2025	189,907	33,428	17.6%	65,485	13,644	2.9	2.5
2030	200,584	35,307	17.6%	69,167	14,470	2.9	2.4
Average annual % change							
Historical:							
1980 - 1990	3.5%	7.8%		3.9%	8.7%		
1990 - 2000	2.5%	4.1%		2.8%	4.2%		
2000 - 2010	1.9%	1.8%		2.1%	2.2%		
Projected:							
2010 - 2015	1.5%	1.5%		1.3%	1.3%		
2015 - 2020	1.4%	1.4%		1.4%	1.6%		
2020 - 2025	1.2%	1.2%		1.2%	1.3%		
2025 - 2030	1.1%	1.1%		1.1%	1.2%		

[1] The Maui County population includes Lanai, Molokai and Kalawao County. The 1980 and 1990 counts are as of April 1; later counts are as of July 1.

[2] 1980 – 2000 figures are based on census tract counts; 2010 data is based on census designated places because census tract data was not available.

[3] County projections are based on growth rates used in DBEDT's 2035 Series and the 2010 Census. Projections for Kihei-Makena are based on the current ratio that Kihei-Makena bears to Maui County overall.

Source: John Child & Company based on data from the U.S. Census and DBEDT 2035 Series, July 2009.

Household Size and Households

The average household in Kihei-Makena includes 2.5 people, down slightly from 2.8 people in 1980. Based on the projected resident population and household size, the number of households in Kihei-Makena is projected to increase from about 11,100 in 2010 to about 14,500 by 2030, also shown in Exhibit III-B.

Average and Total Household Income

The average annual household income for both Kihei-Makena and Maui County overall was about $75,000 in 2010. DBEDT projects personal income will grow by about 1.6% to 1.8% annually on average.

Based on the 2010 income and long-term growth rate assumptions, the average household income in Kihei-Makena is projected to grow to about $81,000 by 2015 and $105,000 by 2030. Based on the projected number of households, total household income for the region would be about $1.5 billion by 2030, as shown in Exhibit III-C. [1]

Resident Retail Expenditures

The average household in Maui County expects to spend about $18,100 annually for groceries (food at home), dining and entertainment, and other retail goods and services. Annual retail expenditures by Kihei-Makena residents similarly total about $18,200, or abut 24% of the average household income, as shown in Exhibit III-D.

Assuming these relationships continue, annual retail expenditures by Kihei-Makena residents are projected to increase from about $202 million in 2010 to about $371 million by 2030, as shown in Exhibit III-E and as follows:

Projected Resident Retail Expenditures in Kihei-Makena
(2010 Dollars, in millions)

Year	Groceries (food at home)	All other	Total
2010	$53.1	148.9	202.0
2015	61.4	172.0	233.4
2020	72.5	203.3	275.8
2025	84.5	236.9	321.4
2030	97.5	273.3	370.8

[1] Projected income and expenditures are expressed in constant 2010 dollars, unless otherwise noted.

HISTORICAL AND PROJECTED TOTAL HOUSEHOLD INCOME
(In 2010 Dollars)
1980 - 2035

	Households		Average Household Income [1]		Total Household Income [2]	
Year	Maui County	Kihei-Makena	Maui County	Kihei-Makena	Maui County	Kihei-Makena
Historical:						
1980	22,581	2,577	$24,270	$23,693	$548.0	$61.1
1990	33,207	5,931	46,979	52,924	1,560.0	313.9
2000	43,622	8,965	63,715	64,436	2,779.4	577.7
2010	53,955	11,098	75,253	74,638	4,060.3	828.3
Projected [3]:						
2015	57,551	11,846	81,469	80,803	4,688.6	957.2
2020	61,694	12,802	89,070	88,342	5,495.1	1,130.9
2025	65,485	13,644	97,380	96,584	6,377.0	1,317.8
2030	69,167	14,470	105,944	105,078	7,327.8	1,520.5
Average annual % change						
Historical:						
1980 - 1990	3.9%	8.7%	6.8%	8.4%	11.0%	17.8%
1990 - 2000	2.8%	4.2%	3.1%	2.0%	5.9%	6.3%
2000 - 2010	2.1%	2.2%	1.7%	1.5%	3.9%	3.7%
Projected:						
2010 - 2015	1.3%	1.3%	1.6%	1.6%	2.9%	2.9%
2015 - 2020	1.4%	1.6%	1.8%	1.8%	3.2%	3.4%
2020 - 2025	1.2%	1.3%	1.8%	1.8%	3.0%	3.1%
2025 - 2030	1.1%	1.2%	1.7%	1.7%	2.8%	2.9%

[1] 1980 - 2000 figures are based on the U.S. Census; the 2010 figures are estimated by ESRI.
[2] In millions of dollars.
[3] Projected income is based on the personal income growth rate assumptions for Maui County used in DBEDT's 2035 Series, as of July 2009.

Source: John Child & Company based on data from the U.S. Census, DBEDT 2035 Series, and ESRI, *Site to Do Business Online* database, August 2011.

2010 HOUSEHOLD BUDGET EXPENDITURES FOR MAUI COUNTY AND KIHEI-MAKENA

	Maui County [1]		Kihei-Makena	
Retail expenditures	% of average household income	Average household expenditures	% of average household income	Average household expenditures
Food at home	6.3%	$4,745	6.4%	$4,787
Food away from home	4.5%	3,418	4.7%	3,502
Household [2]	3.7%	2,750	3.6%	2,696
Apparel and services	2.4%	1,810	2.5%	1,837
Entertainment and recreation	4.8%	3,599	4.7%	3,523
Personal care products and services	1.0%	756	1.0%	760
Other retail [3]	1.4%	1,020	1.5%	1,098
Total retail expenditures	24.0%	$18,098	24.4%	$18,203
Estimated average household income		$75,253		$74,638

[1] Includes Kalawao County.
[2] Includes housekeeping supplies and household furnishings and equipment.
[3] Includes alcoholic beverages and smoking products.

Source: ESRI, *Site to Do Business Online* database, August 2011.

PROJECTED RETAIL EXPENDITURES BY CATEGORY FOR MAUI COUNTY AND KIHEI-MAKENA (2010 Dollars in Millions)

Year	Food at home	Food away from home	Household	Apparel and services	Entertainment and recreation	Personal care products and services	Other retail	Total
Maui County:								
2010	$256.0	$184.4	$148.4	$97.7	$194.2	$40.8	$55.0	$976.5
2015	295.6	213.0	171.3	112.8	224.2	47.1	63.5	1,127.6
2020	346.5	249.6	200.8	132.2	262.8	55.2	74.5	1,321.5
2025	402.1	289.7	233.0	153.4	305.0	64.0	86.4	1,533.6
2030	462.0	332.9	267.8	176.3	350.5	73.6	99.3	1,762.3
Kihei-Makena:								
2010	53.1	38.9	29.9	20.4	39.1	8.4	12.2	202.0
2015	61.4	44.9	34.6	23.6	45.2	9.8	14.1	233.4
2020	72.5	53.1	40.8	27.8	53.4	11.5	16.6	275.8
2025	84.5	61.8	47.6	32.4	62.2	13.4	19.4	321.4
2030	97.5	71.3	54.9	37.4	71.8	15.5	22.4	370.8

Source: John Child & Company.

Visitor Retail Expenditures

Visitor expenditures on Maui totaled nearly $2.5 billion in 2002 and increased to about $3.4 billion by 2007. Visitor expenditures declined to about $2.5 billion in 2009, but increased to $2.9 billion in 2010. The average daily expenditure in 2010 was $172, as shown in Exhibit III-F.

Japanese visitors represent a small proportion of Maui's visitor segment. However, their average daily expenditures have historically been higher than those of other visitor segments, as shown in Exhibit III-G.

Expenditures for transportation and lodging are excluded from the projections of demand for Downtown Kihei because these expenses are paid directly to hotels, airlines, and car rental agencies. Entertainment and recreation expenses including golf and other activity fees are also excluded.

Hotels would be expected to attract a portion of restaurant, grocery, and other purchases; however, considering the relatively small number of full-service hotels in Kihei-Makena, the majority of these purchases (75% to 95%) are projected to occur outside of the hotels. Based on these assumptions, the net retail expenditures available to Downtown Kihei and other non-hotel retail centers in the area are projected to range from about $45 per day for Canadian visitors, to about $138 per day for Japanese visitors, as shown in Exhibit III-H and as follows:

Estimated Daily Retail Expenditures Not Captured in Hotels: 2010

Visitor segment	Groceries	All other	Total
US	$7.20	$39.50	$46.70
Japan	7.70	129.80	137.50
Canada	9.00	36.10	45.10
Other	7.10	60.50	67.60

The average daily expenditure is multiplied by the projected average daily census for Kihei-Makena to estimate the total retail expenditures by visitors in the region. Based on the projections of average daily census previously shown in Exhibit II-O, total visitor expenditures in Kihei-Makena could increase from about $326 million in 2010 to about $437 million by 2030, as shown in Exhibit III-I.

The projected visitor expenditures are divided between groceries and all other retail expenditures. Grocery expenditures are projected to increase from about $50 million in 2010 to about $67 million in 2030. All other retail expenditures are projected to increase from about $276 million in 2010 to about $370 million by 2030, as shown in Exhibit III-J.

TOTAL AND DAILY EXPENDITURES FOR THE STATE AND MAUI ISLAND
2000 – 2010

	Total Expenditures [1]		Average Daily Visitor Census (Arrivals by air)		Daily Expenditures	
Year	State	Maui Island	State	Maui Island	State	Maui Island
Historical:						
2000	$10,395.8	N/A	168,637	41,819	$168.43	--
2001	8,885.5	N/A	158,247	38,724	153.83	--
2002	9,420.9	$2,475.1 [2]	160,195	39,967	161.12	$169.67
2003	9,844.5	2,889.0 [2]	161,048	42,710	167.47	185.32
2004	10,647.6	2,801.1	171,481	44,014	169.65	173.88
2005	11,650.2	3,155.2	185,445	46,923	172.12	184.22
2006	12,242.7	3,368.5	189,441	49,319	177.06	187.12
2007	12,578.3	3,408.8	189,412	49,355	181.94	189.22
2008	11,181.8	2,860.4	172,487	44,433	177.12	175.89
2009	9,374.0	2,472.1	165,925	41,506	154.78	163.18
2010	10,494.7	2,904.4	179,721	46,263	159.98	172.00

[1] In millions; excludes supplemental business expenditures and visitors who entered into Hawaii by foreign-flagged cruise ships.
[2] Cruise and supplemental business expenditures estimated based on historical relationship.

Source: HTA 2010 Report.

AVERAGE DAILY VISITOR EXPENDITURES FOR MAUI ISLAND
2010

Expenditures [1]	Estimated, by Market [2] US	Japan	Canada	Other
Food and beverage:				
Restaurant food	$23.40	$30.00	$18.20	$24.80
Dinner shows and cruises	3.50	4.70	3.20	3.90
Groceries and snacks	7.60	8.10	9.50	7.50
Total food and beverage	34.50	42.80	30.90	36.20
Transportation:				
Interisland airfare	2.80	2.10	1.60	4.80
Ground transportation	0.80	4.60	0.90	2.70
Rental vehicles	12.50	3.50	11.40	10.20
Gasoline, parking, etc.	1.60	0.40	1.50	1.50
Total transportation	17.70	10.60	15.40	19.20
Shopping:				
Fashion and clothing	6.50	24.30	8.70	16.40
Jewelry and watches	3.40	12.40	2.70	5.60
Cosmetics, perfume	0.20	5.20	0.30	1.90
Leather goods	0.50	29.70	0.50	3.70
Hawaii food products	2.10	11.70	1.60	2.70
Souvenirs	4.30	8.50	3.40	6.30
Total shopping	17.00	91.80	17.20	36.60
Entertainment and recreation	14.30	19.50	12.60	15.10
Lodging	61.00	78.20	63.00	63.50
All other expenses [3]	5.90	18.40	6.00	6.50
Total	$150.40	$261.30	$145.10	$177.10

[1] Includes direct spending by visitors while in Hawaii as well as any prepaid package purchased before arrival. Did not include transpacific air costs to and from Hawaii, commissions paid to travel agents or portions of the package in another state or country.

[2] Based on category expenditures for the State by market segment, weighted using the Maui Island ADC.

[3] Includes cruise package and on-ship spending on U.S. Flagged Hawaii home-ported ships. On-ship spending by cruise visitors on U.S. Flagged Hawaii home-ported ships were included in the specific expenditure categories.

Source: John Child & Company, based on HTA 2010 Report.

ESTIMATED RETAIL EXPENDITURES AVAILABLE TO DOWNTOWN KIHEI AND OTHER SHOPPING CENTERS
2010

Expenditures	Capture rate [1]	US	Japan	Canada	Other
Food and beverage:					
Restaurant food	75%	$17.55	$22.50	$13.65	$18.60
Dinner shows and cruises	0%	0.00	0.00	0.00	0.00
Groceries and snacks	95%	7.22	7.70	9.03	7.13
Total food and beverage		24.77	30.20	22.68	25.73
Transportation:					
Interisland airfare	0%	0.00	0.00	0.00	0.00
Ground transportation	0%	0.00	0.00	0.00	0.00
Rental vehicles	0%	0.00	0.00	0.00	0.00
Gasoline, parking, etc.	0%	0.00	0.00	0.00	0.00
Total transportation		0.00	0.00	0.00	0.00
Shopping:					
Fashion and clothing	100%	6.50	24.30	8.70	16.40
Jewelry and watches	100%	3.40	12.40	2.70	5.60
Cosmetics, perfume	100%	0.20	5.20	0.30	1.90
Leather goods	100%	0.50	29.70	0.50	3.70
Hawaii food products	90%	1.89	10.53	1.44	2.43
Souvenirs	90%	3.87	7.65	3.06	5.67
Total shopping		16.36	89.78	16.70	35.70
Entertainment and recreation	0%	0.00	0.00	0.00	0.00
Lodging	0%	0.00	0.00	0.00	0.00
All other expenses	95%	5.61	17.48	5.70	6.18
Total, rounded		$46.70	$137.50	$45.10	$67.60

[1] Estimated share of average daily retail expenditures (shown in Exhibit III-G) spent outside of the hotels.

Source: John Child & Company, based on HTA 2010 Report.

HISTORICAL AND PROJECTED VISITOR RETAIL EXPENDITURES BY VISITORS IN KIHEI-MAKENA
2010 – 2030

	Total Retail Expenditures [1]				
Year	US	Japan	Canada	Other	Total
Historical:					
2010	$247.5	$4.1	$38.1	$35.9	$325.6
Projected:					
2015	290.3	4.1	42.6	42.5	379.4
2020	307.3	4.3	45.1	45.1	401.7
2025	322.7	4.5	47.3	47.3	421.9
2030	334.4	4.7	49.1	49.0	437.1
Average annual % change					
Projected:					
2010 - 2015	3.2%	0.0%	2.3%	3.4%	3.1%
2015 - 2020	1.1%	1.1%	1.1%	1.2%	1.1%
2020 - 2025	1.0%	1.0%	1.0%	1.0%	1.0%
2025 -2030	0.7%	0.7%	0.7%	0.7%	0.7%

[1] In millions, expressed in constant 2010 dollars.

Source: John Child & Company.

HISTORICAL AND PROJECTED VISITOR RETAIL EXPENDITURES IN KIHEI-MAKENA [1]
2010 – 2030

	Retail, Except Groceries					Groceries					
Year	US	Japan	Canada	Other	Total	US	Japan	Canada	Other	Total	Total
Historical:											
2010	$209.3	$3.8	$30.4	$32.1	$275.7	$38.3	$0.2	$7.6	$3.8	$49.9	$325.6
Projected [1]:											
2015	245.4	3.8	34.1	38.1	321.3	44.9	0.2	8.5	4.5	58.1	379.4
2020	259.8	4.1	36.1	40.3	340.2	47.5	0.2	9.0	4.7	61.5	401.7
2025	272.8	4.3	37.9	42.3	357.3	49.9	0.3	9.5	5.0	64.6	421.9
2030	282.7	4.4	39.2	43.8	370.2	51.7	0.3	9.8	5.2	66.9	437.1
Average annual % change											
2010 - 2015	3.2%	0.0%	2.3%	3.4%	3.1%	3.2%	0.0%	2.3%	3.4%	3.1%	3.1%
2015 - 2020	1.1%	1.1%	1.1%	1.2%	1.1%	1.1%	1.1%	1.1%	1.2%	1.1%	1.1%
2020 - 2025	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
2025 - 2030	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%

[1] In millions, expressed in constant 2010 dollars.

Source: John Child & Company.

Total Retail Demand

Based on the analysis, total retail expenditures by Kihei-Makena residents and visitors are projected to increase from about $528 million in 2010 to about $808 million by 2030. These expenditures include grocery sales that increase from about $103 million in 2010 to $165 million in 2030, and all other retail expenditures that increase from about $425 million in 2010 to about $644 million in 2030, as shown in Exhibit III-K.

Estimated Retail Expenditures Captured in Kihei-Makena

Based on the relative size of the resident and visitor components, and considering that expenditures would also be expected from residents and visitors from outside the market area, the capture rates within the Kihei-Makena area from resident and visitor expenditures to equate to total expenditures of about this level would be 80% and 100%, respectively.

As a result, total retail expenditures captured in Kihei-Makena are projected to increase from about $487 million in 2010 to about $734 million in 2030, as shown in Exhibit III-L.

According to the 2007 Census of Retail Trade, retail expenditures in Kihei-Makena totaled about $476 million and represented nearly 16% of the total sales in Maui County. Based on the most recent census, the estimated retail expenditures of $487 million in 2010 is considered reasonable.

RETAIL SUPPLY

The retail supply in Kihei-Makena is described under the following subheadings.

Existing Supply

Based on data from CoStar Group, Inc., Kihei-Makena includes about 1.3 million square feet of rentable area. Nearly 1.0 million square feet or about 74% of the inventory are in retail facilities, shown as follows:

Rentable Commercial Area in Kihei-Makena
(In square feet)

	Total	% of total
Retail	974,626	74%
Office	338,489	26
Total	1,313,115	100%

PROJECTED TOTAL RETAIL EXPENDITURES IN THE KIHEI - MAKENA AREA [1]
2010 – 2030

	Resident Expenditures			Visitor Expenditures			Total Expenditures		
Year	Groceries	Other retail	Total	Groceries	Other retail	Total	Groceries	Other retail	Total
Historical:									
2010	$53.1	$148.9	$202.0	$49.9	$275.7	$325.6	$103.0	$424.6	$527.6
Projected:									
2015	61.4	172.0	233.4	58.1	321.3	379.4	119.5	493.4	612.8
2020	72.5	203.3	275.8	61.5	340.2	401.7	134.1	543.5	677.5
2025	84.5	236.9	321.4	64.6	357.3	421.9	149.1	594.1	743.2
2030	97.5	273.3	370.8	66.9	370.2	437.1	164.5	643.5	807.9

[1] In millions, expressed in constant 2010 dollars.

Source: John Child & Company.

HISTORICAL AND PROJECTED TOTAL RETAIL EXPENDITURES CAPTURED IN THE KIHEI-MAKENA AREA [1]
2010 – 2030

	Resident Expenditures [2]			Visitor Expenditures [3]			Total Expenditures		
Year	Groceries	Other retail	Total	Groceries	Other retail	Total	Groceries	Other retail	Total
Historical:									
2010	$42.5	$119.1	$161.6	$49.9	$275.7	$325.6	$92.4	$394.8	$487.2
Projected:									
2015	49.1	137.6	186.7	58.1	321.3	379.4	107.2	458.9	566.2
2020	58.0	162.6	220.6	61.5	340.2	401.7	119.5	502.8	622.3
2025	67.6	189.5	257.1	64.6	357.3	421.9	132.2	546.7	679.0
2030	78.0	218.6	296.7	66.9	370.2	437.1	145.0	588.8	733.7

[1] In millions, expressed in constant 2010 dollars.
[2] Assumes 80% of resident expenditures projected in Exhibit III-K are made in Kihei-Makena.
[3] Equal to 100% of visitor expenditures projected in Exhibit III-K; considers purchases made by visitors staying outside Kihei-Makena.

Source: John Child & Company.

Most of the commercial activity is concentrated within central Kihei, along South Kihei Road and major thoroughfares between Kihei Road and Piilani Highway, as shown in Exhibit III-M.

The commercial concentration in the Kihei-Makena area can be broadly characterized into four districts:

-
- North Kihei, East of Piilani Highway - Mixed retail, office and warehouse uses
- Central Kihei, along South Kihei Road, Piikea Avenue and Lipoa Street - Retail and office uses in shopping center settings
- South Central Kihei along Kihei Road - Beach-oriented retailing
- Wailea Resort - High-end retail and office uses

The major commercial facilities in Kihei-Makena are identified in Exhibit III-N. The locations of the retail centers are shown in Exhibit III-O.

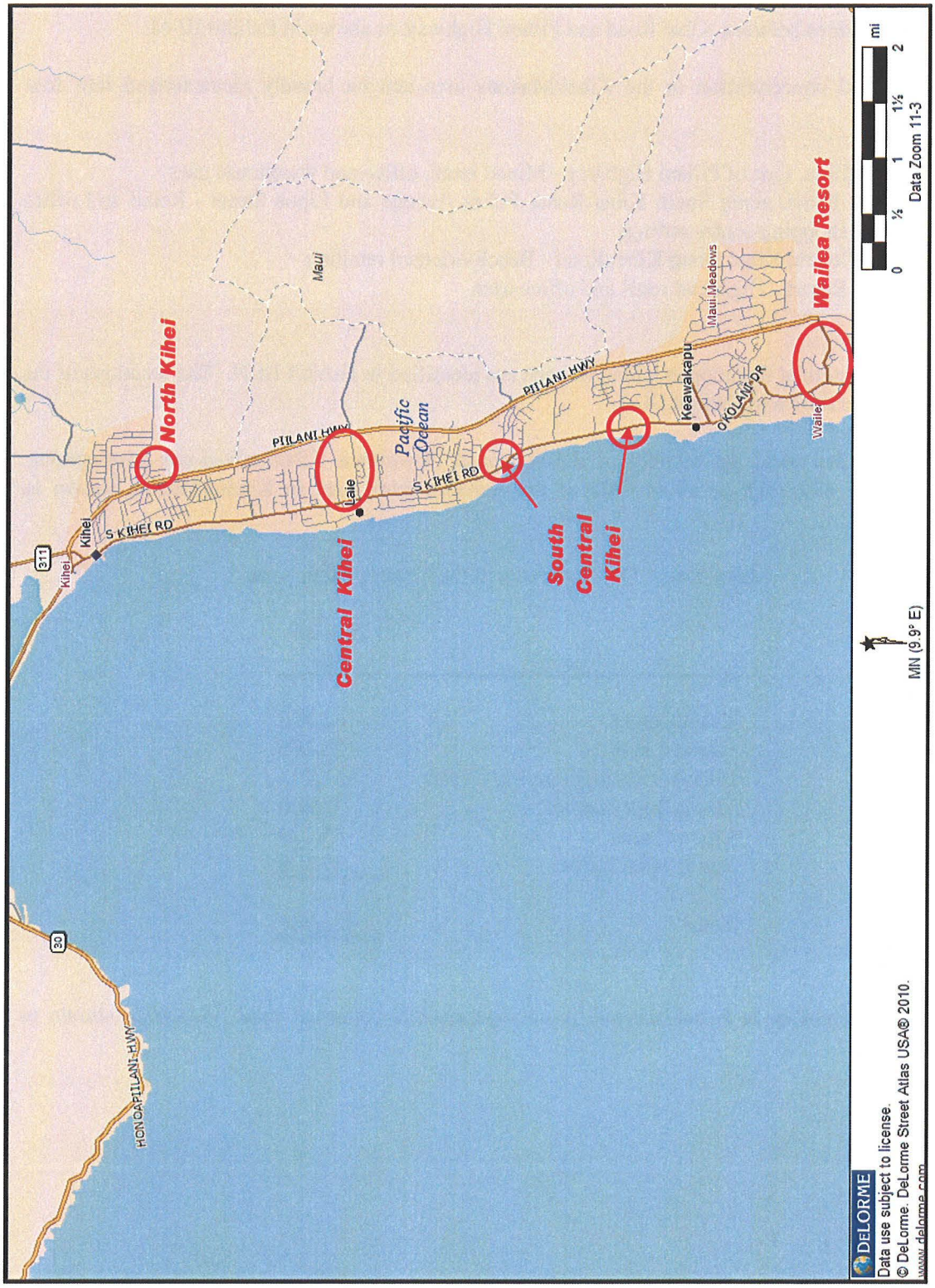
The Central Kihei area, the vicinity of the proposed Downtown Kihei mixed-use development, includes nearly 430,000ƒ or about 44% of the rentable retail area in Kihei-Makena, shown as follows:

Major Retail Developments in the Central Kihei Area

Name	Square feet
Kihei Center	42,596
Azeka I & II	125,386
Piilani Village Shopping Center	151,792
Times Supermarket	37,800
Lipoa Center	45,199
South Maui Center	23,108
Total	426,881

Of the retail inventory in Kihei-Makena, three supermarkets comprise about 114,000ƒ, shown as follows:

CENTERS OF RETAIL ACTIVITY



Source: DeLorme, Street Atlas USA 2010.

IDENTIFICATION OF MAJOR RETAIL AND OFFICE COMPLEXES IN KIHEI-MAKENA

	Rentable Area (sq.ft.)		
	Occupied	Total	Occupancy rate
Retail Complexes:			
The Shops At Wailea	196,183	196,183	100%
Piiliani Village Shopping Center	149,417	151,792	98%
Azeka I & II	125,386	125,386	100%
Lipoa Center	44,439	45,199	98%
Kihei Kalama Village	43,721	43,721	100%
Kihei Center	40,655	42,596	95%
Kihei Trade Center	23,504	23,504	100%
Kukui Mall	39,017	40,782	96%
Wailea Gateway Center	24,556	33,974	72%
Kamole Shopping Center	24,826	29,926	83%
South Maui Center	15,545	23,108	67%
Kealia Beach Center	20,350	20,350	100%
The Dolphin Plaza	17,756	20,112	88%
Maalaea Store	16,837	16,837	100%
Aloha Plaza	15,526	16,461	94%
Kai Nani Village	13,923	13,923	100%
Kamole Beach Center	11,197	12,165	92%
Kihei Pacific Plaza	5,080	11,760	43%
All others	92,607	106,847	87%
Subtotal - Retail Complexes	920,525	974,626	94%
Office Complexes:			
A-American Lipoa	84,885	84,885	100%
Wailea Town Center	45,235	48,746	93%
Premier Place	37,268	48,268	77%
Park Plaza	26,743	35,000	76%
Kihei Plaza	33,002	33,002	100%
Kihei Gateway Plaza	21,410	21,410	100%
South Shore Plaza	18,000	18,000	100%
All others	37,039	49,178	75%
Subtotal - Office Complexes	303,582	338,489	90%
Total	1,224,107	1,313,115	93%

Source: John Child & Company based on data from CoStar, as of August 4, 2011.

LOCATIONS OF MAJOR RETAIL SHOPPING CENTERS

Source: Google Earth.

LOCATIONS OF MAJOR RETAIL SHOPPING CENTERS

Source: Google Earth.

Source: Google Earth.

Supermarkets in Kihei-Makena

Name	Location	Square feet
Safeway	Piilani Village	55,000
Times	Kihei Road	37,800
Foodland	Kihei Town Center	21,000
Total		113,800

Current occupancy rates vary by facility. Overall, CoStar reports the retail occupancy rate is about 94%, as previously shown in Exhibit III-N.

Future Supply

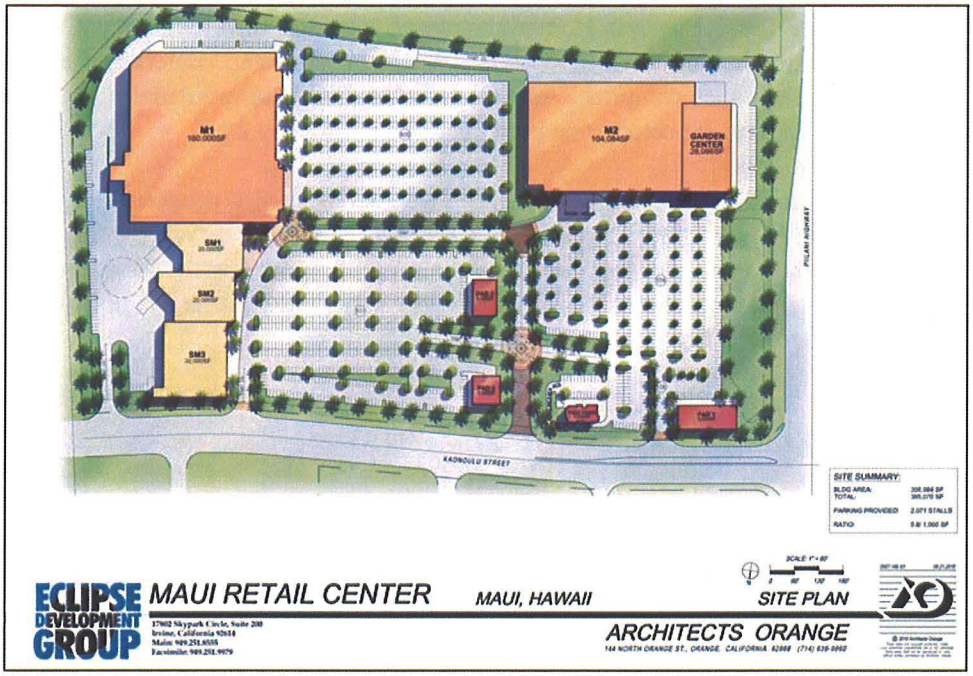
The Downtown Kihei project will be the only new commercial center to be within Central Kihei, below (west of) Piilani Highway. Future commercial development within Central Kihei will continue to be constrained by the lack of zoned land available for development.

- Excluding the Downtown Kihei parcels, Central Kihei includes only 17 acres currently zoned for commercial or light industrial use.
- Quarter-acre to half-acre lots in the Kihei Business Park comprise about one-half of the available land. The remaining lots are also less than 2 acres in size.
- Because of their size, these lots are best suited for owner-user development and would not compete with the Downtown Kihei commercial component.

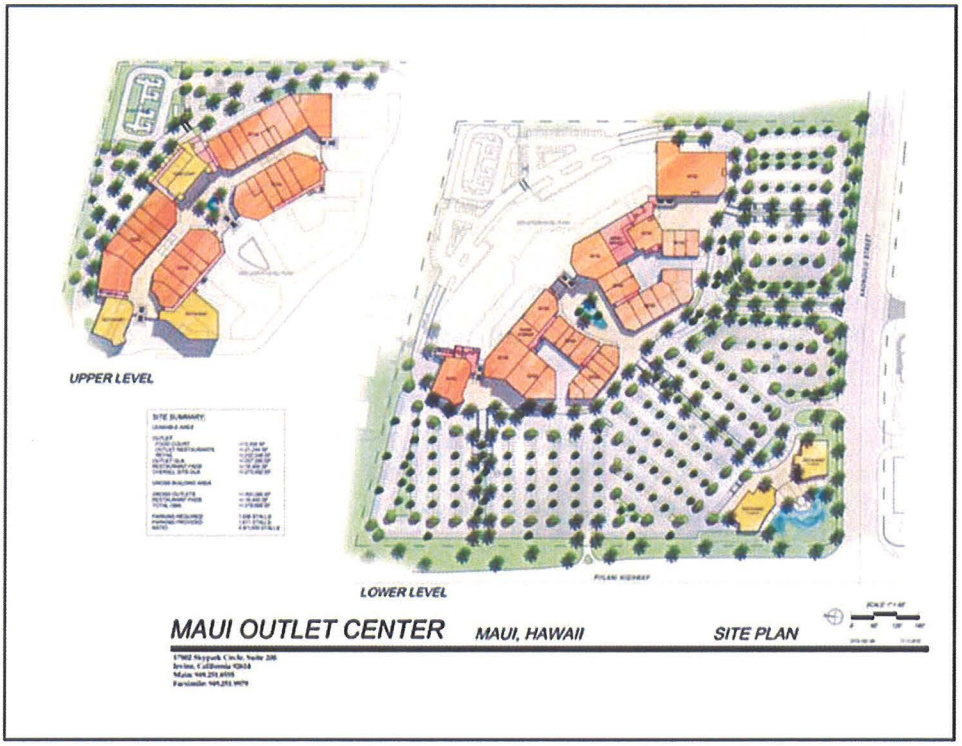
New commercial development is planned on lands east of Piilani Highway. These include a 350,000ƒ retail center (Piilani Promenade) and 300,000ƒ outlet mall (Maui Outlet Center) at the intersection of Piilani Highway and Kaonoulu Street, about 1.5 miles north of Downtown Kihei. According to its recent press release, California-based developer Eclipse Development Group expects construction could be completed by 2014. Its current development plans are shown in Exhibit III-P.

Other commercially-zoned lands in the broader region include a 4-acre parcel in Maalaea Triangle and a 16-acre parcel in Wailea Resort. Their periphery locations within the region make them less desirable for retail development, and there are no near-term plans to develop these sites.

Another quality development from
Eclipse Development Group
For further information please go to: eclipsedevelopmentgroup.com
Leasing by FFO Realty: fforealty.com



Pi'ilani Promenade



Maui Outlet Center

Future additions in Kihei-Makena will require rezoning and urbanization of lands east of Piilani Highway. These include the 1,150-unit Honua'ula master planned development. Current plans include 75,000ƒ of commercial and retail uses divided between two retail centers and an additional 25,000ƒ within the golf clubhouse complex. According to the draft environmental impact statement, two-thirds of the development is expected to be built out and occupied by 2018.

About 58 acres in the Maui Research and Technology Park (MRT) is also proposed for a mixed-use village center with office, live-work units, retail and a business hotel. However, the larger project is still in its entitlement phase, and the timeline for development is unknown. In addition, a retail component within MRT would target tenants within the park and would not be a significant source of competition for the Downtown Kihei commercial component.

PROJECTED COMMERCIAL SPACE REQUIREMENTS

Average retail sales volumes, expressed in terms of a rate per square foot, are used to convert the projected retail expenditures to retail space requirements. Average sales volumes generated in Kihei-Makena consider operating results for commercial and retail facilities on Maui and elsewhere in the State of Hawaii.

Considering the size of the trade area, the limited number of facilities (particularly grocery), and average income levels, sales volumes for grocery stores in Kihei-Makena are estimated to range from about $500/ƒ to $750/ƒ. Sales volumes for other retail facilities in Kihei-Makena are estimated to range from about $350/ƒ to $450/ƒ.

Based on the estimated sales volumes and projected demand for retail goods, retail space requirements are presented in Exhibit III-Q and summarized as follows:

- Grocery space requirements in Kihei-Makena are estimated to be between about 123,000ƒ to 185,000ƒ in 2010 and are projected to increase to between 193,000ƒ and 290,000ƒ by 2030.

- Space requirements for all other retail groups are estimated at between about 877,000ƒ and 1,128,000ƒ in 2010 and are projected to increase to between about 1,308,000ƒ and 1,682,000 by 2030.

The additional new space demand for grocery and non-grocery retail groups is projected to total between 163,000ƒ and 212,000ƒ between 2010 and 2015, and between 110,000ƒ and 146,000ƒ between 2025 and 2030. At a 95% stabilized occupancy, the additional space requirements to meet the demand for non-grocery retail groups are projected as follows:

PROJECTED SPACE DEMAND IN THE KIHEI - MAKENA AREA [1]
2010 – 2030

Year	Total grocery expenditures	Space Requirements (SF) [2]		Total other retail expenditures	Space Requirements (SF) [3]	
		Low	High		Low	High
Historical:						
2010	$92.4	123,000	185,000	$394.8	877,000	1,128,000
Projected:						
2015	107.2	143,000	214,000	458.9	1,020,000	1,311,000
2020	119.5	159,000	239,000	502.8	1,117,000	1,437,000
2025	132.2	176,000	264,000	546.7	1,215,000	1,562,000
2030	145.0	193,000	290,000	588.8	1,308,000	1,682,000

[1] In millions, expressed in constant 2010 dollars.
[2] Assumes average sales of $500/sq.ft. to $750/sq.ft.
[3] Assumes average sales of $350/sq.ft. to $450/sq.ft.

Source: John Child & Company.

Additional Space Requirements for Grocery and Non-Grocery Retail Groups
(In Square Feet)

Period	Additional Space Demand Low		Additional Space Demand High	Stabilized occupancy	Additional Space Requirement Low		Additional Space Requirement High
Grocery:							
2010 - 2015	20,000	-	29,000	95 %	21,000	-	31,000
2015 - 2020	16,000	-	25,000	95	17,000	-	26,000
2020 - 2025	17,000	-	25,000	95	18,000	-	26,000
2025 - 2030	17,000	-	26,000	95	18,000	-	27,000
Non-grocery:							
2010 - 2015	143,000	-	183,000	95	151,000	-	193,000
2015 - 2020	97,000	-	126,000	95	102,000	-	133,000
2020 - 2025	98,000	-	125,000	95	103,000	-	132,000
2025 - 2030	93,000	-	120,000	95	98,000	-	126,000
Total							
2010 - 2015	163,000	-	212,000	95	172,000	-	224,000
2015 - 2020	113,000	-	151,000	95	119,000	-	159,000
2020 - 2025	115,000	-	150,000	95	121,000	-	158,000
2025 - 2030	110,000	-	146,000	95	116,000	-	153,000

PROJECTED MARKET SUPPORT

The project will include about 257,000ƒ of commercial space. However, about 44,000ƒ is expected to be occupied by Cinetopia for a combination theatre-restaurant. Excluding the theatre space, Downtown Kihei will include about 213,000ƒ of retail and ancillary office space available for lease, as follows:

Downtown Kihei Commercial Gross Leasable Area (ƒ)

Planned	257,098
Minus: theatre	(44,180)
Balance	212,918

Key factors that enhance the potential of the Downtown Kihei mixed-use site for commercial-retail development include:

- Large land area with level topography
- Extensive frontage and prominence along Piikea Avenue, a major traffic corridor linking Kihei Road, the North-South Collector Road, and Piilani Highway
- Location within the commercial retail center of Kihei, with synergies created from proximities to Piilani Village Shopping Center and other neighboring commercial centers
- Central location within a residential community that is relatively large and is growing
- Market area is augmented with a large number of visitor accommodations
- Captive market from 150-room hotel also planned for Downtown Kihei.

Of the commercial centers currently planned for Kihei, the Piilani Promenade would compete directly with Downtown Kihei for the new additional space demand.

- The Maui Outlet Center will include big-box/outlet stores that would not compete directly with the neighborhood retail and office tenants that would be attracted to Downtown Kihei. However, the outlet center could attract residents and visitors from outside the Kihei-Makena region and generate additional demand that has not been considered in the analysis.
- Development of additional commercial space in Honuaula and Maui Research and Technology Park will require entitlements, and is speculative at this time.

Current site plans for Piilani Promenade show two large anchors and a garden center are expected. [1] Based on their respective GLAs, Downtown Kihei's fair share of the new space requirement would be about 42% of the total GLA including anchor spaces, and about 77% of in-line space excluding anchors, as follows:

[1] The site plan shows a 160,000 building, 104,084 building, and 28,086 garden center. Anchor tenants for Piilani Promenade have not been announced. However, tenants that have previously shown interest in the site include Target and Walmart.

Fair Share of New Retail Space Requirement

Project	Anchor tenant	Including Anchor(s) Total	Including Anchor(s) % of total	Excluding Anchor(s) Planned GLA (sq. ft.)	Excluding Anchor(s) % of total
Downtown Kihei	Cinetopia	257,098	42%	212,918	77%
Piilani Promenade	Not disclosed	356,984	58%	64,814	23%
Total		614,082	100%	277,732	100%

Compared to Piilani Promenade, Downtown Kihei is centrally located within walking distance to many of Kihei's visitor accommodations. As a result, Downtown Kihei would be expected to capture the majority of the visitor sales that currently account for about two-thirds of all expenditures made in the region. Downtown Kihei could also capture a significant share of the projected additional space requirement generated by resident demand because of its proximity to existing homes and the Piilani Shopping Center.

At 60% share of the additional retail space requirements, the commercial component could achieve a stabilized occupancy by around 2020, shown as follows:

Projected Market Support for the Downtown Kihei Commercial Component [1]

Period	Additional Space Requirement Low	Additional Space Requirement High	Capture rate	Downtown Kihei Commercial Component Per Period Low	Per Period High	Cumulative Low	Cumulative High
2010 – 2015	172,000 -	224,000	60%	103,000 -	134,000	103,000 -	134,000
2015 – 2020	119,000 -	159,000	60	71,000 -	95,000	174,000 -	229,000
2020 – 2025	121,000 -	158,000	60	73,000 -	95,000	247,000 -	324,000
2025 – 2030	116,000 -	153,000	60	70,000 -	92,000	317,000 -	416,000

[1] Excludes 44,000ƒ expected to be leased to Cinetopia.

SCOPE OF PROFESSIONAL SERVICES

Background

John Child & Company is a professional corporation that specializes in real estate appraisal and consulting and business valuation. It is the only company in Hawaii with expertise in both real estate appraisals and business valuations and advises clients on both real estate and business decisions.

John Child & Company was established by John F. Child, Jr. in 1937. The Company was the first firm to specialize in "market research" in Hawaii. Since 1937, the Company has provided a critical knowledge of real estate market conditions and trends gained from the strength of its market research. As a result, its clients have confidence that John Child & Company appraisal and valuation assignments are based on competent analysis and careful documentation, and its consulting assignments focus on the key issues and provide sound alternatives.

The Company's professional team members hold local, regional, and national leadership positions in their professional organizations, helping to establish and promote the highest standards of professional practice and ethics for the industry.

Real Estate Appraisal and Consulting

The Company's real estate consulting and appraisal practice includes a range of specialized services covering real estate in Hawaii and the Pacific area. Professional services include:

- Valuation of real estate
- Litigation support
- Arbitration
- Market rent analysis
- Highest and best use studies
- Market and financial feasibility analyses
- Economic and fiscal impact assessments
- Valuation of fractional interests in real estate.

Its assignments include all types of real estate interests such as fee simple, leasehold, leased fee, and other partial rights and fractional interests. Its assignments cover a variety of land uses and property types such as:

- Office buildings and commercial property
- Industrial property
- Telecommunications facilities
- Hotels and resort properties
- Agricultural, conservation, and vacant land
- Conservation easements
- Shopping centers and retail facilities
- Residential developments (single family, multifamily, and condominium)

- Master-planned and mixed-use projects
- Golf courses
- Healthcare facilities
- Redevelopment projects
- Special-purpose property
- Timeshare properties.

Business Valuation

The Company's business valuation practice focuses on the valuation of closely-held businesses, including controlling and minority interests in corporations, partnerships, limited liability companies (LLCs), and family limited partnerships (FLPs). Its business valuation practice provides assistance in:

- Estate planning, estate and gift tax reporting
- Valuation of minority interests
- Stock transfers and redemptions
- Litigation support.

REPRESENTATIVE ASSIGNMENTS

The Company has provided real estate appraisal and consulting and business valuations for 75 years.

Real Estate Consulting and Appraisal

The Company's real estate appraisal and consulting practice covers a variety of properties and property interests. Real estate interests include fee simple, leasehold, leased fee, and other partial rights and fractional interests. Representative projects are listed as follows:

Redevelopment

Aloha Tower
Honolulu Waterfront Master Development Plan
Kakaako Redevelopment Plan
Kakaako Waterfront Park
Kapalama Development Complex
Pawaa Redevelopment Masterplan

Resorts

Hawaiian Rivera (proposed)
Hualalai
Ka'anapali North Beach
Kauai Lagoons
Ka'upulehu
Ko Olina
Makena
Manini'owali
Mauna Kea
Princeville
Regents International (proposed)
Turtle Bay
Waikoloa Beach Resort
Wailea Resort

Hotels

Ala Moana Hotel
Coco Palms
Embassy Suites Ka'anapali
Four Seasons Resort Hualalai
Halekulani Hotel
Hilton Hawaiian Village
Hotel Hana Maui
Hyatt Regency Maui
Hyatt Regency Waikiki
Kahala Hilton
Kea Lani Hotel
Keauhou Beach Hotel
Koa Kea Hotel
King Kamehameha Kona Beach Hotel
Kona Village
Maui Marriott
Maui Prince
Maui Wailea Inter-Continental Hotel
Pacific Beach Hotel
Princeville Hotel
Sheraton Poipu Beach
Sheraton Waikiki
W Hotel
Wailea Beach Resort
Waikiki Beachcomber
Waikiki Circle Hotel
Waikiki Resort Hotel

Shopping Centers

Ala Moana
Coconut Grove
Enchanted Lakes
Ewa Pointe Marketplace
Hawaii Kai Shopping Center
Hawaii Kai Towne Center
Keauhou Shopping Center
King's Village
Koko Marina
Kona Marketplace
Koolau Center
Lanihau Center
Mililani
Pearl City
Prince Kuhio Mall
Princeville
Royal Hawaiian
Wailea Shopping Village
Windward City
Windward Mall

Golf Courses

Asahi Kanko Olomana Course
Dunes at Maui Lani
Hawaii Country Club
Hawaii Kai Golf Course
Ka'anapali
Kauai Lagoons (Kiele and Lagoons)
Ko Olina
Mid-Pac Country Club
Pearl Country Club
Princeville (Makai and Prince)
Sandalwood Golf Course
Silversword Golf Course
Waikapu Country Club
Waikele Golf Course
Waikoloa (Kings)
Waikoloa Village (two proposed)
Wailea (Blue, Emerald, and Gold)

Office Buildings

1164 Bishop
Ala Moana Building
Ala Moana Pacific Center
Amfac Towers
ANA Kalakaua Center
C. Brewer Building
Commerce Tower
Davies Pacific Center
Financial Plaza of the Pacific
Grosvenor Center
Harbor Court
Hawaiian Life Building
Hawaii National Bank
HMSA Building
James Campbell Building
Pan Am Building
Waialae Building
Waikiki Bank of Hawaii Building
Waikiki Trade Center

Industrial Properties

Airport Industrial Subdivision
Airport Trade Center
Bougainville
Bougainville Commercial Center
Halawa Center
Halawa Industrial Subdivision
Hawaii Business Center
Kapolei

Industrial Properties, Continued

Kona Industrial Subdivision
Lihue Industrial Park
Makalapua Business Center
Manana
Mapunapuna
Mill Town
Panasonic/Technics Center
Waipahu

Residential

Discovery Bay
Ewa by Gentry
Harbor Court
Honolulu Park Place
Imperial Plaza
Kalele Kai
Kamaole Heights
Kamehame Ridge
Ko Olina Fairways
Lahaina Residential
Makakilo
Maui Eldorado
Mawaena Kai
Mililani
Nauru Tower
One Archer Lane
Royal Capitol Plaza
The Kahala Beach
Uplands at Mauna Kea
Victoria Tower
Wailea Golf Vistas
Wailea Pualani Estate

Healthcare

Arcadia Retirement Residence
Castle Medical Center
Hawaii Medical Center, East and West
Kahuku Medical Center
Kapiolani Medical Center for Women and Children
Kauai Care Center
Pali Momi Medical Center
Ponds at Punalu'u
Queen's Diagnostic Laboratories Services
Regency at Hualalai
Roselani Place
Straub Hospital & Clinic
Wilcox

Agricultural, Conservation, and Conservation Easements

Campbell Palehua and Kahe Ranch
Dunbar Ranch
Galbraith Trust Lands
Hana Ranch
Honouliuli Forest Reserve
Kanepuu Conservation Easement
Kaupo Ranch Wai'u and Nu'u Lands
Kealia Pond
Kona Forest Unit Access
Kukaiau Ranch Conservation Easement
Maka'alae Conservation Easement
May's Landing
McCandless Ranch Conservation Easement
Moanalua Valley
Palmyra Atoll
Pupukea Property Conservation Easement
Pu'u O Hoku Ranch
Ulupalakua Ranch Conservation Easements
Waimea Valley
Wao Kele O Puna

Special Purpose

Cemeteries/Memorial Parks
Chinese Cultural Plaza
Churches
Convents
Condominium and residential Lease-to-Fee conversions
Hawaii Newspaper Agency Building
Hawaiian Home Land Claims
Kapaa Land Fill
Kaumalapau Harbor
NAS Barbers Point Electrical Distribution System
Outrigger Canoe Club
Schools
State of Hawaii Airports
Telecommunications Sites
Tokai University
Visitor Attractions

Business Valuation

The Company's business valuation practice focuses on closely-held businesses in Hawaii. Business valuation assignments typically estimate the market value of controlling and minority interests in closely-held corporations or partnerships.

These assignments are prepared to assist in estate planning and estate and gift tax reporting to the Internal Revenue Service. Business valuations are also used to assist in litigation, mergers, and acquisitions covering controlling and minority interests in the closely-held businesses.

Valuations of closely-held businesses include:

Corporations

Aala Produce, Inc. - supplier of provisions to vessels
Dowling Company, Inc. - real estate developer
Finance Investment, Ltd. - real estate developer, investor, and provider of diversified financial services
Gay & Robinson, Inc. - sugar grower
Industrial Investors, Inc. - real estate investor and manager
Jas W. Glover Holding Company, Ltd. - construction contractor
K. Inouye Properties, Inc. - real estate investor and manager
Loyalty Development Company, Inc. - real estate developer, investor, and manager
Loyalty Enterprises, Ltd. - property management and insurance agency
Palani Ranch Company, Inc. - cattle rancher
Ponoholo Ranch Limited - cattle rancher
Sen Plex Corporation - plumbing and air conditioning contractor, real estate manager
SSFM Engineers - professional engineering services

Limited Partnerships and Limited Liability Companies

Aaron Properties Partners of Hilo - Hilo Burger King
Caroline J. Robinson LLC - real estate investor
CGB Partners - real estate investor
Honolulu Open Medical Imaging, LLC - medical imaging facility
J.L.P. Robinson LLC - real estate investor
K.J.L. Associates - real estate investor and manager
KSM Associates LLC - real estate investor
KVH Partners - real estate investor
Lanihau Properties LLC - real estate developer and manager
Leong Brothers - real estate investor and manager
Loyalty Investments - real estate investor
Maui Quest, LLC - real estate investor and developer
Robinson Kunia Land LLC - real estate investor
Taihook Associates - real estate investor and manager
Taira Family Limited Partnership - real estate investor
The Mark A. Robinson Trusts - real estate investors

CLIENTS

The Company provides professional services to a range of clients representing private, non-profit, and public interests. Selected clients in private industry, non-profit organizations, and public agencies are listed.

PRIVATE INDUSTRY

Attorneys

Alston Hunt Floyd & Ing
Ashford & Wriston
Bays Deaver Lung Rose & Holma
Bendet Fidell
Blank Rome LLP (New York office)
Cades Schutte
Carlsmith Ball
Case & Lynch
Case Lombardi & Pettit
Charles Adams Ritchie & Duckworth
Chun Kerr Dodd Beaman & Wong
Crockett & Nakamura
Damon Key Leong Kupchak Hastert
Dwyer Schraff Meyer Grant & Green
Goodsill Anderson Quinn & Stifel
Imanaka Kudo & Fujimoto
Ing Horikawa Jorgensen & Endo
McCorriston Miller Mukai McKinnon
Milberg LLP
Ning, Lily & Jones
Orloff, Lowenbach, Stifelman & Siegel, P.A.
Oshima Chun Fong & Chung
Paul Johnson Park & Niles
Porter Tom Quitiquit Chee & Watts, LLP
Price Okamoto Himeno & Lum
Rush Moore
Serle Court (London)
Starn O'Toole Marcus & Fisher
Tom Petrus & Miller, LLLC
Torkildson Katz Moore Hetherington & Harris
Van Buren Campbell & Shimizu
Wagner Choi Verbrugge
White & Tom

Architects/Planners

AM Partners, Inc.
Belt Collins & Associates
C.H. Guernsey & Company
Cascadia PM
Helber Hastert & Fee Planners
Kober/Hanssen/Mitchell Architects
Leo H. Daley/Alfred A. Yee Division
PBR Hawaii
Parsons Brinkerhoff, Inc.
RM Towill Corp.
Townscape, Inc.
Weston Solutions

Banks/Lenders

American Savings Bank
Bank of America
Bank of Hawaii
Central Pacific Bank
Chemical Bank
Citibank, N.A.
City Bank
Continental Bank, Chicago
First Federal Savings and Loan Association
First Hawaiian Bank
Fukuoka City Bank
GE Capital Hawaii, Inc.
GE Capital Real Estate
GMAC Commercial Mortgage
Hawaii National Bank
Key Commercial Mortgage
Liberty Bank, Connecticut
Nippon Credit Bank
Orix Corporation
Sanwa Bank, Ltd.
The Bank of Tokyo-Mitsubishi, Ltd.

Banks/Lenders, Continued

The Chuo Mitsui Trust & Banking Co., Ltd.
The Daiwa Bank, Ltd.
The Industrial Bank of Japan, Ltd.
The Kyowa-Saitama Bank
The Long-Term Credit Bank of Japan, Ltd.
Wells Fargo Bank

Builders

Armstrong Builders, Ltd.
Charles Pankow Builders
Pacific Construction Co., Ltd.
Tokyu Construction Co., Ltd.

Closely Held Corporations/Limited Partnerships/Family Trusts

Akala Partners
Gay & Robinson
Jas. W. Glover Holding Company, Ltd.
J.L.P. Robinson LLC
KJL Associates
KVH Partners and CGB Partners
Lanihau Properties, LLC
Leong Brothers
Loyalty Development
Loyalty Investments
M & T Yamaguchi Family Limited Partnership
Maui Quest LLC
Palani Trust
Ponoholo Ranch, Limited
Sen Plex Corp.
Sheridan Ing Marital Trust
Taihook Associates
The Mark A. Robinson Trusts

Developers/Landowners

A&B Properties, Inc.
Aloha Towers Associates
Bedford Properties, Inc.
(fka Kaiser National Housing Corporation Development Company)
Bradley Holdings
Campbell Hawaiian Investors, LLC
Central Pacific Realty
Chiyoda Hawaii Corporation
Cuzco Development U.S.A. LLC
Dowling Company, Inc.
Elleair Hawaii, Inc.
Finance Realty
Gentry Companies
Hana Ranch Partners
Hanalei Land Company
Haseko (Hawaii), Inc.
Hemmeter/Tokyu Waterfront Joint Venture
James Campbell Company
Kaneohe Ranch
Kapolei Property Development, LLC
McCandless Land & Cattle Company
McCormack Properties
Nansay Hawaii
Niu Pia Farms
O. G. Hawaii Corporation
Pahio Development
Pauahi Management Corp.
Queen Emma Land Company
Sam Koo Pacific, LLC
Stone Companies
Tesoro Hawaii Corporation
The Myers Corporation
Toyo Real Estate Co., Ltd.
Ulupalakua Ranch Inc.
Violet Hee Lum Properties, Inc.

Diversified Corporations

Amfac/JMB Hawaii, Inc.
- Amfac Property Development Co.

Azabu USA Corporation
Dole Foods (fka Castle & Cooke, Inc.)
- Castle & Cooke Retail
- Mililani Town, Inc.

Oceanic Properties, Inc.
Kitano Indo Gaisa Co., Ltd.
Kokusai-Motorcars Co., Ltd.
Nissho Iwai Corporation
Shimizu Corporation
Shinwa Golf Kabushiki Kaisha

Investors/Investment Bankers/Insurance Companies

First American Title Company, Inc.
IDG Realty, Ltd.
ITOCHU Corporation (C. Itoh & Co., Ltd.)
Mass Mutual
Meridian Pacific
The Equitable Life Assurance Society of the United States of America

Resort Operators/Owners

Alpha U.S.A., Inc.
Kapalua Land Company, Ltd.
Kaupulehu Makai Venture (Hualalai Resort)
Namalu LLC (Makena Resort)
Princeville Development Company
Shinwa International
Turtle Bay Resort
Wailea Resort Company, Inc.

Retailers

City Mill Co., Ltd.
J.C. Penney Company, Inc.
Kyotaru International
Louis Vuitton Hawaii, Inc.
McDonald's Restaurants of Hawaii
Safeway, Inc.
Star Markets, Inc.

Trust Companies and Trusts

First Hawaiian Trust
Hawaiian Trust Co., Ltd.
Knudsen Trusts
The Queen Lili'uokalani Trust

NON-PROFIT ORGANIZATIONS

Castle Medical Center
Chaminade College
Hawaii Health Systems Corporation
Hawaii Opera Theatre
Hawaii Pacific Health
Japan Association of Real Estate Appraisers
Kamehameha Schools
KCAA Pre-Schools of Hawaii
Maui Coastal Land Trust
National Tropical Botanical Garden
Pacific Buddhist Academy
Punahou School
Queen's Health System
Seagull Schools, Inc.
Sisters of the Sacred Hearts
St. Francis Healthcare Systems of Hawaii
The Nature Conservancy
Trust for Public Land
Young Women's Christian Association (YWCA)

PUBLIC AGENCIES

Bank Regulatory Agencies

Federal Depository Insurance Corporation (FDIC)
Federal Home Loan Bank Board (FHLBB)

City & County of Honolulu

Honolulu Authority for Rapid Transportation
Honolulu Public Transit Authority
Department of Housing and Community Development
Department of Design and Construction
Department of the Corporation Counsel

County of Hawaii

Department of Finance
Department of Public Works

County of Kauai
Department of Water

Federal Agencies
Internal Revenue Service
National Business Center, Appraisal Services Directorate
U.S. Attorney General
U.S. Department of Agriculture, Forest Service
U.S. Department of Agriculture, Natural Resource Conservation Service
U.S. Department of the Army
U.S. Department of the Navy
U.S. Department of Interior, Fish & Wildlife Service

Public Utilities
Citizens Utilities Company - Kauai Electric
Hawaiian Electric Industries (HEI, Inc.)
Pacific Resources, Inc.

State of Hawaii
Attorney General
Department of Hawaiian Home Lands
Department of Land & Natural Resources
Department of Transportation
Hawaii Community Development Authority
Hawaii Housing Finance and Development Corporation
Office of Hawaiian Affairs

PROFESSIONAL TEAM QUALIFICATIONS

The professional team has a wide range of real estate experience gained through a variety of field experience, professional accomplishments, training, and education. Team members have earned their reputation for quality work and professional service.

Professional Designations

Team members hold designations earned from the major professional organizations. Team members have earned the MAI designation from the Appraisal Institute, the CRE (Counselor of Real Estate) from The Counselors of Real Estate, and ASA (Accredited Senior Appraiser) from the American Society of Appraisers.

State Certification

Members of the professional team are Certified General Appraisers under the State of Hawaii license and certification program.

Other Qualifications and Training

Professional team members are qualified as expert witnesses in the courts of Hawaii; actively participate in and serve as arbitrators and review appraisers; and continue to attend courses, seminars and workshops to strengthen their own specialized appraisal skills and education.

Professional Team Members

Professional team members include:

- Karen Char, MAI, CRE, ASA, President
- Paul D. Cool, MAI, CRE, Vice President
- Shelly H. Tanaka, Appraiser

The education and professional experiences of team members are outlined in their accompanying resumes.

QUALIFICATIONS OF JOHN CHILD & COMPANY

PAUL D. COOL, MAI, CRE
Vice President

Paul joined John Child & Company in 1972. He has appraised property on all the major islands in Hawaii. With this perspective, Paul understands the cyclical nature of Hawaii's real estate markets. He has also valued properties on the U.S. Mainland, Guam, and the island of Diego Garcia in the Indian Ocean.

Paul has extensive knowledge of the valuation of partial takings, conservation easements and other atypical ownership interests, and compliance with the Uniform Appraisal Standards for Federal Land Acquisitions and the U.S. Department of Transportation Uniform Act (49 CFR Part 24).

Paul serves in leadership positions in NAIOP Hawaii, the Hawaii Chapter of the Counselors of Real Estate, and the Appraisal Institute.

Education

- Bachelor of Business Administration, Business Economics and Quantitative Methods, University of Hawaii, 1980

- Successfully completed various courses, workshops, and seminars, including:
  - Appraisal Institute, National USPAP Update Course, 2010
  - Appraisal Institute, Appraisal Curriculum Overview, 2010
  - Appraisal Institute, Hotel Valuation, 2010
  - Appraisal Institute, Hypothetical Conditions & Extraordinary Assumptions, Common Errors, and Appraiser Review, 2009
  - Appraisal Institute, Business Practices and Ethics, 2009
  - Appraisal Institute, Hawaii Lands, Historical Review, 2009
  - Appraisal Institute, National USPAP Update Course, 2008
  - Appraisal Institute, Litigation Skills for the Appraiser, 2008
  - Appraisal Institute, Uniform Appraisal Standards for Federal Land Acquisitions, 2006
  - American Society of Farm Managers & Rural Appraisers, Agricultural Lease Valuation, 2006
  - Appraisal Institute, Conservation Easements, 2001

Professional Associations

- Member, Appraisal Institute (MAI designation)
  - President, Hawaii Chapter, 2001
  - Chair, Hawaii Chapter Membership Admissions, Development & Retention, 2004 - 2012
  - Chair, Hawaii Chapter Admissions Committee, 1997
  - Chair, Hawaii Chapter External Affairs Committee, 1996
  - Chair, Hawaii Chapter Candidate Guidance Committee, 1994 - 1995
  - Member, Regional Ethics Panel, 1998
  - Member, Young Advisory Council, 1996

- Member, The Counselors of Real Estate (CRE designation)
  - Chairperson, Hawaii Chapter, 2012, 2001
  - Treasurer, Hawaii Chapter, 2009
  - Alternate Chief Delegate, 20th Pan Pacific Congress - Auckland, New Zealand, 2000
  - Alternate Chief Delegate, 19th Pan Pacific Congress - Singapore, 1998

Other Real Estate Associations

- Member, Hawaii Chapter of NAIOP (NAIOP Hawaii)
  - President, Hawaii Chapter, 2002
  - Director, Hawaii Chapter, 2012
  - Chair, Public Relations Committee, 2000 - 2009
  - Treasurer, Hawaii Chapter, 2007 - 2008
  - Chair, Kukulu Hale Awards of Excellence, 2004 - 2005
  - Chair, Membership Committee, 1998 - 1999
  - Chair, Government Affairs Committee, 1997

Public Service

- Member, Real Estate Appraiser Advisory Committee, Professional & Vocational Licensing Division, Department of Commerce and Consumer Affairs, State of Hawaii, 2007 - 2012
- Advisory Committee Member, Regulated Industries Complaints Office, Department of Commerce and Consumer Affairs, State of Hawaii, 2004 - 2012
- Member, City & County of Honolulu Leasehold Conversion Task Group, 2004

Professional Experience

- Vice President, John Child & Company, Inc. (1972 to present)

Professional Certification

- The Appraisal Institute conducts a voluntary program of continuing education for its designated members. Members who meet the minimum standards of this program are awarded periodic educational certification. Paul D. Cool, MAI is certified under this program.

State Certification

- Certified General Appraiser, State of Hawaii, License Number CGA-71, expiring December 31, 2013.

Court Testimony

- Qualified as an expert witness in the valuation of real property in the Courts of the State of Hawaii.

QUALIFICATIONS OF JOHN CHILD & COMPANY

SHELLY H. TANAKA
Appraiser

Shelly estimates the value of closely-held businesses and real estate in Hawaii. Her business valuation assignments include controlling and minority interests in corporations, partnerships, limited liability companies (LLCs) and family limited partnerships (FLPs). Because of her expertise in both real property and business valuation, she is able to effectively assist clients with their estate planning and gifting decisions, tax reporting, acquisitions and mergers, stock transfers and redemptions, and internal accounting. She has also worked on several class action lawsuits providing complex and timely analysis to assist in settlement negotiations.

Shelly's real estate valuations include resort, commercial, industrial, residential, agricultural, and conservation properties on Oahu, Maui, Kauai, and Hawaii. Shelly has also appraised conservation easements, churches, hospitals, and other limited-market properties, and has completed market assessments and fiscal and economic impact studies for various projects.

Education

- Master of Business Administration with Distinction, University of Hawaii at Manoa, 1998
- Bachelor of Arts, Psychology, Cum Laude, University of California at Los Angeles, 1994
- Iolani School, Magna Cum Laude, 1990

- Courses, workshops and seminars including:
  - Appraisal Institute, Online Eminent Domain and Condemnation, 2011
  - Appraisal Institute, Online Appraising From Blueprints and Specifications, 2011
  - Appraisal Institute, Business Practices and Ethics, 2011
  - Appraisal Institute, Hotel Valuation, 2010
  - Appraisal Institute, National USPAP Update Course, 2010
  - Appraisal Institute, National USPAP Update Course, 2009
  - Appraisal Institute, Advanced Applications, 2008
  - Appraisal Institute, Report Writing and Valuation Analysis, 2008
  - Highest & Best Use and Market Analysis, 2008
  - Advanced Sales Comparison and Cost Approaches, 2008
  - Appraisal Institute, Uniform Appraisal Standards for Federal Land Acquisitions, 2006
  - Appraisal Institute, Case Studies in Limited Partnerships and Common Tenancy Valuation, 2005
  - Appraisal Institute, Real Estate Finance, Value and Investment Performance, 2005
    Appraisal Institute, Standards of Professional Practice, 2005
  - Appraisal Institute, Advanced Income Capitalization, 2004
  - Appraisal Institute, Appraisal Principles, 2001
  - Appraisal Institute, Appraisal Procedures, 2001
  - Appraisal Institute, Advanced Sales Comparison, 2000
  - Appraisal Institute, Industrial Valuation, 1998

Professional Association

- Associate Member, Appraisal Institute
- Director, Hawaii Chapter, 2012 – 2014

State Certification

- Certified General Appraiser, State of Hawaii, License Number CGA-648, expiring December 31, 2013.

APPENDIX C.

Preliminary Engineering and Drainage Report

Established 1969

Preliminary Engineering Synopsis

KRAUSZ DOWNTOWN KIHEI (Vicinity of Intersection of Pi'ikea Avenue and Liloa Drive)

Kihei, Maui, Hawaii

TMK (2) 3-9-002:030, 076, and 158

Prepared For:

The Krausz Companies, Inc.
San Francisco, California

CLIFFORD N. MUKAI
LICENSED PROFESSIONAL ENGINEER
NO. 6667-C
HAWAII, U.S.A.

License Expires April 30, 2014

Warren S. Unemori Engineering, Inc.
Civil and Structural Engineers - Land Surveyors
Wells Street Professional Center
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii

Date: January 14, 2013

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Preliminary Engineering Synopsis for Krausz Downtown Kihei

I. INTRODUCTION

A. OBJECTIVE:

This treatise has been prepared as a preliminary engineering evaluation and summary of the proposed Krausz Downtown Kihei (KDK) project, including existing infrastructure in the vicinity of the project and anticipated project improvements.

Additional relevant documents include the following:

- A Preliminary Drainage Report has been prepared and is contained in APPENDIX "A".
- A Traffic Engineering Consultant has been retained by the Applicant and a Traffic Impact and Analysis Report has been prepared [(see "Traffic Impact Analysis Report, Krausz Companies Commercial Mixed-Use Development (Downtown Kihei), Kihei, Maui, Hawaii, Final Draft" (dated April 18, 2012); prepared by Austin, Tsutsumi & Associates, Inc)].
- A Geotechnical (Soils) Engineering Consultant has been retained by the Applicant and a Preliminary Subsurface Investigation report has been prepared (see APPENDIX "B").
- A Wetlands Consultant has been retained by the Applicant to study the on-site topography, hydrology, vegetation and soil characteristics for the presence of wetlands { see "Wetland Survey, Pi'ikea Properties, Azeka Parcels, Pi'ikea Avenue, Kihei, Hawaii 96753, T.M.K. (2) 3-9-02:76, T.M.K. (2) 3-9-02:158" [dated June 13, 2008; prepared by Malama Environmental (MEV, LLC)]; and, "Wetland Survey, Pi'ikea Properties, Pi'ikea Avenue Parcels, Pi'ikea Avenue, Kihei, Hawaii 96753, T.M.K. (2) 3-9-02:30" [dated August 27, 2008; prepared by Malama Environmental (MEV, LLC)] }. Thus no representation is made within this Preliminary Engineering Synopsis of the presence or lack of any presence of wetlands. It is further assumed that the Applicant's Architect has confirmed that all proposed improvements depicted on the Conceptual Architectural Site Plan (see EXHIBIT "C") are expected to be permitted pursuant to any applicable wetland constraints and regulations.

B. SITE LOCATION:

Kihei, on the island of Maui, is located on the southern slope, along the leeward side, of Haleakala, a dormant shield volcano rising up to approximately 10,000 ft. above mean sea level (M.S.L.). The KDK project site (see EXHIBIT "A") is located in Kihei, and is comprised of Tax Map Key parcels (2) 3-9-002: 030, 076, and 158. See Figure 1 for a recent aerial perspective photo of the project site and immediate vicinity.

Figure 1 - Aerial Perspective Photo of Project Site & Immediate Vicinity

It is situated (see EXHIBIT "B") approximately:

- 1,200 ft. west (makai) of Pi'ilani Highway;
- 600 ft. east (mauka) of South Kihei Road; and,
- 1,600 feet inland (easterly) from the Pacific Ocean.

These parcels are situated on both sides of Pi'ikea Avenue (formerly known as Road "C") and:

- To the west (makai) of Liloa Drive (formerly known as N-S Collector) and the recently constructed Kihei Greenway Multi-Use Trail;
- To the east (mauka) of the existing Longs Drugs Retail Center and Azeka Place (Mauka Phase II) Commercial Center;
- To the south (Wailea) of Yee's Orchard [TMK (2) 3-9-046:017]; and,
- To the north (Maalaea) of Haggai Institute.

The recently completed Kihei Roundabout at the intersection of Pi'ikea Avenue and Liloa Drive (see Figures 2a and 2b) abuts the southeast and northeast corners of North Parcel 30 and South Parcel 76, respectively.

Figure 2a - Recently Completed Kihei Roundabout at the Intersection of Pi'ikea Ave. and Liloa Dr. at SE Corner of North Parcel 30

Figure 2b - Recently Completed Kihei Roundabout at the Intersection of Pi'ikea Ave. and Liloa Dr. at NE Corner of South Parcel 76

The recently completed Kihei Greenway Multi-Use Trail (a linear, landscaped, multi-use greenway that extends from East Waipuilani Street to Lipoa Street) abuts the easterly (mauka) side of North Parcel 30 and South Parcel 76 (see EXHIBIT "B" and Figure 3).

Figure 3 - Recently Completed Kihei Greenway Multi-Use Trail Abutting Easterly (Mauka) Side of North Parcel 30 and South Parcel 76 (South Parcel 76 appears to the right in this photo)

The existing Pi'ilani Village (Safeway) Shopping Center and the Pi'ilani Gardens Apartment and Childcare Complex are located to the east (mauka), across Liloa Drive (see EXHIBIT "B").

An existing man-made Wetlands Replacement and Enhancement Site exists at the westerly (makai) end of North Parcel 30, within an approximately 3.000 Ac. easement over and across North Parcel 30 (see Figure 4).

Figure 4 - Existing Man-Made Wetlands Replacement and Enhancement Site (at Westerly End of North Parcel 30 and North of Pi'ikea Avenue)

Another existing man-made Wetlands Replacement and Enhancement Site exists between South Parcel 76 and West Parcel 158, within an approximately 3.500 Ac. Parcel 80 (see Figure 5 & Exhibit "A").

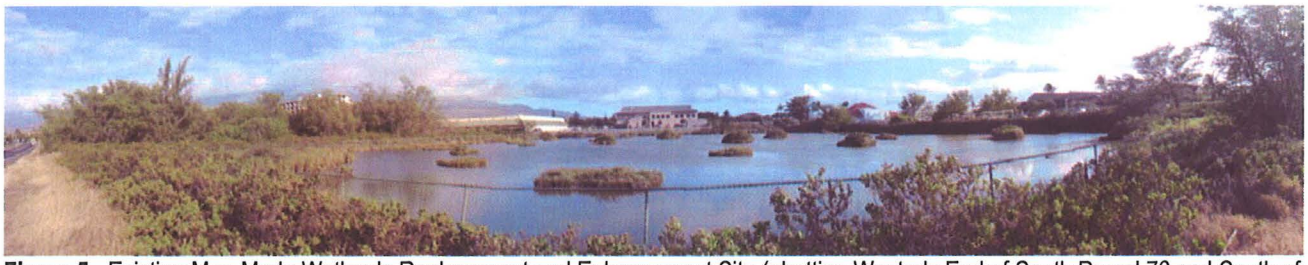


Figure 5 - Existing Man-Made Wetlands Replacement and Enhancement Site (abutting Westerly End of South Parcel 76 and South of Pi'ikea Avenue)

Existing Pi'ikea Avenue (see EXHIBIT "B") begins at its easterly (mauka) terminus at Pi'ilani Highway, then:

- Extends westward (makai) between Pi'ilani Village (Safeway) Shopping Center and the Pi'ilani Gardens Apartment and Childcare Complex;
- Crosses Liloa Drive at the Kihei Roundabout;
- Continues westward (makai) between North Parcel 30 (including the existing North man-made Wetlands Replacement and Enhancement Site), and South Parcel 76 and West Parcel 158 and the existing South Man-Made Wetlands Replacement and Enhancement Site in Parcel 80;
- Continues westward (makai) through the existing Longs Drugs Retail Center and existing Azeka Place (Mauka Phase II) Commercial Center (see Figure 6);

Figure 6 – Pi'ikea Avenue Continues Westward Between Existing Azeka Place (Mauka Phase II) Commercial Center and Existing Longs Drugs Retail Center, to South Kihei Road

- With its westerly (makai) terminus at South Kihei Road.

Improvements are also proposed within the Pi'ikea Avenue right-of-way, along the segment of Pi'ikea Avenue from just west (makai) of Liloa Drive to just east (mauka) of the existing Longs Drugs Retail Center and existing Azeka Place (Mauka Phase II) Commercial Center, which are described later in this synopsis.

C. EXISTING SITE CONDITIONS:

1. GENERAL:

The project site is currently undeveloped and is not being used for any particular purpose. Natural vegetation in the undeveloped areas includes, but is not limited to, buffelgrass and kiawe trees. It is our understanding that:

- The North Parcel 30 was previously partially disturbed around 1991 in conjunction with the construction of the adjoining existing Longs Drugs Retail

- Two existing residential structures were present in the northeasterly end of North Parcel 30 at least through 2003; however, they are no longer present.

- The South Parcel 76 was previously partially disturbed in conjunction with the construction of the adjoining existing South Man-Made Wetlands Replacement and Enhancement Site.

- The West Parcel 158 was previously cleared, grubbed and graded around 1990 in conjunction with the construction of the adjoining existing Azeka Place (Mauka Phase II) Commercial Center and existing Man-Made Wetlands Replacement and Enhancement Site. This parcel is currently being used as a composting site by a local school (see Figure 7).

  - A 24 feet wide driveway stub, from the existing Azeka Place (Mauka Phase II) Commercial Center up to the westerly (makai) edge of West Parcel 158, was master-planned and constructed in conjunction with the construction of the existing Azeka Place (Mauka Phase II) Commercial Center. This driveway stub is located approximately 100 ft. to the south (Wailea) of existing Pi'ikea Avenue.

Figure 7 - West Parcel 158 (Currently Being Used as a Composting Site)

According to the Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, prepared by the United States Department of Agriculture, Soil Conservation Service, the predominant soil classifications found on the project site (see EXHIBIT "H") consist of:

- Pulehu Series, Pulehu clay loam, 0-3 percent slopes (PsA). The Pulehu clay loam (PsA) is characterized as having moderate permeability, slow runoff and a slight erosion hazard.

- Puuone sand, 7 to 30 percent slopes (PZUE). The Puuone sand (PZUE) is characterized as having rapid permeability above the cemented layer, slow runoff and moderate to severe wind erosion hazard.

- Jaucas sand, saline, 0 to 12 percent slopes (JcC). The Jaucas sand (JcC) is somewhat poorly drained in depressions but excessively drained on knolls.

2. TOPOGRAPHY:

The existing ground (see EXHIBIT "L") generally slopes in an easterly to westerly direction in the vicinity.

- The Krausz North Parcel 30 slopes from an elevation of approximately (+) 27 feet M.S.L. (at its easterly end abutting the existing Kihei Greenway Multi-Use Trail and existing Liloa Drive) to approximately (+) 4 feet M.S.L. (at its westerly edge abutting the existing North Man-Made Wetlands Replacement and Enhancement Site), with an average slope of approximately 1.2%.

- The Krausz South Parcel 76 slopes from an elevation of approximately (+) 39 feet M.S.L. (at its easterly end abutting the existing Kihei Greenway Multi-Use Trail and existing Liloa Drive) to approximately (+) 4 feet M.S.L. (at its westerly edge abutting the existing South Man-Made Wetlands Replacement and Enhancement Site), with an average slope of approximately 3.1%.

- The Krausz West Parcel 158 is relatively flat, and slopes in a westerly to easterly direction, from an elevation of approximately (+) 8 feet M.S.L. (at the westerly edge abutting the existing Azeka Place (Mauka Phase II) Commercial Center) to approximately (+) 7 feet M.S.L. (at the easterly edge abutting the existing South Man-Made Wetlands Replacement and Enhancement Site), with an average slope of approximately 0.7%.

3. FLOOD AND TSUNAMI ZONES:

According to Panel 0586E of the Flood Insurance Rate Map, dated September 25, 2009 (see EXHIBIT "I"):

- The majority of North Parcel 30 and South Parcel 76 [TMKs: (2) 3-9-02:30 and 76, respectively] are situated within Zone "X", which is designated as an area outside the 0.2% annual chance flood plain and of minimal flood hazard. A portion of the southwestern corners of both these Parcels (near the locations of the existing Man-Made Wetlands Replacement and Enhancement Sites) are in Zone "AH", which indicates they are in special flood hazard areas subject to inundation by the 100-year shallow flood where flood depths are between one (1) and three (3) feet (usually areas of ponding) and Base Flood Elevation determined at Elevation 6.

- The entire West Parcel 158 [TMK: (2) 3-9-02: 158] is in Zone "AH", which indicates they are in special flood hazard areas subject to inundation by the

100-year shallow flood where flood depths are between one (1) and three (3) feet (usually areas of ponding) and Base Flood Elevation determined at Elevation 6.

The project site is not located within a tsunami zone [which typically does not extend eastward (mauka) beyond South Kihei Road in this immediate area].

D. PROJECT BACKGROUND AND DESCRIPTION:

Organized discussion and planning of a Downtown Kihei date back to at least 1998, when the County Department of Planning and the Kihei Community Association sponsored a Downtown Kihei Design Workshop. The overall study area considered is depicted on the working base plan used at the workshop (see EXHIBIT "J") and was generally bounded by:

- Pi'ilani Highway as its easterly (mauka) limits, including:
  - The then-proposed Pi'ilani Village (Safeway) Shopping Center, the Pi'ilani Village (soccer field) Park immediately to the north of Pi'ilani Village Shopping Center, and the Pi'ilani Gardens Apartment and Childcare Complex (all of which have since been built);
  - The then-proposed Kihei Community and Aquatic Centers (which has since been built);
  - Existing Kihei Elementary and Lokelani Intermediate Schools;
- Pacific Ocean as its westerly (makai) limits;
- Through existing Yee's Orchard as its northerly (Maalaea direction) limits; and,
- Through the existing Kihei Franks Light Industrial Subdivision as its southerly (Wailea direction) limits.

It is our understanding that the Krausz Downtown Kihei Project was developed through extensive County and community input and refinements undertaken by the Applicant. The currently proposed onsite improvements for the Krausz Downtown Kihei project (see EXHIBITS "C" and "D") are expected to ultimately consist of:

- A total of approximately 350,000 s.f. of mixed use building floor area occupying approximately 20.937 Ac. [Parcels 30, 76 and 158 (exclusive of the existing Man-Made Wetlands Replacement and Enhancement Sites)]. Anticipated uses include commercial (e.g., retail, restaurants, and accessory uses), office, accommodations (e.g., hotel), and entertainment (e.g., theater).
- Paved access driveway connections to Pi'ikea Avenue and Liloa Drive.
- Paved onsite driveways and paved onsite parking for approximately 1,200 vehicles, including electric vehicle charging stations. A two-story parking structure at the westerly (makai) end of South Parcel 76 is also planned (see EXHIBIT "C").

- Additional onsite sitework improvements are expected to include:
  - Clearing, grubbing, and grading the three parcels (exclusive of the existing man-made Wetlands Replacement and Enhancement Sites) (see EXHIBIT "E").
  - Retaining walls, railing and perimeter fencing (where required).
  - Concrete curbs, gutters and paved mall walkways and sidewalks.
  - Asphalt or reinforced concrete paved driveways and parking areas.
  - Site lighting.
  - Underground drainage systems (including drainlines, box culverts, etc.) with drain inlets, manholes, and subsurface drainage (detention) systems, and appurtenances (see EXHIBIT "F").
  - At-grade landscaped detention basins (with inlet and outlet structures).
  - Underground wastewater (sewer) systems, and appurtenances.
  - Underground water systems for potable water and fire protection, and appurtenances.
  - Underground electrical, telephone, cable television systems (including, but not limited to, streetlights, parking area lights, walkway/pathway lights, underground ducts, transformers, handholes and manholes, ground mounted cabinets, and appurtenances).
  - Underground gas system with supplemental above ground gas tanks.
  - Landscaping and irrigation (expected to be supplied from the County's R1 reclaimed water system where available).

The construction of onsite improvements are expected to be phased as tenant commitments are progressively secured.

Anticipated offsite infrastructure improvements along the abutting portions of Pi'ikea Avenue and its vicinity (and portions of Liloa Drive where utilities services are required to be brought into the site) are generally expected to typically consist of (where applicable) (see EXHIBIT "D"):

- Clearing, grubbing, and grading the existing roadway corridor for roadway widening and profile refinements (exclusive of the existing man-made Wetlands Replacement and Enhancement Sites).
- Roadway improvements consisting of: asphalt concrete or reinforced concrete pavement; concrete curb and gutters; concrete driveway aprons and curb cut wheelchair ramps; concrete sidewalks; and signage & striping.
- Retaining walls, railing and fencing (where required).
- Underground drainage systems (including drainlines, box culverts, etc.) with drain inlets, manholes, and subsurface drainage (detention) systems, and appurtenances (where required).
- Underground wastewater collection and transmission systems, and appurtenances (where required).
- Underground water transmission and distribution systems for potable water and fire protection, and appurtenances (where required).

- Underground electrical, telephone, cable television systems (including, but not limited to, streetlights, parking area lights, walkway/pathway lights, underground ducts, transformers, handholes and manholes, ground mounted cabinets, and appurtenances; where required).
- Landscaping and irrigation (expected to be supplied from the County's R1 reclaimed water system; where available).
- Traffic signal system and appurtenances (at proposed signalized intersection along Pi'ikea Avenue).

In addition, it is our understanding that the addition of a second left turn lane from east (mauka) bound Pi'ikea Avenue onto north (Maalaea) bound Pi'ilani Highway (see EXHIBIT "B") has already been incorporated into the Engineering Division's Capital Improvements 6-Year Plan for projects programmed into the STIP for Federal Funding (see EXHIBIT "K").

The existing Man-Made Wetlands Replacement and Enhancement sites (previously constructed in 1990), are not expected to be disturbed by the proposed development.

Temporary construction-phase measures are expected to be implemented from the inception of any ground disturbing activities, and maintained as required for erosion and sedimentation mitigation (e.g., dust fences, silt fences, filtration berms, temporary sedimentation basins, etc), pursuant to applicable provisions of:

- Chapter 20.08 of the Maui County Code, "Soil Erosion and Sedimentation Control";
- Construction Best Management Practices (BMPs) for the County of Maui (dated May 2001);
- The recently adopted, Title MC-15, Subtitle 01, Chapter 111, "Rules for the Design of Storm Water Treatment Best Management Practices (adopted November 9, 2012); and,
- Any applicable conditions and requirements of the project-specific National Pollutant Discharge Elimination System (NPDES) Permit.

All sitework construction is expected to conform to the recommendations and requirements of the Soils Engineer (who will be a professional engineer licensed to practice in the State of Hawai'i) and the applicable requirements of the Maui County code. The Owner is expected to retain the Soils Engineer to provide all construction phase monitoring and testing in accordance with the recommendations of the Soils Report and requirements of the County of Maui.

II. ROADWAY IMPROVEMENTS AND TRAFFIC ASSESSMENT:

A. EXISTING CONDITIONS:

1. PI'ILANI HIGHWAY:

Pi'ilani Highway, which provides access to Kihei and Wailea from areas north of Kihei, is a four-lane, undivided, State arterial highway (between its northerly terminus at South Kihei Road / Mokulele Highway, and Kilohana Drive / Mapu Place), generally aligned in a north-south direction, parallel to the coastline and South Kihei Road. Pi'ilani Highway narrows to a two-lane, undivided highway from its intersection with Kilohana Drive / Mapu Place to its southerly terminus at Wailea Ike Drive. The shoulder areas of Pi'ilani Highway are designated as bicycle lanes.

Pi'ilani Highway is currently classified as an Urban Principal Arterial. The posted speed limit on Pi'ilani Highway is generally 40 miles per hour (mph). The speed limit on Pi'ilani Highway is 45 mph in the northbound direction from Wailea Ike Drive to Kilohana Drive; the southbound speed limit on this segment decreases from 45 mph to 25 mph as it approaches Wailea Ike Drive.

The existing segment of Pi'ilani Highway north of Kilohana Drive was widened to four lanes in 2003. The remaining approximately 1,000 ft. of two-lane highway (from Kilohana Drive to its southerly terminus at Wailea Ike Drive) is expected to be widened to four lanes in the near future (the Final Environmental Assessment was filed earlier this year with Findings of No Significant Impact).

2. PI'IKEA AVENUE (Road "C"):

Pi'ikea Avenue (fka Road "C"), is oriented in an easterly (mauka) to westerly (makai) alignment, between Pi'ilani Highway and South Kihei Road (see EXHIBIT "B"), and was constructed as a joint County and private interest project (Road "C" / N-S Collector Federal Aid project) in 2001. Pi'ikea Avenue provides access to South Kihei Road and to existing abutting commercial and residential developments, and bisects the north and south phases of the Krausz Downtown Kihei project (between Liloa Drive and the existing Longs Drugs Retail Center and existing Azeka Place (Mauka Phase II) Commercial Center).

Pi'ikea Avenue is a fully improved four-lane, undivided roadway from its easterly (mauka) terminus at Pi'ilani Highway to the existing signalized mid-block entrance to Pi'ilani Village (Safeway) Shopping Center on the northerly side of Pi'ikea Avenue, which is also the main entrance to the Pi'ilani Gardens Apartments and Child Care Complex on the southerly side of Pi'ikea Avenue. It then narrows to a two-lane, divided roadway as it approaches the Roundabout at the intersection of Pi'ikea Avenue and Liloa Drive. This segment of Pi'ikea Avenue is fully improved (with curb and gutters, sidewalks, curb inlets, fire hydrants, streetlights, etc.).

A single-lane Roundabout, which abuts the easterly end of the Krausz Downtown Kihei projects, was constructed by the County in 2012 at the intersection of Pi'ikea Avenue and Liloa Drive (see Figures 1 and 2). Pedestrian crossings across both Pi'ikea Avenue approaches are provided with pedestrian-activated flashing beacons.

Pi'ikea Avenue remains a two-lane roadway from the Roundabout to its westerly (makai) terminus at South Kihei Road. This segment is only partially improved (shoulders are typically simply asphalt concrete with no curb and gutters or sidewalks, no streetlights, no drainage system, etc.).

The posted speed limit along Pi'ikea Avenue is generally 20 mph (exclusive of the recently constructed Roundabout at the intersection of Pi'ikea Avenue and Liloa Drive). The posted speed limits are reduced to 15 mph through the Roundabout.

3. LILOA DRIVE (N-S Collector):

Liloa Drive (fka N-S Collector), is oriented in a northerly (Maalaea) to southerly (Wailea) alignment, between its current northerly (Maalaea end) terminus at East Waipuilani Street and its southerly terminus at Halekuai St. (where it then continues into the recently completed South Maui Community Park as a private driveway). Liloa Drive was also constructed as a joint County and private interest project (Road "C" / N-S Collector Federal Aid project) in 2001, and provides circulation between East Waipuilani Street and Halekuai Street, and access to the adjoining commercial and residential developments.

The single-lane Roundabout, which abuts the easterly end of the Krausz Downtown Kihei projects, was constructed by the County in 2012 at the intersection of Pi'ikea Avenue and Liloa Drive (see Figures 1 and 2). Pedestrian crossings across both Liloa Drive approaches are provided with pedestrian-activated flashing beacons.

Two existing curbed driveways providing access to the Krausz Downtown Kihei project from Liloa Drive were master-planned and recently constructed with the Roundabout project (see EXHIBIT "D").

- The North Driveway provides access from Liloa Drive to North Parcel 30.
- The South Driveway provides a right turn in/out only access from Liloa Drive to the South Parcel 76 (see Figure 8).

Figure 8 - Right Turn In/Out South Access Driveway from Liloa Drive to South Parcel 76

Liloa Drive is a fully improved two-lane, undivided roadway from its northerly (Maalaea end) terminus at East Waipuilani Street to Kauha'a Street (entrance to Meadowlands Subdivision - Phase II), with curbs and gutters on both sides, a sidewalk on the easterly (mauka) side, and the Kihei Greenway Multi-Use Trail on the westerly (makai) side.

It continues as a substantially improved two-lane, undivided roadway with curb and gutter and sidewalk along its easterly (mauka) side, and asphalt concrete shoulder and Kihei Greenway Multi-Use Trail on the westerly (makai) side to the Roundabout at the intersection of Pi'ikea Avenue and Liloa Drive.

Liloa Drive continues from the Roundabout to Lipoa Street (see Figure 3) as a substantially improved three-lane, undivided roadway (two northbound lanes and one southbound lane) with curb and gutter and sidewalk along its easterly (mauka) side, and asphalt concrete shoulder and the Kihei Greenway Multi-Use Trail on the westerly (makai) side.

The balance of Liloa Drive, from Lipoa Street to Halekuai Street, consists of a two-lane, undivided unimproved roadway with asphalt concrete paved shoulders (no curb and gutter, nor sidewalk).

B. PRELIMINARY TRAFFIC ASSESSMENT:

A preliminary Traffic Impact Assessment Report has been undertaken for the proposed project by a traffic engineering consultant (Austin Tsutsumi & Associates, Inc.) retained by the Client [see "Traffic Impact Analysis Report, Krausz Companies Commercial Mixed-Use Development (Downtown Kihei), Kihei, Maui, Hawaii, Final Draft" (dated April 18, 2012; prepared by Austin, Tsutsumi & Associates, Inc)].

Existing conditions, alternatives considered, and recommended roadway and traffic improvements (both project-specific and regionally) are identified and discussed in more detail therein.

C. PROPOSED ROADWAY IMPROVEMENTS:

1. PI'ILANI HIGHWAY:

A temporary, curbed landscape median currently exists along the northerly (Maalaea) edge of the existing left turn storage lane (for left turns from eastbound Pi'ikea Avenue to northbound Pi'ilani Highway) (see EXHIBIT "B"). A standard County Class "A" pavement section was installed all the way across this upper segment of Pi'ikea Avenue with the County's Road "C" / N-S Collector project when the project was completed in 2001, so that the temporary, curbed, mounded landscape median could be removed, and a second left turn lane could easily be added, in conjunction with the State's widening of Pi'ilani Highway to four lanes. However, this was never implemented by the County with the State's Pi'ilani Highway Four-Lane Widening Project that was completed in 2003, and a single left turn still exists at this location today.

Traffic along the Pi'ikea Avenue eastbound left-turn storage lane (making northbound left turns onto Pi'ilani Highway) has been observed to occasionally queue beyond the existing signalized mid-block entrance to Pi'ilani Village (Safeway) Shopping Center and the Pi'ilani Gardens Apartments and Child Care Complex. This in turn occasionally obstructs the left-turn movements for vehicles exiting the Pi'ilani Village (Safeway) Shopping Center.

These improvements were identified as a recommended improvement for the County's South Maui Community Park project (Phase I of the Park project was completed in 2011). Pursuant to the "Memorandum Of Understanding For Construction Of Offsite Roadway Improvements In The Vicinity Of South Maul Community Park [TMK (2) 2-2-002:042]" (dated October 13, 2008) between the Department of Public Works and the Department of Parks and Recreation (see EXHIBIT "K"), the addition of a second left turn lane from east (mauka) bound Pi'ikea Avenue onto north (Maalaea) bound Pi'ilani Highway (see EXHIBIT "B") should have already been incorporated into the Engineering Division's Capital Improvements 6-Year Plan for projects programmed into the STIP for Federal Funding. However, this planned improvement does not appear to be documented in the latest STIP implementation schedule through 2016.

2. PI'IKEA AVENUE:

The single-lane Roundabout at the intersection of Pi'ikea Avenue and Liloa Drive (see Figure 2b) was completed by the County in 2012. It is our understanding that

this intersection appears to function adequately and thus no further improvements are proposed to the Pi'ikea Avenue approach to this intersection.

Based on the Site Plan proposed by the Applicant (see EXHIBIT "C"), a total of four intersections along Pi'ikea Avenue are proposed for the Krausz Downtown Kihei Project, to provide access to North Parcel 30 and South Parcel 76 through four pairs of driveways (that are aligned across each other) (see EXHIBITS "C" and "E").

- The two pairs of easternmost (mauka-most) driveways are restricted to right turn in/out only to prevent potential conflicts with the Roundabout at the intersection of Pi'ikea Avenue and Liloa Drive.
    - To limit pedestrian crossings across Pi'ikea Avenue, cross walks are proposed only at the lower of these two upper intersections.
- The main intersection (third intersection west or makai of the Roundabout, at the intersection of existing Pi'ikea Ave. and proposed onsite "C" Street) is proposed to be signalized, with crosswalks in both directions.
- The western (makai)-most intersection is proposed to be unsignalized and will allow all turning movements.
- The southerly (Wailea) driveway at this intersection is proposed to serve as access for the proposed parking structure at the west (makai) end of South Parcel 76.

The segment of Pi'ikea Avenue through the project site is proposed to consist of two through lanes (one in each direction) and supplemental left and right turn lanes (see EXHIBIT "C" and "D", including Typical Section on EXHIBIT "D"). In addition, to facilitate an attractive, pedestrian-friendly streetscape (see Figure 9), the vertical alignment of the existing two-lane roadway will be refined to integrate Pi'ikea Avenue with the adjoining development parcels (see EXHIBIT "G").

Figure 9 – Integration of Pedestrian-Friendly Streetscape Along Pi'ikea Avenue (Conceptual Only, Looking North)

Access to West Parcel 158 is proposed to be exclusively from the existing adjoining Azeka Place (Mauka Phase II) Commercial Center (see EXHIBITS "B" and "D").

3. LILOA DRIVE:

Two existing curbed driveways providing access to the Krausz Downtown Kihei project from Liloa Drive (see EXHIBIT "D") were master-planned and recently constructed with the Roundabout project.

- The existing, curbed, three-lane driveway, providing access directly to Liloa Drive, will be extended further into North Parcel 30 and integrated into onsite circulation driveways.

- The existing, curbed, two-lane, right turn in/out driveway, providing direct access to Liloa Drive, will be extended further into the South Parcel 76 and integrated into the onsite circulation driveways.

Pedestrian and bicycle connectivity is expected to be provided to the existing Kihei Greenway Multi-Use Trail between the easterly (mauka) edge of the project and Liloa Drive.

The lane geometry of all intersections and accesses to the Krausz Downtown Kihei project are discussed in more detail in the TIAR.

III. DRAINAGE SYSTEM:

A. EXISTING CONDITIONS:

Since the existing ground generally slopes in an easterly to westerly direction in the vicinity (see EXHIBIT "L"), the majority of the onsite and offsite runoff for North Parcel 30 and South Parcel 76, including existing Pi'ikea Avenue, generally sheet flows across the project site in an easterly to westerly direction, from its easterly end abutting the existing Kihei Greenway Multi-Use Trail and Liloa Drive, towards and into the downstream existing Man-Made Wetlands Replacement and Enhancement Sites on both sides of the existing Pi'ikea Avenue roadway.

The segment of the existing Pi'ikea Avenue roadway and shoulder located between the existing Man-Made Wetlands Replacement and Enhancement Sites also drains into the adjoining existing Man-Made Wetlands Replacement and Enhancement Sites on both sides of the roadway.

The relatively flat West Parcel 158 sheet flows across the project site in a westerly to easterly direction, from the existing Azeka Place (mauka Phase II) Commercial Center to the existing South Man-Made Wetlands Replacement and Enhancement Site.

These existing Man-Made Wetlands Replacement and Enhancement Sites release incoming runoff into existing concrete drainage inlet structures that connect to the underground drainage system within these two retail centers. The runoff is then

conveyed to the County's existing underground drainage system along South Kihei Road, and eventually discharged into the existing St. Theresa Regulation Reservoir that outlets to the ocean.

According to our hydrologic analyses (see APPENDIX "A"), the existing pre-development project site currently generates approximately 21.0 cfs of onsite surface runoff (based on a 50-year recurrence interval, 1-hour duration storm; and, including a portion of the Pi'ikea Avenue right-of-way, but excluding the existing Man-Made Wetlands Replacement and Enhancement Site easement).

According to the previously approved drainage report for the existing Longs Drugs Retail Business Center (dated February 1989; by Warren S. Unemori Engineering, Inc.), the existing drainage system and inlet structure (30" RCP drainline) located east of the existing Longs Drugs Retail Center, within the existing North Man-Made Wetlands Replacement and Enhancement site, was designed to accommodate approximately 14.4 cfs of total allowable runoff from the North Parcel 30 (TMK: (2) 3-9-0:30) when it is developed in the future. This runoff is then conveyed to the existing regulation reservoir located south of St. Theresa Church, by existing drainlines along Pi'ikea Ave. and the existing box culverts along S. Kihei Road.

Approximately 1.6 cfs of onsite surface runoff currently sheet flows from the northerly fringe of the North Parcel 30 in a northerly direction off the project site and into the adjoining Yee's Orchard property.

Based on the previously approved drainage report for the existing Azeka Place Commercial Center (dated March 1989 by Warren S. Unemori Engineering, Inc.), the existing drainage system and inlet structure (36" ASRP drainline) located east of the Azeka Place (Mauka Phase II) Commercial Center, within the existing South Man-Made Wetlands Replacement and Enhancement Site, was designed to accommodate approximately 17.8 cfs of total allowable runoff from the South Parcel 76 and West Parcel 158. This runoff is also then conveyed to the existing Regulation Reservoir located south of St. Theresa Church, by existing drainlines along Pi'ikea Avenue and the existing box culverts beneath S. Kihei Road.

Runoff from the existing 60 ft. wide Pi'ikea Avenue right-of-way that currently sheet flows into the project site (with approximately half of the right-of-way flowing into the North Parcel 30; and, half into the South Parcel 76, West Parcel 158) ultimately drains into the existing North and South Man-Made Wetlands Replacement and Enhancement Sites.

A total of approximately 3.3 cfs (50-year, 1-hour storm) of offsite surface runoff is anticipated from adjoining areas easterly (mauka) of the project site is limited to the narrow strip between the easterly (mauka) edge of the project site and Liloa Drive curbing, which includes surface runoff from the Kihei Greenway Multi-Use Trail. This

offsite runoff currently drains through the project site and into the two downstream existing North and South Man-Made Wetlands Replacement and Enhancement Sites.

B. PROPOSED DRAINAGE IMPROVEMENTS:

All drainage improvements are expected to be implemented pursuant to the current County of Maui's Rules for the Design of Storm Drainage Facilities. The existing pre-development drainage patterns will generally be maintained and any potential increase in runoff generated by the proposed project improvements will be mitigated so that the runoff released downstream will be no greater than what the existing downstream drainage systems were master-planned and designed to accommodate from the project site.

The majority of the onsite and offsite runoff will be intercepted by drain inlets and conveyed by underground drainage systems to onsite detention basins (see EXHIBIT "F"), which will be sized to accommodate the fully developed project site (see APPENDIX "A").

Furthermore, in lieu of allowing onsite and offsite runoff to sheet flow and discharge directly into the existing man-made Wetlands Replacement And Enhancement Sites, as it is presently doing, the runoff will:

- First be intercepted by drain inlets (which will incorporate inserts with activated carbon filters);
- Then be routed through the project's subsurface drainage systems (which will incorporate internal baffles to encourage siltation); and,
- Then be routed through well-vegetated, above-ground Landscaped Detention Basins (which will have provisions for overflow with controlled release to the downstream existing Man-Made Wetlands Replacement and Enhancement Sites).

In the absence of any onsite stormwater detention systems, a total of approximately 65.1 cfs (50-year, 1-hour storm) of the onsite surface runoff could potentially have been generated after development of the project site (including improvements within the Pi'ikea Avenue right-of-way). However, a combination of Subsurface Detention Systems and above ground Landscaped Detention Basins will be implemented (see APPENDIX "A") to limit the peak onsite runoff to rates no greater than the master-planned and designed allowable release into the existing drainage systems from the previously approved Azeka Place (mauka Phase II) Commercial Center and the Longs Drugs Retail Center projects (see APPENDIX "A").

- The net release into the existing Longs Drugs Retail Center drainage system is expected to be approximately 14.0 cfs, ultimately less than the allowable 14.4 cfs from the previously approved drainage report.

- The net release into the existing Azeka Place (Mauka Phase II) Commercial Center drainage system is expected to be approximately 17.3 cfs, ultimately less than the allowable 17.8 cfs from the previously approved drainage report.

A portion of the existing onsite surface runoff from the northerly fringe of North Parcel 30, which currently sheet flows off the property into the adjacent Yee's Orchard, will be allowed to continue as it is presently doing so that there will be no net increase in onsite runoff leaving the project site.

The proposed drainage plan incorporating subsurface drainage systems and two new onsite detention basins will attenuate any potential increase in post-development runoff, so that no more than the master-planned and designed allowable total release of 32.2 cfs (that was identified in the previously approved Drainage Reports for the existing Longs Drugs Retail Center and existing Azeka Place (Mauka Phase II) Commercial Center) will be permitted to discharge downstream, and continue to flow downstream as it is presently doing. Therefore, since the onsite runoff discharging downstream will not exceed the master-planned and designed allowable release allocated for the developed project sites and are thus within the design capacity of the downstream drainage system, the proposed project improvements are not expected to adversely affect the downstream and adjoining properties.

IV. WASTEWATER SYSTEM:

A. EXISTING CONDITIONS:

An 8" sewerline (see EXHIBIT "F") was master planned and originally installed, along what would ultimately become the Road "C" or Pi'ikea Avenue roadway corridor, in 1991, in anticipation of providing sewer service to the future easterly (mauka) residential and commercial developments. This existing 8" sewerline ties into a sewer manhole on South Kihei Road which then flows into a 10" sewerline, which carries the effluent by gravity flow northward along South Kihei Road approximately 500 feet to Sewer Pump Station No. 4. Sewer Pump Station No. 4 then pumps the effluent southward toward the Kihei Wastewater Reclamation Facility via a 12" force main.

The County subsequently extended the 8" sewerline between the existing Longs Drugs Retail Center and existing Azeka Place (Mauka Phase II) Commercial Center approximately 1,600 l.f. to the east (mauka) along Pi'ikea Avenue, up through the intersection of Pi'ikea Avenue and Liloa Drive, in conjunction with the construction of the County's Federal Aid Road "C" / N-S Collector project in 2001.

A Sewer Capacity Analysis was undertaken in 1997 (during the design phase for the County's Road "C" / N-S Collector Federal Aid Project), which confirmed that this Pi'ikea Avenue sewerline extension would have a peak design capacity of at least 530,000 g.p.d., and adequate capacity to serve the proposed Pi'ilani Village (Safeway) Shopping Center, the proposed Pi'ilani Gardens Apartments and Child Care Complex, the future

North Parcel 30, the future South Parcel 76, and the future West Parcel 158. Thus, 8" diameter sewer service laterals were installed at the lower corners of the Krausz Downtown Kihei North Parcel 30, the South Parcel 76, and the West Parcel 158.

According to the Wastewater Reclamation Division, County of Maui, it is our understanding that flow to the Kihei Wastewater Reclamation Facility is currently approximately 4.0 MGD. The facility itself is designed for 8.0 MGD, which is well in excess of current demand. Thus, there are no plans for expansion at this time.

B. PROPOSED WASTEWATER IMPROVEMENTS:

The existing sewer laterals from the existing 8" sewerline along Pi'ikea Avenue (see EXHIBIT "F") will be extended into the site, or where more optimum service points are required, a new sewer manhole will be installed along the existing 8" sewerline along Pi'ikea Avenue and a new 8" diameter sewer lateral will be extended into the site. The onsite wastewater system will typically consist of 8" diameter main sewerlines with sewer manholes and 6" diameter sewer service laterals with cleanouts to the individual building services.

C. ANTICIPATED WASTEWATER DEMANDS:

Based on a Peak Flow Factor of 2.2 (which was used in the aforementioned 1997 Sewer Capacity Analysis):

- The 13.469 Ac. (net 10.469 Ac. excluding existing North Man-Made Wetlands Replacement and Enhancement Site) North Parcel 30 is expected to generate a peak design wastewater flow of approximately 88,900 g.p.d.
- The 9.092 Ac. South Parcel 76 is expected to generate a peak design wastewater flow of approximately 77,200 g.p.d.
- The 1.376 Ac. West Parcel 158 is expected to generate a peak design wastewater flow of approximately 11,700 g.p.d.

V. WATER SYSTEM:

A. EXISTING CONDITIONS:

1. POTABLE WATER SYSTEM:

A potable water storage, transmission and distribution system, developed and managed by the County Department of Water Supply, services this area of Kihei. The 36" diameter high-pressure Central Maui Transmission Line and an 18" diameter transmission/distribution system serve the region, and are located along a utility corridor that runs in a north-south alignment within the Liloa Drive ROW

(see EXHIBIT "F"), just outside of the easterly (mauka) perimeter of North Parcel 30 and South Parcel 76, alongside:

- The Maui Electric Company's 69kV overhead transmission line; and
- The County Wastewater Reclamation Division's 12" reclaimed (R1) water transmission/distribution line ; and,
- The Kihei Greenway Multi-Use Trail.

A 2.0 MG concrete reservoir (at overflow Elevation 248.00 M.S.L.) located immediately above the Maui Research and Technology Park, and approximately 1.0 mile easterly (mauka) of the project site, was constructed in 2000 by a joint venture between the County Department of Water Supply and Pi'ilani Village. This reservoir is serviced from the existing 36" diameter Central Maui Transmission line, and is connected to the existing 18" diameter transmission/distribution system, at Lipoa Street, and provides adequate storage capacity to this area.

In addition, a 12" diameter waterline was installed along Pi'ikea Avenue (see EXHIBIT "F"), from the existing 18" inch transmission/distribution system at the intersection of Pi'ikea Avenue / Liloa Drive to a point approximately 80 ft. west (makai) of Liloa Drive, and temporarily plugged [in anticipation for a future extension further west (makai) towards South Kihei Road to provide potable water service to future developments along Pi'ikea Avenue, between Liloa Drive and the existing Longs Drugs Retail Center and existing Azeka Place (Mauka Phase II) Commercial Center], in conjunction with the County's Federal Aid Road "C" / N S Collector project.

2. NON-POTABLE (R1) RECLAIMED WATER SYSTEM:

A non-potable reclaimed water storage, transmission and distribution system, developed and managed by the County Department of Environmental Management, Wastewater Reclamation Division, services portions of this area of Kihei.

The Kihei Wastewater Reclamation Facility (KWRF), which serves the South Maui area from Wailea to Sugar Beach, produces R-1 water, which is the highest quality of recycled water identified by the State of Hawaii's Department of Health.

It potentially has a dry weather flow capacity and R1 water production capacity near 8.0 MGD.

- In 2010, the daily average volume of R1 water used has been approximately 1.8 MGD or approximately 50% of the total daily R-1 water produced.
- As of August 20, 2012 (based on information provided by the Wastewater Reclamation Division):

- The current R1 water production capacity is approximately 5 MGD, based on two retrofitted channels (each with a capacity of 2.5 MGD) in operation. A third channel (still with an older disinfection system) is currently not in operation.
- The current influent flow to the KWRF is approximately 3.6 MGD.
- Current peak R1 water used is approximately 2.0 MGD.
- Recent peak reuse has been up to approximately 60% (which corresponded to a month of lower influent flow than the 3.6 MGD).

A 12" diameter transmission/distribution system provides non-potable (R1) reclaimed water service to the region, and is located along a utility corridor that runs in a north-south alignment within the Liloa Drive ROW (see EXHIBIT "F"), just outside of the easterly (mauka) perimeter of North Parcel 30 and South Parcel 76, which is shared by:

- The Maui Electric Company's 69kV overhead transmission line;
- The County Department of Water Supply's 36" diameter high-pressure Central Maui Transmission Line and an 18" diameter transmission / distribution line; and,
- The Kihei Greenway Multi-Use Trail.

This reclaimed transmission line currently extends north along this corridor to East Waipuilani Road, then heads west (makai) along East Waipuilani Road to South Kihei Road. The Wastewater Reclamation Division plans to extend this transmission line to additional consumers in the vicinity.

In addition, it is our understanding that service to the Kihei High School (with an expected consumption of approximately 0.2MGD) is being proposed. Although reuse consumption volumes and timelines are not know at this time, projects currently being served by the County's reclaimed R1 water that is expected to expand its use in the future include Maui R&T Park, South Maui Community Park, and the Hokulani Golf Villas.

A second 1.0 MG Tank is tentatively scheduled to be designed in FY 2015 and constructed in FY 2017, which will allow reclaimed R1 water to be used for a wider range of fire protection in the community.

West Parcel 158 is located approximately 1,500 ft. west (makai) of the existing 12" diameter reclaimed (R1) water transmission line, and thus may have the option of providing landscape irrigation service from the County Department of Water Supply's potable water system along Pi'ikea Avenue. The ultimate source of landscape irrigation water will be determined during the future design phase for Krausz West Parcel 158.

B. PROPOSED WATER IMPROVEMENTS:

1. POTABLE WATER SYSTEM:

The existing 12" diameter waterline along Pi'ikea Avenue that is currently terminated approximately 80 ft. west (makai) of Liloa Drive (see EXHIBIT "F") will be extended westward (makai) along Pi'ikea Avenue to provide potable water service for the proposed fire hydrants along Pi'ikea Avenue and to provide potable water service into North Parcel 30 and South Parcel 76, for domestic water service and fire protection.

The existing 8" diameter waterline along Pi'ikea Avenue [from South Kihei Road, between the existing Longs Drugs Retail Center and existing Azeka Place (Mauka Phase II) Commercial Center] will be extended approximately 150 feet east (mauka) to provide potable water service for the proposed fire hydrants along Pi'ikea Avenue and to provide potable water service into West Parcel 158 for domestic water service and fire protection.

It is noted; however, that as of December 14, 2007, the County of Maui amended the Maui County Code to add a new chapter 14.12 "Water Availability". A letter issued to Engineering Consultants dated December 21, 2007, stated the following: "Effective immediately (pursuant to section 14.12.040), the director of the Department of Water Supply shall provide written verification of a long-term, reliable supply of water as a condition for approval of subdivisions. Note the new code does not apply to subdivisions which had construction plans submitted to the Department of Public Works prior to December 14, 2007, pursuant to MCC Sections 18.20.150 through 18.20.170. Accordingly, the Department of Water Supply will no longer accept construction plans for the affected projects that do not have the verification of water supply. Plans inadvertently accepted by the Department of Water Supply will be returned to the transmitter."

Thus, although the infrastructure to service this project is largely in place, the Applicant is expected to pursue a release of this condition from the Department of Water Supply, or develop private water sources for this project.

Low water consumption fixtures are expected to be used and additional uses for reclaimed (R1) water (e.g., for flushing of water closets or portions of fire protection system) can be explored in the future as the County upgrades and improves it's reclaimed (R1) water storage and telemetry infrastructure as described below.

Major tenants and groups of tenant spaces are expected to be sub-metered and proportioned to the tenant, as a means to monitor water consumption and provide an incentive to reduce water consumption.

2. NON-POTABLE WATER SYSTEM:

To conserve precious potable water resources, drought-tolerant and Hawaiian native plants are being considered, and all landscape irrigation is proposed to be serviced from the County's non-potable (R1) water system for North Parcel 30 and South Parcel 76, and for any landscaping within the roadway right-of-ways. Metered non-potable (R1) irrigation service laterals will be installed, from the County's 12" diameter transmission/distribution system within the utility corridor that runs in a north-south alignment, just outside of the easterly (mauka) perimeter. Applicable County and State Department of Health permits will be obtained at the time of final design.

West Parcel 158 is located approximately 1,500 ft. west (makai) of the existing 12" diameter reclaimed (R1) water transmission line, and thus may have the option of providing landscape irrigation service from the County Department of Water Supply's potable water system along Pi'ikea Avenue. The ultimate source of landscape irrigation water will be determined during the future design phase for West Parcel 158.

C. ANTICIPATED DOMESTIC, FIRE AND IRRIGATION WATER DEMANDS:

1. ANTICIPATED DOMESTIC WATER DEMANDS:

Depending on the ultimate tenant mix, average daily potable water demand is expected to range from 48,500 gpd to no more than 143,600 gpd.

- Based on preliminary projections by the Mechanical Engineer (see APPENDIX "C"), the anticipated average daily potable water demand is expected to be at least 48,500 gpd (based on a maximum projected consumption of 17,700,000 gallons per year).

- Based solely on gross land area, the average daily potable water demand is not expected to exceed 143,600 gpd [based on the generic 6,000 gpa for commercial development in Table 100-18, Domestic Consumption Guidelines, of the Water System Standards, Department of Water Supply, County of Maui, State of Hawaii (dated 2002)].

Based on preliminary projections by the Mechanical Engineer (see APPENDIX "C"), the anticipated peak domestic water demands, and anticipated approximate potable water meter sizes, for the respective onsite components are tabulated below.

Component	Anticipated Preliminary Peak Domestic Potable Water Demand (from Mechanical Engineer)	Anticipated Approximate Domestic Potable Water Meter Size
North Parcel 30 – Hotel (including Pool & Cooling Tower)	245 g.p.m.	3" (max. capacity 320 g.p.m.)
North Parcel 30 – Balance	170 g.p.m.	Two (2) 1½" (max. capacity 200 g.p.m.) or 3" (max. capacity 320 g.p.m.; for Tenant Flexibility)
South Parcel 76	190 g.p.m.	Two (2) 1½" (max. capacity 200 g.p.m.) or 3" (max. capacity 320 g.p.m.; for Tenant Flexibility)
West Parcel 158	70 g.p.m.	1½" (max. capacity 100 g.p.m.)

The projections above exclude landscape irrigation demands, which are expected to use reclaimed (R1) water. Detailed domestic potable water demand calculations for both average daily demand and peak flow for sizing meters are expected to be developed based on the ultimate tenant mix at the time of final design.

2. ANTICIPATED FIRE FLOWS:

Based on preliminary projections by the Mechanical Engineer (see APPENDIX "D"), the anticipated fire flows for the respective onsite components are tabulated below, and are not expected to exceed approximately 1,500 g.p.m. (including the proposed Hotel in North Parcel 30).

Component	Anticipated Maximum Preliminary Fire Flow (from Mechanical Engineer)
North Parcel 30 – Proposed Hotel	1,500 g.p.m.
North Parcel 30 – Balance	1,500 g.p.m.
South Parcel 76	1,500 g.p.m.
West Parcel 158	TBD

3. ANTICIPATED IRRIGATION WATER DEMANDS:

Based on preliminary projections by the Landscape Architect (see APPENDIX "E"), the anticipated irrigation water demands for the respective onsite and offsite components are tabulated below.

Component	Anticipated Preliminary Landscape Irrigation Demand (plant establishment rate / long term normal rate)
Krausz North Parcel 30	15,100 g.p.d. / 8,100 g.p.d.
Krausz South Parcel 76	12,000 g.p.d. / 6,400 g.p.d.
Krausz West Parcel 158	2,400 g.p.d. / 1,400 g.p.d.
Pi'ikea Avenue Realignment & Improvements	T.B.D.

As of August 20, 2012, it is our understanding that the Wastewater Reclamation Division has confirmed that adequate capacity exists to provide the anticipated irrigation needs for this project with reclaimed R1 water. Adequate capacity is expected to be confirmed in the future, prior to the construction of this project, since expanded use of reclaimed R1 water is expected to occur in the future as discussed above.

VI. ELECTRICAL, TELEPHONE AND CATV SERVICE:

A. EXISTING CONDITIONS:

Electrical, telephone and cable TV service in the Kihei region is provided by Maui Electric Company, Ltd., GTE Hawaiian Tel., and Oceanic Time Warner Cable of Hawaii, respectively, along the primary overhead utility corridor for Maui Electric Company's 69kV overhead transmission line, that runs in a north-south alignment, just outside of the easterly (mauka) perimeter of North Parcel 30 and South Parcel 76 (see EXHIBIT "D").

B. PROPOSED ELECTRICAL, TELEPHONE AND CATV IMPROVEMENTS:

Electrical, telephone and cable TV service will be provided to the onsite buildings throughout the project via an underground onsite distribution system. Likewise, all new electrical, telephone and cable TV service along Pi'ikea Avenue is expected to be placed underground.

VII. ANTICIPATED CONSTRUCTION COSTS:

A. ORDER OF MAGNITUDE PROBABLE CONSTRUCTION COSTS:

The projected order-of-magnitude probable construction costs for sitework improvements (including site electrical and landscaping/irrigation) for the respective onsite and offsite components are expected to be:

Component	Order-of-Magnitude Probable Construction Cost
North Parcel 30	$ 7,500,000
South Parcel 76	$ 6,800,000
West Parcel 158	$ 1,300,000
Pi'ikea Avenue Realignment & Improvements	$ 2,900,000

The above is subject to refinement based on scope of ultimate regulatory requirements from Federal, State and County agencies, public utilities, final design documents, and contemporary construction costs at the time the improvements will actually be constructed.

VIII. REFERENCES:

1. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* United States Department of Agriculture, Soil Conservation Service. August 1972.

2. *Flood Insurance Rate Map, Maui County, Hawaii*, Community-Panel Number 150003 0586E. September 25, 2009. Federal Emergency Management Agency, Federal Insurance Administration.

3. *Rules for the Design of Storm Drainage Facilities in the County of Maui*, Chapter 4, Department of Public Works and Environmental Management - County of Maui, July 14, 1995.

4. *Rainfall Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43.* 1962. U.S. Department of Commerce, Weather Bureau.

5. *Preliminary Subsurface Investigation Report: Pi'ikea-Liloa Commercial*, Fewell Geotechnical Engineering, Ltd., September 30, 2008.

6. *Drainage and Soil Erosion Report for Azeka Place Commercial Center*, Warren S. Unemori Engineering, Inc., February 1989.

7. *Drainage and Soil Erosion Report for Longs Drugs – Retail Business Center*, Warren S. Unemori Engineering, Inc., March 1989.

8. *Traffic Impact Analysis Report, Krausz Companies Commercial Mixed-Use Development (Downtown Kihei), Kihei, Maui, Hawaii, Final Draft* (prepared by Austin, Tsutsumi & Associates, Inc .; dated April 18, 2012).

9. *Wetland Survey, Pi'ikea Properties, Azeka Parcels, Pi'ikea Avenue, Kihei, Hawaii 96753, T.M.K. (2) 3-9-02:76, T.M.K. (2) 3-9-02:158* [prepared by Malama Environmental (MEV, LLC); dated June 13, 2008;].

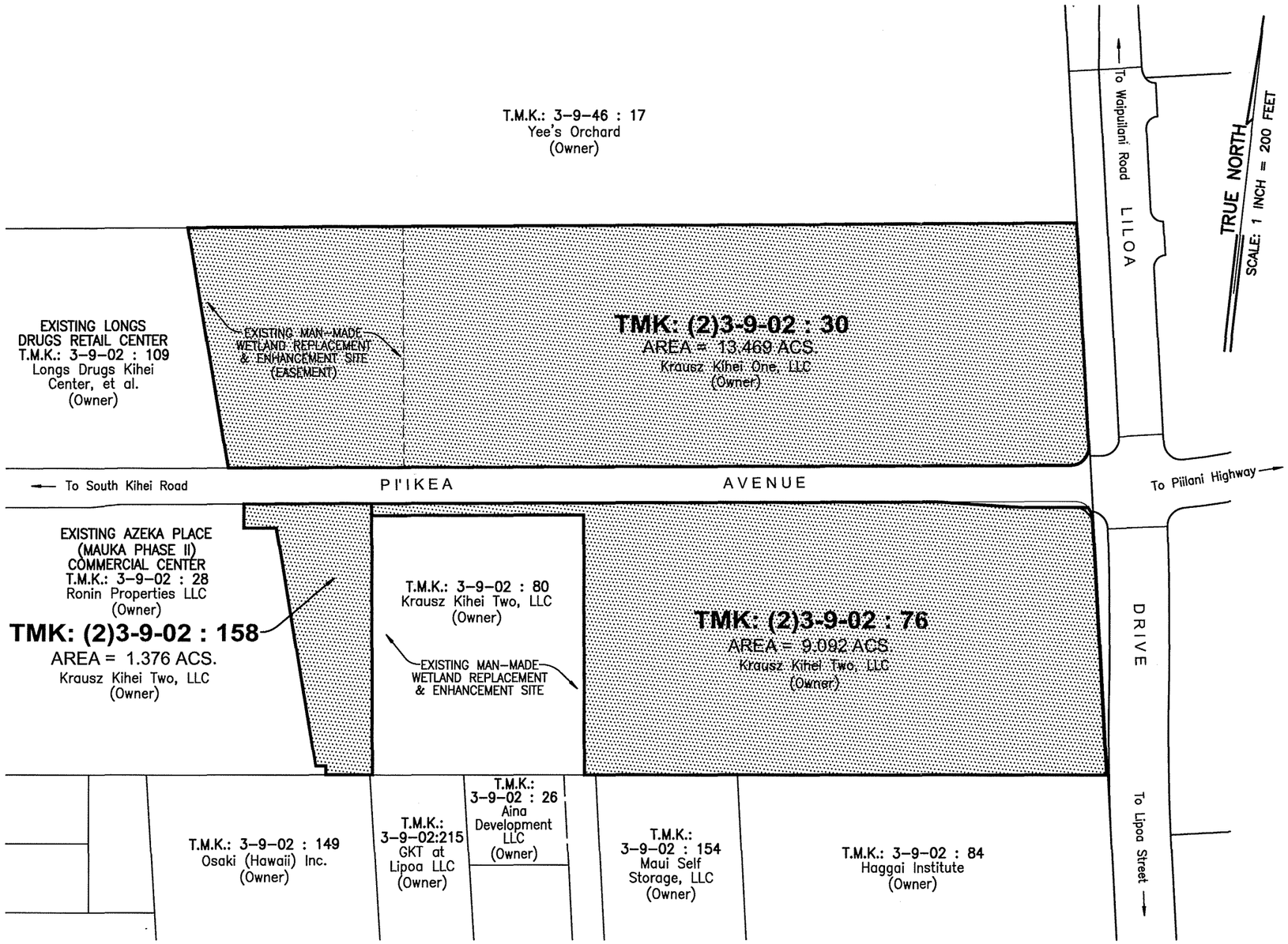
10. *Wetland Survey, Pi'ikea Properties, Pi'ikea Avenue Parcels, Pi'ikea Avenue, Kihei, Hawaii 96753, T.M.K. (2) 3-9-02:30* [prepared by Malama Environmental (MEV, LLC); dated August 27, 2008].

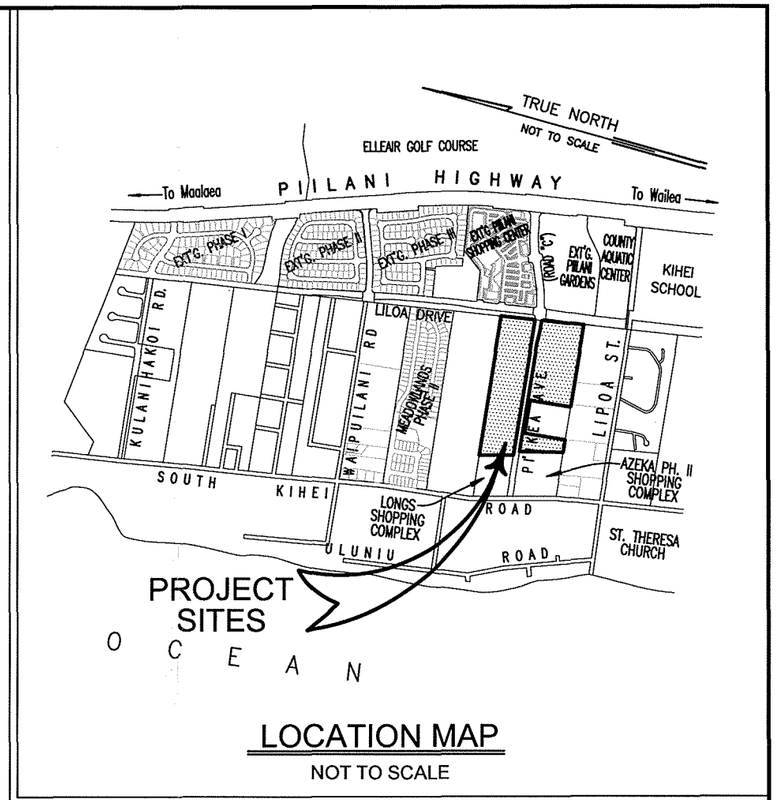
11. *Water System Standards, Department of Water Supply, County of Maui, State of Hawaii* (dated 2002).

12. *Construction Best Management Practices (BMPs) for the County of Maui* (dated May 2001)

EXHIBITS

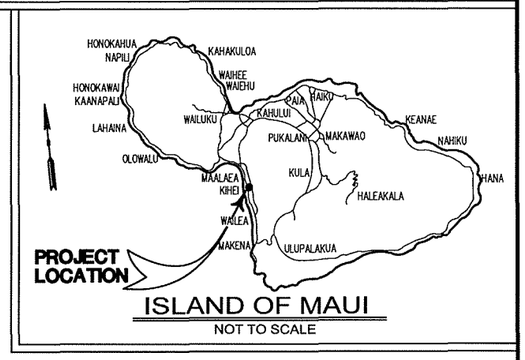
A. Project Location Map
B. General Plan
C. Conceptual Architectural Site Plan
D. Conceptual Site Plan
E. Conceptual Site Grading Plan
F. Conceptual Site Utility Plan
G. Conceptual Plan and Profile, Pi'ikea Avenue Reconstruction (1 of 2; and, 2 of 2)
H. Soils Classification Map
I. Flood Insurance Rate Maps (1 of 3 thru 3 of 3)
J. 1998 Downtown Kihei Planning Workshop Base Map
K. Memorandum of Understanding for Construction of Offsite Roadway Improvements in the Vicinity of South Maui Community Park [TMK (2) 02-02-002:042] Between Department of Public Works and Department of Parks and Recreation (dated October 13, 2008)
L. Topographic Survey Map of Existing Grades





LOCATION MAP

NOT TO SCALE



ISLAND OF MAUI

NOT TO SCALE

EXHIBIT "A" - PROJECT LOCATION MAP

0 200 400 600 800

SCALE: 1 IN. = 200 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

May 17, 2012

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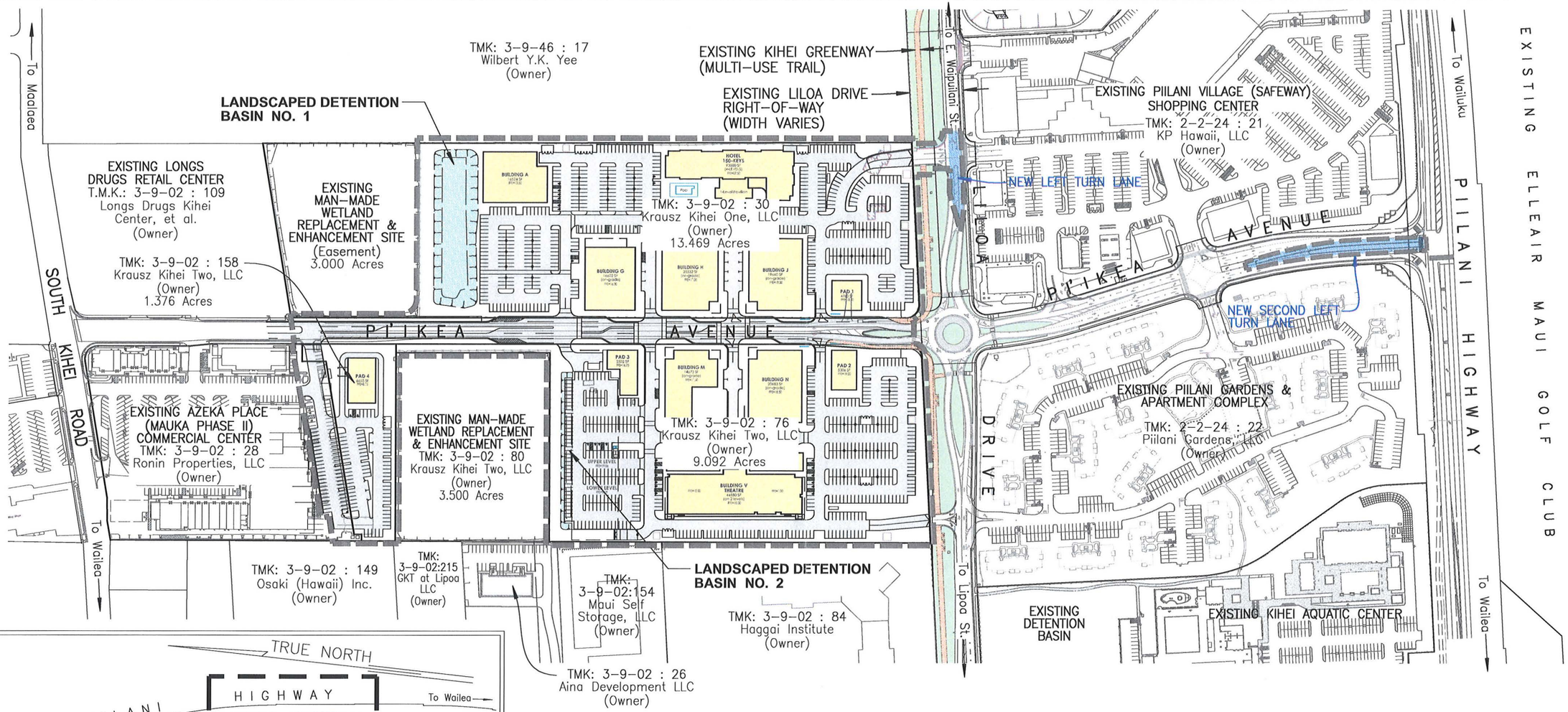

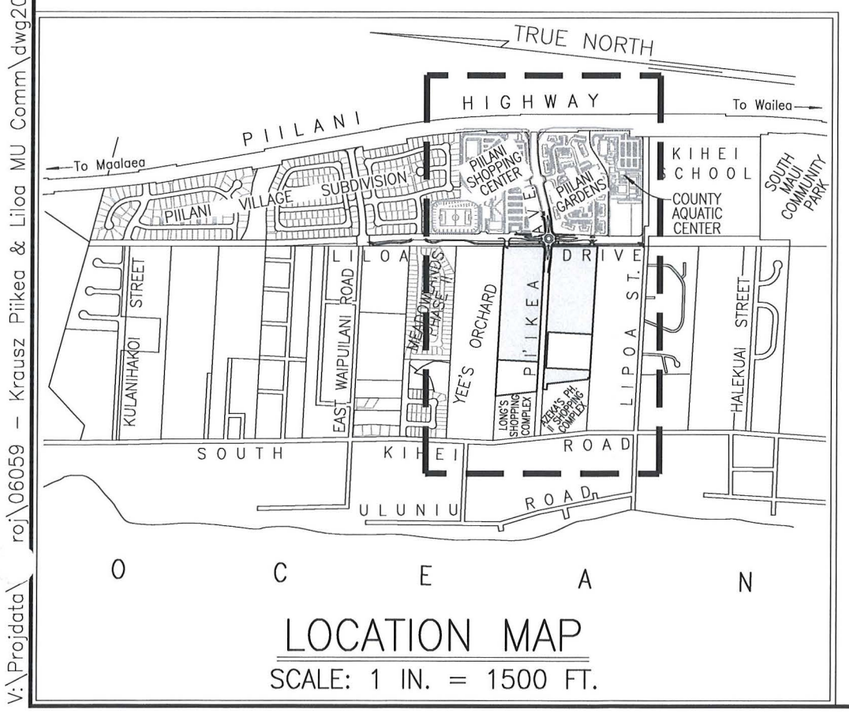

LOCATION MAP

SCALE: 1 IN. = 1500 FT.

LEGEND:

- NEW PAVEMENT AREA
- PROPOSED BUILDINGS
- PROPOSED OFFSITE ROADWAY IMPROVEMENTS
- EXT'G ROUNDABOUT AND KIHEI BIKEWAY
- APPROXIMATE LIMITS OF PROJECT

EXHIBIT "B" - GENERAL PLAN

0 250 500 750 1000

SCALE: 1 IN. = 250 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

July 20, 2012

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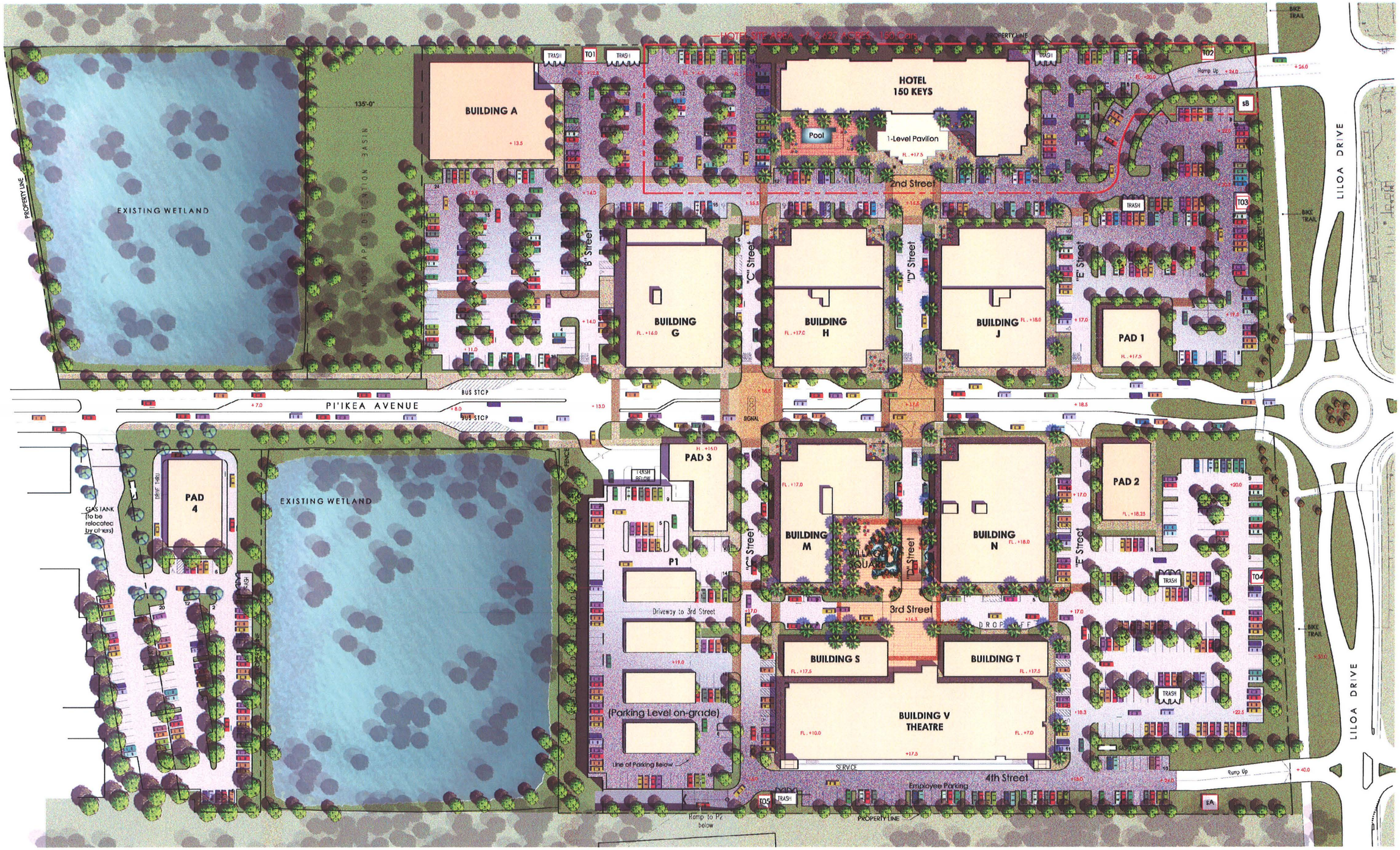


EXHIBIT "C" - CONCEPTUAL ARCHITECTURAL SITE PLAN

Site Development Plan

August 30, 2012

NORTH

0' 50' 100' 150' 200' 250' 300'

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.

44 Montgomery St. Ste 3300 San Francisco Ca 94104 Tel 14157325000

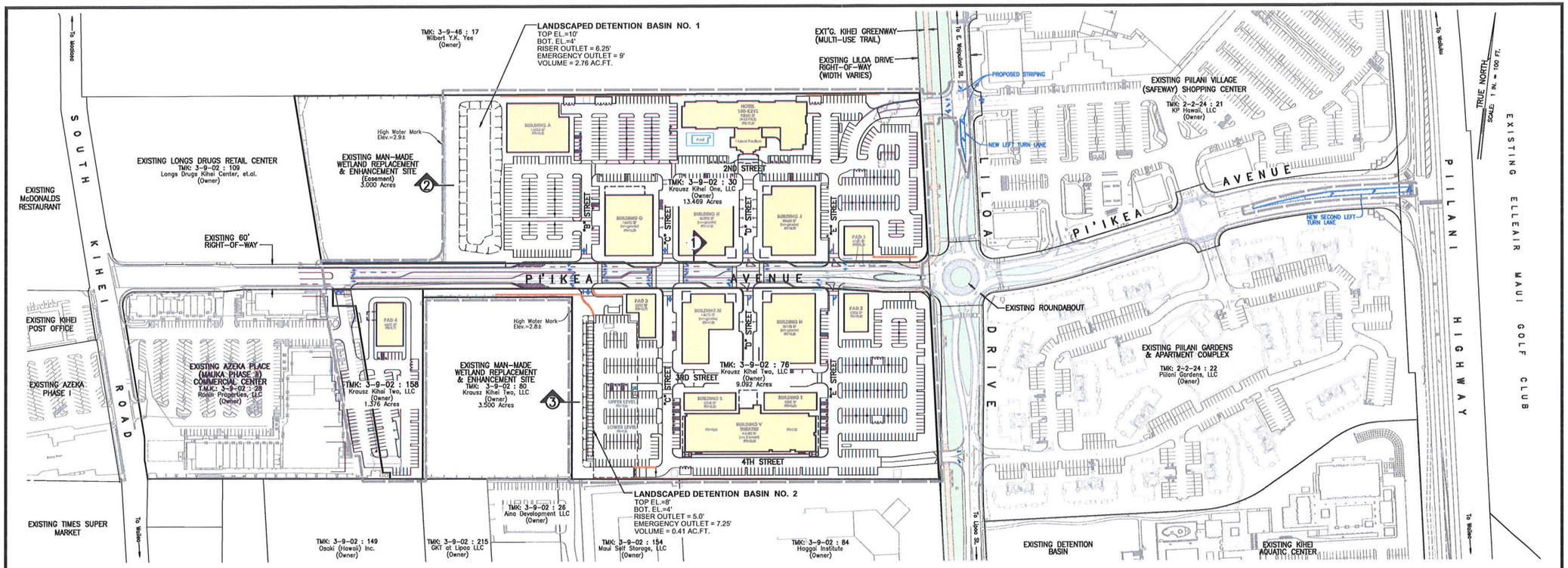
PI'IKEA AVENUE AT LILOA DRIVE KIHEI, HAWAII

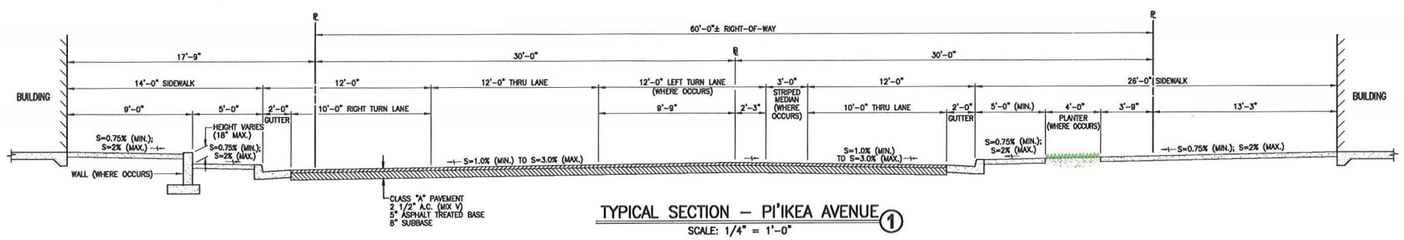
STOUTENBOROUGH INC

Architects and Planners

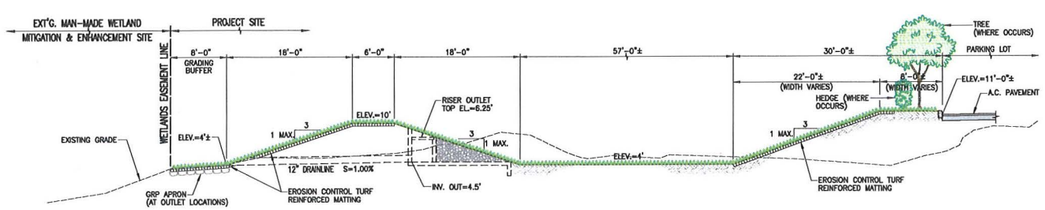
420 Alta Vista Way, Suite 100 Laguna Beach, Ca 92651

T 949 715 3757 | F 949 715 3756 | www.stoutenboroughinc.com

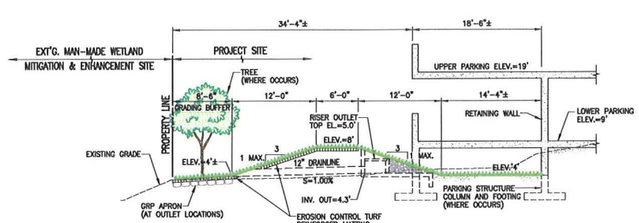




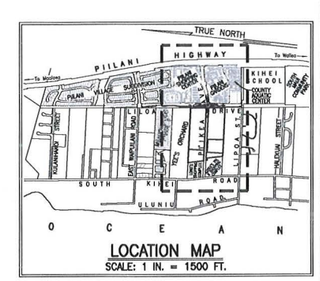
TYPICAL SECTION – PI'IKEA AVENUE (1)
SCALE: 1/4" = 1'-0"



TYPICAL SECTION – NORTH DETENTION BASIN (2)
SCALE: 1/8" = 1'-0"



TYPICAL SECTION – SOUTH DETENTION BASIN (3)
SCALE: 1/8" = 1'-0"



LOCATION MAP
SCALE: 1 IN. = 1500 FT.

LEGEND:

- NEW PAVEMENT AREA
- PROPOSED BUILDINGS WITH I.D. AND SIZE
- PROPOSED OFFSITE ROADWAY IMPROVEMENTS
- PROPOSED RETAINING WALLS
- LIMITS OF PROJECT
- PAVEMENT ARROWS

No.	Date	Revision

Consultant:

CLIFFORD N. MIKA
LICENSED PROFESSIONAL ENGINEER
NO. 6687-C
HAWAII, U.S.A.

SIGNATURE DATE License Expires: April 30, 2014

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION "AS DEFINED IN SECTION 16-115-2 OF THE HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, LAND SURVEYORS AND LANDSCAPE ARCHITECTS"

Project:

DOWNTOWN KIHEI
The KRAUSZ COMPANIES, Inc.
(PLAN DATED APRIL 23, 2012
BASED ON STOUTENBOROUGH SITE)
T.M.K.: (2) 3-9-002 : 30, 76 & 80
PI'IKEA AVENUE / LILOA DRIVE
KIHEI, MAUI, HAWAII

EXHIBIT "D" - CONCEPTUAL SITE PLAN

WARREN S. UNEMORI, ENGR'G., INC.

WARREN S. UNEMORI, ENGINEERING, INC.
Civil & Structural Engineers
Land Surveyors
2145 Wells Street
Suite 403
Wailuku, HI 96793

Job: 06059.00
Issue Date: 4/27/2012
Proj. Engr: C.N.M.
Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:
CONCEPTUAL GENERAL SITE PLAN

Sheet:
C-1

Of:

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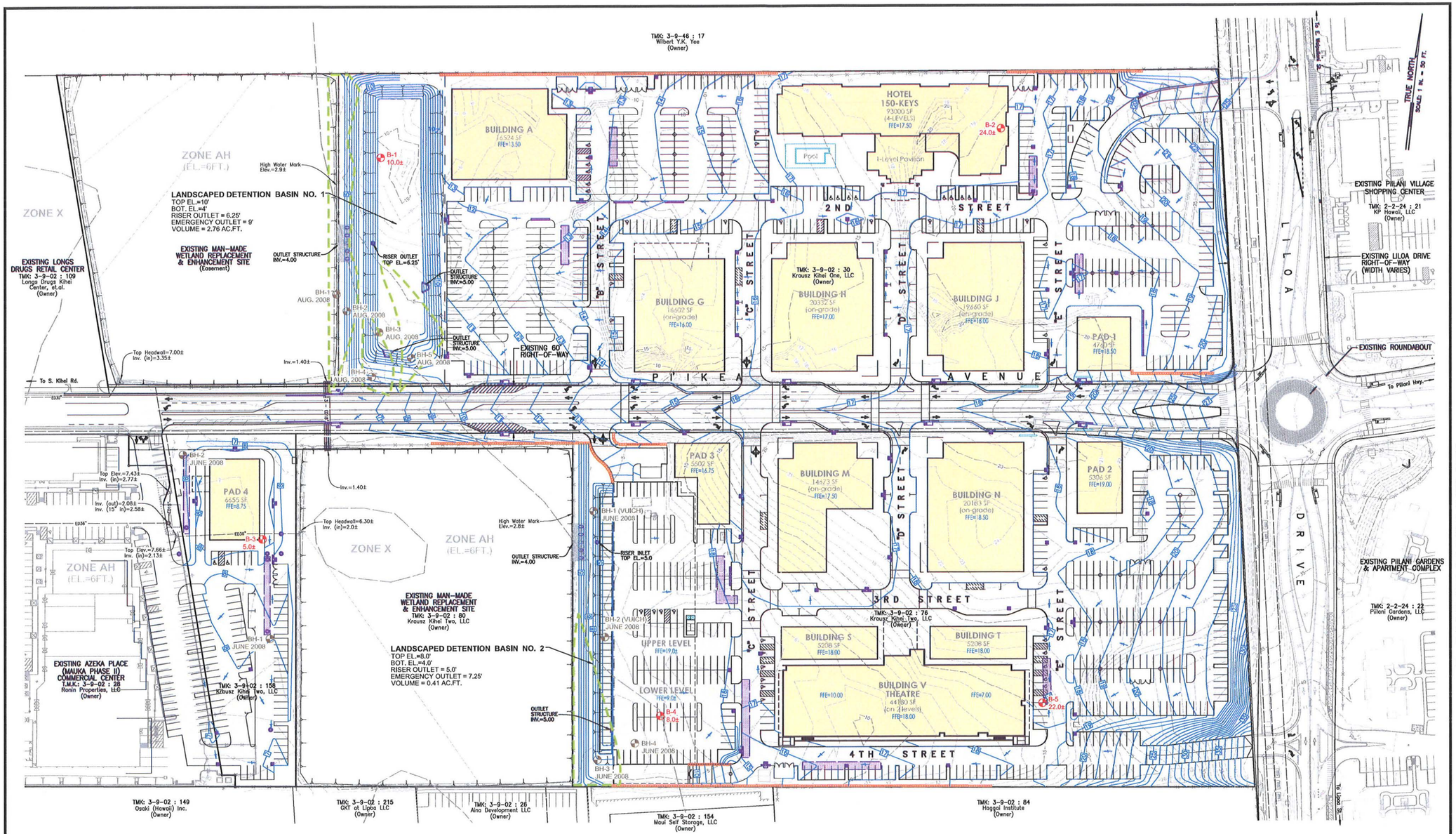


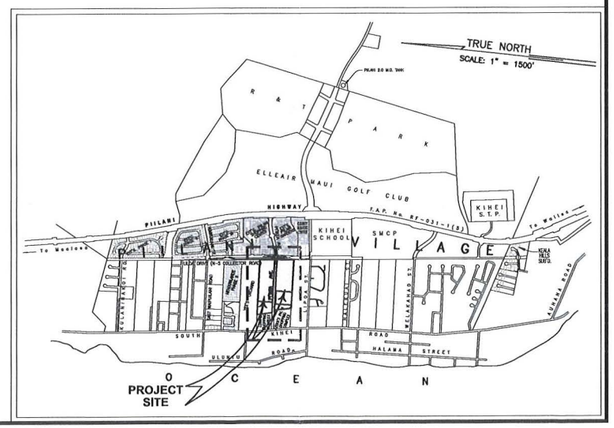
LEGEND:

- GRATED INLET CATCH BASIN
- CURB INLET CATCH BASIN
- DRAIN MANHOLE
- ROOF DOWNSPOUT (CONFIRM LOCATION AND SIZE WITH ARCHITECT PLANS)
- SLOTTED DRAIN PIPE
- DRAIN CLEANOUT TO GRADE
- SUBSURFACE DETENTION SYSTEM
- 26.5 EXISTING SPOT ELEVATION
- EXISTING POWER POLE
- EXISTING POWER POLE W/ GUY WIRE
- EXISTING LIGHT POLE
- EXISTING TRANSFORMER
- EXISTING HANDHOLE OR HANDHOLE GROUP
- EXISTING SEWER MANHOLE
- EXISTING DRAIN MANHOLE
- EXISTING WATER METER W/ BACKFLOW PREVENTER
- EXISITNG WATER VALVE
- EXISTING FIRE HYDRANT
- 10 EXT'G. GRADES WITH ELEVATION
- 10 CONCEPTUAL FINISH GRADE CONTOURS & BUILDING ELEVATIONS
- FEMA FLOOD INSURANCE RATE MAP ZONE
- TOP OF BANK
- BOTTOM OF BANK
- PROPOSED BUILDINGS WITH I.D. & SIZE
- NEW PAVEMENT AREA
- PROPOSED RETAINING WALLS
- FLOW DIRECTION
- F.F.E. FINISH FLOOR ELEVATION
- EXISTING TREES
- B-4 8.0± BORING OR TEST PITS WITH NUMBER AND APPROX.. ELEVATION (FROM THE "PRELIMINARY SUBSURFACE INVESTIGATION REPORT, PI'IKEA-LILOA COMMERCIAL MIXED-USE PROJECT"; BY FEWELL GEOTECHNICAL ENGINEERING LTD.; DATED SEPTEMBER 30, 2008).
- BH-4 JUNE 2008 BOREHOLE LOCATIONS (FROM THE "WETLANDS SURVEY-PIIKEA PROPERTY" CONDUCTED BY MALAMA ENVIRONMENTAL (MEV, LLC), DATED JUNE 13, 2008 AND AUGUST 27, 2008).
- APPROXIMATE LOCATION OF MARGINAL WETLAND CONDITIONS (FROM THE "WETLANDS SURVEY-PIIKEA PROPERTY" CONDUCTED BY MALAMA ENVIRONMENTAL (MEV, LLC), DATED JUNE 13, 2008 AND AUGUST 27, 2008).

EARTHWORK ANALYSIS

SITE	APPROXIMATE EARTHWORK QUANTITIES			GRADING AREA
	EXCAVATION	EMBANKMENT	NET	
NORTH PARCEL TMK: 3-9-02 : 30	23,000	34,000	11,000 (FILL)	*10.47 ACS.
SOUTH PARCEL TMK: 3-9-02 : 76	28,000	35,000	7,000 (FILL)	9.09 ACS.
WEST PARCEL TMK: 3-9-02 : 158	50	1,800	1,750 (FILL)	1.37 ACS.
PI'IKEA AVENUE	1,600	5,000	2,400 (FILL)	1.50 ACS.

*(EXCLUDES WETLAND AREA)



No.	Date	Revision

Consultant:

OXFORD N. MAKI
LICENSED PROFESSIONAL ENGINEER
NO. 6667-C
HAWAII, U.S.A.

License Expires: April 30, 2014

SIGNATURE DATE

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OVERSIGHT AS DEFINED IN SECTION 16-115-2 OF THE HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, LAND SURVEYORS AND LANDSCAPE ARCHITECTS"

Project:

DOWNTOWN KIHEI
The KRAUSZ COMPANIES, Inc.
(PLAN DATED APRIL 23, 2012
BASED ON STOUTENBOROUGH SITE)
T.M.K.: (2) 3-9-002 : 30, 76 & 80
PI'IKEA AVENUE / LILOA DRIVE
KIHEI, MAUI, HAWAII

EXHIBIT "E" - CONCEPTUAL SITE GRADING PLAN

WARREN S. UNEMORI ENGR'G., INC.

WARREN S. UNEMORI, ENGINEERING, INC.
Civil & Structural Engineers
Land Surveyors
2145 Wells Street
Suite 403
Wailuku, HI 96793

Job: 06059.00
Issue Date: 4/27/2012
Proj. Engr: C.N.M.
Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:
CONCEPTUAL SITE AND GRADING PLAN

Sheet:
C-2

Of:

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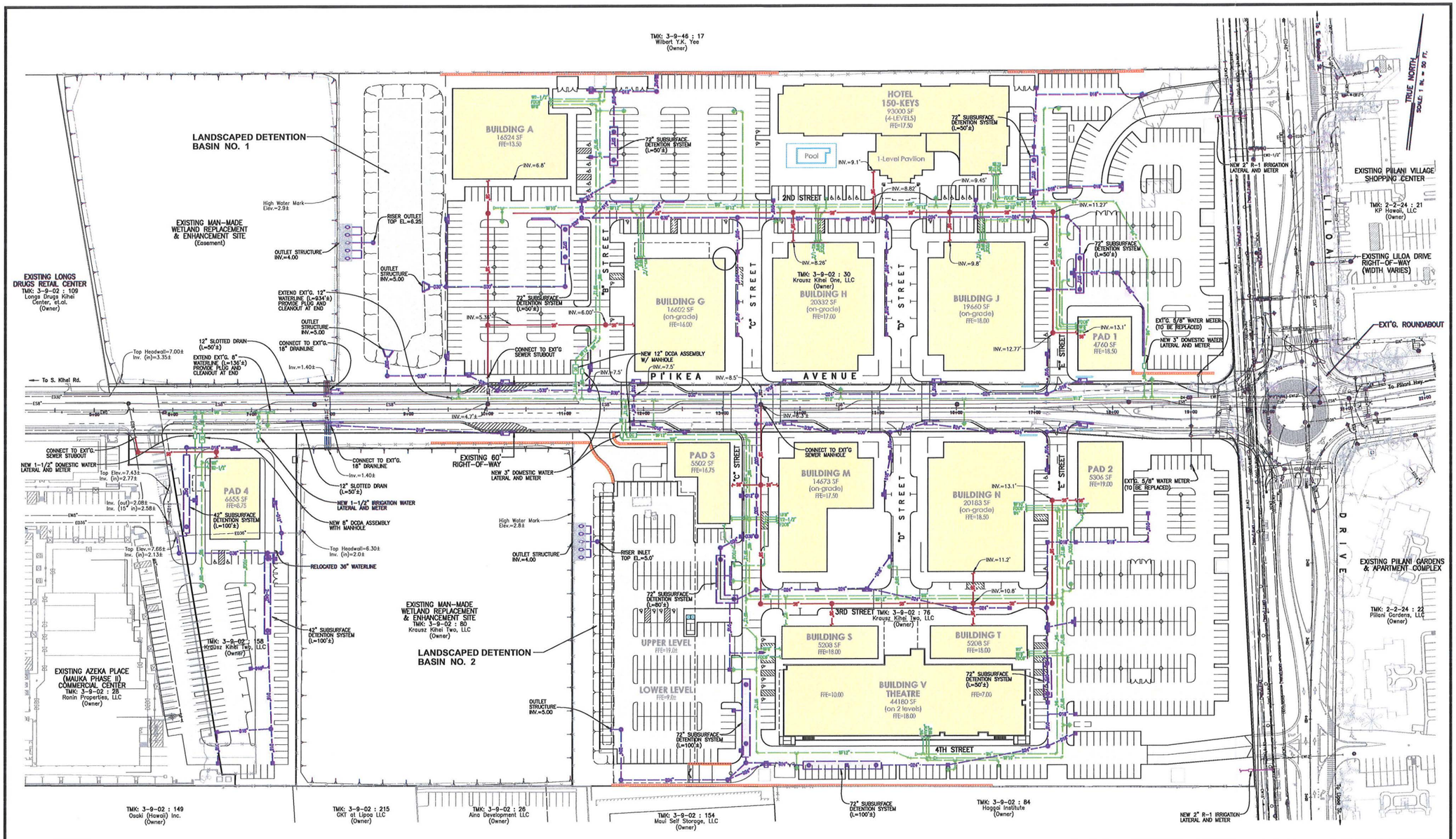
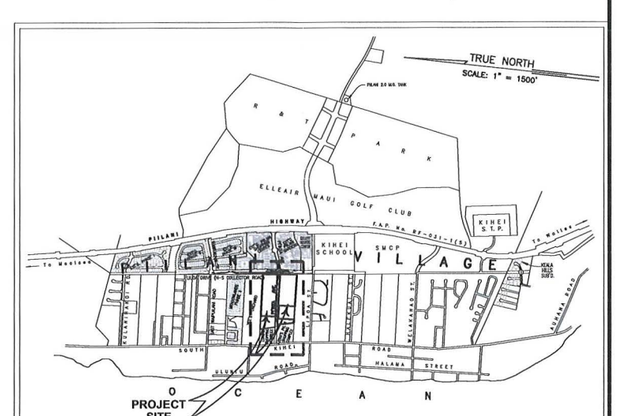


LEGEND:

- GRATED INLET CATCH BASIN
- CURB INLET CATCH BASIN
- DRAIN MANHOLE
- ROOF DOWNSPOUT (CONFIRM LOCATION AND SIZE WITH ARCHITECT PLANS)
- SLOTTED DRAIN PIPE
- DRAIN CLEANOUT TO GRADE
- SUBSURFACE DETENTION SYSTEM
- D24" DRAINLINE W/ SIZE
- GREASE TRAP
- SEWER MANHOLE
- SEWER CLEANOUT TO GRADE
- S8" SEWERLINE W/ SIZE
- WATER METER
- DC DETECTOR CHECK ASSEMBLY
- WATER ARV MANHOLE
- WATER VALVE
- FIRE HYDRANT
- FIRE DEPT. CONNECTION
- W12" WATERLINE FOR FIRE SERVICE W/ SIZE
- W4" WATERLINE FOR DOMESTIC SERVICE W/ SIZE
- RW12" RECLAIMED WATERLINE W/ SIZE
- TRASH ENCLOSURE
- NEW PAVEMENT AREA
- PROPOSED BUILDINGS WITH I.D. AND SIZE
- PROPOSED RETAINING WALLS
- ESFM2" EXISTING SEWER FORCE MAIN W/ SIZE
- EIR8" EXISTING IRRIGATION WATERLINE W/ SIZE
- ED24" EXISTING DRAINLINE W/ SIZE
- ES8" EXISTING SEWERLINE W/ SIZE
- EW8" EXISTING WATERLINE W/ SIZE
- ERW12" EXISTING RECLAIMED WATERLINE W/ SIZE
- EXISTING POWER POLE W/ GUY WIRE
- EXISTING HANDHOLE OR HANDHOLE GROUP
- EXISTING SEWER MANHOLE
- EXISTING DRAIN MANHOLE
- EXISTING WATER METER W/ BACKFLOW PREVENTER
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT



No.	Date	Revision

Consultant:

CLIFFORD H. NAKAZAWA
LICENSED PROFESSIONAL ENGINEER
NO. 6687-C
HAWAII, U.S.A.

SIGNATURE License Expires: April 30, 2014
DATE

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OPERATION "AS DEFINED IN SECTION 16-115-2 OF THE HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, LAND SURVEYORS AND LANDSCAPE ARCHITECTS"

Project:

DOWNTOWN KIHEI
The KRAUSZ COMPANIES, Inc.
(PLAN DATED APRIL 23, 2012
BASED ON STOUTENBOROUGH SITE)
T.M.K.: (2) 3-9-002 : 30, 76 & 80
PI'IKEA AVENUE / LILOA DRIVE
KIHEI, MAUI, HAWAII

EXHIBIT "F" - CONCEPTUAL SITE UTILITY PLAN

WARREN S. UNEMORI, ENGR'G., INC.

WARREN S. UNEMORI, ENGINEERING, INC.
Civil & Structural Engineers
Land Surveyors
2145 Wells Street
Suite 403
Wailuku, HI 96793

Job: 06059.00
Issue Date: 4/27/2012
Proj. Engr: C.N.M.
Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:
CONCEPTUAL UTILITY PLAN

Sheet:
C-3

Of:

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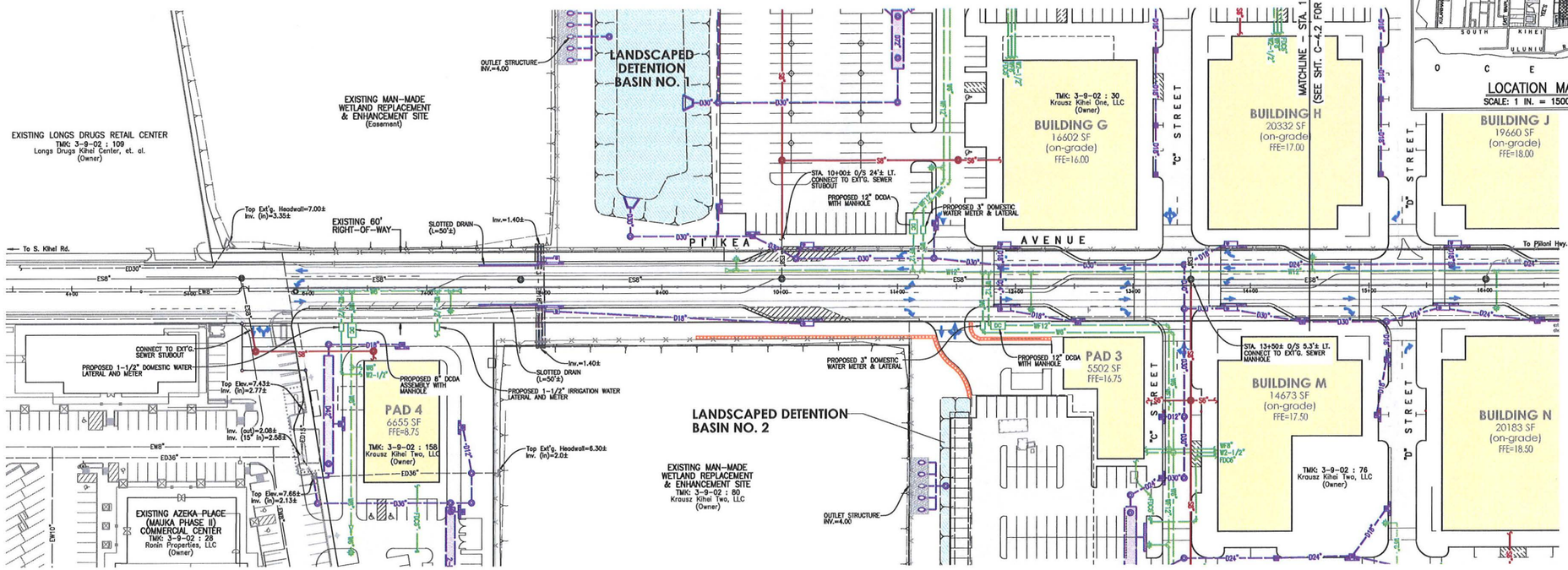
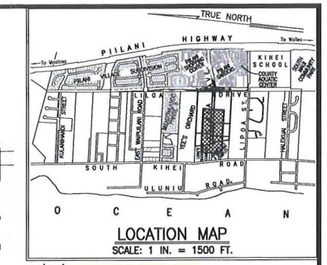
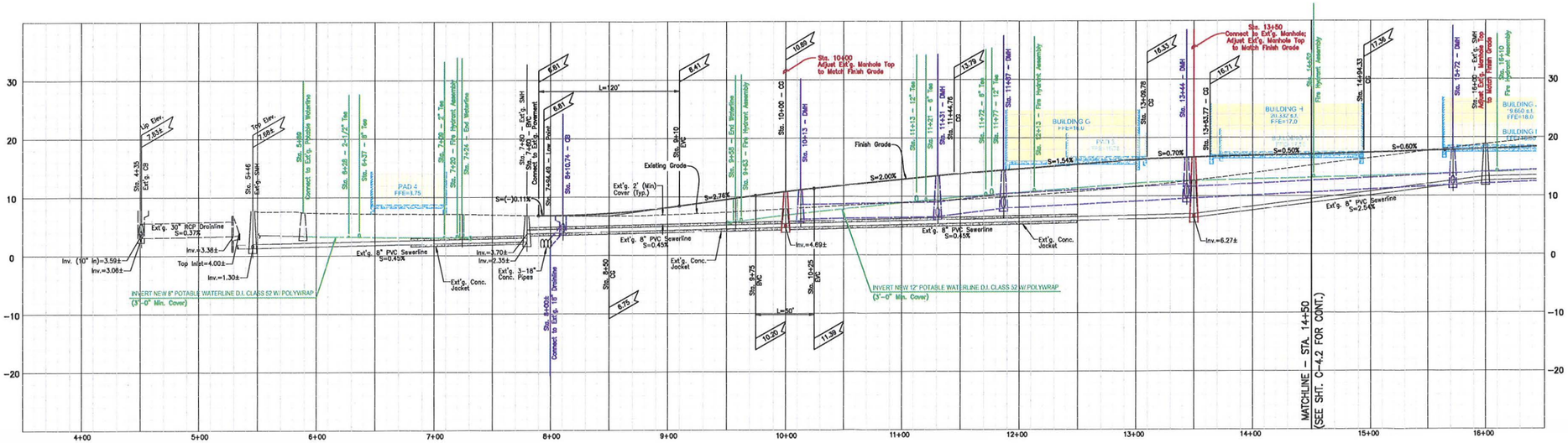


PLAN
Scale: 1 in. = 40 ft.





PROFILE – PI'IKEA AVENUE RECONSTRUCTION
Scale: Horiz. 1" = 40'
Vert. 1" = 8'

LEGEND:

- GRATED INLET CATCH BASIN
- CURB INLET CATCH BASIN
- DRAIN MANHOLE
- ROOF DOWNSPOUT (CONFIRM LOCATION AND SIZE WITH ARCHITECT PLANS)
- SLOTTED DRAIN PIPE
- DRAIN CLEANOUT TO GRADE
- SUBSURFACE DETENTION SYSTEM
- D24" — DRAINLINE W/ SIZE
- GREASE TRAP
- SEWER MANHOLE
- SEWER CLEANOUT TO GRADE
- S8" — SEWERLINE W/ SIZE
- WATER METER
- DCDA — DETECTOR CHECK ASSEMBLY
- WATER ARV MANHOLE
- WATER VALVE
- FIRE HYDRANT
- FIRE DEPT. CONNECTION
- WF12" — WATERLINE FOR FIRE SERVICE W/ SIZE
- W4" — WATERLINE FOR DOMESTIC SERVICE W/ SIZE
- RW12" — RECLAIMED WATERLINE W/ SIZE
- NEW PAVEMENT AREA
- PROPOSED BUILDINGS W/ NUMBER AND SIZE
- PROPOSED RETAINING WALLS
- PAVEMENT ARROWS
- ESF42" — EXISTING SEWER FORCE MAIN W/ SIZE
- ERR8" — EXISTING IRRIGATION WATERLINE W/ SIZE
- ED24" — EXISTING DRAINLINE W/ SIZE
- ES8" — EXISTING SEWERLINE W/ SIZE
- EW8" — EXISTING WATERLINE W/ SIZE
- ERW12" — EXISTING RECLAIMED WATERLINE W/ SIZE
- EXISTING POWER POLE W/ GUY WIRE
- EXISTING HANDHOLE OR HANDHOLE GROUP
- EXISTING SEWER MANHOLE
- EXISTING DRAIN MANHOLE
- EXISTING WATER METER W/ BACKFLOW PREVENTER
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT

NOTE:

1. CONTRACTOR SHALL ADJUST ELEVATIONS OF ALL EXISTING WATER, SEWER, DRAIN, ELECTRICAL, LANDSCAPING AND CURBING TO MATCH REVISED ROADWAY PROFILE GRADES.
2. EXISTING INVERTS AS SHOWN ON THE PLANS ARE FROM AVAILABLE AS-BUILTS AND NEED TO BE VERIFIED IN THE FIELD.

No.	Date	Revision

Consultant:

CLIFFORD H. MIYAKE
LICENSED PROFESSIONAL ENGINEER
NO. 6687-C
HAWAII, U.S.A.

Licenses Expires: April 30, 2014
SIGNATURE DATE

THIS WORK WAS PREPARED BY ME, OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION "AS DEFINED IN SECTION 16-115-2 OF THE HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, LAND SURVEYORS AND LANDSCAPE ARCHITECTS"

Project:

DOWNTOWN KIHEI
The KRAUSZ COMPANIES, Inc.
(PLAN DATED APRIL 23, 2012
BASED ON STOUTENBOROUGH SITE)
T.M.K.: (2) 3-9-002 : 30, 76 & 80
PI'IKEA AVENUE / LILOA DRIVE
KIHEI, MAUI, HAWAII

EXHIBIT "G" - CONCEPTUAL PLAN AND PROFILE, PI'IKEA AVENUE RECONSTRUCTION (1 OF 2)

WARREN S. UNEMORI, ENGR'G., INC.

WARREN S. UNEMORI, ENGINEERING, INC.
Civil & Structural Engineers
Land Surveyors
2145 Wells Street
Suite 403
Wailuku, HI 96793

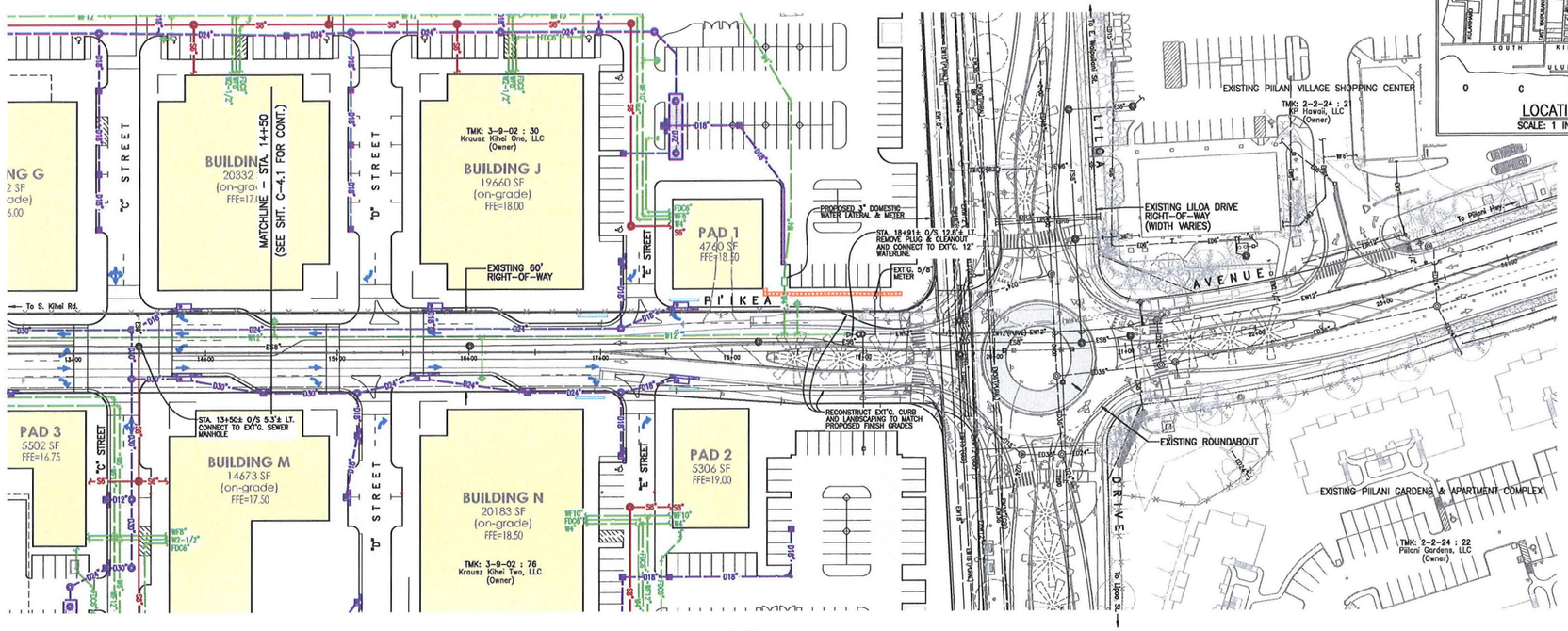
Job: 06059.00
Issue Date: 4/27/2012
Proj. Engr: C.N.M.
Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:
PLAN & PROFILE:
PI'IKEA AVE. RECONSTRUCTION

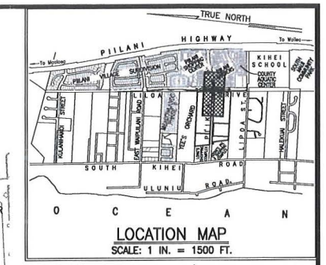
Sheet:
C-4.1

Of:

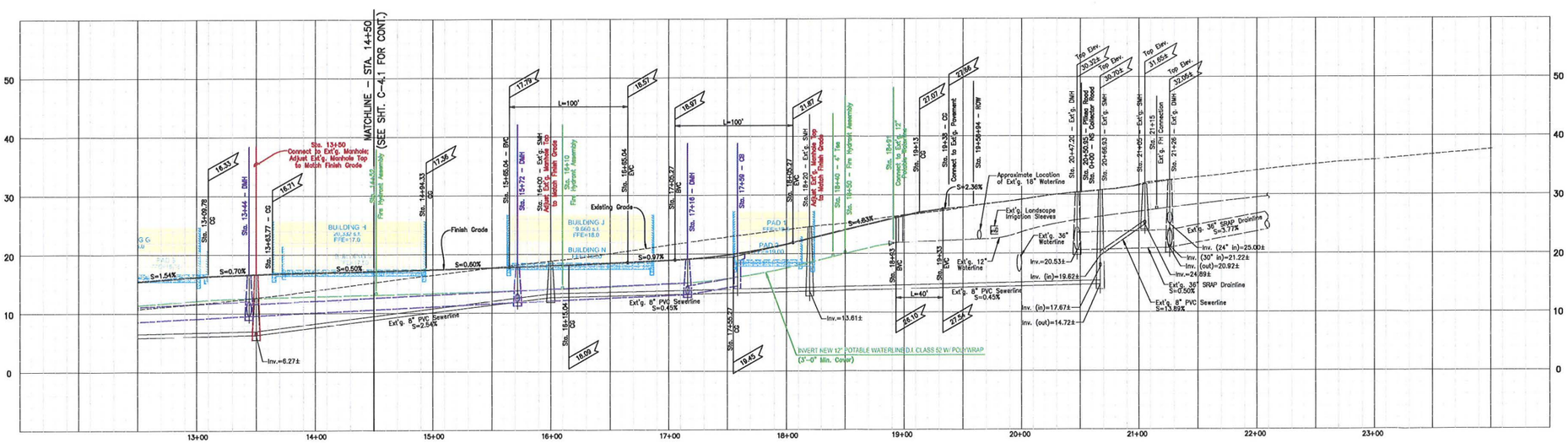
V:\Projects\Dfeng\06059 - Krausz Pikea & Uloa MU Comm\dwg2005\conplans\PRELIMINARY\PL-PIIKEA-02.dwg



PLAN
Scale: 1 in. = 40 ft.



LOCATION MAP
SCALE: 1 IN. = 1500 FT.



PROFILE – PI'IKEA AVENUE RECONSTRUCTION
Scale: Horiz. 1" = 40'
Vert. 1" = 8'

LEGEND:

- GRATED INLET CATCH BASIN
- CURB INLET CATCH BASIN
- DRAIN MANHOLE
- ROOF DOWNSPOUT (CONFIRM LOCATION AND SIZE WITH ARCHITECT PLANS)
- SLOTTED DRAIN PIPE
- DRAIN CLEANOUT TO GRADE
- SUBSURFACE DETENTION SYSTEM
- DRAINLINE W/ SIZE
- GREASE TRAP
- SEWER MANHOLE
- SEWER CLEANOUT TO GRADE
- SEWERLINE W/ SIZE
- WATER METER
- DETECTOR CHECK ASSEMBLY
- WATER ARV MANHOLE
- WATER VALVE
- FIRE HYDRANT
- FIRE DEPT. CONNECTION
- WATERLINE FOR FIRE SERVICE W/ SIZE
- WATERLINE FOR DOMESTIC SERVICE W/ SIZE
- RECLAIMED WATERLINE W/ SIZE
- NEW PAVEMENT AREA
- PROPOSED BUILDINGS W/ NUMBER AND SIZE
- PROPOSED RETAINING WALLS
- PAVEMENT ARROWS
- EXISTING SEWER FORCE MAIN W/ SIZE
- EXISTING IRRIGATION WATERLINE W/ SIZE
- EXISTING DRAINLINE W/ SIZE
- EXISTING SEWERLINE W/ SIZE
- EXISTING WATERLINE W/ SIZE
- EXISTING RECLAIMED WATERLINE W/ SIZE
- EXISTING POWER POLE W/ GUY WIRE
- EXISTING HANDHOLE OR HANDHOLE GROUP
- EXISTING SEWER MANHOLE
- EXISTING DRAIN MANHOLE
- EXISTING WATER METER W/ BACKFLOW PREVENTER
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT

NOTE:

1. CONTRACTOR SHALL ADJUST ELEVATIONS OF ALL EXISTING WATER, SEWER, DRAIN, ELECTRICAL, LANDSCAPING AND CURBING TO MATCH REVISED ROADWAY PROFILE GRADES.
2. EXISTING INVERTS AS SHOWN ON THE PLANS ARE FROM AVAILABLE AS-BUILTS AND NEED TO BE VERIFIED IN THE FIELD.

No.	Date	Revision

Consultant:

CLIFFORD N. MIZUO
LICENSED PROFESSIONAL ENGINEER
NO. 6687-C
HAWAII, U.S.A.

License Expires: April 30, 2014
SIGNATURE DATE

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Project:

DOWNTOWN KIHEI

The KRAUSZ COMPANIES, Inc.
(PLAN DATED APRIL 23, 2012
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T.M.K.: (2) 3-9-002 : 30, 76 & 80
PI'IKEA AVENUE / LILOA DRIVE
KIHEI, MAUI, HAWAII

EXHIBIT "G" - CONCEPTUAL PLAN AND PROFILE, PI'IKEA AVENUE RECONSTRUCTION (2 OF 2)

WARREN S. UNEMORI, ENGR'G., INC.

WARREN S. UNEMORI, ENGINEERING, INC.
Civil & Structural Engineers
Land Surveyors
2145 Wells Street
Suite 403
Wailuku, HI 96793

Job: 06059.00
Issue Date: 4/27/2012
Proj. Engr: C.N.M.
Drawn By: D.P.T.
Checked By: A.L.U.

Sheet Title:
PLAN & PROFILE:
PI'IKEA AVE. RECONSTRUCTION

Sheet:
C-4.2

Of:

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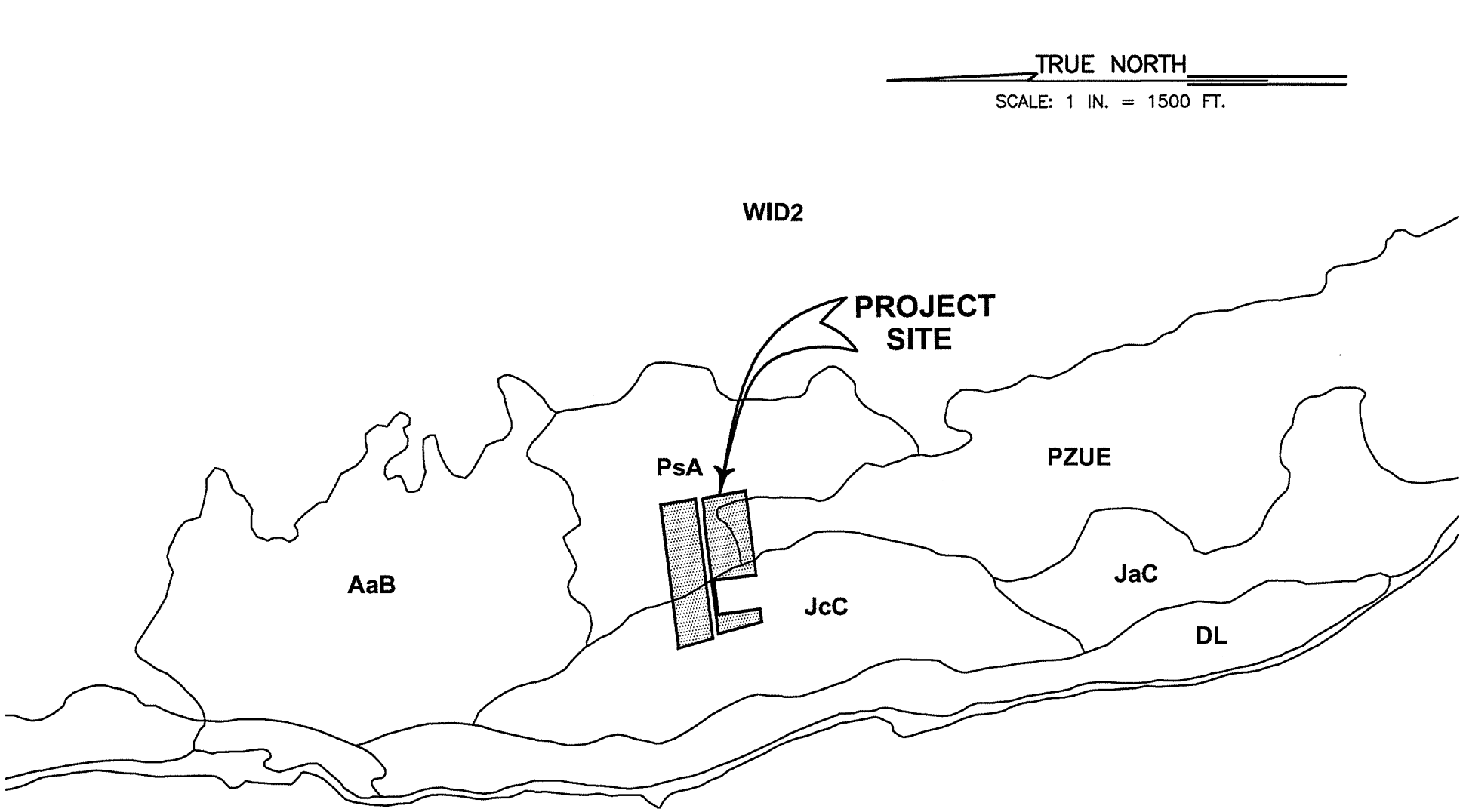


EXHIBIT "H" SOILS CLASSIFICATION MAP

0 1500 3000 4500 6000

SCALE: 1 IN. = 1500 FT.

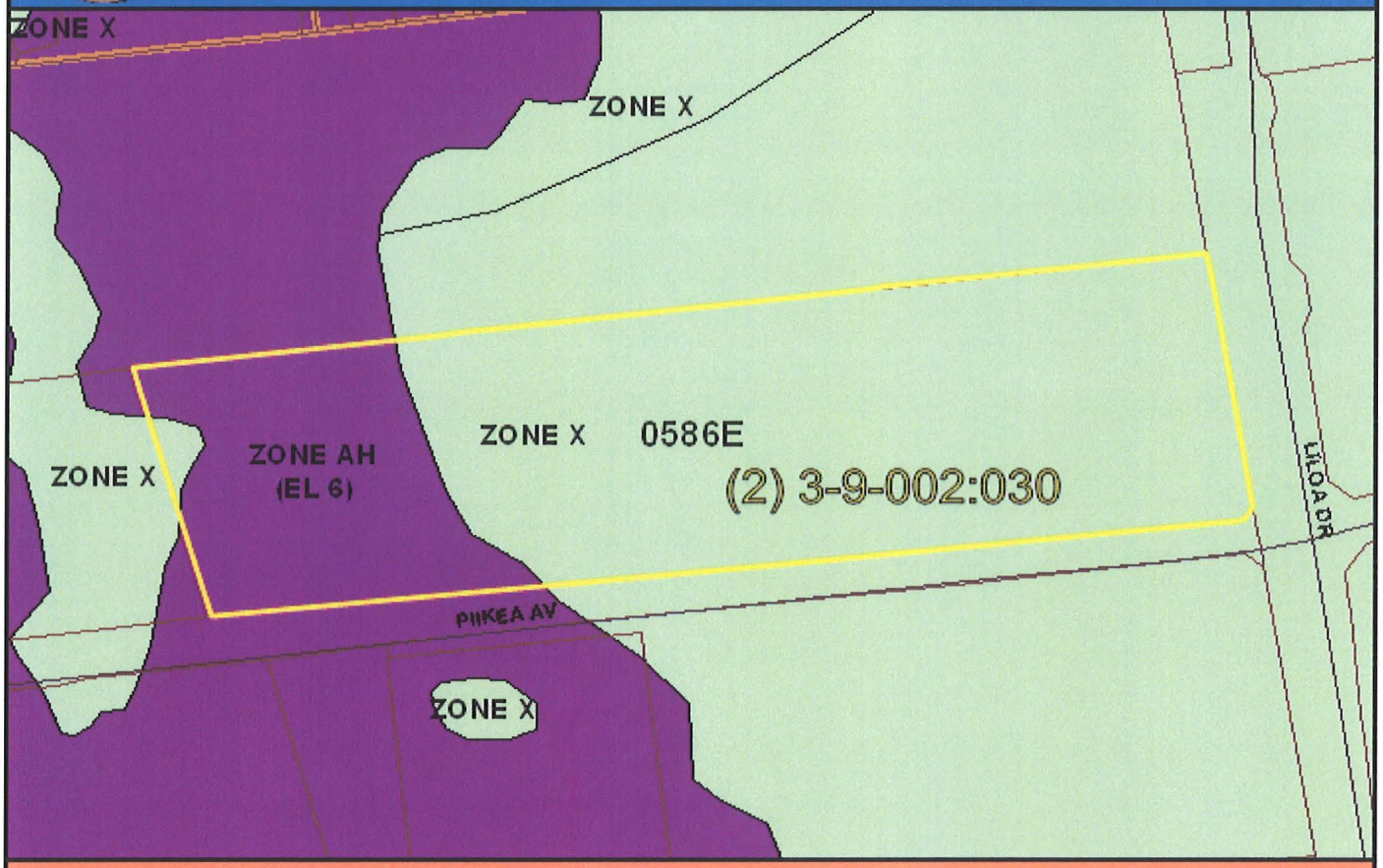
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

May 17, 2012

V:\Projdata\06proj\06059 - Krausz Piikea & Liloa MU Comm\dwg2006\exhibits\prelim-eng\exb-soil.dwg

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- **Zone A:** No BFE determined.
- **Zone AE:** BFE determined.
- **Zone AH:** Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- **Zone AO:** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- **Zone V:** Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE:** Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF:** Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded):** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X:** Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D:** Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-002-030
PARCEL ADDRESS:	1228 S KIHEI RD KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 25, 2009
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586E
PANEL EFFECTIVE DATE:	SEPTEMBER 25, 2009

PARCEL DATA FROM:	MAY 2012
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Maui	
Francis Cerizo, CFM	(808) 270-7771
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

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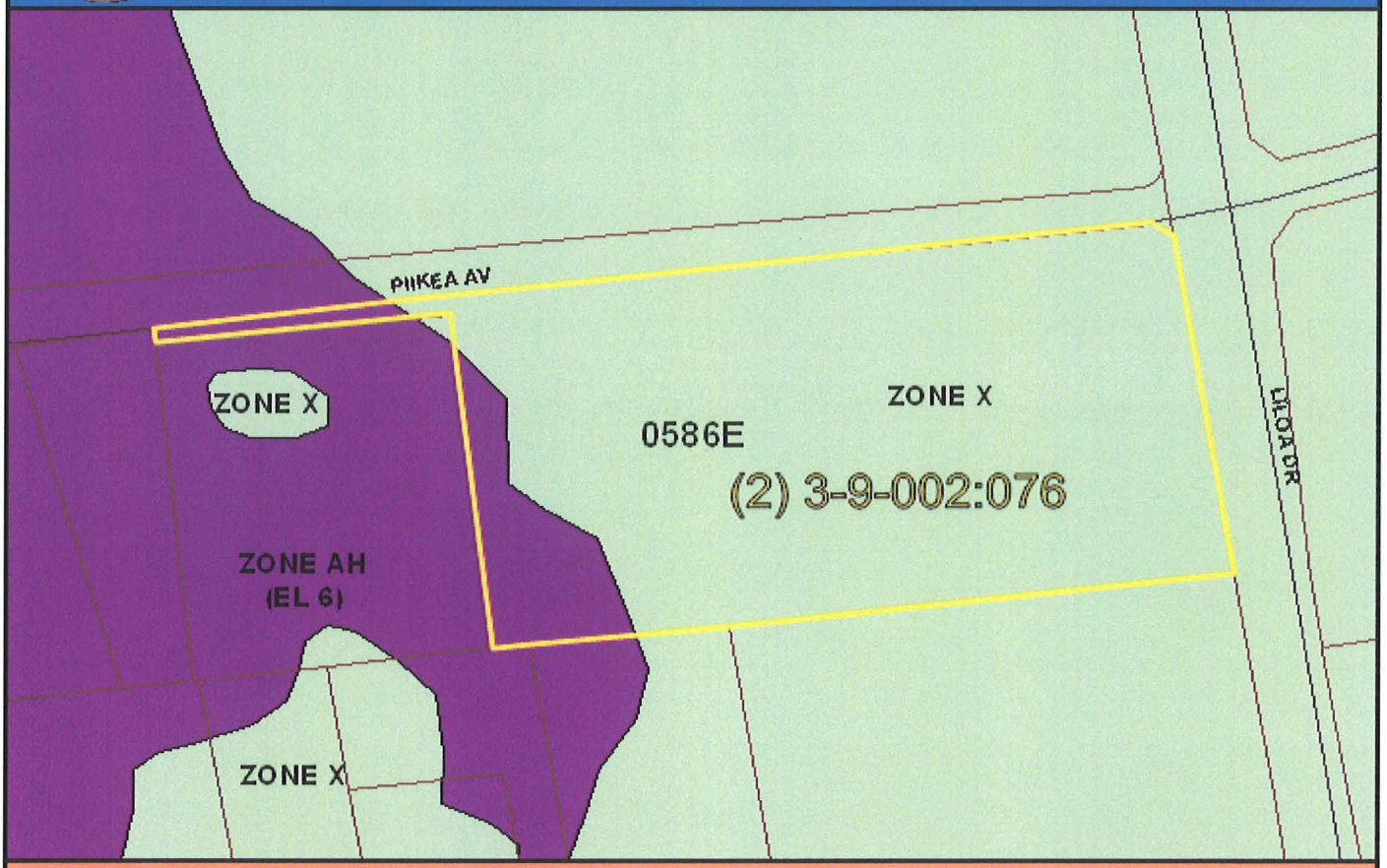
EXHIBIT "I" - FLOOD INSURANCE RATE MAPS (1 OF 3)

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

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- **Zone AE:** BFE determined.
- **Zone AH:** Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- **Zone AO:** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- **Zone V:** Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE:** Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF:** Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

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- **Zone XS (X shaded):** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X:** Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D:** Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-002-076
PARCEL ADDRESS:	PIIKEA AVE KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 25, 2009
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586E
PANEL EFFECTIVE DATE:	SEPTEMBER 25, 2009

PARCEL DATA FROM:	MAY 2012
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Maui	
Francis Cerizo, CFM	(808) 270-7771
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

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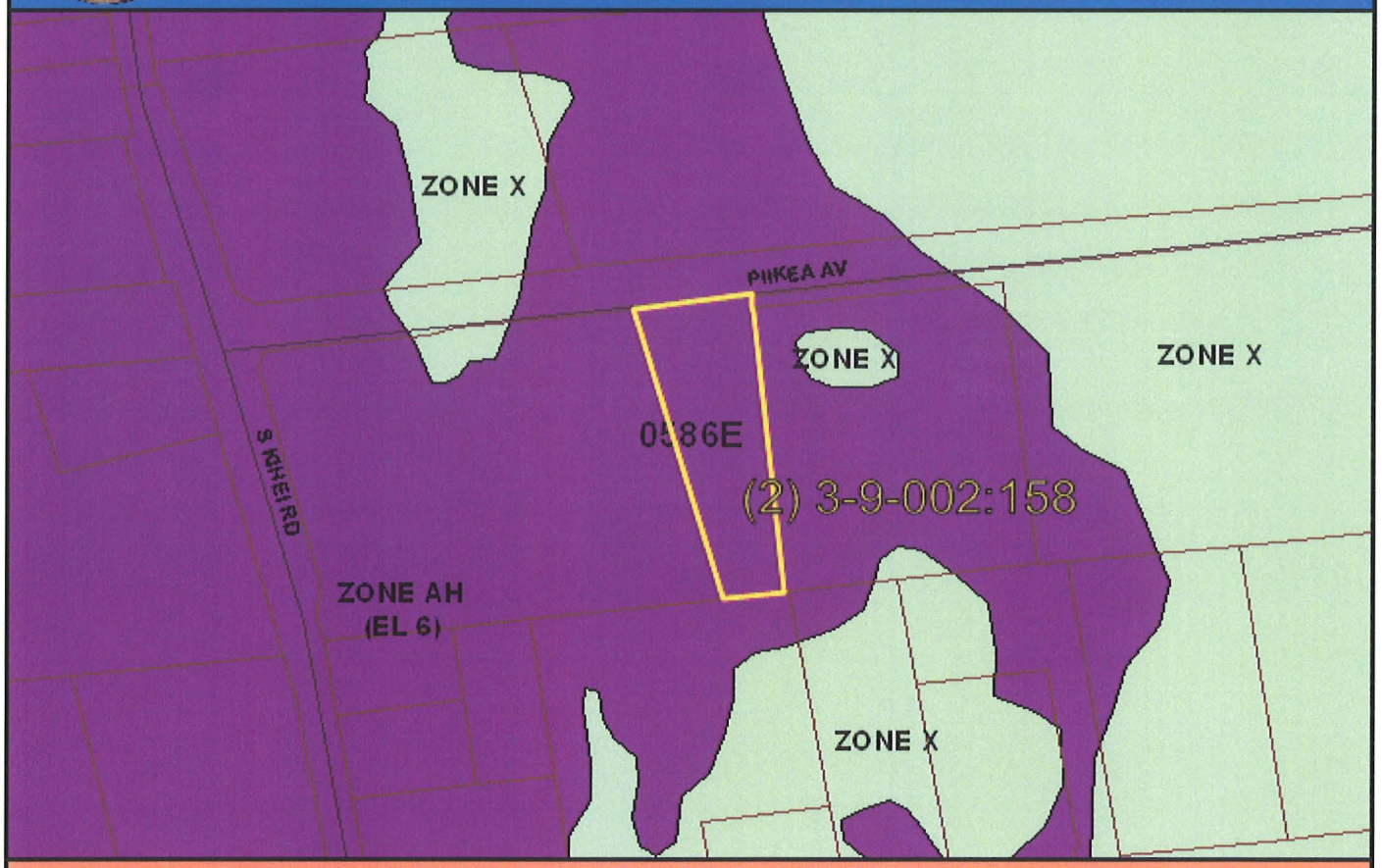
EXHIBIT "I" - FLOOD INSURANCE RATE MAPS (2 OF 3)

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

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- **Zone V:** Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE:** Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF:** Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded):** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X:** Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D:** Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-002-158
PARCEL ADDRESS:	PIIKEA AVE KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 25, 2009
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586E
PANEL EFFECTIVE DATE:	SEPTEMBER 25, 2009

PARCEL DATA FROM:	MAY 2012
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Maui	
Francis Cerizo, CFM	(808) 270-7771
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

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EXHIBIT "I" - FLOOD INSURANCE RATE MAPS (3 OF 3)

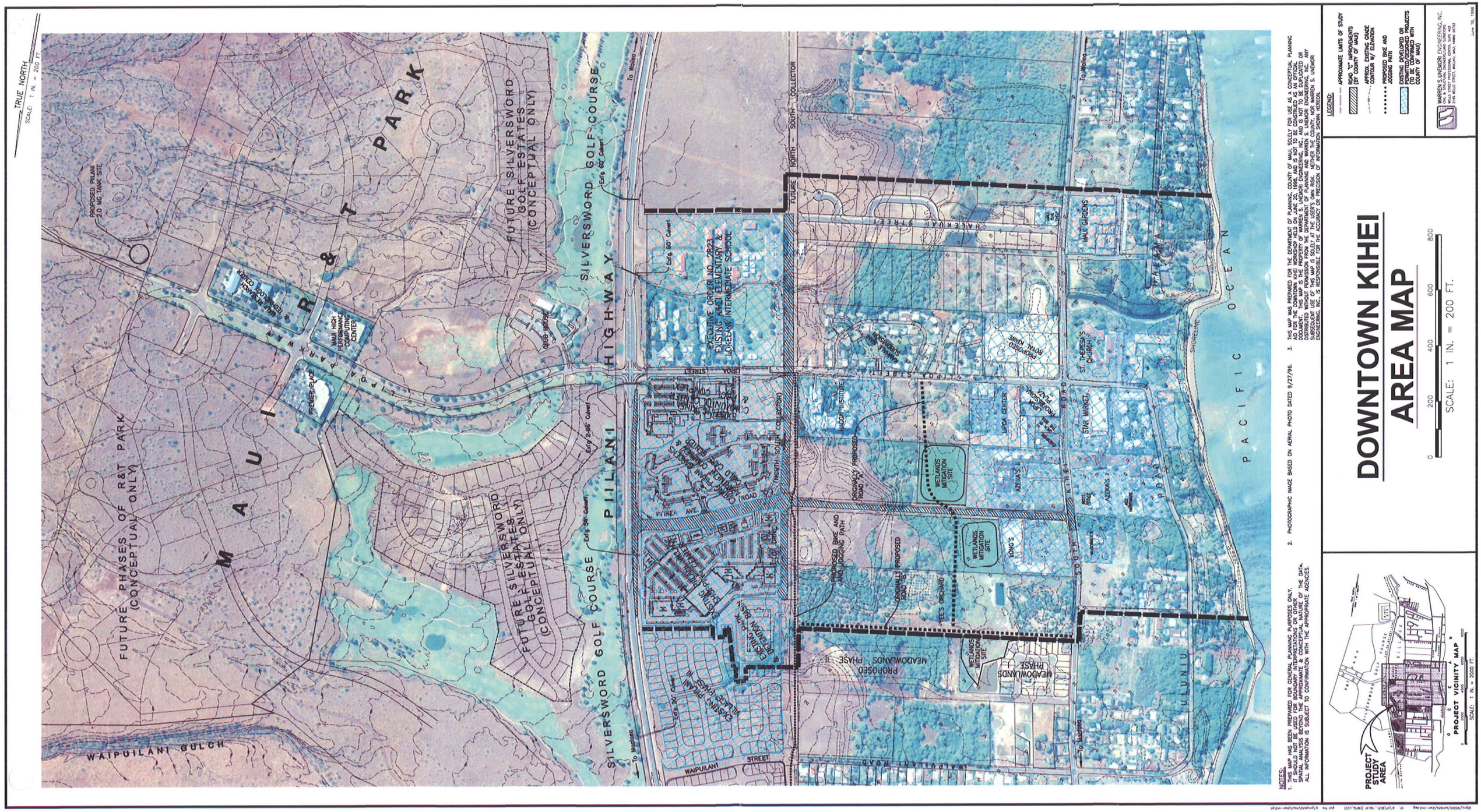


EXHIBIT "J" - 1998 DOWNTOWN KIHEI PLANNING WORKSHOP BASE MAP

CHARMAINE TAVARES
Mayor

MILTON M. ARAKAWA, A.I.C.P.
Director

MICHAEL M. MIYAMOTO
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

October 13, 2008

MEMO TO: Tamara Horcajo, Director
Department of Parks and Recreation

THROUGH: Cary Yamashita, Chief
Engineering Division

FROM: Milton Arakawa, Director
Department of Public Works

COPY TO: Pat Matsui
Planning and Development Division
Department of Parks and Recreation

SUBJECT: **MEMORANDUM OF UNDERSTANDING FOR CONSTRUCTION OF OFFSITE ROADWAY IMPROVEMENTS IN THE VICINITY OF SOUTH MAUI COMMUNITY PARK [TMK (2) 2-2-002:042]**

This confirms that the following roadway improvements, in the vicinity of the proposed South Maui Community Park, have been incorporated into the Engineering Division's Capital Improvements 6-Year Plan for projects programmed into the STIP for Federal Funding:

- Second left turn lane at intersection of Piilani Highway / Piikea Avenue (for east or mauka bound traffic on Piikea Avenue making left turns onto Piilani Highway, to head north on Piilani Highway); and,
- Traffic signals (when warranted) at the existing intersection of Piilani Highway / Welakahao Street.

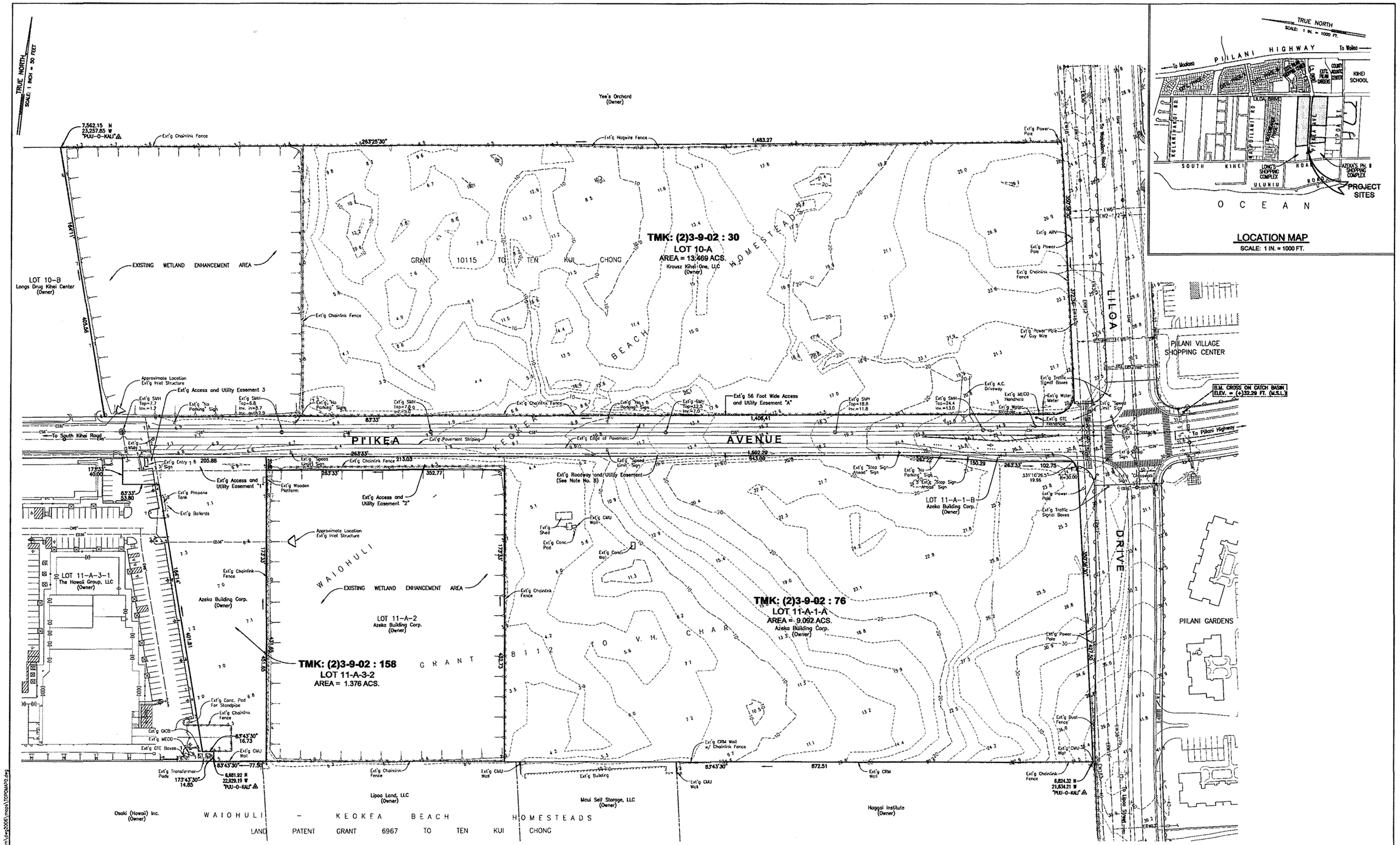
In addition, a 4-way stop is expected to be incorporated into the future intersection of Liloa Drive and Welakahao Street as part of the future North-South Collector Road Improvements project (currently under design by Engineering Division).

If you have any questions, please call Joe Krueger of Engineering Division at 270-7745.

CY/JK(ED08-681)
S:\ENG\ALL\Joe\Letters\194-Park.wpd

EXHIBIT "K" - MEMO OF UNDERSTANDING FOR CONSTRUCTION OF OFFSITE ROADWAY IMPROVEMENT IN THE VICINITY OF SOUTH MAUI COMMUNITY PARK [TMK (2) 2-2-002:042] BETWEEN DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PARKS AND RECREATION (DATED OCTOBER 13, 2008)

EXHIBIT "L" - TOPOGRAPHIC SURVEY MAP OF EXISTING GRADES



LOCATION MAP
SCALE: 1 IN. = 1000 FT.

TOPOGRAPHIC SURVEY MAP OF T.M.K.: (2)3-9-02 : 30, 76 AND 158

(LOTS 10-A, 11-A-1-A AND 11-A-3-2 OF WAIOHULI - KEOKEA BEACH HOMESTEADS)

BEING PORTIONS OF GRANT 10115 TO TEN KUI CHONG AND GRANT 8112 TO V.H. CHAR

WAILUKU, MAUI, HAWAII

0 50 100 150 200

SCALE: 1 IN. = 50 FT.

T.M.K.: (2)3-9-02 : 30
OWNER: KRAUSZ COMPANIES INC.
ADDRESS: SAN FRANCISCO, CALIFORNIA

T.M.K.: (2)3-9-02 : 76 AND 158
OWNER: AZEKA BUILDING CORP.
ADDRESS: KIHEI, HAWAII

NOTES:

1. ALL AZIMUTHS AND RECORD COORDINATES, REFERRED TO GOVERNMENT SURVEY TRIANGULATION STATION "PUU-O-KALI".
2. OWNERS OF ADJOINING LANDS, AS SHOWN ON PLAN, ARE FROM RECORDS IN THE REAL PROPERTY MAPPING BRANCH.
3. LOCATION & EXTENT OF EXISTING UNDERGROUND UTILITIES, SHOWN ON PLAN, ARE APPROXIMATE ONLY, AND ARE BASED ON AVAILABLE CONSTRUCTION PLANS AND / OR VISIBLE FIELD FEATURES LOCATED DURING THE FIELD SURVEY. THE EXACT LOCATION AND EXTENT OF EXISTING UNDERGROUND UTILITIES ARE SUBJECT TO FIELD VERIFICATION.
4. — — — — DENOTES NO VEHICLE ACCESS PERMITTED.

LEGEND:

- Existing Sewer Manhole
- Existing Drain Manhole
- Existing Water Manhole
- Existing Catch Basin
- Existing Fire Hydrant
- Existing Water Valve
- Existing Clean-Out-To-Grade
- Existing Power Pole w/Guy Wire
- Existing Sign
- Existing Street Light
- Existing Waterline w/Size
- Existing Sewerline w/Size
- Existing Drainline w/Size
- Existing Grade
- Existing Spot Elevation

REED M. ARITOMI
LICENSED PROFESSIONAL LAND SURVEYOR
NO. 6597
HONOLULU, U.S.A.

This map was prepared by me or under my supervision. 4/30/08 Expiration Date of License 9/3/07 Date

WARREN S. UNEMORI - ENGINEERING, INC.
Wells Street Professional Center - Suite 403
2145 Wells Street - Wailuku, Maui, Hawaii 96793
(808)242-4403 FAX: (808)244-4656

August 24, 2007

T.M.K.: (2)3-9-02 : 30, 76 AND 158

\\Projects\Kihei\0809 - Krausz Phase 2 Lipoa MU Comm\dwg2005\maps\TOPOMAP0.dwg

APPENDIX A

HYDROLOGIC CALCULATIONS

APPENDIX A-1

Pre-Development Runoff Calculations (By Parcels)
(North Parcel 30, South Parcel 76, West Parcel 158 and Portion of Pi'ikea Avenue)

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: PRE-DEVELOPMENT (TOTAL)

Objective: To determine the total pre-development onsite surface runoff for the proposed Downtown Kihei project site. Areas include North Parcel 30 (excluding existing wetland easement), South Parcel 76, West Parcel 158 and portion of Pi'ikea Avenue.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Area (Ac.):		22.9
Paved Area (Ac.):		1.3
Grassed Area (Ac.):		21.6

3. Runoff Coefficents:

Unimproved Area Coeff't*:		0.30
Paved Runoff Coeff't, C:		0.95
Weighted Runoff Coeff't, C:		0.34

4. Time of Concentration:

Approx. Elev. Diff'l. (ft.):		23
Higher Elev. (ft.):	27	
Lower Elev. (ft.):	4	
Approx. Runoff Length (ft.):		1,030
Average Slope:		2.23%
Time of Concentration (min.):		33

5. Intensity:

Intensity (in./hr.):		2.72

6. Total Runoff:

Q = C x I x A (cfs):		**21.0**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: PRE-DEVELOPMENT-PARCEL 30 (NORTH)

Objective: To determine the pre-development onsite surface runoff for North Parcel 30 of the proposed Downtown Kihei project site. Calculation excludes the existing wetlands easement.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Area (Ac.):		13.5
Wetland Area - Exclude from Calc (Ac.)		3.0
Net Developable Area (Ac.):		10.5

3. Runoff Coefficents:

Unimproved Area Coeff't*:		0.30

4. Time of Concentration:

Approx. Elev. Diff'l. (ft.):		23
Higher Elev. (ft.):	27	
Lower Elev. (ft.):	4	
Approx. Runoff Length (ft.):		1,030
Average Slope:		2.23%
Time of Concentration (min.):		33

5. Intensity:

Intensity (in./hr.):		2.72

6. Total Runoff:

Q = C x I x A (cfs):		**8.5**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: PRE-DEVELOPMENT-PARCEL 76 (SOUTH)

Objective: To determine the pre-development onsite surface runoff for South Parcel 76 of the proposed Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Area (Ac.):		9.1

3. Runoff Coefficents:

Unimproved Area Coeff't*:		0.3

4. Time of Concentration:

Approx. Elev. Diff'l. (ft.):		35
Higher Elev. (ft.):	39	
Lower Elev. (ft.):	4	
Approx. Runoff Length (ft.):		885
Average Slope:		3.95%
Time of Concentration (min.):		27

5. Intensity:

Intensity (in./hr.):		2.96

6. Total Runoff:

Q = C x I x A (cfs):		**8.1**

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: MaY 2012

HYDROLOGIC CALCULATIONS: PRE-DEVELOPMENT-PARCEL 158 (WEST)

Objective: To determine the pre-development onsite surface runoff for West Parcel 158 of the proposed Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Area (Ac.):		1.4

3. Runoff Coefficents:

Unimproved Area Coeff't*:		0.30

4. Time of Concentration:

Approx. Elev. Diff'l. (ft.):		1
Higher Elev. (ft.):	8	
Lower Elev. (ft.):	7	
Approx. Runoff Length (ft.):		68
Average Slope:		1.47%
Time of Concentration (min.):		11.5

5. Intensity:

Intensity (in./hr.):		3.98

6. Total Runoff:

Q = C x I x A (cfs):		**1.6**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: MaY, 2012

HYDROLOGIC CALCULATIONS: PRE-DEVELOPMENT (PORTION OF PI'IKEA AVE)

Objective: To determine the pre-development surface runoff generated in a portion of the existing Pi'ikea Ave. corridor that is being affected by the proposed Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	2.0
Paved Area (Ac.):	1.3
Grassed Area (Ac.):	0.7

3. Runoff Coefficents:

Unimproved Area Coeff't*:	0.30
Paved Runoff Coeff't, C:	0.95
Weighted Runoff Coeff't, C:	0.73

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	40
Average Slope:	3.75%
Overland Travel Time - Grassed (min.):	7.75
Overland (Paved)	
Approx. Runoff Length (ft.):	275
Average Slope:	2.85%
Overland Travel Time - Paved (min.):	5.25
Time of Concentration (min.):	13

5. Intensity:

Intensity (in./hr.):	3.86

6. Total Runoff:

Q = C x I x A (cfs):	**5.7**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

APPENDIX A-2

Post-Development Runoff Calculations (By Parcels)
(North Parcel 30, South Parcel 76, West Parcel 158 and Portion of Pi'ikea Avenue)

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT (TOTAL)

Objective: To determine the post-development onsite surface runoff for the proposed Downtown Kihei project site. Areas include North Parcel 30 (excluding existing wetlands easement), South Parcel 76, West Parcel 158, and portion of Pi'ikea Avenue.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	22.9
Landscaped Area (Ac.):	4.6
Paved Area (Ac.):	18.3

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn *):	0.22
Weighted Runoff Coeff't:	0.80

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	144
Average Slope:	11.0%
Overland Travel Time - Grassed (min.):	10.5
Overland (Paved)	
Approx. Runoff Length (ft.):	246
Average Slope:	2.4%
Overland Travel Time - Paved (min.):	5.5
Pipe Travel Time	
Approx. Runoff Length (ft.):	435
Average Velocity (ft/s):	7.5
In-Pipe Travel Time (min.):	1.0
Time of Concentration (min.):	17.0

5. Intensity:

Intensity (in./hr.):	3.54

6. Total Runoff:

Q = C x I x A (cfs):	**65.1**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT-PARCEL 30 (NORTH)

Objective: To determine the post-development onsite surface runoff for North Parcel 30 of the proposed Downtown Kihei project site. Drainage calc excludes the area of the undisturbed existing wetlands easement.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Area:

Total Area (Ac.):	13.5
Wetland Area - Exclude from Calc (Ac.)	-3.0
Net Developed Area (Ac.):	10.5
Landscaped Area (Ac.):	2.3
Paved Area (Ac.):	8.2

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn *):	0.22
Weighted Runoff Coeff't:	0.79

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	41
Average Slope:	6.0%
Overland Travel Time - Grassed (min.):	7.25
Overland (Paved)	
Approx. Runoff Length (ft.):	115
Average Slope:	3.1%
Overland Travel Time - Paved (min.):	3.75
Pipe Travel Time	
Approx. Runoff Length (ft.):	890
Average Velocity (ft/s):	7.5
In-Pipe Travel Time (min.):	2.0
Time of Concentration (min.):	13.0

5. Intensity:

Intensity (in./hr.):	3.86

6. Total Runoff:

Q = C x I x A (cfs):	**31.9**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT-PARCEL 76 (SOUTH)

Objective: To determine the post-development onsite surface runoff for South Parcel 76 of the proposed Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	9.1
Landscaped Area (Ac.):	1.7
Paved Area (Ac.):	7.4

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn *):	0.22
Weighted Runoff Coeff't:	0.81

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	144
Average Slope:	11.0%
Overland Travel Time - Grassed (min.):	10.5
Overland (Paved)	
Approx. Runoff Length (ft.):	246
Average Slope:	2.4%
Overland Travel Time - Paved (min.):	5.5
Pipe Travel Time	
Approx. Runoff Length (ft.):	435
Average Velocity (ft/s):	7.5
In-Pipe Travel Time (min.):	1.0
Time of Concentration (min.):	17.0

5. Intensity:

Intensity (in./hr.):	3.62

6. Total Runoff:

Q = C x I x A (cfs):	**26.7**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT-PARCEL 158 (WEST)

Objective: To determine the post-development onsite surface runoff for West Parcel 158 of the proposed Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	1.4
Landscaped Area (Ac.):	0.5
Paved Area (Ac.):	0.9

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn *):	0.22
Weighted Runoff Coeff't:	0.69

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	45
Average Slope:	3.5%
Overland Travel Time - Grassed (min.):	8
Time of Concentration (min.):	8.0

5. Intensity:

Intensity (in./hr.):	4.4

6. Total Runoff:

Q = C x I x A (cfs):	**4.2**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT (PI'IKEA AVE)

Objective: To determine the post-development surface runoff for a portion of the Pi'ikea Ave. corridor that is being affected by the Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	2.0
Landscaped Area (Ac.):	0.1
Paved Area (Ac.):	2.0

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn *):	0.22
Weighted Runoff Coeff't:	0.93

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	65
Average Slope:	5.0%
Overland Travel Time - Grassed (min.):	9
Overland (Paved)	
Approx. Runoff Length (ft.):	270
Average Slope:	5.0%
Overland Travel Time - Paved (min.):	5
Time of Concentration (min.):	14.0

5. Intensity:

Intensity (in./hr.):	3.78

6. Total Runoff:

Q = C x I x A (cfs):	**7.1**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

APPENDIX A-3

Offsite Runoff Calculations
(North Parcel 30, South Parcel 76, and Pi'ikea Avenue)

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: TOTAL OFFSITE RUNOFF

Objective: To determine the total pre and post-development offsite surface runoff for the proposed Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Area:

Total Area (Ac.):	1.5
Landscaped Area (Ac.):	0.9
Paved Area (Ac.):	0.7

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn*):	0.22
Weighted Runoff Coeff't:	0.54

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	105
Average Slope:	5.5%
Overland Travel Time - Grassed (min.):	10.5
Overland (Paved)	
Approx. Runoff Length (ft.):	40
Average Slope:	5.5%
Overland Travel Time - Paved (min.):	1.5
Time of Concentration (min.):	12.0

5. Intensity:

Intensity (in./hr.):	3.94

6. Total Runoff:

Q = C x I x A (cfs):	**3.3**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: OFFSITE RUNOFF PARCEL 30 (NORTH)

Objective: To determine the pre and post-development offsite surface runoff for Parcel 30 of the proposed Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Area:

Total Area (Ac.):	0.6
Landscaped Area (Ac.):	0.4
Paved Area (Ac.):	0.2

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn*):	0.22
Weighted Runoff Coeff't:	0.47

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	46
Average Slope:	4.3%
Overland Travel Time - Grassed (min.):	7.75
Overland (Paved)	
Approx. Runoff Length (ft.):	70
Average Slope:	1.4%
Overland Travel Time - Paved (min.):	3.75
Time of Concentration (min.):	11.5

5. Intensity:

Intensity (in./hr.):	3.98

6. Total Runoff:

Q = C x I x A (cfs):	**1.1**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: OFFSITE RUNOFF PARCEL 76 (SOUTH)

Objective: To determine the pre and post-development offsite surface runoff for Parcel 76 of the proposed Downtown Kihei project site.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	0.6
Landscaped Area (Ac.):	0.4
Paved Area (Ac.):	0.2

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn*):	0.22
Weighted Runoff Coeff't:	0.48

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	105
Average Slope:	5.5%
Overland Travel Time - Grassed (min.):	10.5
Overland (Paved)	
Approx. Runoff Length (ft.):	40
Average Slope:	5.5%
Overland Travel Time - Paved (min.):	1.5
Time of Concentration (min.):	12.0

5. Intensity:

Intensity (in./hr.):	3.94

6. Total Runoff:

Q = C x I x A (cfs):	**1.1**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May 2012

HYDROLOGIC CALCULATIONS: OFFSITE RUNOFF (PI'IKEA AVE)

Objective: To determine the pre and post-development offsite surface runoff sheet flowing down Pi'ikea Ave. from the existing Roundabout and Liloa Drive.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Area:

Total Area (Ac.):	0.4
Landscaped Area (Ac.):	0.1
Paved Area (Ac.):	0.3

3. Runoff Coefficents:

Paved Coeff't:	0.95
Landscaped Coeff't (Ave. Heavy Soil Lawn*):	0.22
Weighted Runoff Coeff't:	0.75

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	45
Average Slope:	3.0%
Overland Travel Time - Grassed (min.):	8.5
Overland (Paved)	
Approx. Runoff Length (ft.):	20
Average Slope:	3.0%
Overland Travel Time - Paved (min.):	1
Time of Concentration (min.):	9.5

5. Intensity:

Intensity (in./hr.):	4.18

6. Total Runoff:

Q = C x I x A (cfs):	**1.1**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

APPENDIX A-4

Pre-Development Runoff Calculations (By Discharge Point)
(Existing Inlet Structure No. 1, Existing Inlet Structure No. 2, and Adjacent Northern Parcel)

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: PRE-DEVELOPMENT TOTAL (INLET STRUCTURE NO. 1)

Objective: To determine the total pre-development surface runoff discharging into the existing downstream Inlet Structure No. 1. Note that calculation takes into account both onsite (including wetlands) and offsite runoff. See Exhibit "4", Drainage Area 1.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	13.8
Landscaped Area (Ac.):	12.8
Paved Area (Ac.):	0.9

3. Runoff Coefficents:

Paved Coeff't:	0.95
Unimproved Area Coeff't*:	0.30
Weighted Runoff Coeff't:	0.34

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	1600
Average Slope:	1.6%
Overland Travel Time - Grassed (min.):	29
Time of Concentration (min.):	29.0

5. Intensity:

Intensity (in./hr.):	2.85

6. Total Runoff:

Q = C x I x A (cfs):	**13.5**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: PRE-DEVELOPMENT TOTAL (INLET STRUCTURE NO. 2)

Objective: To determine the total pre-development surface runoff discharging into the existing downstream Inlet Structure No. 2. Note that calculation takes into account both onsite and offsite runoff. See Exhibit "4", Drainage Area 2.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	12.3
Landscaped Area (Ac.):	10.7
Paved Area (Ac.):	1.7

3. Runoff Coefficents:

Paved Coeff't:	0.95
Unimproved Area Coeff't*:	0.30
Weighted Runoff Coeff't:	0.39

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	1,300
Average Slope:	2.5%
Time of Concentration (min.):	25.5

5. Intensity:

Intensity (in./hr.):	3.03

6. Total Runoff:

Q = C x I x A (cfs):	**14.5**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: March, 2012

HYDROLOGIC CALCULATIONS: PRE-DEVELOPMENT (TO NORTH PARCEL)

Objective: To determine the pre-development surface runoff currently discharging into the adjacent northern parcel from project site. See Exhibit "4", Drainage Area 3.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	1.4
Landscaped Area (Ac.):	1.4
Paved Area (Ac.):	0.0

3. Runoff Coefficents:

Paved Coeff't:	0.95
Unimproved Area Coeff't*:	0.30
Weighted Runoff Coeff't:	0.30

4. Time of Concentration:

Overland (Grass)	
Approx. Runoff Length (ft.):	260
Average Slope:	3.9%
Overland Travel Time - Grassed (min.):	12.5
Time of Concentration (min.):	12.5

5. Intensity:

Intensity (in./hr.):	3.9

6. Total Runoff:

Q = C x I x A (cfs):	**1.6**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

APPENDIX A-5

Post-Development Runoff Calculations (By Discharge Point)
(Existing Inlet Structure No. 1, Existing Inlet Structure No. 2, and Adjacent Northern Parcel)

Table A-5: Post-Development Drainage Summary

Discharge Point	Allowable Runoff (Q, cfs)	Post-Dev. Discharge		Net Increase (cfs)
		Drainage Area No.*	Discharge (Q, cfs)	
Ext'g Longs Drugs Retail Center Drainage System (Ext'g Inlet Structure No. 1)	14.4	1A	10.1**	- 0.4 (decrease)
		1B	3.9	
		Total	14.0	
Ext'g Azeka Place (Mauka Phase II) Commercial Center (Ext'g Inlet Structure No. 2)	17.8	2A	9.5**	- 0.5 (decrease)
		2B	2.1**	
		2C	2.0	
		2D	3.7	
		Total	17.3	

* See Exhibit 5 For Drainage Areas

** Post-Development Discharge Taken from the Estimated Outflow of the Proposed Detention Systems (See Appendix B)

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT (DETENTION BASIN NO. 1)

Objective: To determine the post-development onsite and offsite surface runoff intercepted and conveyed to the proposed Detention Basin No. 1. Calculations include tributary areas from Pi'ikea Ave. Liloa Drive and South Parcel. Basin outlets into existing downstream Inlet Structure No. 1 (See Appendix B-1 for Basin outlet calculations). See Exhibit "5", Drainage Area 1A.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Area:

Total Area (Ac.):	16.0
Tributary Area From North Parcel (Ac.):	9.9
Tributary Area From South Parcel (Ac.):	3.6
Tributary Area From Pi'ikea Right-of-Way (Ac.):	1.2
Tributary Area From Liloa Right-of-Way (Ac.):	1.3

3. Runoff Coefficents:

Ave. Coeff't from North Parcel (See Appendix A-2):	0.79
Ave. Coeff't from South Parcel (See Appendix A-2):	0.81
Ave. Coeff't from Pi'ikea:	0.93
Ave. Coeff't from Liloa:	0.54
Weighted Runoff Coeff't:	0.78

4. Time of Concentration:

Time of Concentration (min.):	13.0

(Tc Adopted from Post-Dev. Calc of North Parcel)

5. Intensity:

Intensity (in./hr.):	3.86

6. Total Runoff:

Q = C x I x A (cfs):	**48.5**

Note: Detention Basin Outflow "Q(out)" is approximately **10.1 cfs** (See Appendix B-1)

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT (DISCHARGE FROM REMAINING AREAS INTO EXT'G INLET STRUCTURE NO. 1)

Objective: To determine the post-development surface runoff generated by the project site, Pi'ikea Ave, and the existing wetlands that discharges downstream into the Ext'g Inlet Structure No. 1. See Exhibit "5", Drainage Area 1B.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	3.7
Onsite Area, Grassed (Ac.):	0.3
Piikea Ave (Ac.):	0.4
Ext'g Wetlands (Ac.):	3.0

3. Runoff Coefficents:

Landscape Coeff't (Ave. Heavy Soil Lawn*):	0.22
Piikea Coeff't*:	0.93
Wetlands Coeff't:	0.22
Weighted Runoff Coeff't:	0.29

4. Time of Concentration:

Time of Concentration (min.):	13.0

(Tc Adopted from Post-Dev. Calc of North Parcel)

5. Intensity:

Intensity (in./hr.):	3.68

6. Total Runoff:

Q = C x I x A (cfs):	**3.9**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT (DETENTION BASIN NO. 2)

Objective: To determine the post-development onsite and offsite surface runoff intercepted and conveyed to the proposed Detention Basin No.2. Calculations include tributary areas from Pi'ikea Ave. and Liloa Drive. Basin outlets to the existing downstream Inlet Structure No. 2 (See Appendix B-2 for basin outlet calculations). See Exhibit "5", Drainage Area 2A.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Area:

Total Area (Ac.):	5.4
Tributary Area From South Parcel (Ac.):	4.9
Tributary Area From Liloa Right-of-Way (Ac.):	0.5

3. Runoff Coefficents:

Ave. Coeff't from South Parcel (See Appendix A-2):	0.81
Ave. Coeff't from Liloa:	0.54
Weighted Runoff Coeff't:	0.79

4. Time of Concentration:

Time of Concentration (min.):	17.0

(Tc Adopted from Post-Dev. Calc of South Parcel)

5. Intensity:

Intensity (in./hr.):	3.54

6. Total Runoff:

Q = C x I x A (cfs):	**15.0**

Note: Detention Basin Outflow "Q(out)" is approximately **9.5** cfs (See Appendix B-2)

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT (42" SUBSURFACE DRAIN)

Objective: To determine the post-development onsite and offsite surface runoff intercepted and conveyed to the proposed 42" Subsurface Drain in Parcel 158 (west). The 42" subsurface drain outlets to the existing Azeka Phase II drainage system (See Appendix B-3 for subsurface drain outlet calculations). See Exhibit "5", Drainage Area 2B.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Area:

Total Area (Ac.):	1.1
Paved Area (Ac.):	1.0
Landscaped Area (Ac.):	0.1

3. Runoff Coefficents:

Landscaped Coeff't (Ave. Heavy Soil Lawn*):	0.22
Paved Coeff't:	0.93
Weighted Runoff Coeff't:	0.87

4. Time of Concentration:

Time of Concentration (min.):	8.0

(Tc Adopted from Post-Dev. Calc of West Parcel)

5. Intensity:

Intensity (in./hr.):	4.4

6. Total Runoff:

Q = C x I x A (cfs):	**4.1**

Note: Detention Basin Outflow "Q(out)" is approximately **2.1** cfs (See Appendix B-3)

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVEVELOPMENT (DISCHARGE FROM REMAINING AREAS INTO EXT'G INLET STRUCTURE NO. 2)

Objective: To determine the post-development surface runoff generated by the project site and Pi'ikea Ave that discharges downstream into the Ext'g Inlet Structure No. 2. See Exhibit "5", Drainage Area 2C.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	1.1
Onsite Area, Grassed (Ac.):	0.6
Piikea Ave (Ac.):	0.5

3. Runoff Coefficents:

Landscaped Coeff't (Ave. Heavy Soil Lawn*):	0.22
Piikea Coeff't:	0.93
Weighted Runoff Coeff't:	0.52

4. Time of Concentration:

Time of Concentration (min.):	17.0

(Tc Adopted from Post-Dev. Calc of South Parcel)

5. Intensity:

Intensity (in./hr.):	3.54

6. Total Runoff:

Q = C x I x A (cfs):	**1.9**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: EXISTING WETLANDS (PARCEL 80)

Objective: To determine the surface runoff generated within the existing wetlands replacement and enhancement site (South Parcel 80), that discharges into the existing downstream Inlet Structure No. 2. See Exhibit "5", Drainage Area 2D.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	3.5
Landscaped Area (Ac.):	3.5
Paved Area (Ac.):	0.0

3. Runoff Coefficents:

Paved Coeff't:	0.95
Unimproved Area Coeff't*:	0.30
Weighted Runoff Coeff't:	0.30

4. Time of Concentration:

Time of Concentration (min.):	17.0

(Adopted from Tc of Drainage Area 2A)

5. Intensity:

Intensity (in./hr.):	3.54

6. Total Runoff:

Q = C x I x A (cfs):	**3.7**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street , Suite 403
Wailuku, Maui , Hawaii 96793

Date: May, 2012

HYDROLOGIC CALCULATIONS: POST-DEVELOPMENT DISCHARGE SHEET FLOWING INTO PROPERTY TO THE NORTH (YEE'S ORCHARD)

Objective: To determine the post-development surface runoff discharging into the adjacent property to the north from the project site. See Exhibit "5", Drainage Area 3.

I. 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Kihei, Maui,
R(50 Yr.-1Hr.) = 2.0 inches

2. Total Area:

Total Area (Ac.):	0.3
Onsite Area, Grassed (Ac.):	0.3
Onsite Area, Paved (Ac.):	0.0

3. Runoff Coefficents:

Landscaped Coeff't (Ave. Heavy Soil Lawn*):	0.22
Paved Coeff't:	0.95
Weighted Runoff Coeff't:	0.22

4. Time of Concentration:

Time of Concentration (min.):	6.5

(Tc Adopted from Post-Dev. Calc of North Parcel)

5. Intensity:

Intensity (in./hr.):	4.63

6. Total Runoff:

Q = C x I x A (cfs):	**0.3**

*See Table 2 of the "Rules for the Design of Storm Drainage Facilities in the County of Maui"

APPENDIX B

PRELIMINARY DETENTION BASIN ESTIMATION CALCULATIONS

APPENDIX B-1

Preliminary Detention Basin No. 1 Calculations

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
50	I-D-F Curve	Krausz Kihei (50

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	50	1.839		1.4500	10.05		
POND 10	IN	POND	50	2.905	R	.6500	46.95		
POND 10	OUT	POND	50	1.839		1.4500	10.05	7.64	1.870
SUBAREA 10		AREA	50	2.906	L	.6600	48.49		

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
4.00	-----	.4100	.0000	.000	.000
5.00	-----	.4700	1.3190	.440	.440
6.00	-----	.5200	1.4844	.495	.934
7.00	-----	.5800	1.6492	.550	1.484
8.00	-----	.6400	1.8293	.610	2.094
9.00	-----	.7000	2.0093	.670	2.764
10.00	-----	.7600	2.1894	.730	3.494

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = V:\Projdata\06proj\06059 - Krausz Piikea & Liloa MU Comm\Calcs\drain\p
Inflow  HYG file = NONE STORED - POND 10      IN  50
Outflow HYG file = NONE STORED - POND 10      OUT 50

Pond Node   Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
---------------------------------
Starting WS Elev   =     4.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0500 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     46.95 cfs    at     .6500 hrs
Peak Outflow      =     10.05 cfs    at    1.4500 hrs
-----------------------------------------------------
Peak Elevation    =      7.64 ft
Peak Storage =          1.870 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       2.905
- Infiltration =        .000
- HYG Vol OUT  =       1.839
- Retained Vol =       1.066
                  ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)


WARNING: Inflow hydrograph truncated on right side.
```

RATIONAL METHOD HYDROGRAPH USING Q/Qp TEMPLATE
Q/Qp Template File/ID: Q/Qp1

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

Tag	Freq	File	IDF Curve
50	50		Krausz Kihei (50

Tc = .2200 hrs

Tag	Freq (years)	C	C adj factor	C final	I in/hr	Area acres	Peak Q cfs
50	50	.780	1.000	.780	3.8488	16.020	48.49

HYG file =
HYG ID = SUBAREA 10
HYG Tag = 50

Peak Discharge = 48.49 cfs
Time to Peak = .6600 hrs
HYG Volume = 2.906 ac-ft

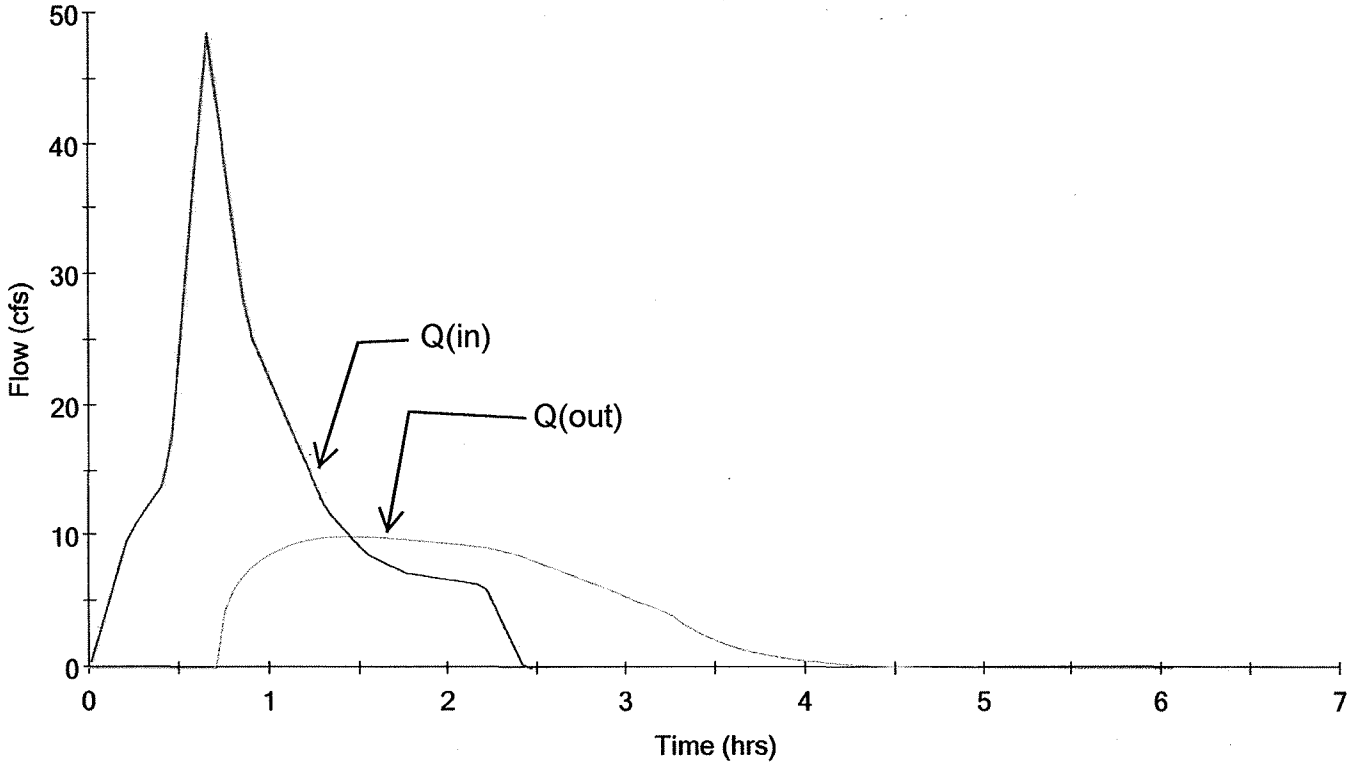
WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0100	.46	2.78	5.09	7.41	9.72
.2600	10.98	11.97	12.96	13.95	17.63
.5100	25.35	33.06	40.78	48.49	43.42
.7600	38.35	33.28	28.21	25.19	23.54
1.0100	21.89	20.23	18.60	17.06	15.52
1.2600	13.97	12.43	11.51	10.73	9.96
1.5100	9.19	8.60	8.27	7.94	7.60
1.7600	7.27	7.16	7.05	6.94	6.83
2.0100	6.72	6.61	6.50	6.39	6.02
2.2600	4.58	3.15	1.72	.29	.00

Hydrograph
SUBAREA 10 50

Detention Basin No. 1



APPENDIX B-2

Preliminary Detention Basin No. 2 Calculations

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
50	I-D-F Curve	Krausz Kihei (50

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	50	1.058		1.1000	9.46		
POND 10	IN	POND	50	1.163		.8500	15.09		
POND 10	OUT	POND	50	1.058		1.1000	9.46	6.85	.378
SUBAREA 10		AREA	50	1.163		.8500	15.09		

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
4.00	-----	.0900	.0000	.000	.000
5.00	-----	.1200	.3139	.105	.105
6.00	-----	.1500	.4042	.135	.239
7.00	-----	.1800	.4943	.165	.404
8.00	-----	.2100	.5844	.195	.599

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = V:\Projdata\06proj\06059 - Krausz Piikea & Liloa MU Comm\Calcs\drain\p
Inflow  HYG file = NONE STORED - POND 10      IN  50
Outflow HYG file = NONE STORED - POND 10      OUT 50

Pond Node   Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
---------------------------------
Starting WS Elev   =     4.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0500 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
====================================================
Peak Inflow       =     15.09 cfs    at     .8500 hrs
Peak Outflow      =      9.46 cfs    at    1.1000 hrs
----------------------------------------------------
Peak Elevation    =      6.85 ft
Peak Storage =           .378 ac-ft
====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       1.163
- Infiltration =        .000
- HYG Vol OUT  =       1.058
- Retained Vol =        .105
                 ----------
Unrouted Vol =       -.000 ac-ft  (.001% of Inflow Volume)
```

RATIONAL METHOD HYDROGRAPH USING Q/Qp TEMPLATE
Q/Qp Template File/ID: Q/Qp1

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

Tag	Freq	File	IDF Curve
50	50		Krausz Kihei (50

Tc = .2833 hrs

Tag	Freq (years)	C	C adj factor	C final	I in/hr	Area acres	Peak Q cfs
50	50	.780	1.000	.780	3.5394	5.420	15.09

HYG file =
HYG ID = SUBAREA 10
HYG Tag = 50

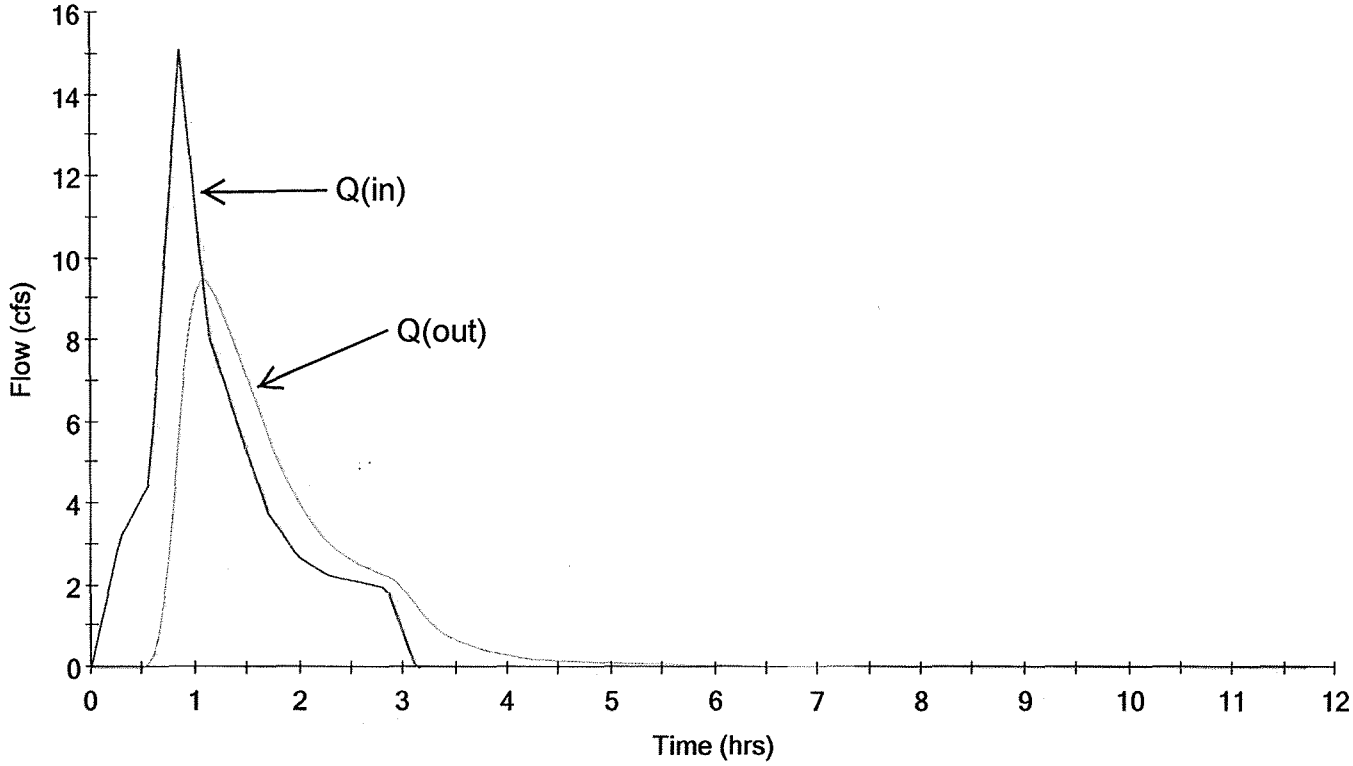
Peak Discharge = 15.09 cfs
Time to Peak = .8500 hrs
HYG Volume = 1.163 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.56	1.12	1.68	2.24
.2500	2.80	3.25	3.49	3.73	3.97
.5000	4.21	4.45	5.77	7.63	9.50
.7500	11.36	13.22	15.09	13.86	12.64
1.0000	11.41	10.19	8.96	8.01	7.61
1.2500	7.22	6.82	6.42	6.02	5.64
1.5000	5.26	4.89	4.52	4.14	3.77
1.7500	3.59	3.40	3.21	3.03	2.84
2.0000	2.69	2.61	2.53	2.45	2.37
2.2500	2.29	2.25	2.22	2.19	2.17
2.5000	2.14	2.11	2.09	2.06	2.03
2.7500	2.01	1.98	1.85	1.50	1.15
3.0000	.81	.46	.12	.00	

Hydrograph
SUBAREA 10 50

Detention Basin No. 2



APPENDIX B-3

Preliminary 42" Subsurface Detention System Calculations

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
50	I-D-F Curve	Krausz Kihei (50

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	50	.084		.5500	2.07		
POND 10	IN	POND	50	.153		.4000	4.21		
POND 10	OUT	POND	50	.084		.5500	2.07	6.01	.079
SUBAREA 10		AREA	50	.153	L	.3990	4.22		

USER DEFINED VOLUME RATING TABLE

Elevation (ft)	Volume (ac-ft)
.00	.000
2.00	.014
3.00	.031
4.00	.051
5.00	.069
6.00	.079
7.00	.080

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = V:\Projdata\06proj\06059 - Krausz Piikea & Liloa MU Comm\Calcs\drain\p
Inflow  HYG file = NONE STORED - POND 10      IN  50
Outflow HYG file = NONE STORED - POND 10      OUT 50

Pond Node   Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
---------------------------------
Starting WS Elev   =      .00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0500 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =      4.21 cfs    at     .4000 hrs
Peak Outflow      =      2.08 cfs    at     .5500 hrs
-----------------------------------------------------
Peak Elevation    =      6.01 ft
Peak Storage =           .079 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =        .153
- Infiltration =        .000
- HYG Vol OUT  =        .084
- Retained Vol =        .069
                 ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)
```

RATIONAL METHOD HYDROGRAPH USING Q/Qp TEMPLATE
Q/Qp Template File/ID: Q/Qp1

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

Tag	Freq	File	IDF Curve
50	50		Krausz Kihei (50

Tc = .1330 hrs

Tag	Freq (years)	C	C adj factor	C final	I in/hr	Area acres	Peak Q cfs
50	50	.870	1.000	.870	4.5000	1.070	4.22

HYG file =
HYG ID = SUBAREA 10
HYG Tag = 50

Peak Discharge = 4.22 cfs
Time to Peak = .3990 hrs
HYG Volume = .153 ac-ft

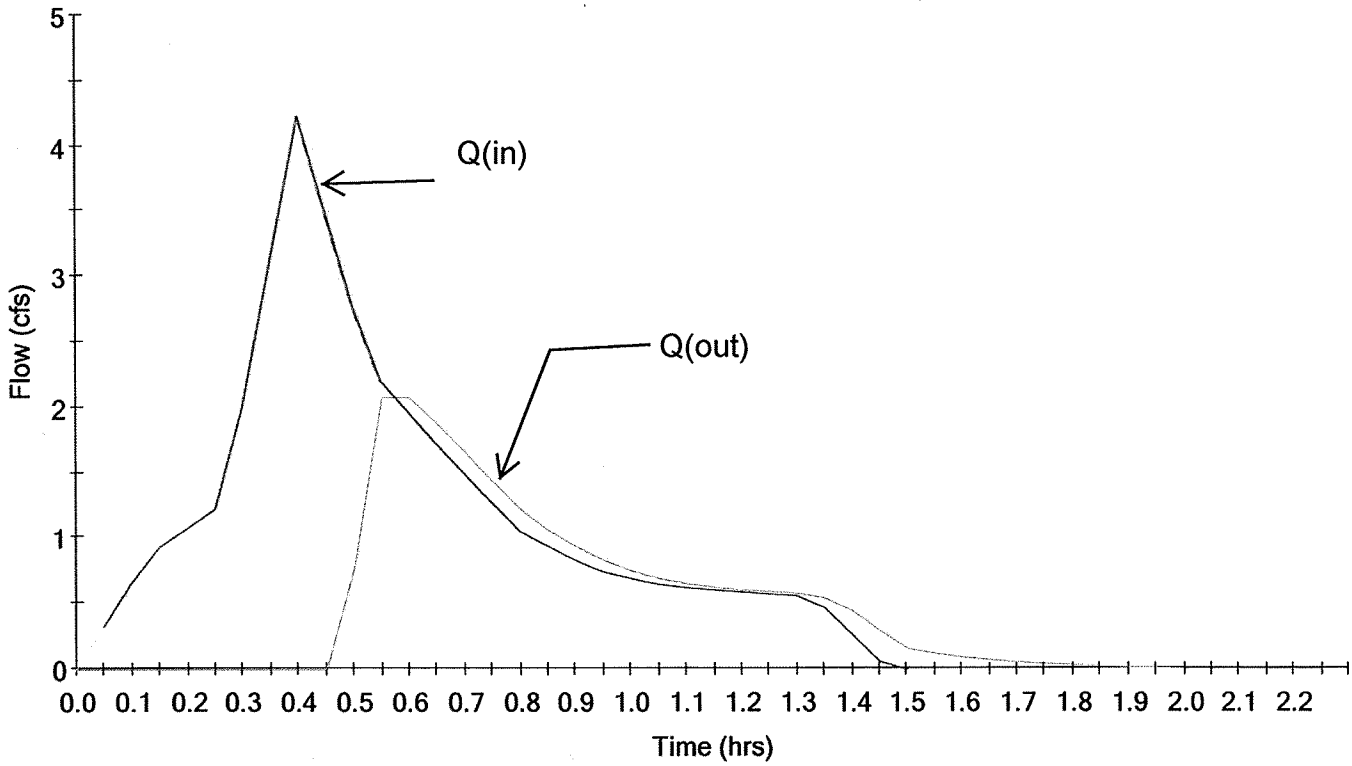
WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0490	.33	.66	.93	1.08	1.22
.2990	2.00	3.11	4.22	3.49	2.76
.5490	2.20	1.96	1.72	1.50	1.27
.7990	1.05	.94	.83	.74	.70
1.0490	.65	.62	.61	.59	.57
1.2990	.56	.47	.26	.06	.00

Hydrograph
SUBAREA 10 50

42" Subsurface Detention System



APPENDIX A

PREMININARY DRAINAGE REPORT

Established 1969

Preliminary Drainage Report for

Krausz Downtown Kihei Project

Kihei, Maui, Hawaii
TMK: (2) 3-9-002: 030, 076, and 158

Prepared For: Krausz Companies, Inc.
44 Montgomery Street, Suite 3300
San Francisco, CA 94104

CLIFFORD N. MUKAI
LICENSED PROFESSIONAL ENGINEER
NO. 6667-C
HAWAII, U.S.A.

License Expires April 30, 2014

Date: August 31, 2012

WARREN S. UNEMORI ENGINEERING, INC.
Civil and Structural Engineers - Land Surveyors
Wells Street Professional Center - Suite 403
2145 Wells Street
Wailuku, Maui, Hawaii 96793

V:\06Proj\06059\reports\Drainage Reports\cover00.crd

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3. Flood Insurance Rate Map
4. Pre-Development Drainage Area Map
5. Conceptual Post-Development Drainage Area Map

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A. Hydrologic Calculations
B. Preliminary Detention Basin Estimation Calculations

Preliminary Drainage Report
for
Krausz Downtown Kihei
Kihei, Maui, Hawaii

I. PURPOSE

This report has been prepared to examine the existing drainage conditions and the proposed drainage plan for the proposed Krausz Downtown Kihei project.

II. PROPOSED PROJECT

A. Site Location

The project site is located in Kihei, on the island of Maui, and in the State of Hawaii, and is comprised of Tax Map Key parcels (2) 3-9-002: 030, 076, and 158. These parcels are located approximately 1,500 ft from the ocean, and are situated along both sides of Pi'ikea Avenue (Road "C"); south of Yee's Orchard; north of the Haggai Institute; immediately west (makai) of the Roundabout at the intersection of Pi'ikea Avenue/Liloa Drive (N-S Collector); and east (mauka) of the existing Azeka Place (Mauka Phase II) Commercial Center, existing Longs Drugs Retail Center and the existing man-made wetlands replacement and enhancement sites (see Exhibit 1). The existing Piilani Village (Safeway) Shopping Center and existing Piilani Gardens Apartments and Child Care Complex are located to the east (mauka) of the project site, across Liloa Drive. Required offsite improvements are expected to include, but are not limited to, work on Piikea Ave. between the existing Longs Drugs Retail Center and the ext'g Roundabout; work on Piikea Ave. between the signalized entrance to Piilani Village Shopping Center and the Piilani Highway intersection; and work on a portion of Liloa Drive, in areas fronting the project site.

B. Project Description

The Project Site is anticipated to be a Commercial development and occupy a total area of approximately 22.4± acres (excluding existing wetland easement and including Pi'ikea Ave. Improvements) on both sides of Pi'ikea Avenue. Improvements are expected to include, but are not limited to, the following:

- Commercial shops, restaurants, offices, theatre, hotel and their associated driveways and parking areas (including a parking structure);
- Concrete curbs, gutters, and paved mall walkways and sidewalks;
- Underground drainage systems consisting of drain inlets, subsurface detention systems (up to 72" diameter perforated pipe), above ground landscaped detention basins, and drainage piping (shallow concrete box culverts or smaller diameter parallel drainlines may be used where vertical clearances are limited);
- Underground wastewater systems;
- Underground water systems for potable water and fire protection;

- Underground gas system with supplemental above ground gas tanks;
- Modifications to the existing Pi'ikea Avenue (roadway widening, turning lanes, profile revisions, etc.);
- Retaining walls;
- Underground electrical, telephone, cable television systems (including streetlights, parking lot lights, underground conduits, handholes, etc.); and,
- Landscaping and Irrigation (expected to be supplied from Maui County's R-1 reclaimed wastewater system).

Improvements are not expected to extend into the existing man-made wetlands replacement and enhancement sites (previously constructed in 1990), and therefore are not expected to be disturbed by the proposed development.

Typical temporary construction-phase measures to control erosion and wind blown silt are expected to be implemented during the mass grading phase as required (e.g., dust fences, silt fences, filtration berms, siltation and infiltration basin, etc.). Furthermore, upon completion of the proposed grading and improvements, all disturbed areas that are still exposed (and not paved or otherwise landscaped) will be grassed as required to minimize erosion.

All site work construction is expected to conform to the recommendations and requirements of the Soils Engineer (who will be a professional engineer licensed to practice in the State of Hawaii) and the applicable requirements of the Maui County code. The Owner is expected to retain a Soils Engineer to provide all construction phase monitoring and testing in accordance with the soils report.

III. EXISTING CONDITIONS

A. Topography and Soil Conditions

The project site is currently undeveloped and is not being used for any particular purpose. The existing ground generally slopes in an easterly (mauka) to westerly (makai) direction, from an elevation of approximately (+) 38 feet M.S.L. to approximately (+) 4 feet M.S.L., with an average slope of approximately 2.3%. Properties east (mauka) of Liloa Drive are developed and consist of Piilani Village Shopping Center and Piilani Gardens Apartments and Childcare Complex. The existing Azeka Place (Mauka Phase II) Commercial Center and existing Longs Drugs Retail Centers, located west (makai) of the project site, are both developed properties with slopes generally consistent with Pi'ikea Avenue. Natural vegetation in the undeveloped areas includes, but is not limited to, buffelgrass and kiawe trees.

According to the *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*, prepared by the United States Department of Agriculture, Soil Conservation Service, the soil classifications predominantly found on the project site are the Pulehu Series, Pulehu clay loam, 0-3 percent slopes (PsA), Puuone sand, 7 to 30 percent slopes (PZUE) and Jaucas sand, saline, 0 to 12 percent slopes (JcC) (See Exhibit 2). The Pulehu clay loam (PsA) is

characterized as having moderate permeability, slow runoff and a slight erosion hazard. The Puuone sand (PZUE) is characterized as having rapid permeability above the cemented layer, slow runoff and moderate to severe wind erosion hazard. The Jaucas sand (JcC) is somewhat poorly drained in depressions but excessively drained on knolls.

B. Existing Drainage Conditions

Presently, the majority of the onsite and offsite runoff generally sheet flows across the project site in an easterly to westerly direction and into the downstream existing man-made wetlands replacement and enhancement sites located immediately mauka of the existing Longs Drugs Retail Center and west Parcel 158 (see Exhibit 4). According to our calculations, the existing pre-development project site (including a portion of the Pi'ikea Avenue right-of-way, but excluding the existing man-made wetlands replacement and enhancement easement) currently generates approximately 21.0 cfs of onsite surface runoff (based on a 50-year recurrence interval, 1-hour duration storm). Two existing concrete inlet structures located within the existing man-made wetland replacement and enhancement sites, collect and convey the runoff through the retail centers' underground drainage systems, and eventually into the County's existing drainage system along South Kihei Road.

According to the previously approved drainage report for the Longs Drugs Retail Business Center (dated February 1989 by Warren S. Unemori Engineering, Inc.), the existing drainage system and inlet structure (30" RCP drainline) located east of the existing Longs Drugs Retail Center within the existing man-made wetlands replacement and enhancement site, was designed to accommodate 14.4 cfs of total allowable runoff from the north Parcel 30 (TMK: (2) 3-9-0:30). The intercepted runoff is then conveyed to the existing regulation reservoir located south of St. Theresa Church, by means of underground drainlines in Piikea Ave. and box culverts beneath South Kihei Road.

In addition, based on the previously approved drainage report for the Azeka Place (Mauka Phase II) Commercial Center (dated March 1989 by Warren S. Unemori Engineering, Inc.), the existing drainage system and inlet structure (36" ASRP drainline) located east of the existing Azeka Place (Mauka Phase II) Commercial Center within the existing wetlands replacement and enhancement site, was designed to accommodate 17.8 cfs of total allowable runoff from the south Parcel 76 and west Parcel 158 (TMKs: (2) 3-9-0:76 and 158) and convey the intercepted runoff to the existing box culvert previously installed by the County within South Kihei Road and eventually to the existing regulation reservoir located south of St. Theresa Church that outlets to the ocean.

Runoff from the existing 60 foot wide Piikea Avenue right-of-way currently sheet flows into the project site (with approximately half of the right-of-way flowing into the north Parcel 30 and half into the south Parcels 76, 158 and 80, based on the crown of the existing road), and into the two downstream existing man-made wetlands replacement and enhancement sites.

Offsite mauka surface runoff is comprised of the area west (makai) of the Liloa Road (N-S Collector) curbing that currently sheet flows into the project site (see Exhibit 4). A total of approximately 3.3 cfs (50-year, 1-hour storm) is generated from these upstream offsite areas that drains onto the project site and into the two downstream existing man-made wetlands replacement and enhancement sites.

Based on the existing grades of north Parcel 30, approximately 1.6 cfs (approx. 1.4 Ac.) sheet flows in a northerly direction off the project site and into the adjoining Yee's Orchard property.

C. Flood and Tsunami Zone

According to Panel 0586E of the Flood Insurance Rate Map, dated September 25, 2009, a majority of north Parcel 30 and south Parcel 76 (TMKs: (2) 3-9-02:30 and 76) are situated within Zone "X", which is designated as an area outside the 0.2% chance flood plain and of minimal flood hazard (see Exhibit 3). A portion of the southwestern corners of both these Parcels (near the locations of the existing man-made wetlands replacement and enhancement sites) along with the entire west Parcel 158 [TMK: (2) 3-9-02: 158] are in Zone "AH", which indicates they are in special flood hazard areas subject to inundation by the 100-year shallow flood where flood depths are between one (1) and three (3) feet (usually areas of ponding), with the base flood elevation determined at elevation 6.

The project site is not located within a tsunami zone.

IV. DRAINAGE PLAN

A. Description

The general drainage plan that will be implemented for the proposed improvements shall include minimal alterations to the existing pre-development drainage patterns, and mitigating the increase in runoff generated by the proposed project improvements such that the runoff released downstream will be no greater than the planned design capacity of the existing drainage systems.

The majority of the onsite surface runoff generated by the proposed project will be intercepted by new curbing and curb-and-gutters, curb inlet and grated inlet type catch basins (with Kristar carbon based filters, or approved equal), and conveyed to new onsite landscaped detention basins by the project's underground drainage system, which has been sized to accommodate the fully developed project site (see Exhibit 5). The majority of the onsite runoff will be routed through the project's subsurface detention systems before going into the landscaped detention basins, which have provisions for overflow with controlled release to the downstream existing man-made wetlands replacement and enhancement sites as it is presently doing.

In the absence of any onsite stormwater detention systems, a total of approximately 65.1 cfs (50-year, 1-hour storm) of the onsite surface runoff could

potentially have been generated after development of the project site (including improvements within the Piikea Avenue right-of-way). However, a combination of subsurface detention systems and above ground landscaped detention basins will be implemented (see Appendix B for preliminary detention calculations) to limit the peak onsite runoff to rates no greater than the planned allowable release for the existing drainage systems from the previously approved Azeka Place (Mauka Phase II) Commercial Center and the Longs Drugs Retail Center projects (See Appendix A-5). The net release into the existing Longs Drugs Retail Center drainage system is expected to be approximately 14.0 cfs, ultimately less than the allowable 14.4 cfs from the previously approved drainage report. The net release into the existing Azeka Place (Mauka Phase II) Commercial Center drainage system is expected to be approximately 17.3 cfs, ultimately less than the allowable 17.8 cfs from the previously approved drainage report. Therefore, since the onsite runoff discharging downstream will not exceed the allowable release of the existing downstream drainage systems, it will be allowed to continue to flow downstream through the County's existing drainage system as it is presently doing. Table 1 below presents a summary of the relevant hydrologic analyses undertaken.

Parcel No.	Pre-Dev Onsite Runoff* (cfs)	Post-Dev Onsite Runoff* - Before Mitigation (cfs)	Mitigative Measure	
			Subsurface Drainage System (l.f.; size)	Landscaped Detention Basins
30 (North)**	8.5	31.9	200 (72")	#1
76 (South)	8.1	26.7	325 (72")	#1 and #2
158 (West)	1.7	4.2	200 (42")	N/A
Pi'ikea Avenue	5.7	7.1	0	#1

*See Appendix A for total drainage area calculations (above component runoff values are conservative, not intended to be added, and is used solely for conservatively sizing the respective mitigative measures)

**Excludes man-made wetland replacement site

Table 1. Pre/Post Drainage Summary for Developable Areas

A portion of the post-development runoff from the south parcel will be routed through the north parcel and into Detention Basin No.1 (see Exhibit 5). However, the Detention Basin No. 1 will be sized to accommodate this additional runoff from the south parcel, such that no more than the allowable release (per the previously approved Longs Drugs Retail Center drainage report) will be permitted to discharge into the downstream drainage system.

The runoff generated by the proposed development of the west Parcel 158 (TMK (2) 3-9-0: 158) will be mitigated by an approximately 200 ft. long 42" subsurface

drainage system that will release runoff to the existing drainage system within the existing Azeka Place (Mauka Phase II) Commercial Center at a rate no greater than the allowable release design capacity of the existing system.

A portion of the existing onsite surface runoff from the northerly fringe (approx. 0.3 Ac.) of the project site that currently sheet flows off the property into the adjacent Yee's Orchard will be allowed to continue as it is presently doing so that there will be no net increase in onsite runoff leaving the project site.

B. Hydrologic Calculations

The hydrologic calculations are based on the "Rules for the Design of Storm Drainage Facilities in the county of Maui", Title MC-15, Chapter 4 and the "Rainfall Frequency Atlas of the Hawaiian Islands", Technical Paper No. 43, dated 1962. The rational method was used to estimate the runoff for this project.

Rational Formula used:

$$Q = CIA$$

Where:
- Q = Rate of Flow (cfs)
- C = Runoff Coefficient
- I = Rainfall Intensity (inch/hour)
- A = Area (Acre)

The design storm used in the calculations for this project is based on a 50-year recurrence interval, 1-hour duration precipitation of approximately 2.0 inches.

APPENDIX A contains the hydrologic calculations used to determine the impact of the proposed project in terms of drainage conditions by comparing the peak flows from before and after development.

C. Conclusion

All drainage improvements are expected to be implemented pursuant to the current County of Maui's Rules for the Design of Storm Drainage Facilities. Although the proposed project improvements could potentially generate approximately 44.1 cfs of additional runoff, the construction of onsite subsurface detention systems and two new landscaped detention basins will attenuate the increase in post-development runoff, so that no more than the allowable total release of 32.2 cfs (that was identified in the previously approved Drainage Reports for the existing Longs Drugs Retail Center and existing Azeka Place (Mauka Phase II) Commercial Center) will be permitted to discharge downstream, and continue to flow downstream as it is presently doing. Therefore, it is our professional opinion that the proposed project improvements are not expected to adversely affect the downstream and adjoining properties.

V. REFERENCES

1. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* United States Department of Agriculture, Soil Conservation Service. August 1972.

2. *Flood Insurance Rate Map, Maui County, Hawaii*, Community-Panel Number 150003 0586E. September 25, 2009. Federal Emergency Management Agency, Federal Insurance Administration.

3. *Rules for the Design of Storm Drainage Facilities in the County of Maui*, Chapter 4, Department of Public Works and Environmental Management - County of Maui, July 14, 1995.

4. *Rainfall Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43.* 1962. U.S. Department of Commerce, Weather Bureau.

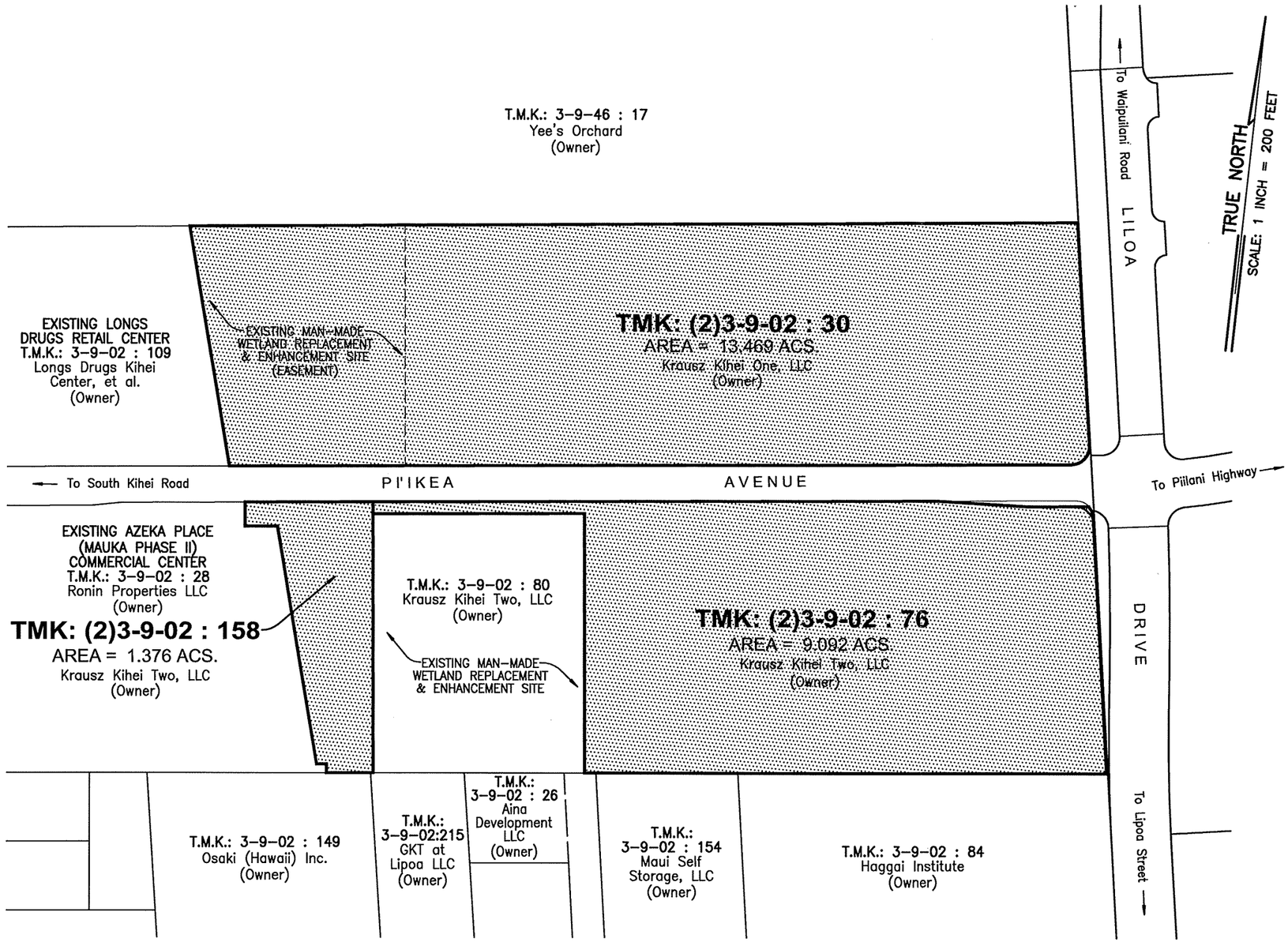
5. *Preliminary Subsurface Investigation Report: Piikea-Liloa Commercial*, Fewell Geotechnical Engineering, Ltd., September 30, 2008.

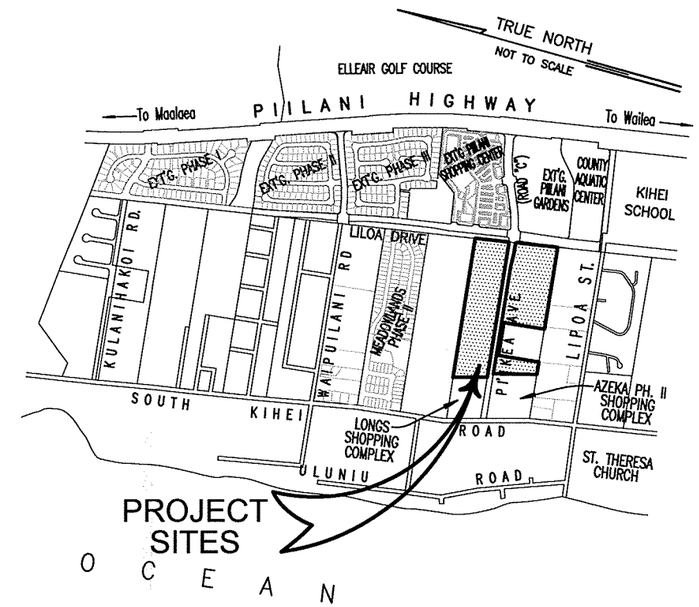
6. *Drainage and Soil Erosion Report for Azeka Place Commercial Center*, Warren S. Unemori Engineering, Inc., February 1989.

7. *Drainage and Soil Erosion Report for Longs Drugs – Retail Business Center*, Warren S. Unemori Engineering, Inc., March 1989.

EXHIBITS

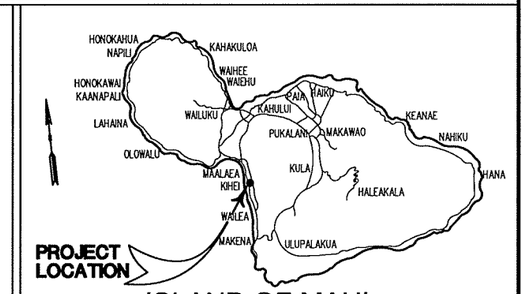
1. Project Location Map and Site Plan
2. Soil Classification Map
3. Flood Insurance Rate Map
4. Pre-development Drainage Area Map
5. Conceptual Post-development Drainage Area Map





LOCATION MAP

NOT TO SCALE



ISLAND OF MAUI

NOT TO SCALE

EXHIBIT 1 - PROJECT LOCATION MAP & SITE PLAN (1 OF 2)

0 200 400 600 800

SCALE: 1 IN. = 200 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

May 17, 2012

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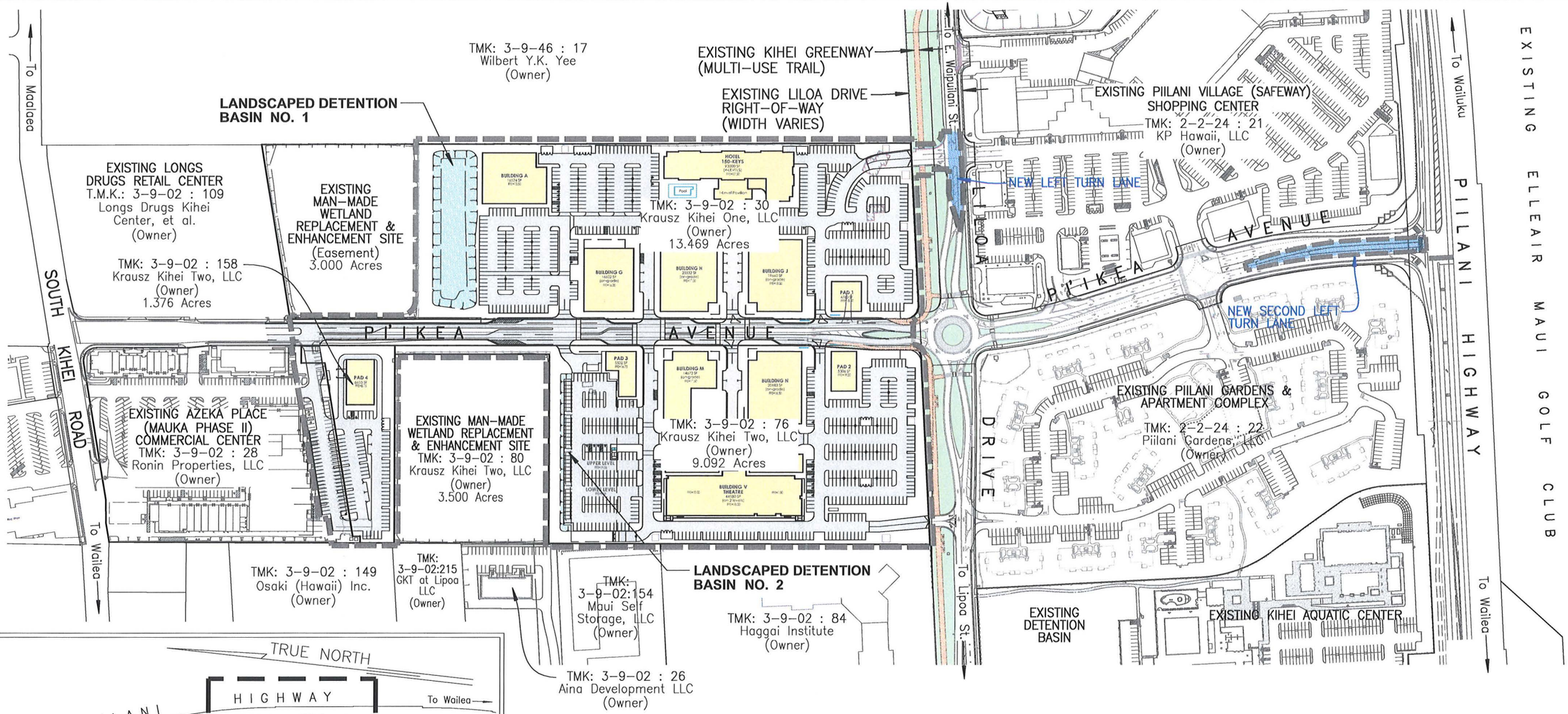

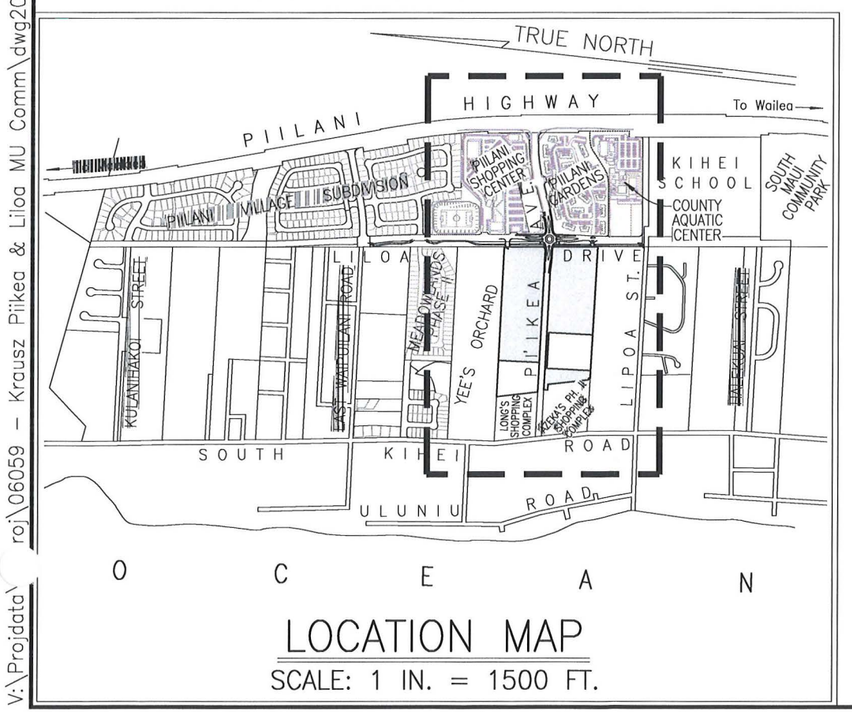

LOCATION MAP

SCALE: 1 IN. = 1500 FT.

LEGEND:

- NEW PAVEMENT AREA
- PROPOSED BUILDINGS
- PROPOSED OFFSITE ROADWAY IMPROVEMENTS
- EXT'G ROUNDABOUT AND KIHEI BIKEWAY
- APPROXIMATE LIMITS OF PROJECT

EXHIBIT 1 - PROJECT LOCATION MAP & SITE PLAN (2 OF 2)

0 250 500 750 1000

SCALE: 1 IN. = 250 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

July 20, 2012

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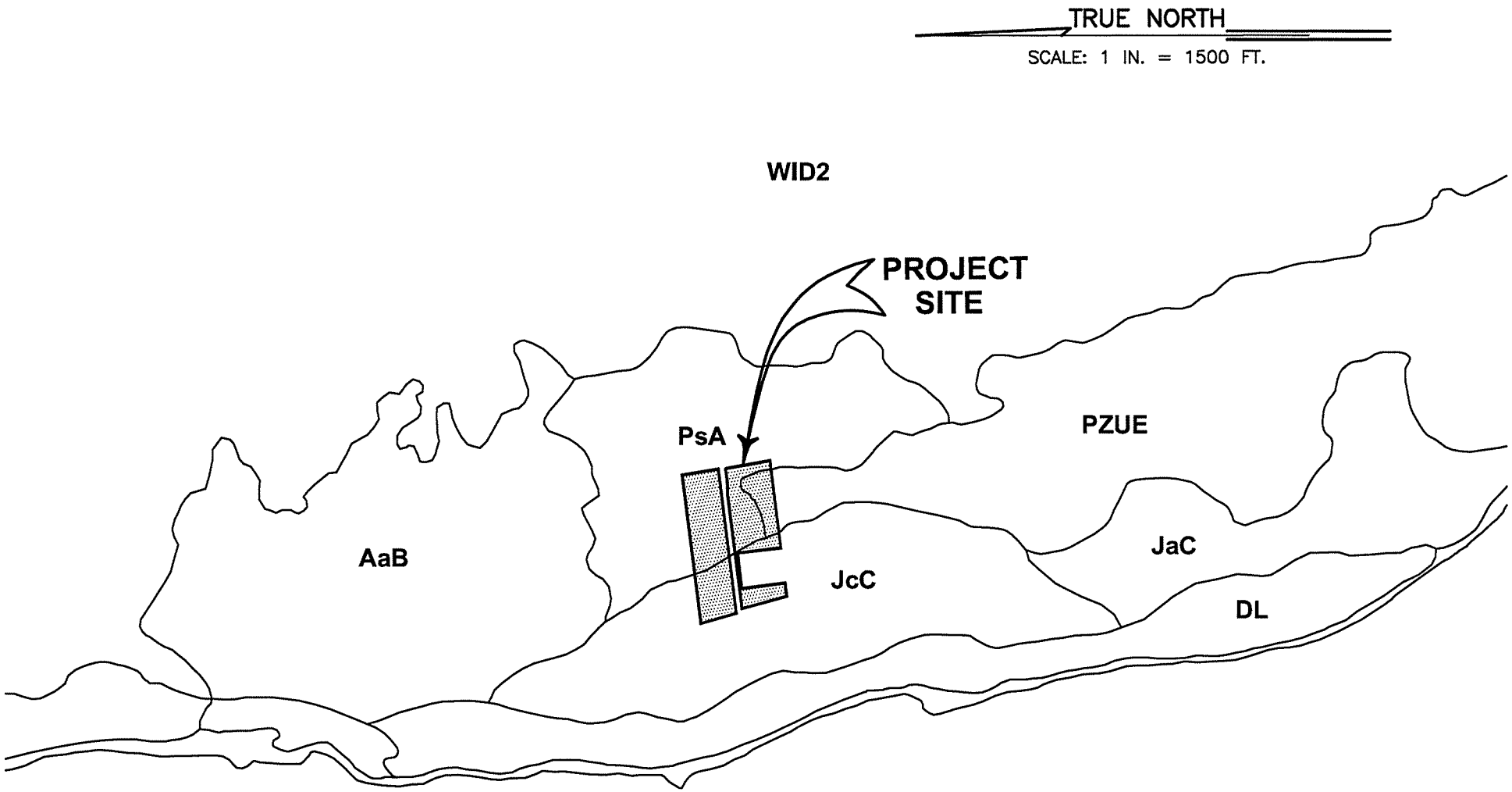

EXHIBIT 2 - SOIL CLASSIFICATION MAP

0 1500 3000 4500 6000

SCALE: 1 IN. = 1500 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

May 17, 2012

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TRUE NORTH
SCALE: 1 IN. = 600 FT.

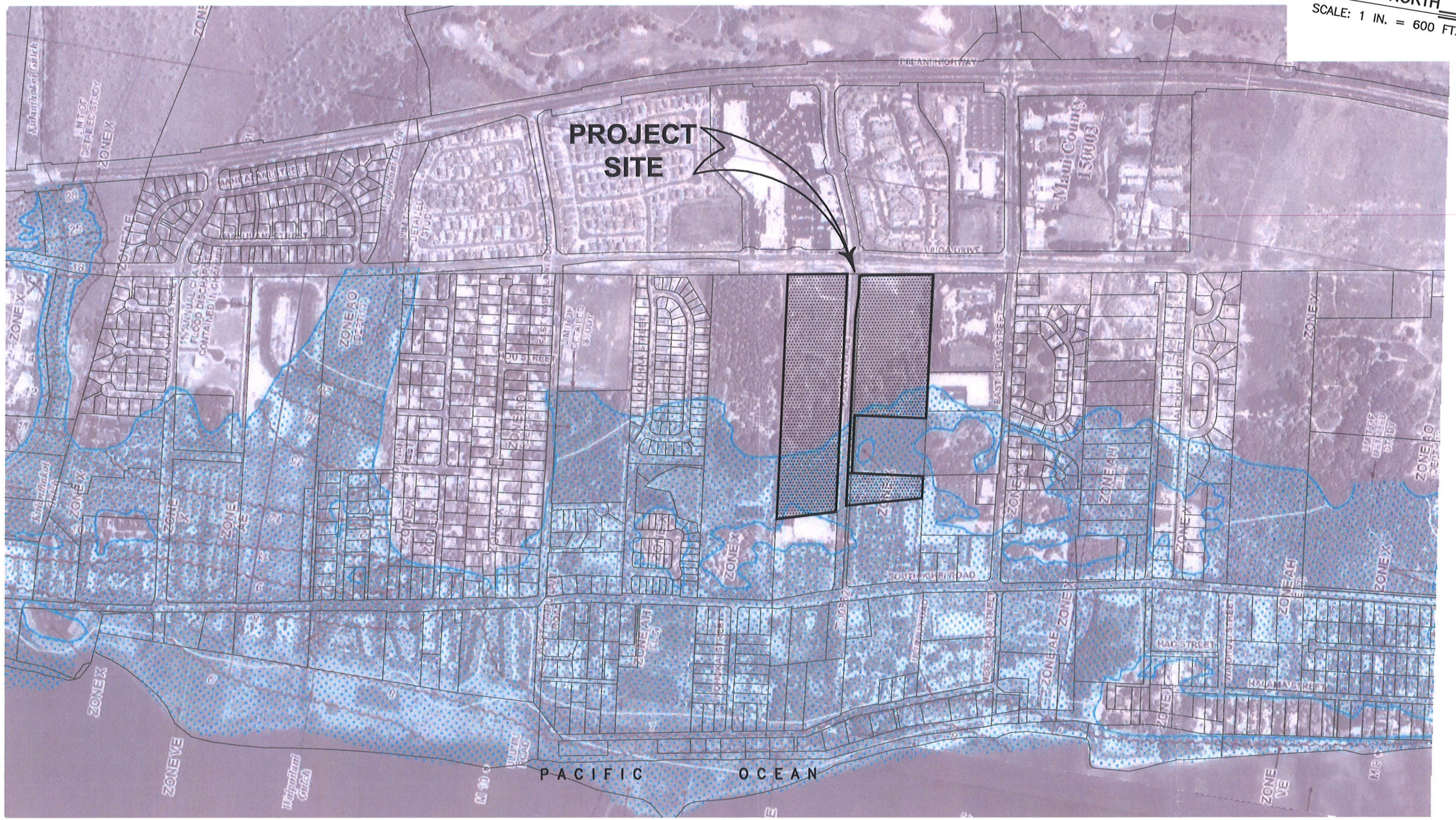

EXHIBIT 3 - FLOOD INSURANCE RATE MAP

0 600 1200 1800 2400

SCALE: 1 IN. = 600 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

May 17, 2012

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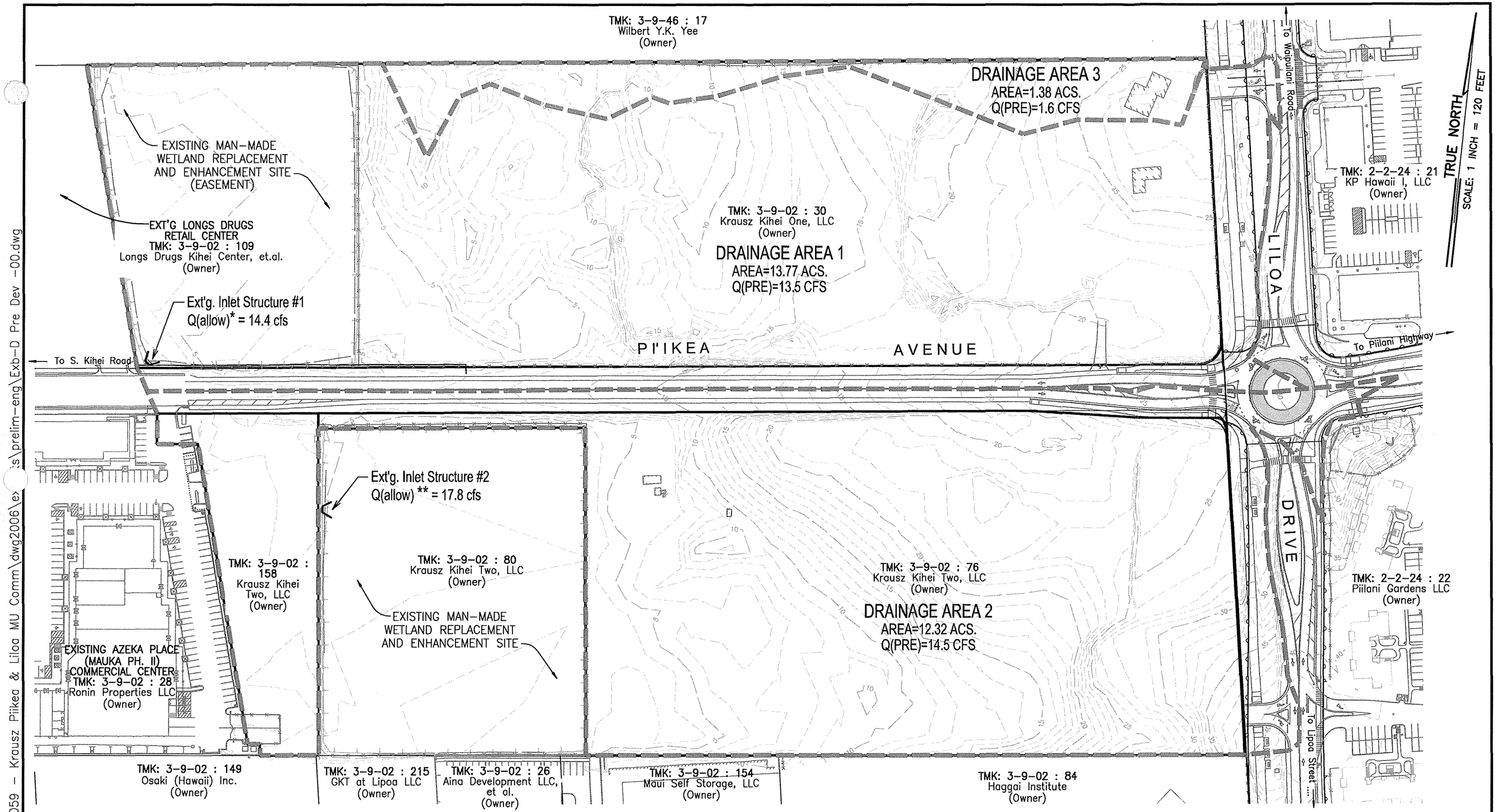

EXHIBIT 4 - PRE-DEVELOPMENT DRAINAGE AREA MAP

NOTE:

* ALLOWABLE Q FOR EXT'G. DRAINAGE INLET STRUCTURE #1 IS TAKEN FROM THE "DRAINAGE AND SOIL EROSION CONTROL REPORT FOR LONGS DRUGS-RETAIL BUSINESS CENTER," PREPARED BY WARREN S. UNEMORI ENGINEERING, INC. (MARCH 1989), BASED ON A 10 YEAR, 1 HOUR STORM.

** ALLOWABLE Q FOR EXT'G. DRAINAGE INLET STRUCTURE #2 IS TAKEN FROM THE "DRAINAGE AND SOILS EROSION REPORT FOR AZEKA PLACE COMMERCIAL CENTER," PREPARED BY WARREN S. UNEMORI ENGINEERING, INC. (FEB. 1989) BASED ON A 50 YEAR, 1 HOUR STORM.

0 120 240 360 480

SCALE: 1 IN. = 120 FT.

LEGEND:

- 300 — EXISTING GRADE W/ ELEVATION
- EXISTING DRAINAGE AREAS BOUNDARIES
- EXISTING FLOW DIRECTION

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

May 17, 2012

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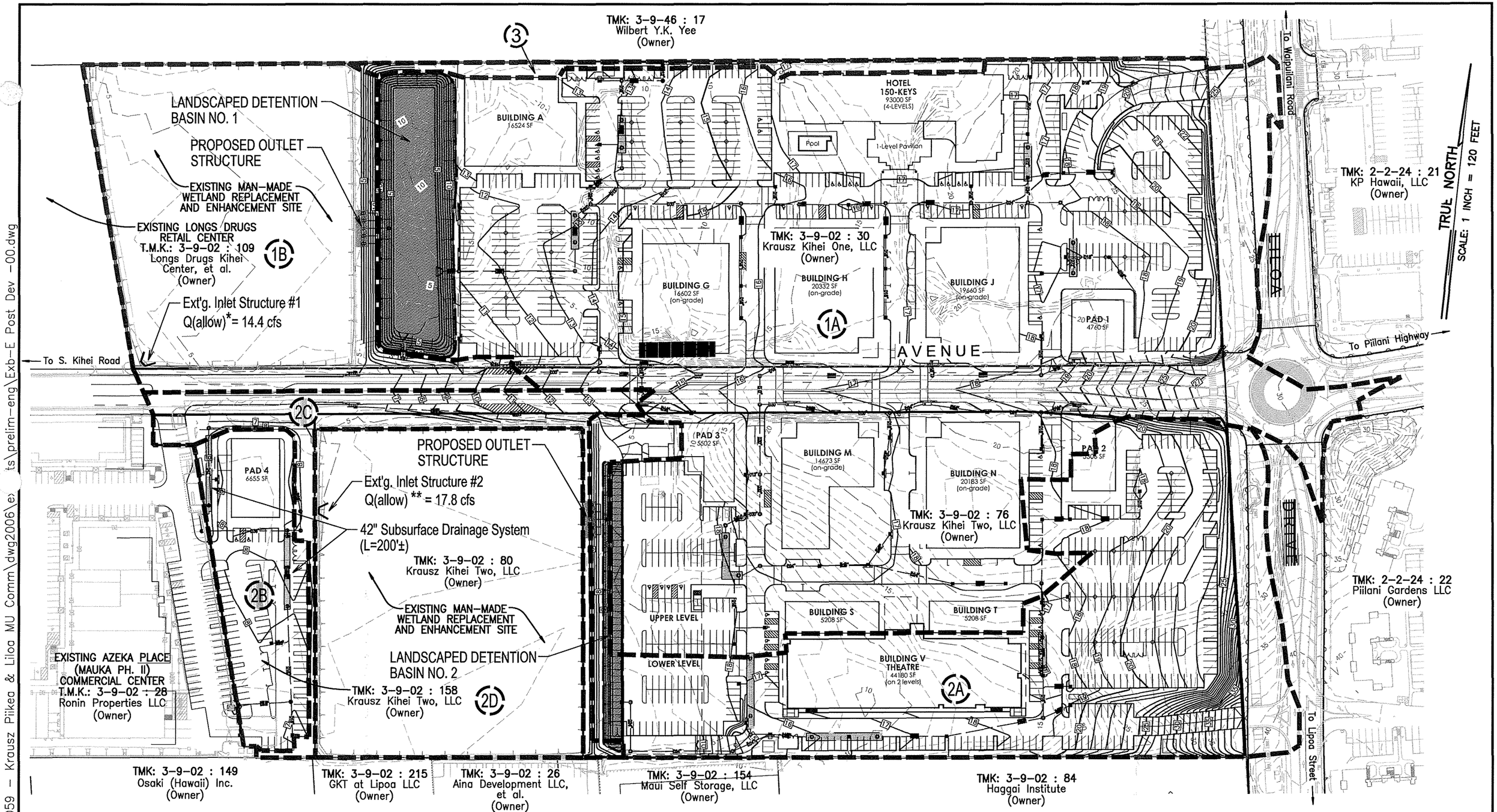

EXHIBIT 5 - CONCEPTUAL POST-DEVELOPMENT DRAINAGE AREA MAP

LEGEND:

- — 10 — — EXISTING GRADE W/ ELEVATION
- —— 10 —— FINISH GRADE W/ ELEVATION
- DRAINAGE AREAS BOUNDARIES
- (1) DRAINAGE AREA ID'S
- FLOW ARROWS

NOTE:

* ALLOWABLE Q FOR EXT'G. DRAINAGE INLET STRUCTURE #1 IS TAKEN FROM THE "DRAINAGE AND SOIL EROSION CONTROL REPORT FOR LONGS DRUGS-RETAIL BUSINESS CENTER," PREPARED BY WARREN S. UNEMORI ENGINEERING, INC. (MARCH 1989), BASED ON A 10 YEAR, 1 HOUR STORM.

** ALLOWABLE Q FOR EXT'G. DRAINAGE INLET STRUCTURE #2 IS TAKEN FROM THE "DRAINAGE AND SOILS EROSION REPORT FOR AZEKA PLACE COMMERCIAL CENTER," PREPARED BY WARREN S. UNEMORI ENGINEERING, INC. (FEB. 1989) BASED ON A 50 YEAR, 1 HOUR STORM.

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SCALE: 1 IN. = 120 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

April 26, 2012

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APPENDIX B

Preliminary Subsurface Investigation Report

FEWELL
GEOTECHNICAL
ENGINEERING, LTD.

Oahu Office
96-1416 Waihona Place
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FAX (808) 456-7062
E-mail: fge@fgeltd.com

Maui Office
360 Papa Place, Suite 103
Kahului, Hawaii 96732-2464
(808) 873-0110
FAX (808) 873-0906

PRELIMINARY SUBSURFACE INVESTIGATION REPORT PIIKEA-LILAO COMMERCIAL MIXED-USE PROJECT KIHEI, MAUI, HAWAII T.M.K. NO.: 3-9-02: 30, 76 AND 158

for

THE KRAUSZ COMPANIES, INC.

by

FEWELL GEOTECHNICAL ENGINEERING, LTD.

SEPTEMBER 30, 2008

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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File 2714.01
September 30, 2008

The Krausz Companies, Inc.
44 Montgomery Street, Suite 3300
San Francisco, California 94104

Attention: Mr. David Pyle
Vice President

Subject: **Preliminary Subsurface Investigation Report**
Piikea-Lilao Commercial Mixed-Use Project
Kihei, Maui, Hawaii
T.M.K. No.: 3-9-02: 30, 76 and 158

We have completed a preliminary subsurface investigation for the site of the proposed Piikea-Lilao Commercial Mixed-Use Project in Kihei, Maui, Hawaii. This report summarizes our findings and conclusions. This work was completed in general accordance with our November 21, 2006 Proposal and your November 28, 2006 authorization to proceed.

The start of the fieldwork for the investigation was initially delayed until July 2007, pending the clearance of access to the proposed boring locations by others. In accordance with our previous discussions with The Krauss Companies, the investigation was then temporarily placed on hold pending the resolution of other matters regarding the site. The work resumed in July 2008 after notification from Warren S. Unemori Engineering Inc. (WSUE), the Project Civil Engineer that the work was resuming.

This report addresses the originally planned construction indicated in the November 13, 2006 Conceptual Plans. However, from our discussions with WSUE, we understand that the originally planned construction may be completely revised in the near future. This report summarizes the general subsurface conditions at the site, the ramifications of the soil conditions on the currently planned construction, and provides general geotechnical guidelines for the geotechnical aspects of the project's design and construction. A final

design level investigation should be completed, with additional test borings and laboratory testing, after more detailed plans for the site are developed.

Project Considerations – The November 13, 2006 Conceptual Site Plan by Perkowitz+Ruth Architects, the Project Architect, indicates that the proposed site of the Piikea-Lilao Commercial Mixed-Use Project includes 3 lots on the western (downhill) side of Lilao Drive, and on both sides of Piikea Avenue in Kihei. The general area is shown on the Project Location Map, Figure 1 in Appendix A.

The site covers a combined total area of about 26 acres. The largest lot of the parcel is on the northern side of Piikea Avenue and covers a total area of about 15.5 acres. The westernmost, approximately 4 acres of this lot, is used as a storm water detention basin, and we understand, is designated as a wetland area. The remaining 2 lots of the parcel are on the southern side of Piikea Avenue and cover areas of about 9.1 and 1.4 acres. These 2 lots are separated by another designated wetland area. The 1.4-acre lot is on the western side of the wetlands area with the 9.1-acre lot on the eastern side.

The existing topography within the parcel generally slopes down gently toward the west at an estimated average gradient of about 5 percent. The August 24, 2007 Topographic Survey Map by WSUE indicates that the ground surface elevations range from about Elev. 38 in the southeastern corner of the site, adjacent to Lilao Drive, down to about Elev. 5 along the western edge of the 1.4-acre lot.

The eastern, uphill portion of the site is covered with knee-high grass and occasional bushes. The portions of the properties immediately east of the existing wetlands are heavily overgrown with dense trees and bushes. The 1.4-acre lot, immediately west of the wetlands on the southern side of Piikea Avenue, is relatively level and covered with short, sparse grass.

The 2006 Conceptual Plan indicates that the development will include commercial shops, offices, townhouses, and apartments, and their associated parking areas. The commercial shops and offices are planned in the eastern half of the site. These buildings will be constructed along both the northern and southern edges of the property and along both sides of Piikea Avenue, which will be widened as part of the overall development.

The townhouse and apartment buildings are planned just east of the wetlands on both sides of Piikea Avenue. We understand that the new construction will maintain minimum horizontal setbacks of at least 20 feet from the edge of the wetland areas.

The preliminary concepts indicate that the new structures will vary from one to three stories in height. The structures are anticipated to use concrete slab-on-grade lower floors. Although no loading information is currently available, we have assumed that the

column and wall loads of the structures will not exceed 60 kips and 3 kips per foot, based on our experience with similar-sized structures.

No detailed grading information has been developed at this preliminary stage. However, we understand that site grading will likely be limited to cuts and fills of less than 5 feet in depth and thickness, respectively. Both graded slopes and retaining walls are anticipated to support the grade differences resulting from the site grading.

Preliminary Subsurface Investigation – Five test borings were drilled on July 5 and 6, 2007 at the approximate locations shown on the attached Site and Boring Location Plan, Figure 2 in Appendix A. The borings were drilled to depths of 8 to 20 feet below the existing ground surface using a Mobile B–34 truck-mounted drilling rig advancing 4-inch diameter continuous flight augers, wash boring equipment, and NX coring tools. The materials encountered in the borings are shown on the Boring Logs, Figures 3 through 7 in Appendix A. A Boring Log Legend is included as Figure 8.

Relatively undisturbed samples of the subsurface soils were obtained at selected depths with a 3.0-inch O.D. split-spoon sampler, and a 2.0-inch O.D. Standard Penetration Test (SPT) split-spoon sampler. Both samplers were driven by a 140-pound hammer falling 30 inches. The number of blows required to advance the sampler the final 12 inches into the soil mass was recorded and is shown on the Boring Logs. The blow counts of the 3.0-inch diameter sampler have not been converted to equivalent SPT blow counts.

Laboratory Atterberg Limits and gradation tests were performed on samples obtained from the borings to assist in the classification of the soils. A Laboratory California Bearing Ratio (CBR) test was performed on a recompacted bulk sample of the predominant near-surface soils to evaluate its recompacted expansion potential and pavement support characteristics. The results of the laboratory tests are shown on the Boring Logs, where appropriate, and are summarized in Table I in Appendix B. Selected test results are shown on Figures 9 through 15 in Appendix B.

General Subsurface Conditions – The test borings indicate that site is underlain by 2 general subsurface conditions. Borings 2, 4, and 5 indicate that the majority of the higher, eastern portion of the site is generally underlain by 0 to 3 feet of alluvial (water-deposited) soils over weathered gravel-sized volcanic rock fragments, or Aa clinker, which extend to depths of between 4 and 8½ feet below the existing ground surface. In Boring 5, the weathered clinker was encountered at the ground surface.

The weathered clinker is underlain by intact basalt, which extends to the bottom of Borings 2 and 4, and to a depth of 7½ feet in Boring 5. In Boring 5, an approximately 18-inch thick void was encountered in the basalt at a depth of 7½ feet. The void was underlain by clinker, which extends to the bottom of this boring.

Boring 1, which was drilled immediately east of the wetlands area in the northern half of the site, encountered about 6 inches of fill, which was generated by the clearing operations required to access the boring location. The fill is underlain by about 14 feet of beach sands over the weathered clinker and basalt. The basalt extends to the bottom of the boring at a depth of 20 feet below the existing ground surface. Boring 3, which was drilled immediately west of the wetland in the southern half of the site, found about 5 feet of previously placed fill over beach sands which extend to the bottom of this boring at a depth of 10 feet.

The fill encountered in Boring 3 generally consists of silty sands, which are classified as SM soils under the Unified Soil Classification (USC) system. The fill generally exhibits dense relative densities, which typically suggest high shear strengths. The fill appeared to have been adequately compacted at the location of Boring 3.

The beach sands generally consist of poorly graded sands and silty sands, which are classified as SP and SM soils under the USC. The sands generally exhibit medium dense relative densities, which indicate moderate shear strengths and compressibility.

The alluvium generally consists of moderately plastic silty clays with sand and gravel. These soils exhibit Liquid Limits (LL's) of 45 to 46 and Plasticity Indices (PI's) of 20 to 21 and are classified as CL soils under the USC. Laboratory swell tests performed on relatively undisturbed samples of the alluvial clay indicated low swells of between 0.1 and 1.3 percent when tested at their in-situ moisture content under a 100 pounds per square foot (p.s.f.) surcharge load. The alluvial soils exhibit hard consistencies, which suggest relatively high shear strengths and low compressibility.

The weathered clinker generally consists of dense to very dense silty sands with gravel and is classified as an SM soil under the USC. The clinker encountered below the void at a depth of about 9 feet in Boring 5, consists of poorly graded gravel-sized rock fragments and is classified as a GP soil under the USC. Based on its high relative densities, the clinker likely possesses moderate to high shear strengths and low compressibility. A laboratory bearing ratio test performed on a re-molded sample of the silty sand clinker indicates a California Bearing Ratio (CBR) of 15 with 0.6 percent swell when recompacted to at least 95 percent of its maximum dry density at its optimum moisture content.

Intact basalt was found in all of the borings, except Boring 3, at depths ranging from 4 to 17½ feet below the existing ground surface. In general, the basalt appeared shallower in the southern side of the site, as indicated by Borings 4 and 5, and deeper in the northern side of the site as shown in Borings 1 and 2. The basalt is generally moderately to slightly weathered and occasionally broken. The basalt is medium hard to hard.

Groundwater was encountered at depths of about 8 and 5 feet in Borings 1 and 3, respectively, which were drilled adjacent to the wetland areas. These depths correspond to between about Elev. 0 to Elev. 2 and appeared to correspond to the water levels in the adjacent wetlands. Groundwater was not encountered in the remaining borings of this investigation.

Discussion and Conclusions – The findings of the preliminary investigation indicate that the site is generally underlain by relatively competent beach sands or alluvium over weathered clinker and intact basalt. No highly compressible, highly expansive, or inherently weak soils were encountered in any of the borings.

The current preliminary design schemes indicate that a setback of 20 feet will be maintained between the edges of the existing wetlands and the site grading and new construction. At this distance, we do not anticipate that the wetlands will be affected by the site grading or the new construction from a geotechnical engineering viewpoint. Nor do we anticipate that the materials within the wetlands will significantly impact the geotechnical aspects of the site grading and new construction.

About 5 feet of fill was encountered in Boring 3, which was drilled in the lower, 1.4-acre lot on the western side of the wetland area on the southern side of Piikea Avenue. While the fill encountered in the boring exhibited dense relatively densities and appeared adequately compacted, pockets of loose, uncompacted fill are potentially present within the fill.

To densify the fill and detect any potential pockets of loose, uncompacted fill, areas designated to receive the new construction within this portion of the site should be proof-rolled with a large, vibratory compactor prior to the start of the grading operations. Similarly, the beach sands encountered in the lower, western portion of the site in the 15.5-acre lot on the northern side of Piikea Avenue should be proof-rolled to densify potentially loose pockets of the near-surface sands.

The majority of the site's shallow excavations within the alluvium, beach sands, and weathered clinker, can likely be completed using relatively standard heavy earthmoving equipment. Excavations within these materials will likely generate predominantly low expansion, 3-inch minus materials, which are suitable for re-use as fill provided all organics and other deleterious materials are removed and they are properly placed and compacted.

Basalt was encountered at depths as shallow as 4 feet below the existing ground surface in the test borings. The basalt is generally hard and occasionally broken and will be difficult to excavate. The use of heavy rock excavating equipment should be anticipated

to facilitate the removal of the basalt in deeper cut areas, and similarly deeper site excavations such as utility trenches.

The excavations within the basalt will likely generate large, boulder-sized rock fragments, which are unsuitable for re-use as fill in the shallow fills anticipated at the site. Significant crushing and screening of the excavated basalt should be anticipated prior to its re-use as fill.

Groundwater was encountered in 2 of the borings, which were drilled in the lower, western portions of the site, at depths corresponding to between about Elev. 0 and Elev. 2. Dewatering should be anticipated for utility trenches and similar site excavations approaching these levels.

We believe that the on-site materials will generally provide relatively good support for the new residential and commercial structures using relatively standard shallow foundation systems. Foundations bearing within the sand fills in the lower, 1.4-acre lot south of Piikea Avenue, and within the beach sands encountered in the lower, western portion of the 15.5-acre lot north of Piikea Avenue, can likely be designed for allowable bearing pressures of between 1,500 p.s.f. and 2,000 p.s.f. Minimum footing widths and embedment depths of 18 inches should be anticipated for foundation bearing on these materials.

The on-site beach sands encountered in the lower, western portion of the site possess little or no binder. The use of forms should be anticipated for the footing excavations within these soils to prevent caving of the excavation sidewalls into the footing bearing levels. The use of shoring and bracing should be anticipated for deeper excavations in the beach sands.

Foundations bearing on the alluvium and weathered clinker, or fills constructed with these materials, can likely be designed for allowable bearing pressures of between 2,500 p.s.f. and 3,500 p.s.f. with reduced minimum embedment depths of between 12 and 18 inches. Foundations bearing entirely upon basalt can likely be designed for higher allowable bearing pressures of 6,000 p.s.f. to 8,000 p.s.f.

An 18-inch deep void was encountered within the basalt at a depth 7½ feet below the existing ground surface in Boring 5, which was drilled near the southwestern corner of the site. Foundation probing may be required for foundations bearing within the basalt layer, to evaluate the presence of voids beneath the future building areas.

Based on the assumed maximum column and wall loads of 60 kips and 3 kips per foot, respectively, estimated maximum total and differential settlements of less than ½ inch are anticipated.

The majority of the on-site soils exhibit low expansion potentials. Overexcavation of expansive soils, and subsequent replacement with low expansion fill, is not anticipated beneath concrete slabs-on-grade throughout most of the site. However, although the moderately plastic alluvial clays are anticipated to exhibit low expansion, pockets of moderately expansive soils are not uncommon within alluvial formations. Occasional overexcavation and replacement of expansive soils may be required in localized areas.

The on-site soils should also generally provide adequate support for retaining walls of up to 10 feet in height. Retaining wall foundations can likely be designed for maximum toe pressures of up to 2,500 p.s.f. for foundations supported on the sand fills or beach sands, and maximum toes pressures of about 4,000 p.s.f. for retaining wall foundations supported on the weathered clinker.

Where used as backfill behind retaining walls, the on-site beach sands and weathered clinker will likely exert active and at-rest lateral earth pressures of about 35 and 55 pounds per cubic foot (p.c.f.), respectively, equivalent fluid pressure.

For foundation lateral support, foundations bearing on the beach sands and clinker can be designed for an estimated friction factor of 0.50. Foundations bearing entirely upon basalt may use a friction factor of 0.60. These soils should also provide passive lateral resistance of about 275 p.c.f. to 300 p.c.f. equivalent fluid pressure for yielding walls. Passive resistance should be disregarded for non-yielding walls, for walls founded within 5 feet of the top of slopes, and for the upper 12 inches of footing embedment.

Permanent fill slopes constructed with the on-site soils can likely be sloped as steep as 2 Horizontal to 1 vertical (2H:1V) for slopes up to 10 feet in height. Permanent cut slopes within the weathered clinker can likely be sloped as steep as 1.5H:1V for heights of up to 10 feet without benches. Slopes exceeding these heights are not anticipated on this project and should be individually evaluated, should they occur.

The on-site alluvial soils, weathered clinker, beach sands, and basalt should provide relatively good pavement support. For the asphalt-paved driveways and parking areas restricted from heavy truck traffic, a pavement section consisting of 2 inches of Asphalt Concrete over 6 inches of Aggregate Base Course should provide adequate pavement support for the anticipated light traffic of passenger vehicles and small pick up trucks. In areas subjected to heavy truck traffic, the Asphalt Concrete thickness will likely need to be increased to at least 3 inches, depending on the actual design traffic anticipated.

Limitations – This preliminary report has been prepared for the exclusive use of **The Krausz Companies, Inc.** for the **Piikea-Lilao Commercial Mixed-Use Project** in Kihei, Maui, Hawaii. In the preparation of this report, we have strived to perform our

services in a manner consistent with that level of care and skill ordinarily exercised by members of the geotechnical profession practicing under similar conditions in Hawaii. No other warranty, expressed or implied, is made.

Our services for this project were limited to reviewing the available soils information for the general area and drilling five test borings to develop preliminary geotechnical guidelines to assist in the site evaluation and cost estimating purposes. A full-scale subsurface investigation should be completed for the actual design and construction of the project once more detailed design information is available. This report should not be used for the final design and construction of the proposed building without written confirmation from Fewell Geotechnical Engineering, Ltd. (FGE).

The analysis, conclusions, and preliminary recommendations of this report are based in part upon the limited data obtained in the borings and upon the assumption that the soil conditions do not deviate from those observed. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that planned at the present time, FGE should be notified so that supplemental recommendations can be given. The conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing.

The scope of work for this investigation was limited to conventional geotechnical services and did not include any environmental evaluations or assessments. Silence in the report regarding any environmental aspects of the site does not indicate the absence of potential environmental problems.

Unanticipated soil conditions are commonly encountered and cannot be fully determined by soil samples, test borings, or test pits. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. Some contingency funds are recommended to accommodate such potential extra costs.

The boring locations were determined in the field based on measurements from existing physical features. The boring elevations were estimated from the August 24, 2007 Topographic Survey Map by WSUE. The locations and elevations of the borings should be considered accurate only to the degree implied by the methods used.

Groundwater was encountered in Borings 1 and 3 during this investigation at the depths and times indicated on the Boring Logs. Groundwater was not encountered in the remaining three borings of this investigation. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, tides, seepage, and other factors not present at the time the measurements were made.

We appreciate the opportunity to be of service to you on this project. Should you have any questions pertaining to any aspect of this report, or if we can be of further assistance to you, please do not hesitate to contact us.

Respectfully submitted,

FEWELL GEOTECHNICAL ENGINEERING, LTD.

By Timothy J. Cavanaugh P.E.

/tjc:ajs:fse

Attachments

TIMOTHY J. CAVANAUGH
LICENSED PROFESSIONAL ENGINEER
No. 6619-C
HAWAII, U.S.A.

APPENDIX A

Preliminary Subsurface Investigation Summary

Project Designation: Piikea-Lilao Commercial Mixed-Used Project **File:** 2714.01

Location: Kihei, Maui, Hawaii

Project Location Map: Figure 1

Boring Location Plan: Figure 2

Drilling Contractor: Hawaii Test Borings, Inc.

Drilling Equipment: Mobile B-34

Drilling Method: /x/ 4-inch Auger / / HQ Core
/ / 5-inch Auger /x/ NX Core
/ / Wash

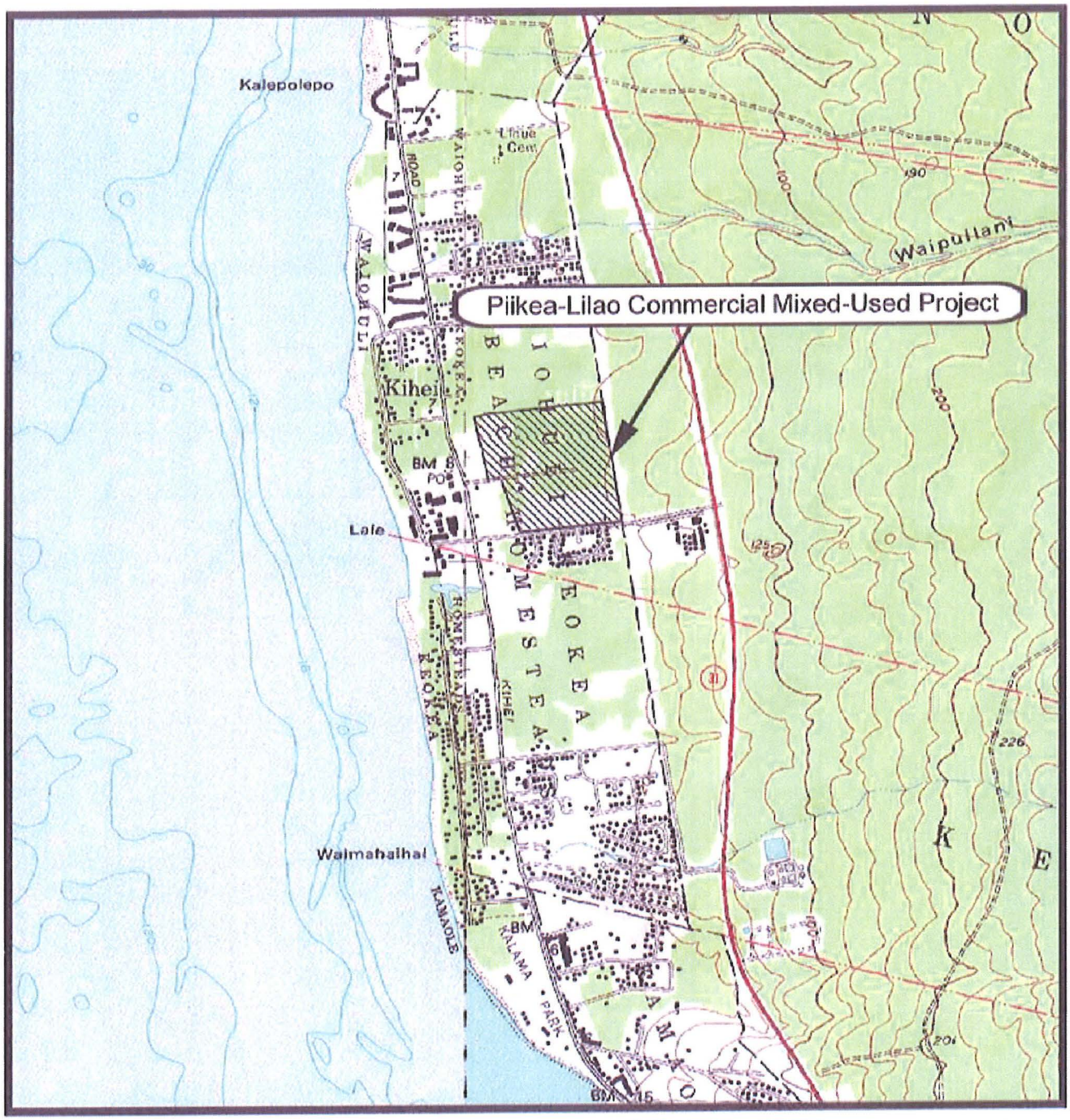
Boring Summary:

Boring	Depth	Number of Samples	Length of NX Core	Depth to Water Table	Boring Log Figure No.
1	20.0′	6	2.5′	8.0′	3
2	13.5′	5	5.0′	N.E.	4
3	10.0′	4	0.0′	5.0′.	5
4	8.0′	2	3.0′	N.E.	6
5	8.0′	2	5.0′	N.E.	7
Totals	59.5′	19	15.5′		

Date Started: July 5, 2007 **Date Completed:** July 6, 2007

N.E. = None Encountered

Boring Log Legend 8



LEGEND:

PROJECT LOCATION

SCALE: 1:24000

GENERAL AREA:
KIHEI, MAUI, HAWAII

REFERENCE:
KIHEI QUADRANGLE
U.S.G.S. TOPOGRAPHIC MAP

F.G.E. Ltd.

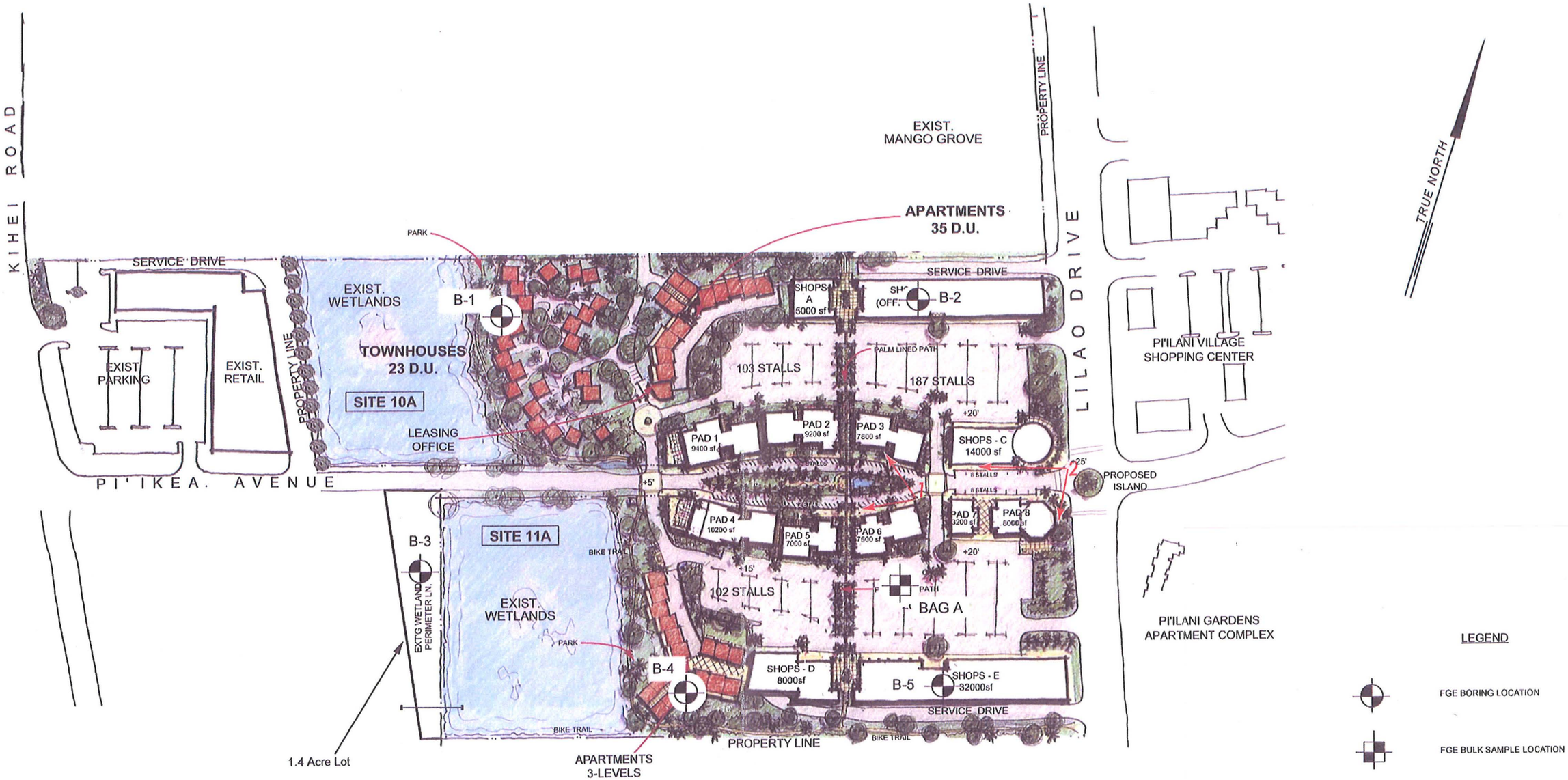
PROJECT LOCATION MAP

Piikea-Lilao Commercial Mixed-Used Project
Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 1



REFERENCE: PLAN PROVIDED BY WARREN S. UNEMORI ENGINEERING, INC. (EMAIL RECEIVED ON 11/13/2006)

F.G.E. Ltd.
99-1410 WAIHONA PLACE PEARL CITY HAWAII 96782-1973

FEWELL GEOTECHNICAL ENGINEERING, LTD.

SITE AND BORING LOCATION PLAN

PIIKEA-LILAO COMMERCIAL MIXED-USED PROJECT

KIHEI, MAUI, HAWAII

FILE: 2714.01 September 2008

FIGURE 2

F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

Boring: 1 **File:** 2714.01
Project: Piikea-Lilao Commercial Mixed-Used Project
Location: Kihei, Maui, Hawaii **Project Engineer:** TJC
Surface Elevation: 10' ± **Field Engineer:** MA
Depth to Water: 8.0'(2:30PM on 7/5/07) **Drafted by:** MA
Date Completed: 7-5-07 **Date of Drawing:** September 2008

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT.	SAMPLE	DEPTH	CLASSIFICATION
						Tan Silty SAND (SP) with roots and wood debris, loose, dry **(FILL)**
Gradation: 0% Gravel 96% Sand 4% Silt			30	1		Tan Silty SAND (SP), medium dense, dry
	5	86	45	2	5	
	11		28	3		
	19		24	4	10	At 8.5', grades to saturated
						(BEACH SAND)
Gradation: 37% Gravel 34% Sand 29% Silt			22	5	15	Brown Silty GRAVEL (GM) with sand, medium dense, saturated
						(WEATHERED CLINKER)
			33/3" REC=100% RQD=13%	6 NX-1	20	Gray Slightly Weathered Slightly Vesicular BASALT (WS), hard, very broken.
						BOH @ 20.0'
					25	
					30	
					35	

Figure 3

F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

Boring: 2
Project: Piikea-Lilao Commercial Mixed-Used Project
Location: Kihei, Maui, Hawaii
Surface Elevation: 24' ±
Depth to Water: None Encountered
Date Completed: 7-6-07

File: 2714.01
Project Engineer: TJC
Field Engineer: AAC/MA
Drafted by: MA
Date of Drawing: October 2008

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT.	SAMPLE	DEPTH	CLASSIFICATION
LL=45, PI=21 1.3% Swell Swell Index =0.25 Gradation: 27% Gravel 49% Sand 24% Silt	17	87	80 37/4" 50/10" 100/7" 8/0" REC=100% RQD=42%	1 2 3 4 5 NX-1	5 10 15 20 25 30 35	Brown Silty CLAY (CL) with Sand and Gravel, hard, dry **(ALLUVIUM)** Brown Silty SAND (SM) with Gravel, very dense, dry **(WEATHERED CLINKER)** Gray Moderately to Slightly Weathered BASALT (WM-WS), hard, occasionally broken **BOH @ 13.5'**

Figure 4

F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

Boring: 3 **File:** 2714.01
Project: Piikea-Lilao Commercial Mixed-Used Project
Location: Kihei, Maui, Hawaii **Project Engineer:** TJC
Surface Elevation: 5' ± **Field Engineer:** MA
Depth to Water: 5.0'(11:30AM on 7/5/07) **Drafted by:** MA
Date Completed: 7-5-07 **Date of Drawing:** October 2008

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT.	SAMPLE	DEPTH	CLASSIFICATION
						Dark Brown Silty SAND (SM), dense, dry
	30	95	58	1		
Gradation: 6% Gravel 76% Sand 18% Silt			70	2		(FILL)
					5	Tan Silty SAND (SM), medium dense, saturated
	26	101	44	3		
	22	105	37	4		(BEACH SAND)
					10	BOH @ 10.0'
					15	
					20	
					25	
					30	
					35	

Figure 5

F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

Boring: 4
Project: Piikea-Lilao Commercial Mixed-Used Project
Location: Kihei, Maui, Hawaii
Surface Elevation: 8' ±
Depth to Water: None Encountered
Date Completed: 7-6-07

File: 2714.01
Project Engineer: TJC
Field Engineer: AAC/MA
Drafted by: MA
Date of Drawing: October 2008

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT.	SAMPLE	DEPTH	CLASSIFICATION
LL=46, PI=20			32	1		Brown Silty CLAY (CL), some Sand and trace Gravel, hard, damp **(ALLUVIUM)**
0.1% Swell Swell Index =0.03	21	89	40/3" R	2	5	Brown Silty SAND (SM) with gravel, dense, dry **(WEATHERED CLINKER)**
			REC=83% RQD=33%	NX-1		Gray Moderately Weathered Vesicular BASALT (WM), hard, occasionally broken.
						BOH @ 8.0'
					10	
					15	
					20	
					25	
					30	
					35	

Figure 6

F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

Boring: 5 **File:** 2714.01
Project: Piikea-Lilao Commercial Mixed-Used Project
Location: Kihei, Maui, Hawaii **Project Engineer:** TJC
Surface Elevation: 22' ± **Field Engineer:** AAC/MA
Depth to Water: None Encountered **Drafted by:** MA
Date Completed: 7-6-07 **Date of Drawing:** September 2008

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT.	SAMPLE	DEPTH	CLASSIFICATION
Gradation: 16% Gravel 52% Sand 32% Silt			50/7"	1		Brown Silty SAND (SM) with Gravel, very dense, dry
			50/1"	2		**(WEATHERED CLINKER)**
			REC=70% RQD=26%	NX-1	5	Gray Slightly Weathered, Slightly Vesicular BASALT (WS), hard, occasionally broken
						Void
					10	Gray Moderately Weathered GRAVEL-sized Basalt Fragments (GP), very dense, damp
						BOH @ 10.0'
					15	
					20	
					25	
					30	
					35	

Figure 7

MAJOR ROCK TYPES

BASALT

TUFF

DECOMPOSED ROCK

CORAL

MAJOR SOIL TYPES

GRAVEL

SAND

SILT

CLAY

PEAT/ORGANICS

SECONDARY CLASSIFICATION

GRAVELLY

SANDY

SILTY

CLAYEY

SAMPLING SYMBOLS

3" O.D. Undisturbed Sample

3" O.D. Disturbed Sample

2" O.D. Standard Penetration Sample

No Recovery

Shelby Tube

Bag Sample

Core

Water Level

F.G.E. Ltd.

BORING LOG LEGEND

Piikea-Lilao Commercial Mixed-Used Project
Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 8

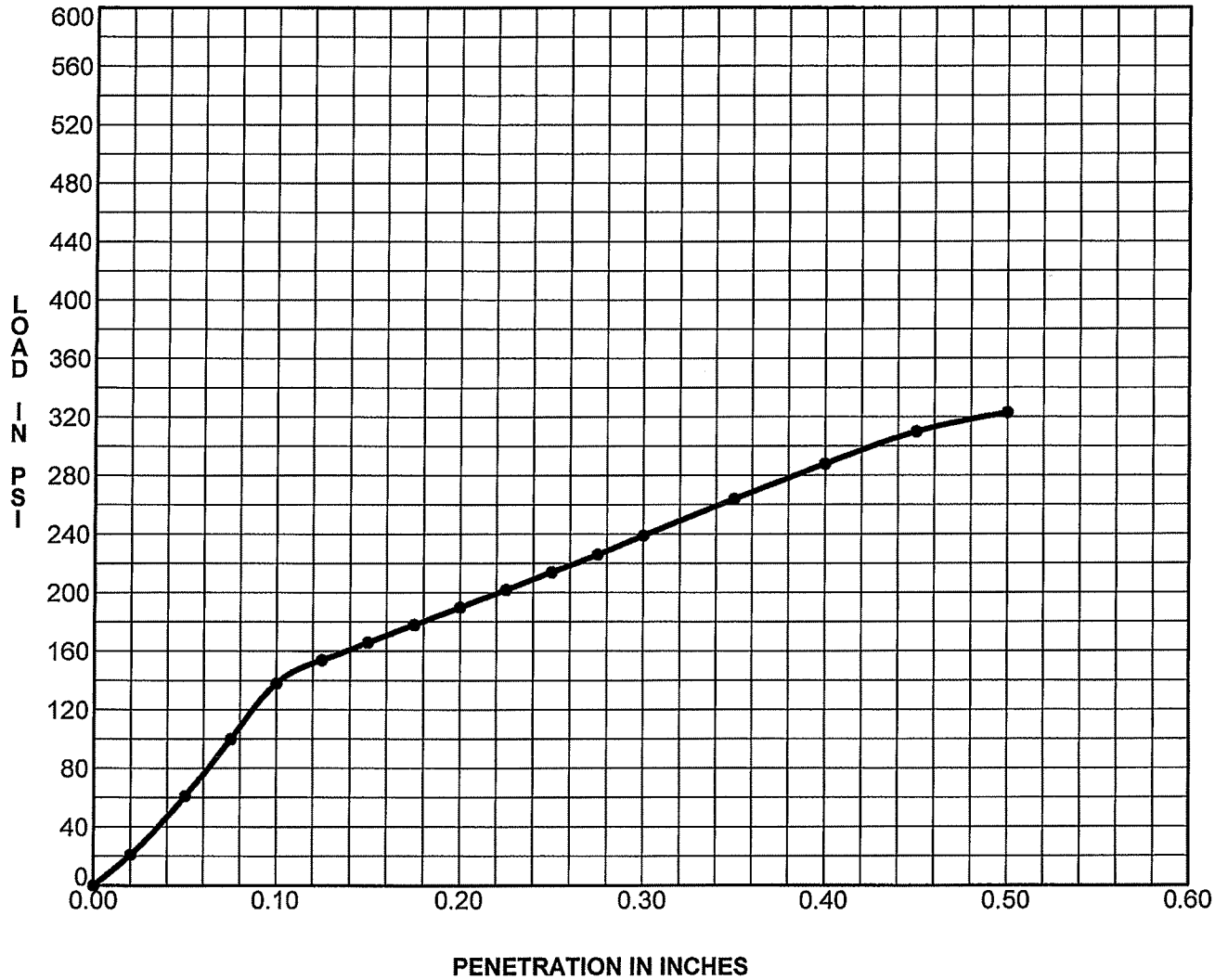
APPENDIX B

Laboratory Testing Summary

Project Designation: Piikea-Lilao Commercial Mixed-Used Project **File:** 2714.01

Location: Kihei, Maui, Hawaii

	Sample No.	Figure Designation
California Bearing Ratio:	A	9
Gradation Curves:	1-1	10
	1-5	11
	2-3	12
	3-2	13
	5-1	14
Plasticity Chart:	2-2	15
	4-1	15
	A	15



	Sample Identification	Classification	CBR	% Comp.	Max Den.	Opt. % MC	% Swell	LL	PI
●	A	Brown Silty SAND (SM)	15.0	96	107.0	19.0	0.6	NP	NP

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CALIFORNIA BEARING RATIO

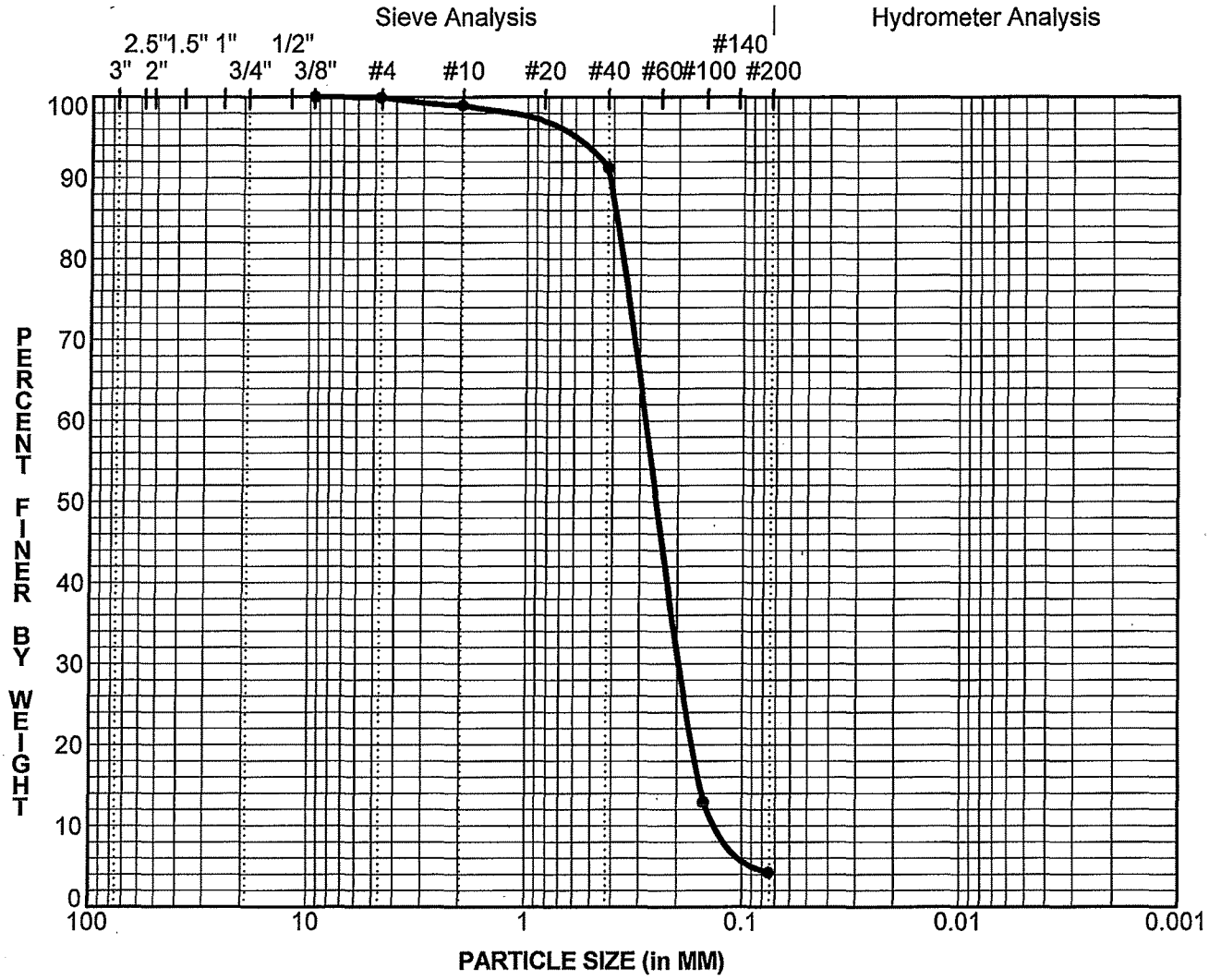
Piikea-Lilao Commercial Mixed-Used Project

Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 9



Gravel		Sand			Silt and Clay
coarse	fine	coarse	medium	fine	

	Sample ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	1 - 1	1.0	Tan SAND (SP)					1	2

	Sample ID	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt & Clay
●	1 - 1	1.0	9.5	0.3	0.19	0.119	0	96	4

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GRAIN SIZE DISTRIBUTION

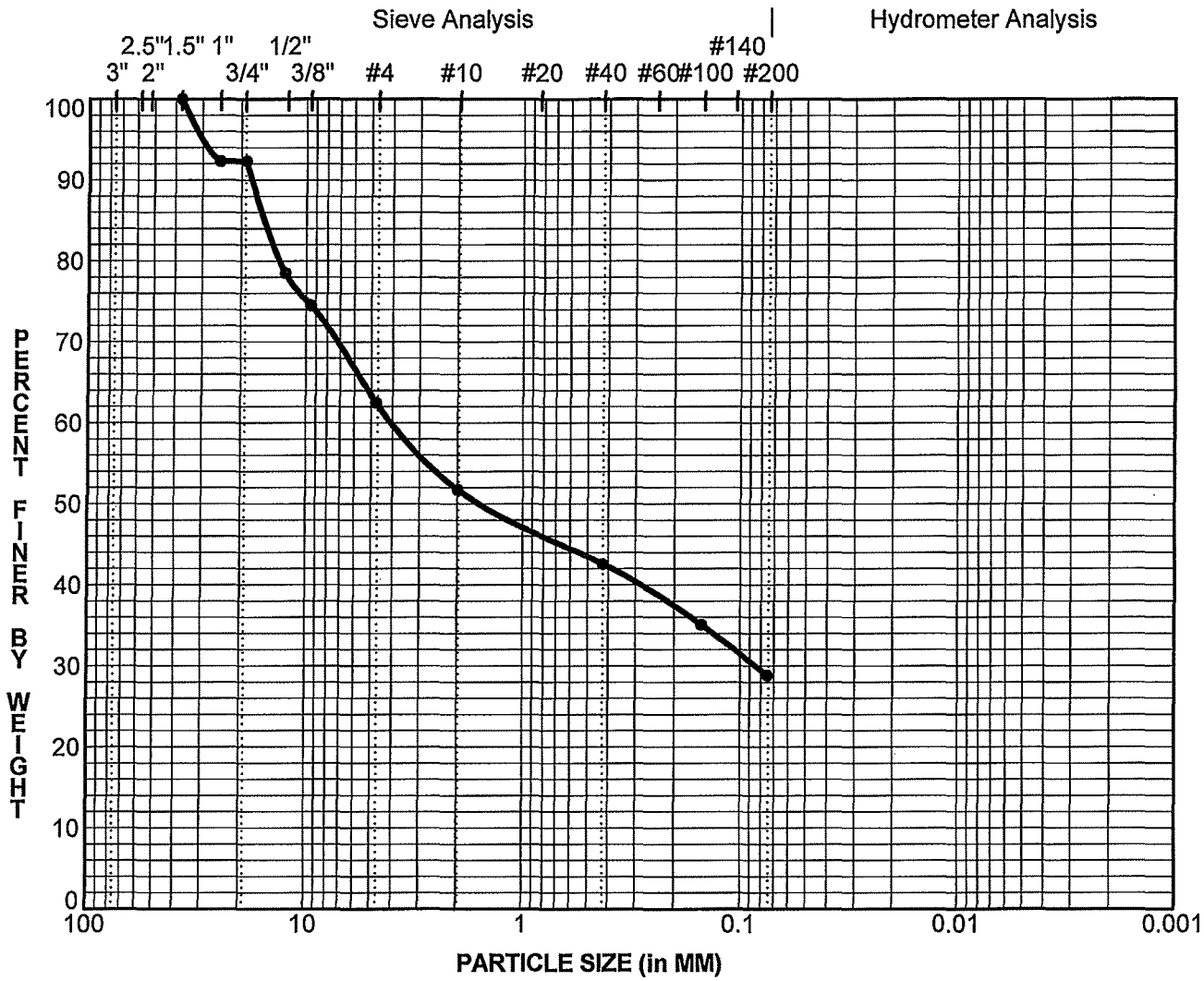
Piikea-Lilao Commercial Mixed-Used Project

Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 10



Gravel		Sand			Silt and Clay
coarse	fine	coarse	medium	fine	

Sample ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
● 1 - 5	14.0	Brown Silty GRAVEL (GM) with Sand						

Sample ID	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt & Clay
● 1 - 5	14.0	37.5	3.9	0.09		38	34	29

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GRAIN SIZE DISTRIBUTION

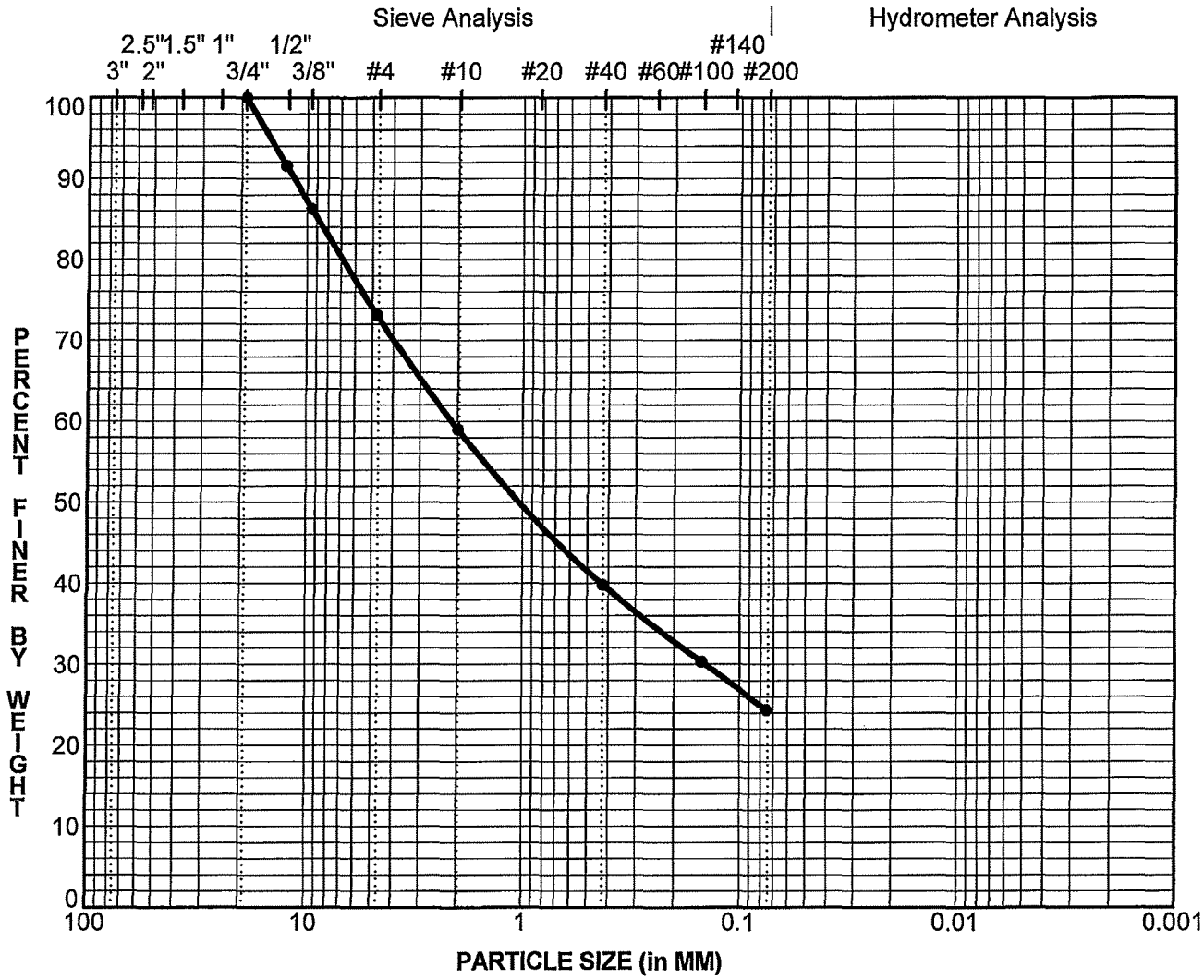
Piikea-Lilao Commercial Mixed-Used Project

Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 11



Gravel		Sand			Silt and Clay
coarse	fine	coarse	medium	fine	

Sample ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
● 2 - 3	3.0	Brown Silty SAND (SM) with Gravel						

Sample ID	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt & Clay
● 2 - 3	3.0	19.0	2.1	0.14		27	49	24

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GRAIN SIZE DISTRIBUTION

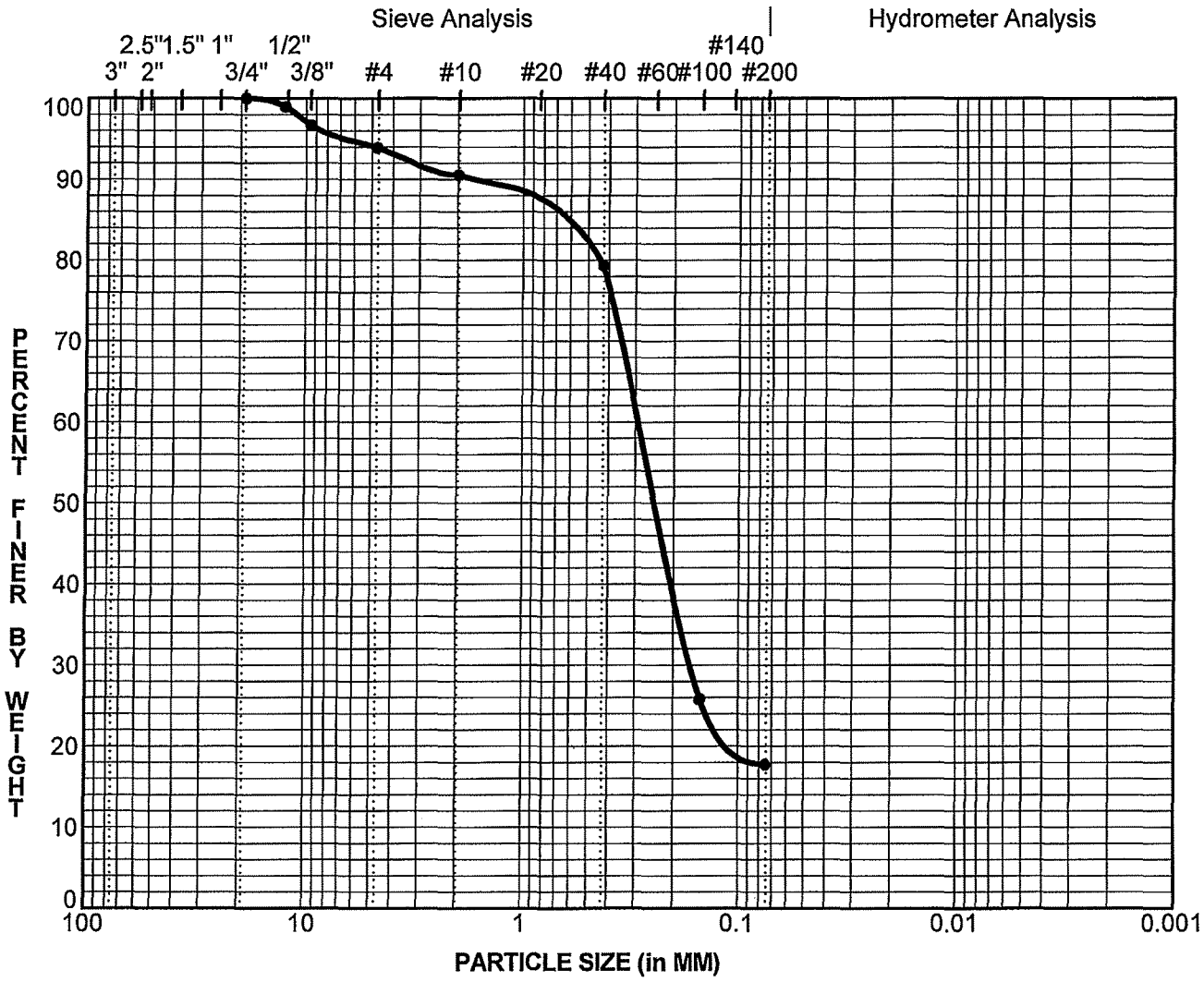
Piikea-Lilao Commercial Mixed-Used Project

Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 12



Gravel		Sand			Silt and Clay
coarse	fine	coarse	medium	fine	

Sample ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
● 3 - 2	3.0	Dark Brown Silty SAND (SM)						

Sample ID	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt & Clay
● 3 - 2	3.0	19.0	0.3	0.16		6	76	18

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GRAIN SIZE DISTRIBUTION

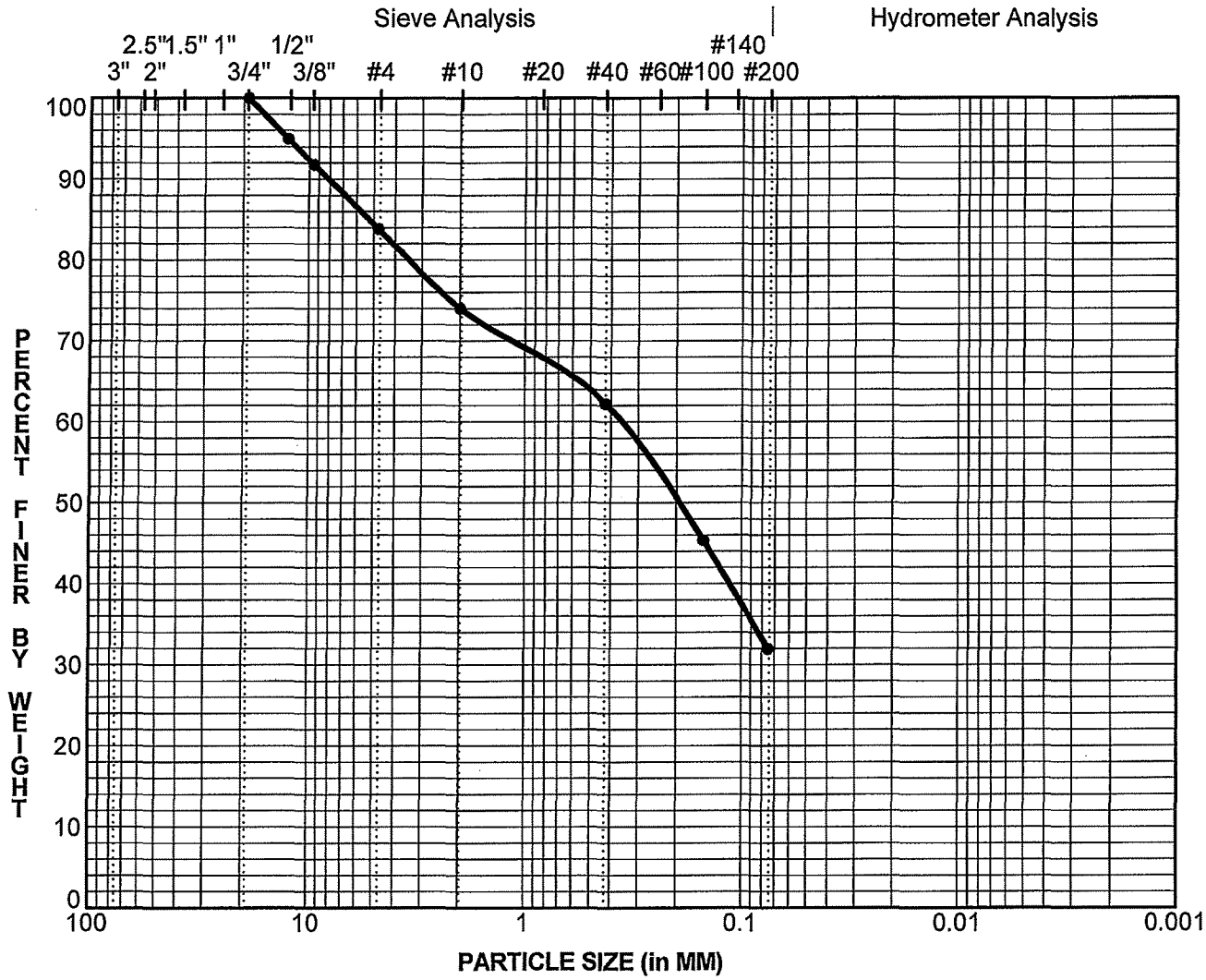
Piikea-Lilao Commercial Mixed-Used Project

Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 13



Gravel		Sand			Silt and Clay
coarse	fine	coarse	medium	fine	

	Sample ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	5 - 1	1.0	Brown Silty SAND (SM) with GRAVEL						

	Sample ID	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt & Clay
●	5 - 1	1.0	19.0	0.4			16	52	32

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GRAIN SIZE DISTRIBUTION

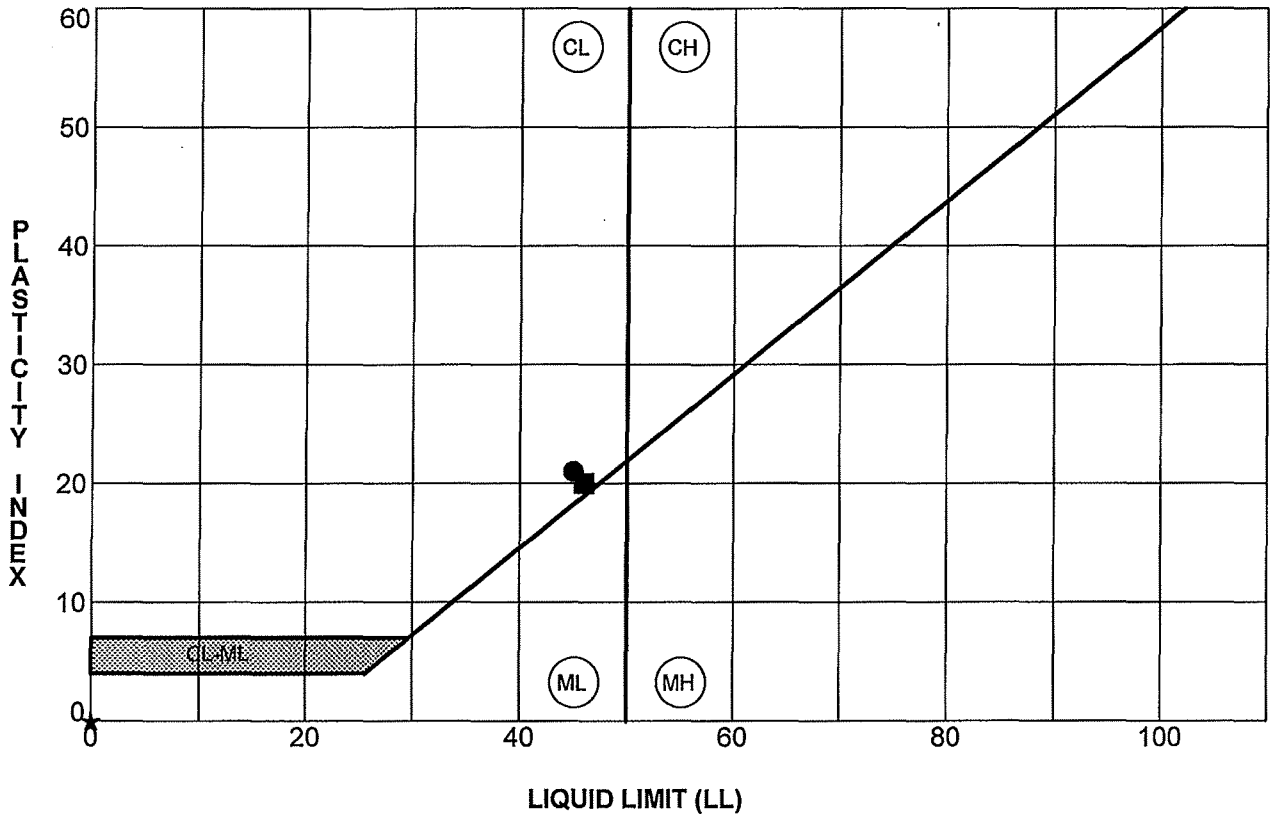
Piikea-Lilao Commercial Mixed-Used Project

Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 14



	Sample ID	Depth (ft)	LL	PL	PI	Classification
●	2 - 1	1.0	45	24	21	Brown Silty CLAY (CL)
■	4 - 1	1.0	46	26	20	Brown Silty CLAY (CL)
★	A	0.0	NP	NP	NP	Brown Silty SAND (SM)

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PLASTICITY INDEX CHART

Piikea-Lilao Commercial Mixed-Used Project
Kihei, Maui, Hawaii

File: 2714.01

September 2008

Figure 15

APPENDIX C

Preliminary Domestic Water Demand Calculations
(from Mechanical Engineer)

Bldg	Site	water									Sewer		
		WFU			GPM			Suggested size			DFU	GPM	Size
		WC/ur	other	total	WC/ur	other	total	WC/ur	other	total			
A	1	90	37	127	66	23	76			3	132	52	4
G	1	70	137	207	59	52	93			4	208	68	4
H	1	105	32	137	70	21	78			3	138	52	4
J	1	100	38	138	69	24	78			3	133	52	4
P1-01	1	25	38	63	38	24	56			3	55	31	4
P2-01	2	25	38	63	38	24	56			3	55	31	4
P3	2	60	43	103	55	26	70			3	65	35	4
P4	3	60	43	103	55	26	70			3	93	42	4
M	2	125	43	168	75	26	85			3	156	57	4
N	2	125	43	168	75	26	85			3	156	57	4
S	2	25	38	63	38	24	56			3	57	32	4
V	2	180	83	263	87	39	103			4	230	71	6
Hotel	1	460	468	928	136	119	200			5	930	195	6
Subtotal Fixture units		1,450	1,081	2,531	259	219	381				2,408	381	
Hotel -pool	1					15	15					2	
Hotel - cooling tower	1					30	30					10	
Total		1,450	1,081	2,531	259	264	426				2,408	392	
Summary by parcel													
3-9-02:30	1	850	750	1,600	191	215	321				1,596	321	
3-9-02:76	2	540	288	828	148	82	188				719	188	
3-9-02:158	3	60	43	103	55	26	70				93	70	
Total		1,450	1,081	2,531	259	264	426				2,408	392	

Notes

Water GPM flows are based on Hunter's curve and are not additive

Sewer GPM flows are based on water flow

An initial fixture unit estiamte was performed for each building with specific use allocations. Similar buildings are based on worst case so that there is flexibility of tenant mix. Actual site demand will be less than the estimate.

Pipe size based on 1 psi/100ft for smooth pipe

APPENDIX D

Preliminary Fire Flow Demand Calculations
(from Mechanical Engineer)

IDS GROUP

January 14, 2013
Stoutenborough, Inc.
420 Alta Vista Way, Suite 100
Laguna Beach, California - 92651

Attention: Todd Stoutenborough, AIA

Reference: **Kihei Village Center**
Pi'ikea Avenue,
Kihei, Maui, Hi

Subject: **Fire Flow Calculations for Downtown Kihei**

Dear Mr. Stoutenborough,

Following are the fire flow calculations for the Kihei Project.
Per our conversation, construction types will be type IIFR for the masonry buildings: Theater and Hotel and type 5-1 hour wood frame for all other buildings.

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

Regards.

Porndhep Kalambaheti, P.E.
IDS Mechanical, Inc.

Building A, TMK (2) 3-9-02:30

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type A Occupancy (Retail/Restaurant/Medical):
      a. Floor Area = 16,524 s.f.
      b. Wood Frame, fire protected construction
      c. Fire Sprinklered
      d. Concrete slab and fire protected wood truss floor
      e. Wood frame, fire protected roof
      f. Construction Type (NFPA 220): 5-1 hour

B. Fire Flow Requirements:
   1. Fire Flow = 2,250 gpm for 16,524 s.f. Type II Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 2,250 gpm x 75% = 1,687.5 gpm fire flow credit
   4. 2,250 gpm - 1,687.5 = 562.5 gpm
   5. Fire Flow required 1,500 gpm.

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Porndhep Kalambaheti, P.E.

04/30/14
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LICENSED
PROFESSIONAL
ENGINEER
No. 6628-M
HAWAII U.S.A.

Building G TMK (2) 3-9-02:30

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type A Occupancy (Retail/Restaurant/Medical):
      a. Floor Area (A) = 30,800 s.f. , Total 16,602 sf first floor and 14,198 sf 2nd floor.
      b. Wood Frame, fire protected construction
      c. Fire Sprinklered
      d. Concrete slab and fire protected wood truss floor
      e. Wood frame, fire protected roof
      f. Construction Type (NFPA 220): 5-1 hour

B. Fire Flow Requirements:
   1. Fire Flow = 3,250 gpm for 30,800 s.f. Type II Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 3,250 gpm x 75% = 2,437.5 gpm fire flow credit
   4. 3,250 gpm - 2,437.5 = 812.5 gpm
   5. Fire Flow required 1,500 gpm.

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Building H TMK (2) 3-9-02:30

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type M Occupancy (Retail/Restaurant):
      a. Floor Area (A) = 32,058 s.f. , Total 20,322 sf first floor and 11,746 sf 2nd floor.
      b. Wood Frame, fire protected construction
      c. Fire Sprinklered
      d. Concrete slab and fire protected wood truss floor
      e. Wood frame, fire protected roof
      f. Construction Type (NFPA 220): 5-1 hour

B. Fire Flow Requirements:
   1. Fire Flow = 3,250 gpm for 32,058 s.f. Type II Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 3,250 gpm x 75% = 2,437.5 gpm fire flow credit
   4. 3,250 gpm - 2,437.5 = 812.5 gpm
   5. Fire Flow required 1,500 gpm.

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Building J TMK (2) 3-9-02:30

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type M Occupancy (Retail/Restaurant):
      a. Floor Area (A) = 32,792 s.f. , Total 19,660 sf first floor and 11,132 sf 2nd floor.
      b. Wood Frame, fire protected construction
      c. Fire Sprinklered
      d. Concrete slab and fire protected wood truss floor
      e. Wood frame, fire protected roof
      f. Construction Type (NFPA 220): 5-1 hour

B. Fire Flow Requirements:
   1. Fire Flow = 3,250 gpm for 32,792 s.f. Type II Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 3,250 gpm x 75% = 2,437.5 gpm fire flow credit
   4. 3,250 gpm - 2,437.5 = 812.5 gpm
   5. Fire Flow required 1,500 gpm.

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Building M TMK (2) 3-9-02:76

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type A Occupancy (Retail/Office/Restaurant):
      a. Floor Area (A) = 29,729 s.f. , Total 14,673 sf first floor and 15,056 sf 2nd floor.
      b. Wood Frame, fire protected construction
      c. Fire Sprinklered
      d. Concrete slab and fire protected wood truss floor
      e. Wood frame, fire protected roof
      f. Construction Type (NFPA 220): 5-1 hour

B. Fire Flow Requirements:
   1. Fire Flow = 3,000 gpm for 29,729 s.f. Type II Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 3,000 gpm x 75% = 2,250 gpm fire flow credit
   4. 3,000 gpm - 2,250 = 750 gpm
   5. Fire Flow required 1,500 gpm.

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Building N TMK (2) 3-9-02:76

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type M Occupancy (Retail/Office):
      a. Floor Area (A) = 40,366 s.f. , Total 20,183 sf first floor and 20,183 sf 2nd floor.
      b. Wood Frame, fire protected construction
      c. Fire Sprinklered
      d. Concrete slab and fire protected wood truss floor
      e. Wood frame, fire protected roof
      f. Construction Type (NFPA 220): 5-1 hour

B. Fire Flow Requirements:
   1. Fire Flow = 3,500 gpm for 40,366 s.f. Type II Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 3,500 gpm x 75% = 2,625 gpm fire flow credit
   4. 3,500 gpm - 2,625 = 875 gpm
   5. Fire Flow required 1,500 gpm.

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Building S TMK (2) 3-9-02:76

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type M Occupancy (Retail):
      a. Floor Area (A) = 5,208 s.f. 1 story
      b. Wood Frame, fire protected construction
      c. Fire Sprinklered
      d. Concrete slab and fire protected wood truss floor
      e. Wood frame, fire protected roof
      f. Construction Type (NFPA 220): 5-1 hour

B. Fire Flow Requirements:
   1. Fire Flow = 1,500 gpm for 5,208 s.f. Type II Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 1,500 gpm x 75% = 1,125 gpm fire flow credit
   4. 1,500 gpm - 1,125 = 375 gpm
   5. Fire Flow required 1,500 gpm.

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Building T TMK (2) 3-9-02:76

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type M Occupancy (Retail):
      a. Floor Area (A) = 5,208 s.f. 1 story
      b. Wood Frame, fire protected construction
      c. Fire Sprinklered
      d. Concrete slab and fire protected wood truss floor
      e. Wood frame, fire protected roof
      f. Construction Type (NFPA 220): 5-1 hour

B. Fire Flow Requirements:
   1. Fire Flow = 1,500 gpm for 5,208 s.f. Type II Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 1,500 gpm x 75% = 1,125 gpm fire flow credit
   4. 1,500 gpm - 1,125 = 375 gpm
   5. Fire Flow required 1,500 gpm.

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Building V TMK (2) 3-9-02:76

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type A Occupancy (Theater):
      a. Floor Area (A) = 44,180 s.f. 2 levels in part.
      b. CMU construction
      c. Fire Sprinklered
      d. Concrete slab, Concrete over steel floors
      e. Concrete over steel frame roof
      f. Construction Type (NFPA 220): II HR

B. Fire Flow Requirements:
   1. Fire Flow = 3,000 gpm for 44,180 s.f. Type II 1 hour Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 3,000 gpm x 75% = 2,250 gpm fire flow credit
   4. 3,000 gpm - 2,250 = 750 gpm
   5. Fire Flow required 1,500 gpm.

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Hotel Building TMK (2) 3-9-02:30

Reference for Hydrant location and distribution is the 'Uniform Fire Code' 1997 Appendix III-B, Table A-III-B-1 : One fire hydrant is required with an average spacing of 500' with a maximum distance of 250' from any point on access road to hydrant.

Reference for Fire Flow Calculations is the 'Uniform Fire Code Handbook' 1997 Appendix III-A, Table A-III-A-l.

A. Type of Construction:
   1. Type R-1 Occupancy (Hotel):
      a. Floor Area (A) = 93,000 s.f. Total. 23,250 sf/floor x 4 stories
      b. CMU construction
      c. Fire Sprinklered
      d. Concrete slab, Concrete over steel floors
      e. Concrete over steel frame roof
      f. Construction Type (NFPA 220): II HR

B. Fire Flow Requirements:
   1. Fire Flow = 4,500 gpm for 93,000 s.f. Type I 1 hour Construction
   2. Fire Flow Reduction for fire sprinklers (H.5.2):
   3. 4,500 gpm x 75% = 3,375 gpm fire flow credit
   4. 4,500 gpm - 3,375 = 1,125 gpm
   5. Fire Flow required 1,500 gpm.

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APPENDIX E

Preliminary Landscape Irrigation Demand
(from Landscape Architect)

PRELIMINARY LANDSCAPE IRRIGATION DAILY DEMAND
FOR
DOWNTOWN KIHEI
Kihei, Maui, Hawaii

Prepared by :

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Preliminary estimates for the landscape irrigation daily average water demand for the three parcels which comprises the project site are based on two different plant type categories: shrubs and groundcovers, and grasses. The shrubs and groundcovers are identified by two subcategories: Native Hawaii/drought tolerant Plants and Introduced/ornamental Plants. The irrigating times are separated into two different watering time periods: the plant establishment period and long term on-going irrigation period.

The following calculations are for irrigating the landscape planting areas for the Downtown Kihei project are based on the assumed and estimated landscape areas for the site plan prepared by Stoutenborough Architects, dated February 29, 2012.

Lot # 1 (North of Pi'ikea Ave):

I. Plant Establishment Irrigation Period (Approx. 90-120 days):

A. Shrubs/Ground Covers:

1. Hawaiian Native/drought-tolerant Plants:
   28,700 s.f.(total area) x .052 in. (weekly irrigation rate) x 7.481(gallonage conversion) x 2.3 (plant establishment time factor) = 25,679 gals/wk.
   3,668 gals/day
2. Introduced/ornamental Plants:
   23,200 s.f. x .104 in. x 7.481 x 2.3 = 41,515 gals/wk.
   5,931 gals/day

B. Grasses:

1. Introduced Grasses:
   29,000 s.f. x .125 in. x 7.481 x 1.4 = 37,966 gals/wk.
   5,424 gals/day

Sub total.....15,023 gals./day

II. Long Term Irrigation Period (On-going):

A. Shrubs/Ground Covers:

1. Hawaiian Native/drought-tolerant Plants:
28,700 s.f.(total area) x .052 in. (weekly irrigation rate) x 7.481(gallonage conversion) = 11,165 gals/wk.
1,595 gals/day

2. Introduced/ornamental Plants:
23,200 s.f. x .104 in. x 7.481 = 18,050 gals/wk.
2,579 gals/day

B. Grasses:

1. Introduced Grasses:
29,000 s.f. x .125 in. x 7.481 = 27,119 gals/wk.
3,874 gals/day

Sub total..... 8,048 gals./day

<u>Lot # 2 (South of Pi'ikea Ave):</u>

I. Plant Establishment Irrigation Period (Approx. 90-120 days):

A. Shrubs/Ground Covers:

1. Hawaiian Native/drought-tolerant Plants:
42,100 s.f.(total area) x .052 in. (weekly irrigation rate) x 7.481(gallonage conversion) x 2.3 (plant establishment time factor) = 37,668 gals/wk.
5,381 gals/day

2. Introduced/ornamental Plants:
9,300 s.f. x .104 in. x 7.481 x 2.3 = 16,642 gals/wk.
2,377 gals/day

B. Grasses:

1. Introduced Grasses:
22,500 s.f. x .125 in. x 7.481 x 1.4 = 29,456 gals/wk.
4,208 gals/day

Sub total.....11,966 gals./day

II. Long Term Irrigation Period (On-going):

A. Shrubs/Ground Covers:
1. Hawaiian Native/drought-tolerant Plants:
42,100 s.f.(total area) x .052 in. (weekly irrigation rate) x 7.481(gallonage conversion) = 16,377 gals/wk.
2,340 gals/day

2. Introduced/ornamental Plants:
9,300 s.f. x .104 in. x 7.481 = 7,236 gals/wk.
1,034 gals/day

B. Grasses:
1. Introduced Grasses:
22,500 s.f. x .125 in. x 7.481 = 21,040 gals/wk.
3,006 gals/day

Sub total..... 6,380 gals./day

<u>Lot # 3(West of Existing Wetland):</u>

I. Plant Establishment Irrigation Period (Approx. 90-120 days):

A. Shrubs/Ground Covers:
1. Hawaiian Native/drought-tolerant Plants:
6,950 s.f.(total area) x .052 in. (weekly irrigation rate) x 7.481(gallonage conversion) x 2.3 (plant establishment time factor) = 6,218 gals/wk.
888 gals/day

2. Introduced/ornamental Plants:
1,500 s.f. x .104 in. x 7.481 x 2.3 = 2,684 gals/wk.
384 gals/day

B. Grasses:
1. Introduced Grasses:
5,650 s.f. x .125 in. x 7.481 x 1.4 = 7,397 gals/wk.
1,057 gals/day

Sub total..... 2,329 gals./day

II. Long Term Irrigation Period (On-going):

A. Shrubs/Ground Covers:

1. Hawaiian Native/drought-tolerant Plants:

6,950 s.f.(total area) x .052 in. (weekly irrigation rate) x 7.481(gallonage conversion) = 2,704 gals/wk.
386 gals/day

2. Introduced/ornamental Plants:

1,500 s.f. x .104 in. x 7.481 = 1,167 gals/wk.
168 gals/day

B. Grasses:

1. Introduced Grasses:

5,650 s.f. x .125 in. x 7.481 = 5,284 gals/wk.
755 gals/day

Sub total..... 1,309 gals./day

Average Maximum Daily Peak Flow Rate: 60 gpm
Minimum psi Requirement: 65 psi

Landscape irrigation system shall be scheduled to operate over a 24-hour cycle period during the plant establishment period (90 - 120 days after initial planting), then scheduled to operate only during the evening hours (non-peak usage hours) to minimize evaporation and transpiration.

APPENDIX D.

Botanical and Fauna Surveys

BOTANICAL AND FAUNA SURVEY

for

THE KRAUSZ COMPANIES

KIHEI MIXED USE DEVELOPMENT

KIHEI, MAUI, HAWAII

by

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Kokomo, Maui
March 2009

Prepared for: Krausz Companies, Inc.

INTRODUCTION

The Krausz Kihei Mixed Use Development project lies on approximately 32.5 acres of land (TMKs (2) 3-9-02:30,76,80,158) in central Kihei. It is bounded on the north by a mango orchard, on the east by Liloa Drive and on the south and west by residential and commercial properties. The property is bisected by Piikea Avenue. This study was initiated in fulfillment of environmental requirements of the planning process.

SITE DESCRIPTION

This property is located on a coastal plain about 1,600 feet from the ocean. The terrain slopes very gradually down from east to west with elevations varying between 20 ft. and 10 ft. above sea level. Soils are Pulehu Clay Loam, 0 – 3% slopes (PsA) in the upper portions of the property and are Puuone Sand, 7-30 % slopes (PZUE) and Jaucus Sand, Saline, 0-12% slopes (JcC) in the lower areas where ground water is within 30 in. of the surface (Foote et al, 1972). Vegetation is open grassland in the upper areas and grades into denser trees and shrubs in the lower area. Annual rainfall averages a very dry 10 in. per year with the bulk of it falling during the winter months.

The lower western part of the property has two man-made wetland ponds, one 5 acres in size and the other 3 acres in size, that were constructed in 1991 in consultation with the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service as a mitigation for the development of nearby wetlands by a previous property owner.

BIOLOGICAL HISTORY

The project area was once a dry native savannah with a scattering of trees and shrubs such as wiliwili (*Erythrina sandwicensis*), 'ohe (*Reynoldsia sandwicensis*) and 'a'ali'i (*Dodonaea viscosa*) and a variety of other native grasses and vines. Nearly two centuries of cattle (*Bos taurus*) grazing and more recently browsing by axis deer (*Axis axis*) have greatly reduced the diversity and numbers of native plants. Wildfires have repeatedly swept through these dry grasslands all but eliminating them. The native plants have been replaced by hardy non-native species that can survive both grazing and fires.

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the proposed Krausz Companies Kihei Mixed Use Development Project which was conducted in March 2009.

The objectives of the survey were to:

1. Document what plant, bird and mammal species occur on the property or may likely occur in the existing habitat.

2. Document the status and abundance of each species.

3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.

4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.

5. Note which aspects of the proposed development pose significant concerns for plants or for wildlife and recommend measures that would mitigate or avoid these problems.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used following a route to ensure complete coverage of the area. Areas most likely to harbor native or rare plants such as gullies or rocky outcroppings were more intensively examined. Notes were made on plant species, distribution and abundance as well as terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation in this project area can be placed in three distinct categories. The first is a dry savannah which consists of two predominant species, buffelgrass (*Cenchrus ciliaris*) and widely scattered kiawe trees *(Prosopis pallida*). The second is a dense kiawe and shrub thicket also with two predominant species, kiawe and sourbush (*Pluchea carolinensis*) that grows in the area with a shallow water table. The third is made up of the two manmade ponds with wetland plants that grow either in the water or on the damp banks. Predominant species here include makaloa (*Cyperus laevigatus*), kaluha (*Bolboschoenus maritimus* subsp. *paludosus*) and pickleweed (*Batis maritima*).

A total of 61 plant species were recorded during the course of the survey. Of these 11 are native to Hawaii: 'äheahea (*Chenopodium oahuense*), makaloa, kaluhä, 'aki'aki (*Sporobolus virginicus*), 'äkulikuli (*Sesuvium portulacastrum*), 'ilima (*Sida fallax*), kipukai (*Heliotropium curassavicum*), pöhuehue (*Ipomoea pes-caprae*), 'uhaloa (*Waltheria indica*), pöpolo (*Solanum americanum*) and 'ae'ae (*Bacopa monnieri*). Seven of these plants are associated with the wetland habitat. The remaining 50 species are non native plants including 5 ornamentals and 45 common weeds.

DISCUSSION AND RECOMMENDATIONS

The majority of the savannah and the kiawe-shrub areas are dominated by non-native plants that have been heavily impacted over many years by grazing animals, fires and human disturbances. Only in the wetland ponds do the native plants make up a significant portion of the vegetation. Of the 11 native plants species only one, the 'äheahea, is endemic only to the Hawaiian Islands. It is found on all the larger Hawaiian Islands in a variety of coastal, dry land and subalpine habitats and is not uncommon. The other 10 native species are indigenous to Hawaii as well as to a number of other Pacific islands and are all widespread and common. No federally

listed Endangered or Threatened species (USFWS,1999) were found on the property, nor do any plants proposed for such status occur here.

The wetland pond habitat comprises a special habitat type that is already being protected under provisions of a mitigation agreement. It will be addressed in more detail in the fauna report.

Since there are no rare or protected plant species on the property, the botanical resources outside of the protected wetlands are not of significant concern. The proposed project on the non-wetland areas is not expected to have a significant negative impact on the botanical resources there or in the Kihei region.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants (Monocots and Dicots) are in accordance with Wagner et al. (1999).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

abundant = forming a major part of the vegetation within the project area.
common = widely scattered throughout the area or locally abundant within a portion of it.
uncommon = scattered sparsely throughout the area or occurring in a few small patches.
rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MONOCOTS			
ARECACEAE (Palm Family)			
Washingtonia robusta H. Wendland	Mexican Washintonia	non-native	rare
ASPHODELACEAE (Asphodel Family)			
Aloe vera (L.) Burm. fil.	common aloe	non-native	rare
CYPERACEAE (Sedge Family)			
Bolboschoenus maritimus (L.) *palla* subsp. (A.Nels.) T.Koyama	kaluhä	indigneous	uncommon
Cyperus laevigatus L.	makaloa	indigenous	uncommon
POACEAE (Grass Family)			
Cenchrus ciliaris L.	buffelgrass	non-native	abundant

Chloris barbata (L.) Sw.	swollen fingergrass	non-native	uncommon
Eleusine indica (L.) Gaertn.	wiregrass	non-native	rare
Eragrostis amabilis (L.) Wight & Arnott	Japanese lovegrass	non-native	rare
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	non-native	uncommon
Panicum maximum Jacq.	Guinea grass	non-native	rare
Panicum repens L.	torpedo grass	non-native	rare
Sporobolus pyramidatus (Lam.) Hitch.	----------	non-native	rare
Sporobolus virginicus (L.) Kunth	'aki'aki	indigenous	rare
DICOTS			
AIZOACEAE (Fig-marigold Family)			
Sesuvium portulacastrum (L.) L.	'äkulikuli	indigenous	rare
AMARANTHACEAE (Amaranth Family)			
Atriplex semibaccata R. Br.	Australian saltbush	non-native	rare
Atriplex suberecta Verd.	----------	non-native	rare
Amaranthus spinosus L.	spiny amaranth	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Chenopodium murale L.	'äheahea	non-native	uncommon
Chenopodium oahuense (Meyen) Aellen	'äheahea	endemic	rare
ANACARDIACEAE (Mango Family)			
Schinus terebinthifolius Raddi	Christmas berry	non-native	rare
ASTERACEAE (Sunflower Family)			
Bidens pilosa L.	Spanish needle	non-native	rare
Crassocephalum crepidioides (Benth.) S. Moore	redflower ragleaf	non-native	rare
Lactuca sativa L.	wild lettuce	non-native	rare
Pluchea carolinensis (Jacq.) G.Don	sourbush	non-native	rare
Pluchea indica (L.) Less.	Indian fleabane	non-native	common
Senecio madagascariensis Poir.	fire weed	non-native	rare
Sonchus oleraceus L.	pualele	non-native	rare
Tridax procumbens L.	coat buttons	non-native	rare

Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	non-native	uncommon
BATACEAE (Saltwort Family)			
Batis maritima L.	pickleweed	non-native	uncommon
BORAGINACEAE (Borage Family)			
Heliotropium curassavicum L.	kipukai	indigenous	rare
Heliotropium procumbens Mill.	fourspike heliotrope	non-native	rare
CARYOPHYLLACEAE (Pink Family)			
Spergularia marina (L.) Griseb.	saltmarsh sand spurry	non-native	rare
CASUARINACEAE (She-oak Family)			
Casuarina equisetifolia L.	common ironwood	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea pes-caprae (L.) R. Br.	pöhuehue	indigenous	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Merremia aegyptia (L.) Urb.	hairy merremia	non-native	rare
EUPHORBIACEAE (Spurge Family)			
Chamaesyce hirta (L.) Millsp.	hairy spurge	non-native	rare
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	non-native	rare
Chamaesyce prostrata (Aiton) Small	prostrate spurge	non-native	rare
Ricinus communis L.	Castor bean	non-native	rare
FABACEAE (Pea Family)			
Acacia farnesiana (L.) Willd.	klu	non-native	rare
Crotalaria incana L.	fuzzy rattlepod	non-native	rare
Crotalaria pallida Aiton	smooth rattlepod	non-native	rare
Gliricidia sepium (Jacq.) Steud.	madre de cacao	non-native	rare
Indigofera hendecaphylla Jacq.	creeping indigo	non-native	rare
Leucaena leucocephala (Lam.) deWit	koa haole	non-native	uncommon
Macroptilium lathyroides (L.) Urb.	wild bean	non-native	rare
Neonotonia wightii (Wight & Arnott) Lackey	glycine	non-native	rare

Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	non-native	common
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	non-native	rare
Malva parviflora L.	cheese weed	non-native	rare
Malvastrum coromandelianum (L.) Garcke	false mallow	non-native	rare
Sida fallax Walp.	'ilima	indigenous	uncommon
Waltheria indica L.	'uhaloa	indigenous	uncommon
NYCTAGINACEAE (Four-o'clock Family)			
Bougainvillea spectabilis Willd.	bougainvillea	non-native	rare
PLANTAGINACEAE (Plantain Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Bacopa monnieri (L.) Pennell	'ae'ae	indigenous	rare
PORTULACACEAE (Purslane Family)			
Portulaca oleracea L.	pigweed	non-native	rare
SOLANACEAE (Nightshade Family)			
Nicandra physalodes (L.) Gaertn.	apple of Peru	non-native	rare
Nicotiana glauca R.C. Graham	tree tobacco	non-native	uncommon
Solanum americanum Mill.	pöpolo	indigenous	rare

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species, abundance, activities and location as well as observations of trails, tracks, scat and signs of feeding. A few hours were spent observing bird life around the ponds at different times of the day and during the evening. In addition the evening visit was made to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

RESULTS

MAMMALS

Just one mammal species was recorded within the project area during three site visits. Taxonomy and nomenclature follows Tomich (1986.)

Axis deer (*Axis axis*) - Trails and signs of feeding were observed on the north side of the property adjacent to the mango orchard. Deer are present throughout the Kihei area and make forays into populated neighborhoods during the dry season. They become active at night so are rarely seen.

Other mammals likely to inhabit the property include Rats (*Rattus spp.*) and mice (*Mus domesticus*). These rodents feed on seeds, fruits and herbaceous vegetation in such habitats. Domestic and feral cats (*Felis catus*) as well as mongoose (*Herpestes*

auropunctatus) would also be expected here. These carnivores hunt for rodents and birds in such areas.

A special effort was made to look for the native Hawaiian hoary bat which is listed as an Endangered species. These bats have been observed in the past around the Waiakoa Stream estuary about 2 miles north of the property. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No evidence of such activity was observed though visibility was excellent. In addition a bat detection device (Batbox IIID) was employed, set to the frequencies of 27,000 to 28,000 hertz which this species is known to use. No bats were detected using this device.

BIRDS

Birdlife was fairly abundant in the area due to the diversity of habitats and the seasonal green condition of the vegetation. Fifteen species of birds were observed including three native waterbirds during three visits to the property. Taxonomy and nomenclature follow American Ornithologists' Union (2005).

Common myna (*Acridotheres tristis*) – Pairs of mynas were seen throughout the property at all times of day.

Zebra dove (*Geopelia striata*) – Many of these small doves were seen feeding on seeds in clearings.

House sparrow (*Passer domesticus*) – Small groups of sparrows were seen feeding on insects and grubs in kiawe trees. These birds are common around human structures.

Northern cardinal (*Cardinalis cardinalis*) – Several individuals and pairs were seen and heard calling from kiawe trees.

Spotted dove (*Streptopelia chinensis*) – Several individuals of these large doves were seen in kiawe trees or in flight over the property.

Ae'o, Black-necked stilt (*Himantopus mexicanus knudseni*) – Several of these endemic and Endangered stilts utilize and occasionally breed in the two existing mitigated wetlands and can be observed there at all times of the day and in the evening.

Auku'u, Black-crowned night-heron (*Nycticorax nycticorax hoactli*) – A few of these indigenous herons utilized the wetland habitat during the day and evening. They feed on small fish, snails and crustaceans in the shallow water.

Gray francolin (*Francolinus pondicerianus*) – Families of these francolins were seen in the margins of clearing where they feed on insects and their calls were heard.

African silverbill (*Lonchura cantans*) - Flocks of these tiny tan birds were seen feeding in grasslands or resting in trees.

Chicken (*Gallus gallus*) – Two flocks of wild chickens were seen scratching for insects under dense kiawe thicks. Their crowing could be heard from a distance.

Red-crested cardinal (*Paroaria coronata*) - A few of the bright red-headed cardinals were seen feeding and calling in kiawe trees.

'Alae ke'oke'o, Hawaiian coot (*Fulica alai*) – Two of these endemic and Endangered 'alae were seen in the wetland ponds swimming about and feeding along the shoreline.

Japanese white-eye (*Zosterops japonicus*) – Two of these small green birds were seen in a kiawe tree and making their high-pitched twittering calls.

Java sparrow (*Padda oryzivora*) – Two of these small colorful birds were seen in a tree near the project boundary.

House finch (*Carpodacus mexicanus*) – Two of these finches were heard chattering in a kiawe tree near the road. They prefer habitat with ironwood trees where they feed on seeds.

A few other non-native birds might be expected to occasionally use this property and some migratory birds such as the Pacific golden plover (*Pluvialis fulva*) would utilize the wetland shorelines, but these migratory birds have recently departed for their arctic breeding grounds.

INSECTS

While insects in general were not tallied, one native Sphingid moth, Blackburn's sphinx moth (*Manduca blackburni*) has been put on the Federal Endangered species list and this designation requires special focus (USFWS 2000). Blackburn's sphinx moth occurs on Maui although it has not been found in this area. Its native host plants are species of 'aiea (*Nothocestrum)* and a non-native alternative host plant is tree tobacco (*Nicotiana glauca*). There are no 'aiea on or near the project area, but about 40 young tree tobacco shrubs were found. Each of these plants were carefully examined but no Blackburn's sphinx moth or their larvae were observed.

CONCLUSIONS AND RECOMMENDATIONS

All of the fauna species found in the dryland portions of this property are common non-native species that are of no special environmental concern, nor are there any special habitats in this portion of the property. The two wetland ponds, however, are both special habitat and support two Endangered bird species the ae'o and the 'alae ke'oke'o. While there are no plans to alter these ponds in any way, the development of the adjacent lands could place structures and human activities close enough to disturb these birds.

Hawaiian stilts and coots have both shown an ability to get used to nearby structures and vehicular traffic to some degree but are less adaptable to humans. They become agitated by human activity nearby and may be discouraged from breeding and nesting. In order for these Endangered birds to successfully utilize these two mitigated wetlands as intended they need adequate space and visual screening to ensure a sufficient comfort level. It is recommended that development planning allow for at least 30 ft. between any structures and the wetland perimeter fences and specify the planting of a dense hedge just outside the perimeter fences that is at least 10 ft. tall (such as oleander) to create a visual barrier for the birds and their habitat.

Seabirds including the Endangered ua'u and the Threatened 'a'o were not found on this property and are highly unlikely to utilize such an area. Yet these birds are known to fly over these lowlands in the evenings to get to their burrows high in the mountains. Young birds which are fledging during the fall months are particularly vulnerable to being confused by bright lights and they are prone to crash and be injured or killed. It is recommended that any outdoor lights in the proposed project be hooded to direct the light downward so the light is not visible from above.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within two groups: Mammals and Birds. For each species the following information is provided:

1. Common name

2. Scientific name

3. Bio-geographical status. The following symbols are used:

   endemic = native only to Hawaii; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.
   migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the overwintering/non-breeding phase of their life cycle.

4. Abundance of each species within the project area:

   abundant = many flocks or individuals seen throughout the area at all times of day.
   common = a few flocks or well scattered individuals throughout the area.
   uncommon = only one flock or several individuals seen within the project area.
   rare = only one or two seen within the project area.

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
MAMMALS			
Axis deer	*Axis axis*	non-native	rare
BIRDS			
Common myna	*Acridotheres tristis*	non-native	common
Zebra dove	*Geopelia striata*	non-native	common
House sparrow	*Passer domesticus*	non-native	common
Northern cardinal	*Cardinalis cardinalis*	non-native	common
Spotted dove	*Streptopelia chinensis*	non-native	common
Ae'o, Black-necked stilt	*Himantopus mexicanus knudseni*	endemic	uncommon
Auku'u, Black-crowned night-heron	*Nycticorax nycticorax hoactli*	indigenous	uncommon
Gray francolin	*Francolinus pondicerianus*	non-native	uncommon
African silverbill	*Lonchura cantans*	non-native	uncommon
Chicken	*Gallus gallus*	non-native	uncommon
Red-crested cardinal	*Paroaria coronata*	non-native	uncommon
'Alae ke'oke'o, Hawaiian coot	*Fulica alai*	endemic	rare
Japanese white-eye	*Zosterops japonicus*	non-native	rare
Java sparrow	*Padda oryzivora*	non-native	rare
House finch	*Carpodacus mexicanus*	non-native	rare

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APPENDIX E.

Department of the Army Approval of Longs Drugs Center Wetland Mitigation Plan, TMK Nos. (2) 3-9-002:030 and 109

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

REPLY TO
ATTENTION OF
Operations Division NOV 13 1990

Mr. George R. Killam
Design Manager
Longs Drug Stores, Inc.
141 N. Civic Drive
Walnut Creek, California

Dear Mr. Killam:

This is in response to your September 26, 1990 letter submitting the Proposed Mitigation Plan for Wetlands at Longs Drugs Retail Business Center, Kihei, Maui, Hawaii, TMK: 3-9-03: 30, 109. The work would involve the placement of 3.8 acres of fill in wetlands for a commercial development and includes 3 acres of wetland enhancement adjacent to the project site as well as 6 acres of wetland enhancement at Kanaha Pond State Wildlife Sanctuary, Kahului, Maui, Hawaii.

Based on this understanding, I have determined that the proposed work is authorized by the Corps Nationwide (NW) permit authority in accordance with Federal Regulations at 33 CFR 330.5(as)(26), and with the special conditions listed below. Excerpts from the regulations which list the conditions and management practices of this authorization are enclosed for your information and compliance (Encl 1).

The following special conditions shall be incorporated as part of the permit:

a. Prior to initiation of any additional wetland fill work, the permittee shall provide written evidence of agreements with the owners of the adjacent Fern parcel where mitigation work is to be performed and with the State of Hawaii for work at Kanaha Pond State Wildlife Sanctuary. Failure to provide this written evidence shall invalidate this authorization.

b. All mitigation work shall be performed as described in the document, "Proposed Mitigation Plan for Wetlands at Longs Drugs Retail Business Center, TMK: 3-9-03: 30, 109, Kihei, Maui, Hawaii," as amended September 26, 1990 and on the accompanying plan, as revised September 25, 1990.

Encl 1

c. A schedule of the construction work will be submitted to the Operations Division within 30 days of the NW authorization. Details of the construction drawings shall be coordinated with and incorporate the design guidance recommendations of the U.S. Fish and Wildlife Service, as contained in the enclosed design criteria and drawing (Encl 2).

d. The permittee shall use best efforts to complete the construction of the mitigation plan within one (1) year of NW authorization. A performance bond, or other formal financial commitment satisfactory to the Corps, equal to one hundred percent of the contract price shall be held by a third party to complete the construction of the mitigation wetland should the wetland construction fail to be completed within the time specified. Evidence of securing the bond or financial commitment shall be provided to the Corps of Engineers within 30 days of award of the construction contract.

e. Upon completion of the mitigation work, an onsite inspection will be held to evaluate the success of the work and document the baseline for completion of the wetland mitigation. Quarterly letter reports summarizing the waters levels, salinity, vegetation cover and use of the wetland by endangered waterbirds and migratory shorebirds shall be submitted by the permittee to the Corps of Engineers for the first year. Subsequent monitoring requirements as well as reasonable modifications that may be required to assure the continued existence of the wetlands will be determined at annual onsite inspections to be held thereafter.

f. All features of the mitigation wetland will be continuously maintained as compensation for the placement of fill authorized by this permit until a substitution of mitigation plan may be authorized, provided that such substitution is acceptable to the Corps of Engineers, in consultation with the U.S. Fish and Wildlife Services and the U.S. Environmental Protection Agency, or until such time as the designation of wetlands for this area has been removed, withdrawn or has been declared invalid."

g. This permit authorization shall be recorded at the Bureau of Conveyances. The permittee shall provide an endorsed copy of the filed permit to the Corps of Engineers within 60 days of the issuance of this permit.

In addition to these conditions and management practices, you are advised that:

a. Nationwide permits do not obviate the need to obtain other Federal, state or local authorizations required by law.

b. Nationwide permits do not grant any property rights or exclusive privileges.

c. Nationwide permits do not authorize any injury to the property or rights of others.

d. Nationwide permits do not authorize interference with any existing or proposed Federal project.

This verification will be valid until the nationwide permit is modified, reissued, or revoked. All the nationwide permits are scheduled to be modified, reissued or revoked prior to January 13, 1992. It is incumbent upon you to remain informed of changes to the nationwide permits. We will issue a public notice announcing the changes when they occur. Furthermore, if you commence or are under contract to commence this activity before the date the nationwide permit is modified or revoked, you will have twelve months from the date of the modification or revocation to complete the activity under the present terms and conditions of this nationwide permit.

Sincerely,

Stanley T. Arakaki

Stanley T. Arakaki
Chief, Operations Division

Enclosures

Copies Furnished:

US FWS, Honolulu Office

US EPA, Region IX, San Francisco, CA.

CONDITIONS TO NATIONWIDE PERMITS

The following special conditions must be followed in order for the nationwide permits identified in paragraph (a) of this section to be valid:

(1) That any discharge of dredged or fill material will not occur in the proximity of a public water supply intake;

(2) That any discharge of dredged or fill material will not occur in areas of concentrated shellfish production unless the discharge is directly related to a shellfish harvesting activity authorized by paragraph (a)(4) of this section;

(3) That the activity will not jeopardize a threatened or endangered species as identified under the Endangered Species Act (ESA), or destroy or adversely modify the critical habitat of such species. In the case of federal agencies, it is the agencies' responsibility to comply with the requirements of the ESA. If the activity may adversely affect any listed species or critical habitat, the district engineer must initiate Section 7 consultation in accordance with the ESA. In such cases, the district engineer may:

(i) Initiate section 7 consultation and then, upon completion, authorize the activity under the nationwide permit by adding, if appropriate, activity specific conditions, or

(ii) Prior to or concurrent with section 7 consultation he may recommend discretionary authority (see section 330.8) or use modification, suspension, or revocation procedures (see 33 CFR 325.7).

(4) That the activity shall not significantly disrupt the movement of those species of aquatic life indigenous to the waterbody (unless the primary purpose of the fill is to impound water);

(5) That any discharge of dredged or fill material shall consist of suitable material free from toxic pollutants (see section 307 of the Clean Water Act) in toxic amounts;

(6) That any structure or fill authorized shall be properly maintained;

(7) That the activity will not occur in a component of the National Wild and Scenic River System; nor in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an officially study status;

(8) That the activity shall not cause an unacceptable interference with navigation;

Encl 1

(9) That, if the activity may adversely affect historic properties which the National Park Service has listed on, or determined eligible for listing on, the National Register of Historic Places, the permittee will notify the district engineer. If the district engineer determines that such historic properties may be adversely affected, he will provide the Advisory Council on Historic Preservation an opportunity to comment on the effects on such historic properties or he will consider modification, suspension, or revocation in accordance with 33 CFR 325.7. Furthermore, that, if the permittee before or during prosecution of the work authorized, encounters a historic property that has not been listed or determine eligible for listing on the National Register, but which may be eligible for listing in the National Register, he shall immediately notify the district engineer;

(10) That the construction or operation of the activity will not impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights;

(11) That in certain stated, an individual state water quality certification must be obtained or waived (see § 330.9);

(12) That in certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see § 330.10);

(13) That the activity will comply with regional conditions which may have been added by the division engineer (see § 330.8(a)); and

(14) That the management practices listed in § 330.6 of this part shall be followed to the maximum extent practicable.

MANAGEMENT PRACTICES

In addition to the conditions specified in the attached sheet, the following management practices shall be followed, to the maximum extent practicable, in order to minimize the adverse effects of these discharges on the aquatic environment. Failure to comply with these practices may be cause for the district engineer to recommend, or the division engineer to take, discretionary authority to regulate the activity on an individual or regional basis.

(1) Discharges or dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

(2) Discharges in spawning areas during spawning seasons shall be avoided.

(3) Discharges shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).

(4) If the discharge creates an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized.

(5) Discharge in wetlands areas shall be avoided.

(6) Heavy equipment working in wetlands shall be placed on mats.

(7) Discharges into breeding areas for migratory waterfowl shall be avoided.

(8) All temporary fills shall be removed in their entirety.

APPENDIX E-1.

Department of the Army Approval of Azeka Commercial Center Wetland Mitigation Plan, TMK Nos. (2) 3-9-002:028, 076, and 080

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

REPLY TO
ATTENTION OF
Operations Division OCT 30 1990

Mr. Lawrence N. C. Ing
Ing, Kushi & Ige
2145 Wells Street, Suite 204
Wailuku, Hawaii 96793-2222

Dear Mr. Ing:

This is in response to your letter, dated August 30, 1990, submitting the amended mitigation plan for the Azeka Building Corporation's Azeka Place project in Kihei, Maui. The work would involve the placement of 4.2 acres of fill in wetlands for a commercial development and includes 3.5 acres of wetland creation/enhancement.

Based on this understanding, I have determined that the proposed work is authorized by the Corps Nationwide (NW) permit authority in accordance with Federal Regulations at 33 CFR 330.5(a)(26), and with the special conditions listed below. Excerpts from the regulations which list the conditions and management practices of this authorization are enclosed for your information and compliance (Encl 1).

The following special conditions shall be incorporated as part of the permit:

a. All mitigation work shall be performed as described in the document, "Proposed Mitigative Measures for Wetlands at Azeka Place Commercial Center, TMK: 3-9-02: 28, 76, 80, Kihei, Maui, Hawaii", as amended August 27, 1990, and on the accompanying plan, as revised August 24, 1990.

b. A schedule of the construction work will be submitted to the Operations Division within 30 days of the NW authorization. Details of the construction drawings shall be coordinated with and incorporate the design guidance recommendations of the U.S. Fish and Wildlife Service, as contained in the enclosed design criteria and drawing. (Encl 2)

c. The permittee shall use best efforts to complete the construction of the mitigation plan within one (1) year of NW authorization. A performance bond, or other formal financial commitment satisfactory to the Corps, equal to one hundred percent of the contract price shall be held by a third party to complete the construction of the mitigation wetland should the wetland construction fail to be completed within the time specified. Evidence of securing the bond or financial commitment shall be provided to the Corps of Engineers within 30 days of award of the construction contract.

d. Upon completion of the mitigation work, an onsite inspection will be held to evaluate the success of the work and document the baseline for completion of the wetland mitigation. Quarterly letter reports summarizing the waters levels, salinity, vegetation cover and use of the wetland by endangered waterbirds and migratory shorebirds shall be submitted by the permittee to the Corps of Engineers for the first year. Subsequent monitoring requirements as well as reasonable modifications that may be required to assure the continued existence of the wetlands will be determined at annual onsite inspections to be held thereafter.

e. All features of the mitigation wetland will be maintained in perpetuity as compensation for the placement of fill authorized by this permit; however, future substitution of mitigation measures may be authorized, provided that such substitution is acceptable to the Corps of Engineers, in consultation with the U.S. Fish and Wildlife Service and the U.S. Environmental Protection Agency.

f. This permit authorization shall be recorded at the Bureau of Conveyances. The permittee shall provide an endorsed copy of the filed permit to the Corps of Engineers within 60 days of the issuance of this permit.

In addition to these conditions and management practices, you are advised that:

a. Nationwide permits do not obviate the need to obtain other Federal, state or local authorizations required by law.

b. Nationwide permits do not grant any property rights or exclusive privileges.

c. Nationwide permits do not authorize any injury to the property or rights of others.

d. Nationwide permits do not authorize interference with any existing or proposed Federal project.

This verification will be valid until the nationwide permit is modified, reissued, or revoked. All the nationwide permits are scheduled to be modified, reissued or revoked prior to January 13, 1992. It is incumbent upon you to remain informed of changes to the nationwide permits. We will issue a public notice announcing the changes when they occur. Furthermore, if you commence or are under contract to commence this activity before the date the nationwide permit is modified or revoked, you will have twelve months from the date of the modification or revocation to complete the activity under the present terms and conditions of this nationwide permit.

Sincerely,

Stanley J. Arakaki

Stanley J. Arakaki
Chief, Operations Division

Enclosures

Copies Furnished:

US FWS, Honolulu Office

US EPA, Region IX, San Francisco, CA.

CONDITIONS TO NATIONWIDE PERMITS

The following special conditions must be followed in order for the nationwide permits identified in paragraph (a) of this section to be valid:

(1) That any discharge of dredged or fill material will not occur in the proximity of a public water supply intake;

(2) That any discharge of dredged or fill material will not occur in areas of concentrated shellfish production unless the discharge is directly related to a shellfish harvesting activity authorized by paragraph (a)(4) of this section;

(3) That the activity will not jeopardize a threatened or endangered species as identified under the Endangered Species Act (ESA), or destroy or adversely modify the critical habitat of such species. In the case of federal agencies, it is the agencies' responsibility to comply with the requirements of the ESA. If the activity may adversely affect any listed species or critical habitat, the district engineer must initiate Section 7 consultation in accordance with the ESA. In such cases, the district engineer may:

(i) Initiate section 7 consultation and then, upon completion, authorize the activity under the nationwide permit by adding, if appropriate, activity specific conditions, or

(ii) Prior to or concurrent with section 7 consultation he may recommend discretionary authority (see section 330.8) or use modification, suspension, or revocation procedures (see 33 CFR 325.7).

(4) That the activity shall not significantly disrupt the movement of those species of aquatic life indigenous to the waterbody (unless the primary purpose of the fill is to impound water);

(5) That any discharge of dredged or fill material shall consist of suitable material free from toxic pollutants (see section 307 of the Clean Water Act) in toxic amounts;

(6) That any structure or fill authorized shall be properly maintained;

(7) That the activity will not occur in a component of the National Wild and Scenic River System; nor in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an officially study status;

(8) That the activity shall not cause an unacceptable interference with navigation;

Encl 1

(9) That, if the activity may adversely affect historic properties which the National Park Service has listed on, or determined eligible for listing on, the National Register of Historic Places, the permittee will notify the district engineer. If the district engineer determines that such historic properties may be adversely affected, he will provide the Advisory Council on Historic Preservation an opportunity to comment on the effects on such historic properties or he will consider modification, suspension, or revocation in accordance with 33 CFR 325.7. Furthermore, that, if the permittee before or during prosecution of the work authorized, encounters a historic property that has not been listed or determine eligible for listing on the National Register, but which may be eligible for listing in the National Register, he shall immediately notify the district engineer;

(10) That the construction or operation of the activity will not impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights;

(11) That in certain stated, an individual state water quality certification must be obtained or waived (see § 330.9);

(12) That in certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see § 330.10);

(13) That the activity will comply with regional conditions which may have been added by the division engineer (see § 330.8(a)); and

(14) That the management practices listed in § 330.6 of this part shall be followed to the maximum extent practicable.

MANAGEMENT PRACTICES

In addition to the conditions specified in the attached sheet, the following management practices shall be followed, to the maximum extent practicable, in order to minimize the adverse effects of these discharges on the aquatic environment. Failure to comply with these practices may be cause for the district engineer to recommend, or the division engineer to take, discretionary authority to regulate the activity on an individual or regional basis.

(1) Discharges or dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

(2) Discharges in spawning areas during spawning seasons shall be avoided.

(3) Discharges shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).

(4) If the discharge creates an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized.

(5) Discharge in wetlands areas shall be avoided.

(6) Heavy equipment working in wetlands shall be placed on mats.

(7) Discharges into breeding areas for migratory waterfowl shall be avoided.

(8) All temporary fills shall be removed in their entirety.

DESIGN CRITERIA FOR WETLAND MITIGATION
AZEKA PLACE COMMERCIAL CENTER, KIHEI, MAUI
U.S. FISH & WILDLIFE SERVICE LTR, DATED OCTOBER 10, 1990

The mitigation wetland shall be constructed and maintained in general conformance with the following design criteria and drawing:

1. Water depths within the wetland shall range from 0 - 0.5 feet, exclusive of the moat.

2. The diameter of the nesting islands shall range from 2 - 10 feet when the water surface elevation is at 2.0 feet MSL.

3. The distance between islands shall be at least 50 feet.

4. The maximum height of the islands above the water level shall be 0.5 feet.

5. The slope of the islands shall be no greater than 5%.

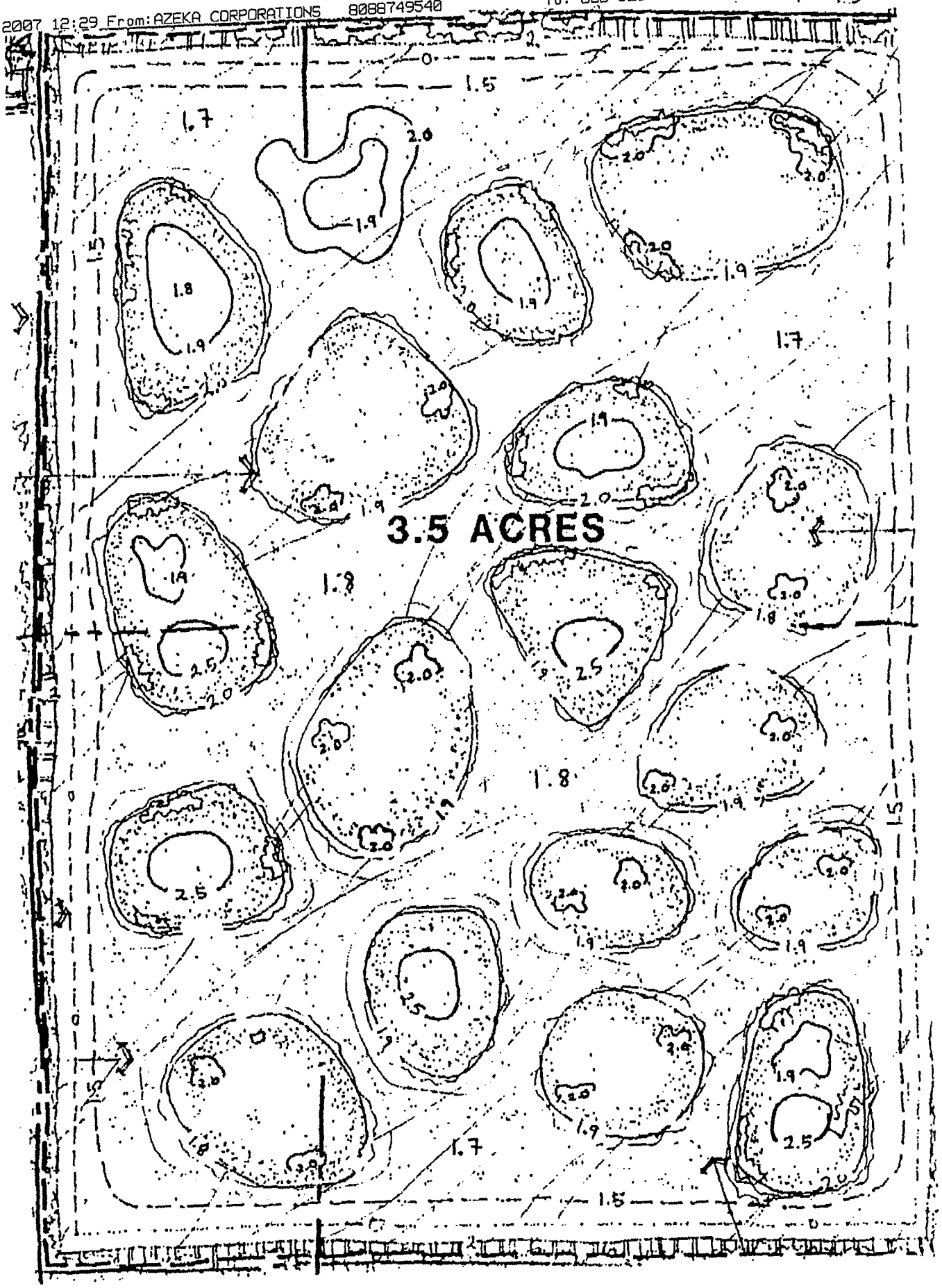
6. Wetland vegetation, such as pickleweed (Batis maritima), makai (Bolboschoenus maritimus = Scirpus maritimus), and water hyssop (Bacopa monnieri) shall be planted by the permittee to provide cover and food for endangered and migratory waterbirds. Vegetation cover on the islands shall be maintained by the applicant to not exceed 30% of the exposed mudflat when the water surface elevation is at 2 feet above MSL.

7. A moat and chain-link fence shall be constructed along the perimeter of the mitigation wetland to deter predators and people from entering the wetland. The moat shall be approximately 2-feet deep, and have a bottom width of no less than 10 feet. Encroachment of vegetation across the moat shall be controlled by the permittee.

8. A 4-foot-high chain-link fence shall be constructed along the outside boundary of the moat. The bottom 8-12 inches of the fence shall be buried below grade to reduce the potential for predators from crawling or digging under the fence. The perimeter fence shall include a secured gate to allow access into the wetland for maintenance purposes.

9. A hedge of vegetation shall be planted along the outside boundary of the fence line to provide a visual buffer between the wetland and the surrounding urban developments. Except at the viewing platform, the vegetation buffer shall be 10 feet in width.

Encl 2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APPENDIX E-2.

Parcel 030 Wetland Determination Summary

MALAMA
Environmental

WETLAND SURVEY

Piikea Property

Subject Site:

PIIKEA AVENUE PARCEL
PIIKEA AVENUE
KIHEI, HAWAII 96753
T.M.K. (2) 3-9-02:30

Prepared for:

THE KRAUSZ COMPANIES, INC.
44 MONTGOMERY, SUITE 3300
SAN FRANCISCO, CA 94104
ATTN: MR. DAVID PYLE

Conducted and Compiled by:
Malama Environmental (MEV, LLC)
MEV Project Number #0807-0106
August 27, 2008

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P.O. Box 880487, Pukalani • Hawaii 96788-0487 • (808)573-0200 Phone • (808)573-0210 Fax

Piikea Parcel Wetland Determination Summary

Prepared by
Malama Environmental (MEV, LLC)
August 26, 2008
MEV Project # 0807-0106

On August 12 & 13, 2008, MEV conducted a wetland determination field survey on the subject property parcel consisting of one (1) separate parcel including vacant land and a previously constructed wetland. The purpose of this survey was to determine if areas with wetland conditions, as defined by the Army Corps of Engineers' (COE) criteria, were located on-site.

SITE LOCATION

The project area is located approximately 1,700 feet east of the Pacific Ocean in the seaside community of Kihei, Maui, Hawaii. See Figure 1, Appendix A. The parcel TMK number is (2)-3-9-002:30. Parcel 30 is located due east of Longs Shopping Center and lies immediately north of Piikea Avenue (southern boundary). The western portion of the subject property consists of a constructed wetland area (fenced) and the remaining portion of the subject site consists of undeveloped, sparsely vegetated land. Total acreage for Parcel 30 consists of approximately 13.469 acres. See Figure 2, Appendix A.

SITE HISTORY

Prior to conducting the field survey, aerial photographs were analyzed to determine the historical uses of the parcel to determine if areas with wetland conditions (ponding water, etc.) could be identified. MEV reviewed aerial photographs dated 1950, 1963, 1971, 1975, 1987, 1998 and 2007. See chronological review below.

Areas of potential surface water ponding were noted on the subject site in a 1963 aerial photo. Most surface water ponding was noted within the western portion of the subject property and along the southern property boundary in the southwestern location of the site (approximately 1 acre of ponded water).

1950 – Undeveloped and sparsely vegetated land with some clearing in the western portion of the property and along the southern boundary in the southwestern location of the site.

1963 – Prominent surface water ponding noted in the western portion and along the southern boundary in the southwestern location of the site (approximately 1 acre of ponded water).

1971 – Surface water ponding is no longer present. Site remains undeveloped and partially vegetated.

1975 – No significant changes.

1987 – No ponding noted. Structure noted in the northeast corner with related unpaved paths. Sparsely vegetated and cleared land in the vicinities of historic surface water ponding.

1998 – A constructed wetland forms the western portion of the subject property and approximates most of the same area as the previously noted natural wetland in the 1963 photo. Possible wetland indicator vegetation noted at the southeastern border of the constructed wetland. The remainder of the site consists of undeveloped vegetated land with several structures located in the northeastern corner.

2007 – No significant changes.

FIELD SURVEY

Parcel 30 consists of a predominantly undeveloped, vegetated lot with a constructed wetland located in the western portion. Only the immediate eastern boundary along the constructed wetland and a small portion along the southern boundary are low-lying with wetland indicator plants. Thereafter, the property elevation rises quickly eastward effectively eliminating any wetland indicators.

Five (5) boreholes (BH-1 through BH-5) were excavated on this parcel. BH-1 is located approximately 30-40 feet east of the constructed wetland's fence line and 180 feet north of Piikea Avenue in an area of wetland indicator plants. BH-2 is located adjacent to an unpaved road and approximately 40 feet southeast of BH-1. BH-3 is located approximately 10 feet east of the unpaved road and 100 feet north of Piikea Avenue. BH-4 is located due south of BH-3 and approximately 25 feet north of Piikea Avenue. BH-5 is located in a low-lying area with wetland indicator plants approximately 50 feet north of Piikea Avenue and 120 feet east of the constructed wetland. These locations were chosen due to their close proximity to the constructed wetland and/or to their close proximity to areas of surface water ponding noted on a historical aerial photo. See Figure 2 and Photos 2 thru 8, Appendix A.

Eastward, from the five (5) low-land borehole sites, was not evaluated by MEV due to the elevated topography and lack of wetland characteristic features.

See Appendix A for a Regional Setting Map (Figure 1) and Site Plan (Figure 2). The approximate locations of the above-noted five (5) boreholes are noted in Figure 2.

The COE Routine Wetland Determination Data Forms that were used for this project are located in Appendix B.

SOIL SURVEY

According to historical aerial photographs of this region, the western portion of Parcel 30 became a constructed wetland in the early 1990's. An unpaved road trends northward located approximately 60 feet east of the wetland. This road is bermed 1-2 feet above the natural surrounding surface soils and has a constructed gravel cap. This unimproved road effectively separates the marginal wetland segments.

Both BH-1 and BH-2 were excavated to the west of the unpaved road to depths of twenty-one (21) inches and twenty-three (23) inches respectively. Reducing conditions and low-chroma soils were noted in both BH-1 and BH-2. No sulfidic odors were encountered. Both BH-1 and BH-2 are located within a low-lying wetland transitional area adjacent to the constructed wetland. See Photos 2-5, Appendix A.

BH-3 was excavated to the east of the unpaved road to a depth of nineteen (19) inches. Reducing conditions and low-chroma soils were noted in BH-3, however no fetid (foul-smelling) odors were present in BH-3. The surface elevation rises significantly

approximately 5 feet east of BH-3 thereby eliminating any wetland classification. Although BH-3 was found to have some hydric soil indicators, MEV believes this borehole lies on the marginal edge of a wetland.

BH-4 was excavated to a depth of eighteen (18) inches. BH-4 is located in a low-lying area immediately east of the unpaved road and also contains reducing conditions and low-chroma soils. This borehole has interfingering mottled organics in the upper horizon consisting of slightly fetid odors. See Photos 2 & 6, Appendix A.

BH-5 was located northeast of BH-4 in a low-lying area with previous water ponding indicators. BH-5 was excavated to a depth of eighteen (18) inches. A salty precipitate skim with a thin strongly sulfidic organic horizon makes up the ground surface in this area. At a depth of approximately 4 inches, lies another organic horizon with fetid odors indicating historic water level fluctuation in this area. See Photos 7 & 8, Appendix A.

COE Data Forms on BH-1 through BH-5 are located in Appendix B.

WETLAND HYDROLOGY

A 1963 historical aerial photo showed prominent surface water ponding in the western portion and along the southern boundary in the southwestern location of the site.

Currently no areas east of the constructed wetland were inundated at the time of the site reconnaissance. However, MEV noted the area containing BH-5 showed characteristics of recent (past year) surface water ponding.

BH-1 and BH-4 had saturated soils located at depths of less than twelve (12) inches. BH-2 and BH-3 had depths to saturated soils of 12-12.5 inches respectively after open-hole conditions greater than one hour duration and are considered marginal for wetland hydrology.

BH-5 had several additional primary wetland hydrology indicators including sediment deposits on the ground surface, historic water marks and drift lines. Although the depth to saturated soils for BH-5 is borderline for wetland characteristics, MEV believes this area would likely meet wetland qualifications for surface water ponding for at least a two week period per year.

COE Data Forms for BH-1 through BH-5 are located in Appendix B.

VEGETATION

A narrow strip of wetland vegetation is located along the eastern boundary of the constructed wetland and in patches of low-lying areas east of the unpaved road in the southwestern portion of the property.

The majority of wetland indicator vegetation encountered consisted of the facultative species *Pluchea indica* (Indian fleabane) and *Sesuvium portulacastrum* (akulikuli). One (1) obligate wetland plant, *Batis maritima (akulikuli-kai)* was also noted in limited extent along the eastern boundary of the constructed wetland and in the location of BH-5.

CONCLUSIONS

Based on the borehole excavations and vegetation survey MEV has concluded that BH-1, BH-2, BH-3, BH-4 and BH-5 have the necessary triple combination of the following wetland indicators (hydric soils, hydrophytic vegetation, and wetland hydrology). Two

boreholes (BH-2 and BH-3) are considered to have marginal parameters. A 1963 historical aerial photo indicated that significant surface water ponding occurred on the western and southwestern portion of the site; however, this was not noted in any other year prior to or after 1963. The constructed wetland on-site was established during the 1990's.

MEV concludes that 3, non-contiguous, depressed areas of the subject site have all three (3) wetland parameters. The estimated areas for each wetland was measured by foot-pace within the wetland designated boundary. The first area is in the immediate area of BH-1 and BH-2 and extends northward along the eastern boundary of the constructed wetland. The estimated area was measured by foot-pace within the wetland designated boundary and is approximately 6,000 square feet in size and is not connected on the surface to the wetland area located to the west. The second area includes BH-3 and BH-4 and is a triangular area located southwest of the unpaved road. The area is approximately 2,200 square feet in size. The third area is located in the vicinity of BH-5 and is approximately 2,000 square feet in size. These 3 locations combined measure approximately 0.23 of an acre. See Figure 2, Appendix A.

MEV believes these areas were historically connected to (eastern limit or transition zone) the larger, natural wetland area located in the western portion of the subject site during the early 1960's. However, it should be noted that no surface water ponding was noted (on historical aerial photos), after the 1970's and post engineered wetland construction.

MEV concludes that though the three previously mentioned areas contain the required parameters to be classified as wetlands, given their combined size (less than 0.25 of an acre) and non-contiguous nature, it may not satisfy the requirements of the COE's wetland definition. We further conclude that these areas currently act as a transition zone between upland conditions east of the unpaved road and the adjacent on-site constructed wetland.

MEV recommends that proper development planning be undertaken to ensure that any future development does not negatively impact the on-site constructed wetland in the western portion of the property. A narrow vegetated buffer zone, which could include the delineated wetland transition zone of this study, is recommended.

Under the Clean Water Act, Section 404, the Army COE has final jurisdictional control of wetlands. For areas less than ¼ acre, formal on-site delineation is not required which simplifies the notification and jurisdictional determination process. The engineered wetland's, construction may have been an approved mitigation factor for any development on the remainder of Parcel 30. If this is verified by the COE, a jurisdictional determination and/or permit may be already applied to work on Parcel 30. Otherwise, a COE pre-construction notification process will determine if the COE claims jurisdiction and requires a Wetland Permit Application.

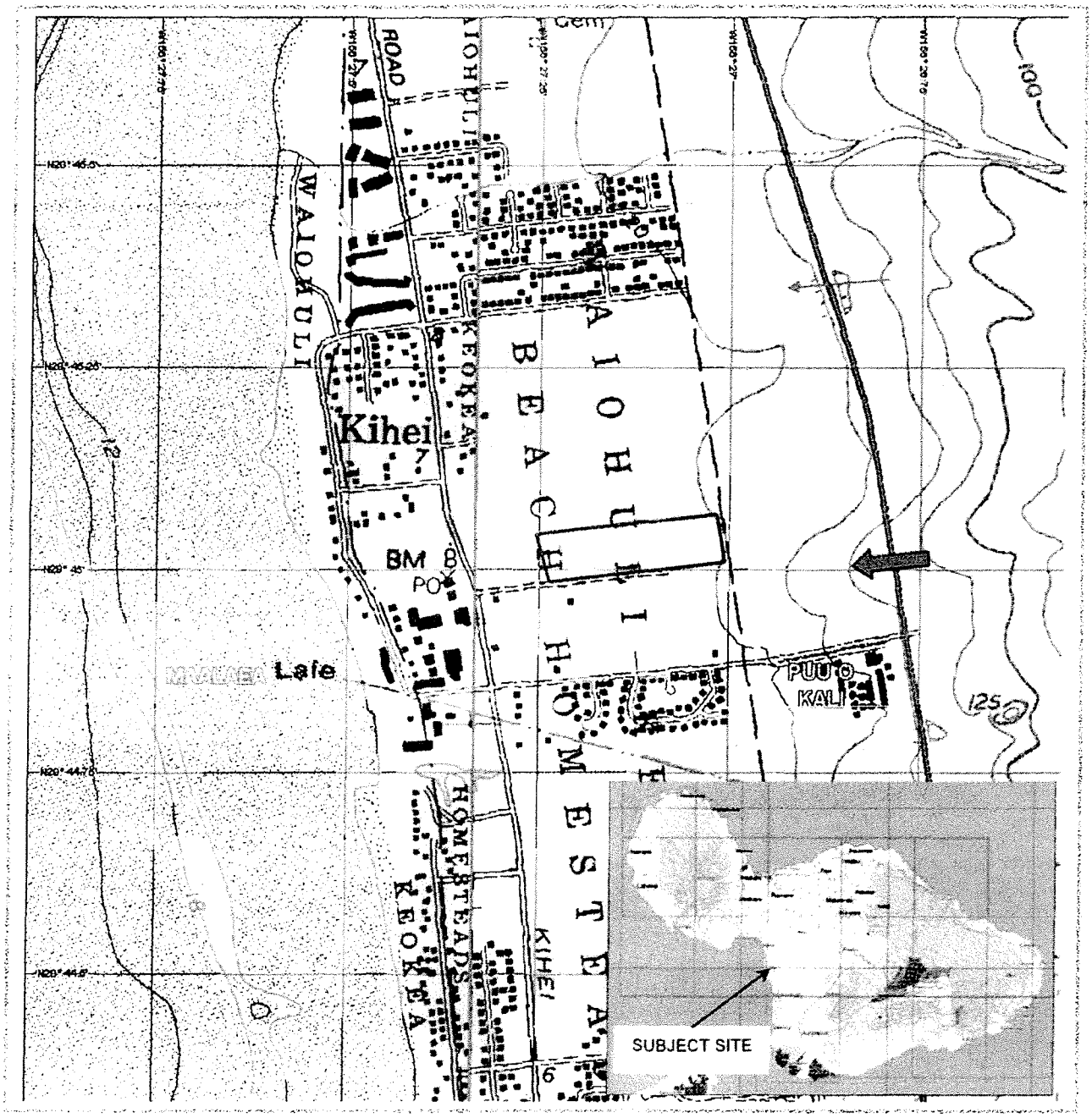
MEV Field Investigators

Mr. John Vuich, Geologist (soils and hydrology)
Ms. Amy Mathis, Environmental Technician (soils, hydrology and mapping)

APPENDIX A

- Figure 1 - Regional Setting Map
- Figure 2 - Site Plan with Borehole Locations
- Site Photographs

FIGURE 1: REGIONAL SETTING MAP



Subject Property

Projected Groundwater Flow

Regional Surface Water Flow

N
W E
S

FIGURE 2: SITE PLAN & BOREHOLE LOCATIONS

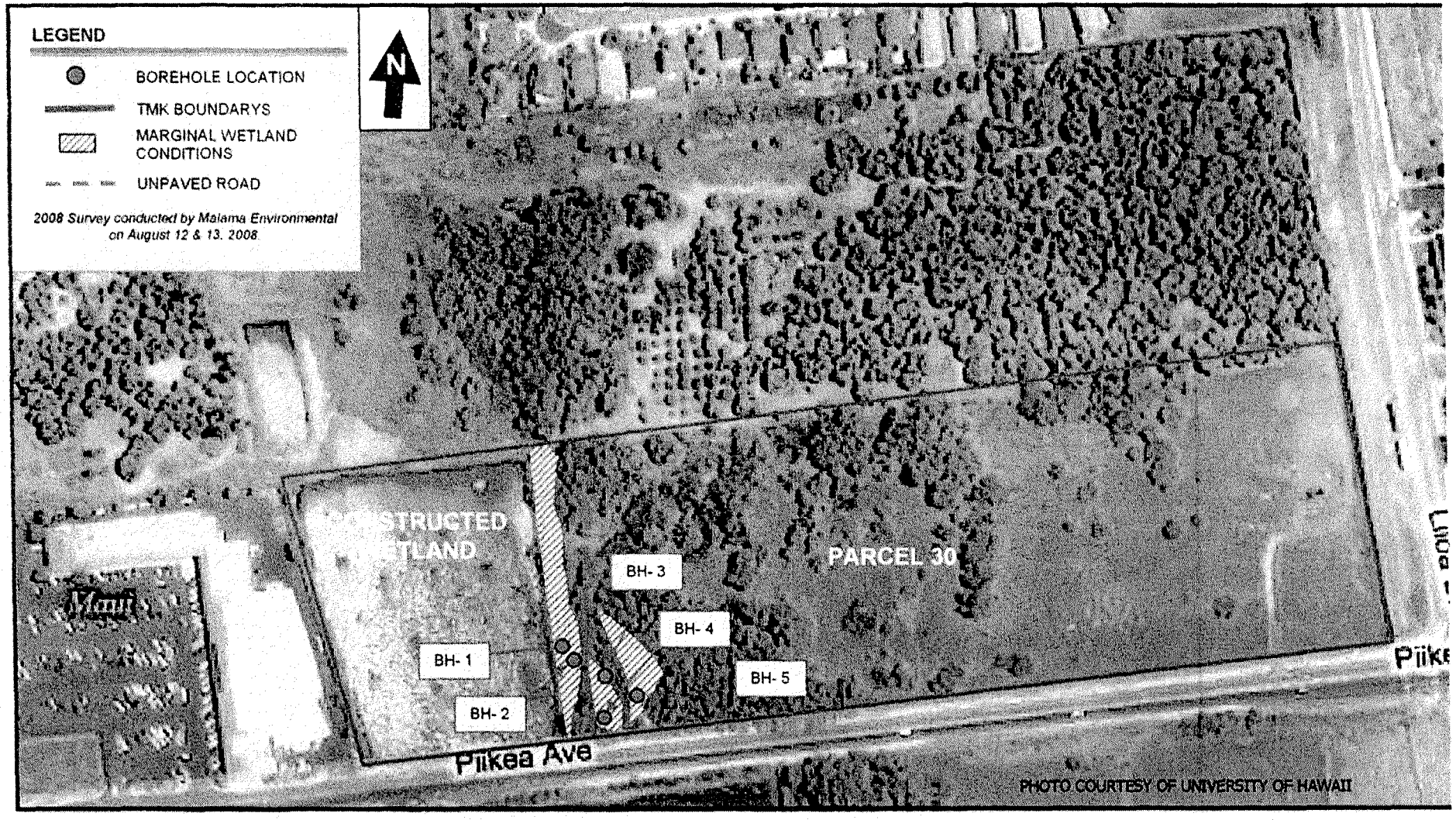


PHOTO 1

Aerial view of the subject property and adjacent properties.

Note that the western portion is a constructed wetland.

Photo source: http://maps.live.com/
Photo date 2008.

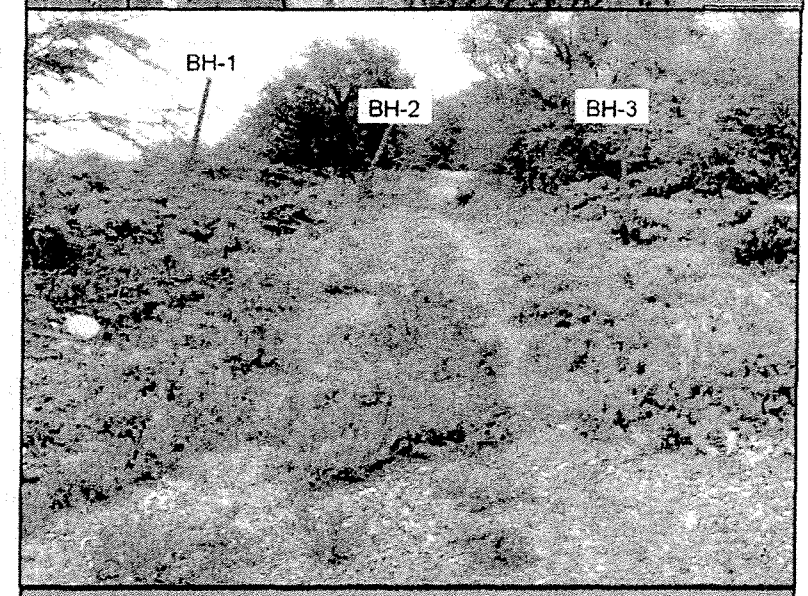


PHOTO 2

Northerly view of the subject Property with the approximate locations of BH-1, BH-2 and BH-3.

The constructed wetland included in the property parcel is located farther to the west.

Note the unpaved road trending northward.

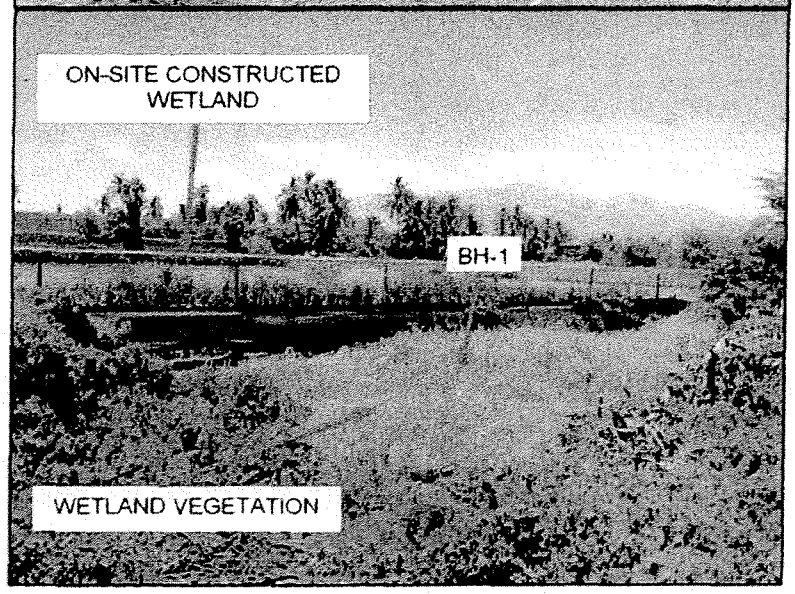


PHOTO 3

Northwesterly view of BH-1 vicinity and the on-site constructed wetland.

Note the wetland indicator vegetation.

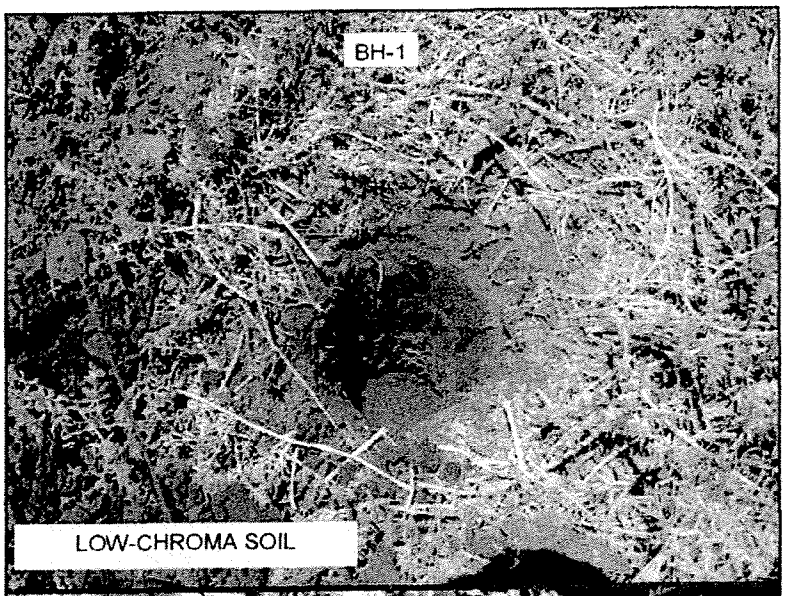


PHOTO 4

BH-1 has all three wetland parameters.

Note the wetland characteristic vegetation and the excavated low-chroma soils indicating reducing conditions are present.

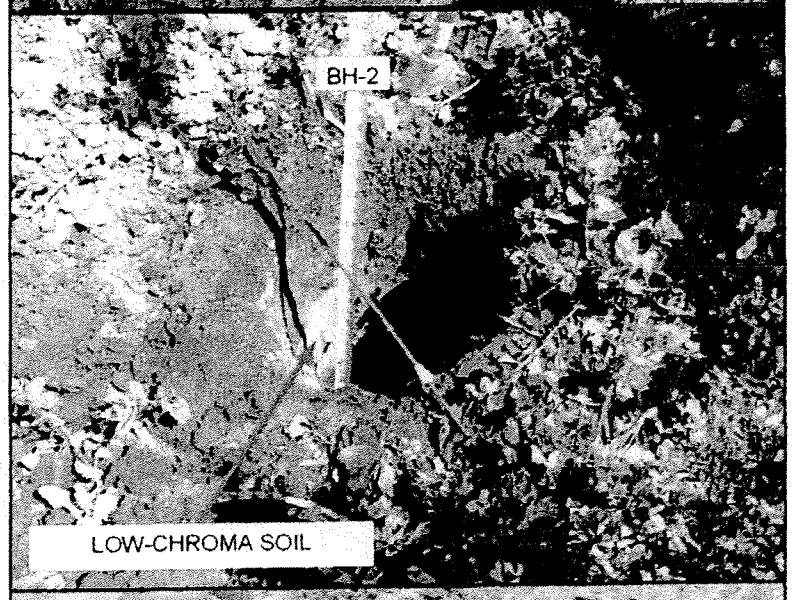


PHOTO 5

BH-2 has marginal hydrology and vegetation indicators and hydric soils are present.

Note the light colored soil horizons indicating reducing conditions are present.

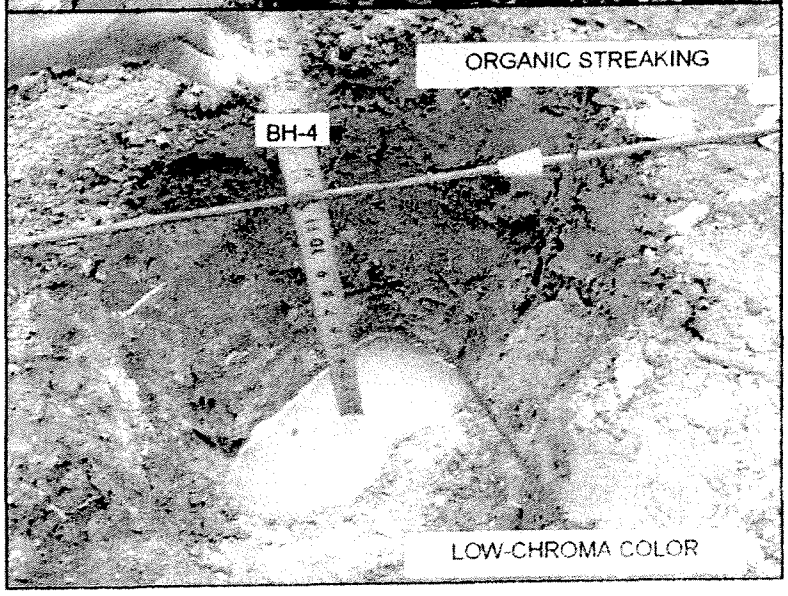


PHOTO 6

BH-4 has wetland hydrology and hydric soils indicators. Vegetation indicators are marginal . The depth to water in the borehole is 12 inches. Soil saturation occurred at 7 inches.

Note the light colored soil horizons indicating reducing conditions are present and the organic streaking in the upper horizon.

PHOTO 7

Low-lying depressed area with wetland hydrology indicators. This area previously contained ponding water, and is the location where BH-5 was excavated.

Note the salty precipitate on the surface and the obligate vegetation.

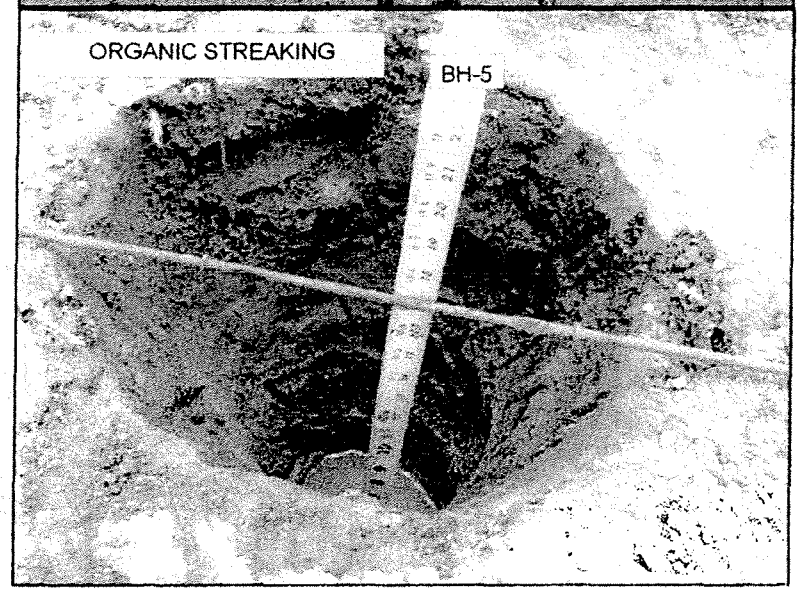


PHOTO 8

BH-5 has all three wetland parameters.

Note the white salty precipitate on the ground surface indicating evaporation of previous water ponding in the area.

Note the organic streaking in the upper horizon and the lower light colored, grayish soil horizons indicating reducing conditions are present.

APPENDIX B

COE Wetland Determination Data Forms

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: PIIKEA, KIHEI	Date: 08/12/08
Applicant/Owner: THE KRAUSZ COMPANIES, INC.	County: MAUI
Investigator: A. MATHIS , J. VUICH,	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID: Akulikuli kai
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: Parcel 30
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-1
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. *Batis maritima* (akulikuli kai)	Herb	FACW
2. *Pluchea Indica* (Indian fleabane)	Shrub	FAC*

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
70% FACW & 30% FAC*

Remarks:

HYDROLOGY

x Recorded Data (Describe in Remarks):
- ____ Stream, Lake, or Tide Gauge
- x Aerial Photographs
- ____ Other

____ No Recorded Data Available

Field Observations:

Depth of Surface Water: n/a (in.)

Depth to Free Water in Pit: *16 (in.)

Depth to Saturated Soil: 8 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ____ Inundated
- x Saturated in Upper 12 Inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12"
- ____ Water-Stained Leaves
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

BH-1 is within 30-40 feet of the constructed wetland due west. The fence line around the western lot perimeter has been bermed approximately 1 foot. Fifty feet to the east is a bermed unpaved road with a gravel cover.
Total hole depth is 21".
*Depth to free water in the pit after 60 minutes is 10 inches.

SOILS

Map Unit Name
(Series and Phase): BH -1

Drainage Class: _____

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): PsA, Puleh clay loam

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0" - 3"	A	5YR-3/2			Sandy clay, 20% organics (roots) slightly indurated.
3" – 6.5"	AB	5YR-3/3	5YR-4/4		Silty sandy clay, minor organics with roots, coral rich sand. Very moist
6.5" - 7"	E	7.5YR-4/3			Medium sand with minor silt, 70% beach sand, 30% volcanics
7" -9.5"	BA	5YR-2.5/1			Clay silty sand, 70%sand, 30% silt
9.5"-13"	CB	7.5YR -5/1			Silty coarse sand, 80% coral beach sand, 20% volcanics
13"-21"	C	5YR-4/1			Sand, beach and volcanic well rounded.

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Concretions
__x High Organic Content in Surface Layer

Sandy Soils
___ Sulfidic Odor
___ Aquic Moisture Regime
__x Reducing Conditions
__x Gleyed or Low-Chroma Colors
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

Horizon CB is totally saturated.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: PIIKEA, KIHEI	Date: 08/13/08
Applicant/Owner: THE KRAUSZ COMPANIES, INC.	County: MAUI
Investigator: A. MATHIS , J. VUICH,	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID: Pluchea indica
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: Parcel 30
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-2
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. *Pluchea Indica* (Indian fleabane)	Shrub	FAC*

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
100% FAC*.

Remarks:

HYDROLOGY

x Recorded Data (Describe in Remarks): ____ Stream, Lake, or Tide Gauge x Aerial Photographs ____ Other ____ No Recorded Data Available	Wetland hydrology Indicators: Primary Indicators: ____ Inundated x Saturated in Upper 12 Inches ____ Water Marks ____ Drift Lines ____ Sediment Deposits ____ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ____ Oxidized Root Channels in Upper 12" ____ Water-Stained Leaves ____ FAC-Neutral Test ____ Other (Explain in Remarks)
Field Observations: Depth of Surface Water: n/a (in.) Depth to Free Water in Pit: 21 (in.) Depth to Saturated Soil: 12 (in.)	

Remarks:

*Depth to free water in the pit after 24 hours is 17 inches.

SOILS

Map Unit Name
(Series and Phase): BH -2

Drainage Class: _____

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): PsA, Puleh clay loam

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0" - 4"	A	7.5YR-2.5/2			Loam, 20% organics and roots. Moist
4" – 7"	AE	7.5YR-4/3	7.5YR-4/4		Loam, 10%organics and roots. Moist
7" – 9.5"	E	7.5YR-4/3	7.5YR-4/4		Loamy medium sand, 80% beach sand, 20% volcanics. Moist
9.5" -15"	CB	7.5YR-5/3			Loamy coarse sand, 80% beach sand, 20% volcanics. Saturated
15"-23"	C	10YR-6/3			Coarse sand, 70% beach sand, 30% volcanics.

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Concretions
___ High Organic Content in Surface Layer

Sandy Soils
___Sulfidic Odor
___Aquic Moisture Regime
_x_Reducing Conditions
_x_Gleyed or Low-Chroma Colors
_x_ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

BH-2 borders an unpaved gravel road.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks: low-chroma colors noted in horizons CB and C. Organic streaking noted in the AE horizon.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: PIIKEA, KIHEI	Date: 08/13/08
Applicant/Owner: THE KRAUSZ COMPANIES, INC.	County: MAUI
Investigator: A. MATHIS , J. VUICH,	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID: Pluchea indica
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: Parcel 30
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-3
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. *Pluchea Indica* (Indian fleabane)	Shrub	FAC*

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
100% FAC*.

Remarks:
Surface above first horizon is littered with recently placed shredded bark.

HYDROLOGY

x Recorded Data (Describe in Remarks): ____ Stream, Lake, or Tide Gauge x Aerial Photographs ____ Other ____ No Recorded Data Available	Wetland hydrology Indicators: Primary Indicators: ____ Inundated x Saturated in Upper 12 Inches* ____ Water Marks ____ Drift Lines ____ Sediment Deposits ____ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ____ Oxidized Root Channels in Upper 12" ____ Water-Stained Leaves ____ FAC-Neutral Test ____ Other (Explain in Remarks)
Field Observations: Depth of Surface Water: n/a (in.) Depth to Free Water in Pit: 18 (in.) Depth to Saturated Soil: *12.5 (in.)	

Remarks:

* Depth to saturated soil within BH-3 is borderline and is located within a transitional wetland zone.

SOILS

Map Unit Name
(Series and Phase): BH -3

Drainage Class: _____

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): PsA, Puleh clay loam

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0" - 2"	A	Dark brown			Organics present
2" – 4"	AB	Medium brown			Mineral silty clay
4" – 8"	E	Light brown			
8" -13"	CE	Light brown/gray			loam
13"-19"	C	Light brown/gray			Sand – medium to coarse

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Concretions
___ High Organic Content in Surface Layer

Sandy Soils
___Sulfidic Odor
___Aquic Moisture Regime
_x_Reducing Conditions
____Gleyed or Low-Chroma Colors
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

BH-3 is an exploratory borehole to determine wetland boundary. Full description was not needed. No fetid odors noticed in any horizons. Other parameters were marginal.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks: BH-3 has very marginal wetland characteristics and is considered to be borderline wetland within a transitional zone.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: PIIKEA, KIHEI	Date: 08/13/08
Applicant/Owner: THE KRAUSZ COMPANIES, INC.	County: MAUI
Investigator: A. MATHIS , J. VUICH,	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID: Pluchea indica
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: Parcel 30
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-4
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. *Pluchea Indica* (Indian fleabane)	Shrub	FAC*
2. *Prosopis pallida* (kiawe)	Tree	FACU-
3. *Ipomoea pescaprae* (pohuehue)	Woody vine	FACU-

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
60% FAC*, 30% pohuehue, 10% FACU-.

Remarks:

HYDROLOGY

x Recorded Data (Describe in Remarks):	Wetland hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
x Aerial Photographs	____ Inundated
____ Other	x Saturated in Upper 12 Inches
____ No Recorded Data Available	____ Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: n/a (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 12 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 7 (in.)	____ Oxidized Root Channels in Upper 12"
	____ Water-Stained Leaves
	____ FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): BH -4

Drainage Class: _____

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): PsA, Puleh clay loam

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0" - 3"	A	7.5-3/2	10YR-2/1		Clay loam with mottled organics. Fetid odor present.
3" – 8"	E	10YR-4/3	10YR-3/2		Loamy med-coarse sand with few mottled organics.
8" – 18"	EC	10YR -5/3			Loamy coarse sand, 80% beach sand, 20% volcanics. Saturated.

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Concretions
___ High Organic Content in Surface Layer

Sandy Soils:

___Sulfidic Odor
___Aquic Moisture Regime
_X_Reducing Conditions
_X_Gleyed or Low-Chroma Colors
_X_ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: PIIKEA, KIHEI	Date: 08/13/08
Applicant/Owner: THE KRAUSZ COMPANIES, INC.	County: MAUI
Investigator: A. MATHIS , J. VUICH,	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID: akulikuli kai
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: Parcel 30
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-5
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. *Batis maritima* (akulikuli kai)	Shrub	FACW
2. *Ipomoea pescaprae* (pohuehue)	Woody vine	FAC-
3. *Nicotiana glauca* (tree tobacco)	Tree	FAC-

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
60% FAC*, 30% pohuehue, 10% FACU-.

Remarks:
80% akulikuli FACW, 10%pohuehue, FAC-, 10% tree tobacco FAC-.

HYDROLOGY

x Recorded Data (Describe in Remarks):
____ Stream, Lake, or Tide Gauge
x Aerial Photographs
____ Other
____ No Recorded Data Available

Field Observations:
Depth of Surface Water: n/a (in.)
Depth to Free Water in Pit: 17 (in.)
Depth to Saturated Soil: 12 (in.)

Wetland hydrology Indicators:
Primary Indicators:
____ Inundated
X Saturated in Upper 12 Inches*
X Water Marks
X Drift Lines
X Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12"
____ Water-Stained Leaves
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

* Current climatic dry period, but BH-5 would likely meet the period of at least 2 weeks of water ponding per year.

SOILS

Map Unit Name
(Series and Phase): BH -5

Drainage Class: _____

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): PsA, Puleh clay loam

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0" – 0.25"	Salt precipitate	5YR-8/1			White salty precipitate.
0.25" – 0.75"	O	7.5YR-2.5/1			Organic rich, fetid odor
0.75"-3.75"	A	7.5YR-3/3			Silty clay with 10% roots and organics.
3.75"-5.75"	Historic O	7.5YR-2.5/1			Clay loam with some organics.
5.75"-9.75"	E	7.5YR-5/1			Sandy clay loam
9.75"-18"	CE	10YR-5/2			Loam

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Concretions
X High Organic Content in Surface Layer

Sandy Soils:

X Sulfidic Odor
___ Aquic Moisture Regime
X Reducing Conditions
X Gleyed or Low-Chroma Colors
X Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

Approved by HQUSACE 3/92

APPENDIX C

Statement of Qualifications

MALAMA
Environmental

JOHN S. VUICH
President & CEO

STATEMENT OF QUALIFICATIONS:

M. S. Geological Engineering, University of Arizona
B. S. Geological Engineering, University of Arizona
Registered Geologist (California)
Registered Environmental Assessor (California)
Certified Environmental Manager (Nevada)

AREAS OF EXPERTISE

ENVIRONMENTAL

- Site Assessments, Phase I, II, III Investigations
- Underground Storage Tank Closure
- Asbestos Inspection and Monitoring, Management Planning, and Abatement Project Design and Removal
- Lead-Containing Paint Surveys and Inspections, and Disturbance Design and Removal
- Site Characterization for Remedial Investigations
- Facility Operation Compliance Audits-ISO 14000 Audits
- Soils/Groundwater Remediation
- Hazardous Waste Management
- Risk Assessment Investigations
- RCRA Compliance and Closure Projects
- Expert Witness/Litigation Support
- Industrial Hygiene Qualified/Competent Person
- Mold/Fungi Sampling, Remediation and Abatement Design and Removal

GEOLOGICAL

- Hydrogeology
- Geologic Hazards Analysis
- Subsurface Excavations and Drilling Investigations and Sampling

Rev. 7/06

P.O. Box 880487, Pukalani, HI 96788-0487 • (808) 573-0200 Phone (808) 573-0210 Fax

RELEVANT EXPERIENCE

Owner-President • MEV, LLC.
Maui, HI • (June 2006 - Present)
Consulting services and project management for remediation projects, property transfers, sampling and site characterization plans, hazardous and toxic waste management, underground storage tanks, regulatory compliance, permit applications and litigation support.

Owner-President • Vuich Environmental Consultants, Inc.
Maui and Honolulu, Oahu • (March, 1994 - Present)
Licensed contractor for asbestos, mold and lead-based paint abatement, general demolition and construction cleanup.

Project Manager • Various Environmental and Geological Companies
Southwest U.S.A • (1972-1994)
Hazardous materials' and environmental assessment. Site characterization and remediation.

OTHER CERTIFICATIONS AND TRAINING

- Asbestos & Demolition Contractor (C-19, C-24) **HI LIC #21212**
- Accredited Asbestos Contractor/Supervisor
- Continuing Education in Hazardous Materials Management, Environmental Studies and Environmental Regulations.

P.O. Box 880487, Pukalani, HI 96788-0487 • (808) 573-0200 Phone (808) 573-0210 Fax

MALAMA
Environmental

STATEMENT OF QUALIFICATIONS
for
Amy Mathis, Environmental Technician

Company Position Environmental Technician

Responsibilities and Duties:

- Assist on Phase I & II Environmental Site Assessments/Investigations
- Assist on Phase III Remediation Projects
- Assist on Underground Storage Tank (UST) Closures
- Assist on Asbestos Inspections
- Assist on Lead-Based Paint Inspections
- Assist on Indoor Air Quality Investigations
- Erosion Control Plan (BMP) Development
- QA/QC Officer for Sampling Projects

Experience:

- Soil Investigations/Remediation
- UST Removal and Closure
- Hazardous Materials Management
- Asbestos and Lead-Based Paint Projects (Inspections)
- Air Quality Sampling for Particulate and Microbiological Contaminants
- Wetland Delineations
- Environmental Report Writing and Compilation
- Ornithological counts/data collections
- Entomological counts/data collections
- Chemical technician specializing in wet chemical methods, analytical instrumentation and sample preparation.
- Geological mapping
- Vegetation mapping

Training & Education

- Bachelor of Science, Geology with Environmental Science Option New Mexico Institute of Mining and Technology, 1996-1999.
- Bachelor of Fine Arts, Music with minors in Fine Art and Theater Kutztown University Pennsylvania 1991-1995.
- 24-hr OSHA HAZWOPER Course

P.O. Box 880487, Pukalani, HI 96788-0487 • (808) 573-0200 Phone (808) 573-0210 Fax

APPENDIX E-3.

Parcels 076 and 158 Wetland Determination Summary

MEV, LLC

MALAMA ENVIRONMENTAL

WETLAND SURVEY

Piikea Properties

Subject Site:

AZEKA PARCELS
PIIKEA AVENUE
KIHEI, HAWAII 96753
T.M.K. (2) 3-9-02:76
T.M.K. (2) 3-9-02:158

Prepared for:

THE KRAUSZ COMPANIES, INC.
44 MONTGOMERY, SUITE 3300
SAN FRANCISCO, CA 94104

ATTN: MR. DAVID PYLE

Conducted and Compiled by:
Malama Environmental (MEV, LLC)
MEV Project Number #0805-0098
June 13, 2008

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Azeka Parcels Wetland Determination Summary

Prepared by
Malama Environmental (MEV, LLC)
June 13, 2008
MEV Project # 0805-0098

On May 15, 2008, MEV conducted a wetland determination field survey on the subject property parcels consisting of two (2) separate parcels of vacant land. The purpose of this survey was to determine if areas with wetland conditions, as defined by the Army Corps of Engineers' (COE) criteria, were located on-site.

SITE LOCATION

The project area is located approximately 1,700 feet east of the Pacific Ocean in the seaside community of Kihei, Maui, Hawaii. See Figure 1, Appendix A. The parcels' TMK numbers are (2)-3-9-002:076 and (2)-3-9-002:158. Parcel 76 is located immediately east of an engineered wetland area (fenced) and Parcel 158 is located immediately east of the Azeka II Shopping Center. Both parcels of land are separated by the constructed wetland located on Parcel 80. Parcel 76 consists of approximately 9.0 acres and Parcel 158 consists of approximately 1.4 acres. The subject parcels lie immediately south of Piikea Avenue (northern boundary). See Figure 2, Appendix A.

SITE HISTORY

Prior to conducting the field survey, aerial photographs were analyzed to determine the historical uses of the two parcels to determine if areas with wetland conditions (ponding water, etc.) could be identified. MEV reviewed aerial photographs dated 1950, 1963, 1971, 1975, 1987, 1998 and 2007. See chronological review below.

A limited area of potential surface water ponding was noted on Parcel 158 in a 1963 aerial photo. Most surface water ponding was noted on the adjoining properties to the west and north of Parcel 158. Limited amounts of transitional wetland plant indicators were potentially identified on isolated portions of both Parcels 158 and the western edge of Parcel 76.

Parcel 158

1950 – Undeveloped and mostly vegetated shrubs, trees and herbs. Road traverses the center of the site in an east-west direction.

1963 – Possible surface water ponding noted in northwest corner. Otherwise, no changes noted. Substantial wetland areas noted off-site, immediately to the west and north.

1971- No ponding noted. Partially cleared land and partially heavily vegetated.

1975 – No significant changes.

1987 – No ponding noted. Additional vegetation clearing near the south portion of parcel. Small structures noted in southeast corner of lot.

1998 – Lot cleared of vegetation and graded to current conditions. Constructed wetland noted on eastern adjacent property.

2007 – No significant changes.

Parcel 76

1950 – Northern portion heavily vegetated. Southern portion less vegetated.

1963 – Northwest portion is an orchard. West and southwest boundaries are heavily vegetated with low-lying vegetation and shrubs and limited tree stands. Suspect wetland area (due to vegetation, no ponding noted) lies immediately to the west on the adjacent Parcel 80. Residential structures on-site noted, east of orchard.

1971- More densely vegetated along west and southwest boundary. The suspect wetland vegetation noted on western adjacent property has been cleared. Bare soils visible. No ponding.

1975 – No significant changes.

1987 – No significant changes. Orchard appears fallow. Large residential structure removed. Suspect transitional wetland vegetation (possible *Pluchea indica*) remains in southwest corner of lot and on adjacent parcel to the west.

1998 – Orchard and most structures removed. Transitional wetland vegetation still noted in southwest corner and portions along west boundary. Constructed wetland located immediately to the west on adjacent Parcel 80.

2007 – No significant changes.

FIELD SURVEY

Parcel 158 consists of a predominantly undeveloped, graded lot with no significant structures. This land parcel's surface was well above (3 feet) the adjacent property's (Parcel 80) constructed wetland's surface water level.

Two (2) boreholes (BH-1 and BH-2) were excavated on this parcel. BH-1 is located near the central eastern boundary of the lot and is situated 18 feet west of the constructed wetland's fence line of Parcel 80. BH-2 is located near the northwest corner of Parcel 158. These locations were chosen due to their close proximity to the constructed wetland and/or to their close proximity to areas of surface water ponding noted on a historical aerial photo. See Figure 2 and Photos 2 thru 5, Appendix A.

Parcel 76 consists of a predominantly undeveloped, vegetated lot. Significant homeless activity was noted on this site. Three (3) small structures including a former open-shaft groundwater well remain on-site. Only the immediate western portion of Parcel 76 is low-lying and is situated adjacent to the constructed wetland located on Parcel 80. This narrow area has wetland indicator plants. The property elevation rises quickly as one heads eastward on-site, effectively eliminating any wetland indicators.

Significant vegetation removal (mechanical) had recently taken place along the western boundary of Parcel 176. Very deep vehicle (heavy equipment) tracks were noted in the soils in this area. See Photos 6, 7 & 15, Appendix A.

Two (2) boreholes (BH-3 and BH-4) were excavated on Parcel 76. BH-3 is located in the southwest corner of the parcel in a low-lying area with wetland indicator plants. This borehole is 15 feet east of the constructed wetland's fence line located on Parcel 80. BH-4 is located slightly east and north of BH-3. These locations were chosen due to their low-lying positions and their close proximity to the constructed wetland. This area was also noted to have suspect wetland vegetation as identified on historical aerial photos. See Figure 2 and Photos 6 thru 15, Appendix A.

Boreholes were not documented by MEV in the west-central or northwestern property boundaries of Parcel 176. These areas were previously surveyed by Vuich Environmental in 2004 and were determined **not** to be within a wetland. MEV verified this in the field but did not re-document the excavations.

See Appendix A for a Regional Setting Map (Figure 1) and Site Plan (Figure 2). The approximate locations of the above-noted four (4) boreholes and two (2) boreholes from a previous survey (Vuich 2004) are noted in Figure 2.

The COE Routine Wetland Determination Data Forms that were used for this project are located in Appendix B.

SOIL SURVEY

Parcel 158 – A significant amount of fill material was historically placed onto this parcel and graded. Historical photos indicate that this took place in approximately 1990, at the time when Parcel 80 (adjacent parcel) was constructed into a wetland. An undetermined amount of the excavated soils from Parcel 80 were likely placed onto Parcel 158. Further, a layer of crushed rock of varying thickness was placed onto the surface of the dredged soils and graded.

Both BH-1 and BH-2 were excavated to depths of twenty (20) inches and nineteen (19) inches respectively. No reducing conditions, low-chroma colors or sulfidic odors were encountered. The upper nine (9) to twelve (12) inches consisted of gravel fill material.

COE Data Forms on BH-1 and BH-2 are located in Appendix B.

Parcel 76 – The soils located on-site along the northwestern boundary of Parcel 76 had likely been disturbed for several years during agricultural use as a mango orchard. Hydric soils were not encountered in this area during a 2004 survey conducted by Vuich Environmental. See Figure 2, Appendix.

Reducing conditions and low-chroma soils were noted in BH-3. A possible faint sulfidic odor was also noted. BH-3 was noted to have hydric soils present, however, this area appeared to be very small and isolated. See Photos 8 & 9, Appendix A.

BH-4 was located slightly eastward and northward of BH-3, however, did not contain hydric soils. See Photo 13, Appendix A.

Other boreholes (not documented) were excavated at nearby locations located east, north and northeast of BH-3 and were also determined **not** to have hydric soils, further indicating that this area of hydric soils is very small and non-contiguous. This was also evident in some of the deeper machinery tracks located in this area.

COE Data Forms for BH-3 and BH-4 are located in Appendix B.

WETLAND HYDROLOGY

A 1963 historical aerial photo showed very limited surface water ponding on a portion of Parcel 158. No other signs of surface water ponding were noted on any other aerial photos for the two (2) parcels.

This survey was conducted within one (1) day after a significant rainfall event had occurred in the Kihei area. No areas of the property were inundated at the time of the site reconnaissance.

Parcel 158 – BH-1 and BH-2 were not saturated within the upper twelve (12) inches and groundwater was not encountered in either borehole excavation. No primary or secondary wetland hydrology indicators were noted. COE Data Forms for BH-1 and BH-2 are located in Appendix B.

Parcel 76 – BH-3 had saturated soils at a depth of eleven (11) inches, however, the depth to free water in the pit was twenty-three (23) inches. These saturated soils were likely related to the relatively recent heavy rainfall in the region. An additional primary wetland hydrology indicator noted at BH-3 was sediment deposits on the ground surface. BH-3 was determined to have wetland hydrology present, however, this parameter was marginal.

BH-4 had saturated soils located at a depth of twelve (12) inches. This was the only primary wetland hydrology indicator noted at this location. Free water in the pit was encountered at twenty-one (21) inches. BH-4 was determined to have wetland hydrology present, however, this parameter was marginal.

COE Data Forms for BH-3 and BH-4 are located in Appendix B.

VEGETATION

COE Data Forms on the four (4) borehole sites for the two (2) parcels are located in Appendix B.

Parcel 158 - No wetland indicator plants were noted on Parcel 158 in the vicinity of the borehole locations.

Parcel 76 - Only a very narrow strip of wetland vegetation is located along the western property boundary of Parcel 76. The majority of this vegetation is established along the southern portion of the extreme western boundary, adjacent to the constructed wetland located on Parcel 80.

The majority of wetland indicator vegetation encountered consisted of the facultative species *Pluchea indica* (Indian fleabane) and *Sesuvium portulacastrum* (akulikuli). One (1) obligate wetland plant, *Batis maritima (akulikuli-kai)* was also noted in limited extent along the western boundary.

CONCLUSIONS

Parcel 158 - Based on the borehole excavations and vegetation survey MEV has concluded that the entirety of Parcel 158 does not to have the necessary triple combination of the following wetland indicators (hydric soils, hydrophytic vegetation, and wetland hydrology). A 1963 historical aerial photo indicated that limited surface water ponding occurred on a very small portion of the site, however, this was not noted in any other year prior to or after 1963. It appears that any substantial wetland area was previously located on both the western and northern adjacent properties.

Parcel 158 appeared to be disturbed or altered to varying degrees up until approximately 1990 when it was filled and graded to its current condition.

It should be noted that Parcel 158 was historically part of the western adjoining property, Parcel 28. In 1997, the western adjoining property was divided forming Parcel 158. Parcel 28 had wetlands located on-site and the mitigation of those wetlands included the construction of the engineered wetland currently located on Parcel 80.

Based on the current field conditions and the historical information noted above, MEV concludes that Parcel 158 is not currently within a wetland and that any possible historical wetland conditions that were located on-site were dealt with properly with the mitigation work completed for the Azeka II Shopping Center that was overseen by the Corps of Engineers.

This above determination should be confirmed by the COE (i.e. if mitigation work is satisfactory and completed to COE requirements.)

Parcel 76 – Based on the survey conducted by MEV and Vuich Environmental (2004 survey), MEV concludes that a small, non-contiguous, depressed area of Parcel 76 has all three (3) wetland parameters. This area is in the immediate area of BH-3 (southwest portion of Parcel 76) and extends slightly northward along the immediate western boundary. This area has been identified on Figure 2, Appendix A. The area is approximately 3,000 square feet in size (<1/10th of an acre) and is not connected on the surface to the wetland area located on the western adjacent property (Parcel 80).

MEV believes this area was historically connected to (eastern limit or transition zone) a larger, potential wetland area (due to suspect vegetation identified in historical aerial photos) that was located on the western adjoining property, Parcel 80. However, it should be noted that no surface water ponding was ever noted (on historical aerial photos) on Parcel 80, prior to the construction of the engineered wetland.

MEV concludes that though the southwestern portion of Parcel 76 in the vicinity of BH-3 contains the required parameters to be classified as a wetland, given its size and non-contiguous nature, it may not satisfy the requirements of the COE's wetland definition. We further conclude that this area on Parcel 76 currently acts as a transition zone between upland conditions on Parcel 76 and the adjacent, constructed wetland boundary on Parcel 80.

MEV recommends that proper development planning be undertaken to ensure that any future development does not negatively impact the adjacent constructed wetland on Parcel 80. A narrow vegetated buffer zone, which could include the aforementioned transition zone on Parcel 76, is recommended.

Under the Clean Water Act, Section 404, the Army COE has final jurisdictional control of wetlands. Approximately 3,000 square feet (less than 1/10 of an acre) may be considered wetlands in the south-western corner of Parcel 76. Typically, pre-construction notification to the COE is required. For areas less than ¼ acre, formal on-site delineation is not required which simplifies the notification and jurisdictional determination process. Since the adjacent Parcel 80 is and engineered wetland, its construction may have been an approved mitigation factor for developing Parcel 158 and possibly Parcel 76. If this if verified by the COE, a jurisdictional determination and/or permit may be already applied to work on Parcel 76. Otherwise, a COE pre-construction notification process will determine if the COE claims jurisdiction and requires a Wetland Permit Application.

MEV Field Investigators

Mr. John Vuich, Geologist (soils and hydrology)
Mr. Jeffrey Kermode, Environmental Scientist (soils, hydrology and mapping)

APPENDIX A

- Figure 1 - Regional Setting Map
- Figure 2 - Site Plan with Borehole Locations
- Site Photographs

FIGURE 1: REGIONAL SETTING MAP

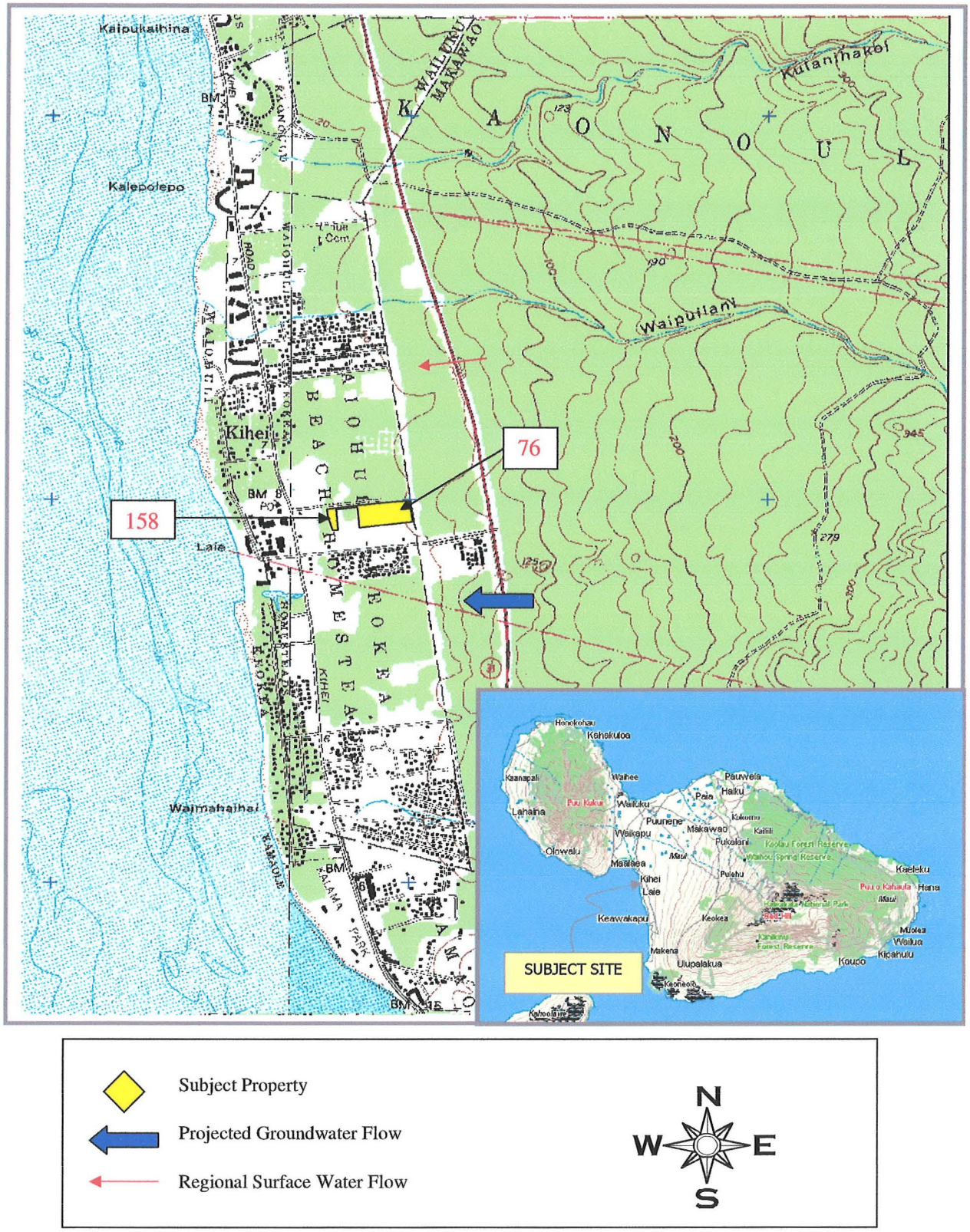

FIGURE 2: BOREHOLE LOCATIONS (2008 & 2004 Survey)

PHOTO COURTESY OF UNIVERSITY OF HAWAII

PHOTO 1

Aerial view of the subject property's parcels (76 & 158) and adjacent properties.

Parcel 80 is located between the two subject property parcels and consists of an engineered wetland constructed in the early 1990's.

Parcel 76
Parcel 158

Photo source: http://maps.live.com/
Photo date 2008.

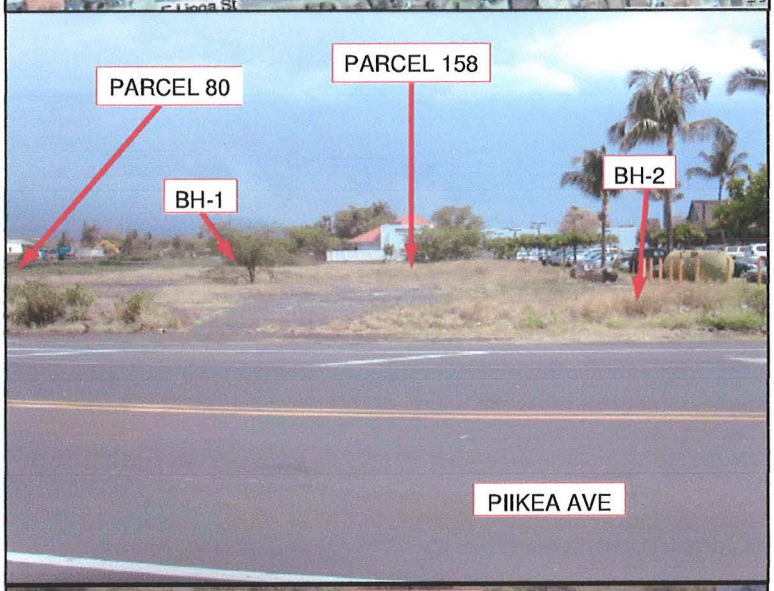

PHOTO 2

Southerly view, across Piikea Avenue, of Parcel 158. Parcel 158 consists of a predominantly undeveloped, graded lot.

The approximate locations of Boreholes 1 & 2 (BH -1 & 2) are indicated.

Parcel 80, an engineered wetland is located on the left side of the photo.

Note: Photos 2 thru 15 taken on 5/15/08.

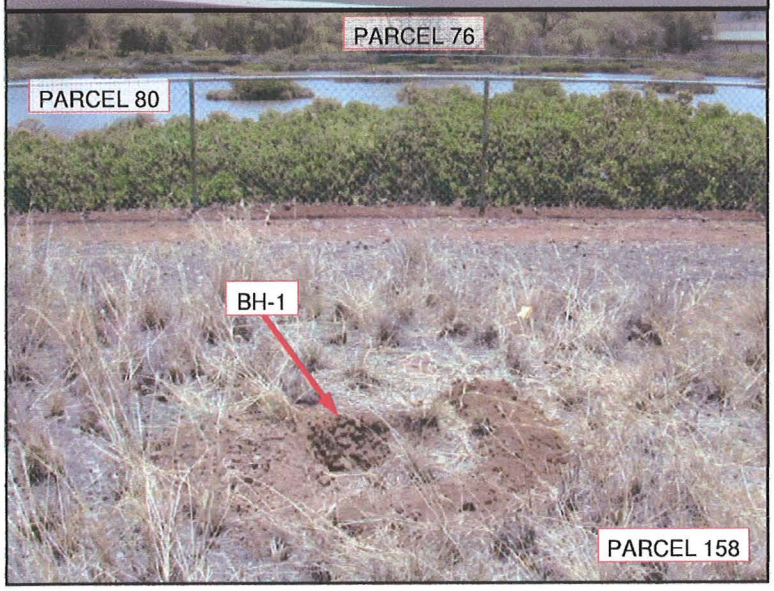

PHOTO 3

Easterly view of BH-1 located on Parcel 158. The view is towards the adjacent engineered wetland on Parcel 80. Parcel 76 is noted further east on the opposite side of the wetland.

BH-1 is located 18 feet west of the wetland property boundary (fence).

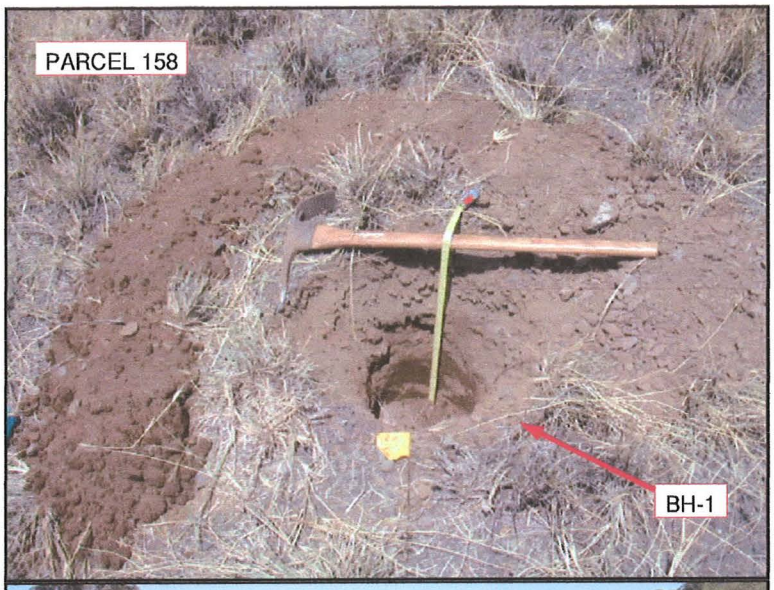

PHOTO 4

BH-1 had no wetland parameters. This site has been significantly altered by the placement of fill material over the native soils.

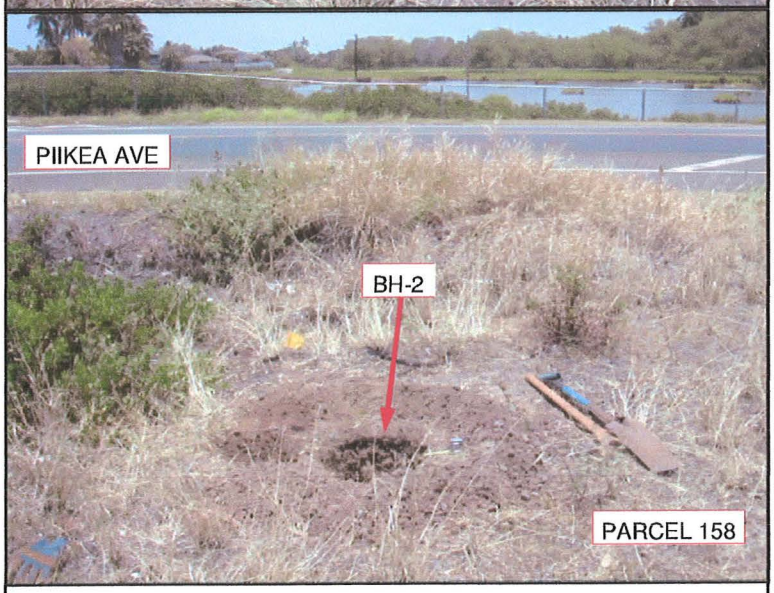

PHOTO 5

Northerly view of BH-2 located on Parcel 158. This borehole description was similar to BH-1 noted above, with no wetland parameters present.

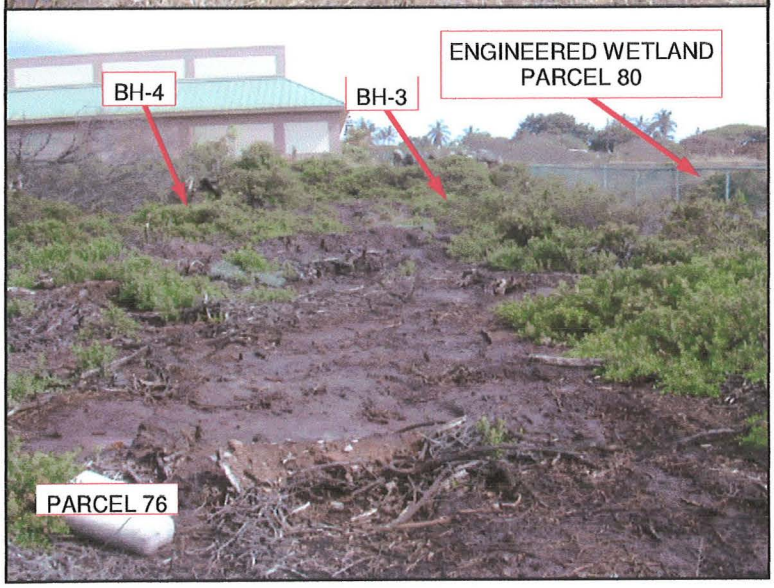

PHOTO 6

Southerly view of the southwestern corner of Parcel 76 where isolated wetland parameters have been identified.

The location of Boreholes 3 & 4 are noted.

This area had been recently cleared of vegetation with heavy mechanical equipment. Deep tracks were noted in the soils.

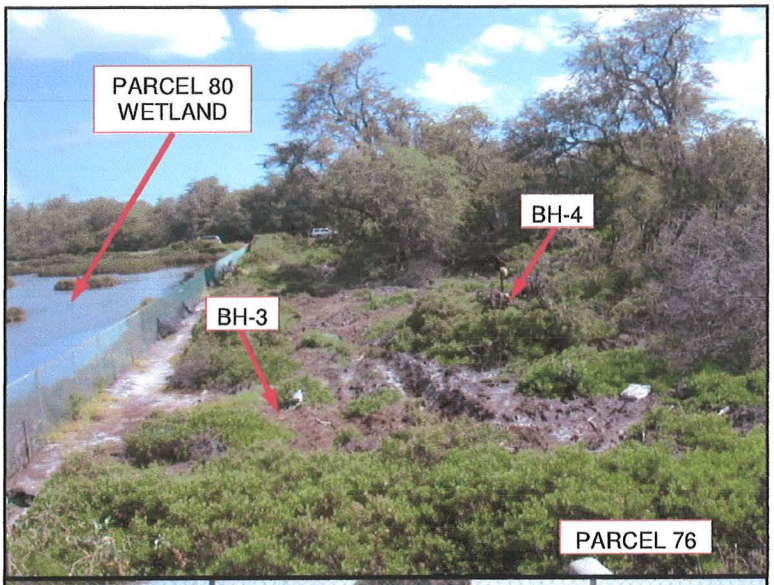

PHOTO 7

Northerly view of the southwestern portion of Parcel 76 where limited wetland parameters have been determined.

BH-3 is located 15 feet east (mauka) of the engineered wetland boundary fence. All three wetland parameters were identified at BH-3.

BH-4 is located 45 feet east (mauka) of the engineered wetland boundary. This borehole had marginal hydrology and vegetation indicators, however, hydric soils were absent.

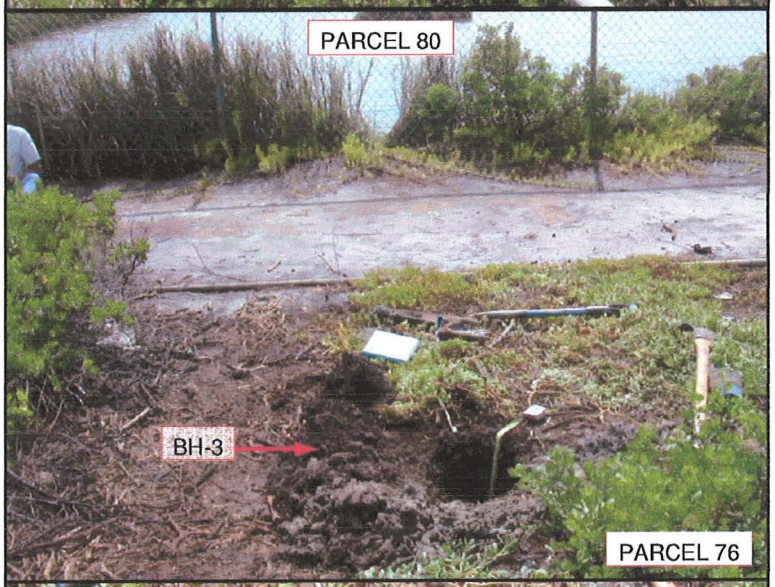

PHOTO 8

Westerly view of BH-3, towards the engineered wetland on Parcel 80.

BH-3 is located 15 feet east (mauka) of the engineered wetland boundary fence. This borehole had evidence of all three wetland parameters.

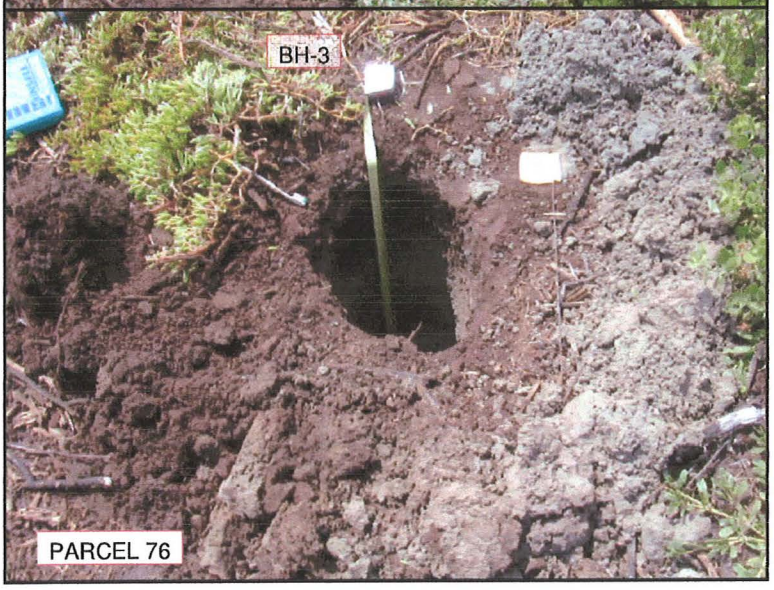

PHOTO 9

Near vertical view of BH-3. Note the low-chroma soils that were excavated.

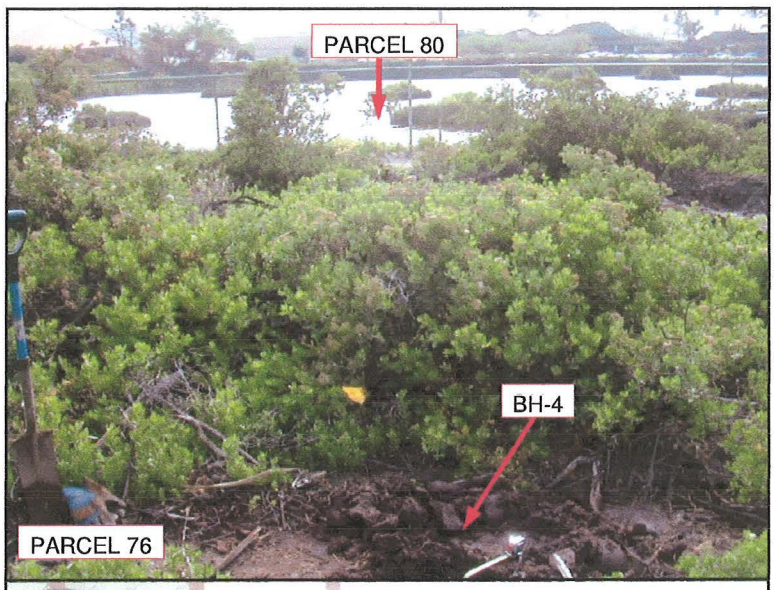

PHOTO 10

Westerly view of Borehole 4, located on Parcel 76. Parcel 80 (engineered wetland) is visible in the background.

Borehole 4 is located approximately 25 feet further east (mauka) of BH-3 and 45 feet east of the engineered wetland.

BH-4 did not have the wetland parameter of hydric soils.

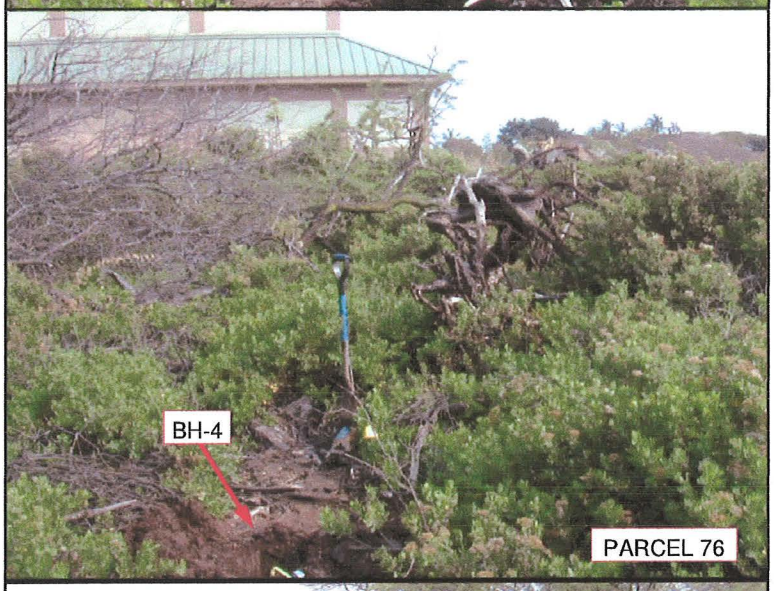

PHOTO 11

Southerly view of BH-4, located on Parcel 76.

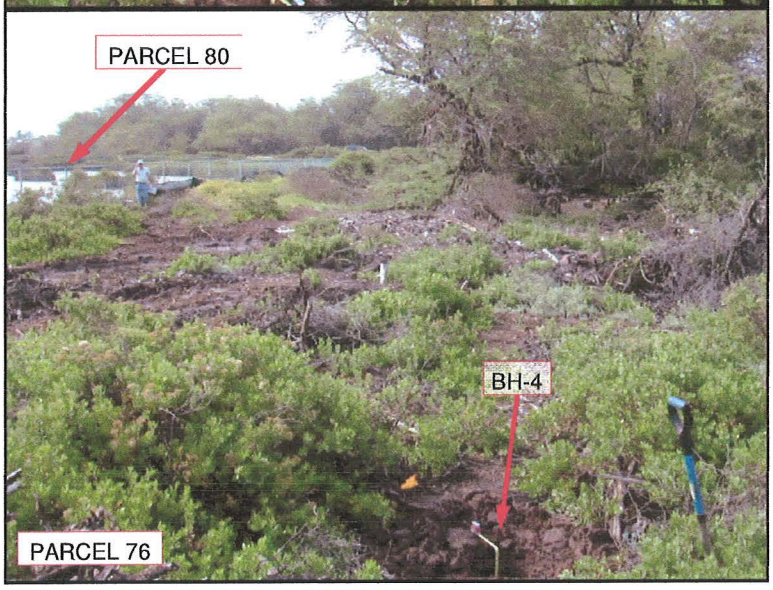

PHOTO 12

Northerly view of BH-4 located on Parcel 76.

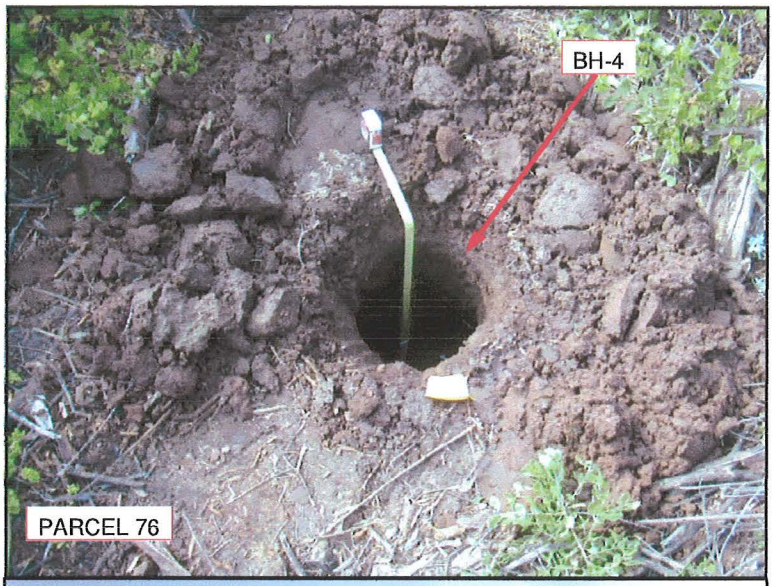

PHOTO 13

Near vertical view of BH-4.

Hydric soils were not noted at this borehole and was determined to be located outside of the wetland area.

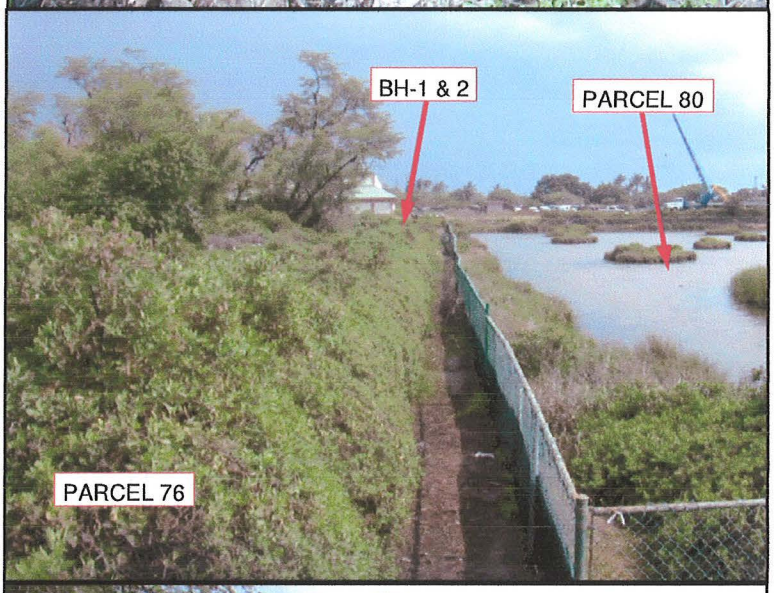

PHOTO 14

Southerly view along the border between the subject site (Parcel 76) and Parcel 80, an engineered wetland.

Wetland parameters fade near the northern portion of Parcel 76's western boundary. A previous survey conducted by Vuich Environmental (2004) indicated that this area did not contain all three wetland parameters. Historical photos indicated that this area (northwest portion of Parcel 76) was a mango orchard for several decades. See also Photo 15.

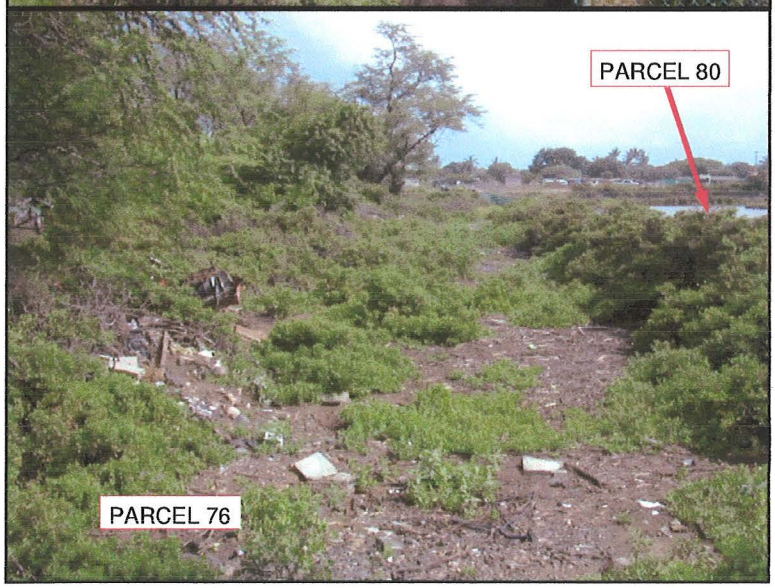

PHOTO 15

Southerly view along the western portion of the subject site (Parcel 76). This photo was taken slightly east (mauka) of Photo 14.

Wetland parameters fade near the northern portion of Parcel 76's western boundary.

This area has been recently cleared of vegetation by heavy machinery.

APPENDIX B

COE Wetland Determination Data Forms

WETLAND DETERMINATIONS
ATYPICAL SITUATIONS
DATA FORM 3

Applicant Name: **The Krauz Companies, Inc.** Appl. No. 001

Project Name: **Azeka Parcel, Piikea - Parcel 158** Location: **Kihei**

Island **Maui** Plot/Hole No: **BH-1** Date **5-15-08**

A. VEGETATION:

1. Type of alteration : Likely grubbing of vegetation and then placement of fill material (gravel cap).
2. Effect on vegetation: Total removal of natural plants. Newly established plants have different soil and hydrological conditions to contend with.
3. Previous vegetation : Possible *Pluchea indica, Prosopis pallida, Batis maritima, and / or Sesuvium portulacastrum*
4. Wetland (hydrophytic) Vegetation previously? Not confirmed, but likely No

B. SOILS:

1. Type of alteration : Placement of dredged fill material (from Parcel 80) and transported fill (gravel cap – up to 1 foot in depth).
2. Effect on soils : Native soils buried.
3. Previous soils : Likely Jaucas Sand as per USDA soil survey
4. Wetland (hydric) Soils previously? Yes Unknown but possibly in localized areas No

C. HYDROLOGY:

1. Type of alteration : Placement and grading of dredged fill material and gravel cap on native soils.
2. Effect on hydrology :
   - Possible change in surface water flow (stormwater).
   - Increasing depth to groundwater level from surface.
3. Previous hydrology : Poor drainage and possible infrequent surface water ponding. Groundwater depth more shallow.
4. Wetland Hydrology Previously? Yes Not verified but likely in localized areas. No

ATTACH DOCUMENTS TO SUPPORT DATA ABOVE

Characterized By : Jeffrey Kermode Title: Field Scientist

John Vuich Field Geologist

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: AZEKA PARCELS, PIIKEA, KIHEI	Date: 05/15/08
Applicant/Owner: AZEKA BUILDING CORPORATION	County: MAUI
Investigator: J. KERMODE , J. VUICH,	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID: Grass on Fill
Is the site significantly disturbed (Atypical Situation)? * (Yes) No	Transect ID: Parcel 158
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-1
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Non-native grass	Herb	n/a
2. *Prosopis pallida* (Kiawe)	Tree	FACU-

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
0% (5% FACU-)

Remarks:
Limited growth on gravel fill transported from quarry rock.
15% bare ground.

HYDROLOGY

x Recorded Data (Describe in Remarks):	Wetland hydrology Indicators:
___ Stream, Lake, or Tide Gauge	Primary Indicators:
x Aerial Photographs	___ Inundated
___ Other	___ Saturated in Upper 12 Inches
___ No Recorded Data Available	___ Water Marks
	___ Drift Lines
Field Observations:	___ Sediment Deposits
Depth of Surface Water: n/a (in.)	___ Drainage Patterns in Wetlands
Depth to Free Water in Pit: not observed (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: not observed (in.)	___ Oxidized Root Channels in Upper 12"
	___ Water-Stained Leaves
	___ FAC-Neutral Test
	___ Other (Explain in Remarks)

Remarks:

Borehole located 18 feet inland from fence line of the adjacent property's (Parcel 80) constructed wetland. Borehole is situated at the property's longitudinal midpoint. Slightly moist soil noted 14"-20".

SOILS

Map Unit Name
(Series and Phase): BH -1

Drainage Class: _____

Field Observations
Confirm Mapped Type? Yes (No)

Taxonomy (Subgroup): JcC, Jaucas Sand

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0" - 6"	Coarse Gravel Cap				
6" - 12"	Fine Gravel Cover				
12" - 20"	A	7.5YR - 4/3		Brown	Top of Original Soil Horizon (Parcel 158) or possibly dredged material from Parcel 80. Coral sand, trace silt and clay.

Hydric Soil Indicators:

- ____ Histosol
- ____ Histic Epipedon
- ____ Sulfidic Odor
- ____ Aquic Moisture Regime
- ____ Reducing Conditions
- ____ Gleyed or Low-Chroma Colors
- ____ Concretions
- ____ High Organic Content in Surface Layer
- ____ Organic Streaking in Sandy Soils
- ____ Listed on Local Hydric Soils List
- ____ Listed on National Hydric Soils List
- ____ Other (Explain in Remarks)

Remarks:

12"-20" soil has coarse coral sand and loam with probable plant parts/organic debris. Likely the original "A" horizon.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? Yes (No)

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks:

* Atypical Situation refers to the following:

1. Land has been cleared of original vegetation.

2. Dredged fill material from man-made constructed wetland located to the east (adjoining lot) has likely been placed on subject parcel's native soils.

3. Transported gravel cap of crushed volcanic rock (¼ "-2" diameter) is approximately 6" thick.

These aspects cause a loss of naturally occurring plants, loss of possible hydrology parameter and burial of any potential hydric soils.

See Attached Atypical Form for BH-1.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: AZEKA PARCELS, PIIKEA, KIHEI	Date: 05/15/08
Applicant/Owner: AZEKA BUILDING CORPORATION	County: MAUI
Investigator: J. KERMODE , J. VUICH,	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID: Grass on Fill
Is the site significantly disturbed (Atypical Situation)? (Yes) No	Transect ID: Parcel 158
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-2
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. Non-native grass	Herb	n/a
2. Pluchea indica (Indian fleabane)	Shrub	FAC*

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
5% FAC*.

Remarks:
Limited growth on gravel fill transported from quarry rock.
15% bare ground.

HYDROLOGY

_x_ Recorded Data (Describe in Remarks): ____ Stream, Lake, or Tide Gauge _x_ Aerial Photographs ____ Other ____ No Recorded Data Available	Wetland hydrology Indicators: Primary Indicators: ____ Inundated ____ Saturated in Upper 12 Inches ____ Water Marks ____ Drift Lines ____ Sediment Deposits ____ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ____ Oxidized Root Channels in Upper 12" ____ Water-Stained Leaves ____ FAC-Neutral Test ____ Other (Explain in Remarks)
Field Observations: Depth of Surface Water: n.a. (in.) Depth to Free Water in Pit: not observed (in.) Depth to Saturated Soil: not observed (in.)	

Remarks:

Slightly moist soil noted below 16".

Dug hole 15 feet inland from northwest corner of lot.

SOILS

Map Unit Name
(Series and Phase): BH-2

Drainage Class: _____

Field Observations
Confirm Mapped Type? Yes (No)

Taxonomy (Subgroup): JcC, Jaucas Sand

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0" - 9"	Top Cap				Coarse Crushed Volcanic Rocks (1/4" – 2" dia)
			TRANSITIONAL		
9" - 19"	A?	7.5YR – 3/3		Very Dark Brown	Coral Sand, Clay and Silt

Hydric Soil Indicators:

- ____ Histosol
- ____ Histic Epipedon
- ____ Sulfidic Odor
- ____ Aquic Moisture Regime
- ____ Reducing Conditions
- ____ Gleyed or Low-Chroma Colors
- ____ Concretions
- ____ High Organic Content in Surface Layer
- ____ Organic Streaking in Sandy Soils
- ____ Listed on Local Hydric Soils List
- ____ Listed on National Hydric Soils List
- ____ Other (Explain in Remarks)

Remarks:

Partially indurated (cemented with clay and coral/lime mud) with lighter colored nodules. Low moisture 16"+.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? Yes (No)

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks:

See Atypical Form for BH-1. Same scenario.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: AZEKA PARCELS, PIIKEA, KIHEI	Date: 05/15/08
Applicant/Owner: AZEKA BUILDING CORPORATION	County: MAUI
Investigator: J. KERMODE , J. VUICH,	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID: akulikuli
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: Parcel 76
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-3
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species			Stratum	Indicator
1. Sesuvium potulacastrum	or	akulikuli	Herb	FACW
2. Pluchea indica	or	Indian fleabane	Woody shrub	FAC*

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
35% FACW & 35% FAC*

Remarks:
Bare ground 30%. Evidence of very recent vegetation clearing with heavy machinery noted (deep tracks in soil).

HYDROLOGY

_x_ Recorded Data (Describe in Remarks): ____ Stream, Lake, or Tide Gauge _x_ Aerial Photographs ____ Other ____ No Recorded Data Available	Wetland hydrology Indicators: Primary Indicators: ____ Inundated *_X_ Saturated in Upper 12 Inches ____ Water Marks ____ Drift Lines _X_ Sediment Deposits ____ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ____ Oxidized Root Channels in Upper 12" ____ Water-Stained Leaves ____ FAC-Neutral Test ____ Other (Explain in Remarks)
Field Observations: Depth of Surface Water: n.a. (in.) Depth to Free Water in Pit: 23 (in.) Depth to Saturated Soil: * 11 (in.)	

Remarks:

Total hole depth is 24".

*Recent localized downpour in area of the subject site. Due to having precipitation within the previous 24 hours, the upper 11" consisted of damp soil. The saturated soil is not consistent to the total depth.

BH-3 is located 15' east of the man-made wetland boundary (fence) of Parcel 80.

SOILS

Map Unit Name
(Series and Phase): BH-3 Drainage Class: _____

Field Observations
Taxonomy (Subgroup): PZUE (Puuone Sand) and PsA (Pulehu clay loam) Confirm Mapped Type? (Yes) No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0"- 1/2"	O	7.5YR – 3/3		Dark Brown	Organics, Sand/Silt, Clay
1/2" - 3"	A	7.5 YR – 4/4		Brown	Silt and Clay with Organics and Sand.
3" - 9"	AE	7.5YR -3/2		Very Dark Brown	Sandy Loam with Clay
9"-22"	C	10YR – 6/1		Gray	Coral Sand

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
_?_ Sulfidic Odor (extremely faint)
___ Aquic Moisture Regime
_X_ Reducing Conditions
_X_ Gleyed or Low-Chroma Colors

___ Concretions
___ High Organic Content in Surface Layer
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:
Low-chroma soils noted.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No Wetland Hydrology Present? (Yes) No Hydric Soils Present? (Yes) No	(Circle) Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

BH-3 is located 15' east of the man-made wetland boundary, located on Parcel 80 and 45' north of the southern property boundary.

BH-3 confirms the existence of a transitional area of wetland located in the southwest corner of Parcel 76. This was originally determined in a Vuich Environmental Survey (also BH-3) dated November 23, 2004.

Area has likely been slightly disturbed (altered) during the significant work that was conducted immediately adjacent to this area (i.e. engineered wetland located on Parcel 80).

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: AZEKA PARCELS, PIIKEA, KIHEI	Date: 05/15/08
Applicant/Owner: AZEKA BUILDING CORPORATION	County: MAUI
Investigator: J. KERMODE, J. VUICH.	State: HAWAII
Do Normal Circumstances Exist on the site? (Yes) No	Community ID Pluchea indica
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: Parcel 76
Is the area a potential Problem Area? Yes (No)	Plot ID: BH-4
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species			Stratum	Indicator
1. *Pluchea indica*	or	Indian fleabane	Woody Shrub	FAC*
2. Sesuvium potulacastrum	or	akulikuli	Herb	FACW
3. *Prosopis pallida*	or	kiawe	Tree	FACU-

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)
80% FAC* Trace FACW Trace FACU-

Remarks:

Area appears to have been recently cleared of vegetation by heavy machinery. Bare ground noted.

HYDROLOGY

x Recorded Data (Describe in Remarks):
- Stream, Lake, or Tide Gauge
- x Aerial Photographs
- Other

No Recorded Data Available

Field Observations:

Depth of Surface Water: n.a. (in.)

Depth to Free Water in Pit: 21 (in.)

Depth to Saturated Soil: 12 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- Inundated
- X Saturated in Upper 12 Inches
- Water Marks
- Drift Lines
- Sediment Deposits
- Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- Oxidized Root Channels in Upper 12"
- Water-Stained Leaves
- FAC-Neutral Test
- Other (Explain in Remarks)

Remarks:

BH-4 is located 40' east of the wetland boundary fence for Parcel 80.

Recent heavy rains in Kihei area.

SOILS

Map Unit Name
(Series and Phase): BH-4 Drainage Class: _____
Field Observations
Taxonomy (Subgroup): PZUE (Puuone Sand) and PsA (Pulehu clay loam) Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0" – 2"	AO			Dark Brown	Organics and Clay Loam
2" - 12"	AE			Medium Brown	Sandy Clay Loam
12"- 21"	EA			Brown	Sandy Loam and Silt

Hydric Soil Indicators:

- ____ Histosol
- ____ Histic Epipedon
- ____ Sulfidic Odor
- ____ Aquic Moisture Regime
- ____ Reducing Conditions
- ____ Gleyed or Low-Chroma Colors
- ____ Concretions
- ____ High Organic Content in Surface Layer
- ____ Organic Streaking in Sandy Soils
- ____ Listed on Local Hydric Soils List
- ____ Listed on National Hydric Soils List
- ____ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No (Marginal)
Hydric Soils Present? Yes (No)

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks:

Hydrology parameter is marginal.

Hydrophytic vegetation is marginal. Mostly FAC*.

BH-4 is located 40' east of the wetland boundary fence for Parcel 80 and approximately 75' from the southern property boundary line.

This point demonstrates that the wetland parameters disappear rapidly, heading eastward of the engineered wetland and northward of BH-3.

Approved by HQUSACE 3/92

APPENDIX C

Statement of Qualifications

MALAMA
Environmental

JOHN S. VUICH
President & CEO

STATEMENT OF QUALIFICATIONS:

M. S. Geological Engineering, University of Arizona
B. S. Geological Engineering, University of Arizona
Registered Geologist (California)
Registered Environmental Assessor (California)
Certified Environmental Manager (Nevada)

AREAS OF EXPERTISE

ENVIRONMENTAL

- Site Assessments, Phase I, II, III Investigations
- Underground Storage Tank Closure
- Asbestos Inspection and Monitoring, Management Planning, and Abatement Project Design and Removal
- Lead-Containing Paint Surveys and Inspections, and Disturbance Design and Removal
- Site Characterization for Remedial Investigations
- Facility Operation Compliance Audits-ISO 14000 Audits
- Soils/Groundwater Remediation
- Hazardous Waste Management
- Risk Assessment Investigations
- RCRA Compliance and Closure Projects
- Expert Witness/Litigation Support
- Industrial Hygiene Qualified/Competent Person
- Mold/Fungi Sampling, Remediation and Abatement Design and Removal

GEOLOGICAL

- Hydrogeology
- Geologic Hazards Analysis
- Subsurface Excavations and Drilling Investigations and Sampling

P.O. Box 880487, Pukalani, HI 96788-0487 ● (808) 573-0200 Phone (808) 573-0210 Fax

RELEVANT EXPERIENCE

Owner-President • MEV, LLC.
Maui, HI • (June 2006 - Present)
Consulting services and project management for remediation projects, property transfers, sampling and site characterization plans, hazardous and toxic waste management, underground storage tanks, regulatory compliance, permit applications and litigation support.

Owner-President • Vuich Environmental Consultants, Inc.
Maui and Honolulu, Oahu • (March, 1994 - Present)
Licensed contractor for asbestos, mold and lead-based paint abatement, general demolition and construction cleanup.

Project Manager • Various Environmental and Geological Companies
Southwest U.S.A • (1972-1994)
Hazardous materials' and environmental assessment. Site characterization and remediation.

OTHER CERTIFICATIONS AND TRAINING

- Asbestos & Demolition Contractor (C-19, C-24) **HI LIC #21212**
- Accredited Asbestos Contractor/Supervisor
- Continuing Education in Hazardous Materials Management, Environmental Studies and Environmental Regulations.

P.O. Box 880487, Pukalani, HI 96788-0487 • (808) 573-0200 Phone (808) 573-0210 Fax

MALAMA
Environmental

STATEMENT OF QUALIFICATIONS
for
Amy Mathis, Environmental Technician

Company Position Environmental Technician

Responsibilities and Duties:

- Assist on Phase I & II Environmental Site Assessments/Investigations
- Assist on Phase III Remediation Projects
- Assist on Underground Storage Tank (UST) Closures
- Assist on Asbestos Inspections
- Assist on Lead-Based Paint Inspections
- Assist on Indoor Air Quality Investigations
- Erosion Control Plan (BMP) Development
- QA/QC Officer for Sampling Projects

Experience:

- Soil Investigations/Remediation
- UST Removal and Closure
- Hazardous Materials Management
- Asbestos and Lead-Based Paint Projects (Inspections)
- Air Quality Sampling for Particulate and Microbiological Contaminants
- Wetland Delineations
- Environmental Report Writing and Compilation
- Ornithological counts/data collections
- Entomological counts/data collections
- Chemical technician specializing in wet chemical methods, analytical instrumentation and sample preparation.
- Geological mapping
- Vegetation mapping

Training & Education

- Bachelor of Science, Geology with Environmental Science Option New Mexico Institute of Mining and Technology, 1996-1999.
- Bachelor of Fine Arts, Music with minors in Fine Art and Theater Kutztown University Pennsylvania 1991-1995.
- 24-hr OSHA HAZWOPER Course

P.O. Box 880487, Pukalani, HI 96788-0487 • (808) 573-0200 Phone (808) 573-0210 Fax

APPENDIX E-4

Maintenance Easement in Parcel 30 for Manmade Wetland

91-005056

STATE OF HAWAII
BUREAU OF CONVEYANCES
RECORDED

'91 JAN 15 PM 1 27

S. FURUKAWA, REGISTRAR

LAND COURT

REGULAR SYSTEM

AFTER RECORDATION, RETURN BY MAIL ( ) PICK-UP (X)

Burke, Sakai, McPheeters,
Borden & Gelardy
Grosvenor Center, Mauka Tower
737 Bishop St. Ste 3100
Honolulu, HI 96813

TGM 10775 3B

R/S

LAND COURT SYSTEM	REGULAR SYSTEM
Return by Mail ( ) Pickup (X) Burke, Sakai, McPheeters, Bordner & Gilardy Grosvenor Center, Mauka Tower 737 Bishop Street, Suite 3100 Honolulu, Hawaii 96813	TGA 107783B RS

EASEMENT

Grantor: STEWART E. FERN, Trustee under that certain Revocable Living Trust Agreement dated February 28, 1983, and JONATHAN EDWARD FERN, and TIMOTHY EVERSON FERN

Grantee: LONGS DRUG STORES CALIFORNIA, INC.

Property Description:

Lot 10-A
Waiohuli-Keokea Beach
Homesteads

EASEMENT

DECLARATIONS

The parties hereby declare:

1. That Stewart E. Fern, is the Trustee under that certain Revocable Living Trust Agreement dated February 28, 1983, with powers to sell, mortgage, lease, and convey as to an undivided 61.96% interest; that Jonathan Edward Fern, husband of Nona Lee Fern, Timothy Everson Fern, husband of Winsome Gay Fern, each own an undivided 19.02% interest as Tenants in Common, those parcels of land designated as TMK 3-9-02, lots 10-A and 10-C located in the City of Kihei, County of Maui, Hawaii , more particularly bounded and described in Exhibit B (the "Fern Parcels") attached hereto (hereinafter collectively referred to as the "Grantors");

2. That Longs Drug Stores California, Inc., a California corporation, whose principal place of business and mailing address is 141 North Civic Drive, Walnut Creek, California 94596 (hereinafter called the "Grantee") is the owner of that certain parcel of land designated as TMK 3-9-02 lot 10-B located in the city of Kihei, County of Maui, Hawaii, more particularly bounded and described in Exhibit B attached hereto (the "Longs Parcel");

3. That Grantee is required to mitigate a wetland at its retail business center to be placed on Parcel 10-B as shown on Parcel Map Exhibit A and as legally described in Exhibit B.

GRANT OF EASEMENT

In consideration of the sum of $100,000.00, and other valuable consideration to Grantors paid by Grantee, the receipt of which is hereby acknowledged, Grantor grants to Grantee a right of way, more particularly designated and described as follows:

I. An easement to construct a flood storage and sedimentation basin on the westerly three acres of Lot 10-A of Waiohuli-Keokea Beach Homesteads which will be enhanced for use by wildlife, specifically water fowl, being more particularly described as follows:

Beginning at a point at the northwesterly corner of this easement, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU-O-KALI", being 7562.15 feet North and 23,257.85 feet West and running by azimuths measured clockwise from True South:

1.	263°	25'	30"	359.24 feet	along Grant 10043, same being Lot 9 of Waiohuli-Keokea Beach Homesteads;
2.	353°	33'		400.94 feet	over and across the remainder of Grant 10115 to Ten Kui Chong and Lot 10-A of Waiohuli-Keokea Beach Homesteads;
3.	83°	33'		293.23 feet	along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-C of Waiohuli-Keokea Beach Homesteads;
4.	164°	11'		405.56 feet	along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-B of Waiohuli-Keokea Beach Homesteads to the point of beginning and containing an Area of 130,685 square feet or 3.000 Acres.

II. An easement approximately 580 feet long, over portion of Lot-C of Waiohuli-Keokea Beach Homesteads which will be cleared and filled for the purpose of providing an unsurfaced access way to Lot 10-A of Waiohuli-Keokea Beach Homesteads including the flood storage and sedimentation basin mentioned above, being more particularly described as follows:

Beginning at a point at the northwesterly corner of this easement, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU-O-KALI", being 7171.94 feet North and 23,147.31 feet West and running by azimuth measured clockwise from True South:

1.	263°	33'	584.62 feet	along Grant 10115 to Ten Kui Chong and Lot 10-A of Waiohuli-Keokea Beach Homesteads;
2.	353°	33'	56.00 feet	over and across a portion of Grant 10115 to Ten Kui Chong and Lot 10-C of Waiohuli-Keokea Beach Homesteads;
3.	83°	33'	575.38 feet	along Grant 8112 to Y.H. Char, same being Lot 11 of Waiohuli-Keokea Beach Homesteads;
4.	164°	11'	56.76 feet	over and across a portion of Grant 10115 to Ten Kui Chong and Lot 10-C of Waiohuli-Keokea Beach Homesteads to the point of beginning and containing an Area of 32,480 square feet or 0.745 Acre.

In consideration of the mutual covenants and agreements herein set forth, the following encumbrances shall be binding upon the parties hereto and shall attach to and run with their respective parcel or parcels and shall be for the benefit of and shall be limitations upon any future owners of the Longs Parcel and the Fern Parcels, and each easement granted herein shall be appurtenant to the dominant estate and all promises, covenants, conditions, restrictions and encumbrances shall be covenants running with the land.

The right of way conveyed by this instrument is for the purpose of ingress and egress via Lots 10-B and 10-C (Fern Lot) into designated mitigation area of Lot 10-A (Fern lot) in order to:

a. Construct a flood storage and sedimentation basin, which will be enhanced for use by wildlife, specifically waterfowl. All work shall be as approved by the U.S. Army Corps of Engineers under provisions of a Nationwide 26 (NW 26) permit. The work to be performed is generally as shown on Exhibit C.

b. Clear and fill an area on Lot 10-C for purposes of providing an unsurfaced roadway, also generally as shown on Exhibit C.

c. Maintain the wetland area shown on Exhibit C as required by conditions of the NW 26 permit.

TERMS AND CONDITIONS

The forgoing grant is made upon the following terms and conditions, which terms and conditions shall be binding upon the Parties:

1. Grantee shall provide all necessary plans, obtain required permits, and have the work executed and maintained at its sole cost. Grantors shall have right of reasonable approval of final improvement plans;

2. Grantee shall perform work only in the area of mitigation improvements as shown in the final approved plans;

3. The Grantee shall defend, indemnify and hold Grantors and subsequent owners of the Fern Parcels, harmless from any and all claims and demands against Grantors for any loss or damage or injury to persons or property caused by Grantee's agents, servants, and employees, including the claims of Grantee's respective agents, servants, and employees, that shall or may arise by reason of the use of said easement and performance of the work at Grantors' property and which is not caused by negligence of the Grantors, Grantor's agents, servants, or employees, and from and against all damages, costs, counsel fees, expenses or liabilities incurred or resulting from any such claim or demand or any action or proceeding brought thereon.

4. The Grantee shall not encumber the subject easement area without the written consent of Grantors, which consent Grantors may withhold at Grantors' sole discretion.

5. The mitigation area shall be posted as a wildlife sanctuary and shall remain accessible only to those persons having specific business relative to it.

6. This grant of easement shall be conditioned upon Grantee obtaining from the U.S. Army Corps of Engineers a Nationwide 26 Permit with conditions reasonably acceptable to both Grantors and Grantee.

TERM

This easement shall terminate at such time as the requirement for wetland mitigation is no longer applicable. Grantors and/or Grantee may, in the future, singularly or mutually petition the government agency controlling wetlands at that time for relief from continued maintenance by means or regulations existing at that time which permit relief. Such relief in whatever form it takes must be with the consent of the Grantors which consent will not be unreasonably withheld.

Grantee to have and to hold the easement according to tenancy hereinabove set forth, subject to the conditions hereinabove set forth.

In witness whereof, the undersigned have caused this instrument to be duly executed this 13 day of November, 1990.

GRANTORS:

STEWART E. FERN, Trustee under that certain Revocable Living Trust dated 2/28/83

JONATHAN EDWARD FERN

TIMOTHY EVERSON FERN

GRANTEE:

LONGS DRUG STORES CALIFORNIA, INC.,
A California Corporation

By O. D. Jones
Sr. Vice President

By M. K. Raphel
Assistant Secretary

(TO BE NOTARIALLY ACKNOWLEDGED)

INDIVIDUAL ACKNOWLEDGEMENT

STATE OF HAWAII)
City &County of Honolulu) ss.

On this 13th day of November, 19 90, before me personally appeared
Timothy Everson Fern

to me known to be the person (X) described in and who executed the foregoing instrument, and acknowledged that He executed the same as His free act and deed.

Notary Public, First Judicial Circuit, State of Hawaii

My commission expires March 13, 1994

182 (REV 7-62)

STATE OF HAWAII)
) SS.
CITY AND COUNTY OF HONOLULU)

On this 13th day of November, 1990, before me personally appeared **STEWART E. FERN**, Trustee as aforesaid, to me known to be the person described in and who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed as such Trustee.

Notary Public, State of Hawaii

My Commission Expires: 12/17/92

INDIVIDUAL

STATE OF HAWAII,
City and County of Honolulu. } ss:

On this 13th *day of* November, *A. D. 19* 90, *before me personally appeared*
Jonathan Edward Fern

to me known to be the person described in and who executed the foregoing instrument and acknowledged that he *executed the same as* his *free act and deed.*

Notary Public, First Judicial Circuit, State of Hawaii

My Commission Expires Feb. 27, 1993

STATE OF CALIFORNIA)
COUNTY OF CONTRA COSTA) SS

ATTACHED TO EASEMENT - DECLARATIONS
STEWART FERN, JONATHAN FERN, AND TIMOTHY FERN
(GRANTORS) AND LONGS DRUG STORES (GRANTEE)

On this 12th day of November, in the year one thousand nine hundred ninety, before me, Janis M. Watt, a Notary Public, State of California, duly commissioned and sworn, personally appeared O. D. Jones & Michael K. Raphel personally known to me (or proved to me on the basis of satisfactory evidence) to be the persons who executed the within instrument as Sr. V.P. & Asst. Secty, resp., or on behalf of the corporation therein named and acknowledged to me that the corporation executed it.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal in the County of Contra Costa.

OFFICIAL SEAL
JANIS M. WATT
NOTARY PUBLIC - CALIFORNIA
CONTRA COSTA COUNTY
My Commission Expires July 12, 1991

Janis M. Watt
Notary Public, State of California

My Commission Expires July 12, 1991

KIHEI, MAUI, HAWAII
(Constr. of Storage and Sedimentation Basin)

RECORDER'S MEMO: Legibility of Writing, Typing or Printing UNSATISFACTORY in this Document when received.

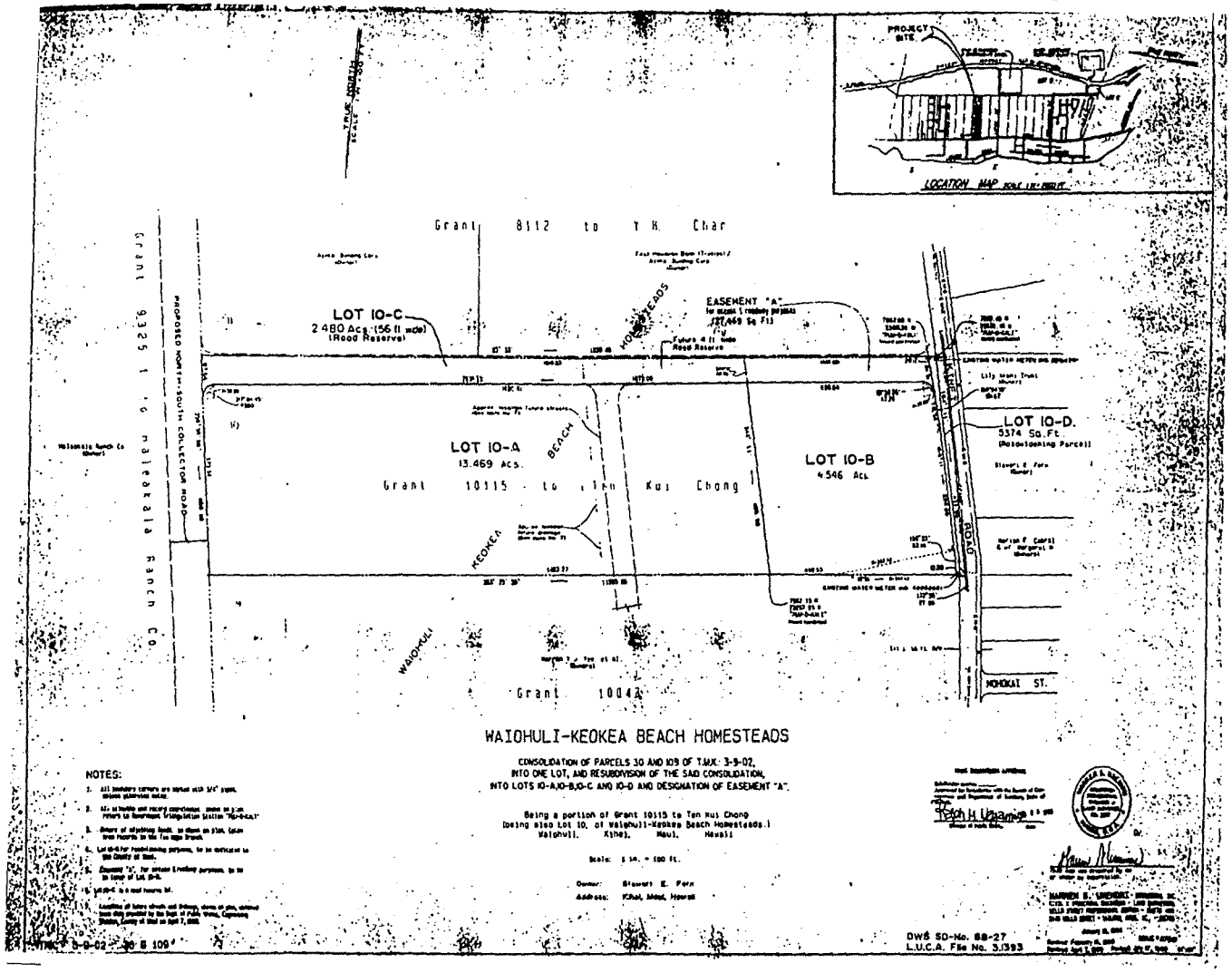

EXHIBIT A

Waiohuli-Keokea Beach Homesteads
Description of Lot 10-A

Land situated on the easterly side of Kihei Road at Waiohuli, Kihei, Maui, Hawaii

Being a portion of Grant 10115 to Ten Kui Chong, being also a portion of Lot 10 of Waiohuli-Keokea Beach Homesteads

Beginning at a point at the northwesterly corner of this lot, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU-O-KALI" being 7,562.15 feet North and 23,257.85 feet West and running by azimuths measured clockwise from True South:

1.	263° 25' 30"	1483.27 feet	along Grant 10043, same being Lot 9 of Waiohuli-Keokea Beach Homesteads to a point;
2.	350° 36' 30"	372.34 feet	along Grant 9325, Apana 1 to Haleakala Ranch Company to a point;
3.	Thence along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-C of Waiohuli-Keokea Beach Homesteads on a curve to the right having a radius of 30.00 feet, the chord azimuth and distance being: 37° 04' 45" 43.50 feet to a point;		
4.	83° 33'	1406.41 feet	along same to a point;
5.	164° 11'	405.56 feet	along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-B of Waiohuli-Keokea Beach Homesteads to the point of beginning and containing an Area of 13.469 acres.

TOGETHER, WITH, a Roadway Access and Utility Easement over and across Lot 10-C of Waiohuli-Keokea Beach Homesteads and being more particularly described as follows:

Beginning at a point at the southwesterly corner of this lot, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU-O-KALI" being 7,062.68 feet North and 23,615.26 feet West and running by azimuths measured clockwise from True South:

EXHIBIT B

1. 150° 24' 10"	31.21 feet	along the remainder of Grant 10115 to Ten Kui Chong and roadwidening Lot 10-D of Waiohuli-Keokea Beach Homesteads;
2. Thence along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-B of Waiohuli-Keokea Beach Homesteads on a curve to the left having a radius of 30.00 feet, the chord azimuth and distance being: 301° 58' 35" 37.29 feet;		
3. 263° 33'	1873.05 feet	along the remainder of Grant 10115 to Ten Kui Chong and Lots 10-B and 10-A of Waiohuli-Keokea Beach Homesteads;
4. Thence along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-A of Waiohuli-Keokea Beach Homesteads on a curve to the left having a radius of 30.00 feet, the chord azimuth and distance being: 217° 04' 45" 43.50;		
5. 150° 36' 30"	87.66 feet	along Grant 9325, Apana 1 to Haleakala Ranch Company;
6. 83° 33'	1918.23 feet	along Grant 8112 to Y. H. Char, same being Lot 11 of Waiohuli-Keokea Beach Homesteads to the point of beginning and containing an Area of 2.480 acres, more or less.

WARREN S. UNEMORI
REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR
No. 1569
HAWAII, U.S.A.

2/27/90

Registered Land Surveyor
Certificate No. 1569, ES

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Waiohuli-Keokea Beach Homesteads
Description of Lot 10-B

Land situated on the easterly side of Kihei Road at Waiohuli, Kihei, Maui, Hawaii

Being a portion of Grant 10115 to Ten Kui Chong, being also a portion of Lot 10 of Waiohuli-Keokea Beach Homesteads

Beginning at a point at the northeasterly corner of this lot, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU-O-KALI", being 7,562.15 feet North and 23,257.85 feet West and running by azimuths measured clockwise from True South:

1.	244°	11'	405.56 feet	along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-A of Waiohuli-Keokea Beach Homesteads to a point;
2.	33°	33'	466.64 feet	along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-C of Waiohuli-Keokea Beach Homesteads to a point;
3.	Thence along same on a curve to the			right having a radius of 30.00 feet, the chord azimuth and distance being: 121° 58' 35" 37.29 feet to a point;
4.	160°	24' 10"	70.36 feet	along the remainder of Grant 10115 to Ten Kui Chong and roadwidening Lot 10-D of Waiohuli-Keokea Beach Homesteads to a point;
5.	164°	11'	258.89 feet	along same to a point;
6.	Thence along same on a curve to the			right having a radius of 342.42 feet, the chord azimuth and distance being: 168° 33' 52.14 feet to a point;
7.	263°	25' 30"	492.53 feet	along Grant 10043, same being Lot 9 of Waiohuli-Keokea Beach Homesteads to the point of beginning and containing an Area of 4.546 acres.

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TOGETHER WITH, Easement "A" for roadway access and utility purposes over and across a portion of Grant 10115 to Ten Kui Chong and Lot 10-C of Waiohuli-Keokea Beach Homesteads, and being more particularly described as follows:

Beginning at a point at the southwesterly corner of this easement, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU-O-KALI", being 7,062.68 feet North and 23,815.26 feet West and running by azimuths measured clockwise from True South:

1.	160°	24'	10"	81.31 feet	along the remainder of Grant 10115 to Ten Kui Chong and roadwidening Lot 10-D of Waiohuli-Keokea Beach Homesteads;
2.	Thence along the remainder of Grant				10115 to Ten Kui Chong and Lot 10-B of Waiohuli-Keokea Beach Homesteads on a curve to the left having a radius of 30.00 feet, the chord azimuth and distance being: 301° 58' 35" 37.29 feet;
3.	263°	33'		466.64 feet	along same;
4.	344°	11'		56.76 feet	over and across a portion of Grant 10115 to Ten Kui Chong and Lot 10-C of Waiohuli-Keokea Beach Homesteads;
5.	33°	33'		486.60 feet	along Grant 8112 to Y.H. Char, same being Lot 11 of Waiohuli-Keokea Beach Homesteads to the point of beginning and containing an Area of 27,469 square feet, more or less.

WARREN S. UNEMORI
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2/27/90
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Waiohuli-Keokea Beach Homesteads
Description of Lot 10-C

Land situated on the easterly side of Kihei Road at Waiohuli, Kihei, Maui, Hawaii

Being a portion of Grant 10115 to Ten Kui Chong, being also a portion of Lot 10 of Waiohuli-Keokea Beach Homesteads

Beginning at a point at the southwesterly corner of this lot, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU-O-KALI" being 7,062.68 feet North and 23,615.26 feet West and running by azimuths measured clockwise from True South:

1. 160° 24' 10" 81.31 feet along the remainder of Grant 10115 to Ten Kui Chong and roadwidening Lot 10-D of Waiohuli-Keokea Beach Homesteads to a point;

2. Thence along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-B of Waiohuli-Keokea Beach Homesteads on a curve to the left having a radius of 30.00 feet, the chord azimuth and distance being: 301° 58' 35" 37.29 feet to a point;

3. 263° 33' 1873.05 feet along the remainder of Grant 10115 to Ten Kui Chong and Lots 10-B and 10-A of Waiohuli-Keokea Beach Homesteads to a point;

4. Thence along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-A of Waiohuli-Keokea Beach Homesteads on a curve to the left having a radius of 30.00 feet, the chord azimuth and distance being: 217° 04' 45" 43.50 feet to a point;

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[illegible] 150°	16'	30"	87.66 feet along Grant 9325, Apana 1 to Haleakala Ranch Company to a point;
[illegible] 13°	23'		1918.22 feet along Grant 8112 to Y. H. Char, same being Lot 11 of Waiohuli-Keokea Beach Homesteads to the point of beginning and containing an Area of 2.480 acres.

SUBJECT, HOWEVER, to the following easement:

1. Easement "A" for roadway access and utility purposes in favor of Lot 10-B of Waiohuli-Keokea Beach Homesteads and being more particularly described as follows:

Beginning at a point at the southwesterly corner of this easement, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU-O-KALI", being 7,062.68 feet North and 23,615.26 feet West and running by azimuths measured clockwise from True South:

1. 160°	24'	10"	81.31 feet along the remainder of Grant 10115 to Ten Kui Chong and roadwidening Lot 10-D of Waiohuli-Keokea Beach Homesteads;
2. Thence along the remainder of Grant 10115 to Ten Kui Chong and Lot 10-B of Waiohuli-Keokea Beach Homesteads on a curve to the left having a radius of 30.00 feet, the chord azimuth and distance being: 301° 58' 35" 37.29 feet;			
3. 263°	33'		466.64 feet along same;
4. 344°	11'		56.76 feet over and across a portion of Grant 10115 to Ten Kui Chong and Lot 10-C of Waiohuli-Keokea Beach Homesteads;

RECORDER'S MEMO: Legibility of Writing, Typing or Printing UNSATISFACTORY in this Document when received.

S. 33° 03' 486.60 feet along Grant 8112 to Y.H. Char, same being Lot 11 of Waiohuli-Keokea Beach Homesteads to the point of beginning and containing an Area of 27,469 square feet, more or less.

WARREN S. UNEMORI
REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR No. 1569
HAWAII U.S.A.

2/27/90

Registered Land Surveyor
Certificate No. 1569, ES

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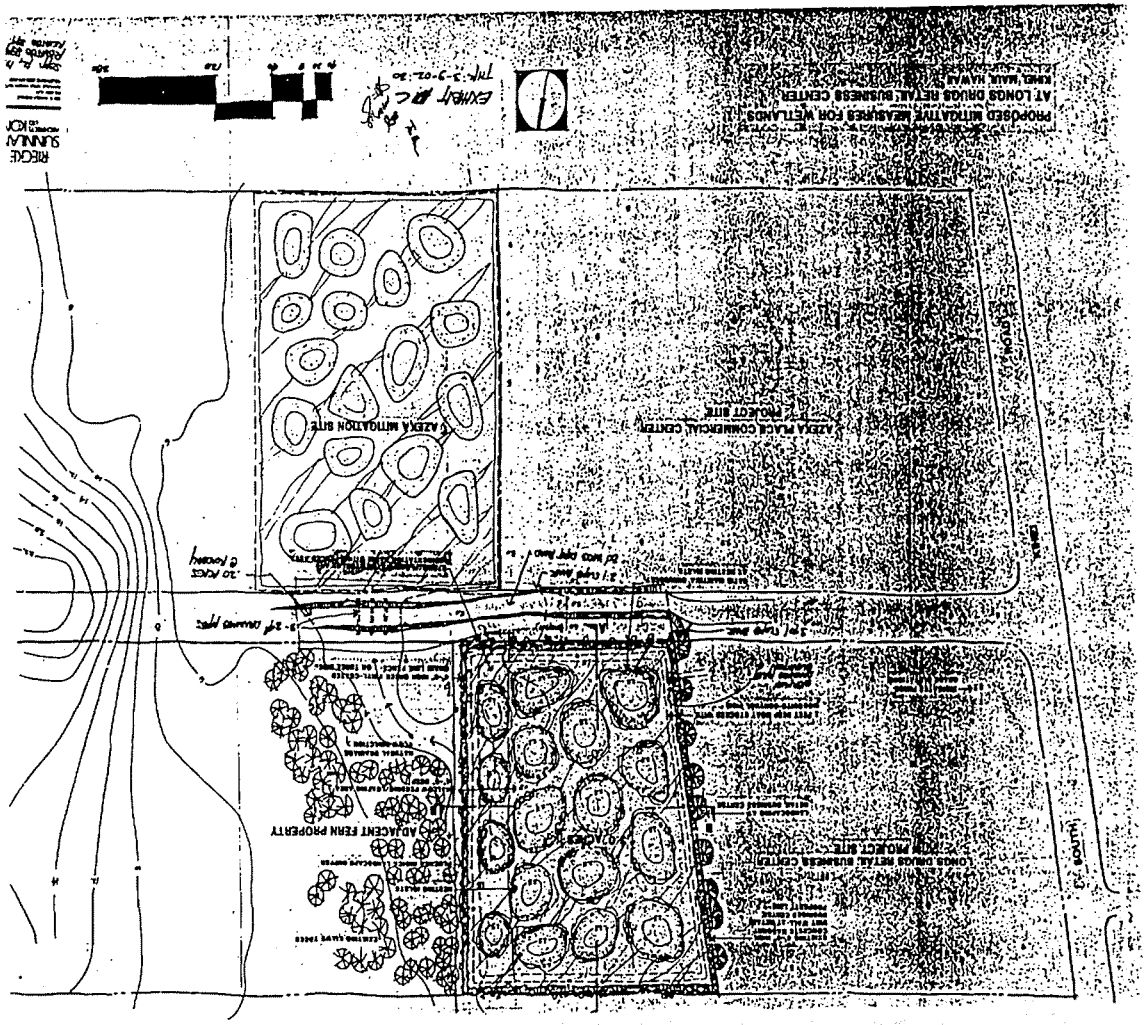


EXHIBIT C

APPENDIX E-5.

Affidavit of Lawrence N.C. Ing Regarding Department of the Army Granting Authorization of Nationwide Permit Affecting Parcels 76 and 80

ORIGINAL

90 174521

STATE OF HAWAII
BUREAU OF CONVEYANCES

90 NOV 9 PM 2 43

S. FUKUSHIMA, REGISTRAR

LAND COURT SYSTEM REGULAR SYSTEM

After Recordation Return by Mail (X) Pickup ( ) To:

LAWRENCE N. C. ING
ING, KUSHI & KIM ATTORNEYS
Walk Street Professional Center
2145 Wells Street, Suite 204
Wailuku, Maui, HI 96793

azeka05.cli/ls

Affects T.M.K. (2) 3-9-02:28, 76 and 80

AFFIDAVIT OF LAWRENCE N. C. ING

STATE OF HAWAII)
) SS.
COUNTY OF MAUI)

LAWRENCE N. C. ING, being first duly sworn on oath, deposes and says:

1. That he is the attorney for Azeka Building Corporation, a Hawaii corporation, of Kihei, Maui, Hawaii;

2. Attached is a true and correct copy of a letter dated October 30, 1990, from Stanley T. Arakaki, Chief, Operations Division, Department of the Army, to the affiant, granting authorization of Nationwide Permit with enclosures as mentioned in same.

3. That the attached affects real property situate at Kihei, Maui, Hawaii, owned by Azeka Building Corporation, being indentified on the Tax Maps of the Second Taxation Division, State of Hawaii, as T.M.K. (2) 3-9-02:28, 76 and 80.

And further affiant sayeth not.

DATED: Wailuku, Maui, Hawaii, November 5, 1990.

LAWRENCE N. C. ING

Subscribed and sworn to before me this 5 day of November, 1990.

Notary Public, State of Hawaii.

My commission expires: 5/23/93

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

REPLY TO
ATTENTION OF
Operations Division OCT 30 1990

Mr. Lawrence N. C. Ing
Ing, Kushi & Ige
2145 Wells Street, Suite 204
Wailuku, Hawaii 96793-2222

Dear Mr. Ing:

This is in response to your letter, dated August 30, 1990, submitting the amended mitigation plan for the Azeka Building Corporation's Azeka Place project in Kihei, Maui. The work would involve the placement of 4.2 acres of fill in wetlands for a commercial development and includes 3.5 acres of wetland creation/enhancement.

Based on this understanding, I have determined that the proposed work is authorized by the Corps Nationwide (NW) permit authority in accordance with Federal Regulations at 33 CFR 330.5(a)(26), and with the special conditions listed below. Excerpts from the regulations which list the conditions and management practices of this authorization are enclosed for your information and compliance (Encl 1).

The following special conditions shall be incorporated as part of the permit:

a. All mitigation work shall be performed as described in the document, "Proposed Mitigative Measures for Wetlands at Azeka Place Commercial Center, TMK: 3-9-02: 28, 76, 80, Kihei, Maui, Hawaii", as amended August 27, 1990, and on the accompanying plan, as revised August 24, 1990.

b. A schedule of the construction work will be submitted to the Operations Division within 30 days of the NW authorization. Details of the construction drawings shall be coordinated with and incorporate the design guidance recommendations of the U.S. Fish and Wildlife Service, as contained in the enclosed design criteria and drawing. (Encl 2)

c. The permittee shall use best efforts to complete the construction of the mitigation plan within one (1) year of NW authorization. A performance bond, or other formal financial commitment satisfactory to the Corps, equal to one hundred percent of the contract price shall be held by a third party to complete the construction of the mitigation wetland should the wetland construction fail to be completed within the time specified. Evidence of securing the bond or financial commitment shall be provided to the Corps of Engineers within 30 days of award of the construction contract.

d. Upon completion of the mitigation work, an onsite inspection will be held to evaluate the success of the work and document the baseline for completion of the wetland mitigation. Quarterly letter reports summarizing the waters levels, salinity, vegetation cover and use of the wetland by endangered waterbirds and migratory shorebirds shall be submitted by the permittee to the Corps of Engineers for the first year. Subsequent monitoring requirements as well as reasonable modifications that may be required to assure the continued existence of the wetlands will be determined at annual onsite inspections to be held thereafter.

e. All features of the mitigation wetland will be maintained in perpetuity as compensation for the placement of fill authorized by this permit; however, future substitution of mitigation measures may be authorized, provided that such substitution is acceptable to the Corps of Engineers, in consultation with the U.S. Fish and Wildlife Service and the U.S. Environmental Protection Agency.

f. This permit authorization shall be recorded at the Bureau of Conveyances. The permittee shall provide an endorsed copy of the filed permit to the Corps of Engineers within 60 days of the issuance of this permit.

In addition to these conditions and management practices, you are advised that:

a. Nationwide permits do not obviate the need to obtain other Federal, state or local authorizations required by law.

b. Nationwide permits do not grant any property rights or exclusive privileges.

c. Nationwide permits do not authorize any injury to the property or rights of others.

d. Nationwide permits do not authorize interference with any existing or proposed Federal project.

This verification will be valid until the nationwide permit is modified, reissued, or revoked. All the nationwide permits are scheduled to be modified, reissued or revoked prior to January 13, 1992. It is incumbent upon you to remain informed of changes to the nationwide permits. We will issue a public notice announcing the changes when they occur. Furthermore, if you commence or are under contract to commence this activity before the date the nationwide permit is modified or revoked, you will have twelve months from the date of the modification or revocation to complete the activity under the present terms and conditions of this nationwide permit.

Sincerely,

Stanley J. Arakaki

Stanley J. Arakaki
Chief, Operations Division

Enclosures

Copies Furnished:

US FWS, Honolulu Office

US EPA, Region IX, San Francisco, CA.

CONDITIONS TO NATIONWIDE PERMITS

The following special conditions must be followed in order for the nationwide permits identified in paragraph (a) of this section to be valid:

(1) That any discharge of dredged or fill material will not occur in the proximity of a public water supply intake;

(2) That any discharge of dredged or fill material will not occur in areas of concentrated shellfish production unless the discharge is directly related to a shellfish harvesting activity authorized by paragraph (a)(4) of this section;

(3) That the activity will not jeopardize a threatened or endangered species as identified under the Endangered Species Act (ESA), or destroy or adversely modify the critical habitat of such species. In the case of federal agencies, it is the agencies' responsibility to comply with the requirements of the ESA. If the activity may adversely affect any listed species or critical habitat, the district engineer must initiate Section 7 consultation in accordance with the ESA. In such cases, the district engineer may:

(i) Initiate section 7 consultation and then, upon completion, authorize the activity under the nationwide permit by adding, if appropriate, activity specific conditions, or

(ii) Prior to or concurrent with section 7 consultation he may recommend discretionary authority (see section 330.8) or use modification, suspension, or revocation procedures (see 33 CFR 325.7).

(4) That the activity shall not significantly disrupt the movement of those species of aquatic life indigenous to the waterbody (unless the primary purpose of the fill is to impound water);

(5) That any discharge of dredged or fill material shall consist of suitable material free from toxic pollutants (see section 307 of the Clean Water Act) in toxic amounts;

(6) That any structure or fill authorized shall be properly maintained;

(7) That the activity will not occur in a component of the National Wild and Scenic River System; nor in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an officially study status;

(8) That the activity shall not cause an unacceptable interference with navigation;

(9) That, if the activity may adversely affect historic properties which the National Park Service has listed on, or determined eligible for listing on, the National Register of Historic Places, the permittee will notify the district engineer. If the district engineer determines that such historic properties may be adversely affected, he will provide the Advisory Council on Historic Preservation an opportunity to comment on the effects on such historic properties or he will consider modification, suspension, or revocation in accordance with 33 CFR 325.7. Furthermore, that, if the permittee before or during prosecution of the work authorized, encounters a historic property that has not been listed or determine eligible for listing on the National Register, but which may be eligible for listing in the National Register, he shall immediately notify the district engineer;

(10) That the construction or operation of the activity will not impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights;

(11) That in certain stated, an individual state water quality certification must be obtained or waived (see § 330.9);

(12) That in certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see § 330.10);

(13) That the activity will comply with regional conditions which may have been added by the division engineer (see § 330.8(a)); and

(14) That the management practices listed in § 330.6 of this part shall be followed to the maximum extent practicable.

MANAGEMENT PRACTICES

In addition to the conditions specified in the attached sheet, the following management practices shall be followed, to the maximum extent practicable, in order to minimize the adverse effects of these discharges on the aquatic environment. Failure to comply with these practices may be cause for the district engineer to recommend, or the division engineer to take, discretionary authority to regulate the activity on an individual or regional basis.

(1) Discharges or dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

(2) Discharges in spawning areas during spawning seasons shall be avoided.

(3) Discharges shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).

(4) If the discharge creates an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized.

(5) Discharge in wetlands areas shall be avoided.

(6) Heavy equipment working in wetlands shall be placed on mats.

(7) Discharges into breeding areas for migratory waterfowl shall be avoided.

(8) All temporary fills shall be removed in their entirety.

DESIGN CRITERIA FOR WETLAND MITIGATION
AZEKA PLACE COMMERCIAL CENTER, KIHEI, MAUI
U.S. FISH & WILDLIFE SERVICE LTR, DATED OCTOBER 10, 1990

The mitigation wetland shall be constructed and maintained in general conformance with the following design criteria and drawing:

1. Water depths within the wetland shall range from 0 - 0.5 feet, exclusive of the moat.

2. The diameter of the nesting islands shall range from 2 - 10 feet when the water surface elevation is at 2.0 feet MSL.

3. The distance between islands shall be at least 50 feet.

4. The maximum height of the islands above the water level shall be 0.5 feet.

5. The slope of the islands shall be no greater than 5%.

6. Wetland vegetation, such as pickleweed (Batis maritima), makai (Bolboschoenus maritimus = Scirpus maritimus), and water hyssop (Bacopa monnieri) shall be planted by the permittee to provide cover and food for endangered and migratory waterbirds. Vegetation cover on the islands shall be maintained by the applicant to not exceed 30% of the exposed mudflat when the water surface elevation is at 2 feet above MSL.

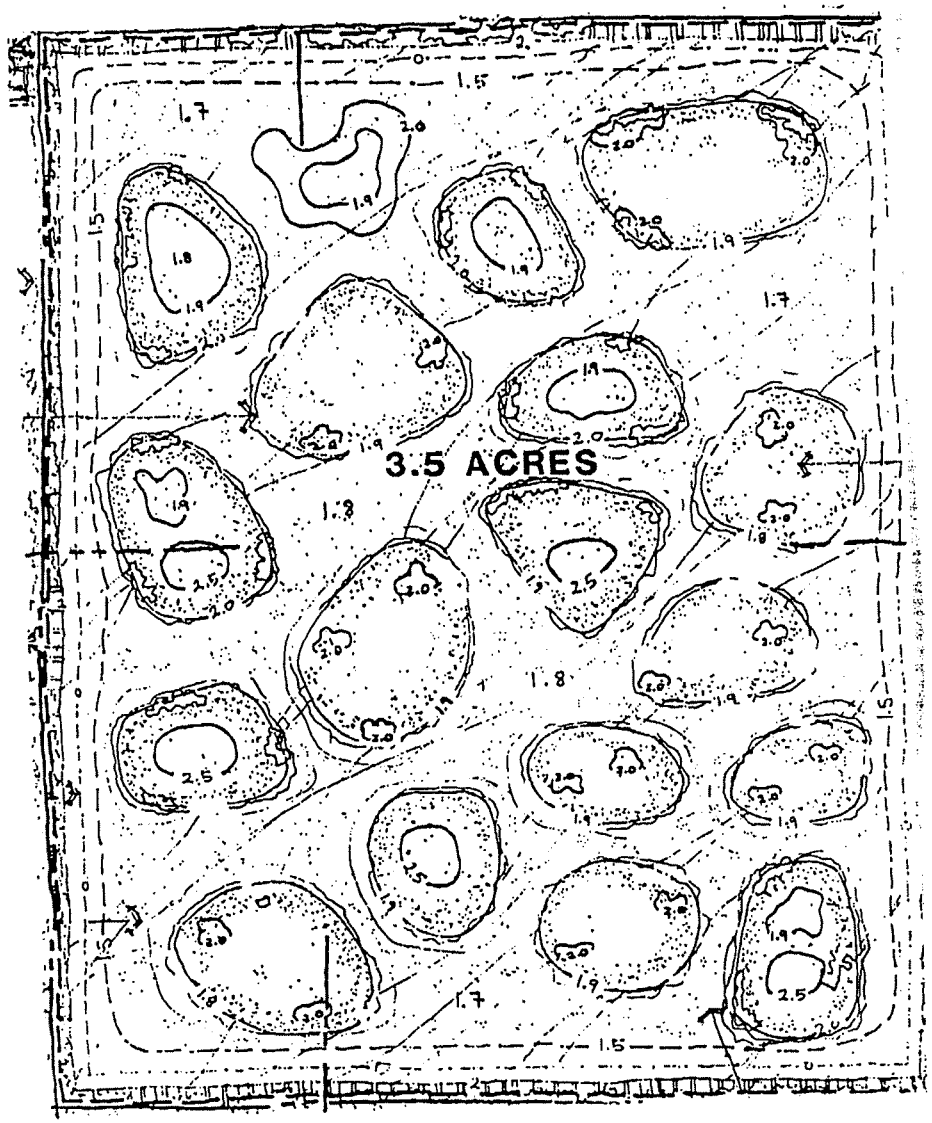
7. A moat and chain-link fence shall be constructed along the perimeter of the mitigation wetland to deter predators and people from entering the wetland. The moat shall be approximately 2-feet deep, and have a bottom width of no less than 10 feet. Encroachment of vegetation across the moat shall be controlled by the permittee.

8. A 4-foot-high chain-link fence shall be constructed along the outside boundary of the moat. The bottom 8-12 inches of the fence shall be buried below grade to reduce the potential for predators from crawling or digging under the fence. The perimeter fence shall include a secured gate to allow access into the wetland for maintenance purposes.

9. A hedge of vegetation shall be planted along the outside boundary of the fence line to provide a visual buffer between the wetland and the surrounding urban developments. Except at the viewing platform, the vegetation buffer shall be 10 feet in width.

Encl 2

10. Interpretive signs shall be installed by the applicant at the viewing platform. The FWS is available to provide assistance to the permittee regarding the design and content of the interpretive program.



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APPENDIX F.

Archaeological Inventory Survey

Archaeological Inventory Survey of 23.937 Acres in Kīhei at Waiohuli-Kēōkea Beach Homesteads Waiohuli/Kēōkea *Ahupua`a*, Wailuku District, Island of Maui

TMK (2) 3-9-002: 030(por.) 076 and 158

Prepared On Behalf of

Krausz Kīhei One, LLC, and
Krausz Kīhei Two, LLC

Prepared by:

Xamanek Researches, LLC
Pukalani, Maui

Jenny Lyn Pickett
Erik M. Fredericksen
Jonas M. Madeus

4 June 2010 (DRAFT)

Abstract

Xamanek Researches, LLC conducted an Archaeological Inventory Survey (AIS) including 23.937 acres of land on Tax Map Key (TMK) 3-9-002:030 (por.), 076, and 158. Parcel 030 is also known as *Lot 10-A*, Parcel 076 as *Lot 11-A-1-A* and Parcel 158 as *Lot 11-A-3-2.* The subject area is located in the town of Kīhei within Waiohuli-Kēōkea *Ahupua`a,* Wailuku District, Maui Island. The study was conducted on behalf of the landowners Krausz Kīhei One, LLC and Krausz Kīhei Two, LLC.

Archaeological fieldwork began on 25 September 2009 and continued intermittently through 11 November 2009. Follow-up investigation was carried out on 14 and 15 December 2009. Fieldwork consisted of both surface and subsurface investigations throughout the subject area. Subsurface testing included eight hand excavated shovel probes, eleven controlled hand excavated 1 m square Test Units (TUs), and twenty controlled mechanical Backhoe test Trench (BT) excavations.

Historic properties were identified and documented. Two Statewide Inventory of Historic Places (SIHP) numbers were assigned during the survey (50-50-04-6669 and 50-50-04-6670 Features A and B). The two sites include three component features: one low lying rock wall with associated concrete foundations and two concentrated surface areas of traditional Hawaiian cultural remain scatters with subsurface component features.

Archaeological monitoring is warranted for any potential future clearing, grubbing, or grading activities. An archaeological monitoring program shall be established, in order to mitigate any potential future inadvertent discoveries that may occur in the subject area.

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Introduction

Xamanek Researches, LLC conducted an Archaeological Inventory Survey (AIS) for 23.937 acres of land on Tax Map Key (TMK) 3-9-002:030, 076, and 158. Parcel 030 is also known as *Lot 10-A*, Parcel 076 as *Lot 11-A-1-A* and Parcel 158 as *Lot 11-A-3-2*. The subject area is located in the town of Kīhei within Waiohuli-Kēōkea *Ahupua`a,* Wailuku District, Maui Island (Figures 1 and 2).

Portions of the subject area have been previously disturbed by former mechanical grading activities. The western portion of parcel 030 is designated as an existing wetland enhancement area. The majority of the subsurface deposition throughout the project area is comprised of Aeolian sand.

This report presents a compilation of information regarding the identification and documentation of historic properties within the subject area. During the fieldwork portion of this archaeological inventory survey, a 100% pedestrian survey was undertaken on the project area with 5 meter spacing. The wetland areas were not included in the systematic pedestrian sweeps of the surface area. Subsurface sampling included extensive hand and mechanical testing. The identification and recordation of two archaeological sites occurred. Both sites are now listed on the Statewide Inventory of Historic Places.

This study was prepared following the Department of Land and Natural Resources, State Historic Preservation Division Hawai`i Administrative Rules (HAR 13-276) and is also in compliance with Maui County guidelines, rules, and recommendations. This report presents information gathered from a combination of background research and field survey results. Interpretation, evaluation, and recommended mitigation measures are provided.

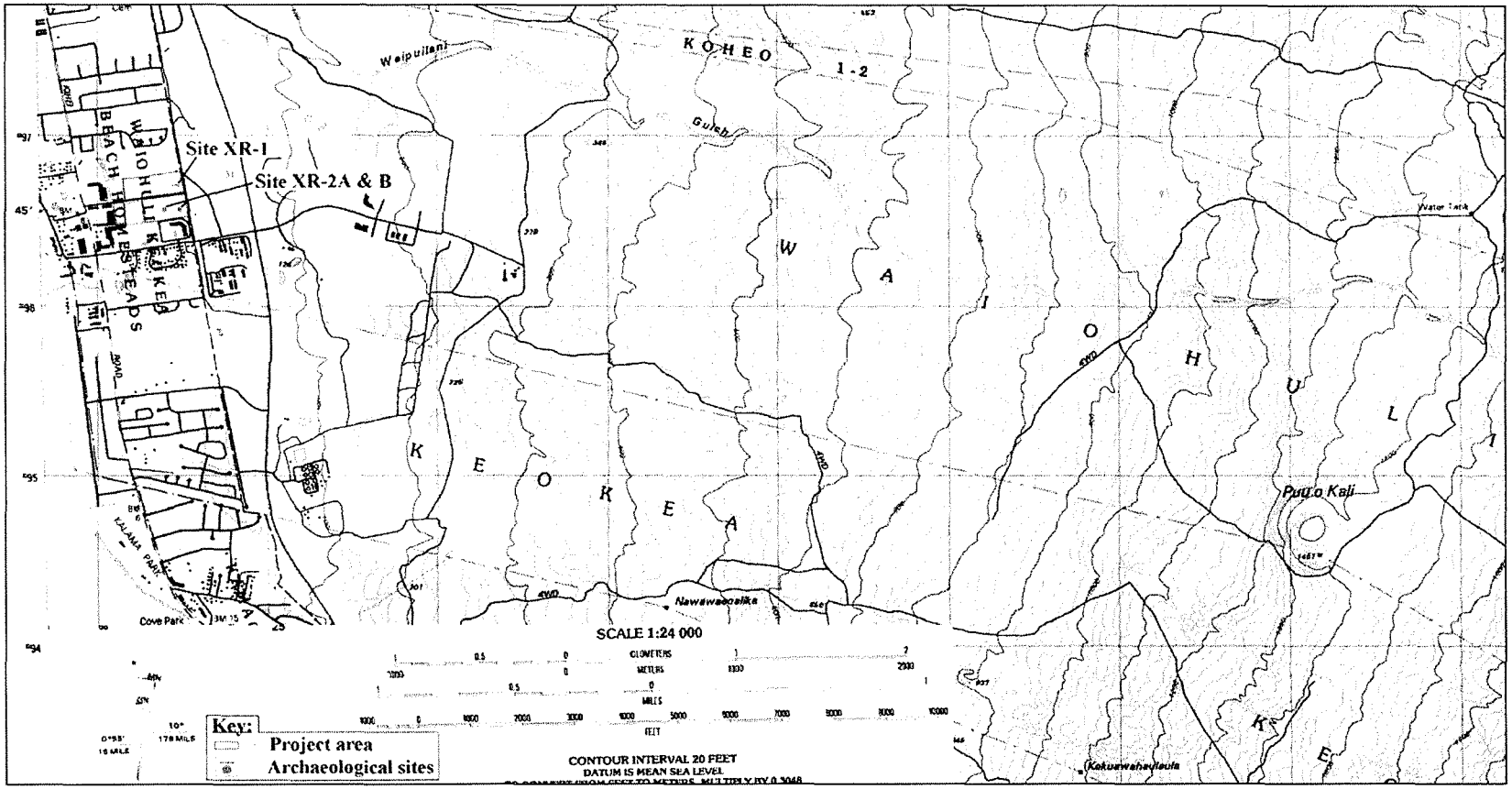

Figure 1: Portion of the topographic map of Pu`u O Kali showing the project area with the location of archaeological sites (XR-1 AKA 50-50-04-6669, and XR-2 A & B AKA 50-50-04-6670A and -6670B).

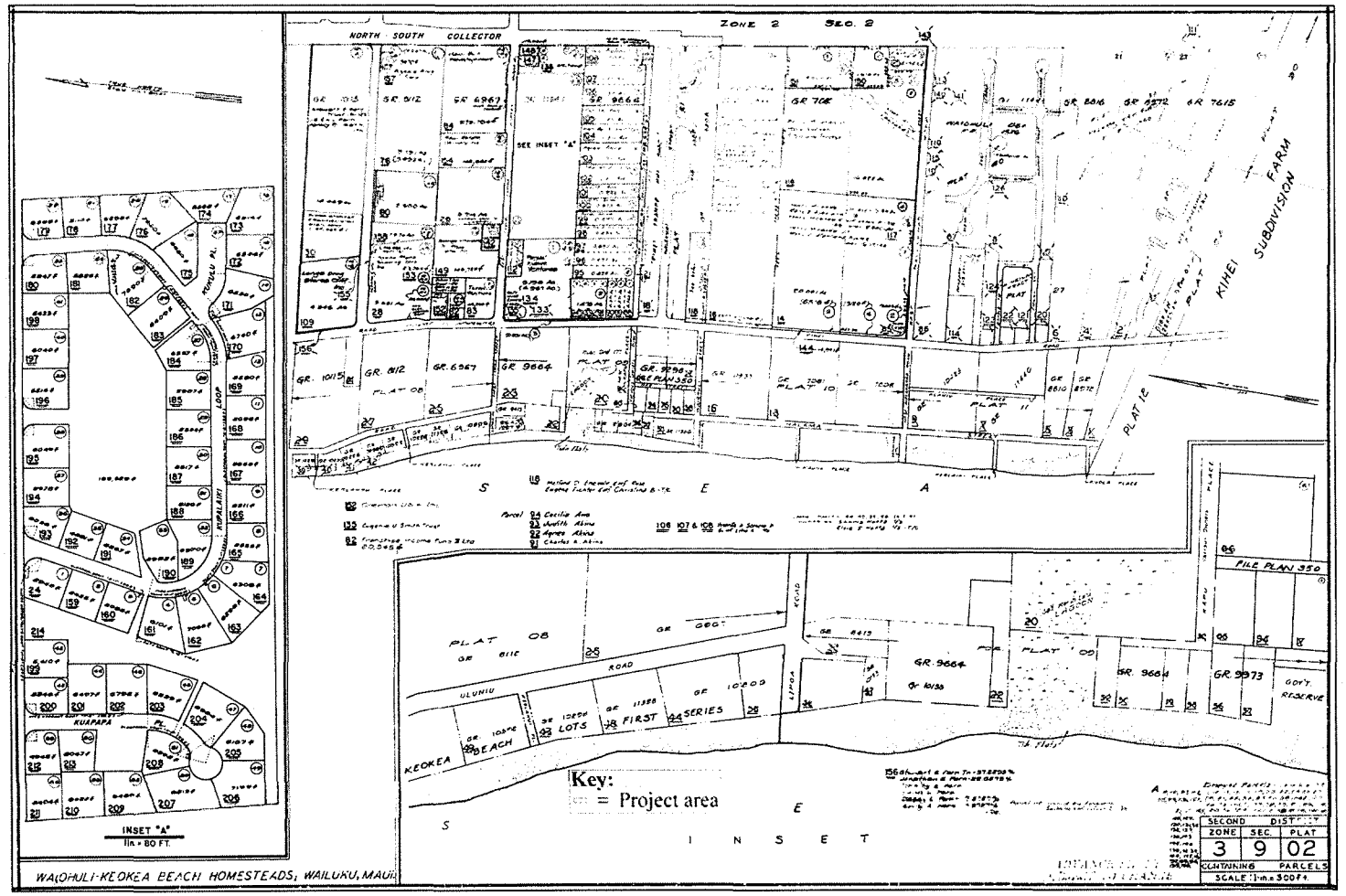

Figure 2: Tax Map Key showing the subject area depicted in yellow.

Study Area

The study area consists of c. 23.937 acres delineated on the Maui County Tax Map Key as TMK [2] 3-9-02: 030 (13.469 acres), 076 (9.092 acres), and 158 (1.376 acres). The subject area is located in Kīhei, Waiohuli-Kēōkea *Ahupua'a*, Wailuku District, Island of Maui.

The subject area is bisected by Pi'ikea Avenue, east of Līloa Drive (AKA "N/S Collector Road") and west of the *Longs Drugs* shopping center. The subject area is located approximately 500 meters or about one-half kilometer east of the shoreline. Elevations range from approximately one meter (3.3 feet) above mean sea level along the western or *makai* boundary to about 11.7 meters (38.4 feet) above mean sea level on the eastern or *mauka* boundary.

Natural History

Kīhei is generally sunny, warm, and dry throughout the year with an average annual high temperature of 86 degrees Fahrenheit and average low temperature of 63 degrees Fahrenheit. In general, northeast trade-winds occur more than 80% of the year. The months of June through August are commonly warmer and the cooler months are usually January through March. Average rainfall varies from under 10 inches per year to 20 inches per year in higher elevations. Rainfall is seasonal, with the majority of wet weather occurring during the colder or winter months.

Vegetation in the area includes introduced *kiawe* trees (Prosopis *pallida*), *koa haole* trees (Leucaena *leucocephela*), and ironwood trees (Casuarina *equisetifolia*). The area is covered with various invasive grass species, lantana (Lantana *camara*) and common annual succulent weeds.

Soils in the project area are assigned to: *Jaucas sand*, saline, 0-12 percent of slope (JcC) occurs near the ocean and water table is shallow with salts accumulated on the surface. This type of soil drains poorly in low areas and is well drained on higher ground. It is used for pasture, wildlife habitation, and urban development (Foote, et. al., 1972, p. 49). Unmarked human burials have been located throughout this type of soil in the area, and across Maui. The eastern portion of the study area is located in an area of generally thin, eroded soil deposits and exposed bedrock outcrops.

Historical Background

Mythological and Traditional Accounts

The subject area is located in the modern division of Wailuku District, formerly within the traditional boundary known as the *Kula Moku*. Kula was a relatively minor political territory under the jurisdiction of West Maui chiefs. It is an arid region with no perennial streams, located on the western slope of Mount Haleakalā. The primary traditional resources of the upland area of the Kula district were dry forest products, and produced various dryland agricultural products, such as the staple sweet potatoes (Kolb, July 1997, p. 25). Within the larger traditional land division, there are several long, narrow *Ahupua`a* that stretch from the top of the volcano to the ocean shore (Figure 3 and Figure 4).

Kula land is described by Handy and Handy (1972, pg. 510) as:

> ...open country, or plain, as distinct from valley or stream bottom, and has long been used as a term to distinguish between dry, or "*kula* land" and "wet-taro land". This is an essential characteristic of Kula, the central plain of Maui which is practically devoid of streams. ...Kula was widely famous for its sweet-potato plantations. *`Uala* [sweet potato] was the staple of life here...

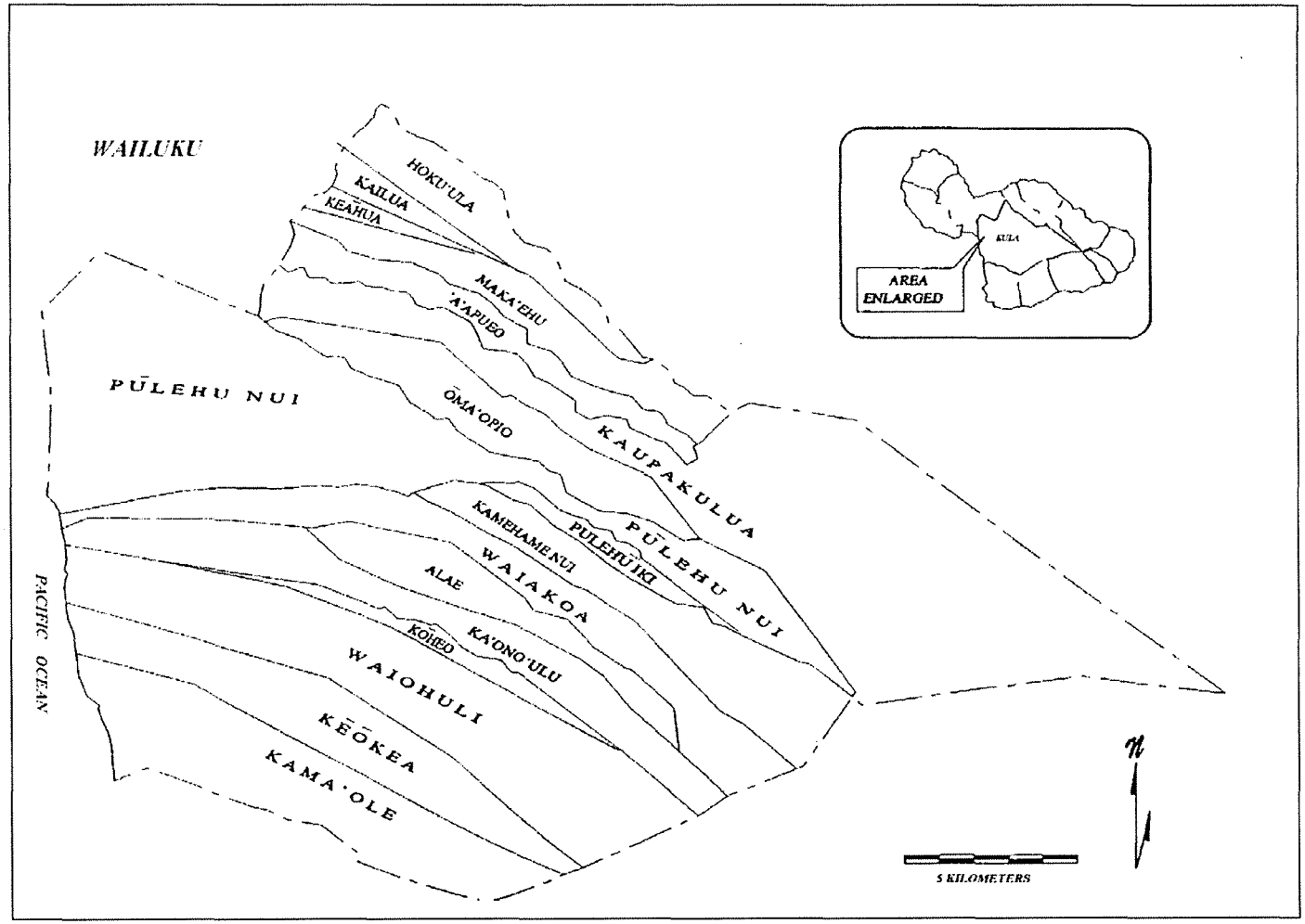

Figure 3: Map showing the traditional land divisions within the Kula Moku (Kolb et al., 1997, p. 24).

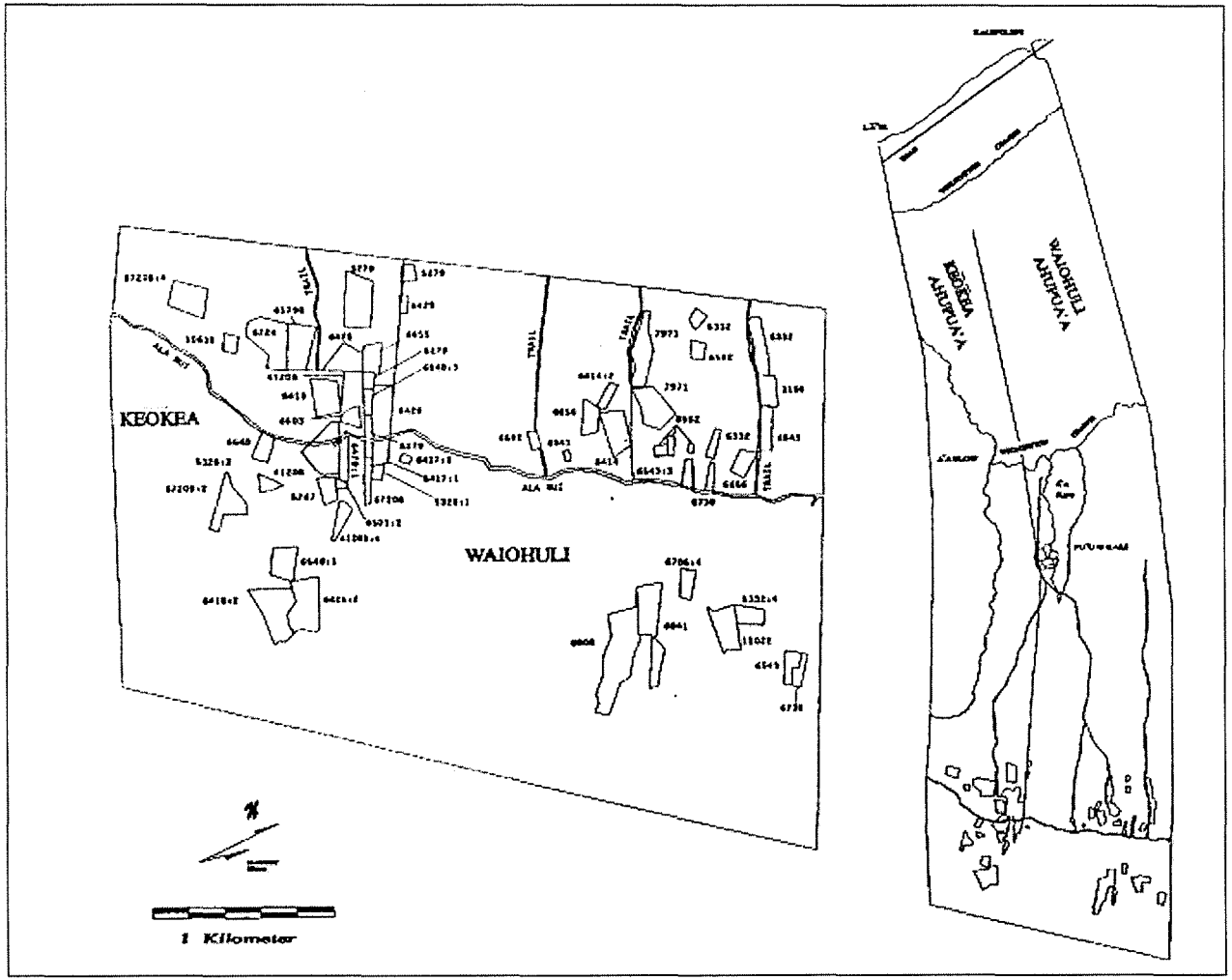

Figure 4: Map showing Land Commission Award distribution in Kēōkea-Waiohuli (from Kolb et al., 1997, p. 54).

Post-Contact

By the 1840s, the increased number of whaling ships anchoring off of Maui's shores created a substantial market for produce such as sweet and Irish potatoes, which grew well in the Kula region. Irish potatoes were coveted more highly, however, and became of greater importance in the produce trade, particularly during the California Gold Rush. They were transported from the Kula fields to the shore, where they were often sold directly to ships that called at Kalepolepo. From there, they were shipped to Lāhaina, where the bulk of the whaling fleet moored.

The California Gold Rush began in 1848, which resulted in a potato boom on Maui that commenced in the fall of 1849. Captain John Halstead established a trading post[1] in 1849 in the village of Kalepolepo, in order to take advantage of this commercial activity. He built a large Pennsylvania Dutch-style, 3-story residence next to the south wall of Kalepolepo Fishpond. His trading station was located on the first floor of this structure. It was known locally as the *Koa* House. Halstead's large prominent house stood as a landmark for nearly one hundred years[2] —and was visited by the King Kamehamehas III, IV and V between 1850 and 1870.

Kuykendall (1938, p. 313) refers to an article in the Polynesian in November of 1849:

> The call for [potatoes] is loud and pressing, as some vessels bound for California have taken as many as 1,000 barrels each. The price is high, and the probability is that the market cannot be supplied this autumn. Kula, however, is full of people...preparing the ground for planting, so that if the demand from California shall be urgent next spring as it is now the people will reap a rich harvest.

Coastal Waiohuli-Kēōkea appears to have been relatively unaffected by the upland "potato boom", which lasted only a few years. For the most part, the coastal area was allegedly fairly sparsely occupied by people who primarily concentrated on the exploitation of marine resources.

The *Māhele*, or *Division*, defines the process of the mid-1800 land tenure system change, which essentially divided land into three categories: (1) Crown Land (for the occupant of the throne), (2) Government Land, and (3) Konohiki Land (set aside for 245 of the highest ranking *Ali'i)*. The philosophy of *private property* had been introduced to the islands. All of the lands were subject to the *rights of native tenants*. If the common people (*maka'āinana*), or "Native Tenants", met certain criteria and filed land claims

---

[1] Captain Halstead arrived in Lāhaina from New York in 1838, and married the chiefess Kauwikikilani Davis, granddaughter of Isaac Davis, Kamehameha I's advisor.

[2] In 1946 it was abandoned and was leased by the Kīhei Yacht Club, the members of which tried to burn it down because it was so unsafe. Several attempts failed, but eventually the Maui Fire Department was called in and succeeded in reducing it to ashes in August of 1946 (Kolb, 1997, p. 70).

under specific guidelines, a Land Commission Award (LCA) was issued. Further efforts for native tenant land rights required paying hefty commutation in addition to conducting expensive land surveys (with limited surveyors available) then finally, a land grant may be awarded. The awarded lands are referred to as *Kuleana.*

No Land Commission Awards were issued for the subject area. Two of the parcels are listed as Grants. Parcel 030 is listed as Grant 10115 and Parcel 076 is listed as Grant 8112. All three of the subject parcels were later referred to as a portion of the *Waiohuli-Kēōkea Beach Homesteads.*

Despite the relatively low population reported living in the overall Kīhei area, the trading village of Kalepolepo represented a relatively large concentration of people, and it was felt that they were in need of spiritual guidance. To this effect, the construction of a small stone church began around 1843 at Kalepolepo near the trading post, under the direction of David Malo.

David Malo was the son of a soldier in the army of Kamehameha I, and was born in 1793 on the Big Island. He later moved to Lāhaina in the 1820s, where he came under the influence of Reverend William Richards and was converted to Christianity. With the establishment of Lāhainaluna High School in 1831, David Malo enthusiastically enrolled as one of its first students. In 1843 he was licensed to the Christian ministry, and assigned to a congregation in Kalepolepo. He began the construction of Kilolani Church, which continued until 1852. It was completed shortly before the death of David Malo on October 21, 1853. Following his death, the Kilolani Church congregation dispersed, and never met again at Kalelepolepo. A fire is said to have damaged the structure, while a flood in the 1880s also impacted the little stone church. The ruins of this church are listed on the National Register of Historic Places and on the Statewide Inventory of Historic Places (SIHP 50-50-09-1587). Religious services were once again conducted at the ruins of this church in 1976. It is known today as "Trinity-Church-By-The-Sea".

Another popular economic activity in the area was cattle ranching, which had become a booming enterprise by the 1880s. Large sections of land in the Lower Kula area became pastureland, and large sections of Crown land were leased for grazing acreage. Two large ranches operated in this part of Maui—Ka`ono`ulu Ranch, and Haleakalā Ranch. The latter was founded in 1888—and presently is owned by the Baldwin Family. It still maintains several thousand cattle on its 32,000 acres.

Ka`ono`ula Ranch lands were originally part of an LCA to H. Hewahewa (LCA 8452 made up of 5715 acres), and LCAs 8452: 19 and 20 to A. Keohokaole. In the 1860s, ranch lands were obtained by a young Chinese immigrant, Young Hee, who was forced to return to China in the 1890s to settle family problems. At that time, the lands were acquired by William H. Cornwell, and they became the Cornwell Ranch. Harold W. Rice purchased the property in 1916, and Ka`ono`ulu Ranch is currently operated by his grandson, Henry Rice, and consists of nearly 9000 acres in its entirety.

A smaller ranch was also located in the general vicinity of the project area—Kama`ole Ranch. An article in The Maui News (December 19, 1908) states that Antone F. Tavares of Makawao "purchased S, Ahmi's Kamaole Ranch property for $8,500.00. The ranch, located in droughty Kula district was a fine piece of property." The article goes on the say that Mr. Ahmi refused a former offer for $9,500.00 when he was asking $15,000.00 for it.[3]

The Maui News (March 7, 1928) noted:

> Senator A.F. Tavares has sold Kamaole Ranch to Haleakala Ranch for approximately $110,000. For himself he retains the title to the cottage on the place and about 5.95 acres surrounding it... At present there are about 500 head of cattle running over the ranch and the purchasers have an option on this live stock at $40 per head. Kamaole ranch has an area of approximately 1500 acres. It adjoins the Ulupalakua ranch which is owned by Frank F. Baldwin. Alexander and Baldwin, Ltd. is agent for Haleakala ranch and the purchase of Kamaole brings together two properties which occupy many thousands of acres of cattle land on the slopes of Haleakala. Kamaole is to be continued by the purchasers as a cattle ranch.

A portion of the Waiohuli Ahupua`a lies within the Makawao District, which was considered Government Land following the Māhele. It was officially designated Crown Land in 1890 by King Kalākaua (Wong-Smith, 1990, B-3). While a good deal of agricultural activity took place in the mid- and latter 1800's in the upland Kula region, little activity is noted for the lower portions. Again, no Land Commission Awards (LCA) of native *kuleana* (house and/or garden plots) are found within the project area, nor were any claimed. Since the early part of the 20th century, the general area has been used primarily for cattle ranching. The importation of alien grass species such as buffel grass (Cenchrus ciliaris) for livestock feed has greatly altered the natural flora of the area. In addition, ranching activities have no doubt impacted any archaeological features that may have once been present in the project area.

During the early 20th century, there was little to attract people to South Maui, except good fishing and fine beaches. Only about 350 people made Kīhei their home at this time. Finally, in 1932, the government offered 11 beach lots for sale—the Waiohuli-Kēōkea Homesteads—with the hope of spurring development of a desirable residential district. The current study area is portion of these homestead lands.

An article in The Maui News dated November 11, 1931 reports that the coveted Kīhei Beach lands "will be opened for Public Sale in the near future for home building". Those in favor of the sale, say that it would promote development of the Kīhei area into a

[3] Mr. Ahmi was also known as Sun Mei, a notable personage in Kula in the early part of the century. In 1901 he was arrested for stealing cattle, and he sued for false imprisonment a few weeks later. In 1903 he was indicted in a police bribery case, but was later acquitted. He was also involved in civil suits, and tax cases, as well as being outspoken in political matters during 1904 and 1905. By 1906 his property was listed in a sheriff's sale, and sold in 1908 (Bartholomew, 1985).

better-class residential district. The chief of the opposition for the sale was Senator Harold W. Rice, who maintained that the area should be preserved as government property and should be turned over to homesteaders.

As it turned out there was little interest in the "coveted" Kīhei lands, and only 6 of the parcels were sold. By 1950, farmland could be purchased for about $225 per acre and residential lots sold for 5 to 10 cents a square foot (Bartholomew and Bailey, p. 142). Kīhei was not considered a desirable living area, for the most part, due to the general dry, dusty and hot conditions.

A few years after the partition of these homestead lots, World War II erupted, and this part of South Maui was soon dominated by the military. During World War II, military activity heavily impacted Kīhei (Photo # 1). Such activities included operations of the Naval Combat Demolition Training and Experimental Base, the Kama`ole Amphibious Training Base, and the Pu`unene Naval Air Station. Archaeological evidence of such military activity was found by Xamanek Researches during an inventory survey in Ka`ono`ulu *Ahupua`a* approximately 2.5 kilometers to the south (Fredericksen, et. al., July 1994).

An article on the front page of The Maui News dated June 9, 1945, gave information about the placing off-limits of land located in Kīhei-Makena. It reads:

> Beginning at the north at the southern boundary of the property of William Harvey, tax map key 390257, which is approximately 3.3 miles south of the pier located across Makena road from the Kīhei Store and ending at the south of the southern end of the Naval Air Station, Puunene, recreation beach five miles south of the pier across from the Kīhei Store, and extending from the western boundary of Makena road to an imaginary extension of the shore line of Maalaea bay extending at all point 2000 yards seaward of the actual shoreline thereof. The northern and southern boundaries of the area described herein have been identified by placing of out-of-bounds signs thereon.

The prohibition applied to military as well as civilian personnel, with the exception of those attached to the Naval Combat Demolition Training and Experimental Base, the Kama`ole Amphibious Training Base, and the Pu`unene Naval Air Station. They were allowed to use the facilities of the Naval Air Station recreation beach situated within the area. Kalama Park was accessible, but persons had to remain within the park boundaries, and could not swim, wade, or fish in the waters adjacent to the park under any circumstances. However, civilians living within the restricted area were allowed access to their homes.

Only in fairly modern times—from the 1960s on—has Kīhei taken on importance as a place of residence and commerce. At present, it is one of Maui's busiest tourist destinations, with condominium/hotel development, and associated commercial activities. At the same time, with the increase of population, it has become a major residential area.

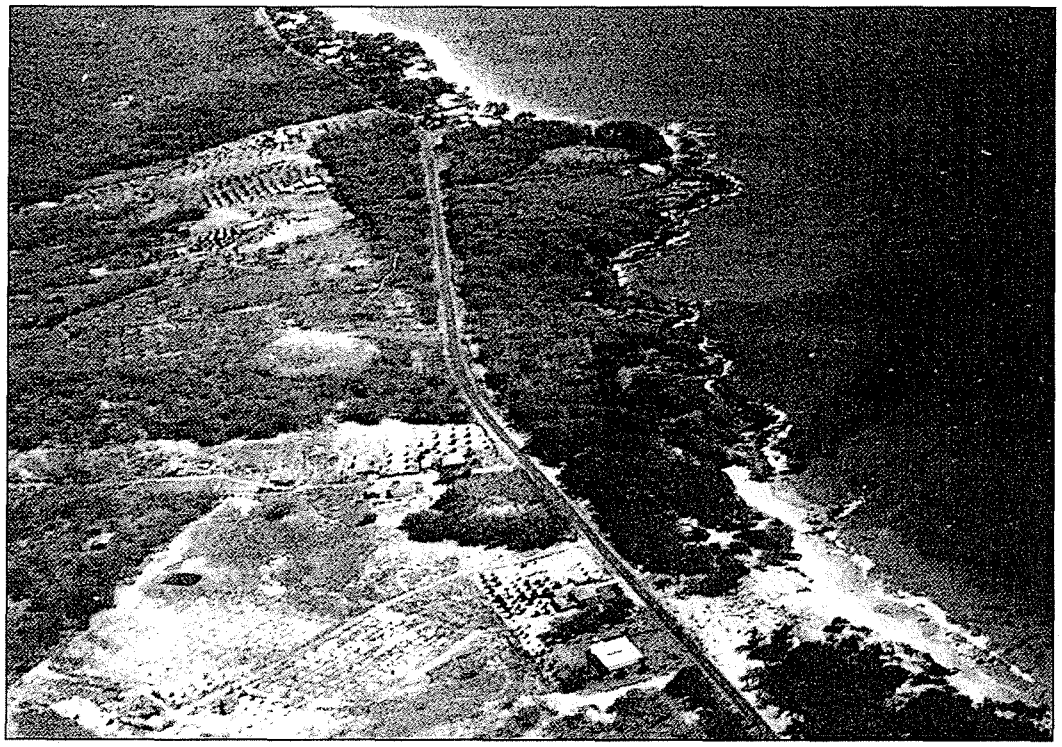

Photo # 1: Aerial view of Kama`ole Beach area in Kīhei during the 1940s, showing military installations (probably the Kama`ole Amphibious Training Base). [Bartholomew and Bailey, p. 142].

Previous Archaeological Study

Winslow Walker carried out the first island-wide assessment of notable sites on Maui in 1929-1930. Walker (1931) identified 23 *heiau* and an L-shaped enclosure within the Kula area. The following 5 *heiau* were listed within Kēōkea and Waiohuli *Ahupua`a*:

Kēōkea

Site 208 is located on the hill 50 yards back of the Kula Sanatorium. It is a small rough platform 22 by 25 feet. It was probably a rain *ko`a* (Ibid., p. 274).

Site 210 is located several hundred yards below the Papakea *heiau*. It is a walled enclosure of *a`a* construction measuring 65 x 90 feet and assumed to be originally L-shaped. The front of the *heiau* is double terraced and the inside was divided into a large court and a higher platform terrace (Ibid., p. 276).

Site 211 is located below the Molohai *heiau* in line with the Haleakalā Church and Pu`u Kali. It is constructed of *a`a* with no *ili`ili* pavement, only rough paving near the northern end indicating a platform. This *heiau* measures 83 x 90 feet facing the ocean with 6 to 9 feet thick walls 4 to 5 feet high (Ibid., p. 277).

Waiohuli

Site 212 is located about a mile northeast of *heiau* Kaumiumimua in a stretch of *a`a*. It is a small walled notched shaped *heiau*. It measures only 50 x 41 feet. The walls are 3-4 feet thick. At the east end there is evidence of pavement. There is a small enclosure at the outside of the *heiau* but it appears to be more modern. There was coral located on the *heiau* but no pebbles (Ibid., p. 278).

Sites 213 and 214 are located about a half a mile below the country road and just south of the second tank. Kaimupe`elua (Site 213) is a *heiau* on a rocky knoll (DHHL lands- permanent preservation). The top area is a natural level spot which has been modified while the northeast side is built of stone up to 10 feet tall. The southeast side is constructed of *a`a* cobbles and forms an enclosure for a house at the south corner. The interior measures 52 x 55 feet. There is a high platform in the center, 11 x 20 feet and 4 feet high. A pit is found on the top. The front of the *heiau* opens to the sea and the naturally occurring levels may have served as terraces. Some coral is present. Pauhu (Site 214) was a large *heiau* that was

destroyed when the present road was built. Pauhu *heiau* was 60 x 66 feet and contained two divisions (Ibid., p. 279).

The subject parcels (TMK 3-9-02:030, 076 and 158) are located within Waiohuli-Kēōkea. Because of recent developments, Waiohuli has been the subject of several archaeological studies within the last 20 years (Figure 5 and Table 1).

In 1986, Joseph Kennedy conducted a surface archaeological reconnaissance survey for the Silversword Golf Course project, and reported in a brief summary letter that no archaeological features were found in the approximately 125-acre survey area.

Two large archaeological surveys were carried out on behalf of the Department of Hawaiian Homes Lands (DHHL) in Waiohuli and Kēōkea. The Bishop Museum conducted a survey of c. 800 acres in 1986. A total of 113 sites, composed of 252 features were located (Riford, October 1986). Additional work was recommended and has subsequently been carried out on portions of this land. PHRI conducted an extensive inventory survey of 1,025 acres in DHHL Kēōkea and Waiohuli subdivisions between 1,800-3,000 feet above mean sea level in early 1989. One hundred sixty sites with several multi-component features were identified—108 in Kēōkea, and 52 in Waiohuli *Ahupua`a* to the south. The various site types identified included habitation and agricultural complexes, enclosures for possible pre-Contact ceremonial uses, ranch-era animal containment features, and human burials (Brown and Haun, 1989).

In the upland region, PHRI conducted an archaeological inventory survey of the proposed Kēōkea and Waiohuli Subdivision for the Department of Hawaiian Home Lands (Brown and Haun, 1989). Later, the University of Hawaii-Manoa held an archaeological field school at some of the features in the summer of 1994, under the direction of Michael Kolb. Both of these studies identified numerous pre-Contact traditional Hawaiian sites, indicating extensive pre-Contact habitation and agricultural activity in the upland region.

Two of the first studies in the lowland portion of Waiohuli, were conducted in association with the construction of the Pi`ilani Highway (Cox, 1976; Cordy, 1977). Former studies by Cox (1976) along the coastal area included information about two *heiau*, Kalaihi Heiau (in the neighboring ahupua`a of Ka`ono`ulu), and Kealaipoa Heiau in Waiohuli ahupua`a. He also mentions 3 fishponds noted from historic sources, one of which may have been rebuilt by Kamehameha I. Cordy found wall remnants at the mouth of Waipuilani Gulch (Site 1704), which may be the remains of one of these ponds (1977). Cordy also located Site 1705, mentioned below, which was in the Pi`ilani Residential Subdivision.

Two archaeological inventory surveys were conducted in the general area of the current project area. One was by Environmental Impact Study Corporation (EISC) in 1982, and the other was by PHRI in July of 1989, for Baldwin Pacific's Pi`ilani Residential Community, Phase I (TMK 2-2-002: por 042).

The EISC study identified one historic property, which was described as "a possible alignment of very loosely stacked basalt extending down slope from an outcrop knoll" (1982, pg. B-4). No further work was recommended because of low research potential. The PHRI survey, conducted by Theresa Donham (July, 1989), encompassed 114 acres situated along the west side of Pi`ilani Highway, between Kīhei Elementary School and Lokenani Intermediate School and the northern border of Waiohuli Ahupua`a. During that survey 5 new sites were discovered, and 2 others relocated—[Site -2476 was assigned by the EISC project, and Site -1705 was initially recorded by Cordy during the archaeological reconnaissance survey for the Army Corps of Engineers (1977)].

Theresa Donham's work on the seven sites determined that 2 were actually bulldozer push piles, so they were not assigned SIHP numbers. The other 5 sites were mapped and tested in order to determine their significance. Cordy's Site -1705 was described as a bi-face wall, possibly a corral. Sites -2473 and -2475 were thought to be historic dependency structures associated with ranching activities. Site -2475 consists of 2 stone cairn features, one of which was recommended for data recovery, as it was thought it might contain human remains. The fifth site, Site -2476 is a complex of 5 rock alignments, which may have had an agricultural function (Donham, 1989, pp. 8-14).

Archaeological data recovery was undertaken in 1990 on Site -2475, to determine if it was a burial complex. Subsurface test excavations did not yield evidence of human remains, or cultural deposits, (midden or charcoal etc). However, further data recovery "indicated that it was a terrace complex covering a major portion of the natural terrace crest and its slopes" (Donham, 1990: 10). The site was interpreted as an agricultural complex and appeared "to represent relatively intensive modification of natural slopes for purposes of planting" (ibid.). The rock alignments that make up nearby Site -2476 may also be additional agricultural terracing. The location of the site, one-half mile mauka of the "coastal zone", was an area more heavily exploited than the "intermediate zone" in general. Donham suggests the possibility of seasonal usage during periods of increased rainfall, or simply the response to land availability pressures in the coastal zone (Donham, 1990: 10).

On the grounds of Lokelani Intermediate School, southeast of the current subject area, Xamanek Researches conducted exploratory subsurface excavations a rock shelter, (Site -3193) in July of 1993 (Fredericksen, et al., September 1993). The rock shelter measured 5.5 meters in length, extended a maximum of 1.6 meters inward, and had a maximum interior height of 0.85 meters. The ceiling was dome shaped and dropped to the ground level at either side. A large *kiawe* tree, which had recently burned, had formerly grown at the drip line. The site appeared to have been used intermittently, and contained marine shell midden, traditional Hawaiian artifacts and over 100 pieces of volcanic glass flakes. Much of the volcanic glass was interpreted as the by-product of knapping activity. Midden consisted primarily of *pipipi* (*Nerita* picea), cowrie (*Cypraea* sp.), and cone shell (*Conus* sp.). Artifacts consisted of bone picks, coral abraders and a piece of worked bone. Three hearths were excavated, and charcoal from one produced a radiocarbon date of AD 1560-1800 (270 +_ 120 RCYBP).

In 1994, Xamanek Researches conducted an archaeological inventory survey and data recovery along the corridor of the proposed County of Maui collector road, identified as "Road C". The subject area consisted of an approximate 150 foot wide corridor that connected South Kīhei Road with Pi`ilani Highway. A single archaeological site was documented as a low overhang rock shelter (SIHP 50-50-10-3529). The archaeological site appeared to be a portion of a lava tube, extending at least 2 meters back from the opening. Subsurface investigation revealed a 20 to 25 centimeter thick cultural deposit approximately 20 to 25 square meters west of the rock shelter and extended up to 16 meters west, north and south from the rock overhang. Marine shell midden and several indigenous artifacts were discovered including a small coral abrader, a small coral file, a possible bone fishhook blank, the shank of a 2-piece bone fishhook, a fish bone pick, a pencil urchin file, 2 utilized basalt flakes, and 23 volcanic glass flakes. Based on radiocarbon analysis, the site was in use during the late pre-Contact period, most likely around the mid-1600s (Fredericksen and Fredericksen August 1995).

Additional archaeological work was conducted west adjacent - or *makai* - of the study area by Xamanek Researches for the Azeka II Shopping Center and Longs Drug Center (Fredericksen, et. al., 1990a and 1990b). No significant archaeological findings were discovered. However, identification of the wetland areas was established at this time, and subsequently the Federal and State Wetlands Sanctuary developed. A parcel at the intersection of Lower Kīhei Road and Lipoa was also surveyed (Fredericksen, et. al., February 1994), and there were no significant archaeological findings. The study area would have likely been near or partly within a wetlands area directly east or *mauka* of the coastal zone sand dunes in ancient times.

Table 1: Selected Archaeological Projects in the Area

Authors	Nature of work	Findings
Burgett, McGerty Dunn and Spear June 1996	TMK: 3-9-12: 13. Monitoring at Kīhei Public Library, Kama`ole *ahupua`a.*	Five sites w/20 features—2 habitation sites, 1 habitation and shrine (*ko`a*), 1 habitation and probable burial, and 1 scatter of human remains. Date ranges AD 1280 to c. 1800.
Donham, 1989	Inventory survey of Pi`ilani Residential Community, Phase I—TMK 2-2-02: por. 42. Waiohuli *ahupua`a*	5 Surface sites, including agricultural terrace (Site 2475). Suggests "coastal perimeter zone" be added to Cordy's model.
1990	Phase II-Kēōkea *ahupua`a*	Similar, but fewer features
Fredericksen, W. & D., 1990	TMK: 3-9-20: 7. Inventory survey.	No significant findings.
July 1990a	Monitoring for Azeka Place.	Wetlands-no significant archaeological findings.
July 1990b	Monitoring for Longs Drugs.	Findings as above.
1991	TMK: 3-9-17: 26. Inventory survey.	No significant findings.
1992	TMK: 3-9-04: 79. Additional inventory work.	Scattered surface human remains in large sand dune area.

Fredericksen, D., E., W. September 1993 August 1994	TMK: 2-2-02: 21. Inventory survey and data recovery. TMK: 3-9-30: 21. Inventory survey.	Rock shelter (Site 3193) with hearths and volcanic glass debitage, shellfish midden. Dated AD 1560-1800 (270 +/- 120 RCYBP). No significant findings.
Fredericksen, E., D., W. June 1994 July 1994 February 1994 November 1994	TMK: 3-9-18: 1. Inventory survey. TMK: 3-9-01: 16 and 2-22-02: por. 15. Inventory survey. TMK: 3-9-02: 91-94, 133-135. Inventory survey. TMK: 3-9-18: 17 and 3-9-20: 27. Subsurface testing Site 2636	11 sites including rock shelter (Site 3541) dated AD 1520 to c. 1800 (220 +/- 60 RCYBP). 21 surface sites, including walls, military cairns, modified rock piles, and 1 petroglyph (Site 3746). Wetlands—no significant archaeological findings. Open area site, indigenous artifacts, and hearth—radiocarbon date: AD 1295 to 1495 (530 +/- 80 BP).
Fredericksen, E. & D. April 1995 Fredericksen, E. & D. September 1996	TMK: 2-2-02: por 66, 67; 3-9-02: 109. Inventory survey. Data recovery on Site 3529.	Wetlands near South Kīhei Road. Rock overhang shelter (Site 3529). Volcanic glass debitage, indigenous artifacts, shellfish midden. Additional indigenous artifacts. 3 radiocarbon dates: AD 1470-c.1800 (260 +/- 70 BP; 240 +/- 60 BP; 230 +/- 60 BP).
Fredericksen, D. & E. 2000 2001 2002	TMK: 2-2-02: por. 69. Data recovery on Site 4727 TMK: 3-9-10: 75 and 78 TMK: 3-9-20: 34	Rock enclosure, temporary habitation, and activity area of coral tool manufacture. Habitation site remnant (Site 5003) with possible associated human burial. Coastal habitation site remnant (Site 5170). Radiocarbon date of 220 +/- 50 BP.
Hammatt and Shideler 1989 and 1992	Inventory survey, Kama'ole *ahupua'a*	Historic house platform, 2 *ko'a* (Sites 2633 and 2637).
Kennedy 1986	Archaeological reconnaissance of Silversword golf course.	No significant findings in 125-acre area.
Neller, Earl 1982	TMK: 3-9-12: 3. Reconnaissance survey of Kalama Park	Investigated finds of human remains.
Pantaleo et al., 1991	Inventory Survey of Kīhei school lots. Kama'ole lands.	Historic sites, food midden scatter.
Rotunno-Hazuka and Pantaleo 1991	TMK: 3-9-18: 1—Diamond Resort parcel.	No significant findings.

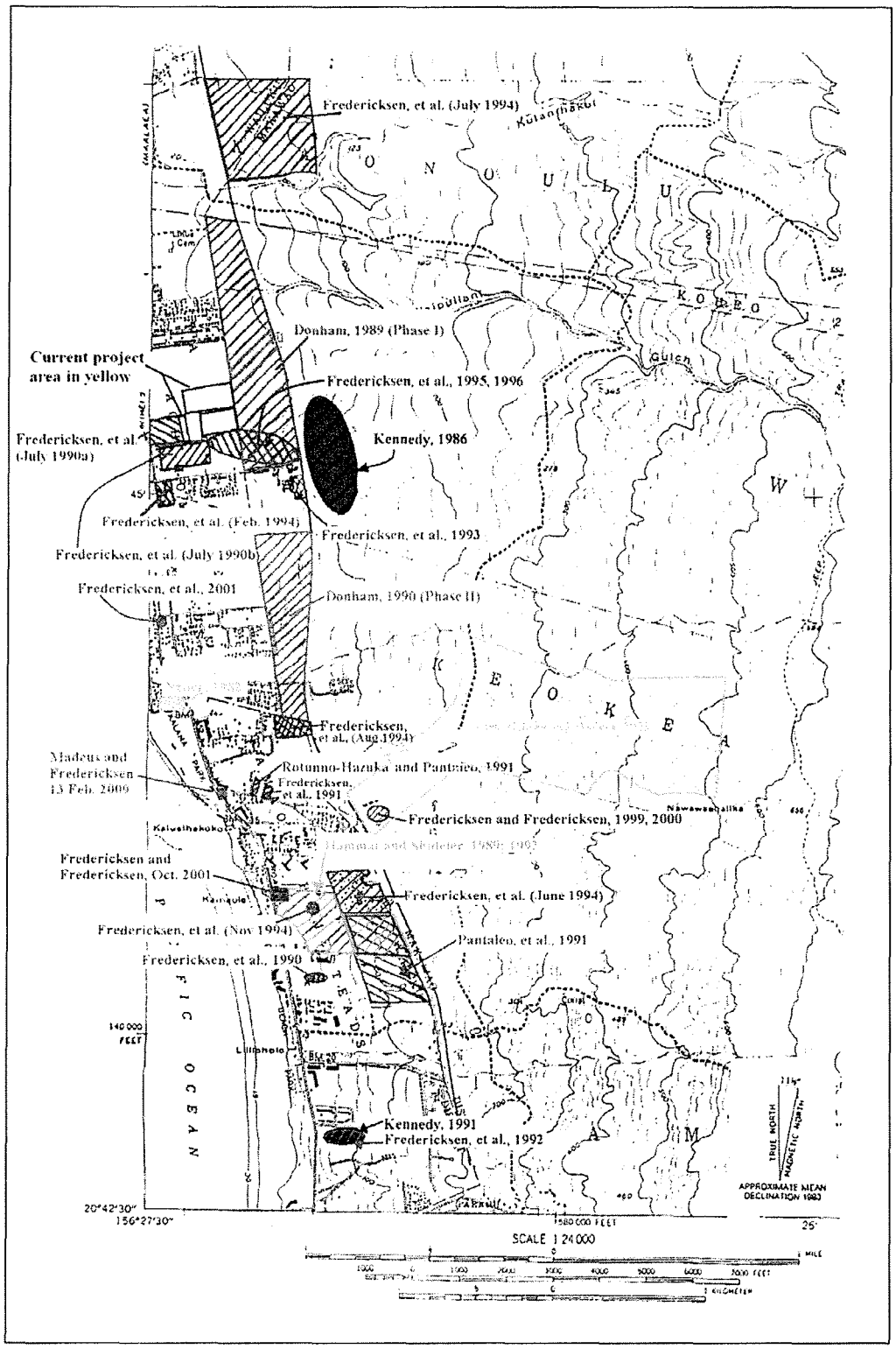

Figure 5: Portion of topographic map showing the location of previous archaeological studies in the vicinity of the current project area

Settlement Patterns and Predicted Findings

Settlement Patterns

The study area lies within what has been referred to as the "barren zone" or "intermediate zone" as postulated by Cordy (1977). The "barren zone" area has been defined as the location between the inhabited coastal and inland zones. Because of generally inhospitable conditions, little human activity is anticipated, with the exception of intermittent and/or transitory habitation. Donham's identification of agricultural terraces *mauka* of the study area, and more recent unpublished archaeological research suggests that the perimeter of the coastal zone may have been more heavily utilized for food production activity then Cordy's model. Donham noted that agricultural activity could have been intermittent during seasonal increases in rainfall, or periods of overall increased moisture. Donham explains another zone to designate this area known as the "coastal perimeter zone".

At present, there are relatively few traditional Hawaiian archaeological sites identified in the "intermediate zone". A few radiocarbon dates have been obtained, the majority of which seem to fall within the late pre-Contact to early post-Contact period, suggesting that relatively little human activity occurred in this region prior to that time. Cordy (1977, p. 12) postulated that the few sites that would be found in the "intermediate zone" would be temporary in nature, and would be "associated with transportation routes (e.g. trails)". Additional archaeological research may prove more traditional Hawaiian land use and habitation than previously postulated.

Predictive Model

Ranching and post-contact agricultural activities have impacted portions of the Kula area. It is noteworthy that the Irish potato boom in the mid-1800s brought about the adaptive reuse and/or expansion of traditional Hawaiian dry land field systems in areas throughout Maui. Based on background research, the expected findings could include possible pre-Contact agricultural site remnants, and/or temporary habitation site remnants, possibly containing associated human burials. In addition, post-contact agricultural site remnants and/or house sites may be present. Finally, plantation era, ranch-era, or World War II associated sites could also be expected in the project area.

Field Methods

Xamanek Researches, LLC conducted an archaeological inventory survey at TMK: [2] 3-9-002: 030 (por.), 076, and 158. The subject area consists of three land parcels, two of which are separated by Pi'ikea Avenue and adjacent to a wetland area.

Archaeological fieldwork was conducted by archaeologists, Hugh Coflin, B.A. and Jonas K. Madeus, B.A., with Erik Fredericksen (SHPD Permit 10-07) as the project director and principal investigator for the project. Fieldwork was initiated on 25 September 2009 and continued intermittently through 11 November 2009. Follow-up fieldwork was carried out on 14-15 December 2009. A total of 14 field work days was expended on the field portion of the archaeological inventory survey.

Archaeological field investigation consisted of a 100% surface pedestrian survey (excluding the wetland areas), 20 mechanically excavated Backhoe test Trenches (BTs), controlled hand excavation of 11 Test Units (TUs), and the manual excavation of eight manual Shovel Tests (STs). The pedestrian inspection of the project area was accomplished through systematic sweeps generally oriented east/west at 5-10 meter intervals. The pedestrian survey began in the southwest corner of the project parcels and continued northeast. All identified features were recorded and documented with written site descriptions, site maps, and digital photographs. Detailed site plan view maps were drawn utilizing tape and compass technique. Sites were plotted onto the project area map with reference points such as corner stakes and other survey land marks. Site boundaries were determined by the extension of identified cultural materials. Architectural construction patterns, location, site type, and subsurface testing were some factors used in site function determination.

Nine of the 20 backhoe tests were systematically placed and excavated on the northern portion of the subject area upon TMK [2] 3-9-002: portion of parcel 030 (Photo #2). Nine backhoe tests were excavated on the southeast portion on TMK [2] 3-9-002: parcel 076 (Photo #3). Two backhoe test trenches were excavated on the southwest portion on TMK [2] 3-9-002: parcel 158 (Photo #4). Five hand excavated test units and four manual shovel tests were excavated at SIHP 50-50-04-6670, Feature A. Six test units and four shovel tests were excavated at SIHP 50-50-04-6670, Feature B.

All screened materials were sifted through 1/8th inch mesh hardware cloth. Recovered portable cultural remains were placed in plastic bags, labeled with the appropriate provenience information, and sent for analysis to the Xamanek Researches laboratory at Pukalani, Maui. The mechanical backhoe test trenches were closely monitored. Trench locations and profiles were documented. The identified charcoal and

recovered artifacts were also sent to the Xamanek Researches, LLC lab for analysis. Back dirt piles were spot checked with rakes and screens, to make sure nothing was inadvertently missed during monitoring. All portable remains are stored on-site at the Xamanek Researches, LLC facility in Pukalani, Maui.

Following subsurface excavations, a representative wall from each of the test units, shovel tests and the backhoe trenches was hand scraped with a trowel to aid in recording the soil stratigraphy. The wall profiles were mapped to scale and described using Munsell soil colors and U.S Soil Conservation Service terminology. The completed subsurface tests were measured then photographed and finally, backfilled.

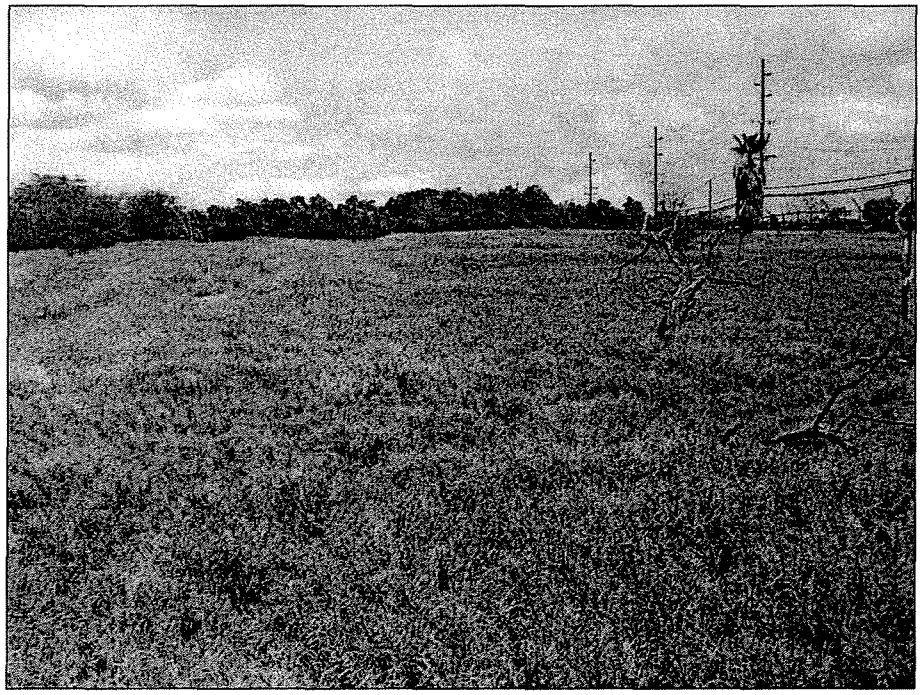

Photo # 2: Overview of the north parcel, view to the north.

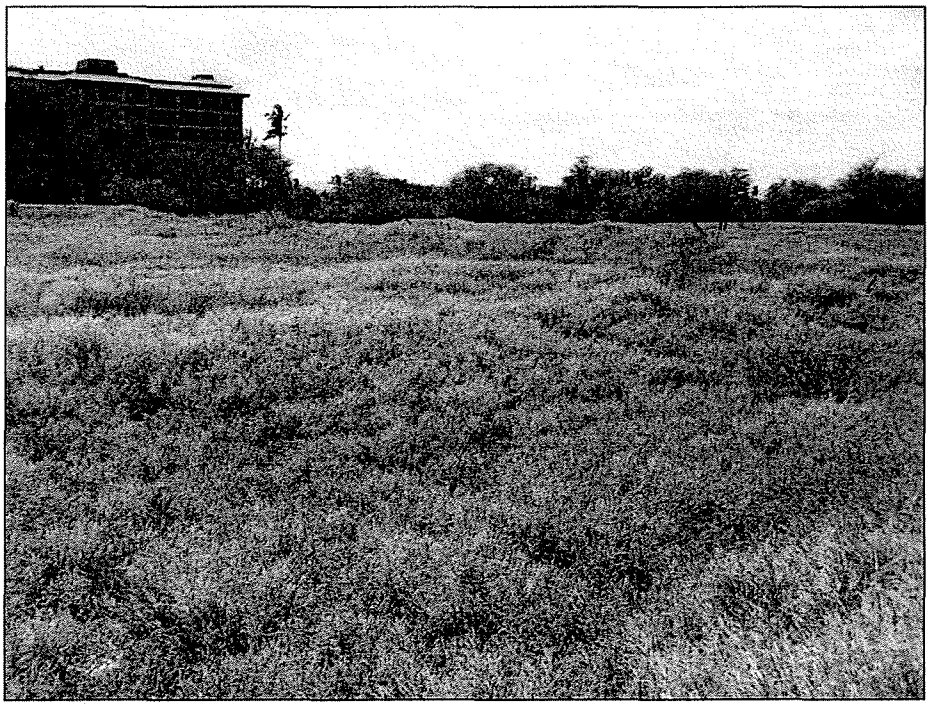

Photo # 3: Overview of the southeast parcel, view to the southwest.

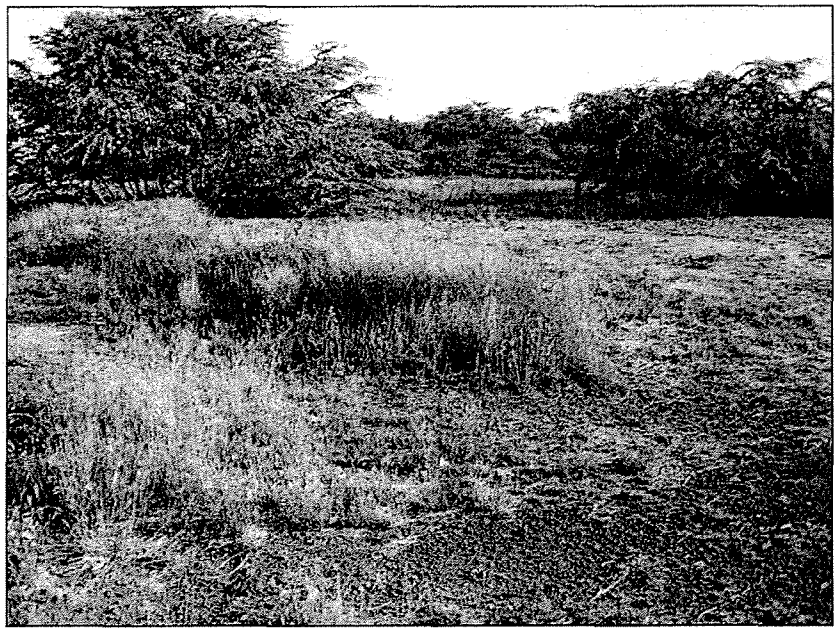

Photo # 4: Overview of the southwest parcel, view to the northwest.

Results of Fieldwork

The archaeological inventory survey fieldwork resulted in the documentation and listing of two historic properties within the subject area (Table 2 and Figure 6). The two sites are comprised of three component features; or designated areas, one of which is determined to be a post-contact feature and the other two analyzed as pre-Contact archaeological features. The new sites listed on the Statewide Inventory of Historic Places (SIHP) consist of: a post-Contact rock wall (SIHP 50-50-04-6669); and two pre-Contact scatters of cultural material remains (SIHP 50-50-04-6670 Features A and B).

Table 2: Inventory survey results and tested features

State Site #	Temporary Site #	Feature	Type	Function	Probable age	Length	Width	Height		Shape	Condition
								Interior	Exterior		
50-50-04-6669	XR-1		Rock wall	Habitation	Post-contact	10 4 m	0.6-1.0 m		0.3 m	Linear	poor
50-50-04-6670	XR-2	A*	Scatter	Temporary habitation	Precontact	21.6 m	17.3 m			Oval	Poor
50-50-04-6670	XR-2	B*	Scatter	Temporary habitation	Precontact	35.0 m	24.0 m			Oval	Poor

* = Tested feature

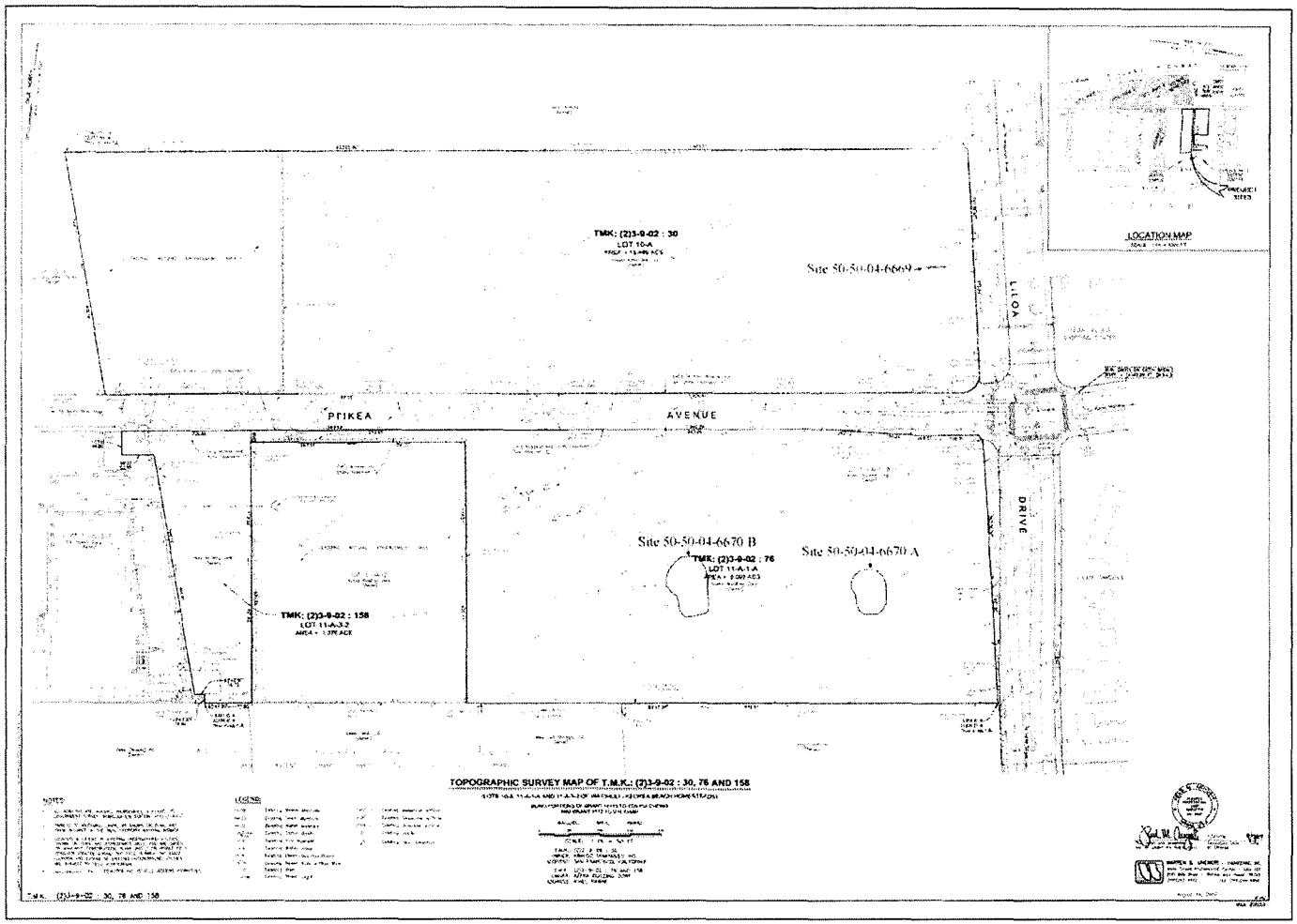

Figure 6: Topographic map of the project area by Warren S. Unemori Engineering, Inc., depicting SIHP 50-50-04-6669 and 50-50-04-6670, Features A and B.

SITE: **50-50-04-6669**
SITE TYPE: Rock wall and Concrete Footings
FUNCTION: Habitation
PROBABLE AGE; Post-Contact
TOTAL FEATURES: 1
DIMENSIONS: 10.4 m E/W by 0.6-1.0 m N/S
CONDITION: Poor
SIGNIFICANCE: Criterion "d"
DESCRIPTION: Site 50-50-04-6669 is composed of a low and collapsed rock wall remnant situated along the east portion of the subject area's northern parcel (030), east of Līloa Drive and north of Pi`ikea Avenue (Figure 7 and Photo #5). The rock wall is built between three aligned concrete posts, indicating post-Contact construction. The site is most likely associated to a former residential building on this property. The rock wall section is constructed of small to medium localized sub-angular basalt boulders and cobbles stacked one to two courses high to a maximum height of 0.3 m. Decomposing milled wood was noted. Marine shell midden (`*opihi*) with water worn cobbles and pebbles were also documented adjacent to the wall, indicating the feature may have been reutilized; but leading to the supposition that the function of the site is related to post-Contact habitation.

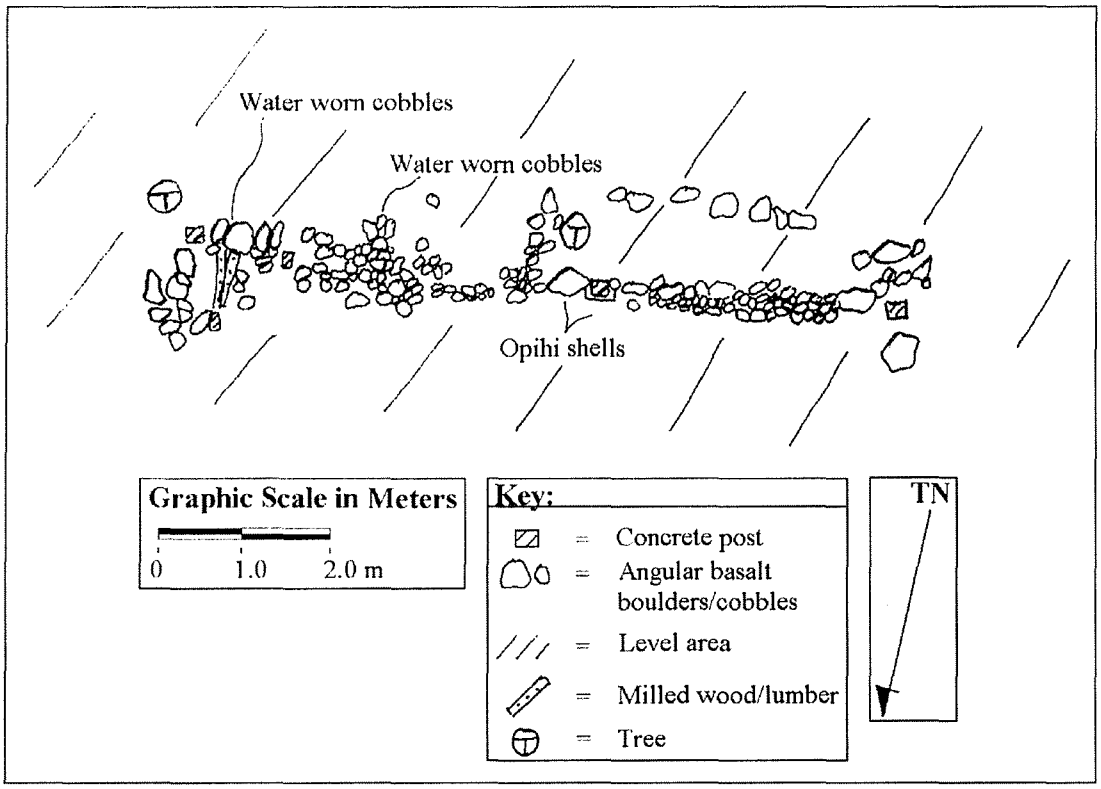

Figure 7: Plan view map of SIHP 50-50-04-6669.

Photo # 5: Overview of Site 50-50-04-6669 view to the west.

SITE:	**50-50-04-6670 Features A and B**
SITE TYPE:	Cultural Material Scatter
FUNCTION:	Temporary habitation
PROBABLE AGE;	Pre-Contact
TOTAL FEATURES:	2 Areas
DIMENSIONS:	Feature A: 21.6 m NE/SW by 17.3 m NW/SE Feature B: 35.0 m N/S by 24.0 m E/W
CONDITION:	Poor
SIGNIFICANCE:	Criterion "d"

DESCRIPTION: SIHP 50-50-04-6670 is composed of two defined areas located at the central and east portions of the southeast parcel (076) south of Pi`ikea Avenue. The site, including both features, covers a total area of approximately 100 meters east/west by 31 meters north/south between the elevations of 8 to 25 feet above mean sea level. The site is located on the top of a relatively flat and gentle slope. The two areas, or features, consist of cultural material remain scatters. Both site and feature boundaries were established by defining the outermost edges of the surface scatter. The general area appears to have been previously disturbed by mechanical grubbing and grading. There is a soil berm, or push-pile, located adjacent to the northwest side of Feature A. Despite the previous disturbance, test results indicate that this area was utilized for temporary habitation during prehistoric times.

50-50-04-6670 Feature A is a scatter of cultural remains situated approximately 35 meters west of Līloa Drive and 75 meters east of Feature B. The scatter of cultural material has been designated Feature A, which measures 21.6 meters

northeast/southwest by 17.3 m northwest/southeast (Figure 8, Photo #6 and Photo #7). The cultural material identified on the surface included various types of bi-valve and gastropod marine shell midden (*Echinoderm, Conus, Cypraea, Tellinidae, and* unidentified gastropods), crab shell (crustacean), and included both brain and branch coral fragments. Surface collections consisted of four coral abraders (A-1 through A-4), one unworked basalt flake (debitage), and one larger piece of unworked coral. For more details on the surface findings, and detailed information on the subsurface findings, refer to the forthcoming *Test Results* sections.

SIHP 50-50-04-6670 Feature A was subject to surface collection as well as subsurface testing including four Shovel Test excavations (ST 1-4), and five formal Test Unit excavations (TU 1-5). Collections contained a variety of cultural material including marine shell midden, sea urchin, coral and basalt flakes.

The subsurface matrix consisted of brown fine to medium sandy silt, or cultural Layer I, overlaying a dark yellowish brown fine to medium natural silty sand. All of test excavations exposed the presence of cultural materials within the surface through the upper silty Layer I to approximately 10/20 centimeters below the existing surface. No cultural materials were observed or recovered from the lower silty sand stratum (Layer II). The hand excavated shovel tests and test units were placed and excavated within the concentrated surface cultural material scatters in order to investigate the features horizontally and also to determine the extent of site boundaries. The clear distinction of site boundaries proved somewhat difficult, due to prior ground disturbance caused by mechanical grubbing activities.

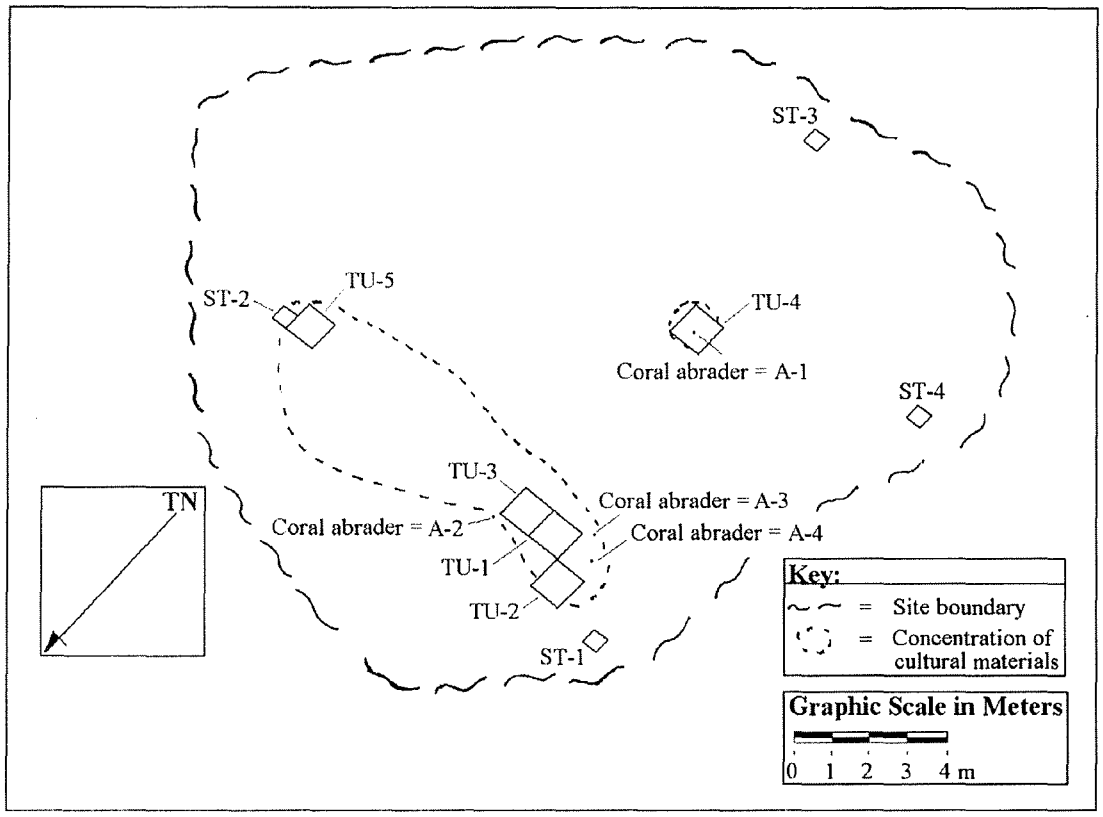

Figure 8: Plan view map of SIHP 50-50-04-6670, Feature A.

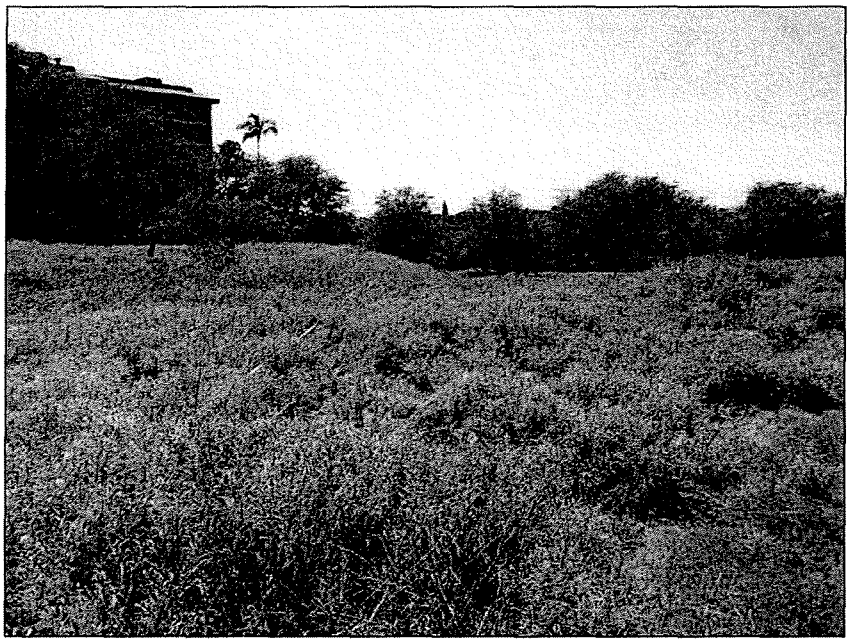

Photo # 6: Overview of the thick grass at Site 50-50-04-6670 A, view to the southwest.

Photo # 7: Close up of a concentrated cultural material remains at Site 50-50-04-6670, Feature A, view to the south.

Test Results

The test areas were intentionally chosen and placed throughout Feature A within the surface concentrations of cultural remains. The subsurface test excavations helped acquire adequate information in order to analyze the probable function and age of Feature A. Test results are summarized in Table 4 and Table 5.

Various types of marine shell midden were collected during both the surface pedestrian survey and subsurface testing. Five coral abraders (A-1 through 5), a piece of ochre, unworked basalt flakes, unworked coral pieces, volcanic glass fragments, a basalt ground stone fragment, charcoal, a small non-diagnostic mammal bone fragment, *hīhīwai*, and a bee-bee pellet, were also collected during Feature A testing. Cultural material was recovered on the surface and throughout Layer I (generally 0-10/20 centimeters below the existing surface). On average, final depths ranged between 20-35 centimeters below the existing surface.

SIHP 50-50-04-6670 Feature A: Shovel Tests 1-4

Four shovel tests (ST 1-4) were excavated throughout the area of SIHP 50-50-04-6670 Feature A. All four square ST excavations each measured 0.50 x 0.50 meters and all of the tests resulted in the discovery of cultural remains.

Shovel Test-1

ST-1 was the northernmost square shovel test excavation in the area that measured 0.50 x 0.50 meters Figure 9 and Photo #8). Cultural material remains included marine shell midden (*Conus, Cypraea, Thaididae, Echinoderm*, or sea urchin, and unidentified gastropods). Findings within ST-1 also included a small non-diagnostic mammal bone fragment. The final depth of ST-1 was 20 centimeters below the existing surface. The base of excavation contained a mixture of basalt and lithified sand cobbles and pebbles.

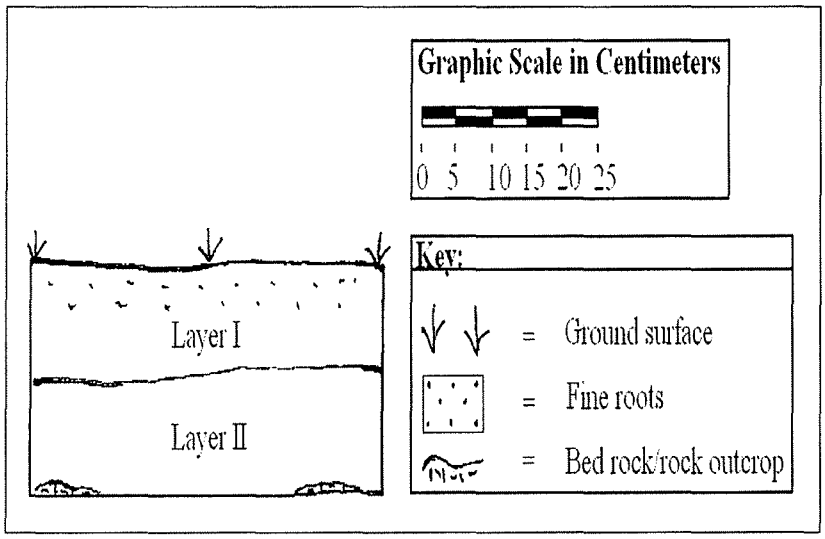

Figure 9: West wall profile of ST-1 at SIHP 50-50-04-6670, Feature A.

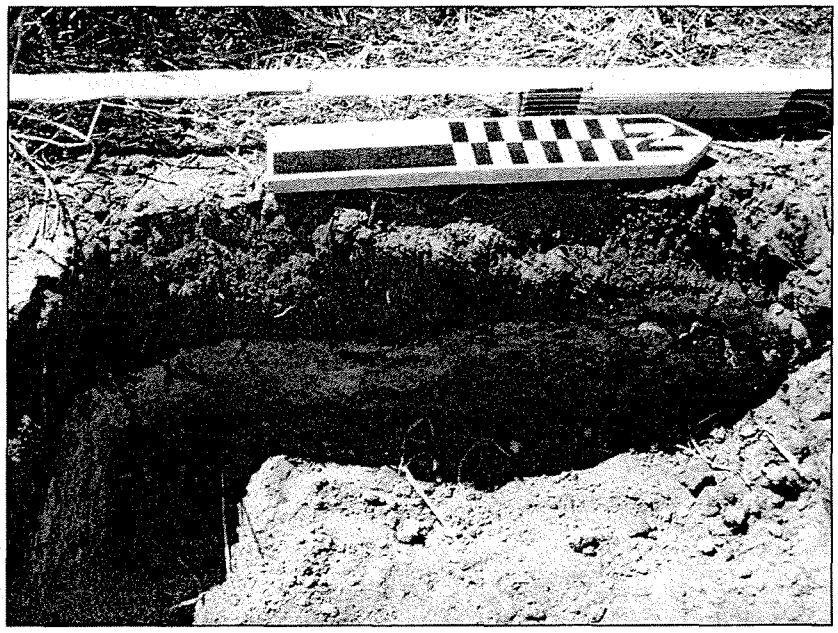

Photo # 8: Overview of ST-1 west wall at SIHP -6670, Feature A.

Shovel Test-2

ST-2 was the easternmost square shovel test excavation in the area that measured 0.50 x 0.50 meters (Figure 10 and Photo #9). Cultural material remains included marine shell midden (*Cellana*, *Conus*, *Cypraea*, *Tellinidae*, *Thaididae*, *Echinoderm*, or sea urchin, and unidentified gastropod species). Similar to ST-1, the final depth of ST-2 was 20 centimeters below the existing surface. The base of excavation contained a mixture of basalt and lithified sand cobbles and pebbles.

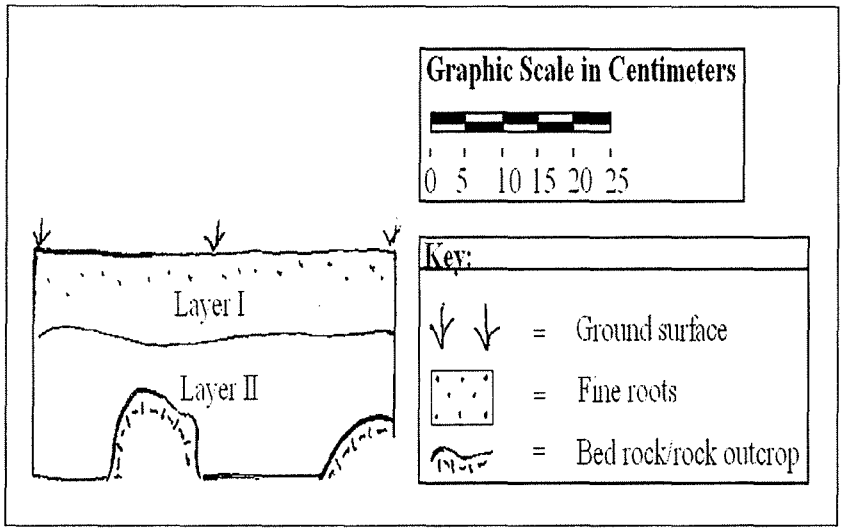

Figure 10: North/northeast wall profile of ST-2 at SIHP 50-50-04-6670, Feature A.

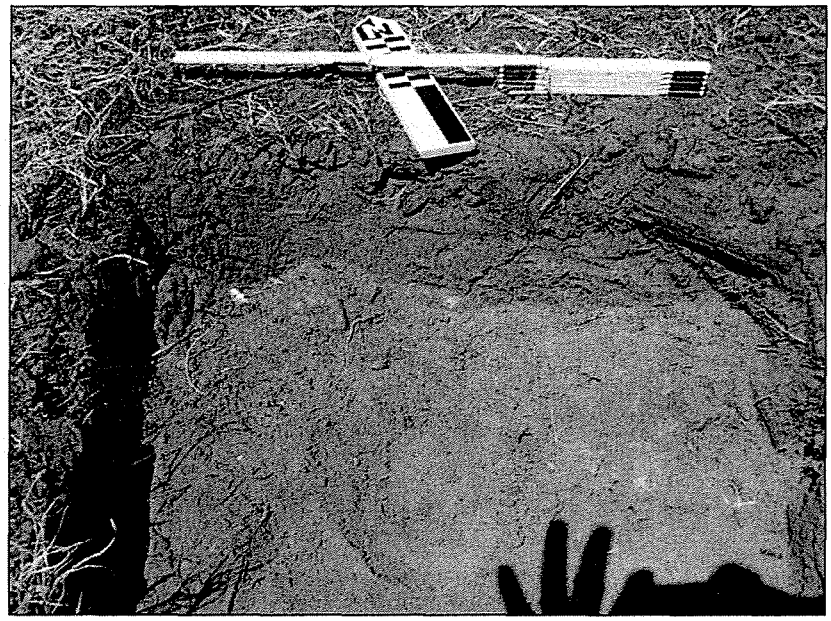

Photo # 9: Overview of ST-2 north/northeast wall at SIHP -6670, Feature A.

Shovel Test-3

ST-3 was the southernmost square shovel test excavation in the area that measured 0.50 x 0.50 meters (Figure 11 and Photo #10). Cultural material remains included marine shell midden (*Cellana, Conus, Cypraea, Echinoderm*, or sea urchin, and unidentified gastropod species). The final depth of ST-3 was the deepest shovel test excavated at Feature A, which reached 35 centimeters below the existing surface. Cultural Layer I was also the deepest shovel test in the area that measured 20 centimeters below the existing surface. The base of excavation contained a mixture of basalt and lithified sand cobbles and pebbles.

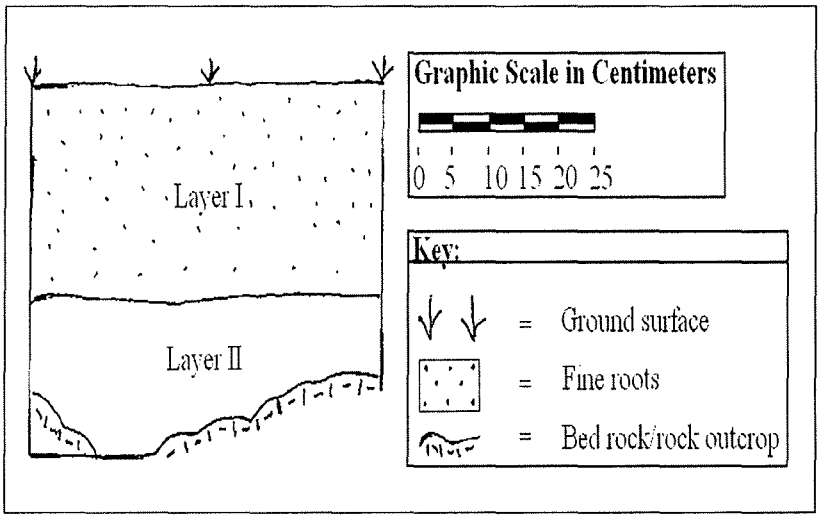

Figure 11: South wall profile of ST-3 at SIHP 50-50-04-6670, Feature A.

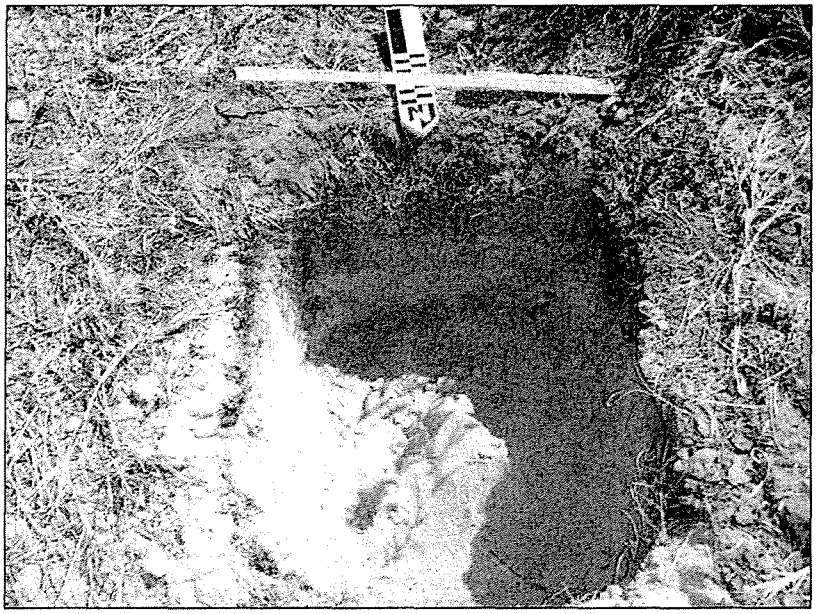

Photo # 10: Overview ST-3 south wall at SIHP 50-50-04-6670, Feature A.

Shovel Test-4

ST-4 was the westernmost square shovel test excavation in the area that measured 0.50 x 0.50 meters (Figure 12 and Photo #11). Shovel test excavation results yielded the least cultural material remains of the four shovel tests in Feature A. small amount of marine shell midden was collected (*Conus, Echinoderm*, or sea urchin, and unidentified gastropods). The final depth of ST-4 was 25 centimeters below the existing surface. The base of excavation contained a mixture of basalt and lithified sand cobbles and pebbles.

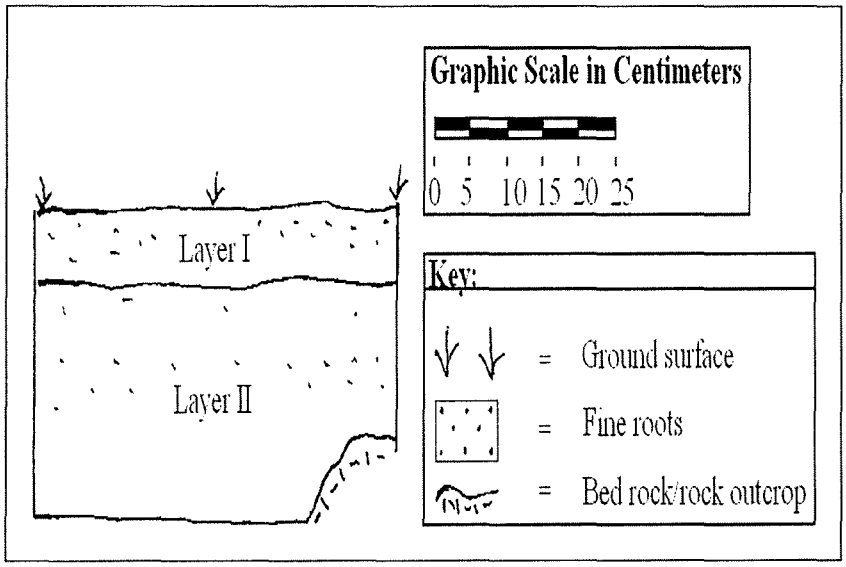

Figure 12: West wall profile of ST-4 at SIHP 50-50-04-6670, Feature A.

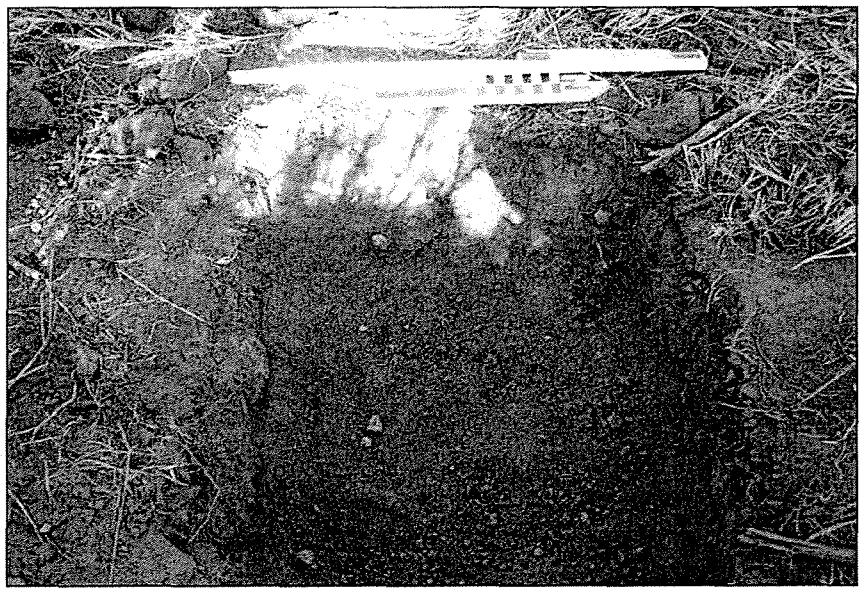

Photo # 11: Overview of ST-4 west wall at SIHP 50-50-04-6670, Feature A.

Table 3: Results of ST-1 through ST-4 at Site 50-50-04-6670, Feature A

Site No.	Cell/ST No.	Surface cultural material	Layer	Depth (cmbs)	Soil texture	Soil color	Subsurface cultural material	Reason for termination
50-50-04-6670: Feature A	ST-1	Positive	I	0-10	Sandy silt	Brown	Positive	Bedrock & Sterile soil
			II	10-20	Silty Sand	Dark yellowish brown	Negative	
	ST-2	Positive	I	0-7	Sandy silt	Brown	Positive	Bedrock & Sterile soil
			II	7-20	Silty Sand	Dark yellowish brown	Negative	
	ST-3	Positive	I	0-20	Sandy silt	Brown	Positive	Bedrock & Sterile soil
			II	20-35	Silty Sand	Dark yellowish brown	Negative	
	ST-4	Positive	I	0-7	Sandy silt	Brown	Positive	Bedrock & Sterile soil
			II	7-25	Silty Sand	Dark yellowish brown	Negative	

SIHP 50-50-04-6670 Feature A: Test Units 1-5

Based on the surface and subsurface collections recovered from the pedestrian survey and shovel tests, additional testing was deemed appropriate in order to obtain more information about the site. Subsequently, five square 1.0 x 1.0 meter Test Units (TU-1 through TU-5) were carefully hand excavated within the perimeters of SIHP 50-50-04-6670A. The test units were excavated to an average final maximum depth of 20 centimeters below the existing surface (cmbs). Two distinct layers were defined in the test areas. All of the excavated units revealed the cultural Layer (I) and the natural Layer (II). The layers were identified below the existing grassy weed vegetation. Test results consistently revealed the same two distinct layers described in the forthcoming summary (Layers I and II):

Layer I (0 to 10 cmbs) — 10YR 4/3, brown; fine to medium, sandy silt, texture; weak, medium, single grain, structure; dry consistency, loose to semi-compacted; moist consistency, friable; wet consistency, non-sticky; plasticity, non-plastic; boundary, clear; topography, smooth; inclusions include 35% of angular basalt cobbles and pebbles; contains cultural materials such as marine shell midden, burnt marine shell, sea urchin, crab shell, volcanic glass and basalt flakes, as well as ochre.

Layer II (10 to 22 cmbs) — 10YR 4/4, dark yellowish brown; fine to medium, silty sand, texture; strong, medium, single grain, structure; dry

consistency, semi-compacted; moist consistency, friable; wet consistency, slightly sticky; plasticity, slightly plastic; boundary, none; topography, none; inclusions include 45% of angular basalt cobbles and pebbles; contains no cultural materials

Test Unit 1

Test Unit 1 was placed northeast of the two coral abraders collected at the surface (A-3 & A-4), southeast adjacent of TU-2, and west adjacent to TU-3 within a concentration of surface cultural remains. A charcoal intrusion was observed at 6 centimeters below the existing surface and a small charcoal sample collected. The fire vestige is presumed to be the result of recent wildfires that spread across the project area. There was also a bee-bee pellet collected from the 1/8" screen. Marine shell midden remains included gastropods such as *Conus, Cypraea, Nerita picea, Terebridae,* as well as unidentified gastropods, and the bivalve *Brachidontes*. Collections also included sea urchin, crab, fish bone, unworked coral pieces, a volcanic glass flake, a piece of ochre, and *hīhīwai*.

TU-1 was eventually bisected, with excavation continuing to a final depth of approximately 22 centimeters in the east half of the square (Figure 13 and Photo 12). The two identified Layers (I & II) were previously described at the beginning of this section. The eastern half of TU-1 was terminated in the sterile, silty sand of Layer II. A mixture of lithified sand and basalt cobbles and pebbles were located at the base of excavation.

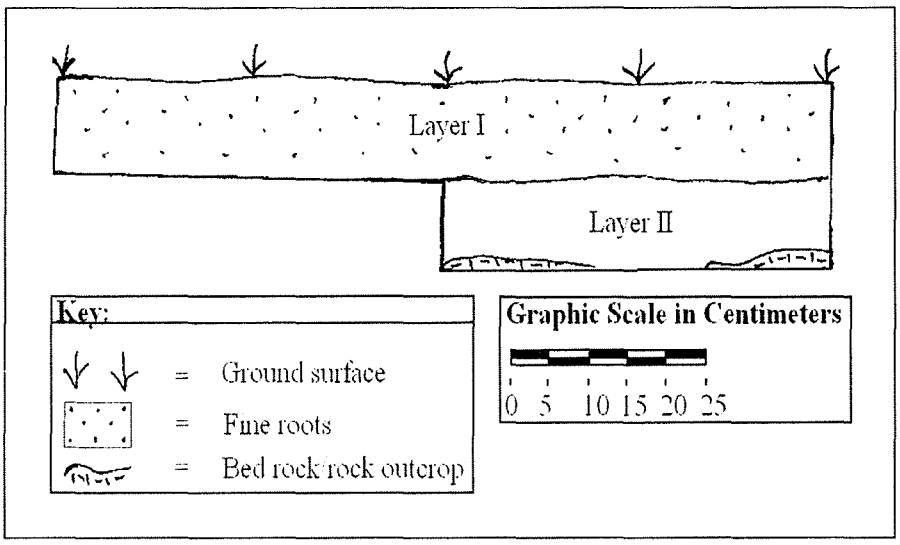

Figure 13: North wall profile of TU-1 at SIHP 50-50-04-6670, Feature A.

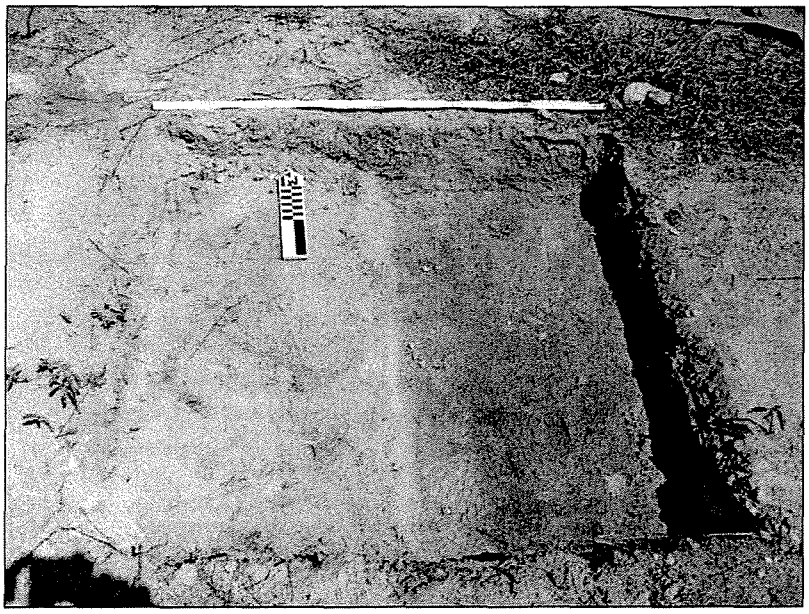

Photo # 12: Overview of TU-1 north wall at Site 50-50-04-6670, Feature A.

Test Unit 2

Test Unit 2 was placed at the northwest corner adjacent to TU-1. TU-2 was the northernmost test unit at Feature A and was situated within the area of surface cultural remains. Marine shell midden remains included gastropods *Conus, Cypraea, Nerita picea, Granul* sandwicensis, *Strombus, Planaxis,* and unidentified gastropods. TU-2 screened collections included sea urchin, crab, basalt flake, and volcanic glass flakes.

TU-2 continued to a final depth of approximately 25 centimeters below the existing surface (Figure 14 and Photo 13). The two identified Layers (I & II) were the same as previously described in the beginning of this section. TU-2 terminated in the sterile, silty sand of Layer II. A mixture of lithified sand and basalt cobbles and pebbles were located at the base of excavation (Figure 14 and Photo #13).

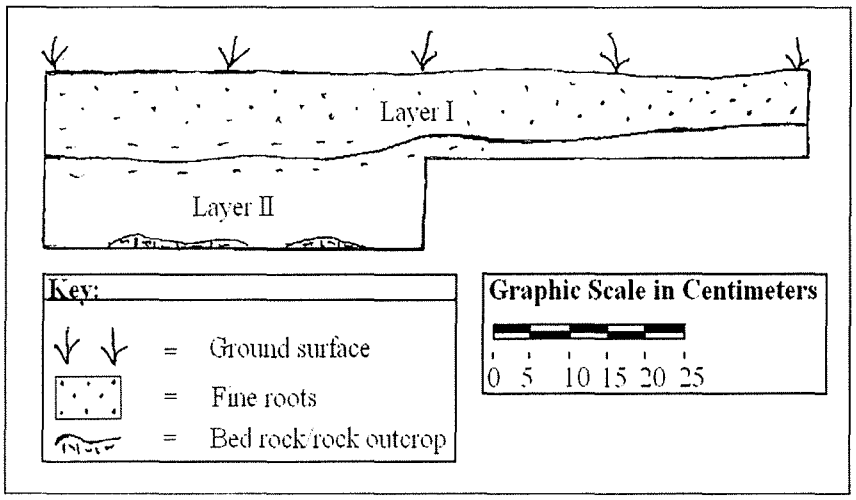

Figure 14: East wall profile of TU-2 at SIHP 50-50-04-6670, Feature A.

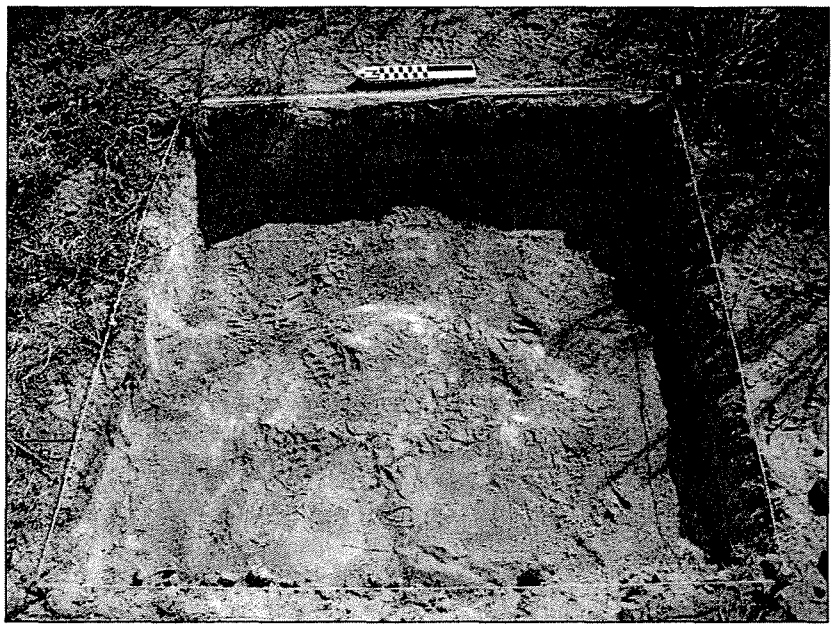

Photo # 13: Overview of TU-2 east wall at SIHP 50-50-04-6670, Feature A.

Test Unit 3

TU-3 extended east adjacent to TU-1 within the area of surface cultural remains. Collected marine shell midden remains included gastropods such as *Cypraea, Nerita* picea, *Tellinidae, Strombus, Planaxis* as well as unidentified gastropods, the bivalve *Isognomon*, and unidentified bivalves. Collections also included small crab claws, a relatively large amount of sea urchin and a small unidentified faunal bone fragment. A brain coral abrader was collected (A-5) and a basalt grind stone fragment (A-6) from the cultural Layer I (0/8 cmbs).

TU-3 was bisected, with excavation continuing to a depth of approximately 20 centimeters below the existing surface in the east half and a maximum depth of approximately 30 centimeters in the west half of the square (Figure 15 and Photo 14). The two identified Layers (I & II) were the same as previously described in the beginning of this section. The west half of TU-3 terminated in the sterile, silty sand of Layer II. A mixture of lithified sand and angular basalt cobbles and pebbles were located at the base of excavation (Figure 15 and Photo #14).

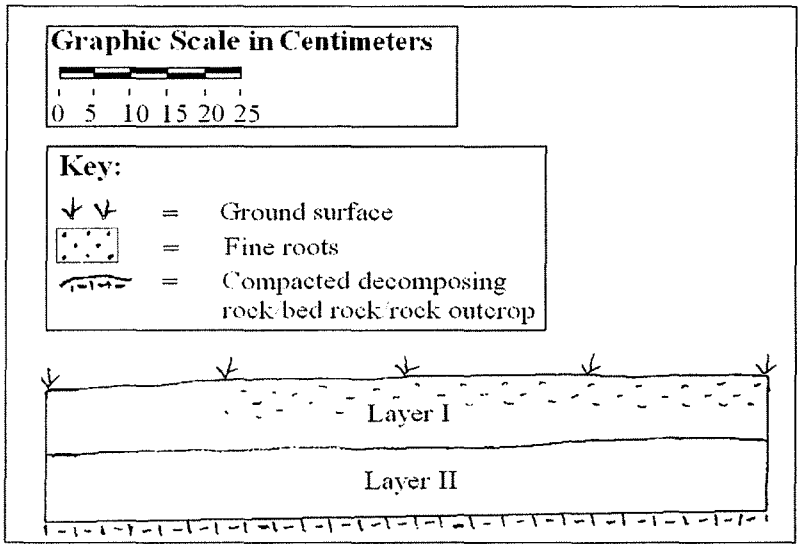

Figure 15: South wall profile of TU-3 SIHP 50-50-04-6670, Feature A.

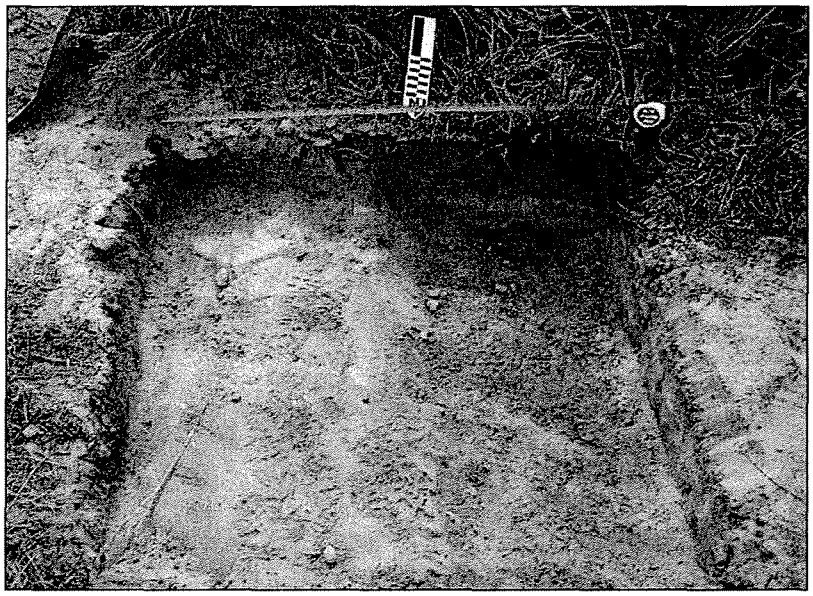

Photo # 14: Overview of TU-3 south wall at SIHP 50-50-04-6670, Feature A.

Test Unit 4

Test Unit 4 was placed around the perimeter of a brain coral abrader identified at the surface (A-1). Marine shell midden was also identified and collected from the surface of this unit. TU-4 was the westernmost of the test units excavated within the area of Feature A. Collected marine shell midden remains included gastropods such as *Conus, Cypraea, Nerita* picea, *Strombus, Tellinidae, Planaxis,* as well as unidentified gastropods. Screened collections also included sea urchin and crab. A modified basalt adz fragment (A-7) was collected from the cultural layer I (0-10 cmbs) within TU-4.

TU-4 was bisected, with excavation continuing to a final depth of approximately 23 centimeters in the east half of the square (Figure 16 and Photo 15). The two identified Layers (I & II) were the same as previously described in the beginning of this section. The eastern half of TU-1 was terminated in the sterile, silty sand of Layer II. A mixture of lithified sand and basalt cobbles and pebbles were located at the base of excavation.

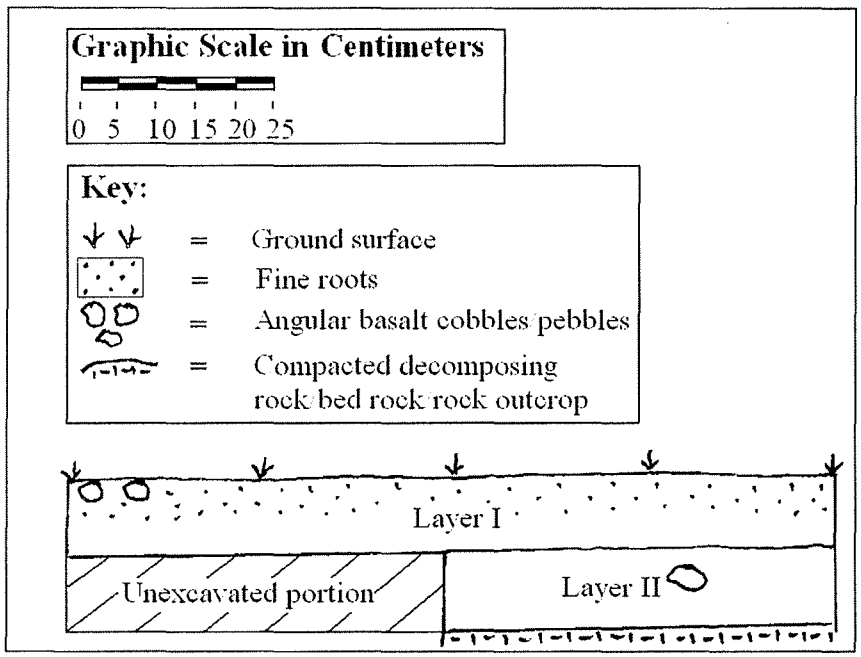

Figure 16: North wall profile of TU-4 at SIHP 50-50-04-6670, Feature A.

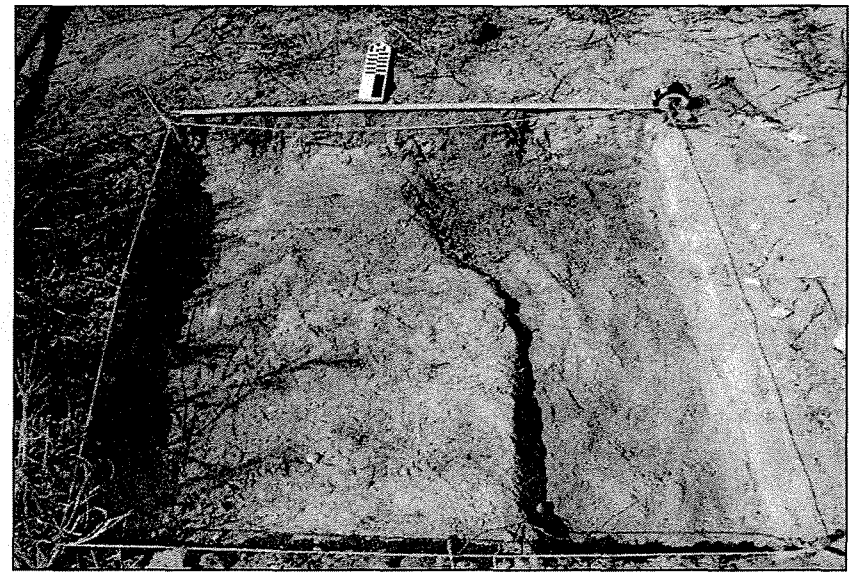

Photo # 15: Overview of TU-4 north wall at SIHP 50-50-04-6670, Feature A.

Test Unit 5

Test Unit 5 was placed several meters east of TU-4 and as an extension of ST-2 within an area of surface cultural remains. Screened marine shell midden remains included gastropods such as *Conus, Cypraea, Nerita picea, Terebridae, Strombus, Planaxis,* as well as unidentified gastropods, and the bivalve *Isognomon*. Collections also included sea urchin, crab, and volcanic glass flakes.

TU-5 contained a single cobble filled cultural Layer I (previously described). TU-5 continued to a maximum final depth of approximately 25 centimeters below the existing surface (Figure 17 and Photo 16). Lithified sand cobbles and pebbles were located throughout the unit as well as at the base of excavation.

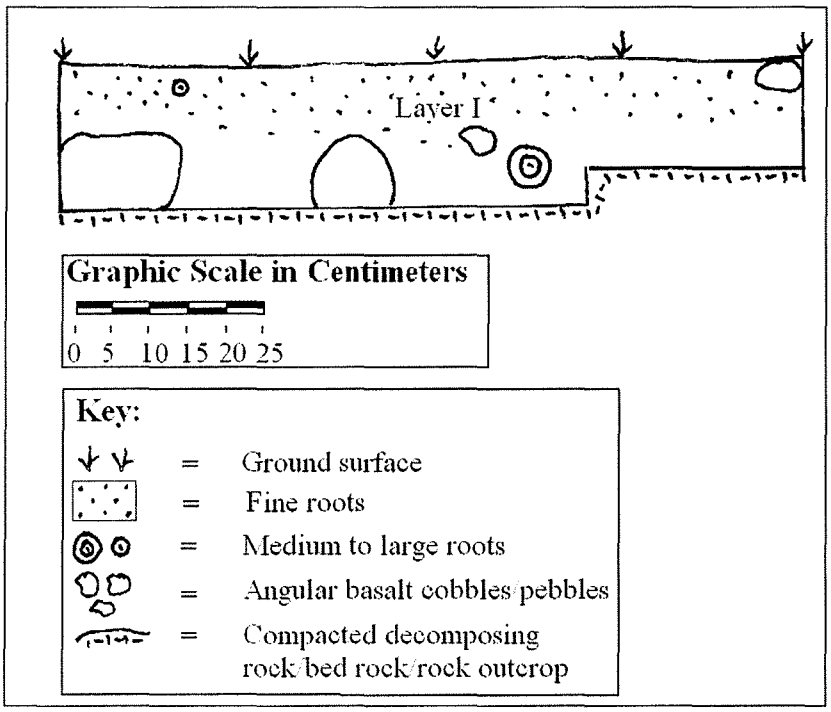

Figure 17: East wall profile of TU-5 at SIHP 50-50-04-6670, Feature A.

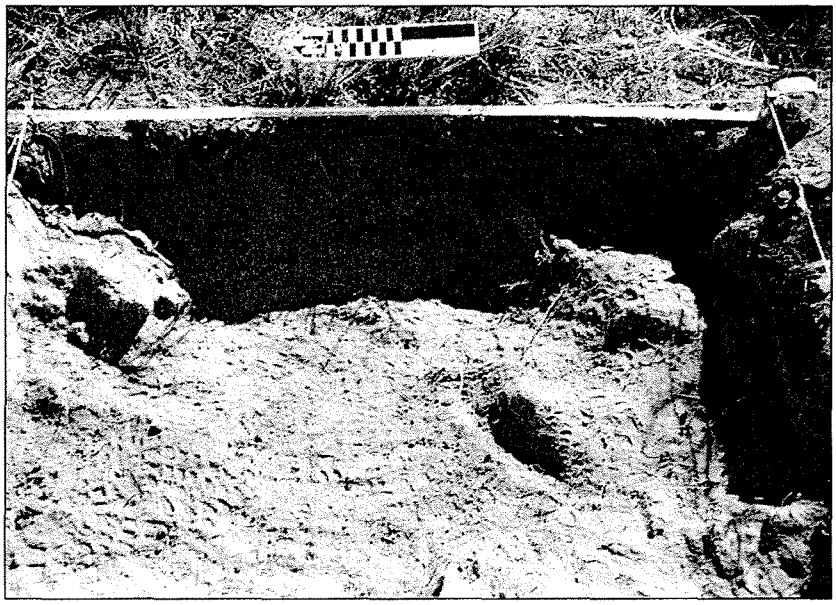

Photo # 16: Overview of TU-5 east wall at SIHP 50-50-04-6670, Feature A.

Table 4: Invertebrates and vertebrates recovered from TU-1 through TU-5 at Site 6670, Feature A

	Test Unit 1		Test Unit 2		Test Unit 3		Test Unit 4		Test Unit 5	
	Surface	**Layer I, 0-10 cmbs**	**Surface**	**Layer I, 0-10 cmbs**	**Surface**	**Layer I, 0-8 cmbs**	**Surface**	**Layer I, 0-10 cmbs**	**Surface**	**Layer I, 0-10 cmbs**
Invertebrates (weight in gm)										
Gastropod										
Conidae	14.0	7.4	1.0	1.5		17.0		3.0	11.0	
Cypraeidae	1.8	14.0		7.0		3.0		2.0	1.0	24.0
Nerita picea (pipipi)		0.6		1.5		1.0		1.0		1.0
Planaxis			<1.0	1.0		1.0		1.0		<1.0
Strombidae				7.5		5.0	2.0	6.0	8.5	23.0
Terebridae		0.7								1.0
Thaididae									<1.0	
Unidentified gastropod		6.3	1.0	16.0	3.0		4.0	3.0	1.0	15.0
Bivalve										
Brachiodontes		1.1								
Isognomonidae						<1.0				<1.0
Tellinidae						1.0		1.0		
Unidentified bivalve				1.0		1.0				
Crustacean										
Echinoidea	0.1	7.3	1.0	33.0	1.0	33.0		6.0		18.0
Crab	0.3	1.8		1.0		2.0		<1.0		1.0

Table 4 continues.

	Test Unit 1		Test Unit 2		Test Unit 3		Test Unit 4		Test Unit 5	
	Surface	**Layer I, 0-10 cmbs**	**Surface**	**Layer I, 0-10 cmbs**	**Surface**	**Layer I, 0-8 cmbs**	**Surface**	**Layer I, 0-10 cmbs**	**Surface**	**Layer I, 0-10 cmbs**
Vertebrates and botanical material (weight in gm)										
Fish bone		<0.1								
Unidentified faunal bone						1.0				
Charcoal										
Other cultural material (weight in gm)										
Ochre		0.1								

Table 5: Indigenous artifacts/cultural material recovered from TU-1 through TU-5 at Site 6670, Feature A

	Test Unit 1		Test Unit 2		Test Unit 3		Test Unit 4		Test Unit 5		Total
	Surface	Layer I, 0-10 cmbs	Surface	Layer I, 0-10 cmbs	Surface	Layer I, 0-8 cmbs	Surface	Layer I, 0-10 cmbs	Surface	Layer I, 0-10 cmbs	
Indigenous artifact or manuport material (number/count)											
Indigenous artifact/materials											
Probable ground stone fragment, A-6		1									1
Probable adz fragment, A-7								1			1
Worked basalt flakes											
Un-worked basalt flakes				1							1
Worked volcanic Glass		1									
Un-worked volcanic glass				2						2	4
Coral abrader fragment, A-1 & A-5						1	1				2
Un-worked coral		1									1

A-#=Accession number of Artifact

SIHP 50-50-04-6670 Feature B is composed of a scatter of cultural material remains located approximately 75 meters down slope (west) of SIHP 50-50-04-6670 Feature A. This scatter of cultural material designated *Feature B* measures 35 meters north/south by 24 meters east/west (Figure 18 and Photo 17 to Photo 18). The cultural material remains observed on the surface of this scatter includes marine shell midden (both bivalves and gastropods), sea urchins, crab shell (crustacean), both brain and branch coral fragments, basalt awl (A-8), several basalt flakes, and volcanic glass. Shovel Tests (ST) 5 through 8 and Test Units (TU) 6 through 11 were excavated throughout Feature B.

SIHP 50-50-04-6670 Feature B was subject to surface collection, subsurface shovel testing, and controlled hand test unit excavations (Photo # 17 & #18 and Figure 18). Four shovel tests were placed along the estimated outside perimeter boundaries (northeast, northwest, southeast and southwest). Feature B subsurface test results revealed similar matrix as Feature A test results. Layer I consists of a brown fine to medium sandy silt, overlaying a dark yellowish brown fine to medium silty sand. All four STs (ST-5 through ST-8) contained cultural material such as marine shell midden, sea urchin, crab shell, coral, basalt flakes, volcanic glass, and charcoal. The charcoal was not collected. No cultural materials were observed in the excavated portions of the lower sandy silt Layer II.

The Shovel Tests (ST 5-8) were intentionally placed and excavated at the scattered concentration of cultural material at Site 50-50-04-6670, Feature B to investigate the feature horizontally and to determine the extent of cultural materials. See Table 6 for the shovel test results. No cultural material remains were observed in the profile walls of the STs (E face wall of ST-5, W face wall of ST-6, E face wall of ST-7 and W face wall of ST-8) on and near the boundary and/or near the outer edge of the scatter. Site and feature boundaries were established based on the field results.

Six 1.0 meter square Test Units were excavated at Feature B during the archaeological inventory survey field work. The six TUs were excavated in the concentrated areas of the cultural material remains (TU-6 through TU-11). Several test units were excavated at this feature in order to acquire adequate materials to analyze the function and probable age of the Feature. See Table 7 and Table 8 for a summary of the test unit results.

Photo # 17: Overview of grass covering the scatter of surface cultural remains at SIHP 50-50-04-6670, Feature B, view to the south/southwest.

Photo # 18: Close up of a section of concentrated surface cultural material remains at SIHP 50-50-04-6670, Feature B, view to the north/northeast.

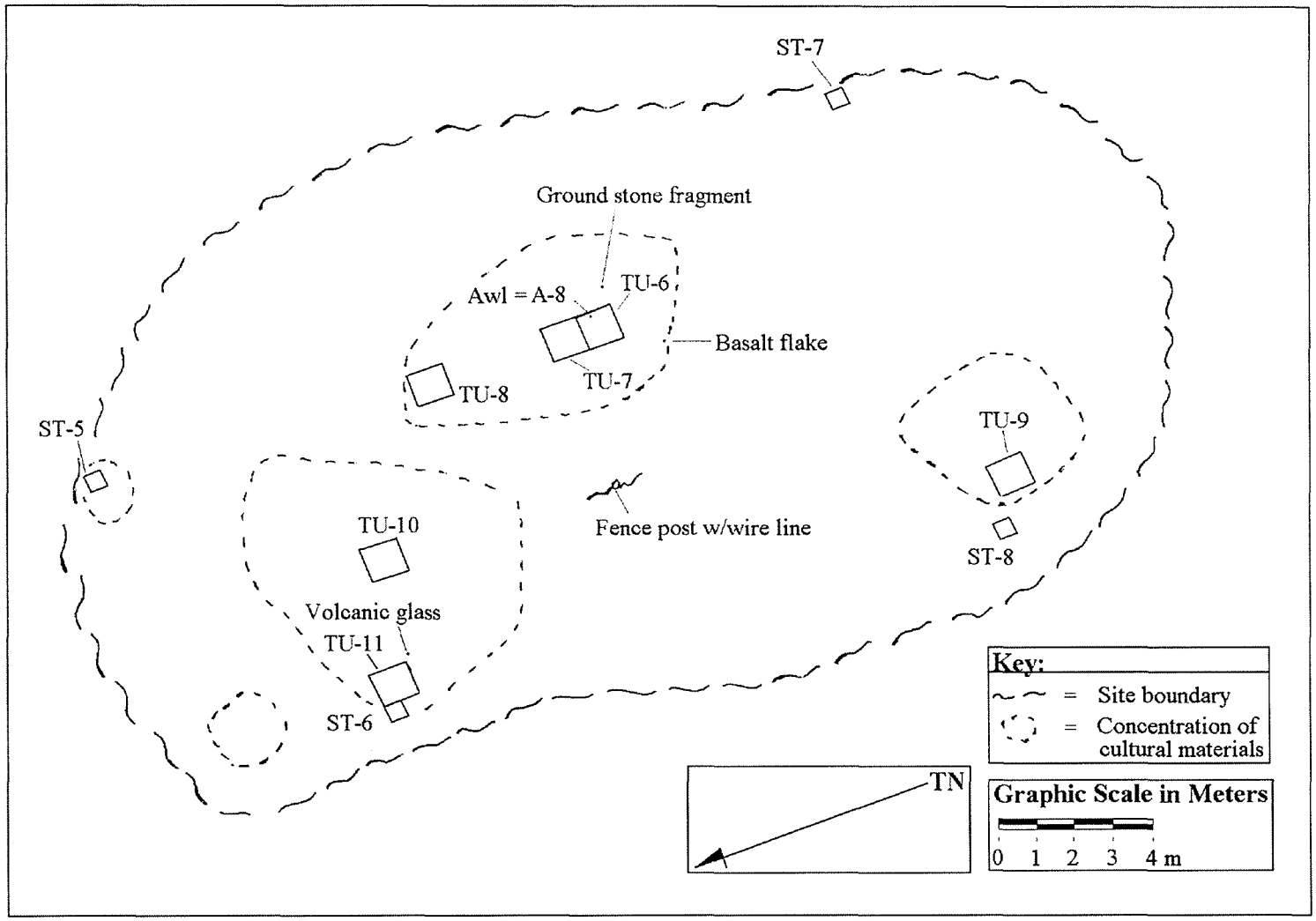

Figure 18: Plan view map depicting the test areas within SIHP 50-50-04-6670, Feature B.

SIHP 50-50-04-6670 Feature B: Shovel Tests 5-8

Four shovel tests (ST 5-8) were excavated throughout the area of SIHP 50-50-04-6670 Feature B. All of the four square ST excavations each measured 0.50 x 0.50 meters. Cultural remains were identified and collected from each of the test areas.

Shovel Test-5

ST-5 was the northernmost square shovel test excavated along the northern edge of the surface cultural remains scatter; along the designated site boundary (Figure 19 and Photo # 19). The test excavation measured 0.50 x 0.50 meters. Basalt debitage was identified along the surface. Recovered cultural material remains included marine shell midden (*Conus, Cypraea, Cymatidae, Terebridae, Trochidae, Echinoderm*, or sea urchin, and unidentified gastropods). *Hīhīwai* was collected from the excavated material. Crab claws, six pieces of coral, volcanic glass flakes, and one unidentified non-diagnostic bone fragment were also identified during ST-5 investigations. Cultural Layer I was documented as 10 centimeters thick. The final depth of ST-5 was 20 centimeters below the existing surface. The base of excavation contained a mixture of basalt and lithified sand cobbles and pebbles.

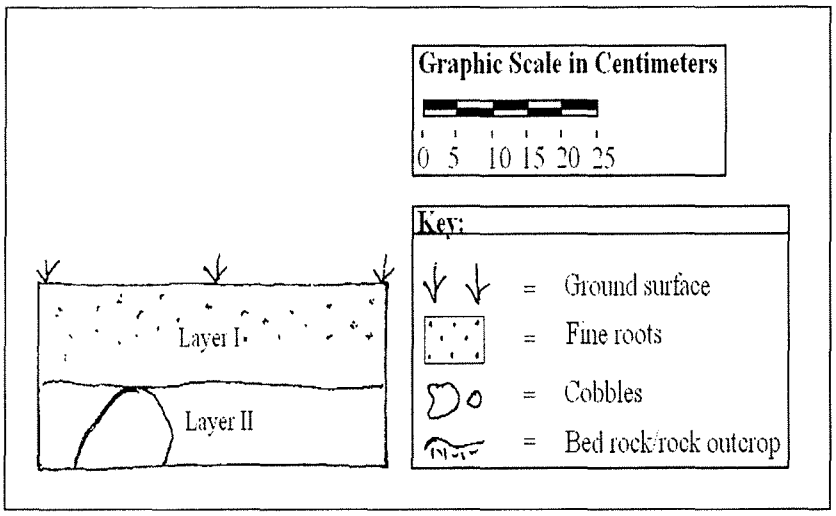

Figure 19: North wall profile of ST-5 at SIHP 50-50-04-6670, Feature B.

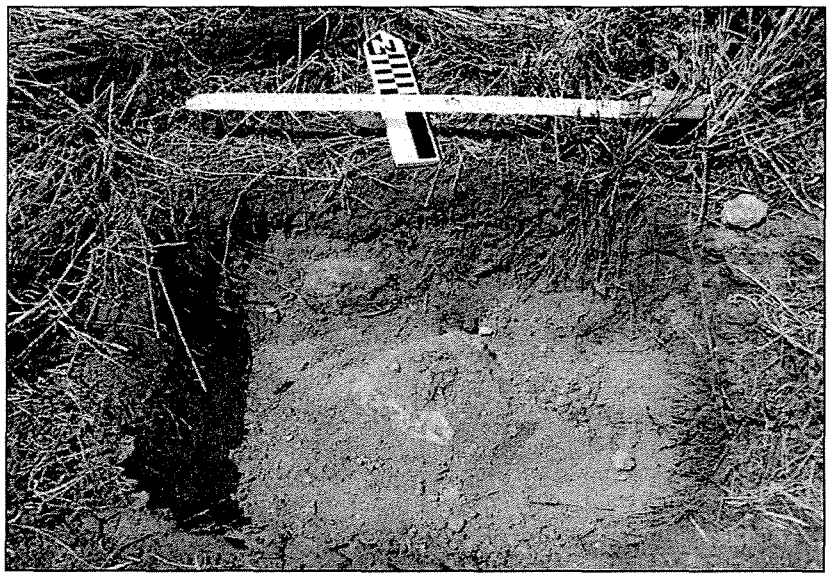

Photo # 19: Overview of ST-5 north wall at SIHP 50-50-04-6670, Feature B.

Shovel Test-6

ST-6 was a square shovel test excavated along the northwestern edge of the surface scatter (Figure 20 and Photo #20). The test excavation measured 0.50 x 0.50 meters. Basalt debitage was identified along the surface of the site. Recovered cultural material remains from ST-6 included crab and marine shell midden (*Conus, Cypraea, Thaididae*, *Echinoderm*, or sea urchin, unidentified gastropods, and the bivalve *Isognomon*). Two pieces of coral were identified during ST-6 investigations as well as 3 basalt flakes. Cultural Layer I was documented as 8 centimeters thick. The final depth of ST-6 was 18 centimeters below the existing surface. The base of excavation contained a mixture of basalt and lithified sand cobbles and pebbles.

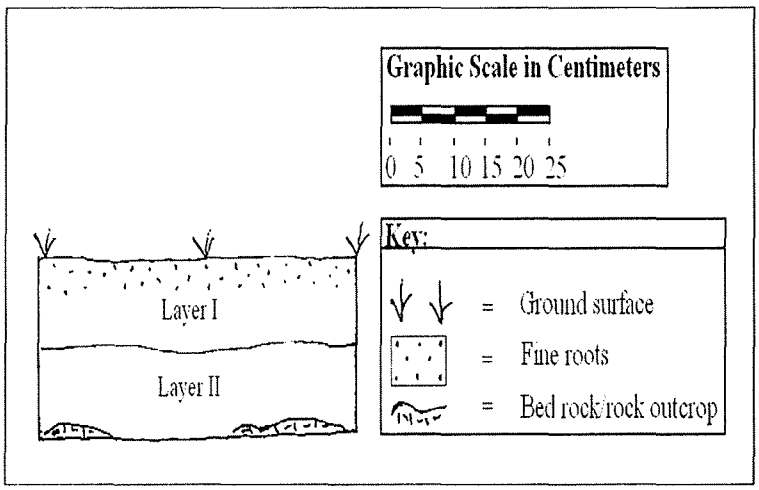

Figure 20: West wall profile of ST-6 at SIHP 50-50-04-6670, Feature B.

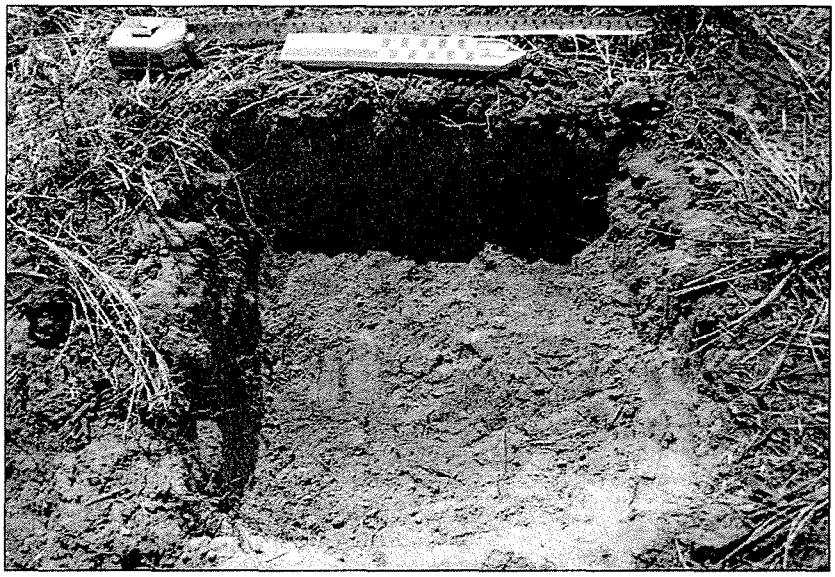

Photo # 20: Overview of ST-6 west wall at SIHP 50-50-04-6670, Feature B.

Shovel Test-7

ST-7 was a square shovel test excavated along the eastern edge of the surface scatter (Figure 21 and Photo #21). The test excavation measured 0.50 x 0.50 meters. Basalt debitage was identified across the surface of the site. Recovered cultural material remains from ST-7 included crab and marine shell midden (*Cellana, Conus, Cypraea,* sea urchin, and unidentified gastropod pieces). A small amount of charcoal was identified during ST-7 investigations, most likely the result of recent wildfires in the area. Cultural Layer I was documented as 40 centimeters deep. The final depth of ST-7 was 50 centimeters below the existing surface. The base of excavation contained a mixture of basalt and lithified sand cobbles and pebbles. The lower section of Layer I was hardened or semi-concreted (lithified).

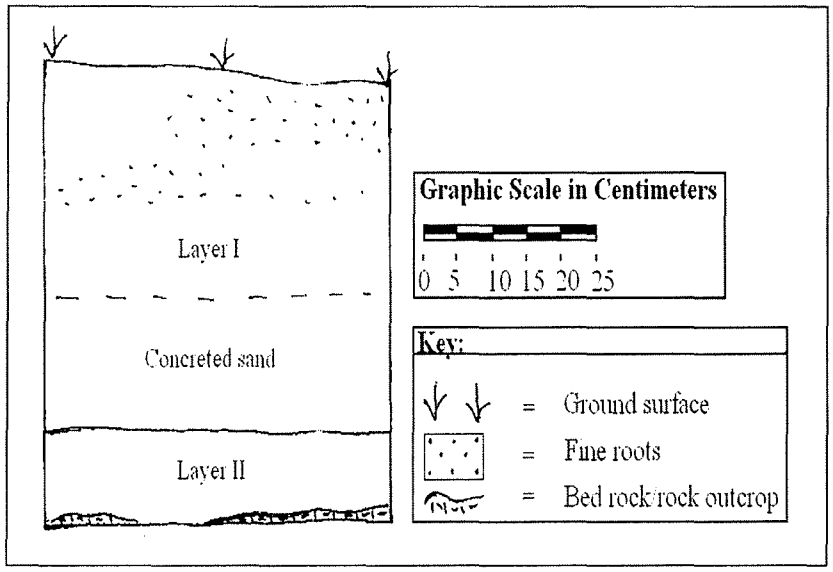

Figure 21: East profile drawing of ST-7 at SIHP 50-50-04-6670, Feature B.

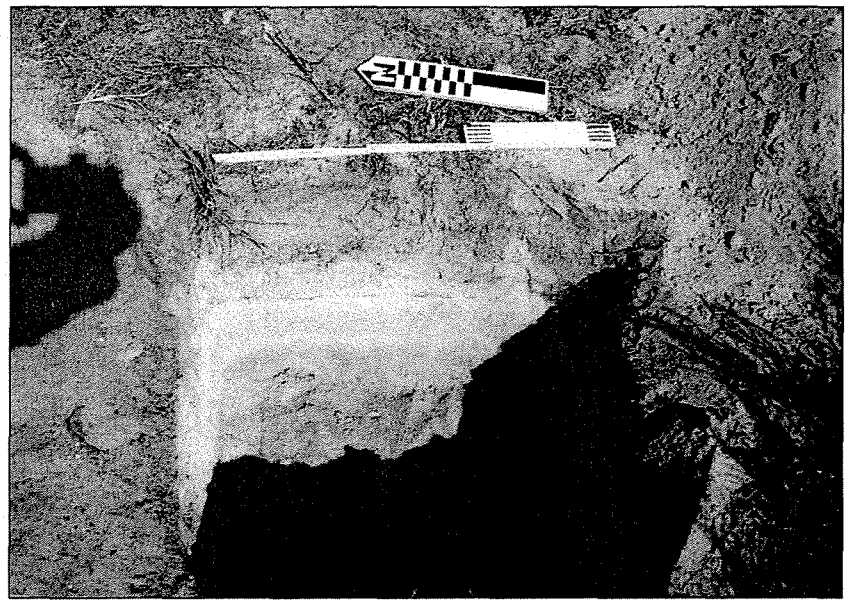

Photo # 21: Overview of ST-7 east wall at SIHP 50-50-04-6670, Feature B.

Shovel Test-8

ST-8 measured 0.50 x 0.50 meters and was placed west adjacent to TU-9. Shovel test excavation results yielded the least cultural material remains of the four shovel tests in Feature B. A small amount of marine shell midden was collected from the surface (*Conus*). No cultural material was encountered during the subsurface testing. The final depth of ST-8 was 55 centimeters below the existing surface. The base of excavation contained a mixture of basalt and lithified sand cobbles and pebbles. Note the sandy

matrix appeared deeper in this shovel test compared with the other shovel probes excavated at Feature B (Figure 22 and Photo #22).

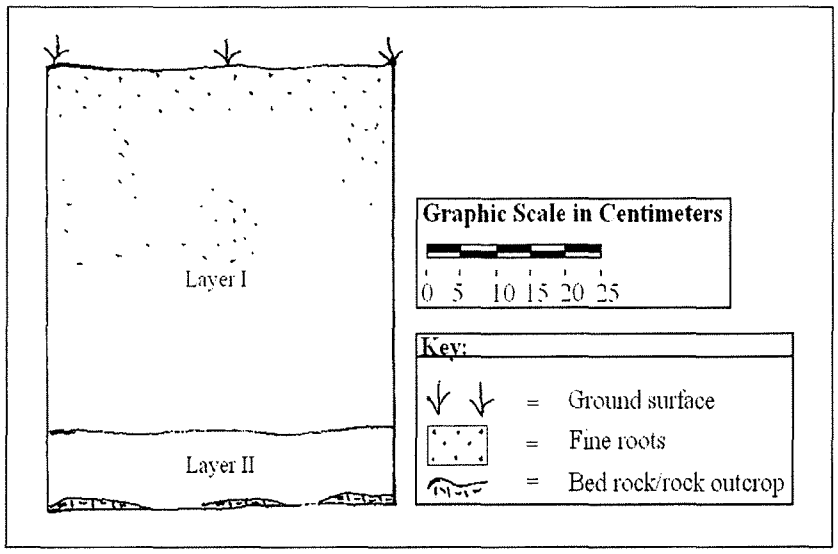

Figure 22: North wall profile of ST-8 at SIHP 50-50-04-6670 Feature B.

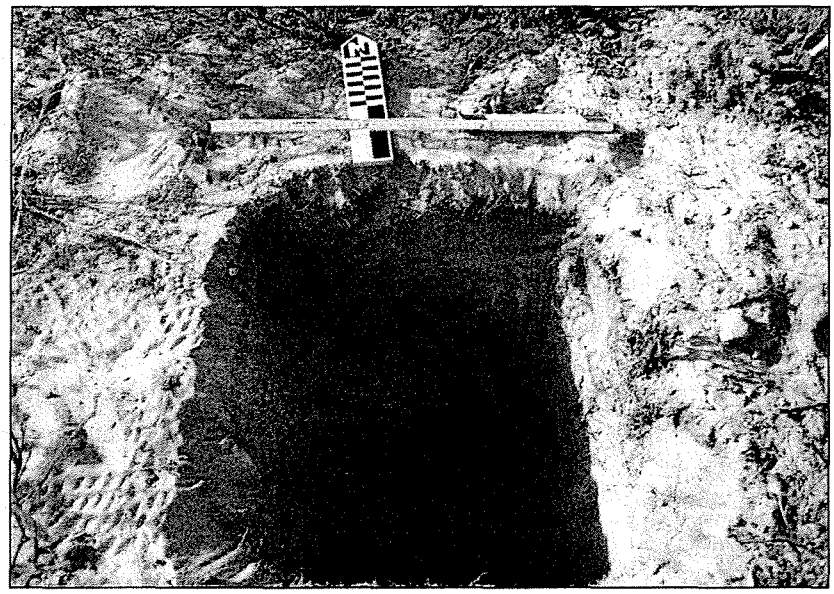

Photo # 22: Overview of ST-8 north wall at SIHP 50-50-04-6670, Feature B.

Table 6. Results of ST-5 through ST-8 at Site 6670, Feature B

Site No.	Cell/ST No.	Surface cultural material	Layer	Depth (cmbs)	Soil texture	Soil color	Subsurface cultural material	Reason for termination
50-50-04-6670 Feature B	ST-5	Positive	I	0-10	Sandy silt	Brown	Positive	Bed rock & Sterile soil
			II	10-20	Silty Sand	Dark yellowish brown	Negative	
	ST-6	Positive	I	0-8	Sandy silt	Brown	Positive	Bed rock & Sterile soil
			II	8-18	Silty Sand	Dark yellowish brown	Negative	
	ST-7	Positive	I	0-40	Sandy silt	Brown	Positive	Bed rock & Sterile soil
			II	40-50	Silty Sand	Dark yellowish brown	Negative	
	ST-8	Positive	I	0-45	Sandy silt	Brown	Positive	Bed rock & Sterile soil
			II	45-55	Silty Sand	Dark yellowish brown	Negative	

SIHP 50-50-04-6670 Feature B: Test Units 6-11

Based on the surface and subsurface collections recovered from the pedestrian survey and shovel tests, additional testing was deemed appropriate in order to obtain more information about the site. Subsequently, six square 1.0 x 1.0 meter Test Units (TU-6 through TU-11) were carefully hand excavated within the perimeters of SIHP 50-50-04-6670: Feature B. The test units were excavated to an average final maximum depth of 20 centimeters below the existing surface (cmbs). Two distinct layers were defined in the test areas. All of the excavated units revealed the cultural Layer (I) and the natural Layer (II). The layers were identified below the existing grassy weed vegetation. Test results consistently revealed the same two distinct layers described in the forthcoming summary (Layers I and II):

Layer I (0 to 10 cmbs) 10YR 4/3, brown; fine to medium, sandy silt, texture; weak, medium, single grain, structure; dry consistency, loose to semi-compacted; moist consistency, friable; wet consistency, non-sticky; plasticity, non-plastic; boundary, clear; topography, smooth; inclusions include 35% of angular basalt cobbles and pebbles; contains cultural materials: various marine shell midden genus (bi-valve and gastropod), sea urchin, crab shell, ochre, basalt awl, basalt scraper, worked basalt cobble, mammal bone, unidentified faunal bone, adz fragment, adz chip, volcanic glass, a possible fish hook blank, coral and worked coral

Layer II (10 to 23 cmbs)	10YR 4/4, dark yellowish brown; fine to medium, silty sand, texture; strong, medium, single grain, structure; dry consistency, semi-compacted; moist consistency, friable; wet consistency, slightly sticky; plasticity, slightly plastic; boundary, none; topography, none; inclusions include 45% of angular basalt cobbles and pebbles; contains no cultural materials

Test Unit 6

Test Unit 6 was placed south adjacent of TU-7 near the center of the concentrated surface scatter of cultural remains. The surface shell midden collection within the limits of TU-6 included a relatively significant amount of *Conus,* as well as *Cypraea*, *Nerita* picea, and unidentified gastropod pieces. Crab and sea urchin remains were also identified. Collections included two volcanic glass flakes and 2 pieces of coral. A basalt awl fragment was collected from the surface of TU-6 (A-8).

The southern half of TU-6 was excavated lower than the north section (Figure 23 and Photo 23). Recovered cultural material from the excavation included marine shell midden (*Cellana*, *Conus, Cypraea, Nerita* picea, *Teribridae*, unidentified gastropods, crab, and sea urchin). Collections also included one piece of coral, one volcanic glass flake, *hīhīwai,* and a small unidentified bone fragment. TU-6 was terminated at Layer II. A mixture of lithified sand with basalt cobbles and pebbles were observed at the base of excavation (Figure 23 and Photo #23).

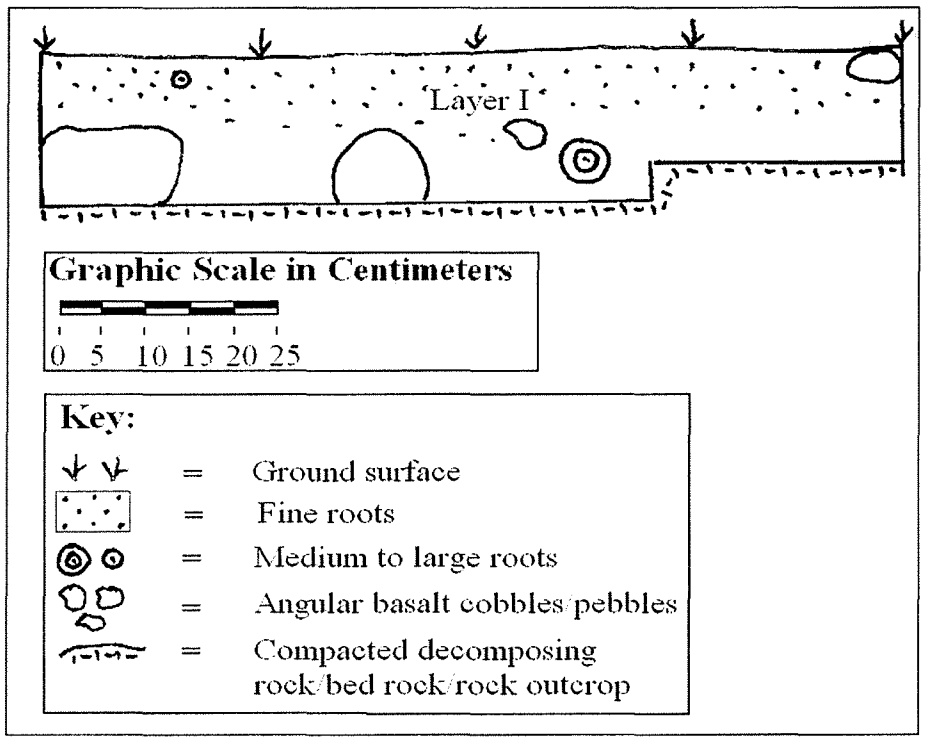

Figure 23: West wall profile of TU-6 at Site 6670, Feature B.

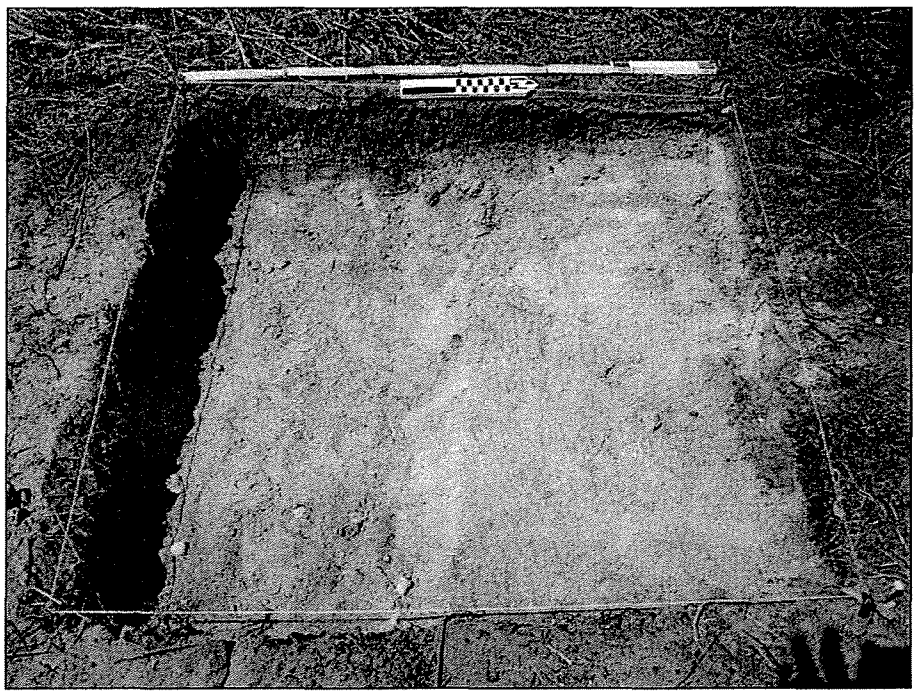

Photo # 23: Overview of TU-6 west wall at SIHP 50-50-04-6670, Feature B.

Test Unit 7

Test Unit 7 was placed as an extension north adjacent to TU-6 within a concentration of surface cultural remains. Surface collections within the limits of TU-7 included marine shell midden (*Cellana*, *Conus, Cypraea*, *Nerita* picea, *Planaxis*, and. Two layers were recorded within the excavation (Figure 24 and Photo 24).

A basalt scraper (A-9) and a bivalve shell fragment -classified as a possible fish hook blank- (A-10) were collected from Layer I. Additional cultural material recovered from the unit consisted of marine shell midden (unidentified gastropods, *Cypraea, Strombus, Nerita* picea, *Teribridae*, *Tellenidae*, the bivalve *Isognomon*, crab, and sea urchin). Collections included a small clear piece of plastic and a small unidentified faunal bone fragment. A clear distinction of alluvial deposition was noted in the excavated unit. A mixture of lithified sand with basalt cobbles and pebbles were observed at the base of excavation.

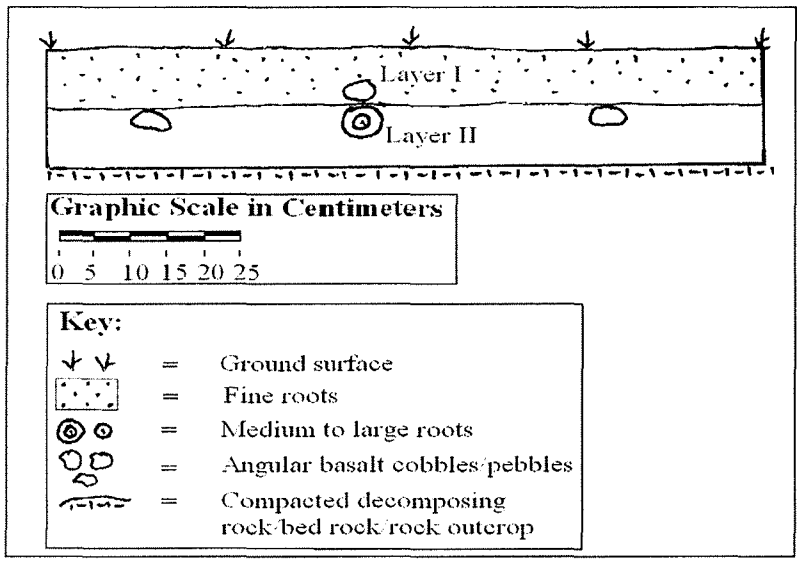

Figure 24: East profile of TU-7 at SIHP 50-50-04-6670, Feature B.

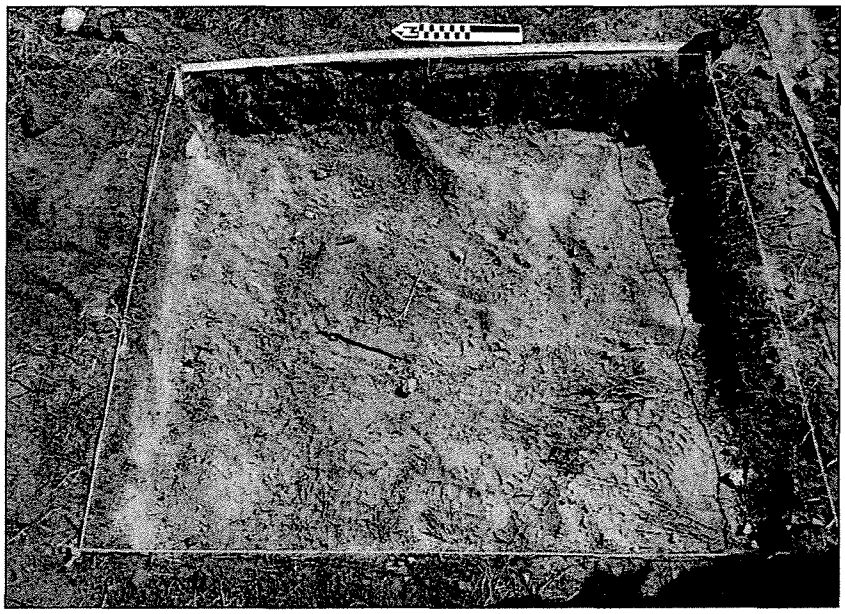

Photo # 24: Overview of TU-7 at Site 50-50-04-6670, Feature B, view to the east.

Test Unit 8

Test Unit 8 was placed approximately 3.5 meters north of TU-7 within an area of concentrated surface cultural remains. Surface collections within the limits of TU-8 included marine shell midden (*Conus, Cypraea, Strombus, Terebridae,* unidentified gastropod pieces, and unidentified bivalve pieces*)*. Sea urchin was also collected. Two layers were recorded within the bisected test unit (Figure 25 and Photo 25).

An ash lens was observed within the central northern portion of the unit; most likely the result of burnt vegetation roots from relatively recent wildfires within the subject area. Marine shell midden remains collected from the subsurface included the gastropods *Conus, Cypraea, Planaxis, Strombus, Turrinae, Tellinidae,* unidentified gastropods, and bivalves *Isognomon, Arcidae,* and unidentified bivalves. Collections also included crab and sea urchin remains.

TU-8 was bisected, with excavation continuing to a final depth of approximately 20 centimeters in the east half of the square. The two identified Layers (I & II) were the same as previously described in the beginning of this section. The eastern half of TU-1 was terminated in the sterile, silty sand of Layer II. A mixture of lithified sand and basalt cobbles and pebbles were located at the base of excavation.

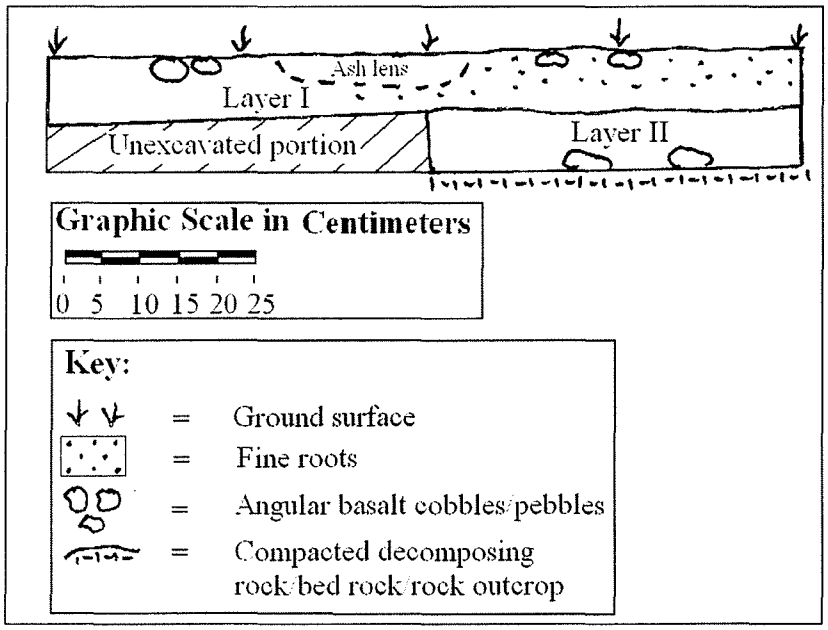

Figure 25: North wall profile of TU-8 at SIHP 50-50-04-6670, Feature B.

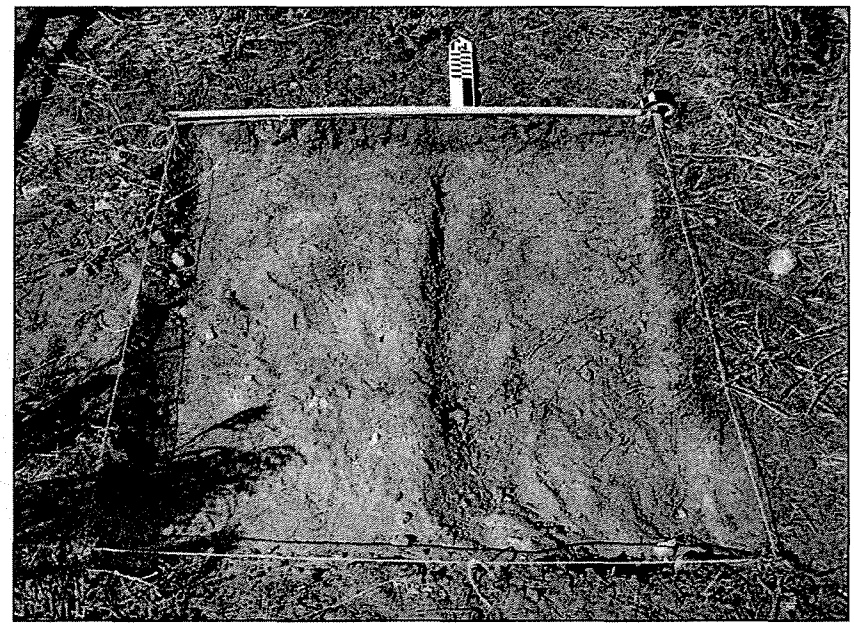

Photo # 25: Overview of TU-8 at SIHP 50-50-04-6670, Feature B, view to the north.

Test Unit 9

Test Unit 9 was excavated in the southern portion of Feature B within a concentration of surface cultural remains. Marine shell midden remains collected from the surface area of TU-9 included gastropod species of *Cypraea* and unidentified

gastropods; as well as bivalve species *Isognomon* and unidentified bivalves. Surface cultural remains also included sea urchin.

A worked basalt flake, classified as a possible adz fragment (A-11), was collected from cultural Layer I. Layer I was from the existing surface to approximately 7 centimeters deep and contained small rodent bones, sea urchin, pencil urchin, and crab. Marine shell midden was also collected from the test unit (gastropod *Conus, Cypraea, Nerita* picea, *Planaxis,* unidentified gastropods, as well as bivalve *Isognomon* and unidentified bivalves

TU-9 was bisected and the subsurface excavation continued to a final depth of approximately 55 centimeters in the east half of the square (Figure 26 and Photo 26). The two identified Layers (I & II) were the same as previously described throughout the project area. The eastern half of TU-9 terminated at the silty sand of Layer II. A mixture of lithified sand and basalt cobbles and pebbles were located at the base of excavation.

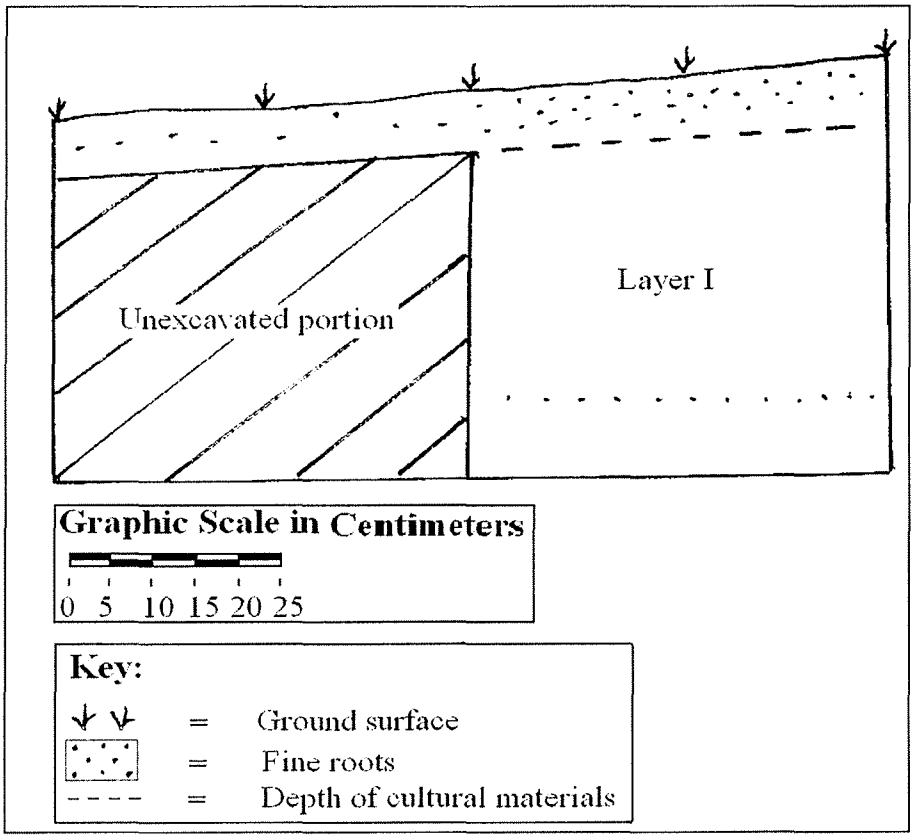

Figure 26: North wall profile of TU-9 at SIHP 50-50-04-6670 Feature B.

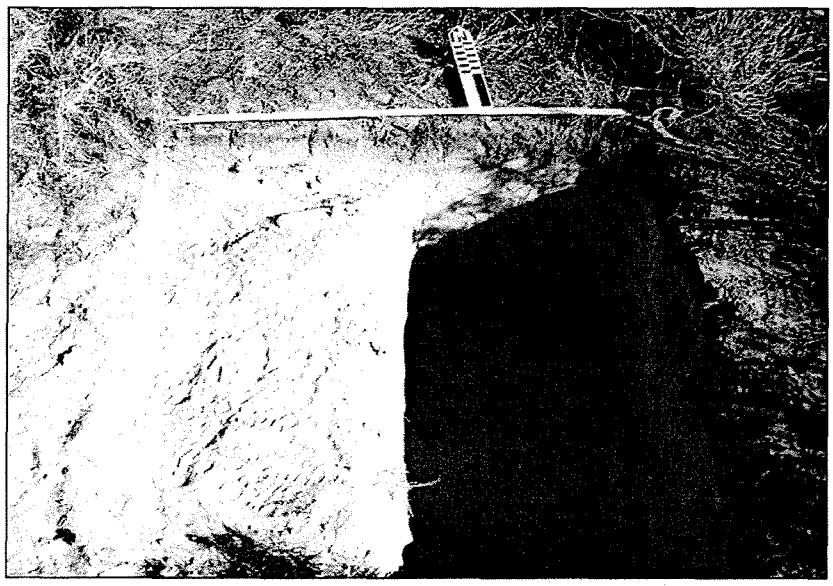

Photo # 26: Overview of bisected TU-9 north face at SIHP 50-50-04-6670, Feature B.

Test Unit 10

Test Unit 10 was placed at the center of a concentrated area of surface cultural remains in the northwestern section of Feature B. A worked piece of basalt classified as an adz fragment (A-12), was collected from the surface of TU-10. Marine shell midden remains recovered from the surface included gastropod *Cypraea, Strombus, Tellinidae, Terebridae,* as well as unidentified gastropods and unidentified bivalves. Sea urchin spine and a metal wire fence nail were identified within the surface collection.

TU-10 was sectioned and excavated in the northeastern quad of the square unit (Figure 27 and Photo 27). The two identified Layers (I & II) were the same as previously defined. Cultural Layer I (0-5 cmbs) yielded a collection sea urchin and marine shell midden including *Conus, Cypraea, Nerita* picea, *Strombus, Turbo* sandwicensis, and unidentified gastropods. The excavated quad terminated at Layer II. A mixture of lithified sand and basalt cobbles and pebbles were located at the base of excavation.

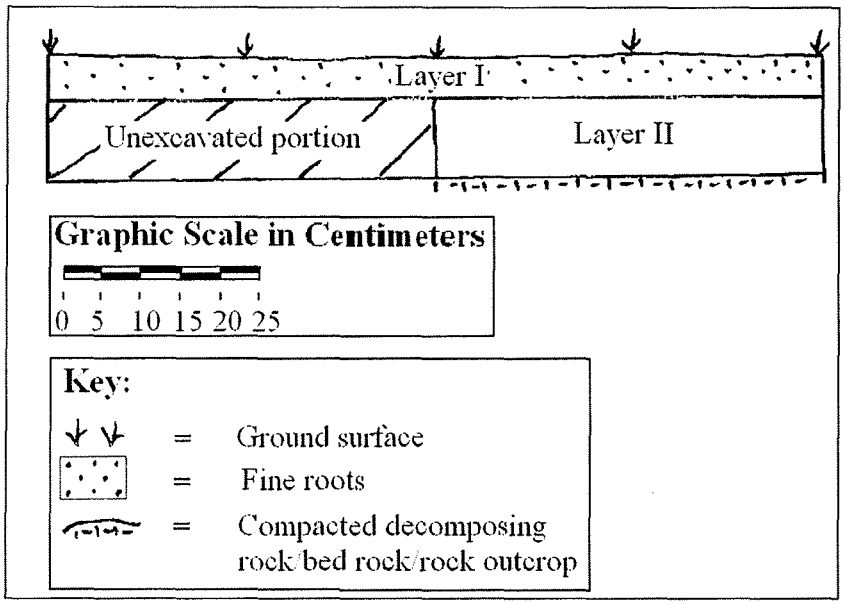

Figure 27: North wall profile of TU-10 at SIHP 50-50-04-6670, Feature B.

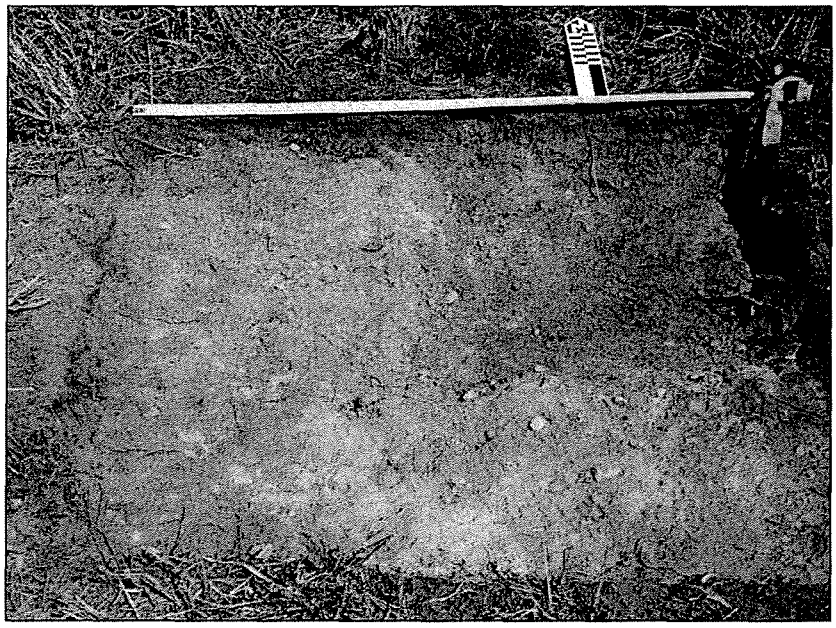

Photo # 27: Overview of TU-10 north wall at SIHP 50-50-04-6670, Feature B.

Test Unit 11

Test Unit 11 was situated approximately 2.5 meters west of TU-10 and was the westernmost unit placed at Feature B. Volcanic glass was collected from the surface adjacent to the test unit. Marine shell midden remains recovered from the surface included gastropods *Conus, Cypraea, Strombus, Tellinidae,* and unidentified gastropods. Crab and sea urchin remains were also collected from the surface.

TU-11 was quartered and excavation continued in the northeastern quad of the square unit (Figure 28 and Photo #28). The two identified Layers (I & II) were the same as previously defined. Cultural Layer I (0-6 cmbs) yielded a collection of crab, sea urchin, and marine shell midden including *Conus, Cypraea, Nerita* picea, *Planaxis, Strombus, Tellinidae, Terebridae, Turbo* sandwicensis, and unidentified gastropods. Bivalve species included Trapeziidae (*Periglypta* reticulate) and unidentified bivalves. The excavated quad terminated at Layer II. A mixture of lithified sand and basalt cobbles and pebbles were located at the base of excavation.

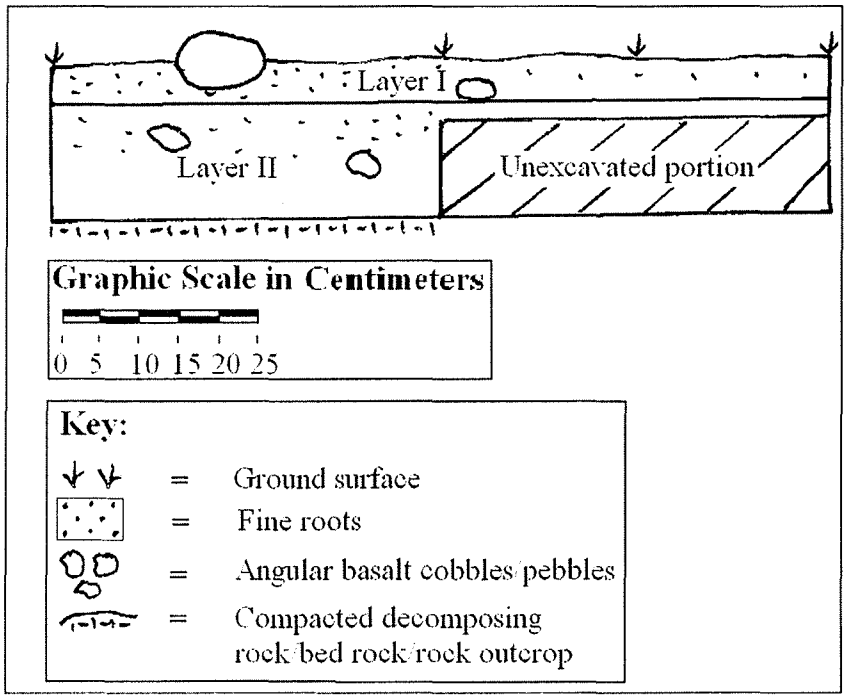

Figure 28: North wall profile of TU-11 at SIHP 50-50-04-6670, Feature B.

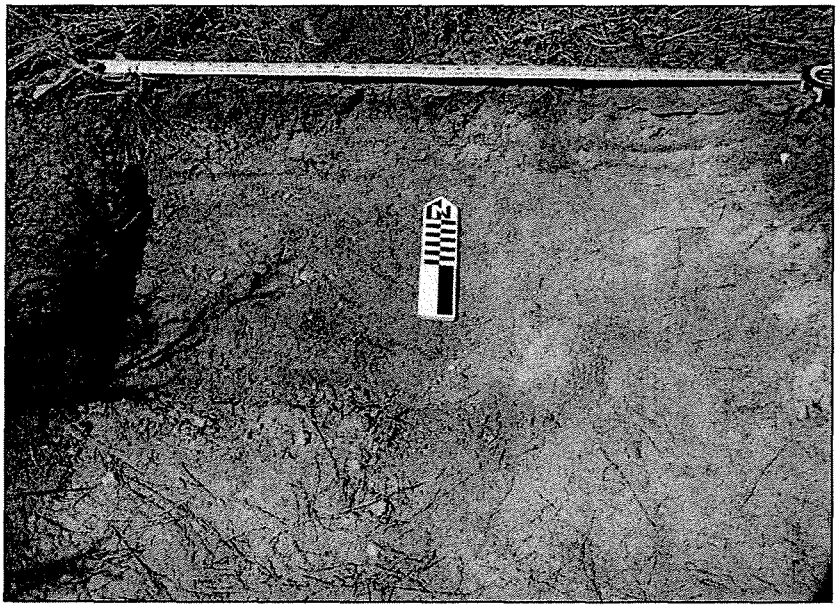

Photo # 28: Overview of TU-11 north face wall at SIHP 50-50-04-6670, Feature B.

Table 7 and Table 8 include a summary of findings from the Test Unit excavations.

Table 7. Invertebrates and vertebrates recovered from TU-6 through TU-11 at Site 6670, Feature B

	Test Unit 6		Test Unit 7		Test Unit 8		Test Unit 9		Test Unit 10		Test Unit 11	
	Surface	Layer I, 0-10 cmbs	Surface	Layer I, 0-10 cmbs	Surface	Layer I, 0-5 cmbs	Surface	Layer I, 0-7cmbs	Surface	Layer I, 0-5 cmbs	Surface	Layer I, 0-6 cmbs
Invertebrates (weight in gm)												
Gastropod												
Cellana		<0.1	1.0									
Conidae	22.4	13.2	1.0		24.0	26.0		11.0		6.0	9.0	19.0
Cypraeidae	1	1.7	17.5	4.0	2.0	4.0	11.0	15.0	3.0	2.0	4.0	5.0
Hipponicidae		<0.1										
Nerita picea (pipipi)	0.3	0.3	<1.0	1.5				1.0		<1.0		<1.0
Planaxis			1.0	1.0		2.0		1.0				1.0
Strombidae				4.0	1.0	7.0			1.0	11.5	7.5	42.0
Terebridae		2.6		<1.0	5.5				<1.0			2.0
Turbinidae										2.0		3.0
Unidentified fragments gastropod shell	4.6	9.5	1.5	17.0	8.0	8.0	6.0	4.0	3.0	6.0	13.0	43.5
Bivalve												
Arcidae						<1.0						
Isognomonidae				10.0		<1.0	< 1.0	<1.0				
Periglypta reticulata												1.0
Tellenidae				1.0		1.0			<1.0		2.0	1.0
Unidentified bivalve					<1.0	<1.0		<1.0				1.5

Table 7 continues.

	Test Unit 6		Test Unit 7		Test Unit 8		Test Unit 9		Test Unit 10		Test Unit 11	
	Surface	**Layer I, 0-10 cmbs**	**Surface**	**Layer I, 0-10 cmbs**	**Surface**	**Layer I, 0-5cmbs**	**Surface**	**Layer I, 0-7 cmbs**	**Surface**	**Layer I, 0-5 cmbs**	**Surface**	**Layer I, 0-6cmbs**
Crustacean												
Echinoidea	0.5	3.1		47.0	1.0	<1.0	<1.0	13.0	<1.0	1.0	<1.0	64.0
Pencil urchin				3.0		2.0		1.0			1.0	1.0
Crab	0.2	0.3		1.5		1.0		1.0				1.0
Vertebrates and botanical material (weight in gm)												
Mammal bone								1.0				
Fish bone												
Unidentified faunal bone		0.1										
Charcoal												

Table 8. Indigenous and Post-contact artifacts/other cultural materials recovered from TU-6 through TU-11 at Site 50-50-04-6670, Feature B

	Test Unit 6		Test Unit 7		Test Unit 8		Test Unit 9		Test Unit 10		Test Unit 11		Total
	Surface	Layer I, 0-10 cmbs	Surface	Layer I, 0-10 cmbs	Surface	Layer I, 0-5 cmbs	Surface	Layer I, 0-7 cmbs	Surface	Layer I, 0-5 cmbs	Surface	Layer I, 0-6 cmbs	
Indigenous and Post-contact artifact/material (number/count)													
Indigenous artifact/material													
Basalt awl, A-8	1												**1**
Basalt scraper, A-9				1									**1**
Ground stone fragment													
Adz fragment, A-12									1				**1**
Probable adz chip, A-11								1					**1**
Un-worked volcanic glass	2	1											**3**
Possible fish hook blank, A-10				1									**1**
Coral													
Un-worked coral	2	1											**3**
Post-contact artifact/material													
Clear plastic (piece)				1									**1**
Fence nail									1				**1**

A-# = Artifact accession number

Artifacts - Discussion

The most common category of cultural materials recovered during the recordation and sub-surface testing of the current inventory survey area consisted of ancient traditional Hawaiian cultural material and food remains. A modest assemblage of coral abraders and a lithic or stone tool were recovered and analyzed. Brain coral abraders accounted for the majority of the recovered traditional Hawaiian artifacts (Table 9).

Table 9: Artifact Catalogue

Acc #	Site/Feature /TU	Lay/Level/Depth in cm	# of pc	Cm Length	Cm Width	Cm Thickness	Total g. Weight	Material/Category/ Type
A-1	6670 A, TU-4	Surface collection	1	3.6 cm	1.7 cm	1.7 cm	6.4 gm	Brain coral abrader
A-2	6670 A	Surface collection	1	2.7 cm	1.5 cm	1.3 cm	3.3 gm	Brain coral abrader
A-3	6670 A	Surface collection	1	3.0 cm	2.0 cm	1.3 cm	6.9 gm	Brain coral abrader
A-4	6670 A	Surface collection	1	3.2 cm	1.8 cm	1.6 cm	6.7 gm	Brain coral abrader
A-5	6670 A, TU-3	Layer I, 0-8 cmbs	1	1.7 cm	1.5 cm	1.1 cm	1.0 gm	Brain coral abrader
A-6	6670 A, TU-3	Layer I, 0-8 cm	1	1.2 cm	1.0 cm	0.6 cm	1.0 gm	Basalt ground stone fragment
A-7	6670 A, TU-4	Layer I, 0-10 cmbs	1	3.0 cm	2.4 cm	1.3 cm	5.0 gm	Basalt adze fragment
A-8	6670 B, TU-6	Surface collection	1	9.7 cm	4.4 cm	2.0 cm	84.6 gm	Basalt awl fragment
A-9	6670 B, TU-7	Layer I, 0-10 cmbs	1	7.1 cm	4.3 cm	1.9 cm	50.0 gm	Basalt scrapper
A-10	6670 B, TU-7	Layer I, 0-10 cmbs	1	6.6 cm	3.7 cm	2.3 cm	40.0 gm	Bivalve shell fragment, possible fish hook blank
A-11	6670 B, TU-9	Layer I, 0-7 cmbs	1	1.2 cm	1.1 cm	0.8 cm	< 1.0 gm	Basalt fragment, possible adze chip
A-12	6670 B, TU-10	Surface collection	1	2.8 cm	2.6 cm	1.1 cm	5.0 gm	Basalt –Adze fragment

Acc =Accession, A-# =Artifact number, TU=Test Unit and cm = centimeter

Traditional Hawaiian Artifacts

A total of 12 traditional Hawaiian pre-Contact artifacts were located during the current inventory survey (Table 9). Accession A-1 was collected from the surface of TU-4 at Site 50-50-04-6670 and Accession A-2 through A-4 were surface collection from SIHP 6670, Feature A (Photo #29). These four abraders are made out of brain coral. A coral abrader, A-5, and a probable basalt ground stone fragment, A-6, were collected from TU-3 at Layer I at the depth of 0-8 cm below surface (Photo #30). A basalt adze fragment, Accession A-7, was recovered from Layer I in TU-4 at Site 50-50-04-6670 Feature A (Photo #31 and Table 9). There were also some un-worked basalt flakes and un-worked coral collected from ST-1 through ST-4 and at TU-1 through TU-5 at SIHP 50-50-04-6670, Feature A. The presence of basalt flakes indicate that lithic reduction was occurring at and/or near this site and the presence of artifacts such as coral abraders suggest that formal tools may have been produced at this site.

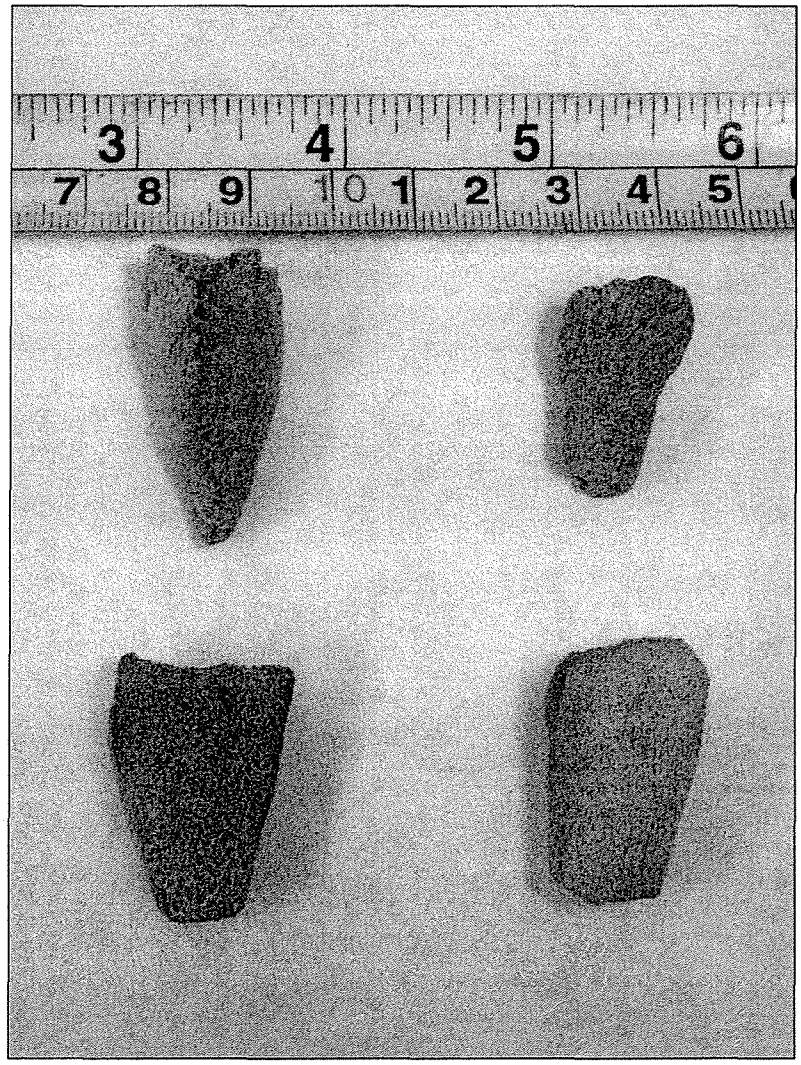

Photo # 29: Four Coral Abrader Artifacts (A), A-1 and A-2 from left at top and A-3 to A-4 from left at bottom, recovered from Site 50-50-04-6670, Feature A. Scale in inches and centimeters.

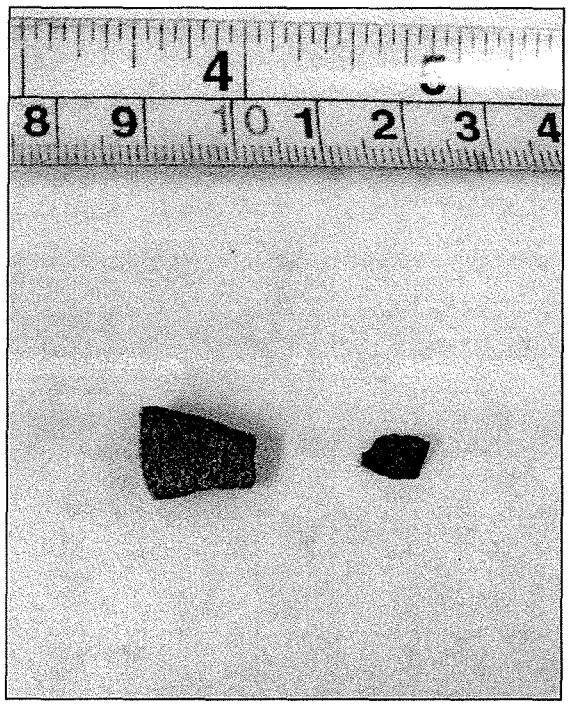

Photo # 30: **Accession number A-5 to A-6 from left to right, were recovered from Layer I in TU-3 at Site 50-50-04-6670, Feature A. Scale in inches and centimeters.**

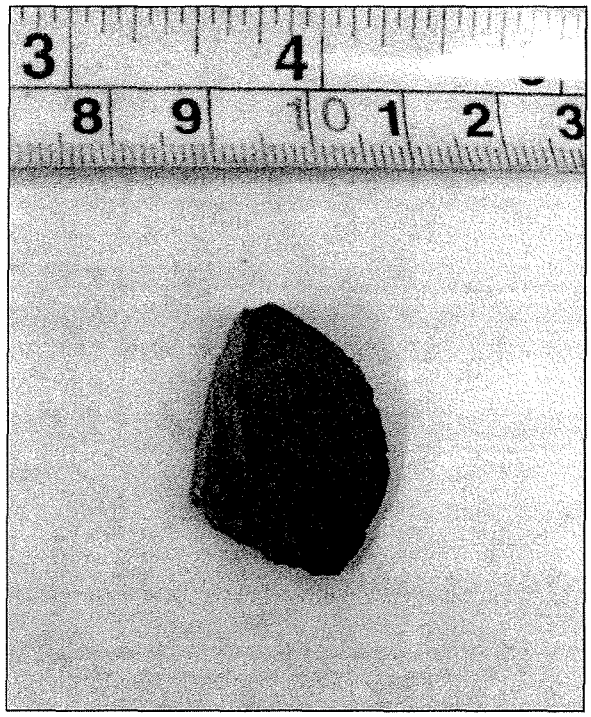

Photo # 31: **Accession number A-7 was recovered from Layer I in TU-4 at Site 50-50-04-6670, Feature A. Scale in inches and centimeters.**

Accession number A-8, the basalt awl fragment (Photo #32 and Table 9) was found on the surface of TU-2 at Site 6670, Feature B. Accession number A-9 and A-10 were recovered from Layer I in TU-7 at Site 50-50-04-6670, Feature B (Photo #33 and Table 9). Accession number A-11 and A-12 were recovered from Layer I in TU-9 and the surface of TU-10 at Site 50-50-04-6670, Feature B, consecutively (Photo #34 and Table 9). The traditional Hawaiian artifacts indicate the site was most likely occupied during the pre-Contact period. Volcanic glass, basalt flakes, coral fragments and the food remains at both Feature A and B of Site 50-50-04-6670 also indicate pre-Contact habitation. There was no formal lithic debitage deposit discovered during recordation and sub-surface testing within the project area. The presence of traditional coral files, volcanic glass pieces, stone tool and basalt flakes indicated that some tool making likely occurred on the project area.

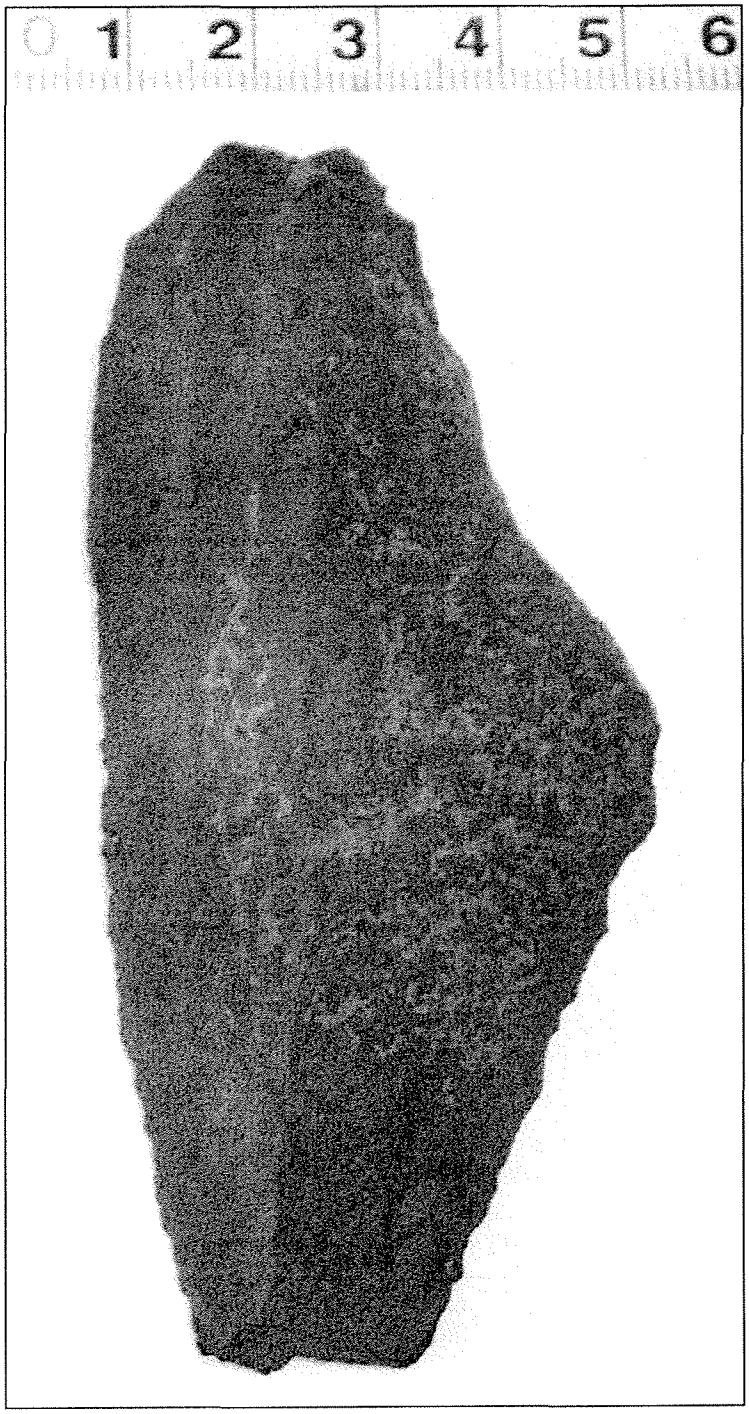

Photo # 32: Basalt awl fragment, (A-8) was recovered from Site 50-50-04-6670, Feature B, surface collection from TU-6. Scale in centimeters.

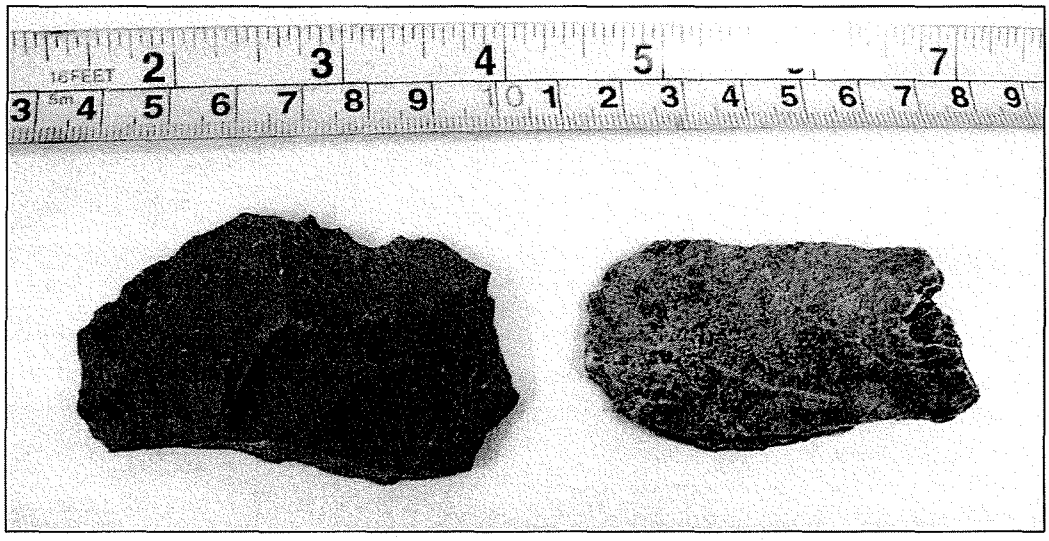

Photo # 33: Accession number A-9 to A-10 from left to right, were recovered from Layer I in TU-7 at Site 50-50-04-6670, Feature B. Scale in inches and centimeters.

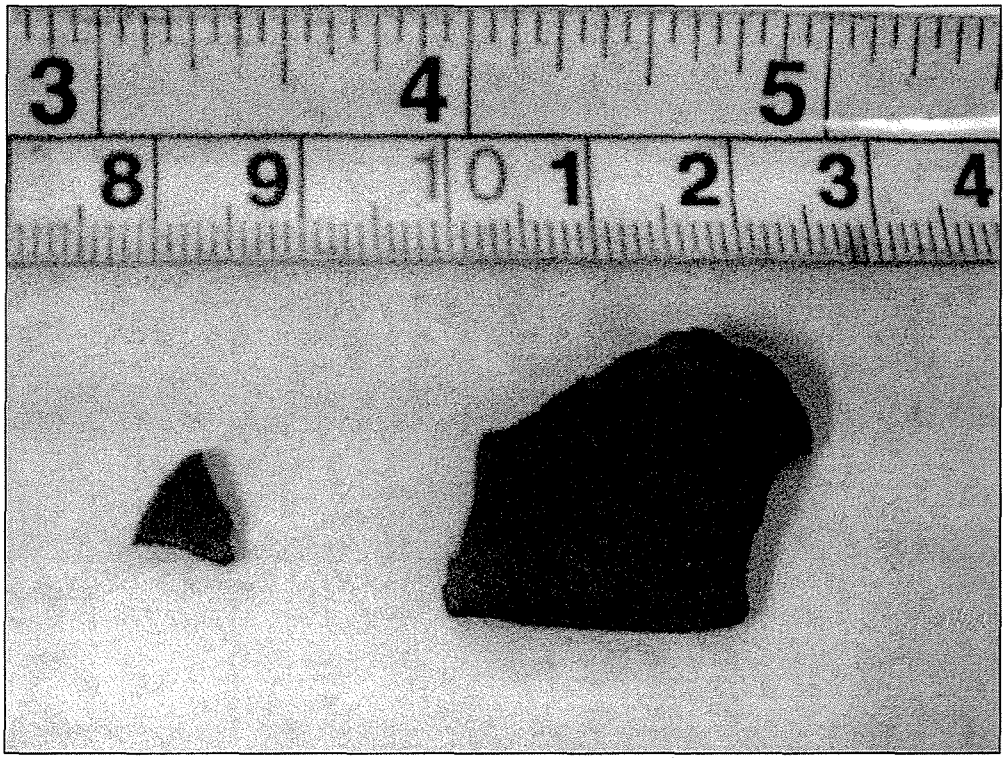

Photo # 34: Accession number A-11 and A-12 from left to right, recovered from Layer I in TU-9 (A-11) and on the surface of TU-10 (A-12) at Site 50-50-04-6670, Feature B. Scale in inches and centimeters.

Backhoe Testing Results

Twenty mechanical backhoe test trenches were excavated to test all the accessible portions of the Kīhei Redevelopment project area. The test trenches were used to determine the presence or absence of cultural deposits and to assess the overall soil stratigraphy within the three parcels (see Figure 29Fig 29). The backhoe test trenches ranged between 4.0 to 5.0 meters in length by 0.8 to 0.95 meters in width and were up to 2.1 m in depth (Table 10). Representative drawings of 3.0 meter long portions of the wall profiles were recorded in detail.

Nine of the 20 backhoe test trenches were systematically placed and excavated on the northern most parcel of the project area. Two test trenches were excavated on the southwest parcel and the remaining nine trenches were excavated on the southeast parcel. Three backhoe test trenches from the north parcel, three from the southeast and one from southwest will be discussed in the backhoe testing results section. See **Appendix A** for additional photographs and profile maps from the BTs not presented in this section.

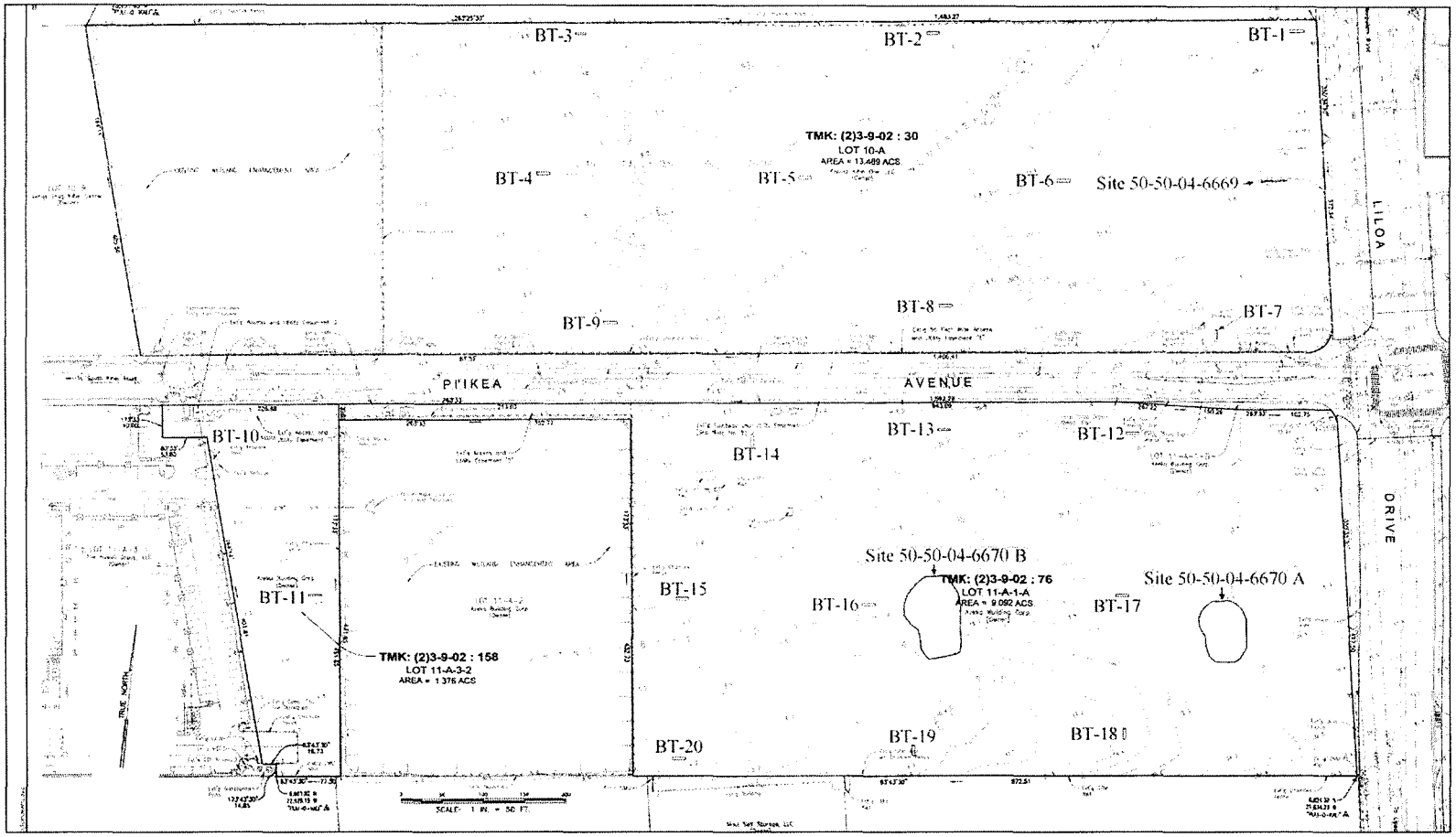

Figure 29: Project area map showing locations of BT-1 through BT-20, map adapted from Warren S. Unemori Engineering, Inc.

Table 10: Stratigraphic summary for Backhoe Tests, BT-1 through BT-9 on the on the north parcel of the project area.

BT #	Length	Width	Wall profile	Layer	Depth	Layer descriptions	Cultural materials
BT-1	4.0 m	0.85 m	South face wall	I	0-35 cmbs	10YR 5/4, yellowish brown, loose to semi-compacted, fine to medium, silty clay, 45% angular basalt boulders/cobbles/pebbles and a lot of fine roots	Some pieces of plywood were identified on the surface of this BT. Terminated due to bedrock.
BT-2	5.0 m	0.9 m	North face wall	I	0-30 cmbs	10YR 7/2, very pale brown, loose, fine to medium, sand, 15% of concreted sand or sand stones, a lot of grass roots	No cultural material
				II	25-55 cmbs	10YR 5/4, yellowish brown, loose to semi-compacted, fine to medium, silty clay, 45% angular basalt boulders/cobbles/pebbles and a lot of fine roots	No cultural material. Terminated due to bedrock
BT-3	4.0 m	0.85	North face wall	I	0-55 cmbs	10YR 7/2, very pale brown, loose, fine to medium, sand, 15% of concreted sand or sand stones, a lot of grass roots	No cultural material
				II	35-210 cmbs	2.5YR 7/4, pale yellow, loose, medium, single grain clean sand, no inclusions	No cultural material. Terminated due to bed rock.
BT-4	4.0 m	0.9 m	North face wall	I	0-40 cmbs	10YR 5/4, yellowish brown, loose to semi-compacted, fine to medium, silty clay, 45% angular basalt boulders/cobbles/pebbles and a lot of fine roots	No cultural material
				II	40-160 cmbs	2.5YR 7/4, pale yellow, loose, medium, single grain clean sand, no inclusions	No cultural material. Terminated due to water table.
BT-5	4.5 m	0.95 m	North face wall	I	0-15 cmbs	10YR 4/3, brown, compacted fine to medium, sandy silt, 55% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material
				II	15-35 cmbs	10YR 5/4, yellowish brown, loose to semi-compacted, fine to medium, silty clay, 45% angular basalt boulders/cobbles/pebbles and a lot of fine roots	No cultural material. Terminated due to bedrock
BT-6	5.0 m	0.85 m	North face wall	I	0-40 cmbs	10YR 4/3, brown, compacted fine to medium, sandy silt, 35% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material
				II	20-50 cmbs	10YR 5/4, yellowish brown, loose to semi-compacted, fine to medium, silty clay, 30% angular basalt boulders/cobbles/pebbles and a lot of fine roots	No cultural material. Terminated due to bedrock
BT-7	4.5 m	0.9 m	West face wall	I	0-70 cmbs	10YR 5/4, yellowish brown, loose to semi-compacted, fine to medium, silty clay, 75% angular basalt boulders/cobbles/pebbles and a lot of fine roots	No cultural material. Terminated due to bedrock
BT-8	4.0 m	0.95	North face wall	I	0-50 cmbs	10YR 5/4, yellowish brown, loose to semi-compacted, fine to medium, silty clay, 45% angular basalt boulders/cobbles/pebbles and a lot of fine roots	No cultural material. Terminated due to bedrock
BT-9	5.0 m	0.8 m	East face profile	I	0-20 cmbs	10YR 7/2, very pale brown, loose, fine to medium, sand, 15% of concreted sand or sand stones, a lot of grass roots	No cultural material. Moist soil
				II	10-60 cmbs	2.5YR 7/4, pale yellow, loose, medium, single grain clean sand, no inclusions	No cultural material. Moist sand
				III	60-80 cmbs	5YR 3/3, dark reddish brown, fine and wet clay, 20% sub-angular basalt boulders/cobbles	No cultural material. Wet silty clay

BT-1 through BT-9 were located on the north parcel (030). BT-1, BT-3 and BT-9 are three representative samples from this area discussed in this section. BT-1 is at the northeast corner of the parcel, BT-3 is at the western section and BT-9 is located at the southwest portion. It appears that the eastern section of the test area is very different from the western section. These trenches are discussed below based on the number of stratigraphic layers encountered. Three out of the nine trenches had only one stratigraphic layer, five trenches revealed two layers and one contained three layers. One Layer was identified in BT-1 that extended 0.5 meters below the existing surface (Figure 30 and Photo #35)

BT-1

Layer I (0 to 50 cmbs) — 10YR 5/4, yellowish brown; fine to medium, silty clay, texture; moderate, medium, single grain, structure; dry consistency, loose to semi-compacted; moist consistency, friable; wet consistency, slightly sticky; plasticity, slightly plastic; boundary, none; topography, none; inclusions include roots and other organic materials, and 45% sub-angular basalt boulders, cobbles and pebbles, contains no significant cultural material.

There were some lumber (2x4s) and pieces of plywood observe on the ground surface adjacent to BT-1. However, there were not any other cultural materials in BT-1 during its excavation. This BT was terminated at bed rock or at decomposing bedrock mixed with lithified sand.

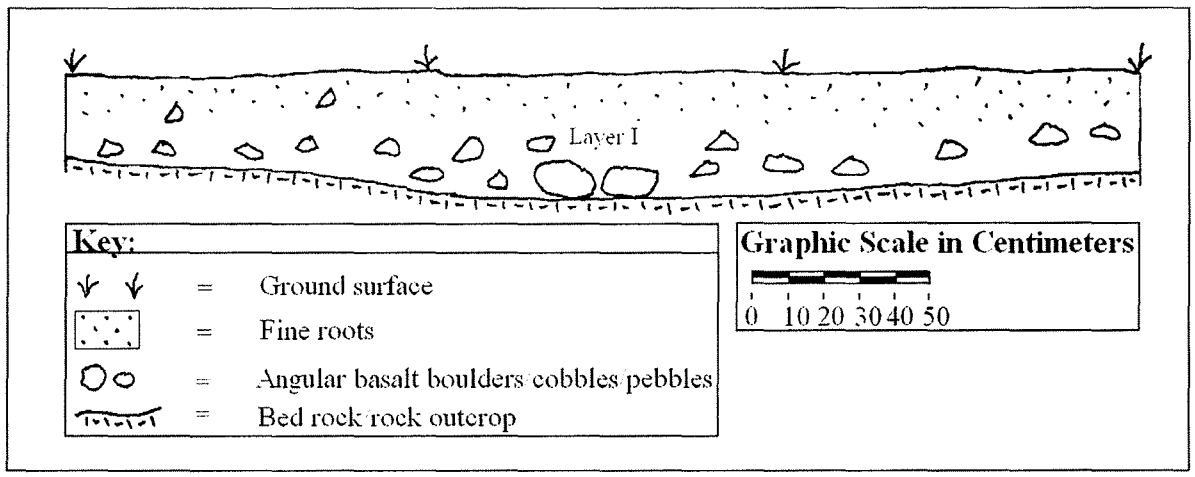

Figure 30: Profile map of the south wall of BT-1.

Photo # 35: Overview of the south wall of BT-1.

BT-3 was located approximately 240.0 meters directly west of BT-1 at the northwestern section of the northern parcel 030. BT-3 contained two stratigraphic layers, which was different from the single layer deposition identified in BT-1. BT-3 was excavated to a depth of 2.1 meters below the existing surface (Figure 31 and Photo #36). Excavation was terminated due to wet sand at the water table.

BT-3

Layer I (0 to 55 cmbs)	10YR 7/2, very pale brown; fine to medium, sand, texture; weak, medium, single grain, structure; dry consistency, loose; moist consistency, friable; wet consistency, non-sticky; plasticity, non-plastic; boundary, clear; topography, smooth; inclusions include 15% of angular basalt cobbles and pebbles; contains no cultural materials.
Layer II (35 to 210 cmbs)	10YR 7/4, pale yellow; medium, clean sand, texture; strong, medium, single grain, structure; dry consistency, loose; moist consistency, friable; wet consistency, non sticky; plasticity, non plastic; boundary, none; topography, none; inclusions include none; contains no cultural materials.

No cultural materials were discovered on the surface or in both layers of this test trench.

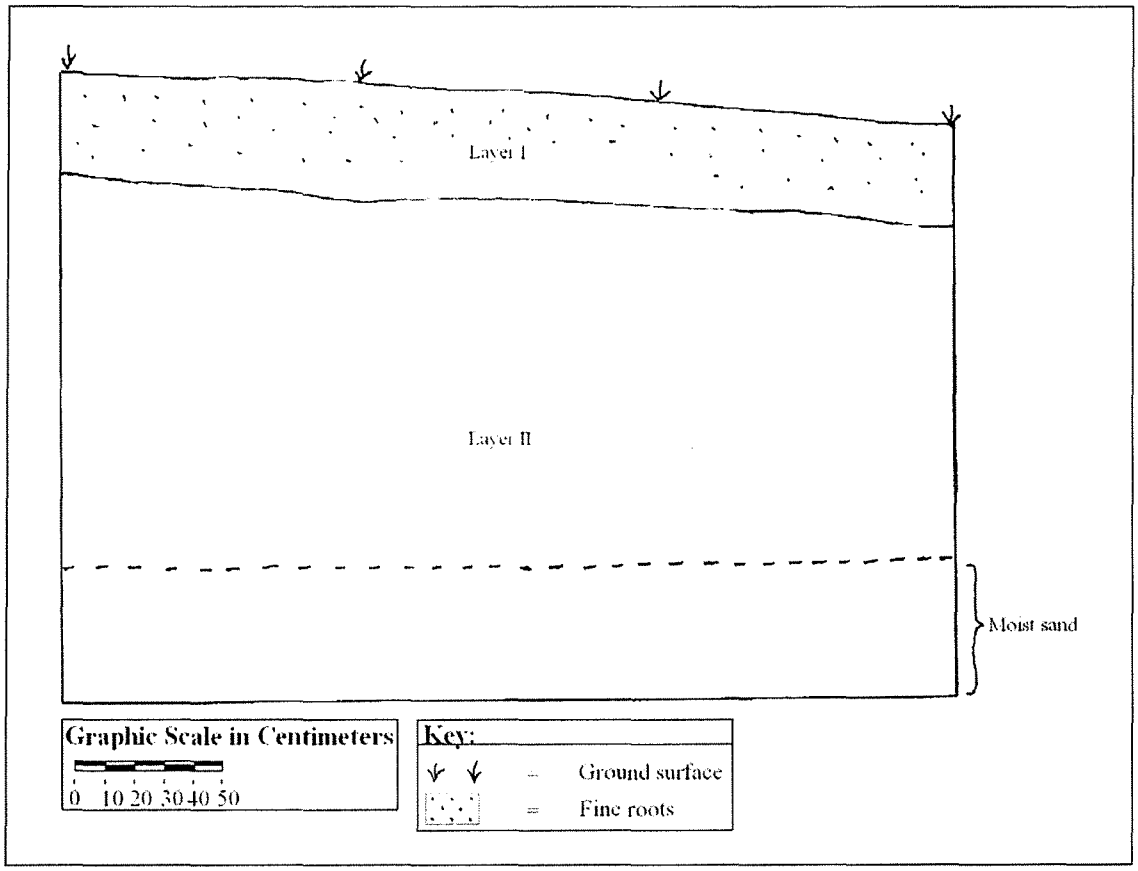

Figure 31: Profile map of the south wall of BT-3.

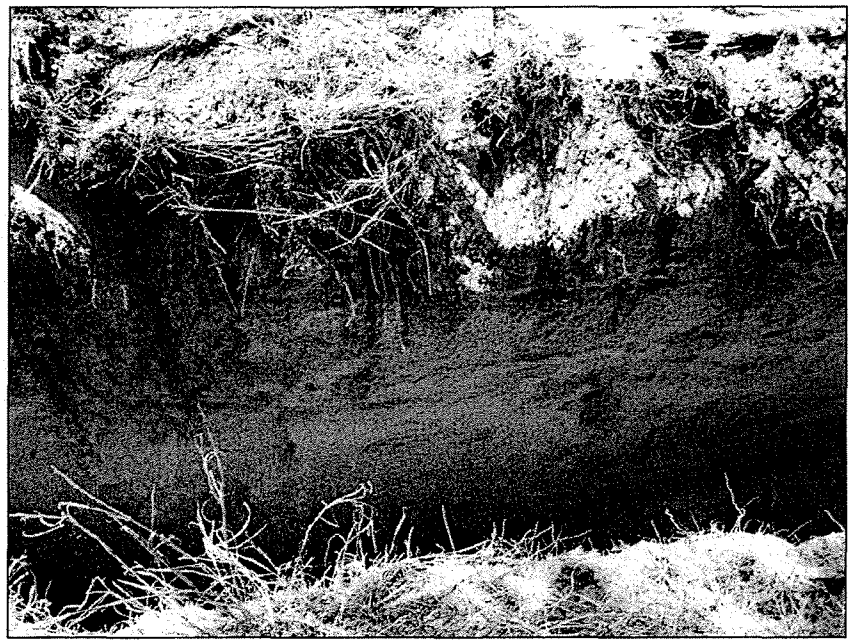

Photo # 36: Overview of BT-3 south wall profile.

BT-9 was located about 115 meters south/southeast of BT-3 in the southwestern section of the northern parcel 030. BT-3 contained two stratigraphic layers which was different from the single layer soil deposit in BT-1 (Figure 32 and Photo #37). BT-9 was excavated to a depth of 0.7 meters below the existing surface. The mechanical test trench was terminated due to wet sand from the water table and decomposing rock.

BT-9

Layer I (0 to 20 cmbs)	10YR 7/2, very pale brown; fine to medium, sand, texture; weak, medium, single grain, structure; dry consistency, loose; moist consistency, friable; wet consistency, non-sticky; plasticity, non-plastic; boundary, clear; topography, smooth; inclusions include 15% angular basalt cobbles and pebbles; contains no cultural materials
Layer II (10 to 50 cmbs)	10YR 7/4, pale yellow; medium, clean sand, texture; strong, medium, single grain, structure; dry consistency, loose; moist consistency, friable; wet consistency, non sticky; plasticity, non plastic; boundary, clear; topography, smooth; inclusions include none; contains no cultural materials

Layer III (50-70 cmbs) 5YR 3/3, dark reddish brown, fine, silty clay, texture; strong, fine, wet clump, structure; dry consistency, loose; moist consistency, friable; wet consistency, sticky; plasticity, plastic; boundary, none; topography, none; inclusions include 20% sub-angular basalt boulders/cobbles; contains no cultural materials

No cultural materials were encountered in BT-9.

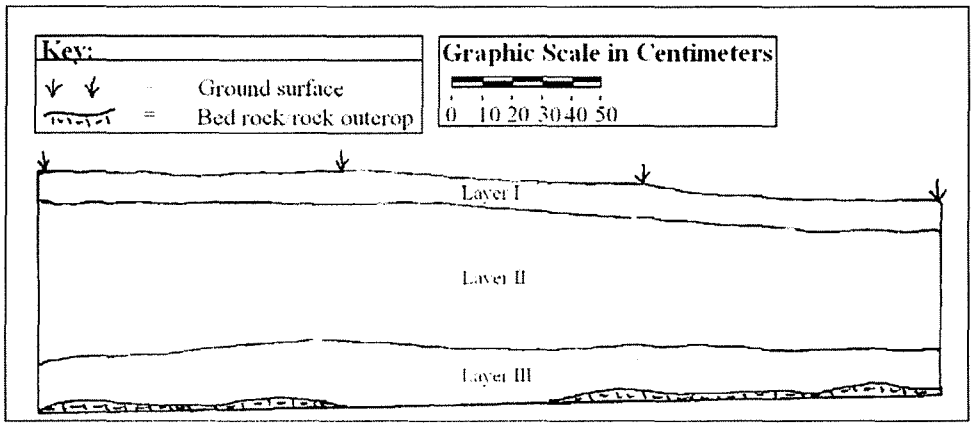

Figure 32: Profile map of the east wall of BT-9.

Photo # 37: Overview of BT-9 east profile.

In summary, three out of the nine backhoe test trenches on the northern portion of the project area contain one stratigraphic layer, five contained two layers and one had three layers. None of the nine backhoe trenches yielded any intact pre-Contact cultural deposits, which suggest that the area was not utilized or the area may have been heavily impacted during the post-Contact period. The conclusion of heavy post-Contact disturbance is also supported by the findings of post-contact building materials. It appears as if the western portion of the subject area has more sand deposits and the soil deposition is deeper in this area. The eastern section revealed shallow stratigraphy, respectively. Also, the subsurface deposits in the area mostly consisted of a single soil deposit.

BT-11, BT-12 and BT-20 are summarized as representative samples for the test trenches within the southern parcels (076 and 158). Similar to the northern parcels, the natural soil deposits are shallower in the east and get deeper and wet westward toward the shoreline. The stratigraphic layers in these BTs represent the three different subsurface deposits that were encountered during the mechanical testing. Seven of the 11 backhoe test trenches in this area had one stratigraphic layer, three test trenches contained two layers and one test trench contained four distinct layers (Table 11). Refer to **Appendix A** for additional photographs and profile maps for the BTs from the southern two parcels that are not presented in this section.

Table 11: Stratigraphic summary for Backhoe Tests, BT-10 through BT-20 on the southeast and southwest parcels

Backhoe Test #	Length	Width	Wall profile	Layer	Depth	Layer descriptions	Cultural materials
BT-10	4.0 m	0.8 m	South face wall	I	0-75 cmbs	7.5YR 2.5/3, very dark brown, very compacted, medium sandy clay, 65% of sub-angular basalt boulders/cobbles/gravels, a lot of fine roots	A few of metal fragments but were not collected. This is a fill layer.
				II	60-115 cmbs	Mottled with different colors, 10YR 3/1, very dark gray, 10YR4/1, dark gray, fine to coarse, wet sandy silt, 10% of sub-angular basalt boulders/cobbles/pebbles	No cultural material. Terminated due to bed rock or rock outcrop.
BT-11	5.0 m	0.95 m	South face wall	I	0-20 cmbs	10YR 5/3, brown, compacted, fine to medium, silty clay, 65% of sub-angular gravels.	No cultural material. This layer is a fill layer.
				II	20-80 cmbs	10YR 5/4, yellowish brown, loose to semi-compacted, medium to coarse, sand, 3% angular basalt boulders/cobbles/pebbles and a lot of fine roots	
				III	80-110 cmbs	10YR 3/2, dark grayish brown, compacted, fine to medium, moist silty clay,	
				IV	110-155 cmbs	Mottled with different colors, 10YR 3/1, very dark gray, 10YR4/1, dark gray, fine to coarse, wet sandy silt, 10% of sub-angular basalt boulders/cobbles/pebbles	No cultural material. Terminated due to water table
BT-12	4.0 m	0.85	South face wall	I	0-50 cmbs	10YR 4/3, brown, semi-compacted fine to medium, silty clay, 55% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material. Terminated due to bed rock or rock outcrop.
BT-13	4.5 m	0.9 m	North face wall	I	0-85 cmbs	10YR 4/3, brown, semi-compacted fine to medium, silty clay, 75% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material. Terminated due to bed rock or rock outcrop.
BT-14	4.0 m	0.8 m	East face wall	I	0-15 cmbs	10YR 3/3, dark brown, loose, medium, loamy sand, 10% of sub-angular basalt cobbles and pebbles, some fine roots	Two pieces of brick were encountered in this layer.
				II	15-50 cmbs	10YR 4/3, brown, semi-compacted fine to medium, silty clay, 75% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material. Terminated due to bed rock or rock outcrop.
BT-15	4.5 m	0.95	South face wall	I	0-120 cmbs	10YR 5/6, yellowish brown, loose to semi-compacted sand, 3% of sub-angular basalt cobbles and pebbles-water table is at the base of this BT.	No cultural material. Terminated due to water table
BT-16	5.0 m	0.85	North face wall	I	0-45 cmbs	10YR 4/3, brown, semi-compacted fine to medium, silty clay, 50% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material. Terminated due to bed rock or rock outcrop.
BT-17	4.0 m	0.9 m	North face wall	I	0-35 cmbs	10YR 4/3, brown, semi-compacted fine to medium, silty clay, 75% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material. Terminated due to bed rock or rock outcrop.

Table 11 continues.

Backhoe Test #	Length	Width	Wall profile	Layer	Depth	Layer descriptions	Cultural materials
BT-18	4.5 m	0.8 m	South face wall	I	0-50 cmbs	10YR 4/3, brown, semi-compacted fine to medium, silty clay, 55% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material. Terminated in bedrock or rock outcrop.
BT-19	4.0 m	0.85	East face wall	I	0-45 cmbs	10YR 4/3, brown, semi-compacted fine to medium, silty clay, 55% of angular basalt boulders/cobbles/pebbles, a lot of fine roots	No cultural material. Terminated in bedrock or rock outcrop.
BT-20	4.0 m	0.9	North face wall	I	0-40 cmbs	10YR 3/2, very dark grayish brown, loose, fine to medium sandy silt, 3% of sub-angular basalt cobbles	No cultural material
				II	30-80 cmbs	7.5YR 3/2, dark brown, semi-compacted, wet sandy clay, 30% of sub-angular basalt boulders/cobbles and pebbles	No cultural material, terminated in the water table.

BT-11, BT-12 and BT-20 (continued). BT-11 was excavated at the southern section of the southwest parcel. BT-11 contains four stratigraphic layers and was excavated down to a depth of 1.55 meters below the surface (Figure 33 and Photo #38). It was terminated at the water table.

BT-11

Layer I (0 to 20 cmbs)	10YR 5/3, brown; fine to medium, silty clay, texture; moderate, medium, single grain, structure; dry consistency, compacted; moist consistency, friable; wet consistency, slightly sticky; plasticity, slightly plastic; boundary, clear; topography, wavy; inclusions include roots and other organic materials, and 65% sub-angular basalt gravels, contains no cultural material.
Layer II (20 to 80 cmbs)	10YR 5/4, yellowish brown; medium to coarse, sand, texture; weak, medium, single grain, structure; dry consistency, loose to semi-compacted; moist consistency, loose; wet consistency, non-sticky; plasticity, non-plastic; boundary, clear; topography, smooth; inclusions include roots, and 3% sub-angular boulders and cobbles; contains no cultural materials.
Layer III (80-110 cmbs)	10YR 3/2, dark grayish brown; fine to medium, silty clay, texture; slightly hard, medium, clump, structure; dry consistency, compacted; moist consistency, firm; wet consistency, slightly sticky; plasticity, slightly plastic; boundary, clear; topography, smooth; inclusions none; contains no cultural materials.
Layer IV (110-155 cmbs)	Mottled with different colors, 10YR 3/1, very dark gray; 10YR 4/1, dark gray fine to coarse, sandy silt, texture; slightly hard, medium, clump, structure; dry consistency, compacted; moist consistency, firm; wet consistency, slightly sticky; plasticity, slightly plastic; boundary, none; topography, none; inclusions includes 10% of sub-angular basalt boulders/cobbles/pebbles; contains no cultural materials.

No cultural materials were discovered during the test trench excavation of BT-11. It appears that this portion of the project area may have been filled at some time in the past, perhaps during the construction of the adjacent Azeka's Shopping Complex.

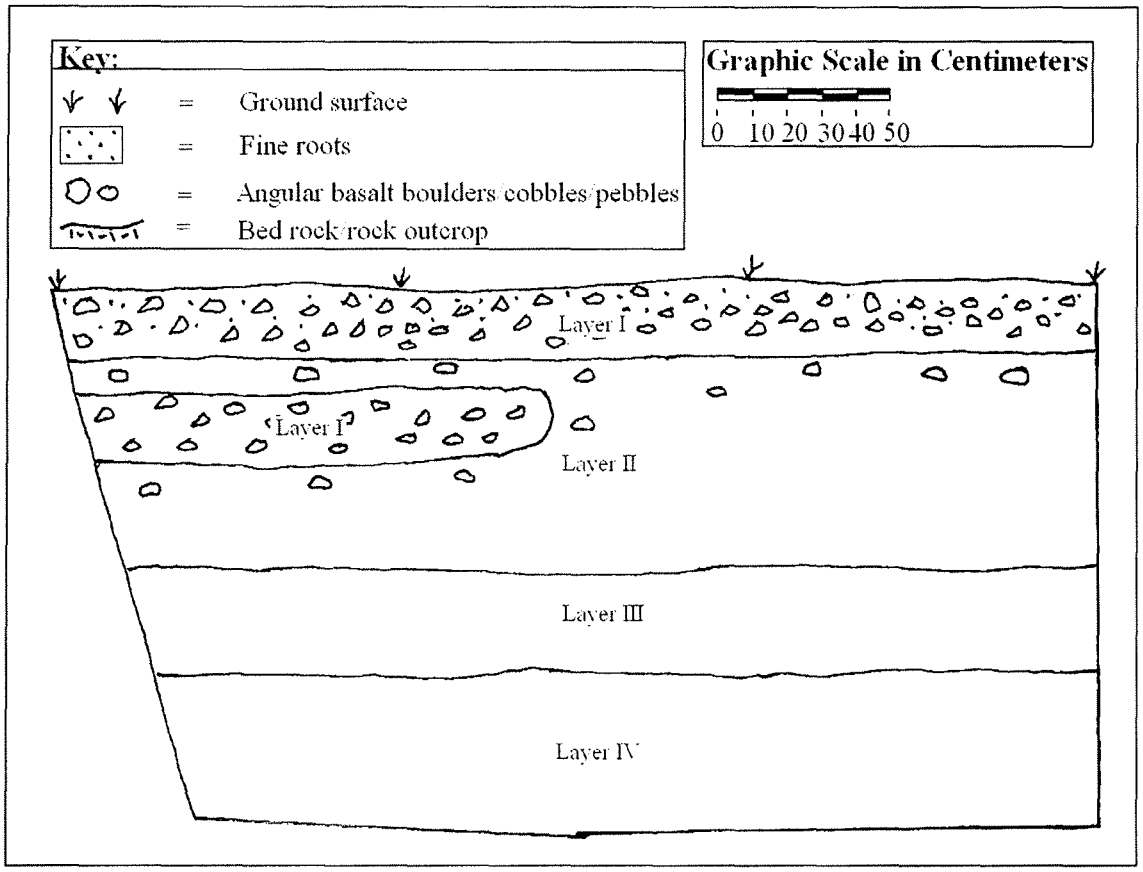

Figure 33: Profile map of the south wall of BT-11.

Photo # 38: Overview of BT-11 south wall.

BT-12 was excavated at the northeast portion of the southeast parcel. It contained one stratigraphic layer down to a depth of 0.5 meters below the existing surface. The test excavation was terminated at decomposing rock at the base (Figure 34 and Photo #39).

BT-12

Layer I (0 to 50 cmbs)	10YR 4/3, brown; fine to medium, silty clay, texture; moderate, medium, single grain, structure; dry consistency, compacted; moist consistency, friable; wet consistency, slightly sticky; plasticity, slightly plastic; boundary, none; topography, none; inclusions include roots and other organic materials, and 55% sub-angular basalt gravels, contains no cultural material

No cultural materials were identified and excavation terminated at decomposing rock.

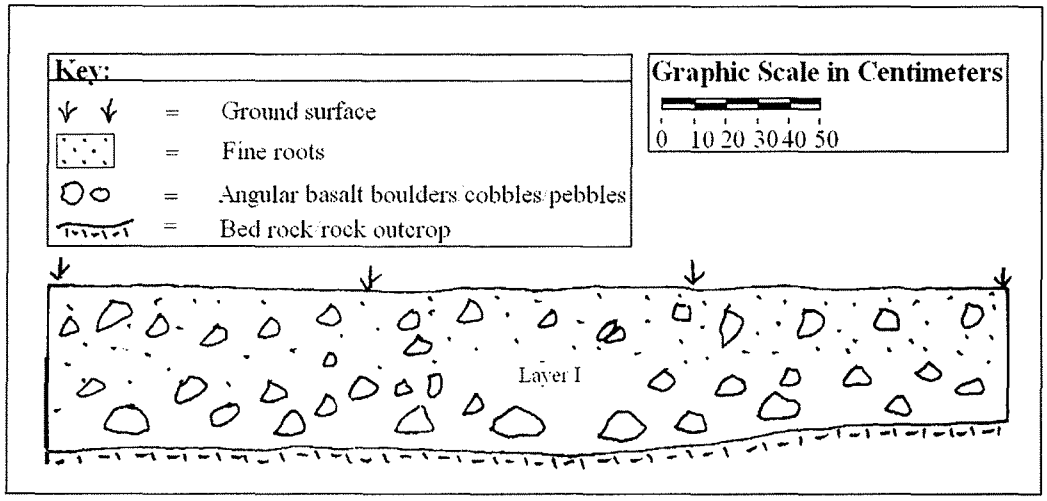

Figure 34: Profile map of the south wall of BT-12.

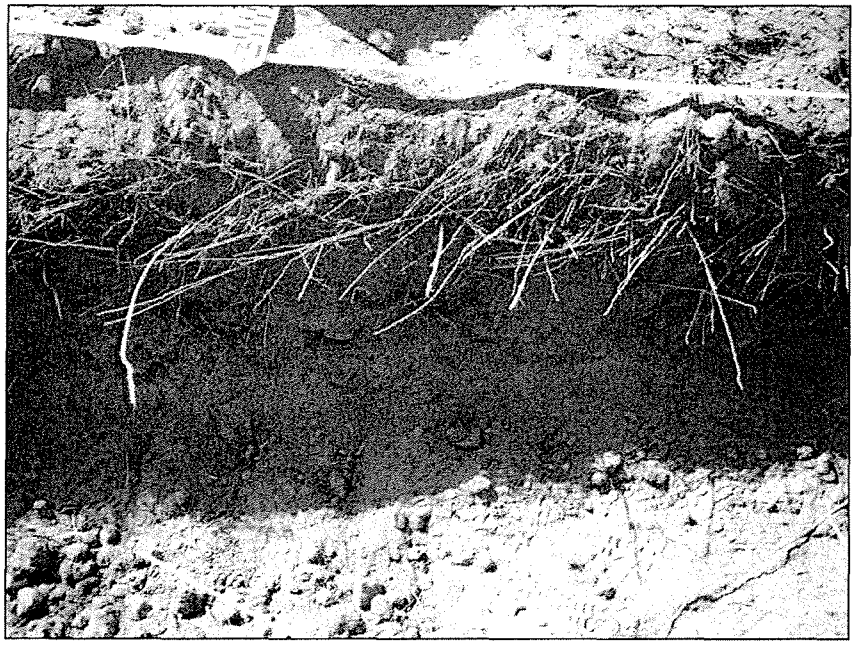

Photo # 39: Overview of BT-12 south wall.

BT-20 was placed at the southwest section of the southeast parcel. BT-20 revealed two stratigraphic layers and was excavated to a maximum depth of 0.8 meters below the existing surface (Figure 35 and Photo #40). The test trench excavation terminated due to wet sandy clay at the water table.

BT-20

Layer I (0 to 40 cmbs) — 10YR 3/2, very dark grayish brown; fine to medium, sand silt, texture; moderate, medium, single grain, structure; dry consistency, compacted; moist consistency, friable; wet consistency, slightly sticky; plasticity, slightly plastic; boundary, clear; topography, smooth; inclusions include roots and other organic materials, and 3% sub-angular basalt gravels, contains no cultural material.

Layer II (30 to 80 cmbs) — 7.5YR 3/2, dark brown; medium to coarse, sandy clay, texture; weak, medium, single grain, structure; dry consistency, semi-compacted; moist consistency, loose; wet consistency, slight sticky; plasticity, slight plastic; boundary, none; topography, none; inclusions include roots, and 30% sub-angular boulders and cobbles; contains no cultural materials.

No cultural materials were encountered in both layers of this BT. There were some sub-angular basalt boulders in Layer II. This BT was terminated due to the water table at the base.

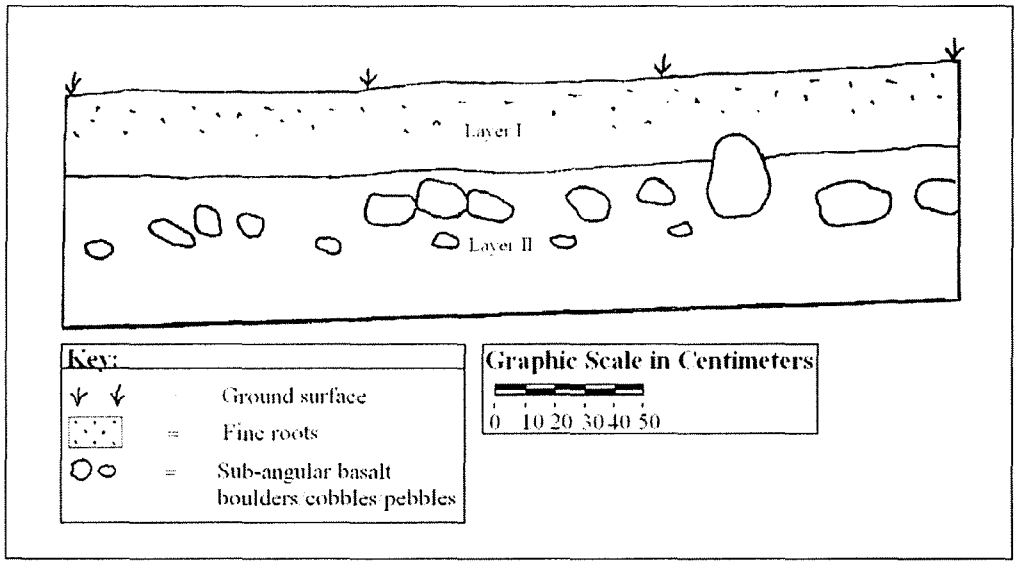

Figure 35: Profile map of the north wall of BT-20.

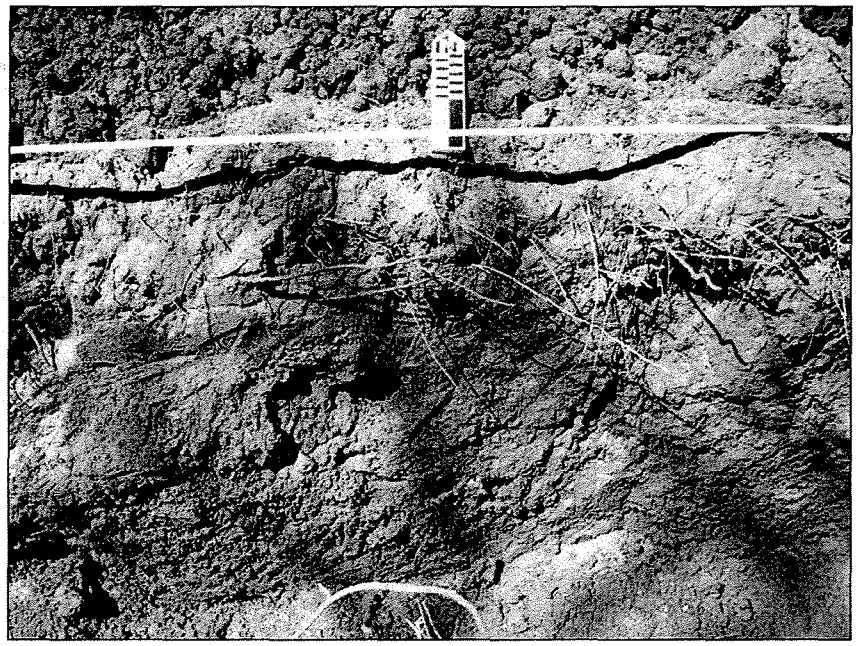

Photo # 40: Overview of BT-20 north wall.

Generally, there were three different stratigraphic layers noted during the subsurface testing of the southeast and southwest sections. Relatively recent modern debris was identified in BT-10 and BT-14. None of the eleven backhoe trenches yielded any significant cultural deposits, which suggest this area may have been heavily impacted during more recent times.

Summary and Interpretation

Site Summary

Two Statewide Inventory of Historic Places (SIHP) site numbers were assigned within the current subject area during the course of this archaeological inventory survey. One site with two features is interpreted as a post-Contact (Site -6669), and the other determined a probable pre-Contact traditional Hawaiian habitation area (Site -6670).

Post-Contact Permanent Habitation

SIHP 50-50-04-6669 is a remnant of a post-Contact habitation feature documented within the subject area. This probable permanent habitation feature is comprised of a crude and low-lying rock wall built between three aligned concrete posts and piers. This rock wall with concrete piers is probably associated with the former residential structure that was located within the project area.

Pre-Contact Temporary Habitation

SIHP 50-50-04-6670 Features A and B consist of two traditional Hawaiian habitation features that were discovered and documented during the archaeological inventory survey. The newly identified temporary habitation sites consist of two areas of surface and subsurface traditional cultural material remains. The cultural materials include a variety of artifacts and manuports including marine shell midden, sea urchin, crab shell, coral fragments, basalt flakes, and volcanic glass.

Conclusion

Results of the archaeological inventory survey of the subject area generally conform to the expectations derived from the historical and archaeological background research. As mentioned in the predictive model, it was expected that there was a slight possibility that the survey might identify human burial features. However, there were no burials identified during the fieldwork. This does not negate the possibility that burial features may still be contained within untested portions of the project area.

Other predictions included the possibility of the identification of traditional Hawaiian agricultural sites as well as temporary habitation sites, and post-Contact

commercial agriculture and habitation sites. The subject area has been previously impacted from natural erosion, mechanical bulldozing activities, as well as animal and human impacts; however, pre- and post-Contact habitation sites were identified within the perimeters.

Significance and Recommendations

Significance Evaluations

The two archaeological sites identified and documented during this archaeological inventory survey are subject to the Secretary of Interior standards established for the State and National Register of Historic Places. According to these rules, a site must possess integrity of location, design, setting, materials, workmanship, feeling and association and shall meet one or more of the following criteria:

- Criterion "a"—Be associated with events that have made an important contribution to the broad patterns of our history;
- Criterion "b"—Be associated with the lives of persons important in our past;
- Criterion "c"—Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- Criterion "d"—Have yielded, or is likely to yield, important information for research on prehistory or history;
- Criterion "e"—Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts.

The archaeological inventory survey was designed and completed to meet the Department of Land and Natural Resources-SHPD recommendations and various county guidelines including subdivision or other types of permits. All of the features documented during this Archaeological Inventory Survey qualify for significance under Criterion "d" for information content.

SIHP 50-50-04-6669 is significant under Criterion "d" because it has yielded information important to the history of the area. This site consists of a post-Contact habitation feature possibly associated with the plantation and/or ranching eras.

SIHP 50-50-04-6670 Features A and B are significant under Criterion "d" for their information content, and are important to the history of Hawai`i. This site is interpreted as a pre-Contact traditional Hawaiian temporary habitation site based on the surface and subsurface ancient traditional Hawaiian cultural material remains.

Recommended Treatment

SIHP 50-50-04-6669 consists of a low-lying rock wall with associated concrete block foundations. The site has been identified, documented, and assessed during this study. No further investigative archaeological work is recommended for the site at this time. Because of the possibility of subsurface cultural remains, archaeological monitoring is recommended for any potential future ground alterations planned for the surrounding areas (Table 12).

SIHP 50-50-04-6670 Features A and B consist of concentrated cultural material scatters and subsurface remains. The features of this site are situated on a flat to gentle slope on the southeast parcel. This site has been identified, documented, and assessed during this study. Because of the possibility of subsurface cultural remains, archaeological monitoring is recommended for any potential future ground alterations planned for the surrounding areas. If necessary, data recovery is recommended for this site during archaeological monitoring (Table 12).

Recommendations with respect to plans for potential changes to the subject area include consideration to the location of the sites within the subject area. Again, no further investigative archaeological fieldwork is recommended for the surveyed portion of the subject area at this point in time, archaeological monitoring is recommended. This precautionary archaeological monitoring recommendation is deemed appropriate, in the event subsurface features and/or human remains are inadvertently encountered. An archaeological monitoring plan shall be prepared in accordance with HAR Chapter 13-13 279.

Table 12. Recommended Archaeological Mitigation

State Site #	Feature designation	Feature type	Function	# of features	Significance	Recommended treatment
50-50-04-6669		Rock wall	Habitation	1	"d"	Archaeological Monitoring
50-50-04-6670	A and B	Surface scatters with subsurface deposit	Temporary Habitation	2	"d"	Data Recovery during Archaeological Monitoring

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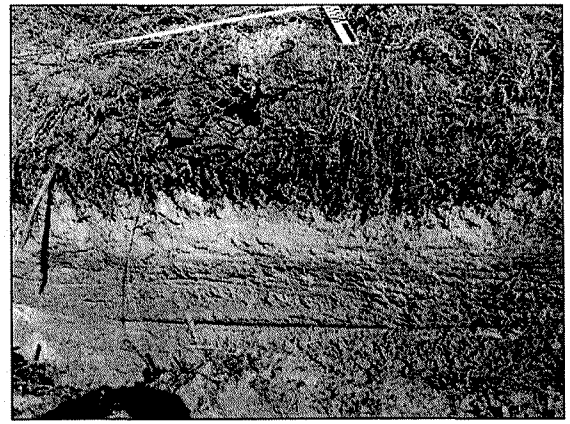
Appendixes

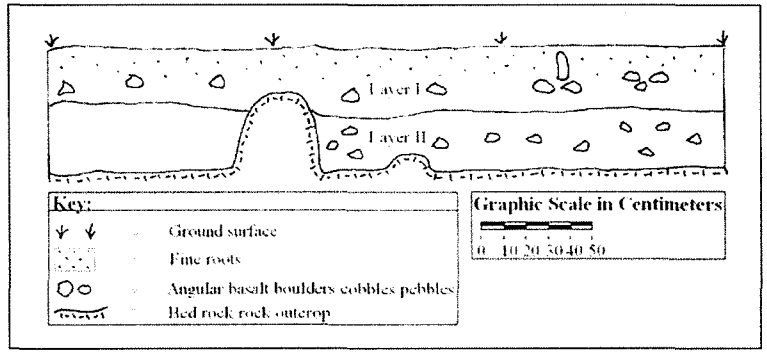
Appendix A Backhoe Test Trench Photographs and Figures: Addition to the Field Results and Backhoe Test Results Sections.

Photographs and Profile maps of Backhoe Test Trenches on the project area

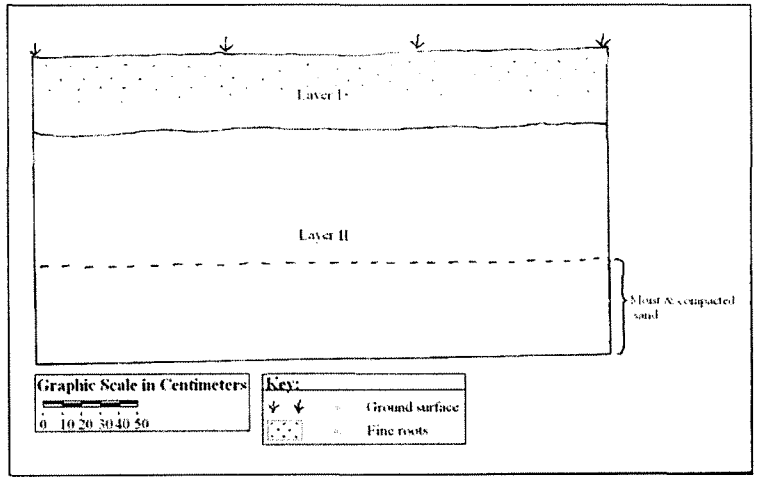
Overview of the north face wall of BT-2



Overview of the north face wall of BT-4



Profile map of the north face wall of BT-2



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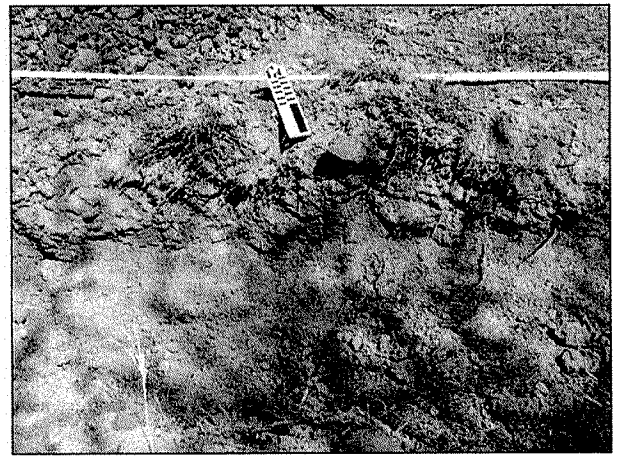

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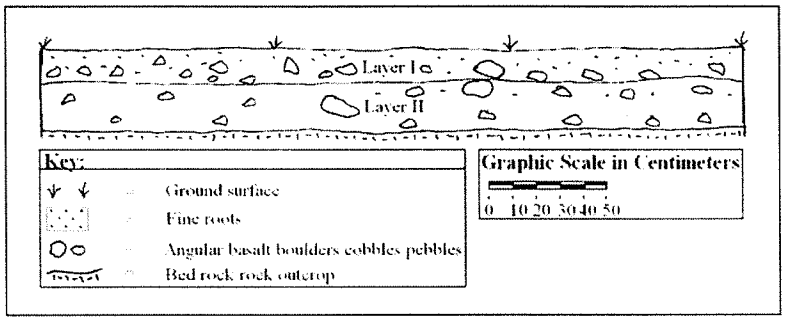

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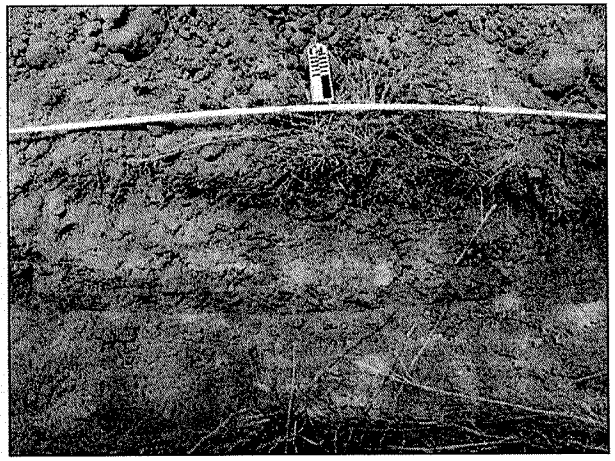

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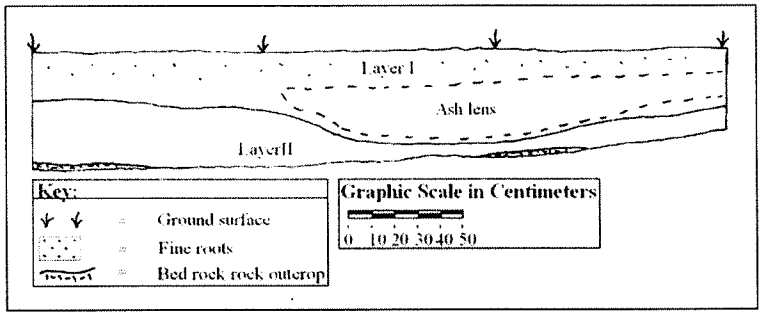

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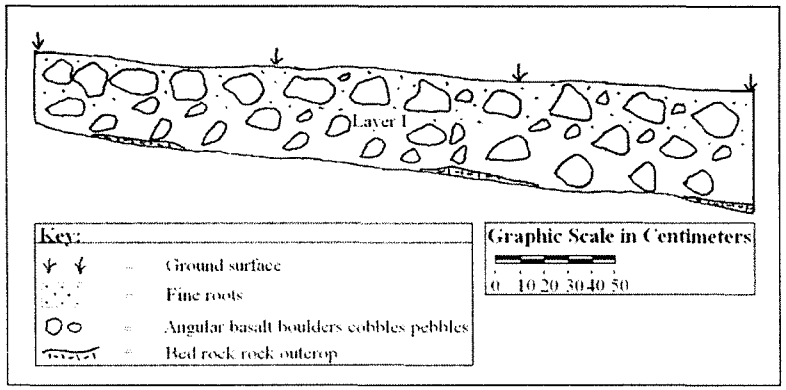
Overview of the west face wall of BT-7



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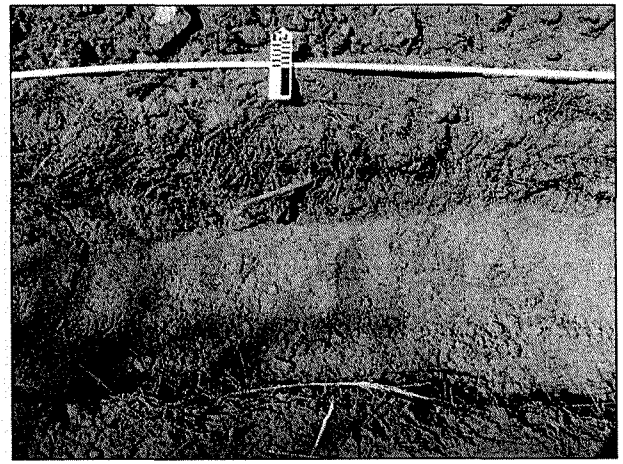

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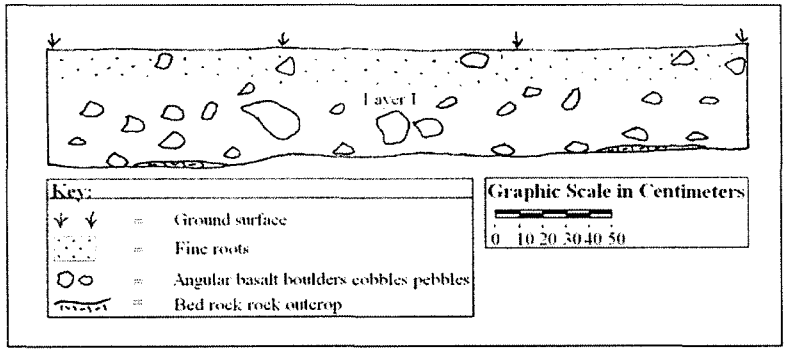

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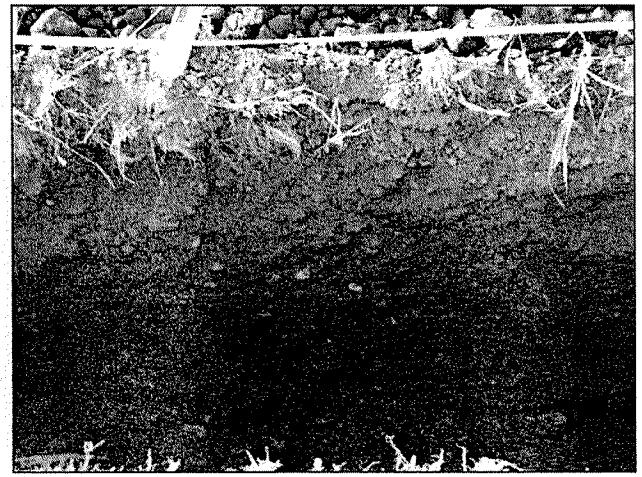

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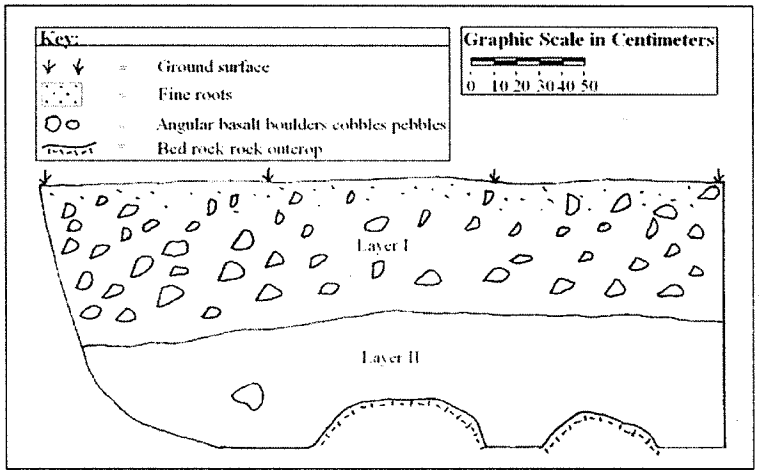
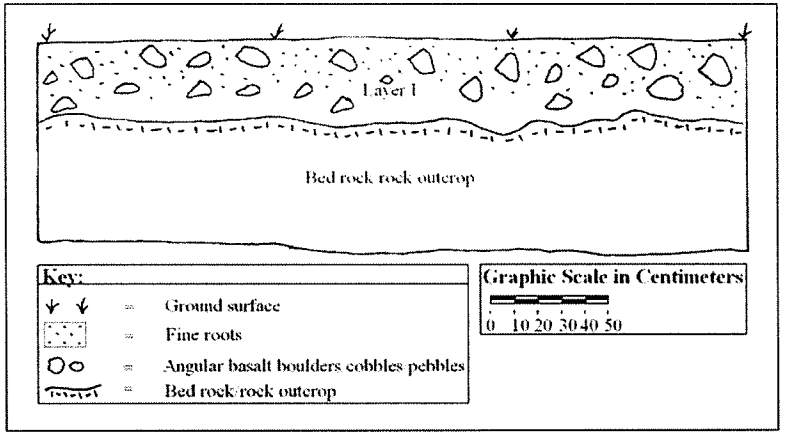


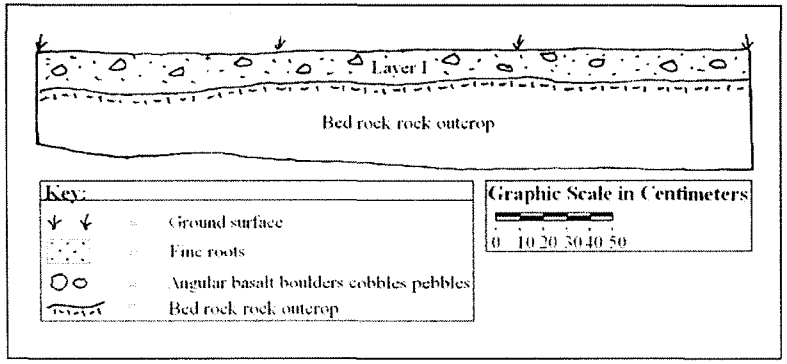
Profile map of the south face wall of BT-10

Overview of the north face wall of BT-13



Profile map of the north face wall of BT-13

Overview of the east face wall of BT-14



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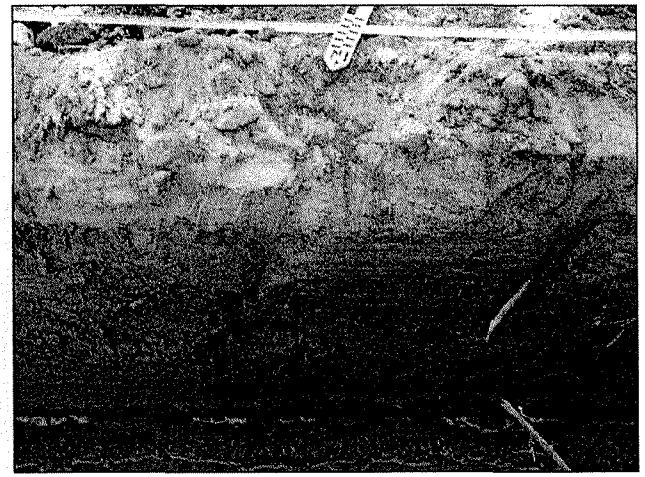

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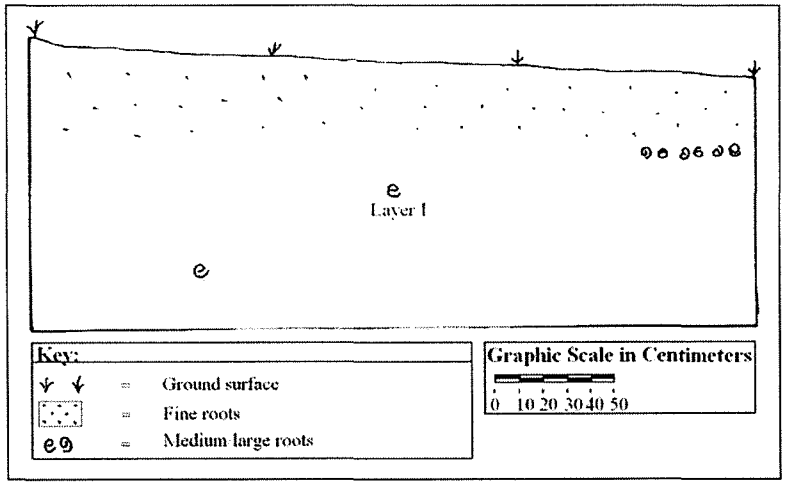

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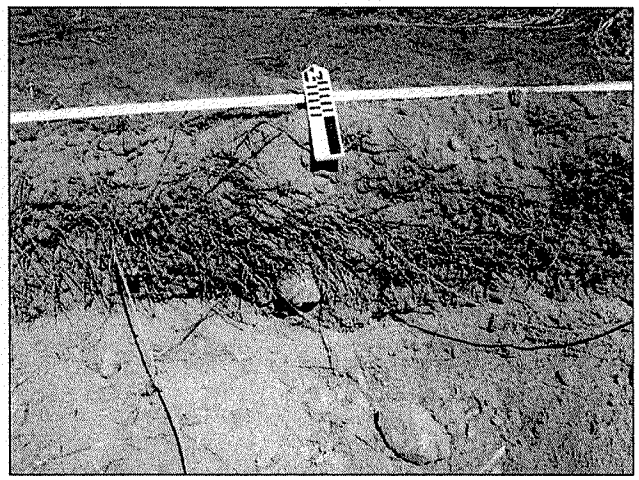

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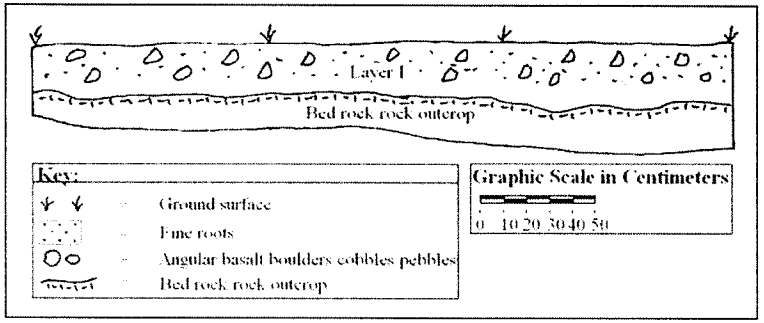

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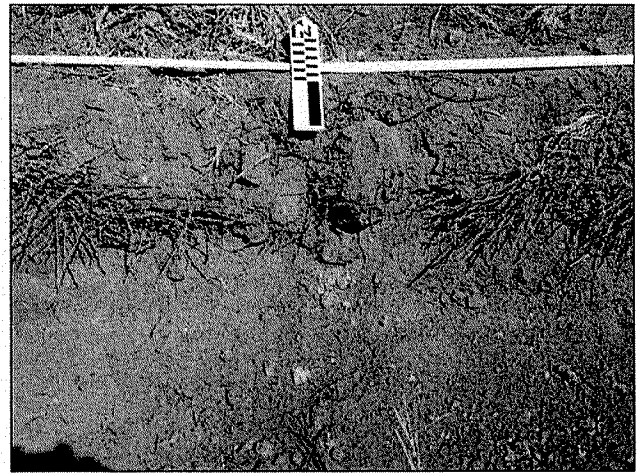

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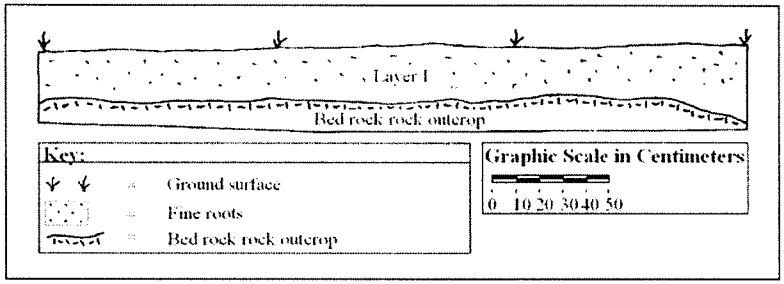

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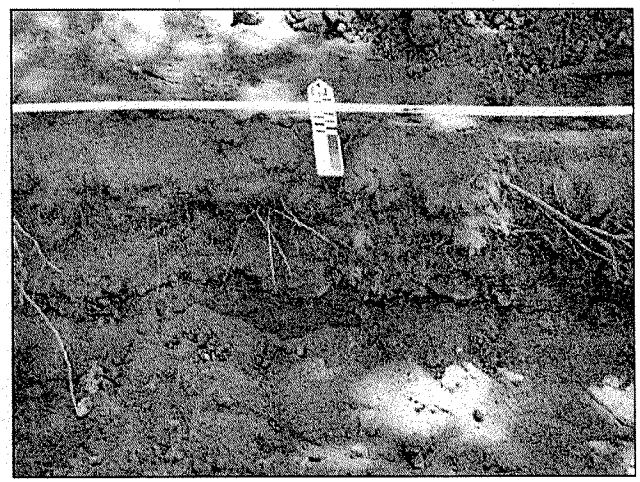

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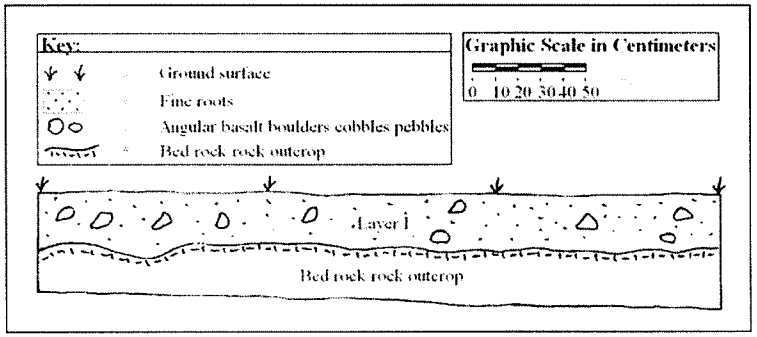

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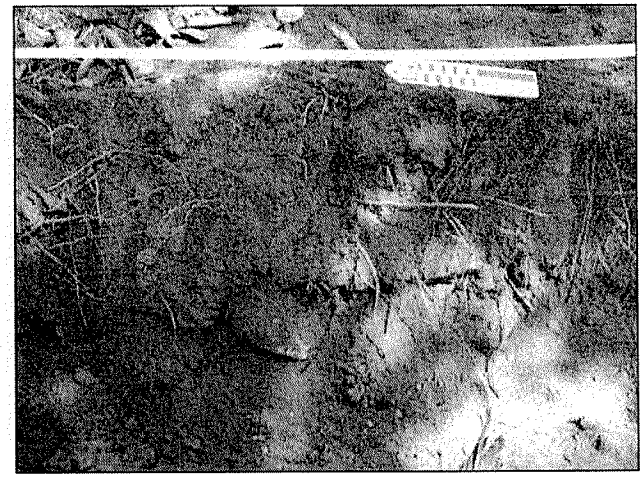
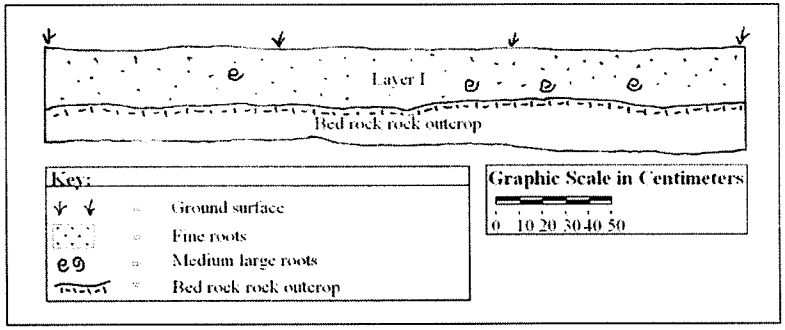


Overview of the east face wall of BT-19



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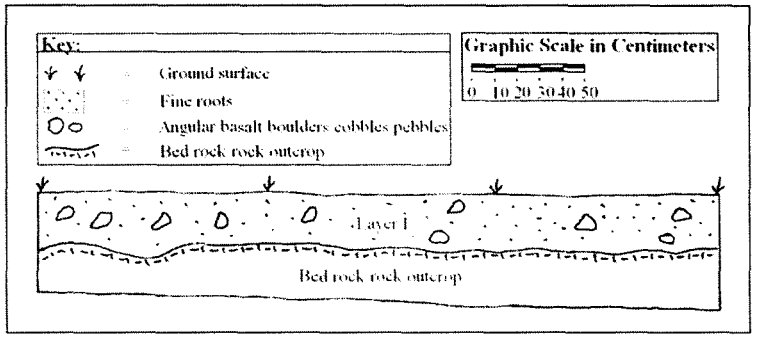

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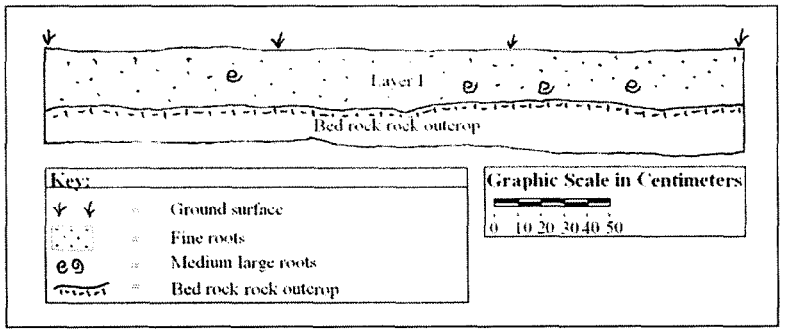

Profile map of the east face wall of BT-19

APPENDIX F-1.

State Historic Preservation Division Acceptance Letter, Dated March 15, 2011

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY KAULUKUKUI
INTERIM FIRST DEPUTY

WILLIAM M. TAM
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

March 15, 2011

Erik M. Fredericksen
Xamanek Researches, LLC
PO Box 880131
Pukalani, Hawaii 96788

LOG NO: 2011.0611
DOC NO: 1103MD34
Archaeology

Dear Mr. Fredericksen:

SUBJECT: Chapter 6E-42 Historic Preservation Review –
Archaeological Inventory Survey of 23.937 Acres with Two New Sites
Waiohuli-Kēōkea Ahupua'a, Wailuku District, Island of Maui
TMK: (2) 3-9-002:030 (por.), 076 & 158

This letter summarizes our review the aforementioned revised report (Pickett, Fredericksen and Madeus, November 2010; *Archaeological Inventory Survey of 23.9746 Acres in Kīhei at Waiohuli-Kēōkea Beach Homestead, Waiohuli-Kēōkea Ahupua'a, Wailuku District, Island of Maui, TMK [2] 3-9-002: 030 (por.) 076 and 158; XRL*), which we received on March 4, 2011.

Fieldwork occurred between late September and mid-December 2009. This report documents the findings from 20 mechanically-excavated backhoe trenches, 11 hand-excavated test units and 8 manual shovel-test units. Two new sites were documented: SIHP 50-50-04-6669 (a concrete and rock post-Contact house foundation segment) and -6670, pre-Contact artifact scatter interpreted as remnants of a temporary habitation site. Both sites are recommended as significant under HRHP Criterion "d."

We concur with the recommended significance assessments, and also for precautionary archaeological monitoring during future subsurface work. We previously reviewed an earlier draft of this report and requested revisions (*Log No. 2010.2832, Doc No. 1010MD10*). These have been adequately addressed. We look forward to reviewing an archaeological monitoring plan for these parcels.

This report is accepted as final pursuant to HAR §13-276. Upon receipt of this letter please submit one paper copy of your report marked "Final" to our Kapolei office along with a CD containing a searchable pdf version of the final report and a copy of this approval letter, marked to the attention of the Kapolei Library. If you have questions about this letter please contact Morgan Davis at (808) 243-5169 or via email to: morgan.e.davis@hawaii.gov.

Aloha,

Theresa K. Donham
Acting Archaeology Branch Chief
State Historic Preservation Division

APPENDIX G.

Cultural Impact Assessment

CULTURAL IMPACT ASSESSMENT
For the
PROPOSED KIHEI DOWNTOWN MIXED-USE PROJECT

June 2009

Hana Pono, LLC

CULTURAL IMPACT ASSESSMENT
For the

PROPOSED

KIHEI DOWNTOWN MIXED-USE PROJECT

TMK: 3-9-02:30, 3-9-02:76,3-9-02:80 & 3-9-02:158

Prepared for:
The Krausz Companies, Inc.
44 Montgomery Street, Suite 3300
San Francisco, Ca 94104

Prepared by:
Hana Pono, LLC
2275 Apala Place
Haiku, Maui, Hawai'i 96708

Kimokeo Kapahulehua, Keli'i Tau'ā &
Kainoa Horcajo

June 2009

Management Summary

Report	Cultural Impact Assessment for the proposed Kihei Downtown Mixed-Use Project; focusing in the area of Kihei, Maui, HI.
Date	June 2009
Project Location	County of Maui; City of Kihei; TMK: 3-9-02:30, 3-9-02:76,3-9-02:80 & 3-9-02:158
Ownership	The Krausz Companies, Inc.
Project Description	Downtown Kihei Mixed-Use Project
Region of Influence	Direct effect on surrounding Kihei community in the Waiohuli Ahupua'a
Agencies Involved	SHPC/DLNR, Maui County Council, Maui County Planning Department, SHPD
Environmental Regulatory Context	The undertaking is subject to both State and County zoning regulations, the Cleanwater Act, and other environmental regulations
Results of Consultation	No impacts to Hawaiian cultural practices discovered. Wetlands within the project area are a refuge for native birds such as the A'eo and the 'Auku'u. No threat in destroying habitat for native plants or animals discovered as long as the wetlands are preserved and protected as mandated by State and Federal agencies.
Recommendations	Based on our findings, Hana Pono, LLC does not feel the proposed project will have adverse affects to the native Hawaiian cultural practices. Therefore, we make no cultural recommendations at this time, other than a suggestion to meet with the community and dialogue to address their individual concerns as outlined in the conclusion of this report.

Cover Photo: Map from Google Maps with project area highlighted yellow.

Cultural Summary

The Krausz Companies' is proposing a Downtown Kihei mixed-use project located in the ahupua'a (land area) of Waiohuli encompassing 12 acres mauka (upland) of South Kihei Road, north of Līpoa and spanning Pi'ikea Street. The proposal is to construct a mixed-use, village concept downtown district with retail, office, and restaurant space with residential condominiums above.

The project is located in the makai (ocean-side) portion of the moku (district) of Kula in the ahupua'a of Waiohuli. This moku runs from Hōkū'ula in the north to Kamaole in the south. The southern geographical border is Keawekapu along the coast. Close to the border of the ahupua'a of Keokea the proposed project area has been covered in kiawe trees for quite some time.

In the makai part of the property are two wetland areas that must be protected and preserved. These now perennial wetlands are some of the last remaining areas in the Kihei area and a refuge for the native A'eo and the Auku'u. In ancient times Kihei had many more wetlands, which through the devastation of the upper elevation forests were filled in with silt and overgrown.

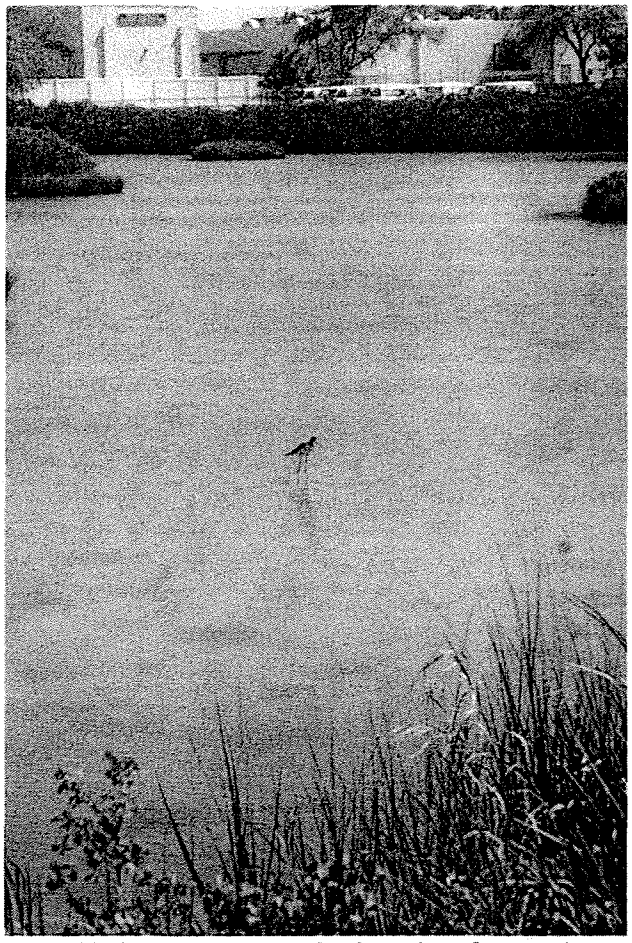

Figure 1: Native A'eo in the wetland portion of the project area

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Introduction

At the request of David Pyle, Vice President of The Krausz Companies, Inc., Hana Pono, LLC has completed a DRAFT report for the Cultural Impact Assessment of the proposed Kihei Downtown Mixed-use Development located at Tax Map Key numbers: 3-9-02:30, 3-9-02:76, 3-9-02:80, & 3-9-02:158. This study was completed in accordance with State of Hawai'i Chapter 343, HRS, and the State of Hawai'i Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impacts (1997).

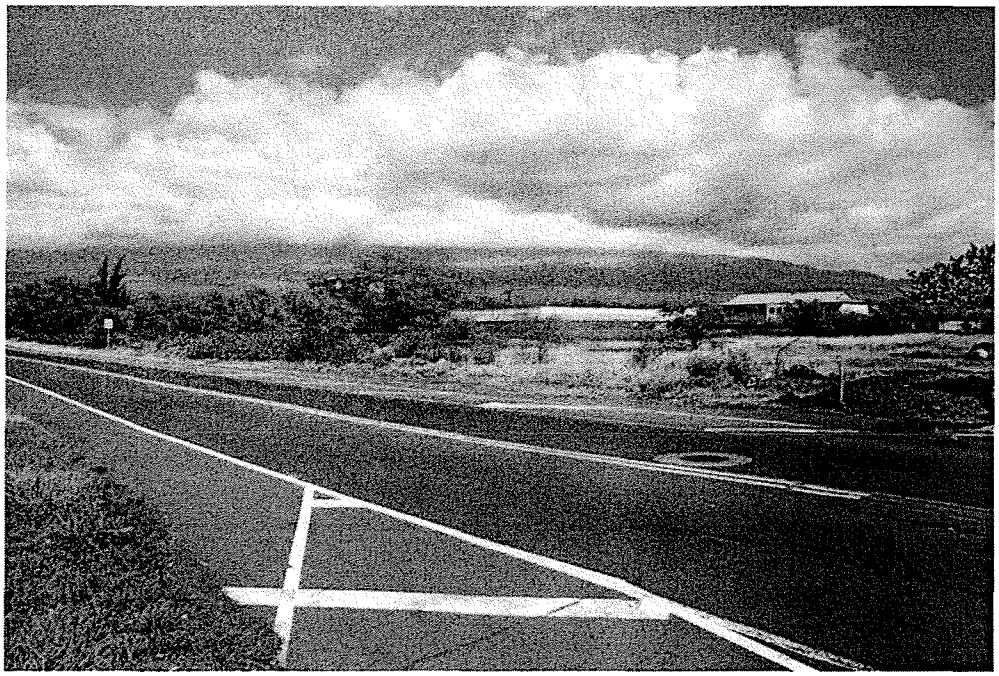

Figure 2: Corner of project site.

Guiding Legislation for Cultural Impact Assessments

It is the policy of the State of Hawaii under Chapter 343, Hawaii Revised Statutes, to alert decision makers about significant environmental effect that may occur due to actions such as development, re-development, or other actions taken on lands. Articles IX and XII of the State Constitution, other state laws, and the courts of the state require the promotion and preservation of cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups.

The Guidelines for Assessing Cultural Impacts, as adopted by the Environmental Council, State of Hawaii 1997 and enforced by the Office of Environmental Quality Control, including HAR Title 11 Chapter 200-4(a) to include, effects on the cultural practices of the community and state. Also amends the definition of "significant effect" to include adverse effects on cultural practices.

Goal and Purpose

The goal of this study is to identify any and all Native Hawaiian, traditional, historical, or otherwise noteworthy practices, resources, sites, and beliefs attached to the project area in order to analyze the impact of the proposed development on these practices and features. Consult with lineal descendents or kupuna (Hawaiian elders) with knowledge of the area in gleaning further information.

Scope

The scope will be to compile various historical, cultural and topographical accounts and facts of the project area and its adjacent ahupua'a. "The geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment...An ahupua'a is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action, particularly if it includes all of the types of cultural practices associated with the project area. In some cases, cultural practices are likely to extend beyond the ahupua'a and the geographical extent of the study area should take into account those cultural practices" (OEQC,Guidelines for Assessing Cultural Impacts, Nov 9, 1997). Data will be compiled beginning with the first migrations of Polynesians to the area, progressing through the pre-contact period of Hawaiian settlement, containing data on the post-contact period, through to the current day and any cultural practices or beliefs still occurring in the project area. Hawaiian kupuna with ties to the area will be interviewed on their knowledge of the area and its associated beliefs, practices, and resources. Additionally, any other individuals or organizations with expertise concerning the types of cultural resources, practices and belief found within the geographical area in question will be consulted.

Project Area

The project is located in the State of Hawaii, County of Maui, at Tax Map Key parcel numbers: 3-9-02:30, 3-9-02:76, 3-9-02:80, & 3-9-02:158. South Kihei Road borders the project on the west, the north-south collector road on the east, mauka (upland) of the Longs Drugs and Azeka's shopping centers, split by Pi'ikea St. down the middle. Historically, the project lies in the moku (district) of Kula and in the ahupua'a of Waiohuli, nearly abutting the ahupua'a of Keokea.

Approach & Method

The approach taken in this study was two-fold. Foremost, historical, involving as appropriate, a review of: The Great Mahele (land division of 1848), land court, census and tax records, previously published or recorded ethnographic interviews and oral histories; community studies, old maps and photographs and other archival documents. Secondly, more current event, involving oral interviews with living persons with ties, either lineal or cultural, to the project area and the surrounding region.

Objectives

The objectives of the Cultural Impact Assessment are as follows:

- to compile and identify historical and current cultural uses of the project area
- to identify historical and current cultural beliefs & practices associated with project area
- to assess the impact of the proposed action on the cultural resources, practices, and beliefs.

Tasks

Data gathered combined available written and recorded background information with the oral interviews of knowledgeable kupuna.

Archival Research

All sources of historical written data, old maps, and literature were culled for information.

Oral Interviews

Tasks completed for oral interviews included: identification of appropriate individuals to be interviewed, determination of legitimate ties to project area and surrounding region, interview recorded in writing and by digital audiocassette, transcription of interview, compilation of pertinent data.

Historical & Current Cultural Resources & Practices

Figure 3: Northern portion of project area

The island of Maui is comprised of twelve (12) traditional land districts, called moku. Each moku is made up of numerous ahupua'a, smaller land divisions wherein a self-inclusive community could find all the things needed for a satisfactory life. Usually these ahupua'a ran from the heights of the mountain peak to the edge of the outer reef like a giant pie slice, although many ahupua'a did not fit this template. As previously mentioned, the project area resides in the moku of Kula and the ahupua'a of Waiohuli. Handy relates that, "Kula was always an arid region, throughout its long, low seashore, vast stony kula (open country) lands and broad uplands. Both on the coast, where fishing was good, and on the lower westward slopes of Haleakalā a considerable population existed" (ESC Handy, 114). The moku of Kula is so called for its kula lands, kula meaning broad open expanses, likened to pasture land by the ranchers of the last century.

The coastal expanse of Kula, now referred to as Kihei town, was at one point home to many fresh and brackish wetlands. With the deforestation of the upper Kula area for farming and ranching, rainwater was less able to filter into the ground and recharge the ponds near the coast. The Honolulu Star-Bulletin and Advertiser reported in 1962, "a secondary result of the clearing of the Kula forests, he said, was the destruction of extensive fresh water ponds in Kihei, on the Mā'alaea Bay coast below Kula. When the

forest was cleared, water was free to rush down the mountain, carrying soil from Kula to the coast and filling with mud the ponds for which Kihei was once famous" (Sterling, 245).

First migrations

Traditional stories start with the creation chant called "Kumulipo." The Kumulipo brings darkness into light. Embedded in this all-encompassing chant includes the tale of the coming of the Hawaiian Islands through the mythical stories of Pele and another demigod named Maui who, with his brothers, pull up all the islands from the bottom of the sea. The latest and last physical appearance of Pele occurred as late as mid-1800s when the Fire Goddess flowed from the top of the southern slopes of Haleakalā down through Honua'ula and landing at the surf of Mākena and Wailea. In the Hawaiian Annual published by Thomas Thrum and James Dana's "Characteristics of Volcanoes", are reported Father Bailey's statements of his oral interviews explaining that the last flow had occurred in 1750 (Sterling 1998: 228). Many of the lava flows in the summit depression and in the Ulupalakua to Nu'u area were dark black and bare 'a'ā (rough, jagged type of lava landscape). The two freshest lava flows run near La Perouse Bay. The upper flow broke out of a fissure near Pu'u Mahoe and the lower flow broke out at Kalua o Lapa cone. Both flows contain large balls or wrapped masses of typical 'a'a found throughout Hawai'i.

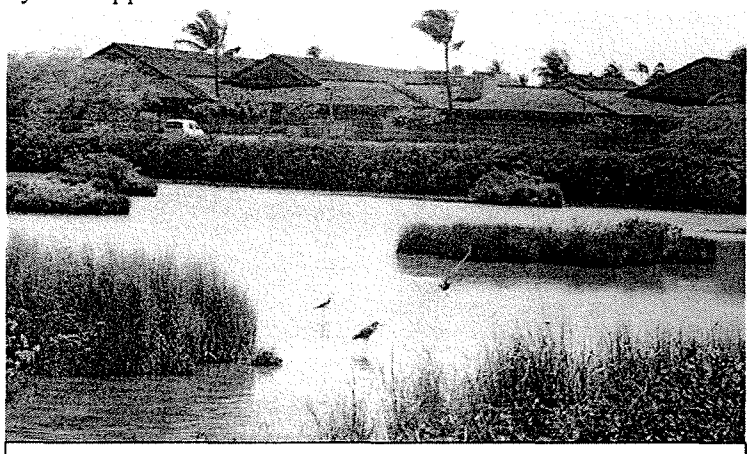

Figure 4: Wetlands in project area with A'eo and Auku'u flying

The occupation of the Hawaiian archipelago after its mythical creation came in distinct eras starting around 0 to 600 A.D. This was the time of migrations from Polynesia, particularly the Marquesas. Between 600 and 1100 A.D. the population in the Hawaiian Islands primarily expanded from natural internal growth on all of the islands. Through the course of this period the inhabitants of the Hawaiian Islands grew to share common ancestors and a common heritage. More significantly, they had developed a Hawaiian culture and language uniquely adapted to the islands of Hawai'i which was distinct from that of other Polynesian peoples (Fornander 1919: 222).

Between 1100 and 1400 A.D., marks the era of the long voyages between Hawai'i and Tahiti and the introduction of major changes in the social system of the Hawaiian nation. The chants, myths and legends record the voyages of great Polynesian chiefs and priests, such as the high priest Pa'ao, the ali'inui (Head Chief) Mō'ikeha and his sons Kiha and La'amaikahiki, and high chief Hawai'iloa. Traditional chants and myths describe how these new Polynesian chiefs and their sons and daughters gradually appropriated the rule over the land from the original inhabitants through intermarriage, battles and ritual

sacrifices. The high priest Pa'ao introduced a new religious system that used human sacrifices, feathered images, and enclosed heiau (temples) to facilitate their sacred religious practices. The migration coincided also with a period of rapid internal population growth. Remnant structures and artifacts dating to this time suggest that previously uninhabited leeward areas were settled during this period. The target area of study is in Kula, named for the open plains found in this land.

Settling of Kula Moku & Ahupua'a

With its gentle and open white sand beaches, the coastal areas of Kula were surely a favorite location for fisherman and their families. Accounts tell of a large population on the coast with much bounty from the ocean, not only by fishing the open sea, but also by the construction of fishponds, gathering limu (seaweed), and diving for octopus and lobster. Inhabitants of this region relied on vegetable foods from other areas of the island. Possibly obtaining kalo (taro) from across the Mā'alaea plain in Waikapū and uala (sweet potato) from the mauka slopes of Haleakalā, the inhabitants of the coastal region were able to supplement their diet of fish, shellfish, and limu.

The project area rests in the ahupua'a of Waiohuli. In ancient times the surrounding areas were known for their fresh (brackish) water ponds that would fill up in times of rain and become dry during the summer months. Previously, there were many of these types of ponds that have now been filled in for development. Two of the remaining wetlands like this are located on the project area.

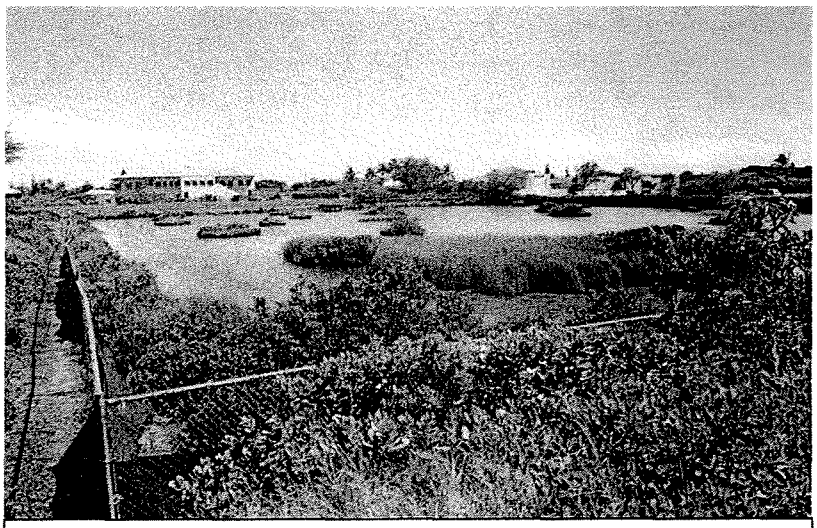

Figure 5: View of Southern wetland on project area

Place names associated with this area

Waiohuli, literally "waters of change", the changing or turning waters. The project resides in this ahupua'a that is bordered by Ka'ono'ulu to the north and Keokea to the south.

Ka'ono'ulu, the hunger or yearning for ulu (breadfruit), is so named for the ulu grown in the upper regions of this ahupua'a.

Keokea is so named for the long beaches found in this region filled with white sand. It is said that Keokea is the shortened form of Ke-one-kea.

Traditional Hawaiian Uses & Practices

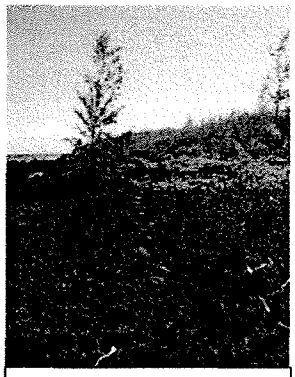

Figure 6: One of the last remaining pieces of the Alaloa trail found near Hana

The inhabitants of the coastal areas of Waiohuli sustained themselves through the bounty of the ocean. Nearby to them was the fishpond of Kalepolepo, commonly called Ko'ie'ie. Kalepolepo was built by an early Maui chief and by the 16th century King 'Umi of Hawai'i Island tasked the commoners with rebuilding the walls. Later, during the reign of Kamehameha I he rebuilt Kalepolepo again, tasking all the people of the west side of Maui to work.

Ke Alaloa o Maui, the broad highway of Maui constructed by King Pi'ilani crosses through the ahupua'a of Waiohuli on its way to Mākena and not much is mentioned of this area besides Kalepolepo pond and the dryness of the area.

Post-Contact Historical Uses & Practices

It was near Kalepolepo and the shoreline north of the project area that Kamehameha is said to have landed his canoes for his invasion of Maui. Kamehameha had previously been beaten by the forces of Maui because of their furious use of the ma'a (sling) for which Maui's warriors were famous. But Kamehameha this time had the foreign technology of mortars, muskets, and cannons. It was here he uttered the now famous saying, "Imua e nā poki'i. He inu i ka wai 'awa'awa", forward my brothers or drink of the bitter waters. He set fire to his canoes, their only form of retreat and challenged his men to win the battle or drink the bitter water of defeat and certain death. From Kalepolepo the army of Kamehameha pushed the warriors of Maui back to the West Maui Mountains.

Figure 7: Picture depicting an aerial view of Kihei circa 1950's.

With the arrival of the foreigners came the foreign interest of making money and one of the first goods to be mass exported from the islands was the Sandalwood. Ili'ahi in Hawaiian, the sandalwood tree has a fragrance highly prized by the Chinese and entire forests were denuded in the rush to make foreign money. Many of these forests were in the upper part of the Kula moku and the deforestation of these forests was a contributor to the siltation of the brackish ponds and loko i'a (fishponds).

While the rest of the island was undergoing a radical transformation of landscape with the construction of large sugar and pineapple plantations, the Kihei area remained largely unchanged due to the lack of water. No foreign investors wanted to stake a claim to land out there knowing there was no way to water their crops. For a long time, Kihei remained the same, a few hundred Hawaiian families living off the bounty of the ocean.

In 1828 the first Catholic priest to the Hawaiian islands, Father Bachelot, brought with him from Paris a seed which he grew into a tree and planted in a church in Honolulu. Soon after the seeds of this tree were taken to all the islands and began to dominate the leeward landscape of Maui. Kiawe soon was the most prolific tree in South Maui, so much so, that the kupuna (elders) of today remember Kihei as being covered in kiawe. There was so much kiawe that they would make slippers out of old car tires, the only thing that would stop the kiawe thorn from puncturing their feet. One account from our oral interviews detailed how they would take the rubber tires off their bikes and replace it with a garden hose, wrapped multiple times and bound with wire, after getting too many flats with a regular tube tire. In the latter part of the 19th century and most of the 20th century the project area was covered in kiawe aside from the intermittent wetlands that would develop depending on tide and flooding.

Current Uses & Practices of Project Area

Currently, the formerly intermittent wetlands on the makai side (ocean side) of the property have been converted into perennial wetlands due to multiple factors. With the development of all surrounding land parcels, the larger intermittent flood plains have been paved over and the grade raised. Oral accounts detail areas surrounding the project location were formerly intermittent wetlands before the construction of shopping malls and condominiums forcing the water elsewhere. The two remaining wetlands are located in the project area. In ancient times the numerous wetlands allowed native birds to pick their favorite spots for feeding and nesting. Oral accounts of the project area do not recall a high incidence of native bird sightings. The occasional Hawaiian stilt, or A'eo, and the Auku'u would be seen, but not frequently. With the minimization of larger wetland areas, the two areas in the project location are the last bastions for many of these native birds and they are now seen with more frequency then in past times.

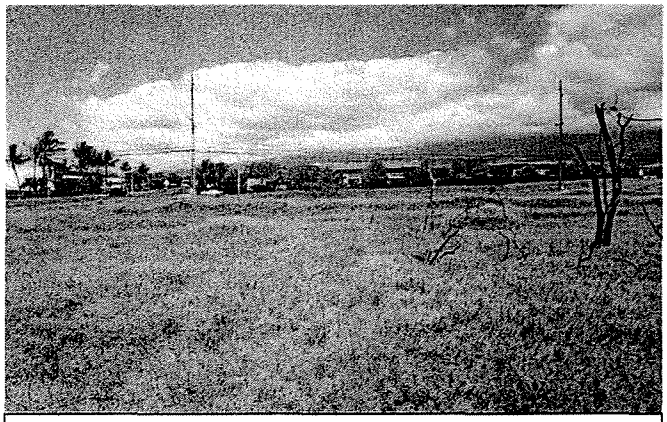

Figure 8: Southern portion of project area

Oral accounts from interviews of kupuna with historical or lineal ties to the area recall only the kiawe forests of the area. As children they would pick the beans of the kiawe tree to sell to the piggeries. One of their uncles would log the kiawe to be made into charcoal.

Synthesis of Archival, Literary, & Oral Accountings

The project area, in the moku of Kula, the ahupua'a of Waiohuli, mauka (upland) of the old road now called South Kihei Road but makai (ocean side) of the north-south collector road contains no significant cultural sites or resources save some of the last remaining wetlands in the region that serve as a resting place and refuge for native flora and fauna. The other acreage that is now in kiawe and scrub brush has been that way for the better part of two centuries, serving as a place to cut kiawe for firewood and charcoal and as access to the beach and through the property to access the lands on either side. The loko i'a (fishpond) of Kalepolepo was a significant resource for the ancient Hawaiians of this region and current efforts have been undertaken to restore the fishpond to its former glory and usefulness. Ke Alaloa o Maui, the broad highway of Maui, started by King Pi'ilani and continued by his son Kihapi'ilani runs makai (ocean side) of the project area providing access to the lands of Honua'ula and beyond. This road is now non-existent in this area and has been paved over by South Kihei road.

Conclusion

This report finds that the development of a Downtown Kihei mixed-use development on the project area encompassing the TMK's of: 3-9-02:30, 76, 80, and 158 will have no significant impact on cultural resources, practices or beliefs, either directly in the project area or the surrounding areas. As already mandated by the State and Federal agencies, care should be taken to protect and preserve the two wetland areas on the property from further encroachment. These wetlands are a refuge for native birds such as the A'eo and the Auku'u. The lands in question have been taken over by the non-native kiawe tree for the better part of two centuries and prior to that no significant cultural sites have been found or discussed by our oral interview participants.

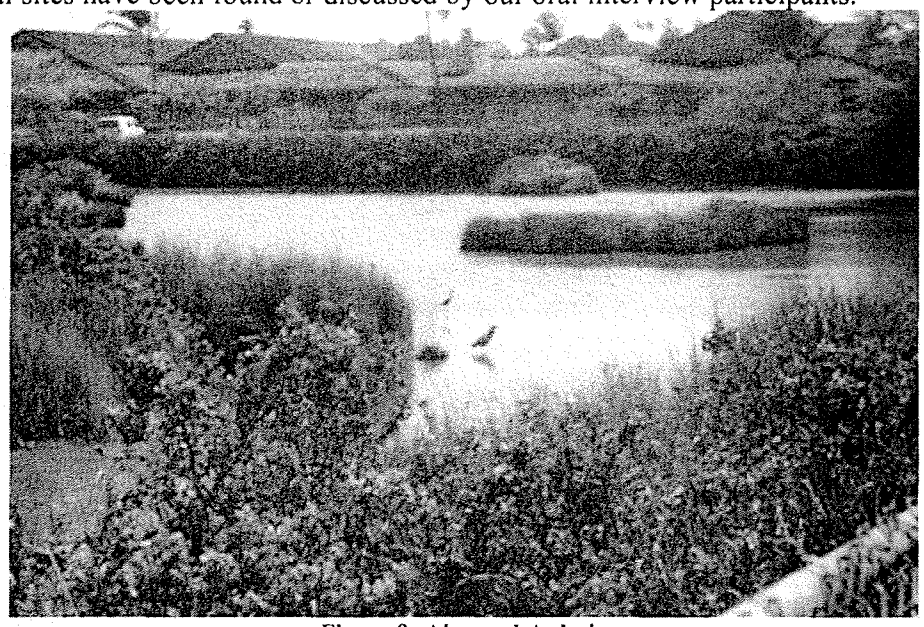

Figure 9: A'eo and Auku'u

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Interviews:

Ole Akaka
Michalene Arcangel
AnnLouise Kahalekai
Kalei Moikeha
Ku'ulei Teshima

Appendix A: Interview Transcripts

Interview: Ole Akaka

By Kimokeo Kapahulehua
April 2, 2009
KK: Kimokeo Kapahulehua
OA: Ole Akaka

KK- I am with Ole No I am with what you call that ole What your name?

OA- Akaka Ole Akaka

KK- I am with Ole Akaka and I'm in Kihei. His address is? What your address?

OA- 1700

KK- 1700

OA- Alaniu Place

KK- Alaniu Place and Ole is been in, Kihei since a child, he's 62?

OA- 63

KK- 63 years old. This residence was his dad's residence since 1947 and the dad bought 25,000 square feet at that time for $9,000.00. Which is from Alaniu place connected to the makai area of Malama Street.

OA- Halama, Halama Street

KK- Halama Street. So Ole, I just wanted to make sure that we talk about your biography. So give us a little history of your biography and the linkage to Kihei area. Particularly we talking about that Krauss project that I talked to you about, you know? At, by Long's Drugs and everything. So just give us a little bit of your background in Kihei. Here you got to talk to this.

OA- Well, I've been in Kihei since 1947 when my dad first bought here in 1947. We actually came, he was from, he was from Waikiki original beach boy with Duke Kahanamoku. My family is the Akaka, the Senator and Abraham Akaka was the Minister, they were two brothers but then we, my dad' job took us to the Big Island first and then to Maui and that's where he bought here in 1947. He was with the Board of Agriculture and Forestry. So I still here live on the land that my dad bought in 1947.

KK- So he was Board of what?

OA- Board of Agriculture and Forestry.

KK- Oh, Board of Agriculture and Forestry. On Maui?

OA- Yeah

KK- Oh so can you tell us a little bit of this area, the Kihei area, about any cultural thing or anything you can remember. Because a lot of these building wasn't here. So You knew like the older families that was around here and the kind of work they did. What about your dad did he do any fishing in front here?

OA- Oh this was good fishing grounds all out here. For seaweed, for fishing, net fishing everything was good out here. that's how I learn how to do everything from my dad and used to always go and do lot of fishing, that's how we live off the ocean too because those days very cheap pay, yeah. My father was making like not even 200.00 a month salary

KK- Wow

OA- And my mom used to work for the county clerk and the county attorney So all cheap pay in those days yeah

KK- this in 1950's

OA- In the 40s and 50s

KK- 50's

OA- And then my dad retired when he was like 54 years old I think 27 years with the board of agriculture and forestry. But when he first came he was like the inspector and go check all the every place out the forest reserves everything and then anytime you like ship anything you got to go see him like before the airport, no more the kind agriculture check. He got go do all that check all the luggage and everything

KK- And this residence is approximately, what about one mile away from the project yeah, by Longs Drugs?

OA- Yeah

KK- Its about one mile away from the Krauss project

OA- Yeah

KK- So when we talking Halama street

they are on the makua side and then there are houses on the makai side. But at that time Ole where there any houses there?

OA- No we was the first house there was nothing even back here, nothing. So we used to come in from this street and then go across and do until they made that Halama Street road yeah.

KK- So Ole was telling you about their fishing so. What kind of fishing that you talking about gathering up there what kind of fishing?

OA- Well my dad did a lot of go dive for octopus, he'e. Squid was one of the big things Seaweed we use to plant and anytime you like you can go get no even need goggles for go get.

KK- What kind? Ogo

OA- Ogo, lipoa you know the eleele no more, the huluhuluwaena my father went

Plant. And the lipoa and ogo was the two main things over here but

Good squid ground this was .And then when we moemoe net oh catch any kine, slipper lobster, any kine

KK- So he talking to you about three types of limu or seaweed was in this area, huluhuluwaena, lipoa and ogo. The ogo they call um manawaea right. So he's talking about that

OA- Right, manawea

KK- But also on this coastline Ole I see had waiwaiiole.

OA- Yeah yeah had waiwai'iole too

KK- Waiwai'iole, so this was the harvesting ground for that type of seaweed for the local people in those times

OA- everybody walk the beach and pick up or you go in the water you no even need goggles for dive. My father use to make glass box. And when we was kids we just go with the glass box and you pull you pull the seaweed and stuff.

KK- So he talking to you about he'e better know as squid or octopus and Squid and octopus different so the he'e was really octopus yeah?

OA- Yeah.

KK- The tako?

OA- yeah

KK- So then he were also telling you about the moemoe. moemoe means is the laying net over night and catching slipper lobster, aholehole, moi, oio, menpache. A different variety of reef fish.

OA- All the different fish all the different fish right outside here. You know was and then had one guy, the family still live down here maybe you should go check with him go down the end of this street, Halama to the left get one bushy place, get one Gary Akina and get one Higashi family.

KK- Oh, Higashi.

OA- Yeah. Higashi, my good time friend. He live there all his life too. The uncle used to take us. He used to live right on the beach and only with kerosene lantern and one shack and he had one canoe. And we used to go out with him go fishing and go diving. For his age, he could still like 30 40 feet. We go outside the reefs and go fishing with him.

KK- Ah, Higahsi family and Gary Akina still there?

OA- Gary Akina still live down there too.

KK- So maybe

OA- That's another 2

KK- And I also heard your neighbor back here is from here too. The girl play guitar. What's her name? The mom

OA- Yeah Yeah right across here, right across here. But they used to be when you go Welakahao right here by the

KK- Right

OA- Go right up towards the highway, go to the left, that was the family, Miranda, Henry Miranada. That was her grandfather. Her mother, was that's the daughter of Henry Miranda. He used to be my, he was my godfather, before we used to go Saint Teresa church. That's long time property owners and then when the mother went marry that, they divorce now they bought over here, oh was cheap before you know

KK- So give us some background, Ole you said you was Honolulu first yeah? Where did you go school in Honolulu?

OA- Never did. I was born in Waikiki, 1945.And then my dad's job took us to the Big Island 46. 47 we was here.

KK- Oh you came here.

OA- Yeah

KK- and then any schooling over here on the island?

OA- I went over here Saint Anthony school, the catholic school that was a big thing in the old days you know

KK- What year was that?

OA- From 1949, 50 to I went 9 years old and then my last years high school I went Baldwin High.

KK- Baldwin High School but you was still in Kihei?

OA- Yeah still in Kihei

KK- And then after high school Baldwin high what did you do for a job

OA- Well what I did was I went go for the, in the old days they get the one for the army the all Hawaiian company

KK- Oh all Hawaiian company.

OA- Yeah I went go for, I went take the test, I never past the physical I past the test 1963 when I got out of high school. So I ended up working from 1963 till 2 years ago.

KK- And basically, was construction

OA- Construction, yeah

KK- And your first marriage what year was that Ole?

OA- 1966

KK- And you had

OA- 4 kids

KK- 4 kids

KK- And so your oldest is Jonah?

OA- Jonah.

KK- Which, Jonah Hauole Aka?

OA- Akaka

KK- Akaka

OA- Yeah

KK- Jonah Hauole Akaka, who is with Office of Hawaiian affairs at this time?

Ole : Yeah

KK- And then you had who?

OA- And then I get one daughter who is a Janesa Hinano Akaka. She's a nurse and trying to go be one doctor. She's a

KK- In where?

OA- In Honolulu.

KK- Honolulu?

OA- Yeah. And then I get my son Jason Kaimanahila Akaka. He is working construction

KK- Construction

OA- And then my last one, is a Jacob Akaka. He was born on the day in 1973, there was one earthquake when I was taking the mother to the hospital. When I reach there I see everyone running around and I wondering what the hell is going on. Oh, you never feel that one earthquake

KK- right

OA- He was the only baby born that day so I gave him the name Ola'e, which they say in Hawaiian, like that the Ola'e down Mākena;

KK- Pu'u Ola'e, blowing up

OA- Yeah well the its like blow, went blow hah. So when I went talk to this Hawaiian lady I went ask her how you say earthquake in Hawaiian, she said Ola'e. I gave him that but my grandfather said no good, bum by he going be destructive so I took, he the only one no more Hawaiian name. But I had one good friend he was related to Kamehameha the III. His name was Lot Kamehameha Lane. He wanted to give me the name Kamehameha for him. But I said nah that's you know kind of.

KK- So you left the Ola'e?

OA- Just never do the Ola'e him the only one no more Hawaiian name. Only get Jacob Lot Akaka.

KK- Oh, okay, okay.

OA- I went name him after the Hawaiian man, I never like give him the Kamehameha.

KK- Oh and now today you retired you stay over here?

OA- Yeah, I retired stay over here two years now

KK- Just give you a little biography of Ole Akaka. As he said to you earlier that the Senator Akaka the Priest or the Kahu,

OA- The Reverend Abraham. That's 2 brothers.

KK- The Reverend Akaka was a surfer and a he did a lot of royal sea burials in Waikiki.

OA- Yeah. My father, my father was Duke Kahanamoku when Duke Kahanamoku, you know that's all the same time he born and raise Waikiki.

KK- Abraham did service for the Duke I seen in the

OA- Yeah. That's why that Abraham in Honolulu, if we die, as long as you get the Akaka name, we get our own cemetery, get one in Honolulu get one Akaka cemetery

KK- Oh, oh.

OA- You know like my, anyone with the Akaka name can go be buried there.

KK- Wow

OA- That' the reverend's father use to take care that cemetery

KK- Yeah, so I was just on the phone with Daniel Senator Akaka

OA- Oh

KK- I was talking to his son, Kaniala.

OA- I don't even know, see because see

KK- He grew up on the Big Island and he do all the canoe blessing like that so I just want to establish your biography

OA- As long as because me I live here all my life when we used to go for the family reunion. My son Jonah Hauole used to always run the show everything for the But when I go down here I don't know all the family. Like him he was living down there when me and the first wife divorce he was living with the mom and then he raise all his life over there yeah so he know all the family. Me, I don't know cause, because live here, so I don't know all the family.

KK- Besides the fishing culture practice in this area in this area what are things you know about the area culturally that was done you know in the area when you were brought up besides fishing anything else Anything else like canoes or

OA- Oh we had our own canoe. My father went make one canoe and we went go fishing we used to have one 3 horse power motor that we used to go fishing with.

KK- what kind of canoe did he make?

Ole. They made it out of plywood but he look like the regular canoe

KK- But it wasn't made out of any material or anything like that.

OA- No, no.

KK- So you can see that the culture practice here was really done at the ocean which he talk to you about he talk to you about gathering the fish

OA- You know over here in the old days every time come summer, when summer vacation. Two and half months we stay on all the different beaches. We could camp out on all the beaches you know you can make fire but you clean up,

KK- Right

OA- We live, every beach down in Kihei and Mākena we camp on the beach. We come home do our job, water, clean yard, clean the house and then we go back stay down the beach the whole summer. That's how we was when kids raising

KK-: As Ole explaining most of the things were at the beach area

OA- Right

KK- What about the sea cucumber, the loli, the wana

OA- uh, we used to pick that too

KK- Yeah. The loli, the wana

OA- Uuh, we, my mother used to make raw loli and then the wana we used to pick, and ho plenty work, you gotta, you gotta get um in this area you go when the kiawe get the bean. That's when the wana suppose to be fat.

KK- The wana good

OA- Yeah

KK- Yeah what about akule opelu?

I used to go with the da kine. Every time the Akinas used to go and then we go help pull the net.

KK- Oh cool. Go hukilau. Go huki down the beaches hah. But a lot of, all kind different fishing before, good fishing before and this the calm side of the island the south side, the leeside. All, all good always good the only time when you get the kona winds then this side rough uh but otherwise over here always good for fishing everything. So now you know. Even we use to go lamalama night time used to have the guys with the torches, the old timers with torches ha, all shallow outside here so you can walk around to spear fish, or you know squid any kine at night the thing all moving around slow so he explaining to you that malamala is really night time fishing with the kukui hele po They use the lamp over the head

OA-Yeah

KK- And go out fishing on the reef and you know spearing the uhu. And at that time you guys used to also harvest the turtle hah?

OA- Yeah turtle, they even serve um in the restaurant. Turtle steak everything. That's why they they figure get more problem with sharks because you no can they come after the turtle that why, but before you catch turtle and you eat everything off the turtle except the shell.

KK- So as you can see as we continue our discussion most of the cultural practices as he understands, Ole Akaka is really on the shoreline and then the ocean and so we can he

doesn't know anything else that was culturally practiced in this area on the land you know.

OA- Yeah

KK- and you know we going to do the shopping center. The Krauss project is building that shopping center do you have any concerns about that area Ole?

OA- no Cause we, the only three supermarkets down here is the main ones Star, Foodland and Safeway.

KK- Right

OA- But then oyu know all I do is oyu get one week sales you just watch the sales and that's how we shop yeah

KK- Right

OA- But you know if we get more things that you can go shopping and buy cheaper maybe good for us

KK- Do you think with this, the a, new shopping center or any of the development around here do you think the perception of the cultural impact, you think there is a real impact on the culture situation.

OA- Nah, I think it's already gone already. we really can not do a lot of the things. They stop you from, even, now you can not even lay net over night and leave um overnight, you got to leave um only little while so a lot of that kind fishing can not even do anymore and then certain kind fish, you can not, like before you mostly catch anything is for come home and eat you know for go sell stuff. but now you can not even do the fishing. That's sad about the culture thing that how we use to live off off everything just go get and you can eat

KK- He says it is pretty sad that we don't have that practices as we did in the 50 and 60.And maybe as high as the 70. He was trying to sum it up by saying that there is a lot of regulation now

OA- Yeah

KK- When we talked to you earlier in the interview about moemoe it means that we lay the net in the early evening and pick it up early morning

OA- Yeah

KK- And today there is a regulation that you can only leave 4 hours

OA- Yeah

KK- But I think now they trying to deregulate the four hours completely I think

OA- Yeah

KK- I think the law says now you can not lay net at all I am not so sure But anyway the whole example was to show you that things change and he was saying to you earlier that when we catch fish we didn't have a size of the fish. So now you got to watch the size of the papio, size of the moi all these sizes that the rules and regulations of the poe haole.

OA- Yeah

KK- Even With the seaweed and opihi now they making by the pound

OA- They can fine you and stuff now if they

KK- Right now they can fine you

OA- They can fine you if they catch you with the smaller fish they tack one fine on you and stuff

KK- So the question was about his perception of the cultural impact. He says yes it does make an impact but it doesn't matter at this time because we don't practice it no more because the laws regulate on what we practice.

OA- Yeah

OA- I know that's why I mean even with you know my brother in law coming from Molokai he used to come here and work he used to do fumigation and stuff you know termite business he said oh Kihei is almost fastest the most growing in all Hawaii I think Kihei is the one that grew really a lot when I came back here, you know I was working in Honolulu, I came back here in 1969 that's when they figure Wailea was going 850 million of work and that's why I came back to Maui, I like to go back to Maui because never have nothing down here Oh then went boom from 1969

KK- I really appreciate you letting me interview you Ole bother Ole and then later I have to come back and take your photograph and we still need to write up this we still you need to sign that and say it is okay and we are able to use it for the report.

OA- Okay. My pleasure Any way I can help

KK- Thank you so much. Higashi, I gotta go see Higashi

Interview: Annlouise "Weezy" Kahalekai & Michalene Arcangel

By Keli'i Tau'ā and Kainoa Horcajo
May 20, 2009

KT - Keli'i Tau'a/Interviewer
KH- Kainoa Horcajo/Interviewer
WK – Wizzie Kahalekai
MA – Michalene Archangel (sister)

KT- We're here in beautiful Kihei with Wizzie Kahalekai. Native of Kihei?

WK- I was born in Kihei. I was born in my old house where we lived. On Halelani place, which is about two streets over from here.

KT- How many in your family?

WK- 5 children

KT- Are you the kahiapo? The oldest?

WK- I'm number two.

KT- What can you remember growing up here, let's take chronology. From your young ages, where did you go to school?

WK – I went to St. Anthony School

KT – All the Akinas went St. Anthony?

WK – I'm not sure. The Akinas donated that land to St. Anthony. My great-grandfather lived over that way. If you look on the map of Wailuku Agri-business, Achuna Akina was the original owner of Wailuku Sugar.

KT- Oh, yeah, that's true. Achuna Akina was the original founder of Wailuku Sugar.

WK- That's my great grandfather's brother.

KT- He was one of two that came over here.

WK- Auhana was our great grandfather.

KT- So the two of them started the…

WK- Well, they were born here...

MA- No, they were born on Kaho'olawe.

WK- Yeah, I mean born in Hawai'i.

KT- Yeah. But they started the Sugar Company together?

WK- My grandfather told me that they lived there behind Sivila Store and one of them was a pharmacist at the hospital there... the Malalani hospital. And then my great grandfather worked at the plantation in Wailuku. Right across the street from St. Anthony. Their house was right down the street by where Wailuku Sugar office is. In fact, he died one night, he used to gamble in the camps there and they killed him on the railroad tracks on his way home because he won all the money. They killed him.

KT- See what happens when you get all the money, they come after you.

WK- Yeah. Anyway, that's why most of us when to St. Anthony. I only went to 8th grade, then I went to Kamehameha. And I only went for two years because I was homesick. Was hard in my year!

KT- What year was that?

WK- 1961-1962.

KT- Oh, right after me, then.

WK- It was really hard cause we couldn't go anywhere. I didn't have relatives to come take me anywhere. You try stay seven days a week in one dormitory!

KT- I loved it! So, you went over there and finished and came home. Did you go to college?

WK- I went to MCC. We were the first graduating class of MCC!

KT- What did you study?

WK- Business.

KT- Now how many children do you have in your family?

WK- 2 children. Both adopted. One from my sister and one from a niece.

KT- So coming back, how did the kids in the neighborhood look at you? Did they think you were snobby going to St. Anthony?

WK- We didn't have neighborhood kids, was mostly just family.

KT- How many houses were there?

WK- I think there were 100 houses in all of Kihei when I was little. Talking from Wailea to Suda store. From Keawekapu all the way to Suda store get maybe 100 houses.

KT- So you guys, meaning the Akina 'ohana, were everything. You roamed the whole land, grandpa did very well and bought so much land. So you walked up and down.

WK- My grandfather didn't buy the land. We got the land because my great-great-grandmother was a midwife to the Queen Lili'uokalani.

KT- Who was that?

WK- The Thompsons. And when they gave land it went from the top of the mountain down to the sea, yeah. So, they owned all this land from years ago. He didn't have to purchase. But he sold a lot of the land.

KT- So when you were growing up, can you recall from the street that you were born on. Did you walk as far as to Suda store or Ma'alaea?

WK—Never all the way to Mā'alaea. But we used to walk to Suda store and back? You know Halloween, all the kids from Keawekapu to Suda store went walking. For trick or treating, like a parade. (laughs)

KT- Can you describe what was on the land if you walked to Suda store, what would you walk into?

WK- Suda store was there when I was little.

KT- Yeah.

WK- So, to be honest most of Kihei was kiawe when I was little. Wherever there wasn't a home, there was kiawe.

KT- What about water? Still yet by the Catholic Church there was a lot of wetlands.

WK- Yeah, there was. You know where Menehune Shores is? It was all water, wetlands coming in. You know where Koa Lagoon is? They build Koa Lagoon right on top of it. They covered it up and built right over. So someday, I think, the water is going to come rushing down and that condo is gonna be gone. They call it Koa Lagoon because that place used to be a lagoon. There used to be a koa house there. And that's why they called it Koa Lagoon. And where Azekas is now, that whole thing was all wetlands, mostly. The Catholic church is all wetlands. They filling up now. Halama St. on the mauka side across the street was all wet lands. And sand dunes.

KT – Kainoa & I are here to do a cultural assessment report. Our study is in back of Longs Drugs on one side and Bank of Hawai'i on the other side.

WK – Yes, it was all wet lands

KT – Other consultants I have interviewed said that it wasn't always filled w/water.

WK – It wasn't always water. It was that green grass, it retained the water.

C2 – The land was so low. When high tide, the water comes up. Wasn't always wet. They made it like that by filling it up with water.

KT - because in the past, not too many people were concerned about the Hawaiian culture like the fishponds of Kalepolepo and Ko'ie'ie and the sand dunes it plus the many bunkers and military pillars out in the ocean. The wharf at Kama'ole I. My father Was in the Navy and worked for them. That's how he met my mother. All of Kama'ole was occupied by the Navy.

WK –The wharf at Kama'ole I. My father Was in the Navy and worked for them. That's how he met my mother. All of Kama'ole was occupied by the Navy. Today, they took it out. Before, Halama Street was a beautiful wide sandy beach. The corp of engineers

went ahead and built a high stone wall. It caused major damage and erosion to the beach. Now it has no beach but a rock wall. It was all ruined, took the beach away.

KT - Do you recall any animals that lived in that neighborhood?

WK - I don't recall any birds living here. But aunty Agnes whose yard was filled with the wet land grass was always burning. She was the firebug of Kihei.

C2 – I don't either. I never saw one bird.

WK – the only type of birds I saw was the pheasant, Franklins, quails but not birds associated with wet lands. I saw @ Mā'alaea the Ae'o and Auku'u. it wasn't a natural wet land but only when the tide came up.

C2 – even when there was water, I never saw any birds. They were never seen in Kihei

WK -Only in Mā'alaea. Kihei Had water on both sides of the road.

KT – One of your family members told me that her father was a logger?

C2 – Oh yes, he logged kiawe wood to produce charcoal. Grandpa started to deliver charoal and later uncle Francis continued the charcoal business. It was big business, Kihei Charcoal. It was very popular. In brown bags.

WK – People called us Kiawe Beans like they call people from Makawao Guavas. We used to spend time picking up kiawe beans to feed the pigs and other animals.

KT – How did you use the beans, boil it?

WK- we boiled it and mix it with other foods. The pig grass that we cut at the wetlands we mixed with the beans as we cooked the pig food.

KH- did you remember the color of the water in the wetlands? Was it a brackish?

WK - it was brackish with white foam floating on the top of the water. Even in our yard we had a well and we had brackish water to water the yard. Kihei had very little water coming to Kihei. We had to have wells to water our yard. You could see the whites in the water so you would know that it was brackish. But you could drink it.

KT- Going over that, out of the 100 families, was your family, Akina, half of them or more?

WK- I don't think we were more, but maybe we were. Cause all of the others. We had people like the Venturas who was the post master. And Delima. All this area down on Auhana and below. And De la Nux and Carvalho's. To tell the truth, everywhere people were, Akinas were around. You know why? Nobody wanted to live Kihei. And my grandfather built the road to Kihei. If it wasn't for him, there wouldn't be a road to Kihei.

KT- How did he build it?

WK- I guess he just got together. My uncle…

KT- What about Charlie Young bridge?

WK- Yeah, he built Charlie Young bridge. 'Cause his house was on the other end, so he built the bridge. He built that bridge and then Charlie Young put his name on it—way after. The Young's were at Young's beach. They lived there for years. Halama Street

has the Kitagawas and the rich people. But only on one side of Halama Street. The beach side had all kine stuff, but the mauka side there was nothing except where the Akina houses were. And where the fire station is now, were HUGE sand dunes. When we had a tidal wave, it didn't get past the sand dunes.

KH- When you say, "HUGE", how high do you mean?

WK- Bigger than this place. Two stories, probably. We used to slide down on them. Twenty feet, maybe even more. From the beach all the way down. Not on Halama Street. Where the fire department, the tennis courts, part of that baseball park—was all sand dunes. They took the sand dunes away and built the tennis courts.

MA- I remember the sand was different next to the Kalama Park extension. Like had fragments bones inside. When my brother and I used to play, we used to find bones.

WK- In the back of our home...

KT- We're talking a couple of blocks from where this development will be. When you hear development, it's going to be an expansion of a shopping center. What do you think? What is your opinion about having a bigger shopping center in your neighborhood?

MA- I think Kihei has enough shopping. I really do. I don't think it needs anymore. I think Kihei is just lost. It's coming like a Waikiki and I miss the old Kihei. The camaraderie of the people. Azeka Store was right next to our house, which was next to Kalama Park. Where the Sansei is, that was Azekas.

KT- I'm sure you folks were first in line for Azeka ribs.

WK- His ribs wasn't until he moved to the other location. My dog used to go shopping, he used to go down and pick up his cookies and then come home. (laughing)

KH- So, where the Azkea store moved to, mauka, have those wet lands. You know, they put a fence around.

WK- Yeah, but never have that before. When we had rain, it would pool there, but within a couple of weeks, it would be gone. Not even a couple of weeks.

KH- It would dry up, yeah?

WK- yeah.

KH- But, in back of that, in back of where the water is now, what was there before?

WK- Nothing.

KH- Just kiawe?

WK- Yeah, just kiawe.

KH- There wasn't any...

WK- Well, couldn't really see, there wasn't a road to go back there. Not back in that area. You just couldn't 'cause it was just... land... just kiawe.

KH- What did you do for social life?

WK- We spent every day of our life in this ocean. (laughing) we played basketball, just riding bicycles. We were just friends, we were all related, you know?

KT- Those two activities are not ocean activities.

WK- You mean like basketball and bicycles? Yeah. But in the summer, Kamaole Park I was like our home. My parents lived across the street, nobody went there because they thought my grandpa owned it. We had all our fishing boats there.

MA- Well, he did own it at one time, but he gave it to the county.

WK- Yeah, so we set it all up there. Bed racks. Put everything together and spent the whole day in the ocean.

KT- So talk story about grandpa's fishing business. Reminisce about one particular day when you were down there and grandpa came in with his akule nets. Kind of give us, the malihini, a look into that experience.

WK- I remember the hukilau days. We did a lot of it @ Kama'ole I. They would lay their nets, bring the ends around, tie the ti leaves on the nets, everybody would pull, everybody and anybody on the beach would join in, it was fun, pull it up to shore then everyone would take out the fish from the net and put it in the bags. We had fun days. My uncle Butch & I were kolohe (rascal) when we were little. Grandpa used to go to Lahaina a lot on the old narrow roads w/his boat and nets. My grandfather had a lot of Filipino employees that he built homes for and they would always go fishing. Doug & I would rise early in the morning at four o'clock to go. Although next day was school, he and I would hide in the boat covering ourselves with the nets. Grandpa use to take roll call and ask if everyone was present and we would answer, "We're here." In arriving in Lahaina, they would find us hiding under the nets cutting out of school. We stayed w/them to fish until Grandma came to pick us up.

KT – Why did you folks go all the way to Lahaina.

WK - We had to go where the school of fish was. By then, my father used to find the school of fish by flying a small plane and spotting the fish or these big red balls in the ocean.

KT – There are no businesses doing that type of fishing in Maui now.

WK - There used to be Kacho but he went out or business.

KT - In your mind, was it a hard life?

WK - I don't think we had a hard life. The men loved it, we loved it, and we had fun. We enjoyed that time growing up. Fun time. My grandfather had money, we had maids, cooks, etc. he had huge rooms of luau tables and everyone came to eat.

KT - Butch and Sandy still live the lifestyle like grandpa with everyone joining together after work hanging out, eating food, etc. at the Akina Bus Company. It's a really a Hawaiian lifestyle of living.

WK - Our house was always open to anyone. Anybody. If they didn't come, they felt that they were rejected. I believe we had the greatest child raising by our parents, grandparents, real Hawaiian way.

KH – Do you remember going to the fishponds? What were they like?

WK – I don't really remember. Kalepolepo was next to the lagoon covered w/kiawe trees, yeah? I remember going there, but..

KH- You didn't really know it was one fishpond?

WK- Yeah, it was all just trees. It was really dirty, so no one really went there into the water. You could see reef, but we just never really swam or into the ocean over there. And then had the time station, where the whale sanctuary is now. That was a time station. Had sand dunes on the other side. Was just sand and water would be there when it was high tide. We never swam there, though. We stayed this side of there.

KT- As you grew up, there were new businesses that came into Kihei. You mentioned Suda store?

WK- Well, Suda store was there from before. Where Azekas was a lot of little stores. Ma and Pop stores. You know right down here, the kwonset huts, which was a café, called Fukutu's, it was a little restaurant. We used to go over there and help the lady cook. And the service station was one of the first ones, that 76 station.

KT- So there wasn't any businesses per se in Kihei?

WK- No, not until the condos starting coming up. You couldn't go shopping in Kihei to buy clothes or anything. You had to go to town.

MA- I think that's why they started the shopping center, because you had to go to town.

KT- Can you recall any other stores?

WK- My grandpa had mango orchards, too. So that was our job, too, to pick mangos. Clean 'em and take 'em to market. And he had, before it was Aunty Becky's bar, it was his, he had a bar and restaurant and a little store. Like a candy store, cigarette store and stuff. Because the Navy was across the street. That's how my father met my mother. And then he had his school busses.

MA- And he raised turtles.

WK- Oh, I don't remember that.

KT- He raised turtles? Where?!

MA- In their yard. They had turtles. Cause the beach was right there. Used to have lots of turtles.

WK- When we were little, that place was full of turtles, Kihei had lots of turtles.

KT- Do you know what variety of turtles?

WK- Was green turtles, I think it was. There was tons of them. We'd be swimming and they'd be swimming around us snapping at us. And we'd ride the turtles, when we were little. It was full!

KT- Just a footnote, I've always been intrigued with the Akina family because Grandpa was such a entrepreneur. And you can hear the multiple businesses that he thought of doing.

WK- And you know the turtle oil was used for burns and would make medicine with it.

KT- Can you switch seats and we'll turn our attention to your sister? Now, please give me your full name.

MA- Michalene Archangel.

KT- Where did you go to school?

MA- Kihei, the old Kihei school. Next to Suda store. You can still see remnants of the old school there, at the beginning. The first part was kindergarten and first grade. And then where they teach hula now was fifth, sixth and seventh grade and the office. And there's the little community center, that was the cafeteria.

KT- Weren't you jealous that you didn't go to St. Anthony?

MA- No. I just was kinda scared... cause where was Jane? I don't think she was in Kihei.

KT- Before I forget, spell your last name.

MA- Arcangel. My brother was at Christ the King, so for awhile I was by myself. And when I would come home I was by myself. That was the only thing, I was like today maybe I was lucky, but it wasn't luck. I would stay outside all day. If anything I went to my cousins to stay at their house until my parents would come home. Then I would come home.

KT- When you look at yourself and say, "We Hawaiians" but we had everything. Because, as you mentioned, Grandpa really provided you folks with a luxury life that other Hawaiians didn't enjoy. With maids and servants. Grandpa really thought BIG thinking.

MA- I think that's what they got from their father. To go out and make something of yourself. And like I was trying to tell you, the Akina was an engineer, that's why he started the sugar mills there. He was the younger one, he probably had more schooling than our grandfather.

KT- Almost like an inherited talent. Cause Uncle Butch in there was also an engineer with so many skills. When you look at all these busses and things.

MA- He's a good entrepreneur. He can think of anything and make money off it. He may not be the smartest on paper, but common sense and working the business, he's right there.

KT- So, with that in mind, do you have your kids go and learn everything they can learn from Uncle and Aunty?

MA- Well, my daughter is heavy into the Hawaiian culture. My son is too, you know. But my son and my daughter was raised on the Kahalekai side. We lived in Waihe'e already when they were little, so it was different. Taro patches and stuff. They still have Hawaiian culture, but was different. My son did the fishing, but when he was older it was all in Waihe'e so he had more the taro side. Compared to the fishing side, the other side. And my daughter is the taro side, too.

KT- Which is great, too. So the family said that you're the keeper of the moʻo kūauhau. What got you interested in keeping genealogy of the family?

MA- I don't know, I've always been interested in history. But, I did a lot of reading in history, Hawaiian history. I was always proud to be Hawaiian. In fact, our generation is what brought it back. I felt that as we were growing up, my parents were ashamed to be Hawaiian. That's how I felt. But I was like whenever someone would ask me what my nationality was—even though I had very little Hawaiian that I knew of, that's always what came first. My Hawaiian was always first, as far as I was concerned. Didn't matter that I had more hāʻole, 'cause our father is pure Polish. So I always wanted to find out where all my Hawaiian came from. So I did the genealogy, and I learned from my other cousins. Interesting to know what your background is, where you came from. Where you come from and where you go. Knowledge.

KT- As a footnote, you search genealogy by looking at people's bibles?

MA- Yeah, my grandmothers bible was handed down, and my mother's bible.

KT- They wrote all the information in their bible?

MA- My grandmother's bible has a lot of information about both sides of my family. That was interesting. I'm just sad that I spent six and a half years of my life with my grandmother and then she died of cancer. My grandmother used to take me everywhere. I could have had more knowledge. And I was maybe two or so, as a child, even though it wasn't allowed in Hawaiian culture, I was allowed to sit at the table with the adults. I was the only child allowed. So I listened to all the stories, not that I can remember it all, but I listened. And my grandmother always said that I was ahead of my time.

KT- What were some of the talk stories that you listened to?

MA- I really can't remember because I was young. And then as I grew up, even though my grandmother had passed, I still carried on the tradition of going to all my kupunas and aunty and uncles and sit with the adults.

KT- What was grandma's concern?

MA- Grandma's, as far as I know, well, I can't really remember what they spoke about, but I know it was about... well she told me that what I heard could not be said. So anything I heard I could not say. So, anything that I heard, was a secret and is going to the grave. So that's why I was the only one allowed, as a child, to sit at the table with adults, because I would never say what I heard.

KT- So let's bring us to the place where we're researching. Outside of what was already said, can you think of anything else in back of Longs in back of Azeka?

MA- Like my sister said, it was just kiawe. So we never really went back there. The only people who would probably know is the Yee's. With their orchard, because that's connected right there with the Yee's. So if anybody ever saw the back of that area.

KT- So, let's go up, mauka from there, across the street. Can you folks remember anything? Right now if the super computer area...

MA- Never had anything there. Used to have cattle and stuff and the rivers. The rivers today that come to Kihei is not the rivers I remember growing up. Because my brother

and I used to go through there. Had some boulders and some water. It's not the river I grew up in. So the natural river is all destroyed.

KT- Which river are you telling me?

MA- Is like coming down into Kihei... what's why they get Waipulani and all that. All the natural rivers, used to be rocks and things and the kiawe on the side. Right next to Kukui mall, the Akinas were there, was right by our house was a huge river. It's not there, it's all homes now.

KT- So walking up in the streams, did you see any petroglyphs or anything?

MA- I don't remember any petroglyphs.

WK- I don't remember any, either.

KT- Do you know where Auhana street is?

MA & WK- Yes.

KT- Just a little a further down...

MA- You know the one that would probably remember more would be my brother. Like I said he would go with his friends and they would go way up. I wouldn't go with them because had cattle and stuff. They were crazy enough to go up. You know boys. He did a lot of research and has a lot of knowledge. I pretty much stayed at the beach area because it was safe. We were probably told not to go there, so that's maybe why.

WK- Plus there was no road, so was just kiawe all the way.

MA- Yeah.

KT- A lot of the streams that come from mauka have different areas that come down from Haleakalā have petroglyphs. Even right down here where Kamali'i School is they found a whole trace of petroglyphs.

MA- But like I said, we didn't even walk in those areas. But the rivers are not like how when we grew up. Now they are full of mud and dirt. You don't even see the natural rocks and things like I remember seeing when we were growing up.

KT- So how old were you in 1940?

MA- Not born. I was born in 1952.

KT- So the military was there?

MA- Maybe they were, yes they were. But I was a baby. I have no idea.

KT- So just the remnants of...

MA- Well, I remember there was no base there. It was just a pier. I just remember a pier in the water. In fact, when I was little they were above water and you could see from the beach and the whole area of Kama'ole was just grass and sand. And the whole naval base, or whatever that was was all gone. The only naval base that I remember was on Mokulele at the old airport.

WK- You can still see those old buildings. And had the bunkers down in Mākena.

MA- Yeah, had the bunkers down in Mākena. And there was a platform that is remnants of a bunker. At the end of Kama'ole I—is the remnants of whatever bunker was there. But used to have sand and like a dune and made a big hole and came back up all through there. The only people who used to go on that beach were lovers and little kids used to be over there spying on them. (laughter). Other than that, we were the only people on that beach, the Akinas.

KH- Did you ever hear stories from the Kupuna about old-kine stuff happening back there? On the property we're researching?

MA- No.

KH- What about kupuna talking about the fishponds? Maybe it was working back then?

MA- You know who might remember is the Kenolio's. They lived at the Koa Lagoon. Theresa Kenolio is married to Teddy Sniffen. She lives right there. At Koa Lagoon. They had their home right on the lagoon. So if anybody were to remember anything about that area, it would be her. She's about my age. I think we were classmates. She would remember, because that's where they lived.

WK- I'm trying to think of other people that lived in that area. There was a haole couple, but I don't remember their name and they're not there anymore. The Morandas lived right on the wetlands, across from Halama Street. On Welakahau. They lived right there, that was all wetlands, too. The same type of land.

KT- We appreciate you folks letting us come to talk story.

Interview: Kalei Mo'ikeha

By Keli'i Tau'ā
November 17, 2008

KT- Keli'i Tau'ā
KM- Kalei Mo'ikeha

KT- Can you give us your full name?

KM- My name is Lee Kalei Mo'ikeha.

KT- Where were you born?

KM- I was born in Wailuku, Maui.

KT- But much of your life you lived in Kihei.

KM- Yes, that is correct.

KT- And many of your family also lived in Kihei.

KM- Yes mostly everyone lived in Wailuku but when Tutu moved to Kihei everyone went follow
Tutu.

KT- So what was Tutu's name?

KM- Tutu's name is, was, Annie Kaluailahainakeaweiwihaleokeawe.

KT- So where abouts in Kihei did you folks live or did you bounce around?

KM- We lived pretty much the same area which is where Azeka's II shopping center is in that area, more or less behind there we had four acres behind there.

KT- If I can recall correctly, wow those were years where there might have been more wetlands but now there's still existing wetlands back there.

KM- Those wetlands we would drive it was a dirt road that we had (we owned the road) and there was basically about three or four wetland areas but it would dry out every summer.

KT- Oh.

KM- And it's not like they have it now where it's wet all the time that's intentional, somebody went up and I understood that when Azeka wanted to build they actually fought it and said that's a wetland. It was never a wetland all year round it always dried out.

KT- Oh, very significant.

KM- Of course! And if I had an opportunity to speak at whatever when people were trying to talk about that I would have told them that because now it's a constant wetland. It was never that I lived there, I know that.

KT- So during the time it was wet did you observe any-what attracted things to that wetland?

KM- Okay every now and then you would see the Hawaiian Stilt Ae'o come in.

KT- Right

KM- Would come in, the would come in but not prominent maybe like one or two. It was quite rare to see them but they would come in. It attracted a lot of tadpoles and frogs and mosquitoes.

KT- That's interesting because when you think of wet areas, at least me growing up and being in a lot of wet areas, it was constantly wet but what you're saying is when it dries up where did those tadpoles and frogs go. But I guess frogs can exist in dry areas and then return to a wet area and then create those tadpoles.

KM- I think it was more toads than frogs. It was toads. And when it would dry you could always see the salt on top. But we played in all that water. It wasn't real deep, you know...

KT- You're showing me by motion of hands so lets try give a measurement.

KM- The water would get at the most maybe about a foot or so deep within that area. We would flood out all the time that we couldn't drive in we actually literally sometimes park at Azeka's and walk in because it would just be flooded all the way into our home.

KT- So you said you played. Define what is play in mud area?

KM- Playing is running, jumping, getting wet, you make boats out of wood and you play inside. Whenever the water started to evaporate and things like that it became real muddy and slippery so later you could just run, slide and jump in. After a while you could take your bicycle in and just kind of slide all around because it was all muddy.

KT- So what kind of boats did you folks make, out of what material?

KM- We just used at that time we just used whatever pieces of wood we could. Maybe was 2x4's, maybe was a 4x6 flat, you just kind of shape it with a saw, pound nails to look

like rails and things like that. You kind of stack a 2x4 on top of a 4x6 to maybe kind of build it up.

KT- So just your immediate family did that or neighboring families and you guys had some small kind competition or was just for the family?

KM- There was only one road, we owned that road it was almost a mile long in and we were so-what we had was we had no neighbors the only neighbors that we had was Kaniela Medeiros that lived right in front and he had one white German Shepard and I remember that. And as you drove down the road you would have a wetland on the right, wetland on the left going in some more than you would hit on the left hand side you would hit a mango orchard owned by the Yokoyama family. And they watered their, because it was all sand in there, and mango trees were watered by a well that they had which was brackish water. But they had tilapias in there you could go fish. In our property we had a well too but it wasn't as refined as theirs. Theirs was built of concrete and things like that, ours was more wood you could dig it, hit it but it always caved in. So we hardly used it although we did have a pump to try and pump water to run to irrigate.

KT- So who was that again that had that well?

KM- I don't know their first names but they were the Yokoyama family.

KT- Yokoyama; did they use the water for anything?

KM- They didn't live on the property it was just mango orchard just like how Yee's Orchard is now except Yokoyama's was I think bigger than or equal to what Yee's Orchard is. And the Yokoyama's also owned a soda making factory here on Maui and they made like Cola which is from what I understand a great tasting cola and strawberry and orange and real basic but they sold soda.

KT- Where did they have their shop?

KM- The shop was pretty much I guess down towards old Beach Road as you're going up what is that Main- I'm not sure. Kind of like where Maui Soda and Star Soda is located.

KT- Lower Main, okay.

KM- Yeah, they were all around the same area too, just a small little warehouse.

KT- So you grew up in Kihei. How many brothers and or sisters did you have?
KM- At that time that we grew up there it was just my older brother and I-my older brother Holani. My younger brother came about like he was ten years after me but by then we had kind of moved back to Wailuiku. I was going back and forth, back and forth Kihei Wailuku, Kihei Wailuku. But my youngest brother Kauokolani was born in Wailuku and he more or less was a Wailuku boy.

KT- So grandma lived there all her life after you guys moved there until she passed?

KM- Correct.

KT- What kind of school did you grow up with when you were in Kihei?

KM- Um, I bounced all over. Just going back to grandma-to Tutu- she didn't live with us though. She lived down on Kenolio Road kind of like where the Kalanikaua's live on that same side maybe about kind of like where that Southpointe Townhouses are, right in that area. It was the only house in that area for a while. But the schools I went to- I attended Kihei School for maybe couple days then I went to the told Kahului School than I went to the new Kahului School.

KT- The old Kahului School is in Pu'unene.

KM- No the old Kahului School is right across from the Maui Beach Hotel. It's no longer there, I think they broke it down but that old Kahului School then became Lihikai School and I attended there too. Then I went to Wailuku Elementary then I went to Iao then I went on to Kamehameha.

KT- So public schools, one of the older one's was Lihikai then?

KM- Yeah. Well, it's not exactly one of the old ones because you have to figure that Kahului School is one of the oldest. Then it became that old Kahului School building turned into the Lihikai School it was created because all the camps were being closed in Puunene all that kind they all moved to 6th increment and all the kids came to Lihikai School.

KT- What was a new development in Kihei that seemed unusual?

KM- The new developments through all the hotels, the condominiums that were coming up like Kihei Kainani, the one across from there-I'm not sure...

KT- That's right off South Kihei Road.

KM- Right off South Kihei Road and then right next to Kamaole I on the far-as you look at the ocean the far left hand side that all those condominiums started to come up. That's where I guess Mana family used to live right on that point there. The grandfather used to have own that right there on that point right where that hotel condominium sits.

KT- Wow.

KM- But all that developments started to come up and Mana Kai going on down then slowly of course Wailea was developed.

KT- Yep, so can you remember traveling that road and if you did what kind of vehicles did you ride?

KM- Back then as I grew up the summers I remember with my older brother and I we would spend a lot of time down at the Kihei Cove.

KT- Okay.

KM- And we either went by bicycle or walk and back then when we grew up there were ditches on both sides of the road and that's where water would drain. And it's almost like the Alawai Canal concept because Kihei is basically pretty much like wetland areas you just don't see it so the water had to go someplace and so they had those ditches all the way down. But we could walk from where Azeka's is now all the way to the Cove in the middle of the road and not see one car.

KT- Wow.

KM- You could just walk all the way down or ride your bicycle all the way in the middle and not, you know that's pretty far.

KT- So actually Maui Lu also was wetlands.

KM- Yeah. Close to Maui Lu there's-the Maui Lu was always on that what do you call it, the terrain that it is now was always pretty much like that. It was not flat, they really didn't bring in too much I think as far as I can remember.

KT- When I interviewed the Rice's they had their pig pens next to, can you remember that?

KM- I remember a piggery right behind there and had a alfalfa farm also where Ka'ono'ulu Estates are right now over there. My tutu and uncles that lives with her had some pigs with her too. But pretty much, not many, but there was quite a few piggeries that was in Kihei, people had their own.

KT- Was it for their own use or for selling?

KM- For us was home use. I remember always pretty much every Thanksgiving, every Christmas and every New Year we killed a pig every one for years.

KT- Did you spend time going to the ocean to go fishing?

KM- When I was younger, yes we spent not a lot of time a lot of it was more spent just swimming. Fishing I would say the luxury was to have a fishing pole or things like that which we never had. You know no more that kind and I'm sure it was sold but it was something that we never did. We had little scoop nets and things but never fishing poles or things like that until we got older.

KT- So Azeka expanded to what it was but can you take us back when Azeka was just a one-room store or that you can remember.

KM- The first Azeka Store that I remember was across from where the basketball court is at Kihei at that point where Kentucky Fried Chicken is. That is, from what I remember, is where Azeka's started right there. Then from there he moved to a smaller store that he built where Azeka's Shopping Center is now. And then from there of course he developed a shopping center and they moved to where I guess Ace Hardware is now, that was the Azeka's Store. So that's what I remember growing up.

KT- So from small kid time can you remember Azeka ribs?

KM- Umm, well I'm half Korean so I don't necessarily remember Azeka's ribs because everybody remembers it but my mom of course made way, way better stuff than Azeka's-come on! (Laughter) So all I know is that I had my own Korean food. I don't necessarily remember how famous they were till I got older because mom moved and I moved so access I had to go Azeka's.

KT- So what were the radical kinds of changes that occurred as you were growing up?

KM- Umm I think it was pretty subtle you know but you would see development that came pretty much on both sides of South Kihei Road. Then the upper highway was built which was a straight shot into Kihei, I mean into Wailea. The things I remember was that Kihei was always dusty, it was always under constant construction. As you look at all of

the development, the homes all on the upper side, all the different subdivisions that kind of came up but you just notice just real subtle. Even with Bill Azeka which people called the mayor of Kihei, you know when he finally developed he didn't just develop his store he developed the whole shopping center Azeka's I, Azeka's II. I mean once you saw a stoplight in Kihei that was pretty outrageous to see a stoplight in Kihei, you know. From there it just kind of changed and it changed pretty radical I think to what we have today. I think the development that kind of stood out the most would have to be Maui Meadows because of the placement of it. And the thing I think about Maui Meadows, I think, is that the local people always thought Kihei was too far they thought sometimes was kind of scary night-time no more street lights everything was dark. Every weekend Kalama Park had a party, always had huge parties the parking lot was always full-local party but everybody always went back Kahului, Wailuku. But the thing I remember about Maui Meadows was that local people didn't buy because it was seen dusty and rocky and it wasn't until the haole came that basically beautified the area with irrigation. People thought wow this is a really nice place, the views are magnificent and things like that. That's my take on the whole thing up there and that's what I think.

KT- So we are getting people's opinion about Kilohana Road which is part of where you just pointed out that will run towards Wailea Ike to expand the road for possible upcoming development with Wailea 670 now known as Honua'ula and also Mākena development. Outside of what you just said are there any other information that was passed on from small kid time what tutu them used to talk about down there?

KM- None that I can remember. My tutu probably passed when I was about 5 so I don't remember too much. My cousins probably spent more time with her that would know a little bit more. My time with tutu was always short although we were always there but we never slept overnight because we lived in Kihei. So we might be there during the day then mom or dad would come pick us up to go home whereas cousins would stay over.

KT- So who were your cousins?

KM- My cousin like Murphy, we called him Honey Boy Moikeha- this one family, my Uncle Sol's children all had nicknames so the oldest was of course my cousin Jimmy.

KT- What was his nickname?

KM- Actually they just called him Jimmy (laughter); And then Junior, which was Solomon Jr., they called him Junior; then Ipo was after that; and then came the last two which was my cousin Baby, Melody; and then my cousin Honey Boy, Murphy.

KT- And they were from Uncle Sol Moikeha?

KM- Uncle Solomon, yeah. And so the thing about my cousin Murphy he carries my tutu's name, the whole name the bugga.

KT- What families can you remember that lived there, Hawaiian families?

KM- My tutu was very close to the Kukahiko's and the Kukahiko's and the Plunketts. In fact my father grew up, Aunty Kuulei Plunkett he always thought that was his sister because she was always over the home so much and he thought they literally grew up like brother and sister she was always there. But my tutu and Aunty Ku'ulei's mom were great friends, I think, I don't know if they were related but no they were just great friends,

they were very close. And so we grew up with the Plunkett's like Billy, we grew up as cousins you know that's how it was we just saw each other as cousins because we just saw each other so much too. So had the Plunkett's, Kukahiko's, Kalanikau's I remember.

KT- But you didn't know Paula and her husband's children because they were a little younger than you.

KM- They were little and by then we had gone to Kamehameha and by then we had moved from that area we had gone to ? Street so we had kind of grew up with the Kauha'aha'a's and their cousins the Wong's and so that group of boys.

KT- So you mentioned over and over the Azeka's Store. What other kinds of offices or buildings existed in Kihei to assist the community?

KM- As far as I remember growing up Azeka's was basically it.

KT- That was the core?

KM- That was the core, that was the center of Kihei. Pretty much everybody gathered there because that was the shopping- the supermarket. There was nothing else until finally I guess Foodland and Star comes in which was years after that and minimals opened up down towards Hale Pau Hana I think it's called too down that area. Just little stores and things began to open but more so for tourists, you know, even as it exists now pretty much.

KT- So what can you remember that was unique that Azeka's sold? You could get anything and everything at Azeka's?

KM- Pretty much, I think because in a sense I think I was pretty much well rounded because we left Kihei probably when I was about nine or ten. But like I said we would always come back, we would just go back and forth. So went to Wailuku, went to Kamehameha, then came back when I was probably maybe about a freshman or eighth grade we moved back to Kihei full on again. So what I'm saying is that a lot of times whatever I needed may not have been bought in Kihei, you know was a purchase in Kahului because that's where I spent time or up in Wailuku. And by then when I was at Kamehameha at the age of eleven, you know everything-whatever I needed came out of Honolulu. So I left home at a very early age per say, you know just eleven years old away from home already. And so I was home on summers and so I didn't necessarily have too many friends until summers and then I came home and that's kind of like how I was.

KT- But you pretty much laid out the community that existed during your time, your parent's time and even grandma's time. But there wasn't that much change until actually after you grew up to be an adult then you saw all of these...

KM- Well I think the late '60s early '70s we saw the real heavy duty development when people started to really move in. Kihei was a very strong Democratic precinct. The parks and things that you have there are not because of Republican party, that's because of the Democratic party because my father's very active in politics and things like that and that's what he always told me. A lot of those fields that we have down there, where all the baseball fields and stuff, was because of the Democratic Party it was a very strong precinct and that's how Kihei got a lot of things including the tennis courts.

KT- You can recall, I'm sure, that almost all of the areas was covered with kiawe?

KM- Yeah.

KT- Did you folks do anything with it?

KM- Well for me if someone was to describe a forest my forest would be described as kiawe trees, brown grass and to me that's beautiful. Other's may say that's desert but for me I don't picture green redwood trees or things like that. For me it's Kihei, brown pili grass and kiawe trees and put me in there I'm at home. I always walked through by myself for miles I always hiked there, my father always told me that even when I was young. I may take the dogs and things like that, I would take some juice but I would always go off on my own. I still find solitude and solace whenever I go into a kiawe forest on my own. The trees, they talk to you, you know if you walk through a heavy dense area like Mākena you can still feel it for me. But I spend a lot of time just walking through the kiawe trees on my own.

KT- So kiawe was to you like koa was to our kupuna?

KM- Probably. But it just so happened that's where I grew up, that's why. If I was in a koa forest probably that's what I would remember the most. Whereas my father was a water inspector for years all the reservoirs and things up in Waikamoi, he was the inspector on the jobs that built it so he spent a lot of time up there I would go up every now and then with him into the rainforest of Maui. But I remember going up with him and just walking the pipeline across gulches, you know, as a young boy. But the forest I remember the most is the kiawe rather than the rainforest.

KT- So if you talk kiawe can you give me an expansion of from where to where?

KM- We used to own the old Kihei Store which later became Suda Store so from there all the way as far as you can go to Mākena was just kiawe because there was no upper highway so the only homes you had was South Kihei Road. And so the development was just off of South Kihei Road so whatever you see on South Kihei Road when I grew up, that's it and Kenolio behind there. Other than that there was nothing. There was homes as you start to go down where like Koa Resort is and stuff was one or two homes in there along beachside other than that there wasn't very much. You know, so there was very little development- there was off of South Kihei Road may just be one or two houses, one dirt road in a little and that was it you know.

KT- So you never were attracted to the fishpond right there?

KM- No we played in it sometimes and more or less that was an old weather station that we grew up. Whenever you drove by on your car you would hear that clock tick tock or whatever and it would say that the national weather bureau or something, you would hear that recording come on. We did play in it, you know, growing up because my tutu was close to there so we would walk to the beach there.

KT- Did you recognize, real close by, a small ocean side recognition of a foreign group of people that they built something to recognize this?

KM- Well one of the oldest developments for Kihei is Maui Lu and it was Canadian people that built it, entrepreneur or whatever. And what the bugga did was he went across the street and threw up one small memorial to Captain Vancover I believe and I

may not necessarily recognize that as anything but as far as I know Hawaiians were there and I would recognize them first. But anyways, yeah there's that thing there that he kind of just put it together and that's all that it is, I don't know if it's recognized by anybody else and I don't know if it needs any type of recognition. But that's just me.

KT- That's a good point. So there's Captain Cook and Vancouver all had a part of the development of the history of Hawaii.

KM- Oh definitely but they sure did not discover anything.

KT- Oh not at all. So anything else that you can think of?

KM- I've always loved Kihei and the reason why I lived in Kihei is so that I told my parents that's where I want, "If you going give me anything I want the Kihei property" and that's how I ended up in Kihei. I've always- I never wanted to live in Wailuku, I never wanted to live in any other place other than Kihei as far as Maui's concerned and maybe it's just how I grew up. Like I said my affinity with forests is kiawe trees. I'm not saying that I couldn't enjoy green trees but for me home is the kiawe, all of that was brought in too but that's all I know. And the dry, you know the beaches and things like that I probably appreciate the beaches more now than I did back then. I mean back then it was more or less a time to just go swim, get wet and come back out and just do whatever we got to do but not a lot of time was spent there till probably my high school years when I got into surfing and things like that. But Kihei has always played an active role in my life. The development has of course taken a lot over at this point but other than that, that's what I remember.

KT- You covered a very important part that might be developed exactly where we're talking about where your house used to be with tutu.

Interview: ***Ku'ulei Teshima***

By Keli'i Tau'ā
May 18, 2009

KT – Keli'i Tau'ā
FKT- Frances Ku'ulei Teshima

KT- How long have you been residing here in Kihei?

FKT – 34 years

KT – Your full name?

FKT – Frances Ku'ulei Teshima.

KT – Your maiden name?

FKT- Frances Ku'ulei Bernie

KT –We are interviewing Kihei residents who know about the wet land area in back of Long's Drugs & Bank of Hawai'i. The Krausz Company wants to create a mixed-use development in Kihei, Maui alongside the Azeka Shopping Center.

During the development of this area, what can you recall about the area I am describing?

FKT – Nothing. There was nothing. The only store they had was Azekas and the Post Office. That was the only development existed in that area.

KT – That was makai (below South Kihei Rd.)

FKT – Makai

KT – So where we are talking about mauka (above South Kihei Road) was un-developed?

FKT – It was a natural area for the water where the ducks, birds, etc. came during a certain time of the year.

KT – But other residents said it wasn't there before. They said they filled it w/water.

FKT – There are still 2 ponds there when you go up to Honoapi'ilani off Pi'ikea. They didn't take away the ponds. If there are more ponds than that I don't know because I

didn't have access to that area. All I remember when we drove down Kihei Rd., there was a ditch that ran on both sides of the road by St. Theresa's Church. Always had a ditch on both sides.

KT – Only recently they started to fill the wet lands @ St. Theresa?

FKT – There area is where the water and ocean meets each other. So right between St. Theresa and big development is a big waterway. It used to be overgrown w/those water lilies. I don't see the water lilies anymore. They must have killed it off. But people still go fishing in there, children as well as adults. I don't know what they catch, maybe 'o'opu – goby fish.

KT – Where is that?

FKT – Right alongside St. Theresa. As you drive towards Mākena, you will see that water. But Kihei Road always had a water ditch to catch rain. Francis Akina told us when we first moved here that Welakahau St. was a gully. Whenever there was big rain in the mountain, that was a ripper and if you look it goes straight to the ocean from Welakahau St. to Halama. It was wetlands but it was covered up to make Welakahau Rd. which was all water.

KT – Was it a gulch?

FKT – Yes, it was a gulch. They covered it up to make a road. When we rain here, our house has never been flooded but my front driveway is a swimming pool. Maybe about two feet of water. The kids loved it though. It turns into a swimming pool when there is a heavy heavy rain. But this is all swamp area. Three feet below my house is ocean.

KT – You're kidding. The ocean came all the way up here?

FKT – If you dig down you touch water. Why do you think the Ulu Tree does so well. They say it's the best tasting Ulu because it hits the salt water. Several airlay the tree but haven't had any results. This came from Francis Akina. When we moved in he said, "I have a tree for you." We had planted a Plumeria, but he said, "NO!" then he dug out the Plumeria and he brought about a 13 to 15 feet tall baby, yet. And that's this Ulu tree.

KT—But the roots are going under.

FKT —Oh, he just got finished digging, he just had to dig all the roots. It goes sideways. But it's a good tree.

K—In many of my interviews that I do many people who lived on Maui are not able to see any Hawaiians anymore. That is happening here, too, in Kihei.

FKT —In Kihei?

K—Yeah, are there still a lot of Hawaiians in Kihei.

FKT —In church. Kalei Mo'ikeha just moved to Wailuku. And the Akina's we only have Bonnie Hambert. So our Hawaiians are dwindling in Kihei. Just looking at the church. But you're saying, exposure to the Hawaiian people?

K— No, I'm saying, just that Hawaiians are dwindling away.

FKT —We have Sanday Akina. And Mildred Weitecha, that's another aunty. And Hamby's sisters and the aunty Paula and Vernon and Vanessa and there's Lincoln Abiera.

And the sister married to Jeff. And then next door is the family, Lincoln's half-brothers. They live there.

K—No more the people, no more the culture.

FKT —Yeah, we no more Punana Leo in Kihei. (laughter)

K—If there was, would your mo'opuna go?

FKT —I wanted to send my grandchildren to Punana Leo. But who wants to drive all the way to Wailuku every morning? He has three children going to Kamehameha. And then you have the Kama's... they have two girls going to Kamehameha. And they have the little boy that's brand new. Keawe is what, six months old. So we have a Hawaiian generation coming up because I consider them Hawaiian. So here we have nine Nalu. The Tanabe's, the Kamalani's and the Motooka's. They have become inactive in church, I don't' know why. The Motooka's are Hawaiian.

K—I thought they went back to Kaua'i?

FKT —The wife?

K—Didn't she work on Kaua'i?

FKT —I didn't think she worked. Because the husband worked for Aloha. You must be thinking of one different Motooka... got plenny kids in that family, it's a BIG house.

K—Must be.

FKT —There was an Eagle Scout his name was Motooka. He was in the paper just now, I just read the thing. Troop 40, was about five boys became Eagle Scout, one of them was named Motooka.

K—Not part of the church program?

FKT —No, no. Just community.

K—So, all of the people who are learning Hawaiian at the college are fair skinned.

FKT —But they Hawaiian? Like me? But I have more Hawaiian than a lot of Hawaiians that look Hawaiian.

K—But the point is, they are interested. Because they say today that Hawaiians don't speak it, but all these non-Hawaiians are...

FKT —But today we have more children speaking Hawaiian than in my day. Because when I asked my mother, "How come you didn't teach us Hawaiian?" because she spoke the language fluently, her mother couldn't even speak English. She said to me, "Because you're Haole." I went, "Ma! That's a lousy excuse!" You know. And then when my mother-in-law lived with us for about a year, shes full-blown alzheimers, and she's talking to my husband in Hawaiian. He goes, "Ma, all my life all you spoke was English. Where is this Hawaiian coming from?" She was calling him names in Hawaiian, it wasn't nice.

K—Did she have an answer as to where it was coming from?

FKT —Oh no, she didn't answer him. You cannot determine anything with Alzheimer's patients. The sad thing was she stopped playing the piano and the ukulele and singing.

Everything was wiped out. To the point that she didn't know she had a baby in 1957. When he said, "she doesn't know who I am." I said, "you are right. She doesn't know you at all."

K—So the years you've lived here you saw a major change?

FKT —Oh please. My goodness! We came here and they never even have one traffic light. In 1959 when we moved to Maui, the only traffic light was in Wailuku. The only one on the whole island. Central and Main. That was the only traffic light. That was in 1959.

K—So nobody at the period of time, nobody was interested in what Hawaiian things were here?

FKT —No. Everybody was interested in 'where am I going to get a home?' Nobody wanted to live in Kihei because Kihei was only kiawe trees and sand. But my father-in-law bought here in 1949 for 10 ten cents per square foot.

K—Wow, that was a good deal.
FKT —So when my husband called his mom. When we moved to Lana'i for his job we had to sell our Hawaiian homestead back to Hawaiian homes. He had to invest that money and Kaua'ula in Lahaina had just built Kaua'ula Subdivision. Selling house and lot for $43,000. So he called his Mama and told his mom, "You put in 6,000 and I put in 6,000, that was the $12,000 deposit. Got the place and then he wanted to move home because he wanted his son to play football, Baldwin. He wanted to come home. So he told his mother, "I'll give you Lahaina, you give me Kihei." Because this was all undeveloped. All kiawe trees. Had the road. That house was there, that house was there and this house was there. But this was empty. Only kiawe trees. So they swapped. We gave her Lahaina, she gave us Kihei. And we built our home in 1975.

K—At that time this was considered wetlands?

FKT-- This is a wetland area. If you look it up in the Civil Defense map, it's a wetland area. So when we have a tidal wave, we have to move. Go uphill. But we've been here 35 years and we've been really blessed. With Eva, we were here through Eva. The only part was Pi'ilani and Suda Store had a floor that was completely covered. Nobody could go in or out. So being he was a police officer they told him to stay in Kihei and take care of all the people in Kihei. So that's what he did, everyday. He only patrolled Kihei. But that's how we managed, I think Iwa was for about a week. No electricity.

K—So, Iniki didn't have that much?

FKT —No. Iniki skirted us. We always get skirted. We're very blessed in Kihei. Kihei, I think, is a very choice area. Anybody goin' get hit is going to be Lahaina. Or Kahului Harbor.

K—They are open and exposed.

FKT —Yeah. Kihei is protected. But Iwa did a lot of damage to our beach. Because we used to go out here. Used to be a garden of limu on the beach out here at Halama.

K—What kind of limu you folks went to pick up?

FKT —We had Wawae'ole, Huluhuluwaina, and we had Lipoa was the garden and then the Manawea. I mean I could just stand in the water and put my hand down and the Lipoa, bunches of lipoa. And when Iwa came because they had stone walls, the people on the beach built stone walls to protect their house, because people built their house way out in the ocean. So to protect it, they built up these huge stonewalls, so when the wave came in it just grabbed everything. So when we went back out there it was just sand and rock. We lost all that lipoa. And lipoa is seasonal, you know, only May to July-August.

K—Yeah, you very seldom see it in the market anywhere.

FKT —Lipoa is hard to find.

K—So, when you came here, can you remember any kind of fishing activities?

FKT —No, um,

K—Only the Akinas was doing the...

FKT —That was WAY before our time. That was in the 1940's, according to Hamby. Hamby told me, if you were an Akina woman, or if you were married to an Akina, when it was time to go get the fish, I mean everyone was in the water. 'Cause you surrounded the net, yeah, everybody was out there bringing in the fish. It was a whole big family project. I was told turtles. Oh my goodness, turtles. Turtles and fish. And then, was it, Alex Akina's son, had the airplane, he would go out and spot the fish.

K- Butch.

FKT-- Was that Butch? These are all the stories that I heard because Flo Akina was my partner for Home Teaching and she was Francis wife. She and I talked story and she would tell me all these stories about the Akinas. And Hamby, Hamby and I were partners for awhile and she would tell me about her father, her father was John Akina. So, there were three brothers, Frank, Alec and John, the three brothers. Frank was the charcol man, the contractor. They worked very hard. But they were the original residendence of Kihei. Hardcore, the Akinas. I don't know, Huddleston, that's Akina family. That's the daughter. Lehua's mom is Frank's granddaughter. She died, but her grandchildren all live here. Huddleston. But that's all. I don't know how many Mo'ikehas are still here. Plunkett's get the two boys here, John and Charles. That's billy's two brothers. They built their homes on that property.

K—Where is that?

FKT —Right on the corner going up by Ohukai. Right after Ohukai you go down and that's all Plunkett, that circle. I think one is in the nursery business. That's Charles and John. They own that condominium at the end by Kalama park. You go on that beach road, off Kihei road, there's a condo that's Charles Plunkett, the grandfather.

K—So you as a community person, what's your opinion about what this development wants to do. They want to expand on the shopping center.

FKT —Expanding the Azeka shopping center? By going mauka? Won't that cover the wetlands? That's not good. Where is that water going to run? You gotta protect the wetlands. We've taken away too much already. Remember the ditches that I told you about on the side of the road always? Now they're gone, no more ditches. Kihei used to

be covered with toads. I loved toads, they eat all the cockroaches and keep the bugs down. NO TOADS! I have a funny story. I'm getting ready to go to work. We always have cats. I come out of my house, closing my door, the cat is trying to eat the food, the bird is on the roof squaking and the toad is over there in the pot eating the food. The toad is in the pot eating the food, the cat is trying to get to the food and the bird is squaking wanting the food. Today no more toad, not one toad in the yard. Why? Because they covered up all the water. I think that was their home.

K—This is why I'm doing this.

FKT —They cannot... We have enough with Pi'ilani shopping center, we have enough with Azeka. We have enough in Kihei. We have already been modernized enough. One thing they need to do, though, is enlarge the Post Office. If anything needs to be added to Kihei, it's the post office. And of course they already approved of the Kihei High School. So, we have that coming. That's it.

K—Where are they going to put that?

FKT —I heard it was going to be mauka of Pi'ilani.

K—Close to that new development?

FKT —I think it's going to be close to Kamali'i. Between the wastewater and then over. That's where I'm thinking it's going to be. Because over there by High Tech they are already building homes.

K—Right.

FKT —So the other place would be after the homes to Ohukai, that area mauka. I don't know. But I was told above Kamali'i. But please, you cannot build above Azeka. That's wetlands.

K—I'm going to take this and transcribe it and submit it so it gets this form. They take it to the county council and they listen to all of these interviews that we're doing.

FKT —Don't take our wetlands. Cause when I see the ducks and the Hawaiian stilts in the water, it's wonderful! That's where they should be. This new church up there, Hope Chapel. They have a huge lawn, and in the corner when you're going up, before the recycling center. Every time it rains it's a big swimming pool, cause it's in a dip, and the Hawaiian stilts are there. They are going to find water where ever there is water. So, and you know, Kealia pond is only flood at certain times of the year. We don't have water in the pond all the time. So where do the Hawaiian stilts go? They have to have water. They come back, I think, to the Azeka ponds. I will call them the Azeka ponds, the Pi'ikea Ave. That's the true ponds. Cause I see the ducks in there and I see the Hawaiian stilts in there. I haven't seen the Auku, the Auku is over there. You always see Auku by St. Theresa's church, that waterway that goes to the ocean. The Auku always standing, watching for the fish, have two or three every now and then over there. Usually I see them only at Kealia. If you take away those wetlands, they won't have anything.

K—Any other concerns you want to make sure that this report will present to the...

FKT —I know they want to continue the road Liloa, between Lokelani and the school. They want that road to go all the way to Maui Meadows. Maybe that would be a good

place for the people to go walking. If we could continue the road. But I don't think we should get another shopping center. I don't think we need another shopping center. I think we get enough with Pi'ilani and Azeka.

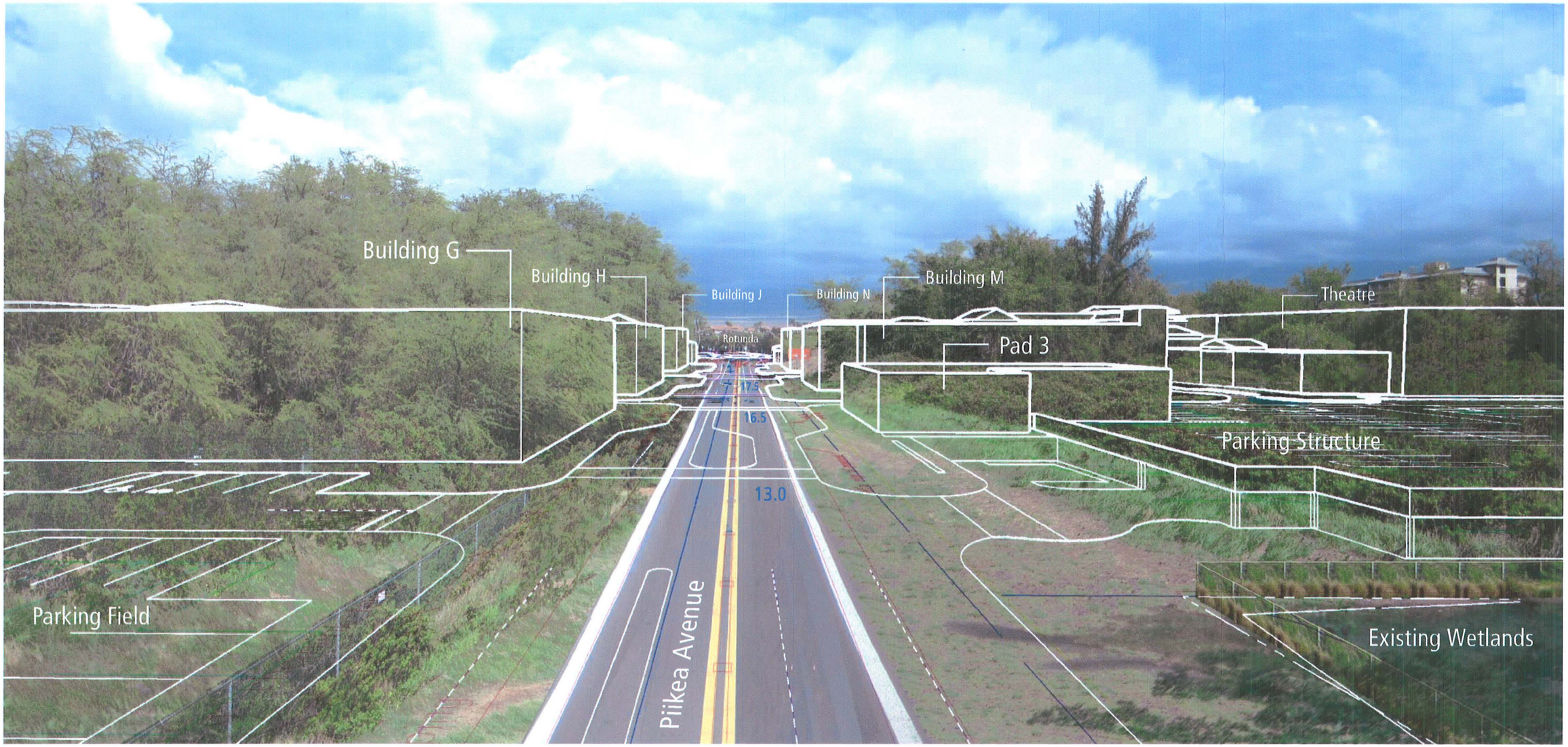
K—Well, I'll write it like you say and let the powers be to address the people's concerns. Any other concerns?

FKT —Is it gonna help to get our bust up roads fixed? These county roads, they got their money back. They submitted 17 million back, they put it back into the budget. They need to fix our roads. Kihei Road. Oh I have plenny roads on this island that I wanna fix—Hansen Road, where all the Hawaiians have to use to get to Kamehameha. They all have to use Hanson road. Fix up our little roads, if they fix the little roads, we'll get off the big highways. The big highways are so busy, we want to take all the little roads, but they're all bust up. Hansen road, if there is a puka (hole), they gonna fill in the puka and then the next rain, another puka. Fill 'em up again. And Kihei road, they go dig 'em up to put in pipes and then they leave a hump. To turn into the post office or out of Longs to get on Kihei Road, you gotta hit that hump. Why we gotta have a hump?! Anyway, we need to have our county roads taken care of. I don't know what that's going to do for your development, but... pro or con, roads have to be done.

KT—Well, Ku'ulei. Thank you very much for your time. We appreciate you talking with us.

APPENDIX H.

View Analysis



3d Model over Existing Conditions - View 1

March 1, 2012

Vicinity Plan

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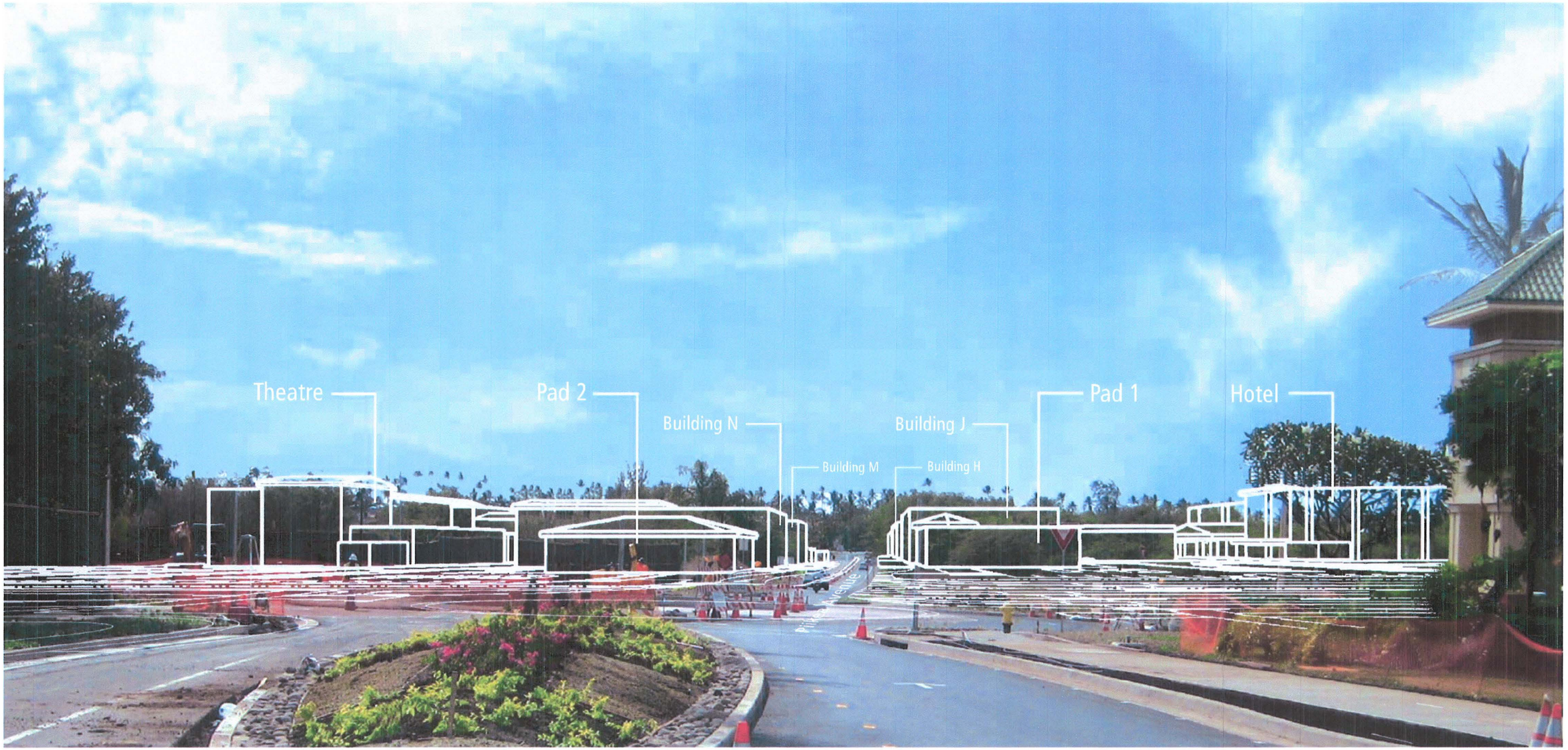

3d Model over Existing Conditions - View 2

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APPENDIX I.

Traffic Impact Assessment Report

TRAFFIC IMPACT ANALYSIS REPORT
KRAUSZ COMPANIES
COMMERICAL MIXED-USE DEVELOPMENT
(DOWNTOWN KIHEI)

KIHEI, MAUI, HAWAII

FINAL DRAFT

April 24, 2012

Prepared for:

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TRAFFIC IMPACT ANALYSIS REPORT
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AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
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TRAFFIC IMPACT ANALYSIS REPORT
Krausz Companies Commercial Mixed-Use Development
(Downtown Kihei)
Kihei, Maui, Hawaii

I. INTRODUCTION

This report documents the findings of a traffic study conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to evaluate the potential traffic impacts associated with the proposed Krausz Companies commercial mixed-use development (hereinafter referred as Downtown Kihei) located in Kihei, Maui, Hawaii.

Downtown Kihei will develop approximately 249,450 square feet (SF) of retail space, approximately 18,500 SF of general office space, and a 150-room hotel on approximately 26.1-acres parcels between the Piilani Village Shopping Center (PVSC) and the Longs and Azeka's centers. Downtown Kihei is expected to complete construction in year 2015 and fully occupied sometime after. Therefore, traffic conditions are measured during the forecast year 2015 conditions.

A. Location

Downtown Kihei is more specifically identified as TMKs: (2) 3-9-002:030, 3-9-002:076, and 3-9-002:158. Downtown Kihei is bounded by Liloa Drive to the east, the wetlands near Azeka Place to the west, with Piikea Avenue running through the proposed development. Figure 1 shows the project location.

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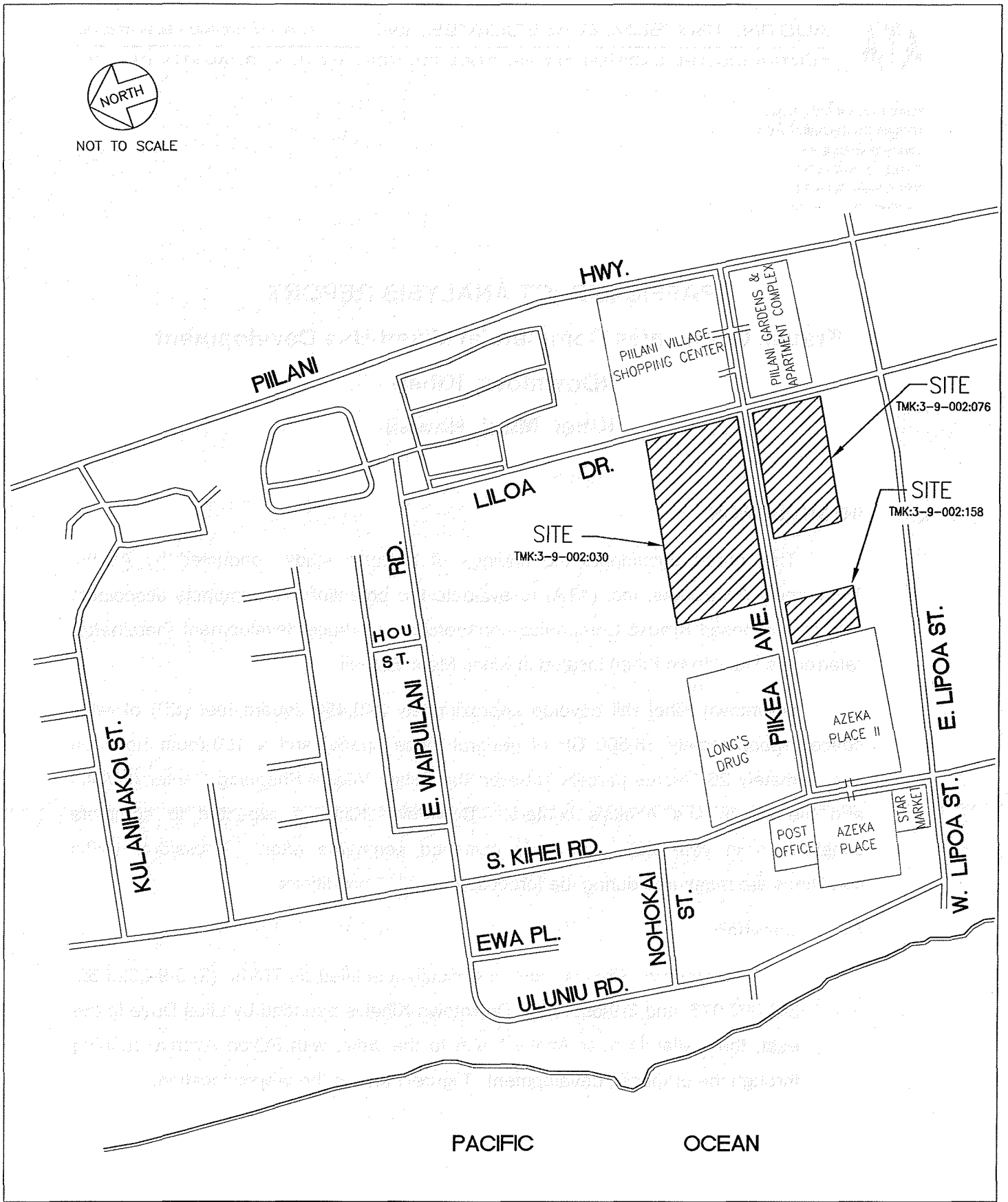


KRAUSZ MIXED-USE DEVELOPMENT DOWNTOWN KIHEI KIHEI, MAUI	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII	FIGURE
	PROJECT LOCATION	1

B. Project Description

The proposed Downtown Kihei development is separated by Piikea Avenue into a southern and northern development. The southern development is located on Parcels 76 and 158 and the northern development is located on Parcel 30.

Access to Parcel 76 is from a driveway access on Liloa Drive directly across the access to the existing Piilani Gardens apartment complex and four (4) driveways on Piikea Avenue. The two (2) easterly driveways on Piikea Avenue will be limited to right-turn in and out. Access to Parcel 158 will be through an existing shared driveway to Azeka Place on Piikea Avenue.

Parcel 76 will contain seven (7) buildings while Parcel 158 will contain one (1) 6,655 square feet (SF) one-story commercial building. Total gross leasable commercial area for the southern development is approximately 141,750 SF.

Access to the northern development located on Parcel 30 will be from a driveway access on Liloa Drive directly across the driveway access to the Piilani Village Shopping Center and four (4) driveways on Piikea Avenue directly across Parcel 76 with the same restrictions to the easterly driveways.

The northern development will contain six (6) buildings consisting of approximately 126,200 SF gross leasable commercial and office space and a 150-room, specialty hotel. See Figure 2 for Project site map.

C. Study Area

To assess the impacts of the proposed Downtown Kihei development, seven (7) intersections (three (3) signalized and four (4) unsignalized) were identified for analysis in this study. The intersections are located in the general vicinity of the site and include:

1. Piilani Highway and Piikea Avenue (Signalized)
2. Piikea Avenue and PVSC Main Access /Piilani Gardens (Signalized)
3. Piikea Avenue and PVSC Secondary Access (Unsignalized, Right-turn in/Right turn out)

4. Liloa Drive and PVSC Makai Access (Unsignalized)
5. Piikea Avenue and Liloa Drive (Unsignalized, All-Way Stop Controlled)
6. Piikea Avenue and Azeka Shopping Center Mauka driveway (Unsignalized, Two-way Stop Controlled)
7. Piikea Avenue/South Kihei Road (Signalized)

D. Study Methodology

This study will address the following study scenarios:

1. Existing traffic operating conditions at the study intersections.
2. Base Year 2015 (build out year for Downtown Kihei) traffic projections (without Downtown Kihei) including traffic generated by a defacto growth rate and the other known developments in the vicinity of Downtown Kihei, which would be completed and occupied by 2015 and which are expected to generate significant traffic demand within the study area.
3. Identify potential traffic mitigation measures for the Base Year 2015 Traffic, if any.
4. Trip generation and traffic assignment characteristics.
5. Determination of the impact of Project-generated (Downtown Kihei) traffic.
6. Recommendations for roadway improvements or other mitigative measures, as appropriate, to reduce or eliminate the adverse impacts resulting from traffic generated by Downtown Kihei.

E. Level of Service

Level of Service (LOS) is a qualitative measure used to describe the conditions of traffic flow at intersections, with values ranging from free-flow conditions at LOS A to congested conditions at LOS F. The Highway Capacity Manual – Special Report 209 (HCM), dated 2000, methods for calculating volume to capacity ratios, delays and corresponding Levels of Service were utilized in this study. LOS definitions for signalized and unsignalized intersections are provided in Appendix B.

The v/c ratio is a measure of capacity sufficiency, that is, whether or not the physical geometry (i.e. lane configurations, type of control) provides sufficient capacity for the subject traffic volume movement or movements. A v/c ratio of less than 1.00 indicates that the volume is less than capacity. As the v/c approaches zero, traffic conditions are generally good with little congestion and low delays for most intersection movements. As the v/c ratio approaches 1.00, traffic becomes more congested and unstable with longer delays.

Delay is a measure of quality of service for the motorist and is measured in seconds per vehicle. Both must be analyzed to fully understand the anticipated operational characteristics of the intersection, and neither can be substituted for the other. Practically, however, it must be recognized that an intersection cannot operate beyond its capacity.

Methodology

Analysis for the study intersections was performed using Synchro, RODEL, and SimTraffic analysis software packages. Synchro is based on the HCM methodologies. RODEL uses empirical correlations between roundabout geometries and capacity and has been used to provide capacity analysis of various design parameters. Capacity estimates by RODEL have been validated by direct field observations. SimTraffic is a microscopic simulation program for use as an adjunct to the Synchro software.

The reports contain quantitative delay results, as based on intersection lane geometry, signal timing (including coordination and actuated minimums and maximums), and hourly traffic volume. For unsignalized intersection, the LOS is based on reserve capacity and average delay per vehicle. Based on the vehicular delay at the intersection, a LOS is assigned (see Appendix B) as a qualitative measure of performance. These results, as confirmed or refined by field observations, constitute the technical analysis that will form the basis of the recommendations outlined in this report.

Site Development Plan

NORTH

0' 50' 100' 150' 200' 250' 300'

DOWN TOWN KIHEI

The KRAUSZ COMPANIES, Inc.

KRAUSZ MIXED–USE DEVELOPMENT DOWNTOWN KIHEI KIHEI, MAUI	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII	FIGURE
	PROJECT SITE	2

II. EXISTING CONDITIONS

A. Roadway Description

The following are brief descriptions of the existing roadway network in the vicinity of the proposed Downtown Kihei project:

Piilani Highway in the project vicinity trends in a north-south direction and begins at its intersection with North Kihei Road. To the south, Piilani Highway continues approximately 7 miles towards its terminus at Wailea Ike Drive. In the vicinity of the study area, Piilani Highway is a four-lane, State arterial highway that provides access to Kihei and Wailea. South of Kilohana Drive, Piilani Highway narrows to two (2) lanes. Left-turn storage lanes and right-turn deceleration lanes are provided at all major intersections on the highway. The shoulder areas of the highway are designated as bicycle lanes throughout the length of the highway. Within the study area, the posted speed limit on Piilani Highway is 40 mph.

Liloa Drive is currently a two-lane, undivided, north-south, minor collector road that provides for circulation between East Waipulani Drive and Halekuai Street. Exclusive left-turn lanes are provided at its major intersections. The posted speed limit along this road is 20 mph.

South Kihei Road is generally a north-south roadway that traverses the Kihei coastline. It begins at its "T"–intersection with North Kihei Road and eventually connects Okolani Drive in Wailea. In the vicinity of the study area, South Kihei Road is a two-lane, undivided, county collector roadway. South Kihei Road provides local access to shopping centers and visitor accommodations. The posted speed limit along this road is 20 mph.

Piikea Avenue is oriented in the east-west direction between Piilani Highway and South Kihei Road. Piikea Avenue is a four-lane, divided roadway between Piilani Highway and Liloa Drive, and narrows to a two-lane roadway between Liloa Drive and South Kihei Road. Piikea Avenue forms a "T"-intersection at Piilani Highway, with Piikea Avenue being the stem of the "T". Between Piilani Highway and the driveway intersection at PVSC/Piilani Gardens, there is a landscaped median on Piikea Avenue. The posted speed limit along this road is 20 mph.

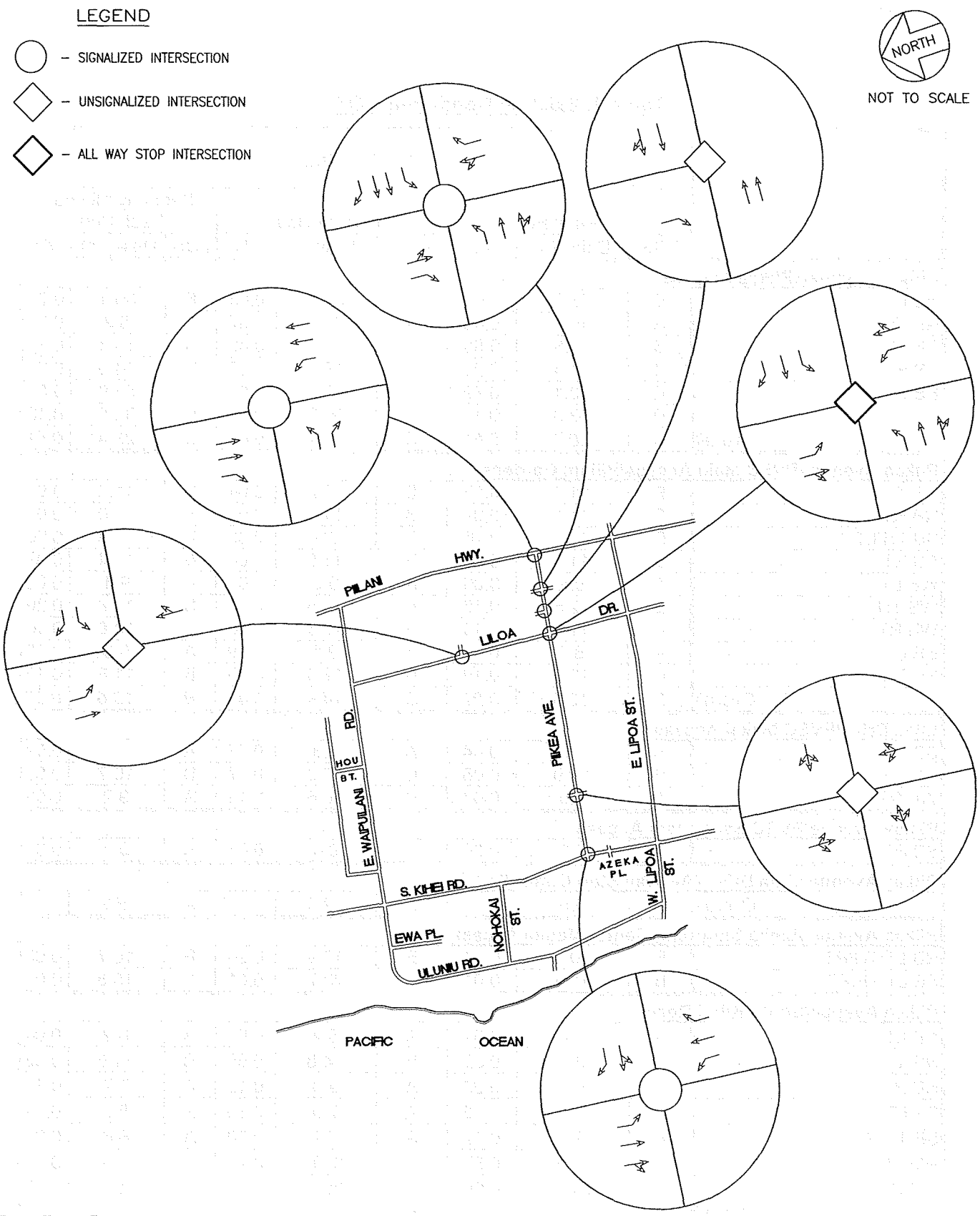
B. Existing Conditions Peak Hour Traffic Volumes

To determine the existing operation, this study utilizes 2009/2010 AM, PM, and Saturday mid-day peak hour intersection counts collected at the study intersections.

Based on traffic count data, the peak hours of traffic were determined to be from 7:15 AM to 8:15 AM and 3:15 PM to 4:15 PM on weekdays, and 12:00 PM to 1:00 PM on the weekend. Detailed traffic count data is provided in Appendix A. Figure 3 shows the existing lane configuration at the study intersections.

C. Existing Conditions Peak Hour Traffic Analysis

The results of the LOS under existing conditions are summarized in Table 1. Detailed LOS analysis output files from Synchro are contained in Appendix C.



KRAUSZ MIXED-USE DEVELOPMENT
DOWNTOWN KIHEI
KIHEI, MAUI

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EXISTING LANE CONFIGURATION

FIGURE 3

Table 1: Existing Conditions LOS

	Existing Year								
	AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak Hour		
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
Piilani Highway/Piikea Avenue									
NB LT	E	73.6	0.69	F	87.9	0.83	F	90.1	0.77
NB TH	A	5.7	0.40	A	5.6	0.37	A	6.2	0.32
SB TH	B	15.8	0.55	C	21.8	0.49	B	16.8	0.37
SB RT	B	11.4	0.20	B	19.3	0.33	B	14.9	0.21
EB LT	E	73.1	0.79	F	89.3	0.81	F	88.6	0.83
EB RT	D	53.3	0.11	E	66.2	0.19	E	62.5	0.13
Overall	*C*	*20.7*	*0.61*	*C*	*30.4*	*0.61*	*C*	*28.4*	*0.51*
Piikea Avenue /PVSC Main Access/Piilani Gardens									
NB TH/LT	B	11.4	0.06	B	11.2	0.04	B	11.2	0.04
NB RT	B	11.1	0.02	B	11.0	0.02	B	11.0	0.01
SB TH/LT	B	16.2	0.46	C	22.4	0.69	B	19.3	0.60
SB RT	B	11.1	0.03	B	11.5	0.08	B	11.4	0.07
WB LT	A	9.4	0.06	A	9.5	0.07	A	9.1	0.02
WB TH	B	12.5	0.16	B	13.5	0.30	B	12.8	0.20
WB RT	B	12.6	0.13	B	13.3	0.20	B	12.8	0.16
EB LT	A	8.2	0.07	A	9.1	0.19	A	9.0	0.18
EB TH/RT	B	12.0	0.19	B	12.3	0.23	B	11.8	0.15
Overall	*B*	*12.8*	*0.27*	*B*	*14.4*	*0.46*	*B*	*13.6*	*0.37*
Liloa Drive/PVSC Makai Access									
SB LT	A	7.6	0.04	A	8.3	0.07	A	7.7	0.02
WB LT	B	11.9	0.06	C	15.2	0.17	B	10.7	0.05
WB RT	A	9.0	0.02	B	10.6	0.14	A	9.2	0.05
Piikea Avenue/PVSC Secondary Access									
SB RT	A	9.2	0.06	A	9.4	0.06	A	9.4	0.05
Piikea Avenue/Liloa Drive (All Way Stop Controlled) [1]									
Overall	*A*	*6.6*	*-*	*B*	*12.3*	*-*	*A*	*5.6*	*-*
Piikea Avenue/Azeka Shopping Center Mauka Access									
NB LT/TH/RT	B	10.0	0.04	B	13.9	0.20	B	10.7	0.06
SB LT/TH/RT	B	11.4	0.01	C	23.7	0.01	C	15.8	0.01
Piikea Avenue/South Kihei Road									
NB LT	A	4.2	0.01	A	8.2	0.04	A	6.2	0.04
NB TH	A	6.4	0.32	B	14.8	0.59	B	11.5	0.52
NB RT	A	4.8	0.06	A	9.3	0.12	A	7.7	0.13
SB LT	A	2.5	0.15	A	7.0	0.30	A	5.3	0.14
SB TH/RT	A	3.7	0.17	A	7.2	0.30	A	6.6	0.24
WB TH/LT	D	37.3	0.57	D	39.8	0.78	D	36.9	0.71
WB RT	C	31.5	0.05	C	25.7	0.14	C	26.3	0.06
Overall	*A*	*9.6*	*--*	*B*	*16.0*	*--*	*B*	*13.6*	*--*

[1] Note: This intersection was analyzed using the SimTraffic Analysis program, since the HCM Method employed by Synchro does not apply to AWSC with legs having more than 2 lanes.

The results show that all of the study intersections currently operate at acceptable level of service except for the Piilani Highway and Piikea Avenue intersection. The Piilani Highway and Piikea Avenue intersection has an overall intersection LOS C or better; however, the Piilani Highway northbound left-turn traffic and the Piikea Avenue eastbound left-turn traffic is operating at LOS E during the AM peak hour and LOS F during the PM and Saturday mid-day peak hours of traffic. In addition, both of the Piilani Highway northbound left-turn and Piikea Avenue eastbound left-turn traffic movements are approaching capacity conditions during the PM and Saturday mid-day peak hour of traffic.

Figure 4 shows existing peak hour volumes and LOS at the study intersections.

Existing Observations

Existing traffic conditions were observed in the field during the peak periods of traffic in order to identify any operational deficiencies and to confirm the accuracy of calculated levels of service.

Piilani Highway/Piikea Avenue

Traffic along Piilani Highway is regional; intersection operations are dominated by north-south traffic along Piilani Highway. Traffic emanating from the Piikea Avenue eastbound left-turn lane occasionally queue beyond the Piikea Avenue/PVSC Main Access/Piilani Gardens intersection during the PM peak hour of traffic. This can be attributed to generally high eastbound left-turn turning volume and a long cycle length.

Piikea Avenue/PVSC Main Access/Piilani Gardens

The intersection of Piikea Avenue/PVSC Main Access/Piilani Gardens was observed to function adequately during the peak hours of traffic. However, the left-turn traffic movements onto Piikea Avenue from the PVSC Main Access were often obstructed when the Piikea Avenue eastbound left-turn at its intersection with Piilani Highway occasionally queue beyond this intersection during the PM peak hour or traffic. The PVSC employees/customers and Piilani Gardens residents constitute the side-street turning movements at this

intersection. The traffic signal uses fully actuated signal timing despite its close proximity to the Piilani Highway/Piikea Avenue intersection.

Piikea Avenue/PVSC Secondary Access

The intersection of Piikea Avenue and PVSC Secondary Access was observed to operate adequately. The PVSC Secondary Access is one (1) of two (2) auxiliary entrance/exits to the shopping center; the other is situated along Liloa Drive (Makai access), to the north of the Piikea Avenue/Liloa Drive intersection. Generally, low volumes are experienced at this right-in/right-out intersection, as the majority use the PVSC Main Access. It is primarily used as a means of accessing the nearby gas station/convenience market, Round Table Pizza, and various strip mall shops residing at the southwest quadrant of the mall.

This intersection is situated approximately 230 feet east of the Piikea Avenue/Liloa Drive intersection – a relatively short distance. Therefore, its operations would be entwined with the Piikea Avenue/Liloa Drive intersection if congestion were to increase.

Piikea Avenue/Liloa Drive

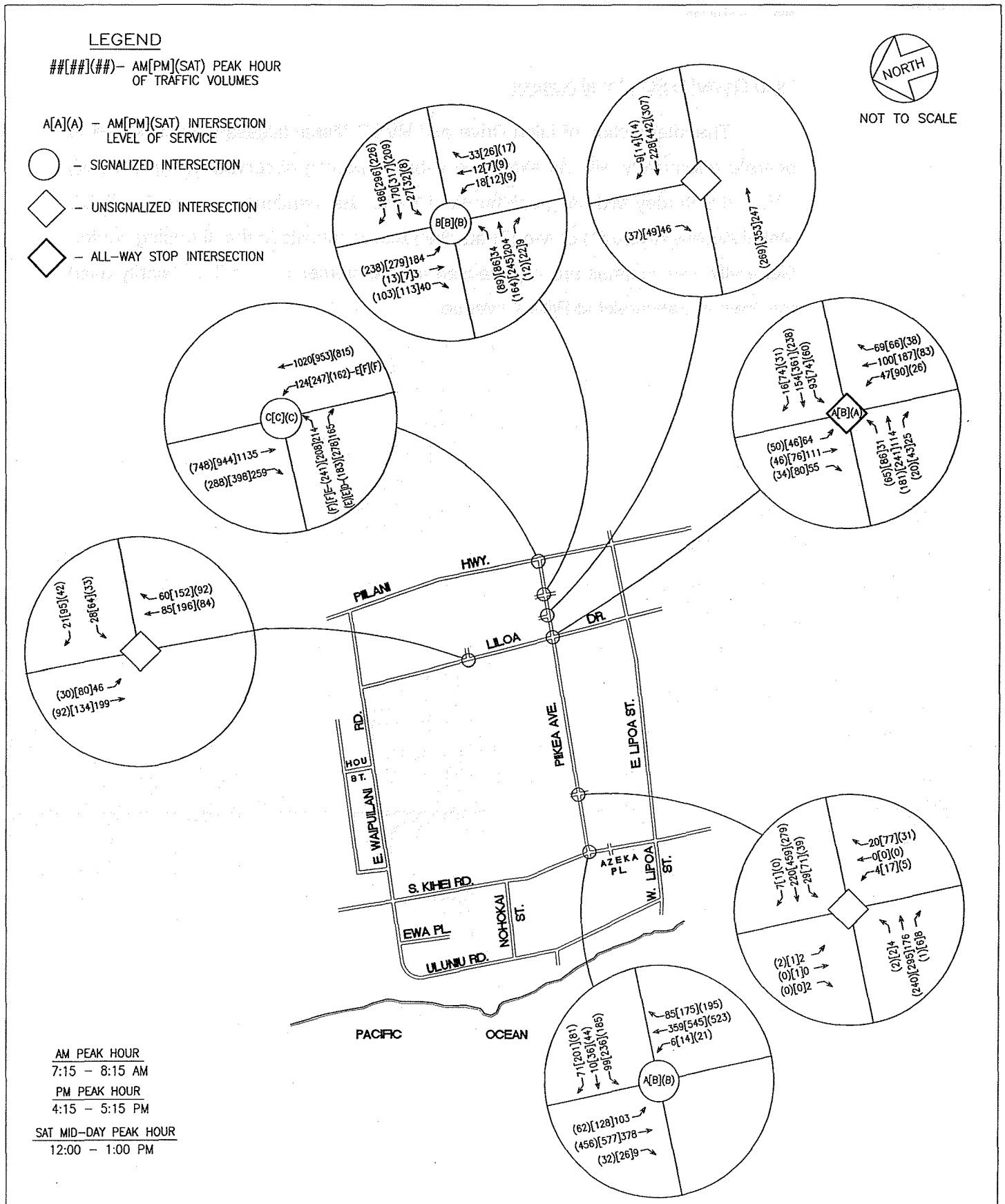
The intersection of Piikea Avenue and Liloa Drive functioned adequately during the AM, PM, and Saturday Mid-day peak hours of traffic. This intersection currently operates using All-Way Stop Control (AWSC), and is situated along a school route. A relatively balanced vehicular flow is experienced across all approaches. The overall volume is relatively low, which allows for AWSC to operate at adequate capacity.

South Kihei Road/Piikea Avenue

The intersection of South Kihei Road/Piikea Avenue functioned adequately during the AM, PM, and Saturday Mid-day peak hours of traffic. Also, the Piikea westbound vehicle queue extended to the adjacent Azeka Shopping Center driveway, approximately 225 feet east along Piikea Avenue during the PM peak hour.

Liloa Drive/PVSC Makai Access

The intersection of Liloa Drive and PVSC Makai access was observed to operate adequately with no extensive vehicle queuing observed during the AM, PM, and Saturday Mid-day peak hours of traffic. As mentioned earlier, the PVSC Makai Access is one (1) of two (2) auxiliary entrance/exits to the shopping center. Generally, low volumes are experienced at this intersection, as the majority used the main entrance/exit at Piikea Avenue.



AM PEAK HOUR
7:15 – 8:15 AM
PM PEAK HOUR
4:15 – 5:15 PM
SAT MID-DAY PEAK HOUR
12:00 – 1:00 PM

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EXISTING PEAK HOUR OF TRAFFIC VOLUMES AND LEVEL OF SERVICE

FIGURE 4

III. BASE YEAR 2015 SCENARIO

Downtown Kihei is expected to have construction completed in year 2015 and open for business sometime after. Therefore, the year 2015 was selected as the base year to measure traffic conditions in the study area. Base Year 2015 was estimated by applying a defacto growth rate, described in the following section, to existing 2011 AM, PM and Saturday Midday peak hour vehicular traffic volumes. Vehicular traffic volumes projected to be generated by other known approved developments expected to be completed and utilized by year 2015 were also added, if any, to the existing vehicular traffic volumes.

A. Defacto Growth Rate

To estimate the traffic volumes that will exist in the vicinity of the proposed Downtown Kihei project during the year of 2015, current available traffic trends were evaluated. The traffic projections in the most recent (1997) Maui Long-Range Land Transportation Plan (MLRLTP) indicate that vehicular traffic volumes will increase by approximately 2 percent through the study area annually. Therefore, the Base Year 2015 background traffic volumes were determined by increasing the existing 2011 traffic volumes by the assumed defacto growth rate for a period of four (4) years.

B. Traffic Forecasts for Other Known Developments

Traffic volume projections for Base Year 2015 include traffic generated by known future developments near Downtown Kihei that were assumed to be constructed by year 2015 and generate significant demand within the study area. The other known future developments and the number of vehicular trips they are expected to generate are shown in Table 2. Traffic generated by the developments discussed below was obtained from traffic impact reports or other sources. Traffic projections for developments for which traffic impacts were not available were estimated by applying the appropriate trip generation rates from the Trip Generation, 8th Edition, published by the Institute of Transportation Engineers (ITE).

Table 2
Trip Generation Summary for New/Future Developments Near the Project

			AM Peak Hour		PM Peak Hour		Sat Mid-day	
Development	*Land Use*	*Units*	*Enter*	*Exit*	*Enter*	*Exit*	*Enter*	*Exit*
Kaiwahine Village	Multi-Family	120 units	19	47	49	31	26	26
Kenolio Affordable Housing	Multi-Family	124 Dwelling Units	20	48	51	32	32	32
Kihei High School	Students	94 Students	27	13	6	6	7	2
Kihei Residential	Single-Family	300 Units	54	163	176	104	110	97
	Multi-Family	150 Units	11	56	53	26	35	30
	Commercial	2250 SF GLA	80	80	62	65	28	26
	Office	5250 SF GLA	14	2	11	54	2	1
	Commercial Park	10 Acres	1	1	1	1	10	10
Maui Lu Resort	Hotel (exist. to be demolished)	125 Units	-44	-36	-53	-40	-54	-54
	Timeshare	400 Units	139	69	92	128	174	174
	Lock-Offs	400 Units	118	70	118	118	174	174
Piilani Promenade	Commercial and Nursery	700,000 SF GLA	422	268	1391	1507	2173	2007
TOTAL			***861***	***781***	***1958***	***2031***	***2716***	***2525***

Kaiwahine Village – This proposed project is located at the east end of Kaiwaihine Drive and will construct 120 multi-family units. For purposes of this study, it was assumed that this project would be complete by 2015.

Kenolio 6 Affordable Housing – This proposed project is a 124 unit multi-family affordable housing development located between Piilani Highway and Kenolio Road. It is anticipated that this project will be completed by 2012.

Kihei High School – This proposed project will be located along the mauka side of Piilani Highway north of Downtown Kihei. The majority of the facilities are expected to be completed when the school opens in year 2015.

Based on the Traffic Impact Report for Kihei High School, conducted by Wilson Okamoto Corporation, dated September 2011, Kihei High School will generate approximately 800 students by year 2015. The study indicated that 704 students from Kihei attend high school in other regions. Therefore, a total of 96 new students were accounted for in this study by year 2015.

Kihei Residential – This proposed project will be located along the mauka side of Piilani Highway between Kaiwahine Street and North Kihei Road. Upon full buildout, the project will consist of 400 single-family units, 200 multi-family units, 3,000 square feet of commercial floor area, and 7,000 square feet of office floor area. For purposes of this study, it was conservatively estimated that 75% of this project would be complete by 2015.

Maui Lu Resort – This project is located at the intersection of South Kihei Road at Kaonoulu Street and plans to demolish a portion of existing hotel facilities and construction a 400 unit timeshare with each timeshare unit having one lock off unit, which may be used as a separate hotel room. For purposes of this study, it was assumed that this project would be complete by 2015.

Piilani Promenade – This project will be located mauka of Piilani Highway opposite of Kaonoulu Street north of Downtown Kihei. The project will include about 700,000 square feet of retail and restaurant space. It is anticipated that this project will be completed by 2015.

C. Planned Roadway Projects

Piikea Avenue and Liloa Drive Intersection – Roundabout

At the time of this report, the County of Maui had an on-going project to construct a single-lane roundabout at the Piikea Avenue and Liloa Drive intersection. The roundabout will replace the current all-way stop controlled intersection, allowing continuous movement of traffic in one direction around a central island. The roundabout is expected to be completed by mid 2012. Therefore, this study's base year and future year with project scenarios assume that the roundabout will be in place.

Piilani Highway and Piikea Avenue Intersection – Second Left-Turn Lane on Piikea Avenue

There was a Memorandum of Understanding (MOU), dated October 13, 2008, between the Maui County Department of Parks and Recreation (DPR) and the Maui County Department of Public Works (DPW) in which, at the time, DPW planned to construct a second left-turn lane for mauka bound traffic on Piikea Avenue at the intersection of Piilani Highway and Piikea Avenue. The construction was identified as a recommended improvement for the DPR South Maui Community Park project. In addition, the MOU stated that funding for this project would be incorporated into DPW's Capital Improvements 6-year Plan for projects programmed into the Statewide Transportation Improvement Program (STIP) for Federal Funding. Based on this timeline, it is anticipated that the construction of the second left-turn lane on Piikea Avenue would be completed by 2015. However, this planned improvement is not currently documented in the latest STIP implementation schedule through 2016. As such, this improvement will not be incorporated into the future conditions at this time.

D. Base Year 2015 Peak Hour Traffic and Analysis

The LOS for Base Year 2015 traffic conditions were determined using the same methods as discussed previously in the Existing Conditions – Level of Service section. The capacity analyses were based on the determined Base Year 2015 traffic volumes. Table 3 outlines the expected Base Year 2015 LOS for the study intersections analyzed.

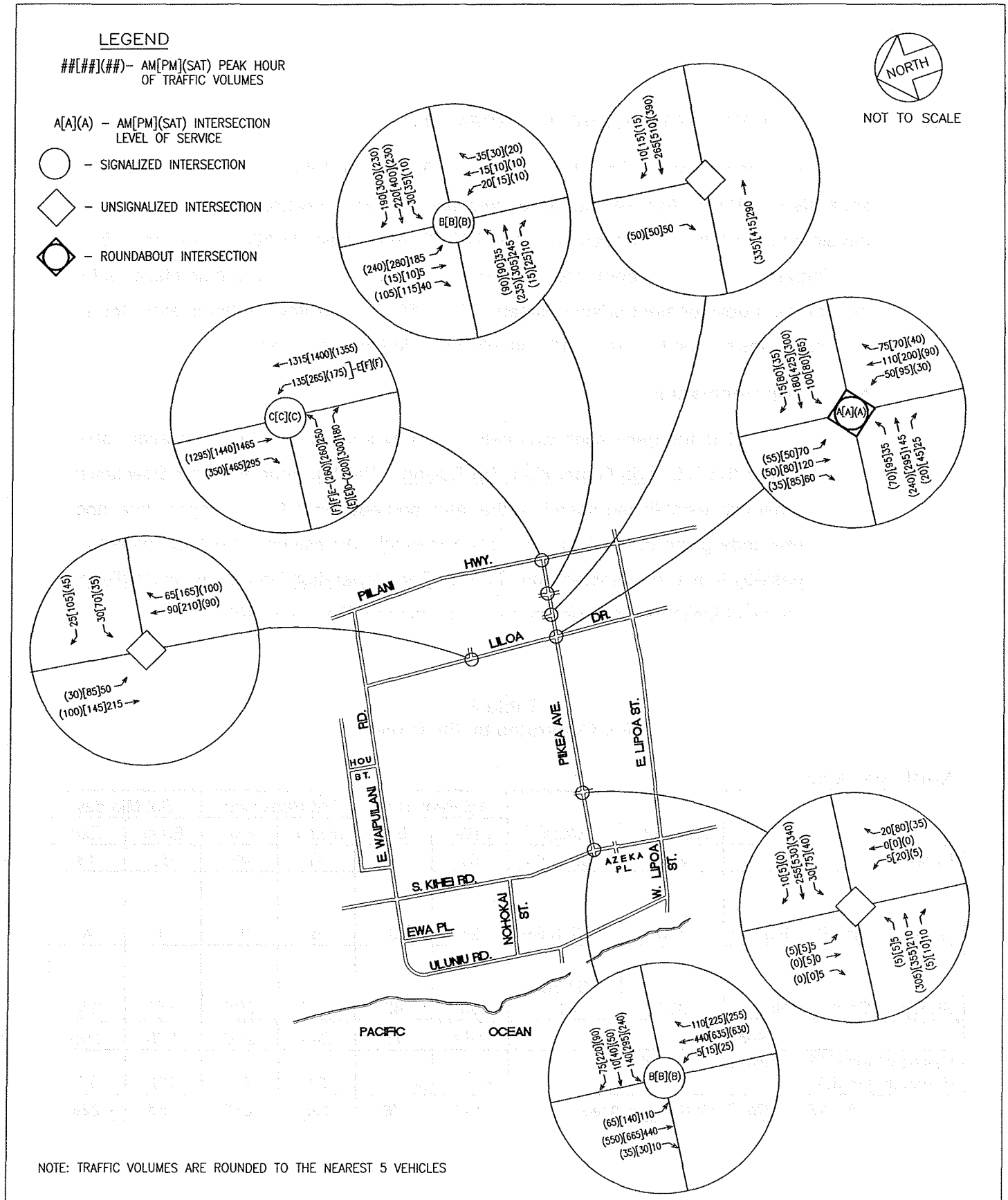
Table 3: Base Year 2015 LOS

	Base Year 2015 Without Project-Generated Traffic								
	AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak Hour		
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
Piilani Highway/Piikea Avenue									
NB LT	E	75.8	0.72	F	94.4	0.88	F	90.8	0.79
NB TH	A	8.0	0.53	A	8.9	0.56	A	9.1	0.54
SB TH	C	22.4	0.74	C	33.8	0.79	C	24.6	0.66
SB RT	B	13.6	0.25	C	23.9	0.43	B	17.7	0.30
EB LT	E	73.0	0.82	F	94.4	0.88	F	88.6	0.85
EB RT	D	50.9	0.12	E	63.2	0.23	E	61.1	0.14
Overall	*C*	*23.4*	*0.75*	*C*	*34.1*	*0.82*	*C*	*28.0*	*0.72*
Piikea Avenue/PVSC Main Access/Piilani Gardens									
NB TH/LT	B	11.4	0.07	B	11.3	0.05	B	11.2	0.04
NB RT	B	11.1	0.02	B	11.0	0.02	B	11.0	0.01
SB TH/LT	B	16.4	0.46	C	22.9	0.70	B	19.5	0.60
SB RT	B	11.1	0.03	B	11.5	0.08	B	11.4	0.07
WB LT	A	9.4	0.07	A	9.5	0.08	A	9.1	0.02
WB TH	B	12.8	0.21	B	14.2	0.38	B	13.3	0.28
WB RT	B	12.6	0.13	B	13.3	0.21	B	12.8	0.16
EB LT	A	8.3	0.07	A	9.4	0.21	A	9.1	0.19
EB TH/RT	B	12.2	0.23	B	12.7	0.29	B	12.2	0.22
Overall	*B*	*12.9*	*0.29*	*B*	*14.6*	*0.50*	*B*	*13.7*	*0.41*
Liloa Drive/PVSC Makai Access									
SB LT	A	7.7	0.04	A	8.4	0.08	A	7.7	0.02
WB LT	B	12.3	0.06	C	16.3	0.19	B	10.9	0.06
WB RT	A	9.0	0.02	B	10.9	0.16	A	9.3	0.05
Piikea Avenue/PVSC Secondary Access									
SB RT	A	9.3	0.06	A	9.2	0.06	A	9.3	0.06

Table 3 (Continued): Base Year 2015 LOS

	Base Year 2015 Without Project-Generated Traffic								
	AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak Hour		
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
Piikea Avenue/Liloa Drive (Roundabout)									
Overall	*A*	*4.5*	--	*A*	*7.3*	--	*A*	*5.3*	--
Piikea Avenue/Azeka Shopping Center Mauka Driveway									
NB LT/TH/RT	B	10.6	0.04	C	17.0	0.27	B	11.5	0.07
SB LT/TH/RT	B	12.2	0.02	D	31.0	0.07	C	19.1	0.02
Piikea Avenue/South Kihei Road									
NB LT	A	5.5	0.01	A	9.1	0.04	A	7.1	0.06
NB TH	A	9.0	0.42	B	19.3	0.72	B	15.2	0.65
NB RT	A	6.3	0.08	B	10.5	0.15	A	8.9	0.18
SB LT	A	3.9	0.19	A	10.0	0.40	A	7.6	0.19
SB TH/RT	A	5.0	0.20	A	8.2	0.35	A	7.7	0.29
WB TH/LT	C	34.3	0.58	D	49.9	0.89	D	41.5	0.81
WB RT	C	28.7	0.05	C	24.8	0.15	C	24.9	0.06
Overall	*B*	*10.9*	--	*B*	*19.4*	--	*B*	*16.1*	--

The study intersections are expected to perform at similar levels of service as the existing conditions with some slight delays in Base Year 2015. Similar to existing conditions, Base Year 2015 conditions continue to show that the Piilani Highway northbound left-turn and Piikea Avenue eastbound left-turn traffic movements are expected to approach capacity conditions during the PM and Saturday Mid-day peak hours of traffic. Figure 5 shows Base Year 2015 peak hour of traffic volumes and LOS.



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BASE YEAR 2015 PEAK HOUR OF TRAFFIC VOLUMES AND LEVEL OF SERVICE

FIGURE 5

IV. FUTURE YEAR 2015 WITH PROJECT SCENARIO

As mentioned earlier, the proposed Downtown Kihei development will be separated by Piikea Avenue into a northern and southern development. The northern development will have approximately 107,700 SF retail area, 18,500 SF general office building area, and a 150-room, specialty hotel. Total gross leasable commercial area for the southern development is approximately 141,750 SF Downtown Kihei is expected to complete construction by year 2015 and fully occupied sometime after.

A. Trip Generation

The trip generation was determined by applying the trip generation rates as per the ITE, Trip Generation, 8th Edition. The trip generation for Downtown Kihei was established based on the rates and equations for the appropriate land use code given in the Trip Generation manual. An estimation of the percent of pass-by trips was obtained from the ITE, Trip Generation Handbook, 2nd Edition. Table 4 highlights the expected trip generation for Downtown Kihei.

Table 4
Trips Generated by the Project

North Site Area

			AM Peak Hour		PM Peak Hour		Sat Mid-day	
	ITE code	*Units*	*Enter*	*Exit*	*Enter*	*Exit*	*Enter*	*Exit*
Hotel	310	150 units	51	33	47	42	60	48
General Office Building	710	18,500 SF	26	3	5	23	4	4
Shopping Center (Retail)	820	107,700 SF	66	42	197	205	274	253
Subtotal			*143*	*78*	*249*	*270*	*338*	*305*
Pass-by trips (25% weekday; 30% Saturday) (Excluding PUD)					51	57	83	77
TOTAL NEW TRIPS (North Site Area)			***143***	***78***	***199***	***213***	***255***	***228***

Table 4 (Continued):
Trips Generated by the Project

South Site Area

			AM Peak Hour		PM Peak Hour		Sat Mid-day	
	ITE code	*Units*	*Enter*	*Exit*	*Enter*	*Exit*	*Enter*	*Exit*
Shopping Center (Retail)	820	141,750 SF	87	55	259	270	361	333
Subtotal			*87*	*55*	*259*	*270*	*361*	*333*
Pass-by trips (25% weekday; 30% Saturday) (Excluding PUD)					65	68	108	100
TOTAL NEW TRIPS (South Site Area)			***87***	***55***	***194***	***203***	***253***	***233***
TOTAL NEW TRIPS (North & South Site Area)			***230***	***133***	***393***	***416***	***508***	***461***

B. Trip Distribution/Assignment

The trip distribution for Downtown Kihei has been determined based on the existing traffic flow patterns experienced in the area, the type of adjacent development, and trip patterns typical for mixed use developments. Figure 6 depicts the expected Project trip distribution.

The site-generated traffic was assigned to the study intersection according to the expected trip distributions. The site generated traffic volumes for Downtown Kihei at the study intersection are shown in Figure 7.

C. Downtown Kihei Site Access

As mentioned earlier, in the Project Description Section, access to the southern development will be from a driveway access on Liloa Drive directly across the access to the existing Piilani Gardens apartment complex and four (4) driveways on Piikea Avenue. The two (2) easterly driveways will be limited to right-turn in and out in order to prevent traffic conflicts with the planned Piikea Avenue and Liloa Drive intersection roundabout. Access to Parcel 158 will be through a shared driveway to Azeka Place on Piikea Avenue.

Access to the northern development will be from a driveway access on Liloa Drive directly across the driveway access to the Piilani Villages Shopping Center and four (4) driveways on Piikea Avenue directly across the southern development with the same restrictions to the easterly driveways.

It should be noted that signalization of one project access along Piikea Avenue, "C Street", is being planned as part of the proposed Downtown Kihei project. This report will verify whether the intersection is projected to have sufficient volumes to warrant the installation of a traffic signal at full development.

The lane geometry of all the study intersection and the proposed Downtown Kihei access are shown in Figure 8.

D. Future Year 2015 with Project Peak Hour Traffic and Analysis

The future traffic volumes were determined by adding the site generated traffic estimate for Downtown Kihei to the base year traffic volumes. The levels of service for the future condition with Downtown Kihei were determined using the same methods as discussed previously in the Existing Condition Level of Service section. The capacity analyses were based on the determined future traffic volumes with Downtown Kihei.

Table 5 outlines the future level of service with the development. Figure 9 shows the future traffic volumes and LOS for the proposed Downtown Kihei.

All study intersections are expected to perform at acceptable levels of service in Future Year 2015 except at the Piilani Highway and Piikea Avenue intersection.

The Piikea Avenue eastbound left-turn lane traffic is expected to continue to operate at LOS E during the AM peak hour of traffic and at LOS F during the PM and Saturday mid-day peak hour of traffic. Moreover, the Piikea Avenue eastbound left-turn traffic movements is expected to operate at over capacity conditions during the PM and Saturday mid-day peak hour of traffic (v/c=1.44 and v/c=1.13, respectively).

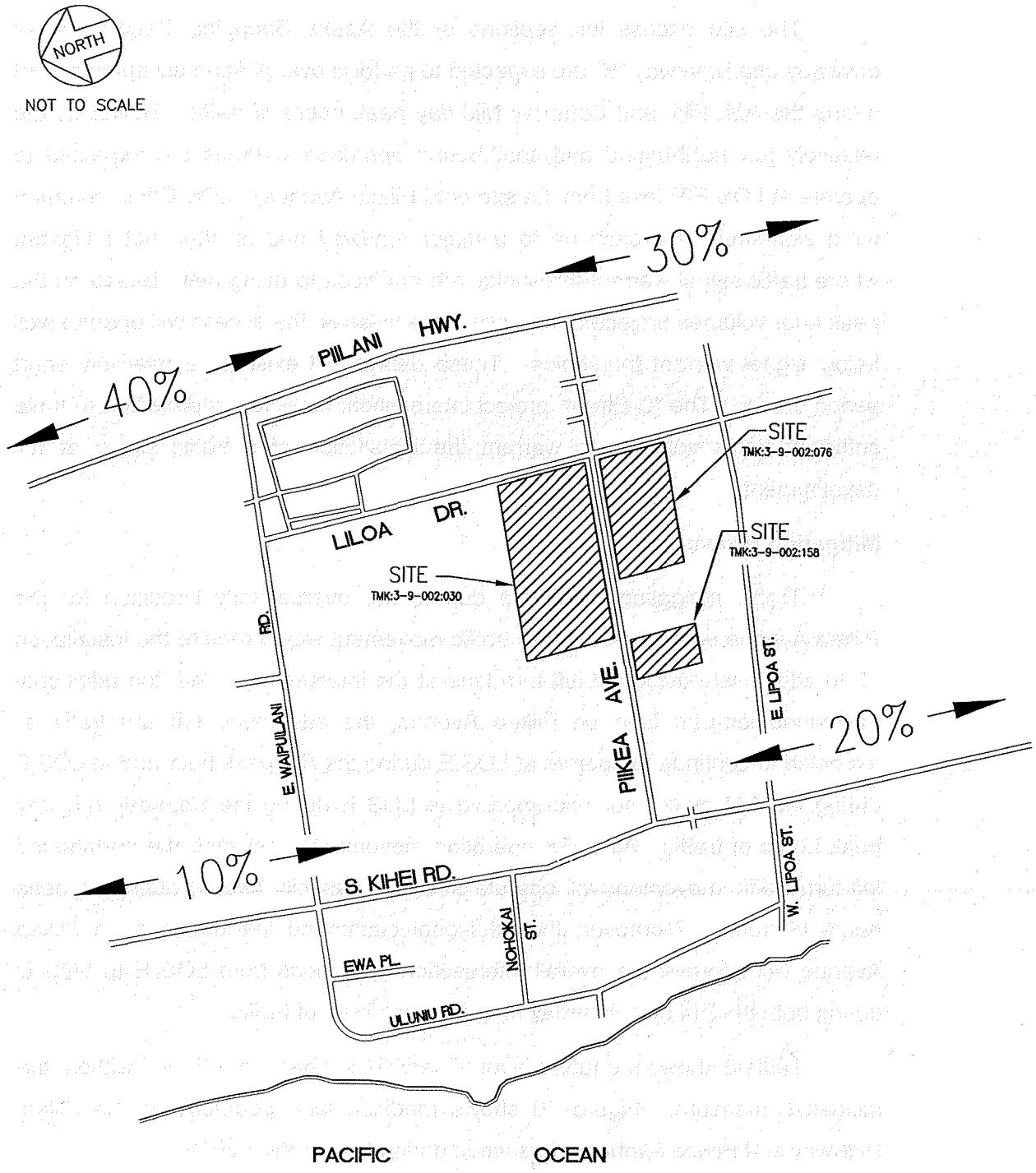
The Piilani Highway northbound left-turn lane is expected to continue to operate at LOS E during the AM peak hour of traffic and at LOS F during the AM, PM and Saturday mid-day peak hours of traffic. Also, the Piilani Highway northbound left-turn traffic movement is expected to operate at over capacity conditions during the PM and Saturday mid-day peak hour of traffic (v/c=1.06 and v/c=1.09, respectively).

The site access intersections at the Azeka Shopping Center Mauka driveway and Driveway "B" are expected to perform overall at an acceptable LOS during the AM, PM, and Saturday Mid-day peak hours of traffic. However, the relatively low northbound and southbound approach volumes are expected to operate at LOS E/F (exit from the site onto Piikea Avenue). LOS E/F is common for a side-street approach on to a major roadway and is often not mitigated where traffic signal warrant thresholds are not close to being met. Based on the peak hour volumes projected for these site accesses, the access will operate well below signal warrant thresholds. These delays will exist for a relatively short period of time. The "C Street" project intersection, however, is projected to have sufficient traffic volumes to warrant the installation of a traffic signal at full development.

Mitigation Measures

Traffic mitigation measures due to the overcapacity condition for the Piikea Avenue eastbound left-turn traffic movement would require the installation of an additional eastbound left-turn lane at the intersection. With the additional eastbound left-turn lane on Piikea Avenue, the eastbound left-turn traffic is expected to continue to operate at LOS E during the AM peak hour and at LOS F during the PM peak hour and improve to LOS E during the Saturday mid-day peak hours of traffic. All traffic operation movements, including the northbound left-turn traffic movement will operate at below capacity (v/c<1) during all peak hours of traffic. Moreover, the additional eastbound left-turn lane on Piikea Avenue will improve the overall intersection operations from LOS E to LOS D during both the PM and Saturday mid-day peak hour of traffic.

Table 6 shows the future level of service comparison with and without the mitigative measure. Figure 10 shows modified lane geometry at the Piilani Highway and Piikea Avenue intersection during Future Year 2015.



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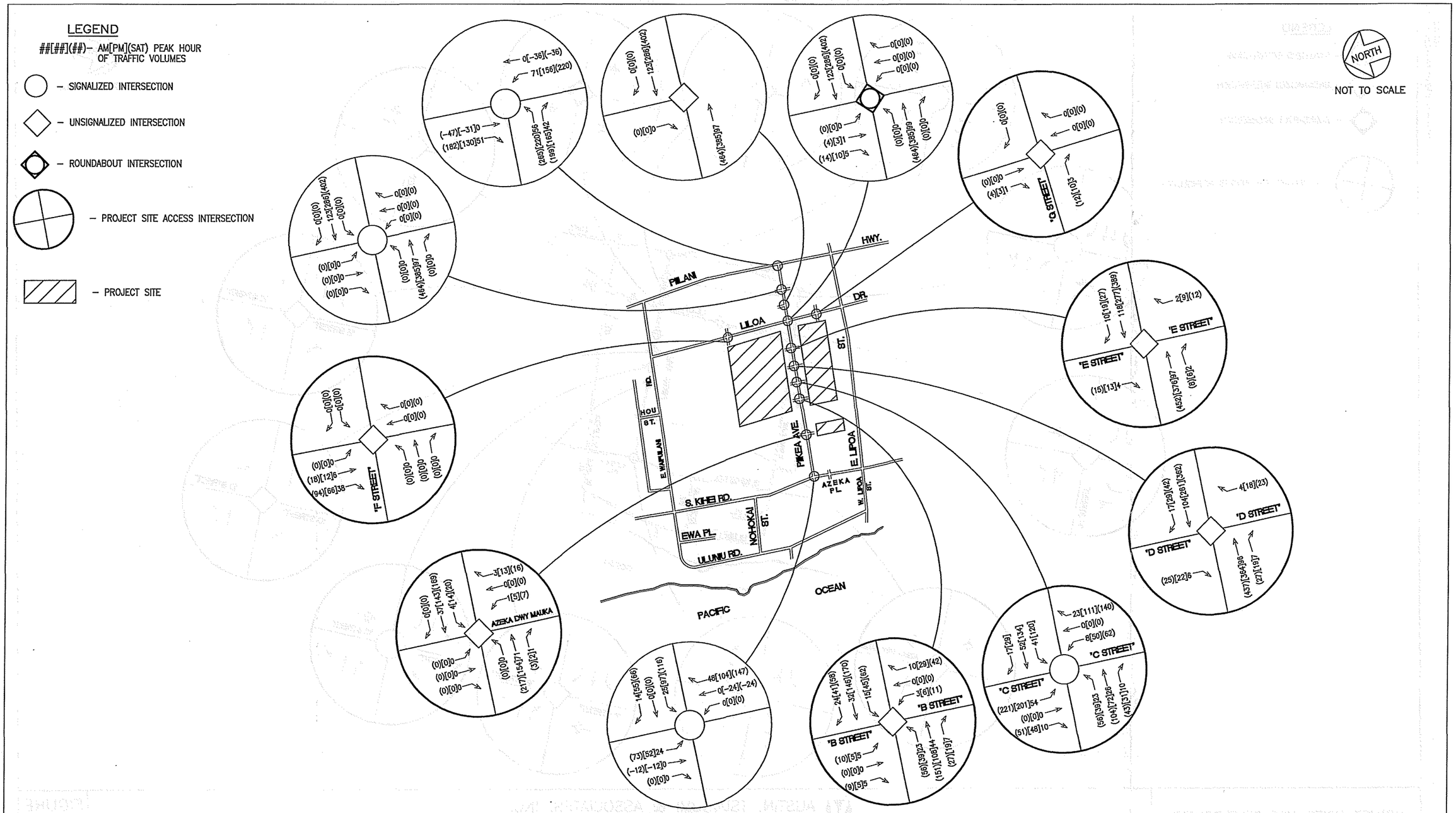
	PROJECT TRIP DISTRIBUTION	6



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PROJECT SITE GENERATED TRAFFIC ONLY VOLUMES

FIGURE
7

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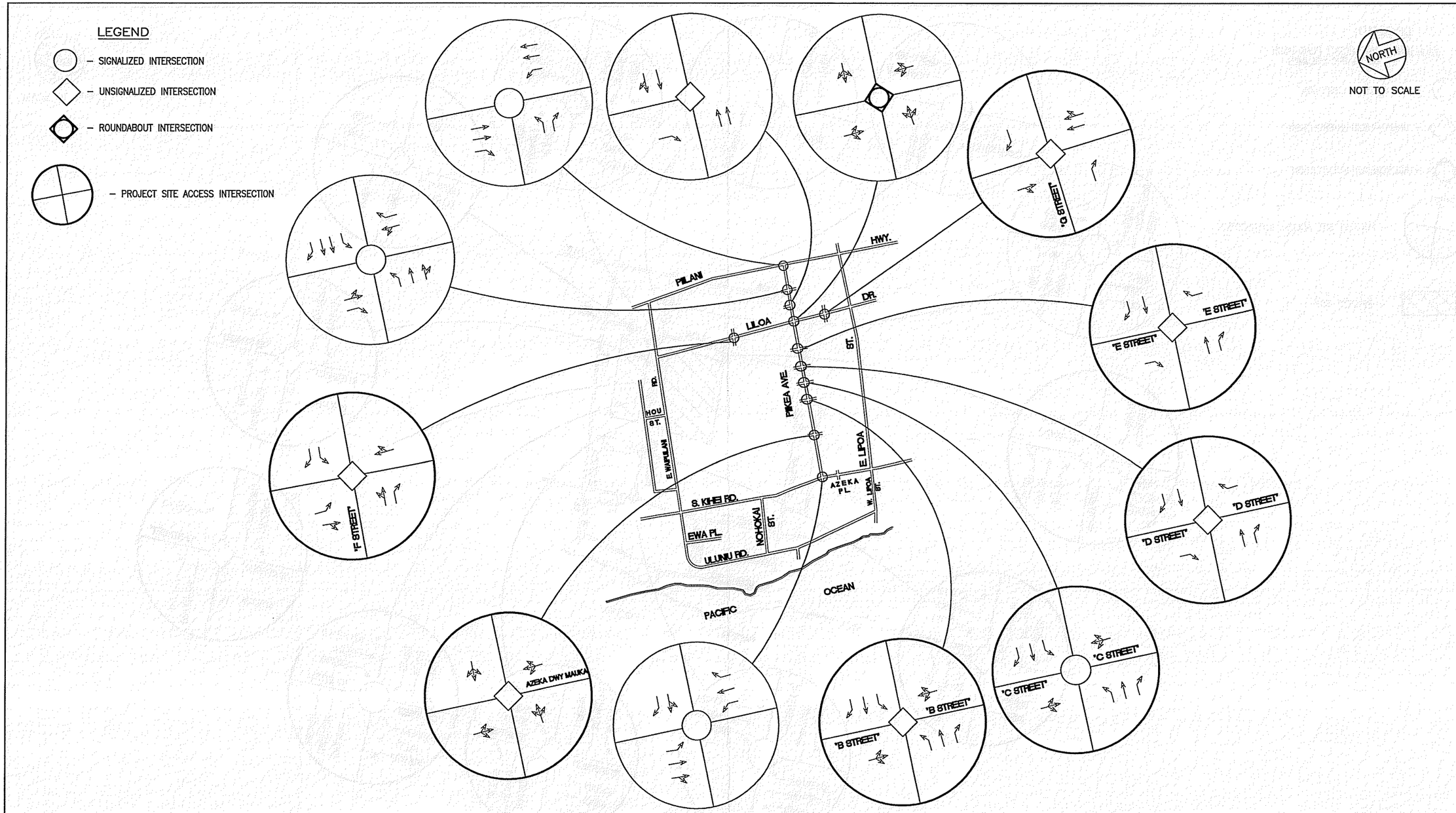

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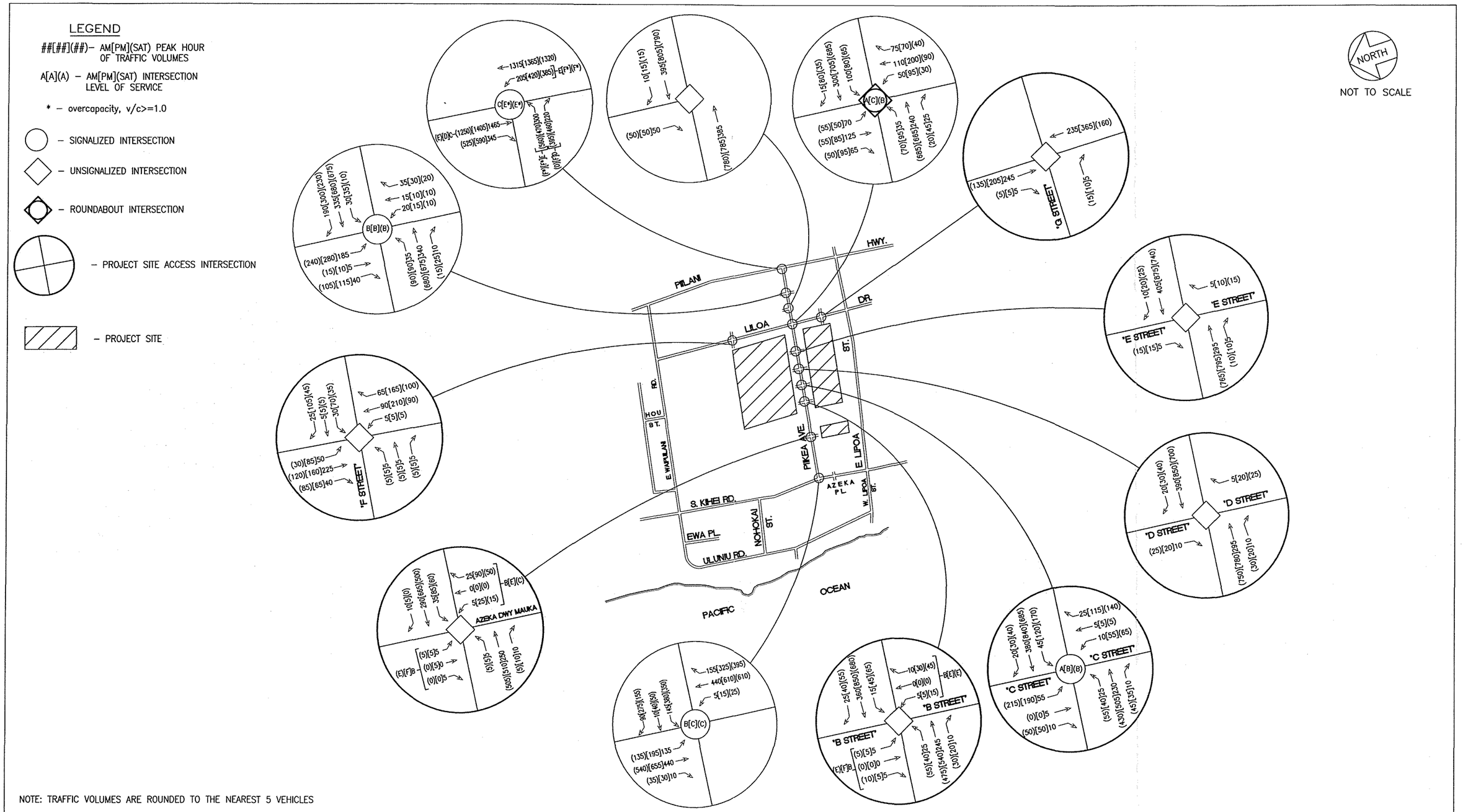
FUTURE YEAR 2015 WITH PROJECT, LANE CONFIGURATION

FIGURE
8



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FUTURE YEAR 2015 WITH PROJECT, PEAK HOUR OF TRAFFIC VOLUMES AND LEVEL OF SERVICE

FIGURE 9

Table 5: Future Year 2015 With Project LOS

	Future Year 2015 With Project-Generated Traffic								
	AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak Hour		
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
Piilani Highway/Piikea Avenue									
NB LT	E	76.5	0.81	F	126.6	1.06*	F	142.3	1.09*
NB TH	A	9.9	0.55	B	10.1	0.55	B	19.8	0.62
SB TH	C	32.3	0.83	D	49.2	0.89	E	64.5	0.94
SB RT	B	19.5	0.32	D	37.0	0.61	D	46.1	0.61
EB LT	E	73.8	0.86	F	286.9	1.44*	F	140.6	1.13*
EB RT	D	48.0	0.15	F	96.5	0.90	D	54.0	0.57
Overall	*C*	*30.0*	*0.83*	*E*	*71.6*	*1.05**	*E*	*64.5*	*1.04**
Piikea Avenue/PVSC Main Access/Piilani Gardens									
NB TH/LT	B	11.4	0.07	B	11.3	0.05	B	11.2	0.04
NB RT	B	11.1	0.02	B	11.0	0.02	B	11.0	0.01
SB TH/LT	B	16.4	0.46	C	22.9	0.70	B	19.5	0.60
SB RT	B	11.1	0.03	B	11.5	0.08	B	11.4	0.07
WB LT	A	9.5	0.07	B	10.3	0.13	A	9.5	0.04
WB TH	B	13.6	0.32	B	17.5	0.65	B	17.5	0.65
WB RT	B	12.6	0.13	B	13.3	0.21	B	12.8	0.16
EB LT	A	8.3	0.08	B	11.1	0.30	B	11.1	0.30
EB TH/RT	B	12.9	0.31	B	16.4	0.63	B	16.3	0.63
Overall	*B*	*13.2*	*0.32*	*B*	*16.5*	*0.57*	*B*	*16.1*	*0.53*
Liloa Drive/PVSC Makai Access/Driveway "F"									
NB LT/TH/RT	A	0.3	0.00	A	0.1	0.00	A	0.2	0.00
SB LT	A	7.7	0.04	A	8.4	0.08	A	7.7	0.02
SB TH/RT	A	0.0	0.17	A	0.0	0.14	A	0.0	0.14
WB LT	B	13.7	0.08	C	19.7	0.25	B	12.0	0.08
WB RT	A	9.1	0.03	B	10.9	0.16	A	9.3	0.05
EB LT	B	13.8	0.01	C	21.7	0.02	B	12.7	0.01
EB TH/RT	B	11.7	0.02	B	13.7	0.03	B	10.9	0.02
Piikea Avenue/PVSC Secondary Access									
SB RT	A	9.1	0.06	A	9.3	0.06	A	9.3	0.06
Piikea Avenue/Liloa Drive (Roundabout)									
Overall	*A*	*5.1*	--	*D*	*27.1*	--	*B*	*13.3*	--
Piikea Avenue/Azeka Shopping Center Mauka Driveway									
NB LT/TH/RT	B	11.0	0.05	E	47.5	0.62	C	19.6	0.22
SB LT/TH/RT	B	13.2	0.02	F	86.3	0.20	E	39.6	0.05

* denotes overcapacity condition, v/c >= 1.0

Table 5 (Continued): Future Year 2015 With Project LOS

	Future Year 2015 With Project-Generated Traffic								
	AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak Hour		
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
Piikea Avenue/South Kihei Road									
NB LT	A	6.2	0.01	B	11.9	0.05	B	11.5	0.07
NB TH	B	10.2	0.43	C	26.5	0.79	C	28.9	0.82
NB RT	A	7.3	0.11	B	14.2	0.22	B	15.4	0.27
SB LT	A	4.2	0.24	B	14.4	0.58	B	14.0	0.49
SB TH/RT	A	5.2	0.21	B	10.0	0.37	B	12.5	0.35
WB TH/LT	C	34.0	0.58	D	54.3	0.94	C	31.7	0.78
WB RT	C	28.4	0.06	C	22.5	0.19	B	19.6	0.11
Overall	*B*	*11.5*	--	*C*	*23.6*	--	*C*	*21.3*	--
Piikea Avenue/Project Driveway "B"									
NB LT/TH/RT	B	12.0	0.03	E	40.2	0.27	E	39.0	0.39
SB LT/TH/RT	B	13.3	0.02	F	115.9	0.25	E	40.9	0.14
WB LT	A	7.8	0.01	A	8.9	0.05	A	8.8	0.07
WB TH	A	0.0	0.23	A	0.0	0.54	A	0.0	0.43
WB RT	A	0.0	0.02	A	0.0	0.03	A	0.0	0.04
EB LT	A	8.2	0.02	B	11.9	0.08	B	10.3	0.08
EB TH	A	0.0	0.16	A	0.0	0.35	A	0.0	0.30
EB RT	A	0.0	0.01	A	0.0	0.01	A	0.0	0.02
Piikea Avenue/Project Driveway "C"									
NB LT/TH/RT	A	7.4	0.06	B	13.0	0.24	B	11.6	0.27
SB LT/TH/RT	A	7.9	0.19	C	20.2	0.69	C	20.8	0.73
WB LT	A	4.5	0.10	A	6.6	0.36	A	8.1	0.48
WB TH	A	5.9	0.51	C	20.7	0.90	B	13.8	0.79
WB RT	A	4.2	0.01	A	4.9	0.03	*A*	*5.6*	*0.04*
EB LT	A	4.4	0.07	A	6.6	0.27	A	7.8	0.35
EB TH	A	5.1	0.31	A	7.5	0.55	A	7.7	0.50
EB RT	A	4.2	0.01	A	4.9	0.03	A	5.5	0.03
Overall	*A*	*5.7*	--	*B*	*14.9*	--	B	12.1	--
Piikea Avenue/Project Driveway "D"									
NB RT	A	9.9	0.01	C	15.7	0.06	C	15.3	0.07
SB RT	B	10.8	0.02	C	16.8	0.07	B	14.5	0.07
WB TH	A	0.0	0.25	A	0.0	0.54	A	0.0	0.45
WB RT	A	0.0	0.01	A	0.0	0.02	A	0.0	0.03
EB TH	A	0.0	0.19	A	0.0	0.50	A	0.0	0.48
EB RT	A	0.0	0.01	A	0.0	0.01	A	0.0	0.02

Table 5 (Continued): Future Year 2015 With Project LOS

	Future Year 2015 With Project-Generated Traffic								
	AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak Hour		
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
Piikea Avenue/Project Driveway "E"									
NB RT	B	10.0	0.01	C	15.6	0.03	C	15.3	0.04
SB RT	B	10.9	0.01	C	17.1	0.05	B	14.8	0.04
WB TH	A	0.0	0.26	A	0.0	0.56	A	0.0	0.47
WB RT	A	0.0	0.01	A	0.0	0.01	A	0.0	0.02
EB TH	A	0.0	0.19	A	0.0	0.51	A	0.0	0.49
EB RT	A	0.0	0.00	A	0.0	0.01	A	0.0	0.01
Liloa Drive/Project Driveway "G"									
NB TH	A	0.0	0.15	A	0.0	0.23	A	0.0	0.10
SB TH/RT	A	0.0	0.16	A	0.0	0.13	A	0.0	0.09
EB RT	A	9.7	0.01	A	9.5	0.01	A	9.1	0.02

Table 6: Comparison of Future Year 2015 With Project LOS, With and Without Mitigative Measures

	Future Year 2015 With Project-Generated Traffic									Future Year 2015 With Project-Generated Traffic with Mitigation								
	AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak Hour			AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak Hour		
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
Piilani Highway/Piikea Avenue																		
NB LT	E	76.5	0.81	F	126.6	1.06*	F	142.3	1.09*	E	74.1	0.79	F	100.8	0.98	E	66.1	0.79
NB TH	A	9.9	0.55	B	10.1	0.55	B	19.8	0.62	A	4.9	0.50	A	8.6	0.54	B	11.2	0.55
SB TH	C	32.3	0.83	D	49.2	0.89	E	64.5	0.94	C	21.1	0.72	D	49.2	0.89	E	61.0	0.93
SB RT	B	19.5	0.32	D	37.0	0.61	D	46.1	0.61	B	13.5	0.30	D	37.0	0.61	D	44.9	0.61
EB LT	E	73.8	0.86	F	286.9	1.44*	F	140.6	1.13*	E	67.9	0.72	E	80.0	0.83	E	74.1	0.82
EB RT	D	48.0	0.15	F	96.5	0.90	D	54.0	0.57	E	58.0	0.15	E	75.2	0.68	E	60.8	0.37
Overall	*C*	*30.0*	*0.83*	*E*	*71.6*	*1.05**	*E*	*64.5*	*1.04**	*C*	*23.5*	*0.73*	*D*	*46.1*	*0.90*	*D*	*46.3*	*0.86*

* denotes overcapacity condition, v/c >= 1.0

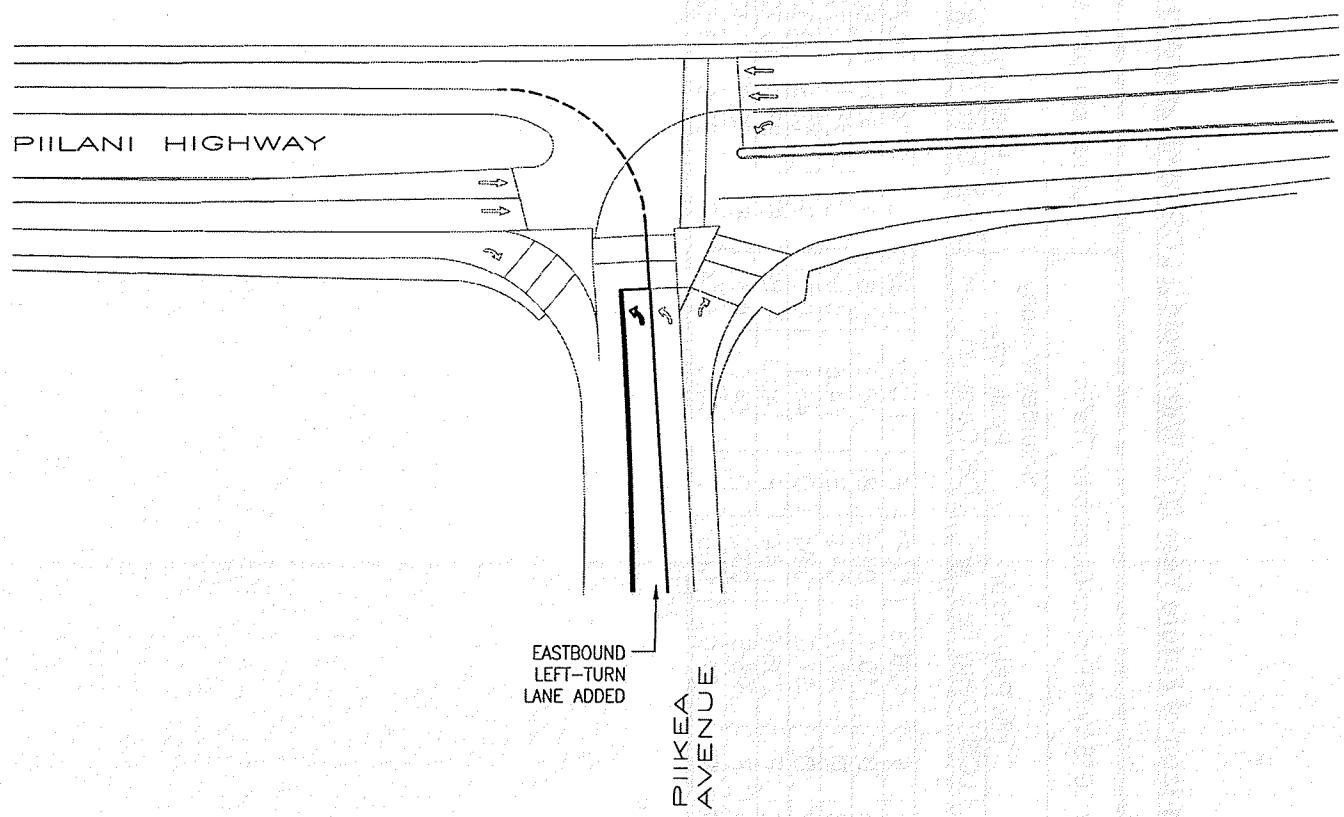
LEGEND

EXISTING

RECOMMENDED MITIGATIVE MEASURE

NORTH

NOT TO SCALE



KRAUSZ MIXED-USE DEVELOPMENT
DOWNTOWN KIHEI
KIHEI, MAUI

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

MODIFIED LANE GEOMETRY AT
PIIKEA AVENUE/PIILANI HIGHWAY

FIGURE
10

V. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

- The proposed Downtown Kihei project will consist of approximately 26.1 acres of land in which, approximately 249,450 square feet of retail area, approximately 18,500 square feet of general office space, and a 150-room, specialty hotel are planned to be built in year 2015 and fully occupied sometime after.

- The comparisons for the future conditions with and without the development, shows that the LOS are not expected to change significantly with the proposed development except at the Piilani Highway and Piikea Avenue intersection. With the Project, the Piikea Avenue eastbound left-turn lane traffic is expected to continue to operate at the LOS E during the AM peak hour of traffic and at LOS F during the PM and Saturday mid-day peak hour of traffic. The Piikea Avenue eastbound left-turn traffic movement and Piilani Highway northbound left-turn movement is expected to operate at over capacity conditions during the PM and Saturday mid-day peak hour of traffic. The construction of an additional left-turn lane at the Piikea Avenue eastbound left-turn approach will result in all movements to operate below capacity (v/c <1.0) and mitigate the traffic generated by the Project since it improves traffic operation with and without the Downtown Kihei development.

- It should be noted and as discussed earlier in this report that the construction of the above additional left-turn lane at the Piikea Avenue eastbound left-turn approach was previously identified as a recommended improvement for the DPR South Maui Community Park project. As a result, the responsibility and commitment for the construction of the second left-turn lane is being provisionally shouldered by DPW as stated in the MOU, dated October 13, 2008. The construction of an additional left-turn lane has been incorporated into DPW's Capital Improvements 6-year Plan for projects programmed into the STIP for Federal Funding. However, this planned improvement is not currently documented in the latest STIP implementation schedule through 2016.

- The Downtown Kihei site access intersections are expected to operate at acceptable LOS. However, at the Azeka Shopping Center Mauka driveway and project Driveway "B Street", the relatively low northbound and southbound approach volumes are expected to operate at LOS E/F (exit from the site onto Piikea Avenue). LOS E/F is common for a side-street approach on to a major roadway and is often not mitigated where traffic signal warrant thresholds are not close to being met. Based on the peak hour volumes projected for these site accesses, the access will operate well below signal warrant thresholds.
- The project driveway, "C Street", is projected to have sufficient traffic volumes to warrant the installation of a traffic signal at full development.

B. Recommendations

- At the intersection of Piilani Highway and Piikea Avenue, install an additional left-turn lane (double left-turn lane) at the Piikea Avenue eastbound approach during project construction development planned in year 2015.
- At the intersection of Piilani Highway and Piikea Avenue, monitor traffic conditions for the Piilani Highway northbound left-turn traffic movements. If future traffic increases cause over-capacity traffic conditions, an additional northbound left-turn lane (double left-turn lane) is recommended.
- Install a traffic signal at the project driveway, "C Street", as planned for the proposed Downtown Kihei development.

REFERENCES

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2. County of Maui Department of Public Works, Engineering Division, Memorandum of Understanding For Construction of Offsite Roadway Improvements in the Vicinity of South Maui Community Park, October 13, 2008.

3. Institute of Transportation Engineers. Traffic Engineering Handbook, 5th Edition. Washington, DC, 1999.

4. Institute of Transportation Engineers, Trip Generation, 8th Edition, 2008.

5. Institute of Transportation Engineers, Trip Generation Handbook, 2nd Edition, 2003.

6. Kaku and Associates, Maui Long-Range Land Transportation Plan, February 1997.

7. Phillip Rowell and Associates, TIAR for Maui Lu Resort, March 7, 2007.

8. Phillip Rowell and Associates, TIAR for Piilani Promenade, January 30, 2012.

9. Transportation Research Board, Highway Capacity Manual, 2000.

10. Wilson Okamoto Corporation, Traffic Impact Report for Kihei High School, September 2011.

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APPENDICES

APPENDIX A

TRAFFIC COUNT DATA

Austin, Tsutsumi and Associates

501 Sumner Street, Suite 521
Honolulu, Hawaii 96817
ph: 533-3646 Fax: 526-1267

File Name : Piilani - Piikea AM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 1

Groups Printed- Unshifted - Bank 1

	Piilani From North				Piikea From East				Piilani From South				Piikea From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30	40	187	0	0	0	0	0	0	0	177	16	0	28	0	36	0	484
06:45	54	238	0	0	0	0	0	0	0	197	27	0	34	0	33	0	583
Total	94	425	0	0	0	0	0	0	0	374	43	0	62	0	69	0	1067
07:00	51	245	0	0	0	0	0	0	0	231	29	0	30	0	45	0	631
07:15	58	293	0	2	0	0	0	0	0	299	25	0	32	0	56	0	765
07:30	77	343	0	0	0	0	0	0	0	262	26	0	40	0	64	0	812
07:45	75	286	0	0	0	0	0	0	0	233	36	0	43	0	40	0	713
Total	261	1167	0	2	0	0	0	0	0	1025	116	0	145	0	205	0	2921
08:00	49	213	0	0	0	0	0	0	0	226	37	0	50	0	54	0	629
Grand Total	404	1805	0	2	0	0	0	0	0	1625	196	0	257	0	328	0	4617
Apprch %	18.3	81.6	0	0.1	0	0	0	0	0	89.2	10.8	0	43.9	0	56.1	0	
Total %	8.8	39.1	0	0	0	0	0	0	0	35.2	4.2	0	5.6	0	7.1	0	
Unshifted	404	1805	0	2	0	0	0	0	0	1625	196	0	257	0	328	0	4617
% Unshifted	100	100	0	100	0	0	0	0	0	100	100	0	100	0	100	0	100
Bank 1	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

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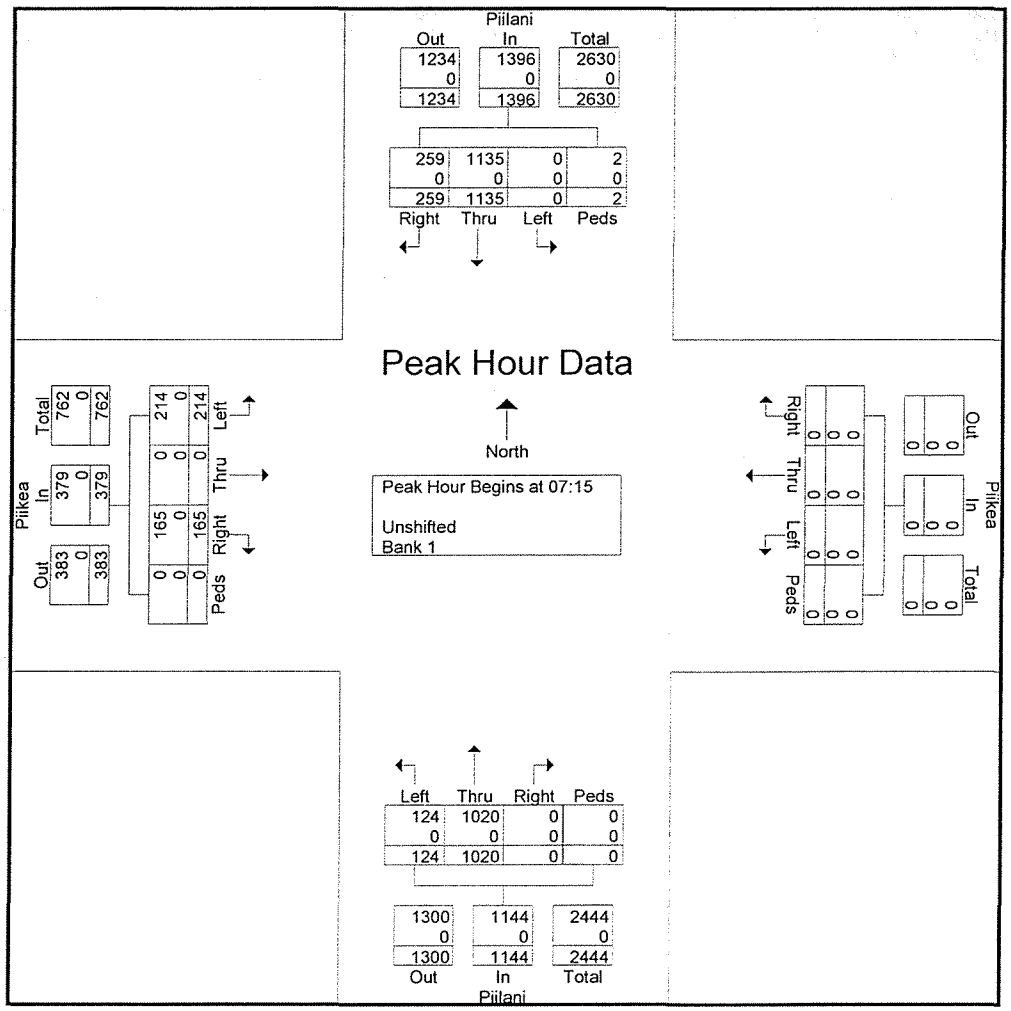
ph: 533-3646 Fax: 526-1267

File Name : Piilani - Piikea AM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 2

	Piilani From North					Piikea From East					Piilani From South					Piikea 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 07:15 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	58	293	0	**2**	353	0	0	0	0	0	0	**299**	25	0	**324**	32	0	56	0	88	765
07:30	**77**	**343**	0	0	**420**	0	0	0	0	0	0	262	26	0	288	40	0	**64**	0	**104**	**812**
07:45	75	286	0	0	361	0	0	0	0	0	0	233	36	0	269	43	0	40	0	83	713
08:00	49	213	0	0	262	0	0	0	0	0	0	226	**37**	0	263	**50**	0	54	0	104	629
Total Volume	259	1135	0	2	1396	0	0	0	0	0	0	1020	124	0	1144	165	0	214	0	379	2919
% App. Total	18.6	81.3	0	0.1		0	0	0	0		0	89.2	10.8	0		43.5	0	56.5	0		
PHF	.841	.827	.000	.250	.831	.000	.000	.000	.000	.000	.000	.853	.838	.000	.883	.825	.000	.836	.000	.911	.899
Unshifted	259	1135										1020									
% Unshifted	100	100	0	100	100	0	0	0	0	0	0	100	100	0	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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501 Sumner Street, Suite 521
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File Name : Liloa - Driveway AM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 1

Groups Printed- Unshifted - Bank 1

	Liloa From North				Commercial Driveway From East				Liloa From South				Commercial Driveway From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30	0	21	6	0	5	0	2	0	7	6	0	0	0	0	0	0	47
06:45	0	27	8	0	3	0	7	0	8	7	0	0	0	0	0	0	60
Total	0	48	14	0	8	0	9	0	15	13	0	0	0	0	0	0	107
07:00	0	39	6	0	7	0	8	0	11	15	0	0	0	0	0	0	86
07:15	0	54	10	0	5	0	10	0	14	15	0	0	0	0	0	0	108
07:30	0	61	11	0	0	0	7	0	8	27	0	0	0	0	0	0	114
07:45	0	46	12	0	11	0	3	0	25	31	0	0	0	0	0	0	128
Total	0	200	39	0	23	0	28	0	58	88	0	0	0	0	0	0	436
08:00	0	38	13	0	5	0	8	0	13	12	0	0	0	0	0	0	89
Grand Total	0	286	66	0	36	0	45	0	86	113	0	0	0	0	0	0	632
Apprch %	0	81.2	18.8	0	44.4	0	55.6	0	43.2	56.8	0	0	0	0	0	0	
Total %	0	45.3	10.4	0	5.7	0	7.1	0	13.6	17.9	0	0	0	0	0	0	
Unshifted	0	286	66	0	36	0	45	0	86	113	0	0	0	0	0	0	632
% Unshifted	0	100	100	0	100	0	100	0	100	100	0	0	0	0	0	0	100
Bank 1	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

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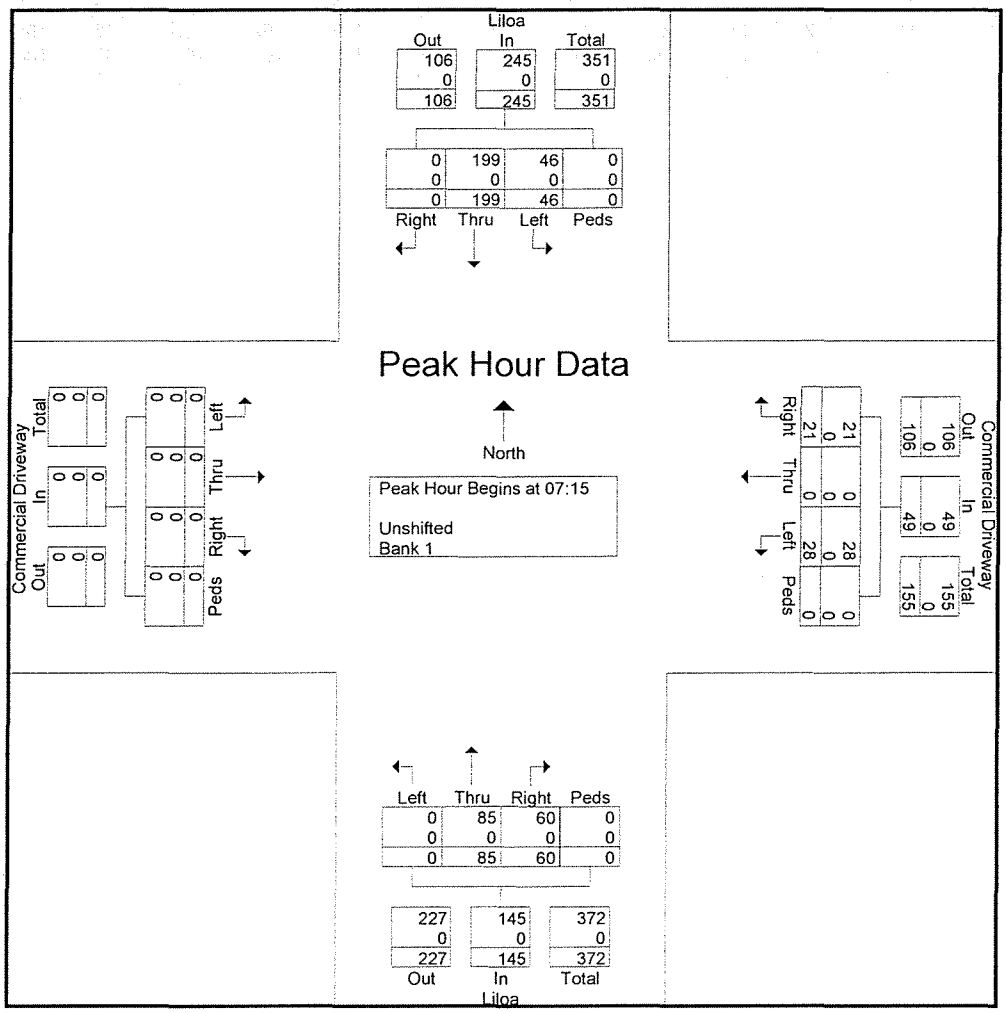
File Name : Liloa - Driveway AM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 2

	Liloa From North					Commercial Driveway From East					Liloa From South					Commercial Driveway 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 07:15 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	0	54	10	0	64	5	0	**10**	0	**15**	14	15	0	0	29	0	0	0	0	0	108
07:30	0	**61**	11	0	**72**	0	0	7	0	7	8	27	0	0	35	0	0	0	0	0	114
07:45	0	46	12	0	58	**11**	0	3	0	14	**25**	**31**	0	0	**56**	0	0	0	0	0	**128**
08:00	0	38	**13**	0	51	5	0	8	0	13	13	12	0	0	25	0	0	0	0	0	89
Total Volume	0	199	46	0	245	21	0	28	0	49	60	85	0	0	145	0	0	0	0	0	439
% App. Total	0	81.2	18.8	0		42.9	0	57.1	0		41.4	58.6	0	0		0	0	0	0		
PHF	.000	.816	.885	.000	.851	.477	.000	.700	.000	.817	.600	.685	.000	.000	.647	.000	.000	.000	.000	.000	.857
Unshifted	0	199	46	0	245	21	0	28	0	49	60	85	0	0	145	0	0	0	0	0	439
% Unshifted																					
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 : Liloa - Piikea AM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 1

Groups Printed- Unshifted - Bank 1

	Liloa From North				Piikea From East				Liloa From South				Piikea From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30	8	7	9	0	1	21	11	10	3	8	4	0	0	19	4	1	106
06:45	11	10	13	2	2	27	13	17	2	4	0	0	2	16	10	1	130
Total	19	17	22	2	3	48	24	27	5	12	4	0	2	35	14	2	236
07:00	13	15	18	0	6	29	17	9	5	12	6	0	5	27	6	5	173
07:15	9	31	24	0	2	30	36	22	16	20	10	2	7	22	8	1	240
07:30	14	41	17	0	5	47	25	8	19	29	10	0	11	29	2	1	258
07:45	14	27	8	0	6	40	19	2	23	39	23	0	3	29	11	0	244
Total	50	114	67	0	19	146	97	41	63	100	49	2	26	107	27	7	915
08:00	18	12	15	0	3	37	13	3	11	12	4	0	4	34	10	0	176
08:15	8	9	15	0	3	34	10	4	6	12	2	1	4	22	4	2	136
Grand Total	95	152	119	2	28	265	144	75	85	136	59	3	36	198	55	11	1463
Apprch %	25.8	41.3	32.3	0.5	5.5	51.8	28.1	14.6	30	48.1	20.8	1.1	12	66	18.3	3.7	
Total %	6.5	10.4	8.1	0.1	1.9	18.1	9.8	5.1	5.8	9.3	4	0.2	2.5	13.5	3.8	0.8	
Unshifted	95	152	119	2	28	265	144	75	85	136	59	3	36	198	55	11	1463
% Unshifted	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
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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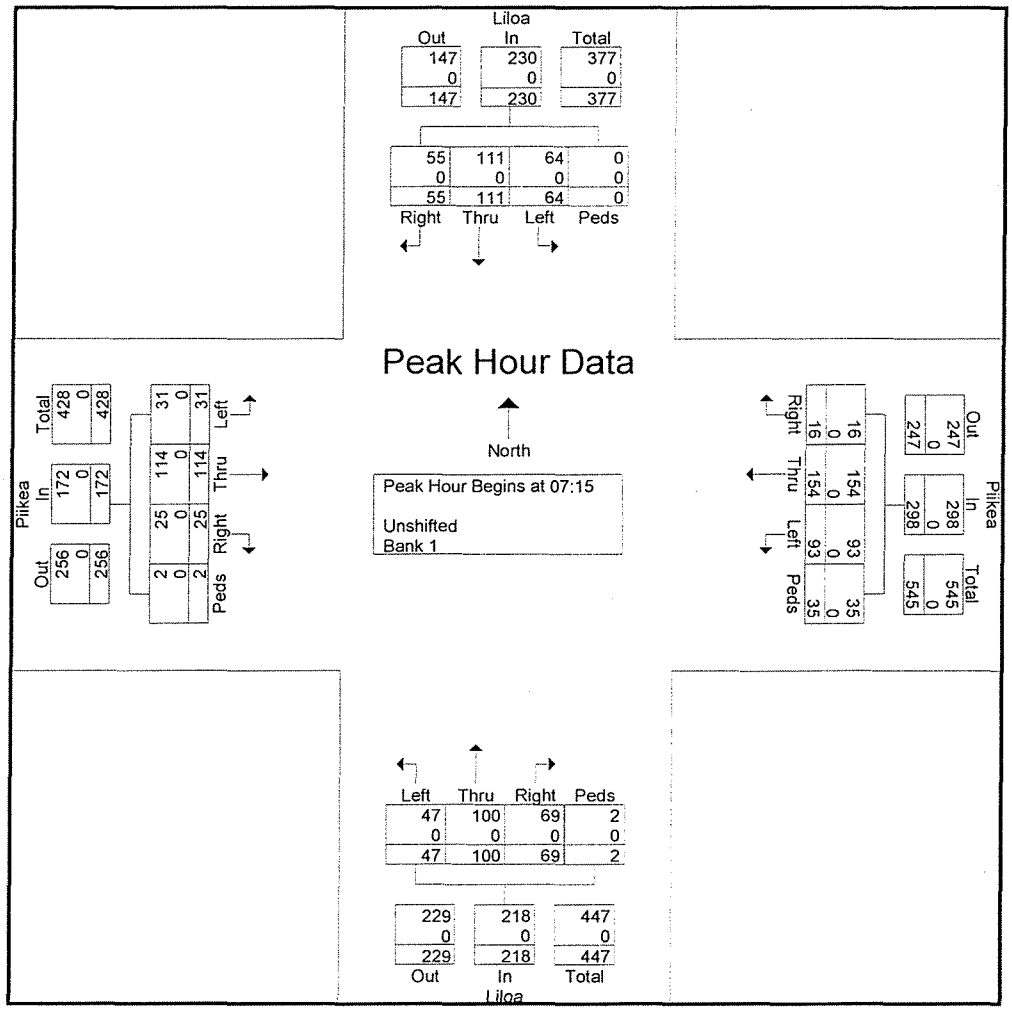
ph: 533-3646 Fax: 526-1267

File Name : Liloa - Piikea AM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 2

	Liloa From North					Piikea From East					Liloa From South					Piikea 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 07:15 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	9	31	**24**	0	64	2	30	**36**	**22**	**90**	16	20	10	**2**	48	7	22	8	**1**	38	240
07:30	14	**41**	17	0	**72**	5	**47**	25	8	85	19	29	10	0	58	**11**	29	2	1	43	**258**
07:45	14	27	8	0	49	**6**	40	19	2	67	**23**	**39**	**23**	0	**85**	3	29	**11**	0	43	244
08:00	**18**	12	15	0	45	3	37	13	3	56	11	12	4	0	27	4	**34**	10	0	**48**	176
Total Volume	55	111	64	0	230	16	154	93	35	298	69	100	47	2	218	25	114	31	2	172	918
% App. Total	23.9	48.3	27.8	0		5.4	51.7	31.2	11.7		31.7	45.9	21.6	0.9		14.5	66.3	18	1.2		
PHF	.764	.677	.667	.000	.799	.667	.819	.646	.398	.828	.750	.641	.511	.250	.641	.568	.838	.705	.500	.896	.890
Unshifted	55	111	64	0	230	16	154	93	35	298	69	100	47	2	218	25	114	31	2	172	918
% Unshifted																					
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



Austin Tsutsumi & Associates

501 Sumner St. Ste. 521
Honolulu, HI 96817
(808) 533-3646

File Name : Azeka Drive & Piikea St AM
Site Code : 00000000
Start Date : 11/1/2011
Page No : 1

Groups Printed- Unshifted

	AZEKA DRIVE From North					PIIKEA ST From East					AZEKA DRIVE From South					PIIKEA ST 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
07:15 AM	0	0	0	0	0	3	42	4	1	50	6	0	1	0	7	1	43	1	0	45	102
07:30 AM	2	0	0	0	2	1	46	4	0	51	4	0	1	0	5	4	38	2	0	44	102
07:45 AM	0	0	1	0	1	2	69	9	0	80	6	0	1	0	7	2	53	1	0	56	144
Total	2	0	1	0	3	6	157	17	1	181	16	0	3	0	19	7	134	4	0	145	348
08:00 AM	0	0	1	0	1	1	55	12	0	68	4	0	1	0	5	1	55	0	0	56	130
Grand Total	2	0	2	0	4	7	212	29	1	249	20	0	4	0	24	8	189	4	0	201	478
Apprch %	50	0	50	0		2.8	85.1	11.6	0.4		83.3	0	16.7	0		4	94	2	0		
Total %	0.4	0	0.4	0	0.8	1.5	44.4	6.1	0.2	52.1	4.2	0	0.8	0	5	1.7	39.5	0.8	0	42.1	

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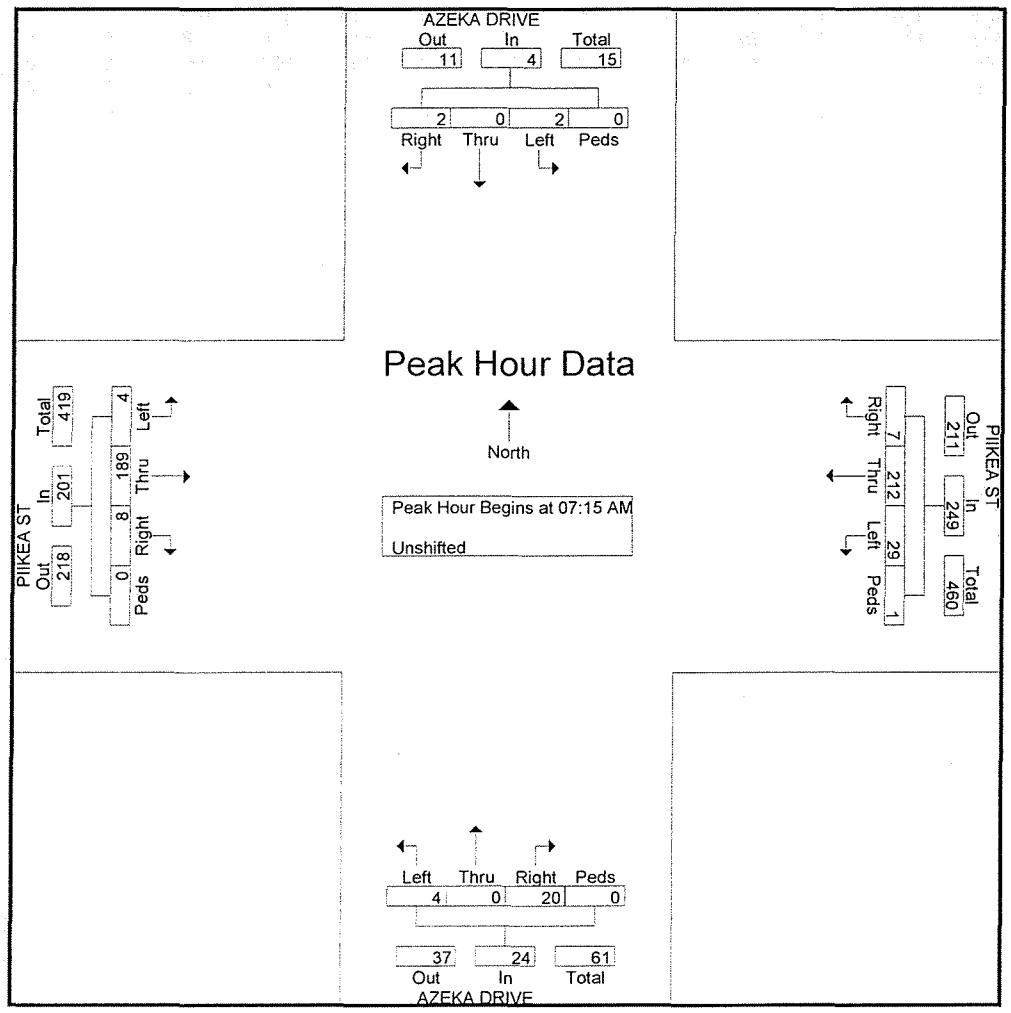
File Name : Azeka Drive & Piikea St AM
Site Code : 00000000
Start Date : 11/1/2011
Page No : 2

	AZEKA DRIVE From North					PIIKEA ST From East					AZEKA DRIVE From South					PIIKEA ST 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 07:15 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	0	0	0	0	0	**3**	42	4	**1**	50	**6**	0	**1**	0	**7**	1	43	1	0	45	102
07:30 AM	**2**	0	0	0	**2**	1	46	4	0	51	4	0	1	0	5	**4**	38	**2**	0	44	102
07:45 AM	0	0	**1**	0	1	2	**69**	9	0	**80**	6	0	1	0	7	2	53	1	0	**56**	**144**
08:00 AM	0	0	1	0	1	1	55	**12**	0	68	4	0	1	0	5	1	**55**	0	0	56	130
Total Volume	2	0	2	0	4	7	212	29	1	249	20	0	4	0	24	8	189	4	0	201	478
% App. Total	50	0	50	0		2.8	85.1	11.6	0.4		83.3	0	16.7	0		4	94	2	0		
PHF	.250	.000	.500	.000	.500	.583	.768	.604	.250	.778	.833	.000	1.000								



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File Name : S Kihei - Piikea AM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 1

Groups Printed- Unshifted - Bank 1

	S Kihei From North				Piikea From East				S Kihei From South				Piikea From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30	0	40	5	0	5	0	2	0	9	33	0	0	0	0	0	0	94
06:45	1	67	10	0	10	0	10	0	14	65	2	1	0	0	0	1	181
Total	1	107	15	0	15	0	12	0	23	98	2	1	0	0	0	1	275
07:00	2	68	20	0	12	3	14	0	21	88	0	0	0	0	0	4	232
07:15	1	72	25	0	17	0	14	0	18	85	1	0	0	0	0	6	239
07:30	0	95	32	0	12	2	25	1	21	87	1	4	0	0	0	2	282
07:45	1	105	26	0	28	5	35	1	24	80	2	3	0	0	0	4	314
Total	4	340	103	0	69	10	88	2	84	340	4	7	0	0	0	16	1067
08:00	7	106	20	0	14	3	25	0	22	107	2	0	0	0	0	3	309
Grand Total	12	553	138	0	98	13	125	2	129	545	8	8	0	0	0	20	1651
Apprch %	1.7	78.7	19.6	0	41.2	5.5	52.5	0.8	18.7	79	1.2	1.2	0	0	0	100	
Total %	0.7	33.5	8.4	0	5.9	0.8	7.6	0.1	7.8	33	0.5	0.5	0	0	0	1.2	
Unshifted	12	553	138	0	98	13	125	2	129	545	8	8	0	0	0	20	1651
% Unshifted	100	100	100	0	100	100	100	100	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
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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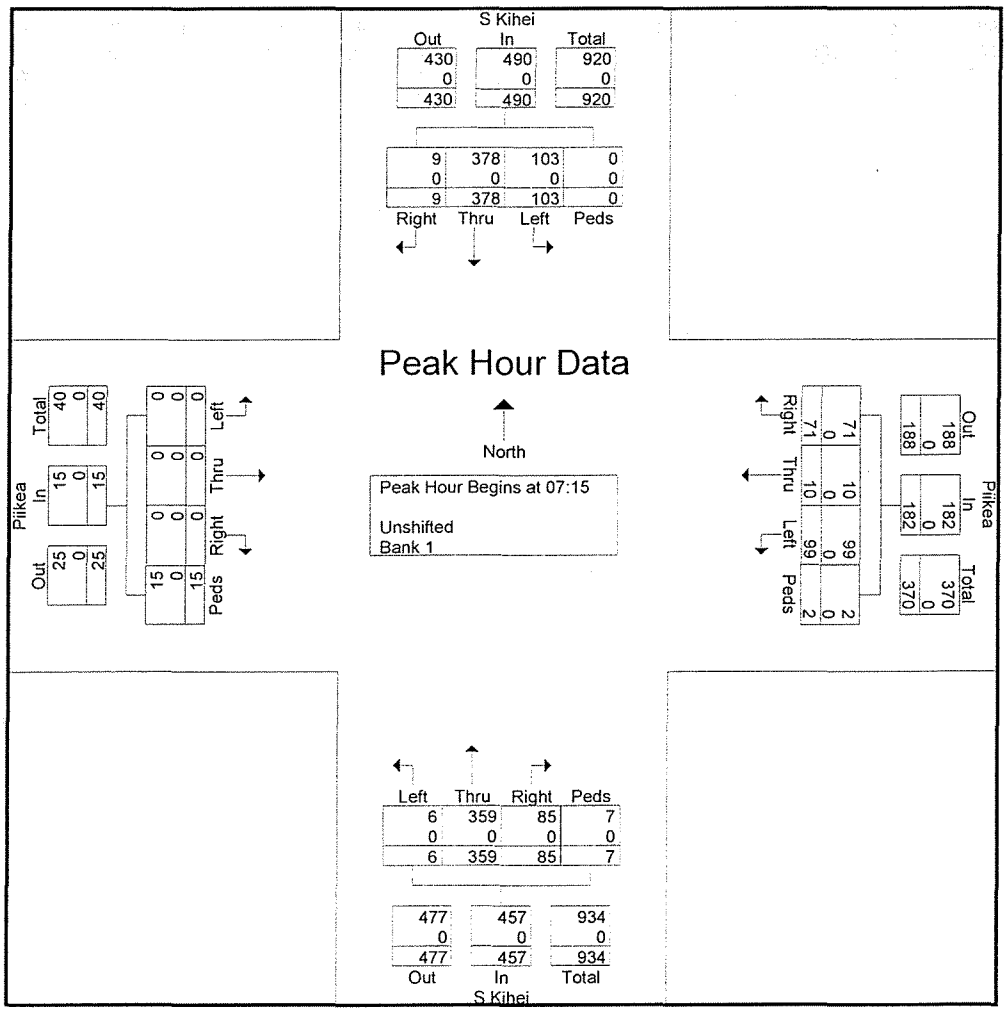
File Name : S Kihei - Piikea AM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 2

	S Kihei From North					Piikea From East					S Kihei From South					Piikea 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 07:15 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	1	72	25	0	98	17	0	14	0	31	18	85	1	0	104	0	0	0	**6**	**6**	239
07:30	0	95	**32**	0	127	12	2	25	**1**	40	21	87	1	**4**	113	0	0	0	2	2	282
07:45	1	105	26	0	132	**28**	**5**	**35**	1	**69**	**24**	80	**2**	3	109	0	0	0	4	4	**314**
08:00	**7**	**106**	20	0	**133**	14	3	25	0	42	22	**107**	2	0	**131**	0	0	0	3	3	309
Total Volume	9	378	103	0	490	71	10	99	2	182	85	359	6	7	457	0	0	0	15	15	1144
% App. Total	1.8	77.1	21	0		39	5.5	54.4	1.1		18.6	78.6	1.3	1.5		0	0	0	100		
PHF	.321	.892	.805	.000	.921	.634	.500	.707	.500	.659	.885	.839	.750	.438	.872	.000	.000	.000	.625	.625	.911
Unshifted	9	378	103	0	490	71	10	99	2	182	85	359	6	7	457	0	0	0	15	15	1144
% Unshifted																					
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 : Piilani - Piikea PM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 1

Groups Printed- Unshifted - Bank 1

	Piilani From North				Piikea From East				Piilani From South				Piikea From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
15:00	88	182	0	0	0	0	0	0	0	135	109	0	43	0	64	0	621
15:15	79	139	0	0	0	0	0	0	0	163	70	0	70	0	36	0	557
15:30	101	218	0	2	0	0	0	0	0	213	81	0	74	0	40	2	731
15:45	131	305	0	0	0	0	0	0	0	361	42	0	77	0	64	0	980
Total	399	844	0	2	0	0	0	0	0	872	302	0	264	0	204	2	2889
16:00	87	282	0	2	0	0	0	0	0	216	54	0	57	0	68	0	766
16:15	88	249	0	0	0	0	0	0	0	316	48	0	69	0	64	0	834
16:30	81	219	0	0	0	0	0	0	0	267	75	0	53	0	70	0	765
16:45	120	270	0	3	0	0	0	0	0	277	62	0	74	0	69	1	876
Total	376	1020	0	5	0	0	0	0	0	1076	239	0	253	0	271	1	3241
Grand Total	775	1864	0	7	0	0	0	0	0	1948	541	0	517	0	475	3	6130
Apprch %	29.3	70.4	0	0.3	0	0	0	0	0	78.3	21.7	0	52	0	47.7	0.3	
Total %	12.6	30.4	0	0.1	0	0	0	0	0	31.8	8.8	0	8.4	0	7.7	0	
Unshifted	775	1864	0	7	0	0	0	0	0	1948	541	0	517	0	475	3	6130
% Unshifted	100	100	0	100	0	0	0	0	0	100	100	0	100	0	100	100	100
Bank 1	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

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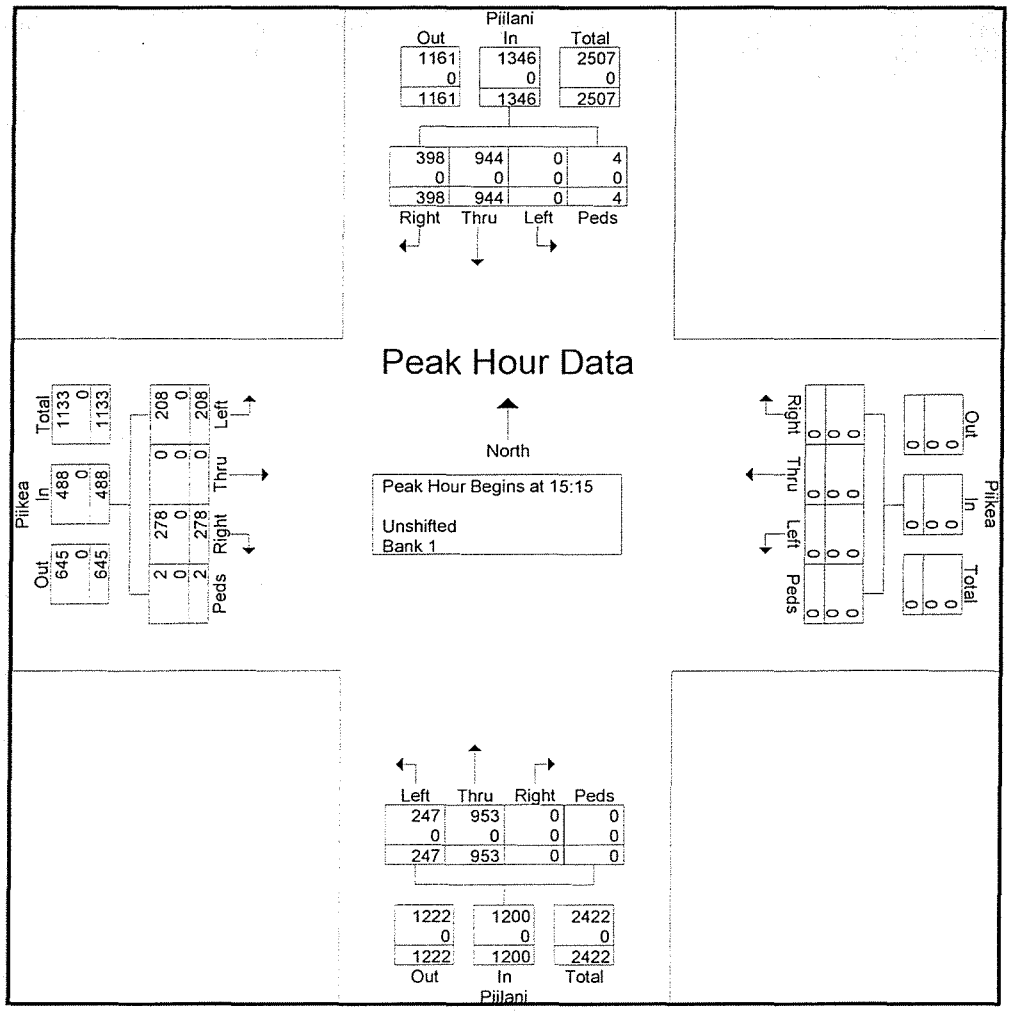
File Name : Piilani - Piikea PM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 2

	Piilani From North					Piikea From East					Piilani From South					Piikea 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 15:15 to 16:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:15																					
15:15	79	139	0	0	218	0	0	0	0	0	0	163	70	0	233	70	0	36	0	106	557
15:30	101	218	0	2	321	0	0	0	0	0	0	213	**81**	0	294	74	0	40	2	116	731
15:45	**131**	**305**	0	0	**436**	0	0	0	0	0	0	**361**	42	0	**403**	**77**	0	64	0	**141**	**980**
16:00	87	282	0	2	371	0	0	0	0	0	0	216	54	0	270	57	0	**68**	0	125	766
Total Volume	398	944	0	4	1346	0	0	0	0	0	0	953	247	0	1200	278	0	208	2	488	3034
% App. Total	29.6	70.1	0	0.3		0	0	0	0		0	79.4	20.6	0		57	0	42.6	0.4		
PHF	.760	.774	.000	.500	.772	.000	.000	.000	.000	.000	.000	.660	.762	.000	.744	.903	.000	.765	.250	.865	.774
Unshifted	398	944	0	4	1346	0	0	0	0	0	0	953	247	0	1200	278	0	208	2	488	3034
% Unshifted																					
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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501 Sumner Street, Suite 521
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File Name : Liloa - Driveway PM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 1

Groups Printed- Unshifted - Bank 1

	Liloa From North				Commercial Driveway From East				Liloa From South				Commercial Driveway From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
15:00	0	40	12	0	22	0	11	0	37	86	0	0	0	0	0	0	208
15:15	0	34	17	0	31	0	13	0	48	53	0	0	0	0	0	0	196
15:30	0	31	24	0	23	0	16	0	44	75	0	0	0	0	0	0	213
15:45	0	41	19	0	23	0	16	0	34	42	0	0	0	0	0	0	175
Total	0	146	72	0	99	0	56	0	163	256	0	0	0	0	0	0	792
16:00	0	28	20	0	18	0	19	0	26	26	0	0	0	0	0	0	137
16:15	0	26	17	0	26	0	13	0	35	24	0	0	0	0	0	0	141
16:30	0	23	8	0	16	0	14	0	34	26	0	0	0	0	0	0	121
16:45	0	26	15	0	20	0	9	0	36	36	0	0	0	0	0	0	142
Total	0	103	60	0	80	0	55	0	131	112	0	0	0	0	0	0	541
Grand Total	0	249	132	0	179	0	111	0	294	368	0	0	0	0	0	0	1333
Apprch %	0	65.4	34.6	0	61.7	0	38.3	0	44.4	55.6	0	0	0	0	0	0	
Total %	0	18.7	9.9	0	13.4	0	8.3	0	22.1	27.6	0	0	0	0	0	0	
Unshifted	0	249	132	0	179	0	111	0	294	368	0	0	0	0	0	0	1333
% Unshifted	0	100	100	0	100	0	100	0	100	100	0	0	0	0	0	0	100
Bank 1	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

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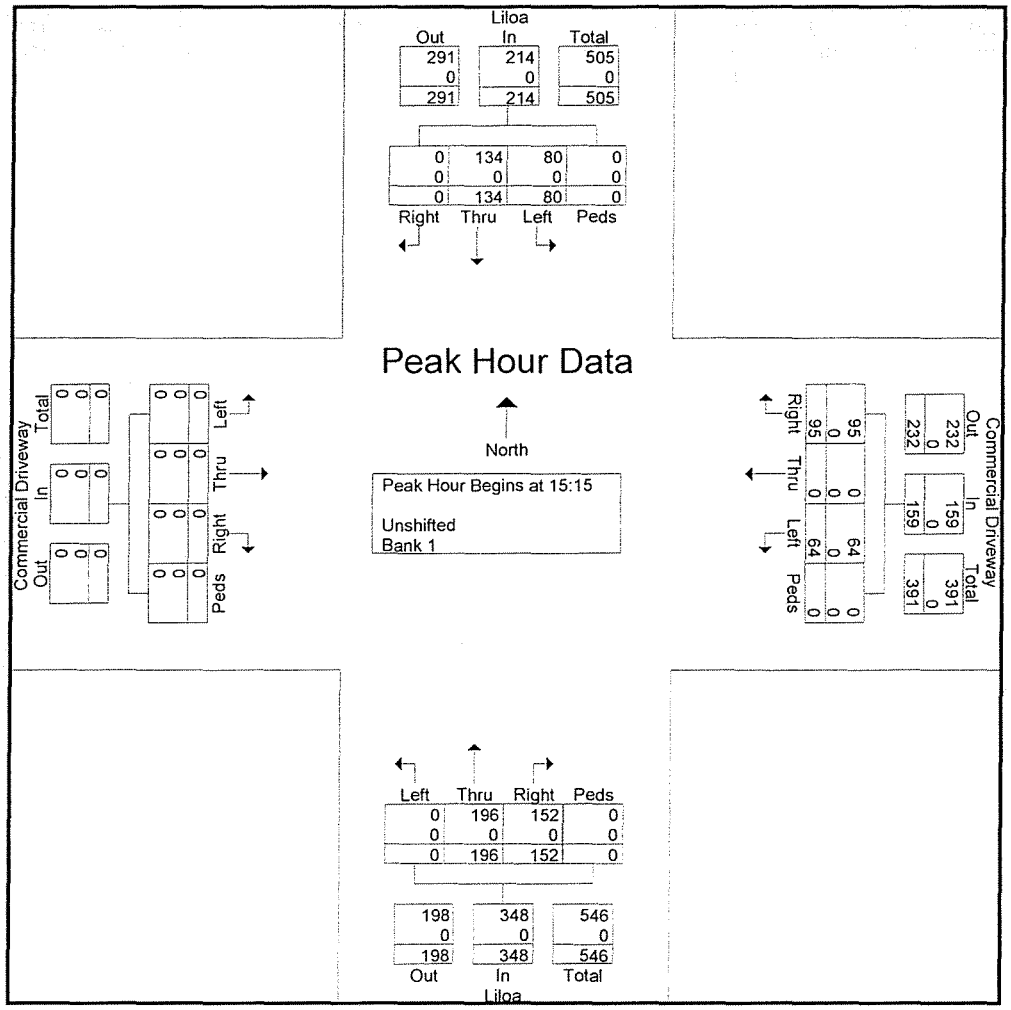
ph: 533-3646 Fax: 526-1267

File Name : Liloa - Driveway PM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 2

	Liloa From North					Commercial Driveway From East					Liloa From South					Commercial Driveway 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 15:15 to 16:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:15																					
15:15	0	34	17	0	51	**31**	0	13	0	**44**	**48**	53	0	0	101	0	0	0	0	0	196
15:30	0	31	**24**	0	55	23	0	16	0	39	44	**75**	0	0	**119**	0	0	0	0	0	**213**
15:45	0	**41**	19	0	**60**	23	0	16	0	39	34	42	0	0	76	0	0	0	0	0	175
16:00	0	28	20	0	48	18	0	**19**	0	37	26	26	0	0	52	0	0	0	0	0	137
Total Volume	0	134	80	0	214	95	0	64	0	159	152	196	0	0	348	0	0	0	0	0	721
% App. Total	0	62.6	37.4	0		59.7	0	40.3	0		43.7	56.3	0	0		0	0	0	0		
PHF	.000	.817	.833	.000	.892	.766	.000	.842	.000	.903	.792	.653	.000	.000	.731	.000	.000	.000	.000	.000	.846
Unshifted	0	134	80	0	214	95	0	64	0	159	152	196	0	0	348	0	0	0	0	0	721
% Unshifted																					
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 : Liloa - Piikea PM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 1

Groups Printed- Unshifted - Bank 1

	Liloa From North				Piikea From East				Liloa From South				Piikea From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
15:00	13	18	18	1	41	93	20	0	21	60	32	2	15	67	23	0	424
15:15	11	22	13	1	22	69	18	4	16	56	26	1	15	61	19	3	357
15:30	23	20	8	1	32	98	22	3	15	68	26	2	11	52	24	1	406
15:45	24	19	14	0	9	105	21	4	22	44	26	0	11	56	24	0	379
Total	71	79	53	3	104	365	81	11	74	228	110	5	52	236	90	4	1566
16:00	22	15	11	0	11	89	13	5	13	19	12	0	6	72	19	0	307
16:15	12	12	12	0	6	78	17	4	12	28	10	0	14	53	24	1	283
16:30	16	9	12	0	7	78	20	1	8	27	11	0	7	56	25	2	279
16:45	17	10	9	0	17	95	21	0	9	34	13	0	9	62	19	0	315
Total	67	46	44	0	41	340	71	10	42	108	46	0	36	243	87	3	1184
Grand Total	138	125	97	3	145	705	152	21	116	336	156	5	88	479	177	7	2750
Apprch %	38	34.4	26.7	0.8	14.2	68.9	14.9	2.1	18.9	54.8	25.4	0.8	11.7	63.8	23.6	0.9	
Total %	5	4.5	3.5	0.1	5.3	25.6	5.5	0.8	4.2	12.2	5.7	0.2	3.2	17.4	6.4	0.3	
Unshifted	138	125	97	3	145	705	152	21	116	336	156	5	88	479	177	7	2750
% Unshifted	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
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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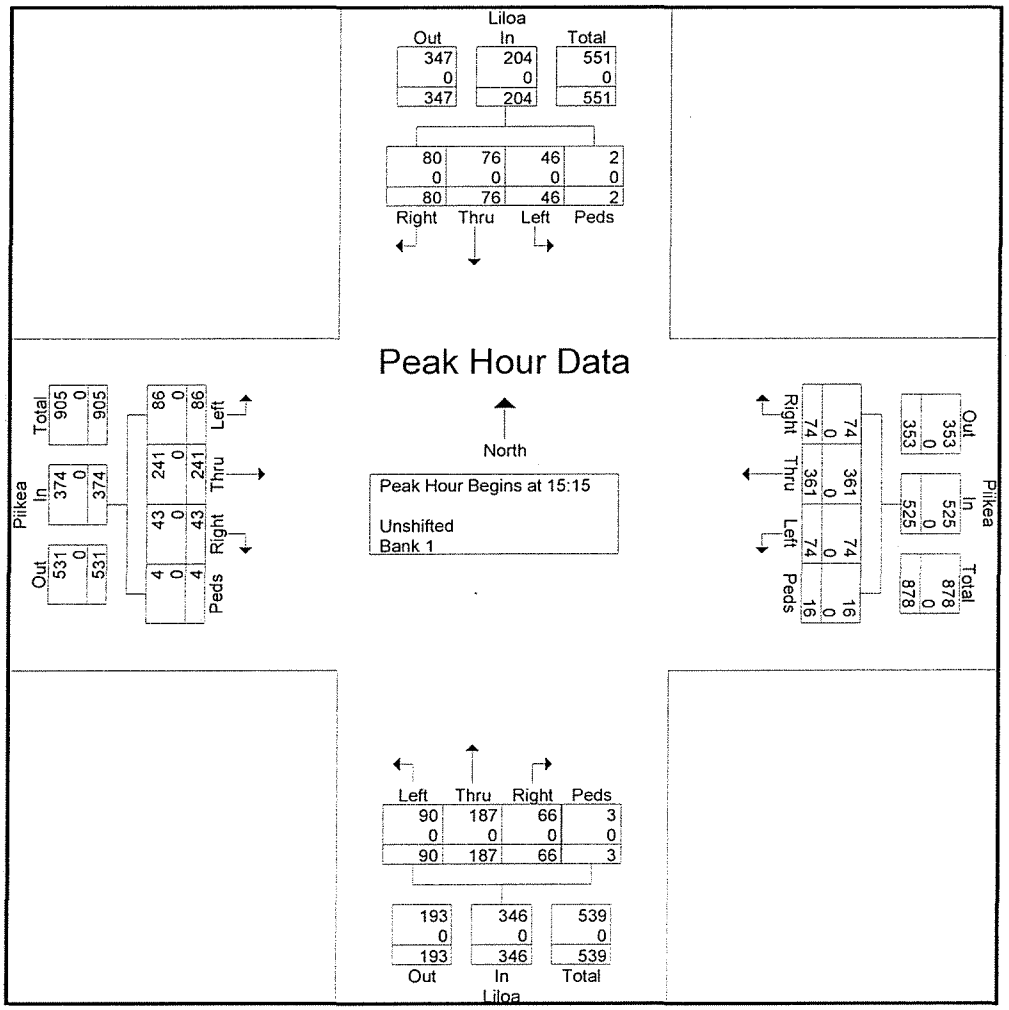
File Name : Liloa - Piikea PM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 2

	Liloa From North					Piikea From East					Liloa From South					Piikea 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 15:15 to 16:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:15																					
15:15	11	22	13	1	47	22	69	18	4	113	16	56	26	1	99	15	61	19	3	98	357
15:30	23	20	8	1	52	32	98	22	3	155	15	68	26	2	111	11	52	24	1	88	406
15:45	24	19	14	0	57	9	105	21	4	139	22	44	26	0	92	11	56	24	0	91	379
16:00	22	15	11	0	48	11	89	13	5	118	13	19	12	0	44	6	72	19	0	97	307
Total Volume	80	76	46	2	204	74	361	74	16	525	66	187	90	3	346	43	241	86	4	374	1449
% App. Total	39.2	37.3	22.5	1		14.1	68.8	14.1	3		19.1	54	26	0.9		11.5	64.4	23	1.1		
PHF	.833	.864	.821	.500	.895	.578	.860	.841	.800	.847	.750	.688	.865	.375	.779	.717	.837	.896	.333	.954	.892
Unshifted	80	76	46	2	204	74	361	74	16	525	66	187	90	3	346	43	241	86	4	374	1449
% Unshifted																					
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



Austin Tsutsumi & Associates

501 Sumner St. Ste. 521
Honolulu, HI 96817
(808) 533-3646

File Name : Azeka Drive & Piikea St PM
Site Code : 00000000
Start Date : 11/1/2011
Page No : 1

Groups Printed- Unshifted

	AZEKA DRIVEWAY From North					PIIKEA ST From East					AZEKA DRIVEWAY From South					PIIKEA ST 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
03:15 PM	0	1	1	0	2	0	93	17	0	110	28	0	9	0	37	3	90	0	0	93	242
03:30 PM	0	0	0	0	0	1	108	23	0	132	20	0	4	0	24	2	89	1	0	92	248
03:45 PM	0	0	0	0	0	0	110	17	0	127	17	0	4	0	21	0	91	0	0	91	239
Total	0	1	1	0	2	1	311	57	0	369	65	0	17	0	82	5	270	1	0	276	729
04:00 PM	0	0	0	0	0	0	73	14	0	87	12	0	0	0	12	1	81	1	0	83	182
Grand Total	0	1	1	0	2	1	384	71	0	456	77	0	17	0	94	6	351	2	0	359	911
Apprch %	0	50	50	0		0.2	84.2	15.6	0		81.9	0	18.1	0		1.7	97.8	0.6	0		
Total %	0	0.1	0.1	0	0.2	0.1	42.2	7.8	0	50.1	8.5	0	1.9	0	10.3	0.7	38.5	0.2	0	39.4	

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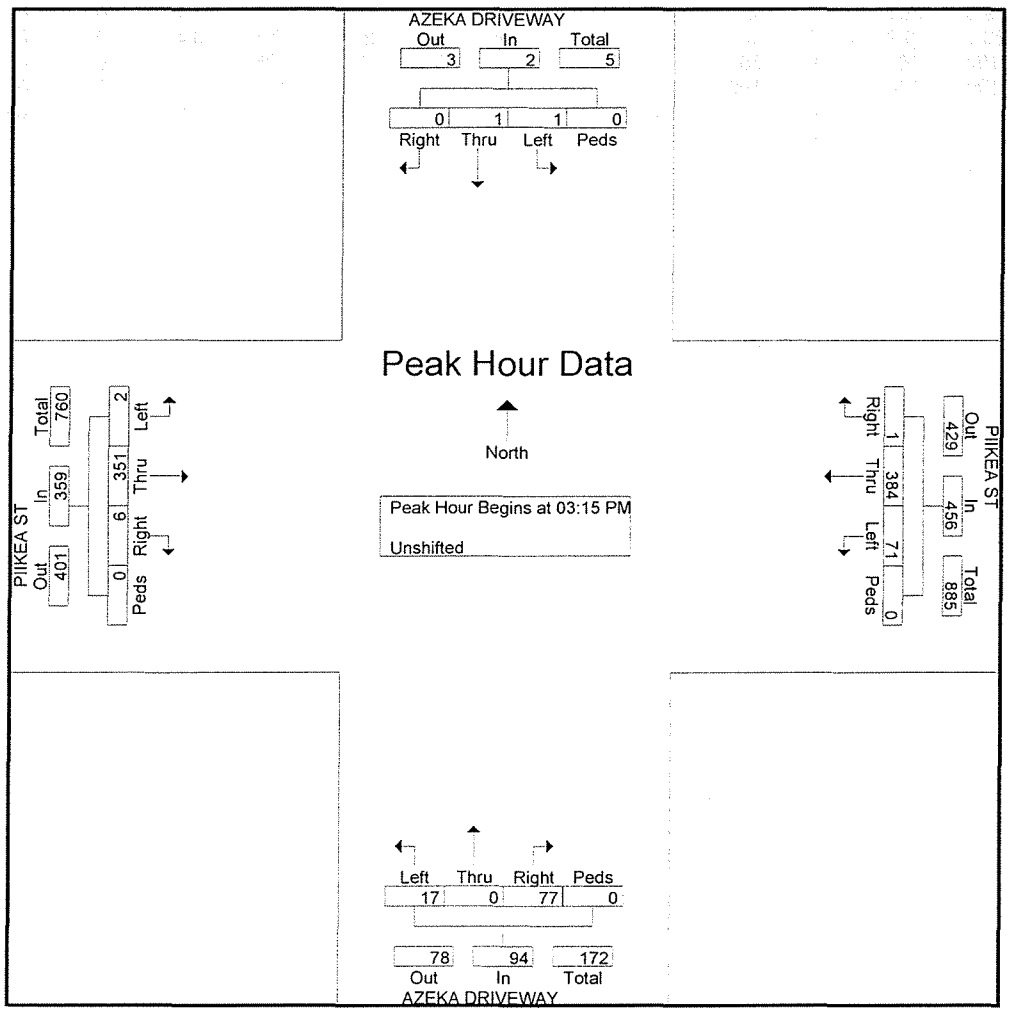
File Name : Azeka Drive & Piikea St PM
Site Code : 00000000
Start Date : 11/1/2011
Page No : 2

	AZEKA DRIVEWAY From North					PIIKEA ST From East					AZEKA DRIVEWAY From South					PIIKEA ST 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 03:15 PM to 04:00 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:15 PM																					
03:15 PM	0	**1**	**1**	0	**2**	0	93	17	0	110	**28**	0	**9**	0	**37**	**3**	90	0	0	**93**	242
03:30 PM	0	0	0	0	0	**1**	108	**23**	0	**132**	20	0	4	0	24	2	89	**1**	0	92	**248**
03:45 PM	0	0	0	0	0	0	**110**	17	0	127	17	0	4	0	21	0	**91**	0	0	91	239
04:00 PM	0	0	0	0	0	0	73	14	0	87	12	0	0	0	12	1	81	1	0	83	182
Total Volume	0	1	1	0	2	1	384	71	0	456	77	0	17	0	94	6	351	2	0	359	911
% App. Total	0	50	50	0		0.2	84.2	15.6	0		81.9	0	18.1	0		1.7	97.8	0.6	0		
PHF	.000	.250	.250	.000	.250	.250	.873	.772	.000	.864	.688	.000	.472	.000	.635	.500	.964	.500	.000	.965	.918



Austin, Tsutsumi and Associates

501 Sumner Street, Suite 521
Honolulu, Hawaii 96817
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File Name : S Kihei - Piikea PM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 1

Groups Printed- Unshifted - Bank 1

	S Kihei From North				Piikea From East				S Kihei From South				Piikea From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
15:00	4	171	35	0	54	12	52	1	44	96	0	1	0	0	0	1	471
15:15	3	141	37	0	50	10	54	5	44	129	2	8	0	0	0	2	485
15:30	8	149	29	0	58	13	58	2	40	159	1	1	0	0	0	3	521
15:45	10	143	38	0	59	4	64	1	47	127	8	1	0	0	0	0	502
Total	25	604	139	0	221	39	228	9	175	511	11	11	0	0	0	6	1979
16:00	5	144	24	0	34	9	60	0	44	130	3	0	0	0	0	4	457
16:15	1	142	34	0	29	10	72	9	53	134	4	3	0	0	0	2	493
16:30	4	145	26	0	30	7	53	2	44	125	4	2	0	0	0	4	446
16:45	2	115	41	0	44	7	73	2	43	144	3	0	0	0	0	0	474
Total	12	546	125	0	137	33	258	13	184	533	14	5	0	0	0	10	1870
Grand Total	37	1150	264	0	358	72	486	22	359	1044	25	16	0	0	0	16	3849
Apprch %	2.5	79.3	18.2	0	38.2	7.7	51.8	2.3	24.9	72.3	1.7	1.1	0	0	0	100	
Total %	1	29.9	6.9	0	9.3	1.9	12.6	0.6	9.3	27.1	0.6	0.4	0	0	0	0.4	
Unshifted	37	1150	264	0	358	72	486	22	359	1044	25	16	0	0	0	16	3849
% Unshifted	100	100	100	0	100	100	100	100	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
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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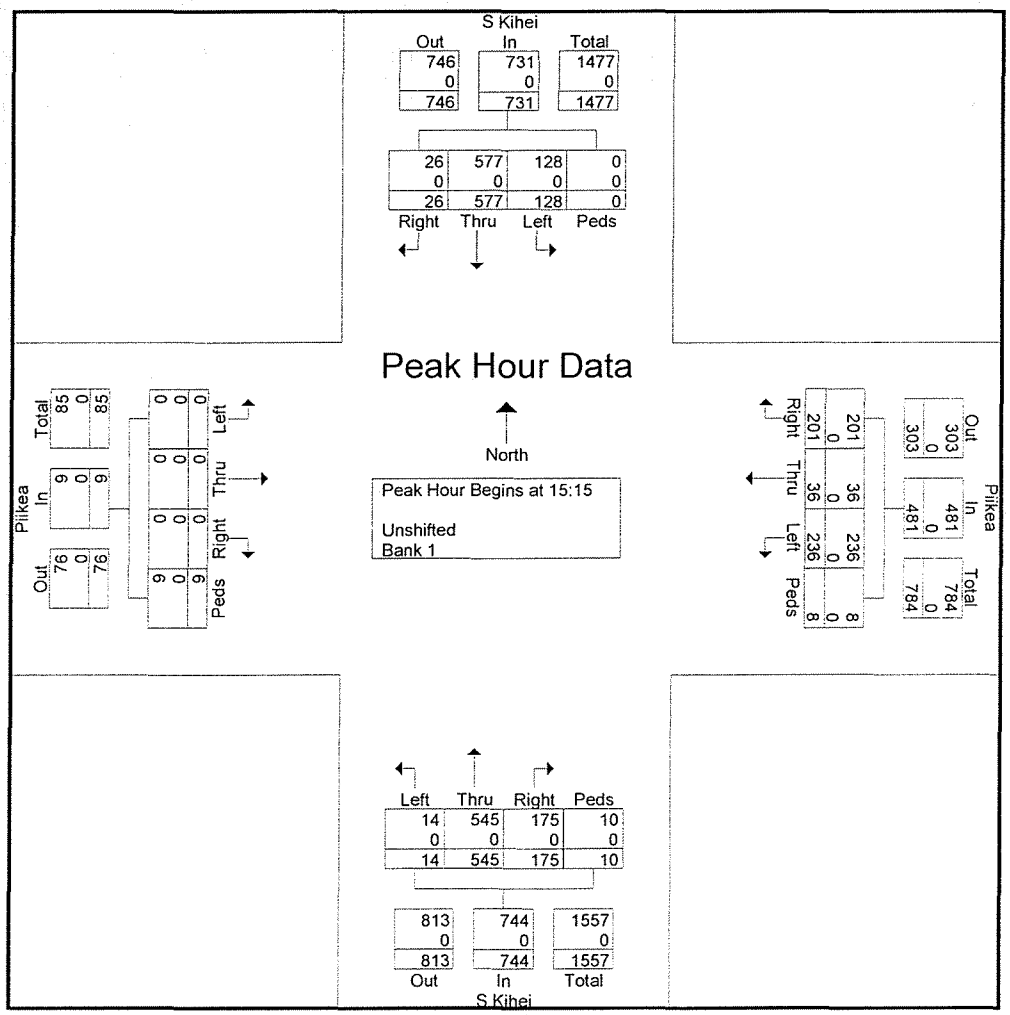
File Name : S Kihei - Piikea PM
Site Code : 00000000
Start Date : 4/9/2009
Page No : 2

	S Kihei From North					Piikea From East					S Kihei From South					Piikea 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 15:15 to 16:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:15																					
15:15	3	141	37	0	181	50	10	54	**5**	119	44	129	2	**8**	183	0	0	0	2	2	485
15:30	8	**149**	29	0	186	58	**13**	58	2	**131**	40	**159**	1	1	**201**	0	0	0	3	3	**521**
15:45	**10**	143	**38**	0	**191**	**59**	4	**64**	1	128	**47**	127	**8**	1	183	0	0	0	0	0	502
16:00	5	144	24	0	173	34	9	60	0	103	44	130	3	0	177	0	0	0	**4**	**4**	457
Total Volume	26	577	128	0	731	201	36	236	8	481	175	545	14	10	744	0	0	0	9	9	1965
% App. Total	3.6	78.9	17.5	0		41.8	7.5	49.1	1.7		23.5	73.3	1.9	1.3		0	0	0	100		
PHF	.650	.968	.842	.000	.957	.852	.692	.922	.400	.918	.931	.857	.438	.313	.925	.000	.000	.000	.563	.563	.943
Unshifted	26	577	128	0	731	201	36	236	8	481	175	545	14	10	744	0	0	0	9	9	1965
% Unshifted																					
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



Austin Tsutsumi & Associates

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File Name : MD_Piilani - Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 1

Groups Printed- Unshifted

	PIILANI From North					PIIKEA From East					PIILANI From South					PIIKEA 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
11:00 AM	77	191	0	0	268	0	0	0	0	0	0	194	45	0	239	51	0	69	0	120	627
11:15 AM	69	169	0	0	238	0	0	0	0	0	0	194	40	0	234	48	0	63	0	111	583
11:30 AM	80	185	0	0	265	0	0	0	0	0	0	213	34	0	247	54	0	68	0	122	634
11:45 AM	79	179	0	0	258	0	0	0	0	0	0	199	34	0	233	44	0	64	0	108	599
Total	305	724	0	0	1029	0	0	0	0	0	0	800	153	0	953	197	0	264	0	461	2443
12:00 PM	78	175	0	0	253	0	0	0	0	0	0	222	49	0	271	51	0	72	0	123	647
12:15 PM	64	172	0	1	237	0	0	0	0	0	0	212	45	0	257	42	0	64	0	106	600
12:30 PM	77	209	0	0	286	0	0	0	0	0	0	190	31	0	221	45	0	55	0	100	607
12:45 PM	69	192	0	0	261	0	0	0	0	0	0	191	37	2	230	45	0	50	0	95	586
Total	288	748	0	1	1037	0	0	0	0	0	0	815	162	2	979	183	0	241	0	424	2440
Grand Total	593	1472	0	1	2066	0	0	0	0	0	0	1615	315	2	1932	380	0	505	0	885	4883
Apprch %	28.7	71.2	0	0		0	0	0	0		0	83.6	16.3	0.1		42.9	0	57.1	0		
Total %	12.1	30.1	0	0	42.3	0	0	0	0	0	0	33.1	6.5	0	39.6	7.8	0	10.3	0	18.1	

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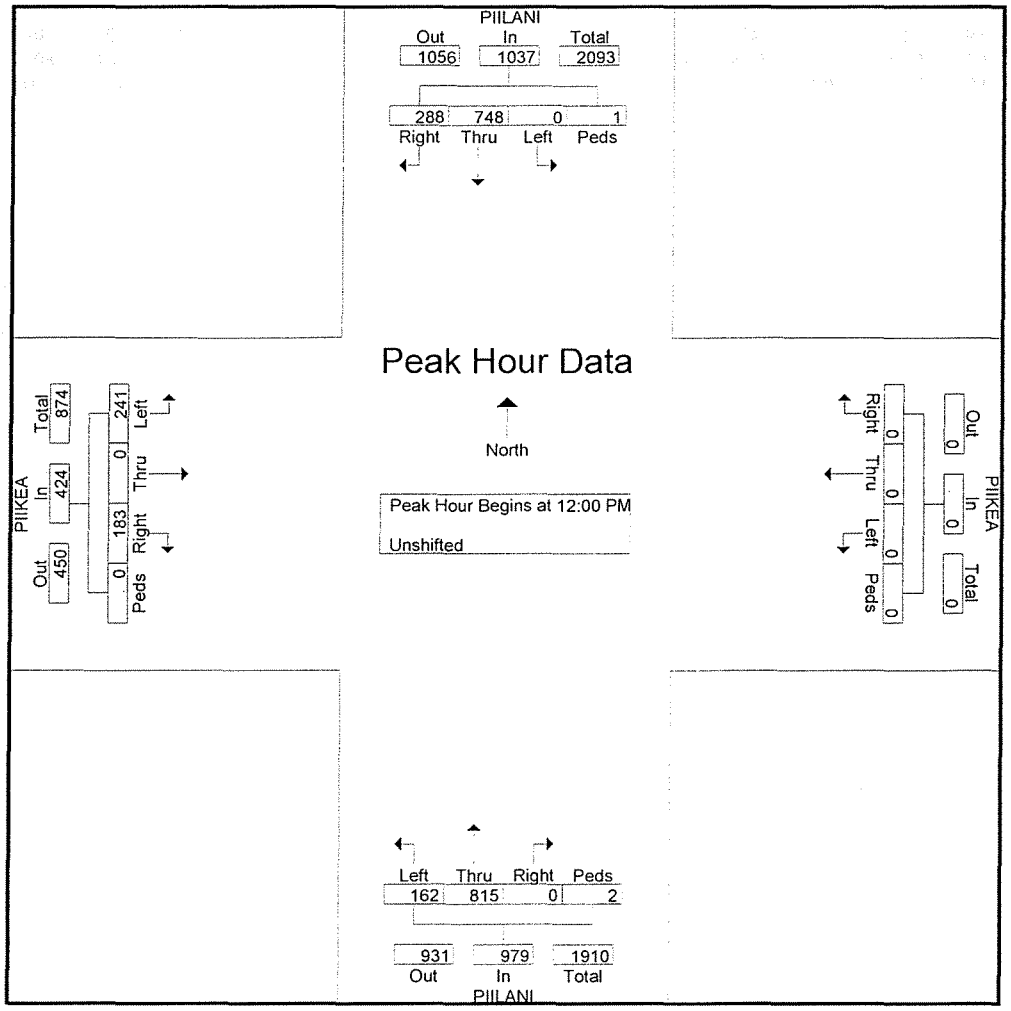
File Name : MD_Piilani - Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 2

	PIILANI From North					PIIKEA From East					PIILANI From South					PIIKEA 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 12:00 PM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	**78**	175	0	0	253	0	0	0	0	0	0	**222**	**49**	0	**271**	**51**	0	**72**	0	**123**	**647**
12:15 PM	64	172	0	**1**	237	0	0	0	0	0	0	212	45	0	257	42	0	64	0	106	600
12:30 PM	77	**209**	0	0	**286**	0	0	0	0	0	0	190	31	0	221	45	0	55	0	100	607
12:45 PM	69	192	0	0	261	0	0	0	0	0	0	191	37	**2**	230	45	0	50	0	95	586
Total Volume	288	748	0	1	1037	0	0	0	0	0	0	815	162	2	979	183	0	241	0	424	2440
% App. Total	27.8	72.1	0	0.1		0	0	0	0		0	83.2	16.5	0.2		43.2	0	56.8	0		
PHF	.923	.895	.000	.250	.906	.000	.000	.000	.000	.000	.000	.918	.827	.250	.903	.897	.000	.837	.000	.862	.943



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501 Sumner Street, Suite 521
Honolulu, HI 96817-5031
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File Name : MD_Kihei Commercial Dr - Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 1

Groups Printed- Unshifted

	KIHEI COMMERCIAL DR From North				PIIKEA From East				KIHEI COMMERCIAL DR From South				PIIKEA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	21	1	57	0	59	58	1	0	1	0	2	0	0	58	20	2	280
11:15 AM	28	3	68	0	49	48	3	0	4	3	4	0	3	45	24	8	290
11:30 AM	23	2	60	1	66	49	3	0	3	1	6	0	3	56	32	6	311
11:45 AM	21	0	64	0	59	53	1	0	1	0	2	0	2	38	22	3	266
Total	93	6	249	1	233	208	8	0	9	4	14	0	8	197	98	19	1147
12:00 PM	23	3	70	0	57	59	5	0	7	2	2	0	3	43	14	2	290
12:15 PM	21	6	57	1	54	47	1	0	3	4	3	0	4	42	29	2	274
12:30 PM	31	2	47	0	55	54	1	0	2	1	2	0	2	48	19	4	268
12:45 PM	28	2	64	0	60	49	1	0	5	2	2	0	3	31	27	2	276
Total	103	13	238	1	226	209	8	0	17	9	9	0	12	164	89	10	1108
Grand Total	196	19	487	2	459	417	16	0	26	13	23	0	20	361	187	29	2255
Apprch %	27.8	2.7	69.2	0.3	51.5	46.7	1.8	0	41.9	21	37.1	0	3.4	60.5	31.3	4.9	
Total %	8.7	0.8	21.6	0.1	20.4	18.5	0.7	0	1.2	0.6	1	0	0.9	16	8.3	1.3	

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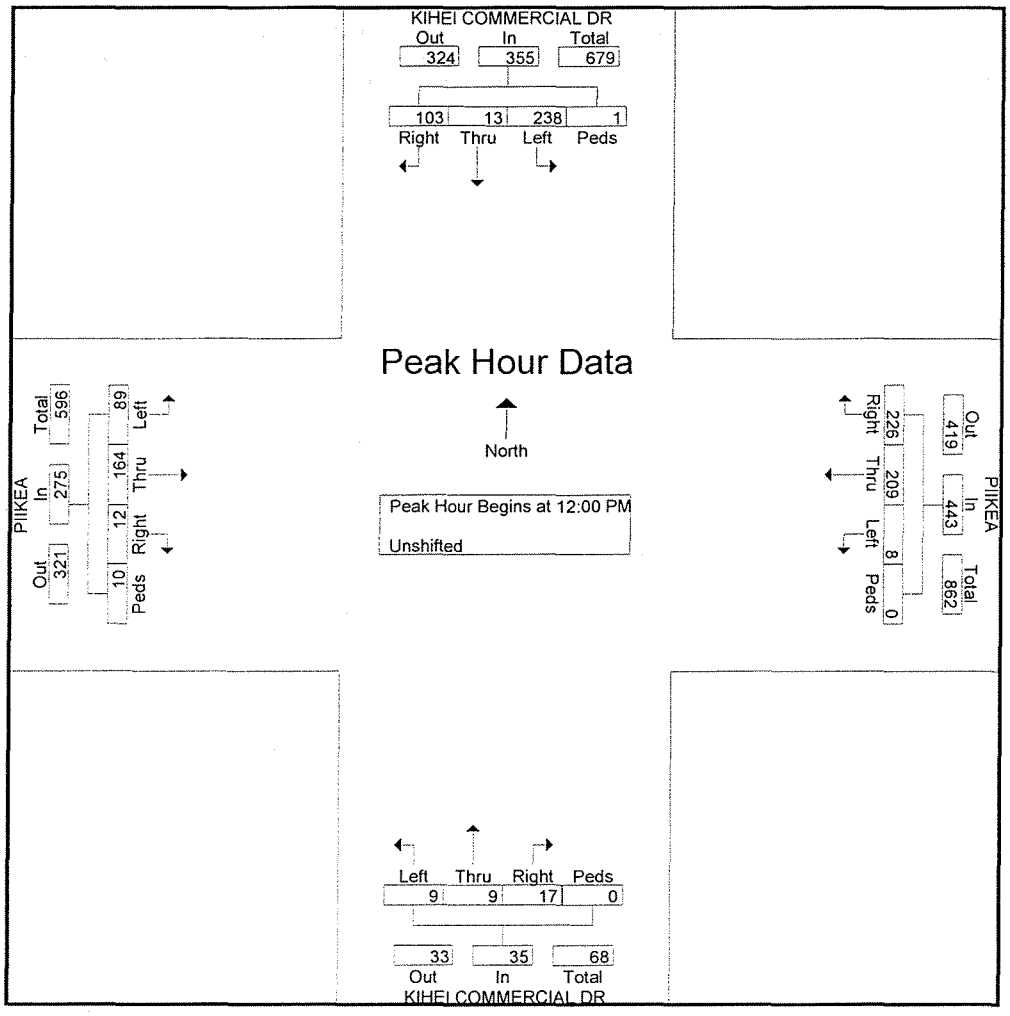
File Name : MD_Kihei Commercial Dr - Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 2

	KIHEI COMMERCIAL DR From North					PIIKEA From East					KIHEI COMMERCIAL DR From South					PIIKEA 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 12:00 PM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	23	3	**70**	0	**96**	57	**59**	**5**	0	**121**	**7**	2	2	0	**11**	3	43	14	2	62	**290**
12:15 PM	21	**6**	57	**1**	85	54	47	1	0	102	3	4	**3**	0	10	4	42	**29**	2	77	274
12:30 PM	**31**	2	47	0	80	55	54	1	0	110	2	1	2	0	5	2	**48**	19	**4**	73	268
12:45 PM	28	2	64	0	94	**60**	49	1	0	110	5	2	2	0	9	3	31	27	2	63	276
Total Volume	103	13	238	1	355	226	209	8	0	443	17	9	9	0	35	12	164	89	10	275	1108
% App. Total	29	3.7	67	0.3		51	47.2	1.8	0		48.6	25.7	25.7	0		4.4	59.6	32.4	3.6		
PHF	.831	.542	.850	.250	.924	.942	.886	.400	.000	.915	.607	.563	.750	.000	.795	.750	.854	.767	.625	.893	.955



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File Name : MD_Liloa - Driveway N of Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 1

Groups Printed- Unshifted

	LILOA From North				N PIIKEA From East				LILOA From South				N PIIKEA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	0	32	6	0	9	0	9	0	25	10	0	0	0	0	0	0	91
11:15 AM	0	28	6	0	8	0	6	0	29	13	0	0	0	0	0	0	90
11:30 AM	0	28	11	0	11	0	10	0	28	18	0	0	0	0	0	0	106
11:45 AM	0	27	12	0	6	0	5	1	27	21	0	0	0	0	0	0	99
Total	0	115	35	0	34	0	30	1	109	62	0	0	0	0	0	0	386
12:00 PM	0	24	9	0	12	0	8	0	27	24	0	0	0	0	0	0	104
12:15 PM	0	23	7	3	9	0	11	0	23	28	0	0	0	0	0	0	104
12:30 PM	0	29	6	0	11	0	8	0	18	16	0	1	0	0	0	0	89
12:45 PM	0	16	8	0	10	0	6	0	24	16	0	0	0	0	0	0	80
Total	0	92	30	3	42	0	33	0	92	84	0	1	0	0	0	0	377
Grand Total	0	207	65	3	76	0	63	1	201	146	0	1	0	0	0	0	763
Apprch %	0	75.3	23.6	1.1	54.3	0	45	0.7	57.8	42	0	0.3	0	0	0	0	
Total %	0	27.1	8.5	0.4	10	0	8.3	0.1	26.3	19.1	0	0.1	0	0	0	0	

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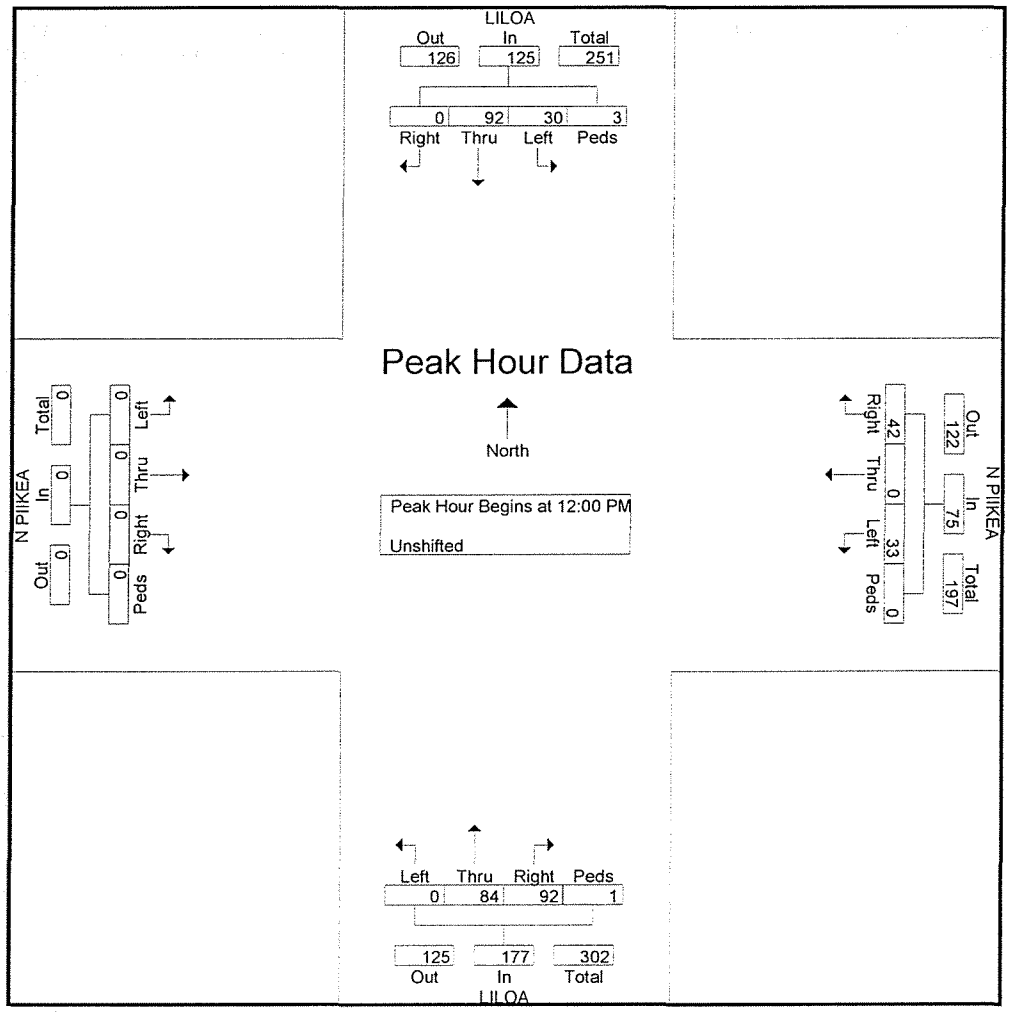
File Name : MD_Liloa - Driveway N of Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 2

	LILOA From North					N PIIKEA From East					LILOA From South					N PIIKEA 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 12:00 PM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	0	24	**9**	0	33	**12**	0	8	0	**20**	**27**	24	0	0	**51**	0	0	0	0	0	**104**
12:15 PM	0	23	7	**3**	33	9	0	**11**	0	20	23	**28**	0	0	51	0	0	0	0	0	104
12:30 PM	0	**29**	6	0	**35**	11	0	8	0	19	18	16	0	**1**	35	0	0	0	0	0	89
12:45 PM	0	16	8	0	24	10	0	6	0	16	24	16	0	0	40	0	0	0	0	0	80
Total Volume	0	92	30	3	125	42	0	33	0	75	92	84	0	1	177	0	0	0	0	0	377
% App. Total	0	73.6	24	2.4		56	0	44	0		52	47.5	0	0.6		0	0	0	0		
PHF	.000	.793	.833	.250	.893	.875	.000	.750	.000	.938	.852	.750	.000	.250	.868	.000	.000	.000	.000	.000	.906



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File Name : MD_Liloa - Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 1

Groups Printed- Unshifted

	LILOA From North				PIIKEA From East				LILOA From South				PIIKEA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	10	8	26	0	8	79	11	3	7	7	4	1	6	66	18	0	254
11:15 AM	8	5	19	0	9	57	17	0	12	16	8	0	8	47	17	0	223
11:30 AM	16	11	12	7	10	56	16	0	13	17	7	0	8	52	19	0	244
11:45 AM	7	13	11	0	3	61	18	0	17	23	9	0	5	36	20	0	223
Total	41	37	68	7	30	253	62	3	49	63	28	1	27	201	74	0	944
12:00 PM	8	9	16	0	9	60	15	0	8	22	7	0	6	45	20	0	225
12:15 PM	9	15	11	0	7	58	15	0	12	28	5	0	4	47	14	0	225
12:30 PM	13	13	10	0	7	66	14	1	6	16	10	0	3	46	12	0	217
12:45 PM	4	9	13	0	8	54	16	0	12	17	4	0	7	43	19	0	206
Total	34	46	50	0	31	238	60	1	38	83	26	0	20	181	65	0	873
Grand Total	75	83	118	7	61	491	122	4	87	146	54	1	47	382	139	0	1817
Apprch %	26.5	29.3	41.7	2.5	9	72.4	18	0.6	30.2	50.7	18.8	0.3	8.3	67.3	24.5	0	
Total %	4.1	4.6	6.5	0.4	3.4	27	6.7	0.2	4.8	8	3	0.1	2.6	21	7.6	0	

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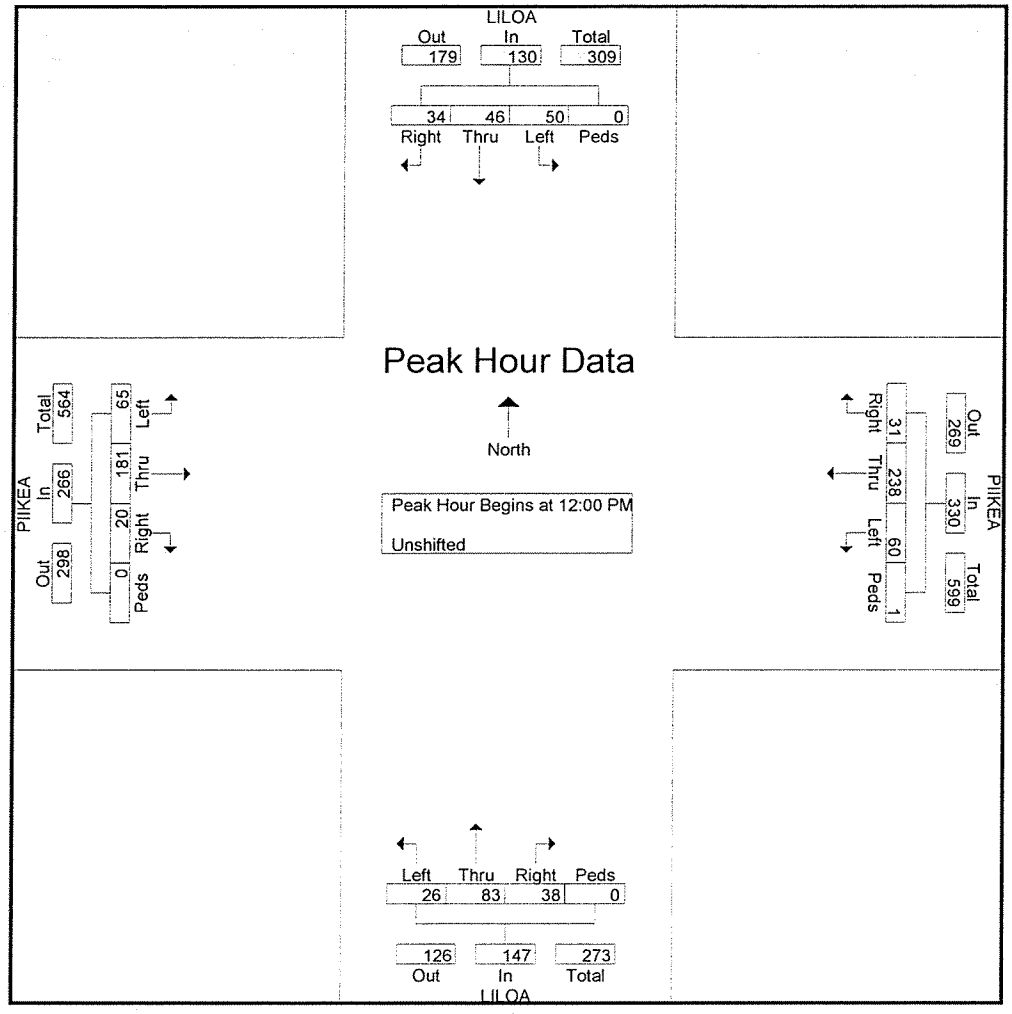
File Name : MD_Liloa - Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 2

	LILOA From North					PIIKEA From East					LILOA From South					PIIKEA 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 12:00 PM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	8	9	**16**	0	33	**9**	60	15	0	84	8	22	7	0	37	6	45	**20**	0	**71**	**225**
12:15 PM	9	**15**	11	0	35	7	58	15	0	80	**12**	**28**	5	0	**45**	4	**47**	14	0	65	225
12:30 PM	**13**	13	10	0	**36**	7	**66**	14	**1**	**88**	6	16	**10**	0	32	3	46	12	0	61	217
12:45 PM	4	9	13	0	26	8	54	**16**	0	78	12	17	4	0	33	7	43	19	0	69	206
Total Volume	34	46	50	0	130	31	238	60	1	330	38	83	26	0	147	20	181	65	0	266	873
% App. Total	26.2	35.4	38.5	0		9.4	72.1	18.2	0.3		25.9	56.5	17.7	0		7.5	68	24.4	0		
PHF	.654	.767	.781	.000	.903	.861	.902	.938	.250	.938	.792	.741	.650	.000	.817	.714	.963	.813	.000	.937	.970



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File Name : MD_Azeka - Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 1

Groups Printed- Unshifted

	AZEKA From North				PIIKEA From East				AZEKA From South				PIIKEA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	0	0	0	0	0	98	11	0	8	0	3	0	0	79	0	0	199
11:15 AM	0	0	0	0	1	82	6	0	8	0	3	0	0	65	0	0	165
11:30 AM	0	0	0	0	0	70	4	0	10	0	1	6	2	74	0	0	167
11:45 AM	0	0	0	0	2	75	6	0	11	0	0	0	0	45	1	0	140
Total	0	0	0	0	3	325	27	0	37	0	7	6	2	263	1	0	671
12:00 PM	0	0	1	0	0	72	11	0	6	0	0	1	0	65	0	0	156
12:15 PM	0	0	0	0	0	62	10	0	8	0	3	0	0	60	1	0	144
12:30 PM	0	0	0	7	0	75	7	0	9	0	2	2	0	52	1	0	155
12:45 PM	0	0	1	0	0	70	11	0	8	0	0	0	1	63	0	0	154
Total	0	0	2	7	0	279	39	0	31	0	5	3	1	240	2	0	609
Grand Total	0	0	2	7	3	604	66	0	68	0	12	9	3	503	3	0	1280
Apprch %	0	0	22.2	77.8	0.4	89.7	9.8	0	76.4	0	13.5	10.1	0.6	98.8	0.6	0	
Total %	0	0	0.2	0.5	0.2	47.2	5.2	0	5.3	0	0.9	0.7	0.2	39.3	0.2	0	

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File Name : MD_Azeka - Piikea
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Start Date : 9/11/2010
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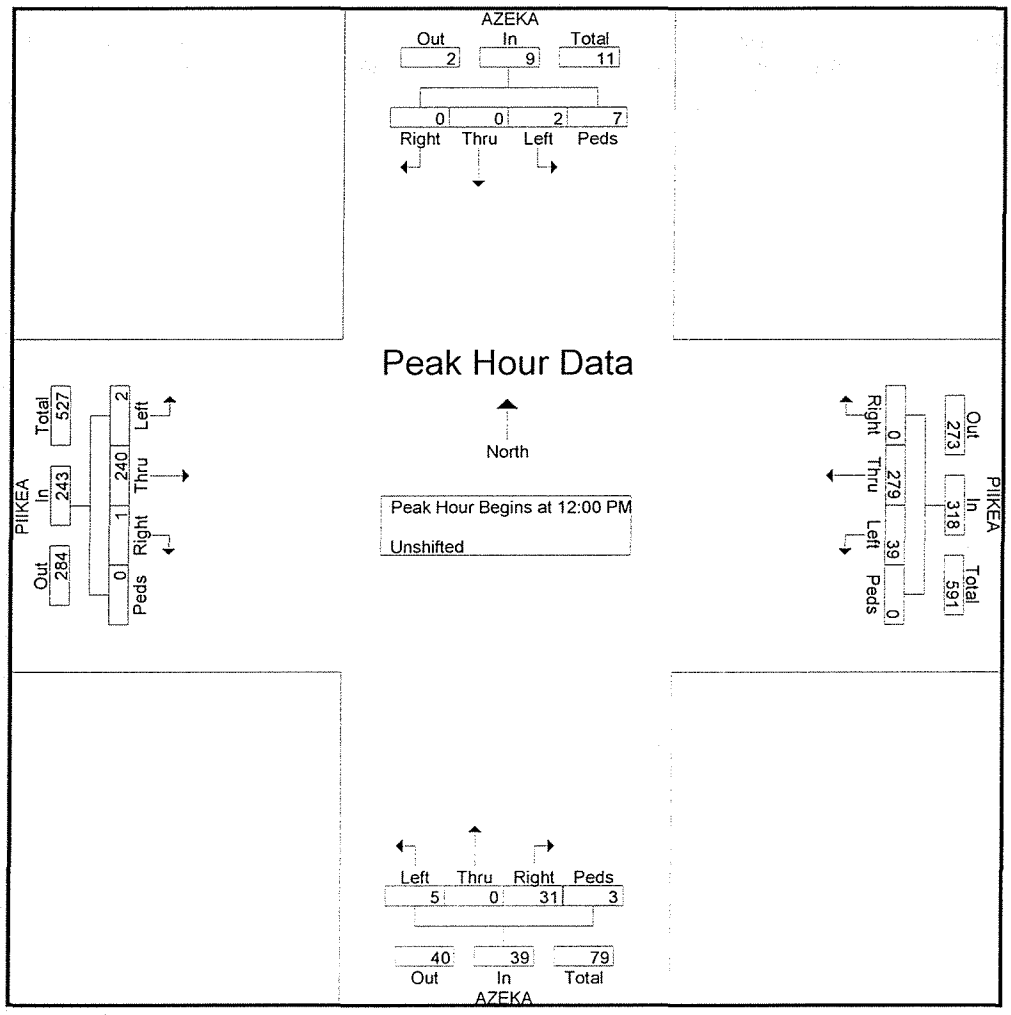
	AZEKA From North					PIIKEA From East					AZEKA From South					PIIKEA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	0	0	1	0	1	0	72	11	0	83	6	0	0	1	7	0	65	0	0	65	156
12:15 PM	0	0	0	0	0	0	62	10	0	72	8	0	3	0	11	0	60	1	0	61	144
12:30 PM	0	0	0	7	7	0	75	7	0	82	9	0	2	2	13	0	52	1	0	53	155
12:45 PM	0	0	1	0	1	0	70	11	0	81	8	0	0	0	8	1	63	0	0	64	154
Total Volume	0	0	2	7	9	0	279	39	0	318	31	0	5	3	39	1	240	2	0	243	609
% App. Total	0	0	22.2	77.8		0	87.7	12.3	0		79.5	0	12.8	7.7		0.4	98.8	0.8	0		
PHF	.000	.000	.500	.250	.321	.000	.930	.886	.000	.958	.861	.000	.417	.375	.750	.250	.923	.500	.000	.935	.976



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File Name : MD_S Kihei - Piikea
Site Code : 00000000
Start Date : 9/11/2010
Page No : 1

Groups Printed- Unshifted

	S KIHEI From North				PIIKEA From East				S KIHEI From South				PIIKEA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	5	112	21	0	22	11	52	1	53	119	2	0	0	0	0	0	398
11:15 AM	8	111	17	0	22	13	55	0	48	101	12	0	0	0	0	0	387
11:30 AM	10	96	19	1	14	11	48	1	59	116	9	0	0	0	0	0	384
11:45 AM	13	108	22	0	27	9	44	1	42	118	3	0	0	0	0	0	387
Total	36	427	79	1	85	44	199	3	202	454	26	0	0	0	0	0	1556
12:00 PM	5	107	15	0	22	8	45	1	40	142	2	0	0	0	0	0	387
12:15 PM	8	123	14	0	14	9	47	0	59	125	4	0	0	0	0	0	403
12:30 PM	7	110	12	0	23	13	53	3	52	125	8	0	0	0	0	0	406
12:45 PM	12	116	21	1	22	14	40	1	44	131	7	0	0	0	0	0	409
Total	32	456	62	1	81	44	185	5	195	523	21	0	0	0	0	0	1605
Grand Total	68	883	141	2	166	88	384	8	397	977	47	0	0	0	0	0	3161
Apprch %	6.2	80.7	12.9	0.2	25.7	13.6	59.4	1.2	27.9	68.8	3.3	0	0	0	0	0	
Total %	2.2	27.9	4.5	0.1	5.3	2.8	12.1	0.3	12.6	30.9	1.5	0	0	0	0	0	

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File Name : MD_S Kihei - Piikea
Site Code : 00000000
Start Date : 9/11/2010
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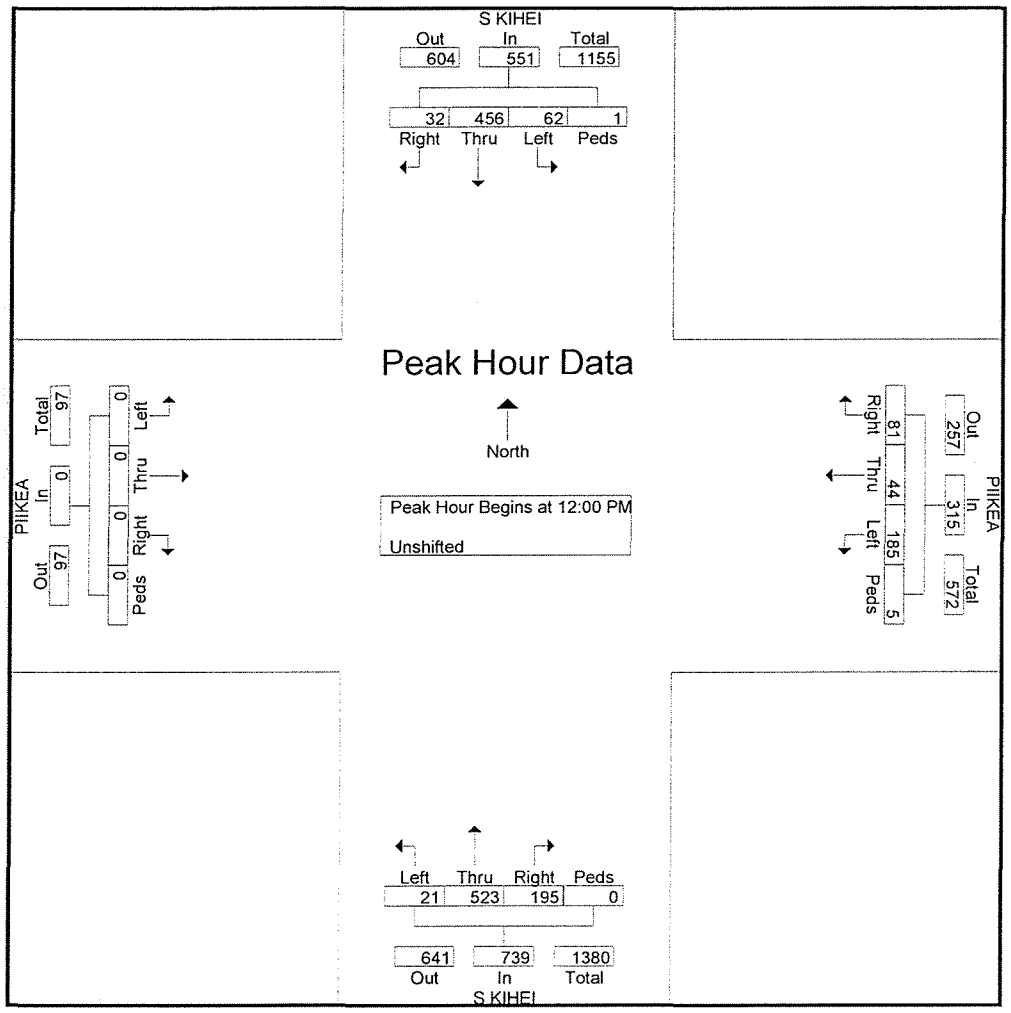
	S KIHEI From North					PIIKEA From East					S KIHEI From South					PIIKEA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	5	107	15	0	127	22	8	45	1	76	40	**142**	2	0	184	0	0	0	0	0	387
12:15 PM	8	**123**	14	0	145	14	9	47	0	70	**59**	125	4	0	**188**	0	0	0	0	0	403
12:30 PM	7	110	12	0	129	**23**	13	**53**	**3**	**92**	52	125	**8**	0	185	0	0	0	0	0	406
12:45 PM	**12**	116	**21**	**1**	**150**	22	**14**	40	1	77	44	131	7	0	182	0	0	0	0	0	**409**
Total Volume	32	456	62	1	551	81	44	185	5	315	195	523	21	0	739	0	0	0	0	0	1605
% App. Total	5.8	82.8	11.3	0.2		25.7	14	58.7	1.6		26.4	70.8	2.8	0		0	0	0	0		
PHF	.667	.927	.738	.250	.918	.880	.786	.873	.417	.856	.826	.921	.656	.000	.983	.000	.000	.000	.000	.000	.981



APPENDIX B

LEVEL OF SERVICE CRITERIA

APPENDIX B – LEVEL OF SERVICE (LOS) CRITERIA

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (HCM 2000)

Level of service for signalized intersections is directly related to delay values and is assigned on that basis. Level of Service is a measure of the acceptability of delay values to motorists at a given intersection. The criteria are given in table below.

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 is dependent 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 or approach in question.

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 2000)

The level of service criteria for unsignalized intersections is defined as the average control delay, in seconds per vehicle.

LOS delay threshold values are lower for two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections than those of signalized intersections. This is because more vehicles pass through signalized intersections, and therefore, drivers expect and tolerate greater delays. While the criteria for level of service for TWSC and AWSC intersections are the same, procedures to calculate the average total delay may differ.

Level of Service Criteria for Two-Way Stop-Controlled Intersections

Level of Service	Average Control Delay (sec/veh)
A	≤ 10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

APPENDIX C

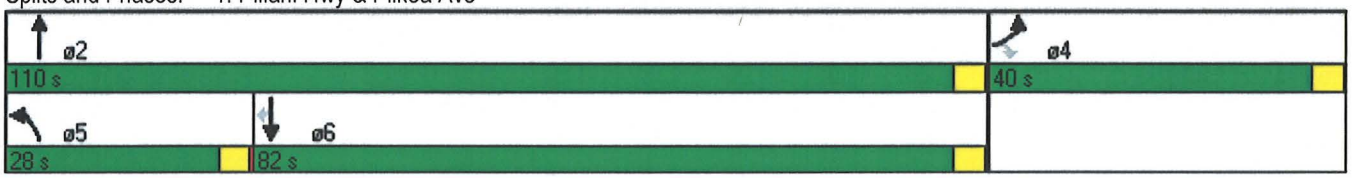
LEVEL OF SERVICE CALCULATIONS

- Existing Conditions AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	214	165	124	1020	1135	259
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	40.0	40.0	28.0	110.0	82.0	82.0
Total Split (%)	26.7%	26.7%	18.7%	73.3%	54.7%	54.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	214	165	124	1020	1135	259
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	233	179	135	1109	1234	282
RTOR Reduction (vph)	0	149	0	0	0	86
Lane Group Flow (vph)	233	30	135	1109	1234	196
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	25.0	25.0	16.7	117.0	96.3	96.3
Effective Green, g (s)	25.0	25.0	16.7	117.0	96.3	96.3
Actuated g/C Ratio	0.17	0.17	0.11	0.78	0.64	0.64
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	295	264	197	2760	2250	1006
v/s Ratio Prot	c0.13		c0.08	0.31	c0.35	
v/s Ratio Perm		0.02				0.13
v/c Ratio	0.79	0.11	0.69	0.40	0.55	0.20
Uniform Delay, d1	60.0	53.1	64.1	5.3	14.8	11.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.1	0.2	9.5	0.4	1.0	0.4
Delay (s)	73.1	53.3	73.6	5.7	15.8	11.4
Level of Service	E	D	E	A	B	B
Approach Delay (s)	64.5			13.1	15.0	
Approach LOS	E			B	B	

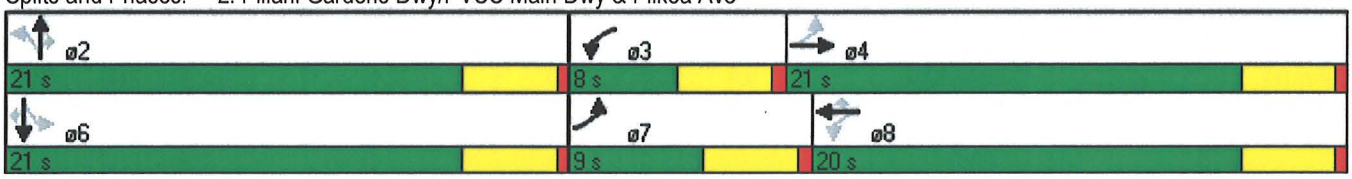
Intersection Summary			
HCM Average Control Delay	20.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	34	204	27	170	186	18	12	33	184	3	40
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: Piilani Gardens Dwy/PVSC Main Dwy & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	204	9	27	170	186	18	12	33	184	3	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	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		0.95	1.00
Satd. Flow (prot)	1770	3516		1770	3539	1583		1808	1583		1775	1583
Flt Permitted	0.60	1.00		0.61	1.00	1.00		0.83	1.00		0.71	1.00
Satd. Flow (perm)	1114	3516		1131	3539	1583		1554	1583		1313	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	222	10	29	185	202	20	13	36	200	3	43
RTOR Reduction (vph)	0	7	0	0	0	137	0	0	24	0	0	28
Lane Group Flow (vph)	37	225	0	29	185	65	0	33	12	0	203	15
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	556	1195		504	1132	507		528	538		446	538
v/s Ratio Prot	c0.01	c0.06		0.00	0.05							
v/s Ratio Perm	0.02			0.02		0.04		0.02	0.01		c0.15	0.01
v/c Ratio	0.07	0.19		0.06	0.16	0.13		0.06	0.02		0.46	0.03
Uniform Delay, d1	8.0	11.6		9.1	12.2	12.1		11.1	11.0		12.9	11.0
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.3		0.2	0.3	0.5		0.2	0.1		3.3	0.1
Delay (s)	8.2	12.0		9.4	12.5	12.6		11.4	11.1		16.2	11.1
Level of Service	A	B		A	B	B		B	B		B	B
Approach Delay (s)		11.5			12.3			11.2			15.3	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	28	21	85	60	46	199
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	23	92	65	50	216
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	441	125			158	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	441	125			158	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	98			96	
cM capacity (veh/h)	553	926			1422	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	30	23	158	50	216
Volume Left	30	0	0	50	0
Volume Right	0	23	65	0	0
cSH	553	926	1700	1422	1700
Volume to Capacity	0.06	0.02	0.09	0.04	0.13
Queue Length 95th (ft)	4	2	0	3	0
Control Delay (s)	11.9	9.0	0.0	7.6	0.0
Lane LOS	B	A		A	
Approach Delay (s)	10.6		0.0	1.4	
Approach LOS	B				

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	24.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	247	228	9	0	46
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	268	248	10	0	50
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			290			
pX, platoon unblocked						
vC, conflicting volume	248				387	129
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	248				387	129
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	94
cM capacity (veh/h)	1315				589	897

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	134	134	165	92	50
Volume Left	0	0	0	0	0
Volume Right	0	0	0	10	50
cSH	1700	1700	1700	1700	897
Volume to Capacity	0.08	0.08	0.10	0.05	0.06
Queue Length 95th (ft)	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	9.2
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.2
Approach LOS					A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	16.6%	ICU Level of Service	A
Analysis Period (min)	15		

5: Liloa St & Piikea Ave Performance by approach

Approach	EB	WB	NB	SB	All
Total Del/Veh (s)	6.5	7.6	6.1	5.9	6.6
Speed Del/Veh (s)	6.5	7.6	6.0	5.8	6.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	176	8	29	220	7	4	0	20	2	0	2
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	191	9	32	239	8	4	0	22	2	0	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529										
pX, platoon unblocked												
vC, conflicting volume	247			200			512	514	196	532	515	243
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	247			200			512	514	196	532	515	243
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			99	100	97	100	100	100
cM capacity (veh/h)	1319			1372			461	452	846	437	452	796

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	204	278	26	4
Volume Left	4	32	4	2
Volume Right	9	8	22	2
cSH	1319	1372	743	565
Volume to Capacity	0.00	0.02	0.04	0.01
Queue Length 95th (ft)	0	2	3	1
Control Delay (s)	0.2	1.1	10.0	11.4
Lane LOS	A	A	B	B
Approach Delay (s)	0.2	1.1	10.0	11.4
Approach LOS			B	B

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	10	71	6	359	85	103	378
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	23.0	23.0	8.0	40.0	40.0	17.0	49.0
Total Split (%)	28.8%	28.8%	10.0%	50.0%	50.0%	21.3%	61.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 71 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	99	10	71	6	359	85	103	378	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1782	1583	1770	1863	1583	1770	3527	
Flt Permitted					0.96	1.00	0.51	1.00	1.00	0.46	1.00	
Satd. Flow (perm)					1782	1583	943	1863	1583	860	3527	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	108	11	77	7	390	92	112	411	10
RTOR Reduction (vph)	0	0	0	0	0	68	0	0	31	0	1	0
Lane Group Flow (vph)	0	0	0	0	119	9	7	390	61	112	420	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					9.3	9.3	54.2	53.0	53.0	62.7	57.5	
Effective Green, g (s)					9.3	9.3	54.2	53.0	53.0	62.7	57.5	
Actuated g/C Ratio					0.12	0.12	0.68	0.66	0.66	0.78	0.72	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					207	184	651	1234	1049	739	2535	
v/s Ratio Prot							0.00	c0.21		c0.01	0.12	
v/s Ratio Perm					0.07	0.01	0.01		0.04	0.11		
v/c Ratio					0.57	0.05	0.01	0.32	0.06	0.15	0.17	
Uniform Delay, d1					33.5	31.4	4.2	5.8	4.7	2.4	3.6	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					3.8	0.1	0.0	0.7	0.1	0.1	0.1	
Delay (s)					37.3	31.5	4.2	6.4	4.8	2.5	3.7	
Level of Service					D	C	A	A	A	A	A	
Approach Delay (s)		0.0			35.0			6.1			3.5	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing Conditions PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	208	278	247	953	944	398
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	45.0	45.0	51.0	135.0	84.0	84.0
Total Split (%)	25.0%	25.0%	28.3%	75.0%	46.7%	46.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary

Cycle Length: 180
Actuated Cycle Length: 180
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	208	278	247	953	944	398
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	226	302	268	1036	1026	433
RTOR Reduction (vph)	0	254	0	0	0	129
Lane Group Flow (vph)	226	48	268	1036	1026	304
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	28.4	28.4	32.6	143.6	107.0	107.0
Effective Green, g (s)	28.4	28.4	32.6	143.6	107.0	107.0
Actuated g/C Ratio	0.16	0.16	0.18	0.80	0.59	0.59
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	279	250	321	2823	2083	931
v/s Ratio Prot	c0.13		c0.15	0.29	c0.29	
v/s Ratio Perm		0.03				0.19
v/c Ratio	0.81	0.19	0.83	0.37	0.49	0.33
Uniform Delay, d1	73.2	65.8	71.1	5.2	20.9	18.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	16.1	0.4	16.8	0.4	0.8	0.9
Delay (s)	89.3	66.2	87.9	5.6	21.8	19.3
Level of Service	F	E	F	A	C	B
Approach Delay (s)	76.1			22.5	21.0	
Approach LOS	E			C	C	

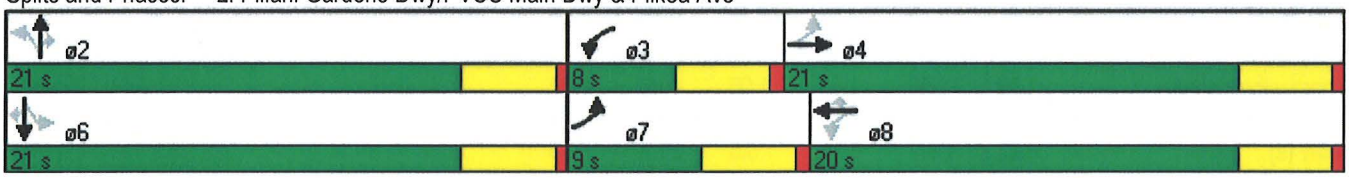
Intersection Summary			
HCM Average Control Delay	30.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	86	245	32	317	296	12	7	26	279	7	113
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: Piilani Gardens Dwy/PVSC Main Dwy & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	86	245	22	32	317	296	12	7	26	279	7	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	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		0.95	1.00
Satd. Flow (prot)	1770	3495		1770	3539	1583		1807	1583		1776	1583
Flt Permitted	0.51	1.00		0.57	1.00	1.00		0.82	1.00		0.72	1.00
Satd. Flow (perm)	955	3495		1070	3539	1583		1536	1583		1334	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	266	24	35	345	322	13	8	28	303	8	123
RTOR Reduction (vph)	0	13	0	0	0	219	0	0	18	0	0	81
Lane Group Flow (vph)	93	277	0	35	345	103	0	21	10	0	311	42
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	502	1188		484	1132	507		522	538		454	538
v/s Ratio Prot	c0.02	0.08		0.01	c0.10							
v/s Ratio Perm	0.06			0.02		0.07		0.01	0.01		c0.23	0.03
v/c Ratio	0.19	0.23		0.07	0.30	0.20		0.04	0.02		0.69	0.08
Uniform Delay, d1	8.3	11.8		9.2	12.8	12.4		11.0	11.0		14.2	11.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	0.5		0.3	0.7	0.9		0.1	0.1		8.2	0.3
Delay (s)	9.1	12.3		9.5	13.5	13.3		11.2	11.0		22.4	11.5
Level of Service	A	B		A	B	B		B	B		C	B
Approach Delay (s)		11.5			13.2			11.1			19.3	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	64	95	196	152	80	134
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	70	103	213	165	87	146
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	615	296			378	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	615	296			378	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	86			93	
cM capacity (veh/h)	421	744			1180	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	70	103	378	87	146
Volume Left	70	0	0	87	0
Volume Right	0	103	165	0	0
cSH	421	744	1700	1180	1700
Volume to Capacity	0.17	0.14	0.22	0.07	0.09
Queue Length 95th (ft)	15	12	0	6	0
Control Delay (s)	15.2	10.6	0.0	8.3	0.0
Lane LOS	C	B		A	
Approach Delay (s)	12.5		0.0	3.1	
Approach LOS	B				

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	353	442	14	0	49
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	384	480	15	0	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			290			
pX, platoon unblocked	0.95				0.95	0.95
vC, conflicting volume	480				680	248
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	357				567	113
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	94
cM capacity (veh/h)	1142				433	875

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	192	192	320	175	53
Volume Left	0	0	0	0	0
Volume Right	0	0	0	15	53
cSH	1700	1700	1700	1700	875
Volume to Capacity	0.11	0.11	0.19	0.10	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	9.4
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.4
Approach LOS					A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	22.7%	ICU Level of Service	A
Analysis Period (min)	15		

5: Liloa St & Piikea Ave Performance by approach

Approach	EB	WB	NB	SB	All
Total Del/Veh (s)	10.4	16.7	10.0	9.7	12.3
Speed Del/Veh (s)	10.4	16.6	10.0	9.7	12.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	295	6	71	459	1	17	0	77	1	1	0
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	321	7	77	499	1	18	0	84	1	1	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529										
pX, platoon unblocked												
vC, conflicting volume	500			327			983	983	324	1066	985	499
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	500			327			983	983	324	1066	985	499
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			94			91	100	88	99	100	100
cM capacity (veh/h)	1064			1232			216	233	717	168	232	571

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	329	577	102	2
Volume Left	2	77	18	1
Volume Right	7	1	84	0
cSH	1064	1232	505	195
Volume to Capacity	0.00	0.06	0.20	0.01
Queue Length 95th (ft)	0	5	19	1
Control Delay (s)	0.1	1.7	13.9	23.7
Lane LOS	A	A	B	C
Approach Delay (s)	0.1	1.7	13.9	23.7
Approach LOS			B	C

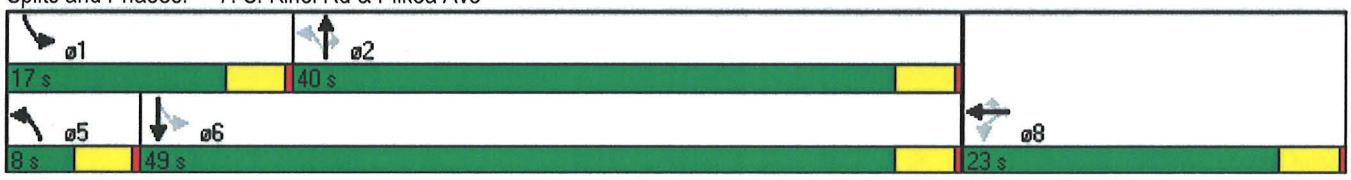
Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	36	201	14	545	175	128	577
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	23.0	23.0	8.0	40.0	40.0	17.0	49.0
Total Split (%)	28.8%	28.8%	10.0%	50.0%	50.0%	21.3%	61.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 71 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	236	36	201	14	545	175	128	577	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1785	1583	1770	1863	1583	1770	3517	
Flt Permitted					0.96	1.00	0.40	1.00	1.00	0.27	1.00	
Satd. Flow (perm)					1785	1583	750	1863	1583	509	3517	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	257	39	218	15	592	190	139	627	28
RTOR Reduction (vph)	0	0	0	0	0	172	0	0	87	0	3	0
Lane Group Flow (vph)	0	0	0	0	296	46	15	592	103	139	652	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					17.0	17.0	44.1	43.3	43.3	55.0	50.2	
Effective Green, g (s)					17.0	17.0	44.1	43.3	43.3	55.0	50.2	
Actuated g/C Ratio					0.21	0.21	0.55	0.54	0.54	0.69	0.63	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					379	336	424	1008	857	471	2207	
v/s Ratio Prot							0.00	c0.32		c0.03	0.19	
v/s Ratio Perm					0.17	0.03	0.02		0.06	0.17		
v/c Ratio					0.78	0.14	0.04	0.59	0.12	0.30	0.30	
Uniform Delay, d1					29.7	25.6	8.1	12.3	9.0	6.7	6.8	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					10.0	0.2	0.0	2.5	0.3	0.4	0.3	
Delay (s)					39.8	25.7	8.2	14.8	9.3	7.0	7.2	
Level of Service					D	C	A	B	A	A	A	
Approach Delay (s)		0.0			33.8			13.4			7.1	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing Conditions Saturday Mid-day

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	241	183	162	815	748	288
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	45.0	45.0	51.0	135.0	84.0	84.0
Total Split (%)	25.0%	25.0%	28.3%	75.0%	46.7%	46.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary
Cycle Length: 180
Actuated Cycle Length: 180
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	241	183	162	815	748	288
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	262	199	176	886	813	313
RTOR Reduction (vph)	0	164	0	0	0	108
Lane Group Flow (vph)	262	35	176	886	813	205
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	31.9	31.9	23.3	140.1	112.8	112.8
Effective Green, g (s)	31.9	31.9	23.3	140.1	112.8	112.8
Actuated g/C Ratio	0.18	0.18	0.13	0.78	0.63	0.63
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	314	281	229	2755	2196	982
v/s Ratio Prot	c0.15		c0.10	0.25	c0.23	
v/s Ratio Perm		0.02				0.13
v/c Ratio	0.83	0.13	0.77	0.32	0.37	0.21
Uniform Delay, d1	71.5	62.3	75.7	5.9	16.3	14.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.1	0.2	14.3	0.3	0.5	0.5
Delay (s)	88.6	62.5	90.1	6.2	16.8	14.9
Level of Service	F	E	F	A	B	B
Approach Delay (s)	77.3			20.1	16.3	
Approach LOS	E			C	B	

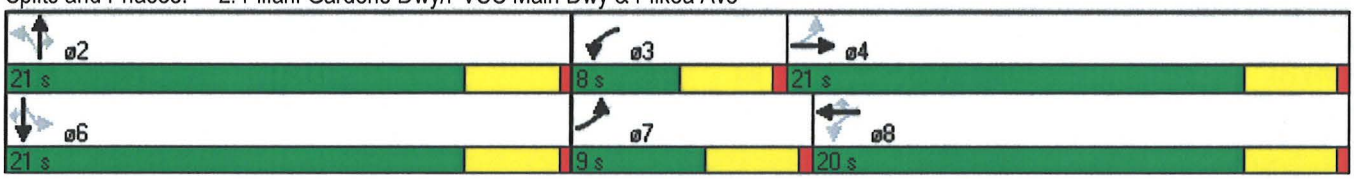
Intersection Summary			
HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	89	164	8	209	226	9	9	17	238	13	103
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: Piilani Gardens Dwy/PVSC Main Dwy & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	89	164	12	8	209	226	9	9	17	238	13	103
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	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		0.98	1.00		0.95	1.00
Satd. Flow (prot)	1770	3503		1770	3539	1583		1817	1583		1778	1583
Flt Permitted	0.57	1.00		0.63	1.00	1.00		0.87	1.00		0.72	1.00
Satd. Flow (perm)	1070	3503		1176	3539	1583		1614	1583		1346	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	178	13	9	227	246	10	10	18	259	14	112
RTOR Reduction (vph)	0	9	0	0	0	167	0	0	12	0	0	74
Lane Group Flow (vph)	97	182	0	9	227	79	0	20	6	0	273	38
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	541	1191		518	1132	507		549	538		458	538
v/s Ratio Prot	c0.02	0.05		0.00	c0.06							
v/s Ratio Perm	0.06			0.01		0.05		0.01	0.00		c0.20	0.02
v/c Ratio	0.18	0.15		0.02	0.20	0.16		0.04	0.01		0.60	0.07
Uniform Delay, d1	8.3	11.5		9.0	12.4	12.2		11.0	10.9		13.7	11.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.7	0.3		0.1	0.4	0.7		0.1	0.0		5.6	0.3
Delay (s)	9.0	11.8		9.1	12.8	12.8		11.2	11.0		19.3	11.4
Level of Service	A	B		A	B	B		B	B		B	B
Approach Delay (s)		10.8			12.7			11.1			17.0	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	33	42	84	92	30	92
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	46	91	100	33	100
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	307	141			191	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	307	141			191	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	95			98	
cM capacity (veh/h)	669	907			1382	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	36	46	191	33	100
Volume Left	36	0	0	33	0
Volume Right	0	46	100	0	0
cSH	669	907	1700	1382	1700
Volume to Capacity	0.05	0.05	0.11	0.02	0.06
Queue Length 95th (ft)	4	4	0	2	0
Control Delay (s)	10.7	9.2	0.0	7.7	0.0
Lane LOS	B	A		A	
Approach Delay (s)	9.8		0.0	1.9	
Approach LOS	A				

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	269	307	14	0	37
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	292	334	15	0	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)			290			
pX, platoon unblocked	1.00				1.00	1.00
vC, conflicting volume	334				488	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	323				478	163
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	95
cM capacity (veh/h)	1229				515	849

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	146	146	222	126	40
Volume Left	0	0	0	0	0
Volume Right	0	0	0	15	40
cSH	1700	1700	1700	1700	849
Volume to Capacity	0.09	0.09	0.13	0.07	0.05
Queue Length 95th (ft)	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	9.4
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.4
Approach LOS					A

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	18.9%	ICU Level of Service	A
Analysis Period (min)	15		

5: Liloa St & Piikea Ave Performance by approach

Approach	EB	WB	NB	SB	All
Total Del/Veh (s)	6.9	7.7	2.6	5.8	5.6
Speed Del/Veh (s)	6.9	7.7	2.6	4.9	5.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	240	1	39	279	0	5	0	31	2	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	261	1	42	303	0	5	0	34	2	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529										
pX, platoon unblocked												
vC, conflicting volume	303			262			654	654	261	688	654	303
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	303			262			654	654	261	688	654	303
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			99	100	96	99	100	100
cM capacity (veh/h)	1258			1302			370	373	777	336	373	736

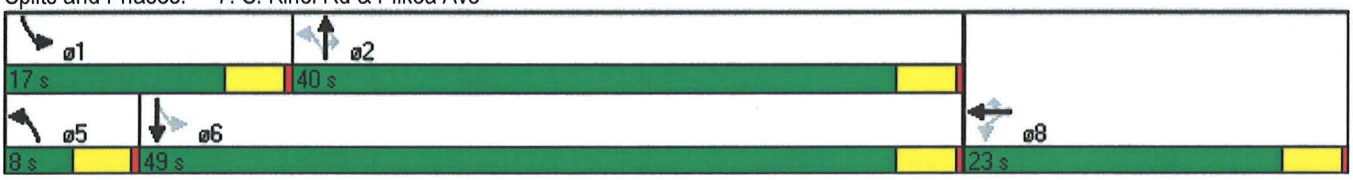
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	264	346	39	2
Volume Left	2	42	5	2
Volume Right	1	0	34	0
cSH	1258	1302	674	336
Volume to Capacity	0.00	0.03	0.06	0.01
Queue Length 95th (ft)	0	3	5	0
Control Delay (s)	0.1	1.2	10.7	15.8
Lane LOS	A	A	B	C
Approach Delay (s)	0.1	1.2	10.7	15.8
Approach LOS			B	C

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	44	81	21	523	195	62	456
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	23.0	23.0	8.0	40.0	40.0	17.0	49.0
Total Split (%)	28.8%	28.8%	10.0%	50.0%	50.0%	21.3%	61.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 71 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	185	44	81	21	523	195	62	456	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1790	1583	1770	1863	1583	1770	3504	
Flt Permitted					0.96	1.00	0.45	1.00	1.00	0.32	1.00	
Satd. Flow (perm)					1790	1583	847	1863	1583	593	3504	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	201	48	88	23	568	212	67	496	35
RTOR Reduction (vph)	0	0	0	0	0	71	0	0	87	0	5	0
Lane Group Flow (vph)	0	0	0	0	249	17	23	568	125	67	526	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					15.6	15.6	48.7	47.0	47.0	56.1	50.7	
Effective Green, g (s)					15.6	15.6	48.7	47.0	47.0	56.1	50.7	
Actuated g/C Ratio					0.19	0.19	0.61	0.59	0.59	0.70	0.63	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					349	309	535	1095	930	495	2221	
v/s Ratio Prot							0.00	c0.30		c0.01	0.15	
v/s Ratio Perm					0.14	0.01	0.03		0.08	0.09		
v/c Ratio					0.71	0.06	0.04	0.52	0.13	0.14	0.24	
Uniform Delay, d1					30.1	26.2	6.2	9.8	7.4	5.2	6.3	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					6.8	0.1	0.0	1.8	0.3	0.1	0.3	
Delay (s)					36.9	26.3	6.2	11.5	7.7	5.3	6.6	
Level of Service					D	C	A	B	A	A	A	
Approach Delay (s)		0.0			34.1			10.4			6.4	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

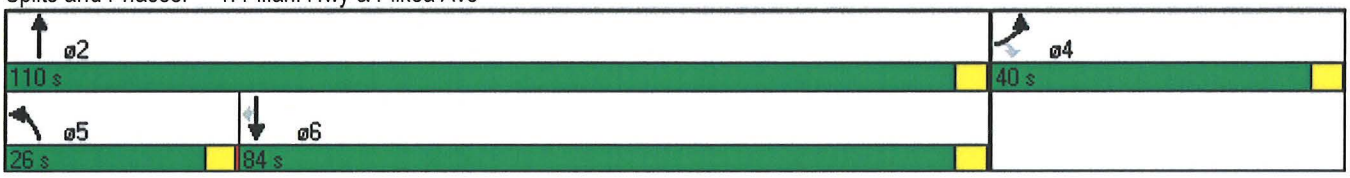
- Base Year 2015 AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	250	180	135	1315	1465	295
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	40.0	40.0	26.0	110.0	84.0	84.0
Total Split (%)	26.7%	26.7%	17.3%	73.3%	56.0%	56.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	250	180	135	1315	1465	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	196	147	1429	1592	321
RTOR Reduction (vph)	0	159	0	0	0	83
Lane Group Flow (vph)	272	37	147	1429	1592	238
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	28.1	28.1	17.3	113.9	92.6	92.6
Effective Green, g (s)	28.1	28.1	17.3	113.9	92.6	92.6
Actuated g/C Ratio	0.19	0.19	0.12	0.76	0.62	0.62
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	332	297	204	2687	2163	967
v/s Ratio Prot	c0.15		c0.08	0.40	c0.45	
v/s Ratio Perm		0.02				0.15
v/c Ratio	0.82	0.12	0.72	0.53	0.74	0.25
Uniform Delay, d1	58.5	50.7	64.0	7.3	20.1	12.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.5	0.2	11.8	0.8	2.3	0.6
Delay (s)	73.0	50.9	75.8	8.0	22.4	13.6
Level of Service	E	D	E	A	C	B
Approach Delay (s)	63.8			14.4	20.9	
Approach LOS	E			B	C	

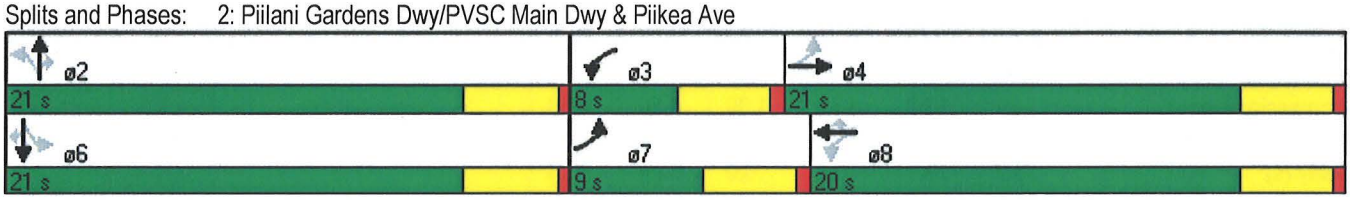
Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	245	30	220	190	20	15	35	185	5	40
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: Piilani Gardens Dwy/PVSC Main Dwy & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	245	10	30	220	190	20	15	35	185	5	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	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		0.95	1.00
Satd. Flow (prot)	1770	3518		1770	3539	1583		1810	1583		1776	1583
Flt Permitted	0.57	1.00		0.58	1.00	1.00		0.83	1.00		0.70	1.00
Satd. Flow (perm)	1057	3518		1083	3539	1583		1554	1583		1310	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	266	11	33	239	207	22	16	38	201	5	43
RTOR Reduction (vph)	0	6	0	0	0	141	0	0	25	0	0	28
Lane Group Flow (vph)	38	271	0	33	239	66	0	38	13	0	206	15
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	536	1196		488	1132	507		528	538		445	538
v/s Ratio Prot	c0.01	c0.08		0.01	0.07							
v/s Ratio Perm	0.02			0.02		0.04		0.02	0.01		c0.16	0.01
v/c Ratio	0.07	0.23		0.07	0.21	0.13		0.07	0.02		0.46	0.03
Uniform Delay, d1	8.0	11.8		9.2	12.4	12.1		11.2	11.0		12.9	11.0
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	0.4		0.3	0.4	0.5		0.3	0.1		3.4	0.1
Delay (s)	8.3	12.2		9.4	12.8	12.6		11.4	11.1		16.4	11.1
Level of Service	A	B		A	B	B		B	B		B	B
Approach Delay (s)		11.8			12.5			11.2			15.5	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	30	20	90	65	50	215
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	22	98	71	54	234
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	476	133			168	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	476	133			168	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	98			96	
cM capacity (veh/h)	527	916			1409	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	33	22	168	54	234
Volume Left	33	0	0	54	0
Volume Right	0	22	71	0	0
cSH	527	916	1700	1409	1700
Volume to Capacity	0.06	0.02	0.10	0.04	0.14
Queue Length 95th (ft)	5	2	0	3	0
Control Delay (s)	12.3	9.0	0.0	7.7	0.0
Lane LOS	B	A		A	
Approach Delay (s)	11.0		0.0	1.4	
Approach LOS	B				

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	25.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	290	265	10	0	50
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	315	288	11	0	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			290			
pX, platoon unblocked	0.99				0.99	0.99
vC, conflicting volume	288				451	149
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	270				434	131
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	94
cM capacity (veh/h)	1282				546	889

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	158	158	192	107	54
Volume Left	0	0	0	0	0
Volume Right	0	0	0	11	54
cSH	1700	1700	1700	1700	889
Volume to Capacity	0.09	0.09	0.11	0.06	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	9.3
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.3
Approach LOS					A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	17.6%	ICU Level of Service	A
Analysis Period (min)	15		

RODEL Roundabout Analysis

5: Liloa St & Piikea Avenue Base Year 2015 AM

8:3:12 KRAUZ PROJECT - BY 2015 16

E	(m)	4.00	4.00	4.00	4.00	TIME PERIOD min	90
L'	(m)	40.00	40.00	40.00	40.00	TIME SLICE min	15
V	(m)	3.65	3.65	3.65	3.65	RESULTS PERIOD min	15 75
RAD	(m)	20.00	20.00	20.00	20.00	TIME COST $/hr	15.00
PHI	(d)	25.00	25.00	25.00	25.00	FLOW PERIOD min	15 75
DIA	(m)	45.00	45.00	45.00	45.00	FLOW TYPE pcu/veh	VEH
GRAD SEP		0	0	0	0	FLOW PEAK am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
WB	1.05	75	110	50	0	1.00	50	0.75	1.125	0.75	15	45	75
SB	1.05	15	180	100	0	1.00	50	0.75	1.125	0.75	15	45	75
EB	1.05	60	120	70	0	1.00	50	0.75	1.125	0.75	15	45	75
NB	1.05	25	145	35	0	1.00	50	0.75	1.125	0.75	15	45	75

MODE 2

FLOW	veh	235	295	250	205	AVEDEL s	4.5
CAPACITY	veh	1036	1066	993	1015	LOS SIG	A
AVE DELAY	secs	4.4	4.5	4.7	4.3	LOS UNSIG	A
MAX DELAY	secs	5.7	6.0	6.3	5.7		
AVE QUEUE	veh	0.3	0.4	0.3	0.3	VEHIC HRS	1.2
MAX QUEUE	veh	0.3	0.4	0.4	0.3	COST $	18

F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	210	10	30	255	10	5	0	20	5	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	228	11	33	277	11	5	0	22	5	0	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529										
pX, platoon unblocked												
vC, conflicting volume	288			239			598	598	234	614	598	283
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	288			239			598	598	234	614	598	283
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			99	100	97	99	100	99
cM capacity (veh/h)	1274			1328			402	404	805	384	404	756

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	245	321	27	11
Volume Left	5	33	5	5
Volume Right	11	11	22	5
cSH	1274	1328	671	510
Volume to Capacity	0.00	0.02	0.04	0.02
Queue Length 95th (ft)	0	2	3	2
Control Delay (s)	0.2	1.0	10.6	12.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.2	1.0	10.6	12.2
Approach LOS			B	B

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	39.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	10	75	5	440	110	110	440
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	23.0	23.0	8.0	40.0	40.0	17.0	49.0
Total Split (%)	28.8%	28.8%	10.0%	50.0%	50.0%	21.3%	61.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 71 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	140	10	75	5	440	110	110	440	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1780	1583	1770	1863	1583	1770	3527	
Flt Permitted					0.96	1.00	0.47	1.00	1.00	0.39	1.00	
Satd. Flow (perm)					1780	1583	882	1863	1583	724	3527	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	152	11	82	5	478	120	120	478	11
RTOR Reduction (vph)	0	0	0	0	0	69	0	0	46	0	2	0
Lane Group Flow (vph)	0	0	0	0	163	13	5	478	74	120	487	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					12.6	12.6	50.5	49.4	49.4	59.4	54.3	
Effective Green, g (s)					12.6	12.6	50.5	49.4	49.4	59.4	54.3	
Actuated g/C Ratio					0.16	0.16	0.63	0.62	0.62	0.74	0.68	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					280	249	569	1150	978	616	2394	
v/s Ratio Prot							0.00	c0.26		c0.01	0.14	
v/s Ratio Perm					0.09	0.01	0.01		0.05	0.13		
v/c Ratio					0.58	0.05	0.01	0.42	0.08	0.19	0.20	
Uniform Delay, d1					31.3	28.6	5.5	7.9	6.1	3.7	4.8	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					3.1	0.1	0.0	1.1	0.2	0.2	0.2	
Delay (s)					34.3	28.7	5.5	9.0	6.3	3.9	5.0	
Level of Service					C	C	A	A	A	A	A	
Approach Delay (s)		0.0			32.4			8.4			4.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2015 PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	260	300	265	1400	1440	465
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	41.0	41.0	42.0	139.0	97.0	97.0
Total Split (%)	22.8%	22.8%	23.3%	77.2%	53.9%	53.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary
Cycle Length: 180
Actuated Cycle Length: 180
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	260	300	265	1400	1440	465
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	283	326	288	1522	1565	505
RTOR Reduction (vph)	0	261	0	0	0	121
Lane Group Flow (vph)	283	65	288	1522	1565	384
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	32.7	32.7	33.3	139.3	102.0	102.0
Effective Green, g (s)	32.7	32.7	33.3	139.3	102.0	102.0
Actuated g/C Ratio	0.18	0.18	0.18	0.77	0.57	0.57
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	322	288	327	2739	1986	888
v/s Ratio Prot	c0.16		c0.16	0.43	c0.45	
v/s Ratio Perm		0.04				0.25
v/c Ratio	0.88	0.23	0.88	0.56	0.79	0.43
Uniform Delay, d1	71.7	62.8	71.4	8.1	30.5	22.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.7	0.4	23.0	0.8	3.3	1.5
Delay (s)	94.4	63.2	94.4	8.9	33.8	23.9
Level of Service	F	E	F	A	C	C
Approach Delay (s)	77.7			22.5	31.4	
Approach LOS	E			C	C	

Intersection Summary			
HCM Average Control Delay	34.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	90	305	35	400	300	15	10	30	280	10	115
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: Piilani Gardens Dwy/PVSC Main Dwy & Piikea Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	305	25	35	400	300	15	10	30	280	10	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	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		0.95	1.00
Satd. Flow (prot)	1770	3499		1770	3539	1583		1809	1583		1777	1583
Flt Permitted	0.44	1.00		0.54	1.00	1.00		0.82	1.00		0.71	1.00
Satd. Flow (perm)	823	3499		1001	3539	1583		1524	1583		1330	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	332	27	38	435	326	16	11	33	304	11	125
RTOR Reduction (vph)	0	12	0	0	0	222	0	0	22	0	0	83
Lane Group Flow (vph)	98	347	0	38	435	104	0	27	11	0	315	43
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	457	1190		462	1132	507		518	538		452	538
v/s Ratio Prot	c0.02	0.10		0.01	c0.12							
v/s Ratio Perm	0.07			0.03		0.07		0.02	0.01		c0.24	0.03
v/c Ratio	0.21	0.29		0.08	0.38	0.21		0.05	0.02		0.70	0.08
Uniform Delay, d1	8.3	12.1		9.2	13.2	12.4		11.1	11.0		14.3	11.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	1.1	0.6		0.3	1.0	0.9		0.2	0.1		8.6	0.3
Delay (s)	9.4	12.7		9.5	14.2	13.3		11.3	11.0		22.9	11.5
Level of Service	A	B		A	B	B		B	B		C	B
Approach Delay (s)		12.0			13.6			11.1			19.6	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	105	210	165	85	145
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	114	228	179	92	158
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	660	318			408	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	660	318			408	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	84			92	
cM capacity (veh/h)	393	723			1151	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	76	114	408	92	158
Volume Left	76	0	0	92	0
Volume Right	0	114	179	0	0
cSH	393	723	1700	1151	1700
Volume to Capacity	0.19	0.16	0.24	0.08	0.09
Queue Length 95th (ft)	18	14	0	7	0
Control Delay (s)	16.3	10.9	0.0	8.4	0.0
Lane LOS	C	B		A	
Approach Delay (s)	13.1		0.0	3.1	
Approach LOS	B				

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	39.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	415	510	15	0	50
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	451	554	16	0	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			290			
pX, platoon unblocked	0.93				0.93	0.93
vC, conflicting volume	554				788	285
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	357				610	66
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	94
cM capacity (veh/h)	1109				394	910

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	226	226	370	201	54
Volume Left	0	0	0	0	0
Volume Right	0	0	0	16	54
cSH	1700	1700	1700	1700	910
Volume to Capacity	0.13	0.13	0.22	0.12	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	9.2
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.2
Approach LOS					A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	24.6%	ICU Level of Service	A
Analysis Period (min)	15		

RODEL Roundabout Analysis

5: Liloa St & Piikea Avenue Base Year 2015 PM

8:3:12 KRAUZ PROJECT - BY 2015 15

E	(m)	4.00	4.00	4.00	4.00	TIME PERIOD min	90
L'	(m)	40.00	40.00	40.00	40.00	TIME SLICE min	15
V	(m)	3.65	3.65	3.65	3.65	RESULTS PERIOD min	15 75
RAD	(m)	20.00	20.00	20.00	20.00	TIME COST $/hr	15.00
PHI	(d)	25.00	25.00	25.00	25.00	FLOW PERIOD min	15 75
DIA	(m)	45.00	45.00	45.00	45.00	FLOW TYPE pcu/veh	VEH
GRAD SEP		0	0	0	0	FLOW PEAK am/op/pm	PM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
WB	1.05	70	200	95	0	1.00	50	0.75	1.125	0.75	15	45	75
SB	1.05	80	425	80	0	1.00	50	0.75	1.125	0.75	15	45	75
EB	1.05	85	80	50	0	1.00	50	0.75	1.125	0.75	15	45	75
NB	1.05	45	295	95	0	1.00	50	0.75	1.125	0.75	15	45	75

MODE 2

FLOW	veh	365	585	215	435	AVEDEL s	7.3
CAPACITY	veh	933	961	847	1058	LOS SIG	A
AVE DELAY	secs	6.3	9.7	5.6	5.7	LOS UNSIG	A
MAX DELAY	secs	8.6	14.5	7.6	7.7		
AVE QUEUE	veh	0.7	1.6	0.3	0.7	VEHIC HRS	3.2
MAX QUEUE	veh	0.8	2.1	0.4	0.8	COST $	49

F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	355	10	75	530	5	20	0	80	5	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	386	11	82	576	5	22	0	87	5	5	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529										
pX, platoon unblocked												
vC, conflicting volume	582			397			1147	1147	391	1231	1149	579
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	582			397			1147	1147	391	1231	1149	579
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			93			87	100	87	96	97	100
cM capacity (veh/h)	993			1162			162	184	657	126	183	515

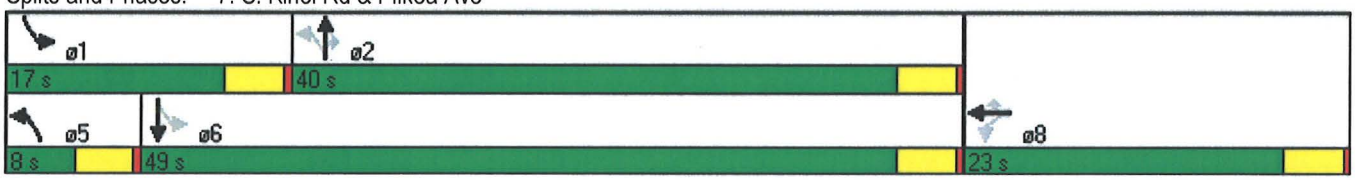
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	402	663	109	11
Volume Left	5	82	22	5
Volume Right	11	5	87	0
cSH	993	1162	408	149
Volume to Capacity	0.01	0.07	0.27	0.07
Queue Length 95th (ft)	0	6	26	6
Control Delay (s)	0.2	1.8	17.0	31.0
Lane LOS	A	A	C	D
Approach Delay (s)	0.2	1.8	17.0	31.0
Approach LOS			C	D

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	40	220	15	635	225	140	665
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	23.0	23.0	8.0	40.0	40.0	17.0	49.0
Total Split (%)	28.8%	28.8%	10.0%	50.0%	50.0%	21.3%	61.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 71 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	295	40	220	15	635	225	140	665	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1784	1583	1770	1863	1583	1770	3516	
Flt Permitted					0.96	1.00	0.36	1.00	1.00	0.19	1.00	
Satd. Flow (perm)					1784	1583	680	1863	1583	354	3516	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	321	43	239	16	690	245	152	723	33
RTOR Reduction (vph)	0	0	0	0	0	184	0	0	118	0	4	0
Lane Group Flow (vph)	0	0	0	0	364	55	16	690	127	152	752	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					18.4	18.4	42.2	41.4	41.4	53.6	48.8	
Effective Green, g (s)					18.4	18.4	42.2	41.4	41.4	53.6	48.8	
Actuated g/C Ratio					0.23	0.23	0.53	0.52	0.52	0.67	0.61	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					410	364	370	964	819	382	2145	
v/s Ratio Prot							0.00	c0.37		c0.04	0.21	
v/s Ratio Perm					0.20	0.03	0.02		0.08	0.23		
v/c Ratio					0.89	0.15	0.04	0.72	0.15	0.40	0.35	
Uniform Delay, d1					29.8	24.6	9.0	14.8	10.1	9.3	7.7	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					20.1	0.2	0.0	4.5	0.4	0.7	0.5	
Delay (s)					49.9	24.8	9.1	19.3	10.5	10.0	8.2	
Level of Service					D	C	A	B	B	A	A	
Approach Delay (s)		0.0			39.9			16.9			8.5	
Approach LOS		A			D			B			A	

Intersection Summary			
HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

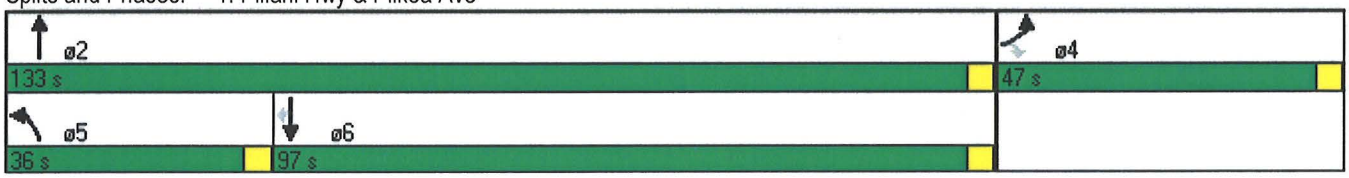
- Base Year 2015 Saturday Mid-day

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	260	200	175	1355	1295	350
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	47.0	47.0	36.0	133.0	97.0	97.0
Total Split (%)	26.1%	26.1%	20.0%	73.9%	53.9%	53.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary

Cycle Length: 180
Actuated Cycle Length: 180
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	260	200	175	1355	1295	350
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	283	217	190	1473	1408	380
RTOR Reduction (vph)	0	176	0	0	0	91
Lane Group Flow (vph)	283	41	190	1473	1408	289
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	33.9	33.9	24.5	138.1	109.6	109.6
Effective Green, g (s)	33.9	33.9	24.5	138.1	109.6	109.6
Actuated g/C Ratio	0.19	0.19	0.14	0.77	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	333	298	241	2715	2134	954
v/s Ratio Prot	c0.16		c0.11	0.42	c0.40	
v/s Ratio Perm		0.03				0.18
v/c Ratio	0.85	0.14	0.79	0.54	0.66	0.30
Uniform Delay, d1	70.6	60.9	75.2	8.4	23.0	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.0	0.2	15.6	0.8	1.6	0.8
Delay (s)	88.6	61.1	90.8	9.1	24.6	17.7
Level of Service	F	E	F	A	C	B
Approach Delay (s)	76.6			18.5	23.2	
Approach LOS	E			B	C	

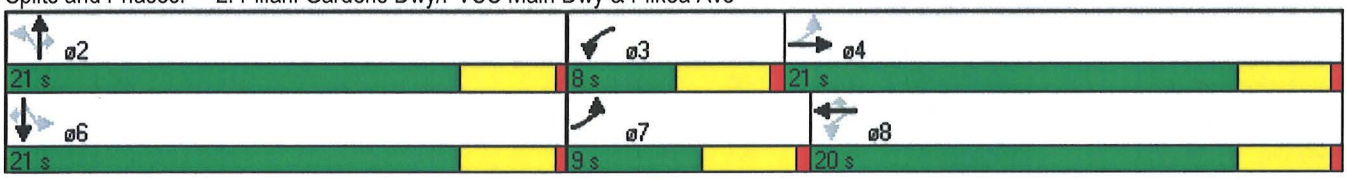
Intersection Summary			
HCM Average Control Delay	28.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	90	235	10	290	230	10	10	20	240	15	105
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: Piilani Gardens Dwy/PVSC Main Dwy & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	235	15	10	290	230	10	10	20	240	15	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	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		0.98	1.00		0.96	1.00
Satd. Flow (prot)	1770	3508		1770	3539	1583		1817	1583		1779	1583
Flt Permitted	0.53	1.00		0.58	1.00	1.00		0.86	1.00		0.72	1.00
Satd. Flow (perm)	983	3508		1089	3539	1583		1606	1583		1346	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	255	16	11	315	250	11	11	22	261	16	114
RTOR Reduction (vph)	0	9	0	0	0	170	0	0	15	0	0	75
Lane Group Flow (vph)	98	262	0	11	315	80	0	22	7	0	277	39
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	511	1193		490	1132	507		546	538		458	538
v/s Ratio Prot	c0.02	0.07		0.00	c0.09							
v/s Ratio Perm	0.07			0.01		0.05		0.01	0.00		c0.21	0.02
v/c Ratio	0.19	0.22		0.02	0.28	0.16		0.04	0.01		0.60	0.07
Uniform Delay, d1	8.3	11.8		9.1	12.7	12.2		11.0	10.9		13.7	11.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	0.4		0.1	0.6	0.7		0.1	0.0		5.8	0.3
Delay (s)	9.1	12.2		9.1	13.3	12.8		11.2	11.0		19.5	11.4
Level of Service	A	B		A	B	B		B	B		B	B
Approach Delay (s)		11.4			13.0			11.1			17.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	35	45	90	100	30	100
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	49	98	109	33	109
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	326	152			207	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	326	152			207	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	95			98	
cM capacity (veh/h)	652	894			1365	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	38	49	207	33	109
Volume Left	38	0	0	33	0
Volume Right	0	49	109	0	0
cSH	652	894	1700	1365	1700
Volume to Capacity	0.06	0.05	0.12	0.02	0.06
Queue Length 95th (ft)	5	4	0	2	0
Control Delay (s)	10.9	9.3	0.0	7.7	0.0
Lane LOS	B	A		A	
Approach Delay (s)	10.0		0.0	1.8	
Approach LOS	A				

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	27.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	335	390	15	0	50
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	364	424	16	0	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			290			
pX, platoon unblocked	0.96				0.96	0.96
vC, conflicting volume	424				614	220
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	327				524	115
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	94
cM capacity (veh/h)	1185				465	882

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	182	182	283	158	54
Volume Left	0	0	0	0	0
Volume Right	0	0	0	16	54
cSH	1700	1700	1700	1700	882
Volume to Capacity	0.11	0.11	0.17	0.09	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	9.3
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.3
Approach LOS					A

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	21.3%	ICU Level of Service	A
Analysis Period (min)	15		

RODEL Roundabout Analysis

5: Liloa St & Piikea Avenue Base Year 2015 Sat MD

8:3:12 KRAUZ PROJECT - BY 2015 17

E (m)	4.00	4.00	4.00	4.00	
L' (m)	40.00	40.00	40.00	40.00	
V (m)	3.65	3.65	3.65	3.65	
RAD (m)	20.00	20.00	20.00	20.00	
PHI (d)	25.00	25.00	25.00	25.00	
DIA (m)	45.00	45.00	45.00	45.00	
GRAD SEP	0	0	0	0	

TIME PERIOD min	90
TIME SLICE min	15
RESULTS PERIOD min	15 75
TIME COST $/hr	15.00
FLOW PERIOD min	15 75
FLOW TYPE pcu/veh	VEH
FLOW PEAK am/op/pm	OP

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME
WB	1.10	40	90	30	0	1.00	50	1.00	1.000	1.00	15 45 75
SB	1.10	35	300	65	0	1.00	50	1.00	1.000	1.00	15 45 75
EB	1.10	35	50	55	0	1.00	50	1.00	1.000	1.00	15 45 75
NB	1.10	20	240	70	0	1.00	50	1.00	1.000	1.00	15 45 75

MODE 2

FLOW	veh	160	400	140	330
CAPACITY	veh	921	1015	904	1026
AVE DELAY	secs	4.7	5.8	4.7	5.2
MAX DELAY	secs	4.7	5.8	4.7	5.2
AVE QUEUE	veh	0.2	0.6	0.2	0.5
MAX QUEUE	veh	0.2	0.6	0.2	0.5

AVEDEL s	5.3
LOS SIG	A
LOS UNSIG	A
VEHIC HRS	1.5
COST $	23

F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	305	5	40	340	0	5	0	35	5	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	332	5	43	370	0	5	0	38	5	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529										
pX, platoon unblocked												
vC, conflicting volume	370			337			802	802	334	840	804	370
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	370			337			802	802	334	840	804	370
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			98	100	95	98	100	100
cM capacity (veh/h)	1189			1222			293	305	708	261	304	676

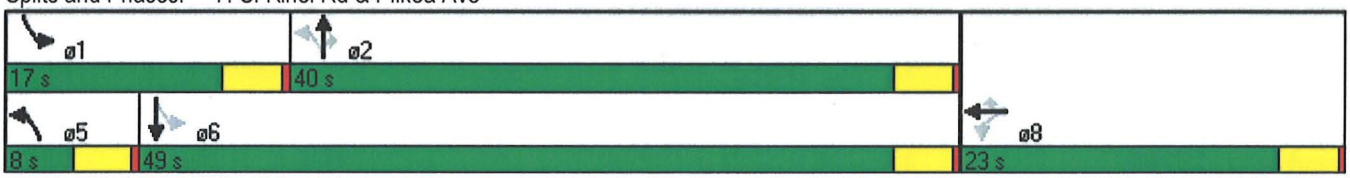
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	342	413	43	5
Volume Left	5	43	5	5
Volume Right	5	0	38	0
cSH	1189	1222	601	261
Volume to Capacity	0.00	0.04	0.07	0.02
Queue Length 95th (ft)	0	3	6	2
Control Delay (s)	0.2	1.2	11.5	19.1
Lane LOS	A	A	B	C
Approach Delay (s)	0.2	1.2	11.5	19.1
Approach LOS			B	C

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	50	90	25	630	255	65	550
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	23.0	23.0	8.0	40.0	40.0	17.0	49.0
Total Split (%)	28.8%	28.8%	10.0%	50.0%	50.0%	21.3%	61.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 71 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	240	50	90	25	630	255	65	550	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1789	1583	1770	1863	1583	1770	3507	
Flt Permitted					0.96	1.00	0.41	1.00	1.00	0.23	1.00	
Satd. Flow (perm)					1789	1583	764	1863	1583	425	3507	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	261	54	98	27	685	277	71	598	38
RTOR Reduction (vph)	0	0	0	0	0	77	0	0	121	0	5	0
Lane Group Flow (vph)	0	0	0	0	315	21	27	685	156	71	631	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					17.4	17.4	46.7	45.1	45.1	54.5	49.0	
Effective Green, g (s)					17.4	17.4	46.7	45.1	45.1	54.5	49.0	
Actuated g/C Ratio					0.22	0.22	0.58	0.56	0.56	0.68	0.61	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					389	344	466	1050	892	382	2148	
v/s Ratio Prot							0.00	c0.37		c0.01	0.18	
v/s Ratio Perm					0.18	0.01	0.03		0.10	0.11		
v/c Ratio					0.81	0.06	0.06	0.65	0.18	0.19	0.29	
Uniform Delay, d1					29.7	24.8	7.0	12.0	8.4	7.4	7.3	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					11.8	0.1	0.1	3.2	0.4	0.2	0.3	
Delay (s)					41.5	24.9	7.1	15.2	8.9	7.6	7.7	
Level of Service					D	C	A	B	A	A	A	
Approach Delay (s)		0.0			37.6			13.2			7.7	
Approach LOS		A			D			B			A	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2015 AM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	300	220	205	1315	1465	345
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	43.0	43.0	33.0	107.0	74.0	74.0
Total Split (%)	28.7%	28.7%	22.0%	71.3%	49.3%	49.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	300	220	205	1315	1465	345
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	326	239	223	1429	1592	375
RTOR Reduction (vph)	0	188	0	0	0	100
Lane Group Flow (vph)	326	51	223	1429	1592	275
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	32.2	32.2	23.5	109.8	82.3	82.3
Effective Green, g (s)	32.2	32.2	23.5	109.8	82.3	82.3
Actuated g/C Ratio	0.21	0.21	0.16	0.73	0.55	0.55
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	380	340	277	2591	1923	860
v/s Ratio Prot	c0.18		c0.13	0.40	c0.45	
v/s Ratio Perm		0.03				0.18
v/c Ratio	0.86	0.15	0.81	0.55	0.83	0.32
Uniform Delay, d1	56.7	47.8	61.0	9.0	28.0	18.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.1	0.2	15.5	0.9	4.3	1.0
Delay (s)	73.8	48.0	76.5	9.9	32.3	19.5
Level of Service	E	D	E	A	C	B
Approach Delay (s)	62.9			18.9	29.8	
Approach LOS	E			B	C	

Intersection Summary			
HCM Average Control Delay	30.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	340	30	335	190	20	15	35	185	5	40
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: Driveway & Piikea Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	340	10	30	335	190	20	15	35	185	5	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00		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		0.95	1.00
Satd. Flow (prot)	1770	3524		1770	3539	1583		1810	1583		1776	1583
Flt Permitted	0.50	1.00		0.53	1.00	1.00		0.83	1.00		0.70	1.00
Satd. Flow (perm)	934	3524		980	3539	1583		1554	1583		1310	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	370	11	33	364	207	22	16	38	201	5	43
RTOR Reduction (vph)	0	4	0	0	0	141	0	0	25	0	0	28
Lane Group Flow (vph)	38	377	0	33	364	66	0	38	13	0	206	15
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	495	1198		455	1132	507		528	538		445	538
v/s Ratio Prot	c0.01	c0.11		0.01	0.10							
v/s Ratio Perm	0.03			0.02		0.04		0.02	0.01		c0.16	0.01
v/c Ratio	0.08	0.31		0.07	0.32	0.13		0.07	0.02		0.46	0.03
Uniform Delay, d1	8.0	12.2		9.2	12.9	12.1		11.2	11.0		12.9	11.0
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	0.7		0.3	0.8	0.5		0.3	0.1		3.4	0.1
Delay (s)	8.3	12.9		9.5	13.6	12.6		11.4	11.1		16.4	11.1
Level of Service	A	B		A	B	B		B	B		B	B
Approach Delay (s)		12.5			13.1			11.2			15.5	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	40.2%	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 (veh/h)	5	5	5	30	5	25	5	90	65	50	225	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	5	33	5	27	5	98	71	54	245	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	549	554	266	505	541	133	288			168		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	549	554	266	505	541	133	288			168		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	99	93	99	97	100			96		
cM capacity (veh/h)	415	421	772	454	429	916	1274			1409		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	5	11	38	27	174	54	288
Volume Left	5	0	33	0	5	54	0
Volume Right	0	5	0	27	71	0	43
cSH	415	545	450	916	1274	1409	1700
Volume to Capacity	0.01	0.02	0.08	0.03	0.00	0.04	0.17
Queue Length 95th (ft)	1	2	7	2	0	3	0
Control Delay (s)	13.8	11.7	13.7	9.1	0.3	7.7	0.0
Lane LOS	B	B	B	A	A	A	
Approach Delay (s)	12.4		11.8		0.3	1.2	
Approach LOS	B		B				

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	385	395	10	0	50
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	418	429	11	0	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			290			
pX, platoon unblocked	0.95				0.95	0.95
vC, conflicting volume	429				644	220
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	286				512	65
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	94
cM capacity (veh/h)	1206				465	934

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	209	209	286	154	54
Volume Left	0	0	0	0	0
Volume Right	0	0	0	11	54
cSH	1700	1700	1700	1700	934
Volume to Capacity	0.12	0.12	0.17	0.09	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	9.1
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.1
Approach LOS					A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	21.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	250	10	35	290	10	5	0	25	5	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	272	11	38	315	11	5	0	27	5	0	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529			757							
pX, platoon unblocked												
vC, conflicting volume	326			283			690	690	277	712	690	321
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	326			283			690	690	277	712	690	321
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			98	100	96	98	100	99
cM capacity (veh/h)	1234			1280			347	356	762	326	356	720

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	288	364	33	11
Volume Left	5	38	5	5
Volume Right	11	11	27	5
cSH	1234	1280	635	449
Volume to Capacity	0.00	0.03	0.05	0.02
Queue Length 95th (ft)	0	2	4	2
Control Delay (s)	0.2	1.1	11.0	13.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.2	1.1	11.0	13.2
Approach LOS			B	B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

RODEL Roundabout Analysis

5: Liloa St & Piikea Avenue Future Year 2015 AM

8:3:12 KRAUZ PROJECT - FY 2015 8

E (m)	4.00	4.00	4.00	4.00	
L' (m)	40.00	40.00	40.00	40.00	
V (m)	3.65	3.65	3.65	3.65	
RAD (m)	20.00	20.00	20.00	20.00	
PHI (d)	25.00	25.00	25.00	25.00	
DIA (m)	45.00	45.00	45.00	45.00	
GRAD SEP	0	0	0	0	

TIME PERIOD	min	90
TIME SLICE	min	15
RESULTS PERIOD	min	15 75
TIME COST	$/hr	15.00
FLOW PERIOD	min	15 75
FLOW TYPE	pcu/veh	VEH
FLOW PEAK	am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME
WB	1.05	75	110	50	0	1.00	50	0.75	1.125	0.75	15 45 75
SB	1.05	15	300	100	0	1.00	50	0.75	1.125	0.75	15 45 75
EB	1.05	65	125	70	0	1.00	50	0.75	1.125	0.75	15 45 75
NB	1.05	25	240	35	0	1.00	50	0.75	1.125	0.75	15 45 75

MODE 2

FLOW	veh	235	415	260	300
CAPACITY	veh	985	1066	928	1012
AVE DELAY	secs	4.7	5.4	5.3	5.0
MAX DELAY	secs	6.2	7.3	7.1	6.6
AVE QUEUE	veh	0.3	0.6	0.4	0.4
MAX QUEUE	veh	0.4	0.8	0.5	0.5

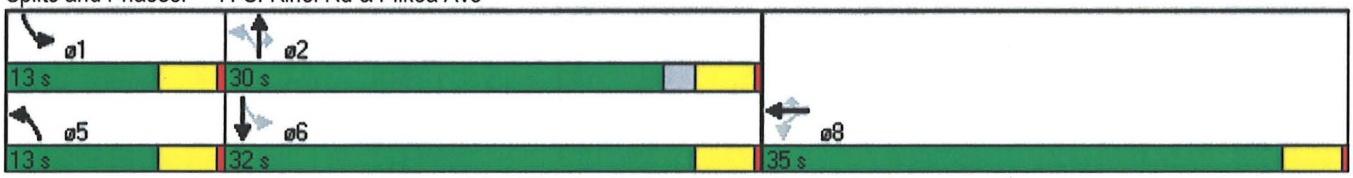
AVEDEL	s	5.1
LOS SIG		A
LOS UNSIG		A
VEHIC HRS		1.7
COST	$	26

F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	10	90	5	440	155	135	440
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	35.0	35.0	13.0	30.0	30.0	13.0	30.0
Total Split (s)	35.0	35.0	13.0	30.0	30.0	13.0	32.0
Total Split (%)	43.8%	43.8%	16.3%	37.5%	37.5%	16.3%	40.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?							
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	145	10	90	5	440	155	135	440	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1780	1583	1770	1863	1583	1770	3527	
Flt Permitted					0.96	1.00	0.47	1.00	1.00	0.38	1.00	
Satd. Flow (perm)					1780	1583	882	1863	1583	703	3527	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	158	11	98	5	478	168	147	478	11
RTOR Reduction (vph)	0	0	0	0	0	82	0	0	68	0	1	0
Lane Group Flow (vph)	0	0	0	0	169	16	5	478	100	147	488	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					13.0	13.0	48.6	47.4	47.4	59.0	53.8	
Effective Green, g (s)					13.0	13.0	48.6	47.4	47.4	59.0	53.8	
Actuated g/C Ratio					0.16	0.16	0.61	0.59	0.59	0.74	0.67	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					289	257	549	1104	938	620	2372	
v/s Ratio Prot							0.00	c0.26		c0.02	0.14	
v/s Ratio Perm					0.09	0.01	0.01		0.06	0.15		
v/c Ratio					0.58	0.06	0.01	0.43	0.11	0.24	0.21	
Uniform Delay, d1					31.0	28.3	6.2	8.9	7.1	4.0	5.0	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					3.0	0.1	0.0	1.2	0.2	0.2	0.2	
Delay (s)					34.0	28.4	6.2	10.2	7.3	4.2	5.2	
Level of Service					C	C	A	B	A	A	A	
Approach Delay (s)		0.0			32.0			9.4			5.0	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: Project Driveway 'B' & Piikea Ave

4/23/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	245	10	15	360	25	5	0	10	5	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	266	11	16	391	27	5	0	11	5	0	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1125			161							
pX, platoon unblocked	0.86						0.86	0.86		0.86	0.86	0.86
vC, conflicting volume	418			277			750	772	266	755	755	391
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	242			277			628	653	266	634	634	211
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			99			98	100	99	98	100	99
cM capacity (veh/h)	1139			1286			328	320	772	323	329	713

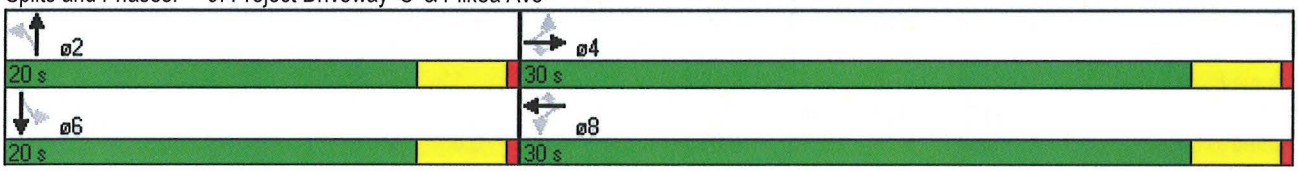
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	27	266	11	16	391	27	16	11
Volume Left	27	0	0	16	0	0	5	5
Volume Right	0	0	11	0	0	27	11	5
cSH	1139	1700	1700	1286	1700	1700	532	445
Volume to Capacity	0.02	0.16	0.01	0.01	0.23	0.02	0.03	0.02
Queue Length 95th (ft)	2	0	0	1	0	0	2	2
Control Delay (s)	8.2	0.0	0.0	7.8	0.0	0.0	12.0	13.3
Lane LOS	A			A			B	B
Approach Delay (s)	0.7			0.3			12.0	13.3
Approach LOS							B	B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	30.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	25	230	10	45	380	20	10	5	55	5
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	NA
Protected Phases		4			8			2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phase	4	4	4	8	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	20.0	20.0	20.0	20.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%	40.0%	40.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 27
Natural Cycle: 40
Control Type: Actuated-Uncoordinated

Splits and Phases: 9: Project Driveway 'C' & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	230	10	45	380	20	10	5	25	55	5	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			0%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	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	1.00	0.85		0.92			0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.96	
Satd. Flow (prot)	1752	1844	1567	1770	1863	1583		1683			1757	
Flt Permitted	0.50	1.00	1.00	0.60	1.00	1.00		0.92			0.75	
Satd. Flow (perm)	921	1844	1567	1125	1863	1583		1565			1367	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	250	11	49	413	22	11	5	27	60	5	11
RTOR Reduction (vph)	0	0	6	0	0	12	0	20	0	0	8	0
Lane Group Flow (vph)	27	250	5	49	413	10	0	23	0	0	68	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	11.7	11.7	11.7	11.7	11.7	11.7		7.0			7.0	
Effective Green, g (s)	11.7	11.7	11.7	11.7	11.7	11.7		7.0			7.0	
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.44	0.44		0.26			0.26	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	404	808	687	493	816	694		410			358	
v/s Ratio Prot		0.14			c0.22							
v/s Ratio Perm	0.03		0.00	0.04		0.01		0.01			c0.05	
v/c Ratio	0.07	0.31	0.01	0.10	0.51	0.01		0.06			0.19	
Uniform Delay, d1	4.3	4.9	4.2	4.4	5.4	4.2		7.4			7.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.1	0.2	0.0	0.1	0.5	0.0		0.1			0.3	
Delay (s)	4.4	5.1	4.2	4.5	5.9	4.2		7.4			7.9	
Level of Service	A	A	A	A	A	A		A			A	
Approach Delay (s)		5.0			5.7			7.4			7.9	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	26.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.6%	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 (veh/h)	0	295	10	0	390	20	0	0	5	0	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	321	11	0	424	22	0	0	5	0	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		191										
pX, platoon unblocked				0.96			0.96	0.96	0.96	0.96	0.96	
vC, conflicting volume	424			321			745	745	321	745	745	424
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	424			266			710	710	266	710	710	424
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	99	100	100	98
cM capacity (veh/h)	1135			1240			328	343	738	331	343	630

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	321	11	424	22	5	11
Volume Left	0	0	0	0	0	0
Volume Right	0	11	0	22	5	11
cSH	1700	1700	1700	1700	738	630
Volume to Capacity	0.19	0.01	0.25	0.01	0.01	0.02
Queue Length 95th (ft)	0	0	0	0	1	1
Control Delay (s)	0.0	0.0	0.0	0.0	9.9	10.8
Lane LOS					A	B
Approach Delay (s)	0.0		0.0		9.9	10.8
Approach LOS					A	B

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	30.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	295	5	0	405	10	0	0	5	0	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	321	5	0	440	11	0	0	5	0	0	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		371										
pX, platoon unblocked												
vC, conflicting volume	440			321			761	761	321	761	761	440
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	440			321			761	761	321	761	761	440
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	99	100	100	99
cM capacity (veh/h)	1120			1239			319	335	720	320	335	617

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	321	5	440	11	5	5
Volume Left	0	0	0	0	0	0
Volume Right	0	5	0	11	5	5
cSH	1700	1700	1700	1700	720	617
Volume to Capacity	0.19	0.00	0.26	0.01	0.01	0.01
Queue Length 95th (ft)	0	0	0	0	1	1
Control Delay (s)	0.0	0.0	0.0	0.0	10.0	10.9
Lane LOS					B	B
Approach Delay (s)	0.0		0.0		10.0	10.9
Approach LOS					B	B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	31.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	5	0	235	245	5
Sign Control	Stop			Free	Free	
Grade	0%			2%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	5	0	255	266	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				465		
pX, platoon unblocked						
vC, conflicting volume	524	269	272			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	524	269	272			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	100			
cM capacity (veh/h)	513	770	1292			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	5	255	272
Volume Left	0	0	0
Volume Right	5	0	5
cSH	770	1700	1700
Volume to Capacity	0.01	0.15	0.16
Queue Length 95th (ft)	1	0	0
Control Delay (s)	9.7	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.7	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	23.2%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2015 PM

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	470	460	420	1365	1405	590
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	40.0	40.0	48.0	137.0	92.0	92.0
Total Split (%)	22.2%	22.2%	26.7%	76.1%	51.1%	51.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary

Cycle Length: 180
Actuated Cycle Length: 180
Offset: 43 (24%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	470	460	420	1365	1405	590
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	511	500	457	1484	1527	641
RTOR Reduction (vph)	0	215	0	0	0	175
Lane Group Flow (vph)	511	285	457	1484	1527	466
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	36.0	36.0	44.0	136.0	88.0	88.0
Effective Green, g (s)	36.0	36.0	44.0	136.0	88.0	88.0
Actuated g/C Ratio	0.20	0.20	0.24	0.76	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	354	317	433	2674	1713	766
v/s Ratio Prot	c0.29		c0.26	0.42	c0.44	
v/s Ratio Perm		0.18				0.30
v/c Ratio	1.44	0.90	1.06	0.55	0.89	0.61
Uniform Delay, d1	72.0	70.2	68.0	9.3	41.7	33.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	214.9	26.3	58.6	0.8	7.5	3.6
Delay (s)	286.9	96.5	126.6	10.1	49.2	37.0
Level of Service	F	F	F	B	D	D
Approach Delay (s)	192.8			37.5	45.6	
Approach LOS	F			D	D	

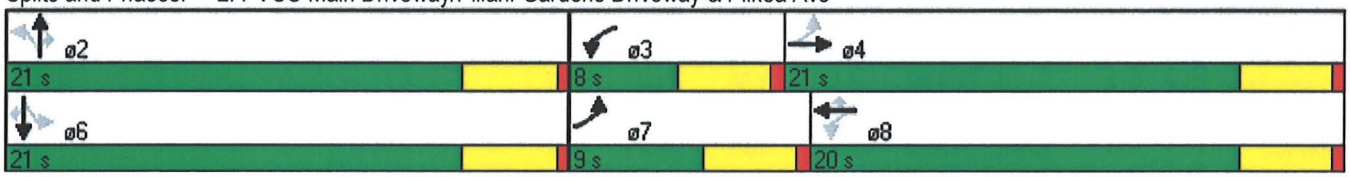
Intersection Summary			
HCM Average Control Delay	71.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	90	675	35	680	300	15	10	30	280	10	115
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: PVSC Main Driveway/Piilani Gardens Driveway & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	675	25	35	680	300	15	10	30	280	10	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	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		0.95	1.00
Satd. Flow (prot)	1770	3520		1770	3539	1583		1809	1583		1777	1583
Flt Permitted	0.24	1.00		0.26	1.00	1.00		0.82	1.00		0.71	1.00
Satd. Flow (perm)	438	3520		488	3539	1583		1524	1583		1330	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	734	27	38	739	326	16	11	33	304	11	125
RTOR Reduction (vph)	0	5	0	0	0	222	0	0	22	0	0	83
Lane Group Flow (vph)	98	756	0	38	739	104	0	27	11	0	315	43
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	326	1197		298	1132	507		518	538		452	538
v/s Ratio Prot	c0.03	c0.21		0.01	0.21							
v/s Ratio Perm	0.10			0.04		0.07		0.02	0.01		c0.24	0.03
v/c Ratio	0.30	0.63		0.13	0.65	0.21		0.05	0.02		0.70	0.08
Uniform Delay, d1	8.8	13.9		9.4	14.6	12.4		11.1	11.0		14.3	11.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	2.4	2.5		0.9	2.9	0.9		0.2	0.1		8.6	0.3
Delay (s)	11.1	16.4		10.3	17.5	13.3		11.3	11.0		22.9	11.5
Level of Service	B	B		B	B	B		B	B		C	B
Approach Delay (s)		15.8			16.0			11.1			19.6	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.5%	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 (veh/h)	5	5	5	70	5	105	5	210	165	85	160	65
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	5	76	5	114	5	228	179	92	174	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	840	812	209	696	758	318	245			408		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	840	812	209	696	758	318	245			408		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	98	99	77	98	84	100			92		
cM capacity (veh/h)	222	287	831	326	308	723	1322			1151		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	5	11	82	114	413	92	245
Volume Left	5	0	76	0	5	92	0
Volume Right	0	5	0	114	179	0	71
cSH	222	426	325	723	1322	1151	1700
Volume to Capacity	0.02	0.03	0.25	0.16	0.00	0.08	0.14
Queue Length 95th (ft)	2	2	24	14	0	7	0
Control Delay (s)	21.7	13.7	19.7	10.9	0.1	8.4	0.0
Lane LOS	C	B	C	B	A	A	
Approach Delay (s)	16.3		14.6		0.1	2.3	
Approach LOS	C		B				

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	785	805	15	0	50
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	853	875	16	0	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			290			
pX, platoon unblocked	0.82				0.82	0.82
vC, conflicting volume	875				1310	446
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	424				951	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	94
cM capacity (veh/h)	934				213	894

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	427	427	583	308	54
Volume Left	0	0	0	0	0
Volume Right	0	0	0	16	54
cSH	1700	1700	1700	1700	894
Volume to Capacity	0.25	0.25	0.34	0.18	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	9.3
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.3
Approach LOS					A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		

RODEL Roundabout Analysis

5: Liloa St & Piikea Avenue Future Year 2015 PM

8:3:12 KRAUZ PROJECT - FY 2015 10

E	(m)	4.00	4.00	4.00	4.00	TIME PERIOD min	90
L'	(m)	40.00	40.00	40.00	40.00	TIME SLICE min	15
V	(m)	3.65	3.65	3.65	3.65	RESULTS PERIOD min	15 75
RAD	(m)	20.00	20.00	20.00	20.00	TIME COST $/hr	15.00
PHI	(d)	25.00	25.00	25.00	25.00	FLOW PERIOD min	15 75
DIA	(m)	45.00	45.00	45.00	45.00	FLOW TYPE pcu/veh	VEH
GRAD SEP		0	0	0	0	FLOW PEAK am/op/pm	PM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
WB	1.05	70	200	95	0	1.00	50	0.75	1.125	0.75	15	45	75
SB	1.05	80	705	80	0	1.00	50	0.75	1.125	0.75	15	45	75
EB	1.05	95	85	50	0	1.00	50	0.75	1.125	0.75	15	45	75
NB	1.05	45	665	95	0	1.00	50	0.75	1.125	0.75	15	45	75

MODE 2

FLOW	veh	365	865	230	805	AVEDEL s	27.1
CAPACITY	veh	734	961	697	1055	LOS SIG	C
AVE DELAY	secs	9.9	50.5	7.5	15.4	LOS UNSIG	D
MAX DELAY	secs	14.9	104.8	10.6	25.3		
AVE QUEUE	veh	1.0	12.5	0.5	3.6	VEHIC HRS	17.1
MAX QUEUE	veh	1.4	25.0	0.6	5.2	COST $	256

F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	510	10	85	665	5	25	0	90	5	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	554	11	92	723	5	27	0	98	5	5	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529			757							
pX, platoon unblocked	0.61			0.98			0.62	0.62	0.98	0.62	0.62	0.61
vC, conflicting volume	728			565			1484	1484	560	1579	1486	726
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	241			549			1410	1410	543	1563	1415	236
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			91			57	100	82	87	93	100
cM capacity (veh/h)	813			1003			63	78	530	43	77	492

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	571	821	125	11
Volume Left	5	92	27	5
Volume Right	11	5	98	0
cSH	813	1003	203	55
Volume to Capacity	0.01	0.09	0.62	0.20
Queue Length 95th (ft)	1	8	88	17
Control Delay (s)	0.2	2.3	47.5	86.3
Lane LOS	A	A	E	F
Approach Delay (s)	0.2	2.3	47.5	86.3
Approach LOS			E	F

Intersection Summary			
Average Delay	5.8		
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	40	275	15	610	325	195	655
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	2.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	26.0	26.0	8.0	36.0	36.0	18.0	32.0
Total Split (%)	32.5%	32.5%	10.0%	45.0%	45.0%	22.5%	40.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?							
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	380	40	275	15	610	325	195	655	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1782	1583	1770	1863	1583	1770	3516	
Flt Permitted					0.96	1.00	0.37	1.00	1.00	0.15	1.00	
Satd. Flow (perm)					1782	1583	687	1863	1583	273	3516	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	413	43	299	16	663	353	212	712	33
RTOR Reduction (vph)	0	0	0	0	0	218	0	0	195	0	4	0
Lane Group Flow (vph)	0	0	0	0	456	81	16	663	158	212	741	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					21.8	21.8	36.7	35.9	35.9	50.2	45.4	
Effective Green, g (s)					21.8	21.8	36.7	35.9	35.9	50.2	45.4	
Actuated g/C Ratio					0.27	0.27	0.46	0.45	0.45	0.63	0.57	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					486	431	326	836	710	364	1995	
v/s Ratio Prot							0.00	c0.36		c0.07	0.21	
v/s Ratio Perm					0.26	0.05	0.02		0.10	0.29		
v/c Ratio					0.94	0.19	0.05	0.79	0.22	0.58	0.37	
Uniform Delay, d1					28.4	22.3	11.8	18.9	13.5	12.0	9.5	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					25.9	0.2	0.1	7.6	0.7	2.4	0.5	
Delay (s)					54.3	22.5	11.9	26.5	14.2	14.4	10.0	
Level of Service					D	C	B	C	B	B	B	
Approach Delay (s)		0.0			41.7			22.1			11.0	
Approach LOS		A			D			C			B	

Intersection Summary			
HCM Average Control Delay	23.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: Project Driveway 'B' & Piikea Ave

4/23/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	540	20	45	850	40	5	0	30	5	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	587	22	49	924	43	5	0	33	5	0	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1125			161							
pX, platoon unblocked	0.53						0.53	0.53		0.53	0.53	0.53
vC, conflicting volume	967			609			1701	1739	587	1728	1717	924
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	504			609			1876	1947	587	1927	1906	423
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			95			79	100	94	76	100	98
cM capacity (veh/h)	567			970			26	30	510	23	32	337

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	43	587	22	49	924	43	38	11
Volume Left	43	0	0	49	0	0	5	5
Volume Right	0	0	22	0	0	43	33	5
cSH	567	1700	1700	970	1700	1700	140	43
Volume to Capacity	0.08	0.35	0.01	0.05	0.54	0.03	0.27	0.25
Queue Length 95th (ft)	6	0	0	4	0	0	26	21
Control Delay (s)	11.9	0.0	0.0	8.9	0.0	0.0	40.2	115.9
Lane LOS	B			A			E	F
Approach Delay (s)	0.8			0.4			40.2	115.9
Approach LOS							E	F

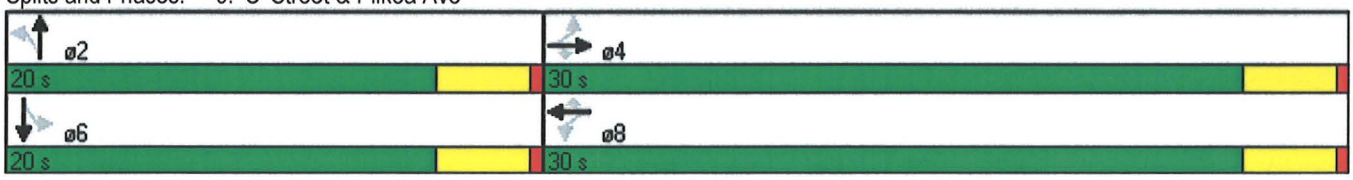
Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	40	505	35	120	840	30	55	5	190	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	NA
Protected Phases		4			8			2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phase	4	4	4	8	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	20.0	20.0	20.0	20.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%	40.0%	40.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min

Intersection Summary

Cycle Length: 50
Actuated Cycle Length: 46.2
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 9: 'C' Street & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	505	35	120	840	30	55	5	115	190	0	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			0%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	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	1.00	0.85		0.91			0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.96	
Satd. Flow (prot)	1752	1844	1567	1770	1863	1583		1671			1742	
Flt Permitted	0.16	1.00	1.00	0.36	1.00	1.00		0.87			0.68	
Satd. Flow (perm)	295	1844	1567	675	1863	1583		1470			1235	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	549	38	130	913	33	60	5	125	207	0	54
RTOR Reduction (vph)	0	0	14	0	0	7	0	89	0	0	20	0
Lane Group Flow (vph)	43	549	24	130	913	26	0	101	0	0	241	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	25.0	25.0	25.0	25.0	25.0	25.0		13.1			13.1	
Effective Green, g (s)	25.0	25.0	25.0	25.0	25.0	25.0		13.1			13.1	
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.54	0.54		0.28			0.28	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	160	1000	850	366	1010	858		418			351	
v/s Ratio Prot		0.30			c0.49							
v/s Ratio Perm	0.15		0.02	0.19		0.02		0.07			c0.20	
v/c Ratio	0.27	0.55	0.03	0.36	0.90	0.03		0.24			0.69	
Uniform Delay, d1	5.7	6.9	4.9	6.0	9.5	4.9		12.7			14.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.9	0.6	0.0	0.6	11.2	0.0		0.3			5.5	
Delay (s)	6.6	7.5	4.9	6.6	20.7	4.9		13.0			20.2	
Level of Service	A	A	A	A	C	A		B			C	
Approach Delay (s)		7.3			18.5			13.0			20.2	
Approach LOS		A			B			B			C	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	46.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	780	20	0	850	30	0	0	20	0	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	848	22	0	924	33	0	0	22	0	0	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		191										
pX, platoon unblocked				0.80			0.80	0.80	0.80	0.80	0.80	
vC, conflicting volume	924			848			1772	1772	848	1772	1772	924
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	924			685			1839	1839	685	1839	1839	924
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	94	100	100	93
cM capacity (veh/h)	739			727			43	60	359	44	60	327

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	848	22	924	33	22	22
Volume Left	0	0	0	0	0	0
Volume Right	0	22	0	33	22	22
cSH	1700	1700	1700	1700	359	327
Volume to Capacity	0.50	0.01	0.54	0.02	0.06	0.07
Queue Length 95th (ft)	0	0	0	0	5	5
Control Delay (s)	0.0	0.0	0.0	0.0	15.7	16.8
Lane LOS					C	C
Approach Delay (s)	0.0		0.0		15.7	16.8
Approach LOS					C	C

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	795	10	0	875	20	0	0	10	0	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	864	11	0	951	22	0	0	11	0	0	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		371										
pX, platoon unblocked				0.81			0.81	0.81	0.81	0.81	0.81	
vC, conflicting volume	951			864			1815	1815	864	1815	1815	951
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	951			712			1891	1891	712	1891	1891	951
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	97	100	100	95
cM capacity (veh/h)	722			716			41	57	349	42	57	315

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	864	11	951	22	11	16
Volume Left	0	0	0	0	0	0
Volume Right	0	11	0	22	11	16
cSH	1700	1700	1700	1700	349	315
Volume to Capacity	0.51	0.01	0.56	0.01	0.03	0.05
Queue Length 95th (ft)	0	0	0	0	2	4
Control Delay (s)	0.0	0.0	0.0	0.0	15.6	17.1
Lane LOS					C	C
Approach Delay (s)	0.0		0.0		15.6	17.1
Approach LOS					C	C

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	10	0	365	205	5
Sign Control	Stop			Free	Free	
Grade	0%			2%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	11	0	397	223	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				465		
pX, platoon unblocked						
vC, conflicting volume	622	226	228			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	622	226	228			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	100			
cM capacity (veh/h)	450	814	1340			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	397	228
Volume Left	0	0	0
Volume Right	11	0	5
cSH	814	1700	1700
Volume to Capacity	0.01	0.23	0.13
Queue Length 95th (ft)	1	0	0
Control Delay (s)	9.5	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.5	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	22.5%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2015 Saturday Mid-day

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	560	395	385	1320	1250	525
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	59.0	59.0	43.0	121.0	78.0	78.0
Total Split (%)	32.8%	32.8%	23.9%	67.2%	43.3%	43.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary
Cycle Length: 180
Actuated Cycle Length: 180
Offset: 43 (24%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	560	395	385	1320	1250	525
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	609	429	418	1435	1359	571
RTOR Reduction (vph)	0	155	0	0	0	175
Lane Group Flow (vph)	609	274	418	1435	1359	396
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	55.0	55.0	39.0	117.0	74.0	74.0
Effective Green, g (s)	55.0	55.0	39.0	117.0	74.0	74.0
Actuated g/C Ratio	0.31	0.31	0.22	0.65	0.41	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	541	484	384	2300	1441	644
v/s Ratio Prot	c0.34		c0.24	0.41	c0.39	
v/s Ratio Perm		0.17				0.25
v/c Ratio	1.13	0.57	1.09	0.62	0.94	0.61
Uniform Delay, d1	62.5	52.5	70.5	18.5	51.0	41.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	78.1	1.5	71.8	1.3	13.5	4.3
Delay (s)	140.6	54.0	142.3	19.8	64.5	46.1
Level of Service	F	D	F	B	E	D
Approach Delay (s)	104.8			47.5	59.1	
Approach LOS	F			D	E	

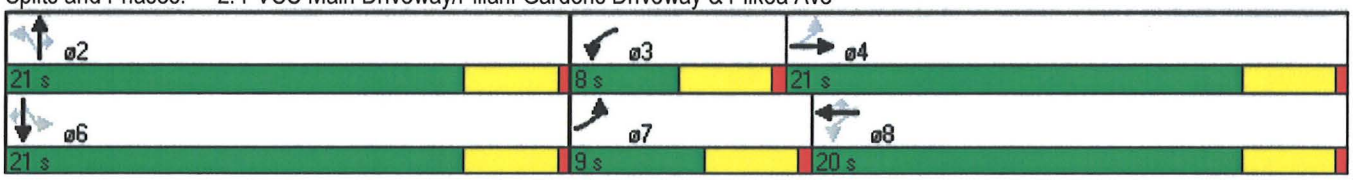
Intersection Summary			
HCM Average Control Delay	64.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	90	680	10	675	230	10	10	20	240	15	105
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8			2			6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	7	4	3	8	8	2	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	9.0	21.0	8.0	20.0	20.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (%)	18.0%	42.0%	16.0%	40.0%	40.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes						
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed

Splits and Phases: 2: PVSC Main Driveway/Piilani Gardens Driveway & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	680	15	10	675	230	10	10	20	240	15	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00		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		0.98	1.00		0.96	1.00
Satd. Flow (prot)	1770	3528		1770	3539	1583		1817	1583		1779	1583
Flt Permitted	0.24	1.00		0.27	1.00	1.00		0.86	1.00		0.72	1.00
Satd. Flow (perm)	438	3528		495	3539	1583		1606	1583		1346	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	739	16	11	734	250	11	11	22	261	16	114
RTOR Reduction (vph)	0	3	0	0	0	170	0	0	15	0	0	75
Lane Group Flow (vph)	98	752	0	11	734	80	0	22	7	0	277	39
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Effective Green, g (s)	22.0	17.0		20.0	16.0	16.0		17.0	17.0		17.0	17.0
Actuated g/C Ratio	0.44	0.34		0.40	0.32	0.32		0.34	0.34		0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	326	1200		300	1132	507		546	538		458	538
v/s Ratio Prot	c0.03	c0.21		0.00	0.21							
v/s Ratio Perm	0.10			0.01		0.05		0.01	0.00		c0.21	0.02
v/c Ratio	0.30	0.63		0.04	0.65	0.16		0.04	0.01		0.60	0.07
Uniform Delay, d1	8.8	13.8		9.2	14.6	12.2		11.0	10.9		13.7	11.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	2.4	2.5		0.2	2.9	0.7		0.1	0.0		5.8	0.3
Delay (s)	11.1	16.3		9.5	17.5	12.8		11.2	11.0		19.5	11.4
Level of Service	B	B		A	B	B		B	B		B	B
Approach Delay (s)		15.7			16.2			11.1			17.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.4%	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 (veh/h)	5	5	5	35	5	45	5	90	100	30	120	85
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	5	38	5	49	5	98	109	33	130	92
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	457	459	177	367	451	152	223			207		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	457	459	177	367	451	152	223			207		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	99	93	99	95	100			98		
cM capacity (veh/h)	472	485	866	568	490	894	1346			1365		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	5	11	43	49	212	33	223
Volume Left	5	0	38	0	5	33	0
Volume Right	0	5	0	49	109	0	92
cSH	472	622	557	894	1346	1365	1700
Volume to Capacity	0.01	0.02	0.08	0.05	0.00	0.02	0.13
Queue Length 95th (ft)	1	1	6	4	0	2	0
Control Delay (s)	12.7	10.9	12.0	9.3	0.2	7.7	0.0
Lane LOS	B	B	B	A	A	A	
Approach Delay (s)	11.5		10.6		0.2	1.0	
Approach LOS	B		B				

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	33.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	780	790	15	0	50
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	848	859	16	0	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			290			
pX, platoon unblocked	0.83				0.83	0.83
vC, conflicting volume	859				1291	438
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	409				932	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	94
cM capacity (veh/h)	947				219	896

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	424	424	572	303	54
Volume Left	0	0	0	0	0
Volume Right	0	0	0	16	54
cSH	1700	1700	1700	1700	896
Volume to Capacity	0.25	0.25	0.34	0.18	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	9.3
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.3
Approach LOS					A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		

RODEL Roundabout Analysis

5: Liloa St & Piikea Avenue Future Year 2015 Sat MD

8:3:12 KRAUZ PROJECT - FY 2015 9

E (m)	4.00	4.00	4.00	4.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	3.65	3.65	3.65	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	45.00	45.00	45.00	45.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	OP

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
WB	1.10	40	90	30	0	1.00	50	1.00	1.000	1.00	15	45	75
SB	1.10	35	685	65	0	1.00	50	1.00	1.000	1.00	15	45	75
EB	1.10	50	55	55	0	1.00	50	1.00	1.000	1.00	15	45	75
NB	1.10	20	685	70	0	1.00	50	1.00	1.000	1.00	15	45	75

MODE 2

FLOW	veh	160	785	160	775	AVEDEL s	13.3
CAPACITY	veh	680	1015	696	1024	LOS SIG	B
AVE DELAY	secs	6.9	15.1	6.7	14.1	LOS UNSIG	B
MAX DELAY	secs	6.9	15.4	6.7	14.3		
AVE QUEUE	veh	0.3	3.3	0.3	3.1	VEHIC HRS	6.9
MAX QUEUE	veh	0.3	3.4	0.3	3.1	COST $	104

F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	505	5	60	500	0	15	0	50	5	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	549	5	65	543	0	16	0	54	5	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		529			757							
pX, platoon unblocked	0.87						0.87	0.87		0.87	0.87	0.87
vC, conflicting volume	543			554			1236	1236	552	1291	1239	543
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	406			554			1199	1199	552	1261	1202	406
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			94			88	100	90	95	100	100
cM capacity (veh/h)	1008			1016			134	151	534	109	150	564

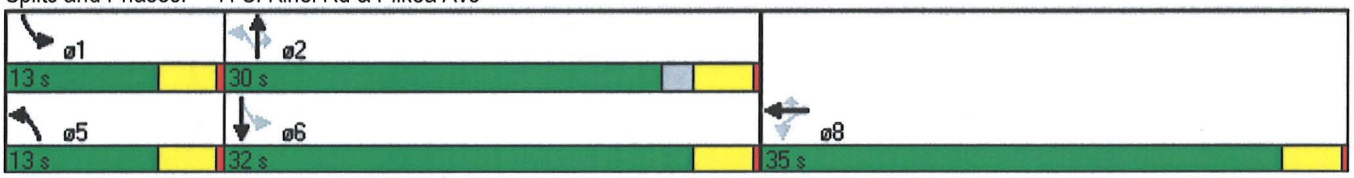
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	560	609	71	5
Volume Left	5	65	16	5
Volume Right	5	0	54	0
cSH	1008	1016	317	109
Volume to Capacity	0.01	0.06	0.22	0.05
Queue Length 95th (ft)	0	5	21	4
Control Delay (s)	0.2	1.7	19.6	39.6
Lane LOS	A	A	C	E
Approach Delay (s)	0.2	1.7	19.6	39.6
Approach LOS			C	E

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	50	155	25	610	395	135	540
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	8		5	2		1	6
Permitted Phases		8	2		2	6	
Detector Phase	8	8	5	2	2	1	6
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	35.0	35.0	13.0	30.0	30.0	13.0	30.0
Total Split (s)	35.0	35.0	13.0	30.0	30.0	13.0	32.0
Total Split (%)	43.8%	43.8%	16.3%	37.5%	37.5%	16.3%	40.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?							
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 7: S. Kihei Rd & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	350	50	155	25	610	395	135	540	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	1.00	1.00	1.00	0.95	
Frt					1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected					0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)					1785	1583	1770	1863	1583	1770	3507	
Flt Permitted					0.96	1.00	0.41	1.00	1.00	0.13	1.00	
Satd. Flow (perm)					1785	1583	773	1863	1583	247	3507	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	380	54	168	27	663	429	147	587	38
RTOR Reduction (vph)	0	0	0	0	0	116	0	0	242	0	4	0
Lane Group Flow (vph)	0	0	0	0	434	53	27	663	187	147	621	0
Turn Type				Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases				8		8	2		2	6		
Actuated Green, G (s)					25.0	25.0	37.5	34.8	34.8	47.0	40.3	
Effective Green, g (s)					25.0	25.0	37.5	34.8	34.8	47.0	40.3	
Actuated g/C Ratio					0.31	0.31	0.47	0.43	0.43	0.59	0.50	
Clearance Time (s)					4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)					558	495	396	810	689	301	1767	
v/s Ratio Prot							0.00	c0.36		c0.05	0.18	
v/s Ratio Perm					0.24	0.03	0.03		0.12	0.24		
v/c Ratio					0.78	0.11	0.07	0.82	0.27	0.49	0.35	
Uniform Delay, d1					25.0	19.6	11.5	19.8	14.5	12.8	12.0	
Progression Factor					1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2					6.7	0.1	0.1	9.0	1.0	1.2	0.6	
Delay (s)					31.7	19.6	11.5	28.9	15.4	14.0	12.5	
Level of Service					C	B	B	C	B	B	B	
Approach Delay (s)		0.0			28.4			23.3			12.8	
Approach LOS		A			C			C			B	

Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: Project Driveway 'B' & Piikea Ave

4/23/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	475	30	65	680	55	15	0	45	5	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	516	33	71	739	60	16	0	49	5	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1125			161							
pX, platoon unblocked	0.67						0.67	0.67		0.67	0.67	0.67
vC, conflicting volume	799			549			1527	1576	516	1565	1549	739
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	455			549			1540	1613	516	1597	1573	366
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			93			70	100	91	88	100	98
cM capacity (veh/h)	742			1021			55	60	559	47	63	456

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	60	516	33	71	739	60	65	16
Volume Left	60	0	0	71	0	0	16	5
Volume Right	0	0	33	0	0	60	49	11
cSH	742	1700	1700	1021	1700	1700	169	116
Volume to Capacity	0.08	0.30	0.02	0.07	0.43	0.04	0.39	0.14
Queue Length 95th (ft)	7	0	0	6	0	0	42	12
Control Delay (s)	10.3	0.0	0.0	8.8	0.0	0.0	39.0	40.9
Lane LOS	B			A			E	E
Approach Delay (s)	1.0			0.7			39.0	40.9
Approach LOS							E	E

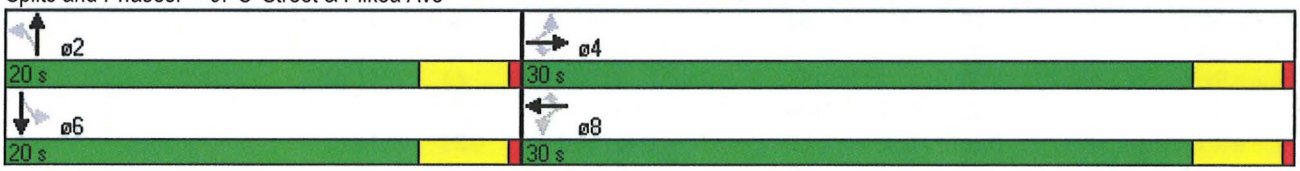
Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	55	430	45	170	685	40	65	5	215	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	NA
Protected Phases		4			8			2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phase	4	4	4	8	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	20.0	20.0	20.0	20.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%	40.0%	40.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min

Intersection Summary

Cycle Length: 50
Actuated Cycle Length: 44.3
Natural Cycle: 50
Control Type: Actuated-Uncoordinated

Splits and Phases: 9: 'C' Street & Piikea Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	430	45	170	685	40	65	5	140	215	0	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			0%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	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	1.00	0.85		0.91			0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.96	
Satd. Flow (prot)	1752	1844	1567	1770	1863	1583		1669			1745	
Flt Permitted	0.18	1.00	1.00	0.41	1.00	1.00		0.86			0.65	
Satd. Flow (perm)	341	1844	1567	770	1863	1583		1452			1175	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	467	49	185	745	43	71	5	152	234	0	54
RTOR Reduction (vph)	0	0	23	0	0	13	0	104	0	0	16	0
Lane Group Flow (vph)	60	467	26	185	745	30	0	124	0	0	272	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	22.2	22.2	22.2	22.2	22.2	22.2		13.9			13.9	
Effective Green, g (s)	22.2	22.2	22.2	22.2	22.2	22.2		13.9			13.9	
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.50	0.50		0.32			0.32	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	172	928	789	388	938	797		458			370	
v/s Ratio Prot		0.25			c0.40							
v/s Ratio Perm	0.18		0.02	0.24		0.02		0.09			c0.23	
v/c Ratio	0.35	0.50	0.03	0.48	0.79	0.04		0.27			0.73	
Uniform Delay, d1	6.6	7.3	5.5	7.2	9.1	5.5		11.3			13.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	1.2	0.4	0.0	0.9	4.7	0.0		0.3			7.4	
Delay (s)	7.8	7.7	5.5	8.1	13.8	5.6		11.6			20.8	
Level of Service	A	A	A	A	B	A		B			C	
Approach Delay (s)		7.5			12.3			11.6			20.8	
Approach LOS		A			B			B			C	

Intersection Summary			
HCM Average Control Delay	12.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	44.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	750	30	0	700	40	0	0	25	0	0	25
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	815	33	0	761	43	0	0	27	0	0	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		191										
pX, platoon unblocked				0.83			0.83	0.83	0.83	0.83	0.83	
vC, conflicting volume	761			815			1576	1576	815	1576	1576	761
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	761			677			1591	1591	677	1591	1591	761
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	93	100	100	93
cM capacity (veh/h)	851			761			67	89	377	67	89	405

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	815	33	761	43	27	27
Volume Left	0	0	0	0	0	0
Volume Right	0	33	0	43	27	27
cSH	1700	1700	1700	1700	377	405
Volume to Capacity	0.48	0.02	0.45	0.03	0.07	0.07
Queue Length 95th (ft)	0	0	0	0	6	5
Control Delay (s)	0.0	0.0	0.0	0.0	15.3	14.5
Lane LOS					C	B
Approach Delay (s)	0.0		0.0		15.3	14.5
Approach LOS					C	B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	765	10	0	740	25	0	0	15	0	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		2%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	832	11	0	804	27	0	0	16	0	0	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		371										
pX, platoon unblocked				0.85			0.85	0.85	0.85	0.85	0.85	
vC, conflicting volume	804			832			1636	1636	832	1636	1636	804
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	804			710			1661	1661	710	1661	1661	804
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	96	100	100	96
cM capacity (veh/h)	820			752			63	82	367	63	82	383

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	832	11	804	27	16	16
Volume Left	0	0	0	0	0	0
Volume Right	0	11	0	27	16	16
cSH	1700	1700	1700	1700	367	383
Volume to Capacity	0.49	0.01	0.47	0.02	0.04	0.04
Queue Length 95th (ft)	0	0	0	0	3	3
Control Delay (s)	0.0	0.0	0.0	0.0	15.3	14.8
Lane LOS					C	B
Approach Delay (s)	0.0		0.0		15.3	14.8
Approach LOS					C	B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	50.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	15	0	160	135	5
Sign Control	Stop			Free	Free	
Grade	0%			2%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	16	0	174	147	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				465		
pX, platoon unblocked						
vC, conflicting volume	323	149	152			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	323	149	152			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	98	100			
cM capacity (veh/h)	670	897	1429			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	16	174	152
Volume Left	0	0	0
Volume Right	16	0	5
cSH	897	1700	1700
Volume to Capacity	0.02	0.10	0.09
Queue Length 95th (ft)	1	0	0
Control Delay (s)	9.1	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.1	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	17.4%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

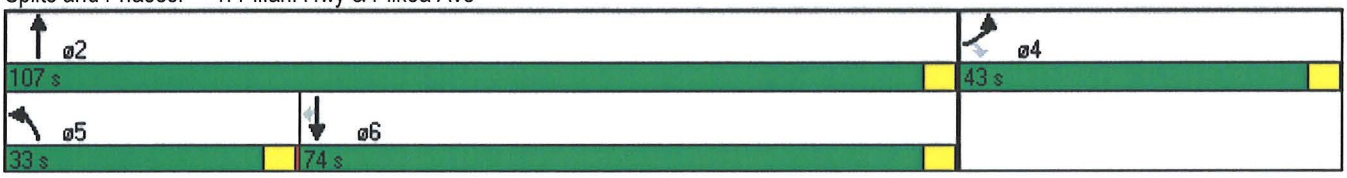
- Future Year 2015 AM With Mitigation

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	300	220	205	1315	1465	345
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	43.0	43.0	33.0	107.0	74.0	74.0
Total Split (%)	28.7%	28.7%	22.0%	71.3%	49.3%	49.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	300	220	205	1315	1465	345
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	326	239	223	1429	1592	375
RTOR Reduction (vph)	0	207	0	0	0	83
Lane Group Flow (vph)	326	32	223	1429	1592	292
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	19.8	19.8	24.0	122.2	94.2	94.2
Effective Green, g (s)	19.8	19.8	24.0	122.2	94.2	94.2
Actuated g/C Ratio	0.13	0.13	0.16	0.81	0.63	0.63
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	453	209	283	2883	2201	984
v/s Ratio Prot	c0.09		c0.13	0.40	c0.45	
v/s Ratio Perm		0.02				0.19
v/c Ratio	0.72	0.15	0.79	0.50	0.72	0.30
Uniform Delay, d1	62.4	57.7	60.6	4.3	19.0	12.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	0.3	13.5	0.6	2.1	0.8
Delay (s)	67.9	58.0	74.1	4.9	21.1	13.5
Level of Service	E	E	E	A	C	B
Approach Delay (s)	63.7			14.3	19.7	
Approach LOS	E			B	B	

Intersection Summary			
HCM Average Control Delay	23.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2015 PM With Mitigation

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	470	460	420	1365	1405	590
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	40.0	40.0	48.0	137.0	92.0	92.0
Total Split (%)	22.2%	22.2%	26.7%	76.1%	51.1%	51.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary

Cycle Length: 180
Actuated Cycle Length: 180
Offset: 43 (24%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	470	460	420	1365	1405	590
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	511	500	457	1484	1527	641
RTOR Reduction (vph)	0	307	0	0	0	175
Lane Group Flow (vph)	511	193	457	1484	1527	466
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	32.4	32.4	47.6	139.6	88.0	88.0
Effective Green, g (s)	32.4	32.4	47.6	139.6	88.0	88.0
Actuated g/C Ratio	0.18	0.18	0.26	0.78	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	618	285	468	2745	1713	766
v/s Ratio Prot	c0.15		c0.26	0.42	c0.44	
v/s Ratio Perm		0.12				0.30
v/c Ratio	0.83	0.68	0.98	0.54	0.89	0.61
Uniform Delay, d1	71.1	68.9	65.6	7.8	41.7	33.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.9	6.3	35.2	0.8	7.5	3.6
Delay (s)	80.0	75.2	100.8	8.6	49.2	37.0
Level of Service	E	E	F	A	D	D
Approach Delay (s)	77.6			30.3	45.6	
Approach LOS	E			C	D	

Intersection Summary			
HCM Average Control Delay	46.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2015 Saturday Mid-day With Mitigation

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	560	395	385	1320	1250	525
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	59.0	59.0	43.0	121.0	78.0	78.0
Total Split (%)	32.8%	32.8%	23.9%	67.2%	43.3%	43.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max

Intersection Summary

Cycle Length: 180
Actuated Cycle Length: 180
Offset: 43 (24%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 1: Piilani Hwy & Piikea Ave

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	560	395	385	1320	1250	525
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	2%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	1770	3539	3504	1567
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	1770	3539	3504	1567
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	609	429	418	1435	1359	571
RTOR Reduction (vph)	0	301	0	0	0	173
Lane Group Flow (vph)	609	128	418	1435	1359	398
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	39.0	39.0	53.6	133.0	75.4	75.4
Effective Green, g (s)	39.0	39.0	53.6	133.0	75.4	75.4
Actuated g/C Ratio	0.22	0.22	0.30	0.74	0.42	0.42
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	744	343	527	2615	1468	656
v/s Ratio Prot	c0.18		c0.24	0.41	c0.39	
v/s Ratio Perm		0.08				0.25
v/c Ratio	0.82	0.37	0.79	0.55	0.93	0.61
Uniform Delay, d1	67.1	60.1	58.1	10.3	49.6	40.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.0	0.7	8.0	0.8	11.4	4.1
Delay (s)	74.1	60.8	66.1	11.2	61.0	44.9
Level of Service	E	E	E	B	E	D
Approach Delay (s)	68.6			23.6	56.3	
Approach LOS	E			C	E	

Intersection Summary			
HCM Average Control Delay	46.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX J.

Kihei Community Association Meeting Summary

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

MEETING MEMORANDUM

Date of Meeting: April 21, 2009

Project Team: David Pyle and Jay Krigsman, The Krausz Companies, Inc.
Clifford Mukai and Reed Ariyoshi, Warren S. Unemori Engineering, Inc.
Gwen Ohashi Hiraga and Colleen Suyama, Munekiyo & Hiraga, Inc.

Participants: See Attached Sign-In Sheets

From: Colleen Suyama, Senior Associate

Purpose of Meeting: Kihei Community Association Meeting

Approximately 75 persons, both members and nonmembers, attended the Kihei Community Association Meeting. The Krausz Companies, Inc. presented their plans to develop vacant land west of the Piilani Shopping Center owned by The Krausz Companies, Inc. Jay Krigsman presented an overview of the project. The key points made regarding the project include the following:

1. The project is envisioned as a walkable mixed-use development which will create an identifiable downtown for Kihei and include residential housing units integrated within the retail/commercial uses. The housing units will meet the County's affordable housing criteria for rental units and will be made available to families making between 50 percent to 120 percent of Maui's median income.

2. The commercial uses will be sited into city blocks between the northern and southern portions of the development along both sides of Piikea Avenue. Although the existing wetlands are owned by the developer, it will be left intact and is not part of the proposed development. Adequate landscape buffers will be provided between the wetlands and development.

3. The developers are coordinating the proposed development with the County of Maui, Department of Public Works regarding access from the Piilani Shopping Center and Liloa Drive as well as from Piikea Avenue. The coordination efforts also

includes the proposed round-about at the intersection of Piikea Avenue and Liloa Drive and required right-of-way dedication.

4. The development will be two-stories for the commercial/retail uses while the apartments units are proposed to be four-stories. The project is proposed as a sustainable development and is aiming for certification as LEEDS Gold.

5. Drainage for the development is being planned and consideration is being given to bio-swales, underground perforated pipes to capture and reuse runoff as well as other drainage technology.

The public asked the following questions:

1. When do they anticipate breaking ground?

   Response: Hopefully within two (2) years with three (3) to four (4) years to complete.

2. What is the build-out time?

   Response: Depending on market conditions, Phase 1 within 12 to 18 months and Phase 2 within 18-24 months

3. Will there be an opportunity for ownership of the commercial space?

   Response: The Krausz Companies, Inc. are fee developers that maintain ownership of their projects. The project will be leasehold.

4. Where are you getting water?

   Response: The developer is aware of the County's "Show Me the Water" Bill and is working towards obtaining water for the project. The developer is investigating options such as reducing the amount of water used onsite and utilizing the R-1 water from the sewer treatment plant for non-drinking purposes.

There being no other comments the meeting adjourned at 7:30 p.m.

Colleen Suyama
Senior Associate

CS:lh
Enclosure
Cc: David Pyle, The Krausz Companies, Inc. (w/enclosure)
Jay Krigsman, The Krausz Companies, Inc. (w/enclosure)
Clifford Mukai, Warren S. Unemori Engineering, Inc. (w/enclosure)
F:\DATA\Krausz\Kihei MixedUse\042109 KCA meeting memo.doc

KCA

Kihei Community Association

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62	Name Mark Ralph & Alicia Ralph Address 490 Kenolio Rd Kihei	Phone Email
63	Name Bill Collard Address	Phone Email
64	Name Wilbert YEE Address	Phone Email
65	Name CHRIS SCHAUER Address	Phone Email
66	Name Koinoa Horcajo Daily Address 8DA Iao Valley Rd	Phone Email
67	Name Lisa Burke Address 1684 Hoonanea St. Kihei	Phone Email
68	Name GAYLAND YEE Address 887 MAKENANI ST.	Phone Email
69	Name Graham Peake Address 111 Ponani St. Kihei	Phone Email
70	Name Bill Graham Address 161 Wimaolii Place Bldg	Phone Email
71	Name Bonnie King Address 1221 Iliili Rd	Phone Email
72	Name Scott Crockford Address PO Box 331102 Kahului	Phone Email
73	Name KACHINA PALENGA Address 3318 A KEHA DR.	Phone Email
74	Name Trisha Smith Address 175 Waipuhe St. Kihei	Phone Email
75	Name Jarrachelam Puni Address 15 Kulanihakoi St.	Phone Email

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Kihei Community Association

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	Address 213 MEHANI CIR	Email
21	Name Constance Willian	Phone
	Address 480 Kenolio Rd	Email
22	Name Liza Pierce	Phone
	Address 277 Palani Pl	Email
23	Name Steve Slater	Phone
	Address 264 Palima Kihei	Email
24	Name	Phone
	Address	Email
25	Name	Phone
	Address	Email
26	Name	Phone
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20	Name Brown, Phil & Evelyn	Phone
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21	Name Burke, Chuck & Lisa	Phone
	Address	Email
22	Name Coleman, Berney & Pat	Phone
	Address	Email
23	Name Coronesi, Mark	Phone
	Address	Email
24	Name Couch, Don	Phone
	Address	Email
25	Name Dovma, Thomas	Phone
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Kihei Community Association

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21	Name King, Maury	Phone Email
22	Name Krause, Joel	Phone Email
23	Name Mathay, Edward	Phone Email
24	Name Miller, Jon	Phone Email
25	Name Moran, Michael	Phone Email
26	Name Munekiyo & Hiraga	Phone Email
27	Name MW Commercial Realty	Phone Email
28	Name Phillips, Clifford	Phone Email
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30	Name Richardson, Robert & Lis	Phone Email

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34	Name Wyche, Susan	Phone Email
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36	Name Zarro, Gene	Phone Email
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