VOLUME III OF III
(Appendices F to O)

Final Environmental Assessment

MAKALAPUA PROJECT DISTRICT
(TMK NOS. (3)7-4-008:002 (por.), (3)7-4-010:009 and 010, (3)7-4-025:001, 002, 003, 005, 015, and 021)

Prepared for:

Liliʻuokalani Trust

Approving Agency:

County of Hawaiʻi
Planning Department

October 2024

MUNEKIYO HIRAGA

Planning. Project Management. Sustainable Solutions.

VOLUME III OF III
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MAKALAPUA PROJECT DISTRICT
(TMK NOS. (3)7-4-008:002 (por.), (3)7-4-010:009 and 010, (3)7-4-025:001, 002, 003, 005, 015, and 021)

Prepared for:

Lili‘uokalani Trust

Approving Agency:

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Planning Department

October 2024

MUNEKIYO HIRAGA

LIST OF APPENDICES (VOLUME II OF III)

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CHAPTER 6E-8 CONSULTATION RESPONSE LETTER FROM SHPD DATED FEBRUARY 27, 2020

APPENDIX F

DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

February 27, 2020

IN REPLY REFER TO:
Log No. 2019.00636
Doc. No. 2002SN04
Archaeology

Michael Yee, Planning Director
County of Hawaii – Planning Department
101 Pauahi Street, Suite 3
Hilo, Hawaiʻi 96720

Dear Mr Yee:

SUBJECT: **Chapter 6E-8 Historic Preservation Review –**
Request for Concurrence with a Determination of Effect for the Makalapua Project District
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002

This letter provides the State Historic Preservation Division's (SHPD's) comments on the request for concurrence with an HRS 6E project effect determination for the proposed Makalapua Project District (MPD). Liliʻuokalani Trust (LT) is proposing the development of the 67.2-acre property. The County of Hawaiʻi (County) has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received this submittal on March 25, 2019.

The County of Hawaii Planning Department letter indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment (EA) for the project.

Several archaeological inventory surveys (AIS) studies have been conducted that include portions of the MPD. These include the following:

1993 O'Hare and Rosendahl (1993), titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015), titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaii [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS in a letter dated August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019), titled, *Archaeological Inventory Survey of Urban Phase III Parcel Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaii [TMK: (3) 7-4-008:002 por.]*. The archaeological inventory survey (AIS) totaled 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS in a letter dated September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05).

The County's letter further indicates that of these three AIS, two were conducted in support of the current MPD: McIntosh et al. (2015) and Reeve et al. (2019) and provides the following summary of historic properties within the MPD (Table 1).

Table 1. Previously documented dites within the boundaries of the MPD.

SIHP#	Feat.	Site/Feature Type	Possible Function	Significance	Treatment	Study
Site 50-10-27-13260	A	Modified Sink	Water Catchment	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13260	B	Modified Sink	Water Catchment	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13260	C	Modified Sink	Water Catchment	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261		Enclosure	Ceremonial	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502		Modified Depression	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508		Wailed Overhang	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	A	Stone Mound	Agriculture	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	B	Filled Depression	None		No Further Work	Kona Commons SAIS
Site 50-10-27-18509	C	Stone Mound	Agriculture	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	D	Lava Excavation	Agriculture	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	A	Modified Overhang	Habitation	d	Preservation	Kona Commons SAIS
Site 50-10-27-18511	B	Lava Excavation	Agriculture	d	Preservation	Kona Commons SAIS
Site 50-10-27-18511	C	Modified Lava Tube	Burial	d, e	Preservation (burial treatment)	Kona Commons SAIS
Site 50-10-27-18511	D	Lava Excavation	Quarry	d	Preservation	Kona Commons SAIS
Site 50-10-27-18511	E	Lava Excavation	Quarry	d	Preservation	Kona Commons SAIS
Site 50-10-27-29111		C-Shaped Wall	Habitation	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112		C-Shaped Wall	Habitation/ Processing	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	E	Modified Overhang	Storage	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	F	Modified Overhang	Storage	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207		Lava Excavation	Uncertain	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208		Stone Mound	Marker	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209		Enclosure	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	A	Modified Overhang	Storage	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	B	Lava Excavation	Uncertain	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	C	C-Shaped Wall	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	D	Enclosure	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30211		Petroglyph	Communication	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212		C-Shaped Wall	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287		Trail	Travel	d	Partial Preservation	Kona Commons SAIS

The County's letter identifies the remaining outstanding previously agreed-upon mitigation commitments still need to be addressed for documented historic properties in the MPD:

(1) Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
(2) Data recovery of Site 50-10-27-30210 Feature B;
(3) Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261 (enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
(4) Archaeological monitoring during ground disturbing construction activities.

Subsequent to the County's letter, the Hawaii Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019. Additionally, the HIBC recommended that SHPD accepted the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

Also subsequent to the County's letter, SHPD (Susan Lebo) consulted with the archaeological consulting firm, Pacific Legacy staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020 regarding the un-surveyed portions of the MPD and updating the results and recommendations of the two MPD studies (McIntosh et al. 2015 and Reeve et al. 2019). **SHPD requested the following**:

(1) A literature review and field inspection be conducted for areas not previously surveyed within the boundaries of the MPD. SHPD approved during the consultation that this work could be initiated immediately;
(2) Site integrity and site significance assessments be updated and that this update include consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised; and
(3) Following completion of #1 and #2, SHPD concur with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "**Effect, with agreed upon mitigation commitments**," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD shall notify the County when the agreed upon mitigation plans have been reviewed and accepted and the permit issuance process may continue.

Please contact Sean Nāleimaile at (808) 933-7653 or at Sean.P.Naleimaile@hawaii.gov for questions regarding archaeological resources or this letter.

Aloha,
Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc. Melissa Dacayanan, Melissa.dacayanan@hawaiicounty.gov
Jeff Darrow, jeff.darrow@hawaiicounty.gov
Michael Shibata, mshibata@onipaa.org
Mara Mulrooney, mulrooney@pacificlegacy.com
Paul Cleghorn, cleghorn@pacificlegacy.com

ARCHAEOLOGICAL FIELD INSPECTION REPORT FOR TMK (3)7-4-010:009 AND (3)7-4-010:010

APPENDIX F-1

Pacific Basin — Oʻahu
30 Aulike Street, Suite 301
Kailua, HI 96734

Phone: 808.263.4800
Fax: 808.263.4300
www.pacificlegacy.com

March 12, 2020

Dr. Susan Lebo, Archaeology Branch Chief
State Historic Preservation Division
Department of Land and Natural Resources
601 Kamokila Blvd., Suite 555
Kapolei, HI 96707
Via: dlnr.intake.shpd@hawaii.gov

SUBJECT: Field inspection of two parcels proposed for inclusion in the Liliʻuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi (TMK: [3] 7-4-010:009; [3] 7-4-010:010)

Dear Dr. Lebo,

At the request of the State Historic Preservation Division (Log No. 2019.00636; Doc. No. 2002SN04) and on behalf of the Liliʻuokalani Trust, Pacific Legacy, Inc. completed a literature review and archaeological field inspection of two parcels in Keahuolū Ahupuaʻa, district of North Kona, Island of Hawaiʻi.

The parcels are included in the Liliʻuokalani Trust's proposed Makalapua Project District (Figure 1 and Figure 2, attached; also see letter dated March 15, 2019 from Michael Yee, Planning Director, County of Hawaiʻi Planning Department to Susan Lebo, SHPD, and letter dated February 27, 2020 from Alan Downer, SHPD to Michael Yee, County of Hawaiʻi Planning Department). The two parcels, which cover an area of 2.1 acres and encompass the entirety of TMK parcels (3) 7-4-010:009 and (3) 7-4-010:010, are located between Loloku Street and Kaiwi Street. The parcels have been previously developed and are currently in use for commercial/industrial purposes. Two parallel warehouse buildings and a paved parking lot cover nearly all of the subject area (Figure 3).

A literature review indicates that no previous archaeological studies have been conducted in these parcels. According to Hawaiʻi County tax records from the Real Property Tax Office, the warehouses that occupy the space were both built in 1972.

The Kona Commons project area, located adjacent to the western boundary of the parcels of interest, was subjected to an archaeological inventory survey, the report for which was accepted in 1993 (OʻHare and Rosendahl, 1993, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*, as well as a supplemental AIS, which was accepted in 2015 (McIntosh et al., 2015, *Supplemental Archaeological Inventory Survey of the 119 Acre Kona Commons Parcel of Queen Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaii [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*.

The field inspection included a walk-through of the parcels by M. Mulrooney, Ph.D. of Pacific Legacy on 17 January 2020. Photographic documentation was limited to the exterior of the existing buildings (Figures 4–10). No historic properties were identified during the field inspection.

As the entire area's geologic substrate consists of *pāhoehoe* lava flows with little to no soil accumulation on the surface, it is unlikely that subsurface deposits exist within the inspected area. No further archaeological work is recommended for this parcel.

Please do not hesitate to contact me if you have any questions or require additional information.

Sincerely,

Mara Mulrooney, Ph.D.
Senior Project Supervisor

Attachments

cc: Mana Purdy, Liliʻuokalani Trust
Michael Shibata, Liliʻuokalani Trust
LeeAnn Silva, Liliʻuokalani Trust

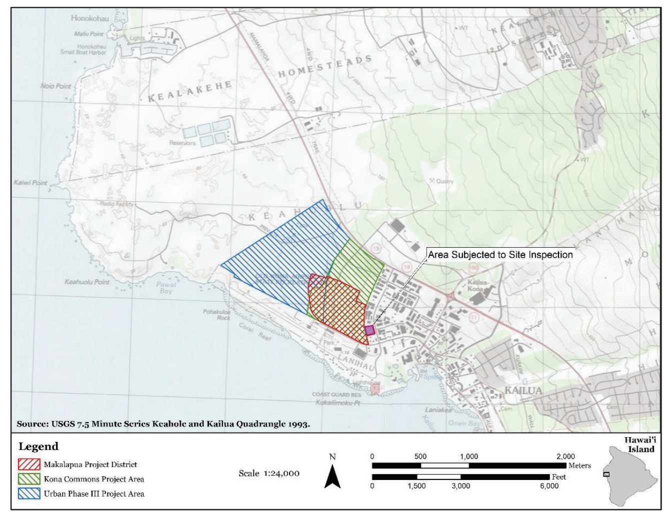

Figure 1. Location of area that was inspected with Makalapua Project District, Kona Commons Project Area, and Urban Phase III Project Areas shown.

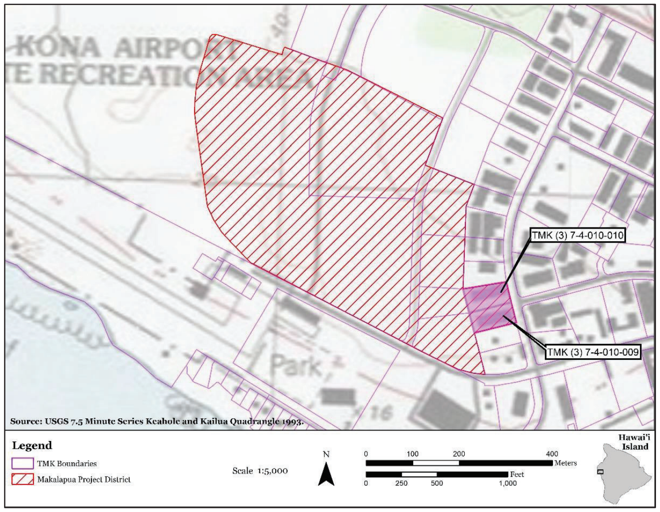

Figure 2. Location of parcels that were inspected with the Makalapua Project District shown.

Figure 3. Aerial photograph showing existing buildings and parking lot within the parcels that were inspected.

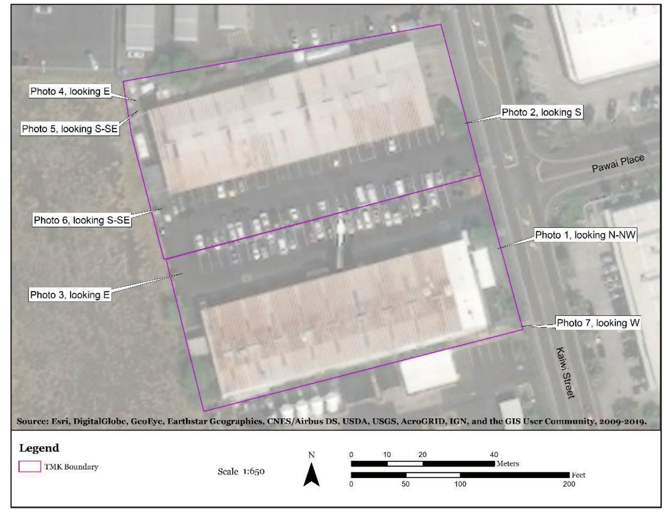

Figure 4. Aerial photograph showing locations and directions of photographs taken during inspection.

Figure 5. **Photo 1:** View of eastern perimeter of parcels along Kaiwi St., showing warehouse built on TMK (3) 7-4-010:010 (view to north-northwest).

Figure 6. **Photo 2:** View of eastern perimeter of parcels along Kaiwi St., showing warehouse built on TMK (3) 7-4-010:009 (view to south).

Figure 7. **Photo 3:** View of paved parking lot between warehouses (view to east).

Figure 8. **Photo 4:** View of northern perimeter of TMK (3) 7-4-010:010 (view to east).

Figure 9. **Photo 5:** View of western perimeter of parcels from northwestern corner of TMK (3) 7-4-010:010 (view to south-southeast).

Figure 10. **Photo 6:** View of western perimeter of parcels showing warehouse in TMK (3) 7-4-010:009 (view to south-southeast).

Figure 11. **Photo 7:** View of southern perimeter of TMK (3) 7-4-010:009 showing pāhoehoe substrate, warehouse, and modern features such as rock walls (view to west).

SHPD ACCEPTANCE LETTER FOR FIELD INSPECTION REPORT DATED JUNE 25, 2020

APPENDIX F-2

DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

June 25, 2020

Michael Yee, Planning Director
County of Hawaii
101 Pauahi Street, Suite 3
Hilo, HI 96720

IN REPLY REFER TO:
Log No. 2020.000607
Doc. No. 2006SN05
Archaeology

Dear Mr. Yee:

SUBJECT: **Chapter 6E-8 Historic Preservation Review –**
Request for Concurrence for the Development at the Makalapua Project District
Archaeological Field Inspection for Two Parcels in the Makalapua Project District
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-2-010:009 and 010

This letter updates the State Historic Preservation Division's (SHPD's) review of a County of Hawaii request for concurrence with a determination of effect for the Makalapua Project District (MPD). Liliʻuokalani Trust (LT) is proposing the development of the MPD which is a 67.2-acre property. The County of Hawaiʻi (County) has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received this submittal on March 25, 2019.

In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated that via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] the two un-surveyed subject parcels within the MPD project area needed the following:

1. additional investigation that includes a literature review and field inspection and;
2. that site integrity and site significance assessments for sites within the MPD be updated following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals.

The current submittal included a literature review and field inspection report titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaii (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020).

Project Description

The two parcels, which cover an area of 2.1 acres and encompass the entirety of TMK: (3) 7-4-010:009 and TMK: (3) 7-4-010:010, are located between Loloku Street and Kaiwi Street. The current project area is with the larger MPD. The parcels have been previously developed and are currently in use for commercial/industrial purposes. Two parallel warehouse buildings and a paved parking lot cover nearly all the subject area.

Findings

A review of our records indicate that the current project area has not been subject to an adequate archaeological inventory survey. The current submittal indicates that according to Hawaii County tax records, the warehouses within the current project area were both built in 1972. The larger Kona Commons project area, located adjacent to the western boundary of the parcels of interest, was subjected to an archaeological inventory survey, the report for which was accepted in 1993 (OʻHare and Rosendahl, 1993; *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*, as well as a supplemental AIS, which was accepted in 2015 (McIntosh et al., 2015; *Supplemental*

Archaeological Inventory Survey of the 119 Acre Kona Commons Parcel of Queen Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaii [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]).
The field inspection included photographic documentation of the existing buildings. No historic properties were identified during the field inspection on the subject parcels.

Determination
This letter informs the County that the current submittal satisfies SHPD's first request and that SHPD accepts the field inspection report as adequate for the two subject parcels. **SHPD's looks forward** to receiving additional information relating to SHPD's second request for site integrity and site significance assessments for sites within the overall MPD project area. **SHPD will notify the County when** this requirement has been completed and when the project may move forward.

Please contact Sean Nāleimaile at (808) 933-7651 or at Sean.P.Naleimaile@Hawaii.gov for any questions or concerns regarding this letter.

Aloha,
Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: COH Department of Public Works, public_works@hawaiicounty.gov
Michael Shibata, mshibata@onipaa.org
LeeAnn Silva, lsilva@onipaa.org
Mara Mulrooney, mulrooney@pacificlegacy.com
Krickette Pacubus, pacubas@pacificlegacy.com

APPENDIX G

DATA RECOVERY PLAN

Pacific Legacy

Historic Preservation

FINAL

ARCHAEOLOGICAL DATA RECOVERY PLAN
FOR SIHP 50-10-27-30210, FEATURE B
LILIʻUOKALANI TRUST LANDS
IN THE AHUPUAʻA OF KEAHUOLŪ
NORTH KONA DISTRICT, HAWAIʻI ISLAND

[TMK: (3) 7-4-008:002 (por.);
(3) 7-4-010:009 and 010;
(3) 7-4-025:001, 002, 003, 005, 015, and 021]

Pacific Legacy: Exploring the past, informing the present, enriching the future.

CULTURAL RESOURCES CONSULTANTS

Hawaiʻi Office:
Kailua, Oʻahu

California Offices:
Business Office
Bay Area
Sierra/Central Valley

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FINAL

ARCHAEOLOGICAL DATA RECOVERY PLAN FOR SIHP 50-10-27-30210, FEATURE B LILIʻUOKALANI TRUST LANDS IN THE AHUPUAʻA OF KEAHUOLŪ NORTH KONA DISTRICT, HAWAIʻI ISLAND

[TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009 and 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021]

Prepared by:
Mara A. Mulrooney, Ph.D.
and
Paul L. Cleghorn, Ph.D.

Pacific Legacy, Inc.
146 Hekili Street, Suite 205
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(808) 263-4800

Prepared for:
Liliʻuokalani Trust
1100 Alakea Street, Suite 1100
Honolulu, HI 96813

January 2023

ACKNOWLEDGEMENTS

Mahalo to Rowland B. Reeve, M.A. for his research and substantial contributions to the data recovery plan.

TABLE OF CONTENTS

LIST OF FIGURES

Note: *In this report, the spellings and the use of diacritical marks (glottal stops and macrons) follow conventions issued by Pukui and Elbert (1986) and Pukui et al. (1974) with limited exceptions – spellings and diacritical marks are used as the original sources used them in quotations, titles, and proprietary names.*

Cover photo: *Site 50-10-27-30210, Feature B lava excavation (view to northeast).*

1.0 INTRODUCTION

At the request of the Liliʻuokalani Trust, Pacific Legacy, Inc. has prepared the following archaeological data recovery plan (DRP) to guide excavations at Site 50-10-27-30210, Feature B in the Makalapua Project District, located within portions of the Kona Commons and Urban Phase III project areas of Trust lands within the *ahupuaʻa* (land division) of Keahuolū in the district of North Kona on the island of Hawaiʻi [TMK: (3) 7-4-008:002; (3) 7-4-010:009 and 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021].

Site 50-10-27-30210 is located within the Kona Commons project area, which was the subject of an archaeological inventory survey (AIS) undertaken by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1992 (O'Hare and Rosendahl 1993) and a supplemental archaeological inventory survey (SAIS) undertaken by Pacific Legacy in 2014 (McIntosh et al. 2015). It was during the course of the 2014 Pacific Legacy survey that the lava excavation was identified. At that time, the excavation was assigned State Inventory of Historic Places (SIHP) site number 50-10-27-30210 and designated as Feature B of that site. The report of the 2014 SAIS in the Kona Commons project area was reviewed by the Hawaiʻi State Historic Preservation Division (SHPD) and its findings and recommendations were accepted (Log No. 2015.02142, Doc. No. 1508MV17, Appendix A). In 2019, the AIS report for the neighboring Urban Phase III project area, a portion of which is included in the Makalapua Project District, was reviewed and accepted by SHPD (Log No. 2019.01679; Doc. No. 1909AM05; see Appendix A).

The owner of the land on which the SIHP 50-10-27-30210, Feature B lava excavation is located is Liliʻuokalani Trust.

1.1 STATUTORY REQUIREMENTS

This data recovery plan is intended to satisfy the requirements of Hawaiʻi Administrative Rules Chapter 13-278 (HAR §13-278, Rules Governing Standards for Archaeological Data Recovery Studies and Reports). HAR §13-278 Section 3 describes the components of an archaeological data recovery plan prepared pursuant to Hawaiʻi Administrative Rules Chapter 13-284 (HAR §13-284, Rules Governing Procedures For Historic Preservation Review To Comment On Section 6E-42, HRS, Projects). These components include:

(1) Identify historic properties to be studied.
(2) Identify research objectives to be addressed. This shall be done through reviewing prior archaeological and historical work in the parcel, *ahupuaʻa*, and wider region. The specifics of these research objectives will vary with the extent of prior work.
(3) Identify data needed to address the research objectives.
(4) Identify field methods to be used to acquire and analyze the data. Any sampling approaches to be used shall be noted here. The plan shall also use the most efficient methods to address the research objectives.
(5) Identify any necessary laboratory work. This work may include, but not be limited to, dating, faunal analyses, soil analyses, botanical analyses, and artifact analyses.
(6) Identify a procedure for depositing collections after conclusion of the data recovery project.

1.2 REPORT ORGANIZATION

The following archaeological data recovery plan has been organized into seven sections to address the proposed data recovery investigations of the Site 50-10-27-30210, Feature B lava excavation.

Section 1	Provides an introduction to the data recovery plan.
Section 2	Presents background on the Makalapua Project District project area including its location and environment and a brief overview of previous archaeological investigations.
Section 3	Provides a detailed description of the Site 30210 complex and discusses treatment recommendations.
Section 4	Discusses research objectives of the data recovery investigations at Site 30210.
Section 5	Presents field and laboratory methods, and curation parameters.
Section 6	Presents a summary of the data recovery plan.
Section 7	Lists references cited.

Attached to the data recovery plan are two appendices. Appendix A includes a copy of the letter from SHPD accepting the findings and recommendations of the SAIS report for the Kona Commons project area (McIntosh et al. 2015), as well as a copy of the acceptance letter for the AIS report for the adjacent Urban Phase III project area (Reeve et al. 2019). Appendix B includes a copy of the letter from SHPD requesting a data recovery plan for Site 30210, Feature B, along with other mitigation plans for the Makalapua Project District.

2.0 PROJECT BACKGROUND

This section of the data recovery plan provides location and other background information on the Makalapua Project District. It also discusses the various archaeological investigations that have taken place within the Kona Commons property, a portion of which is included in the Makalapua Project District.

2.1 SITE LOCATION

The Site 50-10-27-30210, Feature B lava excavation is located within the Liliʻuokalani Trust's Makalapua Project District. The Liliʻuokalani Trust is proposing the development, enhancement, and refinement of approximately 67.2 acres of land that includes portions of the 100-acre Kona Commons property and the adjacent 213-acre Urban Phase III parcel (Figure 1, Figure 2). The area is at the northern edge of Kailua town in the coastal portion of the *ahupuaʻa* of Keahuolū in the district of North Kona on the island of Hawaiʻi, in TMK: (3) 7-4-008:002 (Figure 3).

The Makalapua Project District includes the southern half of the Kona Commons parcel as well as the eastern portion of the Urban Phase III parcel. The area to the northeast contains the Liliʻuokalani Children's Center complex, the area to the north and northwest is now occupied by a mix of commercial properties and parking areas, to the southeast lies commercially developed land that forms part of the Kona industrial area, and to the southwest are playing fields that are within the Old Kona Airport State Recreation Area.

Though mostly undeveloped at present, portions of the Makalapua Project District area have been disturbed by bulldozing, and by landscaping associated with the construction of the former Swing Zone driving range in the southwestern corner of the area. Site 50-10-27-30210 is situated on undulating *pāhoehoe* lava vegetated in a thin covering of fountain grass (*Pennisetum setaceum*).

Site 50-10-27-30210 is located near the eastern edge of the disturbed area where the Swing Zone driving range used to be located. It is in an undeveloped section of land *makai* (seaward) of the Target store and its associated parking area. This undisturbed lot consists of undulating *pāhoehoe* lava vegetated in a thin covering of fountain grass (*Pennisetum setaceum*).

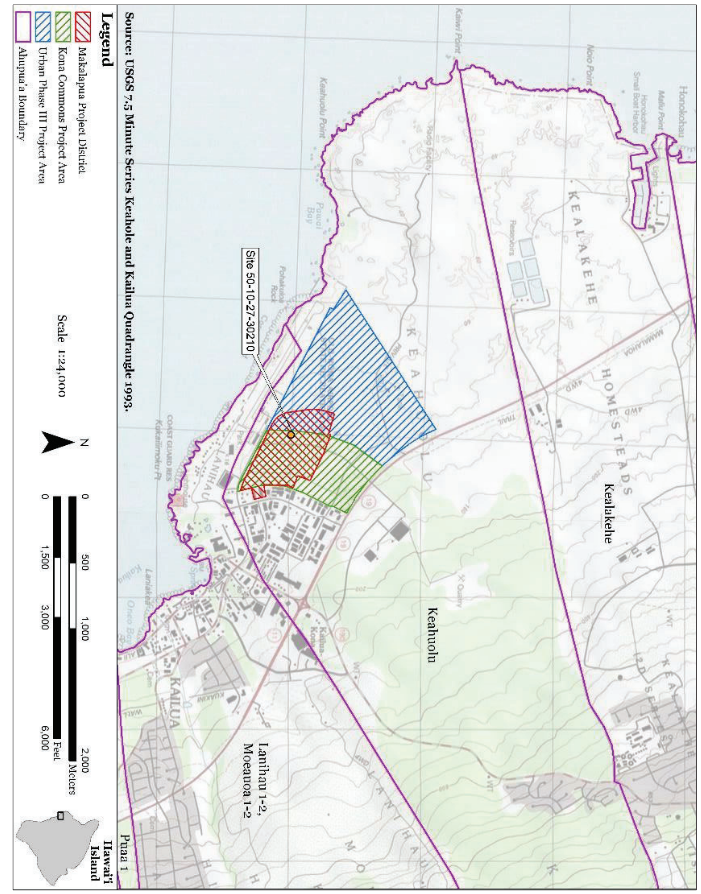

Figure 1. Location of Site 50-10-27-30210 in the Makalapua Project District on USGS Keahole Point and Kailua Quadrangles 1996. Kona Commons and Urban Phase III parcels also shown.

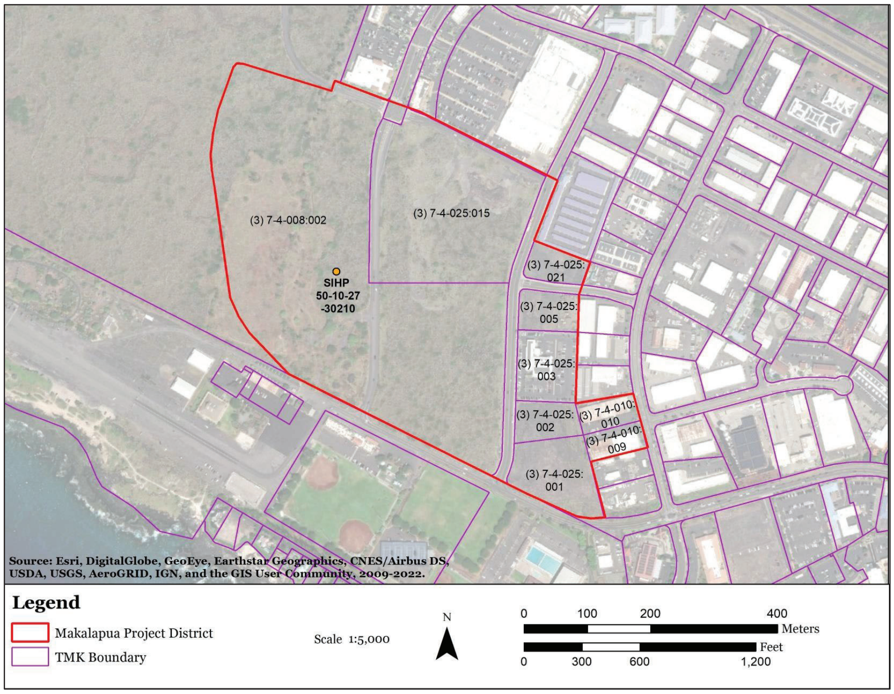

Figure 3. Location of Site 50-10-27-30210 and the TMK boundaries within the Makalapua Project District (base map: Esri World Imagery 2021).

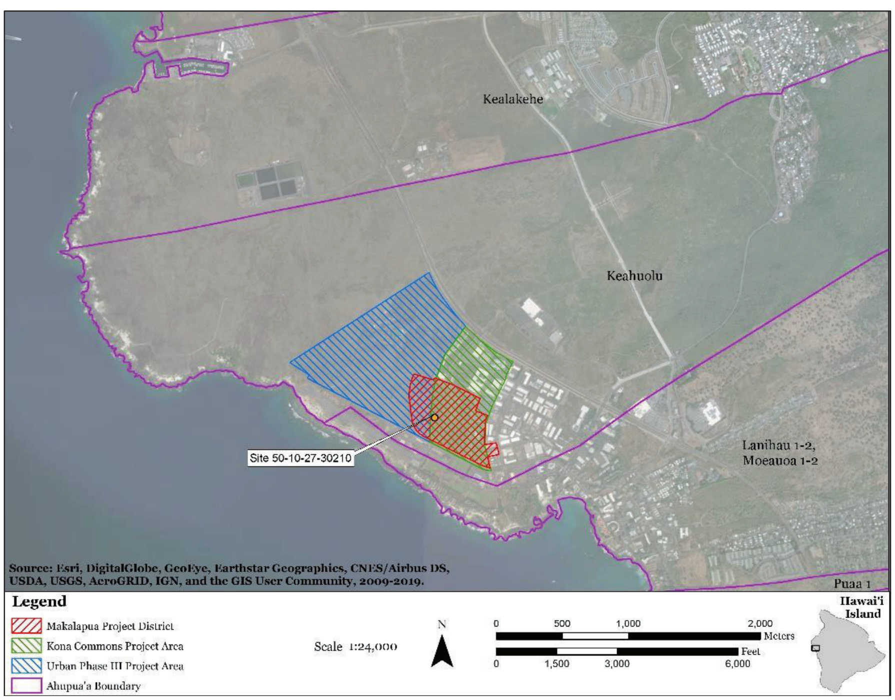

Figure 2. Location of Site 50-10-27-30210 in the Makalapua Project District (Esri World Imagery 2019). Kona Commons and Urban Phase III parcels also shown.

2.2 Environmental Setting

The Makalapua Project District is located at the foot of the volcanic peak of Hualālai, on the drier leeward side of the island of Hawaiʻi. The Site 30210 complex is situated at roughly 40 feet in elevation above sea level and approximately 470 meters inland of the shoreline. The geology underlying most of the Kona Commons property, including the Site 30210 area, consists of gently undulating *pāhoehoe* lava flows laid down sometime between 1,500 and 3,000 years ago (Wolfe and Morris 1996). These *pāhoehoe* flows possess very little in the way of surface soil, most of which consist of thin aeolian sediments that have accumulated in depressions and low-lying areas (soil type rLW in Sato et al. 1973:Map 85). The lava is scarred by upthrust pressure ridges, fissures, collapsed blisters, and lava sinks. Subsurface lava tubes and blisters are also present within the flow.

There is less than 750 millimeters (c. 29.5 inches) of rainfall in a year along this stretch of the Kona coast (Giambelluca et al. 1986). Due to the limited amount of rainfall, vegetation in the area is relatively sparse. The undisturbed *pāhoehoe* lavas within the Kona Commons property are vegetated in a ground cover of introduced fountain grass (*Pennisetum setaceum*), with occasional stunted *kiawe* (*Prosopis pallida*), and Christmas berry (*Schinus terebinthifolius*) trees, as well as *koa haole* (*Leucaena leucocephala*), klu (*Acacia farnesiana*), lantana (*Lantana camara*), and bougainvillea (*Bougainvillea spp.*) shrubs. Scattered native shrubs, such as *ʻuhaloa* (*Waltheria indica*), are also present, with Polynesian-introduced *noni* trees (*Morinda citrifolia*) growing out of lava sinks and other natural depressions in the terrain. During the pre-Contact period, the dominant vegetation throughout this area would most probably have been *pili* grass (*Heteropogon contortus*).

2.3 Cultural and Historical Background

The Site 30210, Feature B lava excavation is in the *ahupuaʻa* of Keahuolū, which follows the traditional *mauka* to *makai* (from the mountains to the sea) pattern, extending from the upper slopes of Hualālai to the coastal waters north of Kailua Bay. Keahuolū is bounded to the north by the *ahupuaʻa* of Kealakehe and to the south by the *ahupuaʻa* of Lanihaunui (large Lanihau, also referred to as Lanihau 1) and Honuaʻula 3.

The *ahupuaʻa* of Keahuolū possesses a rich cultural history that has been investigated in depth as part of the various cultural and archaeological studies undertaken for the Liliʻuokalani Trust by Pacific Legacy. A detailed narrative of the cultural and historical background of the *ahupuaʻa*, with emphasis on its coastal region, is provided in the supplemental archaeological inventory survey report of the Kona Commons property (McIntosh et al. 2015:11–50), and the reader is directed to that report, as well as the archaeological inventory survey of the property conducted by Paul H. Rosendahl Ph.D., Inc. in 1992 (O'Hare and Rosendahl 1993), for a more in-depth background to the area. The following provides a brief overview of the cultural history of the Kona Commons property.

2.3.1 Traditional Settlement

Archaeological studies and historic research suggest that the primary centers of population within the *ahupuaʻa* of Keahuolū during the pre-Contact period were located at the coast and in the well-watered uplands. Although coastal residences were strung along the shoreline, situated near small bays and canoe landings, the main areas of coastal settlement seem to have been located at the small crescent bays of Halepaʻo and Pawai (also known as Papawai, according to

Clark 2003:287), as well as along the sandy beach immediately south of Pawai in the area known as Makāʻeo. The area surrounding Site 30210, located inland of these coastal settlements, appears to have been used for temporary occupation and use during the pre-Contact period (see McIntosh et al. 2015).

2.3.2 Post-Contact Period

In the early years following Western contact, little changed in the lives of the inhabitants of coastal Keahuolū. With time, however, the introduction of foreign diseases for which the *kamaʻāina* (native-born residents) possessed no natural resistance, as well as population shifts caused by changing economic conditions resulted in a general decrease in the coastal population of the *ahupuaʻa*. Despite this general population decline, the fishing settlements of Pawai and Makāʻeo continued to be occupied by local *ʻohana* (families) into the 1940s when the village of Makāʻeo and its attendant coconut grove was destroyed to make way for the Kona Airport (Clark 1985:110; McIntosh et al. 2015:25–28).

At the time of the Mahele ʻĀina (land division) of the 1840s, the entire *ahupuaʻa* of Keahuolū was awarded to the *aliʻi wahine* (chiefess) Analea (Ane) Keohokālole under Land Commission Award 8452: Apana 12 (Royal Patient 6851). Only six smaller *kuleana* claims were awarded to *makaʻāinana* (commoners) within the *ahupuaʻa* of Keahuolū. All of these were located in the upland portion of the *ahupuaʻa*, well away from the coast. Two historic-era trails (the Māmalahoa Trail and a smaller horse trail) are known to have crossed the Kona Commons property during the post-Contact period. As with the pre-Contact period, there does not appear to have been any permanent occupation on the property during the post-Contact period. Development of the Kona Commons for commercial purposes only took place after 1992.

2.4 Archaeological Background

The *ahupuaʻa* of Keahuolū has been the subject of several archaeological investigations beginning in the first decade of the twentieth century, when Bishop Museum archaeologist John F.G. Stokes began documenting the *heiau* (shrines) of Hawaiʻi Island (Stokes 1991). The earliest investigations formed part of larger regional or island-wide surveys, and as a result were not as detailed as later studies. These initial surveys were concentrated along the coast, which was the main area of settlement during the pre-Contact period. A detailed review of these early archaeological studies, as well as those later investigations undertaken within the broader *ahupuaʻa* as a whole, is provided in the SAIS report of the Kona Commons property (McIntosh et al. 2015:51–69). The following sections provide information on the two most recent archaeological studies undertaken within the Kona Commons property, which are the most relevant with regards to the Site 30210 complex, as well as previous studies in the adjacent Urban Phase III project area, a portion of which is within the Makalapua Project District.

2.4.1 PHRI Inventory Survey of the Kona Commons Project Area, 1992

In 1992, Paul H. Rosendahl Ph.D., Inc. (PHRI) conducted an AIS of the 100-acre Kona Commons property (O'Hare and Rosendahl 1993). The 1992 survey identified a total of 18 archaeological sites containing 38 component features (Figure 4). These sites included a segment of the historic Māmalahoa Trail, as well as lava excavations, modified outcrops, filled depressions, stone alignments, stone mounds, terraces, walls, hearths, walled overhangs, an enclosure, a modified depression, a cairn, a cave shelter, and a lava tube burial (O'Hare and Rosendahl 1993:ii). The 1992 inventory did not identify the Site 50-10-27-30210 complex. The

1992 AIS provided substantial evidence of human activity within the Kona Commons project area during the pre-Contact period. These activities, however, all appear to have been primarily short-term in nature, undertaken by individuals visiting or passing through the area rather than residing within it.

2.4.2 Pacific Legacy Supplemental Archaeological Inventory Survey of the Kona Commons Project Area, 2014

In 2014, Pacific Legacy, Inc. conducted an SAIS of the Kona Commons property (McIntosh et al. 2015) that included both the original 100 acres surveyed by PHRI in 1992 and an additional 10 acres extending off of its southwest corner in the area formerly occupied by the Swing Zone driving range (Figure 5). This SAIS was undertaken to assist the Lili'uokalani Trust in planning for the future development of the area. The purpose of this survey was to assess the current state of the historic properties initially identified during the 1992 survey and to determine if any additional historic properties existed on the property.

During the course of the SAIS, 11 archaeological sites consisting of 21 component features were identified. These sites consist primarily of small and crudely constructed features or modified natural features, including stone mounds, modified depressions, modified overhangs, C-shaped walls and alignments, small enclosures, a historic petroglyph, and a historic trail. Of the 11 sites identified, four had been previously recorded (SIHP 50-10-27-18502, 50-10-27-18508, 50-10-27-18509, 50-10-27-18511), while seven sites were newly identified (SIHP 50-10-27-30207, 50-10-27-30208, 50-10-27-30209, 50-10-27-30210, 50-10-27-30211, 50-10-27-30212, 50-10-27-30287). These features appear to have served a range of functions. Among these were temporary habitation, storage, travel, visual markers, possibly stone quarrying and/or crop cultivation (in the case of the lava excavations), communication (in the case of the historic petroglyph), and burial.

The results of the 2014 survey indicated that the majority of the sites located within the Kona Commons survey area dated from the pre-Contact period. Three sites, the Site 50-10-27-18502 modified depression, the Site 50-10-27-30211 petroglyph (which consists of two English letters, possibly representing personal initials), and the Site 50-10-27-30287 trail appeared to date from the post-Contact or modern periods. The remainder of the sites possessed a more traditional style of construction, suggesting that they were pre-Contact in age.

All of the sites identified during the 2014 survey appeared to have been associated with relatively short-term activities. Among these activities was the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, and burial crypts. Small stone enclosures and walled shelters appeared to have been erected to serve as temporary camping areas. Low stone mounds were built to serve as markers. Rough excavations were created in the lava surface, either to supply stone for the construction of nearby surface features, or to open pits that could be filled with mulch and used to grow dryland crops (McIntosh et al. 2015).

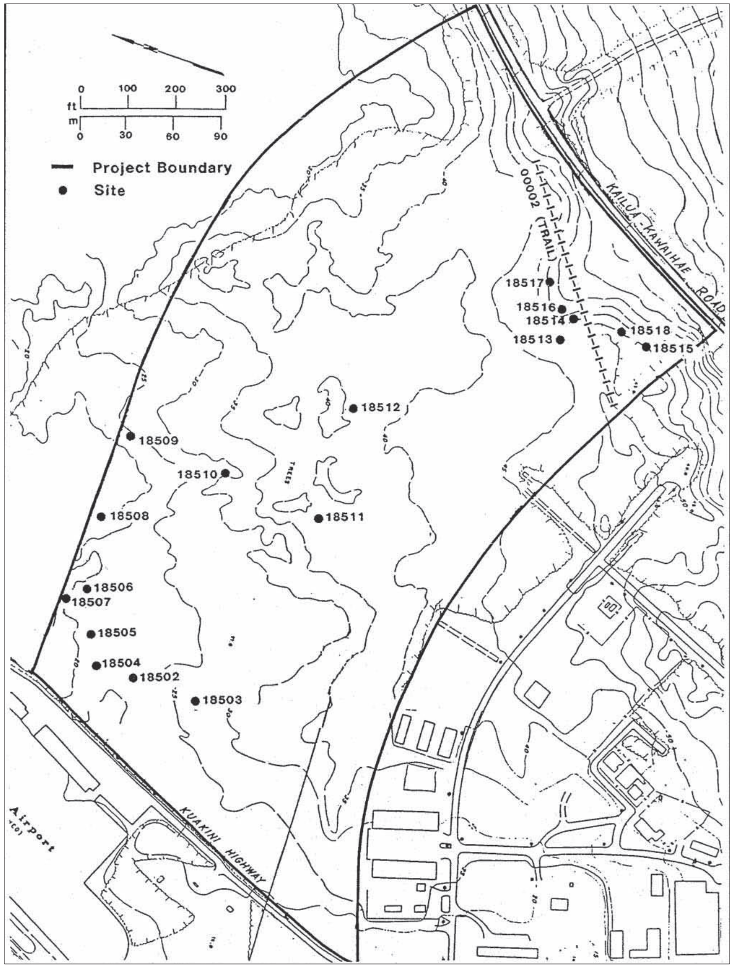

Figure 4. Relative locations of sites identified during the 1992 PHRI survey (O'Hare and Rosendahl 1993:Figure 2).

Figure 5. Aerial photograph showing sites documented during the 2014 SAIS in the Kona Commons survey area (base map: Esri World Imagery 2019).

2.4.3 Archaeological Surveys of the Urban Phase III Project Area

The Urban Phase III project area was the subject of a reconnaissance survey by the Archaeological Research Center Hawaiʻi (ARCH; Ching 1978), an Archaeological Inventory Survey (AIS) undertaken by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1989–1990 (Donham 1990), and an AIS undertaken by Pacific Legacy in 2011 (Reeve et al. 2019). Haun & Associates (Haun and Henry 2006) also completed an archaeological survey that included a road corridor through a portion of the Urban Phase III project area.

In 1978, Francis Ching of Archaeological Research Center Hawaiʻi, Inc. (ARCH) conducted a reconnaissance survey of 987 acres within the *ahupuaʻa* of Keahuolū. This survey covered much of the coastal portion of the *ahupuaʻa*, extending from the shoreline up to the Queen Kaʻahumanu Highway. The survey resulted in the recording of a total of 59 archaeological sites containing 140 individual component features. Nine of the sites appeared to be located within the Urban Phase III survey area.

In 1990, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an AIS and test excavations of sites situated within a 1,100-acre portion of Liliʻuokalani Trust lands within Keahuolū (Donham 1990). The designated survey area covered lands located both *mauka* and *makai* of the Queen Kaʻahumanu Highway. This survey was the most extensive archaeological investigation to be undertaken within the *ahupuaʻa* up to that time. Included within the survey was a 212-acre parcel located *makai* of the Kaʻahumanu Highway that had formed part of Ching's original 1978 survey area and included the Urban Phase III project area. The PHRI survey recorded a total of 239 sites (composed of 1,810+ component features) within its survey area. Of these, 55 sites were located within the 212-acre parcel located *makai* of Kaʻahumanu Highway, which roughly corresponds to the Urban Phase III project area. Among the numerous features documented within this portion of the 1,100-acre survey area were excavated areas within the *pāhoehoe* lava, stone mounds, rock walls, cave shelters containing marine shell midden, stone platforms and terraces, and petroglyphs.

In 2006, archaeologists from Haun & Associates conducted an archaeological inventory survey of the proposed Kona Kai Ola project, which consisted of two parcels encompassing a total of ca. 370.5 acres in the *ahupuaʻa* of Kealakehe located immediately north of coastal Keahuolū (Haun and Henry 2006). Their survey area also included a road corridor that extended south into Keahuolū and crossed through the Urban Phase III project area. They identified eight sites within the Urban Phase III road corridor, one of which had been previously recorded during the 1990 PHRI survey (Site 50-10-27-13271), while the remaining seven were assigned new State Inventory of Historic Places site numbers (Sites 50-10-27-25644 to 50-10-27-25650). The sites identified within the Keahuolū corridor consisted of stone alignments, stone mounds, and a lava blister.

In 2011, Pacific Legacy, Inc. conducted an AIS for the Urban Phase III project, which included the recording of 120 archaeological sites containing 214 component features (Reeve et al. 2019). The survey also identified and recorded the locations of 540 lava excavations. Excavations of this type were distributed throughout the survey area. While each lava excavation was individually recorded, all were grouped together under one State Inventory of Historic Places site number: SIHP 50-10-27-29175. These lava excavations bring the total number of sites recorded up to 121.

Of the 121 sites identified in the Urban Phase III project area during the 2019 AIS, 36 had been previously recorded, either during the 1978 ARCH reconnaissance survey (seven sites, four of which had been assigned new site numbers by the 1990 survey; Ching 1978), the 1990 PHRI inventory survey (27 sites and five lava excavations; Donham 1990), or the 2006 Haun & Associates survey (six sites; Haun and Henry 2006). A total of 85 sites were newly identified during the 2019 AIS (Reeve et al. 2019).

Nine of the sites documented in 1978 by the Archaeological Research Center Hawaiʻi (Ching 1978) reconnaissance survey appear to have been located within the limits of the present survey area. Only two of these sites were positively re-identified during the 2011 AIS. Five additional sites (one of which may be a lava excavation) were tentatively identified. The remaining two sites were not re-located and appear to have been destroyed, as they were recorded in the area formerly occupied by the Swing Zone driving range.

During the course of the 2011 survey, an effort was also made to re-locate and re-identify all of the structural features recorded during the 1990 PHRI survey and the 2006 Haun & Associates survey. The 2011 survey was able to identify 36 of the 55 sites that were previously documented during the 1990 PHRI inventory survey. Five of these sites (SIHP 50-10-27-13276, 50-10-27-13277, 50-10-27-13285, 50-10-27-13296, and 50-10-27-13352) were lava excavations and were recorded under SIHP 50-10-27-29175. It also re-located seven sites recorded by Haun & Associates (along with two features possessing site tags with temporary site numbers, most likely assigned by the 2006 survey, that did not appear on the final site map). Several of the sites recorded during the 1990 survey that were not re-identified during the 2011 survey consist of what the 1990 survey report refers to as "pahoehoe excavations" and which the 2011 survey identified simply as "lava excavations." Some of the sites recorded during the 1990 survey were located toward the southeastern corner of the survey area. These sites were likely destroyed by ground-disturbing activities associated with the transformation of the Old Kona Airport into a beach park and the construction and landscaping of the Swing Zone driving range. All 14 of the sites containing petroglyphs that were documented by Stasack and Stasack (2012) were re-located during the 2011 survey. An additional four sites containing petroglyphs were also documented.

Within the current Makalapua Project District, the complex of modified collapsed sinks (State Inventory of Historic Places [SIHP] No. 50-10-27-13260) and enclosure (SIHP 50-10-27-13261) were identified during the PHRI AIS and were re-identified and recorded in detail during the 2011 AIS. The report of the 2011 AIS was reviewed by the Hawaiʻi State Historic Preservation Division (SHPD) and its findings and recommendations were accepted in 2019 (Appendix A).

2.4.4 Identified Sites within the Makalapua Project District

Many of the sites identified during previous surveys of the Kona Commons and Urban Phase III project areas appear to have been associated with relatively short-term activities. Among these activities is the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, water catchment areas, and burial crypts. Small stone enclosures and walled shelters were likely erected to serve as temporary habitation areas or small shrines (*heiau*). People traveled across these areas on trails, low stone mounds were built to serve as markers, and concentrations of petroglyphs were created to mark *wahi pana* (storied places) or trails that people used to traverse the landscape. Rough excavations were created in the lava surface, to supply stone for the construction of nearby surface features, to provide birds with nesting areas, or to open pits that could be filled with mulch and used to grow dryland crops.

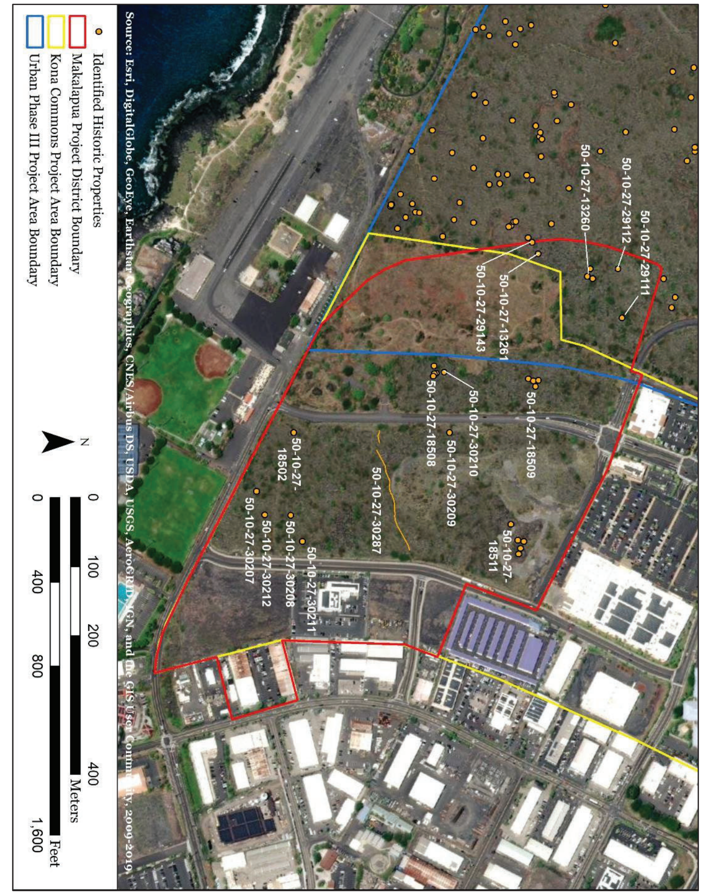

Figure 6. Locations of previously identified sites in the Makalapua Project District and in the adjacent portion of the Urban Phase III Project Area (base map: Esri World Imagery 2021).

Table 1. Summary of Historic Properties Identified within the Makalapua Project District, Recorded during AIS and SAIS of Kona Commons and Urban Phase III Project Areas

SIHP #	Site/Feature Type	Significance	Treatment	Study
50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work/ Data Recovery	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/ No Further Work/ Burial Treatment	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30287	Trail, petroglyph	d, e	Preservation	Kona Commons SAIS (McIntosh et al. 2015)

3.0 SITE 50-10-27-30210 DESCRIPTION AND RECOMMENDATIONS

3.1 SITE DESCRIPTION

The following section provides a detailed description of Site 50-10-27-30210. This description is summarized from the full description included in the report of the 2014 SAIS of the Kona Commons property (McIntosh et al. 2015:137–141).

Site 50-10-27-30210 is a complex consisting of four individual features: a modified overhang (Feature A), a lava excavation (Feature B), a C-shaped wall (Feature C), and an enclosure (Feature D). The site is located at the central southwestern portion of the 2014 Kona Commons project area, approximately 60 meters west of Makala Boulevard and just east of the former Swing Zone driving range.

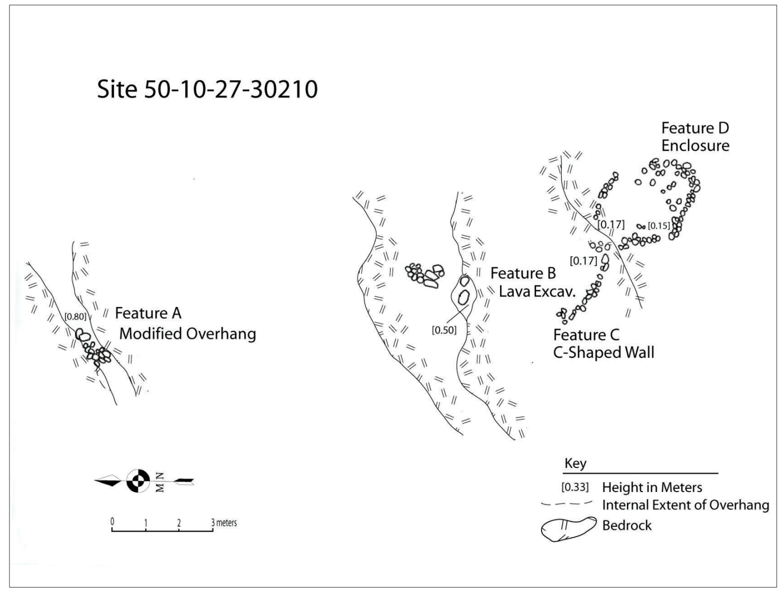

Figure 7. Plan-view map of the Site 50-10-27-30210 complex.

Feature A
Site 50-10-27-30210, Feature A is a small modified overhang located at the northern portion of the complex. The overhang is formed by a partially collapsed lava blister and is oriented roughly east to west, with the opening facing north (Figure 8). Angular basalt boulders and cobbles have been stacked to the southwest of the overhang, narrowing the opening. The interior is covered in loose rubble with no soil. The modified overhang measures c. 1.5 m in length, is c. 2 m deep and has a maximum height of c. 0.6 m. The overhang appears too small to have served as a temporary shelter, and may have been used as a storage area during the pre-Contact period. It is in fair condition.

Feature B
Site 50-10-27-30210, Feature B, which is the subject of the present data recovery plan, is a lava excavation located at the central portion of the Site 50-10-27-30210 site complex, approximately 10.9 m south (169°) from the Feature A modified overhang. The Feature B lava excavation is situated near the top of a low knoll of *pāhoehoe* lava. It is irregular in shape and measures approximately 1.3 m in length (NE–SW) by c. 0.75 m in width (NW–SE), and has a maximum depth of 0.37 m (Figure 9). Located within the interior of the excavation is a single basalt boulder measuring 0.6 by 0.35 m. Several other basalt boulders that appear to have originally been removed from the lava excavation are loosely piled less than 1 m north of the feature. A small amount of soil and organic debris from fountain grass was noted on the floor of the lava excavation. No cultural material was observed within or surrounding the feature. It seems likely that the Feature B lava excavation was created during the traditional period, either as a quarry for building stone or as a small planting area (the large stone having fallen or been placed in its interior after abandonment). The feature's function is uncertain.

Feature C
Site 50-10-27-30210, Feature C is a C-shaped wall located in the southern portion of the complex, ca. 2 m south (174°) of the Feature B lava excavation. It is constructed on a relatively level surface of *pāhoehoe* lava. The wall consists of a single course of basalt cobbles, but it appears originally to have consisted of two or more courses in height in some sections (Figure 10). The C-shaped wall is open to the northeast and measures c. 2.2 m long (east to west) by 1.2 m deep (north to south), with a maximum height of 0.12 m. No cultural material was observed at this feature. This low windbreak wall was most likely utilized as a temporary shelter during the pre-Contact period. It is in poor condition.

Feature D
Site 50-10-27-30210, Feature D is a small enclosure located at the southern end of the complex. It is ca. 1 m southwest (134°) of Feature C. Feature D appears to have originally been roughly circular in shape, but a number of stones from its eastern wall are presently scattered throughout the interior (Figure 11). The enclosure wall is made of small to medium subangular basalt boulders, cobbles, and *pāhoehoe* slabs. These stones may have been loosely stacked or piled, but now are mostly tumbled. The number and size of the stones along the eastern section of the wall suggests that this portion was originally slightly higher than the others and may have been positioned to block the force of the prevailing wind. Several of the *pāhoehoe* slabs in this area may have been set upright and supported by smaller stones. The northwestern edge of the enclosure wall incorporates a raised section of *pāhoehoe* lava bedrock (c. 0.17 m in height). The Feature D enclosure measures c. 3.20 m in length (east to west) by 2.90 m in width (north to south), with a maximum height of 0.20 m. No cultural material was observed within or surrounding this feature. The structure likely served as a temporary windbreak shelter built and used during the pre-Contact period. It is in relatively poor condition.

Figure 8. Site 50-10-27-30210, Feature A modified overhang (view to south).

Figure 9. Site 50-10-27-30210, Feature B lava excavation (view to northeast).

Figure 10. Site 50-10-27-30210, Feature C, C-shaped wall (view to southwest).

Figure 11. Site 50-10-27-30210, Feature D, enclosure (view to southwest).

The Site 50-10-27-30210 complex appears to represent a short-term campsite consisting of two temporary windbreak shelters (Features C and D), a small possible storage area (Feature A), and an excavation in the *pāhoehoe* lava (Feature B) that may have served either as a quarry for stones used in the construction of the nearby shelters or as a soil-filled planting area for a dryland crop such as *ʻuala* (sweet potato, *Ipomoea batatas*).

Low stone-walled enclosures and C-shaped walls are common features in other areas of coastal Keahuolū (Reeve et al. 2009:48, Reeve et al. 2016:176–183). These structures are almost always constructed on patches of relatively smooth and level *pāhoehoe* lava and are generally relatively small in area. As with Site 30210, Features C and D, these structures do not possess an associated stone-lined hearth or other evidence of cooking, nor do they contain any midden remains or other surface cultural materials. This lack of associated features and cultural remains seems to confirm their temporary nature.

It seems probable that these low walled features were constructed as temporary windbreak shelters by individuals traveling across or working in the area. Their relatively small size and rough construction indicate that they were structures of convenience, built relatively quickly and occupied on a short-term basis. These features, unless they were somehow roofed over with palm fronds, a mat, or some other material, would only have provided protection from the wind and not from the sun. The level stretches of *pāhoehoe* lava on which they were constructed would have served to reflect the sun and increase the heat. For this reason, they do not appear to be inviting spots to rest during the day. At night, however, with the residual heat radiating up from the lava and a *pāhoehoe* slab wall to block the wind, they might (with the addition of a flooring of cut *pili* grass) provide comfortable sleeping areas. The size of most enclosures suggests that they were built to shelter a single individual. They are too small to have served as much more than simple sleeping areas.

3.2 Assessment of Site Significance

The 2014 SAIS report assessed each of the sites documented during the survey as to their significance under criteria defined in Hawaiʻi Administrative Rules (HAR) §13-284-6. This system is patterned after the Secretary of Interior's standards as outlined in 36 Code of Federal Regulations §60.4 and is meant to provide a framework for the evaluation of historic property significance. All of Site 50-10-27-30210 was found to be significant under Criterion d as having "yielded, or may be likely to yield, information important in prehistory or history" (McIntosh et al. 2015:174–175).

3.3 Recommendations

Of the eleven sites documented during the 2014 SAIS, eight were recommended for no further work. The Site 50-10-27-18511, Feature C burial lava tube was recommended for preservation due to the presence of *iwi kūpuna*, or human remains (McIntosh et al. 2015). A detailed Burial Treatment Plan (BTP) outlining how the *iwi kūpuna* will be protected has been reviewed by the Hawaiʻi Island Burial Council and has been reviewed and accepted by the State Historic Preservation Division (Reeve and Cleghorn 2019; Log No. 2019.01526; Doc. No. 1911CJO01; see Appendix B). The Site 50-10-27-30287 trail was recommended for preservation and interpretation. It was proposed that one of the more visibly distinct segments of the trail be preserved with interpretive signage and is part of a forthcoming Preservation Plan for the Makalapua Project District.

As Site 50-10-27-30210, Feature B was the only lava excavation within the 2014 survey area found to contain traces of remnant soil, SHPD requested that the soil be excavated and analyzed for the presence of microbotanical remains. This will help to determine whether the feature served as a quarry or a planting area. The 2014 SAIS report noted that, while the information obtained during the survey adequately documented Site 50-10-27-30210, Feature B, it was recommended data recovery excavations be undertaken and soil samples collected.

> Data Recovery is being recommended for Site T-005, Feature B, the only lava excavation identified during the present survey as containing soil. Previous archaeological researches have suggested a number of possible functions for lava excavations. This type of feature may have been created during quarrying activities to obtain building material for nearby sites, they may be the result of "prospecting" for lava tubes that could be used for shelters or storage areas, or they may have been created to open up shallow depressions in the lava that could then be filled with mulch and utilized as planting areas. While the information obtained during the present survey can be said to adequately document the Site 50-10-27-30210, Feature B lava excavation, it is recommended that as part of data recovery activities the lava excavation be excavated and soil samples collected. The resulting soil samples should be submitted for pollen, phytolith and starch analyses. Such analyses may indicate the presence or absence of pollen or starch grains from cultigens such as *ʻuala* (*Ipomoea batatas*, sweet potato). Microbotanical remains identified as belonging to *Ipomoea batatas* have been recovered from shallow lava excavations located further north along the Kona coast in the *mauka* portion of the *ahupuaʻa* of Kaʻūpūlehu (Cleghorn and McIntosh 2013:14). These finding[s] would appear [to] support the proposition that at least some lava excavations were used in the pre-Contact period for crop cultivation. If similar analyses are conducted on soil samples collected from Site 50-10-27-30210, Feature B, similar, or at least comparative results, may be forthcoming.
>
> The results of pollen and phytolith analyses from samples collected during data recovery at Site 50-10-27-30210, Feature B could help to shed light on the question of whether some of the lava excavations within the present project area did indeed serve as planting areas. It is also recommended that comparative baseline samples be taken from shallow soil deposits located outside of the lava excavation in areas not well suited for direct cultivation. If *ʻuala* (sweet potato) pollen or starch grains are also found in these baseline samples, this may indicate that such micro-botanical remains do not necessarily derive from plants grown in situ, but could have originated elsewhere and been deposited by natural agencies such as the wind or water. A detailed Data Recovery Plan (mitigation plan) will need to be submitted to the State Historic Preservation Division for review and approval prior to the initiation of any data recovery investigations. (McIntosh et al. 2015:179)

4.0 RESEARCH OBJECTIVES

The primary objective of the data recovery research to be undertaken at Site 50-10-27-30210, Feature B is to provide further information regarding the function of lava excavations, and specifically what activities were carried out at lava excavations. The data recovery investigation will further assess the role lava excavations had as part of temporary habitation complexes in the Kona region.

4.1 Lava Excavations

Shallow excavations into the surface of the lava are among the most ubiquitous and enigmatic archaeological features encountered in coastal Keahuolū and elsewhere in the lava plains of Hawaiʻi Island. Such features are often associated with loose piles or scatters of lava boulders that appear to represent the material removed during the excavation. The 1992 AIS referred to these features as "pahoehoe excavations." Surveys conducted in other areas of Keahuolū (Reeve et al. 2009:45), as well as in other parts of North Kona (such as Makalawena, see Reeve et al. 2014:68), have encountered these excavations on both *pāhoehoe* and *ʻaʻā* lava flows (though less commonly on *ʻaʻā*). For this reason, it seems appropriate to refer to them simply as lava excavations.

Lava excavations were found scattered throughout the Kona Commons project area as well as elsewhere along the Kona coast, often in spatial association with temporary habitation features. While more often encountered in the vicinity of other features, some excavations are relatively isolated with no surviving surface structures located anywhere nearby. The typical lava excavation consists of a patch of *pāhoehoe* (or, in more limited instances, *ʻaʻā*) lava that has been battered until the surface layer fractures. The broken pieces, which often take the form of angular or tabular blocks, can then be extracted, leaving a shallow, flat-bottomed depression. On occasion, small lava blisters have been broken open to create a shallow depression in the lava. Excavations also occurred along the base of lava ridges where the breaking up of the lava revealed shallow overhangs. The resulting loose rubble has often been removed from the excavation and either piled around its edges or apparently taken away for use elsewhere. In some cases, at least some of this rubble has fallen or been placed back into the excavation, partially covering the floor. In areas closer to the coast, it is not unusual to encounter one or more waterworn basalt boulders within or near a lava excavation. Such stones usually exhibit signs of battering at one or both ends. It seems likely that these boulders were utilized as large hammerstones to break up the lava so that blocks of it could be removed.

Various explanations have been put forward to explain the creation of these excavations, which occur throughout the lava lands of the Kona and Kohala districts and inland as far as Pōhakuloa in the saddle between Mauna Kea and Mauna Loa (Nakamura et al. 1998:112). Their relative abundance suggests that they served some definitive purpose(s). The 1990 report of PHRI surveys conducted within other portions of Keahuolū proposed that some of these lava excavations may have been utilized as quarries for the acquisition of building material, while others were created to act as shallow depressions which could be filled with mulch and used as small planting areas for the cultivation of crops (Donham 1990:19). The use of lava excavations as quarries was initially proposed in 1972 by Moore and Bevacqua, who recorded some 230 pits in the *ahupuaʻa* of Waikoloa (Moore and Bevacqua 1972). They suggested that the upper layers of the excavated *pāhoehoe* were used to fashion lava abraders, while the lower layers were used for building material (Moore and Bevacqua 1972:18–20).

It has also been suggested that lava excavations, particularly those located in the uplands at places such as Pōhakuloa, were created to serve as nesting areas for ground-nesting seabirds, such as shearwaters or the *ʻuaʻu* (dark rumped petrel, *Pterodroma sandwichensis*), whose eggs or juveniles could then be harvested for food (Nakamura et al. 1998:116). This theory, that lava excavations were created and used as artificially enhanced nesting areas, is interesting in that it proposed the intentional localization of a usually dispersed resource and the first steps in what might be considered the semi-domestication of wild birds. Some possible support for this theory was found at the *ahupuaʻa* of Maniniʻowali and Kukiʻo 2 in North Kona, where over 1,200 excavated *pāhoehoe* pits were recorded (Dye 2002:95–96). A small number of pits (19 in all) were found to contain gravel-sized pieces of pumice, which were interpreted as having been digested and excreted by seabirds.

In some cases, it would appear that the purpose of the excavation was to find and open a natural overhang at the base of a lava ridge. Most of these overhangs are too small to have served as temporary shelters. In the uplands, these overhangs could have served as nesting sites for the *ʻuaʻu*, though this is less likely along the coast. Seabirds are also somewhat particular about the size and shape of the lava overhangs they choose as nesting sites. Such nesting areas are low-roofed and narrow, extending back far enough (a meter or more) that the bird feels safe. Most of the coastal lava excavations that open overhangs are much larger and shallower, which would make them unsuitable as nesting areas.

An alternate proposal, that lava excavations were created for use as planting pits, was put forward by William Barrera as early as 1971 (Barrera 1971:60). This theory has been proffered by a number of researchers (Carter 1986, Hammatt et al. 1987, and O'Hare and Goodfellow 1994), though most have suggested multiple uses for these features. Tom Dye has argued that traditional cultivation in excavated pits was only undertaken in areas of *ʻaʻā* lava, and that the marginal environments in which they are found and their sporadic distribution would argue against their agricultural use. The meager amount of crops that could be produced would not have warranted the apparent intensive effort involved in creating the pits themselves (Dye 2002:96).

If lava excavations were used for the cultivation of *ʻuala* and other dryland crops, the pits would need to have been filled with soil or vegetative mulch. Most coastal lava excavations possess little if any internal sediment. This general lack of interior soil could be taken as an indicator that these features were not utilized for the cultivation of crops, though it is also possible that the original sediment has been blown or washed away. Recent analysis of soil samples taken from lava excavations located in the *ahupuaʻa* of Kaʻūpūlehu, North Kona, revealed the presence not only of Poaceae *Heteropogon*-type pollen, which might indicate the expected presence of *pili* grass (*Heteropogon contortus*), but also of *Ipomoea batatas*-type pollen, suggesting that the excavation may have been used for the cultivation of *ʻuala* (Cleghorn and McIntosh 2013:14).

This evidence for the use of lava excavations as planting pits may be supported by ethnohistoric accounts. There exist references in the ethnographic literature that describe the use of mulch in the growing of crops on "bare lava." One such reference appears the writings of botanist William Hillebrand, who was a resident of the Hawaiian Islands from 1850 to 1870. In his book *Flora of the Hawaiian Islands*, Hillebrand remarked that, "The natives of Puna, Hawaii raise good crops of sweet-potatoes in the hollows and cracks of bare lava by simply covering the budding sprigs with decayed leaves and herbs" (Hillebrand 1981 as cited in Ladefoged et al. 1987).

Missionary Chester Lyman describes such plantings which he encountered while visiting the Kamoamoa area of the Puna District.

> We passed a potato patch in the broken lava which exceeded anything I had seen. Not a particle of soil was anywhere to be seen, and the holes dug among the stones to receive the potatoes were some of them 6 feet in depth – thus securing a degree of moisture and shelter from the sun – though no more soil than on the surface. (Emory et al. 1959:24)

In describing the dryland cultivation of *kalo* (taro, *Colocasia esculenta*) and *ʻuala* on the island of Hawaiʻi, the Hawaiian-language newspaper *Ka Nupepa Kuokoa*, in an article published on March 24, 1922, makes reference to mulch being placed within "hollows made on the *pāhoehoe*."

> Another way of doing this [planting dryland *kalo* (taro) or ʻ*uala* (sweet potato)] was to rot weeds where the soil was good and then carry them to fill the hollows made on the *pāhoehoe* and then plant whatever plants he chose. O my reader, the proofs of these are on Hawaiʻi. There are the *pāhoehoe* lava beds walled in by the ancestors, in which sweet potatoes and sugar cane were planted and they are still growing today. (cited in Handy et al. 1972:131–132)

This reference would appear to suggest that lava excavations, similar to those encountered in the Kona Commons project area, may have been mulched and planted with either *kalo* or *ʻuala* during both the pre-Contact and early historic periods.

In order to further test the hypothesis that some lava excavations were created to serve as planting pits, additional soil sampling and microbotanical analyses need to be undertaken at lava excavations. The only lava excavation within the Kona Commons project area that was found to contain a small amount of soil was Site 50-10-27-30210, Feature B. It was for this reason that the 2014 SAIS report recommended that Site 30210, Feature B be excavated and soil samples be collected from the sediment within it. These samples would then be sent out for pollen, phytolith, and starch analyses to determine the presence or absence of any traditional cultigens. If pollen, phytolith, or starch remains from any dryland crops such as *kalo* or *ʻuala* are recovered, then this evidence could be taken as suggesting that the Site 50-10-27-30210, Feature B lava excavation was used during the pre-Contact and/or early post-Contact periods as a planting area.

In instances such as at Site 50-10-27-30210, Feature B, *ʻuala* could be planted in a lava excavation filled with mulch so that sweet potato tubers might be available for consumption by individuals camping out at the site. The purpose of conducting data recovery operations at Site 50-10-27-30210, Feature B is to test the viability of this scenario.

4.2 Data Needed to Address Research Objectives

In order to address the research objectives presented above, data recovery operations at Site 50-10-27-30210, Feature B would need to acquire samples of sediment from within the floor of the lava excavation. This can be done through a program of controlled excavation as described in Section 5.

5.0 METHODS

Data recovery of the Site 50-10-27-30210, Feature B lava excavation will involve mapping, controlled excavation, soil sampling, and subsequent laboratory analyses.

5.1 Field Methods

5.1.1 Mapping

The 2014 SAIS prepared a map of the surface structures that constitute Site 50-10-27-30210 (Figure 7). Prior to the start of data recovery excavations, a large-scale detailed tape and compass map will be drafted of the Site 50-10-27-30210, Feature B lava excavation itself.

5.2 Laboratory Analyses

All materials collected during the course of data recovery will be transported to Pacific Legacy's Oʻahu laboratory for processing, identification, and detailed analysis. Cultural materials will be thoroughly cleaned in the laboratory and appropriate metric attributes will be recorded. Analysis of recovered materials will include sorting, identification, labeling, and curation.

If any midden is recovered, it will be taxonomically identified to the greatest degree possible, sorted as to recognizable taxa, weighed, analyzed, and entered onto a site midden table.

If any artifacts are recovered, they will be cleaned, identified, measured, weighed, described, photographed, cataloged, and analyzed for function and chronological patterns. An artifact table will be prepared if necessary.

If, during the course of excavation, any charcoal is recovered from secure contexts, it will be submitted for radiocarbon dating. Prior to submission for radiometric analyses, the charcoal sample will be submitted for taxa identification. The purpose of this analysis is to determine the presence or absence of post-Contact introduced wood and to differentiate between short-lived and long-lived species (short-lived species are better indicators of the true date at which a piece of wood was burned). Selected charcoal samples (if any are recovered) will then be sent to Beta Analytic Radiocarbon Dating Laboratory. The results of radiocarbon analyses of the sample(s) will be included in the final archaeological data recovery report.

Soil sample(s) collected from sediment present within the lava excavation will be submitted to Dr. Mark Horrocks at Microfossil Research Limited in Auckland, New Zealand for pollen, phytolith, and starch analyses.

5.3 Reporting

Upon completion of all fieldwork and laboratory analyses, an archaeological data recovery report will be prepared in accordance with the requirements outlined in HAR §13-278-4.

5.4 Curation

All field records (descriptions, notes and photographs) resulting from the present study, as well as all cultural materials and soil samples collected during data recovery excavations, will be temporarily housed in the Pacific Legacy Kailua, Oʻahu office. These will be provided to the landowner, Liliʻuokalani Trust, once the project has been completed.

5.4.1 Excavation

Controlled subsurface excavations will be conducted at Site 50-10-27-30210, Feature B. These excavations will encompass the entire interior of the pit. The excavation will be fully and systematically documented.

The excavation will be undertaken in 5 centimeter (cm) arbitrary levels within natural layers, and all excavated materials (with the exception of soil samples) will be sieved through nested ¼-inch and ⅛-inch mesh screen. Observations will be recorded on standard Pacific Legacy excavation forms. The pit will be photographed before, during, and after excavation.

Initially, the sediment within one half of the pit will be removed and screened. A stratigraphic profile will be drawn of the exposed face of the interior sediment. The profile will be described in conformance with Munsell Color Notation and U.S. Department of Agriculture (USDA) references (Natural Resources Conservation Service 1995). Soil sample(s) will then be collected from within the exposed face. The number of soil samples collected will depend upon the depth of the sediment.

If any artifacts recovered in situ, their three-dimensional locations will be recorded in relation to the excavation datum, and plan-views maps will be drafted of artifact locations and cultural features. If any midden materials (bone, marine shell, and cultural organics) or natural materials such as pumice or coral are collected from the screen, they will be bagged according to the level within the natural layer. Any charcoal found in secure contexts will be collected for wood identification and radiocarbon dating.

The lava excavation will be completely excavated so that the base of the excavation can be carefully examined for any potential scars from the extraction of raw materials and the base of excavation will be documented using photography and three-dimensional LiDAR scanning.

6.0 SUMMARY

This archaeological data recovery plan was prepared to satisfy the requirements of Section 3 of Hawai‘i Administrative Rules Chapter 13-278 (HAR §13-278, Rules Governing Standards for Archaeological Data Recovery Studies and Reports). The data recovery plan describes Site 50-10-27-30210 and the lava excavation that forms Feature B of this site. Feature B was recommended for data recovery operations by the SHPD and that recommendation was incorporated in the 2014 SAIS for the Kona Commons project area (McIntosh et al. 2015:179).

Data recovery excavations are being conducted at Site 50-10-27-30210, Feature B in order to further test the hypothesis that lava excavations within the coastal Kona region were created to serve as planting pits for dryland crops. Data recovery at Site 30210, Feature B will involve controlled excavation of the sediment present within the interior of the pit and the collection of soil samples from within this sediment. These sample(s) will then be submitted for pollen, phytolith, and starch analyses to determine the presence or absence of any traditional cultigens.

If pollen, phytolith, or starch remains from dryland crops such as *kalo* or *‘uala* are recovered, then this evidence could be assumed to suggest that the Site 50-10-27-30210, Feature B lava excavation was used during the pre-Contact and/or early post-Contact periods as a planting area. If no pollen, phytolith, or starch remains are recovered, this would suggest that the Site 30210 Feature B lava excavation was not used for agricultural activities. If debitage or other artifacts are recovered from the excavations, it may suggest that the excavation was used for the extraction of basalt for building materials. If the lava excavation contains gravel-sized pieces of pumice, this may suggest it functioned as a nesting area for birds.

The data recovery investigations described herein will provide insights into the function of lava excavations in the Kona region and will explore their use by the occupants of spatially associated temporary habitation features like those present at Site 50-10-27-30210. If the Feature B lava excavation contains evidence of use as an agricultural feature, it would indicate that people created a food source that would be available in close proximity to their temporary habitation features. If stone resource extraction is evidenced, this might suggest that people built temporary habitation features adjacent to resource-rich areas. If evidence for bird nesting is found, this may provide insights into bird hunting practices in the region.

This archaeological data recovery plan will be approved by the SHPD prior to the start of data recovery activities.

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APPENDIX A

SHPD ACCEPTANCE LETTERS: KONA COMMONS SAIS REPORT, URBAN PHASE III AIS REPORT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555

August 11, 2015

Dr. Paul L. Cleghorn, Senior Archaeologist
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LOG NO: 2015.02142
DOC NO: 1508MV17
Archaeology

Subject: **HRS Chapter 6E-42 Historic Preservation Review -**
Supplemental Archaeological Inventory Survey of the 110 Acre
Queen Liliuokalani Trust Kona Commons Parcel
Keahuolu Ahupua'a, North Nona District, Island of Hawai'i
TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022

Thank you for the opportunity to review the revised draft report titled: *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolu, North Kona, Island of Hawai'i TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022* (J. McIntosh, T. Lizama, R. Reeve, J. Cleghorn and P. Cleghorn May 2015). This document was received by our office on June 1, 2015. This survey was undertaken in order to supplement the previous archaeological survey undertaken Rosendahl (1992). The survey utilized a 100% pedestrian survey with transects spaced at 10-15 meters. In addition, excavation in the form of test borings was conducted in five locations. The archaeological survey documented a total of 11 archaeological sites comprised of 20 component features in the project area. Four of these historic properties a modified depression (SIHP 50-10-27-18502), a modified overhang (SIHP 18508), a complex (SIHP 18509), and a complex that contains a burial feature (SIHP 18511) were previously recorded during the Rosendahl (1992) archaeological survey. However, it is important to note that previously unrecorded features of SIHP 18509 (feature D) and 18511 (features D and E) were newly identified during the current supplemental inventory survey. In addition to these features, the supplemental AIS identified and recorded 6 previously unrecorded historic properties. The newly recorded historic properties include: a lava excavation (SIHP 30207), a stone mound (SIHP 30208), an enclosure (SIHP 30209), a complex (SIHP 30210), a petroglyph (SIHP 30211), a C-shaped alignment (SIHP 30212) and a trail (SIHP 30287). With the exception of the burial feature (SIHP 18511fea. C) that is assessed as significant under criteria D and E, all of these sites have been assessed as significant under criteria D only. The report indicates that SIHP 18511fea. C and SIHP 30287 have been recommended for preservation, SIHP 30210 fea. B has been recommended for Data Recovery and the remaining sites are recommended for no further work. SHPD agrees with the significance assessments and treatment recommendations presented in this report. We believe that the entire trail (SIHP 30287) should be preserved until it can be confirmed with Na Ala Hele whether or not this trail is eligible for inclusion as a state trail. However it is possible that the trail may be breached in accordance with an approved preservation plan. The changes that were made to the report are the result of the SHPD review of a previous draft (Log No. 2015.04866, Doc No. 1503MV20). The report has been revised in response to the SHPD review of a previous draft of this report (Log 2012.3111, Doc. 1210MV40). The revisions and explanations have adequately addressed our concerns. This report meets the requirements of Hawaii Administrative Rule (HAR) §13-276 and is accepted. Please send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office. Please contact Mike Vitousek at (808) 692-8029 or Michael.Vitousek@hawaii.gov for any questions or concerns relating to this letter.

Aloha,

Mike Vitousek

Michael Vitousek,
Lead Archaeologist Hawaii Island Section
Historic Preservation Division

DAVID Y. IGE
GOVERNOR OF
HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

September 9, 2019

IN REPLY REFER TO:
Log No.: 2019.01679
Doc. No.: 1909AM05
Archaeology

Michael Shibata, Development Manager
Lili'uokalani Trust
1100 Alakea Street Suite 1100
Honolulu HI 96813
Email: mshibata@onipaa.org

Dear Mr. Shibata:

SUBJECT: **Hawaii Revised Statutes (HRS) Chapter 6E-42 Historic Preservation Review – Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands Keahuolū Ahupua'a North Kona District Island of Hawai'i TMK: (3) 7-4-008:002 por.**

This letter provides the State Historic Preservation Division's (SHPD's) review comments concerning the report titled *Revised Draft Archaeological Inventory Survey of Urban Phase III Parcel Queen Lili'uokalani Trust Lands in Keahuolū, North Kona Island of Hawai'i [TMK: (3) 7-4-008:002 por.]* (Reeve et al., July 2019). The SHPD received this revised draft on July 31, 2019. Previously, the SHPD requested revision of the initial draft in a letter dated August 16, 2018 (Log No. 2016.00071, Doc. No. 1808SL04).

Pacific Legacy, Inc., conducted the archaeological inventory survey (AIS) in support of the of the Lili'uokalani Trust (LT) Urban Phase III project, for which a master plan is being prepared for future residential, commercial, and civic/community areas, and open space. The Urban Phase III project area, totaling 213 acres, is owned by LT, a non-profit organization dedicated to the welfare of Hawai'i's children. The Urban Phase III project will involve grubbing, grading, and trench excavation for building construction and installation of utilities.

The letter that accompanies this revised draft AIS report also mentions a separate project, the Makalapua Project District (MPD) project, whose project area totals approximately 67.2 acres and includes multiple TMK parcels. An *Environmental Impact Statement* is being prepared for the MPD, which will create residential, hotel, retail, commercial, office, and civic/community areas.

The 213-acre Urban Phase III project area is bounded on the southwest by the old Kona Airport, now a State Recreation Area; on the northwest by a 628-acre conservation parcel belonging to LT; on the northeast by Queen Ka'ahumanu Highway; and on the southeast by the Kona Commons Shopping Center and undeveloped land along Makala Boulevard. The project area begins a short distance north of the north edge of the Kailua-Kona town core.

Previous correspondence concerning earlier, related projects, cited and summarized in the current AIS report (page 100) includes the following, concerning the Keahuolū project, as proposed at the time of Paul H. Rosendahl, Ph.D., Inc.'s AIS (PHRI 1994) and AMP (PHRI 1993):

- March 5, 1993 – SHPD to PHRI (Log No. 6851, Doc. No. 9303RC03), limiting data recovery to two sample blocks plus a few sites outside the project area;
- June 10, 1993 – PHRI to SHPD (not available);

- July 28, 1993 – DLNR to Belt, Collins & Associates (Log No. 8976, Doc. No. 9307RC40), stating that June 10, 2993, addendum to mitigation plan was not received; and
- December 21, 1993 – DLNR to PHRI (Log No. 10383, Doc No. 9312RC30), accepting sampling strategy for mitigation phase.

More recent correspondence in SHPD's files concerns archaeological studies conducted in support of shoreline-improvement removal in the LT Keahuolū campgrounds. The following letters were sent to Pacific Legacy:

- March 15, 2012 – SHPD's review letter (Log No. 2010.2686, Doc. No. 1203TD09) accepting campgrounds AIS report, and agreeing with recommendations for preservation of 87 sites, and data recovery for 235 sites;
- April 2, 2014 – SHPD's review letter (Log No 2014.0913, Doc. No. 1404MV01), accepting an archaeological monitoring plan for the campgrounds project; and
- June 3, 2015 – SHPD's review letter (Log No. 2015.01602, Doc. No. 1506MV14), accepting archaeological monitoring report for campgrounds project.

One additional letter, also to Pacific Legacy, concerns an AIS of the 25-acre LT Historic Preserve Area, adjacent to the current project area:

- March 23, 2012 – SHPD's review letter (Log No. 2012.0682, Doc. No. 1203MV33), accepting an AIS report that documents 96 archaeological sites containing 489 features. Twenty-three of the sites had been recorded earlier; 73 are newly identified. Significance is recommended for the entire preserve under Criteria a, c, d, and e; listing on the National Register of Historic Places (NRHP) is also recommended.

The current AIS identified 121 sites, 36 previously recorded and 85 newly identified. These consist of State Inventory of Historic Places [SIHP] Sites 50-10-27-13256 through 13258, 13260 through 13262, 13269, 13271, 13272, 13274, 13275, 13280 through 13282, 18286 through 13288, 13293, 13294, 13298 through 13302, 13351, 13353, 13386, 25655, 25644, 25646 through 25649, and 29088 through 29176. Of these, one site, Site 29175, consists of 540 excavated lava pits.

The 121 historic sites documented during the current AIS survey are assessed for site integrity and for significance according to Hawaii Administrative Rules (HAR) §13-284-6 Criteria a-e. All the sites are considered significant for their information content (Criterion d). Six sites are considered significant for their distinctive characteristics or high artistic value (Criterion c). Twenty-one sites are considered significant for their cultural importance to the Native Hawaiian community (Criterion e). The four sites considered significant under Criterion e include probable small shrines, a lava tube containing human skeletal remains, possible burial mounds, and 17 petroglyph fields.

SHPD agrees with the project effect determination of "Effect, with agreed upon mitigation commitments." The agreed upon mitigations includes no further work for 83 sites (120 features), mitigative archaeological data recovery for 28 sites (40 features), preservation (conservation) for 20 sites (55 features), and burial treatment for Site 50-10-27-18511. Mitigation plans will include a data recovery plan, a preservation plan, and archaeological monitoring plan for the project, and a burial treatment plan.

No Further Work

Sites 50-10-27-13256, 13257, 13258, 13269, 13271, 13272, 13282, 13286, 13288, 13293, 13298, 13300, 13301, 13302, 13351, 25644, 25646, 25647, 25648, 29089, 29093, 29094, 29096, 29097, 29099, 29100, 29101, 29102, 29103, 29104, 29105, 29106, 29107, 29108, 29109, 29110, 29111, 29112, 29113, 29114, 29115, 29116, 29117, 29119, 29120, 29121, 29122, 29123, 29126, 29127, 29128, 29129, 29131, 29132, 29133, 29134, 29136, 29137, 29138, 29139, 29140, 29141, 29143, 29145, 29146, 29147, 29151, 29153, 29154, 29155, 29156, 29157, 29161, 29162, 29163, 29164, 29166, 29169, 29171, 29172, 29173, 29174, and 29176.

Data Recovery

Sites 50-10-27-13258, 13262, 13272, 13274, 13280, 13351, 13386, 25649, 29088, 29095, 29099, 29104, 29118, 29124, 29125, 29130, 29135, 29144, 29146, 29148, 29149, 29150, 29152, 29158, 29165, 29168, 29170, and 29175.

Mr. Shibata
September 9, 2019
Page 3

Preservation

Sites 50-10-27-13260, 13261, 13272, 13274, 13275, 13280, 13281, 13287, 13294, 13299, 13353, 29090, 29091, 29092, 29098, 29142, 29144, 29159, 29160, and 29167.

The AIS report meets the requirements of HAR §13-276-5. **It is accepted.** Please send two hard copies of the document, clearly marked FINAL, and a text-searchable PDF version, to the Kapolei office, attention SHPD Library. Additionally, please include a copy of this acceptance letter with the hard copies of the report.

Pursuant to HAR §13-284-3, Steps (1) through (4) of the historic preservation review process are complete. As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "Effect, with agreed upon mitigation commitments," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD looks forward to receiving for review and acceptance, a data recovery plan meeting the requirements of HAR §13-278-4, an archaeological preservation plan meeting the requirements of HAR §13-277, and an archaeological monitoring plan meeting the requirements of HAR §13-279-4 for the current project and a Burial Treatment Plan (BTP) for Site 50-10-27-18511.

SHPD shall notify the County and the Liliʻuokalani Trust when the afore-mentioned mitigation plans have been reviewed and accepted and the permit issuance process may proceed.

Please contact Andrew McCallister, Archaeologist III, at (808) 692-8010 or at Andrew.McCallister@hawaii.gov if you have any questions, or if we can be of assistance in any way.

Aloha,

Alan Downer

Alan S. Downer, Ph.D.
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: daryn.arai@hawaiicounty.gov
cleghorn@pacificlegacy.com
mulrooney@pacificlegacy.com
planning@hawaiicounty.gov
sean.p.naleimaile@hawaii.gov

APPENDIX B

SHPD ACCEPTANCE LETTER FOR THE BURIAL SITE COMPONENT OF A PRESERVATION PLAN FOR SIHP 50-10-27-18511,

EFFECT DETERMINATION LETTER REQUESTING A DATA RECOVERY PLAN, PRESERVATION PLAN, AND ARCHAEOLOGICAL MONITORING PLAN FOR THE MAKALAPUA PROJECT DISTRICT

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
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
KAHO'OLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

November 08, 2019

Queen Liliʻuokalani Trust
C/O Mana Purdy
74-5490 Makala Blvd.
Kailua-Kona, HI 96740

LOG NO: 2019.01526
DOC NO: 1911CJO01

Aloha e Mr. Purdy,

SUBJECT: **DRAFT Burial Treatment Plan for Site #50-10-27-18511, Liliʻuokalani Trust Lands in Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi, TMK: (3) 7-4-025:015.**

We apologize for the delay of this notification. At its monthly meeting on October 17, 2019, the Hawaiʻi Island Burial Council (HIBC) made the determination to preserve in place the above burial site, SIHP #50-10-27-18511. Additionally, the HIBC recommended that the State Historic Preservation Division (SHPD) accept the DRAFT Burial Treatment Plan.

Following the recommendation of the HIBC, the *DRAFT Burial Treatment Plan for Site #50-10-27-18511, Liliʻuokalani Trust Lands in Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi, TMK: (3) 7-4-025:015* is accepted by the SHPD. Please change the title from "DRAFT Burial Treatment Plan" to "Burial Site Component of a Preservation Plan" and submit hard copies of the final version with a copy of this letter and a text-searchable PDF CD to both our Kapolei and Hilo offices.

Should you have any further questions or concerns, you may contact our Hawaiʻi Island Burial Sites Specialist, Christian Omerod, at (808) 294-9573 or Christian.Omerod@Hawaii.gov.

Mahalo,

Hinano Rodrigues

Mr. Hinano Rodrigues, B.A., J.D.
History & Culture Branch Chief

CC: Mara Mulrooney, Pacific Legacy, Inc.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
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M. KALEO MANUEL
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AQUATIC RESOURCES
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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

July 26, 2022

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2207NM07
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District
Additional Consultation Regarding Archaeological Sites
Request for Concurrence with Effect Determination
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por., (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi request for concurrence with a determination of effect for the Makalapua Project District (MPD) and the supporting document titled *Additional consultation regarding archaeological sites located in the Liliʻuokalani Trust Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi, TMK: (3) 7-4-008:002 por., (3) 7-4-025:001-003, 005, 012, 015, (3) 7-4-010:009, 010* (Mulrooney, April 2022). Liliʻuokalani Trust (LT) is proposing the development of the MPD which is a 67.2-acre property. The County of Hawaiʻi has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original submittal on March 25, 2019 (Log No. 2019.00636). The current submittal was received on April 21, 2022 and includes a letter from Pacific Legacy (archaeological consultant) regarding the additional consultation that was requested by SHPD on July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05). Previous SHPD correspondence related to this project is provided in the Attachment.

The County of Hawaiʻi Planning Department letter, on behalf of Liliʻuokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; and 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD:

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was conducted for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

The County's letter identifies the previously agreed-upon mitigation commitments that still need to be addressed for documented historic properties in the MPD:

1. Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
2. Archaeological data recovery of Site 50-10-27-30210 Feature B;
3. Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261 (enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
4. Archaeological monitoring during ground disturbing construction activities.

The Attachment below includes a summary of the SHPD correspondence associated with the current MPD project. In a letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05), SHPD indicated that previously

requested items #1-4 had been completed but request item #5, additional consultation, was still needed. The recent letter from Pacific Legacy to SHPD dated April 21, 2022, includes the additional consultation efforts which were conducted between August 2021 and April 2022 and included consultation with the Ala Kahakai Trail Association, Nā Ala Hele Trail and Access, and cultural descendant Nicole Lui. The additional consultation resulted in assessing trail Site 50-10-27-30287 as additionally significant under Criterion "e" and changing the site mitigation from partial preservation to preservation with agreed upon potential breaches. During consultation, representatives from Ala Kahakai Trail Association and Nā Ala Hele Trail and Access recommended a 30-ft.-wide buffer from the outer edges of the trail. Nicole Lui agreed with the current 10-foot buffer on either side of the trail. Additionally, a petroglyph associated with the trail was identified during trail clearing and it will be added to the archaeological preserve.

Based on the additional consultation efforts, SHPD agrees with (1) Site 50-10-27-30287 being additionally assessed significant under Criterion e, (2) the preservation of Site 50-10-27-30287 being changed from partial to full preservation with allowance for agreed-upon breaches, and (3) preservation of the newly identified petroglyph. Lastly, SHPD indicates that the additional consultation efforts conducted by Pacific Legacy (August 2021 to April 2022) meet the requested item #5 detailed in SHPD's letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05).

SHPD's effect determination is "Effect, with agreed upon mitigation commitments" for the current project. As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "Effect, with agreed upon mitigation commitments," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD looks forward to receiving for review and acceptance a data recovery plan for Site 50-10-30210, Feature B meeting the requirements of HAR §13-278-3; a preservation plan meeting the requirements of HAR §13-277 for Site 50-27-13260, Site 50-10-27-13261, Site 50-10-27-18511 Feature A, Feature B, Feature D and Feature E, and Site 50-10-27-30287; and an archaeological monitoring plan meeting the requirements of HAR §13-279-4. Please upload a text-searchable PDF version of each document and their associated filing review fee to HICRIS Project No. 2020PR34163, in response to the new attachment request.

SHPD shall notify the County and LT when the mitigation commitments have been completed and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Alan Arakawa, aarakawa@onipaa.org
Mana Purdy, mpurdy@onipaa.org
Mara Mulrooney, mulrooney@pacificlegacy.com
Krickette Pacubus, pacubas@pacificlegacy.com
Lauren Morawski, laurenm@oha.org
Kamakana Ferreira, kamakanaf@oha.org
Jackson Bauer, jackson.m.bauer@hawaii.gov
Rick Gmirkin, rick_gmirkin@nps.gov

Attachment
SHPD Project Correspondence

November 8, 2019
Subsequent to the County's letter, the Hawai'i Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019. Additionally, the HIBC recommended that SHPD accepted the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

February 27, 2020
In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] that the two un-surveyed subject parcels within the MPD project area needed the following:

1. Additional investigation that includes a literature review and field inspection and;
2. that site integrity and site significance assessments for sites within the MPD be updated following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals.
3. Following completion of #1 and #2, SHPD concur with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

June 25, 2020
In a letter dated June 25, 2020 (Log No. 2020.000607, Doc. No. 2006SN05), SHPD accepted the field inspection report and determined the #1 request in the previous letter was adequately addressed; however, the additional information (#2) regarding the site integrity, site significance assessments and mitigation commitments for the 15 sites in the MPD project area had not yet been addressed.

September 4, 2020
Pacific Legacy, Inc. sent a letter dated September 4, 2020 (Log No. 2020.02056) to SHPD to address SHPD concerns. The submittal indicated consultation efforts were conducted by Pacific Legacy Inc., at the request of SHPD and on behalf of the Lili'uokalani Trust. Based on the additional consultation, Lili'uokalani Trust recommended that no changes to the site integrity and significance assessments or mitigation commitments are necessary for any of the 15 identified sites in the Makalapua Project District.

March 29, 2021
In a letter dated March 29, 2021 (Project No. 2020PR34163, Doc. No. 2103NM08), SHPD responded to the previous letter and requested the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.
5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

July 21, 2021
In a letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05), SHPD indicated that requested items 1-4 had been completed but request #5, additional consultation, was still needed.

SHPD ACCEPTANCE LETTER FOR DATA RECOVERY PLAN DATED DECEMBER 20, 2022

APPENDIX G-1

JOSH GREEN, M.D.
GOVERNOR | KE KIAʻĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIAʻĀINA

STATE OF HAWAII | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

December 20, 2022

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2212NM06
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District Data Recovery Plan
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por.; (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi Makalapua Project District (MPD) and the supporting document titled *Archaeological Data Recovery Plan for SIHP 50-10-27-30210, Feature B Liliʻuokalani Trust Lands in the Ahupuaʻa of Keahuolū, North Kona District, Island of Hawaiʻi, [TMK: (3) 7-4-008:002 (por.,) (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015]* (Mulrooney and Cleghorn, December 2022). Liliʻuokalani Trust (LT) is proposing the development of the 67.2-acre MPD property. The County of Hawaiʻi has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original submittal on March 25, 2019 (Log No. 2019.00636). The current submittal was received on December 19, 2022, and includes a revised data recovery plan (DRP) with an attached letter from Pacific Legacy (archaeological consultant). The DRP was originally submitted on August 10, 2022, and SHPD requested revisions on October 19, 2022. Previous SHPD correspondence related to this project is provided in the Attachment.

The County of Hawaiʻi Planning Department letter, on behalf of Liliʻuokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; and 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD:

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi*

[TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was conducted for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

In a letter dated July 26, 2022 (Project No. 2020PR34163, Doc. No. 2207NM07), SHPD made a project effect determination of "Effect, with agreed upon mitigation commitments," and requested an archaeological monitoring plan, an archaeological data recovery plan, and an archaeological preservation plan for the proposed project.

The DRP (Mulrooney and Cleghorn, December 2022) indicates that data recovery will consist of hand excavation, soil sampling, and laboratory analysis at Site 50-10-27-30210, Feature B. The excavation will consist of the entirety of the feature. The research objectives include identifying additional information regarding lava excavations and the activities carried out at the site along with the role lava excavations had as part of temporary habitation complexes in the Kona region. Research techniques will include cultural material analyses, radiocarbon analysis of short-lived species from documented contexts (if recovered), and soil samples submitted for pollen, phytolith, and starch analyses. All recovered materials will be temporarily housed at the Pacific Legacy office in Kailua, Oʻahu office until the project is complete. The permanent curation will be decided by the landowner in consultation with SHPD once the project is complete.

The DRP (Mulrooney and Cleghorn, December 2022) meets the requirements of HAR §13-278-3. **It is accepted.** Please send two hard copies of the document, clearly marked FINAL, along with a text-searchable PDF copy of the document and a copy of this acceptance letter to the Kapolei SHPD office, attention SHPD Library. Additionally, please upload a text-searchable PDF version of the document to HICRIS Project No. 2020PR34163 in response to the HICRIS request and send a PDF copy to lehua.k.soares@hawaii.gov.

SHPD herby notifies the County that the DRP has been accepted and **SHPD looks forward to** receiving for review and acceptance an archaeological data recovery report for Site 50-10-27-30210, Feature B that meets the requirements of HAR §13-278-4.

SHPD shall notify the County and LT when the additional mitigation commitments have been completed and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawaiʻi Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,
Susan A. Lebo
Signed For
Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Alan Arakawa, aarakawa@onipaa.org
Mana Purdy, mpurdy@onipaa.org
Mara Mulrooney, mulrooney@pacificlegacy.com
Krickette Pacubus, pacubas@pacificlegacy.com
Lauren Morawski, laurenm@oha.org
Kamakana Ferreira, kamakanaf@oha.org
Jackson Bauer, jackson.m.bauer@hawaii.gov
Rick Gmirkin, rick_gmirkin@nps.gov

POST-FIELD SUMMARY REPORT FOR DATA RECOVERY INVESTIGATIONS AT SIHP NO. 50-10-27-30210, FEATURE B DATED MAY 18, 2023

APPENDIX G-2

Pacific Basin — Oʻahu
146 Hekili Street, Suite 205
Kailua, HI 96734

Phone: 808.263.4800
Fax: 808.263.4300
www.pacificlegacy.com

May 18, 2023

Mr. Bryan Esmeralda
Liliʻuokalani Trust
1100 Alakea Street, Suite 1100
Honolulu, HI 96813

RE: Post-Field Summary Report of Data Recovery Investigations at SIHP 50-10-27-30210, Feature B in the Makalapua Project District, Liliʻuokalani Trust Lands, Keahuolū, North Kona, Hawaiʻi Island [TMK: (3) 7-4-008:002 (por.)]

Dear Mr. Esmeralda:

Pacific Legacy, Inc., at the request of Liliʻuokalani Trust (LT), conducted archaeological data recovery excavations at SIHP 50-10-27-30210, Feature B in the Makalapua Project District, located within portions of the Kona Commons and Urban Phase III project areas within the *ahupuaʻa* (land division) of Keahuolū in the district of North Kona on the island of Hawaiʻi [TMK: (3) 7-4-008:002; (3) 7-4-010:009 and 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021] (Figure 1). SIHP 50-10-27-30210 is situated in the western portion of the project area within TMK: (3) 7-4-008:002 on undulating *pāhoehoe* lava (Figure 2).

Data Recovery Investigations

Archaeological data recovery investigations were conducted between May 10 and 11, 2023. Pacific Legacy archaeologists Caleb Fechner, B.A. and James McIntosh, B.A. conducted the field investigations while Mara A. Mulrooney, Ph.D. served as Principal Investigator. The data recovery excavations were conducted in accordance with the data recovery plan (Mulrooney and Cleghorn 2023), which was reviewed and accepted by SHPD on December 20, 2022 (Project No. 2020PR34163, Log No. 2019.00636, Doc. No. 2212NM06).

Site Description

SIHP 50-10-27-30210, Feature B is a lava excavation (Figure 3) located at the central portion of the SIHP 50-10-27-30210 site complex, approximately 10.9 m south (169°) from the Feature A modified overhang. The Feature B lava excavation is situated near the top of a low knoll of *pāhoehoe* lava. It is irregular in shape and measures approximately 1.3 m in length (NE–SW) by 0.75 m in width (NW–SE) and has a maximum depth of 0.37 m (Figure 4). Located within the interior of the excavation was a single basalt boulder measuring 0.6 by 0.35 m. Several other basalt boulders that appear to have originally been removed from the lava excavation are loosely piled less than 1 m north of the feature. During the AIS, a small amount of soil and organic debris from fountain grass was noted on the floor of the lava excavation and no cultural material was observed within or surrounding the feature. It seems likely that the Feature B lava excavation was created during the pre-Contact period, either as a quarry for building stone or as a small planting area (the large stone having fallen or been placed in its interior after abandonment). The feature's function was documented as uncertain in the AIS report for the Kona Commons Project Area (McIntosh et al. 2015).

Excavation Results

Prior to the start of data recovery excavations, the feature was cleared of fountain grass. A scaled hand-drawn plan map of the feature was produced using a tape and compass. The feature location was recorded using GPS. Geospatial data was recorded in the field using a handheld Trimble R1 GNSS receiver to submeter precision, differentially corrected in real time and subsequently uploaded to ArcGIS Online. GNSS positions were collected in the field as Esri shapefiles with a WGS 1984 Web Mercator (auxiliary sphere) projection. Terrestrial LiDAR was also used to record the feature (collected via the 3D Scanner App on an iPhone 14 Pro Plus).

The large columnar basalt boulder present in the center of the feature was removed (Figure 5 and Figure 6). The interior portion of the lava excavation was bisected in half with a centerline down the middle prior to excavation (north/south). The soil surface of the excavation was approximately 45 cm below datum prior to the start of the data recovery excavations. The eastern half of the excavation unit was excavated using a trowel and dustpan (Figure 7). All soil from the northeastern half of the feature was screened and examined for the presence of cultural material. Two golf balls were removed from the unit. No traditional cultural material was identified. Soil in the northeastern half was thin, less than 6 cm thick and consisted of a single stratigraphic layer of soil (Layer I). No profile was recorded. The southwestern half of the unit was then excavated in a similar fashion (Figure 8).

Soil deposition was minimal with only a single soil layer (Layer I) identified measuring a maximum of 7 cm thick. This layer consisted of very dark brown clay loam (10YR 2/2) with abundant organic material and fragments of broken basalt. No other archaeological material was observed.

A single soil sample was collected from the southwestern half of the unit and was not screened. The soil sample from Layer I was collected for potential paleoethnobotanical analysis. All other excavated soil was screened through 1/8" sieve directly into a 5-gallon bucket. Following the completion of data recovery investigations, the soil was placed back into the lava excavation.

Summary

Data recovery excavation at SIHP 50-10-27-30210, Feature B did not identify any extensive archaeological materials or subsurface features. The current function of the feature has not yet been determined and will depend on the results of the paleoethnobotanical analysis. A full data recovery report (DRR) meeting the requirements of HAR §13-278-4 is forthcoming and will be submitted to SHPD via HICRIS Project No. 2020PR34163 for review and acceptance.

Please do not hesitate to contact me via email or phone if you have any questions regarding our ongoing work for this project.

Sincerely,

Mara A. Mulrooney Ph.D.
Principal and Senior Archaeologist

Attachment: Figures

cc: Paka Davis, Liliʻuokalani Trust
Alan Arakawa, Liliʻuokalani Trust
Nicole Mello, SHPD
Sean Naleimaile, SHPD
Susan Lebo, SHPD

References

McIntosh, J., T. Lizama, R. Reeve, J.K. Cleghorn, and P.L. Cleghorn
2015 *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 Por.; (3) 7-4-025:001–003, 005, 007, 010–022].* Pacific Legacy, Inc., Kailua.

Mulrooney, M.A. and P.L. Cleghorn
2023 *Archaeological Data Recovery Plan for SIHP 50-10-27-30210 Feature B, Liliʻuokalani Trust Lands in the Ahupuaʻa of Keahuolū, North Kona District, Hawaiʻi Island [TMK: (3) 7-4-008:002 (por.)].* Pacific Legacy, Inc., Kailua.

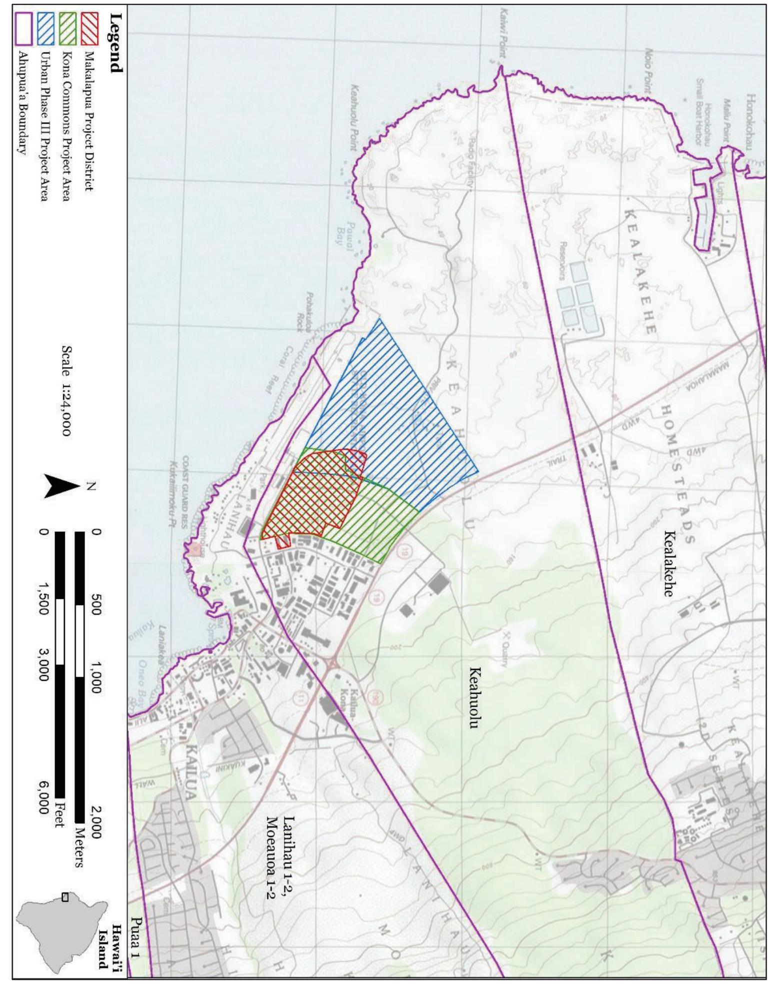

Figure 1. Location of the Makalapua Project District, Kona Commons Project Area, and Urban Phase III Project Area plotted on USGS Keahole and Kailua Quadrangles (1993).

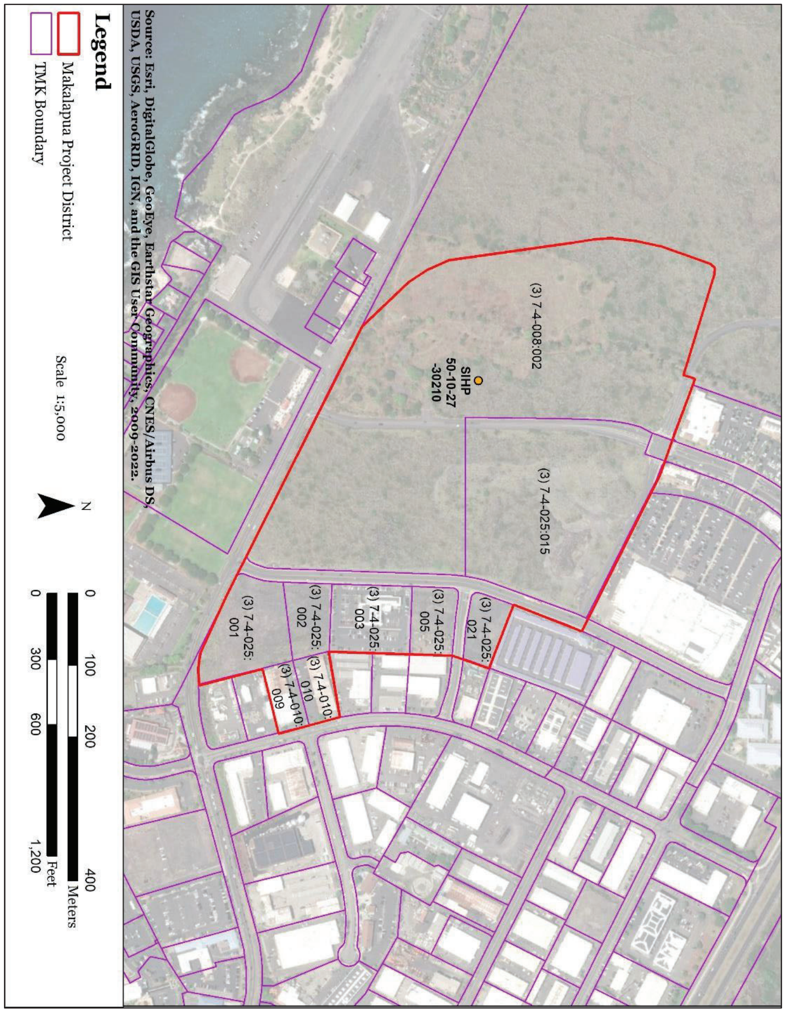

Figure 2. Makalapua Project District showing the location of SIHP 50-10-27-30210 overlaid on TMK parcels.

Figure 3. Location of SIHP 50-10-27-30210, Feature B prior to excavation (view to northeast).

Figure 4. SIHP 50-10-27-30210, Feature B after clearing (view to northeast).

Figure 5. SIHP 50-10-27-30210, Feature B after removal of large basalt boulder on the left (view to northeast).

Figure 6. SIHP 50-10-27-30210, Feature B lava excavation prior to data recovery (plan view).

Figure 7. SIHP 50-10-27-30210, Feature B lava excavation, bisected data recovery unit following excavation of northeastern portion of feature (plan view).

Figure 8. SIHP 50-10-27-30210, Feature B lava excavation following full excavation (plan view).

SHPD ACCEPTANCE LETTER FOR END-OF-FIELDWORK REPORT OF DATA RECOVERY INVESTIGATIONS AT SIHP NO. 50-10-27-30210, FEATURE B, DATED OCTOBER 5, 2023

APPENDIX G-3

STATE OF HAWAII | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

October 5, 2023

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2310NM01
Archaeology

Zendo Kern, Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Hawaii Revised Statutes (HRS) §6E-42 Historic Preservation Review –**
Makalapua Project District End-of-Fieldwork Report of Data Recovery Investigations
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por.; (3) 7-4-010:009, 010; (3) 7-4-025:001, 002, 003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi Makalapua Project District (MPD) and the supporting document titled *Post-Field Summary Report of Data Recovery Investigations at SIHP 50-10-27-30210, Feature B in the Makalapua Project District, Liliʻuokalani Trust Lands in the Ahupuaʻa of Keahuolū, North Kona District, Island of Hawaiʻi, [TMK: (3) 7-4-008:002 (por.)]* (Mulrooney, May 2023). Our office received the document on May 19, 2023.

The County of Hawaiʻi Planning Department, on behalf of the Liliʻuokalani Trust (LT), has provided the SHPD with a cover letter dated March 15, 2019 describing the proposed project and the County's HRS §6E effect determination for the project. The SHPD received the original project submittal on March 25, 2019 (Log No. 2019.00636).

The LT proposes the development of the MPD which is a 67.2-acre property. The MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. Additional improvements may include a Kuakini Highway extension.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD. SHPD made a project effect determination of "Effect, with agreed upon mitigation commitments" for the project and requested an archaeological monitoring plan, an archaeological data recovery plan, and an archaeological preservation plan (July 26, 2022; Doc. No. 2207NM07). Subsequently, SHPD accepted the data recovery plan (December 20, 2022; Doc. No. 2212NM06), the archaeological monitoring plan (February 24, 2023; Doc. No. 2302NM06), and the archaeological preservation plan (March 6, 2023; 2303NM03). For previous SHPD correspondence related to this project see the Attachment in HICRIS Project No. 2020PR34163.

Data recovery efforts were conducted by Pacific Legacy Inc. on May 10-11, 2023, at Site 50-10-27-30210, Feature B. The site was mapped, and LiDAR was used to record the feature. Site 30210, Feature B was hand excavated with a trowel and no cultural material was identified. A soil sample was collected for paleoethnobotanical analysis.

The End-of-Fieldwork Letter Report (Mulrooney, May 2023) adequately documents the completion of data recovery investigations in accordance with the SHPD-accepted archaeological data recovery plan and as specified in HAR §13-

278-3. **It is accepted**. Within 6 months of the completion of archaeological data recovery work, SHPD looks forward to the opportunity to review and accept the detailed results of the data recovery for Site 50-10-27-30210, Feature B, meeting the requirements of HAR §13-278-4. When completed, please submit the report to SHPD via HICRIS Project No. 2020PR34163 using the Project Supplement option.

Pursuant to HRS §6E-42 and HAR §13-284-3(b)(1-5), LT has completed the first 5 of the 6 historic preservation review procedural steps. To address step 6, Verification of Completion, pursuant to HAR §13-284-3(b)(6) and HAR §13-284-9(d), LT proposes the following procedures and schedules:

- LT has implemented the interim and long-term protective measures specified in the SHPD-accepted burial site component of a preservation plan;
- LT has initiated the data recovery fieldwork in accordance with the SHPD-accepted data recovery plan;
- An end-of-fieldwork data recovery letter report was submitted to SHPD following the completion of data recovery fieldwork at Site 50-10-27-30210;
- Within 6 months after completion of the data recovery fieldwork, a data recovery report meeting the requirements of HAR §13-278-4 will be submitted to SHPD for review and acceptance;
- During the pre-construction period (tentatively scheduled for early 2026), LT will implement the archaeological monitoring plan pre-construction meeting so that all contractors are aware of the plan's requirements;
- During construction, LT will ensure compliance with all provisions in the archaeological monitoring plan;
- Following completion of construction, LT will submit within 6 months an archaeological monitoring report meeting the requirements of HAR §13-279-5 for SHPD review and acceptance.

Based on the above, SHPD indicates it has reviewed and commented on the effect of the proposed project pursuant to HRS §6E-42 and HAR §13-284-3; that it is SHPD's determination that LT has completed Steps 1 through 5 pursuant to HAR §13-284-3(b)(1-5), and that SHPD concurs with the procedures and schedule LT has proposed to complete Step 6 (verification of completion) per HAR §13-284-3(b).

SHPD hereby notifies the County that the permit issuance process may continue. Subsequently, SHPD will notify the County when a data recovery report meeting the requirements of HAR §13-278-4 and an archaeological monitoring report meeting the requirements of HAR §13-279-5 have been accepted and the HRS 6E historic review process will be completed.

Please contact Nicole A. Mello, Hawaiʻi Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Alan Arakawa, aarakawa@onipaa.org
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DRAFT DATA RECOVERY REPORT

APPENDIX

G-4

Pacific Legacy
Historic Preservation

DRAFT

DATA RECOVERY REPORT FOR
SIHP 50-10-27-30210, FEATURE B
LILIʻUOKALANI TRUST LANDS
IN THE AHUPUAʻA OF KEAHUOLŪ
NORTH KONA DISTRICT, HAWAIʻI ISLAND

[TMK: (3) 7-4-008:002 (por.);
(3) 7-4-010:009 and 010;
(3) 7-4-025:001, 002, 003, 005, 015, and 021]

Cultural Resources Consultants

Hawaiʻi Offices:
Kailua, Oʻahu

California Offices:
Business Office
Bay Area
Sierra/Central Valley

Pacific Legacy: Exploring the past, informing the present, enriching the future.

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DRAFT

**DATA RECOVERY REPORT FOR
SIHP 50-10-27-30210, FEATURE B
LILIʻUOKALANI TRUST LANDS
IN THE AHUPUAʻA OF KEAHUOLŪ
NORTH KONA DISTRICT, HAWAIʻI ISLAND**

**[TMK: (3) 7-4-008:002 (por.);
(3) 7-4-010:009 and 010;
(3) 7-4-025:001, 002, 003, 005, 015, and 021]**

Prepared by:
James McIntosh, B.A.,
Jillian A. Swift, Ph.D.,
and
Mara A. Mulrooney, Ph.D.

Pacific Legacy, Inc.
146 Hekili Street, Suite 205
Kailua, HI 96734
(808) 263-4800

Prepared for:
Liliʻuokalani Trust
1100 Alakea Street, Suite 1100
Honolulu, HI 96813

January 2024

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LIST OF FIGURES

LIST OF TABLES

Note: *In this report, the spellings and the use of diacritical marks (glottal stops and macrons) follow conventions issued by Pukui and Elbert (1986) and Pukui et al. (1974) with limited exceptions—spellings and diacritical marks are used as the original sources used them in quotations, titles, and proprietary names. For example, Pohakuloa Training Area is used without the macron in "Pohakuloa" because it is part of the name of the installation, but when referring to the region in general, the Hawaiian name "Pōhakuloa" is used.*

Cover Image: *A plan-view LiDAR image of SIHP 50-10-27-30210, Fe, B. lava excavation (view to north).*

MANAGEMENT SUMMARY

Reference	Data Recovery Report for SIHP 50-10-27-30210, Feature B, Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi. [TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009 and 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021] (McIntosh et al. 2024)
Date	January 2024 (DRAFT)
Project Number(s)	Pacific Legacy, Inc. Job Code: 3941.03 HICRIS Project No. 2020PR34163
Project Location	The project area is located within TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009 and 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021, Keahuolū Ahupuaʻa, North Kona District , Island of Hawaiʻi.
Project Description and Related Ground Disturbance	Data recovery investigations consisted of mapping, photography, and controlled excavation of the SIHP 50-10-27-30210, Feature B lava excavation. The purpose of data recovery was to investigate the nature and function of the lava excavation and to determine what role(s) lava excavations served for temporary habitation complexes in the Kona region. The feature was bisected and all soil was removed and screened through a 1/8" mesh sieve for the identification of archaeological materials. A single soil sample (MS1) was collected from the western half of the unit and submitted for microfossil (starch, pollen, and phytoliths) analysis.
Project Area Land Jurisdiction	Private, Liliʻuokalani Trust
Project Proponent	Liliʻuokalani Trust
Investigation Permit Number	Fieldwork for this data recovery was performed under Pacific Legacy's Hawaiʻi State Historic Preservation Division (SHPD) annual archaeological permit 23-04, issued per Hawaiʻi Administrative Rules (HAR) §13-282. Pacific Legacy's current permit for calendar year 2024 is 24-15.
Agency	State Historic Preservation Division (SHPD)
Project Area Acreage	67.2 acres
Document Purpose and Historic Preservation Regulatory Context	This document was prepared to support the project's historic preservation review under Hawaiʻi Revised Statutes (HRS) §6E-42 and to satisfy the requirements of Hawaiʻi Administrative Rules (HAR) §13-284. This document was designed to fulfill the State requirements for an archaeological data recovery report, in accordance with HAR §13-278-4. Archaeological data recovery was conducted in accordance with the project's accepted archaeological data recovery plan (DRP) (Mulrooney and Cleghorn 2023).
Fieldwork Effort	Fieldwork was conducted between May 10 and 11, 2023 by Pacific Legacy archaeologists Caleb Fechner, B.A. and James McIntosh, B.A. Fieldwork required four person-days to complete. All fieldwork was conducted under the general supervision of Mara A. Mulrooney, Ph.D. (principal investigator).
Excavation Results	Data recovery excavation at SIHP 50-10-27-30210, Feature B identified a single, thin layer of soil mixed with organic detritus. No archaeological materials were identified during the excavation. Microfossil analysis identified the presence of Polynesian-introduced cultivars (coconut, taro, and banana) as well as eggs from a parasite most commonly found in the small intestine of dogs (*Toxocara canis*). The mixed nature of the soil deposit and lack of charcoal or other materials suitable for chronometric dating poses some interpretive challenges. Nevertheless, the results of data recovery support the interpretation of a pre-Contact agricultural function for SIHP -30210, Feature B. Further, the results demonstrate the interpretive utility of microfossil analyses for testing potential agricultural features within the Kona region.

1.0 INTRODUCTION

Pacific Legacy, Inc., under contract to Liliʻuokalani Trust (LT), conducted archaeological data recovery investigations at SIHP 50-10-27-30210, Feature B in the Makalapua Project District (MPD), within the *ahupuaʻa* (land division) of Keahuolū, district of North Kona, island of Hawaiʻi [TMK: (3) 7-4-008:002; (3) 7-4-010:009 and 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021].

SIHP 50-10-27-30210 is a lava excavation located on LT lands within the Kona Commons project area, which was the subject of an archaeological inventory survey (AIS) by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1992 (O'Hare and Rosendahl 1993). A supplemental AIS (SAIS) was undertaken by Pacific Legacy in 2014 (McIntosh et al. 2015), during which a site complex of four features was identified and assigned State Inventory of Historic Places (SIHP) site number 50-10-27-30210. Three of the four features (Feature A, an overhang; Feature C, a C-shaped wall; and Feature D, an enclosure) were assessed as significant under criterion d and recommended for no further work. Feature B, a lava excavation, was assessed as significant under criterion d and recommended for data recovery. The SAIS (McIntosh et al. 2015) was accepted by the Hawaiʻi State Historic Preservation Division (SHPD) in 2015 (Log No. 2015.02142, Doc. No. 1508MV17, Appendix A). In 2019, the AIS report for the neighboring Urban Phase III project area, a portion of which is included in the Makalapua Project District, was accepted by SHPD (Log No. 2019.01679; Doc. No. 1909AM05; see Appendix A).

1.1 PROJECT DESCRIPTION

Liliʻuokalani Trust is proposing the development, enhancement, and refinement of approximately 67.2 acres of land that includes portions of the 110-acre Kona Commons property and the adjacent 213-acre Urban Phase III parcel, as well as a small section of the previously developed land known as the "Kona Industrial Area" east of the Kona Commons parcel. The area is at the northern edge of Kailua town in the coastal portion of the *ahupuaʻa* of Keahuolū.

The MPD responds to the need for housing and provides economic growth opportunities for the County of Hawaiʻi's growing population. Though mostly undeveloped at present, portions of the MPD Area have been disturbed by bulldozing, and by landscaping associated with the construction of the surrounding area. Although the land plan for the MPD is still being envisioned, future developments in the MPD include potential residential, hotel, retail, commercial, civic/community uses, and open space. Related modification of the landscape would include grubbing, grading, and trenching for building pads and utilities.

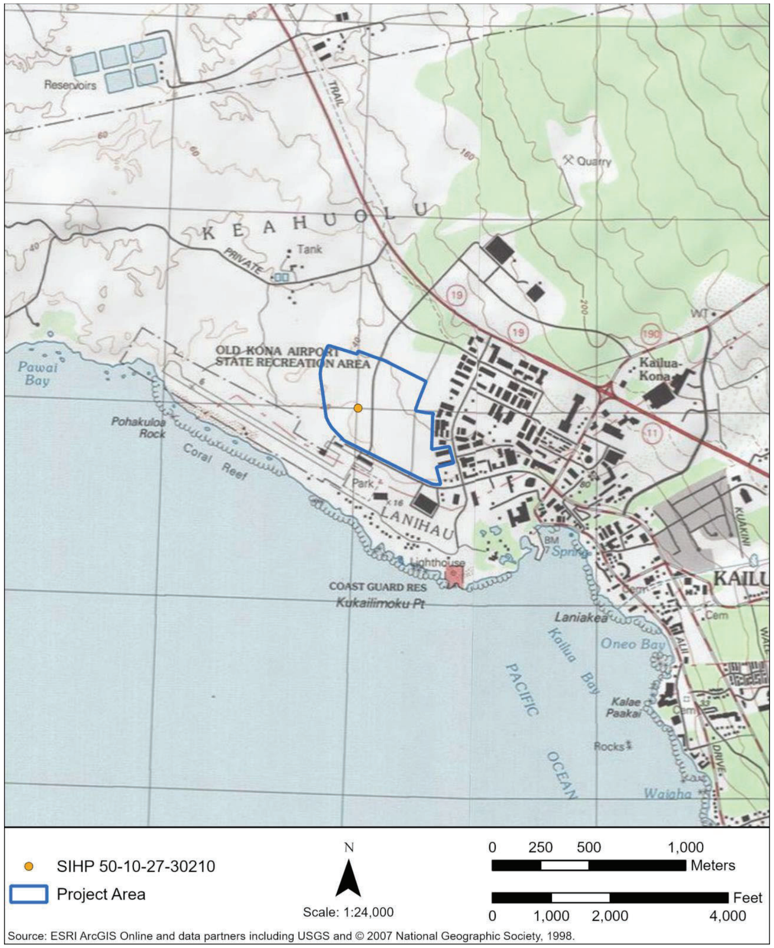

Figure 1. Location of SIHP 50-10-27-30210 within the Makalapua Project District project area on USGS Keahole Point and Kailua Quadrangles 1996.

Figure 2. Location of SIHP 50-10-27-30210 and the TMK boundaries within the Makalapua Project District project area (base map: Esri World Imagery 2021).

1.2 Environmental Setting

The Makalapua Project District is located at the foot of the volcanic peak of Hualālai, on the drier leeward side of the island of Hawaiʻi. SIHP -30210 is situated at roughly 40 ft in elevation above sea level and approximately 470 m inland of the shoreline. The geology underlying most of the Kona Commons property, including the portion of the Makalapua Project District that contains SIHP -30210, consists of gently undulating *pāhoehoe* lava flows laid down sometime between 1,500 and 3,000 years ago (Wolfe and Morris 1996). These *pāhoehoe* flows possess very little in the way of surface soil, most of which consist of thin aeolian sediments that have accumulated in depressions and low-lying areas (soil type rLW in Sato et al. 1973:Map 85). The lava is scarred by upthrust pressure ridges, fissures, collapsed blisters, and lava sinks. Subsurface lava tubes and blisters are also present within the flow.

This stretch of the Kona coast receives less than 750 millimeters (c. 29.5 inches) of annual rainfall (Giambelluca et al. 1986). Due to the limited amount of rainfall, vegetation in the area is relatively sparse. The undisturbed *pāhoehoe* lavas within the Kona Commons property are vegetated in a ground cover of introduced fountain grass (*Pennisetum setaceum*), with occasional stunted *kiawe* (*Prosopis pallida*), and Christmas berry (*Schinus terebinthifolius*) trees, as well as *koa haole* (*Leucaena leucocephala*), klu (*Acacia farnesiana*), lantana (*Lantana camara*), and bougainvillea (*Bougainvillea spp.*) shrubs. Scattered native shrubs, such as *ʻuhaloa* (*Waltheria indica*), are also present, with Polynesian-introduced *noni* trees (*Morinda citrifolia*) growing out of lava sinks and other natural depressions in the terrain. During the pre-Contact period, the dominant vegetation throughout this area would most probably have been *pili* grass (*Heteropogon contortus*).

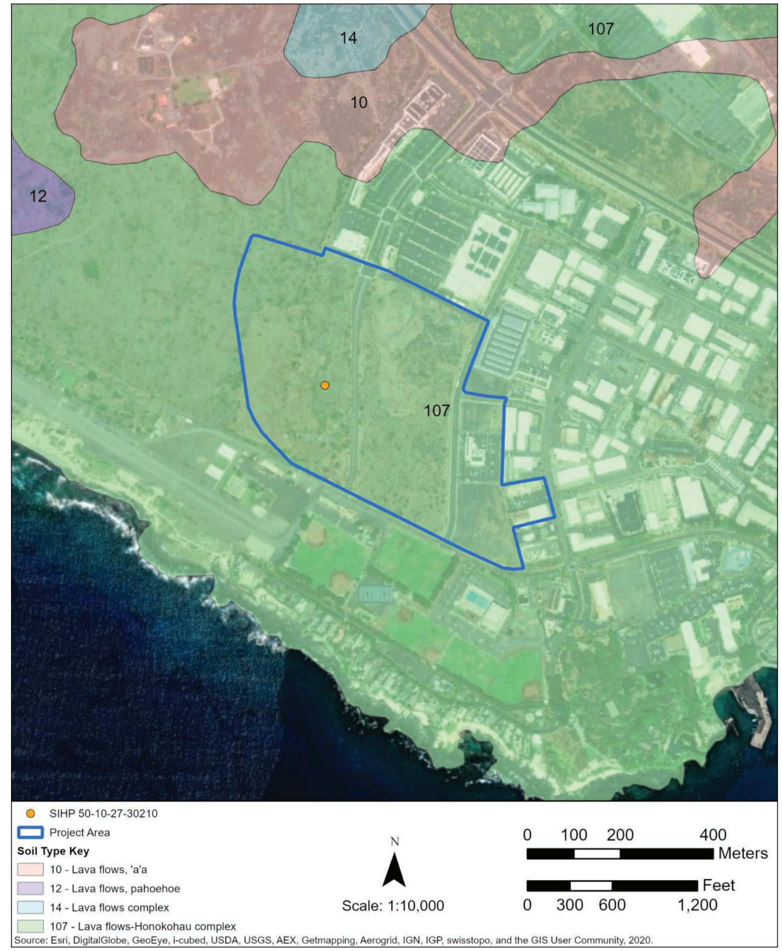

Figure 3. Soil classifications in the Makalapua Project District project area (Soil Survey Staff 2020).

2.0 BACKGROUND

2.1 Traditional and Historical Background Summary

The primary centers of population within the *ahupuaʻa* of Keahuolū during the pre-Contact period were located at the coast and in the well-watered uplands. Although coastal residences were strung along the shoreline, situated near small bays and canoe landings, the main areas of coastal settlement seem to have been located at the small crescent bays of Halepaʻo and Pawai (also known as Papawai; Clark 2003:287), as well as along the sandy beach immediately south of Pawai in the area known as Makāʻeo. The area surrounding SIHP -30210, located inland of these coastal settlements, appears to have been used sporadically and primarily during the pre-Contact period (see McIntosh et al. 2015).

2.1.1 Post-Contact Period

In the early years following Western contact, little seems to have changed in the lives of the inhabitants of coastal Keahuolū. With time, however, the introduction of foreign diseases for which the *kamaʻāina* (native-born residents) possessed no natural resistance, as well as population shifts caused by changing economic conditions resulted in a general decrease in the coastal population of the *ahupuaʻa*. Despite this population decline, the fishing settlements of Pawai and Makāʻeo continued to be occupied by local *ʻohana* (families) into the 1940s when the village of Makāʻeo and its attendant coconut grove was destroyed to make way for the Kona Airport (Clark 1985:110; McIntosh et al. 2015:25–28).

During the Mahele in the 1840s, the entire *ahupuaʻa* of Keahuolū was awarded to the *aliʻi wahine* (chiefess) Analea (Ane) Keohokālole under Land Commission Award 8452: Apana 12 (Royal Patient 6851). Only six smaller *kuleana* claims were awarded to *makaʻāinana* (commoners) within the *ahupuaʻa* of Keahuolū. All of these were located in the upland portion of the *ahupuaʻa*, well away from the coast. Two historic-era trails (the Māmalahoa Trail and a smaller horse trail) are known to have crossed the Kona Commons property during the post-Contact period. There is likewise no evidence for permanent occupation on the property during the post-Contact period. Development of the Kona Commons for commercial purposes only took place after 1992.

2.2 Archaeological Background Summary

The *ahupuaʻa* of Keahuolū has been the subject of several archaeological investigations beginning in the first decade of the twentieth century, when Bishop Museum archaeologist John F.G. Stokes began documenting the *heiau* (shrines) of Hawaiʻi Island (Stokes 1991). The earliest investigations formed part of larger regional or island-wide surveys, and as a result were not as detailed as later studies. These initial surveys were concentrated along the coast, which was the main area of settlement during the pre-Contact period. A detailed review of these early archaeological studies, as well as those later investigations undertaken within the broader *ahupuaʻa* as a whole, is provided in the SAIS report of the Kona Commons property (McIntosh et al. 2015:51–69). The following sections provide information on the two most recent archaeological studies undertaken within the Kona Commons property, which are the most relevant to SIHP -30210, as well as previous studies in the adjacent Urban Phase III project area, a portion of which is within the Makalapua Project District.

2.3 Summary of AIS Findings

2.3.1 PHRI Kona Commons Project Area Archaeological Inventory Survey (AIS)

In 1992, Paul H. Rosendahl Ph.D., Inc. (PHRI) conducted an AIS of the 100-acre Kona Commons property (O'Hare and Rosendahl 1993). They identified 18 historic properties with a total of 38 component features. Sites included a segment of the historic Māmalahoa Trail, lava excavations, modified outcrops, filled depressions, stone alignments, stone mounds, terraces, walls, hearths, walled overhangs, an enclosure, a modified depression, a cairn, a cave shelter, and a lava tube burial (O'Hare and Rosendahl 1993:ii). The 1992 survey did not identify SIHP 50-10-27-30210. The AIS identified substantial evidence of human activity within the project area during the pre-Contact period. These activities all appear to have been primarily short-term in nature, i.e., visiting or passing through the area rather than residing within it.

2.3.2 Pacific Legacy Kona Commons Project Area Supplemental Archaeological Inventory Survey (SAIS)

In 2014, Pacific Legacy, Inc. conducted a SAIS of the Kona Commons property (McIntosh et al. 2015) that included both the original 100 acres surveyed by PHRI in 1992 and an additional 10 acres extending to the southwest in the area formerly occupied by the Swing Zone driving range. The SAIS was undertaken to assist LT in planning for future development of the area. The purpose of this survey was to assess the current state of the historic properties initially identified during the 1992 survey (O'Hare and Rosendahl 1993) and to determine if there were any additional historic properties present on the property.

The SAIS identified 11 historic properties with 21 component features. Sites consisted primarily of small and expediently constructed features or modified natural features, including stone mounds, modified depressions, modified overhangs, C-shaped walls and alignments, small enclosures, a historic petroglyph, and a historic trail. Of the 11 sites identified, four had been previously recorded (SIHP 50-10-27-18502, 50-10-27-18508, 50-10-27-18509, 50-10-27-18511), while seven sites were newly identified (SIHP 50-10-27-30207, 50-10-27-30208, 50-10-27-30209, 50-10-27-30210, 50-10-27-30211, 50-10-27-30212, 50-10-27-30287). These features appear to have served a range of functions. Among these were temporary habitation, storage, travel, visual markers, possibly stone quarrying and/or crop cultivation (in the case of the lava excavations), communication (in the case of the historic petroglyph), and burial.

The results of the 2014 survey indicated that the majority of the sites located within the Kona Commons survey area dated from the pre-Contact period. Three sites, (SIHP 50-10-27-18502, a modified depression; 50-10-27-30211, a petroglyph consisting of two English letters, possibly representing personal initials; and 50-10-27-30287, a trail) appeared to date from the post-Contact or modern periods. The remainder of the sites possessed a more traditional style of construction, suggesting that they were pre-Contact in age.

All sites identified during the 2014 survey were likely associated with relatively short-term activities. Among these activities was the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, and burial crypts. Small stone enclosures and walled shelters appeared to have been erected to serve as temporary camping areas. Low stone mounds were built to serve as markers. Rough excavations were created in the lava surface, either to supply stone for the construction of nearby surface features, or to open pits that could be filled with mulch and used to grow dryland crops (McIntosh et al. 2015).

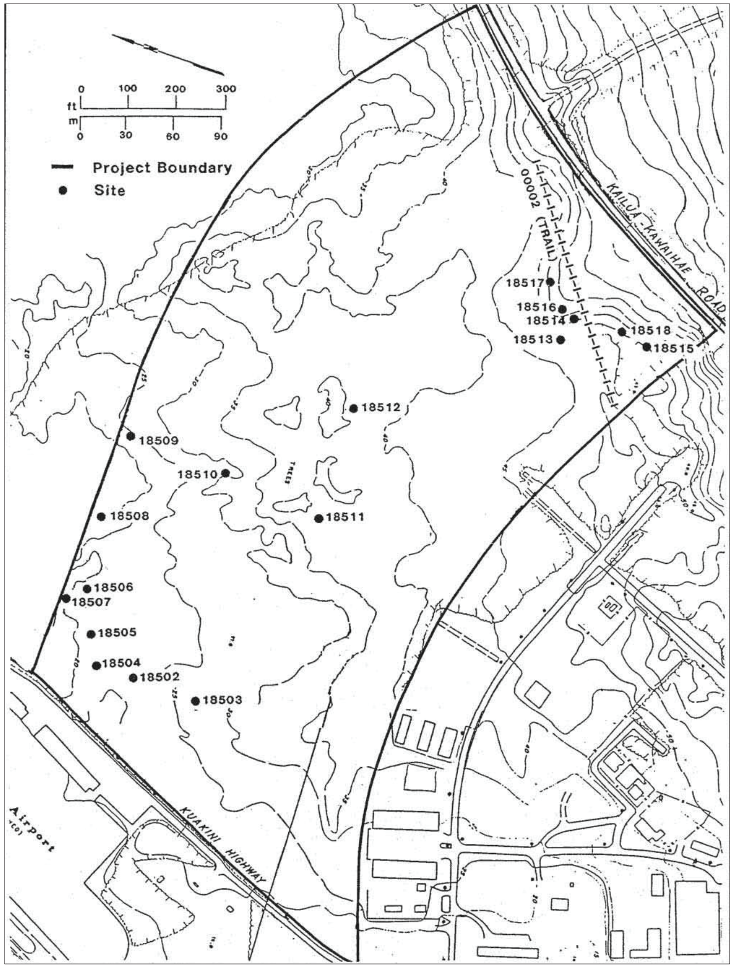

Figure 4. Relative locations of sites identified during the 1992 PHRI survey (O'Hare and Rosendahl 1993:Figure 2).

Figure 5. Aerial photograph showing sites documented during the 2014 SAIS in the Kona Commons survey area (base map: Esri World Imagery 2019).

2.3.3 Archaeological Surveys of the Urban Phase III Project Area

The Urban Phase III project area was the subject of a reconnaissance survey by the Archaeological Research Center Hawai'i (ARCH; Ching 1978), an Archaeological Inventory Survey (AIS) undertaken by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1989–1990 (Donham 1990), and an AIS undertaken by Pacific Legacy in 2011 (Reeve et al. 2019). Haun & Associates (Haun and Henry 2006) also completed an archaeological survey that included a road corridor through a portion of the Urban Phase III project area.

In 1978, Francis Ching of Archaeological Research Center Hawai'i, Inc. (ARCH) conducted a reconnaissance survey of 987 acres within the *ahupua'a* of Keahuolū. This survey covered much of the coastal portion of the *ahupua'a*, extending from the shoreline up to the Queen Ka'ahumanu Highway. The survey resulted in the recording of a total of 59 archaeological sites containing 140 individual component features. Nine of the sites appeared to be located within the Urban Phase III survey area.

In 1990, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an AIS and test excavations of sites situated within a 1,100-acre portion of Lili'uokalani Trust lands within Keahuolū (Donham 1990). The designated survey area covered lands located both *mauka* and *makai* of the Queen Ka'ahumanu Highway. This survey was the most extensive archaeological investigation to be undertaken within the *ahupua'a* up to that time. Included within the survey was a 212-acre parcel located *makai* of the Ka'ahumanu Highway that had formed part of Ching's original 1978 survey area and included the Urban Phase III project area. The PHRI survey recorded a total of 239 sites (composed of 1,810+ component features) within its survey area. Of these, 55 sites were located within the 212-acre parcel located *makai* of Ka'ahumanu Highway, which roughly corresponds to the Urban Phase III project area. Among the numerous features documented within this portion of the 1,100-acre survey area were excavated areas within the *pāhoehoe* lava, stone mounds, rock walls, cave shelters containing marine shell midden, stone platforms and terraces, and petroglyphs.

In 2006, archaeologists from Haun & Associates conducted an archaeological inventory survey of the proposed Kona Kai Ola project, which consisted of two parcels encompassing a total of ca. 370.5 acres in the *ahupua'a* of Kealakehe located immediately north of coastal Keahuolū (Haun and Henry 2006). Their survey area also included a road corridor that extended south into Keahuolū and crossed through the Urban Phase III project area. They identified eight sites within the Urban Phase III road corridor, one of which had been previously recorded during the 1990 PHRI survey (SIHP 50-10-27-13271), while the remaining seven were assigned new State Inventory of Historic Places site numbers (SIHP 50-10-27-25644 to 50-10-27-25650). The sites identified within the Keahuolū corridor consisted of stone alignments, stone mounds, and a lava blister.

In 2011, Pacific Legacy, Inc. conducted an AIS for the Urban Phase III project, which included the recording of 120 archaeological sites containing 214 component features (Reeve et al. 2019). The survey also identified and recorded the locations of 540 lava excavations. Excavations of this type were distributed throughout the survey area. While each lava excavation was individually recorded, all were grouped together under one State Inventory of Historic Places site number: SIHP 50-10-27-29175. These lava excavations bring the total number of sites recorded up to 121.

Of the 121 sites identified in the Urban Phase III project area during the 2019 AIS, 36 had been previously recorded, either during the 1978 ARCH reconnaissance survey (seven sites, four of which had been assigned new site numbers by the 1990 survey; Ching 1978), the 1990 PHRI inventory survey (27 sites and five lava excavations; Donham 1990), or the 2006 Haun & Associates survey (six sites; Haun and Henry 2006). A total of 85 sites were newly identified during the 2019 AIS (Reeve et al. 2019).

Nine of the sites documented in 1978 by the Archaeological Research Center Hawai'i (Ching 1978) reconnaissance survey appear to have been located within the limits of the present survey area. Only two of these sites were positively re-identified during the 2011 AIS. Five additional sites (one of which may be a lava excavation) were tentatively identified. The remaining two sites were not re-located and appear to have been destroyed, as they were recorded in the area formerly occupied by the Swing Zone driving range.

During the course of the 2011 survey, an effort was also made to re-locate and re-identify all of the structural features recorded during the 1990 PHRI survey and the 2006 Haun & Associates survey. The 2011 survey was able to identify 36 of the 55 sites that were previously documented during the 1990 PHRI inventory survey. Five of these sites (SIHP 50-10-27-13276, 50-10-27-13277, 50-10-27-13285, 50-10-27-13296, and 50-10-27-13352) were lava excavations and were recorded under SIHP 50-10-27-29175. It also re-located seven sites recorded by Haun & Associates (along with two features possessing site tags with temporary site numbers, most likely assigned by the 2006 survey, which did not appear on the final site map). Several of the sites recorded during the 1990 survey that were not re-identified during the 2011 survey consist of what the 1990 survey report refers to as "pahoehoe excavations" and which the 2011 survey identified simply as "lava excavations." Some of the sites recorded during the 1990 survey were located toward the southeastern corner of the survey area. These sites were likely destroyed by ground-disturbing activities associated with the transformation of the Old Kona Airport into a beach park and the construction and landscaping of the Swing Zone driving range. All 14 of the sites containing petroglyphs that were documented by Stasack and Stasack (2012) were re-located during the 2011 survey. An additional four sites containing petroglyphs were also documented.

Within the Makalapua Project District, the complex of modified collapsed sinks (SIHP 50-10-27-13260) and enclosure (SIHP 50-10-27-13261) were identified during the PHRI AIS and were re-identified and recorded in detail during the 2011 AIS. The report of the 2011 AIS was reviewed by the Hawai'i State Historic Preservation Division (SHPD) and its findings and recommendations were accepted in 2019.

2.3.4 Identified Sites within the Makalapua Project District

Many of the sites identified during previous surveys of the Kona Commons and Urban Phase III project areas appear to have been associated with relatively short-term activities. Among these activities is the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, water catchment areas, and burial crypts. Small stone enclosures and walled shelters were likely erected to serve as temporary habitation areas or small shrines (*heiau*). People traveled across these areas on trails, low stone mounds were built to serve as markers, and concentrations of petroglyphs were created to mark *wahi pana* (storied places) or trails that people used to traverse the landscape. Rough excavations were created in the lava surface, to supply stone for the construction of nearby surface features, to provide birds with nesting areas, or to open pits that could be filled with mulch and used to grow dryland crops.

Table 1. Summary of Historic Properties Identified within the Makalapua Project District, Recorded during AIS and SAIS of Kona Commons and Urban Phase III Project Areas

SIHP # (50-10-27)	Site/Feature Type	Significance	Treatment	Study
-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS (Donham 1990; Reeve et al. 2019)
-13261	Enclosure	d, e	Preservation	Urban Phase III AIS (Donham 1990; Reeve et al. 2019)
-18502	Modified Depression	d	No Further Work	Kona Commons AIS, SAIS (O'Hare & Rosendahl 1993; McIntosh et al. 2015)
-18508	Walled Overhang	d	No Further Work	Kona Commons AIS, SAIS (O'Hare & Rosendahl 1993; McIntosh et al. 2015)
-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work/ Data Recovery	Kona Commons AIS, SAIS (O'Hare & Rosendahl 1993; McIntosh et al. 2015)
-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/ No Further Work/ Burial Treatment	Kona Commons AIS, SAIS (O'Hare & Rosendahl 1993; McIntosh et al. 2015)
-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
-30208	Stone Mound	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
-30209	Enclosure	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work Data Recovery (Fe. B)	Kona Commons SAIS (McIntosh et al. 2015)
-30211	Petroglyph	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
-30287	Trail, petroglyph	d, e	Preservation	Kona Commons SAIS (McIntosh et al. 2015)

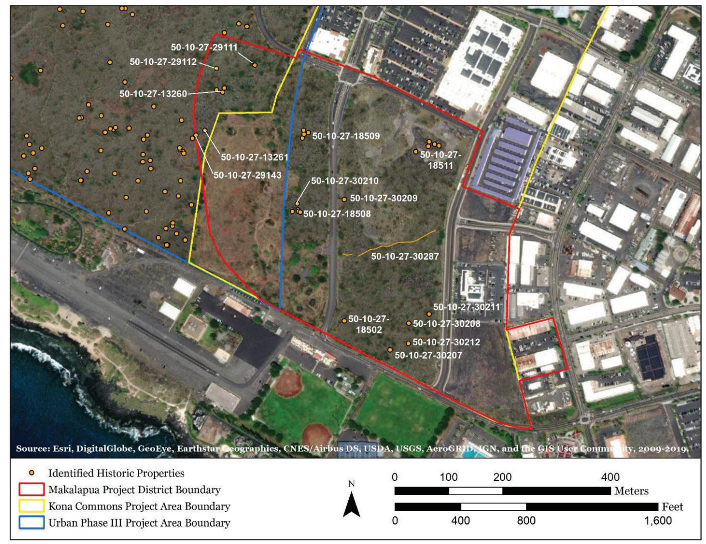

Figure 6. Sites identified within the LT project areas, with SIHP numbers for sites identified within the Makalapua Project District labeled.

3.0 HISTORIC PROPERTY

3.1 Site Description, SIHP 50-10-27-30210

The following section provides a summary description of SIHP 50-10-27-30210 (Figure 7). Refer to McIntosh et al. (2015:137–141) for a full site description.

SIHP 50-10-27-30210 is a complex consisting of four individual features: a modified overhang (Feature A), a lava excavation (Feature B), a C-shaped wall (Feature C), and an enclosure (Feature D). The site is located at the central southwestern portion of the 2014 Kona Commons project area, approximately 60 meters west of Makala Boulevard and just east of the former Swing Zone driving range.

Feature A

SIHP 50-10-27-30210, Feature A is a small, modified overhang in the northern portion of the complex. The overhang is formed by a partially collapsed lava blister and is oriented roughly east to west, with the opening facing north (Figure 8). Angular basalt boulders and cobbles have been stacked to the southwest of the overhang, narrowing the opening. The interior is covered in loose rubble with no soil. The modified overhang measures roughly 1.5 m in length, 2 m deep, and has a maximum height of approximately 0.6 m. The overhang appears too small to have served as a temporary shelter and may have been used as a storage area during the pre-Contact period. It is in fair condition.

Feature B

SIHP 50-10-27-30210, Feature B, which is the subject of the present data recovery plan, is a lava excavation located at the central portion of the SIHP 50-10-27-30210 site complex, approximately 10.9 m south (169°) from the Feature A modified overhang. The Feature B lava excavation is situated near the top of a low knoll of *pāhoehoe* lava. It is irregular in shape and measures approximately 1.3 m in length (NE–SW) by 0.75 m in width (NW–SE), and has a maximum depth of 0.37 m (Figure 9). Located within the interior of the excavation is a single basalt boulder measuring 0.6 by 0.35 m. Several other basalt boulders that appear to have originally been removed from the lava excavation are loosely piled less than 1 m north of the feature. A small amount of soil and organic debris from fountain grass was noted on the floor of the lava excavation. No cultural material was observed within or surrounding the feature. It seems likely that the Feature B lava excavation was created during the traditional period, either as a quarry for building stone or as a small planting area (the large stone having fallen or been placed in its interior after abandonment). The feature's function is uncertain.

Feature C

SIHP 50-10-27-30210, Feature C is a C-shaped wall located in the southern portion of the complex, ca. 2 m south (174°) of the Feature B lava excavation. It is constructed on a relatively level surface of *pāhoehoe* lava. The wall consists of a single course of basalt cobbles, but it appears to have originally consisted of two or more courses in height in some sections (Figure 10). The C-shaped wall is open to the northeast and measures 2.2 m long (east to west) by 1.2 m

deep (north to south), with a maximum height of 0.12 m. No cultural material was observed at this feature. This low windbreak wall was most likely utilized as a temporary shelter during the pre-Contact period. It is in poor condition.

Feature D

SIHP 50-10-27-30210, Feature D is a small enclosure located at the southern end of the complex. It is roughly 1 m southwest (134°) of Feature C. Feature D appears to have originally been roughly circular in shape, but a number of stones from its eastern wall are presently scattered throughout the interior (Figure 11). The enclosure wall is made of small to medium subangular basalt boulders, cobbles, and *pāhoehoe* slabs. These stones may have been loosely stacked or piled, but now are mostly tumbled. The number and size of the stones along the eastern section of the wall suggests that this portion was originally slightly higher than the others and may have been positioned to block the force of the prevailing wind. Several of the *pāhoehoe* slabs in this area may have been set upright and supported by smaller stones. The northwestern edge of the enclosure wall incorporates a raised section of *pāhoehoe* lava bedrock (approximately 0.17 m in height). The Feature D enclosure measures 3.2 m in length (east to west) by 2.9 m in width (north to south), with a maximum height of 0.2 m. No cultural material was observed within or surrounding this feature. The structure likely served as a temporary windbreak shelter built and used during the pre-Contact period. It is in relatively poor condition.

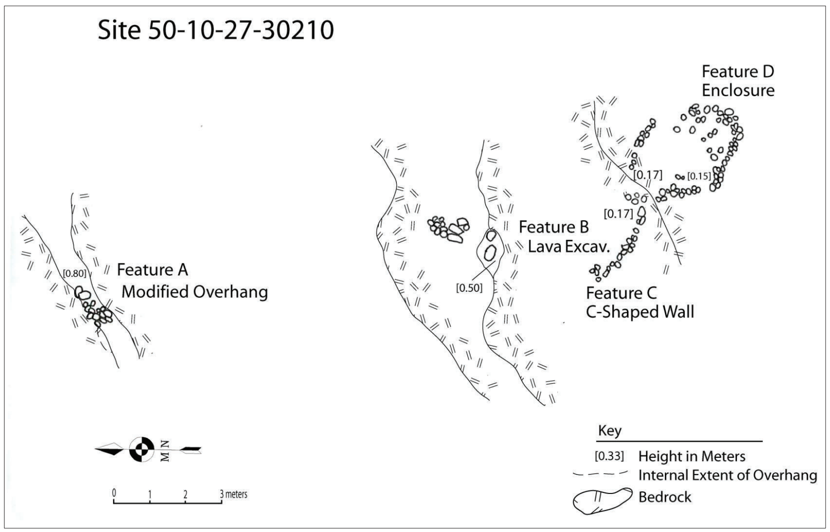

Figure 7. Plan-view map of SIHP 50-10-27-30210.

Figure 8. SIHP 50-10-27-30210, Feature A modified overhang (view to south).

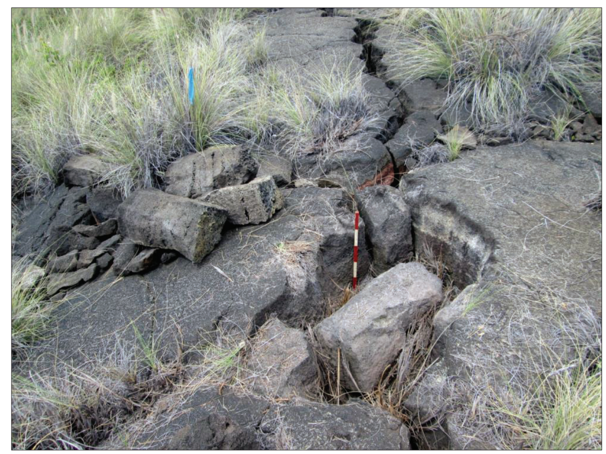

Figure 9. SIHP 50-10-27-30210, Feature B lava excavation (view to northeast).

Figure 10. SIHP 50-10-27-30210, Feature C, C-shaped wall (view to southwest).

Figure 11. SIHP 50-10-27-30210, Feature D, enclosure (view to southwest).

The SIHP 50-10-27-30210 complex appears to represent a short-term campsite consisting of two temporary windbreak shelters (Features C and D), a small possible storage area (Feature A), and an excavation in the *pāhoehoe* lava (Feature B) that may have served either as a quarry for stones used in the construction of the nearby shelters or as a soil-filled planting area for a dryland crop such as *ʻuala* (sweet potato, *Ipomoea batatas*).

Low stone-walled enclosures and C-shaped walls are common features in other areas of coastal Keahuolū (Reeve et al. 2009:48, Reeve et al. 2016:176–183). These structures are almost always constructed on patches of relatively smooth and level *pāhoehoe* lava and are generally relatively small in area. As with SIHP -30210, Features C and D, these structures do not possess an associated stone-lined hearth or other evidence of cooking, nor do they contain any midden remains or other surface cultural materials. This lack of associated features and cultural remains seems to confirm their temporary nature.

It seems probable that these low walled features were constructed as temporary windbreak shelters by individuals traveling across or working in the area. Their small size and rough construction indicate that they were structures of convenience, built relatively quickly and occupied on a short-term basis. These features, unless they were somehow roofed over with palm fronds, a mat, or some other material, would only have provided protection from the wind and not from the sun. The level stretches of *pāhoehoe* lava on which they were constructed would have served to reflect the sun and increase the heat. For this reason, they do not appear to be inviting spots to rest during the day. At night, however, with the residual heat radiating up from the lava and a *pāhoehoe* slab wall to block the wind, they might (with the addition of a flooring of cut *pili* grass) provide comfortable sleeping areas. The size of most enclosures suggests that they were built to shelter a single individual. They are too small to have served as much more than simple sleeping areas.

3.2 Assessment of Site Significance

The 2014 SAIS report assessed each of the sites documented during the survey as to their significance under criteria defined in Hawaiʻi Administrative Rules (HAR) §13-284-6. This system is patterned after the Secretary of Interior's standards as outlined in 36 Code of Federal Regulations §60.4 and is meant to provide a framework for the evaluation of historic property significance. All of SIHP 50-10-27-30210 was found to be significant under Criterion d as having "yielded, or may be likely to yield, information important in prehistory or history" (McIntosh et al. 2015:174–175).

3.3 Recommendations

Of the eleven sites documented during the 2014 SAIS, eight were recommended for no further work. The SIHP 50-10-27-18511, Feature C burial lava tube was recommended for preservation due to the presence of *iwi kūpuna*, or human remains (McIntosh et al. 2015). A detailed Burial Treatment Plan (BTP) outlining how the *iwi kūpuna* will be protected has been reviewed by the Hawaiʻi Island Burial Council and has been reviewed and accepted by the State Historic Preservation Division (Reeve and Cleghorn 2019; Log No. 2019.01526; Doc. No. 1911CJO01; see Appendix B). The SIHP 50-10-27-30287 trail was recommended for preservation and interpretation. It was proposed that one of the more visibly distinct segments of the trail be preserved with interpretive signage and is part of a forthcoming Preservation Plan for the Makalapua Project District.

As SIHP 50-10-27-30210, Feature B was the only lava excavation within the 2014 survey area found to contain traces of remnant soil, SHPD requested that the soil be excavated and analyzed for the presence of microbotanical remains. This will help to determine whether the feature served as a quarry or a planting area. The 2014 SAIS report noted that, while the information obtained during the survey adequately documented Site 50-10-27-30210, Feature B, it was recommended data recovery excavations be undertaken and soil samples collected.

> Data Recovery is being recommended for Site T-005, Feature B, the only lava excavation identified during the present survey as containing soil. Previous archaeological researchers have suggested a number of possible functions for lava excavations. This type of feature may have been created during quarrying activities to obtain building material for nearby sites, they may be the result of "prospecting" for lava tubes that could be used for shelters or storage areas, or they may have been created to open up shallow depressions in the lava that could then be filled with mulch and utilized as planting areas. While the information obtained during the present survey can be said to adequately document the Site 50-10-27-30210, Feature B lava excavation, it is recommended that as part of data recovery activities the lava excavation be excavated, and soil samples collected. The resulting soil samples should be submitted for pollen, phytolith and starch analyses. Such analyses may indicate the presence or absence of pollen or starch grains from cultigens such as *ʻuala* (*Ipomoea batatas*, sweet potato). Microbotanical remains identified as belonging to *Ipomoea batatas* have been recovered from shallow lava excavations located further north along the Kona coast in the *mauka* portion of the *ahupuaʻa* of Kaʻūpūlehu (Cleghorn and McIntosh 2013:14). These finding[s] would appear [to] support the proposition that at least some lava excavations were used in the pre-Contact period for crop cultivation. If similar analyses are conducted on soil samples collected from Site 50-10-27-30210, Feature B, similar, or at least comparative results, may be forthcoming.
>
> The results of pollen and phytolith analyses from samples collected during data recovery at Site 50-10-27-30210, Feature B could help to shed light on the question of whether some of the lava excavations within the present project area did indeed serve as planting areas. It is also recommended that comparative baseline samples be taken from shallow soil deposits located outside of the lava excavation in areas not well suited for direct cultivation. If *ʻuala* (sweet potato) pollen or starch grains are also found in these baseline samples, this may indicate that such micro-botanical remains do not necessarily derive from plants grown in situ, but could have originated elsewhere and been deposited by natural agencies such as the wind or water. A detailed Data Recovery Plan (mitigation plan) will need to be submitted to the State Historic Preservation Division for review and approval prior to the initiation of any data recovery investigations. (McIntosh et al. 2015:179)

4.0 RESEARCH OBJECTIVES

The primary objectives of the data recovery excavation at SIHP 50-10-27-30210, Feature B were to further investigate the function(s) of, and activities carried out at lava excavations, and to assess the role lava excavations played within temporary habitation complexes in the Kona region.

4.1 LAVA EXCAVATIONS

Shallow excavations into the surface of the lava are among the most ubiquitous and enigmatic archaeological features encountered in coastal Keahuolū and elsewhere in the lava plains of Hawaiʻi Island. Such features are often associated with loose piles or scatters of lava boulders that appear to represent the material removed during the excavation. O'Hare and Rosendahl (1993) referred to these features as "pahoehoe excavations." Surveys conducted in other areas of Keahuolū (e.g., Reeve et al. 2009:45), as well as in other parts of North Kona (such as Makalawena, see Reeve et al. 2014:68), have encountered these excavations on both *pāhoehoe* and *ʻaʻā* lava flows (though less commonly on *ʻaʻā*). For this reason, it seems appropriate to refer to them simply as lava excavations.

Lava excavations were found scattered throughout the Kona Commons project area as well as elsewhere along the Kona coast, often in spatial association with temporary habitation features. While more often encountered in the vicinity of other features, some excavations are relatively isolated with no surviving surface structures located anywhere nearby. The typical lava excavation consists of a patch of *pāhoehoe* (or, in more limited instances, *ʻaʻā*) lava that has been battered until the surface layer fractures. The broken pieces, which often take the form of angular or tabular blocks, can then be extracted, leaving a shallow, flat-bottomed depression. On occasion, small lava blisters have been broken open to create a shallow depression in the lava. Excavations also occurred along the base of lava ridges where the breaking up of the lava revealed shallow overhangs. The resulting loose rubble has often been removed from the excavation and either piled around its edges or apparently taken away for use elsewhere. In some cases, at least some of this rubble has fallen or been placed back into the excavation, partially covering the floor. In areas closer to the coast, it is not unusual to encounter one or more waterworn basalt boulders within or near a lava excavation. Such stones usually exhibit signs of battering at one or both ends. It seems likely that these boulders were utilized as large hammerstones to break up the lava so that blocks of it could be removed.

Various explanations have been put forward to explain the creation of these excavations, which occur throughout the lava lands of the Kona and Kohala districts and inland as far as Pōhakuloa in the saddle between Mauna Kea and Mauna Loa (Nakamura et al. 1998:112). Their relative abundance suggests that they served some definitive purpose(s). Donham (1990) proposed that some lava excavations in Keahuolū may have been utilized as quarries for the acquisition of building material, while others may have been created to act as shallow depressions which could be filled with mulch and used as small planting areas for the cultivation of crops (Donham 1990:19). The use of lava excavations as quarries was initially proposed by Moore and Bevacqua (1972), who recorded some 230 pits in the *ahupuaʻa* of Waikoloa. They suggested that the upper layers of the excavated *pāhoehoe* were used to fashion lava abraders, while the lower layers were used for building material (Moore and Bevacqua 1972:18–20).

It has also been suggested that lava excavations, particularly those located in the uplands at places such as Pōhakuloa, were created to serve as nesting areas for ground-nesting seabirds, such as shearwaters or the *ʻuaʻu* (dark rumped petrel, *Pterodroma sandwichensis*), whose eggs or juveniles could then be harvested for food (e.g., Nakamura et al. 1998:116). The theory that lava excavations were created and used as artificially enhanced nesting areas proposed the intentional localization of a usually dispersed resource, representing the first steps in what might be considered the semi-domestication of wild birds. Some possible support for this theory was found at the *ahupuaʻa* of Maniniʻowali and Kukiʻo 2 in North Kona, where over 1,200 excavated *pāhoehoe* pits were recorded (Dye 2002:95–96). Nineteen of these pits were found to contain gravel-sized pieces of pumice, Dye (2002) interpreted as having been digested and excreted by seabirds.

In some cases, it would appear that the purpose of the excavation was to find and open a natural overhang at the base of a lava ridge. Most of these overhangs are too small to have served as temporary shelters. In the uplands, these overhangs could have served as nesting sites for the *ʻuaʻu*, though this is less likely along the coast. Seabirds are also somewhat particular about the size and shape of the lava overhangs they choose as nesting sites. Such nesting areas are low-roofed and narrow, extending back far enough (a meter or more) that the bird feels safe. Most of the coastal lava excavations that open overhangs are much larger and shallower, which would make them unsuitable as nesting areas.

An alternate proposal, that lava excavations were created for use as planting pits, was put forward by William Barrera as early as 1971 (Barrera 1971:60). This theory has been proffered by a number of researchers (e.g., Carter 1986, Hammatt et al. 1987, and O'Hare and Goodfellow 1994), though most have suggested multiple uses for these features. Dye has argued that traditional cultivation in excavated pits was only undertaken in areas of *ʻaʻā* lava, and that the marginal environments in which they are found and their sporadic distribution would argue against their agricultural use. According to Dye, the meager amount of crops that could be produced would not have warranted the apparent intensive effort involved in creating the pits themselves (Dye 2002:96).

If lava excavations were used for the cultivation of *ʻuala* and other dryland crops, the pits would need to have been filled with soil or vegetative mulch. Most coastal lava excavations possess little if any internal sediment. This general lack of interior soil could be taken as an indicator that these features were not utilized for the cultivation of crops, though it is also possible that the original sediment has been blown or washed away. Recent analysis of soil samples taken from lava excavations located in the *ahupuaʻa* of Kaʻūpūlehu, North Kona, revealed the presence not only of Poaceae *Heteropogon*-type pollen, which might indicate the expected presence of *pili* grass (*Heteropogon contortus*), but also of *Ipomoea batatas*-type pollen, suggesting that the excavation may have been used for the cultivation of *ʻuala* (Cleghorn and McIntosh 2013:14).

This evidence for the use of lava excavations as planting pits may be supported by ethnohistoric accounts. There exist references in the ethnographic literature that describe the use of mulch in the growing of crops on "bare lava." One such reference appears the writings of botanist William Hillebrand, who was a resident of the Hawaiian Islands from 1850 to 1870. In his book *Flora of the Hawaiian Islands*, Hillebrand remarked that, "The natives of Puna, Hawaii raise good crops of sweet-potatoes in the hollows and cracks of bare lava by simply covering the budding sprigs with decayed leaves and herbs" (Hillebrand 1981 as cited in Ladefoged et al. 1987).

Missionary Chester Lyman describes such plantings which he encountered while visiting the Kamoamoa area of the Puna District.

> We passed a potato patch in the broken lava which exceeded anything I had seen. Not a particle of soil was anywhere to be seen, and the holes dug among the stones to receive the potatoes were some of them 6 feet in depth – thus securing a degree of moisture and shelter from the sun – though no more soil than on the surface. (Emory et al. 1959:24)

In describing the dryland cultivation of *kalo* (taro, *Colocasia esculenta*) and *ʻuala* on the island of Hawaiʻi, the Hawaiian-language newspaper *Ka Nupepa Kuokoa*, in an article published on March 24, 1922, makes reference to mulch being placed within "hollows made on the *pāhoehoe*."

> Another way of doing this [planting dryland *kalo* (taro) or *ʻuala* (sweet potato)] was to rot weeds where the soil was good and then carry them to fill the hollows made on the *pāhoehoe* and then plant whatever plants he chose. O my reader, the proofs of these are on Hawaiʻi. There are the *pāhoehoe* lava beds walled in by the ancestors, in which sweet potatoes and sugar cane were planted and they are still growing today. (*Ka Nupepa Kuokoa* as cited in Handy et al. 1972:131–132)

This reference would appear to suggest that lava excavations, similar to those encountered in the Makalapua Project District project area, may have been mulched and planted with either *kalo* or *ʻuala* during both the pre-Contact and early post-Contact periods.

Microfossil analyses of soil samples recovered from lava excavations could provide further insight into whether some lava excavations were created to serve as planting pits. The only lava excavation identified within the Kona Commons project area during the SAIS that was found to contain a small amount of soil was SIHP 50-10-27-30210, Feature B. It was for this reason that McIntosh et al. (2015) recommended that SIHP -30210, Feature B be excavated, and soil samples be collected from the sediment within it. These samples would then be sent out for microfossil (pollen, phytolith, and starch) analysis to determine the presence or absence of any traditional cultigens. If microfossil remains from any dryland crops such as *kalo* or *ʻuala* are identified within the recovered soil samples, then the SIHP 50-10-27-30210, Feature B lava excavation was likely used during the pre-Contact and/or early post-Contact periods as a planting area.

The purpose of data recovery investigations at SIHP 50-10-27-30210, Feature B is to examine whether *ʻuala* or other dryland crops may have been planted in a lava excavation filled with mulch to serve as a potential food source for individuals camping out at the site.

4.2 Data Needed to Address Research Objectives

To address the research objectives presented above, data recovery excavation at SIHP 50-10-27-30210, Feature B needed to acquire samples of sediment from within the floor of the lava excavation.

5.0 METHODS

Archaeological data recovery was conducted on May 10 and 11, 2023 by Pacific Legacy archaeologists Caleb C. Fechner, B.A. and James McIntosh, B.A., under the overall guidance of principal investigator Mara Mulrooney, Ph.D.

Data recovery for the SIHP 50-10-27-30210, Feature B lava excavation involved mapping, controlled excavation, soil sampling, and subsequent laboratory analyses.

5.1 Field Methods

Prior to the start of data recovery excavations, the feature was cleared of fountain grass. A scaled hand-drawn tape and compass plan map of the feature was produced. The feature location was recorded using GPS. Geospatial data was recorded in the field using a handheld Trimble R1 GNSS receiver to submeter precision, differentially corrected in real time and subsequently uploaded to ArcGIS Online. GNSS positions were collected in the field as Esri shapefiles with a WGS 1984 Web Mercator (auxiliary sphere) projection. Terrestrial LiDAR was also used to record the feature (collected via the 3D Scanner App on an iPhone 14 Pro Plus).

5.1.1 Excavation

Below-surface depths were measured with reference to a datum point established on the eastern end of the lava excavation at the highest point of the ground surface. The lava excavation was bisected, with the northeastern section excavated first, followed by the southwestern section. Excavation was conducted by hand using a trowel, brush, and dustpan. All soil from the northeastern section was screened through a 1/8" mesh sieve directly into a 5-gallon bucket to examine it for the presence of any cultural material or midden.

A single soil sample (MS1) was collected from Layer I in the southwestern half of the unit for microfossil analysis.

No archaeological materials were recovered from the excavation. Following the completion of data recovery excavation, the sieved soil was placed back into the lava excavation.

5.2 Laboratory Analyses

The single soil sample (MS1) that was collected during data recovery was transported to Pacific Legacy's Oʻahu laboratory. MS1 was subsampled in the laboratory and submitted to Dr. Mark Horrocks (Microfossil Research Limited, Auckland, New Zealand) for microfossil (pollen, phytolith, starch) analyses.

6.0 DATA RECOVERY RESULTS

The archaeological data recovery excavation conducted at SIHP 50-10-27-30210, Feature B identified a thin layer of soil mixed with organic detritus, which was 1-2 cm across most of the unit, and had a maximum thickness of 7 cm in the western corner of the feature (Figure 12-Figure 19; Table 2). The size and large quantity of organic material within the soil made it difficult to pass through the screen. Every effort was made to screen the soil, though when this proved impossible, a visual check of the material was made before clearance into the screened material bucket.

A single soil layer was recorded during the data recovery excavation (Table 2). The layer contained abundant root matter from fountain grass. No artifacts or other biocultural materials, such as charcoal, marine shell, or fauna, were identified during excavation. Four golf balls, likely from the former "Swing Zone" commercial entertainment facility nearby, were recovered during excavations. Due to the thin nature of the soil deposit, no soil profile was recorded. A bulk soil sample was collected from the southwestern half of the excavation and subsampled for microfossil analysis.

Table 2. Soil Recorded at Excavation Unit 1, SIHP 50-10-27-30210, Feature B.

Layer	Depth (cm below datum)	Description
I	45-52	Very dark brown (10YR 2/2) clay loam, structureless, very fine grain very friable, slightly sticky, slightly plastic. Contains abundant fine roots and root matter, weathered basalt fragments. No cultural material observed.

Figure 12. SIHP 50-10-27-30210, Feature B, prior to excavation and vegetation clearing (view to northeast).

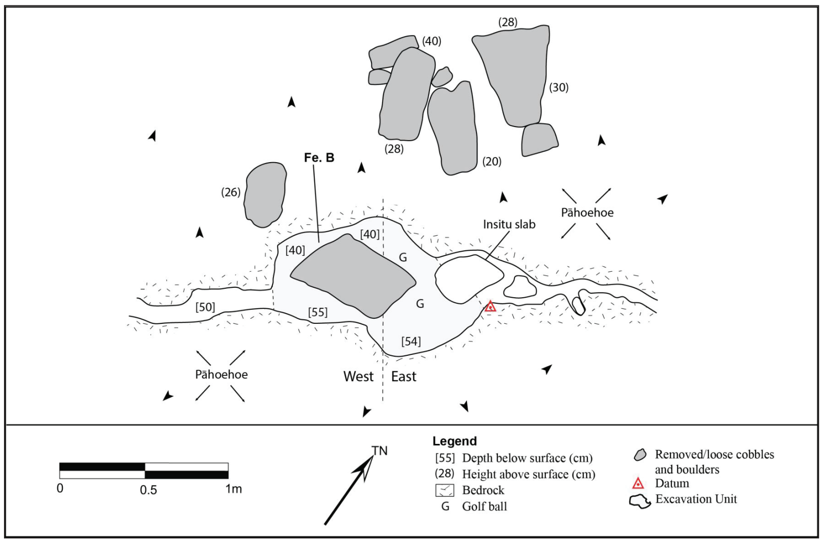

Figure 13. Plan-view map of SIHP 50-10-27-30210, Feature B.

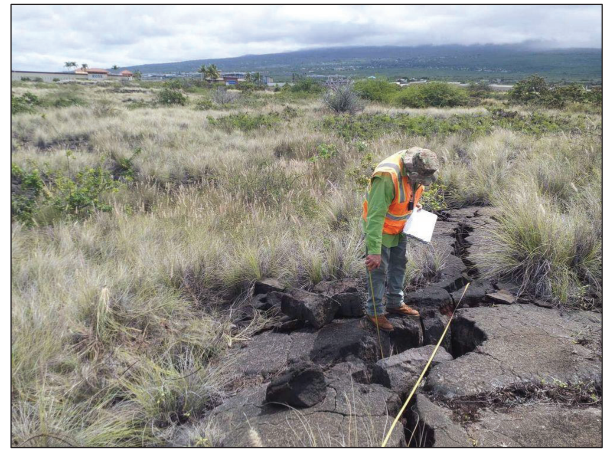

Figure 14. Photo showing tape-and-compass mapping of SIHP 50-10-27-30210, Feature B (view to northwest).

Figure 15. SIHP 50-10-27-30210, Feature B prior to start of excavation (view to southeast).

Figure 16. View of SIHP 50-10-27-30210, Feature B after removal of boulder and prior to excavation of soil (view to southeast).

Figure 17. View of SIHP 50-10-27-30210, Feature B, after excavation of northeastern portion of the feature (view to southeast).

Figure 18. View of SIHP 50-10-27-30210, Feature B after soil removal (view to southeast).

Figure 19. Overview photo of completed data recovery excavations of SIHP 50-10-27-30210, Feature B (view to southwest).

7.0 RESULTS OF LABORATORY ANALYSIS

A single soil sample (MS-01) was collected from the southwestern half of the excavation unit at SIHP 50-10-27-30210, Feature B and submitted to Dr. Mark Horrocks at Microfossil Research, Ltd. for identification and interpretation of microfossils and other plant material (Figure 20, Figure 21, and see Appendix C). This analysis of starch, pollen, and phytoliths is intended to identify the presence and type of botanical remains in the soil recovered from SIHP 50-10-27-30210, Feature B, a lava excavation with an undetermined function. In particular, the presence of previously cultivated taxa within MS-01 would support the hypothesis that SIHP 50-10-27-30210, Feature B served an agricultural function.

Microfossil analysis identified the presence of Polynesian-introduced cultivars (coconut, *Cocos nucifera*; taro, *Colocasia esculenta*; and banana, *Musa* sp.) as well as eggs from a parasite most commonly found in the small intestine of dogs (*Toxocara canis*).

Pollen and spore analysis identified the presence of microscopic fragments of plant charcoal, which were of insufficient quantity to submit for AMS radiocarbon dating but are indicative of vegetation burning activities within the area. The pollen assemblage was dominated by fern spores, though also present in the assemblage was coconut (*Cocos nucifera*) and the European-introduced ironwood (*Casuarina equisetifolia*). Similarly, the phytolith assemblage consisted largely of grasses and fern frond tissue. A banana leaf phytolith (*Musa* sp.) was also found within the phytolith assemblage, further supporting pre-Contact agricultural activities in the area. Only one type of starch was identified, which was consistent with *kalo* (taro, *Colocasia esculenta*) corm starch grains.

Interpretive challenges arise due to the mixed nature of the deposit. For example, the identification of a dog intestinal parasite within an archaeological site in Hawai'i is an unexpected and potentially novel find. If the context were determined to be pre-Contact in age, it would represent the first instance of ancient dog parasite eggs in Polynesia outside of New Zealand (Horrocks pers. comm.). Unfortunately, due to the mixed nature of the single-layer deposit, the absence of macroscopic charcoal or other materials suitable for dating, and the presence of recent materials (e.g., microfossil remains from European-introduced plants, golf balls) does not allow for a confident pre-Contact association for the parasite eggs. As domestic dogs are still present on Hawai'i Island, these eggs may have been deposited more recently.

Fig. 1. Pollen percentage diagram from Makalapua Project District, Keahuolū Ahupua'a, North Kona District, Hawai'i Island (+ = found after count).

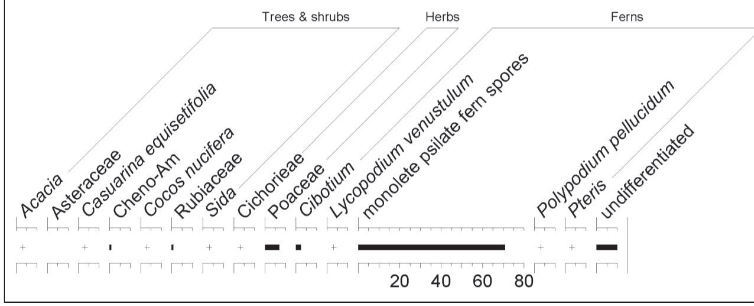

Figure 20. Pollen percentage diagram courtesy of Dr. Mark Horrocks, Microfossil Research, Ltd. (See Appendix C).

Fig. 2. Phytolith percentage and parasite diagram from Makalapua Project District, Keahuolū Ahupua'a, North Kona District, Hawai'i Island (+ = found after count, ++ = present in low concentration, +++ = present in high concentration).

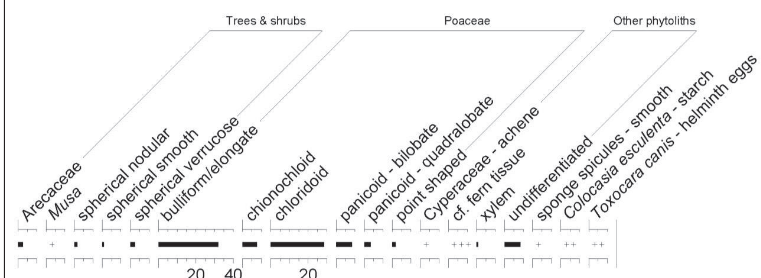

Figure 21. Phytolith percentage diagram courtesy of Dr. Mark Horrocks, Microfossil Research, Ltd. (See Appendix C).

8.0 RESEARCH CONCLUSIONS

Pacific Legacy, Inc., conducted an archaeological data recovery excavation at SIHP 50-10-27-30210, Feature B, a lava excavation located in the Makalapua Project District project area, owned by Liliʻuokalani Trust, in Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi [TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009 and 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021]. The purpose of the data recovery excavation was to investigate the nature and function of the lava excavation and to determine what role(s) lava excavations served for temporary habitation complexes in the Kona region.

Data recovery excavation at SIHP -30210, Feature B was undertaken on May 10 and 11, 2023. The excavation identified a single, thin layer of soil mixed with organic detritus and recent materials. No archaeological materials were identified during the excavation.

A single soil sample (MS-01) was collected from the southwestern half of the unit and submitted to Dr. Mark Horrocks (Microfossil Research, Ltd.) for microfossil (starch, pollen, and phytoliths) analysis. Microfossil analysis identified the presence of Polynesian-introduced cultivars (coconut, taro, and banana) as well as eggs from a parasite most commonly found in the small intestine of dogs (*Toxocara canis*). The mixed nature of the deposit and absence of dateable material poses some interpretive challenges. For example, it is not possible to confidently ascribe the presence of *T. canis* eggs to pre-Contact activities. Although the identified microfossil remains show similar mixing of Polynesian- and European-introduced taxa within the same deposit, it is more likely that the identified Polynesian cultivars are associated with pre-Contact agricultural activities, given the limited evidence for occupation and use of this landscape during the post-Contact era. Though caution must be taken in directly associating the identified cultigens with SIHP -30210, Feature B, their presence is a strong indication of past agricultural activities within the vicinity of the feature. It therefore appears likely that agricultural use was a – if not the primary – function of SIHP -30210, Feature B, and that these cultivation activities may have occurred intermittently throughout the pre-Contact period.

These results demonstrate the interpretive utility of microfossil analyses for testing potential agricultural features within the Kona region. Additional microfossil analyses in lava excavations where secure stratigraphic contexts are available would continue to refine our understanding of pre-Contact Hawaiian environments and agricultural activities.

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APPENDIX A

SHPD ACCEPTANCE LETTERS: KONA COMMONS SAIS REPORT, URBAN PHASE III AIS REPORT

DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
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SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
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KEKOA KALUHIWA
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W. ROY HARDY
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
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CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

August 11, 2015

Dr. Paul L. Cleghorn, Senior Archaeologist
Pacific Basin Division, Pacific Legacy, Inc.
30 Aulike Street, Suite 301
Kailua, Hawaii 96734

LOG NO: 2015.02142
DOC NO: 1508MV17
Archaeology

Subject: **HRS Chapter 6E-42 Historic Preservation Review -**
Supplemental Archaeological Inventory Survey of the 110 Acre
Queen Liliuokalani Trust Kona Commons Parcel
Keahuolu Ahupua'a, North Nona District, Island of Hawai'i
TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022

Thank you for the opportunity to review the revised draft report titled: *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolu, North Kona, Island of Hawai'i TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022* (J. McIntosh, T. Lizama, R. Reeve, J. Cleghorn and P. Cleghorn May 2015). This document was received by our office on June 1, 2015. This survey was undertaken in order to supplement the previous archaeological survey undertaken Rosendahl (1992). The survey utilized a 100% pedestrian survey with transects spaced at 10-15 meters. In addition, excavation in the form of test borings was conducted in five locations. The archaeological survey documented a total of 11 archaeological sites comprised of 20 component features in the project area. Four of these historic properties a modified depression (SIHP 50-10-27-18502), a modified overhang (SIHP 18508), a complex (SIHP 18509), and a complex that contains a burial feature (SIHP 18511) were previously recorded during the Rosendahl (1992) archaeological survey. However, it is important to note that previously unrecorded features of SIHP 18509 (feature D) and 18511 (features D and E) were newly identified during the current supplemental inventory survey. In addition to these features, the supplemental AIS identified and recorded 6 previously unrecorded historic properties. The newly recorded historic properties include: a lava excavation (SIHP 30207), a stone mound (*SIHP* 30208), an enclosure (SIHP 30209), a complex (SIHP 30210), a petroglyph (SIHP 30211), a C-shaped alignment (SIHP 30212) and a trail (SIHP 30287). With the exception of the burial feature (SIHP 18511fea. C) that is assessed as significant under criteria D and E, all of these sites have been assessed as significant under criteria D only. The report indicates that SIHP 18511fea. C and SIHP 30287 have been recommended for preservation, SIHP 30210 fea. B has been recommended for Data Recovery and the remaining sites are recommended for no further work. SHPD agrees with the significance assessments and treatment recommendations presented in this report. We believe that the entire trail (SIHP 30287) should be preserved until it can be confirmed with Na Ala Hele whether or not this trail is eligible for inclusion as a state trail. However it is possible that the trail may be breached in accordance with an approved preservation plan. The changes that were made to the report are the result of the SHPD review of a previous draft (Log No. 2015.04866, Doc No. 1503MV20). The report has been revised in response to the SHPD review of a previous draft of this report (Log 2012.3111, Doc. 1210MV40). The revisions and explanations have adequately addressed our concerns. This report meets the requirements of Hawaii Administrative Rule (HAR) §13-276 and is accepted. Please send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office. Please contact Mike Vitousek at (808) 692-8029 or Michael.Vitousek@hawaii.gov for any questions or concerns relating to this letter.

Aloha,

Mike Vitousek

Michael Vitousek,
Lead Archaeologist Hawaii Island Section
Historic Preservation Division

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

September 9, 2019

IN REPLY REFER TO:
Log No.: 2019.01679
Doc. No.: 1909AM05
Archaeology

Michael Shibata, Development Manager
Lili'uokalani Trust
1100 Alakea Street Suite 1100
Honolulu HI 96813
Email: mshibata@onipaa.org

Dear Mr. Shibata:

SUBJECT: **Hawaii Revised Statutes (HRS) Chapter 6E-42 Historic Preservation Review – Archaeological Inventory Survey of Urban Phase III Parcel**
Lili'uokalani Trust Lands
Keahuolū Ahupua'a North Kona District Island of Hawai'i
TMK: (3) 7-4-008:002 por.

This letter provides the State Historic Preservation Division's (SHPD's) review comments concerning the report titled *Revised Draft Archaeological Inventory Survey of Urban Phase III Parcel Queen Lili'uokalani Trust Lands in Keahuolū, North Kona Island of Hawai'i [TMK: (3) 7-4-008:002 por.]* (Reeve et al., July 2019). The SHPD received this revised draft on July 31, 2019. Previously, the SHPD requested revision of the initial draft in a letter dated August 16, 2018 (Log No. 2016.00071, Doc. No. 1808SL04).

Pacific Legacy, Inc., conducted the archaeological inventory survey (AIS) in support of the of the Lili'uokalani Trust (LT) Urban Phase III project, for which a master plan is being prepared for future residential, commercial, and civic/community areas, and open space. The Urban Phase III project area, totaling 213 acres, is owned by LT, a non-profit organization dedicated to the welfare of Hawai'i's children. The Urban Phase III project will involve grubbing, grading, and trench excavation for building construction and installation of utilities.

The letter that accompanies this revised draft AIS report also mentions a separate project, the Makalapua Project District (MPD) project, whose project area totals approximately 67.2 acres and includes multiple TMK parcels. An *Environmental Impact Statement* is being prepared for the MPD, which will create residential, hotel, retail, commercial, office, and civic/community areas.

The 213-acre Urban Phase III project area is bounded on the southwest by the old Kona Airport, now a State Recreation Area; on the northwest by a 628-acre conservation parcel belonging to LT; on the northeast by Queen Ka'ahumanu Highway; and on the southeast by the Kona Commons Shopping Center and undeveloped land along Makala Boulevard. The project area begins a short distance north of the north edge of the Kailua-Kona town core.

Previous correspondence concerning earlier, related projects, cited and summarized in the current AIS report (page 100) includes the following, concerning the Keahuolū project, as proposed at the time of Paul H. Rosendahl, Ph.D., Inc.'s AIS (PHRI 1994) and AMP (PHRI 1993):

- March 5, 1993 – SHPD to PHRI (Log No. 6851, Doc. No. 9303RC03), limiting data recovery to two sample blocks plus a few sites outside the project area;
- June 10, 1993 – PHRI to SHPD (not available);

- July 28, 1993 – DLNR to Belt, Collins & Associates (Log No. 8976, Doc. No. 9307RC40), stating that June 10, 2993, addendum to mitigation plan was not received; and
- December 21, 1993 – DLNR to PHRI (Log No. 10383, Doc No. 9312RC30), accepting sampling strategy for mitigation phase.

More recent correspondence in SHPD's files concerns archaeological studies conducted in support of shoreline-improvement removal in the LT Keahuolū campgrounds. The following letters were sent to Pacific Legacy:

- March 15, 2012 – SHPD's review letter (Log No. 2010.2686, Doc. No. 1203TD09) accepting campgrounds AIS report, and agreeing with recommendations for preservation of 87 sites, and data recovery for 235 sites;
- April 2, 2014 – SHPD's review letter (Log No 2014.0913, Doc. No. 1404MV01), accepting an archaeological monitoring plan for the campgrounds project; and
- June 3, 2015 – SHPD's review letter (Log No. 2015.01602, Doc. No. 1506MV14), accepting archaeological monitoring report for campgrounds project.

One additional letter, also to Pacific Legacy, concerns an AIS of the 25-acre LT Historic Preserve Area, adjacent to the current project area:

- March 23, 2012 – SHPD's review letter (Log No. 2012.0682, Doc. No. 1203MV33), accepting an AIS report that documents 96 archaeological sites containing 489 features. Twenty-three of the sites had been recorded earlier; 73 are newly identified. Significance is recommended for the entire preserve under Criteria a, c, d, and e; listing on the National Register of Historic Places (NRHP) is also recommended.

The current AIS identified 121 sites, 36 previously recorded and 85 newly identified. These consist of State Inventory of Historic Places [SIHP] Sites 50-10-27-13256 through 13258, 13260 through 13262, 13269, 13271, 13272, 13274, 13275, 13280 through 13282, 18286 through 13288, 13293, 13294, 13298 through 13302, 13351, 13353, 13386, 25655, 25644, 25646 through 25649, and 29088 through 29176. Of these, one site, Site 29175, consists of 540 excavated lava pits.

The 121 historic sites documented during the current AIS survey are assessed for site integrity and for significance according to Hawaii Administrative Rules (HAR) §13-284-6 Criteria a-e. All the sites are considered significant for their information content (Criterion d). Six sites are considered significant for their distinctive characteristics or high artistic value (Criterion c). Twenty-one sites are considered significant for their cultural importance to the Native Hawaiian community (Criterion e). The four sites considered significant under Criterion e include probable small shrines, a lava tube containing human skeletal remains, possible burial mounds, and 17 petroglyph fields.

SHPD agrees with the project effect determination of "Effect, with agreed upon mitigation commitments." The agreed upon mitigations includes no further work for 83 sites (120 features), mitigative archaeological data recovery for 28 sites (40 features), preservation (conservation) for 20 sites (55 features), and burial treatment for Site 50-10-27-18511. Mitigation plans will include a data recovery plan, a preservation plan, and archaeological monitoring plan for the project, and a burial treatment plan.

No Further Work

Sites 50-10-27-13256, 13257, 13258, 13269, 13271, 13272, 13282, 13286, 13288, 13293, 13298, 13300, 13301, 13302, 13351, 25644, 25646, 25647, 25648, 29089, 29093, 29094, 29096, 29097, 29099, 29100, 29101, 29102, 29103, 29104, 29105, 29106, 29107, 29108, 29109, 29110, 29111, 29112, 29113, 29114, 29115, 29116, 29117, 29119, 29120, 29121, 29122, 29123, 29126, 29127, 29128, 29129, 29131, 29132, 29133, 29134, 29136, 29137, 29138, 29139, 29140, 29141, 29143, 29145, 29146, 29147, 29151, 29153, 29154, 29155, 29156, 29157, 29161, 29162, 29163, 29164, 29166, 29169, 29171, 29172, 29173, 29174, and 29176.

Data Recovery

Sites 50-10-27-13258, 13262, 13272, 13274, 13280, 13351, 13386, 25649, 29088, 29095, 29099, 29104, 29118, 29124, 29125, 29130, 29135, 29144, 29146, 29148, 29149, 29150, 29152, 29158, 29165, 29168, 29170, and 29175.

Mr. Shibata
September 9, 2019
Page 3

Preservation

Sites 50-10-27-13260, 13261, 13272, 13274, 13275, 13280, 13281, 13287, 13294, 13299, 13353, 29090, 29091, 29092, 29098, 29142, 29144, 29159, 29160, and 29167.

The AIS report meets the requirements of HAR §13-276-5. **It is accepted.** Please send two hard copies of the document, clearly marked FINAL, and a text-searchable PDF version, to the Kapolei office, attention SHPD Library. Additionally, please include a copy of this acceptance letter with the hard copies of the report.

Pursuant to HAR §13-284-3, Steps (1) through (4) of the historic preservation review process are complete. As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "Effect, with agreed upon mitigation commitments," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD looks forward to receiving for review and acceptance, a data recovery plan meeting the requirements of HAR §13-278-4, an archaeological preservation plan meeting the requirements of HAR §13-277, and an archaeological monitoring plan meeting the requirements of HAR §13-279-4 for the current project and a Burial Treatment Plan (BTP) for Site 50-10-27-18511.

SHPD shall notify the County and the Liliʻuokalani Trust when the afore-mentioned mitigation plans have been reviewed and accepted and the permit issuance process may proceed.

Please contact Andrew McCallister, Archaeologist III, at (808) 692-8010 or at Andrew.McCallister@hawaii.gov if you have any questions, or if we can be of assistance in any way.

Aloha,

Alan Downer

Alan S. Downer, Ph.D.
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: daryn.arai@hawaiicounty.gov
cleghorn@pacificlegacy.com
mulrooney@pacificlegacy.com
planning@hawaiicounty.gov
sean.p.naleimaile@hawaii.gov

APPENDIX B

SHPD CORRESPONDENCE RELATING TO MITIGATION PLANS FOR THE MAKALAPUA PROJECT DISTRICT

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
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
KAHO'OLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

November 08, 2019

Queen Liliʻuokalani Trust
C/O Mana Purdy
74-5490 Makala Blvd.
Kailua-Kona, HI 96740

LOG NO: 2019.01526
DOC NO: 1911CJO01

Aloha e Mr. Purdy,

SUBJECT: **DRAFT Burial Treatment Plan for Site #50-10-27-18511, Liliʻuokalani Trust Lands in Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi, TMK: (3) 7-4-025:015.**

We apologize for the delay of this notification. At its monthly meeting on October 17, 2019, the Hawaiʻi Island Burial Council (HIBC) made the determination to preserve in place the above burial site, SIHP #50-10-27-18511. Additionally, the HIBC recommended that the State Historic Preservation Division (SHPD) accept the DRAFT Burial Treatment Plan.

Following the recommendation of the HIBC, the *DRAFT Burial Treatment Plan for Site #50-10-27-18511, Liliʻuokalani Trust Lands in Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi, TMK: (3) 7-4-025:015* is accepted by the SHPD. Please change the title from "DRAFT Burial Treatment Plan" to "Burial Site Component of a Preservation Plan" and submit hard copies of the final version with a copy of this letter and a text-searchable PDF CD to both our Kapolei and Hilo offices.

Should you have any further questions or concerns, you may contact our Hawaiʻi Island Burial Sites Specialist, Christian Omerod, at (808) 294-9573 or Christian.Omerod@Hawaii.gov.

Mahalo,

Hinano Rodrigues

Mr. Hinano Rodrigues, B.A., J.D.
History & Culture Branch Chief

CC: Mara Mulrooney, Pacific Legacy, Inc.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
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601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

July 26, 2022

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2207NM07
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District
Additional Consultation Regarding Archaeological Sites
Request for Concurrence with Effect Determination
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por., (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi request for concurrence with a determination of effect for the Makalapua Project District (MPD) and the supporting document titled *Additional consultation regarding archaeological sites located in the Liliʻuokalani Trust Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi, TMK: (3) 7-4-008:002 por., (3) 7-4-025:001-003, 005, 012, 015, (3) 7-4-010:009, 010* (Mulrooney, April 2022). Liliʻuokalani Trust (LT) is proposing the development of the MPD which is a 67.2-acre property. The County of Hawaiʻi has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original submittal on March 25, 2019 (Log No. 2019.00636). The current submittal was received on April 21, 2022 and includes a letter from Pacific Legacy (archaeological consultant) regarding the additional consultation that was requested by SHPD on July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05). Previous SHPD correspondence related to this project is provided in the Attachment.

The County of Hawaiʻi Planning Department letter, on behalf of Liliʻuokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; and 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD:

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was conducted for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

The County's letter identifies the previously agreed-upon mitigation commitments that still need to be addressed for documented historic properties in the MPD:

1. Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
2. Archaeological data recovery of Site 50-10-27-30210 Feature B;
3. Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261 (enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
4. Archaeological monitoring during ground disturbing construction activities.

The Attachment below includes a summary of the SHPD correspondence associated with the current MPD project. In a letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05), SHPD indicated that previously

requested items #1-4 had been completed but request item #5, additional consultation, was still needed. The recent letter from Pacific Legacy to SHPD dated April 21, 2022, includes the additional consultation efforts which were conducted between August 2021 and April 2022 and included consultation with the Ala Kahakai Trail Association, Nā Ala Hele Trail and Access, and cultural descendant Nicole Lui. The additional consultation resulted in assessing trail Site 50-10-27-30287 as additionally significant under Criterion "e" and changing the site mitigation from partial preservation to preservation with agreed upon potential breaches. During consultation, representatives from Ala Kahakai Trail Association and Nā Ala Hele Trail and Access recommended a 30-ft.-wide buffer from the outer edges of the trail. Nicole Lui agreed with the current 10-foot buffer on either side of the trail. Additionally, a petroglyph associated with the trail was identified during trail clearing and it will be added to the archaeological preserve.

Based on the additional consultation efforts, SHPD agrees with (1) Site 50-10-27-30287 being additionally assessed significant under Criterion e, (2) the preservation of Site 50-10-27-30287 being changed from partial to full preservation with allowance for agreed-upon breaches, and (3) preservation of the newly identified petroglyph. Lastly, SHPD indicates that the additional consultation efforts conducted by Pacific Legacy (August 2021 to April 2022) meet the requested item #5 detailed in SHPD's letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05).

SHPD's effect determination is "Effect, with agreed upon mitigation commitments" for the current project. As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "Effect, with agreed upon mitigation commitments," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD looks forward to receiving for review and acceptance a data recovery plan for Site 50-10-30210, Feature B meeting the requirements of HAR §13-278-3; a preservation plan meeting the requirements of HAR §13-277 for Site 50-27-13260, Site 50-10-27-13261, Site 50-10-27-18511 Feature A, Feature B, Feature D and Feature E, and Site 50-10-27-30287; and an archaeological monitoring plan meeting the requirements of HAR §13-279-4. Please upload a text-searchable PDF version of each document and their associated filing review fee to HICRIS Project No. 2020PR34163, in response to the new attachment request.

SHPD shall notify the County and LT when the mitigation commitments have been completed and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Alan Arakawa, aarakawa@onipaa.org
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Zendo Kern
July 26, 2022
Page 2

Attachment
SHPD Project Correspondence

November 8, 2019
Subsequent to the County's letter, the Hawai'i Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019. Additionally, the HIBC recommended that SHPD accepted the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

February 27, 2020
In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] that the two un-surveyed subject parcels within the MPD project area needed the following:

1. Additional investigation that includes a literature review and field inspection and;
2. that site integrity and site significance assessments for sites within the MPD be updated following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals.
3. Following completion of #1 and #2, SHPD concur with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

June 25, 2020
In a letter dated June 25, 2020 (Log No. 2020.000607, Doc. No. 2006SN05), SHPD accepted the field inspection report and determined the #1 request in the previous letter was adequately addressed; however, the additional information (#2) regarding the site integrity, site significance assessments and mitigation commitments for the 15 sites in the MPD project area had not yet been addressed.

September 4, 2020
Pacific Legacy, Inc. sent a letter dated September 4, 2020 (Log No. 2020.02056) to SHPD to address SHPD concerns. The submittal indicated consultation efforts were conducted by Pacific Legacy Inc., at the request of SHPD and on behalf of the Lili'uokalani Trust. Based on the additional consultation, Lili'uokalani Trust recommended that no changes to the site integrity and significance assessments or mitigation commitments are necessary for any of the 15 identified sites in the Makalapua Project District.

March 29, 2021
In a letter dated March 29, 2021 (Project No. 2020PR34163, Doc. No. 2103NM08), SHPD responded to the previous letter and requested the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.
5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

July 21, 2021
In a letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05), SHPD indicated that requested items 1-4 had been completed but request #5, additional consultation, was still needed.

JOSH GREEN, M.D.
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SYLVIA LUKE
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STATE OF HAWAII | KA MOKU'ĀINA 'O HAWAI'I
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KAPOLEI, HAWAII 96707

February 24, 2023

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2302NM06
Archaeology

Zendo Kern, Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District
Archaeological Monitoring Plan
Keahuolū Ahupua'a, North Kona District, Island of Hawai'i
TMK: (3) 7-4-008:002 por.; (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawai'i Makalapua Project District (MPD) and the supporting document titled *Revised Draft Archaeological Monitoring Plan for the Makalapua Project District, Lili'uokalani Trust Lands in the Ahupua'a of Keahuolū, North Kona District, Island of Hawai'i, [TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015]* (Tuitavuki and Mulrooney, December 2022). The archaeological monitoring plan (AMP) was originally submitted on August 10, 2022. SHPD requested revisions on October 24, 2022 and received the revised AMP with an attached letter from Pacific Legacy (archaeological consultant) on December 19, 2022.

The County of Hawai'i Planning Department, on behalf of the Lili'uokalani Trust, has provided the SHPD with a cover letter dated March 15, 2019 describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original project submittal on March 25, 2019 (Log No. 2019.00636).

The Lili'uokalani Trust proposes the development of the MPD within a 67.2-acre project area. The MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. Additional improvements may include a Kuakini Highway extension.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD (see Attachment). SHPD made a project effect determination of "Effect, with agreed upon mitigation commitments" for the project and requested an archaeological monitoring plan, an archaeological data recovery plan, and an archaeological preservation plan (July 26, 2022; Project No. 2020PR34163, Doc. No. 2207NM07). In a letter dated December 20, 2022 (Project No. 2020PR34163, Doc. No. 2212NM06), SHPD accepted the data recovery plan (Mulrooney and Cleghorn, December 2022). The preservation plan is currently under review by SHPD. For previous SHPD correspondence related to this project see the Attachment in HICRIS Project No. 2020PR34163.

The AMP (Tuitavuki and Mulrooney, December 2022) meets the requirements of HAR §13-279-4. **It is accepted.** Please send one hard copy of the document, clearly marked FINAL, along with a copy of this letter and a text-searchable PDF version of the AMP to the Kapolei SHPD office, attention SHPD Library. In addition, please send a copy of the AMP to the Hawai'i Island SHPD Office, Attn: Sean Naleimaile. Also, submit a text-searchable PDF copy of the Final AMP to HICRIS Project No. 2020PR34163 using the Project Supplement option and a PDF copy of the AMP to lehua.k.soares@hawaii.gov.

SHPD requests to be notified at the start of archaeological monitoring via HICRIS and email. Within 60 days of completion of archaeological monitoring fieldwork, SHPD looks forward to reviewing an archaeological monitoring report (AMR) meeting the requirements of HAR §13-279-5.

SHPD shall notify the County and LT when the additional mitigation commitments have been completed and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

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Attachment
SHPD Reviews of Previous Archaeological Studies Related to Current Proposed Project

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Lili'uokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawai'i (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites. The report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted this AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

Most recently, a field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was completed for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

JOSH GREEN, M.D.
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KAPOLEI, HAWAII 96707

December 20, 2022

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2212NM06
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District Data Recovery Plan
Keahuolū Ahupua'a, North Kona District, Island of Hawai'i
TMK: (3) 7-4-008:002 por.; (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawai'i Makalapua Project District (MPD) and the supporting document titled *Archaeological Data Recovery Plan for SIHP 50-10-27-30210, Feature B Lili'uokalani Trust Lands in the Ahupua'a of Keahuolū, North Kona District, Island of Hawai'i, [TMK: (3) 7-4-008:002 (por.,) (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015]* (Mulrooney and Cleghorn, December 2022). Lili'uokalani Trust (LT) is proposing the development of the 67.2-acre MPD property. The County of Hawai'i has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original submittal on March 25, 2019 (Log No. 2019.00636). The current submittal was received on December 19, 2022, and includes a revised data recovery plan (DRP) with an attached letter from Pacific Legacy (archaeological consultant). The DRP was originally submitted on August 10, 2022, and SHPD requested revisions on October 19, 2022. Previous SHPD correspondence related to this project is provided in the Attachment.

The County of Hawai'i Planning Department letter, on behalf of Lili'uokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; and 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD:

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Lili'uokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawai'i (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i*

[TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
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Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was conducted for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

In a letter dated July 26, 2022 (Project No. 2020PR34163, Doc. No. 2207NM07), SHPD made a project effect determination of "Effect, with agreed upon mitigation commitments," and requested an archaeological monitoring plan, an archaeological data recovery plan, and an archaeological preservation plan for the proposed project.

Zendo Kern
December 20, 2022
Page 3

The DRP (Mulrooney and Cleghorn, December 2022) indicates that data recovery will consist of hand excavation, soil sampling, and laboratory analysis at Site 50-10-27-30210, Feature B. The excavation will consist of the entirety of the feature. The research objectives include identifying additional information regarding lava excavations and the activities carried out at the site along with the role lava excavations had as part of temporary habitation complexes in the Kona region. Research techniques will include cultural material analyses, radiocarbon analysis of short-lived species from documented contexts (if recovered), and soil samples submitted for pollen, phytolith, and starch analyses. All recovered materials will be temporarily housed at the Pacific Legacy office in Kailua, O‘ahu office until the project is complete. The permanent curation will be decided by the landowner in consultation with SHPD once the project is complete.

The DRP (Mulrooney and Cleghorn, December 2022) meets the requirements of HAR §13-278-3. **It is accepted.** Please send two hard copies of the document, clearly marked FINAL, along with a text-searchable PDF copy of the document and a copy of this acceptance letter to the Kapolei SHPD office, attention SHPD Library. Additionally, please upload a text-searchable PDF version of the document to HICRIS Project No. 2020PR34163 in response to the HICRIS request and send a PDF copy to lehua.k.soares@hawaii.gov.

SHPD herby notifies the County that the DRP has been accepted and **SHPD looks forward to** receiving for review and acceptance an archaeological data recovery report for Site 50-10-27-30210, Feature B that meets the requirements of HAR §13-278-4.

SHPD shall notify the County and LT when the additional mitigation commitments have been completed and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai‘i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,
Susan A. Lebo
Signed For
Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

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March 6, 2023

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2303NM03
Archaeology

Zendo Kern, Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District Archaeological Preservation Plan
Keahuolū Ahupua‘a, North Kona District, Island of Hawai‘i
TMK: (3) 7-4-008:002 por.; (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawai‘i Makalapua Project District (MPD) and the supporting document titled *Revised Draft Preservation Plan for SIHP 50-10-27-13260, 50-10-27-13261, and 50-10-27-30287, Lili‘uokalani Trust Lands in the Ahupua‘a of Keahuolū, North Kona District, Island of Hawai‘i, [TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015]* (Mulrooney and Cleghorn, March 2023). Our office received the initial draft preservation plan (PP) on August 15, 2022; requested revisions on November 2, 2022 and March 1, 2023; and received the revised PP on March 6, 2023.

The County of Hawai‘i Planning Department, on behalf of the Lili‘uokalani Trust, has provided the SHPD with a cover letter dated March 15, 2019 describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original project submittal on March 25, 2019 (Log No. 2019.00636).

The Lili‘uokalani Trust proposes the development of the MPD which is a 67.2-acre property. The MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. Additional improvements may include a Kuakini Highway extension.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD (see Attachment). SHPD made a project effect determination of "Effect, with agreed upon mitigation commitments" for the project and requested an archaeological monitoring plan, an archaeological data recovery plan, and an archaeological preservation plan (July 26, 2022; Project No. 2020PR34163, Doc. No. 2207NM07). Subsequently, SHPD accepted the data recovery plan (Mulrooney and Cleghorn, December 2022) on December 20, 2022 (Project No. 2020PR34163, Doc. No. 2212NM06), and the archaeological monitoring plan (Tuitavuki and Mulrooney, December 2022) on the February 24, 2023 (Project No. 2020PR34163, Doc. No. 2302NM06). For previous SHPD correspondence related to this project see the Attachment in HICRIS Project No. 2020PR34163.

The PP (Mulrooney and Cleghorn, December 2022) meets the requirements of HAR §13-277. **It is accepted.** Please send one hard copy of the document, clearly marked FINAL, along with a copy of this letter and a text-searchable PDF version of the AMP to the Kapolei SHPD office, attention SHPD Library. In addition, please send a copy of the AMP to the Hawai‘i Island SHPD Office attn, Sean Naleimaile. Also, submit a text-searchable PDF copy of the final

AMP to HICRIS Project No. 2020PR34163 using the Project Supplement option and a PDF copy of the PP to lehua.k.soares@hawaii.gov.

SHPD requests via email and HICRIS written and photographic verification that the interim protection measures for the preservation sites have been implemented prior to project initiation.

SHPD shall notify the County and LT when the data recovery report has been accepted by SHPD and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

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Attachment
SHPD Reviews of Previous Archaeological Studies Related to Current Proposed Project

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Lili'uokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawai'i (TMK: 3-7-4-008:Por. 2).* This survey documented 18 sites. The report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022].* The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK:(3) 7-4-008:002 por.].* The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted this AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented archaeological sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was conducted for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

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LAND
STATE PARKS

STATE OF HAWAII | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

October 5, 2023

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2310NM01
Archaeology

Zendo Kern, Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Hawaii Revised Statutes (HRS) §6E-42 Historic Preservation Review –**
Makalapua Project District End-of-Fieldwork Report of Data Recovery Investigations
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por.; (3) 7-4-010:009, 010; (3) 7-4-025:001, 002, 003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi Makalapua Project District (MPD) and the supporting document titled *Post-Field Summary Report of Data Recovery Investigations at SIHP 50-10-27-30210, Feature B in the Makalapua Project District, Liliʻuokalani Trust Lands in the Ahupuaʻa of Keahuolū, North Kona District, Island of Hawaiʻi, [TMK: (3) 7-4-008:002 (por.)]* (Mulrooney, May 2023). Our office received the document on May 19, 2023.

The County of Hawaiʻi Planning Department, on behalf of the Liliʻuokalani Trust (LT), has provided the SHPD with a cover letter dated March 15, 2019 describing the proposed project and the County's HRS §6E effect determination for the project. The SHPD received the original project submittal on March 25, 2019 (Log No. 2019.00636).

The LT proposes the development of the MPD which is a 67.2-acre property. The MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. Additional improvements may include a Kuakini Highway extension.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD. SHPD made a project effect determination of "Effect, with agreed upon mitigation commitments" for the project and requested an archaeological monitoring plan, an archaeological data recovery plan, and an archaeological preservation plan (July 26, 2022; Doc. No. 2207NM07). Subsequently, SHPD accepted the data recovery plan (December 20, 2022; Doc. No. 2212NM06), the archaeological monitoring plan (February 24, 2023; Doc. No. 2302NM06), and the archaeological preservation plan (March 6, 2023; 2303NM03). For previous SHPD correspondence related to this project see the Attachment in HICRIS Project No. 2020PR34163.

Data recovery efforts were conducted by Pacific Legacy Inc. on May 10-11, 2023, at Site 50-10-27-30210, Feature B. The site was mapped, and LiDAR was used to record the feature. Site 30210, Feature B was hand excavated with a trowel and no cultural material was identified. A soil sample was collected for paleoethnobotanical analysis.

The End-of-Fieldwork Letter Report (Mulrooney, May 2023) adequately documents the completion of data recovery investigations in accordance with the SHPD-accepted archaeological data recovery plan and as specified in HAR §13-

278-3. **It is accepted**. Within 6 months of the completion of archaeological data recovery work, SHPD looks forward to the opportunity to review and accept the detailed results of the data recovery for Site 50-10-27-30210, Feature B, meeting the requirements of HAR §13-278-4. When completed, please submit the report to SHPD via HICRIS Project No. 2020PR34163 using the Project Supplement option.

Pursuant to HRS §6E-42 and HAR §13-284-3(b)(1-5), LT has completed the first 5 of the 6 historic preservation review procedural steps. To address step 6, Verification of Completion, pursuant to HAR §13-284-3(b)(6) and HAR §13-284-9(d), LT proposes the following procedures and schedules:

- LT has implemented the interim and long-term protective measures specified in the SHPD-accepted burial site component of a preservation plan;
- LT has initiated the data recovery fieldwork in accordance with the SHPD-accepted data recovery plan;
- An end-of-fieldwork data recovery letter report was submitted to SHPD following the completion of data recovery fieldwork at Site 50-10-27-30210;
- Within 6 months after completion of the data recovery fieldwork, a data recovery report meeting the requirements of HAR §13-278-4 will be submitted to SHPD for review and acceptance;
- During the pre-construction period (tentatively scheduled for early 2026), LT will implement the archaeological monitoring plan pre-construction meeting so that all contractors are aware of the plan's requirements;
- During construction, LT will ensure compliance with all provisions in the archaeological monitoring plan;
- Following completion of construction, LT will submit within 6 months an archaeological monitoring report meeting the requirements of HAR §13-279-5 for SHPD review and acceptance.

Based on the above, SHPD indicates it has reviewed and commented on the effect of the proposed project pursuant to HRS §6E-42 and HAR §13-284-3; that it is SHPD's determination that LT has completed Steps 1 through 5 pursuant to HAR §13-284-3(b)(1-5), and that SHPD concurs with the procedures and schedule LT has proposed to complete Step 6 (verification of completion) per HAR §13-284-3(b).

SHPD hereby notifies the County that the permit issuance process may continue. Subsequently, SHPD will notify the County when a data recovery report meeting the requirements of HAR §13-278-4 and an archaeological monitoring report meeting the requirements of HAR §13-279-5 have been accepted and the HRS 6E historic review process will be completed.

Please contact Nicole A. Mello, Hawaiʻi Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
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APPENDIX C

PLANT MICROFOSSIL ANALYSIS OF AN ARCHAEOLOGICAL SAMPLE FROM MAKALAPUA PROJECT DISTRICT, KAHUOLŪ AHUPUAʻA, NORTH KONA DISTRICT, HAWAIʻI ISLAND

REPORT BY DR. MARK HORROCKS, MICROFOSSIL RESEARCH, LTD.

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4 December 2023

Plant microfossil analysis of an archaeological sample from Makalapua Project District, Keahuolū Ahupuaʻa, North Kona District, Hawaiʻi Island

Summary

The microfossils provide evidence of disturbed open vegetation, dominated by ground ferns. There is also evidence of Polynesian introduced cultigens, namely coconut, taro, and banana, and for the intestinal dog parasite *Toxocara canis*. The presence of a modern pollen type indicates mixing of different aged material.

Methods

A soil/sediment sample from an archaeological feature was analysed for pollen, phytoliths, starch, and helminth eggs to provide a record of past vegetation, environments, and human activity. The latter are parasitic worms. Detailed methods of analysis are described in the Appendix.

Results and discussion

Taphonomy

In ground substrates at archaeological sites such as in this study, mixing of plant microfossils of different ages can occur by erosion, percolation, bioturbation, or mechanical disturbance. Interpretations based on the microfossils should thus be made cautiously.

Pollen and spores

The sample contained microscopic fragments of charcoal, reflecting burning of vegetation by people in the region. The pollen and spore assemblage was overwhelmingly dominated by fern spores, reflecting an open disturbed landscape with abundant ground ferns (Fig. 1). Pollen of the Polynesian introduced cultigen *Cocos nucifera* (coconut) and European introduced *Casuarina equisetifolia* (ironwood) was found in the sample (Whistler 2009). The latter indicates mixing of different aged material. Another introduction was pollen of Cichorieae, an herbaceous plant tribe. As the Hawaiian Islands have no indigenous members of the Cichorieae, this pollen type is presumably of the *Sonchus* genus, a probable accidental Polynesian introduction (Arthur Whistler, pers. comm.) or of European introduced *Taraxacum officinale* (dandelion).

Phytoliths

The phytolith assemblage was overwhelmingly dominated by fragmented phytoliths of fern frond tissue and Poaceae (grasses) leaf phytoliths (Fig. 2). Although grasses tend to be over-represented in phytolith spectra, their large phytolith amounts support the pollen and spore evidence of open, disturbed vegetation (Fig. 1), along with the fern phytoliths. A leaf phytolith of the Polynesian introduced cultigen *Musa* sp. (banana) was found in the sample (Whistler 2009).

Starch and other biotic material

One type of starch was identified in this study, in a very small amount. This type comprised a mass of starch grains consistent with the corm of the Polynesian introduced cultigen *Colocasia esculenta* (taro) (Fig. 2).

This extraction also yielded microscopic eggs of the helminth parasite *Toxocara canis* (Fig. 2). Helminths are worm like parasites. This species is a roundworm of the dog family (Canidae), with a worldwide distribution. Both early Polynesians and subsequent Europeans introduced dogs to the Hawaiian Islands. The parasite inhabits the small intestine of the definitive host, and is usually asymptomatic, except in the case of massive infection in pups, which may be fatal. Eggs are deposited in the faeces of the dog and the worm develops within the egg, and once embryonated it becomes infectious. Dogs are infected when they ingest embryonated eggs from contaminated soil, or the worm larvae are directly acquired by a pup trans-placentally. In young dogs the larvae hatch out and migrate to the lungs where they are coughed up and swallowed,

bringing them again to the intestine where they mature to adulthood. In dogs over three months old the larval worm either remains in the gut to mature and produce eggs for dispersal or enters the bloodstream and migrates to any organ of the body, where it will encyst in the tissues (Harris-Linton 2001).

Toxocariasis is a zoonotic (animals to humans or vice versa) disease, usually acquired by children ingesting eggs from soil. Infective larvae hatch in the intestine, but the juvenile stages do not mature. Instead, they wander throughout the body for months or up to several years, damaging where they settle, and potentially causing blindness or death in the case of ocular or neurological infections.

Polynesian agriculture at the site

The cultigen microfossils identified in this study may not be directly associated with the sampled feature but can indicate cultivation in its vicinity.

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Appendix

Plant microfossil methods

Pollen analysis

Pollen analysis includes pollen grains of seed plants and spores of ferns and other plants. It provides insight into past vegetation and environments and in Polynesia can allow the differentiation of sediments deposited in pre-settlement, and pre- and post-contact times (Horrocks et al. 2012a, 2013). Pollen can also provide evidence for Polynesian introduced plants, for example *Aleurites moluccana* (candlenut tree), *Colocasia esculenta* (taro), *Cordyline fruticosa* (ti), *Cyrtosperma merkusii* (giant swamp taro), *Ipomoea batatas* (sweet potato), *Lagenaria siceraria* (bottle gourd), and *Morinda citrifolia* (Athens and Ward 1997; Horrocks et al. 2012a, 2012b, 2022a, 2023a, 2023b, 2023c; Kahn et al. 2014; McCoy et al. 2016; Prebble et al. 2019; Handley et al. 2020; Horrocks and Thomas 2022b; Flexner et al. in press).

The sample was prepared for pollen analysis by the standard acetolysis method (Moore et al. 1991, Horrocks 2020). A sum of at least 100 pollen grains and spores was counted, and the slide was scanned for types not found during the count.

Starch and other plant remains can sometimes be found in pollen preparations. Microscopic fragments of charred plant material are also extracted during pollen preparation, providing evidence of fire.

Phytolith analysis

Phytoliths are particles of silica formed in inflorescences, stems, leaves, and roots of many plants (Piperno 2006). Phytolith analysis compliments pollen analysis and can provide evidence for Polynesian introduced crops, such as *Musa* (banana) and *Broussonetia papyrifera* (paper mulberry) (Horrocks 2004; Horrocks and Rechtman 2009; Horrocks et al. 2012a, 2012b, 2013, 2023b; Kahn et al. 2014). Other types of microscopic biosilicates, notably diatoms, radiolarians, and sponge spicules, are extracted along with phytoliths during preparation. Diatoms are unicellular algae and have cell walls composed of silica; radiolarians are a type of amoeboid protozoa with siliceous skeletons; sponges are multi-cellular animals with skeletons often composed of siliceous spicules. Diatoms are found in aquatic and sub-aquatic environments; radiolarians and sponges are exclusively aquatic. Diatoms and sponges are found in both marine and freshwater environments; radiolarians are exclusively of marine origin.

The sample was prepared for phytolith analysis by density separation (Piperno 2006, Horrocks 2020). A sum of at least 100 phytoliths was counted, and the slide was scanned for types not found during the count. Fragmented phytoliths of fern frond tissue were not included in the count as they were present in a very high concentration, and it is often difficult to differentiate them from fragments of other silicates. Instead, they are shown simply as “present in high concentration” in the phytolith graphical diagram.

Analysis of starch and other plant material

This analysis includes starch grains and other plant material such as calcium oxalate crystals and xylem (Pearsall 2015). Starch is the main substance of food storage for plants and is mostly found in high concentrations of microscopic grains in underground stems (e.g., tubers and corms), roots, and seeds. The grains are synthesised and stored in amyloplasts; sub-cellular units specialised for this function. Calcium oxalate crystals, comprising raphides which are needle-like and druses which are compound, are found in both the aerial and underground parts of many plant taxa. Xylem is a vascular tissue comprising elongated cells through which most of the water and minerals of a plant are conducted. Starch analysis can provide evidence from archaeological sites for Polynesian introduced starch crops, such as *Ipomoea batatas*, *Colocasia esculenta*, and *Dioscorea* spp. (yams), and European introduced plants such as *Solanum tuberosum* (potato) (Horrocks and Weisler 2006; Horrocks et al. 2007, 2012a, 2012b; Kahn et al. 2014, 2022b, 2023a, 2023b, 2023c; Flexner et al. in press). As well as at archaeological sites, *I. batatas* and *C. esculenta* starch and associated material have also been identified in an offshore marine sediment core (Handley et al. 2020).

Advances in this method include the use of Fourier Transform InfraRed spectroscopy to positively identify degraded starch, often uncertain due to loss of distinguishing features, and the discovery of non-starch *Colocasia* microfossil types, namely shoot epidermal tissue and phenolic inclusions from the skin of the corm (Horrocks and Barber 2005; Horrocks et al. 2012a, 2012b, 2014, 2016, 2017, 2023a; Kahn et al. 2014).

Starch and other biotic remains, including helminth eggs, were prepared for analysis by density separation and presence/absence noted (Pearsall 2015, Horrocks 2020). These remains can sometimes be found in pollen preparations, despite the harsh chemicals used in that procedure. Occasional pollen and spores can be found in starch preparations.

Fig. 1. Pollen percentage diagram from Makalapua Project District, Keahuolū Ahupuaʻa, North Kona District, Hawaiʻi Island (+ = found after count).

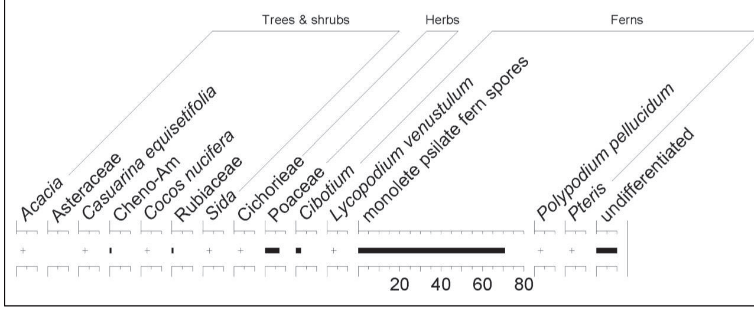
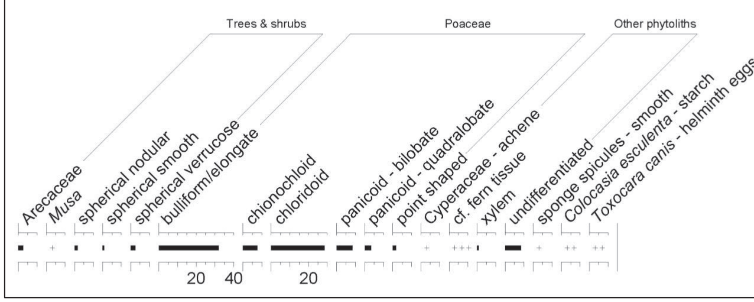


Fig. 2. Phytolith percentage and parasite diagram from Makalapua Project District, Keahuolū Ahupuaʻa, North Kona District, Hawaiʻi Island (+ = found after count, ++ = present in low concentration, +++ = present in high concentration).



BURIAL TREATMENT PLAN

APPENDIX H

Pacific Legacy

Historic Preservation

BURIAL SITE COMPONENT OF A PRESERVATION PLAN FOR SITE 50-10-27-18511 LILI‘UOKALANI TRUST LANDS IN THE AHUPUA‘A OF KEAHUOLŪ NORTH KONA DISTRICT HAWAI‘I ISLAND [TMK (3) 7-4-025:015]

Pacific Legacy: Exploring the past, informing the present, enriching the future.

CULTURAL RESOURCES CONSULTANTS

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Bay Area
Sierra/Central Valley

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BURIAL SITE COMPONENT OF A PRESERVATION PLAN
FOR SITE 50-10-27-18511
LILIʻUOKALANI TRUST LANDS
IN THE AHUPUAʻA OF KEAHUOLŪ
NORTH KONA DISTRICT, HAWAIʻI ISLAND
[TMK (3) 7-4-025:015]

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November 2019

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Cover image: *Site 50-10-27-18511, Feature C (view southwest).*

GLOSSARY OF HAWAIIAN TERMS

ahupua‘a	traditional land division usually extending from the mountains to the sea and encompassing a range of environmental zones that were known and used by the land’s early Hawaiian residents
ali‘i kāne	chief
ali‘i wahine	chiefess
ho‘okupu	an offering, literally “to cause to grow”
‘ili	a traditional land division, usually a subdivision of the *ahupua‘a*
iwi	bone, human bones
iwi kupuna	ancestral remains
kahu	caretaker, steward
kama‘āina	native-born, one born in a place, literally a child of the land
kīhāpai	small garden or field
kuleana	right, responsibility, property, the term is often used to refer to lands awarded to native claimants during the Mahele ‘Āina, the land division of 1848
makai	toward the sea
maka‘āinana	commoners
mana‘o	thought, idea or opinion
mauka	towards the mountains (inland)
‘ohana	family, extended family
pāhoehoe	smooth and often undulating lava differing from the more broken *‘a‘ā* lava
pono	proper, correct
wahi kapu	forbidden or restricted place, often used to refer to a culturally sensitive area

1.0 INTRODUCTION

At the request of the Liliʻuokalani Trust, Pacific Legacy, Inc. has prepared the following Burial Treatment Plan (BTP) to address the protection and long-term preservation of a single identified human burial present within the 100-acre Kona Commons portion of Trust lands located within the *ahupuaʻa* (land division) of Keahuolū in the district of North Kona on the island of Hawaiʻi. This property was the subject of an Archaeological Inventory Survey (AIS) undertaken by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1992 (O'Hare and Rosendahl 1993) and a Supplemental Archaeological Inventory Survey (SAIS) undertaken by Pacific Legacy in 2014 (McIntosh et al. 2014). It was during the course of the 1992 PHRI survey that the burial for which this Burial Treatment Plan has been prepared was discovered. At that time, the burial, which is situated within a lava tube, was recorded and assigned State Inventory of Historic Places site number 50-10-27-18511, Feature C. The Site 18511, Feature C burial was relocated and further documented during the 2014 Pacific Legacy survey.

The landowner information for the location of the Site 50-10-27-18511, Feature C burial is below:

Liliʻuokalani Trust
1100 Alakea Street, Suite 1100
Honolulu, HI 96813

The Trust recognizes the importance of the Site 50-10-27-18511, Feature C lava tube burial and the *iwi kūpuna* (ancestral remains) that it contains. It is their intention to preserve this burial in place and to ensure that it is not disturbed during the development of the surrounding area or its future use. The objective of this Burial Treatment Plan (BTP) is to satisfy the cultural resource requirements of the Department of Land and Natural Resources as promulgated in Hawaiʻi Administrative Rules §13-300-33 (Request for Council Determination to Preserve or Relocate Native Hawaiian Burial Sites).

1.1 Burial Location

The Site 50-10-27-18511, Feature C burial is located within the Liliʻuokalani Trust's 100-acre Kona Commons property at the northern edge of Kailua town. This property is situated in the coastal portion of the *ahupuaʻa* of Keahuolū in the district of North Kona on the island of Hawaiʻi (Figure 1). The burial site is located within Hawaiʻi County tax map parcel (3) 7-4-025:015 (Figure 2). Site 50-10-27-18511, Feature C is the only identified Native Hawaiian burial within the Kona Commons property.

The Kona Commons property is bounded to the northeast by the Queen Kaʻahumanu Highway, to the northwest by the 213-acre Urban Phase III parcel, which contains the Liliʻuokalani Children's Center complex, to the southeast by commercially developed land that forms part of the Kona industrial area, and to the southwest by playing fields that form part of the Old Kona Airport State Recreation Area (Figure 3).

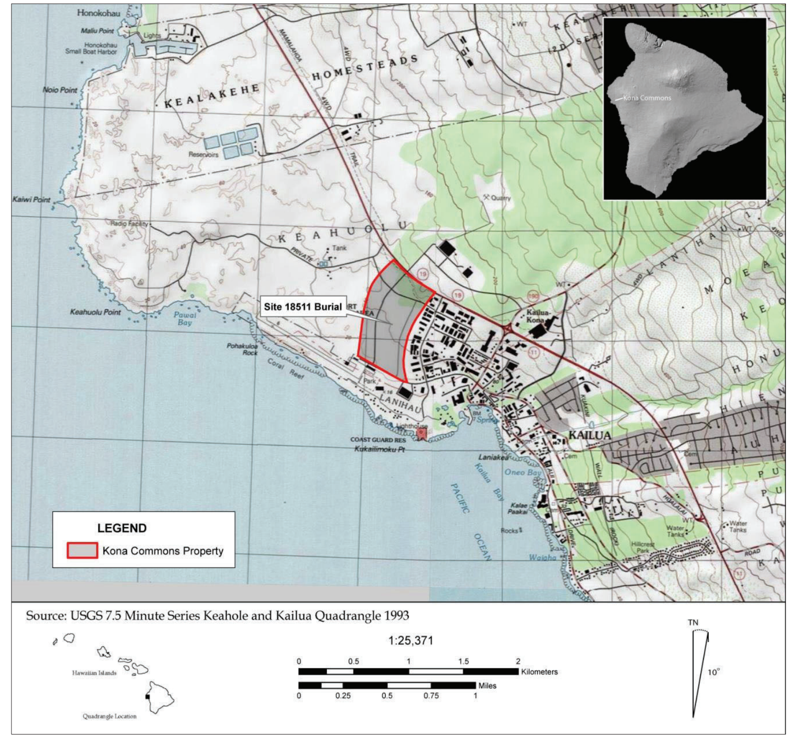

Figure 1. Location of the Liliʻuokalani Trust Kona Commons parcel (base map U.S.G.S. Kailua and Keahole Point quadrangles 1993, North American Datum 1983).

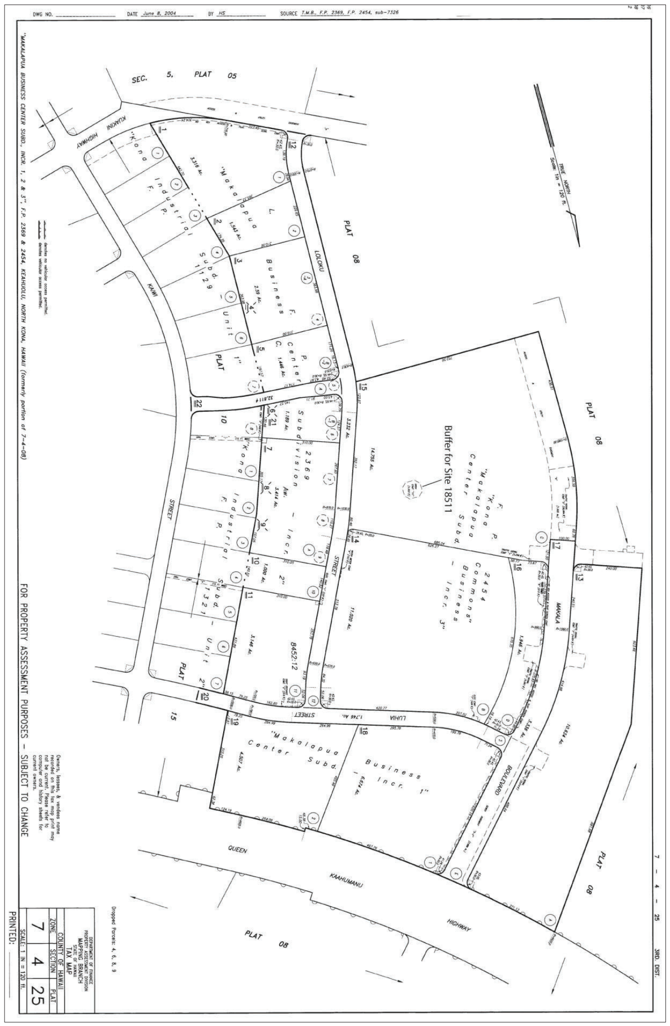

Figure 2. County of Hawai'i Tax Map Key [TMK] (3) 7-4-25 showing the archaeological buffer established around the Site 50-10-27-18511 burial (County of Hawai'i Planning Department 2004 map).

Figure 3. Aerial photograph showing the relative location of Site 50-10-27-18511 (background aerial from Google Earth, accessed 2014).

Portions of the Kona Commons property have been developed for commercial use. Most of this development has been concentrated in the *mauka* (inland) half of the property. These *mauka* lands are now occupied by a mix of commercial properties and parking areas (Figure 3). At present, the more *makai* (seaward) half of the Kona Commons property remains relatively undeveloped, though portions of this undeveloped land have been disturbed by bulldozing, and by landscaping associated with the construction of the former Swing Zone driving range.

The Site 50-10-27-18511, Feature C lava tube burial is located on an undeveloped section of land just *makai* (seaward) of the Target store and its associated parking area (Figure 4). This undisturbed lot consists of undulating *pāhoehoe* lava vegetated in a thin covering of fountain grass (*Pennisetum setaceum*).

1.2 Statutory Requirements

Hawaiʻi Administrative Rules, Title 13, Subtitle 13, Chapter 300 (HAR §13-300) outlines the "Rules of Practice and Procedure Relating to Burial Sites and Human Remains" within the State of Hawaiʻi. Under these administrative rules, the Hawaiʻi Island Burial Council has jurisdiction over all requests to preserve or relocate previously identified Native Hawaiian burial sites (HAR §13-300-33: Request for Council Determination to Preserve or Relocate Native Hawaiian Burial Sites).

HAR §13-300-33(b) requires that the applicant "submit a request to preserve in place or relocate a Native Hawaiian burial site to the department [the State Historic Preservation Division] in the form of a burial treatment plan." As mentioned above, it is the intent of the Liliʻuokalani Trust to preserve in place the human remains located at Site 50-10-27-18511, Feature C. The following Burial Treatment Plan details the proposed treatment of this burial site. It complies with all necessary requirements as set forth in HAR §13-300-33. This plan is being submitted to the State Historic Preservation Division (SHPD) and the Hawaiʻi Island Burial Council (HIBC) for review and determination.

1.3 Report Organization

The following Burial Treatment Plan has been organized into eight sections to address the various issues associated with the protection and long-term preservation of the Site 50-10-27-18511, Feature C burial site.

Section 1: Provides an introduction to the Burial Treatment Plan.
Section 2: Presents background on the Site 18511 burial including a brief natural and cultural history of the Kona Commons property and the previous archaeological work undertaken within it.
Section 3: Provides a detailed description of the Site 18511, Feature C burial site.
Section 4: Discusses the Burial Treatment Plan prepared by PHRI in 1993 to address numerous burials located within Liliʻuokalani Trust lands in Keahuolū.

Figure 4. Location of the Site 50-10-27-18511, Feature C lava tube burial (background aerial from Google Earth, accessed 2016).

Section 5: Details the efforts undertaken to identify lineal and cultural descendants associated with the Site 18511 burial and lists the recognized cultural descendants of the Keahuolū area.
Section 6: Discusses the proposed development for the area surrounding the Site 18511 burial.
Section 7: Outlines the plans to protect and preserve the Site 18511 burial from potential adverse effects during the development and use of the surrounding area.
Section 8: Lists the various references cited in the document.

A glossary of Hawaiian words used within the Burial Treatment Plan is provided at the beginning of the document.

The Burial Treatment Plan also includes the following appendices:

Appendix A: Description of Site 50-10-27-18511
Appendix B: Burial Treatment Plan Prepared by Paul H. Rosendahl, Ph.D., Inc., 1993
Appendix C: Copies of Public Notices
Appendix D: Descendant Consultation

2.0 PROJECT BACKGROUND

This section of the Burial Treatment Plan provides background information on the Site 50-10-27-18511 burial and its place within the *ahupuaʻa* of Keahuolū and the larger North Kona region. It discusses the historic background of the Kona Commons property and the various archaeological investigations that have taken place within it.

2.1 Environmental Setting

The Kona Commons property is located at the foot of the volcanic peak of Hualālai, on the drier leeward side of the island of Hawaiʻi. The Site 18511 burial is situated at roughly 12 meters (40 feet) in elevation above sea level and approximately 200 meters inland of the shoreline. The geology underlying most of the Kona Commons property, including the Site 18511 area, consists of gently undulating *pāhoehoe* lava flows laid down sometime between 1,500 and 3,000 years ago (Wolfe and Morris 1996). These *pāhoehoe* flows possess very little in the way of surface soil, most of which consists of thin aeolian sediments that have accumulated in depressions and low-lying areas (soil type rLW in Sato et al. 1973:Map 85). The lava is scarred by upthrust pressure ridges, fissures, collapsed blisters, and lava sinks. Subsurface lava tubes and blisters are also present within the flow. Several of these natural geologic features show evidence of having been modified and utilized by the pre-Contact inhabitants of coastal Keahuolū. The lava tube that forms Site 18511, Feature C is one such volcanic feature.

Less than 750 millimeters (approximately 29.5 inches) of rain fall in a year along this stretch of the Kona coast (Giambelluca et al. 1986). Due to the limited amount of rainfall, vegetation in the area is relatively sparse. The undisturbed *pāhoehoe* lavas within the Kona Commons property are covered in a sparse to dense ground cover of introduced fountain grass (*Pennisetum setaceum*), with occasional stunted *kiawe* (*Prosopis pallida*), and Christmas berry (*Schinus terebinthifolius*) trees, as well as *koa haole* (*Leucaena leucocephala*), klu (*Acacia farnesiana)*, lantana (*Lantana camara*), and bougainvillea (*Bougainvillea spp.*) shrubs. Scattered native shrubs such as *ʻuhaloa* (*Waltheria indica*), are also present, with Polynesian-introduced *noni* (*Morinda citrifolia*) trees growing out of lava sinks and other natural depressions in the terrain. During the pre-Contact period, the dominant vegetation throughout this area would most probably have been *pili* grass (*Heteropogon contortus*) (Figure 5).

2.2 Cultural and Historical Background

The Site 18511 burial is located within the *ahupuaʻa* (land division) of Keahuolū, which follows the traditional *mauka* to *makai* (from the mountains to the sea) pattern, extending from the upper slopes of Hualālai to the coastal waters north of Kailua Bay. Keahuolū is bounded to the north by the *ahupuaʻa* of Kealakehe and to the south by the *ahupuaʻa* of Lanihaunui (large Lanihau, also referred to as Lanihau 1) and Honuaʻula 3 (Figure 6).

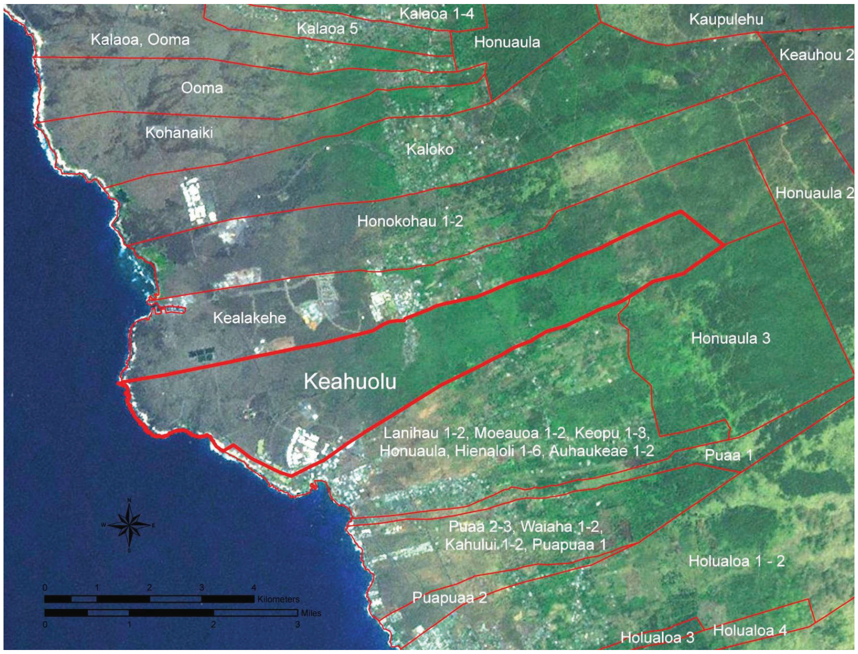

Figure 6. The relative location of the *ahupua'a* of Keahuolū (aerial base from ESRI ArcGIS Online and data partners, including imagery from agencies supplied via the Content Sharing Program; image date 2009; data from the Hawai'i Biodiversity and Mapping Program).

Figure 5. Vegetation surrounding the Site 50-10-27-18511 burial (view northeast).

The *ahupuaʻa* of Keahuolū possesses a rich cultural history that has been investigated in depth as part of the various cultural and archaeological studies undertaken for the Liliʻuokalani Trust by Pacific Legacy. A detailed narrative of the cultural and historical background of the *ahupuaʻa*, with emphasis on its coastal region, is provided in the Supplemental Archaeological Inventory Survey report of the Kona Commons property (McIntosh et al. 2014:11–50). This report was prepared to supplement the existing Archaeological Inventory Survey of the property conducted by Paul H. Rosendahl, Ph.D., Inc. in 1992 (O'Hare and Rosendahl 1993). The following sections provide a brief overview of the cultural history of the Kona Commons property.

2.2.1 Traditional Settlement

Archaeological studies and historic research suggest that the primary centers of population within the *ahupuaʻa* of Keahuolū during the pre-Contact period were located at the coast and in the well-watered uplands (McIntosh et al. 2014:23–26). Although coastal residences were strung along the shoreline, situated near small bays and canoe landings (Reeve et al. 2012), the main areas of coastal settlement seem to have been located at the small crescent bays of Halepaʻo and Pawai, as well as along the sandy beach immediately south of Pawai in the area known as Makāʻeo.

Evidence suggests that the coconut grove which is known historically to have fringed Pawai Bay stretched further south along the shoreline to shade the fishing settlement of Makāʻeo. Boundary Commission testimony, collected in the latter half of the 19th century, indicates that there was "an old village, on Lanihau, called Makaeo" (Boundary Commission Vol. A, No. 1:354). Makāʻeo was located along the shoreline to the south and east of the prominent outcropping of lava known as Pōhakuloa, which rises from the sea near the northern end of the Old Kona Airport runway and marks the boundary point along the shore between the *ahupuaʻa* of Keahuolū and Lanihau. The fishing village of Makāʻeo appears to have been the closest settlement to the Kona Commons property. Although the Kona Commons itself shows some evidence of traditional human activity (see Section 2.3), this activity all appears to have been of a temporary nature and the area does not look to have supported a permanent pre-Contact population (McIntosh et al. 2014:183–184).

2.2.2 Post-Contact Period

In the early years following Western contact, little changed in the lives of the inhabitants of coastal Keahuolū. With time, however, the introduction of foreign diseases for which the *kamaʻāina* (native born residents) possessed no natural resistance as well as population shifts caused by changing economic conditions resulted in a general decrease in the coastal population of the *ahupuaʻa* (McIntosh et al. 2014:28). Despite this general population decline, the fishing settlements of Pawai and Makāʻeo continued to be occupied by local *ʻohana* (families) into the 1940s, when the village of Makāʻeo and its attendant coconut grove was destroyed to make way for the Kona Airport (Clark 1985:110 and McIntosh et al. 2014:25–26).

At the time of the Māhele ʻĀina (land division) of the 1840s, the entire *ahupuaʻa* of Keahuolū was awarded to the *aliʻi wahine* (chiefess) Analea (Ane) Keohokālole under Land Commission Award 8452: Apana 12 (Royal Patent 6851). Only six smaller *kuleana* claims were awarded to *makaʻāinana* (commoners) within the *ahupuaʻa* of Keahuolū. All of these were located within the

upland portion of the *ahupuaʻa*, well away from the coast (see Section 5.2.1). Two historic-era trails (the Māmalahoa Trail and a smaller horse trail) are known to have crossed the Kona Commons property during the post-Contact period (McIntosh et al. 2014:28–29, 182–183). These trails represent the only known post-Contact sites in the area. As with the pre-Contact period, there does not appear to have been any permanent occupation on the property during the post-Contact period (McIntosh et al. 2014:183–184). Development of the Kona Commons for commercial purposes only took place after 1992.

2.3 Archaeological Background

The *ahupuaʻa* of Keahuolū has been the subject of several archaeological investigations beginning in the first decade of the 20th century. The earliest of these formed part of larger regional or island-wide surveys, and as a result were not as detailed as later studies. These initial surveys were concentrated for the most part along the coast, which was the main area of settlement during the pre-Contact period. A detailed review of these early archaeological studies, as well as those later investigations undertaken within the broader *ahupuaʻa*, is provided in Section 4.0 of the Supplemental Archaeological Inventory Survey report of the Kona Commons property (McIntosh et al. 2014:51–69). The following sections provide information on the two most recent archaeological studies undertaken within the Kona Commons property, which are the most relevant in regards to the Site 18511, Feature C burial.

2.3.1 Paul H. Rosendahl, Ph.D., Inc. Inventory Survey, 1992

In October of 1992, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an Archaeological Inventory Survey (AIS) of the 100-acre Kona Commons property (the report of the survey's findings was completed in 1993; O'Hare and Rosendahl 1993). At that time, the Kona Commons project area was referred to as the Kona Industrial Subdivision (KIS) Expansion Site. The 1992 survey identified a total of 18 archaeological sites containing 38 component features (Figure 7).

These sites included a segment of the historic Māmalahoa Trail, as well as lava excavations, modified outcrops, filled depressions, stone alignments, stone mounds, terraces, walls, hearths, walled overhangs, an enclosure, a modified depression, a cairn, a cave shelter, and a lava tube burial (O'Hare and Rosendahl 1993:ii).

The 1992 inventory survey was the first survey to identify the human burial at Site 50-10-27-18511. The survey recorded three features at the site; a walled overhang (Feature A), a *pāhoehoe* excavation (Feature B), and a lava tube (Feature C) (O'Hare and Rosendahl 1993:10, 13, 15 and A-10 thru 12; see Appendix A for the full site description from the 1992 survey). The Feature C lava tube was found to contain a scatter of human bone resting on the cave floor and among the loose stones covering it. The inventory survey report noted that, "The skeletal material consists of scattered finger, toe, and foot bones, some vertebrae, and one incisor" (O'Hare and Rosendahl 1993:A-12).

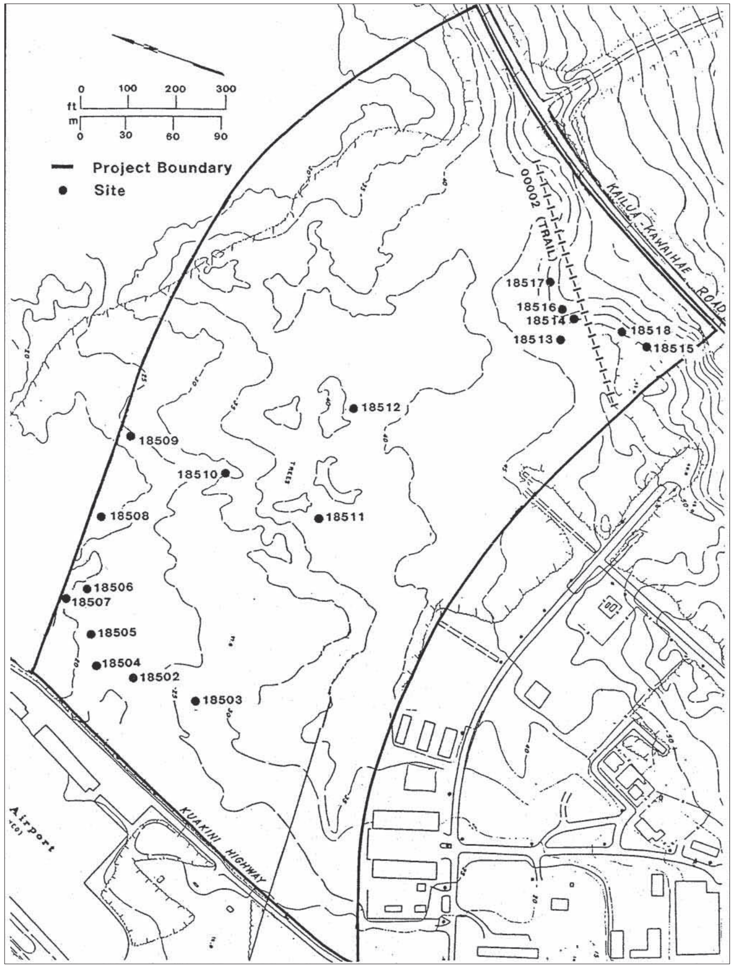

Figure 7. Relative locations of sites identified during the 1992 PHRI survey (O'Hare and Rosendahl 1993:Figure 2).

An area of piled stones was also observed near the entrance of the tube, and a filled depression in the central area of the cave. "Most of the scattered bone was observed either in this depression, on top or among the cobbles, or on a bare bedrock shelf adjacent to and south of the depression" (O'Hare and Rosendahl 1993:A-12).

The PHRI field crew moved some of the rocks in these two areas in order to determine if an articulated burial might rest beneath the stones. "There was an area of piled stones near the entrance of the cave, and a filled depression in the central area of the cave. Enough rocks were moved in these two areas to determine if an articulated burial was under the rocks. Only a few more scattered bones were found" (O'Hare and Rosendahl 1993:15).

The archaeological inventory survey report suggested that a complete burial was once placed within the lava tube, but was later removed, leaving only the scattered bones that were identified. A single waterworn cap to a conus shell with a hole through its center (described by the survey report as a "puka shell") was observed in the piled stones near the entrance. A clear glass patent medicine bottle found inside the cave was collected (O'Hare and Rosendahl 1993:A-12).

The PHRI report concluded the following:

> It seems probable that a complete burial was once present in the cave, possibly on top of the level central area of the cave, but was later removed. This might have taken place during historic times when the cave might have been used for temporary habitation. The cave is wet, with continual dripping from the roof, and the glass bottle found in the cave may be historic evidence for use of the cave as a water catchment area. (O'Hare and Rosendahl 1993:A-12)

The 1992 Archaeological Inventory Survey provided substantial evidence of human activity within the Kona Commons project area during the pre-Contact period. These activities, however, all appear to have been primarily short-term in nature, undertaken by individuals visiting or passing through the area rather than residing within it.

The PHRI Archaeological Inventory Survey report assessed the significance of the archaeological sites documented within the Kona Industrial Subdivision Expansion Site based upon the Secretary of the Interior's standards for listing on the National Register of Historic Places as defined in the Code of Federal Regulation Title 36 (36 CFR §60.4). The report determined that the lava tube burial at Site 50-10-27-18511 was significant both for its information content and its cultural value. It was recommended for provisional further data collection and preservation "as is" (O'Hare and Rosendahl 1993:18).

2.3.2 Pacific Legacy Supplemental Archaeological Inventory Survey, 2014

In 2014, Pacific Legacy, Inc. conducted a Supplemental Archaeological Inventory Survey (SAIS) of the Kona Commons property that included both the original 100 acres surveyed by PHRI in 1992 and an additional 10 acres extending off of its southwest corner in the area formerly occupied by the Swing Zone driving range (Figure 8) (McIntosh et al. 2014:1–5). This SAIS was undertaken to assist the Liliʻuokalani Trust in planning for the future development of the area. The purpose of this survey was to assess the current state of the historic properties initially identified during the 1992 survey and to determine if any additional historic properties existed on the property.

During the course of the Supplemental Archaeological Inventory Survey, a total of 11 archaeological sites (consisting of 21 component features) were identified within the project area. These sites consist primarily of small and crudely constructed features or modified natural features, including stone mounds, modified depressions, modified overhangs, C-shaped walls and alignments, small enclosures, a historic petroglyph, and a historic trail (Figure 9). Of the 11 sites identified, four had been previously recorded, while seven sites were newly discovered (McIntosh et al. 2014:75–77).

The 2014 survey found that approximately 51 acres of the Kona Commons property remained undeveloped, though portions of this undeveloped area have been disturbed by bulldozing and by landscaping associated with the former Swing Zone driving range (McIntosh et al. 2014:9–10). The surviving sites located within the survey area consisted primarily of small and crudely constructed features or modified natural features, including stone mounds, modified depressions, modified overhangs, C-shaped walls and alignments, small enclosures, lava excavations, a historic petroglyph, and a post-Contact trail (Figure 10). These features appear to have served a range of functions. Among these were temporary habitation, storage, travel, visual markers, possibly stone quarrying and/or crop cultivation (in the case of the lava excavations), communication (in the case of the historic petroglyph), and burial (McIntosh et al. 2014:75).

The results of the 2014 survey indicated that the majority of the sites located within the Kona Commons survey area dated from the pre-Contact period. Three sites, the Site 50-10-27-18502 modified depression, the Site 50-10-27-30211 petroglyph (which consists of two English letters, possibly representing personal initials), and the Site 50-10-27-30287 trail appeared to date from the historic or modern periods. The remainder of the sites possessed a more traditional style of construction, suggesting that they were pre-Contact in age (McIntosh et al. 2014:165).

Figure 8. Aerial photograph of the 2014 Pacific Legacy supplemental archaeological inventory survey area (McIntosh et al. 2014:Figure 3).

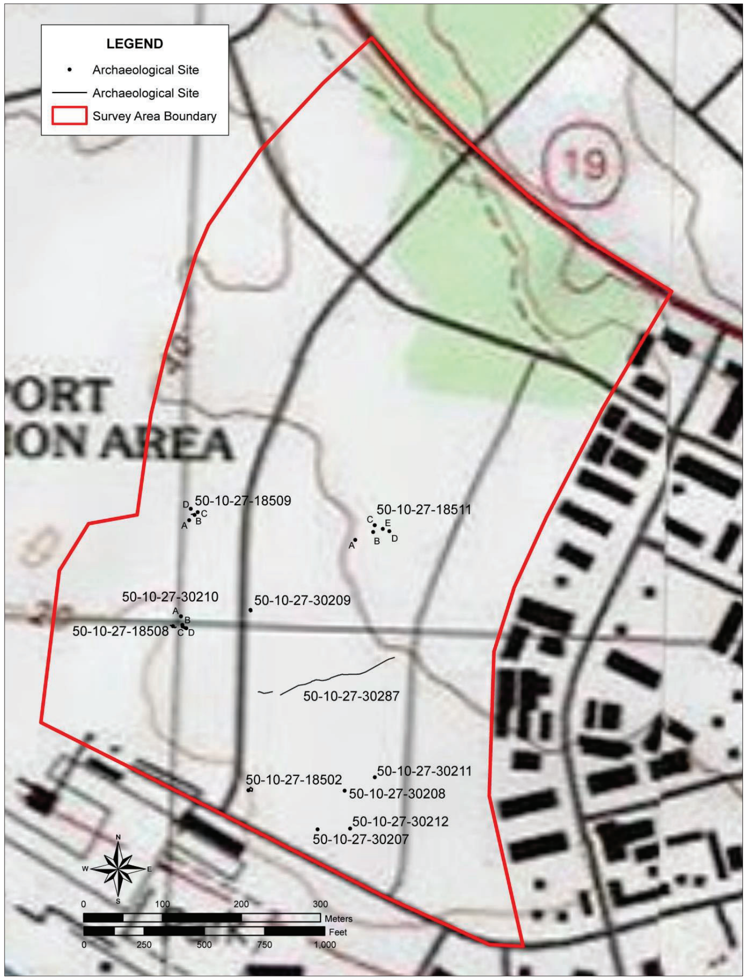

Figure 9. Relative locations of archaeological sites identified during the 2014 Pacific Legacy supplemental archaeological inventory survey (McIntosh et al. 2014:Figure 34).

Figure 10. The range of feature types identified during the 2014 Pacific Legacy supplemental archaeological inventory survey (McIntosh et al. 2014:Figure 79).

All of the sites identified during the 2014 supplemental archaeological inventory survey appeared to have been associated with relatively short-term activities. Among these activities was the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, and burial crypts. Small stone enclosures and walled shelters appeared to have been erected to serve as temporary camping areas. Low stone mounds were built to serve as markers. Rough excavations were created in the lava surface, either to supply stone for the construction of nearby surface features, or to open pits that could be filled with mulch and used to grow dryland crops.

The eleven historic properties identified during the supplemental archaeological inventory survey were assessed as to their significance under the Secretary of Interior's standards for listing on the National Register of Historic Places. All of the eleven sites were assessed as significant for their information content (Criterion D), while the burial feature at Site 50-10-27-18511 (Feature C) was also designated significant for its importance to Native Hawaiian culture (Criterion E). Given its significance as a repository for *iwi kupuna* (ancestral remains), the Site 50-10-27-18511, Feature C lava tube burial was recommended for preservation.

3.0 THE SITE 50-10-27-18511 BURIAL

The following section provides a description of Site 50-10-27-18511 with emphasis on the Feature C lava tube burial. This site description is taken from the report of the 2014 Supplemental Archaeological Inventory Survey of the Kona Commons property (McIntosh et al. 2014: 108–121). A more detailed description of all the features present at Site 50-10-27-18511 is provided in Appendix A.

3.1 Site 50-10-27-18511

Site 50-10-27-18511 consists of a complex of five separate features: a modified overhang (Feature A), a lava excavation (Feature B), a lava tube (Feature C), and two additional lava excavations (Feature D and Feature E). Features A through C were originally identified and recorded during the 1992 PHRI survey (O'Hare and Rosendahl 1993:A-10 to A-12), while the Feature D and Feature E lava excavations were identified and recorded during the 2014 Pacific Legacy survey (McIntosh et al. 2014:118–121).

Site 18511 is located approximately 50 meters *makai* of the present Target store and its adjoining parking lot. It is approximately 170 meters east of Makala Boulevard and approximately 85 meters west of Loloku Street (Figure 3). The site complex covers an area measuring approximately 44.4 meters in length (east to west) by approximately 18.8 meters in width (north to south). Site 18511 appears to be a multi-use complex whose component features served a range of functions. The Feature A overhang seems to have been modified for use as a temporary shelter, the Feature C lava tube served as a burial chamber, the Feature B lava excavation could have been utilized as either a planting area or a quarry, while the Feature D and E lava excavations seem most likely to represent areas where stone was quarried for use as building material.

3.2 Site 50-10-27-18511, Feature C

Site 50-10-27-18511, Feature C was originally recorded during the 1992 PHRI survey and described as a "burial cave" located "at the south base of a large *pāhoehoe* pressure ridge. It contains scattered human bones" (O'Hare and Rosendahl 1993:A-12). Feature C was recorded as measuring ca. 2.90 meters by ca. 2.28 meters, with a maximum ceiling height of ca. 0.82 meters (Figure 12). The PHRI feature description for Site 18511, Feature C further notes the following:

> Entrance is possible from a 0.80 m by 0.60 m hole in the ceiling of the cave. The cave opens up both east and west from the opening, but skeletal material is present only in the west half. The cave floor is c. 0.72 m below the ground surface at the opening, but only a narrow strip (1.60 m long and 0.25 m wide) down the middle of the cave has a ceiling high enough (0.72–0.80 m high) to allow further access. This strip down the middle consists of a natural depression that had been filled with

> pahoehoe gravel and cobbles to create a smooth floor. Most of the scattered bone was observed either in this depression, on top or among the cobbles, or on a bare bedrock shelf adjacent to and south of the depression. The skeletal material consists of scattered finger, toe, and foot bones, some vertebrae, and one incisor. The west end of this tube is blocked by roof fall. A glass patent medicine bottle was observed in this roof fall. Pahoehoe cobbles and boulders have also been stacked on the cave floor below the entrance. The stacked area (c. 0.30 m by 0.90 m) is flush with the side of the cave on the north and west sides, and elevated c. 0.20–0.30 m above the cave floor on the south and east sides. Some rocks in this stacked area and some of the rocks in the central depression were moved during the present survey in order to see if an articulated burial was present in the cave. Only a *puka* shell (*Conus sp.*) was discovered in the stones by the entrance. A few more scattered bones were observed under the depression fill, but no major bones (long bones or cranial material) were present. It seems probable that a burial was once present in the cave, possibly on top of the level central area of the cave, but was later removed. This might have taken place during historic times when the cave might have been used for temporary habitation. The cave is wet, with continual dripping from the roof, and the glass bottle found in the cave may be historic evidence for use of the cave as a water catchment area. The feature is unaltered-and in good condition. The glass bottle was collected, the *puka* shell was not, and the bones were left in place. (O'Hare and Rosendahl 1993:A-12)

During the 2014 Pacific Legacy survey, the Feature C modified lava tube was re-identified and found to be situated at the northern edge of the Site 18511 complex, approximately 8.8 meters north (11°) of the Feature B lava excavation. As noted during the 1992 survey, the relatively small lava tube that forms Feature C is located within and beneath a raised lava pressure ridge that forms a rough crescent-shaped *pu'u* (low hill). The tube entrances are located on the inner (northeastern) edge of this crescent (Figure 11).

The main entrance into the lava tube, labeled "Entrance B" on the original PHRI site map (Figure 12), measures approximately 0.80 meters by 0.60 meters. There are boulders roughly stacked around and partially blocking this entrance. The two other entrances marked on the PHRI map were too small to allow access into the tube.

The interior of the Feature C lava tube measures ca. 8.0+ meters in length by ca. 3.0 meters in width, with a maximum ceiling height of ca. 0.9 meters. The floor of the lava tube currently appears to be rough and unlevel due to rock fall. Within the lava tube, to the east (left) of the main entrance is a somewhat disturbed stone-filled terrace measuring ca. 0.3 meters in height.

Human skeletal remains were observed scattered within three concentrated areas inside the lava tube. Those areas that contain human bone fragments included an area on top of the stone terrace, an area within a natural channel of the floor surface just north of the terrace, and an area on a lava shelf just south of the natural channel. No long bones or cranial elements were present among the scatter of human skeletal remains. There were no other interior or exterior features noted within the lava tube. No artifacts or other cultural material was observed within Feature C. The glass medicine bottle noted in the original site description had been collected by the PHRI field crew, while the "*puka* shell" was not observed.

Given the lack of historic artifacts directly associated with the human remains, it seems likely that the Feature C burial dates from the pre-Contact period. It is unclear whether the bones and bone fragments present within the Feature C lava tube represent the remnants of a previously removed burial, as suggested in the PHRI report (O'Hare and Rosendahl 1993:A-12), or the very badly decayed remains of an in situ individual.

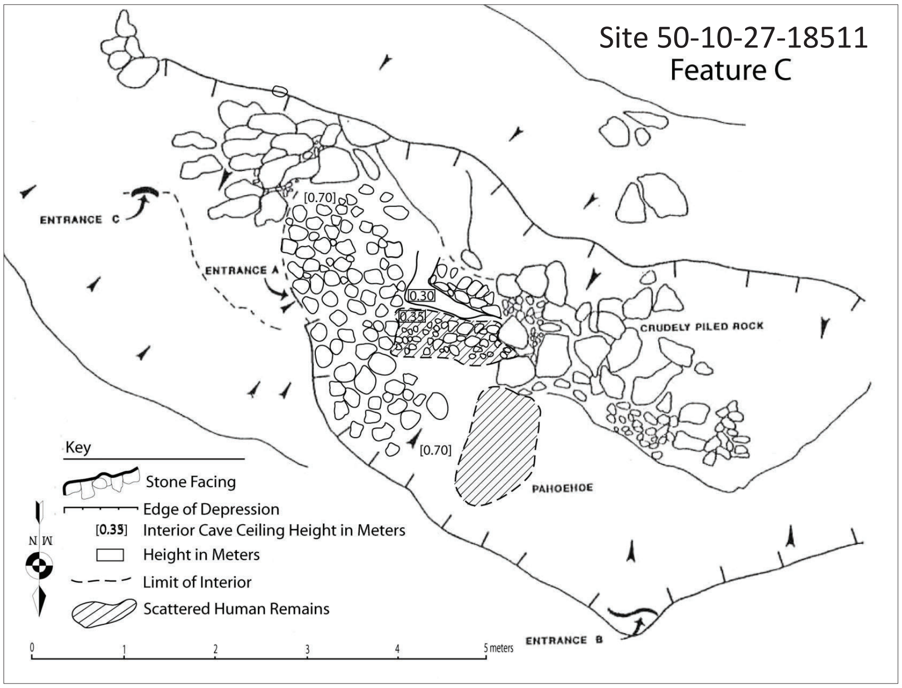

Figure 12. Plan view map of Site 50-10-27-18511, Feature C modified lava tube (base map from O'Hare and Rosendahl 1993:Figure A-5, with modifications from the 2014 Pacific Legacy survey, McIntosh et al. 2014:Figure 55).

Figure 11. Oblique aerial photograph showing the relative location of the Site 50-10-27-18511, Feature C lava tube burial and the associated lava pressure ridge (view south) (from Bing Aerials, accessed 2017).

4.0 PREVIOUS BURIAL TREATMENT PLAN

In 1993, a Burial Treatment Plan was developed by PHRI for the Lili'uokalani Trust's Keahuolū lands (Maly and Rosendahl 1993). This plan addressed nine known and possible human burials. Eight of these burials had been discovered during a 1990 PHRI survey of 1,100 acres of Lili'uokalani Trust lands located north and east of the Kona Commons property. The final burial considered in this BTP was the Site 50-10-27-18511 lava tube burial identified during the 1992 PHRI survey of the 100-acre Kona Commons property.

The 1993 Burial Treatment Plan did not address specific burials in detail, but recommended that all confirmed and potential burials be preserved in place (Maly and Rosendahl 1993:4). This Burial Treatment Plan appears to have been considered by the Hawai'i Island Burial Council during its meeting on November 3, 1993. It was apparently approved by the Council with an amendment to provide 30-foot protective buffers around the sites during construction, instead of the five-meter buffers originally recommended in the BTP (Belt Collins Hawai'i 1993). It also appears that the BTP was approved by the State Historic Preservation Division in September of 2002 (Belt Collins Hawai'i 2008). A 30-foot-wide buffer was established around Site 50-10-27-18511, Feature C and still remains intact with orange construction fencing encircling the burial site.

In 2008, a Final Environmental Assessment (EA) and Finding of No Significant Impact report was prepared by Belt Collins Hawai'i (on behalf of the Lili'uokalani Trust) for the proposed Kona Commons project. This EA addressed the development of 67 acres within the Kona Commons property. The only archaeological site within the property that was mentioned in the EA was the Site 50-10-27-18511, Feature C lava tube burial. The AIS indicated that, prior to any land disturbance activities, a 30-foot-wide buffer would be established around Site 18511, Feature C, "in accordance with the November 1993 burial treatment plan recommended by the Hawai'i Island Burial Council and subsequently approved by the State Historic Preservation Division in September 2002" (Belt Collins Hawai'i 2008).

4.1 Ground Disturbance in the Surrounding Area

Following the 2008 Final Environmental Assessment, a 30-foot-wide buffer was established around Site 18511. The outer boundary of this buffer was marked with highly visible orange construction fencing to protect the burial area. During the subsequent development of portions of the Kona Commons property, some ground-disturbing activities took place in areas north and west of the Site 18511 burial. As can be seen in Figure 13, a construction staging area was established north of Site 18511 (immediately south of the present Target store parking area) and an open area of lava west and southwest of the site was utilized as a gravel quarry.

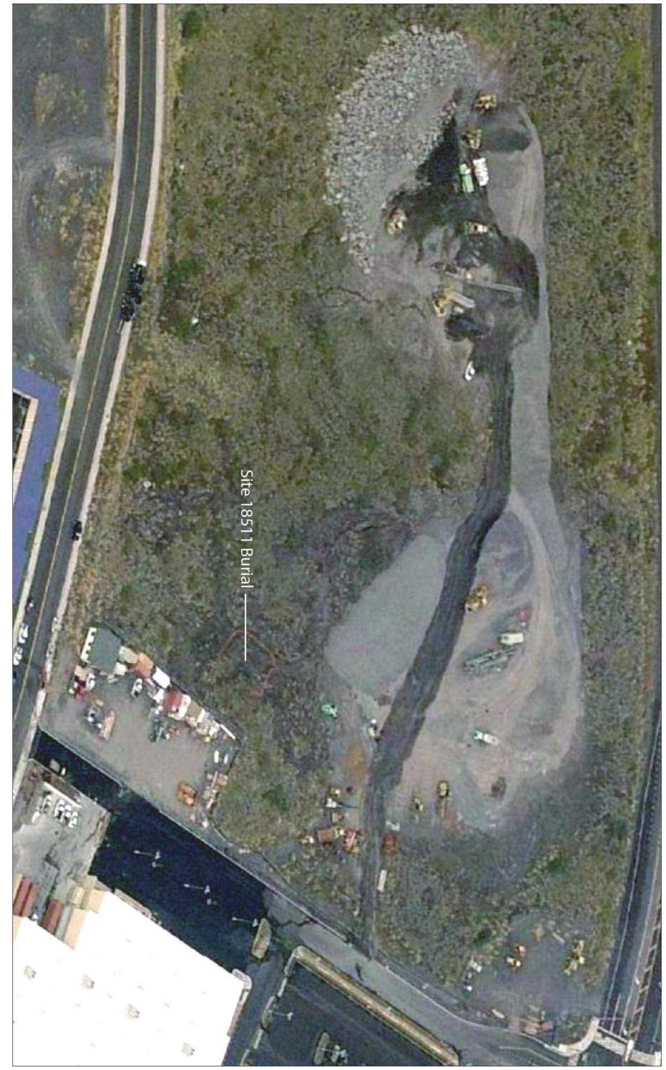

Figure 13. Previous ground-disturbing activities conducted north and west of the Site 18511, Feature C burial. Orange construction fencing is visible surrounding the 30-foot site buffer (view west) (Oblique aerial photograph from Bing Aerials, date unknown).

5.0 CULTURAL DESCENDANTS

In the preparation of this Burial Treatment Plan, a good faith effort has been made to identify all possible lineal or cultural descendants who might possess connections to the skeletal remains present within the Kona Commons property. This was done in accordance with the requirements of HAR §13-300-33(b)(1).

The search for lineal and cultural descendants involved research of relevant land conveyance and other historic documents (HAR §13-300-33[b][1][a]); inquiry of individuals who might possess knowledge of families possibly affiliated with the remains (HAR §13-300-33[b][1][b]); and the publication of notices in newspapers seeking individuals who might claim lineal or cultural association with the burial (HAR §13-300-33[b][1][c]). Individuals identified as descendants were consulted in the preparation of this Burial Treatment Plan.

5.1 Lineal and Cultural Descendants

With respect to Native Hawaiian remains, Hawai‘i Administrative Rule §13-300-2 defines a "lineal descendant" as an individual who has established to the satisfaction of the Burial Council that they possess a direct or collateral genealogical connection to certain Native Hawaiian skeletal remains.

The category of "cultural descendant" is more broadly defined as being an individual recognized by the Burial Council as having established genealogical connections to Native Hawaiian ancestors who once resided in or are buried in (or both) the same *ahupua‘a* or district in which the remains are located or originated from.

5.2 Ethnohistoric Research

As part of the attempt to locate possible lineal or cultural descendants who might possess connections to the skeletal remains present within the Kona Commons property, a search was made of ethnohistorical sources to identify individuals and families who were historically associated with the area. An examination was made of land conveyance documents, including both Land Court Awards and Boundary Commission records. The following section includes a discussion of the information obtained from these documents and a list of historic individuals known to be associated with the *ahupua‘a*. This list may contain individuals whose descendants may qualify as lineal or cultural descendants.

5.2.1 The Māhele ‘Āina

As previously mentioned (see Section 2.2.2), at the time of the Māhele ‘Āina, the majority of the lands within the *ahupua‘a* of Keahuolū were awarded to the *ali‘i wahine* (chiefess) Analea (Ane) Keohokālole under Land Commission Award 8452: Apana 12 (Royal Patent 6851) (Wong Smith 1990:B3). Chiefess Ane Keohokālole was born in Kailua-Kona in 1816, the daughter of *ali‘i kāne*

(chief) ‘Aikanaka and the *ali‘i wahine* (chiefess) Kama‘eokalani. She was named Keohokālole, which means straight hair, by Ka‘ahumanu because of her father's straight hair. Her fraternal great-grandfathers were Kame‘eiamoku and Keawe-a-Heulu, two of the five major war chiefs who assisted Kamehameha I in conquering and uniting the islands (Kelly 1983:31).

Ane Keohokālole served as a member of the House of Nobles from 1841 to 1847, and on the King's Privy Council from 1846 to 1847. In 1833, Ane Keohokālole married her first cousin, Caesar Kaluaiku Kamaka‘ehukai Kahana Keola Kapa‘akea. Just as her *kūpuna* (ancestors) had played an important role in helping Kamehameha I establish the kingdom of Hawai‘i, Ane Keohokālole's offspring were to play a significant role in its continuation. Among the many children born to Ane Keohokālole and her husband Kapa‘akea were David La‘amea Kamanakapu‘u Mahinulani Nalaiaehuokalani Lumialani Kalākaua, who became the 7th king of Hawai‘i, and Lydia Lili‘u Loloku Walania Wewehi Kamaka‘ehā (more commonly known by her royal name of Lili‘uokalani) who succeeded her brother as its 8th and final ruler. Ane Keohokālole's youngest daughter, Miriam Kapili Kekāuluohi Likelike, was herself the mother of Princess Victoria Ka‘iulani Kalaninuiahilapalapa Kawekiu i Lunalilo Cleghorn, who was proclaimed heir apparent to the throne in 1891 and would have become the 9th ruler if the kingdom had not been overthrown in 1893.

Chiefess Keohokālole inherited extensive tracts of land from her paternal grandmother Keohohiwa and great uncle Naihe. Land court documents indicate that the chiefess held two walled house lots "from very ancient times" along the shore of Keahuolū. At her death, the lands of Keahuolū passed on to her heir, Lili‘uokalani.

Although Ane Keohokālole was given title to the entire *ahupua‘a*, there were existing tenants who resided and cultivated land within Keahuolū. Some of these filed claims with The Board of Commissioners to Quiet Land Titles and were awarded *kuleana* lands (Wong Smith 1990: B-4, Native Register). A total of six smaller Land Commission Award claims were granted within the *ahupua‘a* of Keahuolū:

L.C.A. 7351: to Kahuanui
L.C.A. 8012: to Apiki
L.C.A. 10198: to Hailewalewa
L.C.A. 10303: to Maa
L.C.A. 10345: to Naalualu
L.C.A. 11071: to Aki

Five of these *kuleana* Land Commission Award claims appear on County Tax Maps as being located along the boundary with the *ahupua‘a* of Lanihau just *mauka* of where it is crossed by the Old Mauka Government Road (now the Māmalahoa Highway). This area appears to correspond to the settlement of Maili, which is described in Boundary Commission testimony as, "an old village at Puu o Kaliu a palipali ahua [precipitous mound or hillock], where houses used to stand" (Boundary Commission Testimony 1:355). Testimony accompanying these land claims (both Native and Foreign Testimony) indicates that all of the *kuleana* parcels contained one or more cultivated *kīhāpai* (small gardens or fields, Pukui and Elbert 1971:136).

The crops mentioned in testimonies related to these claims include both *kalo* (taro) and ʻ*uala* (sweet potatoes) (Wong Smith 1990: B-4). At the time of the Māhele, coffee was planted in one of the *kalo* patches in Land Commission Award parcel 7351.

No *kuleana* claims were awarded within the coastal portions of Keahuolū. This appears to reflect the general decline in the local population and the gradual abandonment of the coastal settlements. That is not to say that the coastal regions of Keahuolū were completely deserted by the late 1840s. Not all Hawaiian families made *kuleana* claims (in fact, the percentage that did so was relatively small), and it is likely that many of the surviving coastal residents continued to dwell in their ancestral homesteads. It is also probable that many families living along the more barren stretches of the coast shifted their place of residence to more fertile areas, such as the coconut grove at Pawai Bay and Makāʻeo, where a small community survived well into the historic period. Given the relatively barren and inhospitable nature of the more interior areas of the *kula* zone, it is not surprising that there were no *kuleana* claims made for lands located within this area.

Ethnohistoric research indicates that no individual Land Court Award claims were made for lands located specifically within the limits of the Kona Commons property. This, combined with the lack of any archaeological structural remains that would suggest permanent habitation in the area, suggests that the barren *pāhoehoe* plain currently occupied by the Kona Commons property was not utilized as an area of Hawaiian settlement during the pre-Contact or early post-Contact periods. It is likely that the human remains found at Site 50-10-27-18511 belong to an individual who lived either in one of the settlements along the coast or further inland where older lava flows offered deeper soil deposits suitable for the cultivation of crops.

There appears to be some evidence to suggest that the *konohiki* (land manager) for the *ahupua*ʻ*a* of Keahuolū at the time of the Māhele was named Papaula (Native Testimony Volume 10:234). In his testimony in support of Naalualu's claim for Land Commission Award Helu (parcel) 10345, Kuia swore that, "I have known in the same way as Mahu has related here except that at the time J. Fuller surveyed this section 2 claim of Nahaalualu, three of Papaula's fields were discovered here and another two fields were in Kahuenui's claim all under Papaula the konohiki." (Native Testimony Volume 10:234, translation from http://www.avakonohiki.org/hawaii-land-documents.html).

5.2.2 Boundary Commission

The Board of Commissioners for Boundaries was established by the legislature of the Kingdom of Hawaiʻi in 1862 to formalize the boundaries of large land divisions, such as *ahupua*ʻ*a*, which had not been accurately surveyed at the time of the Māhele. As part of this process, the Board collected detailed testimonies from older native residents called on to relate what they knew of the boundaries of the various *ahupua*ʻ*a*. The collected testimonies of local witnesses and the resulting Boundary Certificates are preserved in the Boundary Commission Records and are accessible on microfilm at the Hawaiʻi State Archives (Boundary Commission).

An application for the judication of the boundaries of the *ahupua*ʻ*a* of Keahuolū was made by John Owen Dominis, the husband of Queen Liliʻuokalani. Testimony regarding the boundaries

of the *ahupua*ʻ*a* of Keahuolū was heard by the Commission on August 12, 1873 at the Court House in Kailua-Kona (an annotation on the Boundary Certificate for Keahuolū indicates that the accompanying testimony was included in Folio 354, Book A). A number of native residents gave testimony as to the boundaries of the *ahupua*ʻ*a* of Keahuolū, and its adjacent *ahupua*ʻ*a*. Several of these individuals were *kama*ʻ*āina* of Keahuolū.

5.2.3 Residents of Keahuolū in the 1800s

Land Commission Award documents and Boundary Commission testimonies provide us with the names of several individuals who appear to have been living within (or knowledgeable about) the *ahupua*ʻ*a* of Keahuolū during the years between roughly 1840 and 1880. An annotated list of these names is included below:

Aki: Claimed Land Commission Award Helu 11071 in the ʻ*ili* of Pauaaiki in Keahuolū. Aki appears to have received these lands from Kaea, Nahaalualu, and Kalekahi in the time of Kamehameha I.

Apiki: Claimed Land Commission Award Helu 8012 in Keahuolū. He was given the land by the *konohiki* before the death of Governor Kuakini.

Hai: In his testimony regarding LCA 8012, Mahu stated that Apiki's *kalo* (taro) patches were bounded on its *mauka* (upslope) side by Hai's land.

Hailewalewa: Claimed Land Commission Award Helu 10198 in the ʻ*ili* of Ulelele in Keahuolū. The land was given to him by his parents.

Haino: In his testimony regarding LCA 8012, Mahu stated that Apiki's ʻ*uala* (sweet potato) land was bounded on its *mauka* (upslope) side by Haino's land.

Kahili: In his testimony regarding LCA 8012, Mahu stated that Apiki's ʻ*uala* (sweet potato) land was bounded on its *makai* (downslope) side by Kahili's land.

Kahookohukaneole: In his testimony regarding LCA 7351, Papaula stated that Kahuanui's land was bounded on its *mauka* (upslope) side by the land of Kahookohukaneole.

Kahuanui: Claimed Land Commission Award Helu 7351 in Keahuolū. He received the land from his brother in 1846. Kahuanui gave testimony before the Boundary Commission regarding the boundaries of the *ahupua*ʻ*a* of Keahuolū. In his testimony he stated that he was an adult male who had lived his entire life in Kealakehe and knew the boundaries between Keahuolū and Kealakehe.

Kamaha: Father of Mahu. Mahu noted in his testimony before the Boundary Commission that, "my parents who were kamaainas of the land [Keahuolū] told me the boundaries" (Boundary Commission Vol. A, No. 1:358). Mahu also stated that, "My Father's name was Kamaha and my Mother's name was Lorna" (Boundary Commission Vol. A, No. 1:358).

Kapea: A male resident of the *ahupua*ʻ*a* of Moeauoa located south of Lanihau who gave testimony before the Boundary Commission regarding the boundaries of the *ahupua*ʻ*a* of Keahuolū.

Kealakai: A male resident of Keahuolū who was born within the *ahupua*ʻ*a* (possibly around 1810) and lived there most of his life. Kealakai gave testimony before the Boundary Commission regarding the boundaries of the *ahupua*ʻ*a* of Keahuolū. He learned the *makai* boundaries of the *ahupua*ʻ*a* from his *makua kāne hānai* (his foster father).

Kuia: Gave testimony for Nahaalualu's land claim (LCA 10345).

Lorna: Mother of Mahu. Mahu noted in his testimony before the Boundary Commission that, "my parents who were kamaainas of the land [Keahuolū] told me the boundaries" (Boundary Commission Vol. A, No. 1:358). Mahu also stated that, "My Father's name was Kamaha and my Mother's name was Lorna" (Boundary Commission Vol. A, No. 1:358).

Maa: Claimed Land Commission Award Helu 10303 in the ʻ*ili* of Maili in Keahuolū. Maa's grandparents received the land at the time of Kamehameha I.

Mahu: Gave testimony for Apiki's land claim (LCA 8012), Hailewalewa's land claim (LCA 10198), and Maa's land claim (LCA 10303). Mahu also gave testimony before the Boundary Commission regarding the boundaries of the *ahupua*ʻ*a* of Keahuolū. In that testimony he indicated that he was a male resident of the land of Keahuolū who was born at the time of the birth of Kamehameha II [circa 1779]. Mahu noted that, "my parents who were kamaainas of the land told me the boundaries" (Boundary Commission Vol. A, No. 1:358). He also stated that, "My Father's name was Kamaha and my Mother's name was Lorna" (Boundary Commission Vol. A, No. 1:358).

Naalualu (name as shown on the land claim, it appears as **Nahaalualu** in the testimony): Claimed Land Commission Award Helu 10345 in the ʻ*ili* of Puuokaliu in Keahuolū. In his testimony regarding LCA 7351, Papaula stated that Kahuanui's land was bounded on its *makai* (downslope) side by the land of Nahaalualu.

Papaula: In his testimony regarding LCA 8012, Mahu stated that Apiki's *kalo* (taro) patches were bounded on its *makai* (downslope) side by Papaula's land. Papaula also provided supporting testimony for Kahuanui's land claim (LCA 7351). There is some suggestion that Papaula may have been the *konohiki* (land manager) of the *ahupua*ʻ*a* of Keahuolū at the time of the Māhele. In his testimony in support of Naalualu's claim for Land Commission Award Helu (parcel) 10345, Kuia swore that, "I have known in the same way as Mahu has related here except that at the time J. Fuller surveyed this section 2 claim of Nahaalualu, three of Papaula's fields were discovered here and another two fields were in Kahuenui's claim all under Papaula the konohiki" (Native Testimony Volume 10:234, translation from http://www.avakonohiki.org/hawaii-land-documents.html).

J. F. Waiau: A male resident of Lanihauiki who was born at Honuaula in 1819, "at the time of the fight of Keakuaokalani" (the battle of Kuamoʻo). Waiau gave testimony before the Boundary Commission regarding the boundaries of the *ahupua*ʻ*a* of Keahuolū.

Although none of these individuals can be directly linked to the lands presently covered by the 100-acre Kona Commons property or to the Site 18511 burial, they all appear to have been in some way associated with the *ahupua*ʻ*a* of Keahuolū and their descendants might be considered cultural descendants of the area.

5.3 Identified Cultural Descendants

In its role as land manager and long-term steward of the Keahuolū lands, the Liliʻuokalani Trust has developed close connections with several individuals and ʻ*ohana* (families) who possess a genealogical connection to the *ahupua*ʻ*a* of Keahuolū and whose ancestors lived within it. Several of these *kama*ʻ*āina* have been recognized by the State Historic Preservation Division and the Hawaiʻi Island Burial Council as cultural descendants of the area.

At present, no individuals have been recognized by the Burial Council as lineal descendants of *iwi kūpuna* present at Site 50-10-27-18511.

The Trust has sought the *mana*ʻ*o* (thoughts and opinions) of those individuals recognized by the State Historic Preservation Division and the Hawaiʻi Island Burial Council as cultural descendants of Keahuolū in resolving previous burial issues, as well as in addressing cultural issues related to such endeavors as the development of the 25-acre Keahuolū Historic Preserve Area and Interpretive Center located a short distance *mauka* of the Kona Commons property.

The individuals and ʻ*ohana* recognized as cultural descendants of the *ahupua*ʻ*a* of Keahuolū are listed below:

- The Lui Family
  - Ms. Nicole Kealohaokalani Lui
  - Mr. Aaron Joseph Lui
- Mr. Aka M. Mahi (deceased)
- Ms. Ruby Pua Keanaaina-McDonald (deceased)
- Mr. Ronald S. K. Mitchell
- Ms. Hannah Wahinemaikaiokaahumanukeliiulananioleokalama Kane Reeves
- The Keohokālole Family
  - Ms. Emma Emalia Keohokālole
  - Mr. Dennis Kaimi Keohokālole
  - Mr. Adrian Kealoha Keohokālole
  - Mr. Joseph Moses Keohokālole Jr.

5.3.1 Recognition of Cultural Descendants

In 2009 a Burial Treatment Plan was prepared for burial sites located within and adjacent to the alignment of the Ane Keohokālole Highway situated inland of the Kona Commons property (McDermott and Tulchin 2009). At that time several individuals and families were formally recognized by the Hawaiʻi Island Burial Council as cultural descendants of the identified burials located within the Keahuolū portion of the highway corridor.

> Ms. Nicole K. Lui was recognized by the HIBC as a cultural descendent of the project's previously identified burials (SIHP # 50-10-28-13387, -26831 & -26836) at the HIBC's 20 August 2009 meeting. At the HIBC's 17 September 2009 meeting additional cultural descendents of the project's burials were recognized by the HIBC, including Mr. Aka Mahi, Ms. Ruby McDonald, and Ms. Hannah Reeves. Additionally, at the HIBC's 15 October 2009 meeting, the Keohokālole Family was recognized as cultural descendents to the project's previously identified burials. (McDermott and Tulchin 2009:53)

At the June 17, 2010 meeting of the Hawaiʻi Island Burial Council, Mr. Aaron Joseph Lui and Mr. Ronald S. K. Mitchell were recognized as cultural descendants to identified Native Hawaiian burials in the *ahupua*ʻ*a* of Keahuolū.

5.4 Additional Consulted Parties

Additional individuals who are not formally recognized by SHPD as cultural descendants of the Native Hawaiian burials within Keahuolū, but who belong to families with genealogical connections to the *ahupua*ʻ*a*, were included in discussions regarding the Site 50-10-27-18511 lava tube burial. These individuals were consulted during the preparation of the present Burial Treatment Plan:

Ms. Agnes Pelekane Kaelemakule Lui
Mr. Raymond "Joe" K. Lui
Ms. Francine K. Lui
Ms. Paulette Kaʻanohi Kaleikini
Mr. Jim Medeiros

5.5 Public Notice

Efforts were also made to identify and notify any additional individuals and families who might possess lineal or cultural genealogical connections to the skeletal remains at Site 50-10-27-18511. As required by Hawaiʻi Administrative Rule §13-300-33 (b)(1)(C), notices were placed in three island newspapers requesting information from descendants of families from the Keahuolū area or persons with information about families from the area. The newspapers and publication dates are as follows:

Honolulu Star Advertiser	18 to 21 January 2016
*West Hawai*ʻ*i Today*	18 to 21 January 2016
Ka Wai Ola	January 2016

Copies of the original public notices along with the affidavit of publication (as per HAR §13-300-33[b][1][C]) are presented in Appendix C. A text of the public notice is included below.

PUBLIC NOTICE

Pacific Legacy is preparing a Burial Treatment Plan for Liliʻuokalani Trust lands located *makai* of Queen Kaʻahumanu Highway, in the *ahupua*ʻ*a* of Keahuolū, North Kona, Hawaiʻi (TMK (3) 7-4-025:015). This plan addresses the permanent preservation and protection in place of identified human remains in accordance with Chapter 6E, Section 43. The burial is probably Native Hawaiian, based on location, context, and association. Descendants of families from the area or persons with information of the area are requested to participate in the development of the Burial Treatment Plan. Please contact Herbert Poepoe, State Historic Preservation Division (808-933-7650) or Rowland Reeve, Pacific Legacy (808-351-9560) within 30 days to participate.

Respondents to these public notifications who wished to be identified as recognized lineal or cultural descendants were required by law to demonstrate a genealogical connection by providing relevant information to the Department of Land and Natural Resources State Historic Preservation Division, pursuant to Hawaiʻi Administrative Rule §13-300-35 (Recognition of Lineal and Cultural Descendants).

No responses were received to any of the Public Notices.

There remains the possibility that additional lineal and/or cultural descendants will come forward at some time in the future. Consultations with future recognized lineal and/or cultural descendants will take place after this Burial Treatment Plan has been accepted and approved.

5.6 Descendant Consultation

A series of site visits and consultation meetings were held with the recognized cultural descendants of the *ahupua*ʻ*a* of Keahuolū and additional concerned parties so that their input could be incorporated into the development of the present Burial Treatment Plan. The discussions that took place during these site visits and consultation meetings are detailed in Appendix D. The proposed burial treatments presented in this Burial Treatment Plan (see Section 7.0) were developed through these discussions and are based primarily upon the *manaʻo* (thoughts and ideas) of the consulted parties.

6.0 PROPOSED DEVELOPMENT WITHIN THE KONA COMMONS PARCEL

As previously mentioned (see Section 1.1), the more inland portion of the 100-acre Kona Commons property has been extensively developed for commercial use. This development consists of retail and warehouse structures with their associated parking areas (Figure 3). The Lili‘uokalani Trust is presently planning to develop the remaining undeveloped portion of the Kona Commons property.

The Lili‘uokalani Trust is proposing the development, enhancement and refinement of approximately 67.2 acres of land located within and adjacent to the Kona Commons property. This project is referred to as the Makalapua Project District.

6.1 Project Location

The proposed Makalapua Project District is located northwest of Kailua Village and *makai* (southwest) of the existing Kona Commons Shopping Center. It includes Tax Map Key (TMK) parcels (3) 7-4-008:002 (por.), (3) 7-4-025:001, 002, 003, 005, 015, 021, 999 (por.), and (3) 7-4-010:009, 010.

The project site is bordered to the north by the existing Kona Commons Shopping Center, to the northwest by vacant lands, to the east by the existing Kona Industrial Subdivision (KIS), and to the south by the County’s Kailua Park (also known as the Old Kona Airport State Recreation Area) (Figure 14). The project site is currently vacant and undeveloped with the exception of 1) a former recreational sports facility (the Swing Zone) located on Makala Boulevard, 2) a BMW car dealership on Loloku Street, 3) temporary storage and staging areas on Loloku Street, and 4) light industrial warehouses on Kaiwi Street.

The proposed Makalapua Project District covers the presently undeveloped property within which the Site 50-10-27-18511, Feature C lava tube burial is located. Planning of the Project District has included a detailed plan for the preservation and long-term protection of the site.

6.2 Project Description

The Makalapua Project District will include residential, hotel, retail, commercial, office, and civic/community uses. The Project District will be organized around an interconnected, pedestrian-oriented street network where homes, businesses, and entertainment are intermingled to provide a diverse experience for residents and visitors.

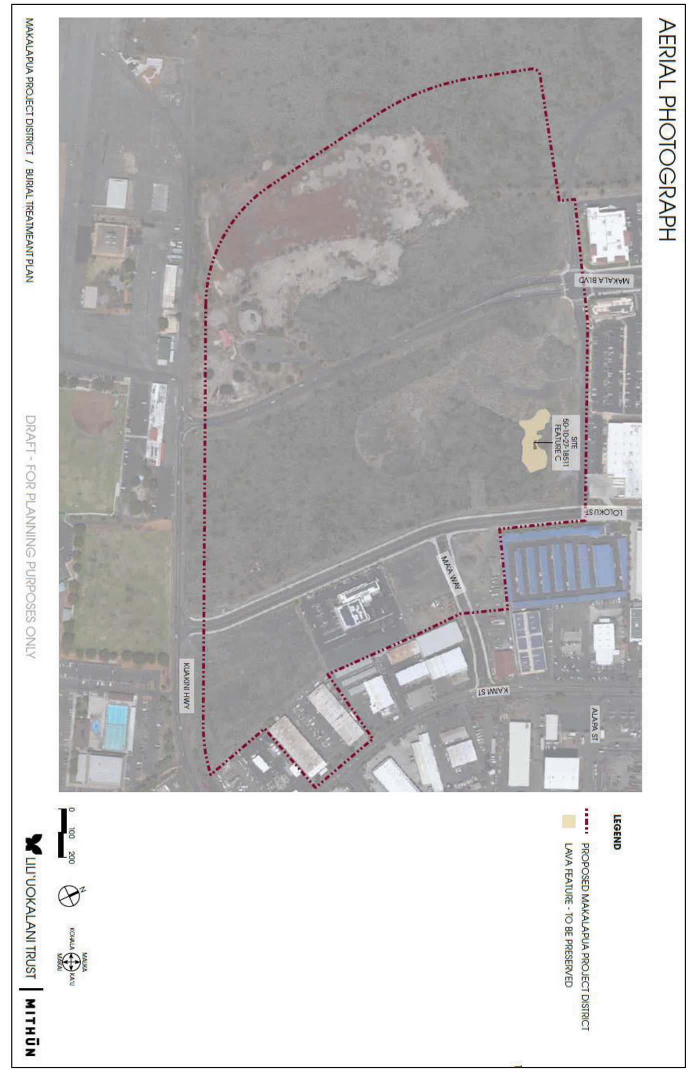

Figure 14. Location of the proposed Makalapua Project District.

The proposed mixed-use project will include approximately 300 residential units; 220 hotel rooms; 50,000 square feet of community facilities/civic offerings; 470,000 square feet of commercial use (retail, employment); and a variety of open space features (Figure 15).

The proposed Makalapua Project District responds to the need to provide housing and economic growth opportunities for the County of Hawai‘i's growing population. The project will serve to meet the varied housing and commercial needs of the region at an attractive growth location adjacent to Kailua-Kona. As envisioned by the Kona Community Development Plan, the project will serve as a natural extension of Kailua Village.

As can be seen in Figure 15, the Site 50-10-27-18511, Feature C lava tube burial is situated in an area designated for commercial development. In planning the Makalapua Project District, Lili‘uokalani Trust has taken into consideration the long-term preservation of the Site 18511 burial. At the request of cultural descendants, they have incorporated an undeveloped buffer to surround not only the burial site, but also the full extent of the natural *pu‘u* (low lava hill) that encompasses it. The outer perimeter of this buffer zone will be marked by a protective stone wall to prevent unauthorized access to the burial area. The details of these protective measures are presented in Section 7.0.

Figure 15. Proposed land use within the Makalapua Project District.

7.0 BURIAL TREATMENT

As *kahu* (caretaker) of the *ahupua'a* of Keahuolū, it is the Lili'uokalani Trust's desire and intention to do what is *pono* (proper) in protecting and preserving the *iwi kupuna* present on their lands. This Burial Treatment Plan is intended to facilitate the best method of caring for the Native Hawaiian burial located within the Kona Commons property. The specific treatment recommendations for the Site 50-10-27-18511, Feature C lava tube burial were developed in consultation with the recognized cultural descendants of the *ahupua'a* of Keahuolū and other concerned individuals (see Appendix D). The following section includes specific short- and long-term treatment recommendations for the preservation of the Site 18511 burial.

7.1 Proposed Burial Treatments

It is the intention of the Lili'uokalani Trust to preserve in place the known human burial located within the lava tube at Site 50-10-27-18511, Feature C. Since the site is slated for preservation, no further efforts will be made to investigate or otherwise examine the remains. This is in keeping with Hawai'i Administrative Rule §13-300-31(h), which states that, "where a previously identified burial site is proposed to be preserved in place, no osteological or disturbing archaeological investigation shall occur, unless authorized by the department [SHPD]."

In order to ensure that the Site 18511 burial is not inadvertently impacted during activities associated with the development and use of the surrounding area, certain mitigation procedures will be implemented. These involve both short-term measures instituted to protect the burial site during any development of the Kona Commons property, as well as long-term measures to properly manage and preserve the burial site.

The central component of this mitigation strategy is the establishment of a protective buffer that will surround both the burial chamber and the overlying lava pressure ridge. This will be a permanent buffer that will remain undeveloped, with the possible exception of the planting of native vegetation to serve as a visual screen.

7.2 Short-Term Protective Measures

The following interim protective measures will be implemented to protect the Site 18511 burial during activities associated with the development of the Makalapua Project District. As described in Section 6.0, these development activities will include the construction of commercial buildings, parking, roadways, sidewalks, and landscaped areas.

7.2.1 Buffer Zone

In order to establish the boundaries of the buffer zone surrounding the Site 18511 burial, the location and extent of both the Feature C lava tube and the low lava *pu'u* that covers it were mapped using a Trimble Geo7X Global Navigational Satellite System (GNSS) unit. The limits of the subsurface lava tube, its entrances, and the lava pressure ridge within which it rests, as well as bulldozed areas located adjacent to them, are shown in Figure 16 and Figure 17. These figures also show the limits of the existing 30-foot buffer fence established by the previous Burial Treatment Plan.

At the request of cultural descendants and other consulting individuals, the perimeter of the proposed buffer zone was extended to encompass the entire extent of the *pu'u* that contains the lava tube (Figure 18). The designated buffer area measures approximately 62.5 meters (ca. 205 feet) in length (northwest to southeast) by 37 meters (ca. 120 feet) in width (northeast to southwest). No construction activity will be allowed to occur within this buffer zone.

The boundary of the buffer zone was designed to follow the outer edge of the roughly crescent-shaped lava pressure ridge along its eastern, western, and southern sides. Along its northern side, the outer edge of the buffer zone cuts straight across from one tip of the crescent to the other, including the level area of lava partially enclosed by the *pu'u*. This level area, which fronts the lava tube opening, will serve as an entryway to the burial site and provide adequate space for individuals to approach it without the need to climb atop the *pu'u* itself.

7.2.2 Protective Fencing

Bright orange plastic fencing has been erected surrounding the Site 18511 burial, and this will be expanded to include the buffer zone and maintained prior to the construction of the surrounding wall (see Section 7.3.2). This fencing will continue to serve as a highly visible temporary barrier to alert people in the area to the presence of the burial until long-term protective measures are put in place (Section 7.3).

Figure 17. Global Navigational Satellite System map of the Site 50-10-27-18511, Feature C lava tube and associated lava pressure ridge overlaid atop an aerial photograph of the site (background aerial from Google Earth, accessed 2016).

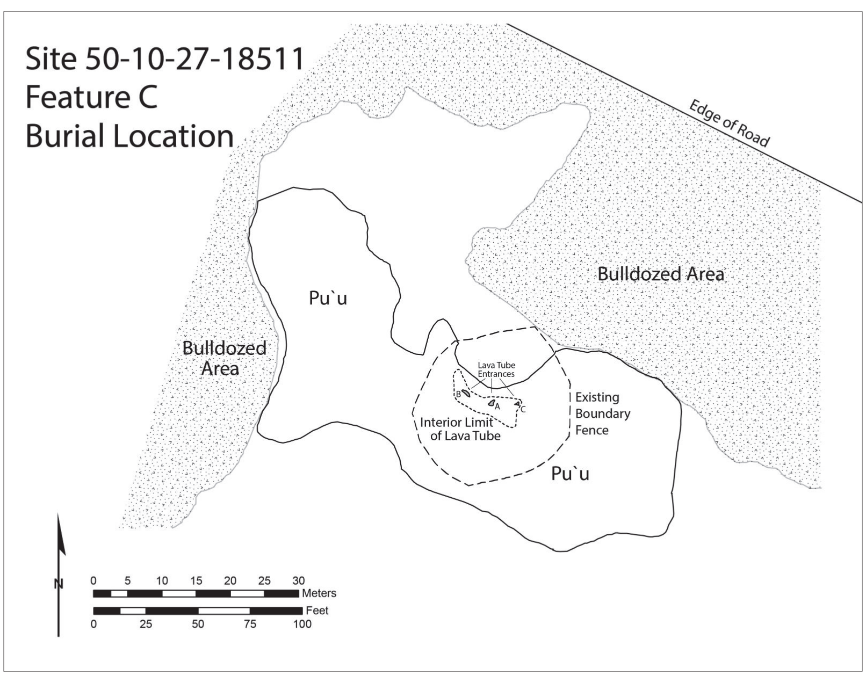

Figure 16. Global Navigational Satellite System map of the Site 50-10-27-18511, Feature C lava tube and associated lava pressure ridge, including the existing boundary fence and adjacent bulldozed areas.

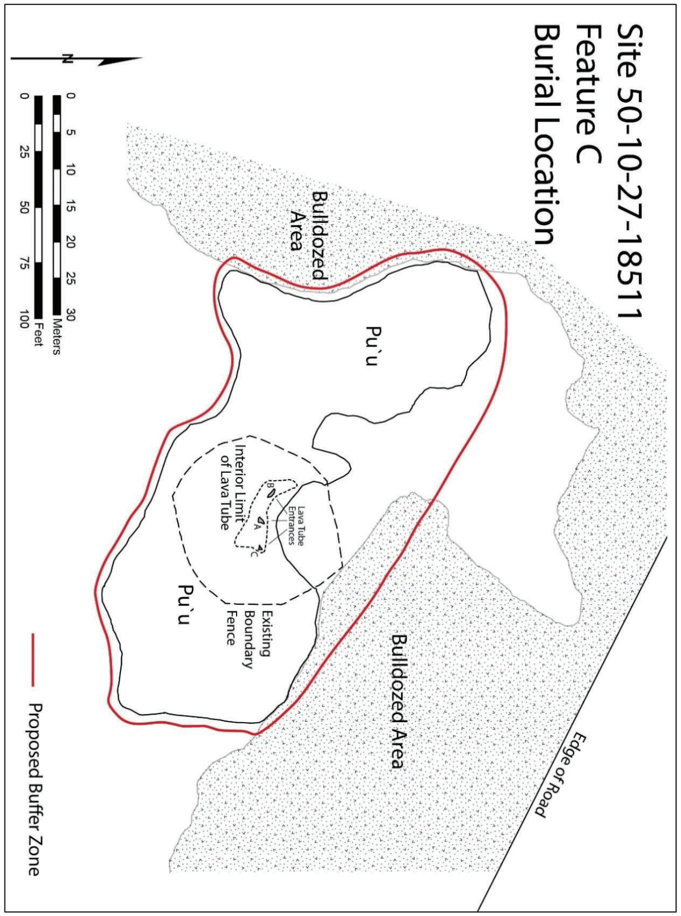

Figure 18. Global Navigational Satellite System map of the Site 50-10-27-18511, Feature C lava tube and associated lava pressure ridge showing the limits of the proposed buffer zone.

7.2.3 Construction Plans

The location of the Site 18511 burial and its buffer zone will be accurately plotted on all grading and construction plans utilized by construction personnel prior to the start of any land-altering activities associated with the development of the Makalapua Project District.

7.2.4 Archaeological and Cultural Monitoring

Both a trained archaeological monitor and a cultural monitor will be on site during any ground-disturbing activities conducted in the vicinity of the Site 18511 burial. The cultural monitor will preferably be a cultural descendant of the area. Prior to the undertaking of any construction activities in the vicinity of the burial, all construction crew members and equipment operators involved in the construction will be given a cultural and archaeological awareness briefing. This briefing will introduce construction personnel to the general history of the area as well as to the location and importance of the Site 18511 burial. Construction crews will also be instructed as to the proper protocols to be followed when working around the burial, the proper procedures to follow in order to avoid adversely impacting the site, and the proper procedures to follow should they encounter previously unidentified human remains.

7.3 Long-Term Protective Measures

7.3.1 Sealing of the Lava Tube

Since the remains at the Site 18511, Feature C lava tube will be left *in situ*, the Lili'uokalani Trust, following the expressed wishes of the cultural descendants and other consulted individuals, intends to seal the entrances to the tube. The tube openings will be sealed with locally procured stones mortared together with cement. The mortar may be stained to blend in with the stones and make it less visible.

7.3.2 Enclosing Wall Around the Site

A low wall of stacked stones mortared together with cement will be constructed to completely encircle the burial site. This wall will mark the outer perimeter of the designated protective buffer zone. Measuring approximately 2½ feet in height, the wall will serve as a visual indication of the location of the burial and act to deter access into the area. The wall will be built of locally available stone and will be erected in close consultation with cultural descendants prior to the commencement of construction activities in the immediate vicinity of the burial location.

A narrow opening (approximately four feet in width) will be set within the northern portion of the enclosing wall to allow access into the site area for maintenance and for visitation by recognized cultural descendants and other individuals identified by the Lili'uokalani Trust. Cultural descendants and other consulted individuals felt that a gate should not be placed at this opening; instead a simple metal chain or rope will be strung across it to discourage access by unauthorized individuals, but allow entry into the burial area when appropriate.

7.3.3 Vegetation

Existing invasive vegetation will be cleared from within the designated buffer area surrounding the burial. At present this non-native vegetation includes fountain grass (*Pennisetum setaceum*), klu (*Acacia farnesiana*), and Christmas berry (*Schinus terebinthifolius*) shrubs. Native species may be allowed to grow within the buffer. The decision as to what, if any, native vegetation is to be planted within the buffer area will be determined once invasive vegetation is cleared. If native vegetation is planted within the burial area, it should be appropriate to the dry climate of coastal Keahuolū. The option of planting native vegetation outside of the enclosing wall to provide a visual buffer for the burial would be considered based upon the future use of the surrounding area.

7.3.4 Signage

Given the location of the Site 18511 burial within a relatively high traffic area, the cultural descendants and other consulting individuals felt there was a need for some form of signage to mark the burial location as a culturally sensitive area. A small brass plaque will be attached to large boulders placed outside the enclosing buffer wall and will be installed upon completion of the wall's construction. The plaque will be the same as that created for burial sites located alongside the route of the Ane Keohokālole Highway. The wording on this sign was developed by Analu Josephus, a cultural descendant of the area. The plaque will indicate, in both Hawaiian and English, that the site is a *wahi kapu*, a culturally sensitive area. The text of the plaque will read as follows:

WAHI KAPU

(Sacred Site)

He wahi mea nui kēia i ka moʻolelo o ko Hawaiʻi Paeʻāina;
pāpā ʻia ke komo ʻana. E hoʻihi i ke kapu o kēia wahi. Mai komo.

(This is a culturally significant place; access is restricted.
Please show your respect by not entering this area.)

Mālama ʻia nā wahi i helu ʻia he mea nui ma ke kānāwai o ka Mokuʻāina.
Hiki ke hoʻopaʻiʻia he hoʻopaʻi uku he $20,000.
(Mokuna 6E-11, Hawaiʻi Revised Statutes). DLNR-SHPD (808) 692-8015

(Historic sites are protected under state law violation could result in a $20,000 fine.
(Chapter 6E-11, Hawaiʻi Revised Statutes) DLNR-SHPD (808) 692-8015)

7.3.5 Site Access

Access within the buffer wall of the Site 50-10-27-18511, Feature C burial will be provided to cultural descendants, and other individuals wishing to visit the burial for cultural purposes with permission from cultural descendants, upon request of the Liliʻuokalani Trust.

7.3.6 Site Monitoring, Maintenance, and Security

Maintenance and security of the Site 50-10-27-18511 burial will be provided by the Liliʻuokalani Trust. At minimum, annual site inspections will be carried out to check the condition of the burial site so that any potential threats from human or natural agencies can be identified and managed accordingly.

8.0 REFERENCES

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MAPS

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2009 Aerial photographic base layer from ESRI ArcGIS Online and data partners, including imagery from agencies supplied via the 2009Content Sharing Program. Contributing sources include ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. This map layer presents high-resolution imagery for the United States and other areas around the world. For more information on this map go to http://goto.arcgisonline.com/maps/World_Imagery.

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APPENDIX A

DESCRIPTION OF SITE 50-10-27-18511

The following description of Site 50-10-27-18511 was taken from the Paul H. Rosendahl, Ph.D., Inc. 1993 report of their Archaeological Inventory Survey of the 100-acre Kona Industrial Subdivision Expansion Site (O'Hare and Rosendahl 1993:A-10 to A-12).

was noted on the northeast side of the mound. The feature is unaltered and in fair condition. No portable remains or cultural deposits were observed at this feature.

FEATURE B: Filled depression
FUNCTION: Indeterminate
DIMENSIONS: 5.50 m by 5.00 m by 0.09 m (max. depth)
DESCRIPTION: Feature B is a filled depression. This feature is in the center of the site c. 4.50 m northeast (50°) of Feature A, and c. 2.50 m southwest (230°) of Feature C. A serpentine crack, oriented at 85°/265° and on top of a pahoehoe bedrock dome, is filled with pahoehoe gravel and cobbles one to two courses deep. The rocks are piled to the lip of the crack and 0.04 m above the lip in some places. The feature is unaltered and in fair condition. No portable remains or cultural deposits were observed at this feature.

FEATURE C: Mound
FUNCTION: Agriculture
DIMENSIONS: 1.70 m by 1.30 m by 0.45 m (max. height)
DESCRIPTION: Feature C is a roughly circular mound. The feature is at the northeast end of the site, c. 2.50 m northeast (50°) of Feature B. It is constructed of subangular pahoehoe gravel and cobbles piled two to four courses high on top of bare pahoehoe bedrock. The interior is bare, so this feature was probably used as a planting plot. It is unaltered and in fair condition. No portable remains or cultural deposits were observed at this feature.

SITE NO.: State: 18510 PHRI: T-10
SITE TYPE: Pahoehoe excavation (3)
TOPOGRAPHY: Generally level undulating pahoehoe around site; the excavations are on the east face of a large elevated pahoehoe outcrop
VEGETATION: *'Ilima*, fountain grass and lantana grow in bedrock cracks; some small *kiawe* trees growing in natural depressions.
SITE ELEVATION: 17 m AMSL
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Quarry
DIMENSIONS: 6.40 m by 3.10 m by 0.65 m (max. height)
DESCRIPTION: Site 18510 consists of three pahoehoe excavations in a row (at 40°/220°) at the east base of a large elevated pahoehoe outcrop. The site is in the center of the project area. The excavated areas are 0.60-0.75 m in maximum diameter, and are excavated to a depth of 0.28-0.65 m. A narrow, level strip at the base of the outcrop consists of fractured bedrock in gravel and cobble size (c. 0.05-0.20 m in diameter). Some pahoehoe boulders that probably came from the excavations are scattered around. However, there are not enough of these rocks to account for the amount of material that must have been excavated from the outcrop. Therefore, some of the material must have been carried away. This is good evidence that the main function of the excavations was to quarry material. A discontinuous alignment of about nine boulders in front of the southernmost excavation may have been man-made or natural. These boulders are up to c. 0.35 m in diameter. The feature is unaltered and in good condition. No portable remains or cultural deposits were observed at this feature.

SITE NO.: State: 18511 PHRI: T-11
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Undulating pahoehoe flows with large elevated pahoehoe bedrock upthrusts
VEGETATION: Sparse fountain grass, *'ilima*, lantana, and *koa-haole* on the outcrop; dense vegetation at the base of the outcrop.
SITE ELEVATION: 13 m AMSL
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric-historic
FUNCTIONAL INTERPRETATION: Multiple
DESCRIPTION: Site 18511 consists of one walled overhang (Feature A), one pahoehoe excavation (Feature B), and one burial cave (Feature C). These features are on top or at the base of two large elevated pahoehoe pressure ridges in the central portion of the project area. The overall site measures c. 30.00 m (68°/248°) by 10.00 m.

FEATURE A: Walled overhang *(Figure A-5)*
FUNCTION: Temporary habitation
DIMENSIONS: 9.00 m by 6.00 m by 1.25 m (max. ceiling height)
DESCRIPTION: Feature A is a walled overhang. This feature is at the south end of the site at the base of an outcrop, c. 25.0 m southwest (248°) of Feature B. The overhang is oriented at 100°/280° and opens up at the base of a large pressure ridge. It is 7.00 m long and has an average depth of 5.00 m. An area in front of the overhang is fairly level and has been cleared of most rock. A short wall has been built across the west entrance to this depressed area. The wall is constructed of pahoehoe cobbles and boulders piled on top of bare bedrock. There are some goat bones against the back wall of the overhang. The overhang area gives access to a narrow, low-ceilinged cave. There is no evidence that the cave has been modified or utilized in any way. It is unaltered and in fair condition. No cultural deposits or soil deposits were observed at this feature.

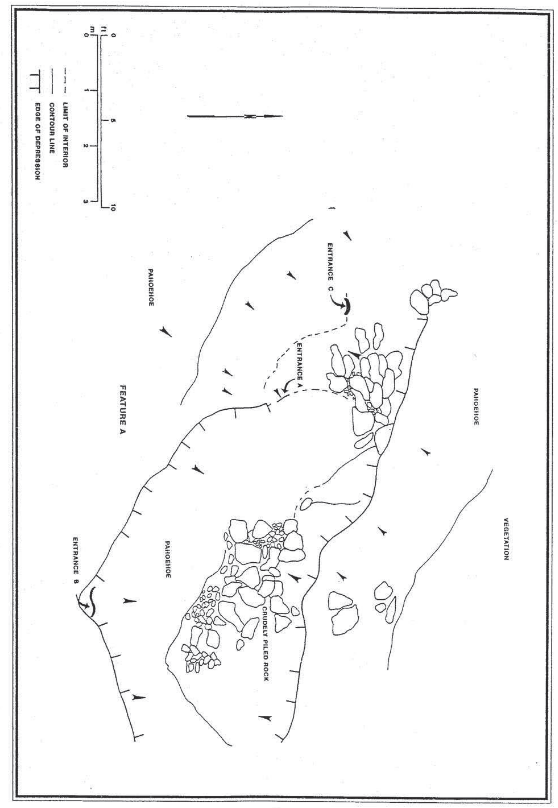

Figure A-5. Site 18511, Feature A

FEATURE B: Pahoehoe excavation
FUNCTION: Indeterminate
DIMENSIONS: 3.00 m by 1.50 m by 1.60 m (max. depth)
DESCRIPTION: Feature B is a pahoehoe excavation in the center of the site, c. 25.00 m northeast (68°) of Feature A. Many naturally fractured bedrock fragments are at the bottom of a crevice at the crest of a pressure ridge. This crevice is oriented at 115°/295° and is c. 5.00 m long and 1.75 m wide. Some of the boulders (c. 0.40-0.50 m in diameter) in the west half of this crevice have been removed and are scattered outside on the south slope of the pressure ridge. This creates deep, bare pockets (up to 1.60 m deep) in the crevice. These pockets may have been used for growing purposes, for cache areas, or for quarrying of raw materials. Vegetation is growing in two of the pockets, although little soil was noted. Only a shallow (0.05-0.10 m deep) deposit of duff was observed. The feature is unaltered and in good condition. A waterworn boulder (c. 0.20 m by 0.25 m by 0.15 m) was observed in the crevice.

FEATURE C: Burial cave
FUNCTION: Ceremonial
DIMENSIONS: 2.90 m by 2.28 m by 0.82 m (max. ceiling height)
DESCRIPTION: Feature C is a burial cave at the north end of the site, at the base of the same outcrop on which Feature B is located. The cave is c. 5.00 m northeast (68°) of Feature B. The cave is at the south base of a large pahoehoe pressure ridge. It contain's scattered human bones. Entrance is possible from a 0.80 m by 0.60 m hole in the ceiling of the cave. The cave opens up both east and west from the opening, but skeletal material is present only in the west half. The cave floor is c. 0.72 m below the ground surface at the opening, but only a narrow strip (1.60 m long and 0.25 m wide) down the middle of the cave has a ceiling high enough (0.72-0.80 m high) to allow further access. This strip down the middle consists of a natural depression that had been filled with pahoehoe gravel and cobbles to create a smooth floor. Most of the scattered bone was observed either in this depression, on top or among the cobbles, or on a bare bedrock shelf adjacent to and south of the depression. The skeletal material consists of scattered finger, toe, and foot bones, some vertebrae, and one incisor. The west end of this tube is blocked by roof fall. A glass patent medicine bottle was observed in this roof fall.

Pahoehoe cobbles and boulders have also been stacked on the cave floor below the entrance. The stacked area (c. 0.30 m by 0.90 m) is flush with the side of the cave on the north and west sides, and elevated c. 0.20-0.30 m above the cave floor on the south and east sides. Some rocks in this stacked area and some of the rocks in the central depression were moved during the present survey in order to see if an articulated burial was present in the cave. Only a *puka* shell (*Conus sp.*) was discovered in the stones by the entrance. A few more scattered bones were observed under the depression fill, but no major bones (long bones or cranial material) were present. It seems probable that a burial was once present in the cave, possibly on top of the level central area of the cave, but was later removed. This might have taken place during historic times when the cave might have been used for temporary habitation. The cave is wet, with continual dripping from the roof, and the glass bottle found in the cave may be historic evidence for use of the cave as a water catchment area. The feature is unaltered and in good condition. The glass bottle was collected, the *puka* shell was not, and the bones were left in place.

SITE NO.: State: 18512 **PHRI:** T-13
SITE TYPE: Alignment
TOPOGRAPHY: Fairly level undulating pahoehoe flows
VEGETATION: *'Ilima*, lantana, and fountain grass growing from cracks; *koa-haole* growing in natural depressions; morning glory vines; one *noni* tree due north at c. 3.60 m.
SITE ELEVATION: 12 m AMSL
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Indeterminate
FUNCTIONAL INTERPRETATION: Indeterminate
DIMENSIONS: 1.80 m by 1.72 m by 0.32 m (max. height)
DESCRIPTION: Site 18512 is a circular alignment of boulders. This site is in the central portion of the project area. It is constructed of large pahoehoe slabs and boulders that have been placed on top of bare pahoehoe to form a ring. The boulders are c. 0.25-0.64 m in diameter, and the slabs are c. 0.15-0.22 m in diameter. Occasionally the ends of the boulders overlap, but there is no real piling. Most of the ring consists of just one course of rock. Three large boulders are placed on edge on the north side of feature. This feature is rather large to be a traditional prehistoric planting plot. The feature might have been associated with recent camping in the area. No portable remains or cultural deposits were observed at this feature.

SITE NO.: State: 18513 **PHRI:** T-14
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Fairly level ground surface with many fractured pahoehoe outcrops
VEGETATION: Dense *kiawe*, California grass, fountain grass, lantana, and morning glory vines.
SITE ELEVATION: 15 m AMSL
CONDITION: Good

The following description of Site 50-10-27-18511 is taken from the 2014 Pacific Legacy, Inc. report of their Supplemental Archaeological Inventory Survey of the Kona Commons property (McIntosh et al. 2014:103–116):

SIHP Number: 50-10-27-18511
Site Type: Complex
Status: Relocated
Present Condition: Fair
Description: Site 50-10-27-18511 is a complex comprised of five features: a modified overhang (Feature A), a lava excavation (Feature B), a lava tube (Feature C), and two additional lava excavations (Feature D and Feature E). The Feature C lava tube contains human remains. Features A through C were originally identified and recorded during the 1992 PHRI survey (O'Hare and Rosendahl 1993:A-10 to A-12), while the Feature D and Feature E lava excavations were discovered during the present survey.

Site 18511 was relocated by Pacific Legacy archaeologists and found to be situated toward the center of the project area, approximately 170 meters east of Makala Boulevard and c. 85 meters west of Loloku Street (Figure 3). It is located c. 211 meters east (95°) of the Site 18509 complex. In overall extent, the site complex measures c. 44.4 meters in length (east to west) and c. 18.8 meters in width (north to south).

Site 18511 appears to be a multi-use complex whose component features served a range of functions. The Feature A overhang seems to have been modified for use as a temporary shelter, the Feature C lava tube served as a burial chamber, the Feature B lava excavation could have been utilized as either a planting area or a quarry, while the Feature D and E lava excavations seem most likely to represent areas where stone was quarried for use as building material.

Feature A
Site 50-10-27-18511, Feature A was originally recorded during the 1992 PHRI survey as a "walled overhang," measuring c. 9.00 meters by c. 6.00 meters, with a maximum ceiling height of c. 1.25 meters (O'Hare and Rosendahl 1993:A-10). The PHRI feature description for site 18511, Feature A further notes that

> The overhang is oriented at 100°/280° and opens up at the base of a large pressure ridge. It is 7.00 m long and has an average depth of 5.00 m. An area in front of the overhang is fairly level and has been cleared of most rock. A short wall has been built across the west entrance to this depressed area. The wall is constructed of pahoehoe cobbles and boulders piled on top of bare bedrock. There are some goat bones against the back wall of the overhang. The overhang area gives access to a narrow, low-ceilinged cave. There is no evidence that the cave has been modified or utilized in any way. It is unaltered and in fair condition. No cultural deposits or soil deposits were observed at this feature (O'Hare and Rosendahl 1993:A-10).

Feature A was re-identified during the present survey and was found to be located at the southwestern edge of the Site 18511 complex, approximately 24.7 meters southwest (245°) of the Feature B lava excavation. Upon inspection, Feature A appears to be a modified overhang, rather than a walled overhang, as it had previously been described (Figure 19). No distinct wall was identified; instead, stone stacking was observed in a crevice to the east of the overhang that stands approximately 3 to 4 courses high and measures c. 1.2 meters by c. 0.70 meters (Figure 20). Stacking was also noted to the west of the overhang, standing approximately two courses high and measuring c. 0.60 meters by c. 0.50 meters. The overall dimensions of the overhang are c. 5.5 meters long, c. 1.6 meters wide, and c. 1.4 meters deep, making it much smaller than was originally recorded during the 1992 survey. Some modern trash was observed within the eastern crevice of the overhang, including an aluminum Coca-Cola can, a clear glass screw-top bottle, and what appears to be a can of acetone.

A lava tube is located to the south of the modified overhang. It measures c. 10.0 meters in length, c. 2.5 meters in width, with a maximum interior height of c. 1.25 meters. The main entrance is located on its western side, and contains tumbled rock that naturally slopes into the lava tube. There is also a skylight entrance on the eastern side of the lava tube. The interior of the lava tube is clear of debris and its floor relatively flat. No modifications to the lava tube were noted. Goat and dog bones are scattered throughout the north side of the lava tube. Recent trash, such as batteries and plastic debris, are also present inside of the tube. No other cultural material was observed.

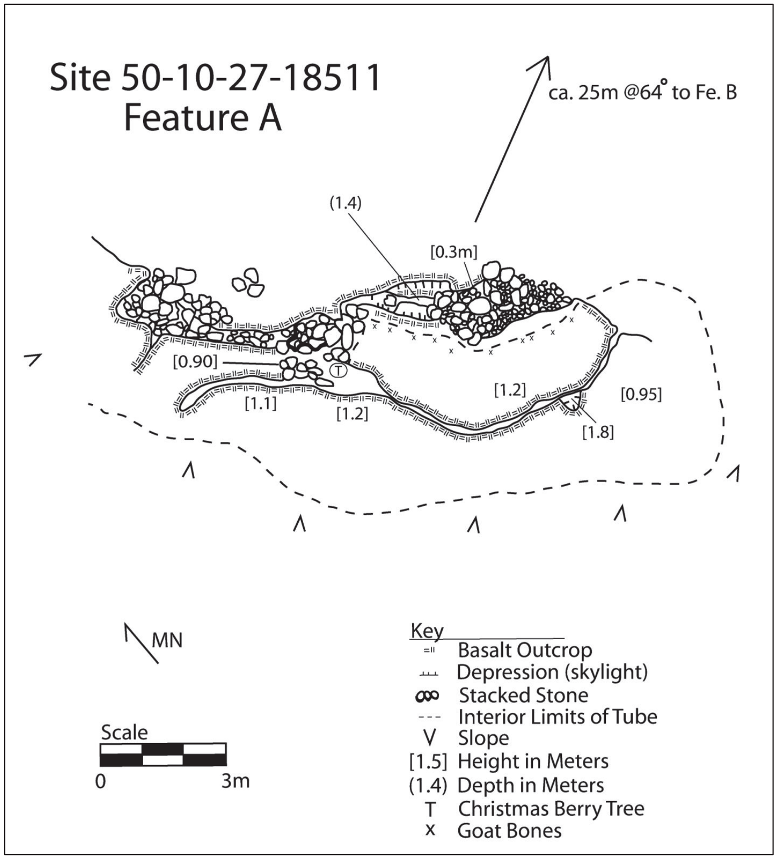

Figure 19. Plan view map of the Site 50-10-27-18511, Feature A.

Figure 20. Site 50-10-27-18511, Feature A modified overhang (view northeast).

Figure 21. Site 50-10-27-18511, Feature A lava tube entrance (view south).

The Feature A modified overhang appears to be in fair condition. The overhang and lava tube show evidence of having been occupied by homeless individuals. It is difficult to determine, however, if there have been recent alterations made to Feature A since the 1992 PHRI survey. The modified overhang most likely served as a temporary habitation shelter during the pre-Contact period.

Feature B

Site 50-10-27-18511, Feature B is a lava excavation that was originally recorded during the 1992 PHRI survey. At that time the lava excavation was recorded as measuring c. 3.0 meters by c. 1.50 meters, with a maximum depth of c. 1.60 meters (O'Hare and Rosendahl 1993:A-12). The PHRI feature description for Site 18511, Feature B also indicates that

> Many naturally fractured bedrock fragments are at the bottom of a crevice at the crest of a pressure ridge. This crevice is oriented at 115°/295° and is c. 5.00 m long and 1.75 m wide. Some of the boulders (c. 0.40–0.50 m in diameter) in the west half of this crevice have been removed and are scattered outside on the south slope of the pressure ridge. This creates deep, bare pockets (up to 1.60 m deep) in the crevice. These pockets may have been used for growing purposes, for cache areas, or for quarrying of raw materials. Vegetation is growing in two of the pockets, although little soil was noted. Only a shallow (0.05–0.10 m deep) deposit of duff was observed. The feature is unaltered and in good condition. A waterworn boulder (c. 0.20 m by 0.25 m by 0.15 m) was observed in the crevice. (O'Hare and Rosendahl 1993:A-12)

The Site 18511, Feature B lava excavation was relocated during the present survey (Figure 22). It is situated at the crest of a *pāhoehoe* ridge in the central portion of the site complex, approximately 24.7 meters northeast (65°) of the Feature A walled overhang. The lava excavation was found to currently measure c. 5.8 meters in length by c. 1.6 meters in width, and to be c. 1.5 meters in depth. There is a large amount of organic debris from growing vegetation (fountain grass, *Pennisetum setaceum*) and Christmas berry, *Schinus terebinthifolius*) within the interior of the lava excavation. Numerous cobbles and boulders that were apparently removed from the lava excavation are scattered on the lava surface to the south.

A small vesicular waterworn boulder was observed within the lava excavation (Figure 23). Although this boulder shows no evidence of battering, it could have been brought to the site to be used as a hammerstone. No other cultural material was noted in or around the excavation. Feature B is currently in fair condition. This lava excavation may have been used as a quarry site during the pre-Contact period.

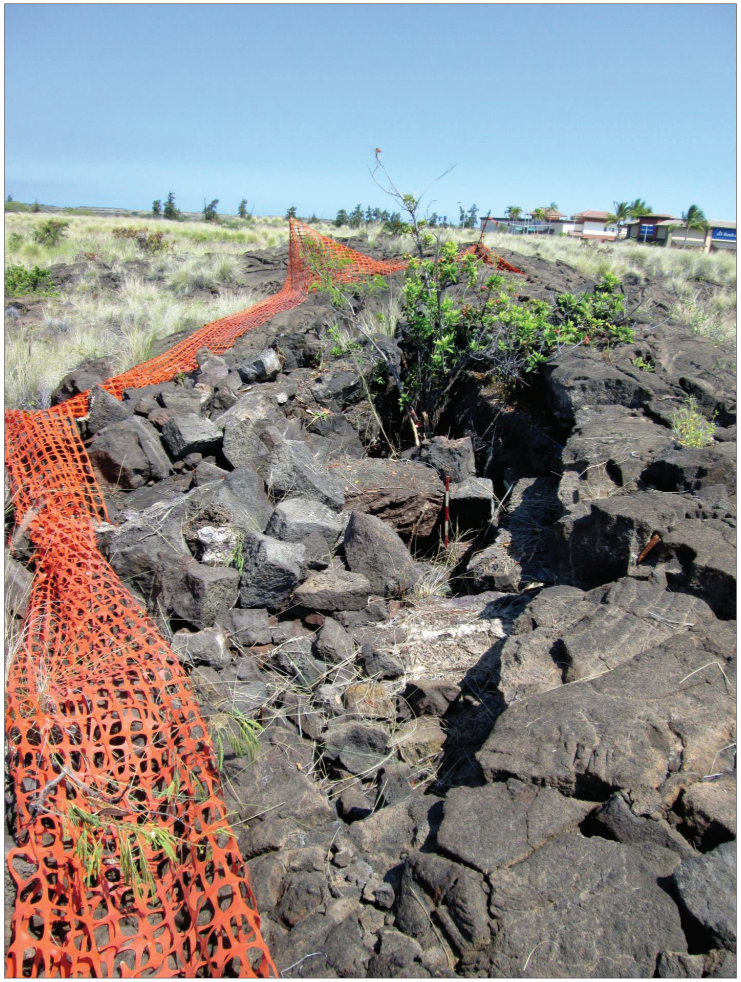

Figure 22. Site 50-10-27-18511, Feature B lava excavation (view northwest).

Figure 23. Site 50-10-27-18511, Feature B waterworn boulder.

Feature C

Site 50-10-27-18511, Feature C was originally recorded during the 1992 PHRI survey and described as a "burial cave" located "at the south base of a large *pāhoehoe* pressure ridge. It contains scattered human bones" (O'Hare and Rosendahl 1993:A-12). Feature C was recorded as measuring c. 2.90 meters by c. 2.28 meters, with a maximum ceiling height of c. 0.82 meters (Figure 24). The PHRI feature description for Site 18511, Feature C further notes that

> Entrance is possible from a 0.80 m by 0.60 m hole in the ceiling of the cave. The cave opens up both east and west from the opening, but skeletal material is present only in the west half. The cave floor is c. 0.72 m below the ground surface at the opening, but only a narrow strip (1.60 m long and 0.25 m wide) down the middle of the cave has a ceiling high enough (0.72–0.80 m high) to allow further access. This strip down the middle consists of a natural depression that had been filled with pahoehoe gravel and cobbles to create a smooth floor. Most of the scattered bone was observed either in this depression, on top or among the cobbles, or on a bare bedrock shelf adjacent to and south of the depression. The skeletal material consists of scattered finger, toe, and foot bones, some vertebrae, and one incisor. The west end of this tube is blocked by roof fall. A glass patent medicine bottle was observed in this roof fall.

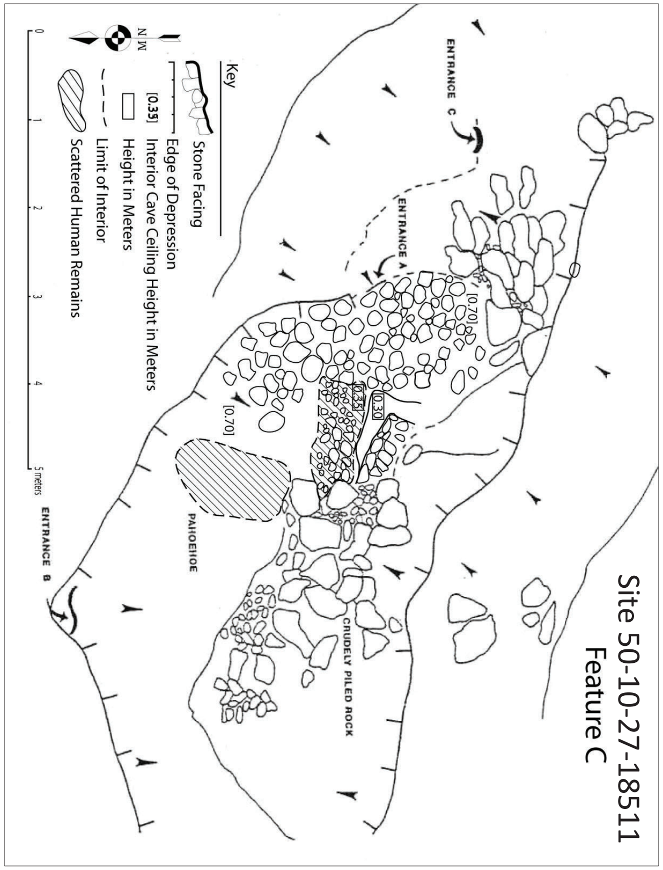

Figure 24. Plan view map of Site 50-10-27-18511, Feature C modified lava tube (base map from O'Hare and Rosendahl 1993:Figure A-5, with modifications from the present survey).

> Pahoehoe cobbles and boulders have also been stacked on the cave floor below the entrance. The stacked area (c. 0.30 m by 0.90 m) is flush with the side of the cave on the north and west sides, and elevated c. 0.20–0.30 m above the cave floor on the south and east sides. Some rocks in this stacked area and some of the rocks in the central depression were moved during the present survey in order to see if an articulated burial was present in the cave. Only a *puka* shell (*Conus sp.*) was discovered in the stones by the entrance. A few more scattered bones were observed under the depression fill, but no major bones (long bones or cranial material) were present. It seems probable that a burial was once present in the cave, possibly on top of the level central area of the cave, but was later removed. This might have taken place during historic times when the cave might have been used for temporary habitation. The cave is wet, with continual dripping from the roof, and the glass bottle found in the cave maybe historic evidence for use of the cave as a water catchment area. The feature is unaltered-and in good condition. The glass bottle was collected, the *puka* shell was not, and the bones were left in place. (O'Hare and Rosendahl 1993:A-12)

The Feature C modified lava tube was relocated during the present survey (Figure 25). It is situated at the northern edge of the Site 18511 complex, approximately 8.8 meters north (11°) of the Feature B lava excavation. The main entrance into the lava tube, labeled "Entrance B" on the PHRI site map, measures c. 0.80 meters by c. 0.60 meters. There are boulders roughly stacked around and partially blocking this entrance. The interior of the lava tube measures c. 8.0+ meters in length by c. 3.0 meters in width, with a maximum ceiling height of c. 0.90 meters. The floor of the lava tube currently appears to be rough and unlevel due to rock fall.

Within the lava tube, east of the main entrance is a stone filled terrace, measuring c. 0.30 meters in height. Human skeletal remains were observed scattered within three concentrated areas inside of the lava tube. The areas that contain human bone fragments include an area on top of the stone terrace, an area within a natural channel of the floor surface, and an area on a lava shelf just south of the natural channel. No long bones or cranial elements were present among the scatter of human skeletal remains. There were no other interior or exterior features noted within the lava tube.

No artifacts or other cultural material was observed within the Feature C lava tube. The glass medicine bottle noted in the original site description had been collected by the PHRI field crew, while the "*puka* shell" was not observed. This lava tube currently appears to be in fair condition. Feature C served as a burial, most likely pre-Contact in age.

Figure 25. Site 50-10-27-18511, Feature C modified lava tube entrance (view east).

Feature D

Site 50-10-27-18511, Feature D is a lava excavation that was discovered and recorded during the present survey (Figure 26). This lava excavation is located at the eastern end of the Site 18511 complex, approximately 19.8 meters east (111°) of the Feature C lava tube. It is situated on the slope of a low lava ridge. The excavation is irregular in shape, measuring c. 4.2 meters in length (east to west) by c. 2.8 meters in width (north to south), and c. 0.20 meters in depth. The upper layer of lava has been broken apart over a sizeable area, and block-like chunks of *pāhoehoe* appear to have been removed, leaving a relatively smooth (though sloping) interior floor, which is scattered with discarded subangular basalt boulders and cobbles.

A small vesicular basalt hammerstone that is discoidal in shape was observed within the excavated area (Figure 27). The hammerstone measures c. 0.9 centimeters in length, c. 0.8 centimeters in width, and c. 0.4 centimeters in thickness. The artifact was collected from the feature and, following documentation, was given into the care of the Liliʻuokalani Trust for curation. Given the relatively small size of the artifact, it seems unlikely that it was used to break up the lava surface. Larger waterworn boulders, such as that found at Feature B, appear to have been more commonly utilized for that purpose. It is possible that the discoidal hammerstone was used to shape the edges of the stones removed from the excavation. However, though this too seems unlikely, taking into account its size and highly vesicular nature (which would have made it softer and less durable than a similar sized waterworn stone of dense basalt). It seems more probable that the artifact was used for some purpose not directly related to the excavation of the feature, as a hammerstone for softer material, or as a very coarse abrader.

The Feature D lava excavation is in fair condition. The fact that much of the broken-up stone that originally formed the upper layer of the excavation's lava surface appears to have been removed suggests that the feature was most likely utilized as a quarry for obtaining thick, tabular chunks of basalt stone that could be used elsewhere as building material. It is probable that Site 18511, Feature D dates to the pre-Contact period.

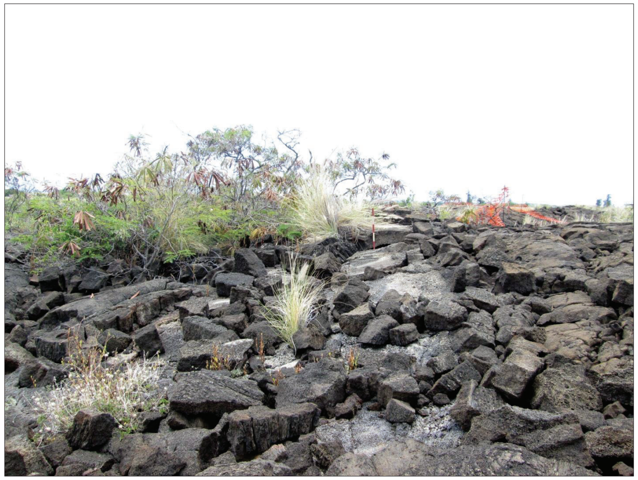

Figure 26. Site 50-10-27-18511, Feature D lava excavation (view west).

Figure 27. Site 50-10-27-18511, Feature D hammerstone.

Feature E

Site 50-10-27-18511, Feature E is a lava excavation that was discovered and recorded during the present survey (Figure 28). This lava excavation is located along the northeastern edge of the Site 18511 complex. It is situated approximately 8.5 meters west (288°) of the Feature D lava excavation along the same lava ridge. The excavation is roughly rectangular in shape, measuring c. 4.2 meters in length (northeast to southwest) by c. 1.6 meters in width (northwest to southeast). There is a natural fracture extending through the excavation in a northeasterly (59°) direction. Feature E is similar to Feature D, in that it appears only the first course of loose material was removed from the lava excavation. A small number of large boulders and cobbles remain within the interior of the excavation, mostly along its edges.

No cultural material was observed within the Feature E lava excavation. The feature is in fair condition. It seems likely that the lava excavation was utilized for the quarrying of basalt stone for use as building material during the pre-Contact period.

Figure 28. Site 50-10-27-18511, Feature E lava excavation (view southwest).

APPENDIX B

BURIAL TREATMENT PLAN PREPARED BY
PAUL H. ROSENDAHL, Ph.D., INC., 1993

Report 1437-101293

Burial Treatment Plan
Archaeological Mitigation Program
Queen Lili'uokalani Trust
Keahuolu Lands

Land of Keahuolu, North Kona District
Island of Hawai'i

BY

Kepā Maly • Cultural Resources Specialist

AND

Paul H. Rosendahl, Ph.D. • Principal Archaeologist

PREPARED FOR

Queen Lili'uokalani Trust
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OCTOBER 1993

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INTRODUCTION

PROGRAM BACKGROUND

At the request of Ms. Sue Rutka of Belt Collins Hawaii Inc., for their client, the Queen Lili'uokalani Trust, Paul H. Rosendahl, Ph.D., Inc., (PHRI) has prepared this Burial Treatment Plan, for the Trust lands located within Keahuolu (*ahupua'a*), in North Kona on the Island of Hawai'i. The overall objective of this plan is to satisfy the cultural resource requirements of the Department of Land and Natural Resources - State Historic Preservation Division (DLNR-SHPD) and the Hawai'i County Planning Department (HCPD). Additionally, pursuant to Hawai'i State Law, Chapter 6E:43 (as amended by Act 306), pertaining to the treatment of ancestral Hawaiian remains, this burial treatment plan is being submitted to the Hawai'i Island Burial Council for review and comment.

FINDINGS OF PREVIOUS ARCHAEOLOGICAL STUDIES

Between July 10, 1989, and January 29, 1990, PHRI conducted a full archaeological inventory survey of the Queen Lili'uokalani Trust Property project area (Donham 1990). Three sites (13275, 13359, and 13360) were determined to contain one burial each. Sites 13350 (Feature D) and 13377 (Feature B) contain fragmented human skeletal remains. Sites 13350 (Feature H), 13373, and 13376 are thought to possibly contain human remains (Figure 1). It should be noted here that Sites 13350, 13373, and 13376 are within a 25-acre archaeological preserve.

Based on the findings of the 1990 PHRI survey, and based on input from DLNR-SHPD and the HCPD, a detailed archaeological mitigation plan containing preservation component as well as data recovery components was determined to be the most appropriate vehicle for developing site-specific mitigation commitments. A five-phased program was deemed appropriate in consideration of the various objectives being sought and for compliance with requirements of the HCPD and DLNR-SHPD:

Phase I - Preparation of a formal archaeological mitigation plan, including (a) data collection, (b) interim site preservation, and (c) construction monitoring;

Phase II - Archaeological data recovery and data collection work, including mobilization, historical documentary research, field work, data analyses, and preparation of interim and final reports; also included in conjunction with this phase would be execution of the interim preservation plan;

Phase III - Preparation of a site preservation plan; upon completion of the Phase II data recovery and collection work, to provide for long-term site preservation and interpretive development concerns at selected project area sites; the preservation plan would be included in, and made a part of, the phase II final report;

Phase IV - Implementation of the site preservation plan, as formulated in the Phase III detailed site preservation plan; and

Phase V - Archaeological monitoring, as appropriate, of construction activities that might affect significant archaeological remains already identified or that may remain undetected within the project area.

During October 14-22, 1992, an additional archaeological inventory survey was conducted for the Queen Lili'uokalani Trust 100-Acre Kona Industrial Subdivision (KIS) Expansion Site, also in Keahuolu. During the survey work, human skeletal remains were identified at Site 18511 (Figure 1) (O'Hare and Rosendahl 1993).

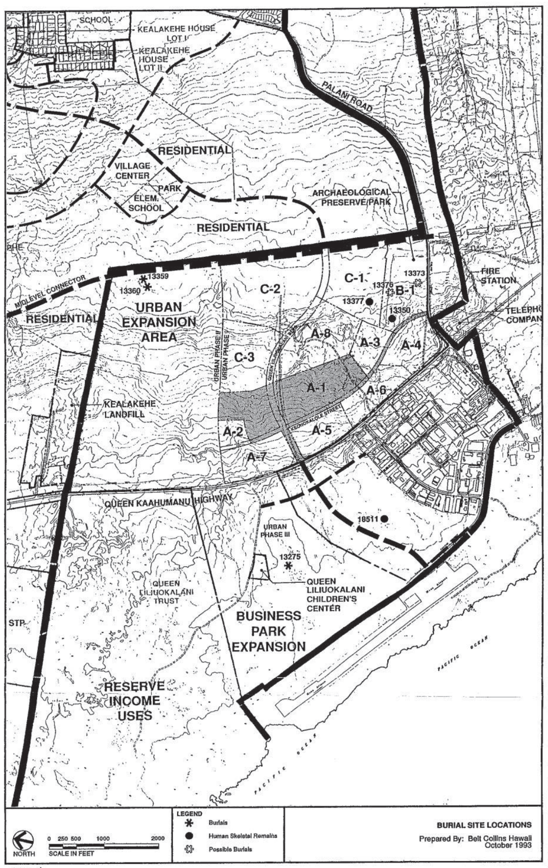

Figure 1.
Project Area and Locations of Identified Burials, Human Skeletal Remains, and Possible Burials (Prepared by Belt Collins Hawaii)

BURIAL TREATMENT PLAN

PUBLIC NOTICE

As a part of the preparation for development of this Burial Treatment Plan, a Public Notice (Figure 2.) was placed in four island newspapers requesting information from native informants and possible lineal descendants of those people who traditionally lived within the project area lands. The public notice was published in: The *Honolulu Advertiser* (September 10-12, 1993), *West Hawai'i Today* (September 9, 10 and 12, 1993), *Hawai'i Tribune Herald* (September 9, 10 & 12, 1993), and *Ka Wai Ola o OHA* (October 1993).

No contacts or claims of lineal descent were received as a result of this public notice. Mrs. Gail Souza-Save, of the Queen Lili'uokalani Children's Center (Kona at Keahuolu), and Mrs. Ruby McDonald, Kona office Liaison of the Office of Hawaiian Affairs, are in contact with area families. If their discussions produce recommendations, they will be included as a part of the long-term site preservation treatment.

PROPOSED BURIAL TREATMENTS

In the matter of preserving ancient Hawaiian remains, it is the Trust's desire to do what is correct, and this burial treatment plan is intended to facilitate the best method of preservation of the *iwi kūpuna* (ancestral remains) identified within the project area. Following a review of the PHRI findings and a preliminary meeting with the Hawai'i Island Burial Council (September 20, 1993), Trustees of The Queen Lili'uokalani Trust and *ahupua'a* tenants have determined that preservation-in-place of all the confirmed burials and possible burial sites is the preferred treatment.

PUBLIC
NOTICE

All persons having information concerning possible unmarked human burials outside of designated cemeteries in the Queen Lili'uokalani Trust Land of Keahuolu, between sea level to the elevation of 300 feet in North Kona District, Island of Hawai'i (TMK:3-7-4-08:Por.2 and 3-7-4-08:Por.2,12), are hereby requested to contact Mrs. Ruby McDonald, Liaison, Office of Hawaiian Affairs (West Hawai'i), (808) 329-7368, 75-5706 Hanama Place, Suite 107, Kailua-Kona, Hawai'i 96740; Mr. Alan T. Walker, Hawai'i Projects Director, or Kepā Maly, Cultural Resources Specialist, at Paul H. Rosendahl, Inc. (PHRI), (808) 969-1763, 305 Mohouli Street, Hilo, Hawai'i 96720; and/or Mr. Edward Halealoha Ayau, Burials Program Administrator, Department of Land and Natural Resources - State Historic Preservation Division (DLNR-SHPD), (808) 587-0047, P.O. Box 621, Honolulu, Hawai'i 96809.

(No. 4530 - September 9, 10 and 12, 1993)

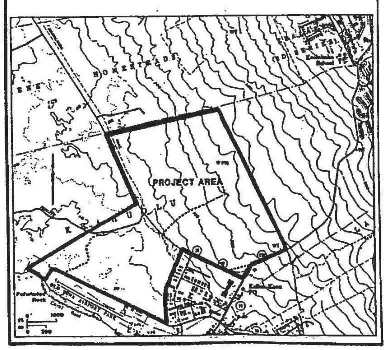

Figure 2. Public Notice Published in Four Hawai'i Newspapers (With Project Area Map)

PRESERVATION

Preservation is defined here as the act or process of utilizing procedures to maintain the existing form, integrity, and material of a building or structure, and the existing form and vegetative cover of a site (36CFR Part 60.2[b]). Preservation of archaeological sites generally falls into two categories: (1) avoidance and protection (conservation), and (2) exhibition (DLNR 1987). In the case of Category 1, an archaeological property is typically preserved with no planned future action except limited archaeological examination and required stabilization in order to prevent deterioration. In this context, preservation means continued physical survival for the purpose of preserving specific properties for future research programs and for resource banking or, as in the present case with human remains, for periodic visitation by direct or indirect lineal descendants and others.

INTERIM PRESERVATION

Interim-preservation-zone buffers for sites requiring such protection will be marked with brightly colored fencing (Figure 1). Sites at which this form of protection is required are 18511 and 13377. No construction or land modification will occur within the interim preservation zones. Sites 13350, 13373, and 13376 are within the 25-acre archaeological preserve (B-1), and no construction will occur within the preserve; thus these sites will not require individual buffer fencing. The *makai*-Keohokālole Road boundary and the A-3 and C-1 boundaries of preserve area B-1 will be marked with brightly colored fencing during construction. Sites 13275, 13359, and 13360 are situated far outside any areas of planned construction. In order to minimize the number of casual visitors to these sites (by reducing the site's visibility) buffer-zone fencing will not be placed at their locations. Interim preservation will be ensured by adopting the following general protective measures:

1. All sites shall be plotted accurately on grading plans and construction plans prior to the initiation of any grading, grubbing, and/or construction activities;

2. It is proposed that a buffer zone of five meters be identified and mapped around all site perimeters. The preservation buffer zones will be staked and construction activity will not be allowed to occur within the buffer zones;

3. Explicit notification of construction supervisors as to the nature and location of the sites, the significance of the buffer zones, and the color and meaning of any site perimeter and buffer zone flagging tape; and

4. There will be on-site monitoring of initial construction grubbing and grading in the immediate vicinity of all sites to be preserved.

Upon completion of all construction work, preservation buffer fencing will be removed from the sites, in order to minimize their visibility and keep the curious from the sites.

LONG-TERM PRESERVATION

Following consultation with DLNR-SHPD and the Hawai'i Island Burial Council, final treatment recommendations for the preservation of the various remains and associated funerary items can be made, in compliance with Chapter 6E:43 (as amended by Act 306). Should lineal descendants come forward, preference should be given to their wishes.

In the event that no lineal descendants are identified, determination of appropriate preservation treatments including grave preparation and marking, ceremonies/blessings, site closure, and preservation-in-perpetuity agreements should be determined through consultation with DLNR-SHPD, the Hawai'i Island Burial Council, the County of Hawai'i, and the Queen Lili'uokalani Trust.

It is proposed that sites in which human remains have been identified, and the two possible burial sites be marked by preservation buffers of five meters on all sides. No construction or land modification (other than appropriate landscaping with native plants, and site stabilization) will occur within five meters on all sides of the preserve. The preservation buffer zones might be delineated by a planted buffer with *hala* at the corners, or in some other acceptable configuration; or marked by natural stone walls and/or platforms, and appropriate native vegetation.

Additionally, a simple plaque, as described below could be used to identify the site. Visitation of the sites will be limited to native Hawaiians who claim familial relationship-connection to the area.

Concerns for long-term preservation include:

1. Documentation of burial/possible-burial site locations on maps for future reference in development planning and/or land use evolution;

2. Monitoring site integrity; i.e., assigning maintenance schedules for landscaping and liter control, and monitoring levels of pedestrian impact and inappropriate site uses. It might also be suggested that the sites be sealed by rock work, similar to other traditional interment sites, as a part of the long-term preservation process;

3. Site landscaping and identification; landscaping within the general vicinity of the burial sites should use the native, and Hawaiian-introduced vegetation of the region.

   A variety of plants may be used. Among them are the following plants, which are often found along the *pāhoehoe* and *'a'ā* flows, *kīpuka*, and traditional community sites of *Kona 'akau*:

Pili	*Hetropogon*
Ma'o	A native cotton [*Gossypium sandwicensis*]
'Ilima	*Sida fallax*
Nehe	*Lipochaeta lavarum*
Maiapilo	*Capparis sandwichiana*) and
Pōhinahina	The beach vitex [*Vitex trifolia* var. *simplicifolia*]
Kō	Native sugar canes
'Uala	Native sweet potatoes
Ipu or ***Hue***	Gourds

The above plants are all appropriate, low-impact ground covers. Additionally, the following plants are important for their symbolism and/or their regional uses.

La'I (the ti leaf [*Cordyline terminalis*]) is often suggested because of its important cultural symbolism. If properly cared for in a traditional mulched mound or hole-type planting environments, it would be an important addition.

Wiliwili (*Erythrina sandwicensis*) is a beautiful native tree, upon which the native inhabitants of this region relied. Its wood was used in association with fishing, canoeing, recreation, and water catchment, and the seeds and flowers were used for *lei* making.

Hala (*Pandanus odoratissimus*), like the *wiliwili*, is a beautiful native tree of many traditional uses. In this context, *pū hala* (pandanus trees) would serve as a symbol for those who have already passed from this life to their final resting place. The Hawaiian word *hala* not only describes the native tree, but also means to "pass on." Thus a prominent *pū hala* on the lava fields could serve as one way of identifying the burial sites for those who wish to pay their respects.

Kukui (*Aleurites moluccana*, the candle nut tree) is an important tree; it symbolizes light and knowledge, and formerly had many religious and domestic uses. For Kona, the *kukui* is particularly important, as it is a body-form of the god Lono, provider of the rain clouds of *Kona kai 'ōpua* (Kona of the billowing horizon clouds) and successful growth of crops which nurtured the *po'e kahiko* (ancient people).

Plantings of the larger trees must be done carefully so that they will not affect the remains in the future. It is suggested that if any other plants are to be used, they be those that do not establish a deep root base or develop destructive root systems. The landscaping, if appropriate, will be within the five-meter buffer zones surrounding each of the sites. The suggestions of any lineal descendants and the Hawai'i Island Burial Council in regards to landscaping should also be taken into consideration.

4. Should access to the site be maintained or improved (depending upon lineal descendant wishes and Hawai'i Island Burial Council recommendations), appropriate signage should be set in place, describing the cultural sensitivity of the sites and asking that respect be given and that nothing be removed. Below is one suggestion for sign text:

> **KULA IWI**
>
> This is a culturally sensitive site.
> Please respect those who came before us
> and refrain from entering within this area.
> Your respect will be greatly appreciated.

Use of the term "*kula iwi*" (literally: bone plain; i.e. Native land where one's bones are laid to rest) will notify native practitioners of the significance of the site(s), while the term will also name the feature(s) for those who might come across it while visiting the area. Any suggestions concerning the design of the sign and exact text by the Hawai'i Island Burial Council and/or any direct lineal descendants should be strongly considered;

5. Once landscaping is done, the integrity of the sites must be maintained through proper maintenance and upkeep;

6. Should it be desired by lineal descendants, it is recommended that access to the burial sites be maintained. Any person claiming lineal descent from the burials should have access to the site(s) for visitation purposes. Should lineal descendants be identified, it is recommended that an "In-situ Burial Agreement" between DLNR-SHPD, the County of Hawai'i, any affected land owner(s), and lineal descendants should be formalized.

INADVERTENT DISCOVERY OF HUMAN REMAINS

There is the possibility that inadvertent finds of additional burials or scattered human remains will be made during future construction work; therefore, the presence of a qualified archaeologist, on site to monitor this work, as outlined in the Phased Mitigation Plan (Jensen et al., 1992), is advisable. This monitoring will be done in conformance the DLNR-SHPD standards. In the event burials are inadvertently found within the project area during construction, they will be treated on a case by case basis in accordance with the stipulations of Chapter 6E:43 (as amended by Act 306), and following consultations with DLNR-SHPD, the Hawai'i Island Burial Council, and any direct lineal descendants.

While preservation-in-place would be the preferred treatment, should disinterment with reinterment and preservation in another location be recommended, this process will be undertaken with sensitivity and in compliance with the wishes of identified lineal descendants and/or DLNR-SHPD. At times, natural phenomena or human activities pose a threat to ancient remains, and preservation of those remains can be best achieved through reinterment in another location. It is recommended here, that reinterment of human remains and funerary objects (if applicable) should occur within the *ahupua'a* (traditional land division) of original interment.

'ŌLELO WEHEWEHE (Explanatory Comments)

The land in this area of *Kona 'akau* was generally known as Kekaha (The shore or place). The land was also affectionately called *Kaha-ka-weka* (The hard [stingy] place), as it was a *kaha 'ai 'ole* (place without vegetable foods) and a *kaha wai 'ole* (waterless place) (*He Mo'olelono Makalei* [A Hawaiian Legend about Makalei] by *Ho'olaleaka'ūkiu. Ka Hoku o Hawai'i*, March 6, 1928 [Kepā Maly, translator]). Though these names reflect the rugged nature of the land, the people who lived within Kekaha felt a kinship to the land and ocean, and were nurtured by natural resources. While this might have been a difficult place in which to live, it might also be noted that the region exhibits evidence of more or less uninterrupted occupation since c. AD 1000.

To live upon this land required an intimate knowledge of the gods, resources, and ways of the *'āina* (land). It is evident that a variety of occupations, ranging from harvesting marine resources to extensive dry-land agriculture were enjoyed by the people of this area. It seems that Hawaiian settlement first occurred along the shoreline, especially in small, protected bays, which allowed easy access to marine resources and coastal springs. Initially, planting would have occurred in and around these coastal communities. As the population grew and the political and religious systems became more formalized (c. AD 1300-1400), the communities also spread out, requiring more land. The *ko kula kahakai* and *ko kula uka* (coastal and upland plains) were extensively planted with important staple- and supplemental-crops that were less water dependent than the *kalo wai* (wet taro) that was the staple of the *Ko'olau* (windward) side of the island, with its watered valleys. *Pu'epu'e* (planting in built up mounds), *mākālua* and *'umoki* (planting in dugout-mulched holes) are three methods of planting techniques that were extensively used in this part of Kona.

Crops such as sweet potatoes, sugar cane, bananas, breadfruit, gourds, and coconuts provided the "bread" of the Hawaiian diet. On the upper slopes, agricultural practices would have included propagation and harvesting of *olonā* (*Touchardia latifolia*) for cordage, and *'awa* (Piper methysticum) for ceremonial and domestic use, and collecting from the upland forests various woods and resources that were used for items such as spears, paddles, canoes, and tools.

There is an ancient proverb about a mound that rises upon the plain between Keahuolu and Kealakehe. The saying offers us insight into the customs and nature of the people who lived there. In March 1914, Hawaiian historian and author, Isaac Kihe published the following account in the Hawaiian language newspaper *Ka Hōkū o Hawai'i*.

> Pu'u-o-Kaloa is a mound-hill site in the lands of Keahuolu, near the shore of Kaiwi and Hi'iakanoholae. During periods of dry weather (*Ka lā malo'o*) when planted crops, from the grassy plains to the *'āma'uma'u* (fern forest) zone, and even the ponds (*ki'o wai*) were dry, people would watch this hill for signs of coming rains. When the *līhau* (light dew mists) sat atop the hill of Pu'u-o-Kaloa, rains were on the way.
>
> Planters of the district's agricultural fields watched for omens at Pu'uokaloa, and it was from keen observation and diligent work that people prospered on the land. If a native of the land was hungry, and came asking for food, the person would be asked—*'ōlelo no'eau:*

Ua ka ua i Pu'uokaloa, ihea 'oe?—When rains fell at Pu'uokaloa, where were you? [If the answer was...]

I Kona nei no!—In Kona! [there would be no sweet potatoes for this person.] But if the answer was:

I Kohala nei no!—In Kohala! [The person would be given food to eat for they had been away, thus unable to accomplish the planting.] [*Nā Ho'onanea o ka Manawa, Kekāhi mau wahi pana o Kekaha ma* Kona (A Pleasant Passing of Time, [Stories from] Some famous Places of Kekaha at Kona) 3/19/14, Kepā Maly, translator].

Fishing in this region was considered some of the best on Hawai'i, and it is likely that a great deal of energy went into harvesting ocean resources. Though farmers probably gathered some ocean resources, and fishermen probably kept some food plants near their homes, it is generally accepted that many of the tasks related to the well-being of the community as a whole were entrusted to specialists. It is therefore reasonable to assume that the fishermen provided fish and other ocean resources to the planters, who in turn supplied the products of the land to the fishermen.

At the head of this stratified community, was a religious, political, and social elite that was well established and maintained in this area. Indeed, the royal decisions and priestly practices of this region held ramifications of island-wide significance. The religious beliefs, cultural practices and history of the Hawaiian people reflect both their Polynesian origins, and the uniqueness of Hawai'i's island resources. The Hawaiian people lived within the limitations of their island resources; they worked the land, fished the sea, and developed their unique "Hawaiianess." Their only recorded contact with the outside world was occasional interactions with other Polynesians. Because each facet of Hawaiian existence relied so completely on the bounty of the earth, every aspect of life reflected the relationship of people to their land.

For modern Hawaiians, one of the most revered manifestations of their relationship to the land and their past is found in the context of Hawaiian burials. Many of the *maka'āinana* (people of the land) were buried near the places where they had lived, just as their ancestors had been buried before them. Living and working among the bones of their *kūpuna*, the people of ancient Hawai'i communed with their ancestors as they led their daily lives. The winds carried their prayers, and the spirits of their ancestors to the rich fishing grounds, to their agricultural sites, and to the forested regions, all of which were harvested for the bounty of their resources. This interaction of gods, nature, bone, and ancestral spirits allowed the Hawaiians to identify with their ancestors, and kept the "*po'e kahiko*" (ancient people) alive as a promise to nurture the future.

The burials of Hawaiians symbolize a trust between those who came before us, their gods, the environment that gave them their essence, and Hawai'i's future. Hawaiian burials are part of a bond between families, the elements of nature, and the creative forces of nature that the Hawaiians worshipped.

The ancient saying "*Moe kau a ho'oilo*" (Sleep undisturbed from the dry season of *kau* to the wet season of *ho'oilo*; i.e. sleeping from season to season [M.K. Pukui, pers. comm.; 1976]) is associated with the setting of loved ones in their resting places. Thus as we have become more

sensitive to the rights of those who came before us, and in the context of this Burial Treatment Plan, it is our hope that this rest will continue undisturbed season to season.

O nā mea maika'i mālama, o nā mea maika'i 'ole kāpae 'ia
(Those things which are correct keep, those things which are inappropriate, set aside)

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APPENDIX C

PUBLIC NOTICES WITH AFFIDAVITS OF PUBLICATION

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
PUBLIC NOTICE

STATE OF HAWAII } SS.
City and County of Honolulu

Doc. Date: DEC 2 1 2016 **# Pages:** 1
Notary Name: Patricia K. Reese First Judicial **Circuit**
Doc. Description: Affidavit of Publication

DEC 2 1 2016
Notary Signature Date

PATRICIA K. REESE
NOTARY PUBLIC
Comm. No. 86-467
STATE OF HAWAII

PUBLIC NOTICE

Pacific Legacy is preparing a Burial Treatment Plan for Lili'uokalani Trust lands located makai of Queen Ka'ahumanu Highway, in the *ahupua'a* of Keahuolu, North Kona, Hawai'i (TMK (3) 7-4-025:015). This plan addresses the permanent preservation and protection in place of identified human remains in accordance with Chapter 6E, Section 43. The burial is probably Native Hawaiian, based on location, context, and association. Descendants of families from the area or persons with information of the area are requested to participate in the development of the Burial Treatment Plan. Please contact Herbert Poepoe, State Historic Preservation Division (808-933-7650) or Rowland Reeve, Pacific Legacy (808-351-9560) within 30 days to participate.
(SA945362 12/18, 12/21/16)

Gwyn Pang being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser, MidWeek, The Garden Island, West Hawaii Today, and Hawaii Tribune-Herald, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser 2 times on:
12/18, 12/21/2016
MidWeek 0 times on:
The Garden Island 0 times on:
Hawaii Tribune-Herald 0 times on:
West Hawaii Today 0 times on:
Other Publications: 0 times on:

PATRICIA K. REESE
NOTARY PUBLIC
Comm. No. 86-467
STATE OF HAWAII

And that affiant is not a party to or in any way interested in the above entitled matter.

Gwyn Pang
Gwyn Pang

Subscribed to and sworn before me this 21st day of December A.D. 2016

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Oct 07, 2018

Ad # 0000945362 SP.NO.: ____________ L.N.

Figure 29. Affidavit of Publication for legal notice in *Hawai'i Star Advertiser*.

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
PUBLIC NOTICE

STATE OF HAWAII } SS.
City and County of Honolulu

Doc. Date: DEC 2 1 2016 **# Pages:** 1
Notary Name: Patricia K. Reese First Judicial **Circuit**
Doc. Description: Affidavit of Publication

DEC 2 1 2016
Notary Signature Date

PATRICIA K. REESE
NOTARY PUBLIC
Comm. No. 86-467
STATE OF HAWAII

PUBLIC NOTICE

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(WHT945030 12/18, 12/21/16)

Gwyn Pang being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser, MidWeek, The Garden Island, West Hawaii Today, and Hawaii Tribune-Herald, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser 0 times on:
MidWeek 0 times on:
The Garden Island 0 times on:
Hawaii Tribune-Herald 0 times on:
West Hawaii Today 2 times on:
12/18, 12/21/2016
Other Publications: 0 times on:

PATRICIA K. REESE
NOTARY PUBLIC
Comm. No. 86-467
STATE OF HAWAII

And that affiant is not a party to or in any way interested in the above entitled matter.

Gwyn Pang
Gwyn Pang

Subscribed to and sworn before me this 21st day of December A.D. 2016

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Oct 07, 2018

Ad # 0000945030 SP.NO.: ____________ L.N.

Figure 30. Affidavit of Publication for legal notice in *West Hawai'i Today*.

APPENDIX D

DESCENDANT CONSULTATION

A series of consultation meetings were held with the recognized cultural descendants of the *ahupuaʻa* of Keahuolū (as listed in Section 5.3) and additional concerned parties (as listed in Section 5.4) during the development of the present Burial Treatment Plan.

KEAHUOLŪ DESCENDANT MEETING AND SITE VISIT, 24 MAY 2017

Attendees

Mr. Mana Purdy, Liliʻuokalani Trust
Mr. Michael Shibata, Liliʻuokalani Trust
Mr. Morgan Leleiwi, Liliʻuokalani Trust
Mr. Rowland Reeve, Pacific Legacy, Inc.
Ms. Paulette Kaʻanohi Kaleikini (Consulting Party)
Ms. Nicole Kealohaokalani Lui (Cultural Descendant)
Mr. Jim Medeiros (Consulting Party)

On May 24, 2017 the Liliʻuokalani Trust held a site visit to the Site 50-10-27-18511, Feature C lava tube burial for recognized cultural descendant and additional individuals with family connections to Keahuolū. Time was spent examining the lava tube entrance and the surrounding environment.

Following the site visit, a meeting was held at the Liliʻuokalani Trust offices in Kona. At this meeting, the Trust presented an overview of the proposed realignment of the Kuakini Highway and the planned development for the Makalapua Project District. The descendants and consulting individuals then provided their *manaʻo* (thoughts and opinions) concerning the proper future treatment of the Site 18511 burial. The attendees also expressed concern about the Trust's more general plans for development. It was agreed that these wider concerns would be addressed in future meetings with Liliʻuokalani Trust staff.

The descendants and consulting individuals agreed that the *iwi* (human remains) present within the Site 18511, Feature C lava tube should be preserved in place. They felt that all of the openings to the lava tube should be sealed with stones to protect the *iwi*.

The attendees were not comfortable with the existing 30-foot buffer proposed by the 1993 Burial Treatment Plan (Maly and Rosendahl 1993). Ms. Nicole Lui suggested that the buffer be expanded to encompass the entire lava *puʻu* covering the burial. She expressed that *puʻu* are an important feature of the natural and cultural landscape of coastal Keahuolū, and that the entire *puʻu* should be preserved as it was an important component of the burial area. The general feeling was that it was better for the buffer area to be based upon a natural landscape feature than on an arbitrary numeric distance. It was agreed that archaeologists from Pacific Legacy would map out the extent of the *puʻu* so that it could be included in development plans and that a more adequate buffer area could be established.

The consulting parties were in agreement that a low stone wall (approximately 2½ feet in height) should be constructed to mark the outer perimeter of the buffer area. For stability, the wall of stacked stones will be mortared with cement. They felt that there should be a small opening in the wall to allow access. Mr. Jim Medeiros expressed his opinion that a gate not be placed in the opening, as it would only rust or rot and need replacement. He and Ms. Kaleikini suggested that the opening be secured with a simple metal chain that could be unlocked to allow entry into the walled buffer area.

The general feeling was that all non-native vegetation should be removed from within the walled burial area, and that only native species be allowed to grow there. It was felt that if native vegetation was planted, it should be appropriate to the dry climate of coastal Keahuolū. Mr. Leleiwi noted that mature trees or brush should not be planted as that would only serve to attract homeless individuals who might shelter themselves within the burial area. If any native vegetation was introduced, it should be low growing. The decision as to what, if any, native vegetation should be planted within the buffer wall was left to a later time.

Some discussion was held as to what, if any, signage would be appropriate to mark the burial. Ms. Lui mentioned the brass plaques that had been placed at the burials located adjacent to the Ane Keohokālole Highway and suggested that something similar might be used. The group expressed the desire to further consider the question of signage before coming to a decision.

It was agreed that the recognized cultural descendant and additional consulting individuals would reconvene once the lava *pu*ʻ*u* had been mapped and the Burial Treatment Plan had been modified to reflect their suggestions.

Following the close of the general meeting, Ms. Nicole Lui, Mr. Mana Purdy, Mr. Michael Shibata, Mr. Morgan Leleiwi, and Mr. Rowland Reeve returned to the burial site to reexamine the area and establish the limits of the *pu*ʻ*u* and the proposed buffer perimeter that was requested during the meeting. It was agreed that Mr. Reeve would return at a later date to map the extent and locations of the lava pressure ridge, the burial tube, and the nearby bulldozing so that an adequate and agreed upon buffer area could be established. The limits of the *pu*ʻ*u* would be taken as the base of its slope. It was found that bulldozing had taken place along the northern and western edges of the lava pressure ridge, providing an established boundary for the proposed buffer zone. The remaining edges were examined and marked so that they could be mapped for planning purposes.

KEAHUOLŪ DESCENDANT MEETING, 5 OCTOBER 2017

Attendees

Ms. LeeAnn Crabbe, Liliʻuokalani Trust
Mr. Mana Purdy, Liliʻuokalani Trust
Mr. Morgan Leleiwi, Liliʻuokalani Trust
Ms. Nicole Kealohaokalani Lui (Cultural Descendant)

On October 5, 2017 the Liliʻuokalani Trust staff met with cultural descendant Ms. Nicole Kealohaokalani Lui to discuss the buffer zone around the Site 50-10-27-18511, Feature C lava

tube burial. During the previous descendant meeting, Ms. Lui had indicated her desire to have the buffer zone extended to include the full area of the lava pressure ridge (*pu*ʻ*u*) within which the lava tube burial is located. In preparation for the meeting, archaeologists from Pacific Legacy plotted the limits of the subsurface lava tube, its entrances, and the *pu*ʻ*u* within which it rests, as well as the bulldozed areas located adjacent to it using a Trimble Geo7X Global Navigational Satellite System (GNSS) unit (Figure 16). The resulting map was then overlaid onto the proposed street network of the development to determine the proximity of the *pu*ʻ*u* to the proposed realigned Kuakini Highway extension road corridor. The corridor was found to overlap a section of the southeastern end of the *pu*ʻ*u*. This information was shared with Ms. Lui, who agreed to the removal of the section of the *pu*ʻ*u* that overlapped the road corridor as long as the remainder of the *pu*ʻ*u* was left intact.

When discussing the planned construction of the low (2 to 2.5 foot high) stone wall surrounding the burial area, Ms. Lui suggested that four boulders (preferably taken from the material removed from the road cut at the eastern edge of the *pu*ʻ*u*) be embedded into the wall marking the four cardinal directions. She also recommended that the bronze plaque identifying the burial be located on the north-facing boulder.

Also discussed was the future appearance of the undeveloped areas located northeast and across the Kuakini Highway extension road corridor from the *pu*ʻ*u*. Ms. Lui recommended that these areas be landscaped as naturally as possible with the open lava being planted with *maiapilo* (*Capparis sandwichiana*) bushes, *pili* (*Heteropogon contortus*) grass, and/or other native vegetation from the surrounding area.

KEAHUOLŪ DESCENDANT MEETING, 1 MARCH 2018

Attendees

Ms. LeeAnn Crabbe, Liliʻuokalani Trust
Mr. Mana Purdy, Liliʻuokalani Trust
Mr. Morgan Leleiwi, Liliʻuokalani Trust
Mr. Mike Ikeda, Liliʻuokalani Trust
Ms. Robyn Ito, SSFM International
Mr. Austen Drake, SSFM International
Mr. Rowland Reeve, Pacific Legacy, Inc.
Ms. Nicole Kealohaokalani Lui (Cultural Descendant)
Mr. Jim Medeiros (Consulting Party)

On March 1, 2018 the Liliʻuokalani Trust held a follow-up meeting with recognized cultural descendants and additional individuals with family connections to Keahuolū to discuss the treatment recommendations for the Site 50-10-27-18511, Feature C lava tube burial. This meeting was held at the Trust offices in Kona. Prior to the meeting, all of the attendees had been provided with copies of the revised draft Burial Treatment Plan. The purpose of the meeting was to obtain clarity from the descendants and other attendees as to the proposed treatment recommendations for the burial.

Prior to the main discussion, Mr. Jim Medeiros expressed his opinion that lineal descendants of the Queen should be considered lineal descendants of all burials located on her lands.

Following an introductory *pule*, Mr. Mana Purdy of Liliʻuokalani Trust presented a review of the burial treatment recommendations as they had been developed from previous meetings. He discussed the original 1993 Burial Treatment Plan, referenced the descendants' general feeling that the remains should be preserved in place, and mentioned the existing recommendations and issues to be discussed: sealing the lava tube entrances, construction of a physical buffer wall, leaving an opening in the wall for access, removing invasive species from within the buffer, and establishing the size and limits of the protective buffer.

Mr. Rowland Reeve, the archaeologist from Pacific Legacy, then began eliciting from the descendants and concerned individuals their thoughts on the various burial treatment recommendations.

Everyone in attendance was in agreement that the *iwi kupuna* (human remains) within the Site 50-10-27-18511, Feature C lava tube should be preserved in place.

<u>Sealing the Tube</u>: Mr. Medeiros expressed that there was no cultural reason for anyone to go into the tube. Ms. Lui and Mr. Medeiros both agreed that it would be best to seal off all entrances to the lava tube. This could be done with stones collected from the surrounding area placed within the openings to seal them. Mr. Medeiros would have preferred that the stones sealing the entrances be dry-stacked rather than cemented together, but acknowledged the reality of needing to mortar the stones in order to protect the burial from disturbance. It was agreed that the mortar should be stained to disguise it and to make it less visible.

<u>Long-Term Site Monitoring</u>: Ms. Lui expressed the desire for long-term monitoring of the condition of the burial site. She was assured by Liliʻuokalani Trust staff that they regularly visit and monitor the condition of the known burials on their lands. Statements regarding the long-term monitoring, maintenance, and security of the Site 50-10-27-18511 burial have been included in the Burial Treatment Plan. "Maintenance and security of the Site 50-10-27-18511 burial will be provided by the Liliʻuokalani Trust. The condition of the burial site will be assessed on a regular basis so that any potential threats from human or natural agencies can be identified."

<u>Encircling Wall (visual buffer)</u>: Ms. Lui and Mr. Medeiros were both of the opinion that the burial site should be encircled with a low stacked stone wall. The reason for this wall would be to protect the site from future impacts. This wall would be placed along the outer boundary of the protective buffer zone. Mr. Medeiros felt that the wall should be two feet high and that it be mortared for stability. The stone used in the construction of the wall should be taken from the immediate area. Mr. Medeiros also suggested that the wall have a four-foot-wide entrance opening to allow access for maintenance and site visitation. When not in use, this opening would be closed off by means of a chain or rope. The placement of this opening would depend upon the shape and location of the buffer zone boundary. Ms. Lui reaffirmed her feeling that larger stones should be set into the wall to mark the four cardinal directions.

She agreed with Mr. Medeiros that these stones would be incorporated into the wall and would not be higher than the height of the wall itself.

<u>Signage</u>: Ms. Lui and Mr. Medeiros both felt that, given the location of the burial within a relatively high traffic area, there was a need for some form of signage. Rather than being placed in the enclosing wall, it was suggested that the signs be attached to large boulders placed outside the wall. Ms. Lui possesses several brass signs that were originally created for burial sites located alongside the route of the Ane Keohokālole Highway, but never used. The wording on these signs, which was in both Hawaiian and English, had been developed by Analu Josephus, a cultural descendant of the area. It was agreed by Ms. Lui and Mr. Medeiros that these existing signs could be used for the Site 50-10-27-18511 burial.

<u>Buffer Zone</u>: Ms. Lui had previously expressed her feeling that the protective buffer zone surrounding the burial should include the full extent of the lava pressure ridge (*puʻu*) within which the lava tube burial is located. The existing plan prepared for Liliʻuokalani Trust by SSFM International calls for the realigned route of the Kuakini Highway to pass northeast of the burial site. This alignment would necessitate the removal of roughly 30 feet from the eastern edge of the *puʻu*. Mr. Medeiros stated that he wanted to save the entire *puʻu*, no matter what. The planners from SSFM International and the Liliʻuokalani Trust staff explained the reasons for the proposed alignment of the highway, indicating that the County of Hawaiʻi required that the road be four lanes (including a bike lane) and that in order to fit the required speed (35 miles per hour) it could not have a sharper bend (which would allow it to be positioned further from the burial).

Mr. Medeiros was insistent that the alignment needed to be moved. He asked the planners to provide him with an alternate option. Mr. Medeiros felt that the entire *puʻu* was part of the burial site and wanted the pressure ridge to be preserved in its entirety. He would not agree with the proposed design of the road and buffer area, and stressed the preciousness of the *iwi kupuna* at Site 50-10-27-18511 as it was the only one left in the area.

Ms. Lui agreed with Mr. Medeiros, stating that she felt the *puʻu* was part of the burial. She also noted that the lava tube was an area where water was found and could have been used as a water catchment, giving it added significant in this dry region of coastal North Kona. She pointed out that if the highway affected the *puʻu*, it might also affect the availability of water in the tube. She expressed the hope that the Trust could come up with a different plan to route the road around the *puʻu* and not cut into it.

Mr. Medeiros suggested moving the road alignment so that it ran *makai* of the burial site. Ms. Crabbe explained that the proposed highway realignment needed to meet up with the existing intersection at Makala. The planners stressed that the highway alignment needed to be a smooth curve rather than an 'S' bend for safety reasons. Mr. Medeiros said that he understood these limitations, but that he felt the planning should overcome them to make it work.

Ms. Crabbe clarified that the Trust originally considered the lava tube to be the burial area, but now understood that the descendants felt that the entire *puʻu* was part of the burial.

Mr. Medeiros stated that there needed to be more options for the alignment of the highway, that he would like to see options for going different routes. He expressed his gratitude to the Trust for being included in the planning process, and understood there might be costs involved in rerouting the highway alignment, but felt that this was an opportunity for Liliʻuokalani Trust to be "not just another developer," and to preserve its *kūpuna*. As a lineal descendant to the Queen, "My duty is to advocate for the *kūpuna*." He hoped it would be possible to examine more options. Thanking the Trust for its patience, he asked for another design that would use the open land to the south and west and reroute the road away from the burial. "We aren't stuck. We are only just starting."

Ms. Crabbe asked how the perimeter of the lava pressure ridge was determined. Ms. Lui explained that what was mapped was the visible edge of the *puʻu* where its slope met the surrounding relatively level lava. Mr. Medeiros re-emphasized that, "we see the burial as the entire *puʻu*." He asked rhetorically, "What do we get as a people by yielding to construction?" Ms. Lui asked why the road alignment had to be so wide. The planners explained that the County intended for the highway to be four lanes of traffic. Mr. Medeiros requested that the Trust reconsider their plans and come back with an alternative alignment. He expressed the desire of the descendants to save the entire site.

Ms. Crabbe requested clarification for the future, asking if the Trust should consider natural terrain features when determining the boundaries of cultural sites and buffer zones. The general opinion was, yes, that natural boundaries were a more traditional way of looking at things. Mr. Medeiros also stressed that it is important to ask for consultation and save as much as you can. "Our *kuleana* is the *kūpuna*," he explained. "It is not our job to design the road." He was not ready to compromise or say yes to any plans, and felt there needed to be more creativity.

Mr. Ikeda asked if it would be possible to use the rock from that portion of the *puʻu* which would be cut by the highway to seal the tube openings. In that way the removed stones from the *puʻu* could become part of the burial. Mr. Medeiros indicated that this would be a "worst case" scenario, that he would prefer not to damage the *puʻu* in the first place.

At the close of the meeting, the decision of the Trust staff was that they and the planners would return to the drawing board and that once alternative avenues were explored the group would reconvene for a future meeting.

KEAHUOLŪ DESCENDANT MEETING, 18 APRIL 2018

Attendees

Ms. LeeAnn Crabbe, Liliʻuokalani Trust
Mr. Mana Purdy, Liliʻuokalani Trust
Mr. Morgan Leleiwi, Liliʻuokalani Trust
Mr. Mike Ikeda, Liliʻuokalani Trust

Mr. Rowland Reeve, Pacific Legacy, Inc.
Ms. Nicole Kealohaokalani Lui (Cultural Descendant)
Mr. Aaron Joseph Lui (Cultural Descendant)
Mr. Jim Medeiros (Consulting Party)

On April 18, 2018 the Liliʻuokalani Trust held a fourth meeting with recognized cultural descendants and additional individuals with family connections to Keahuolū to present design plan changes developed to address concerns raised at the previous meeting (held on March 1, 2018). The April 18th meeting was held at the Trust offices in Kona. The purpose of the meeting was for Liliʻuokalani Trust staff to present to the descendants and other attendees revised road designs that would serve to protect the entire extent of the lava pressure ridge (*puʻu*) within which the Site 50-10-27-18511, Feature C lava tube burial is located.

Concerns had been raised during the March 1, 2018 meeting that the existing design plan called for the realigned route of the Kuakini Highway to pass northeast of the burial site, an alignment which would necessitate the removal of roughly 30 feet from the eastern edge of the *puʻu*. This alignment was felt by the descendants and other attendees to be unacceptable, and they requested that Liliʻuokalani Trust staff consult with their experts to come up with one or more alternative alignments that would avoid impacting the entire *puʻu*.

Following an introductory *pule*, Mr. Mana Purdy of Liliʻuokalani Trust presented a review of the results of the previous meetings held regarding the Burial Treatment Plan for the Site 50-10-27-18511, Feature C lava tube burial. The initial meetings had resulted in the general agreement that the permanent preservation buffer surrounding the burial should include not only the lava tube itself, but also the low *puʻu* (lava pressure ridge) containing the lava tube. Mr. Purdy expressed the Trust's appreciation to the descendants for sharing their *manaʻo* that a cultural site consists not only of a structure (or in this case a burial), but the land form that encompasses it (in this case the *puʻu*), and how important it is to preserve the entirety of the land form.

Mr. Purdy then discussed the results of the previous meeting and the rejection of the plan put forth by the Trust that would necessitate the removal of a portion of the *puʻu*. He then explained that following the meeting, Liliʻuokalani Trust staff had met with their planners and technical professionals to discuss possible solutions. A number of alternatives were broached, and two possible options were agreed upon. Both of these options realigned the streets in the area to avoid impacting the *puʻu*.

Mr. Purdy then showed plans depicting the two options. In the first option, the route of the proposed realigned Kuakini Highway was redesigned so as to pass further northeast of the burial site, thereby avoiding impacting the *puʻu*. This option required that the realigned highway encroach 10 feet onto the lot presently occupied by the BMW dealership and 24 feet into the Target parking area. This option would require negotiation with both Target and the BMW dealership.

The second option kept Kuakini Highway along its present alignment south of the Kona Commons area and then had it swing north to the west of the current Makala Boulevard. In both options, the area surrounding the *puʻu* would be framed by roads and by a bicycle/walking path. Both options ensured that the *puʻu* containing the burial was not impacted by construction activities.

The descendants and other attendees were happy with the two new options. They expressed their appreciation to the Trust for its willingness to go back to the drawing board and come up with a plan to preserve the *puʻu*. Although both options were agreeable to the group, Mr. Medeiros preferred the second option as it would not require any discussions with Target or the BMW dealership. Mr. Medeiros explained that he supports the second option and that he would also support this through the Burial Council process. The primary purpose of the first option to realign Kuakini Highway was to create a pedestrian and bicycle promenade next to the park area along the present alignment of the highway. Mr. Medeiros did not care about bikers or a walkway. Mr. Lui said to let the County worry about bike lanes. He and Ms. Lui agreed that they felt the second option was best.

Mr. Reeve, the archaeologist from Pacific Legacy, then went over with the descendants and other attendees the treatment recommendations previously agreed upon.

<u>Sealing the Tube</u>: The descendants expressed their desire to be involved in the sealing of the lava tube entrances. Ms. Lui requested that Mr. Medeiros be hired to seal the entrances. The descendants want to be present during the sealing of the tube, and to have representatives of Liliʻuokalani Trust present, to ensure that the proper protocols are followed.

<u>Encircling Wall</u>: Ms. Lui and Mr. Medeiros both felt that the low stacked stone wall enclosing the burial and marking the visible buffer should follow the perimeter of the lava pressure ridge. On the northern edge, however, the wall should run straight across from one point of the crescent-shaped lava pressure ridge to the other, allowing for an entrance area. Mr. Medeiros reiterated that the wall should be approximately two and a half feet high and that it have a four-foot-wide entrance opening to allow access for maintenance and site visitation. When not in use, this opening would be closed off by means of a simple chain or rope.

<u>Signage</u>: It was agreed that one of the brass signs originally created for burial sites located alongside the route of the Ane Keohokālole Highway and presently in the possession of Ms. Lui be used to mark the Site 50-10-27-18511 burial.

<u>Vegetation</u>: It was generally agreed that all non-native vegetation should be removed from within the walled burial area, and that only native species be allowed to grow there. If native vegetation was planted within the burial area it should be appropriate to the dry climate of coastal Keahuolū. The decision as to what, if any, native vegetation was to be planted within the buffer wall would be determined once invasive vegetation was cleared and the area was given a chance to recover. It was agreed upon that the option of planting native vegetation outside of the enclosing wall to provide a visual buffer for the burial would be considered based upon the future use of the surrounding area.

At the close of the meeting the descendants and others in attendance again thanked the Trust staff for their willingness to come up with alternative design plans that made it possible to preserve the burial and the surrounding *puʻu* in their entirety.

SHPD ACCEPTANCE LETTER FOR BURIAL TREATMENT PLAN, DATED NOVEMBER 8, 2019

APPENDIX

H-1

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
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
KAHO'OLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

November 08, 2019

Queen Lili‘uokalani Trust
C/O Mana Purdy
74-5490 Makala Blvd.
Kailua-Kona, HI 96740

LOG NO: 2019.01526
DOC NO: 1911CJO01

Aloha e Mr. Purdy,

SUBJECT: DRAFT Burial Treatment Plan for Site #50-10-27-18511, Lili‘uokalani Trust Lands in Keahuolū Ahupua‘a, North Kona District, Island of Hawai‘i, TMK: (3) 7-4-025:015.

We apologize for the delay of this notification. At its monthly meeting on October 17, 2019, the Hawai‘i Island Burial Council (HIBC) made the determination to preserve in place the above burial site, SIHP #50-10-27-18511. Additionally, the HIBC recommended that the State Historic Preservation Division (SHPD) accept the DRAFT Burial Treatment Plan.

Following the recommendation of the HIBC, the *DRAFT Burial Treatment Plan for Site #50-10-27-18511, Lili‘uokalani Trust Lands in Keahuolū Ahupua‘a, North Kona District, Island of Hawai‘i, TMK: (3) 7-4-025:015* is accepted by the SHPD. Please change the title from “DRAFT Burial Treatment Plan” to “Burial Site Component of a Preservation Plan” and submit hard copies of the final version with a copy of this letter and a text-searchable PDF CD to both our Kapolei and Hilo offices.

Should you have any further questions or concerns, you may contact our Hawai‘i Island Burial Sites Specialist, Christian Omerod, at (808) 294-9573 or Christian.Omerod@Hawaii.gov.

Mahalo,

Hinano Rodrigues

Mr. Hinano Rodrigues, B.A., J.D.
History & Culture Branch Chief

CC: Mara Mulrooney, Pacific Legacy, Inc.

HISTORIC PRESERVATION PLAN FOR SITE NOS. 50-10-27-13260, 50-10-27-13261, AND 50-10-27-30287

APPENDIX

I

Pacific Legacy

Historic Preservation

FINAL

**PRESERVATION PLAN
FOR SIHP 50-10-27-13260,
50-10-27-13261,
AND 50-10-27-30287,
LILIʻUOKALANI TRUST LANDS
IN THE AHUPUAʻA OF KEAHUOLŪ,
NORTH KONA DISTRICT,
HAWAIʻI ISLAND**

**[TMK: (3) 7-4-008:002 (por.);
(3) 7-4-010:009, 010;
(3) 7-4-025:001–003, 005, 012, 015]**

Pacific Legacy: Exploring the past, informing the present, enriching the future.

Cultural Resources Consultants

Hawaiʻi Offices:
Kailua, Oʻahu

California Offices:
Business Office
Bay Area
Sierra/Central Valley

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FINAL

PRESERVATION PLAN
FOR SIHP 50-10-27-13260, 50-10-27-13261, AND 50-10-27-30287, LILIʻUOKALANI TRUST LANDS IN THE AHUPUAʻA OF KEAHUOLŪ, NORTH KONA DISTRICT, HAWAIʻI ISLAND

[TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010;
(3) 7-4-025:001–003, 005, 012, 015]

Prepared by:
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March 2023

ACKNOWLEDGEMENTS

The authors would like to thank several individuals whose contributions were vital in the preparation of this preservation plan. Mahalo to Rowland B. Reeve, M.A. for his research and substantial contributions to the preservation plan. Mahalo to Nicole Lui and cultural descendants from Keahuolū for their *manaʻo* and *ʻike*. Mahalo to Jackson Bauer (Nā Ala Hele Trails Access Program, Division of Forestry and Wildlife, State of Hawaiʻi) and Rick Gmirkin, Tanya Lizama, and Fred Baldenweck (Ala Kahakai National Historic Trail, National Park Service) for their input in the consultation process.

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Note: *In this report, the spellings and the use of diacritical marks (glottal stops and macrons) follow conventions employed by Pukui and Elbert (1986) and Pukui et al. (1974) with limited exceptions – spellings and diacritical marks in quotations, titles, and proprietary names are given as they appear in the original sources.*

Cover photograph: *SIHP 50-10-27-13260, Feature A, modified collapsed sink.*

1.0 INTRODUCTION

At the request of the Lili‘uokalani Trust, Pacific Legacy, Inc. has prepared the following Preservation Plan (PP) to address the protection and long-term preservation of three historic properties situated within the Makalapua Project District. These three historic properties, which include State Inventory of Historic Places (SIHP) site numbers 50-10-27-13260, a complex with three modified collapsed sinks; SIHP 50-10-27-13261, an enclosure; and the SIHP 50-10-27-30287 trail and associated petroglyph, are being preserved because of their cultural significance. The historic properties included in this plan were recorded within the 213-acre Urban Phase III parcel and the 100-acre Kona Commons parcel of Lili‘uokalani Trust lands located within the *ahupua‘a* (land division) of Keahuolū in the district of North Kona on Hawai‘i Island. The sites included in this plan are located within the 67-acre Makalapua Project District, which includes a portion of the Urban Phase III project area as well as a portion of the Kona Commons project area [TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010; (3) 7-4-025:001–003, 005, 012, 015].

This Preservation Plan has been developed in consultation with cultural descendants from the area, the Office of Hawaiian Affairs (OHA), Nā Ala Hele Trails and Access Program, Ala Kahakai National Historic Trail, NPS, the State Historic Preservation Division (SHPD), and the landowner (Lili‘uokalani Trust).

1.1 STATUTORY REQUIREMENTS

This Preservation Plan is intended to satisfy the requirements of Hawai‘i Administrative Rules Chapter 13-277 (HAR §13-277, Rules Governing Requirements for Archaeological Site Preservation and Development). HAR §13-277, Section 3 describes the components of a Preservation Plan prepared pursuant to Hawai‘i Administrative Rules, Chapter 13-284 (HAR §13-284, Rules Governing Procedures For Historic Preservation Review To Comment On Section 6E-42, HRS, Projects). These components include the following:

(1) Identify for each significant historic property which forms of preservation will be implemented: avoidance and protection (conservation), stabilization, rehabilitation, restoration, reconstruction, interpretation, or appropriate cultural use.

(2) Specify the buffer zones around each significant historic property and depict them on a map of sufficient scale.

(3) Specify short-term protection measures for each significant historic property that will be within or near a construction area.

(4) Discuss the agency or person’s consultation process for historic properties deemed significant under paragraphs 13-275-6(b) (5) or 13-284-6(b)(5). The agency or person shall consult with ethnic organizations and individuals for whom the historic properties are of significance. The comments on preservation treatment expressed by these individuals or organizations shall be considered when preparing the preservation plan. The plan shall include a list of individuals and organizations consulted, and shall summarize their input.

(5) Specify the long-term preservation measures to be undertaken at each significant historic property.

1.2 REPORT ORGANIZATION

This Preservation Plan has been organized into eight sections to address the various matters associated with the protection and long-term preservation of SIHP 50-10-27-13260, 50-10-27-13261, and 50-10-27-30287.

Section 1	Provides an introduction to the Preservation Plan.
Section 2	Presents background on the Urban Phase III and Kona Commons Project Areas and SIHP 50-10-27-13260, 13261, and 30287, including location, environment, and a brief overview of the previous archaeological work undertaken in the area.
Section 3	Provides a detailed description of SIHP 13260, 13261, and 30287.
Section 4	Discusses the proposed development for the area surrounding SIHP 13260, 13261, and 30287.
Section 5	Details the consultation process undertaken in regards to SIHP 13260, 13261, and 30287.
Section 6	Outlines the plans to protect and preserve the SIHP 13260 complex, the SIHP 13261 enclosure, and the SIHP 30287 trail and associated petroglyph from potential adverse effects during the development and use of the surrounding area.
Section 7	Provides a summary of the Preservation Plan.
Section 8	Lists the various references cited in the document.

Appendix A contains the acceptance letters from SHPD for the 2014 Kona Commons SAIS report (McIntosh et al. 2015) and the 2011 AIS report for the Urban Phase III parcel (Reeve et al. 2019). Appendix B includes additional correspondence with SHPD regarding historic properties in the Makalapua Project District. Appendix C contains the Burial Site Component of a Preservation Plan for SIHP 50-10-27-18511, Feature C.

2.0 PROJECT BACKGROUND

This section of the preservation plan provides background information on the project area. It discusses the physical attributes of the area as well as its archaeological resources.

2.1 PROJECT DESCRIPTION

The Liliʻuokalani Trust is proposing the development, enhancement, and refinement of approximately 67.2 acres of land that includes portions of the 100-acre Kona Commons property and the adjacent 213-acre Urban Phase III parcel, as well as a small section of previously developed land east of the Kona Commons parcel (Figure 1 and Figure 2). This project is referred to as the Makalapua Project District, and is described in detail in Section 4. The area is at the northern edge of Kailua town in the coastal portion of the *ahupuaʻa* of Keahuolū in the district of North Kona on the island of Hawaiʻi.

The Makalapua Project District includes the southern half of the Kona Commons parcel as well as the eastern portion of the Urban Phase III parcel. The area to the northeast contains the Liliʻuokalani Children's Center complex, the area to the northwest is now occupied by a mix of commercial properties and parking areas, to the southeast lies commercially developed land that forms part of the Kona Industrial Area, and to the southwest are playing fields that are within the Old Kona Airport State Recreation Area.

Though mostly undeveloped at present, portions of the Makalapua Project District area have been disturbed by bulldozing, and by landscaping associated with the construction of the former Swing Zone driving range in the southwestern corner of the area, roadways, and commercial/industrial buildings in the eastern portion of the project area.

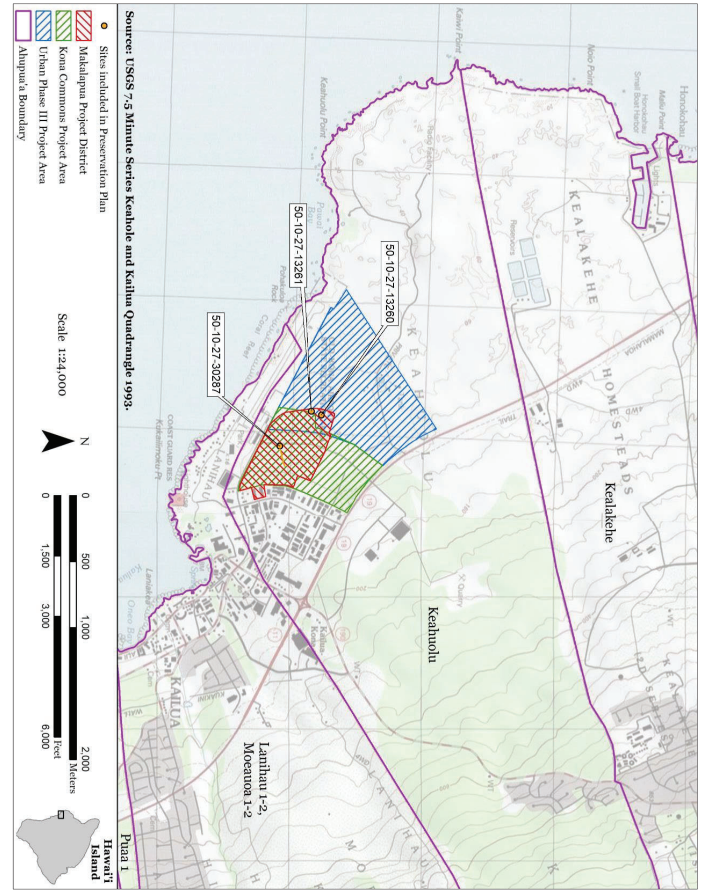

Figure 1. Location of SIHP 50-10-27-13260, 13261, and 30287 in the Makalapua Project District, with Urban Phase III and Kona Commons project areas shown on USGS Keahole Point and Kailua Quadrangles 1996.

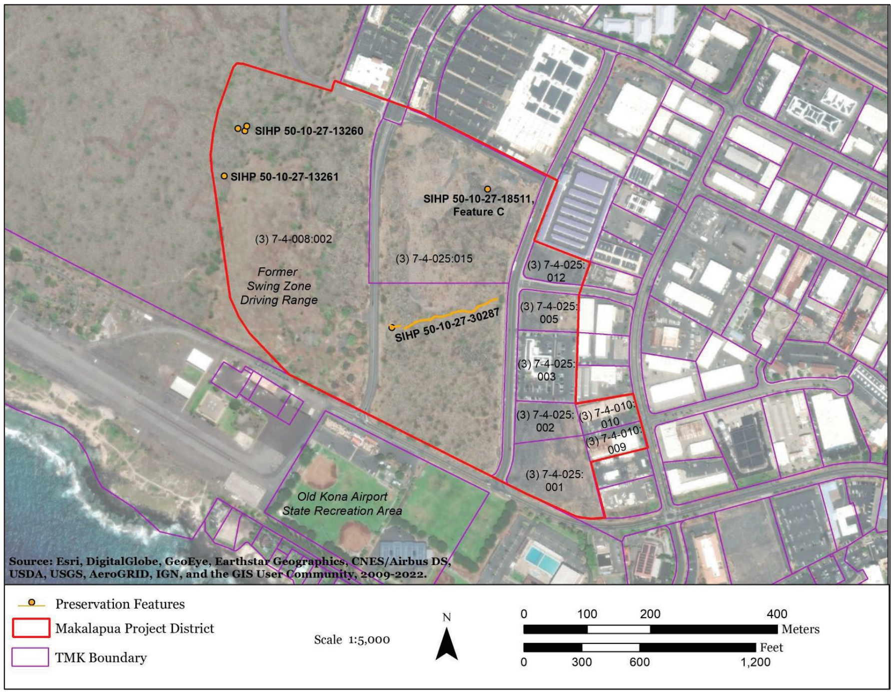

Figure 3. Location of Makalapua Project District and historic properties included in the Preservation Plan and the Burial Site Component on an aerial photo with TMK boundaries (Esri World Imagery 2019).

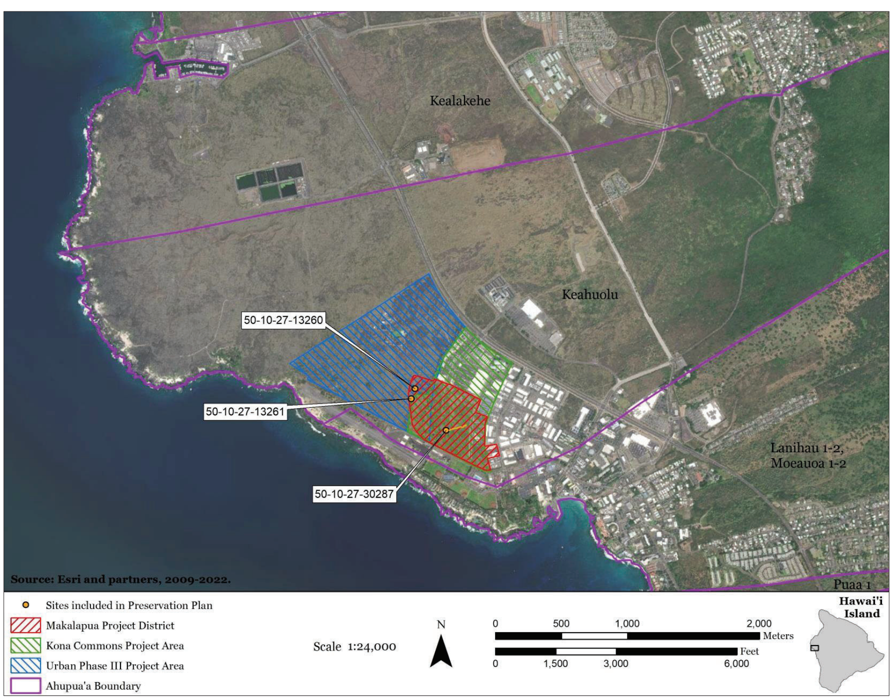

Figure 2. Location of SIHP 50-10-27-13260, 13261, and 30287 in the Makalapua Project District, with Urban Phase III and Kona Commons project areas shown on an aerial photo (Esri World Imagery 2019).

2.2 Environmental Setting

The Makalapua Project District is located at the foot of the volcanic peak of Hualālai, on the drier leeward side of the island of Hawai‘i. The geology underlying most of the area, including the areas containing SIHP 13260, 13261, and 30287, consists of gently undulating *pāhoehoe* lava flows laid down sometime between 1,500 and 3,000 years ago (Wolfe and Morris 1996). These *pāhoehoe* flows possess very little in the way of surface soil, most of which consist of thin aeolian sediments that have accumulated in depressions and low-lying areas (soil type rLW in Sato et al. 1973:Map 85). The lava is scarred by upthrust pressure ridges, fissures, collapsed blisters, and lava sinks. Subsurface lava tubes and blisters are also present within the flow.

Less than 750 mm (c. 29.5 in.) of rain falls in a year along this stretch of the Kona coast (Giambelluca et al. 1986). Due to the limited amount of rainfall, vegetation is relatively sparse. The undisturbed *pāhoehoe* lavas within the Makalapua Project District are vegetated in a ground cover of introduced fountain grass (*Pennisetum setaceum*), with occasional stunted *kiawe* (*Prosopis pallida*), and Christmas berry (*Schinus terebinthifolius*) trees, as well as *koa haole* (*Leucaena leucocephala*), klu *(Acacia farnesiana)*, lantana (*Lantana camara*), and bougainvillea (*Bougainvillea spp.*) shrubs. Scattered native shrubs such as *‘uhaloa* (*Waltheria indica*), are also present, with Polynesian-introduced *noni* (*Morinda citrifolia*) trees growing out of lava sinks and other natural depressions in the terrain. During the Pre-Contact period, the dominant vegetation throughout this area would probably have been *pili* (*Heteropogon contortus*) grass.

2.3 Cultural and Historical Background

SIHP 50-10-27-13260, 13261, and 30287 are located within the *ahupua‘a* (land division) of Keahuolū, which follows the traditional *mauka* to *makai* (from the mountains to the sea) pattern, extending from the upper slopes of Hualālai to the coastal waters north of Kailua Bay. Keahuolū is bounded to the north by the *ahupua‘a* of Kealakehe and to the south by the *ahupua‘a* of Lanihaunui (also referred to as Lanihau 1) and Honua‘ula 3.

The *ahupua‘a* of Keahuolū possesses a rich cultural history that has been investigated as part of the various cultural and archaeological studies undertaken for the Lili‘uokalani Trust by Pacific Legacy. A detailed narrative of the cultural and historical background of the *ahupua‘a*, with emphasis on its coastal region, is provided in the SAIS report for the Kona Commons property (McIntosh et al. 2015) as well as the AIS report for work undertaken in the Urban Phase III parcel (Reeve et al. 2019).

Archaeological studies and historic research suggest that the primary centers of population within the *ahupua‘a* of Keahuolū during the pre-Contact period were located at the coast and in the well-watered uplands (McIntosh et al. 2015:23–26). The main areas of coastal settlement seem to have been located at the small crescent bays of Halepa‘o and Pawai (also known as Papawai, according to Clark 2003:287), as well as along the sandy beach immediately south of Pawai in the area known as Makā‘eo. The fishing village of Makā‘eo appears to have been the closest settlement to the Makalapua Project District. Although the Makalapua Project District area shows some evidence of human activity during the pre-Contact period, this activity all appears to have been of a temporary nature and the area does not look to have supported a permanent pre-Contact population (McIntosh et al. 2015).

In the early years following Western contact, little changed in the lives of the inhabitants of coastal Keahuolū. With time, however, the introduction of foreign diseases for which the *kama‘āina* (native-born residents) possessed no natural resistance as well as population shifts caused by changing economic conditions resulted in a general decrease in the coastal population of the *ahupua‘a* (McIntosh et al. 2015). Despite this general population decline, the fishing settlements of Pawai and Makā‘eo continued to be occupied by local *‘ohana* (families) into the 1940s, when the village of Makā‘eo and its attendant coconut grove was destroyed to make way for the Kona Airport (Clark 1985:110; McIntosh et al. 2015:25–26).

At the time of the Māhele ‘Āina (land division) of the 1840s, the entire *ahupua‘a* of Keahuolū was awarded to the *ali‘i wahine* (chiefess) Analea (Ane) Keohokālole under Land Commission Award 8452: Apana 12 (Royal Patent 6851). Two post-Contact trails (the Māmalahoa Trail and a smaller horse trail) are known to have crossed the Kona Commons property during the post-Contact period (McIntosh 2015:28–29, 182–183). As with the pre-Contact period, there does not appear to have been any permanent occupation on the property during the post-Contact period (McIntosh et al. 2015:183–184).

2.4 Archaeological Background

The *ahupua‘a* of Keahuolū has been the subject of several archaeological investigations beginning in the first decade of the twentieth century, when Bishop Museum archaeologist John F.G. Stokes began documenting the *heiau* (shrines) of Hawai‘i Island (Stokes 1991). The earliest investigations formed part of larger regional or island-wide surveys, and as a result were not as detailed as later studies. These initial surveys were concentrated along the coast, which was the main area of settlement during the pre-Contact period. A detailed review of these early archaeological studies, as well as those later investigations undertaken within the broader *ahupua‘a* as a whole, is provided in the SAIS report of the Kona Commons property (McIntosh et al. 2015:51–69). The following sections provide information on the two most recent archaeological studies undertaken within the Kona Commons project area as well as previous studies in the adjacent Urban Phase III project area, portions of which are within the Makalapua Project District.

2.4.1 PHRI Inventory Survey of the Kona Commons Project Area, 1992

In 1992, Paul H. Rosendahl Ph.D., Inc. (PHRI) conducted an AIS of the 100-acre Kona Commons property (O’Hare and Rosendahl 1993). The 1992 survey identified a total of 18 archaeological sites containing 38 component features. These sites included a segment of the historic Māmalahoa Trail, as well as lava excavations, modified outcrops, filled depressions, stone alignments, stone mounds, terraces, walls, hearths, walled overhangs, an enclosure, a modified depression, a cairn, a cave shelter, and a lava tube burial (O’Hare and Rosendahl 1993:ii). The 1992 inventory did not identify the SIHP 50-10-27-30210 complex. The 1992 AIS provided substantial evidence of human activity within the Kona Commons project area during the pre-Contact period. These activities, however, all appear to have been primarily short-term in nature, undertaken by individuals visiting or passing through the area rather than residing within it.

2.4.2 Pacific Legacy Supplemental Archaeological Inventory Survey of the Kona Commons Project Area, 2014

In 2014, Pacific Legacy, Inc. conducted an SAIS of the Kona Commons property (McIntosh et al. 2015) that included both the original 100 acres surveyed by PHRI in 1992 and an additional 10 acres extending off of its southwest corner in the area formerly occupied by the Swing Zone driving range. This SAIS was undertaken to assist the Lili'uokalani Trust in planning for the future development of the area. The purpose of this survey was to assess the current state of the historic properties initially identified during the 1992 survey and to determine if any additional historic properties existed on the property.

During the course of the SAIS, 11 archaeological sites consisting of 21 component features were identified. These sites consist primarily of small and crudely constructed features or modified natural features, including stone mounds, modified depressions, modified overhangs, C-shaped walls and alignments, small enclosures, a historic petroglyph, and a historic trail. Of the 11 sites identified, four had been previously recorded (SIHP 50-10-27-18502, 50-10-27-18508, 50-10-27-18509, 50-10-27-18511), while seven sites were newly identified (SIHP 50-10-27-30207, 50-10-27-30208, 50-10-27-30209, 50-10-27-30210, 50-10-27-30211, 50-10-27-30212, 50-10-27-30287). These features appear to have served a range of functions. Among these were temporary habitation, storage, travel, visual markers, possibly stone quarrying and/or crop cultivation (in the case of the lava excavations), communication (in the case of the historic petroglyph), and burial.

The results of the 2014 survey indicated that the majority of the sites located within the Kona Commons survey area dated from the pre-Contact period. Three sites, the SIHP 50-10-27-18502 modified depression, the SIHP 50-10-27-30211 petroglyph (which consists of two English letters, possibly representing personal initials), and the SIHP 50-10-27-30287 trail appeared to date from the post-Contact or modern periods. The remainder of the sites possessed a more traditional style of construction, suggesting that they were pre-Contact in age.

All of the sites identified during the 2014 survey appeared to have been associated with relatively short-term activities. Among these activities was the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, and burial crypts. Small stone enclosures and walled shelters appeared to have been erected to serve as temporary camping areas. Low stone mounds were built to serve as markers. Rough excavations were created in the lava surface, either to supply stone for the construction of nearby surface features, or to open pits that could be filled with mulch and used to grow dryland crops (McIntosh et al. 2015).

2.4.3 Archaeological Surveys of the Urban Phase III Project Area

The Urban Phase III project area was the subject of a reconnaissance survey by the Archaeological Research Center Hawai'i (ARCH; Ching 1978), an Archaeological Inventory Survey (AIS) undertaken by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1989–1990 (Donham 1990), and an AIS undertaken by Pacific Legacy in 2011 (Reeve et al. 2019). Haun & Associates (Haun and Henry 2006) also completed an archaeological survey that included a road corridor through a portion of the Urban Phase III project area. Stasack and Stasack completed detailed recording and analysis of petroglyph sites throughout Lili'uokalani Trust lands in Keahuolū, including 14 of the 18 identified sites containing petroglyphs within the Urban Phase III project area (Stasack and Stasack 2012).

In 1978, Francis Ching of Archaeological Research Center Hawai'i, Inc. (ARCH) conducted a reconnaissance survey of 987 acres within the *ahupua'a* of Keahuolū. This survey covered much of the coastal portion of the *ahupua'a*, extending from the shoreline up to the Queen Ka'ahumanu Highway. The survey resulted in the recording of a total of 59 archaeological sites containing 140 individual component features. Nine of the sites appeared to be located within the Urban Phase III survey area.

In 1990, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an AIS and test excavations of sites situated within a 1,100-acre portion of Lili'uokalani Trust lands within Keahuolū (Donham 1990). The designated survey area covered lands located both *mauka* and *makai* of the Queen Ka'ahumanu Highway. This survey was the most extensive archaeological investigation to be undertaken within the *ahupua'a* up to that time. Included within the survey was a 212-acre parcel located *makai* of the Ka'ahumanu Highway that had formed part of Ching's original 1978 survey area and included the Urban Phase III project area. The PHRI survey recorded a total of 239 sites (composed of 1,810+ component features) within its survey area. Of these, 55 sites were located within the 212-acre parcel located *makai* of Ka'ahumanu Highway, which roughly corresponds to the Urban Phase III project area. Among the numerous features documented within this portion of the 1,100-acre survey area were excavated areas within the *pāhoehoe* lava, stone mounds, rock walls, cave shelters containing marine shell midden, stone platforms and terraces, and petroglyphs.

In 2006, archaeologists from Haun & Associates conducted an archaeological inventory survey of the proposed Kona Kai Ola project, which consisted of two parcels encompassing a total of ca. 370.5 acres in the *ahupua'a* of Kealakehe located immediately north of coastal Keahuolū (Haun and Henry 2006). Their survey area also included a road corridor that extended south into Keahuolū and crossed through the Urban Phase III project area. They identified eight sites within the Urban Phase III road corridor, one of which had been previously recorded during the 1990 PHRI survey (SIHP 50-10-27-13271), while the remaining seven were assigned new State Inventory of Historic Places site numbers (SIHP 25644 to 25650). The sites identified within the Keahuolū corridor consisted of stone alignments, stone mounds, and a lava blister.

In 2011, Pacific Legacy, Inc. conducted an AIS for the Urban Phase III project, which included the recording of 120 archaeological sites containing 214 component features (Reeve et al. 2019). The survey also identified and recorded the locations of 540 lava excavations. Excavations of this type were distributed throughout the survey area. While each lava excavation was individually recorded, all were grouped together under one State Inventory of Historic Places site number: SIHP 50-10-27-29175. These lava excavations bring the total number of sites recorded up to 121.

Of the 121 sites identified in the Urban Phase III project area during the 2019 AIS, 36 had been previously recorded, either during the 1978 ARCH reconnaissance survey (seven sites, four of which had been assigned new site numbers by the 1990 survey; Ching 1978), the 1990 PHRI inventory survey (27 sites and five lava excavations; Donham 1990), or the 2006 Haun & Associates survey (six sites; Haun and Henry 2006). A total of 85 sites were newly identified during the 2019 AIS (Reeve et al. 2019).

Nine of the sites documented in 1978 by the ARCH (Ching 1978) reconnaissance survey appear to have been located within the limits of the present survey area. Only two of these sites were positively re-identified during the 2011 AIS. Five additional sites (one of which may be a lava excavation) were tentatively identified. The remaining two sites were not re-located and appear to have been destroyed, as they were recorded in the area formerly occupied by the Swing Zone driving range.

During the course of the 2011 survey, an effort was also made to re-locate and re-identify all of the structural features recorded during the 1990 PHRI survey and the 2006 Haun & Associates survey. The 2011 survey was able to identify 36 of the 55 sites that were previously documented during the 1990 PHRI inventory survey. Five of these sites (SIHP 50-10-27-13276, 50-10-27-13277, 50-10-27-13285, 50-10-27-13296, and 50-10-27-13352) were lava excavations and were recorded under SIHP 50-10-27-29175. It also re-located seven sites recorded by Haun & Associates (along with two features possessing site tags with temporary site numbers, most likely assigned by the 2006 survey, that did not appear on the final site map). Several of the sites recorded during the 1990 survey that were not re-identified during the 2011 survey consist of what the 1990 survey report refers to as “pahoehoe excavations” and which the 2011 survey identified simply as “lava excavations.” Some of the sites recorded during the 1990 survey were located toward the southeastern corner of the survey area. These sites were likely destroyed by ground-disturbing activities associated with the transformation of the Old Kona Airport into a beach park and the construction and landscaping of the Swing Zone driving range. All 14 of the sites containing petroglyphs that were documented by Stasack and Stasack (2012) were re-located during the 2011 survey. An additional four sites containing petroglyphs were also documented.

2.4.4 Identified Sites within the Makalapua Project District

A total of 16 historic properties have been identified within in the Makalapua Project District (Figure 4, Table 1). Many of the sites identified during previous surveys of the Kona Commons and Urban Phase III project areas appear to have been associated with relatively short-term activities. Among these activities is the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, water catchment areas, and burial crypts. Small stone enclosures and walled shelters were likely erected to serve as temporary habitation areas or small shrines (*heiau*). People traveled across these areas on trails, low stone mounds were built to serve as markers, and concentrations of petroglyphs were created to mark *wahi pana* (storied places) or trails that people used to traverse the landscape. Rough excavations were created in the lava surface, either to supply stone for the construction of nearby surface features, to provide nesting areas for birds, or to open pits that could be filled with mulch and used to grow dryland crops.

Five of the previously identified sites were documented during the AIS of the Urban Phase III project area (Donham 1990; Reeve et al. 2019). These include SIHP 50-10-27-13260, a complex of modified collapsed sinks used for water collection that was assessed as significant under Criteria c and d and recommended for preservation by Reeve et al. (2019). SIHP 50-10-27-13261, an enclosure interpreted as a ceremonial structure, was assessed as significant under Criteria d and e and was also recommended for preservation. A preservation plan has been prepared for these sites (Mulrooney and Cleghorn 2022a). Three additional sites were identified within the portion of the Urban Phase III project area that is within the Makalapua Project District. These include SIHP 50-10-27-29111, a C-shaped wall; SIHP 50-10-27-29112, a C-shaped wall; and SIHP 50-10-27-29143, Features E and F, which are modified overhangs. All three of these historic properties were assessed as significant under Criterion d and recommended for no further work.

The remaining 11 sites were documented during the AIS and/or SAIS of the Kona Commons project area. These include eight sites that were assessed as significant under Criterion d and recommended for no further work: SIHP 50-10-27-18502, a modified depression used for temporary habitation; SIHP 50-10-27-18508, a walled overhang used for temporary habitation; SIHP 50-10-27-18509, consisting of two stone mounds, a lava excavation, and a modified depression; SIHP 50-10-27-30207, a lava excavation with an uncertain function; SIHP 50-10-27-30208, a stone mound used as a marker; SIHP 50-10-27-30209, an enclosure used for temporary habitation; SIHP 50-10-27-30211, a post-Contact petroglyph; and SIHP 50-10-27-30212, a C-shaped wall used for temporary habitation. SIHP 50-10-27-30287 is a post-Contact trail segment with a spatially associated petroglyph that has been assessed as significant under Criteria d and e and has been recommended for preservation (Mulrooney and Cleghorn 2022a).

At SIHP 50-10-27-30210, three features used for temporary habitation (Feature A, a modified overhang; Feature C, a C-shaped wall; and Feature D, an enclosure) were assessed as significant under Criterion d and recommended for no further work during the SAIS for Kona Commons. The fourth feature, Feature B, a lava excavation, was assessed as significant under Criterion d and recommended for data recovery. A data recovery plan has been developed to guide data recovery investigations at this feature (Mulrooney and Cleghorn 2022b). SIHP 50-10-27-18511 contains five features. Feature A is a modified overhang that was used for temporary habitation; Feature B is a lava excavation interpreted as an agricultural feature; Feature C is a modified lava tube containing *iwi kupuna*; and Features D and E are lava excavations interpreted as quarrying areas. Features A, B, D, and E were assessed as significant under Criterion d and recommended for no further work. The Feature C burial was assessed as significant under Criteria d and e and was recommended for preservation in place; a burial treatment plan has been implemented (Reeve and Cleghorn 2019).

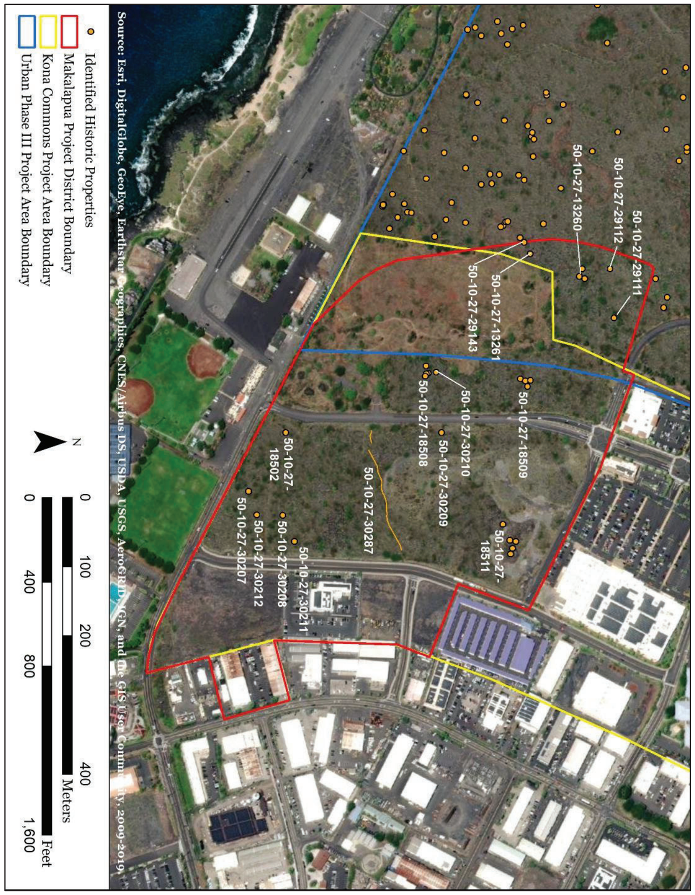

Figure 4. Locations of previously identified sites in the Makalapua Project District and in the adjacent portion of the Urban Phase III Project Area (base map: Esri World Imagery 2021).

Table 1. Identified Historic Properties in the Makalapua Project District with Updated Significance Assessments and Mitigation Recommendations*

SIHP# (50-10-27-)	Site/Feature Type	Significance	Recommended Mitigation	Study
13260	Modified Sink (A, B, C)	c, d, e	Preservation	Urban Phase III AIS
13261	Enclosure	d, e	Preservation	Urban Phase III AIS
18502	Modified Depression	d	No Further Work	Kona Commons SAIS
18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/ No Further Work/ Burial Treatment	Kona Commons SAIS
29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
30208	Stone Mound	d	No Further Work	Kona Commons SAIS
30209	Enclosure	d	No Further Work	Kona Commons SAIS
30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	Data Recovery	Kona Commons SAIS
30211	Petroglyph	d	No Further Work	Kona Commons SAIS
30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
30287	Trail and associated petroglyph	d, e	Preservation	Kona Commons SAIS

*Historic properties recommended for preservation are shaded.

3.0 DESCRIPTIONS OF HISTORIC PROPERTIES

The following section provides detailed descriptions of SIHP 50-10-27-13260, 50-10-27-13261, and 50-10-27-30287. These descriptions are summarized from those included in the report of the 2011 Archaeological Inventory Survey of the Urban Phase III parcel (Reeve et al. 2019) and the 2014 Supplemental Archaeological Inventory Survey of the Kona Commons property (McIntosh et al. 2015) and additional information is provided for SIHP 30287. A fourth historic property, SIHP 50-10-27-18511, is also being preserved within the Makalapua Project District, and long-term protection of the *iwi kupuna* (ancestral remains) identified within the Feature C lava tube and surrounding features at the site are guided by a burial site component of a preservation plan (Reeve and Cleghorn 2019; included in Appendix C).

SIHP 50-10-27-13260

SIHP 50-10-27-13260 is a complex with three modified collapsed sinks, Features A through C (Figure 5). The 1990 PHRI survey recorded SIHP 50-10-27-13260 as a complex consisting of six features:

> two walls, one of which is constructed across an overhang (Feature A). The second wall is associated with a sinkhole (Feature B). Also present are two pahoehoe excavations (Features C and D), a filled crevice (Feature E) and an overhang (Feature F). (Donham 1990:A-5 to A-6).

Feature B was described as a wall "built across a sinkhole and pahoehoe crevice" (Donham 1990:A-5). Donham noted that:

> A coconut shell fragment, gourd fragments, and 12 thin, smooth sticks (c. 15cm in length and c.0.8cm in diameter) occur inside the overhang. The sticks are situated beneath the gourd and coconut fragments. A waterworn basalt hammerstone (16×13 cm) is also present. (Donham 1990: A-5)

The 2011 survey identified the site and was able to identify most of the previously recorded features. Features A and B were given their original designations and a total of 12 lava excavations were identified near the site, among them the lava excavations previously designated as Features C and D by PHRI. These lava excavations were among the 540 lava excavations that were identified during the Urban Phase III AIS (Reeve et al. 2019) that were designated as SIHP 50-10-27-29175. The previously identified Feature E stone-filled crevice and Feature F overhang were located but were determined to be natural features and were not recorded during the 2011 survey. The 2011 survey identified an additional feature; which was designated Feature C, a modified collapsed sink. Reeve et al. (2019 Volume II:29–35) provided the description below for the site.

All three modified sinks (Features A, B, and C) are quite similar in their construction. Each of these natural lava collapsed sinks has had one or more of its edges filled and faced with stones so as to narrow the diameter of the opening and limit the amount of light entering it. *Pāhoehoe* slabs have been placed on the sink floor under overhanging portions of the roof and directly beneath natural water seeps. These slabs appear to have acted as supports for water catchment vessels. Two fragments of *ipu* (bottle gourd, *Lageneria siceraria*, synonym *Lageneria vulgaris*) were observed within the interior of the Feature A sink, while gourd fragments and the remnants of a coconut shell cup were found within Feature B. Additional cultural material noted at the site included a waterworn basalt cobble at Feature A and a group of three small sticks near the coconut cup in Feature B, which were left *in situ*. No cultural material was observed within Feature C.

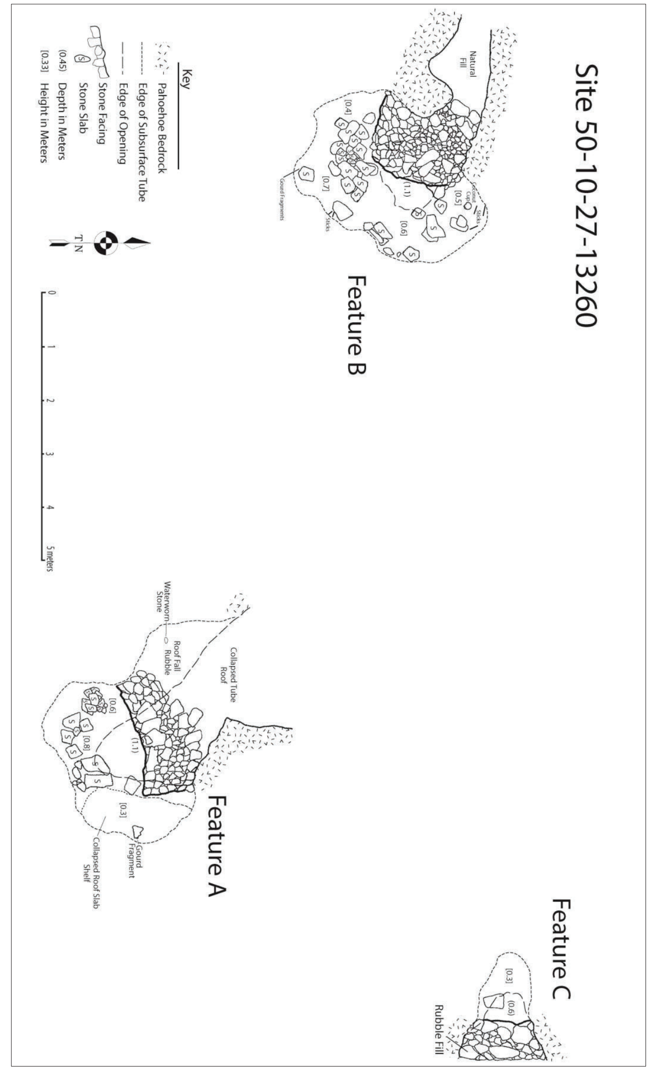

Figure 5. Plan-view map of SIHP 50-10-27-13260 modified collapse sinks.

SIHP 50-10-27-13260 is in good to fair condition. It appears that all three of these modified collapsed sinks functioned as water catchment features. The faced stone fills that block a portion of each sink opening seem intended to narrow their interior dimensions, possibly to help limit evapotranspiration from sunlight and wind. The set *pāhoehoe* slabs are all located under the dripline of the collapse sinks and may have supported water catchment vessels. Gourd water containers, the remnants of which were found within Features A and B, were likely placed atop the *pāhoehoe* slabs and beneath the drips so as to catch and hold drinking water. The coconut cup was probably used to dip water out of these vessels into other, more portable, containers. SIHP 50-10-27-13260 was most likely constructed and utilized during the pre-Contact and/or early post-Contact periods.

Feature A is located in the southeastern portion of the site, approximately 8 m south (202˚) of Feature B (Figure 6). Feature A consists of a deep, natural collapse sink which has been filled and faced at its north end, narrowing the size of its opening. The facing consists of small to medium sub-angular basalt boulders that have been loosely stacked up to four to five courses on the bedrock collapse sink floor. It measures approximately 1.65 m long (east to west) by ca. 1.15 m in height. A fill of small to medium sub-angular basalt boulders and large cobbles has been piled behind (to the north of) the boulder facing. This fill extends ca. 1.05 m in width. The remaining opening to the collapse sink measures ca. 1.15 m in length (north to south), by ca. 1.05 m in width (east to west). Near the bottom of the sink are natural overhangs that extend out to the southwest and northeast. The floor of the collapse sink therefore is larger than its opening, with maximum internal measurements of ca. 2.53 m in length (northeast to southwest) by ca. 1.85 m in width (northwest to southeast).

The floor of the feature is fairly level with some visible bedrock in the northwestern portion and medium to large *pāhoehoe* slabs set onto the bedrock in the southeastern portion. These slabs appear to have been placed underneath the natural dripline of the collapse sink. In the northeastern area of the collapse sink, a natural collapsed roof slab created a small shelf with two large gourd fragments atop it. The pieces of gourd are body fragments that are currently stacked on each other. One measures ca. 18.5 cm by ca. 14 cm and the other measures ca. 9.5 centimeters by ca. 7.0 cm. This shelf area remains dry during precipitation, and may have functioned as a storage area. Continuing north from the shelf area is a narrow lava tube in which a single *pāhoehoe* slab has been placed.

Feature A is in good condition. In addition to the two gourd fragments, a waterworn vesicular medium sized basalt cobble manuport was found 1.1 m northwest of the northwest edge of the feature under a natural overhang. The modifications to the natural collapse sink, the placement of the *pāhoehoe* slabs beneath its dripline, and the fragments of bottle gourd all suggest that SIHP -13260, Feature A apparently functioned as a water catchment feature. The intentional narrowing of the opening of the collapse sink may have been intended to decrease evapotranspiration of the water being collected.

Feature B is located in the northwestern portion of the site atop a low *pāhoehoe* lava ridgeline, approximately 11.5 m west (287˚) of Feature A (Figure 7). Modifications have been made to the northwestern wall and floor of the natural collapse sink … Near the bottom of the sink, a low overhang opens for a short distance to the northeast.

The northwestern section of the collapse sink has been filled with small to medium sub-angular basalt boulders and large cobbles. This fill extends roughly northwest to southeast and covers the sink's entire northwestern section. It appears intended to narrow the opening of the collapse sink. The inner edge of the fill has been nicely faced with loosely stacked small to large sub-

angular basalt boulders. The southwestern corner of the fill extends into the southern section of the collapse sink's overhang, and the fill seems to have been placed so as to form a small chamber that extends into the northwest portion of the collapse sink.

The area of fill measures 1.5 m in length (northwest to southeast) by ca. 0.95 m in width (northeast to southwest). Its maximum height is 0.91 m. The remaining opening of the sink measures 1.2 m in length (north to south) by 0.75 m in width (east to west). The internal measurements at the level of the floor are larger, being 3.0 m in length (north to south) by 1.45 m in width (east to west).

The floor of the collapsed sink appears to have been cleared, and some small to medium *pāhoehoe* boulder slabs have been placed to roughly level portions of the floor. Several of these slabs or concentrations of slabs may have served as supports for gourd vessels set up to collect water dripping from the ceiling. A fragment of gourd was found next to one such slab.

Feature B is in good condition. It does not appear to have suffered much tumble. In addition to the gourd fragment located in the eastern portion of the feature's interior, there is the remnant half of a coconut shell located in the northern interior. The bottom of the coconut has rotted away, leaving a ring of shell. Portions of the upper edge of the shell show evidence of having been smoothed, suggesting that the artifact was originally a cup like dipper. This rough coconut cup may have been used either to collect water dripping from the cave ceiling, or, more likely, as a dipper to transfer water from the gourd collecting bowl to a more portable container.

Adjacent to the coconut shell are three sticks without bark. These range in length from 0.21 m to 0.34 m. The function of these sticks, if any, is unclear. The previous 1990 PHRI survey recorded the presence of a basalt hammerstone. While no hammerstone was observed within Feature B, a waterworn vesicular cobble was present in Feature A, which was left *in situ*. No other cultural material was noted.

Feature B's construction style and the presence of gourd and coconut fragments suggest that it may have functioned as a water catchment feature. The fill and facing on the northwestern portion of the collapse sink appear to narrow the opening, possibly to help reduce water evaporation. The fragments of gourd and coconut suggest that water dripping from the ceiling and sides of the interior overhang was collected in gourd containers placed atop set *pāhoehoe* slabs.

Feature C is located near the northeast end of the site approximately 8 m north (22˚) of Feature A (Figure 8). It is situated in the western end of a large boulder-filled collapse sink. The eastern portion of the collapse sink is filled with medium to large sub-angular basalt *pāhoehoe* boulders with the west corner of the sink being open. The fill has been roughly faced (to the west) to narrow the west corner of the triangular-shaped opening. The opening exposes a very shallow overhang. The floor of the opening consists of *pāhoehoe* bedrock and is covered with sub-angular basalt *pāhoehoe* cobbles and one large *pāhoehoe* boulder that appears to have come from a natural collapse. This feature appears to be similar in construction to Features A and B, but is smaller and simpler in form … The entire collapsed sink measures approximately 5.2 m in length (east to west) and 2.97 m in width (north to south). The triangular-shaped opening in the west corner of the sink measures approximately 0.8 m in length (north to south), by 0.62 m in width (east to west). The floor of the opening measures 0.85 m in length (north to south) and 0.55 m in width (east to west). The wall facing created by the fill runs north to south measuring approximately 88 m in length and is 0.55 m in height.

Feature C is in fair condition. It appears that only one large boulder has collapsed into the floor of the opening. No cultural material was observed in or adjacent to the sink. Given its similarity in construction to the other features at the site, it is likely that Feature C was constructed and utilized during the pre-Contact and/or early post-Contact period for water catchment.

Figure 6. SIHP 50-10-27-13260, Feature A, modified collapsed sink (view to north).

Figure 7. SIHP 50-10-27-13260, Feature B modified collapsed sink (view to west).

Figure 8. SIHP 50-10-27-13260, Feature C modified collapsed sink (view to east).

SIHP 50-10-27-13261

SIHP 50-10-27-13261 is a roughly square stone-walled enclosure that was recorded during the 1990 PHRI survey as a square enclosure with a possible entrance at its southwest corner. It was designated as SIHP 50-10-27-13261 (Donham 1990:A-6). During the PHRI survey, three waterworn basalt cobbles and five coral fragments were observed within the enclosure (Figure 9). A single 1 by 1 m test unit was excavated in the southwestern corner of the enclosure wall and the associated wall tumble, which was described as “rockfill”:

> The rockfill consisted of a single layer of slabs (possibly wall fall) and two to three layers of smaller pahoehoe cobbles and pebbles. Thickness of the fill ranged from 0.16 to 0.20 meters. Two small pockets of very dry soil were located in low spots of the crevice, beneath the rock fill. A sample of the soil was collected. No portable remains or other cultural material occurred in the test unit. (Donham 1990:A-6)

SIHP 13261 may also be the “Enclosure of small aa boulders with cobble fill, interior paved in aa clinkers with some coral depression in center of enclosure; measures 4.5 m long, 4 meters wide; walls 40 centimeters wide” recorded as SIHP 50-10-27-06542 during the 1978 survey (Ching 1978:6). Though the description does not exactly match the site, it is located in the same general area as SIHP 06542.

The site was recorded during the 2011 AIS of the Urban Phase III parcel. Reeve et al. (2019 Volume II:40–41) provided a full description for the site, which is summarized below.

The enclosure that forms SIHP 13261 is located in the southeastern portion of the project area, approximately 79 m south (203˚) of SIHP 50-10-27-13260, Feature A. It is situated on the eastern edge of a large lava depression, which contains the SIHP 50-10-27-29143 complex. The surrounding vegetation consists of a ground cover of dense patches of fountain grass, and scattered lantana and Christmasberry trees.

The stone-walled enclosure is roughly square in shape and is comprised of four walls (Figure 10). The southern, eastern, and western walls are relatively straight, while the northern wall is slightly curved. The northwest and northeast corners of the northern wall are rounded, creating a more crescent-like shape to the north wall. There is a gap in the east end of the southern wall measuring approximately 1.1 m wide, which could possibly be an entrance.

The exterior of the enclosure measures approximately 5.1 m (north to south) by 5.1 m (east to west). The interior measures 3.8 m in length (north to south) and 3.6 m in width (east to west).

All four walls are faced with loosely stacked medium to large sub-angular basalt *pāhoehoe* boulders and boulder slabs, and filled with *pāhoehoe* boulders and cobbles. The enclosure wall ranges in thickness from 0.6 m to 0.8 m, with a maximum height (taken from the interior of the northeast corner) of 0.56 m (Figure 11 and Figure 12).

The interior of the enclosure consists of sloping, undulating *pāhoehoe* bedrock. It appears that the northern portion of the interior was filled and leveled with medium to large *pāhoehoe* boulder and cobble slabs creating what is now a badly disturbed, possible low terrace that is backed by the northern wall. This possible terrace measures approximately 3.4 m in length (east to west), by 1.4 m in width (north to south) and 0.22 m in height. Atop the terrace is a line of three medium-sized boulders that are set on edge (measuring 0.9 m in from the western wall) and appear to subdivide the interior terrace.

Within the interior of the enclosure are three small oblong waterworn basalt boulders that could have originally been set upright (*ku‘ula*), but which are now tumbled and scattered. Two waterworn coral cobbles and a cobble-sized sand conglomerate were found within the interior fill. Three waterworn basalt cobbles, one waterworn cobble sized coral fragment and one waterworn pebble were found in the fill of the interior. Also, one waterworn pebble was found outside of the enclosure near the gap in the south wall. In the center of the enclosure’s interior is what appears to be a lava excavation. Stones removed from the excavation are scattered within the interior, with one of the excavated *pāhoehoe* boulders tumbled on top of one of the three oblong waterworn boulders. SIHP 13261 is in fair condition with sections of the enclosures wall slightly tumbled along its the outer edges and the possible terrace within the interior badly disturbed.

The formal structure of the enclosure’s walls, the possible internal terrace, and the presence of coral and three oblong waterworn boulders suggest that SIHP 13261 may possibly have been a ceremonial structure, possibly a small shrine. It was likely constructed during the pre-Contact and/or early post-Contact periods.

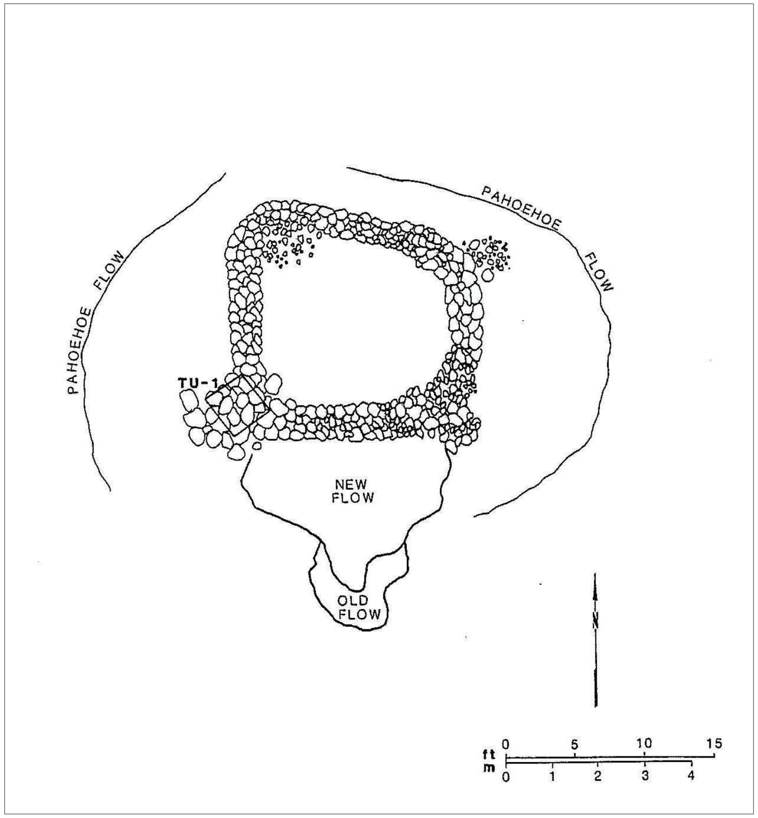

Figure 9. PHRI plan-view map of the SIHP 50-10-27-13261 enclosure showing the location of their test excavation (Donham 1990:A-7, Figure A-4).

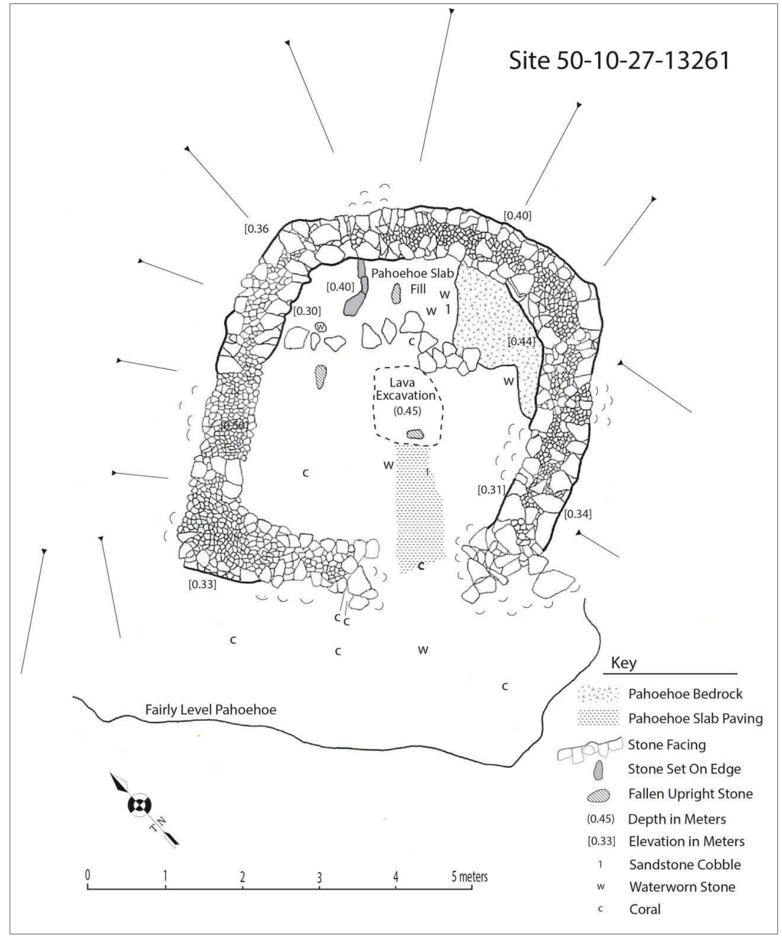

Figure 10. Plan-view map of the SIHP 50-10-27-13261 enclosure.

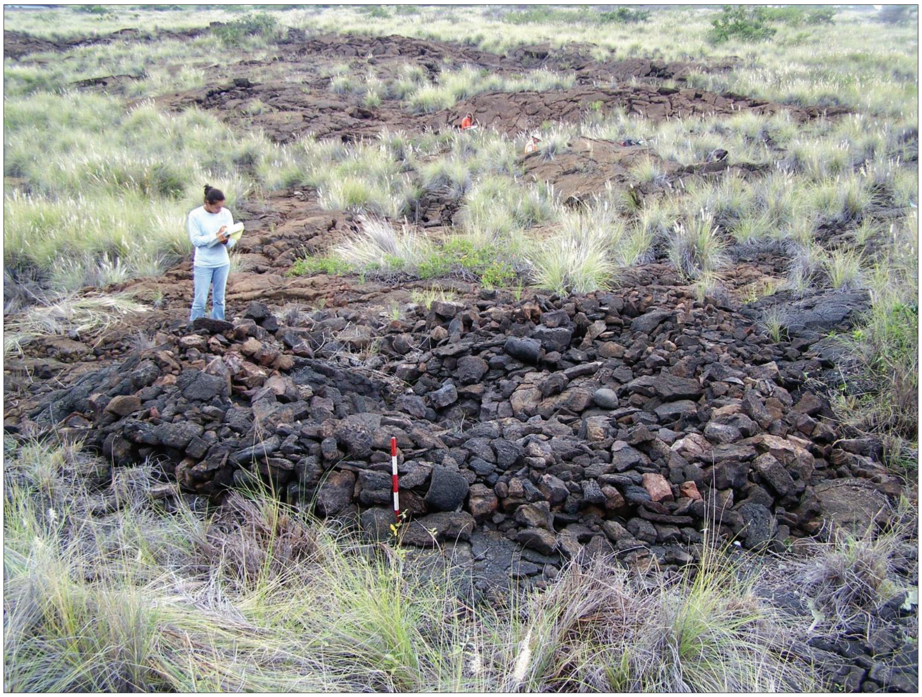

Figure 12. SIHP 50-10-27-13261 enclosure (view to west).

Figure 11. SIHP 50-10-27-13261 enclosure (view to northeast).

SIHP 50-10-27-30287

The SIHP 50-10-27-30287 was described in the 2014 SAIS as a remnant segment of a trail. SIHP 30287 was not identified during the 1993 PHRI survey, but was documented during the 2014 SAIS of the Kona Commons property (McIntosh et al. 2015). This remnant trail segment runs diagonally across the *makai* portion of the Kona Commons survey area.

The route of the SIHP 50-10-27-30287 trail was initially recognized on the 1924 USGS topographic map of Keahole Point Quadrangle, where it appears as a dotted line connecting the historic Māmalahoa Trail with the traditional coastal trail. This smaller trail branches off the Māmalahoa Trail in the Kona industrial area and extends northwest, joining the coastal trail in the vicinity of the former Makāʻeo settlement (now occupied by the Old Kona Airport Park). Previous development has destroyed both ends of the trail, leaving only a short intact section that runs diagonally through the undeveloped portion of the Kona Commons survey area.

In order to more precisely determine the course of this historic trail, its route (as shown on the 1924 USGS topographic map) was overlaid atop a contemporary aerial photograph of the area (Figure 13). The aerial revealed that the only portion of the connecting trail that might be expected to have survived was that portion running between Makala Blvd. and Loloku Street. Following identification of the trail's approximate route based on the 1924 USGS map, a subsequent field investigation led to the observation of linear stretches of worn *pāhoehoe* lava that appeared to represent the bed of the historic trail traveled by shod horses and mules. These remnant traces of the trail were GPS mapped (see McIntosh et al. 2015:161).

A physical examination of the area revealed an intermittent and faint, but discernible, line of abrasion on the surface of the *pāhoehoe* lava (Figure 14 and Figure 17). This wear pattern would have been caused by the passage of shod horses and mules along the trail, their iron shoes eroding the lava, wearing away the more glossy surface and leaving a distinctive line of darker lava. In some places, the bed of the trail is slightly (less than a cm) depressed, having been worn down by the passage of shod animals. The discoloration that marks the trail bed varies slightly along its length, but averages approximately 0.7 m in width. The visible course of the trail is intermittent, being broken at one point toward its western end by a line of bulldozer push and being obscured in other areas by vegetation. The visibility of the trail varies. It is most evident at its western end, just before it is broken by the shoulder of Makala Blvd., and again near its center. It is least visible at its eastern end near Loloku Street.

There are occasional areas of battering along the course of the trail (Figure 18). These consist of concentrations of shallow marks in the surface of the lava where it appears to have been struck repeatedly by a hard object such as a stone. Areas of battering can be found both within and adjacent to the trail. They seem to be the result of some processing activity, but what that activity was or how it may have been related to the trail is uncertain. No portable cultural material was observed on or alongside the trail during the 2014 SAIS and subsequent site visits.

Although relatively faint and difficult to discern over most of its length, the trail appears to be in fair condition. The best-preserved section (most visible) is approximately six meters in length and located at its western end. Here it is traceable for approximately 15 m before it is cut by a line of bulldozer push. The second most visible segment is closer to the center of the surviving trail segment. Here there are roughly 12 m of clearly discernible trail. There are no other physical manifestations of the trail beyond the abrasion of the lava surface, no laid trail bed or stone curbing as is present on surviving sections of the Māmalahoa Trail.

The northeastern end of the trail, where it would have connected to the Māmalahoa Trail, has been destroyed by the development of the Kona industrial area, while its southwestern end, where it would have joined the coastal trail, was demolished during the construction of the Old Kona Airport and the grading of the Swing Zone driving range. All that remains is a roughly 174-m long remnant section in what would have originally been the central portion of the trail. This remnant is itself cut into two parts toward its western end by a line of bulldozer push (Figure 14).

It is not clear whether the SIHP 50-10-27-30287 trail existed during the pre-Contact period, or whether it was a post-Contact development resulting from the need to connect the historic Māmalahoa Trail (which was thought to have been constructed at some time between 1836 and 1855) with the traditional shoreline trail and the coastal settlement of Makāʻeo (situated in the area now covered by the Old Kona Airport). Given that the Māmalahoa Trail is known to have been constructed during the early post-Contact period, it is possible that the SIHP 50-10-27-30287 connector trail is post-Contact in age and that it served as a route of travel for individuals leaving the Māmalahoa Trail for the coastal settlements of Makāʻeo and Pawai.

ADDITIONAL DOCUMENTATION

In January 2022, an additional feature was identified near the western end of the SIHP 50-10-27-30287 trail. A petroglyph known as a *piko poho* (cupule) consisting of a circular depression with four concentric circles around it, was identified approximately 1.5 m from the southern edge of the trail. The petroglyph measures 30 cm long by 30 cm wide and is 2 cm deep (Figure 14, Figure 15, Figure 16).

According to Cox and Stasack:

> dots and circles are found almost exclusively on the island of Hawaii and are widely distributed there. This fact and their obvious age at Puuloa suggest that these simple symbols are probably as old as the basic lineal human figure. (Cox and Stasack 1970:56)

Beckwith recorded the following in 1914 regarding the function of the petroglyph field at Puʻuloa, located in the Puna District of Hawaiʻi Island:

> Here is a large *pahoehoe* mound used as a depository for the umbilical cord (*piko*), at the birth of a child. A hole is made in the hard crust, the cord is put in and a stone is placed over it. In the morning the cord has disappeared—there is no trace of it. This insures long life for the child. (Beckwith n.d. as cited in Cox and Stasack 1970:56)

Beckwith's guide suggested that a dot or hole surrounded by concentric circles served as a mark for a first-born child, leading her to identify a dot with two concentric circles as "the first-born of an *aliʻi*" at Puʻuloa (Cox and Stasack 1970:68). At Puʻuloa, the petroglyphs were carved surrounding a *pāhoehoe* trail that is similar in form to the SIHP 50-10-27-30287 trail.

In 1924, Ellis opined that concentric circles may have been related to travel, denoting movement around the island: "when there were a number of concentric circles with a dot or mark in the centre, the dot signified a man, and the number of rings denoted the number in the party who had circumambulated the island" (Ellis 1917:346 as cited in Cox and Stasack 1970:31). This interpretation was later discounted by Lee and Stasack (1999:86) due to inconsistencies (whether the concentric circles represented people or journeys).

Lee and Stasack (1999) noted the following regarding circular petroglyphs:

> The circle was a constant theme which we believe was carved throughout all periods. There are thousands of variations of this universal symbol on Hawai‘i Island. They may refer to a concept of completion, a journey, or encompassing by forming a ring around otherwise separate units. Whatever their significance, they appear to have been of considerable importance. (Lee and Stasack 1999:61–62)

The petroglyph at SIHP 30287 is type “7402 cup with more than one ring” according to Lee and Stasack’s typology (1999:179). They inventoried 25 petroglyphs of this type at ‘Anaeho‘omalu and 42 at Pu‘uloa. Interestingly, the concentrations of petroglyphs at both ‘Anaeho‘omalu and Pu‘uloa surround trails and are dominated by circular forms and *poho*. The similar context of the petroglyph alongside the SIHP 50-10-27-30287 trail is noteworthy.

Additional documentation of the SIHP 30287 trail and petroglyph using GPS was completed in January–March 2022. Ala Kahakai National Historic Trail, NPS staff members completed GPS documentation of the trail on January 27, 2022. LiDAR scanning and photogrammetry were carried out by Ala Kahakai National Historic Trail, NPS staff members on March 3 and March 18, 2022.

Following additional consultation carried out for this preservation plan (see Section 5), the significance assessment for the SIHP 50-10-27-30287 trail and associated petroglyph has been updated to include Criterion e as well as Criterion d, and both features are recommended for preservation.

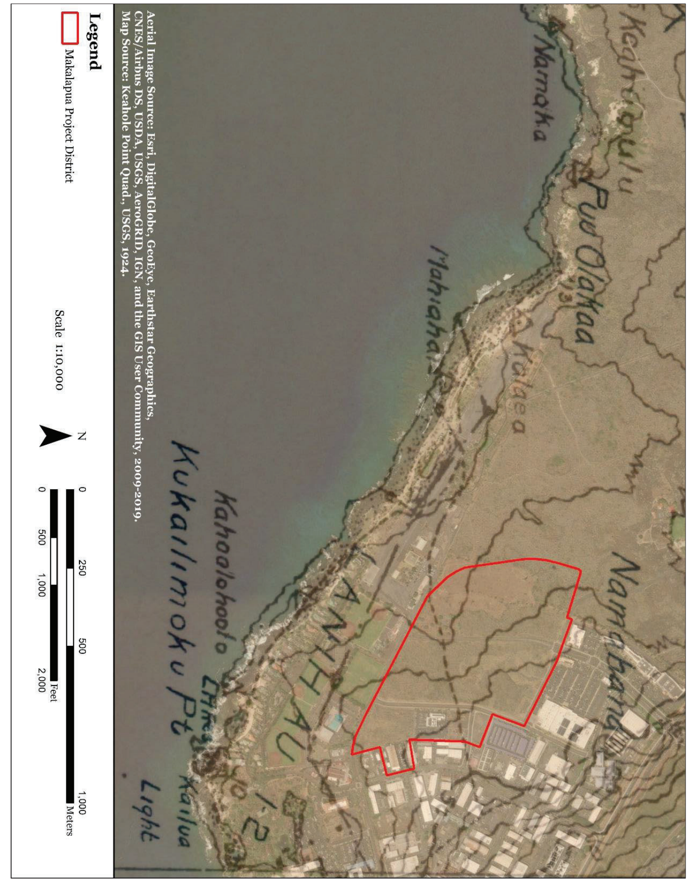

Figure 13. Portion of the 1924 U.S. Geological Survey map, Keahole Point Quadrangle overlaid on an aerial image (United States Geological Survey 1924).

Figure 15. Newly identified petroglyph adjacent to SIHP 50-10-27-30287 trail (person standing on trail) (view to northeast).

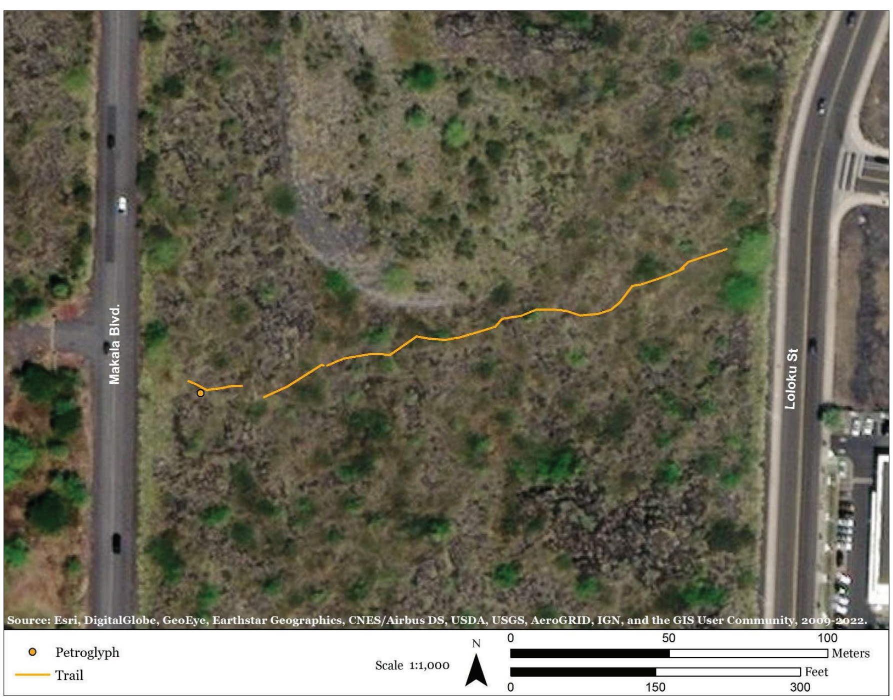

Figure 14. Visible remnants of the SIHP 50-10-27-30287 trail and associated petroglyph (Esri World Imagery 2021).

Figure 16. Petroglyph at SIHP 50-10-27-30287 (plan view).

Figure 17. Abrasions marking the course of the SIHP 50-10-27-30287 trail (view to southwest).

Figure 18. SIHP 50-10-27-30287, trail bed and battering marks (view to southwest).

4.0 PROPOSED DEVELOPMENT

The *mauka* (inland) portion of the 100-acre Kona Commons property has been extensively developed for commercial use. This development consists of retail and warehouse structures with their associated parking areas (see Figure 2). Liliʻuokalani Trust is presently planning to develop the remaining undeveloped portion of the Kona Commons property, along with the easternmost portion of the Urban Phase III parcel, as well as two parcels that are currently occupied by warehouses on the eastern side of the Kona Commons property. This development project is referred to as the Makalapua Project District.

4.1 PROJECT LOCATION

The proposed Makalapua Project District is located northwest of Kailua Village and *makai* (southwest) of the existing Kona Commons Shopping Center. It includes Tax Map Key (TMK) parcels (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021.

The project site is bordered to the northeast by the existing Kona Commons Shopping Center, to the northwest by vacant lands, to the east by the existing Kona Industrial Subdivision (KIS), and to the southwest by the County's Kailua Park (also known as Old Airport Park). The project site is currently vacant and undeveloped with the exception of 1) a former recreational sports facility (the Swing Zone) located on Makala Boulevard, 2) a BMW car dealership on Loloku Street, 3) temporary storage and staging areas on Loloku Street, and 4) light industrial warehouses on Kaiwi Street.

4.2 PROJECT DESCRIPTION

The Makalapua Project District is envisioned to include residential, hotel, retail, commercial, office, and civic/community uses. The proposed project will be organized around an interconnected, pedestrian-oriented street network where homes, businesses, and entertainment are intermingled to provide a diverse experience for residents and visitors.

The proposed Makalapua Project District responds to the need for housing and economic growth opportunities for the County of Hawaiʻi's growing population. The project will provide varied housing and commercial opportunities adjacent to the existing Kailua-Kona town in an area identified by the Kona Community Development Plan as a Regional Commercial Center ("Makaeo Village").

The modified sinks at SIHP 50-10-27-13260 and the SIHP 50-10-27-13261 enclosure are situated in areas designated for open space. The SIHP 50-10-27-30287 trail preservation area will maintain its natural *pāhoehoe* surface, which will distinguish it from the surrounding area. In planning the Makalapua Project District, Liliʻuokalani Trust has taken into consideration the long-term preservation of these three sites.

5.0 CONSULTATION

HAR §13-277:3(4) states that as part of the preparation of a preservation plan, the organization involved:

> shall consult with ethnic organizations and individuals for whom the historic properties are of significance. The comments on preservation treatment expressed by these individuals or organizations shall be considered when preparing the preservation plan. The plan shall include a list of individuals and organizations consulted, and shall summarize their input.

In the preparation of this Preservation Plan, Liliʻuokalani Trust has consulted with the Office of Hawaiian Affairs (OHA), Nā Ala Hele Trails and Access Program, Ala Kahakai National Historic Trail, NPS, the State Historic Preservation Division (SHPD), and recognized cultural descendants of the *ahupuaʻa* of Keahuolū, including Ms. Nicole Lui and her parents, Mr. Raymond "Joe" K. Lui and Ms. Agnes Pelekane Kaelemakule Lui. The recommended treatments presented in this preservation plan were developed through discussions with each of these individuals and groups and are based upon the *manaʻo* (thoughts and ideas) of the consulted parties.

5.1 CONSULTATION SUMMARY

The preservation plan was developed in consultation with recognized cultural descendants of the *ahupuaʻa* of Keahuolū. Specific components of the plan were discussed during site visits with Nicole Lui on the following dates:

- December 6, 2019
- January 24, 2020
- January 19, 2022
- March 16, 2022

Video conference calls were held on the following dates:

- August 14, 2020
- November 5, 2021
- February 18, 2022
- April 1, 2022
- May 11, 2022

At the request of SHPD, additional consultation was carried out with Nā Ala Hele Trails and Access Program and Ala Kahakai National Historic Trail, NPS regarding the preservation of the SIHP 50-10-27-30287 trail. Video conference calls were held with Jackson Bauer (Nā Ala Hele Trails and Access Program) and Rick Gmirkin (Ala Kahakai National Historic Trail, NPS) on the following dates:

- August 2, 2021
- September 2, 2021
- April 14, 2022

Site visits were held on the following dates:

- September 14, 2021
- January 19, 2022

- March 3, 2022
- March 18, 2022

A preliminary draft of the preservation plan was presented to Kamakana Ferreira and Lauren Morawski of the Compliance Division at OHA on February 5, 2020. A complete draft of the plan was subsequently sent to them for review on November 17, 2020. The current draft plan was sent to Mr. Ferreira and Ms. Morawski for review upon submittal to SHPD for review.

The components of the preservation plan were discussed during numerous meetings and site visits. Most of the feedback that was received during the development of this preservation plan related to the SIHP 50-10-27-30287 trail. The accepted SAIS report (McIntosh et al. 2015) had recommended partial preservation of one of the best-preserved sections of the trail. Upon further review, SHPD requested that additional consultation be undertaken with cultural descendants as well as Nā Ala Hele Trails and Access Program and Ala Kahakai National Historic Trail, NPS to gather additional feedback regarding significance assessments and mitigation recommendations, including proposed preservation measures (see Appendix B). A summary of feedback received during the various meetings and site visits is included below.

December 6, 2019 site visit with Nicole Lui (cultural descendant):

- Suggestion to extend the buffer at SIHP 50-10-27-13260 and SIHP 50-10-27-13261 to include the surrounding topography.
- Discussion about whether to include enclosing walls for safety and interpretive signage around preservation areas.
- Discussion about whether the trail should be walkable
- Identification of best sections of trail to be preserved.
- Suggestion to clear vegetation around SIHP 13260 and 30287 and return to GPS proposed buffers

January 24, 2020 site visit with Nicole Lui (cultural descendant):

- GPS documentation of buffer around SIHP 13260
- GPS documentation of best sections of trail to be preserved

February 5, 2020 meeting with Lauren Morawski and Kamakana Ferreira (OHA):

- Agreement with proposed interim protective measures and long-term preservation measures.

August 14, 2020 meeting with Nicole Lui (cultural descendant):

- Agreement with significance assessments and mitigation recommendations for all identified sites in the Makalapua Project District as assessed in the 2015 SAIS for Kona Commons and the 2019 AIS for the Urban Phase III project area.
- Agreement with previously discussed components of the preservation plan (buffer distances, interpretive signage, and surrounding walls.

August 2, 2021 meeting with Jackson Bauer (Nā Ala Hele Trails and Access Program) and Rick Gmirkin (Ala Kahakai National Historic Trail, NPS):

- Other examples of “blended landscape” approach with trails cited.
- Suggestion of establishing MOAs for trail maintenance (LT, NAH, AK, SHPD).

- Ownership question—Jackson offered to follow up on Moana Rowland’s (Nā Ala Hele) determination that was made while the Kona Commons SAIS was in progress.
- Clarification received from Rick about initial identification and consultation process.
- Recommendation to look at NPS and Kalanamanu Trail signage for interpretive content.
- Suggestion to look at NAH guidelines for breach sections, resurfacing if needed.
- Recommendation to preserve entire trail segment, apply a buffer distance of 30 ft. on either side of the trail., and assess the trail as significant under Criterion e

September 2, 2021 meeting with Jackson Bauer (Nā Ala Hele Trails and Access Program) and Rick Gmirkin (Ala Kahakai National Historic Trail, NPS):

- Re. buffer size, possible range for discussion, comes down to SHPD. Cultural descendants’ opinion carries the most weight.
- Followed up on abstract; State not definitive on ownership. Possibility of MOA.
- Site visit scheduled for Sept. 14.

September 14, 2021 site visit with Jackson Bauer and Moana Rowland (Nā Ala Hele Trails and Access Program) and Rick Gmirkin and Tanya Lizama (Ala Kahakai National Historic Trail, NPS):

- Hokulia trail noted as example where archaeologists were able to directly date trail.
- Connection to Mamalahoa Trail suggests trail is pre-1892.
- Previously disturbed (bulldozed) areas could provide flexibility for breaches, blending into development.
- Adaptive use of trail encouraged.
- Suggestion to clear trail for documentation.
- Ideas discussed with cultural descendants shared (10 ft. buffer on either side, low wall, interpretive signage, ADA-accessible sidewalk).
- Feedback that 10 ft. seemed too narrow for a buffer.
- Feedback that preference would be weaving in and out, with ADA-accessible areas where impacted or not apparent and continued use elsewhere.

November 5, 2021 meeting with Nicole Lui (cultural descendant):

- Follow-up on discussion during Sept. 14, 2021 site visit.

January 19, 2022 site visit with Jackson Bauer (Nā Ala Hele Trails and Access Program); Rick Gmirkin, Tanya Lizama, Fred Baldenweck (Ala Kahakai National Historic Trail, NPS); and Nicole Lui (cultural descendant):

- Piko poho petroglyph—incorporate into preserve, justification for wider buffer.
- Methods of documentation, possibility to add virtual component with LiDAR scanning and photogrammetry.
- Suggestion to identify areas of restoration, breaches, and “no touch zones” in Preservation Plan.
- Discussion about how to make trail more accessible. Meandering sidewalk, leveling of low areas if needed, rehabilitation of impacted areas following NAH’s guidelines, encouraging continued use.
- Additional areas for clearing identified and flagged.

January 27, 2022 site visit with Rick Gmirkin, Tanya Lizama, Fred Baldenweck (Ala Kahakai National Historic Trail, NPS)

- GPS documentation of the trail.

February 18, 2022 meeting with Nicole Lui (cultural descendant):

- Suggestion to rehabilitate lower sections of the trail for safety.
- Suggestion to allow breaches in less obvious sections of the trail, including the bulldozer push area.

March 16, 2022 site visit with Nicole Lui (cultural descendant):

- Identification of priority areas for preservation, possible breach areas.
- Recommendation of 10 to 15 ft. (3 to 4.5 m) buffers extending from outer edges of trail.

March 18, 2022 site visit with Rick Gmirkin, Tanya Lizama, Fred Baldenweck (Ala Kahakai National Historic Trail, NPS):

- Documentation of trail using LiDAR and photogrammetry.

April 1, 2022 meeting with Nicole Lui (cultural descendant):

- Discussion regarding limits of grading and buffers, agreement that a minimum buffer of 10 ft. (3 m) is sufficient when taken into consideration with the grading change and setback for any buildings in adjacent area.

April 14, 2022 meeting with Jackson Bauer (Nā Ala Hele Trails and Access Program) and Rick Gmirkin (Ala Kahakai National Historic Trail, NPS):

- Agreement regarding possible breach zones and priority areas for preservation.
- Recommendation of 30 ft. (10 m) buffer extending from outer edges of trail.
- Discussion regarding ownership of trail and future areas for development where trail is no longer visible.

May 11, 2022 meeting with Nicole Lui (cultural descendant):

- Finalization of language for interpretive signage.

July 1, 2022 site visit with Nicole Lui (cultural descendant):

- Discussion regarding options for potential breach in central portion of trail segment.

July 27, 2022 meeting with Jackson Bauer (Nā Ala Hele Trails and Access Program),Rick Gmirkin (Ala Kahakai National Historic Trail, NPS), and Nicole Lui (cultural descendant):

- Discussion about options for potential breach in central portion of trail segment to accommodate a pedestrian walkway.
- Agreement regarding specific location of potential breach in the central portion of trail segment.

6.0 PRESERVATION RECOMMENDATIONS

The following section outlines the specific treatment recommendations made to ensure the preservation and interpretation of SIHP 50-10-27-13260, 50-10-27-13261, and 50-10-27-30287 (Figure 19). The physical integrity of the sites within this plan shall not be compromised.

Overall Short-Term Protective Measures
Prior to any ground-disturbing activities, a qualified archaeologist will physically show the buffers of each preservation site to the construction crew and explain that no heavy machinery will be permitted within the orange construction fencing, the only exception being for the allotted SIHP 30287 trail breach locations.

Written and photographic verification of interim protection measures for each of the sites will be provided to SHPD via HICRIS and email and approved by SHPD prior to the initiation of ground-disturbing activities.

Overall Long-Term Protective Measures
A licensed land surveyor is required to establish the metes and bounds description for SIHP 13260, 13261, and 30287. The restrictions and requirements of the current preservation plan, including a map of the preservation areas, and the metes and bounds description of the permanent preservation buffers, shall be incorporated into the property deed as a restrictive covenant and will be recorded with the Bureau of Conveyances with a copy submitted to SHPD via HICRIS and email.

Non-Compliance
The landowner is responsible for ensuring these protection and avoidance measures are implemented.

As specified in HAR §13-277-8, non-compliance with the provisions and procedures established by this chapter may result in a directive to the person not to proceed with construction in the project area, a denial or revocation of SHPD's written concurrence or agreement, and penalties as provided in section §6E-11, HAR, and applicable laws.

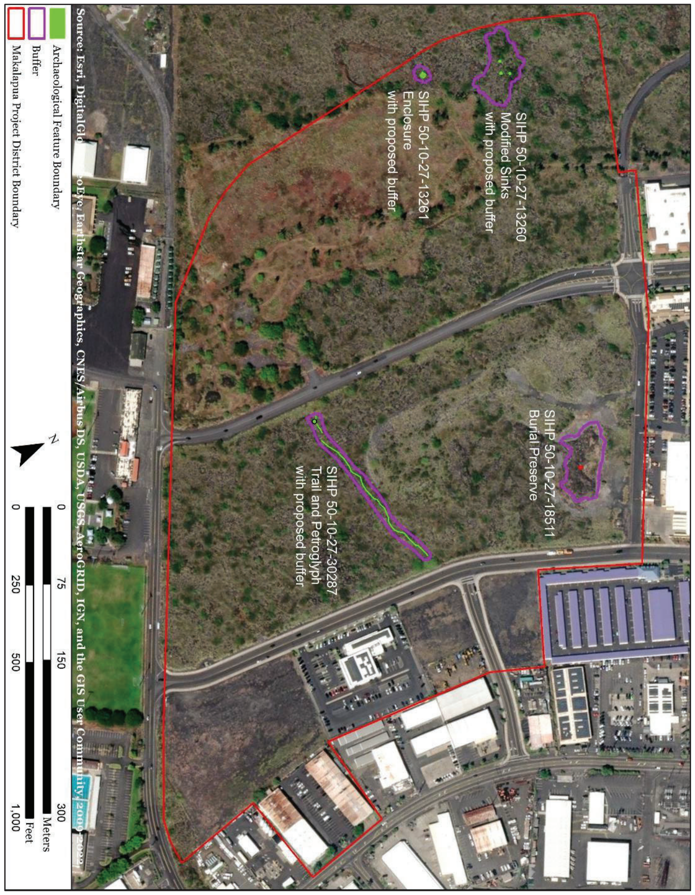

Figure 19. Location of burial preserve for SIHP 50-10-27-18511, Feature C and proposed preserves for SIHP 50-10-27-13260, 13261, and 30287 on an aerial image (base map: Esri World Imagery 2021).

6.1 Preservation Plan for SIHP 50-10-27-30287 Trail and Petroglyph

At the time of the 2014 survey, the status of the SIHP 50-10-27-30287 trail was taken under consideration by Nā Ala Hele, the Hawaii State Trail and Access System. It determined that since the trail was not found on any maps prior to 1892, Nā Ala Hele would defer to SHPD's recommendations regarding the trail. SHPD felt that a section of the trail should be preserved. For this reason, the 2015 SAIS report recommended the site for partial preservation and interpretation:

> The Site 50-10-27-30287 trail has been recommended for partial preservation and interpretation. It is proposed that one of the more visibly distinct segments of the trail be preserved with interpretive signage. This interpretive material would include a map showing the original course of the trail, as well as a written text describing the trail, indicating its relationship with the historic Māmalahoa Trail and the traditional shoreline trail, and explaining its importance to the residents of the nearby coastal settlements. Two potential preservation areas have been identified. The best preserved section of the trail is approximately six meters in length and located at its furthest western end. At this end, the trail is traceable for approximately 15 meters before it is cut by a line of bulldozer push. It is suggested that this entire 15 meter section be designated for preservation. The second most visible segment is closer to the center of the surviving trail segment. Here there are roughly 12 meters of clearly discernible trail, which could serve as an alternate preservation segment. It is recommended that one of these trail segments be selected for preservation and that interpretive signage be mounted adjacent to it. (McIntosh et al. 2015:180)

Following additional consultation with Nā Ala Hele, Ala Kahakai, and cultural descendant Nicole Lui and her family, as well as the identification of a petroglyph near the eastern end of the trail, the recommendation was updated to include the entire length of the trail that was documented in January–March 2022 with agreed-upon sections where the trail is not as discernible that may possibly be breached (Figure 20). Sections that may be breached include a 25-m section in the western portion of the trail, a 7-m section in the center, and a 15-m section at the eastern end of the trail.

6.1.1 Buffer Zone

The buffer zone for the preserved trail will extend at least 10 ft. (3 m) from the outer extent of either side of the trail in order to provide an overall preserved area with a minimum width of 6.5 m (Figure 20). The buffer will serve as the limit of grading and there will be an additional setback beyond the buffer due to anticipated grading, plus additional setbacks for any buildings that are constructed in adjacent areas. No construction activities or heavy machinery will be permitted within the 3-m buffer for SIHP 30287. Interpretive signage will be installed near the eastern and western ends of the trail. The minimum buffer of 10 feet from the outer edges of the trail was established in consultation with Nicole Lui and her *ʻohana* (Keahuolū Cultural Descendants). It should be noted that Rick Gmirkin (Ala Kahakai National Historic Trail, NPS) and Jackson Bauer (Nā Ala Hele Trail and Access) do not agree with this buffer distance and requested that the buffer distance be set at a minimum of 30 feet from either side of the outer edges of the trail.

6.1.2 Short-Term Protective Measures

Protective Fencing

Prior to any ground-disturbing activities associated with construction in the area surrounding the SIHP 50-10-27-30287 trail and petroglyph to be preserved, bright orange plastic fencing will be erected around the outer perimeter of the designated buffer zone. This fencing will serve as a highly visible temporary barrier to alert heavy equipment operators and other construction personnel to the presence of the trail segment.

Construction Plans
The location of the SIHP 30287 trail segment to be preserved and its designated buffer zone will be accurately plotted on all grading and construction plans utilized by construction personnel prior to the start of any land-altering activities associated with the development of the Makalapua Project District.

Archaeological Monitoring
A qualified archaeological monitor will be on site during all ground-disturbing activities conducted in the vicinity of the SIHP 30287 trail. Prior to the undertaking of any construction activities in the vicinity of the trail, all construction crew members and equipment operators involved in the construction will be given an archaeological awareness briefing. This briefing will introduce construction personnel to the general history of the area as well as to the location and importance of the SIHP 30287 trail. Construction crews will also be instructed as to the proper procedures to follow in order to avoid adversely impacting the site.

6.1.3 Long-Term Protective Measures

Vegetation Removal and Litter Control
Existing invasive vegetation will be cleared by hand from within the designated buffer area surrounding the trail segment. At present this non-native vegetation includes fountain grass, klu, and Christmas berry shrubs. No vegetation will be planted within the preserve. Vegetation maintenance and litter control will be carried out by the landowner on a quarterly basis.

Access
Pedestrian access to the trail will be open to the public and pedestrian use of the trail will be encouraged. Vehicles, bicycles, skateboards, scooters, and strollers will be prohibited and signs will be posted at each entry point.

Interpretive Signage
The SIHP 50-10-27-30287 trail is not an easily recognizable cultural site. For this reason, it is important to have interpretive signage mounted adjacent to the trail to explain its importance. Metal signs may be erected at the eastern and western ends of the preserve containing the trail, as well as along access points where the trail may potentially be breached (see Figure 20). The signs may include a map of the original trail route showing its relationship to the Māmalahoa Trail and the coastal trail. A text accompanying the map will explain its significance. This text will read as follows:

Historic Trail

> The faint abrasions on the surface of the pāhoehoe lava in front of you mark the course of a mauka-makai historic trail that once connected the Māmalahoa Trail with an ancient coastal trail that connected communities along the Kona coast. The Māmalahoa Trail was built for horse and wagon traffic during the early 19th century. This connecting trail linked the Māmalahoa Trail to the coastal settlements of Makāʻeo and Pāwai, and on to Halepaʻo.

> This is a significant Native Hawaiian cultural site. Please respect this site and do not alter or damage the area in any way. Violations are punishable by law under HRS Chapter 6E-11.

Potential Breaches
Three small sections of the trail have been identified as potential breach areas. The trail may need to be breached to increase connectivity and facilitate movement within the proposed development. This includes a proposed footpath near the center of the trail segment as well as areas along the eastern and western portions of the trail segment where existing roads may be realigned. Treatment of these sections will be determined in consultation with cultural descendants, Nā Ala Hele Trails and Access Program, and Ala Kahakai National Historic Trail, NPS.

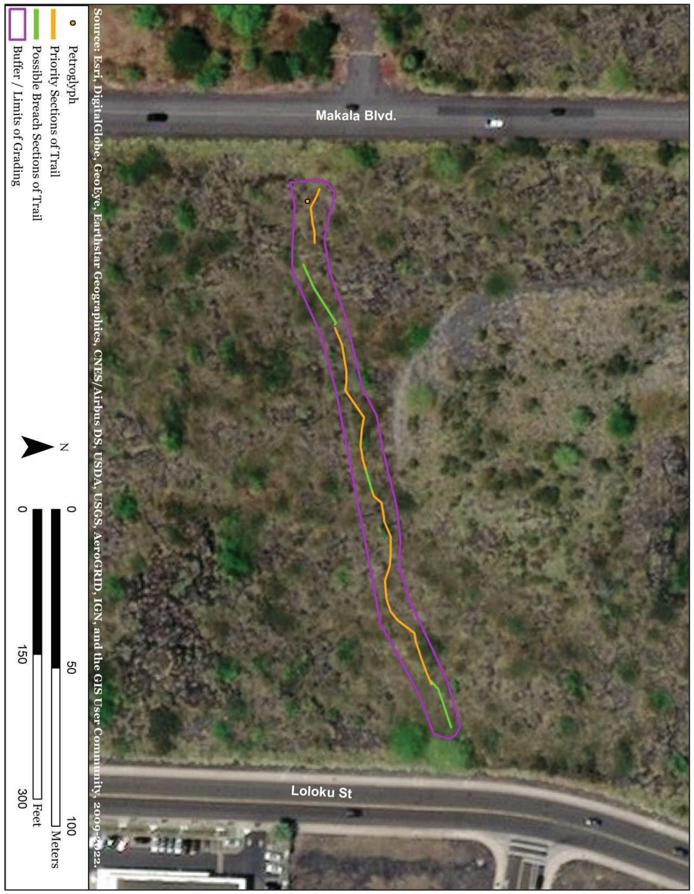

Figure 20. Close-up of preservation area for SIHP 50-10-27-30287 trail segment showing buffer (proposed limits of grading) (base map: Esri World Imagery 2021).

6.2 Preservation Plan for SIHP 50-10-27-13260 Modified Sinks

The SIHP 50-10-27-13260 modified sinks were described as “the best examples of the unusual water catchment features” and were recommended for preservation as “a relatively well-preserved example of an unusual site type [that] reveals the ingenuity of the area’s local residents in obtaining drinking water in an extremely arid environment” (Reeve et al. 2019:234).

6.2.1 Buffer Zone

The buffer zone for the modified sinks will extend to the edges of the natural *puʻu*, or uplifted *pāhoehoe* on which the modified sinks are situated. The minimum distance between a preserved feature and the outer edge of the buffer is 8 meters. No construction activities or heavy machinery will be permitted within the 8-m buffer for SIHP 13260. This buffer zone is shown in Figure 21 and is both the short-term and long-term buffer for this site.

6.2.2 Short-Term Protective Measures

Protective Fencing

Prior to any ground-disturbing activities associated with construction in the area surrounding the preserve area, bright orange plastic fencing will be erected around the outer perimeter of the designated buffer zone. This fencing will serve as a highly visible temporary barrier to alert heavy equipment operators and other construction personnel to the presence of the features.

Construction Plans

The location of the SIHP 13260 complex to be preserved and its designated buffer zone will be accurately plotted on all grading and construction plans utilized by construction personnel prior to the start of any land-altering activities associated with the development of the Makalapua Project District.

Archaeological Monitoring

A trained archaeological monitor will be on site during any ground-disturbing activities conducted in the vicinity of the SIHP 13260 modified sinks to be preserved. Prior to the undertaking of any construction activities in the vicinity of the features, all construction crew and equipment operators involved in the construction will be given an archaeological awareness briefing. This briefing will introduce construction personnel to the general history of the area as well as to the location and importance of the modified sinks. Construction crews will also be instructed as to the proper procedures to follow in order to avoid adversely impacting the site.

6.2.3 Long-Term Protective Measures

Vegetation Maintenance and Litter Control

Existing invasive vegetation will be cleared by hand from within the designated buffer area surrounding the modified sinks. At present this non-native vegetation includes fountain grass, klu, and Christmas berry shrubs. Native plants and Polynesian-introduced species may be planted by LT’s natural resource managers within the preserve and in the open area surrounding it. Vegetation maintenance and litter control will be carried out by the landowner on a quarterly basis

Enclosing Wall

A partial enclosing wall will be built along the base of the northern half of the natural rise, where the topography slopes gently, at a minimal distance of 8 m from the preservation features (see Figure 21). No wall will be built around the southern portion of the rise, as the topography is more abrupt in this area. A single entrance will be included for access and its location will be determined based on safety and feasibility.

Access

Access will be managed by the landowner due to safety concerns. Signage will be posted at the entrance to the preserve with information on scheduling access with Liliʻuokalani Trust.

Interpretive Signage

Interpretive signage will be mounted adjacent to entrance to the preserve to explain the importance of the features. A metal sign will be erected adjacent to the entrance.
This sign will include a plan map of the site to help orient visitors. A text accompanying the map will explain its significance. This text will read as follows:

Water Catchment Site

> The Kekaha region of North Kona is one of the most arid regions in Hawaiʻi. Due to the scarcity of surface water, the ancient inhabitants of Keahuolū modified the environment in ingenious ways to access subsurface fresh water and collect rainwater. The three collapsed lava blisters in this preserve were modified to collect water. People added stacked stones to reduce light inside the blisters, reducing evaporation. They put pāhoehoe slabs under roof edges and placed water catchment vessels such as ipu (gourds) on the slabs to collect water from natural seeps and rainfall. Fragments of ipu were found inside these lava blisters, as was a coconut shell cup, which may have been used to transfer water from large ipu to more portable containers.
>
> This is a significant Native Hawaiian cultural site. Please respect this site and do not alter or damage the area in any way. Violations are punishable by law under HRS Chapter 6E-11.

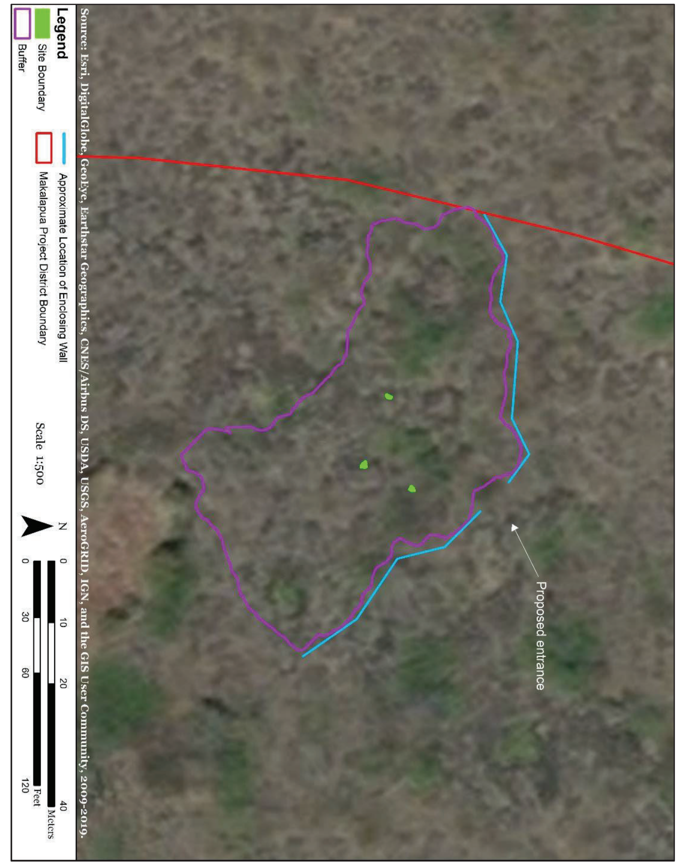

Figure 21. Close-up of preservation area for SIHP 50-10-27-13260 showing buffer, enclosing wall, and proposed entrance location (base map: Esri World Imagery 2021).

6.3 Preservation Plan for SIHP 50-10-27-13261 Enclosure

The SIHP 50-10-27-13261 enclosure was recommended for preservation based on its classification as a ceremonial feature. Various pieces of coral were identified at the site, as were three waterworn boulders which may have originally been placed in an upright position and been image stones (*ki'i pōhaku*).

6.3.1 Buffer Zone

The buffer zone for the enclosure will extend to the edges of the natural *pu'u*, or rise, on which the enclosure is situated. The short- and long-term buffer will be established at a minimum distance of 3 m from the outermost edges of SIHP 13261. No construction activities or heavy machinery will be permitted within the buffer for SIHP 13261. This zone is shown in Figure 22.

6.3.2 Short-Term Protective Measures

Protective Fencing

Prior to any ground-disturbing activities associated with construction in the area surrounding the area to be preserved, bright orange plastic fencing will be erected around the outer perimeter of the designated buffer zone. This fencing will serve as a highly visible temporary barrier to alert heavy equipment operators and other construction personnel to the presence of the features.

Construction Plans

The location of the SIHP 13261 enclosure to be preserved and its designated buffer zone will be accurately plotted on all grading and construction plans utilized by construction personnel prior to the start of any land-altering activities associated with the development of the Makalapua Project District.

Archaeological Monitoring

A trained archaeological monitor will be on site during any ground-disturbing activities conducted in the vicinity of the SIHP 13261 enclosure to be preserved. Prior to the undertaking of any construction activities in the vicinity of the site, all construction crew members and equipment operators involved in the construction will be given an archaeological awareness briefing. This briefing will introduce construction personnel to the general history of the area as well as to the location and importance of the enclosure. Construction crews will also be instructed as to the proper procedures to follow in order to avoid adversely impacting the site.

6.3.3 Long-Term Protective Measures

Vegetation Maintenance and Litter Control

Existing invasive vegetation will be cleared by hand from within the designated buffer area surrounding the enclosure. At present this non-native vegetation includes fountain grass, lantana, and Christmasberry shrubs. No vegetation will be planted within the preserve. Vegetation maintenance and litter control will be carried out by the landowner on a quarterly basis.

Enclosing Wall

An enclosing wall will be built around the edges of the gently sloping natural rise atop which the enclosure was constructed at a minimal distance of 3 m from the outermost edges of SIHP 13261. A single entrance in the enclosing wall will be included for access and its location will be determined based on safety and feasibility (Figure 22).

Access

Access will be managed by the landowner due to safety concerns. Signage will be posted at the entrance to the preserve with information on scheduling access with Lili'uokalani Trust.

Interpretive Signage

Interpretive signage will be mounted adjacent to entrance to the preserve to explain the importance of the site. A metal sign will be erected adjacent to the entrance.

This sign will include a plan map of the site to help orient visitors. A text accompanying the map will explain its significance. This text will read as follows:

Ceremonial Enclosure

> The enclosure in front of you is a ceremonial space where traditional cultural practices were carried out in the past. The pieces of fresh branch coral that are scattered on the floor of the enclosure were probably placed there by people as ho'okupu, or offerings. The waterworn boulders may be kū'ula once erected for abundance of water and other resources. This space may have been used for ceremonial activities linked to the collection of fresh water given its location near freshwater sources that were vital to the communities who lived in the ahupua'a of Keahuolū on the arid plains of Kekaha.
>
> This is a significant Native Hawaiian cultural site. Please respect this site and do not alter or damage the area in any way. Violations are punishable by law under HRS Chapter 6E-11.

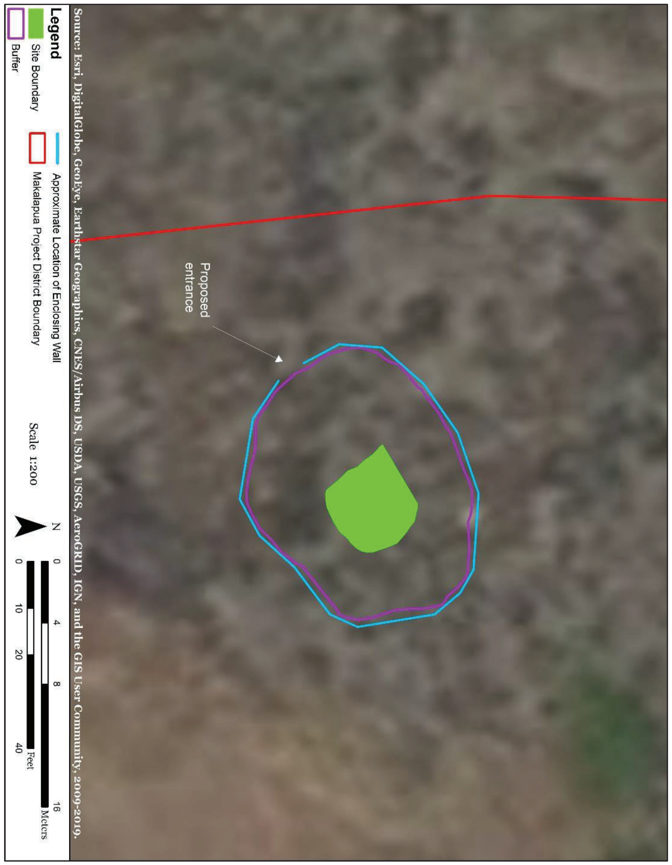

Figure 22. Close-up of preservation area for SIHP 50-10-27-13261 showing buffer, enclosing wall, and proposed entrance location (base map: Esri World Imagery 2021).

7.0 SUMMARY

This preservation plan was prepared to satisfy the requirements of Hawaiʻi Administrative Rules Chapter 13-277 (HAR §13-277, Rules Governing Requirements for Archaeological Site Preservation and Development). The preservation plan describes the plan for preserving SIHP 50-10-27-13260, 50-10-27-13261, and 50-10-27-30287. It identifies the type of preservation intended, which will be preservation with interpretation, and addresses in detail both the interim protective measures to be employed to protect these sites during construction activities and the long-term protective measures to be put in place to preserve them. It also addresses the placement and wording of the interpretive signage mounted adjacent to each preservation area. The preservation plan must be approved by the SHPD prior to the start of ground-disturbing activities associated with the development of the Makalapua Project District.

8.0 REFERENCES

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1836–55 The Land Commission Awards are individual *kuleana* claims awarded during the Māhele 'Āina. They are preserved in the Hawai'i State Archives, where they are accessible on microfilm, and can also be found online at http://www.avakonohiki.org/hawaii-land-documents.html or http://www.papakilodatabase.com.

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1993 *Archaeological Inventory Survey Queen Lili'uokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawai'i (TMK: 3-7-4-008:Por.2)*. Paul H. Rosendahl, Ph.D., Inc.

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APPENDIX A

KONA COMMONS SAIS REPORT AND URBAN PHASE III AIS SHPD ACCEPTANCE LETTERS

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
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ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
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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
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555

August 11, 2015

Dr. Paul L. Cleghorn, Senior Archaeologist
Pacific Basin Division, Pacific Legacy, Inc.
30 Aulike Street, Suite 301
Kailua, Hawaii 96734

LOG NO: 2015.02142
DOC NO: 1508MV17
Archaeology

Subject: **HRS Chapter 6E-42 Historic Preservation Review -**
Supplemental Archaeological Inventory Survey of the 110 Acre
Queen Liliuokalani Trust Kona Commons Parcel
Keahuolu Ahupua'a, North Nona District, Island of Hawai'i
TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022

Thank you for the opportunity to review the revised draft report titled: *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolu, North Kona, Island of Hawai'i TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022* (J. McIntosh, T. Lizama, R. Reeve, J. Cleghorn and P. Cleghorn May 2015). This document was received by our office on June 1, 2015. This survey was undertaken in order to supplement the previous archaeological survey undertaken Rosendahl (1992). The survey utilized a 100% pedestrian survey with transects spaced at 10-15 meters. In addition, excavation in the form of test borings was conducted in five locations. The archaeological survey documented a total of 11 archaeological sites comprised of 20 component features in the project area. Four of these historic properties a modified depression (SIHP 50-10-27-18502), a modified overhang (SIHP 18508), a complex (SIHP 18509), and a complex that contains a burial feature (SIHP 18511) were previously recorded during the Rosendahl (1992) archaeological survey. However, it is important to note that previously unrecorded features of SIHP 18509 (feature D) and 18511 (features D and E) were newly identified during the current supplemental inventory survey. In addition to these features, the supplemental AIS identified and recorded 6 previously unrecorded historic properties. The newly recorded historic properties include: a lava excavation (SIHP 30207), a stone mound (*SIHP 30208*), an enclosure (SIHP 30209), a complex (SIHP 30210), a petroglyph (SIHP 30211), a C-shaped alignment (SIHP 30212) and a trail (SIHP 30287). With the exception of the burial feature (SIHP 18511fea. C) that is assessed as significant under criteria D and E, all of these sites have been assessed as significant under criteria D only. The report indicates that SIHP 18511fea. C and SIHP 30287 have been recommended for preservation, SIHP 30210 fea. B has been recommended for Data Recovery and the remaining sites are recommended for no further work. SHPD agrees with the significance assessments and treatment recommendations presented in this report. We believe that the entire trail (SIHP 30287) should be preserved until it can be confirmed with Na Ala Hele whether or not this trail is eligible for inclusion as a state trail. However it is possible that the trail may be breached in accordance with an approved preservation plan. The changes that were made to the report are the result of the SHPD review of a previous draft (Log No. 2015.04866, Doc No. 1503MV20). The report has been revised in response to the SHPD review of a previous draft of this report (Log 2012.3111, Doc. 1210MV40). The revisions and explanations have adequately addressed our concerns. This report meets the requirements of Hawaii Administrative Rule (HAR) §13-276 and is accepted. Please send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office. Please contact Mike Vitousek at (808) 692-8029 or Michael.Vitousek@hawaii.gov for any questions or concerns relating to this letter.

Aloha,

Mike Vitousek

Michael Vitousek,
Lead Archaeologist Hawaii Island Section
Historic Preservation Division

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

September 9, 2019

IN REPLY REFER TO:
Log No.: 2019.01679
Doc. No.: 1909AM05
Archaeology

Michael Shibata, Development Manager
Lili'uokalani Trust
1100 Alakea Street Suite 1100
Honolulu HI 96813
Email: mshibata@onipaa.org

Dear Mr. Shibata:

SUBJECT: **Hawaii Revised Statutes (HRS) Chapter 6E-42 Historic Preservation Review – Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands Keahuolū Ahupua'a North Kona District Island of Hawai'i TMK: (3) 7-4-008:002 por.**

This letter provides the State Historic Preservation Division's (SHPD's) review comments concerning the report titled *Revised Draft Archaeological Inventory Survey of Urban Phase III Parcel Queen Lili'uokalani Trust Lands in Keahuolū, North Kona Island of Hawai'i [TMK: (3) 7-4-008:002 por.]* (Reeve et al., July 2019). The SHPD received this revised draft on July 31, 2019. Previously, the SHPD requested revision of the initial draft in a letter dated August 16, 2018 (Log No. 2016.00071, Doc. No. 1808SL04).

Pacific Legacy, Inc., conducted the archaeological inventory survey (AIS) in support of the of the Lili'uokalani Trust (LT) Urban Phase III project, for which a master plan is being prepared for future residential, commercial, and civic/community areas, and open space. The Urban Phase III project area, totaling 213 acres, is owned by LT, a non-profit organization dedicated to the welfare of Hawai'i's children. The Urban Phase III project will involve grubbing, grading, and trench excavation for building construction and installation of utilities.

The letter that accompanies this revised draft AIS report also mentions a separate project, the Makalapua Project District (MPD) project, whose project area totals approximately 67.2 acres and includes multiple TMK parcels. An *Environmental Impact Statement* is being prepared for the MPD, which will create residential, hotel, retail, commercial, office, and civic/community areas.

The 213-acre Urban Phase III project area is bounded on the southwest by the old Kona Airport, now a State Recreation Area; on the northwest by a 628-acre conservation parcel belonging to LT; on the northeast by Queen Ka'ahumanu Highway; and on the southeast by the Kona Commons Shopping Center and undeveloped land along Makala Boulevard. The project area begins a short distance north of the north edge of the Kailua-Kona town core.

Previous correspondence concerning earlier, related projects, cited and summarized in the current AIS report (page 100) includes the following, concerning the Keahuolū project, as proposed at the time of Paul H. Rosendahl, Ph.D., Inc.'s AIS (PHRI 1994) and AMP (PHRI 1993):

- March 5, 1993 – SHPD to PHRI (Log No. 6851, Doc. No. 9303RC03), limiting data recovery to two sample blocks plus a few sites outside the project area;
- June 10, 1993 – PHRI to SHPD (not available);

- July 28, 1993 – DLNR to Belt, Collins & Associates (Log No. 8976, Doc. No. 9307RC40), stating that June 10, 2993, addendum to mitigation plan was not received; and
- December 21, 1993 – DLNR to PHRI (Log No. 10383, Doc No. 9312RC30), accepting sampling strategy for mitigation phase.

More recent correspondence in SHPD's files concerns archaeological studies conducted in support of shoreline-improvement removal in the LT Keahuolū campgrounds. The following letters were sent to Pacific Legacy:

- March 15, 2012 – SHPD's review letter (Log No. 2010.2686, Doc. No. 1203TD09) accepting campgrounds AIS report, and agreeing with recommendations for preservation of 87 sites, and data recovery for 235 sites;
- April 2, 2014 – SHPD's review letter (Log No 2014.0913, Doc. No. 1404MV01), accepting an archaeological monitoring plan for the campgrounds project; and
- June 3, 2015 – SHPD's review letter (Log No. 2015.01602, Doc. No. 1506MV14), accepting archaeological monitoring report for campgrounds project.

One additional letter, also to Pacific Legacy, concerns an AIS of the 25-acre LT Historic Preserve Area, adjacent to the current project area:

- March 23, 2012 – SHPD's review letter (Log No. 2012.0682, Doc. No. 1203MV33), accepting an AIS report that documents 96 archaeological sites containing 489 features. Twenty-three of the sites had been recorded earlier; 73 are newly identified. Significance is recommended for the entire preserve under Criteria a, c, d, and e; listing on the National Register of Historic Places (NRHP) is also recommended.

The current AIS identified 121 sites, 36 previously recorded and 85 newly identified. These consist of State Inventory of Historic Places [SIHP] Sites 50-10-27-13256 through 13258, 13260 through 13262, 13269, 13271, 13272, 13274, 13275, 13280 through 13282, 18286 through 13288, 13293, 13294, 13298 through 13302, 13351, 13353, 13386, 25655, 25644, 25646 through 25649, and 29088 through 29176. Of these, one site, Site 29175, consists of 540 excavated lava pits.

The 121 historic sites documented during the current AIS survey are assessed for site integrity and for significance according to Hawaii Administrative Rules (HAR) §13-284-6 Criteria a-e. All the sites are considered significant for their information content (Criterion d). Six sites are considered significant for their distinctive characteristics or high artistic value (Criterion c). Twenty-one sites are considered significant for their cultural importance to the Native Hawaiian community (Criterion e). The four sites considered significant under Criterion e include probable small shrines, a lava tube containing human skeletal remains, possible burial mounds, and 17 petroglyph fields.

SHPD agrees with the project effect determination of "Effect, with agreed upon mitigation commitments." The agreed upon mitigations includes no further work for 83 sites (120 features), mitigative archaeological data recovery for 28 sites (40 features), preservation (conservation) for 20 sites (55 features), and burial treatment for Site 50-10-27-18511. Mitigation plans will include a data recovery plan, a preservation plan, and archaeological monitoring plan for the project, and a burial treatment plan.

No Further Work

Sites 50-10-27-13256, 13257, 13258, 13269, 13271, 13272, 13282, 13286, 13288, 13293, 13298, 13300, 13301, 13302, 13351, 25644, 25646, 25647, 25648, 29089, 29093, 29094, 29096, 29097, 29099, 29100, 29101, 29102, 29103, 29104, 29105, 29106, 29107, 29108, 29109, 29110, 29111, 29112, 29113, 29114, 29115, 29116, 29117, 29119, 29120, 29121, 29122, 29123, 29126, 29127, 29128, 29129, 29131, 29132, 29133, 29134, 29136, 29137, 29138, 29139, 29140, 29141, 29143, 29145, 29146, 29147, 29151, 29153, 29154, 29155, 29156, 29157, 29161, 29162, 29163, 29164, 29166, 29169, 29171, 29172, 29173, 29174, and 29176.

Data Recovery

Sites 50-10-27-13258, 13262, 13272, 13274, 13280, 13351, 13386, 25649, 29088, 29095, 29099, 29104, 29118, 29124, 29125, 29130, 29135, 29144, 29146, 29148, 29149, 29150, 29152, 29158, 29165, 29168, 29170, and 29175.

APPENDIX B

ADDITIONAL CORRESPONDENCE WITH SHPD REGARDING SIGNIFICANCE ASSESSMENTS AND MITIGATION RECOMMENDATIONS FOR HISTORIC PROPERTIES IN THE MAKALAPUA PROJECT DISTRICT

Pacific Basin — Oʻahu
30 Aulike Street, Suite 301
Kailua, HI 96734

Phone: 808.263.4800
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www.pacificlegacy.com

September 4, 2020

Dr. Susan Lebo, Archaeology Branch Chief
State Historic Preservation Division
Department of Land and Natural Resources
601 Kamokila Blvd., Suite 555
Kapolei, HI 96707
Via: dlnr.intake.shpd@hawaii.gov

SUBJECT: Significance assessments of archaeological sites located in the Liliʻuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi (TMK: [3] 7-4-008:002 (por.); [3] 7-4-025:001-003, 005, 012, 015; [3] 7-4-010:009, 010)

Dear Dr. Lebo:

At the request of the State Historic Preservation Division (Log No. 2019.00636, Doc. No. 2002SN04; Log No. 2020.000607, Doc. No. 2006SN05) and on behalf of the Liliʻuokalani Trust, Pacific Legacy, Inc. completed additional consultation regarding significance and integrity assessments for sites within the proposed Makalapua Project District in Keahuolū Ahupuaʻa, district of North Kona, Island of Hawaiʻi.

Liliʻuokalani Trust's proposed Makalapua Project District contains 15 archaeological sites that were identified during an archaeological inventory survey (AIS) of the Urban Phase III project area (Reeve et al. 2019) and a supplemental AIS conducted in the Kona Commons project area (O'Hare and Rosendahl 1993; McIntosh et al. 2015) (Figures 1 and 2, attached; also see letters dated February 27, 2020 and June 25, 2020 from Alan Downer, SHPD to Michael Yee, County of Hawaiʻi Planning Department, attached).

In a letter dated February 27, 2020 from Alan Downer, SHPD to Michael Yee, County of Hawaiʻi Planning Department, SHPD requested that:

> "Site integrity and site significance assessments be updated and that this update include consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised."

Following receipt of this request, Pacific Legacy initiated additional consultation on behalf of Liliʻuokalani Trust. On May 8, 2020, Mara Mulrooney sent an email to Office of Hawaiian Affairs (OHA) Compliance Archaeologists Lauren Morawski and Kamakana Ferreira requesting consultation regarding site integrity and significance assessments that were included in the AIS and SAIS reports for the Urban Phase III and Kona Commons project areas. The full reports were shared via an online file-sharing platform. On June 3, 2020, Lauren Morawski replied and requested clarification on various projects and previous consultation efforts. With regards to recent consultation for the nearby Liliʻuokalani Trust Mauka AIS, she stated the following:

> "In general our Comments focused on recommending that QLT consider applying

criteria "e" to additional sites types in addition to burial and heiau. As many Hawaiian historic and cultural sites across the pae aina have been lost to various forms of development over the recent and distant past. Many involved in traditional cultural practices have asserted that all types of cultural and historic sites are important to Native Hawaiians. OHA has been encouraging CRM firms to consider applying criteria "e" to a full range of site types as we feel that all traditional period sites are important to the Native Hawaiian people, as they are a record of per-contact life. In addition, many of our beneficiaries prefer to look at our lands as cultural landscapes with all sites and features being interconnected none less valuable than another."

With regards to the Urban Phase III project in particular, Ms. Morawski stated that:

"OHA would like to recommend the same general broader application of criteria "e" for sites identified for this project."

Following receipt of the recommendation from OHA, additional consultation was undertaken with Keahuolū cultural descendant Nicole Lui. On August 14, 2020 and August 28, 2020, Mana Purdy and Michael Shibata (Lili'uokalani Trust) and Mara Mulrooney (Pacific Legacy) met with Ms. Lui via Zoom. The request from SHPD that additional consultation be undertaken and the recommendation received from OHA that sites be considered significant under criterion "e" were shared with Ms. Lui. Maps, photographs, significance assessments and integrity for each of the 15 identified sites in the Makalapua Project District were reviewed, along with the proposed mitigation recommendations that were included in the accepted SAIS report for the Kona Commons project area (McIntosh et al. 2015) and the accepted AIS report for the Urban Phase III project area (Reeve et al. 2019). For each site, Ms. Lui concluded that she was in agreement with the significance assessments and mitigation recommendations that were included in the 2015 SAIS report and 2019 AIS report. These assessments and recommendations were also detailed in the letter dated March 15, 2019 from Michael Yee, Planning Director, County of Hawai'i Planning Department to Susan Lebo, SHPD and Alan Downer's response to Michael Yee dated February 27, 2020 (attached).

Following additional consultation as outlined above, Lili'uokalani Trust has determined that no changes to the site integrity and significance assessments or mitigation commitments are warranted for any of the 15 identified sites in the Makalapua Project District.

Please do not hesitate to contact me if you have any questions or require additional information.

Sincerely,

Mara Mulrooney, Ph.D.
Senior Project Supervisor

Attachments

cc: Mana Purdy, Lili'uokalani Trust
Michael Shibata, Lili'uokalani Trust
Sean Nāleimaile, SHPD
Lauren Morawski, Office of Hawaiian Affairs
Kamakana Ferreira, Office of Hawaiian Affairs

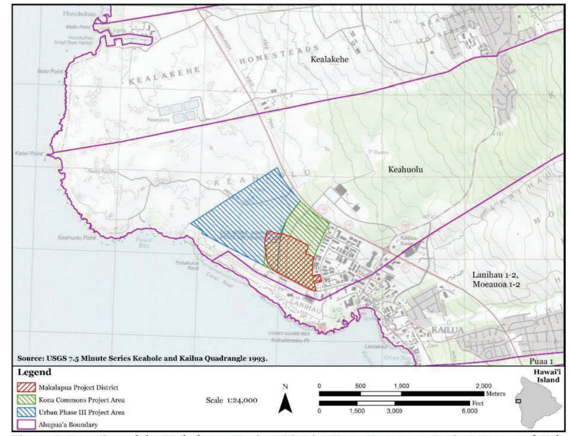

Figure 1. Location of the Makalapua Project District,Kona Commons Project Area, and Urban Phase III Project Area.

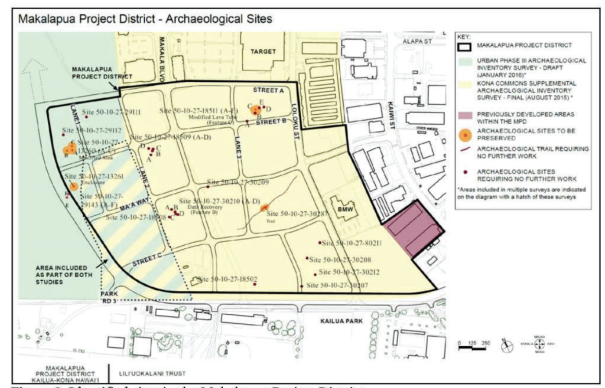

Figure 2. Identified sites in the Makalapua Project District.

DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

March 29, 2021

IN REPLY REFER TO:
Project No. 2020PR34163
Log. No. 2020.02056
Doc. No. 2103NM08
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Request for Concurrence with a Determination of Effect for Makalapua Project District
Additional Information Regarding Site Integrity and Significance Assessments
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por., (3) 7-4-010:009, 010, and (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi request for concurrence with a determination of effect for the Makalapua Project District (MPD). Liliʻuokalani Trust (LT) is proposing the development of the MPD within their 67.2-acre privately owned property. The County of Hawaiʻi has provided the SHPD with a cover letter describing the proposed LT project and the County's HRS 6E effect determination for the project on behalf of LT. The SHPD received the original submittal on March 25, 2019. The current submittal was received by SHPD on September 4, 2020 and includes two previous SHPD correspondence letters and a letter from Pacific Legacy, Inc. detailing additional consultation regarding the site integrity and site significance assessments and mitigation committments for 15 sites.

The County of Hawaiʻi Planning Department letter, on behalf of Liliʻuokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment (EA) for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD. These include the following:

1993 O'Hare and Rosendahl (1993) report titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This AIS documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) report titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS in a letter dated August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) report titled, *Archaeological Inventory Survey of Urban Phase III Parcel Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK:(3) 7-4-008:002 por.]*. The AIS totaled 213 acres, portions of which were previously surveyed by earlier studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS in a letter dated September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05).

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were documented in the MPD (Table 1).

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection was conducted for a 2.1-acre portion of the project area not previously subject to an AIS. The report is titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney, March 2020) The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

The County's letter identifies the remaining outstanding previously agreed-upon mitigation commitments still need to be addressed for documented historic properties in the MPD:

1. Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
2. Data recovery of Site 50-10-27-30210 Feature B;
3. Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261(enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
4. Archaeological monitoring during ground disturbing construction activities.

Subsequent to the County's letter, the Hawaiʻi Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019.

Zendo Kern
March 29, 2021
Page 2

Additionally, the HIBC recommended that SHPD accept the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] that the two un-surveyed subject parcels within the MPD project area needed the following:

1. Additional investigation that includes a literature review and field inspection;
2. Updating of the site integrity and site significance assessments for sites within the MPD following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals; and
3. Following completion of #1 and #2, SHPD concurrence with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

In a letter dated June 25, 2020 (Log No. 2020.000607, Doc. No. 2006SN05), SHPD accepted the field inspection report and determined that stipulation #1 (above) requested in the previous letter was adequately addressed; however, the additional information, stipulation #2, regarding the site integrity, site significance assessments and mitigation commitments for the 15 sites in the MPD project area had not yet been addressed.

The current submittal indicates consultation efforts were conducted by Pacific Legacy Inc., at the request of SHPD and on behalf of the Lili‘uokalani Trust. Pacific Legacy contacted Lauren Morawski and Kamakana Ferreira from Office of Hawaiian Affairs (OHA) and Keahuolū cultural descendant Nicole Lui. OHA presented a general comment recommending CRM firms to apply Criteria "e" to a larger range of Hawaiian cultural and historic sites. Nicole Lui agreed with OHA regarding the larger application of Criteria "e" to sites other than just burial and heiau and agreed with the current site integrity, significance assessments, and mitigation commitments for the sites in the current project area. Based on the additional consultation, Lili‘uokalani Trust recommended that no changes to the site integrity and significance assessments or mitigation commitments are necessary for any of the 15 identified sites in the Makalapua Project District.

SHPD appreciates the efforts to conduct additional consultation with OHA and cultural descendants; however, SHPD does not believe these efforts fully address stipulation #2 (above) requested by SHPD in previous letters (Log No. 2019.00636, Doc. No. 2002SN04; Log No. 2020.000607, Doc. No. 2006SN05). The AIS reports that include sites within the project area determine site significance and site integrity of the individual features. In accordance with HAR §13-284-6, site significance and integrity are based on the overall site, not the individual features. Additionally, SHPD requests additional consultation efforts, potential application of Criterion "e" to the trail site, and other clarifications.

Based on the current information, SHPD does not concur with the "no change" for the site integrity and significance assessments or mitigation committments for the 16 identified sites in the Makalapua Project District. SHPD requests the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.

Zendo Kern
March 29, 2021
Page 2

5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

When completed, please submit the additional information to SHPD via HICRIS to Project No. 2020PR34163 using the Project Supplement option.

SHPD shall notify the County when the additional information has been reviewed and approved and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai‘i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: County of Hawaii Public Works, public_works@hawaiicounty.gov
Alan Arakawa, aarakawa@onipaa.org
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May 19, 2021

Dr. Alan S. Downer, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
601 Kamokila Blvd., Suite 555
Kapolei, HI 96707
Via: HICRIS Project No. 2020PR34163

SUBJECT: RE. Significance assessments of archaeological sites located in the Liliʻuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi (TMK: [3] 7-4-008:002 (por.); [3] 7-4-025:001–003, 005, 012, 015; [3] 7-4-010:009, 010)

Dear Dr. Downer:

This letter is in response to the State Historic Preservation Division's review of the additional consultation effort carried out by Pacific Legacy, Inc. on behalf of the Liliʻuokalani Trust (Project No. 2020PR34163; Log. No. 2020.02056, Doc. No. 2103NM08). The additional consultation effort was conducted regarding significance and integrity assessments completed for sites within the proposed Makalapua Project District in Keahuolū Ahupuaʻa, district of North Kona, Island of Hawaiʻi.

Liliʻuokalani Trust's proposed Makalapua Project District contains 16 historic properties that were identified during an archaeological inventory survey (AIS) of the Urban Phase III project area (Reeve et al. 2019) and a supplemental AIS (SAIS) conducted in the Kona Commons project area (O'Hare and Rosendahl 1993; McIntosh et al. 2015) (Figures 1 and 2, attached; also see letters dated February 27, 2020 and June 25, 2020 from Alan Downer, SHPD to Michael Yee, County of Hawaiʻi Planning Department, and letter dated March 29, 2021 from Alan Downer to Zendo Kern, County of Hawaiʻi Planning Department, attached).

In the letter dated March 29, 2021 from Alan Downer, SHPD to Zendo Kern, County of Hawaiʻi Planning Department, SHPD indicated that the site integrity, site significance assessments, and mitigation commitments had not yet been addressed. The letter stated the following:

> "OHA presented a general comment recommending CRM firms to apply Criteria "e" to a larger range of Hawaiian cultural and historic sites. **Nicole Lui agreed with OHA regarding the large application of Criteria "e" to sites other than just burial and heiau** and agreed with the current site integrity, significance assessments, and mitigation commitments for the sites in the current project area." [emphasis added]

The statement above is incorrect. Our letter dated September 4, 2020 stated the following:

> "The request from SHPD that additional consultation be undertaken and the recommendation received from OHA that sites be considered significant under criterion "e" **were shared with** Ms. Lui. Maps, photographs, significance assessments and integrity for each of the 15 identified sites in the Makalapua

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> Project District were reviewed, along with the proposed mitigation recommendations that were included in the accepted SAIS report for the Kona Commons project area (McIntosh et al. 2015) and the accepted AIS report for the Urban Phase III project area (Reeve et al. 2019). For each site, Ms. Lui concluded that she **was in agreement with the significance assessments and mitigation recommendations that were included in the 2015 SAIS report and 2019 AIS report**." [emphasis added]

Nicole Lui did not agree with OHA's suggestion that Criterion "e" be applied to a wider range of sites. She agreed that no changes were warranted to the significance assessments and mitigation recommendations as presented in the accepted AIS and SAIS reports.

In your letter dated March 29, 2021, SHPD requests the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.
5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

The following are responses to SHPD's requests:

1. See Table 1 for updated list. Please note that Criterion "e" has been added to Site 50-10-27-13260 and Site 50-10-27-30210 has a recommendation of Data Recovery, as included in the accepted SAIS report.
2. This applies to the Site 50-10-27-30287 trail. Please see detailed response to items 4 and 5, below.
3. All 16 sites included in Table 1 were addressed in the most recent consultation.
4. This recommendation was detailed in the accepted SAIS report, along with information about how the trail was identified and how its temporal designation was determined:

   > In order to more precisely determine the course of this historic trail, its route (as shown on the 1924 USGS topographic map) was overlaid atop a contemporary aerial photograph of the area [...] A detailed field examination of the possible route of the trail was then undertaken by Pacific Legacy archaeologist Rowland Reeve, assisted by Michael Vitousek, Hawaiʻi Island archaeologist with the Hawaiʻi State Historic Preservation Division and Rick Gmirkin, archaeologist for the Ala Kahakai National Historic Trail. (McIntosh et al. 2015:161)
   >
   > The status of the Site 50-10-27-30287 trail was taken under consideration by Nā Ala Hele, the Hawaiʻi State Trail and Access System. It determined that since the trail was not found on any maps prior to 1892, Nā Ala Hele would defer to the State Historic Preservation Divisions' recommendations regarding the trail.
   >
   > The Site 50-10-27-30287 trail has been recommended for partial preservation and interpretation. It is proposed that one of the more visibly distinct segments of the trail be preserved with interpretive signage. This interpretive material would include a map showing the original course of the trail, as well as a written text describing the trail, indicating its relationship with the historic Māmalahoa Trail and the traditional shoreline trail, and explaining its importance to the residents of the nearby coastal settlements. Two potential preservation areas have been identified [...] The best preserved section of the trail is approximately six meters in length and located at its furthest western end. At this end, the trail

> is traceable for approximately 15 meters before it is cut by a line of bulldozer push. It is suggested that this entire 15 meter section be designated for preservation. The second most visible segment is closer to the center of the surviving trail segment. Here there are roughly 12 meters of clearly discernible trail, which could serve as an alternate preservation segment. It is recommended that one of these trail segments be selected for preservation and that interpretive signage be mounted adjacent to it. (McIntosh et al. 2015:179–180)

During the consultation process for the forthcoming Preservation Plan (PP), two site visits were conducted with cultural descendant Nicole Lui, and the trail was discussed in detail during the site visits and subsequent meetings where Lili'uokalani Trust staff members presented the surrounding development plans. These include the construction of a parking lot and sidewalks in the immediate vicinity of the trail. During the site visits and subsequent meetings, Ms. Lui agreed that partial preservation of the trail was appropriate. Access, interpretive signage, and protective measures were discussed, and these will be detailed in the forthcoming PP.

5. The excerpt from the accepted SAIS report documents the consultation that was undertaken with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association as part of the SAIS. These organizations will also be consulted regarding the PP that includes the Site 50-10-27-30287 trail. The consultation process and resulting recommendations will be detailed in the PP.

Regarding the question of whether the application of Criterion "e" would be appropriate in this instance, we do not believe that Criterion "e" is applicable, as this post-Contact trail was utilized by people belonging to diverse ethnic groups who occupied this region during the late 19th to early 20th century. Criterion "e", as defined in HAR §13-284-6 is applicable to historic properties that:

> Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

The Site 50-10-27-30287 trail does not reflect a single group's history and cultural identity, and Criterion "e" is therefore not applicable to this site as presently defined in the administrative rules.

Please do not hesitate to contact me if you have any questions or require additional information.

Sincerely,

Mara Mulrooney, Ph.D.
Principal Investigator

Attachments

cc: Zendo Kern, County of Hawaii
Mana Purdy, Lili'uokalani Trust
Alan Arakawa, Lili'uokalani Trust
Susan Lebo, SHPD
Sean Nāleimaile, SHPD
Nicole Mello, SHPD
Lauren Morawski, Office of Hawaiian Affairs
Kamakana Ferreira, Office of Hawaiian Affairs

Table 1. Documented historic properties in the Makalapua Project District (changes from table included in SHPD's letter dated March 29, 2021 are in bold print).

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d, **e**	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	**Data Recovery**	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

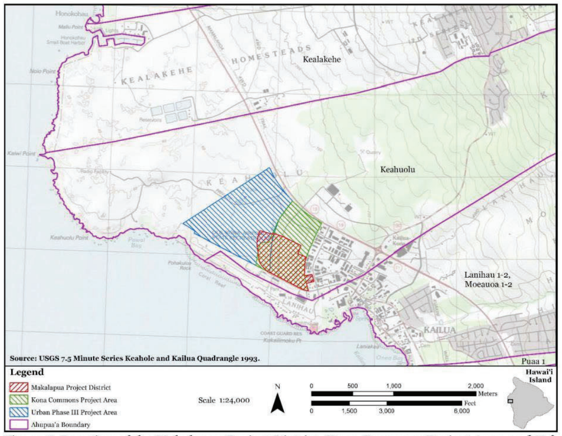

Figure 1. Location of the Makalapua Project District, Kona Commons Project Area, and Urban Phase III Project Area.

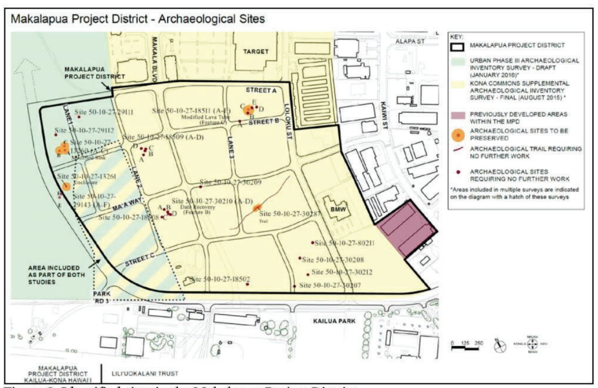

Figure 2. Identified sites in the Makalapua Project District.

Page 5 of 5

DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
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ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

July 21, 2021

IN REPLY REFER TO:
Project No. 2020PR34163
Submission No. 2020PR34163.002
Log No. 2020.02056
Doc. No. 2107NM05
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Request for Concurrence with a Determination of Effect for Makalapua Project District
Additional Information Regarding Site Integrity and Significance Assessments
Keahuolū Ahupua'a, North Kona District, Island of Hawai'i
TMK: (3) 7-4-008:002 por., (3) 7-4-010:009, 010, and (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawai'i request for concurrence with a determination of effect for the Makalapua Project District (MPD). Lili'uokalani Trust (LT) is proposing the development of the MPD within their 67.2-acre privately owned property. The County of Hawai'i has provided the SHPD with a cover letter describing the proposed LT project and the County's HRS 6E effect determination for the project on behalf of LT. The SHPD received the original submittal on March 25, 2019. An additional submittal was received by SHPD on September 4, 2020 and included two previous SHPD correspondence letters and a letter from Pacific Legacy, Inc. detailing additional consultation regarding the site integrity and site significance assessments and mitigation committments for 15 sites. The current submittal consists of an updated letter from Pacific Legacy received by SHPD on May 19, 2021.

The County of Hawai'i Planning Department letter, on behalf of Lili'uokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment (EA) for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD. These include the following:

1993 O'Hare and Rosendahl (1993) report titled, *Archaeological Inventory Survey Queen Lili'uokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawai'i (TMK: 3-7-4-008:Por. 2)*. This AIS documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) report titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS in a letter dated August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) report titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK:(3) 7-4-008:002 por.]*. The AIS totaled 213 acres, portions of which were previously surveyed by earlier studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS in a letter dated September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05).

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were documented in the MPD (Table 1).

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection was conducted for a 2.1-acre portion of the project area not previously subject to an AIS. The report is titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney, March 2020) The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

The County's letter identifies the remaining outstanding previously agreed-upon mitigation commitments that still need to be addressed for the documented historic properties in the MPD:

1. Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
2. Data recovery of Site 50-10-27-30210 Feature B;
3. Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261(enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
4. Archaeological monitoring during ground disturbing construction activities.

Subsequent to the County's letter, the Hawai'i Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019.

Additionally, the HIBC recommended that SHPD accept the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] that the two un-surveyed subject parcels within the MPD project area needed the following:

1. Additional investigation that includes a literature review and field inspection;
2. Updating of the site integrity and site significance assessments for sites within the MPD following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals; and
3. Following completion of #1 and #2, SHPD concurrence with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

In a letter dated June 25, 2020 (Log No. 2020.000607, Doc. No. 2006SN05), SHPD accepted the field inspection report and determined that stipulation #1 (above) requested in the previous letter was adequately addressed; however, the additional information, stipulation #2, regarding the site integrity, site significance assessments and mitigation commitments for the 15 sites in the MPD project area had not yet been addressed.

Pacific Legacy, Inc. sent a letter dated September 4, 2020 (Log No. 2020.02056) to SHPD to address SHPD concerns. The submittal indicated consultation efforts were conducted by Pacific Legacy Inc., at the request of SHPD and on behalf of the Lili'uokalani Trust. Pacific Legacy contacted Lauren Morawski and Kamakana Ferreira from the Office of Hawaiian Affairs (OHA) and Keahuolū cultural descendant Nicole Lui. OHA presented a general comment recommending CRM firms to apply Criteria "e" to a larger range of Hawaiian cultural and historic sites. Nicole Lui agreed with the current significance assessments, and mitigation commitments for the sites in the current project area. Based on the additional consultation, Lili'uokalani Trust recommended that no changes to the site integrity and significance assessments or mitigation commitments are necessary for any of the 15 identified sites in the Makalapua Project District.

In a letter dated March 29, 2021 (Project No. 2020PR34163, Doc. No. 2103NM08), SHPD responded to the previous letter and requested the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.
5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

The current submittal addresses Stipulation #s 1-4; however, due to the time that has passed since the previous consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association, SHPD requests that additional consultation occurs to ensure they are in current agreement with the significance assessments and mitigation commitments for the trail. Additional consultation is also requested as the guidelines for trails have recently been updated (April 2020) and these trail groups have indicated they would like all trails to be considered for Criterion e significance. SHPD (Nicole Mello) reached out to Rick Gmirkin from Ala Kahakai Trail Association and Jackson Bauer from Nā Ala Hele Trail and Access to ask if they had any concerns regarding the trail (Email correspondence between Nicole Mello [SHPD] and Rick Gmirkin [Ala Kahakai Trail Association] and Jackson Bauer [Nā Ala Hele

Zendo Kern
July 21, 2021
Page 2

Trail and Access] on July 20-21, 2021). Rick indicated that the trail site was probably in use during the mid-1800s as it is believed to have been in use at the same time as the Māmalahoa Trail. Additionally, he indicated that "the trail should be significant under 6E criterion e and broader consultation with the descendent community should occur." Both indicated they would like additional consultation and that the trail is likely a Highways Act trail.

Based on the current information, SHPD does not concur with the "no change" for the site integrity and significance assessments or mitigation committments for the 16 identified sites in the Makalapua Project District. SHPD requests the following:

1. Please conduct additional consultation with Nā Ala Hele Trail and Access, Ala Kahakai Trail Association and any other interested cultural/lineal descendants with regards to the trail Site 50-10-27-30287. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate. Additionally, please confirm that all interested parties agree with only partial preservation of the trail.

When completed, please submit the additional information to SHPD via HICRIS to Project No. 2020PR34163 using the Project Supplement option.

SHPD shall notify the County when the additional information has been reviewed and approved and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Alan Arakawa, aarakawa@onipaa.org
Mana Purdy, mpurdy@onipaa.org
Mara Mulrooney, mulrooney@pacificlegacy.com
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Lauren Morawski, laurenm@oha.org
Kamakana Ferreira, kamakanaf@oha.org
Jackson Bauer, Nā Ala Hele Trail and Access, jackson.m.bauer@hawaii.gov
Rick Gmirkin, Ala Kahakai Trail Association, rick_gmirkin@nps.gov

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April 21, 2022

Dr. Alan S. Downer, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
601 Kamokila Blvd., Suite 555
Kapolei, HI 96707
Via: HICRIS Project No. 2020PR34163

SUBJECT: RE. Additional consultation regarding archaeological sites located in the Lili'uokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK: [3] 7-4-008:002 (por.); [3] 7-4-025:001–003, 005, 012, 015; [3] 7-4-010:009, 010)

Dear Dr. Downer:

This letter is in response to the State Historic Preservation Division's review of the additional consultation effort carried out by Pacific Legacy, Inc. on behalf of the Lili'uokalani Trust (Project No. 2020PR34163; Log. No. 2020.02056, Doc. No. 2107NM05). The additional consultation effort was conducted regarding significance and integrity assessments completed for sites within the proposed Makalapua Project District in Keahuolū Ahupua'a, district of North Kona, Island of Hawai'i.

Lili'uokalani Trust's proposed Makalapua Project District contains 16 historic properties that were identified during an archaeological inventory survey (AIS) of the Urban Phase III project area (Reeve et al. 2019) and a supplemental AIS (SAIS) conducted in the Kona Commons project area (O'Hare and Rosendahl 1993; McIntosh et al. 2015) (Figures 1 and 2, attached; also see letters dated February 27, 2020 and June 25, 2020 from Alan Downer, SHPD to Michael Yee, County of Hawai'i Planning Department, and letters dated March 29, 2021 and July 21, 2021 from Alan Downer to Zendo Kern, County of Hawai'i Planning Department, attached).

In your letter dated March 29, 2021, SHPD requested the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.
5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

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In your letter dated July 21, 2021, SHPD stated the following:

> The current submittal addresses Stipulation #s 1-4; however, due to the time that has passed since the previous consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association, SHPD requests that additional consultation occurs to ensure they are in current agreement with the significance assessments and mitigation commitments for the trail. Additional consultation is also requested as the guidelines for trails have recently been updated (April 2020) and these trail groups have indicated they would like all trails to be considered for Criterion e significance. SHPD (Nicole Mello) reached out to Rick Gmirkin from Ala Kahakai Trail Association and Jackson Bauer from Nā Ala Hele Trail and Access to ask if they had any concerns regarding the trail (Email correspondence between Nicole Mello [SHPD] and Rick Gmirkin [Ala Kahakai Trail Association] and Jackson Bauer [Nā Ala Hele Trail and Access] on July 20-21, 2021). Rick indicated that the trail site was probably in use during the mid-1800s as it is believed to have been in use at the same time as the Māmalahoa Trail. Additionally, he indicated that "the trail should be significant under 6E criterion e and broader consultation with the descendent community should occur." Both indicated they would like additional consultation and that the trail is likely a Highways Act trail.
>
> Based on the current information, SHPD does not concur with the "no change" for the site integrity and significance assessments or mitigation committments for the 16 identified sites in the Makalapua Project District. SHPD requests the following:
>
> 1. Please conduct additional consultation with Nā Ala Hele Trail and Access, Ala Kahakai Trail Association and any other interested cultural/lineal descendants with regards to the trail Site 50-10-27-30287. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate. Additionally, please confirm that all interested parties agree with only partial preservation of the trail.

Additional consultation was undertaken between August 2021 and April 2022. This included the following:

- August 2, 2021: Meeting with Rick Gmirkin (Ala Kahakai Trail Association) and Jackson Bauer (Nā Ala Hele Trail and Access) via Zoom
- September 2, 2021: Meeting with Rick Gmirkin (Ala Kahakai Trail Association) and Jackson Bauer (Nā Ala Hele Trail and Access) via Zoom
- September 14, 2021: Site visit with Rick Gmirkin and Tanya Lizama (Ala Kahakai Trail Association), Moana Rowland and Jackson Bauer (Nā Ala Hele Trail and Access)
- November 5, 2021: Meeting with Nicole Lui (Keahuolū Cultural Descendant) via Zoom
- January 19, 2022: Site visit with Rick Gmirkin, Tanya Lizama, and Fred Baldenweck (Ala Kahakai Trail Association), Moana Rowland and Jackson Bauer (Nā Ala Hele Trail and Access), and Nicole Lui (Keahuolū Cultural Descendant)
- January 27, 2022: Site visit with Rick Gmirkin, Tanya Lizama, and Fred Baldenweck (Ala Kahakai Trail Association) (documentation of trail segment)
- February 18, 2022: Meeting with Nicole Lui (Keahuolū Cultural Descendant) via Zoom
- March 3, 2022: Site visit with Rick Gmirkin, Tanya Lizama, and Fred Baldenweck (Ala Kahakai Trail Association) (documentation of trail segment)
- March 16, 2022: Site visit with Nicole Lui (Keahuolū Cultural Descendant)
- March 18, 2022: Site visit with Rick Gmirkin, Tanya Lizama, and Fred Baldenweck (Ala Kahakai Trail Association) (documentation of trail segment)
- April 1, 2022: Meeting with Nicole Lui (Keahuolū Cultural Descendant) via Zoom
- April 14, 2022: Meeting with Rick Gmirkin (Ala Kahakai Trail Association) and Jackson Bauer (Nā Ala Hele Trail and Access) via Zoom

As a result of the additional consultation undertaken regarding appropriate preservation measures for the SIHP 50-10-27-30287 trail segment, the following changes have been made:

- The -30287 trail segment has been assessed as significant under criterion "e" in addition to criterion "d". In addition, a petroglyph was identified during clearing of the trail and will be included in the archaeological preserve (see attached Figures 2, 3, 4)
- The mitigation recommendation for the -30287 trail segment has been changed from "partial preservation" to "preservation" with agreed-upon potential breach areas (see attached Table 1). A newly-identified petroglyph will also be preserved (Figures 2, 3, 4).
- In consultation with Nicole Lui and her ʻohana (Keahuolū Cultural Descendants), Rick Gmirkin (Ala Kahakai Trail Association), and Jackson Bauer (Nā Ala Hele Trail and Access), priority sections for preservation and sections that may potentially be breached have been identified (see Figure 2).
- A minimum buffer of 10 feet from the outer edges of the trail has been established in consultation with Nicole Lui and her ʻohana (Keahuolū Cultural Descendants). It should be noted that Rick Gmirkin (Ala Kahakai Trail Association) and Jackson Bauer (Nā Ala Hele Trail and Access) do not agree with this buffer distance and requested that the buffer distance be set at a minimum of 30 feet from either side of the outer edges of the trail.

We look forward to SHPD's concurrence with the changes to significance assessments and mitigation recommendations for identified historic properties within the Makalapua Project District, as detailed in the attached Table 1. A detailed preservation plan is being developed for the SIHP 50-10-27-30287 and other historic properties that have been recommended for preservation (SIHP 50-10-27-13260 and SIHP 50-10-27-13261).

Please do not hesitate to contact me if you have any questions or require additional information.

Sincerely,

Mara Mulrooney, Ph.D.
Principal, Senior Archaeologist

Attachments

cc: Zendo Kern, County of Hawaii
Mana Purdy, Liliʻuokalani Trust
Alan Arakawa, Liliʻuokalani Trust
Susan Lebo, SHPD
Sean Nāleimaile, SHPD
Nicole Mello, SHPD
Lauren Morawski, Office of Hawaiian Affairs
Kamakana Ferreira, Office of Hawaiian Affairs

Table 1. Documented historic properties in the Makalapua Project District (changes from table included in SHPD's letter dated March 29, 2021 are in bold print).

SIHP#	Site/Feature Type	Signifi-cance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d, **e**	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	**Data Recovery**	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail **and associated petroglyph**	d, **e**	**Preservation**	Kona Commons SAIS

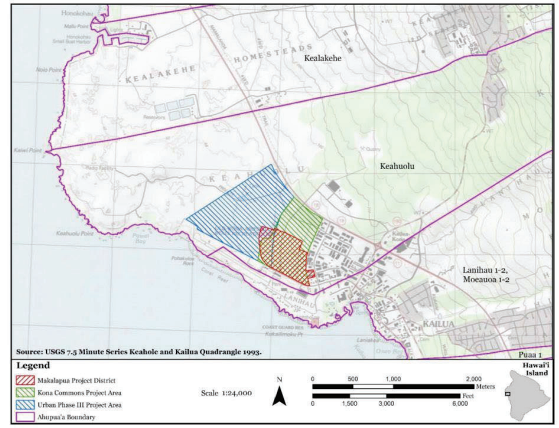

Figure 1. Location of the Makalapua Project District, Kona Commons Project Area, and Urban Phase III Project Area.

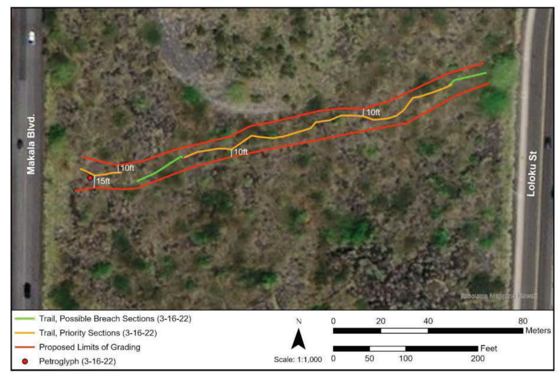

Figure 2. Map showing revised preservation buffer (limits of grading) for SIHP 50-10-27-30287 trail segment in the Makalapua Project District.

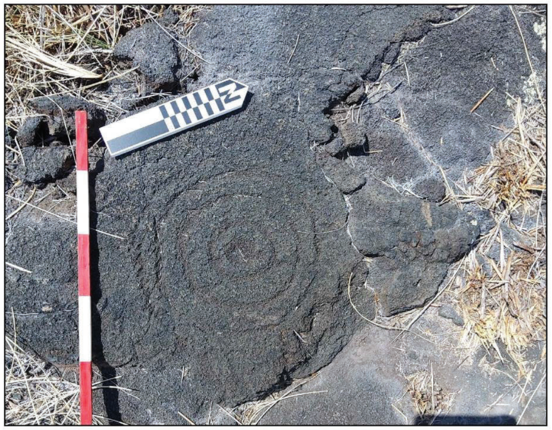

Figure 3. Petroglyph adjacent to SIHP 50-10-27-30287 trail segment in the Makalapua Project District.

Figure 4. Petroglyph adjacent to SIHP 50-10-27-30287 trail segment in the Makalapua Project District, showing proximity to trail.

APPENDIX C

SHPD EFFECT DETERMINATION LETTER REQUESTING A DATA RECOVERY PLAN, PRESERVATION PLAN, AND ARCHAEOLOGICAL MONITORING PLAN

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

July 26, 2022

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2207NM07
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District
Additional Consultation Regarding Archaeological Sites
Request for Concurrence with Effect Determination
Keahuolū Ahupua‘a, North Kona District, Island of Hawai‘i
TMK: (3) 7-4-008:002 por., (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawai‘i request for concurrence with a determination of effect for the Makalapua Project District (MPD) and the supporting document titled *Additional consultation regarding archaeological sites located in the Lili‘uokalani Trust Makalapua Project District, Ahupua‘a of Keahuolū, District of North Kona, Island of Hawai‘i, TMK: (3) 7-4-008:002 por., (3) 7-4-025:001-003, 005, 012, 015, (3) 7-4-010:009, 010* (Mulrooney, April 2022). Lili‘uokalani Trust (LT) is proposing the development of the MPD which is a 67.2-acre property. The County of Hawai‘i has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original submittal on March 25, 2019 (Log No. 2019.00636). The current submittal was received on April 21, 2022 and includes a letter from Pacific Legacy (archaeological consultant) regarding the additional consultation that was requested by SHPD on July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05). Previous SHPD correspondence related to this project is provided in the Attachment.

The County of Hawai‘i Planning Department letter, on behalf of Lili‘uokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; and 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD:

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Lili‘uokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawai‘i (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawai‘i [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili‘uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai‘i [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua‘a of Keahuolū, District of North Kona, Island of Hawai‘i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was conducted for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

The County's letter identifies the previously agreed-upon mitigation commitments that still need to be addressed for documented historic properties in the MPD:

1. Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
2. Archaeological data recovery of Site 50-10-27-30210 Feature B;
3. Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261 (enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
4. Archaeological monitoring during ground disturbing construction activities.

The Attachment below includes a summary of the SHPD correspondence associated with the current MPD project. In a letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05), SHPD indicated that previously requested items #1-4 had been completed but request item #5, additional consultation, was still needed. The recent letter from Pacific Legacy to SHPD dated April 21, 2022, includes the additional consultation efforts which were conducted between August 2021 and April 2022 and included consultation with the Ala Kahakai Trail Association, Nā Ala Hele Trail and Access, and cultural descendant Nicole Lui. The additional consultation resulted in assessing trail Site 50-10-27-30287 as additionally significant under Criterion "e" and changing the site mitigation from partial preservation to preservation with agreed upon potential breaches. During consultation, representatives from Ala Kahakai Trail Association and Nā Ala Hele Trail and Access recommended a 30-ft.-wide buffer from the outer edges of the trail. Nicole Lui agreed with the current 10-foot buffer on either side of the trail. Additionally, a petroglyph associated with the trail was identified during trail clearing and it will be added to the archaeological preserve.

Based on the additional consultation efforts, SHPD agrees with (1) Site 50-10-27-30287 being additionally assessed significant under Criterion e, (2) the preservation of Site 50-10-27-30287 being changed from partial to full preservation with allowance for agreed-upon breaches, and (3) preservation of the newly identified petroglyph. Lastly, SHPD indicates that the additional consultation efforts conducted by Pacific Legacy (August 2021 to April 2022) meet the requested item #5 detailed in SHPD's letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05).

SHPD's effect determination is "Effect, with agreed upon mitigation commitments" for the current project. As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "Effect, with agreed upon mitigation commitments," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD looks forward to receiving for review and acceptance a data recovery plan for Site 50-10-30210, Feature B meeting the requirements of HAR §13-278-3; a preservation plan meeting the requirements of HAR §13-277 for Site 50-27-13260, Site 50-10-27-13261, Site 50-10-27-18511 Feature A, Feature B, Feature D and Feature E, and Site 50-10-27-30287; and an archaeological monitoring plan meeting the requirements of HAR §13-279-4. Please upload a text-searchable PDF version of each document and their associated filing review fee to HICRIS Project No. 2020PR34163, in response to the new attachment request.

SHPD shall notify the County and LT when the mitigation commitments have been completed and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
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Attachment
SHPD Project Correspondence

November 8, 2019
Subsequent to the County's letter, the Hawai'i Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019. Additionally, the HIBC recommended that SHPD accepted the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

February 27, 2020
In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] that the two un-surveyed subject parcels within the MPD project area needed the following:

1. Additional investigation that includes a literature review and field inspection and;
2. that site integrity and site significance assessments for sites within the MPD be updated following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals.
3. Following completion of #1 and #2, SHPD concur with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

June 25, 2020
In a letter dated June 25, 2020 (Log No. 2020.000607, Doc. No. 2006SN05), SHPD accepted the field inspection report and determined the #1 request in the previous letter was adequately addressed; however, the additional information (#2) regarding the site integrity, site significance assessments and mitigation commitments for the 15 sites in the MPD project area had not yet been addressed.

September 4, 2020
Pacific Legacy, Inc. sent a letter dated September 4, 2020 (Log No. 2020.02056) to SHPD to address SHPD concerns. The submittal indicated consultation efforts were conducted by Pacific Legacy Inc., at the request of SHPD and on behalf of the Lili'uokalani Trust. Based on the additional consultation, Lili'uokalani Trust recommended that no changes to the site integrity and significance assessments or mitigation commitments are necessary for any of the 15 identified sites in the Makalapua Project District.

March 29, 2021
In a letter dated March 29, 2021 (Project No. 2020PR34163, Doc. No. 2103NM08), SHPD responded to the previous letter and requested the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.
5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

July 21, 2021
In a letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05), SHPD indicated that requested items 1-4 had been completed but request #5, additional consultation, was still needed.

APPENDIX D

BURIAL SITE COMPONENT OF A PRESERVATION PLAN FOR SIHP 50-10-27-18511, FEATURE C

Pacific Legacy
Historic Preservation

BURIAL SITE COMPONENT OF A PRESERVATION PLAN FOR SITE 50-10-27-18511 LILIʻUOKALANI TRUST LANDS IN THE AHUPUAʻA OF KEAHUOLŪ NORTH KONA DISTRICT HAWAIʻI ISLAND [TMK (3) 7-4-025:015]

Pacific Legacy: Exploring the past, informing the present, enriching the future.

Cultural Resources Consultants

Hawaiʻi Offices:
Kailua, Oʻahu

California Offices:
Business Office
Bay Area
Sierra/Central Valley

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BURIAL SITE COMPONENT OF A PRESERVATION PLAN
FOR SITE 50-10-27-18511
LILIʻUOKALANI TRUST LANDS
IN THE AHUPUAʻA OF KEAHUOLŪ
NORTH KONA DISTRICT, HAWAIʻI ISLAND
[TMK (3) 7-4-025:015]

Prepared by:
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November 2019

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LIST OF FIGURES

Cover image: *Site 50-10-27-18511, Feature C (view southwest).*

GLOSSARY OF HAWAIIAN TERMS

ahupua'a	traditional land division usually extending from the mountains to the sea and encompassing a range of environmental zones that were known and used by the land's early Hawaiian residents
ali'i kāne	chief
ali'i wahine	chiefess
ho'okupu	an offering, literally "to cause to grow"
'ili	a traditional land division, usually a subdivision of the *ahupua'a*
iwi	bone, human bones
iwi kupuna	ancestral remains
kahu	caretaker, steward
kama'āina	native-born, one born in a place, literally a child of the land
kīhāpai	small garden or field
kuleana	right, responsibility, property, the term is often used to refer to lands awarded to native claimants during the Mahele 'Āina, the land division of 1848
makai	toward the sea
maka'āinana	commoners
mana'o	thought, idea or opinion
mauka	towards the mountains (inland)
'ohana	family, extended family
pāhoehoe	smooth and often undulating lava differing from the more broken *'a'ā* lava
pono	proper, correct
wahi kapu	forbidden or restricted place, often used to refer to a culturally sensitive area

1.0 INTRODUCTION

At the request of the Lili'uokalani Trust, Pacific Legacy, Inc. has prepared the following Burial Treatment Plan (BTP) to address the protection and long-term preservation of a single identified human burial present within the 100-acre Kona Commons portion of Trust lands located within the *ahupua'a* (land division) of Keahuolū in the district of North Kona on the island of Hawai'i. This property was the subject of an Archaeological Inventory Survey (AIS) undertaken by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1992 (O'Hare and Rosendahl 1993) and a Supplemental Archaeological Inventory Survey (SAIS) undertaken by Pacific Legacy in 2014 (McIntosh et al. 2014). It was during the course of the 1992 PHRI survey that the burial for which this Burial Treatment Plan has been prepared was discovered. At that time, the burial, which is situated within a lava tube, was recorded and assigned State Inventory of Historic Places site number 50-10-27-18511, Feature C. The Site 18511, Feature C burial was relocated and further documented during the 2014 Pacific Legacy survey.

The landowner information for the location of the Site 50-10-27-18511, Feature C burial is below:

Lili'uokalani Trust
1100 Alakea Street, Suite 1100
Honolulu, HI 96813

The Trust recognizes the importance of the Site 50-10-27-18511, Feature C lava tube burial and the *iwi kūpuna* (ancestral remains) that it contains. It is their intention to preserve this burial in place and to ensure that it is not disturbed during the development of the surrounding area or its future use. The objective of this Burial Treatment Plan (BTP) is to satisfy the cultural resource requirements of the Department of Land and Natural Resources as promulgated in Hawai'i Administrative Rules §13-300-33 (Request for Council Determination to Preserve or Relocate Native Hawaiian Burial Sites).

1.1 BURIAL LOCATION

The Site 50-10-27-18511, Feature C burial is located within the Lili'uokalani Trust's 100-acre Kona Commons property at the northern edge of Kailua town. This property is situated in the coastal portion of the *ahupua'a* of Keahuolū in the district of North Kona on the island of Hawai'i (Figure 1). The burial site is located within Hawai'i County tax map parcel (3) 7-4-025:015 (Figure 2). Site 50-10-27-18511, Feature C is the only identified Native Hawaiian burial within the Kona Commons property.

The Kona Commons property is bounded to the northeast by the Queen Ka'ahumanu Highway, to the northwest by the 213-acre Urban Phase III parcel, which contains the Lili'uokalani Children's Center complex, to the southeast by commercially developed land that forms part of the Kona industrial area, and to the southwest by playing fields that form part of the Old Kona Airport State Recreation Area (Figure 3).

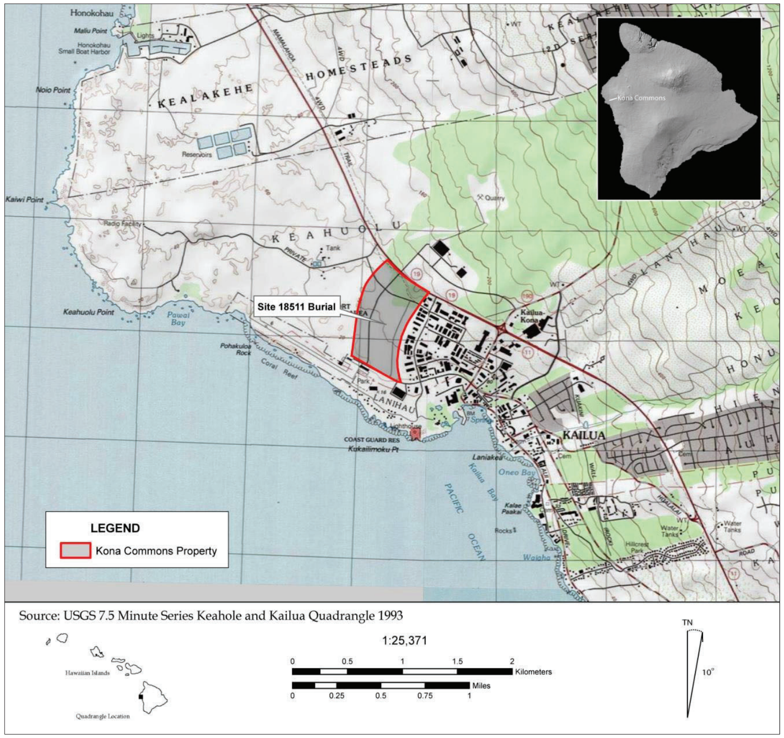

Figure 1. Location of the Liliʻuokalani Trust Kona Commons parcel (base map U.S.G.S. Kailua and Keahole Point quadrangles 1993, North American Datum 1983).

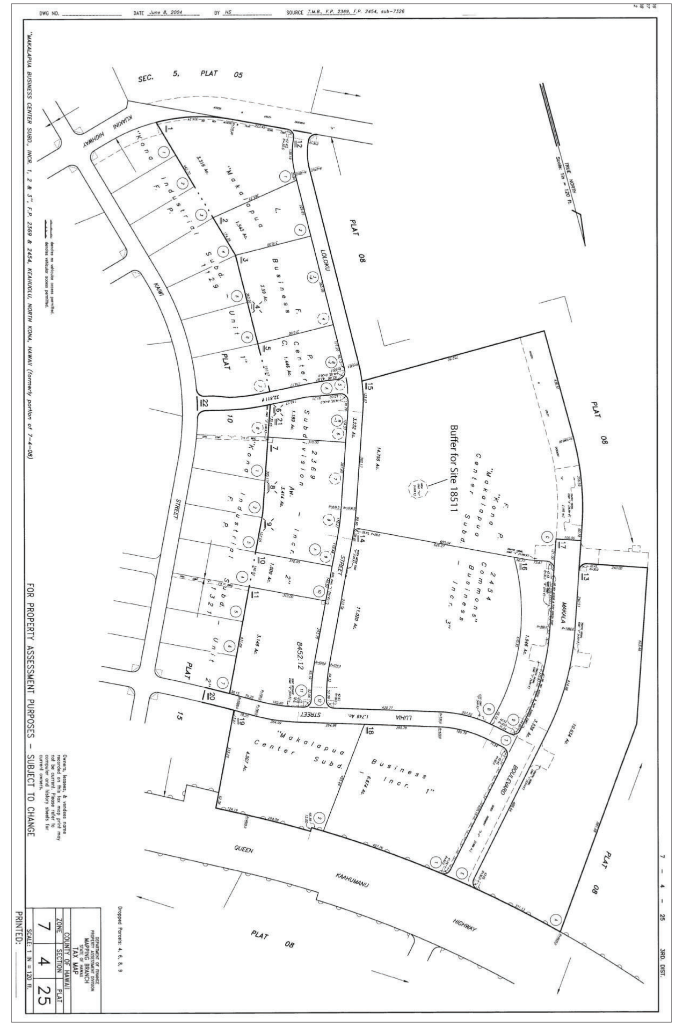

Figure 2. County of Hawaiʻi Tax Map Key [TMK] (3) 7-4-25 showing the archaeological buffer established around the Site 50-10-27-18511 burial (County of Hawaiʻi Planning Department 2004 map).

Figure 3. Aerial photograph showing the relative location of Site 50-10-27-18511 (background aerial from Google Earth, accessed 2014).

Portions of the Kona Commons property have been developed for commercial use. Most of this development has been concentrated in the *mauka* (inland) half of the property. These *mauka* lands are now occupied by a mix of commercial properties and parking areas (Figure 3). At present, the more *makai* (seaward) half of the Kona Commons property remains relatively undeveloped, though portions of this undeveloped land have been disturbed by bulldozing, and by landscaping associated with the construction of the former Swing Zone driving range.

The Site 50-10-27-18511, Feature C lava tube burial is located on an undeveloped section of land just *makai* (seaward) of the Target store and its associated parking area (Figure 4). This undisturbed lot consists of undulating *pāhoehoe* lava vegetated in a thin covering of fountain grass (*Pennisetum setaceum*).

1.2 Statutory Requirements

Hawai‘i Administrative Rules, Title 13, Subtitle 13, Chapter 300 (HAR §13-300) outlines the "Rules of Practice and Procedure Relating to Burial Sites and Human Remains" within the State of Hawai‘i. Under these administrative rules, the Hawai‘i Island Burial Council has jurisdiction over all requests to preserve or relocate previously identified Native Hawaiian burial sites (HAR §13-300-33: Request for Council Determination to Preserve or Relocate Native Hawaiian Burial Sites).

HAR §13-300-33(b) requires that the applicant "submit a request to preserve in place or relocate a Native Hawaiian burial site to the department [the State Historic Preservation Division] in the form of a burial treatment plan." As mentioned above, it is the intent of the Lili‘uokalani Trust to preserve in place the human remains located at Site 50-10-27-18511, Feature C. The following Burial Treatment Plan details the proposed treatment of this burial site. It complies with all necessary requirements as set forth in HAR §13-300-33. This plan is being submitted to the State Historic Preservation Division (SHPD) and the Hawai‘i Island Burial Council (HIBC) for review and determination.

1.3 Report Organization

The following Burial Treatment Plan has been organized into eight sections to address the various issues associated with the protection and long-term preservation of the Site 50-10-27-18511, Feature C burial site.

- Section 1: Provides an introduction to the Burial Treatment Plan.
- Section 2: Presents background on the Site 18511 burial including a brief natural and cultural history of the Kona Commons property and the previous archaeological work undertaken within it.
- Section 3: Provides a detailed description of the Site 18511, Feature C burial site.
- Section 4: Discusses the Burial Treatment Plan prepared by PHRI in 1993 to address numerous burials located within Lili‘uokalani Trust lands in Keahuolū.

Figure 4. Location of the Site 50-10-27-18511, Feature C lava tube burial (background aerial from Google Earth, accessed 2016).

Section 5: Details the efforts undertaken to identify lineal and cultural descendants associated with the Site 18511 burial and lists the recognized cultural descendants of the Keahuolū area.
Section 6: Discusses the proposed development for the area surrounding the Site 18511 burial.
Section 7: Outlines the plans to protect and preserve the Site 18511 burial from potential adverse effects during the development and use of the surrounding area.
Section 8: Lists the various references cited in the document.

A glossary of Hawaiian words used within the Burial Treatment Plan is provided at the beginning of the document.

The Burial Treatment Plan also includes the following appendices:

Appendix A: Description of Site 50-10-27-18511
Appendix B: Burial Treatment Plan Prepared by Paul H. Rosendahl, Ph.D., Inc., 1993
Appendix C: Copies of Public Notices
Appendix D: Descendant Consultation

2.0 PROJECT BACKGROUND

This section of the Burial Treatment Plan provides background information on the Site 50-10-27-18511 burial and its place within the *ahupua*ʻ*a* of Keahuolū and the larger North Kona region. It discusses the historic background of the Kona Commons property and the various archaeological investigations that have taken place within it.

2.1 Environmental Setting

The Kona Commons property is located at the foot of the volcanic peak of Hualālai, on the drier leeward side of the island of Hawaiʻi. The Site 18511 burial is situated at roughly 12 meters (40 feet) in elevation above sea level and approximately 200 meters inland of the shoreline. The geology underlying most of the Kona Commons property, including the Site 18511 area, consists of gently undulating *pāhoehoe* lava flows laid down sometime between 1,500 and 3,000 years ago (Wolfe and Morris 1996). These *pāhoehoe* flows possess very little in the way of surface soil, most of which consists of thin aeolian sediments that have accumulated in depressions and low-lying areas (soil type rLW in Sato et al. 1973:Map 85). The lava is scarred by upthrust pressure ridges, fissures, collapsed blisters, and lava sinks. Subsurface lava tubes and blisters are also present within the flow. Several of these natural geologic features show evidence of having been modified and utilized by the pre-Contact inhabitants of coastal Keahuolū. The lava tube that forms Site 18511, Feature C is one such volcanic feature.

Less than 750 millimeters (approximately 29.5 inches) of rain fall in a year along this stretch of the Kona coast (Giambelluca et al. 1986). Due to the limited amount of rainfall, vegetation in the area is relatively sparse. The undisturbed *pāhoehoe* lavas within the Kona Commons property are covered in a sparse to dense ground cover of introduced fountain grass (*Pennisetum setaceum*), with occasional stunted *kiawe* (*Prosopis pallida*), and Christmas berry (*Schinus terebinthifolius*) trees, as well as *koa haole* (*Leucaena leucocephala*), klu (*Acacia farnesiana*), lantana (*Lantana camara*), and bougainvillea (*Bougainvillea spp.*) shrubs. Scattered native shrubs such as ʻ*uhaloa* (*Waltheria indica*), are also present, with Polynesian-introduced *noni* (*Morinda citrifolia*) trees growing out of lava sinks and other natural depressions in the terrain. During the pre-Contact period, the dominant vegetation throughout this area would most probably have been *pili* grass (*Heteropogon contortus*) (Figure 5).

2.2 Cultural and Historical Background

The Site 18511 burial is located within the *ahupua*ʻ*a* (land division) of Keahuolū, which follows the traditional *mauka* to *makai* (from the mountains to the sea) pattern, extending from the upper slopes of Hualālai to the coastal waters north of Kailua Bay. Keahuolū is bounded to the north by the *ahupua*ʻ*a* of Kealakehe and to the south by the *ahupua*ʻ*a* of Lanihaunui (large Lanihau, also referred to as Lanihau 1) and Honuaʻula 3 (Figure 6).

Figure 5. Vegetation surrounding the Site 50-10-27-18511 burial (view northeast).

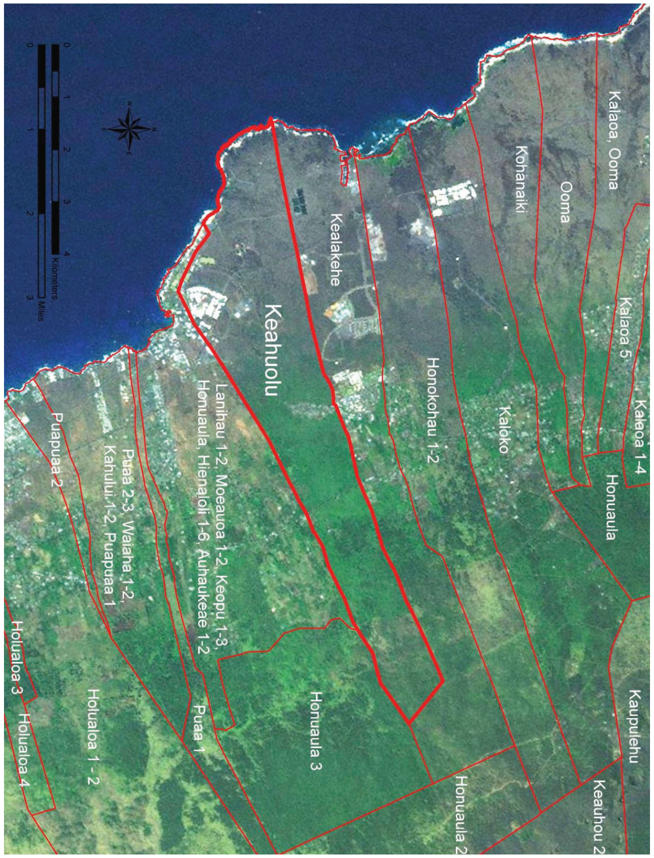

Figure 6. The relative location of the *ahupua'a* of Keahuolū (aerial base from ESRI ArcGIS Online and data partners, including imagery from agencies supplied via the Content Sharing Program; image date 2009; data from the Hawai'i Biodiversity and Mapping Program).

The *ahupua*'*a* of Keahuolū possesses a rich cultural history that has been investigated in depth as part of the various cultural and archaeological studies undertaken for the Lili'uokalani Trust by Pacific Legacy. A detailed narrative of the cultural and historical background of the *ahupua*'*a*, with emphasis on its coastal region, is provided in the Supplemental Archaeological Inventory Survey report of the Kona Commons property (McIntosh et al. 2014:11–50). This report was prepared to supplement the existing Archaeological Inventory Survey of the property conducted by Paul H. Rosendahl, Ph.D., Inc. in 1992 (O'Hare and Rosendahl 1993). The following sections provide a brief overview of the cultural history of the Kona Commons property.

2.2.1 Traditional Settlement

Archaeological studies and historic research suggest that the primary centers of population within the *ahupua*'*a* of Keahuolū during the pre-Contact period were located at the coast and in the well-watered uplands (McIntosh et al. 2014:23–26). Although coastal residences were strung along the shoreline, situated near small bays and canoe landings (Reeve et al. 2012), the main areas of coastal settlement seem to have been located at the small crescent bays of Halepa'o and Pawai, as well as along the sandy beach immediately south of Pawai in the area known as Makā'eo.

Evidence suggests that the coconut grove which is known historically to have fringed Pawai Bay stretched further south along the shoreline to shade the fishing settlement of Makā'eo. Boundary Commission testimony, collected in the latter half of the 19th century, indicates that there was "an old village, on Lanihau, called Makaeo" (Boundary Commission Vol. A, No. 1:354). Makā'eo was located along the shoreline to the south and east of the prominent outcropping of lava known as Pōhakuloa, which rises from the sea near the northern end of the Old Kona Airport runway and marks the boundary point along the shore between the *ahupua*'*a* of Keahuolū and Lanihau. The fishing village of Makā'eo appears to have been the closest settlement to the Kona Commons property. Although the Kona Commons itself shows some evidence of traditional human activity (see Section 2.3), this activity all appears to have been of a temporary nature and the area does not look to have supported a permanent pre-Contact population (McIntosh et al. 2014:183–184).

2.2.2 Post-Contact Period

In the early years following Western contact, little changed in the lives of the inhabitants of coastal Keahuolū. With time, however, the introduction of foreign diseases for which the *kama*'*āina* (native born residents) possessed no natural resistance as well as population shifts caused by changing economic conditions resulted in a general decrease in the coastal population of the *ahupua*'*a* (McIntosh et al. 2014:28). Despite this general population decline, the fishing settlements of Pawai and Makā'eo continued to be occupied by local '*ohana* (families) into the 1940s, when the village of Makā'eo and its attendant coconut grove was destroyed to make way for the Kona Airport (Clark 1985:110 and McIntosh et al. 2014:25–26).

At the time of the Māhele 'Āina (land division) of the 1840s, the entire *ahupua*'*a* of Keahuolū was awarded to the *ali*'*i wahine* (chiefess) Analea (Ane) Keohokālole under Land Commission Award 8452: Apana 12 (Royal Patent 6851). Only six smaller *kuleana* claims were awarded to *maka*'*āinana* (commoners) within the *ahupua*'*a* of Keahuolū. All of these were located within the upland portion of the *ahupua'a*, well away from the coast (see Section 5.2.1). Two historic-era trails (the Māmalahoa Trail and a smaller horse trail) are known to have crossed the Kona Commons property during the post-Contact period (McIntosh et al. 2014:28–29, 182–183). These trails represent the only known post-Contact sites in the area. As with the pre-Contact period, there does not appear to have been any permanent occupation on the property during the post-Contact period (McIntosh et al. 2014:183–184). Development of the Kona Commons for commercial purposes only took place after 1992.

2.3 Archaeological Background

The *ahupua'a* of Keahuolū has been the subject of several archaeological investigations beginning in the first decade of the 20th century. The earliest of these formed part of larger regional or island-wide surveys, and as a result were not as detailed as later studies. These initial surveys were concentrated for the most part along the coast, which was the main area of settlement during the pre-Contact period. A detailed review of these early archaeological studies, as well as those later investigations undertaken within the broader *ahupua'a*, is provided in Section 4.0 of the Supplemental Archaeological Inventory Survey report of the Kona Commons property (McIntosh et al. 2014:51–69). The following sections provide information on the two most recent archaeological studies undertaken within the Kona Commons property, which are the most relevant in regards to the Site 18511, Feature C burial.

2.3.1 Paul H. Rosendahl, Ph.D., Inc. Inventory Survey, 1992

In October of 1992, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an Archaeological Inventory Survey (AIS) of the 100-acre Kona Commons property (the report of the survey's findings was completed in 1993; O'Hare and Rosendahl 1993). At that time, the Kona Commons project area was referred to as the Kona Industrial Subdivision (KIS) Expansion Site. The 1992 survey identified a total of 18 archaeological sites containing 38 component features (Figure 7).

These sites included a segment of the historic Māmalahoa Trail, as well as lava excavations, modified outcrops, filled depressions, stone alignments, stone mounds, terraces, walls, hearths, walled overhangs, an enclosure, a modified depression, a cairn, a cave shelter, and a lava tube burial (O'Hare and Rosendahl 1993:ii).

The 1992 inventory survey was the first survey to identify the human burial at Site 50-10-27-18511. The survey recorded three features at the site; a walled overhang (Feature A), a *pāhoehoe* excavation (Feature B), and a lava tube (Feature C) (O'Hare and Rosendahl 1993:10, 13, 15 and A-10 thru 12; see Appendix A for the full site description from the 1992 survey). The Feature C lava tube was found to contain a scatter of human bone resting on the cave floor and among the loose stones covering it. The inventory survey report noted that, "The skeletal material consists of scattered finger, toe, and foot bones, some vertebrae, and one incisor" (O'Hare and Rosendahl 1993:A-12).

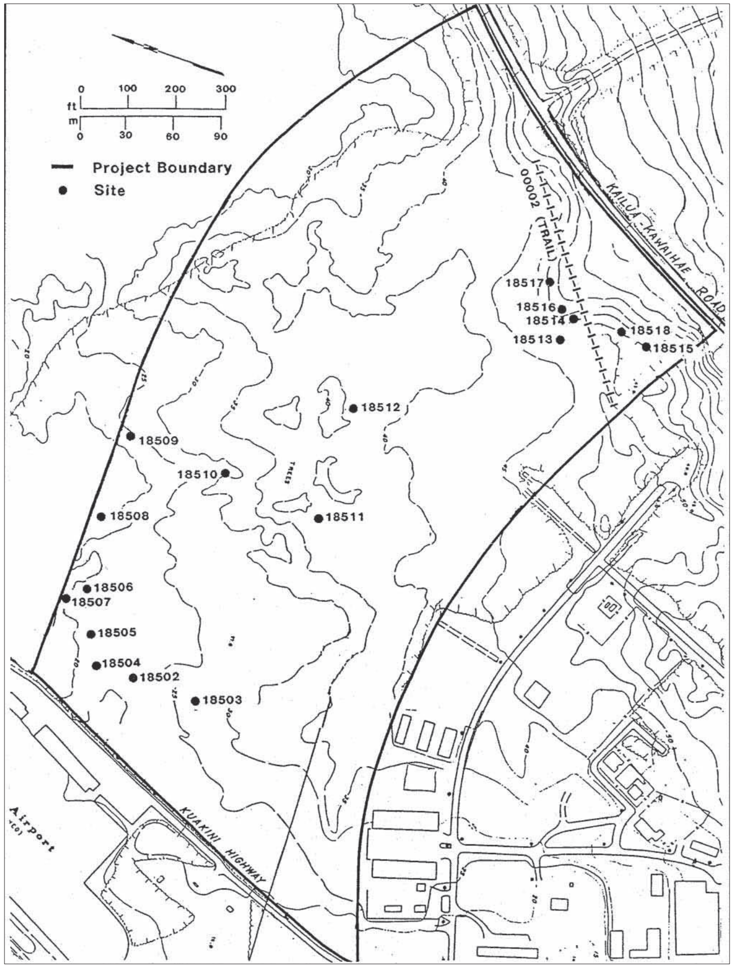

Figure 7. Relative locations of sites identified during the 1992 PHRI survey (O'Hare and Rosendahl 1993:Figure 2).

An area of piled stones was also observed near the entrance of the tube, and a filled depression in the central area of the cave. "Most of the scattered bone was observed either in this depression, on top or among the cobbles, or on a bare bedrock shelf adjacent to and south of the depression" (O'Hare and Rosendahl 1993:A-12).

The PHRI field crew moved some of the rocks in these two areas in order to determine if an articulated burial might rest beneath the stones. "There was an area of piled stones near the entrance of the cave, and a filled depression in the central area of the cave. Enough rocks were moved in these two areas to determine if an articulated burial was under the rocks. Only a few more scattered bones were found" (O'Hare and Rosendahl 1993:15).

The archaeological inventory survey report suggested that a complete burial was once placed within the lava tube, but was later removed, leaving only the scattered bones that were identified. A single waterworn cap to a conus shell with a hole through its center (described by the survey report as a "puka shell") was observed in the piled stones near the entrance. A clear glass patent medicine bottle found inside the cave was collected (O'Hare and Rosendahl 1993:A-12).

The PHRI report concluded the following:

> It seems probable that a complete burial was once present in the cave, possibly on top of the level central area of the cave, but was later removed. This might have taken place during historic times when the cave might have been used for temporary habitation. The cave is wet, with continual dripping from the roof, and the glass bottle found in the cave may be historic evidence for use of the cave as a water catchment area. (O'Hare and Rosendahl 1993:A-12)

The 1992 Archaeological Inventory Survey provided substantial evidence of human activity within the Kona Commons project area during the pre-Contact period. These activities, however, all appear to have been primarily short-term in nature, undertaken by individuals visiting or passing through the area rather than residing within it.

The PHRI Archaeological Inventory Survey report assessed the significance of the archaeological sites documented within the Kona Industrial Subdivision Expansion Site based upon the Secretary of the Interior's standards for listing on the National Register of Historic Places as defined in the Code of Federal Regulation Title 36 (36 CFR §60.4). The report determined that the lava tube burial at Site 50-10-27-18511 was significant both for its information content and its cultural value. It was recommended for provisional further data collection and preservation "as is" (O'Hare and Rosendahl 1993:18).

2.3.2 Pacific Legacy Supplemental Archaeological Inventory Survey, 2014

In 2014, Pacific Legacy, Inc. conducted a Supplemental Archaeological Inventory Survey (SAIS) of the Kona Commons property that included both the original 100 acres surveyed by PHRI in 1992 and an additional 10 acres extending off of its southwest corner in the area formerly occupied by the Swing Zone driving range (Figure 8) (McIntosh et al. 2014:1–5). This SAIS was undertaken to assist the Lili'uokalani Trust in planning for the future development of the area. The purpose of this survey was to assess the current state of the historic properties initially

identified during the 1992 survey and to determine if any additional historic properties existed on the property.

During the course of the Supplemental Archaeological Inventory Survey, a total of 11 archaeological sites (consisting of 21 component features) were identified within the project area. These sites consist primarily of small and crudely constructed features or modified natural features, including stone mounds, modified depressions, modified overhangs, C-shaped walls and alignments, small enclosures, a historic petroglyph, and a historic trail (Figure 9). Of the 11 sites identified, four had been previously recorded, while seven sites were newly discovered (McIntosh et al. 2014:75–77).

The 2014 survey found that approximately 51 acres of the Kona Commons property remained undeveloped, though portions of this undeveloped area have been disturbed by bulldozing and by landscaping associated with the former Swing Zone driving range (McIntosh et al. 2014:9–10). The surviving sites located within the survey area consisted primarily of small and crudely constructed features or modified natural features, including stone mounds, modified depressions, modified overhangs, C-shaped walls and alignments, small enclosures, lava excavations, a historic petroglyph, and a post-Contact trail (Figure 10). These features appear to have served a range of functions. Among these were temporary habitation, storage, travel, visual markers, possibly stone quarrying and/or crop cultivation (in the case of the lava excavations), communication (in the case of the historic petroglyph), and burial (McIntosh et al. 2014:75).

The results of the 2014 survey indicated that the majority of the sites located within the Kona Commons survey area dated from the pre-Contact period. Three sites, the Site 50-10-27-18502 modified depression, the Site 50-10-27-30211 petroglyph (which consists of two English letters, possibly representing personal initials), and the Site 50-10-27-30287 trail appeared to date from the historic or modern periods. The remainder of the sites possessed a more traditional style of construction, suggesting that they were pre-Contact in age (McIntosh et al. 2014:165).

Figure 8. Aerial photograph of the 2014 Pacific Legacy supplemental archaeological inventory survey area (McIntosh et al. 2014:Figure 3).

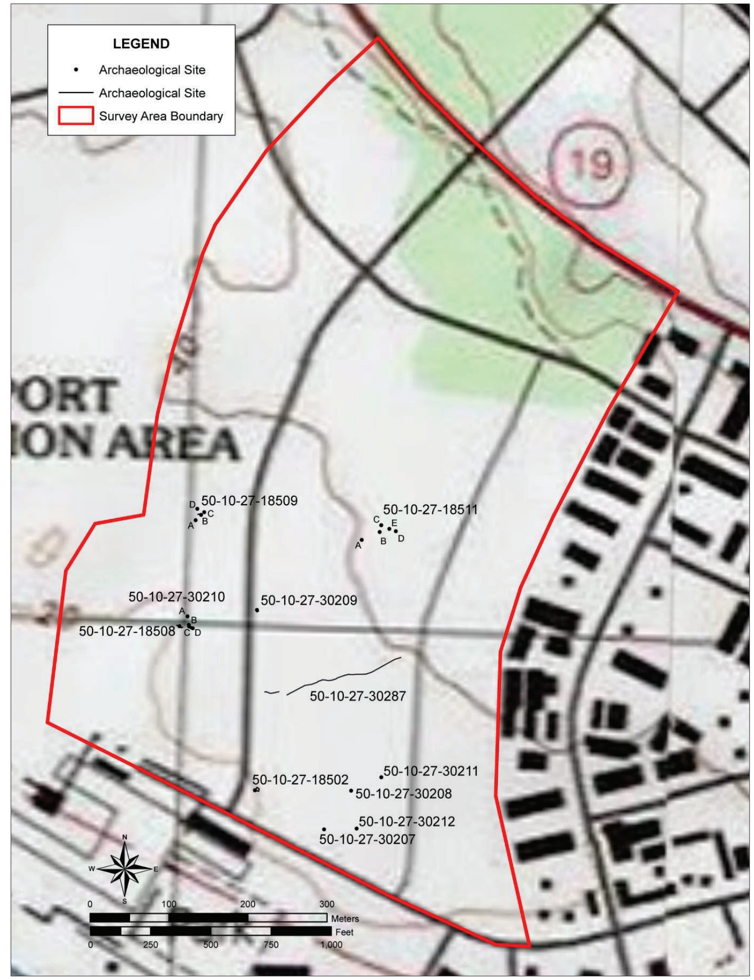

Figure 9. Relative locations of archaeological sites identified during the 2014 Pacific Legacy supplemental archaeological inventory survey (McIntosh et al. 2014:Figure 34).

Figure 10. The range of feature types identified during the 2014 Pacific Legacy supplemental archaeological inventory survey (McIntosh et al. 2014:Figure 79).

All of the sites identified during the 2014 supplemental archaeological inventory survey appeared to have been associated with relatively short-term activities. Among these activities was the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, and burial crypts. Small stone enclosures and walled shelters appeared to have been erected to serve as temporary camping areas. Low stone mounds were built to serve as markers. Rough excavations were created in the lava surface, either to supply stone for the construction of nearby surface features, or to open pits that could be filled with mulch and used to grow dryland crops.

The eleven historic properties identified during the supplemental archaeological inventory survey were assessed as to their significance under the Secretary of Interior's standards for listing on the National Register of Historic Places. All of the eleven sites were assessed as significant for their information content (Criterion D), while the burial feature at Site 50-10-27-18511 (Feature C) was also designated significant for its importance to Native Hawaiian culture (Criterion E). Given its significance as a repository for *iwi kupuna* (ancestral remains), the Site 50-10-27-18511, Feature C lava tube burial was recommended for preservation.

3.0 THE SITE 50-10-27-18511 BURIAL

The following section provides a description of Site 50-10-27-18511 with emphasis on the Feature C lava tube burial. This site description is taken from the report of the 2014 Supplemental Archaeological Inventory Survey of the Kona Commons property (McIntosh et al. 2014: 108–121). A more detailed description of all the features present at Site 50-10-27-18511 is provided in Appendix A.

3.1 Site 50-10-27-18511

Site 50-10-27-18511 consists of a complex of five separate features: a modified overhang (Feature A), a lava excavation (Feature B), a lava tube (Feature C), and two additional lava excavations (Feature D and Feature E). Features A through C were originally identified and recorded during the 1992 PHRI survey (O'Hare and Rosendahl 1993:A-10 to A-12), while the Feature D and Feature E lava excavations were identified and recorded during the 2014 Pacific Legacy survey (McIntosh et al. 2014:118–121).

Site 18511 is located approximately 50 meters *makai* of the present Target store and its adjoining parking lot. It is approximately 170 meters east of Makala Boulevard and approximately 85 meters west of Loloku Street (Figure 3). The site complex covers an area measuring approximately 44.4 meters in length (east to west) by approximately 18.8 meters in width (north to south). Site 18511 appears to be a multi-use complex whose component features served a range of functions. The Feature A overhang seems to have been modified for use as a temporary shelter, the Feature C lava tube served as a burial chamber, the Feature B lava excavation could have been utilized as either a planting area or a quarry, while the Feature D and E lava excavations seem most likely to represent areas where stone was quarried for use as building material.

3.2 Site 50-10-27-18511, Feature C

Site 50-10-27-18511, Feature C was originally recorded during the 1992 PHRI survey and described as a "burial cave" located "at the south base of a large *pāhoehoe* pressure ridge. It contains scattered human bones" (O'Hare and Rosendahl 1993:A-12). Feature C was recorded as measuring ca. 2.90 meters by ca. 2.28 meters, with a maximum ceiling height of ca. 0.82 meters (Figure 12). The PHRI feature description for Site 18511, Feature C further notes the following:

> Entrance is possible from a 0.80 m by 0.60 m hole in the ceiling of the cave. The cave opens up both east and west from the opening, but skeletal material is present only in the west half. The cave floor is c. 0.72 m below the ground surface at the opening, but only a narrow strip (1.60 m long and 0.25 m wide) down the middle of the cave has a ceiling high enough (0.72–0.80 m high) to allow further access. This strip down the middle consists of a natural depression that had been filled with

> pahoehoe gravel and cobbles to create a smooth floor. Most of the scattered bone was observed either in this depression, on top or among the cobbles, or on a bare bedrock shelf adjacent to and south of the depression. The skeletal material consists of scattered finger, toe, and foot bones, some vertebrae, and one incisor. The west end of this tube is blocked by roof fall. A glass patent medicine bottle was observed in this roof fall. Pahoehoe cobbles and boulders have also been stacked on the cave floor below the entrance. The stacked area (c. 0.30 m by 0.90 m) is flush with the side of the cave on the north and west sides, and elevated c. 0.20–0.30 m above the cave floor on the south and east sides. Some rocks in this stacked area and some of the rocks in the central depression were moved during the present survey in order to see if an articulated burial was present in the cave. Only a *puka* shell (*Conus sp.*) was discovered in the stones by the entrance. A few more scattered bones were observed under the depression fill, but no major bones (long bones or cranial material) were present. It seems probable that a burial was once present in the cave, possibly on top of the level central area of the cave, but was later removed. This might have taken place during historic times when the cave might have been used for temporary habitation. The cave is wet, with continual dripping from the roof, and the glass bottle found in the cave may be historic evidence for use of the cave as a water catchment area. The feature is unaltered-and in good condition. The glass bottle was collected, the *puka* shell was not, and the bones were left in place. (O'Hare and Rosendahl 1993:A-12)

During the 2014 Pacific Legacy survey, the Feature C modified lava tube was re-identified and found to be situated at the northern edge of the Site 18511 complex, approximately 8.8 meters north (11°) of the Feature B lava excavation. As noted during the 1992 survey, the relatively small lava tube that forms Feature C is located within and beneath a raised lava pressure ridge that forms a rough crescent-shaped *puʻu* (low hill). The tube entrances are located on the inner (northeastern) edge of this crescent (Figure 11).

The main entrance into the lava tube, labeled "Entrance B" on the original PHRI site map (Figure 12), measures approximately 0.80 meters by 0.60 meters. There are boulders roughly stacked around and partially blocking this entrance. The two other entrances marked on the PHRI map were too small to allow access into the tube.

The interior of the Feature C lava tube measures ca. 8.0+ meters in length by ca. 3.0 meters in width, with a maximum ceiling height of ca. 0.9 meters. The floor of the lava tube currently appears to be rough and unlevel due to rock fall. Within the lava tube, to the east (left) of the main entrance is a somewhat disturbed stone-filled terrace measuring ca. 0.3 meters in height.

Human skeletal remains were observed scattered within three concentrated areas inside the lava tube. Those areas that contain human bone fragments included an area on top of the stone terrace, an area within a natural channel of the floor surface just north of the terrace, and an area on a lava shelf just south of the natural channel. No long bones or cranial elements were present among the scatter of human skeletal remains. There were no other interior or exterior features noted within the lava tube. No artifacts or other cultural material was observed within Feature C. The glass medicine bottle noted in the original site description had been collected by the PHRI field crew, while the "*puka* shell" was not observed.

Given the lack of historic artifacts directly associated with the human remains, it seems likely that the Feature C burial dates from the pre-Contact period. It is unclear whether the bones and bone fragments present within the Feature C lava tube represent the remnants of a previously removed burial, as suggested in the PHRI report (O'Hare and Rosendahl 1993:A-12), or the very badly decayed remains of an in situ individual.

Figure 11. Oblique aerial photograph showing the relative location of the Site 50-10-27-18511, Feature C lava tube burial and the associated lava pressure ridge (view south) (from Bing Aerials, accessed 2017).

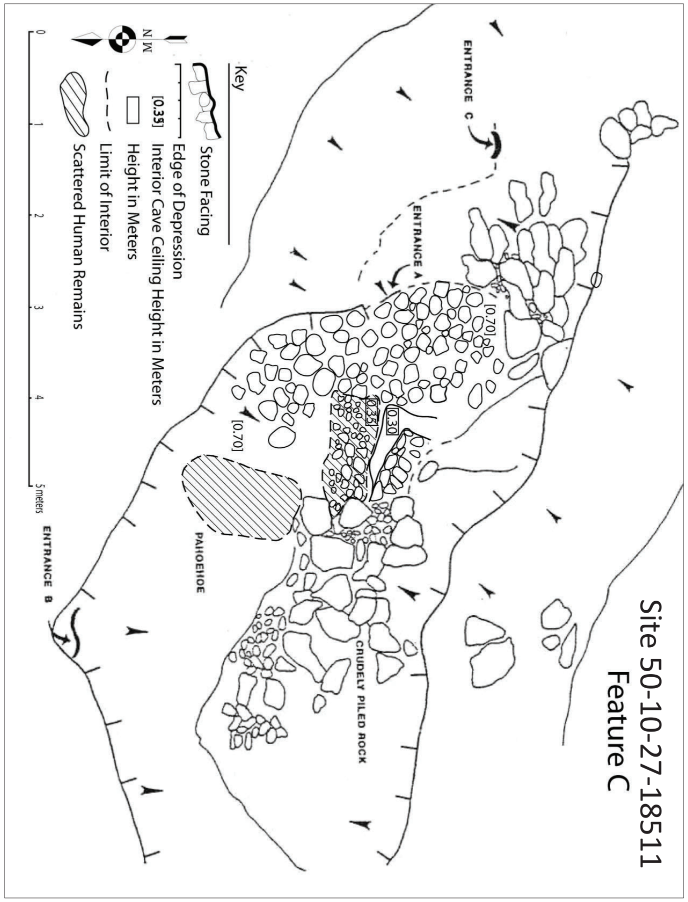

Figure 12. Plan view map of Site 50-10-27-18511, Feature C modified lava tube (base map from O'Hare and Rosendahl 1993:Figure A-5, with modifications from the 2014 Pacific Legacy survey, McIntosh et al. 2014:Figure 55).

4.0 PREVIOUS BURIAL TREATMENT PLAN

In 1993, a Burial Treatment Plan was developed by PHRI for the Liliʻuokalani Trust's Keahuolū lands (Maly and Rosendahl 1993). This plan addressed nine known and possible human burials. Eight of these burials had been discovered during a 1990 PHRI survey of 1,100 acres of Liliʻuokalani Trust lands located north and east of the Kona Commons property. The final burial considered in this BTP was the Site 50-10-27-18511 lava tube burial identified during the 1992 PHRI survey of the 100-acre Kona Commons property.

The 1993 Burial Treatment Plan did not address specific burials in detail, but recommended that all confirmed and potential burials be preserved in place (Maly and Rosendahl 1993:4). This Burial Treatment Plan appears to have been considered by the Hawaiʻi Island Burial Council during its meeting on November 3, 1993. It was apparently approved by the Council with an amendment to provide 30-foot protective buffers around the sites during construction, instead of the five-meter buffers originally recommended in the BTP (Belt Collins Hawaiʻi 1993). It also appears that the BTP was approved by the State Historic Preservation Division in September of 2002 (Belt Collins Hawaiʻi 2008). A 30-foot-wide buffer was established around Site 50-10-27-18511, Feature C and still remains intact with orange construction fencing encircling the burial site.

In 2008, a Final Environmental Assessment (EA) and Finding of No Significant Impact report was prepared by Belt Collins Hawaiʻi (on behalf of the Liliʻuokalani Trust) for the proposed Kona Commons project. This EA addressed the development of 67 acres within the Kona Commons property. The only archaeological site within the property that was mentioned in the EA was the Site 50-10-27-18511, Feature C lava tube burial. The AIS indicated that, prior to any land disturbance activities, a 30-foot-wide buffer would be established around Site 18511, Feature C, "in accordance with the November 1993 burial treatment plan recommended by the Hawaiʻi Island Burial Council and subsequently approved by the State Historic Preservation Division in September 2002" (Belt Collins Hawaiʻi 2008).

4.1 Ground Disturbance in the Surrounding Area

Following the 2008 Final Environmental Assessment, a 30-foot-wide buffer was established around Site 18511. The outer boundary of this buffer was marked with highly visible orange construction fencing to protect the burial area. During the subsequent development of portions of the Kona Commons property, some ground-disturbing activities took place in areas north and west of the Site 18511 burial. As can be seen in Figure 13, a construction staging area was established north of Site 18511 (immediately south of the present Target store parking area) and an open area of lava west and southwest of the site was utilized as a gravel quarry.

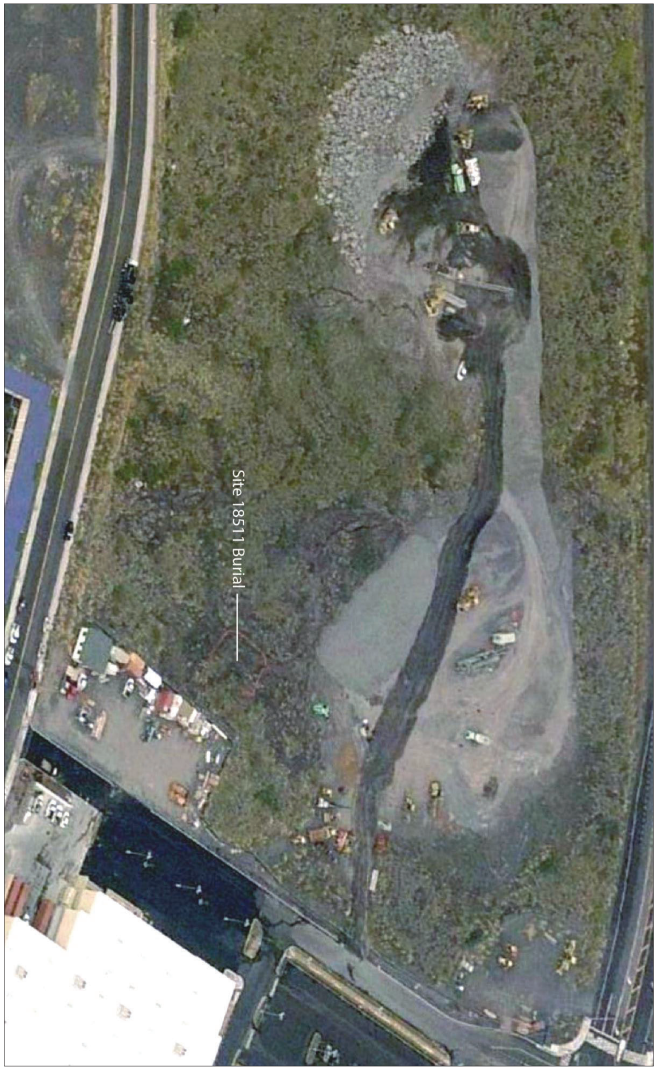

Figure 13. Previous ground-disturbing activities conducted north and west of the Site 18511, Feature C burial. Orange construction fencing is visible surrounding the 30-foot site buffer (view west) (Oblique aerial photograph from Bing Aerials, date unknown).

5.0 CULTURAL DESCENDANTS

In the preparation of this Burial Treatment Plan, a good faith effort has been made to identify all possible lineal or cultural descendants who might possess connections to the skeletal remains present within the Kona Commons property. This was done in accordance with the requirements of HAR §13-300-33(b)(1).

The search for lineal and cultural descendants involved research of relevant land conveyance and other historic documents (HAR §13-300-33[b][1][a]); inquiry of individuals who might possess knowledge of families possibly affiliated with the remains (HAR §13-300-33[b][1][b]); and the publication of notices in newspapers seeking individuals who might claim lineal or cultural association with the burial (HAR §13-300-33[b][1][c]). Individuals identified as descendants were consulted in the preparation of this Burial Treatment Plan.

5.1 Lineal and Cultural Descendants

With respect to Native Hawaiian remains, Hawai'i Administrative Rule §13-300-2 defines a "lineal descendant" as an individual who has established to the satisfaction of the Burial Council that they possess a direct or collateral genealogical connection to certain Native Hawaiian skeletal remains.

The category of "cultural descendant" is more broadly defined as being an individual recognized by the Burial Council as having established genealogical connections to Native Hawaiian ancestors who once resided in or are buried in (or both) the same *ahupua'a* or district in which the remains are located or originated from.

5.2 Ethnohistoric Research

As part of the attempt to locate possible lineal or cultural descendants who might possess connections to the skeletal remains present within the Kona Commons property, a search was made of ethnohistorical sources to identify individuals and families who were historically associated with the area. An examination was made of land conveyance documents, including both Land Court Awards and Boundary Commission records. The following section includes a discussion of the information obtained from these documents and a list of historic individuals known to be associated with the *ahupua'a*. This list may contain individuals whose descendants may qualify as lineal or cultural descendants.

5.2.1 The Māhele 'Āina

As previously mentioned (see Section 2.2.2), at the time of the Māhele 'Āina, the majority of the lands within the *ahupua'a* of Keahuolū were awarded to the *ali'i wahine* (chiefess) Analea (Ane) Keohokālole under Land Commission Award 8452: Apana 12 (Royal Patent 6851) (Wong Smith 1990:B3). Chiefess Ane Keohokālole was born in Kailua-Kona in 1816, the daughter of *ali'i kāne* (chief) ʻAikanaka and the *aliʻi wahine* (chiefess) Kamaʻeokalani. She was named Keohokālole, which means straight hair, by Kaʻahumanu because of her father's straight hair. Her fraternal great-grandfathers were Kameʻeiamoku and Keawe-a-Heulu, two of the five major war chiefs who assisted Kamehameha I in conquering and uniting the islands (Kelly 1983:31).

Ane Keohokālole served as a member of the House of Nobles from 1841 to 1847, and on the King's Privy Council from 1846 to 1847. In 1833, Ane Keohokālole married her first cousin, Caesar Kaluaiku Kamakaʻehukai Kahana Keola Kapaʻakea. Just as her *kūpuna* (ancestors) had played an important role in helping Kamehameha I establish the kingdom of Hawaiʻi, Ane Keohokālole's offspring were to play a significant role in its continuation. Among the many children born to Ane Keohokālole and her husband Kapaʻakea were David Laʻamea Kamanakapuʻu Mahinulani Nalaiaehuokalani Lumialani Kalākaua, who became the 7th king of Hawaiʻi, and Lydia Liliʻu Loloku Walania Wewehi Kamakaʻehā (more commonly known by her royal name of Liliʻuokalani) who succeeded her brother as its 8th and final ruler. Ane Keohokālole's youngest daughter, Miriam Kapili Kekāuluohi Likelike, was herself the mother of Princess Victoria Kaʻiulani Kalaninuiahilapalapa Kawekiu i Lunalilo Cleghorn, who was proclaimed heir apparent to the throne in 1891 and would have become the 9th ruler if the kingdom had not been overthrown in 1893.

Chiefess Keohokālole inherited extensive tracts of land from her paternal grandmother Keohohiwa and great uncle Naihe. Land court documents indicate that the chiefess held two walled house lots "from very ancient times" along the shore of Keahuolū. At her death, the lands of Keahuolū passed on to her heir, Liliʻuokalani.

Although Ane Keohokālole was given title to the entire *ahupuaʻa*, there were existing tenants who resided and cultivated land within Keahuolū. Some of these filed claims with The Board of Commissioners to Quiet Land Titles and were awarded *kuleana* lands (Wong Smith 1990: B-4, Native Register). A total of six smaller Land Commission Award claims were granted within the *ahupuaʻa* of Keahuolū:

L.C.A. 7351: to Kahuanui
L.C.A. 8012: to Apiki
L.C.A. 10198: to Hailewalewa
L.C.A. 10303: to Maa
L.C.A. 10345: to Naalualu
L.C.A. 11071: to Aki

Five of these *kuleana* Land Commission Award claims appear on County Tax Maps as being located along the boundary with the *ahupuaʻa* of Lanihau just *mauka* of where it is crossed by the Old Mauka Government Road (now the Māmalahoa Highway). This area appears to correspond to the settlement of Maili, which is described in Boundary Commission testimony as, "an old village at Puu o Kaliu a palipali ahua [precipitous mound or hillock], where houses used to stand" (Boundary Commission Testimony 1:355). Testimony accompanying these land claims (both Native and Foreign Testimony) indicates that all of the *kuleana* parcels contained one or more cultivated *kīhāpai* (small gardens or fields, Pukui and Elbert 1971:136).

The crops mentioned in testimonies related to these claims include both *kalo* (taro) and *ʻuala* (sweet potatoes) (Wong Smith 1990: B-4). At the time of the Māhele, coffee was planted in one of the *kalo* patches in Land Commission Award parcel 7351.

No *kuleana* claims were awarded within the coastal portions of Keahuolū. This appears to reflect the general decline in the local population and the gradual abandonment of the coastal settlements. That is not to say that the coastal regions of Keahuolū were completely deserted by the late 1840s. Not all Hawaiian families made *kuleana* claims (in fact, the percentage that did so was relatively small), and it is likely that many of the surviving coastal residents continued to dwell in their ancestral homesteads. It is also probable that many families living along the more barren stretches of the coast shifted their place of residence to more fertile areas, such as the coconut grove at Pawai Bay and Makāʻeo, where a small community survived well into the historic period. Given the relatively barren and inhospitable nature of the more interior areas of the *kula* zone, it is not surprising that there were no *kuleana* claims made for lands located within this area.

Ethnohistoric research indicates that no individual Land Court Award claims were made for lands located specifically within the limits of the Kona Commons property. This, combined with the lack of any archaeological structural remains that would suggest permanent habitation in the area, suggests that the barren *pāhoehoe* plain currently occupied by the Kona Commons property was not utilized as an area of Hawaiian settlement during the pre-Contact or early post-Contact periods. It is likely that the human remains found at Site 50-10-27-18511 belong to an individual who lived either in one of the settlements along the coast or further inland where older lava flows offered deeper soil deposits suitable for the cultivation of crops.

There appears to be some evidence to suggest that the *konohiki* (land manager) for the *ahupuaʻa* of Keahuolū at the time of the Māhele was named Papaula (Native Testimony Volume 10:234). In his testimony in support of Naalualu's claim for Land Commission Award Helu (parcel) 10345, Kuia swore that, "I have known in the same way as Mahu has related here except that at the time J. Fuller surveyed this section 2 claim of Nahaalualu, three of Papaula's fields were discovered here and another two fields were in Kahuenui's claim all under Papaula the konohiki." (Native Testimony Volume 10:234, translation from http://www.avakonohiki.org/hawaii-land-documents.html).

5.2.2 Boundary Commission

The Board of Commissioners for Boundaries was established by the legislature of the Kingdom of Hawaiʻi in 1862 to formalize the boundaries of large land divisions, such as *ahupuaʻa*, which had not been accurately surveyed at the time of the Māhele. As part of this process, the Board collected detailed testimonies from older native residents called on to relate what they knew of the boundaries of the various *ahupuaʻa*. The collected testimonies of local witnesses and the resulting Boundary Certificates are preserved in the Boundary Commission Records and are accessible on microfilm at the Hawaiʻi State Archives (Boundary Commission).

An application for the judication of the boundaries of the *ahupuaʻa* of Keahuolū was made by John Owen Dominis, the husband of Queen Liliʻuokalani. Testimony regarding the boundaries of the *ahupua'a* of Keahuolū was heard by the Commission on August 12, 1873 at the Court House in Kailua-Kona (an annotation on the Boundary Certificate for Keahuolū indicates that the accompanying testimony was included in Folio 354, Book A). A number of native residents gave testimony as to the boundaries of the *ahupua'a* of Keahuolū, and its adjacent *ahupua'a*. Several of these individuals were *kama'āina* of Keahuolū.

5.2.3 Residents of Keahuolū in the 1800s

Land Commission Award documents and Boundary Commission testimonies provide us with the names of several individuals who appear to have been living within (or knowledgeable about) the *ahupua'a* of Keahuolū during the years between roughly 1840 and 1880. An annotated list of these names is included below:

Aki: Claimed Land Commission Award Helu 11071 in the *'ili* of Pauaaiki in Keahuolū. Aki appears to have received these lands from Kaea, Nahaalualu, and Kalekahi in the time of Kamehameha I.

Apiki: Claimed Land Commission Award Helu 8012 in Keahuolū. He was given the land by the *konohiki* before the death of Governor Kuakini.

Hai: In his testimony regarding LCA 8012, Mahu stated that Apiki's *kalo* (taro) patches were bounded on its *mauka* (upslope) side by Hai's land.

Hailewalewa: Claimed Land Commission Award Helu 10198 in the *'ili* of Ulelele in Keahuolū. The land was given to him by his parents.

Haino: In his testimony regarding LCA 8012, Mahu stated that Apiki's *'uala* (sweet potato) land was bounded on its *mauka* (upslope) side by Haino's land.

Kahili: In his testimony regarding LCA 8012, Mahu stated that Apiki's *'uala* (sweet potato) land was bounded on its *makai* (downslope) side by Kahili's land.

Kahookohukaneole: In his testimony regarding LCA 7351, Papaula stated that Kahuanui's land was bounded on its *mauka* (upslope) side by the land of Kahookohukaneole.

Kahuanui: Claimed Land Commission Award Helu 7351 in Keahuolū. He received the land from his brother in 1846. Kahuanui gave testimony before the Boundary Commission regarding the boundaries of the *ahupua'a* of Keahuolū. In his testimony he stated that he was an adult male who had lived his entire life in Kealakehe and knew the boundaries between Keahuolū and Kealakehe.

Kamaha: Father of Mahu. Mahu noted in his testimony before the Boundary Commission that, "my parents who were kamaainas of the land [Keahuolū] told me the boundaries" (Boundary Commission Vol. A, No. 1:358). Mahu also stated that, "My Father's name was Kamaha and my Mother's name was Lorna" (Boundary Commission Vol. A, No. 1:358).

Kapea: A male resident of the *ahupua'a* of Moeauoa located south of Lanihau who gave testimony before the Boundary Commission regarding the boundaries of the *ahupua'a* of Keahuolū.

Kealakai: A male resident of Keahuolū who was born within the *ahupua'a* (possibly around 1810) and lived there most of his life. Kealakai gave testimony before the Boundary Commission regarding the boundaries of the *ahupua'a* of Keahuolū. He learned the *makai* boundaries of the *ahupua'a* from his *makua kāne hānai* (his foster father).

Kuia: Gave testimony for Nahaalualu's land claim (LCA 10345).

Lorna: Mother of Mahu. Mahu noted in his testimony before the Boundary Commission

that, "my parents who were kamaainas of the land [Keahuolū] told me the boundaries" (Boundary Commission Vol. A, No. 1:358). Mahu also stated that, "My Father's name was Kamaha and my Mother's name was Lorna" (Boundary Commission Vol. A, No. 1:358).

Maa: Claimed Land Commission Award Helu 10303 in the *'ili* of Maili in Keahuolū. Maa's grandparents received the land at the time of Kamehameha I.

Mahu: Gave testimony for Apiki's land claim (LCA 8012), Hailewalewa's land claim (LCA 10198), and Maa's land claim (LCA 10303). Mahu also gave testimony before the Boundary Commission regarding the boundaries of the *ahupua'a* of Keahuolū. In that testimony he indicated that he was a male resident of the land of Keahuolū who was born at the time of the birth of Kamehameha II [circa 1779]. Mahu noted that, "my parents who were kamaainas of the land told me the boundaries" (Boundary Commission Vol. A, No. 1:358). He also stated that, "My Father's name was Kamaha and my Mother's name was Lorna" (Boundary Commission Vol. A, No. 1:358).

Naalualu (name as shown on the land claim, it appears as **Nahaalualu** in the testimony): Claimed Land Commission Award Helu 10345 in the *'ili* of Puuokaliu in Keahuolū. In his testimony regarding LCA 7351, Papaula stated that Kahuanui's land was bounded on its *makai* (downslope) side by the land of Nahaalualu.

Papaula: In his testimony regarding LCA 8012, Mahu stated that Apiki's *kalo* (taro) patches were bounded on its *makai* (downslope) side by Papaula's land. Papaula also provided supporting testimony for Kahuanui's land claim (LCA 7351). There is some suggestion that Papaula may have been the *konohiki* (land manager) of the *ahupua'a* of Keahuolū at the time of the Māhele. In his testimony in support of Naalualu's claim for Land Commission Award Helu (parcel) 10345, Kuia swore that, "I have known in the same way as Mahu has related here except that at the time J. Fuller surveyed this section 2 claim of Nahaalualu, three of Papaula's fields were discovered here and another two fields were in Kahuenui's claim all under Papaula the konohiki" (Native Testimony Volume 10:234, translation from http://www.avakonohiki.org/hawaii-land-documents.html).

J. F. Waiau: A male resident of Lanihauiki who was born at Honuaula in 1819, "at the time of the fight of Keakuaokalani" (the battle of Kuamo'o). Waiau gave testimony before the Boundary Commission regarding the boundaries of the *ahupua'a* of Keahuolū.

Although none of these individuals can be directly linked to the lands presently covered by the 100-acre Kona Commons property or to the Site 18511 burial, they all appear to have been in some way associated with the *ahupua'a* of Keahuolū and their descendants might be considered cultural descendants of the area.

5.3 Identified Cultural Descendants

In its role as land manager and long-term steward of the Keahuolū lands, the Lili'uokalani Trust has developed close connections with several individuals and *'ohana* (families) who possess a genealogical connection to the *ahupua'a* of Keahuolū and whose ancestors lived within it. Several of these *kama'āina* have been recognized by the State Historic Preservation Division and the Hawai'i Island Burial Council as cultural descendants of the area.

At present, no individuals have been recognized by the Burial Council as lineal descendants of *iwi kūpuna* present at Site 50-10-27-18511.

The Trust has sought the *mana*ʻ*o* (thoughts and opinions) of those individuals recognized by the State Historic Preservation Division and the Hawaiʻi Island Burial Council as cultural descendants of Keahuolū in resolving previous burial issues, as well as in addressing cultural issues related to such endeavors as the development of the 25-acre Keahuolū Historic Preserve Area and Interpretive Center located a short distance *mauka* of the Kona Commons property.

The individuals and ʻ*ohana* recognized as cultural descendants of the *ahupua*ʻ*a* of Keahuolū are listed below:

The Lui Family
- Ms. Nicole Kealohaokalani Lui
- Mr. Aaron Joseph Lui

Mr. Aka M. Mahi (deceased)
Ms. Ruby Pua Keanaaina-McDonald (deceased)
Mr. Ronald S. K. Mitchell
Ms. Hannah Wahinemaikaiokaahumanukeliiulananioleokalama Kane Reeves
The Keohokālole Family
- Ms. Emma Emalia Keohokālole
- Mr. Dennis Kaimi Keohokālole
- Mr. Adrian Kealoha Keohokālole
- Mr. Joseph Moses Keohokālole Jr.

5.3.1 Recognition of Cultural Descendants

In 2009 a Burial Treatment Plan was prepared for burial sites located within and adjacent to the alignment of the Ane Keohokālole Highway situated inland of the Kona Commons property (McDermott and Tulchin 2009). At that time several individuals and families were formally recognized by the Hawaiʻi Island Burial Council as cultural descendants of the identified burials located within the Keahuolū portion of the highway corridor.

> Ms. Nicole K. Lui was recognized by the HIBC as a cultural descendent of the project's previously identified burials (SIHP # 50-10-28-13387, -26831 & -26836) at the HIBC's 20 August 2009 meeting. At the HIBC's 17 September 2009 meeting additional cultural descendents of the project's burials were recognized by the HIBC, including Mr. Aka Mahi, Ms. Ruby McDonald, and Ms. Hannah Reeves. Additionally, at the HIBC's 15 October 2009 meeting, the Keohokālole Family was recognized as cultural descendents to the project's previously identified burials. (McDermott and Tulchin 2009:53)

At the June 17, 2010 meeting of the Hawaiʻi Island Burial Council, Mr. Aaron Joseph Lui and Mr. Ronald S. K. Mitchell were recognized as cultural descendants to identified Native Hawaiian burials in the *ahupua*ʻ*a* of Keahuolū.

5.4 Additional Consulted Parties

Additional individuals who are not formally recognized by SHPD as cultural descendants of the Native Hawaiian burials within Keahuolū, but who belong to families with genealogical connections to the *ahupua*ʻ*a*, were included in discussions regarding the Site 50-10-27-18511 lava tube burial. These individuals were consulted during the preparation of the present Burial Treatment Plan:

- Ms. Agnes Pelekane Kaelemakule Lui
- Mr. Raymond "Joe" K. Lui
- Ms. Francine K. Lui
- Ms. Paulette Kaʻanohi Kaleikini
- Mr. Jim Medeiros

5.5 Public Notice

Efforts were also made to identify and notify any additional individuals and families who might possess lineal or cultural genealogical connections to the skeletal remains at Site 50-10-27-18511. As required by Hawaiʻi Administrative Rule §13-300-33 (b)(1)(C), notices were placed in three island newspapers requesting information from descendants of families from the Keahuolū area or persons with information about families from the area. The newspapers and publication dates are as follows:

Honolulu Star Advertiser	18 to 21 January 2016
*West Hawai*ʻ*i Today*	18 to 21 January 2016
Ka Wai Ola	January 2016

Copies of the original public notices along with the affidavit of publication (as per HAR §13-300-33[b][1][C]) are presented in Appendix C. A text of the public notice is included below.

PUBLIC NOTICE

> Pacific Legacy is preparing a Burial Treatment Plan for Liliʻuokalani Trust lands located *makai* of Queen Kaʻahumanu Highway, in the *ahupua*ʻ*a* of Keahuolū, North Kona, Hawaiʻi (TMK (3) 7-4-025:015). This plan addresses the permanent preservation and protection in place of identified human remains in accordance with Chapter 6E, Section 43. The burial is probably Native Hawaiian, based on location, context, and association. Descendants of families from the area or persons with information of the area are requested to participate in the development of the Burial Treatment Plan. Please contact Herbert Poepoe, State Historic Preservation Division (808-933-7650) or Rowland Reeve, Pacific Legacy (808-351-9560) within 30 days to participate.

Respondents to these public notifications who wished to be identified as recognized lineal or cultural descendants were required by law to demonstrate a genealogical connection by providing relevant information to the Department of Land and Natural Resources State Historic Preservation Division, pursuant to Hawai‘i Administrative Rule §13-300-35 (Recognition of Lineal and Cultural Descendants).

No responses were received to any of the Public Notices.

There remains the possibility that additional lineal and/or cultural descendants will come forward at some time in the future. Consultations with future recognized lineal and/or cultural descendants will take place after this Burial Treatment Plan has been accepted and approved.

5.6 Descendant Consultation

A series of site visits and consultation meetings were held with the recognized cultural descendants of the *ahupua‘a* of Keahuolū and additional concerned parties so that their input could be incorporated into the development of the present Burial Treatment Plan. The discussions that took place during these site visits and consultation meetings are detailed in Appendix D. The proposed burial treatments presented in this Burial Treatment Plan (see Section 7.0) were developed through these discussions and are based primarily upon the *mana‘o* (thoughts and ideas) of the consulted parties.

6.0 PROPOSED DEVELOPMENT WITHIN THE KONA COMMONS PARCEL

As previously mentioned (see Section 1.1), the more inland portion of the 100-acre Kona Commons property has been extensively developed for commercial use. This development consists of retail and warehouse structures with their associated parking areas (Figure 3). The Lili‘uokalani Trust is presently planning to develop the remaining undeveloped portion of the Kona Commons property.

The Lili‘uokalani Trust is proposing the development, enhancement and refinement of approximately 67.2 acres of land located within and adjacent to the Kona Commons property. This project is referred to as the Makalapua Project District.

6.1 Project Location

The proposed Makalapua Project District is located northwest of Kailua Village and *makai* (southwest) of the existing Kona Commons Shopping Center. It includes Tax Map Key (TMK) parcels (3) 7-4-008:002 (por.), (3) 7-4-025:001, 002, 003, 005, 015, 021, 999 (por.), and (3) 7-4-010:009, 010.

The project site is bordered to the north by the existing Kona Commons Shopping Center, to the northwest by vacant lands, to the east by the existing Kona Industrial Subdivision (KIS), and to the south by the County’s Kailua Park (also known as the Old Kona Airport State Recreation Area) (Figure 14). The project site is currently vacant and undeveloped with the exception of 1) a former recreational sports facility (the Swing Zone) located on Makala Boulevard, 2) a BMW car dealership on Loloku Street, 3) temporary storage and staging areas on Loloku Street, and 4) light industrial warehouses on Kaiwi Street.

The proposed Makalapua Project District covers the presently undeveloped property within which the Site 50-10-27-18511, Feature C lava tube burial is located. Planning of the Project District has included a detailed plan for the preservation and long-term protection of the site.

6.2 Project Description

The Makalapua Project District will include residential, hotel, retail, commercial, office, and civic/community uses. The Project District will be organized around an interconnected, pedestrian-oriented street network where homes, businesses, and entertainment are intermingled to provide a diverse experience for residents and visitors.

Figure 14. Location of the proposed Makalapua Project District.

The proposed mixed-use project will include approximately 300 residential units; 220 hotel rooms; 50,000 square feet of community facilities/civic offerings; 470,000 square feet of commercial use (retail, employment); and a variety of open space features (Figure 15).

The proposed Makalapua Project District responds to the need to provide housing and economic growth opportunities for the County of Hawai'i's growing population. The project will serve to meet the varied housing and commercial needs of the region at an attractive growth location adjacent to Kailua-Kona. As envisioned by the Kona Community Development Plan, the project will serve as a natural extension of Kailua Village.

As can be seen in Figure 15, the Site 50-10-27-18511, Feature C lava tube burial is situated in an area designated for commercial development. In planning the Makalapua Project District, Lili'uokalani Trust has taken into consideration the long-term preservation of the Site 18511 burial. At the request of cultural descendants, they have incorporated an undeveloped buffer to surround not only the burial site, but also the full extent of the natural *pu'u* (low lava hill) that encompasses it. The outer perimeter of this buffer zone will be marked by a protective stone wall to prevent unauthorized access to the burial area. The details of these protective measures are presented in Section 7.0.

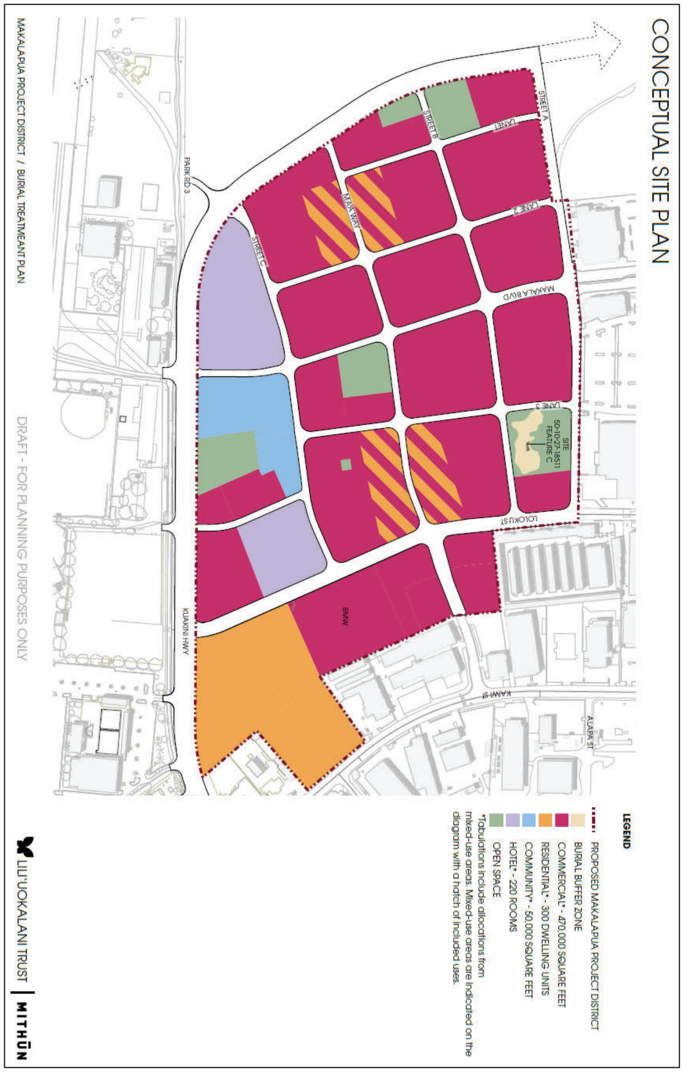

Figure 15. Proposed land use within the Makalapua Project District.

7.0 BURIAL TREATMENT

As *kahu* (caretaker) of the *ahupua'a* of Keahuolū, it is the Lili'uokalani Trust's desire and intention to do what is *pono* (proper) in protecting and preserving the *iwi kupuna* present on their lands. This Burial Treatment Plan is intended to facilitate the best method of caring for the Native Hawaiian burial located within the Kona Commons property. The specific treatment recommendations for the Site 50-10-27-18511, Feature C lava tube burial were developed in consultation with the recognized cultural descendants of the *ahupua'a* of Keahuolū and other concerned individuals (see Appendix D). The following section includes specific short- and long-term treatment recommendations for the preservation of the Site 18511 burial.

7.1 Proposed Burial Treatments

It is the intention of the Lili'uokalani Trust to preserve in place the known human burial located within the lava tube at Site 50-10-27-18511, Feature C. Since the site is slated for preservation, no further efforts will be made to investigate or otherwise examine the remains. This is in keeping with Hawai'i Administrative Rule §13-300-31(h), which states that, "where a previously identified burial site is proposed to be preserved in place, no osteological or disturbing archaeological investigation shall occur, unless authorized by the department [SHPD]."

In order to ensure that the Site 18511 burial is not inadvertently impacted during activities associated with the development and use of the surrounding area, certain mitigation procedures will be implemented. These involve both short-term measures instituted to protect the burial site during any development of the Kona Commons property, as well as long-term measures to properly manage and preserve the burial site.

The central component of this mitigation strategy is the establishment of a protective buffer that will surround both the burial chamber and the overlying lava pressure ridge. This will be a permanent buffer that will remain undeveloped, with the possible exception of the planting of native vegetation to serve as a visual screen.

7.2 Short-Term Protective Measures

The following interim protective measures will be implemented to protect the Site 18511 burial during activities associated with the development of the Makalapua Project District. As described in Section 6.0, these development activities will include the construction of commercial buildings, parking, roadways, sidewalks, and landscaped areas.

7.2.1 Buffer Zone

In order to establish the boundaries of the buffer zone surrounding the Site 18511 burial, the location and extent of both the Feature C lava tube and the low lava *pu'u* that covers it were mapped using a Trimble Geo7X Global Navigational Satellite System (GNSS) unit. The limits of the subsurface lava tube, its entrances, and the lava pressure ridge within which it rests, as well as bulldozed areas located adjacent to them, are shown in Figure 16 and Figure 17. These figures also show the limits of the existing 30-foot buffer fence established by the previous Burial Treatment Plan.

At the request of cultural descendants and other consulting individuals, the perimeter of the proposed buffer zone was extended to encompass the entire extent of the *pu'u* that contains the lava tube (Figure 18). The designated buffer area measures approximately 62.5 meters (ca. 205 feet) in length (northwest to southeast) by 37 meters (ca. 120 feet) in width (northeast to southwest). No construction activity will be allowed to occur within this buffer zone.

The boundary of the buffer zone was designed to follow the outer edge of the roughly crescent-shaped lava pressure ridge along its eastern, western, and southern sides. Along its northern side, the outer edge of the buffer zone cuts straight across from one tip of the crescent to the other, including the level area of lava partially enclosed by the *pu'u*. This level area, which fronts the lava tube opening, will serve as an entryway to the burial site and provide adequate space for individuals to approach it without the need to climb atop the *pu'u* itself.

7.2.2 Protective Fencing

Bright orange plastic fencing has been erected surrounding the Site 18511 burial, and this will be expanded to include the buffer zone and maintained prior to the construction of the surrounding wall (see Section 7.3.2). This fencing will continue to serve as a highly visible temporary barrier to alert people in the area to the presence of the burial until long-term protective measures are put in place (Section 7.3).

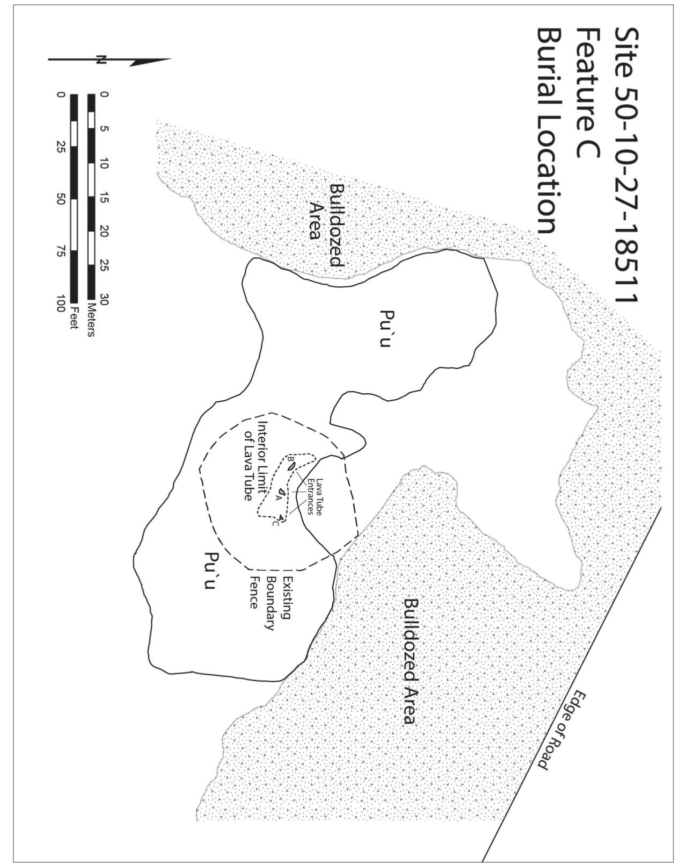

Figure 16. Global Navigational Satellite System map of the Site 50-10-27-18511, Feature C lava tube and associated lava pressure ridge, including the existing boundary fence and adjacent bulldozed areas.

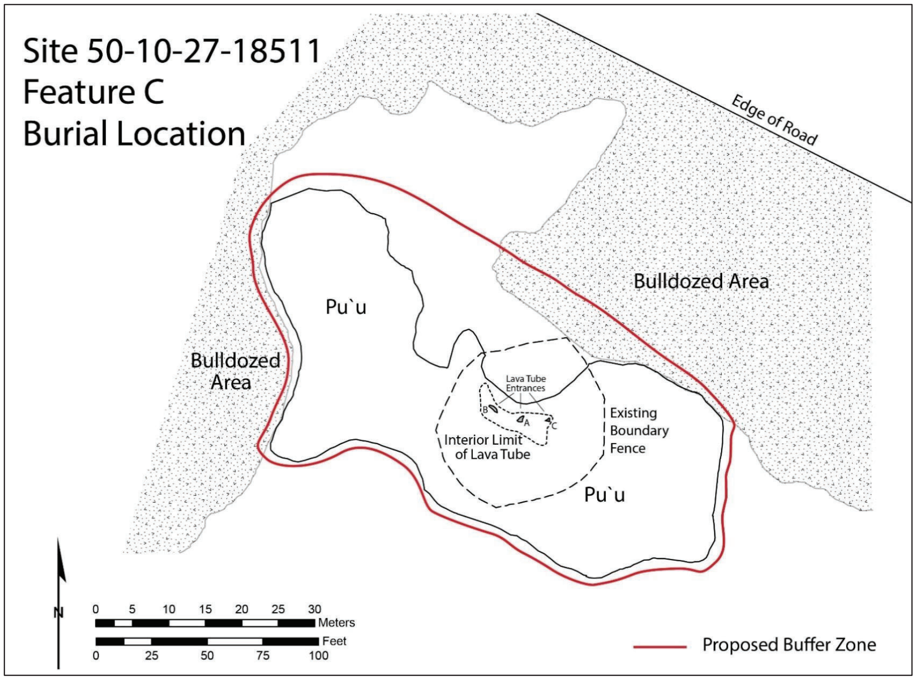

Figure 18. Global Navigational Satellite System map of the Site 50-10-27-18511, Feature C lava tube and associated lava pressure ridge showing the limits of the proposed buffer zone.

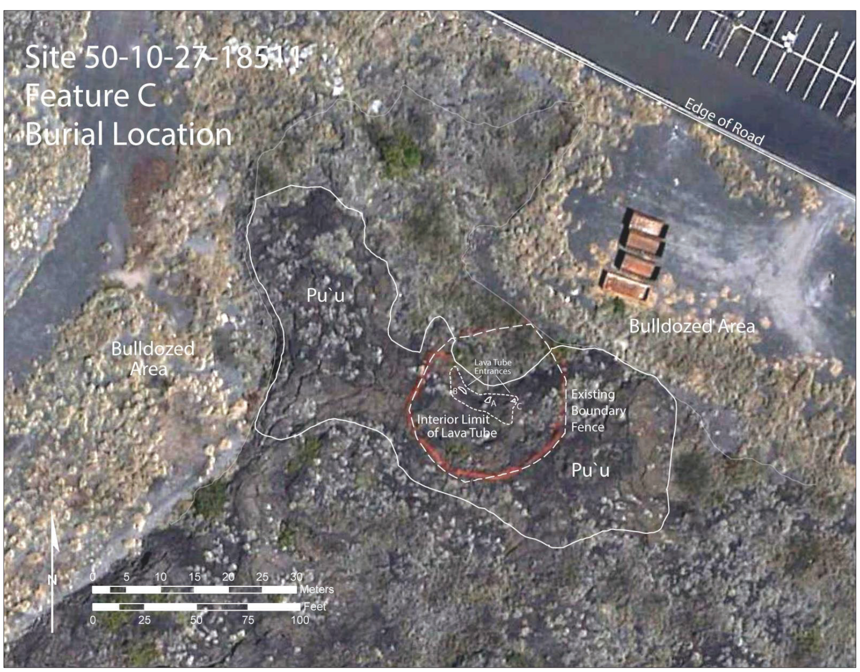

Figure 17. Global Navigational Satellite System map of the Site 50-10-27-18511, Feature C lava tube and associated lava pressure ridge overlaid atop an aerial photograph of the site (background aerial from Google Earth, accessed 2016).

7.2.3 Construction Plans

The location of the Site 18511 burial and its buffer zone will be accurately plotted on all grading and construction plans utilized by construction personnel prior to the start of any land-altering activities associated with the development of the Makalapua Project District.

7.2.4 Archaeological and Cultural Monitoring

Both a trained archaeological monitor and a cultural monitor will be on site during any ground-disturbing activities conducted in the vicinity of the Site 18511 burial. The cultural monitor will preferably be a cultural descendant of the area. Prior to the undertaking of any construction activities in the vicinity of the burial, all construction crew members and equipment operators involved in the construction will be given a cultural and archaeological awareness briefing. This briefing will introduce construction personnel to the general history of the area as well as to the location and importance of the Site 18511 burial. Construction crews will also be instructed as to the proper protocols to be followed when working around the burial, the proper procedures to follow in order to avoid adversely impacting the site, and the proper procedures to follow should they encounter previously unidentified human remains.

7.3 Long-Term Protective Measures

7.3.1 Sealing of the Lava Tube

Since the remains at the Site 18511, Feature C lava tube will be left *in situ*, the Liliʻuokalani Trust, following the expressed wishes of the cultural descendants and other consulted individuals, intends to seal the entrances to the tube. The tube openings will be sealed with locally procured stones mortared together with cement. The mortar may be stained to blend in with the stones and make it less visible.

7.3.2 Enclosing Wall Around the Site

A low wall of stacked stones mortared together with cement will be constructed to completely encircle the burial site. This wall will mark the outer perimeter of the designated protective buffer zone. Measuring approximately 2½ feet in height, the wall will serve as a visual indication of the location of the burial and act to deter access into the area. The wall will be built of locally available stone and will be erected in close consultation with cultural descendants prior to the commencement of construction activities in the immediate vicinity of the burial location.

A narrow opening (approximately four feet in width) will be set within the northern portion of the enclosing wall to allow access into the site area for maintenance and for visitation by recognized cultural descendants and other individuals identified by the Liliʻuokalani Trust. Cultural descendants and other consulted individuals felt that a gate should not be placed at this opening; instead a simple metal chain or rope will be strung across it to discourage access by unauthorized individuals, but allow entry into the burial area when appropriate.

7.3.3 Vegetation

Existing invasive vegetation will be cleared from within the designated buffer area surrounding the burial. At present this non-native vegetation includes fountain grass (*Pennisetum setaceum*), klu (*Acacia farnesiana*), and Christmas berry (*Schinus terebinthifolius*) shrubs. Native species may be allowed to grow within the buffer. The decision as to what, if any, native vegetation is to be planted within the buffer area will be determined once invasive vegetation is cleared. If native vegetation is planted within the burial area, it should be appropriate to the dry climate of coastal Keahuolū. The option of planting native vegetation outside of the enclosing wall to provide a visual buffer for the burial would be considered based upon the future use of the surrounding area.

7.3.4 Signage

Given the location of the Site 18511 burial within a relatively high traffic area, the cultural descendants and other consulting individuals felt there was a need for some form of signage to mark the burial location as a culturally sensitive area. A small brass plaque will be attached to large boulders placed outside the enclosing buffer wall and will be installed upon completion of the wall's construction. The plaque will be the same as that created for burial sites located alongside the route of the Ane Keohokālole Highway. The wording on this sign was developed by Analu Josephus, a cultural descendant of the area. The plaque will indicate, in both Hawaiian and English, that the site is a *wahi kapu*, a culturally sensitive area. The text of the plaque will read as follows:

WAHI KAPU

(Sacred Site)

He wahi mea nui kēia i ka moʻolelo o ko Hawaiʻi Paeʻāina;
pāpā ʻia ke komo ʻana. E hoʻihi i ke kapu o kēia wahi. Mai komo.

(This is a culturally significant place; access is restricted.
Please show your respect by not entering this area.)

Mālama ʻia nā wahi i helu ʻia he mea nui ma ke kānāwai o ka Mokuʻāina.
Hiki ke hoʻopaʻiʻia he hoʻopaʻi uku he $20,000.
(Mokuna 6E-11, Hawai'i Revised Statutes). DLNR-SHPD (808) 692-8015

(Historic sites are protected under state law violation could result in a $20,000 fine.
(Chapter 6E-11, Hawai'i Revised Statutes) DLNR-SHPD (808) 692-8015)

7.3.5 Site Access
Access within the buffer wall of the Site 50-10-27-18511, Feature C burial will be provided to cultural descendants, and other individuals wishing to visit the burial for cultural purposes with permission from cultural descendants, upon request of the Liliʻuokalani Trust.

7.3.6 Site Monitoring, Maintenance, and Security
Maintenance and security of the Site 50-10-27-18511 burial will be provided by the Liliʻuokalani Trust. At minimum, annual site inspections will be carried out to check the condition of the burial site so that any potential threats from human or natural agencies can be identified and managed accordingly.

8.0 REFERENCES

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APPENDIX A

DESCRIPTION OF SITE 50-10-27-18511

The following description of Site 50-10-27-18511 was taken from the Paul H. Rosendahl, Ph.D., Inc. 1993 report of their Archaeological Inventory Survey of the 100-acre Kona Industrial Subdivision Expansion Site (O'Hare and Rosendahl 1993:A-10 to A-12).

was noted on the northeast side of the mound. The feature is unaltered and in fair condition. No portable remains or cultural deposits were observed at this feature.

FEATURE B: Filled depression
FUNCTION: Indeterminate
DIMENSIONS: 5.50 m by 5.00 m by 0.09 m (max. depth)
DESCRIPTION: Feature B is a filled depression. This feature is in the center of the site c. 4.50 m northeast (50°) of Feature A, and c. 2.50 m southwest (230°) of Feature C. A serpentine crack, oriented at 85°/265° and on top of a pahoehoe bedrock dome, is filled with pahoehoe gravel and cobbles one to two courses deep. The rocks are piled to the lip of the crack and 0.04 m above the lip in some places. The feature is unaltered and in fair condition. No portable remains or cultural deposits were observed at this feature.

FEATURE C: Mound
FUNCTION: Agriculture
DIMENSIONS: 1.70 m by 1.30 m by 0.45 m (max. height)
DESCRIPTION: Feature C is a roughly circular mound. The feature is at the northeast end of the site, c. 2.50 m northeast (50°) of Feature B. It is constructed of subangular pahoehoe gravel and cobbles piled two to four courses high on top of bare pahoehoe bedrock. The interior is bare, so this feature was probably used as a planting plot. It is unaltered and in fair condition. No portable remains or cultural deposits were observed at this feature.

SITE NO.: State: 18510 **PHRI:** T-10
SITE TYPE: Pahoehoe excavation (3)
TOPOGRAPHY: Generally level undulating pahoehoe around site; the excavations are on the east face of a large elevated pahoehoe outcrop
VEGETATION: *'Ilima*, fountain grass and lantana grow in bedrock cracks; some small *kiawe* trees growing in natural depressions.
SITE ELEVATION: 17 m AMSL
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Quarry
DIMENSIONS: 6.40 m by 3.10 m by 0.65 m (max. height)
DESCRIPTION: Site 18510 consists of three pahoehoe excavations in a row (at 40°/220°) at the east base of a large elevated pahoehoe outcrop. The site is in the center of the project area. The excavated areas are 0.60-0.75 m in maximum diameter, and are excavated to a depth of 0.28-0.65 m. A narrow, level strip at the base of the outcrop consists of fractured bedrock in gravel and cobble size (c. 0.05-0.20 m in diameter). Some pahoehoe boulders that probably came from the excavations are scattered around. However, there are not enough of these rocks to account for the amount of material that must have been excavated from the outcrop. Therefore, some of the material must have been carried away. This is good evidence that the main function of the excavations was to quarry material. A discontinuous alignment of about nine boulders in front of the southernmost excavation may have been man-made or natural. These boulders are up to c. 0.35 m in diameter. The feature is unaltered and in good condition. No portable remains or cultural deposits were observed at this feature.

SITE NO.: State: 18511 **PHRI:** T-11
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Undulating pahoehoe flows with large elevated pahoehoe bedrock upthrusts
VEGETATION: Sparse fountain grass, *'ilima*, lantana, and *koa-haole* on the outcrop; dense vegetation at the base of the outcrop.
SITE ELEVATION: 13 m AMSL
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric-historic
FUNCTIONAL INTERPRETATION: Multiple
DESCRIPTION: Site 18511 consists of one walled overhang (Feature A), one pahoehoe excavation (Feature B), and one burial cave (Feature C). These features are on top or at the base of two large elevated pahoehoe pressure ridges in the central portion of the project area. The overall site measures c. 30.00 m (68°/248°) by 10.00 m.

FEATURE A: Walled overhang *(Figure A-5)*
FUNCTION: Temporary habitation
DIMENSIONS: 9.00 m by 6.00 m by 1.25 m (max. ceiling height)
DESCRIPTION: Feature A is a walled overhang. This feature is at the south end of the site at the base of an outcrop, c. 25.0 m southwest (248°) of Feature B. The overhang is oriented at 100°/280° and opens up at the base of a large pressure ridge. It is 7.00 m long and has an average depth of 5.00 m. An area in front of the overhang is fairly level and has been cleared of most rock. A short wall has been built across the west entrance to this depressed area. The wall is constructed of pahoehoe cobbles and boulders piled on top of bare bedrock. There are some goat bones against the back wall of the overhang. The overhang area gives access to a narrow, low-ceilinged cave. There is no evidence that the cave has been modified or utilized in any way. It is unaltered and in fair condition. No cultural deposits or soil deposits were observed at this feature.

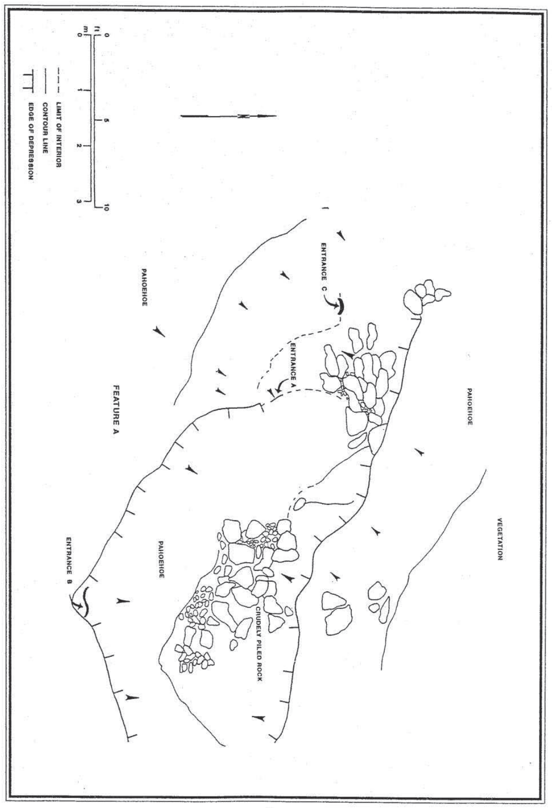

Figure A-5. Site 18511, Feature A

FEATURE B: Pahoehoe excavation
FUNCTION: Indeterminate
DIMENSIONS: 3.00 m by 1.50 m by 1.60 m (max. depth)
DESCRIPTION: Feature B is a pahoehoe excavation in the center of the site, c. 25.00 m northeast (68°) of Feature A. Many naturally fractured bedrock fragments are at the bottom of a crevice at the crest of a pressure ridge. This crevice is oriented at 115°/295° and is c. 5.00 m long and 1.75 m wide. Some of the boulders (c. 0.40-0.50 m in diameter) in the west half of this crevice have been removed and are scattered outside on the south slope of the pressure ridge. This creates deep, bare pockets (up to 1.60 m deep) in the crevice. These pockets may have been used for growing purposes, for cache areas, or for quarrying of raw materials. Vegetation is growing in two of the pockets, although little soil was noted. Only a shallow (0.05-0.10 m deep) deposit of duff was observed. The feature is unaltered and in good condition. A waterworn boulder (c. 0.20 m by 0.25 m by 0.15 m) was observed in the crevice.

FEATURE C: Burial cave
FUNCTION: Ceremonial
DIMENSIONS: 2.90 m by 2.28 m by 0.82 m (max. ceiling height)
DESCRIPTION: Feature C is a burial cave at the north end of the site, at the base of the same outcrop on which Feature B is located. The cave is c. 5.00 m northeast (68°) of Feature B. The cave is at the south base of a large pahoehoe pressure ridge. It contains scattered human bones. Entrance is possible from a 0.80 m by 0.60 m hole in the ceiling of the cave. The cave opens up both east and west from the opening, but skeletal material is present only in the west half. The cave floor is c. 0.72 m below the ground surface at the opening, but only a narrow strip (1.60 m long and 0.25 m wide) down the middle of the cave has a ceiling high enough (0.72-0.80 m high) to allow further access. This strip down the middle consists of a natural depression that had been filled with pahoehoe gravel and cobbles to create a smooth floor. Most of the scattered bone was observed either in this depression, on top or among the cobbles, or on a bare bedrock shelf adjacent to and south of the depression. The skeletal material consists of scattered finger, toe, and foot bones, some vertebrae, and one incisor. The west end of this tube is blocked by roof fall. A glass patent medicine bottle was observed in this roof fall.

Pahoehoe cobbles and boulders have also been stacked on the cave floor below the entrance. The stacked area (c. 0.30 m by 0.90 m) is flush with the side of the cave on the north and west sides, and elevated c. 0.20-0.30 m above the cave floor on the south and east sides. Some rocks in this stacked area and some of the rocks in the central depression were moved during the present survey in order to see if an articulated burial was present in the cave. Only a *puka* shell (*Conus sp.*) was discovered in the stones by the entrance. A few more scattered bones were observed under the depression fill, but no major bones (long bones or cranial material) were present. It seems probable that a burial was once present in the cave, possibly on top of the level central area of the cave, but was later removed. This might have taken place during historic times when the cave might have been used for temporary habitation. The cave is wet, with continual dripping from the roof, and the glass bottle found in the cave may be historic evidence for use of the cave as a water catchment area. The feature is unaltered and in good condition. The glass bottle was collected, the *puka* shell was not, and the bones were left in place.

SITE NO.: State: 18512 **PHRI:** T-13
SITE TYPE: Alignment
TOPOGRAPHY: Fairly level undulating pahoehoe flows
VEGETATION: *'Ilima*, lantana, and fountain grass growing from cracks; *koa-haole* growing in natural depressions; morning glory vines; one *noni* tree due north at c. 3.60 m.
SITE ELEVATION: 12 m AMSL
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Indeterminate
FUNCTIONAL INTERPRETATION: Indeterminate
DIMENSIONS: 1.80 m by 1.72 m by 0.32 m (max. height)
DESCRIPTION: Site 18512 is a circular alignment of boulders. This site is in the central portion of the project area. It is constructed of large pahoehoe slabs and boulders that have been placed on top of bare pahoehoe to form a ring. The boulders are c. 0.25-0.64 m in diameter, and the slabs are c. 0.15-0.22 m in diameter. Occasionally the ends of the boulders overlap, but there is no real piling. Most of the ring consists of just one course of rock. Three large boulders are placed on edge on the north side of feature. This feature is rather large to be a traditional prehistoric planting plot. The feature might have been associated with recent camping in the area. No portable remains or cultural deposits were observed at this feature.

SITE NO.: State: 18513 **PHRI:** T-14
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Fairly level ground surface with many fractured pahoehoe outcrops
VEGETATION: Dense *kiawe*, California grass, fountain grass, lantana, and morning glory vines.
SITE ELEVATION: 15 m AMSL
CONDITION: Good

The following description of Site 50-10-27-18511 is taken from the 2014 Pacific Legacy, Inc. report of their Supplemental Archaeological Inventory Survey of the Kona Commons property (McIntosh et al. 2014:103–116):

SIHP Number: 50-10-27-18511
Site Type: Complex
Status: Relocated
Present Condition: Fair
Description: Site 50-10-27-18511 is a complex comprised of five features: a modified overhang (Feature A), a lava excavation (Feature B), a lava tube (Feature C), and two additional lava excavations (Feature D and Feature E). The Feature C lava tube contains human remains. Features A through C were originally identified and recorded during the 1992 PHRI survey (O'Hare and Rosendahl 1993:A-10 to A-12), while the Feature D and Feature E lava excavations were discovered during the present survey.

Site 18511 was relocated by Pacific Legacy archaeologists and found to be situated toward the center of the project area, approximately 170 meters east of Makala Boulevard and c. 85 meters west of Loloku Street (Figure 3). It is located c. 211 meters east (95°) of the Site 18509 complex. In overall extent, the site complex measures c. 44.4 meters in length (east to west) and c. 18.8 meters in width (north to south).

Site 18511 appears to be a multi-use complex whose component features served a range of functions. The Feature A overhang seems to have been modified for use as a temporary shelter, the Feature C lava tube served as a burial chamber, the Feature B lava excavation could have been utilized as either a planting area or a quarry, while the Feature D and E lava excavations seem most likely to represent areas where stone was quarried for use as building material.

Feature A
Site 50-10-27-18511, Feature A was originally recorded during the 1992 PHRI survey as a "walled overhang," measuring c. 9.00 meters by c. 6.00 meters, with a maximum ceiling height of c. 1.25 meters (O'Hare and Rosendahl 1993:A-10). The PHRI feature description for site 18511, Feature A further notes that

> The overhang is oriented at 100°/280° and opens up at the base of a large pressure ridge. It is 7.00 m long and has an average depth of 5.00 m. An area in front of the overhang is fairly level and has been cleared of most rock. A short wall has been built across the west entrance to this depressed area. The wall is constructed of pahoehoe cobbles and boulders piled on top of bare bedrock. There are some goat bones against the back wall of the overhang. The overhang area gives access to a narrow, low-ceilinged cave. There is no evidence that the cave has been modified or utilized in any way. It is unaltered and in fair condition. No cultural deposits or soil deposits were observed at this feature (O'Hare and Rosendahl 1993:A-10).

Feature A was re-identified during the present survey and was found to be located at the southwestern edge of the Site 18511 complex, approximately 24.7 meters southwest (245°) of the Feature B lava excavation. Upon inspection, Feature A appears to be a modified overhang,

rather than a walled overhang, as it had previously been described (Figure 19). No distinct wall was identified; instead, stone stacking was observed in a crevice to the east of the overhang that stands approximately 3 to 4 courses high and measures c. 1.2 meters by c. 0.70 meters (Figure 20). Stacking was also noted to the west of the overhang, standing approximately two courses high and measuring c. 0.60 meters by c. 0.50 meters. The overall dimensions of the overhang are c. 5.5 meters long, c. 1.6 meters wide, and c. 1.4 meters deep, making it much smaller than was originally recorded during the 1992 survey. Some modern trash was observed within the eastern crevice of the overhang, including an aluminum Coca-Cola can, a clear glass screw-top bottle, and what appears to be a can of acetone.

A lava tube is located to the south of the modified overhang. It measures c. 10.0 meters in length, c. 2.5 meters in width, with a maximum interior height of c. 1.25 meters. The main entrance is located on its western side, and contains tumbled rock that naturally slopes into the lava tube. There is also a skylight entrance on the eastern side of the lava tube. The interior of the lava tube is clear of debris and its floor relatively flat. No modifications to the lava tube were noted. Goat and dog bones are scattered throughout the north side of the lava tube. Recent trash, such as batteries and plastic debris, are also present inside of the tube. No other cultural material was observed.

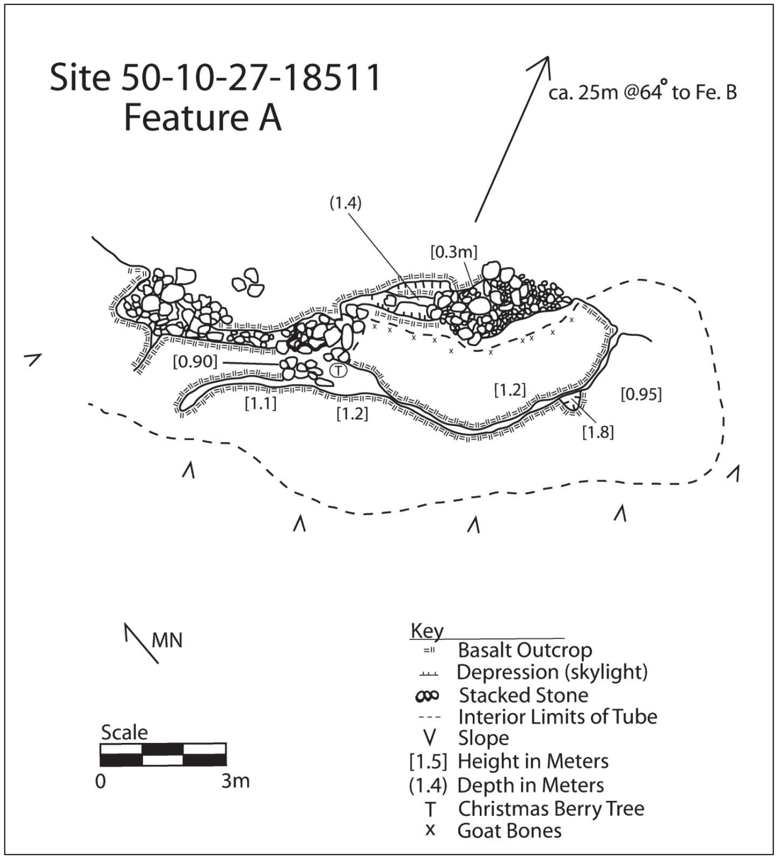

Figure 19. Plan view map of the Site 50-10-27-18511, Feature A.

Figure 20. Site 50-10-27-18511, Feature A modified overhang (view northeast).

Figure 21. Site 50-10-27-18511, Feature A lava tube entrance (view south).

The Feature A modified overhang appears to be in fair condition. The overhang and lava tube show evidence of having been occupied by homeless individuals. It is difficult to determine, however, if there have been recent alterations made to Feature A since the 1992 PHRI survey. The modified overhang most likely served as a temporary habitation shelter during the pre-Contact period.

Feature B

Site 50-10-27-18511, Feature B is a lava excavation that was originally recorded during the 1992 PHRI survey. At that time the lava excavation was recorded as measuring c. 3.0 meters by c. 1.50 meters, with a maximum depth of c. 1.60 meters (O'Hare and Rosendahl 1993:A-12). The PHRI feature description for Site 18511, Feature B also indicates that

> Many naturally fractured bedrock fragments are at the bottom of a crevice at the crest of a pressure ridge. This crevice is oriented at 115°/295° and is c. 5.00 m long and 1.75 m wide. Some of the boulders (c. 0.40–0.50 m in diameter) in the west half of this crevice have been removed and are scattered outside on the south slope of the pressure ridge. This creates deep, bare pockets (up to 1.60 m deep) in the crevice. These pockets may have been used for growing purposes, for cache areas, or for quarrying of raw materials. Vegetation is growing in two of the pockets, although little soil was noted. Only a shallow (0.05–0.10 m deep) deposit of duff was observed. The feature is unaltered and in good condition. A waterworn boulder (c. 0.20 m by 0.25 m by 0.15 m) was observed in the crevice. (O'Hare and Rosendahl 1993:A-12)

The Site 18511, Feature B lava excavation was relocated during the present survey (Figure 22). It is situated at the crest of a *pāhoehoe* ridge in the central portion of the site complex, approximately 24.7 meters northeast (65°) of the Feature A walled overhang. The lava excavation was found to currently measure c. 5.8 meters in length by c. 1.6 meters in width, and to be c. 1.5 meters in depth. There is a large amount of organic debris from growing vegetation (fountain grass, *Pennisetum setaceum*) and Christmas berry, *Schinus terebinthifolius*) within the interior of the lava excavation. Numerous cobbles and boulders that were apparently removed from the lava excavation are scattered on the lava surface to the south.

A small vesicular waterworn boulder was observed within the lava excavation (Figure 23). Although this boulder shows no evidence of battering, it could have been brought to the site to be used as a hammerstone. No other cultural material was noted in or around the excavation. Feature B is currently in fair condition. This lava excavation may have been used as a quarry site during the pre-Contact period.

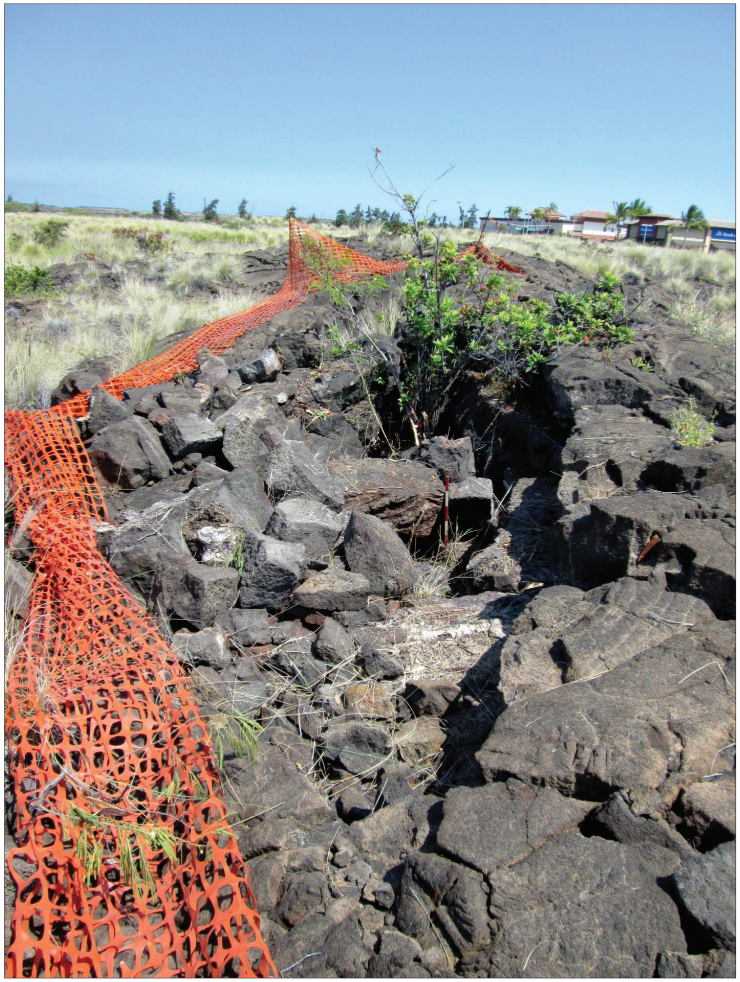

Figure 22. Site 50-10-27-18511, Feature B lava excavation (view northwest).

Figure 23. Site 50-10-27-18511, Feature B waterworn boulder.

Feature C

Site 50-10-27-18511, Feature C was originally recorded during the 1992 PHRI survey and described as a "burial cave" located "at the south base of a large *pāhoehoe* pressure ridge. It contains scattered human bones" (O'Hare and Rosendahl 1993:A-12). Feature C was recorded as measuring c. 2.90 meters by c. 2.28 meters, with a maximum ceiling height of c. 0.82 meters (Figure 24). The PHRI feature description for Site 18511, Feature C further notes that

> Entrance is possible from a 0.80 m by 0.60 m hole in the ceiling of the cave. The cave opens up both east and west from the opening, but skeletal material is present only in the west half. The cave floor is c. 0.72 m below the ground surface at the opening, but only a narrow strip (1.60 m long and 0.25 m wide) down the middle of the cave has a ceiling high enough (0.72–0.80 m high) to allow further access. This strip down the middle consists of a natural depression that had been filled with pahoehoe gravel and cobbles to create a smooth floor. Most of the scattered bone was observed either in this depression, on top or among the cobbles, or on a bare bedrock shelf adjacent to and south of the depression. The skeletal material consists of scattered finger, toe, and foot bones, some vertebrae, and one incisor. The west end of this tube is blocked by roof fall. A glass patent medicine bottle was observed in this roof fall.

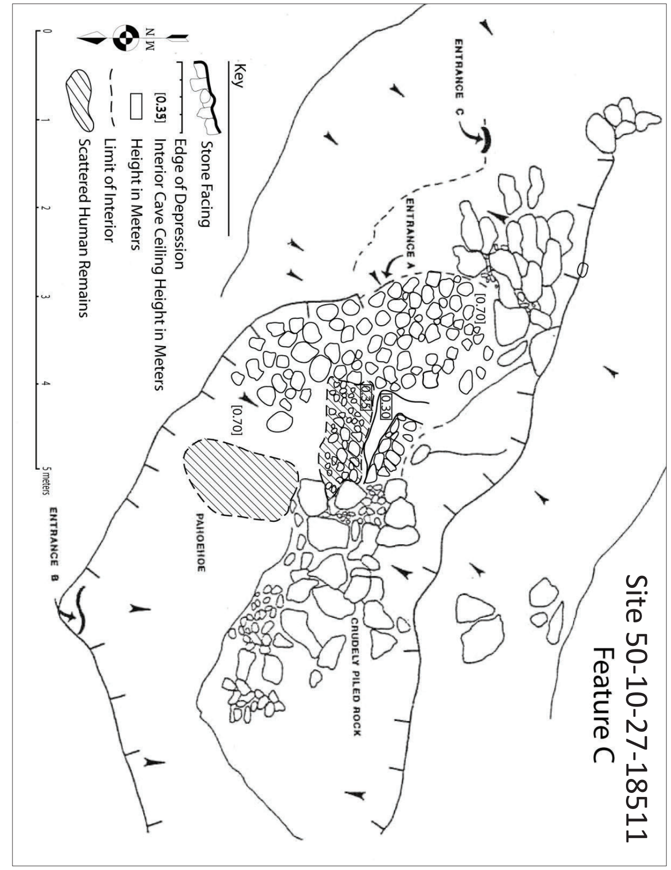

Figure 24. Plan view map of Site 50-10-27-18511, Feature C modified lava tube (base map from O'Hare and Rosendahl 1993:Figure A-5, with modifications from the present survey).

Pahoehoe cobbles and boulders have also been stacked on the cave floor below the entrance. The stacked area (c. 0.30 m by 0.90 m) is flush with the side of the cave on the north and west sides, and elevated c. 0.20–0.30 m above the cave floor on the south and east sides. Some rocks in this stacked area and some of the rocks in the central depression were moved during the present survey in order to see if an articulated burial was present in the cave. Only a *puka* shell (*Conus sp.*) was discovered in the stones by the entrance. A few more scattered bones were observed under the depression fill, but no major bones (long bones or cranial material) were present. It seems probable that a burial was once present in the cave, possibly on top of the level central area of the cave, but was later removed. This might have taken place during historic times when the cave might have been used for temporary habitation. The cave is wet, with continual dripping from the roof, and the glass bottle found in the cave maybe historic evidence for use of the cave as a water catchment area. The feature is unaltered-and in good condition. The glass bottle was collected, the *puka* shell was not, and the bones were left in place. (O'Hare and Rosendahl 1993:A-12)

The Feature C modified lava tube was relocated during the present survey (Figure 25). It is situated at the northern edge of the Site 18511 complex, approximately 8.8 meters north (11°) of the Feature B lava excavation. The main entrance into the lava tube, labeled "Entrance B" on the PHRI site map, measures c. 0.80 meters by c. 0.60 meters. There are boulders roughly stacked around and partially blocking this entrance. The interior of the lava tube measures c. 8.0+ meters in length by c. 3.0 meters in width, with a maximum ceiling height of c. 0.90 meters. The floor of the lava tube currently appears to be rough and unlevel due to rock fall.

Within the lava tube, east of the main entrance is a stone filled terrace, measuring c. 0.30 meters in height. Human skeletal remains were observed scattered within three concentrated areas inside of the lava tube. The areas that contain human bone fragments include an area on top of the stone terrace, an area within a natural channel of the floor surface, and an area on a lava shelf just south of the natural channel. No long bones or cranial elements were present among the scatter of human skeletal remains. There were no other interior or exterior features noted within the lava tube.

No artifacts or other cultural material was observed within the Feature C lava tube. The glass medicine bottle noted in the original site description had been collected by the PHRI field crew, while the "*puka* shell" was not observed. This lava tube currently appears to be in fair condition. Feature C served as a burial, most likely pre-Contact in age.

Figure 25. Site 50-10-27-18511, Feature C modified lava tube entrance (view east).

Feature D

Site 50-10-27-18511, Feature D is a lava excavation that was discovered and recorded during the present survey (Figure 26). This lava excavation is located at the eastern end of the Site 18511 complex, approximately 19.8 meters east (111°) of the Feature C lava tube. It is situated on the slope of a low lava ridge. The excavation is irregular in shape, measuring c. 4.2 meters in length (east to west) by c. 2.8 meters in width (north to south), and c. 0.20 meters in depth. The upper layer of lava has been broken apart over a sizeable area, and block-like chunks of *pāhoehoe* appear to have been removed, leaving a relatively smooth (though sloping) interior floor, which is scattered with discarded subangular basalt boulders and cobbles.

A small vesicular basalt hammerstone that is discoidal in shape was observed within the excavated area (Figure 27). The hammerstone measures c. 0.9 centimeters in length, c. 0.8 centimeters in width, and c. 0.4 centimeters in thickness. The artifact was collected from the feature and, following documentation, was given into the care of the Liliʻuokalani Trust for curation. Given the relatively small size of the artifact, it seems unlikely that it was used to break up the lava surface. Larger waterworn boulders, such as that found at Feature B, appear to have been more commonly utilized for that purpose. It is possible that the discoidal hammerstone was used to shape the edges of the stones removed from the excavation. However, though this too seems unlikely, taking into account its size and highly vesicular nature (which would have made it softer and less durable than a similar sized waterworn stone of dense basalt). It seems more probable that the artifact was used for some purpose not directly related to the excavation of the feature, as a hammerstone for softer material, or as a very coarse abrader.

The Feature D lava excavation is in fair condition. The fact that much of the broken-up stone that originally formed the upper layer of the excavation's lava surface appears to have been removed suggests that the feature was most likely utilized as a quarry for obtaining thick, tabular chunks of basalt stone that could be used elsewhere as building material. It is probable that Site 18511, Feature D dates to the pre-Contact period.

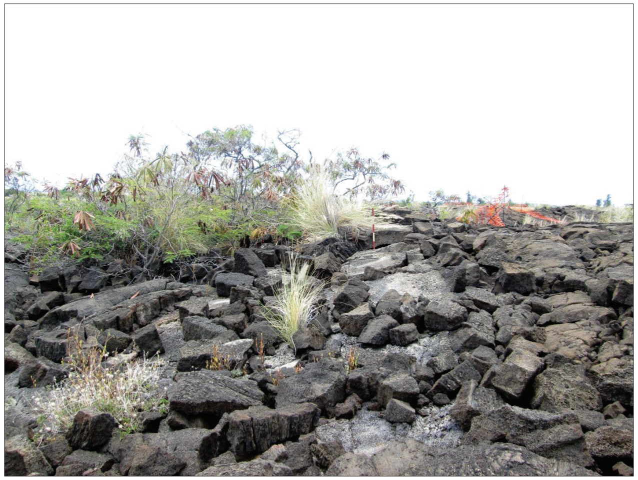

Figure 26. Site 50-10-27-18511, Feature D lava excavation (view west).

Figure 27. Site 50-10-27-18511, Feature D hammerstone.

Feature E

Site 50-10-27-18511, Feature E is a lava excavation that was discovered and recorded during the present survey (Figure 28). This lava excavation is located along the northeastern edge of the Site 18511 complex. It is situated approximately 8.5 meters west (288°) of the Feature D lava excavation along the same lava ridge. The excavation is roughly rectangular in shape, measuring c. 4.2 meters in length (northeast to southwest) by c. 1.6 meters in width (northwest to southeast). There is a natural fracture extending through the excavation in a northeasterly (59°) direction. Feature E is similar to Feature D, in that it appears only the first course of loose material was removed from the lava excavation. A small number of large boulders and cobbles remain within the interior of the excavation, mostly along its edges.

No cultural material was observed within the Feature E lava excavation. The feature is in fair condition. It seems likely that the lava excavation was utilized for the quarrying of basalt stone for use as building material during the pre-Contact period.

Figure 28. Site 50-10-27-18511, Feature E lava excavation (view southwest).

APPENDIX B

BURIAL TREATMENT PLAN PREPARED BY
PAUL H. ROSENDAHL, Ph.D., INC., 1993

Report 1437-101293

Burial Treatment Plan
Archaeological Mitigation Program
Queen Lili‘uokalani Trust
Keahuolu Lands

Land of Keahuolu, North Kona District
Island of Hawai‘i

BY

Kepā Maly • Cultural Resources Specialist

AND

Paul H. Rosendahl, Ph.D. • Principal Archaeologist

PREPARED FOR

Queen Lili‘uokalani Trust
c/o Belt Collins Hawaii
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OCTOBER 1993

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INTRODUCTION

PROGRAM BACKGROUND

At the request of Ms. Sue Rutka of Belt Collins Hawaii Inc., for their client, the Queen Liliʻuokalani Trust, Paul H. Rosendahl, Ph.D., Inc., (PHRI) has prepared this Burial Treatment Plan, for the Trust lands located within Keahuolu (*ahupua'a*), in North Kona on the Island of Hawaiʻi. The overall objective of this plan is to satisfy the cultural resource requirements of the Department of Land and Natural Resources - State Historic Preservation Division (DLNR-SHPD) and the Hawaiʻi County Planning Department (HCPD). Additionally, pursuant to Hawaiʻi State Law, Chapter 6E:43 (as amended by Act 306), pertaining to the treatment of ancestral Hawaiian remains, this burial treatment plan is being submitted to the Hawaiʻi Island Burial Council for review and comment.

FINDINGS OF PREVIOUS ARCHAEOLOGICAL STUDIES

Between July 10, 1989, and January 29, 1990, PHRI conducted a full archaeological inventory survey of the Queen Liliʻuokalani Trust Property project area (Donham 1990). Three sites (13275, 13359, and 13360) were determined to contain one burial each. Sites 13350 (Feature D) and 13377 (Feature B) contain fragmented human skeletal remains. Sites 13350 (Feature H), 13373, and 13376 are thought to possibly contain human remains (Figure 1). It should be noted here that Sites 13350, 13373, and 13376 are within a 25-acre archaeological preserve.

Based on the findings of the 1990 PHRI survey, and based on input from DLNR-SHPD and the HCPD, a detailed archaeological mitigation plan containing preservation component as well as data recovery components was determined to be the most appropriate vehicle for developing site-specific mitigation commitments. A five-phased program was deemed appropriate in consideration of the various objectives being sought and for compliance with requirements of the HCPD and DLNR-SHPD:

Phase I - Preparation of a formal archaeological mitigation plan, including (a) data collection, (b) interim site preservation, and (c) construction monitoring;

Phase II - Archaeological data recovery and data collection work, including mobilization, historical documentary research, field work, data analyses, and preparation of interim and final reports; also included in conjunction with this phase would be execution of the interim preservation plan;

Phase III - Preparation of a site preservation plan; upon completion of the Phase II data recovery and collection work, to provide for long-term site preservation and interpretive development concerns at selected project area sites; the preservation plan would be included in, and made a part of, the phase II final report;

Phase IV - Implementation of the site preservation plan, as formulated in the Phase III detailed site preservation plan; and

Phase V - Archaeological monitoring, as appropriate, of construction activities that might affect significant archaeological remains already identified or that may remain undetected within the project area.

During October 14-22, 1992, an additional archaeological inventory survey was conducted for the Queen Lili'uokalani Trust 100-Acre Kona Industrial Subdivision (KIS) Expansion Site, also in Keahuolu. During the survey work, human skeletal remains were identified at Site 18511 (Figure 1) (O'Hare and Rosendahl 1993).

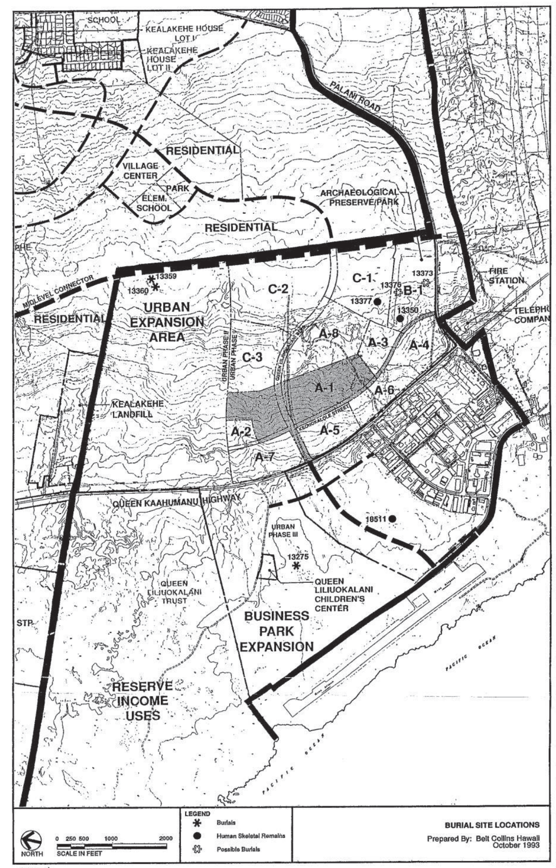

Figure 1.
Project Area and Locations of Identified Burials, Human Skeletal Remains, and Possible Burials (Prepared by Belt Collins Hawaii)

BURIAL TREATMENT PLAN

PUBLIC NOTICE

As a part of the preparation for development of this Burial Treatment Plan, a Public Notice (Figure 2.) was placed in four island newspapers requesting information from native informants and possible lineal descendants of those people who traditionally lived within the project area lands. The public notice was published in: The *Honolulu Advertiser* (September 10-12, 1993), *West Hawai'i Today* (September 9, 10 and 12, 1993), *Hawai'i Tribune Herald* (September 9, 10 & 12, 1993), and *Ka Wai Ola o OHA* (October 1993).

No contacts or claims of lineal descent were received as a result of this public notice. Mrs. Gail Souza-Save, of the Queen Lili'uokalani Children's Center (Kona at Keahuolu), and Mrs. Ruby McDonald, Kona office Liaison of the Office of Hawaiian Affairs, are in contact with area families. If their discussions produce recommendations, they will be included as a part of the long-term site preservation treatment.

PROPOSED BURIAL TREATMENTS

In the matter of preserving ancient Hawaiian remains, it is the Trust's desire to do what is correct, and this burial treatment plan is intended to facilitate the best method of preservation of the *iwi kūpuna* (ancestral remains) identified within the project area. Following a review of the PHRI findings and a preliminary meeting with the Hawai'i Island Burial Council (September 20, 1993), Trustees of The Queen Lili'uokalani Trust and *ahupua'a* tenants have determined that preservation-in-place of all the confirmed burials and possible burial sites is the preferred treatment.

PUBLIC NOTICE

All persons having information concerning possible unmarked human burials outside of designated cemeteries in the Queen Lili'uokalani Trust Land of Keahuolu, between sea level to the elevation of 300 feet in North Kona District, Island of Hawai'i (TMK:3-7-4-08:Por.2 and 3-7-4-08:Por.2,12), are hereby requested to contact Mrs. Ruby McDonald, Liaison, Office of Hawaiian Affairs (West Hawai'i), (808) 329-7368, 75-5706 Hanama Place, Suite 107, Kailua-Kona, Hawai'i 96740; Mr. Alan T. Walker, Hawai'i Projects Director, or Kepā Maly, Cultural Resources Specialist, at Paul H. Rosendahl, Inc. (PHRI), (808) 969-1763, 305 Mohouli Street, Hilo, Hawai'i 96720; and/or Mr. Edward Halealoha Ayau, Burials Program Administrator, Department of Land and Natural Resources - State Historic Preservation Division (DLNR-SHPD), (808) 587-0047, P.O. Box 621, Honolulu, Hawai'i 96809.

(No. 4530 - September 9, 10 and 12, 1993)

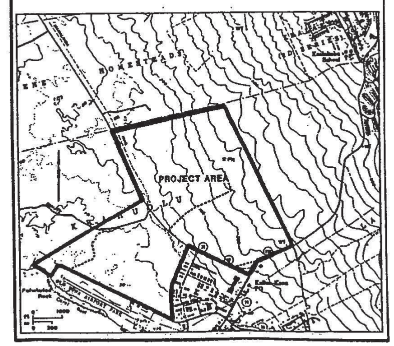

Figure 2. Public Notice Published in Four Hawai'i Newspapers (With Project Area Map)

PRESERVATION

Preservation is defined here as the act or process of utilizing procedures to maintain the existing form, integrity, and material of a building or structure, and the existing form and vegetative cover of a site (36CFR Part 60.2[b]). Preservation of archaeological sites generally falls into two categories: (1) avoidance and protection (conservation), and (2) exhibition (DLNR 1987). In the case of Category 1, an archaeological property is typically preserved with no planned future action except limited archaeological examination and required stabilization in order to prevent deterioration. In this context, preservation means continued physical survival for the purpose of preserving specific properties for future research programs and for resource banking or, as in the present case with human remains, for periodic visitation by direct or indirect lineal descendants and others.

INTERIM PRESERVATION

Interim-preservation-zone buffers for sites requiring such protection will be marked with brightly colored fencing (Figure 1). Sites at which this form of protection is required are 18511 and 13377. No construction or land modification will occur within the interim preservation zones. Sites 13350, 13373, and 13376 are within the 25-acre archaeological preserve (B-1), and no construction will occur within the preserve; thus these sites will not require individual buffer fencing. The *makai*-Keohokālole Road boundary and the A-3 and C-1 boundaries of preserve area B-1 will be marked with brightly colored fencing during construction. Sites 13275, 13359, and 13360 are situated far outside any areas of planned construction. In order to minimize the number of casual visitors to these sites (by reducing the site's visibility) buffer-zone fencing will not be placed at their locations. Interim preservation will be ensured by adopting the following general protective measures:

1. All sites shall be plotted accurately on grading plans and construction plans prior to the initiation of any grading, grubbing, and/or construction activities;

2. It is proposed that a buffer zone of five meters be identified and mapped around all site perimeters. The preservation buffer zones will be staked and construction activity will not be allowed to occur within the buffer zones;

3. Explicit notification of construction supervisors as to the nature and location of the sites, the significance of the buffer zones, and the color and meaning of any site perimeter and buffer zone flagging tape; and

4. There will be on-site monitoring of initial construction grubbing and grading in the immediate vicinity of all sites to be preserved.

Upon completion of all construction work, preservation buffer fencing will be removed from the sites, in order to minimize their visibility and keep the curious from the sites.

LONG-TERM PRESERVATION

Following consultation with DLNR-SHPD and the Hawai'i Island Burial Council, final treatment recommendations for the preservation of the various remains and associated funerary items can be made, in compliance with Chapter 6E:43 (as amended by Act 306). Should lineal descendants come forward, preference should be given to their wishes.

In the event that no lineal descendants are identified, determination of appropriate preservation treatments including grave preparation and marking, ceremonies/blessings, site closure, and preservation-in-perpetuity agreements should be determined through consultation with DLNR-SHPD, the Hawai'i Island Burial Council, the County of Hawai'i, and the Queen Lili'uokalani Trust.

It is proposed that sites in which human remains have been identified, and the two possible burial sites be marked by preservation buffers of five meters on all sides. No construction or land modification (other than appropriate landscaping with native plants, and site stabilization) will occur within five meters on all sides of the preserve. The preservation buffer zones might be delineated by a planted buffer with *hala* at the corners, or in some other acceptable configuration; or marked by natural stone walls and/or platforms, and appropriate native vegetation.

Additionally, a simple plaque, as described below could be used to identify the site. Visitation of the sites will be limited to native Hawaiians who claim familial relationship-connection to the area.

Concerns for long-term preservation include:

1. Documentation of burial/possible-burial site locations on maps for future reference in development planning and/or land use evolution;

2. Monitoring site integrity; i.e., assigning maintenance schedules for landscaping and liter control, and monitoring levels of pedestrian impact and inappropriate site uses. It might also be suggested that the sites be sealed by rock work, similar to other traditional interment sites, as a part of the long-term preservation process;

3. Site landscaping and identification; landscaping within the general vicinity of the burial sites should use the native, and Hawaiian-introduced vegetation of the region.

   A variety of plants may be used. Among them are the following plants, which are often found along the *pāhoehoe* and *'a'ā* flows, *kīpuka*, and traditional community sites of *Kona 'akau*:

Pili	*Hetropogon*
Ma'o	A native cotton [*Gossypium sandwicensis*]
'Ilima	*Sida fallax*
Nehe	*Lipochaeta lavarum*
Maiapilo	*Capparis sandwichiana*) and
Pōhinahina	The beach vitex [*Vitex trifolia* var. *simplicifolia*]
Kō	Native sugar canes
'Uala	Native sweet potatoes
Ipu or ***Hue***	Gourds

The above plants are all appropriate, low-impact ground covers. Additionally, the following plants are important for their symbolism and/or their regional uses.

La'I (the ti leaf [*Cordyline terminalis*]) is often suggested because of its important cultural symbolism. If properly cared for in a traditional mulched mound or hole-type planting environments, it would be an important addition.

Wiliwili (*Erythrina sandwicensis*) is a beautiful native tree, upon which the native inhabitants of this region relied. Its wood was used in association with fishing, canoeing, recreation, and water catchment, and the seeds and flowers were used for *lei* making.

Hala (*Pandanus odoratissimus*), like the *wiliwili*, is a beautiful native tree of many traditional uses. In this context, *pū hala* (pandanus trees) would serve as a symbol for those who have already passed from this life to their final resting place. The Hawaiian word *hala* not only describes the native tree, but also means to "pass on." Thus a prominent *pū hala* on the lava fields could serve as one way of identifying the burial sites for those who wish to pay their respects.

Kukui (*Aleurites moluccana*, the candle nut tree) is an important tree; it symbolizes light and knowledge, and formerly had many religious and domestic uses. For Kona, the *kukui* is particularly important, as it is a body-form of the god Lono, provider of the rain clouds of *Kona kai 'ōpua* (Kona of the billowing horizon clouds) and successful growth of crops which nurtured the *po'e kahiko* (ancient people).

Plantings of the larger trees must be done carefully so that they will not affect the remains in the future. It is suggested that if any other plants are to be used, they be those that do not establish a deep root base or develop destructive root systems. The landscaping, if appropriate, will be within the five-meter buffer zones surrounding each of the sites. The suggestions of any lineal descendants and the Hawai'i Island Burial Council in regards to landscaping should also be taken into consideration.

4. Should access to the site be maintained or improved (depending upon lineal descendant wishes and Hawai'i Island Burial Council recommendations), appropriate signage should be set in place, describing the cultural sensitivity of the sites and asking that respect be given and that nothing be removed. Below is one suggestion for sign text:

   KULA IWI

   This is a culturally sensitive site.
   Please respect those who came before us
   and refrain from entering within this area.
   Your respect will be greatly appreciated.

   Use of the term "*kula iwi*" (literally: bone plain; i.e. Native land where one's bones are laid to rest) will notify native practitioners of the significance of the site(s), while the term will also name the feature(s) for those who might come across it while visiting the area. Any suggestions concerning the design of the sign and exact text by the Hawai'i Island Burial Council and/or any direct lineal descendants should be strongly considered;

5. Once landscaping is done, the integrity of the sites must be maintained through proper maintenance and upkeep;

6. Should it be desired by lineal descendants, it is recommended that access to the burial sites be maintained. Any person claiming lineal descent from the burials should have access to the site(s) for visitation purposes. Should lineal descendants be identified, it is recommended that an "In-situ Burial Agreement" between DLNR-SHPD, the County of Hawai'i, any affected land owner(s), and lineal descendants should be formalized.

INADVERTENT DISCOVERY OF HUMAN REMAINS

There is the possibility that inadvertent finds of additional burials or scattered human remains will be made during future construction work; therefore, the presence of a qualified archaeologist, on site to monitor this work, as outlined in the Phased Mitigation Plan (Jensen et al., 1992), is advisable. This monitoring will be done in conformance the DLNR-SHPD standards. In the event burials are inadvertently found within the project area during construction, they will be treated on a case by case basis in accordance with the stipulations of Chapter 6E:43 (as amended by Act 306), and following consultations with DLNR-SHPD, the Hawai'i Island Burial Council, and any direct lineal descendants.

While preservation-in-place would be the preferred treatment, should disinterment with reinterment and preservation in another location be recommended, this process will be undertaken with sensitivity and in compliance with the wishes of identified lineal descendants and/or DLNR-SHPD. At times, natural phenomena or human activities pose a threat to ancient remains, and preservation of those remains can be best achieved through reinterment in another location. It is recommended here, that reinterment of human remains and funerary objects (if applicable) should occur within the *ahupua'a* (traditional land division) of original interment.

‘ŌLELO WEHEWEHE (Explanatory Comments)

The land in this area of *Kona ‘akau* was generally known as Kekaha (The shore or place). The land was also affectionately called *Kaha-ka-weka* (The hard [stingy] place), as it was a *kaha ‘ai ‘ole* (place without vegetable foods) and a *kaha wai ‘ole* (waterless place) (*He Mo`olelono Makalei* [A Hawaiian Legend about Makalei] by *Ho‘olaleaka‘ūkiu. Ka Hoku o Hawai`i,* March 6, 1928 [Kepā Maly, translator]). Though these names reflect the rugged nature of the land, the people who lived within Kekaha felt a kinship to the land and ocean, and were nurtured by natural resources. While this might have been a difficult place in which to live, it might also be noted that the region exhibits evidence of more or less uninterrupted occupation since c. AD 1000.

To live upon this land required an intimate knowledge of the gods, resources, and ways of the *‘āina* (land). It is evident that a variety of occupations, ranging from harvesting marine resources to extensive dry-land agriculture were enjoyed by the people of this area. It seems that Hawaiian settlement first occurred along the shoreline, especially in small, protected bays, which allowed easy access to marine resources and coastal springs. Initially, planting would have occurred in and around these coastal communities. As the population grew and the political and religious systems became more formalized (c. AD 1300-1400), the communities also spread out, requiring more land. The *ko kula kahakai* and *ko kula uka* (coastal and upland plains) were extensively planted with important staple- and supplemental-crops that were less water dependent than the *kalo wai* (wet taro) that was the staple of the *Ko‘olau* (windward) side of the island, with its watered valleys. *Pu‘epu‘e* (planting in built up mounds), *mākālua* and *‘umoki* (planting in dugout-mulched holes) are three methods of planting techniques that were extensively used in this part of Kona.

Crops such as sweet potatoes, sugar cane, bananas, breadfruit, gourds, and coconuts provided the "bread" of the Hawaiian diet. On the upper slopes, agricultural practices would have included propagation and harvesting of *olonā* (*Touchardia latifolia*) for cordage, and *‘awa* (Piper methysticum) for ceremonial and domestic use, and collecting from the upland forests various woods and resources that were used for items such as spears, paddles, canoes, and tools.

There is an ancient proverb about a mound that rises upon the plain between Keahuolu and Kealakehe. The saying offers us insight into the customs and nature of the people who lived there. In March 1914, Hawaiian historian and author, Isaac Kihe published the following account in the Hawaiian language newspaper *Ka Hōkū o Hawai‘i*.

> Pu‘u-o-Kaloa is a mound-hill site in the lands of Keahuolu, near the shore of Kaiwi and Hi‘iakanoholae. During periods of dry weather (*Ka lā malo‘o*) when planted crops, from the grassy plains to the *‘āma‘uma‘u* (fern forest) zone, and even the ponds (*ki‘o wai*) were dry, people would watch this hill for signs of coming rains. When the *līhau* (light dew mists) sat atop the hill of Pu‘u-o-Kaloa, rains were on the way.
>
> Planters of the district's agricultural fields watched for omens at Pu‘uokaloa, and it was from keen observation and diligent work that people prospered on the land. If a native of the land was hungry, and came asking for food, the person would be asked—*‘ōlelo no‘eau*:

> *Ua ka ua i Pu‘uokaloa, ihea ‘oe?*—When rains fell at Pu‘uokaloa, where were you? [If the answer was...]
>
> *I Kona nei no!*—In Kona! [there would be no sweet potatoes for this person.] But if the answer was:
>
> *I Kohala nei no!*—In Kohala! [The person would be given food to eat for they had been away, thus unable to accomplish the planting.] [*Nā Ho‘onanea o ka Manawa, Kekāhi mau wahi pana o Kekaha ma* Kona (A Pleasant Passing of Time, [Stories from] Some famous Places of Kekaha at Kona) 3/19/14, Kepā Maly, translator].

Fishing in this region was considered some of the best on Hawai'i, and it is likely that a great deal of energy went into harvesting ocean resources. Though farmers probably gathered some ocean resources, and fishermen probably kept some food plants near their homes, it is generally accepted that many of the tasks related to the well-being of the community as a whole were entrusted to specialists. It is therefore reasonable to assume that the fishermen provided fish and other ocean resources to the planters, who in turn supplied the products of the land to the fishermen.

At the head of this stratified community, was a religious, political, and social elite that was well established and maintained in this area. Indeed, the royal decisions and priestly practices of this region held ramifications of island-wide significance. The religious beliefs, cultural practices and history of the Hawaiian people reflect both their Polynesian origins, and the uniqueness of Hawai‘i's island resources. The Hawaiian people lived within the limitations of their island resources; they worked the land, fished the sea, and developed their unique "Hawaiianess." Their only recorded contact with the outside world was occasional interactions with other Polynesians. Because each facet of Hawaiian existence relied so completely on the bounty of the earth, every aspect of life reflected the relationship of people to their land.

For modern Hawaiians, one of the most revered manifestations of their relationship to the land and their past is found in the context of Hawaiian burials. Many of the *maka‘āinana* (people of the land) were buried near the places where they had lived, just as their ancestors had been buried before them. Living and working among the bones of their *kūpuna*, the people of ancient Hawai‘i communed with their ancestors as they led their daily lives. The winds carried their prayers, and the spirits of their ancestors to the rich fishing grounds, to their agricultural sites, and to the forested regions, all of which were harvested for the bounty of their resources. This interaction of gods, nature, bone, and ancestral spirits allowed the Hawaiians to identify with their ancestors, and kept the "*po‘e kahiko*" (ancient people) alive as a promise to nurture the future.

The burials of Hawaiians symbolize a trust between those who came before us, their gods, the environment that gave them their essence, and Hawai‘i's future. Hawaiian burials are part of a bond between families, the elements of nature, and the creative forces of nature that the Hawaiians worshipped.

The ancient saying "*Moe kau a ho‘oilo*" (Sleep undisturbed from the dry season of *kau* to the wet season of *ho‘oilo*; i.e. sleeping from season to season [M.K. Pukui, pers. comm.; 1976]) is associated with the setting of loved ones in their resting places. Thus as we have become more sensitive to the rights of those who came before us, and in the context of this Burial Treatment Plan, it is our hope that this rest will continue undisturbed season to season.

O nā mea maika'i mālama, o nā mea maika'i 'ole kāpae 'ia
(Those things which are correct keep, those things which are inappropriate, set aside)

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APPENDIX C

PUBLIC NOTICES WITH AFFIDAVITS OF PUBLICATION

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
PUBLIC NOTICE

STATE OF HAWAII }
} SS.
City and County of Honolulu }

Doc. Date: DEC 2 1 2016 **# Pages:** 1
Notary Name: Patricia K. Reese First Judicial **Circuit**
Doc. Description: Affidavit of Publication

DEC 2 1 2016
Notary Signature Date

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

PUBLIC NOTICE

Pacific Legacy is preparing a Burial Treatment Plan for Lili'uokalani Trust lands located makai of Queen Ka'ahumanu Highway, in the *ahupua'a* of Keahuolu, North Kona, Hawai'i (TMK (3) 7-4-025:015). This plan addresses the permanent preservation and protection in place of identified human remains in accordance with Chapter 6E, Section 43. The burial is probably Native Hawaiian, based on location, context, and association. Descendants of families from the area or persons with information of the area are requested to participate in the development of the Burial Treatment Plan. Please contact Herbert Poepoe, State Historic Preservation Division (808-933-7650) or Rowland Reeve, Pacific Legacy (808-351-9560) within 30 days to participate.
(SA945362 12/18, 12/21/16)

Gwyn Pang being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser, MidWeek, The Garden Island, West Hawaii Today, and Hawaii Tribune-Herald, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser 2 times on:
12/18, 12/21/2016
MidWeek 0 times on:
The Garden Island 0 times on:
Hawaii Tribune-Herald 0 times on:
West Hawaii Today 0 times on:
Other Publications: 0 times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Gwyn Pang
Gwyn Pang

Subscribed to and sworn before me this 21st day of December A.D. 2016

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Oct 07, 2018

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

Ad # 0000945362 SP.NO.: ______ L.N.

Figure 29. Affidavit of Publication for legal notice in *Hawai'i Star Advertiser*.

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF }
PUBLIC NOTICE }

STATE OF HAWAII }
} SS.
City and County of Honolulu }

Doc. Date: DEC 21 2016	**# Pages:** 1
Notary Name: Patricia K. Reese	First Judicial **Circuit**
Doc. Description: Affidavit of Publication	
Notary Signature	Date DEC 21 2016

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

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(WHT945030 12/18, 12/21/16)

Gwyn Pang being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser, MidWeek, The Garden Island, West Hawaii Today, and Hawaii Tribune-Herald, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser	0	times on:
MidWeek	0	times on:
The Garden Island	0	times on:
Hawaii Tribune-Herald	0	times on:
West Hawaii Today	2	times on:

12/18, 12/21/2016

Other Publications: 0 times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Gwyn Pang

Gwyn Pang

Subscribed to and sworn before me this 21st day of December A.D. 2016

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii

My commission expires: Oct 07, 2018

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

Ad # 0000945030 SP.NO.: ________ L.N.

Figure 30. Affidavit of Publication for legal notice in *West Hawai'i Today*.

APPENDIX D

DESCENDANT CONSULTATION

A series of consultation meetings were held with the recognized cultural descendants of the *ahupua'a* of Keahuolū (as listed in Section 5.3) and additional concerned parties (as listed in Section 5.4) during the development of the present Burial Treatment Plan.

KEAHUOLŪ DESCENDANT MEETING AND SITE VISIT, 24 MAY 2017

Attendees

Mr. Mana Purdy, Lili'uokalani Trust
Mr. Michael Shibata, Lili'uokalani Trust
Mr. Morgan Leleiwi, Lili'uokalani Trust
Mr. Rowland Reeve, Pacific Legacy, Inc.
Ms. Paulette Ka'anohi Kaleikini (Consulting Party)
Ms. Nicole Kealohaokalani Lui (Cultural Descendant)
Mr. Jim Medeiros (Consulting Party)

On May 24, 2017 the Lili'uokalani Trust held a site visit to the Site 50-10-27-18511, Feature C lava tube burial for recognized cultural descendant and additional individuals with family connections to Keahuolū. Time was spent examining the lava tube entrance and the surrounding environment.

Following the site visit, a meeting was held at the Lili'uokalani Trust offices in Kona. At this meeting, the Trust presented an overview of the proposed realignment of the Kuakini Highway and the planned development for the Makalapua Project District. The descendants and consulting individuals then provided their *mana'o* (thoughts and opinions) concerning the proper future treatment of the Site 18511 burial. The attendees also expressed concern about the Trust's more general plans for development. It was agreed that these wider concerns would be addressed in future meetings with Lili'uokalani Trust staff.

The descendants and consulting individuals agreed that the *iwi* (human remains) present within the Site 18511, Feature C lava tube should be preserved in place. They felt that all of the openings to the lava tube should be sealed with stones to protect the *iwi*.

The attendees were not comfortable with the existing 30-foot buffer proposed by the 1993 Burial Treatment Plan (Maly and Rosendahl 1993). Ms. Nicole Lui suggested that the buffer be expanded to encompass the entire lava *pu'u* covering the burial. She expressed that *pu'u* are an important feature of the natural and cultural landscape of coastal Keahuolū, and that the entire *pu'u* should be preserved as it was an important component of the burial area. The general feeling was that it was better for the buffer area to be based upon a natural landscape feature than on an arbitrary numeric distance. It was agreed that archaeologists from Pacific Legacy would map out the extent of the *pu'u* so that it could be included in development plans and that a more adequate buffer area could be established.

The consulting parties were in agreement that a low stone wall (approximately 2½ feet in height) should be constructed to mark the outer perimeter of the buffer area. For stability, the

wall of stacked stones will be mortared with cement. They felt that there should be a small opening in the wall to allow access. Mr. Jim Medeiros expressed his opinion that a gate not be placed in the opening, as it would only rust or rot and need replacement. He and Ms. Kaleikini suggested that the opening be secured with a simple metal chain that could be unlocked to allow entry into the walled buffer area.

The general feeling was that all non-native vegetation should be removed from within the walled burial area, and that only native species be allowed to grow there. It was felt that if native vegetation was planted, it should be appropriate to the dry climate of coastal Keahuolū. Mr. Leleiwi noted that mature trees or brush should not be planted as that would only serve to attract homeless individuals who might shelter themselves within the burial area. If any native vegetation was introduced, it should be low growing. The decision as to what, if any, native vegetation should be planted within the buffer wall was left to a later time.

Some discussion was held as to what, if any, signage would be appropriate to mark the burial. Ms. Lui mentioned the brass plaques that had been placed at the burials located adjacent to the Ane Keohokālole Highway and suggested that something similar might be used. The group expressed the desire to further consider the question of signage before coming to a decision.

It was agreed that the recognized cultural descendant and additional consulting individuals would reconvene once the lava *pu'u* had been mapped and the Burial Treatment Plan had been modified to reflect their suggestions.

Following the close of the general meeting, Ms. Nicole Lui, Mr. Mana Purdy, Mr. Michael Shibata, Mr. Morgan Leleiwi, and Mr. Rowland Reeve returned to the burial site to reexamine the area and establish the limits of the *pu'u* and the proposed buffer perimeter that was requested during the meeting. It was agreed that Mr. Reeve would return at a later date to map the extent and locations of the lava pressure ridge, the burial tube, and the nearby bulldozing so that an adequate and agreed upon buffer area could be established. The limits of the *pu'u* would be taken as the base of its slope. It was found that bulldozing had taken place along the northern and western edges of the lava pressure ridge, providing an established boundary for the proposed buffer zone. The remaining edges were examined and marked so that they could be mapped for planning purposes.

KEAHUOLŪ DESCENDANT MEETING, 5 OCTOBER 2017

Attendees

Ms. LeeAnn Crabbe, Lili'uokalani Trust
Mr. Mana Purdy, Lili'uokalani Trust
Mr. Morgan Leleiwi, Lili'uokalani Trust
Ms. Nicole Kealohaokalani Lui (Cultural Descendant)

On October 5, 2017 the Lili'uokalani Trust staff met with cultural descendant Ms. Nicole Kealohaokalani Lui to discuss the buffer zone around the Site 50-10-27-18511, Feature C lava tube burial. During the previous descendant meeting, Ms. Lui had indicated her desire to have the buffer zone extended to include the full area of the lava pressure ridge (*pu'u*) within which the lava tube burial is located. In preparation for the meeting, archaeologists from Pacific Legacy plotted the limits of the subsurface lava tube, its entrances, and the *pu'u* within which it rests, as well as the bulldozed areas located adjacent to it using a Trimble Geo7X Global Navigational Satellite System (GNSS) unit (Figure 16). The resulting map was then overlaid onto the proposed street network of the development to determine the proximity of the *pu'u* to the proposed realigned Kuakini Highway extension road corridor. The corridor was found to overlap a section of the southeastern end of the *pu'u*. This information was shared with Ms. Lui, who agreed to the removal of the section of the *pu'u* that overlapped the road corridor as long as the remainder of the *pu'u* was left intact.

When discussing the planned construction of the low (2 to 2.5 foot high) stone wall surrounding the burial area, Ms. Lui suggested that four boulders (preferably taken from the material removed from the road cut at the eastern edge of the *pu'u*) be embedded into the wall marking the four cardinal directions. She also recommended that the bronze plaque identifying the burial be located on the north-facing boulder.

Also discussed was the future appearance of the undeveloped areas located northeast and across the Kuakini Highway extension road corridor from the *pu'u*. Ms. Lui recommended that these areas be landscaped as naturally as possible with the open lava being planted with *maiapilo* (*Capparis sandwichiana*) bushes, *pili* (*Heteropogon contortus*) grass, and/or other native vegetation from the surrounding area.

KEAHUOLŪ DESCENDANT MEETING, 1 MARCH 2018

Attendees

Ms. LeeAnn Crabbe, Lili'uokalani Trust
Mr. Mana Purdy, Lili'uokalani Trust
Mr. Morgan Leleiwi, Lili'uokalani Trust
Mr. Mike Ikeda, Lili'uokalani Trust
Ms. Robyn Ito, SSFM International
Mr. Austen Drake, SSFM International
Mr. Rowland Reeve, Pacific Legacy, Inc.
Ms. Nicole Kealohaokalani Lui (Cultural Descendant)
Mr. Jim Medeiros (Consulting Party)

On March 1, 2018 the Lili'uokalani Trust held a follow-up meeting with recognized cultural descendants and additional individuals with family connections to Keahuolū to discuss the treatment recommendations for the Site 50-10-27-18511, Feature C lava tube burial. This meeting was held at the Trust offices in Kona. Prior to the meeting, all of the attendees had been provided with copies of the revised draft Burial Treatment Plan. The purpose of the meeting was to obtain clarity from the descendants and other attendees as to the proposed treatment recommendations for the burial.

Prior to the main discussion, Mr. Jim Medeiros expressed his opinion that lineal descendants of the Queen should be considered lineal descendants of all burials located on her lands.

Following an introductory *pule*, Mr. Mana Purdy of Lili'uokalani Trust presented a review of the burial treatment recommendations as they had been developed from previous meetings. He discussed the original 1993 Burial Treatment Plan, referenced the descendants' general feeling that the remains should be preserved in place, and mentioned the existing recommendations and issues to be discussed: sealing the lava tube entrances, construction of a physical buffer wall, leaving an opening in the wall for access, removing invasive species from within the buffer, and establishing the size and limits of the protective buffer.

Mr. Rowland Reeve, the archaeologist from Pacific Legacy, then began eliciting from the descendants and concerned individuals their thoughts on the various burial treatment recommendations.

Everyone in attendance was in agreement that the *iwi kupuna* (human remains) within the Site 50-10-27-18511, Feature C lava tube should be preserved in place.

Sealing the Tube: Mr. Medeiros expressed that there was no cultural reason for anyone to go into the tube. Ms. Lui and Mr. Medeiros both agreed that it would be best to seal off all entrances to the lava tube. This could be done with stones collected from the surrounding area placed within the openings to seal them. Mr. Medeiros would have preferred that the stones sealing the entrances be dry-stacked rather than cemented together, but acknowledged the reality of needing to mortar the stones in order to protect the burial from disturbance. It was agreed that the mortar should be stained to disguise it and to make it less visible.

Long-Term Site Monitoring: Ms. Lui expressed the desire for long-term monitoring of the condition of the burial site. She was assured by Lili'uokalani Trust staff that they regularly visit and monitor the condition of the known burials on their lands. Statements regarding the long-term monitoring, maintenance, and security of the Site 50-10-27-18511 burial have been included in the Burial Treatment Plan. "Maintenance and security of the Site 50-10-27-18511 burial will be provided by the Lili'uokalani Trust. The condition of the burial site will be assessed on a regular basis so that any potential threats from human or natural agencies can be identified."

Encircling Wall (visual buffer): Ms. Lui and Mr. Medeiros were both of the opinion that the burial site should be encircled with a low stacked stone wall. The reason for this wall would be to protect the site from future impacts. This wall would be placed along the outer boundary of the protective buffer zone. Mr. Medeiros felt that the wall should be two feet high and that it be mortared for stability. The stone used in the construction of the wall should be taken from the immediate area. Mr. Medeiros also suggested that the wall have a four-foot-wide entrance opening to allow access for maintenance and site visitation. When not in use, this opening would be closed off by means of a chain or rope. The placement of this opening would depend upon the shape and location of the buffer zone boundary. Ms. Lui reaffirmed her feeling that larger stones should be set into the wall to mark the four cardinal directions.

She agreed with Mr. Medeiros that these stones would be incorporated into the wall and would not be higher than the height of the wall itself.

Signage: Ms. Lui and Mr. Medeiros both felt that, given the location of the burial within a relatively high traffic area, there was a need for some form of signage. Rather than being placed in the enclosing wall, it was suggested that the signs be attached to large boulders placed outside the wall. Ms. Lui possesses several brass signs that were originally created for burial sites located alongside the route of the Ane Keohokālole Highway, but never used. The wording on these signs, which was in both Hawaiian and English, had been developed by Analu Josephus, a cultural descendant of the area. It was agreed by Ms. Lui and Mr. Medeiros that these existing signs could be used for the Site 50-10-27-18511 burial.

Buffer Zone: Ms. Lui had previously expressed her feeling that the protective buffer zone surrounding the burial should include the full extent of the lava pressure ridge (*pu*ʻ*u*) within which the lava tube burial is located. The existing plan prepared for Liliʻuokalani Trust by SSFM International calls for the realigned route of the Kuakini Highway to pass northeast of the burial site. This alignment would necessitate the removal of roughly 30 feet from the eastern edge of the *pu*ʻ*u*. Mr. Medeiros stated that he wanted to save the entire *pu*ʻ*u*, no matter what. The planners from SSFM International and the Liliʻuokalani Trust staff explained the reasons for the proposed alignment of the highway, indicating that the County of Hawaiʻi required that the road be four lanes (including a bike lane) and that in order to fit the required speed (35 miles per hour) it could not have a sharper bend (which would allow it to be positioned further from the burial).

Mr. Medeiros was insistent that the alignment needed to be moved. He asked the planners to provide him with an alternate option. Mr. Medeiros felt that the entire *pu*ʻ*u* was part of the burial site and wanted the pressure ridge to be preserved in its entirety. He would not agree with the proposed design of the road and buffer area, and stressed the preciousness of the *iwi kupuna* at Site 50-10-27-18511 as it was the only one left in the area.

Ms. Lui agreed with Mr. Medeiros, stating that she felt the *pu*ʻ*u* was part of the burial. She also noted that the lava tube was an area where water was found and could have been used as a water catchment, giving it added significant in this dry region of coastal North Kona. She pointed out that if the highway affected the *pu*ʻ*u*, it might also affect the availability of water in the tube. She expressed the hope that the Trust could come up with a different plan to route the road around the *pu*ʻ*u* and not cut into it.

Mr. Medeiros suggested moving the road alignment so that it ran *makai* of the burial site. Ms. Crabbe explained that the proposed highway realignment needed to meet up with the existing intersection at Makala. The planners stressed that the highway alignment needed to be a smooth curve rather than an 'S' bend for safety reasons. Mr. Medeiros said that he understood these limitations, but that he felt the planning should overcome them to make it work.

Ms. Crabbe clarified that the Trust originally considered the lava tube to be the burial area, but now understood that the descendants felt that the entire *pu*ʻ*u* was part of the burial.

Mr. Medeiros stated that there needed to be more options for the alignment of the highway, that he would like to see options for going different routes. He expressed his gratitude to the Trust for being included in the planning process, and understood there might be costs involved in rerouting the highway alignment, but felt that this was an opportunity for Liliʻuokalani Trust to be "not just another developer," and to preserve its *kūpuna*. As a lineal descendant to the Queen, "My duty is to advocate for the *kūpuna*." He hoped it would be possible to examine more options. Thanking the Trust for its patience, he asked for another design that would use the open land to the south and west and reroute the road away from the burial. "We aren't stuck. We are only just starting."

Ms. Crabbe asked how the perimeter of the lava pressure ridge was determined. Ms. Lui explained that what was mapped was the visible edge of the *pu*ʻ*u* where its slope met the surrounding relatively level lava. Mr. Medeiros re-emphasized that, "we see the burial as the entire *pu*ʻ*u*." He asked rhetorically, "What do we get as a people by yielding to construction?" Ms. Lui asked why the road alignment had to be so wide. The planners explained that the County intended for the highway to be four lanes of traffic. Mr. Medeiros requested that the Trust reconsider their plans and come back with an alternative alignment. He expressed the desire of the descendants to save the entire site.

Ms. Crabbe requested clarification for the future, asking if the Trust should consider natural terrain features when determining the boundaries of cultural sites and buffer zones. The general opinion was, yes, that natural boundaries were a more traditional way of looking at things. Mr. Medeiros also stressed that it is important to ask for consultation and save as much as you can. "Our *kuleana* is the *kūpuna*," he explained. "It is not our job to design the road." He was not ready to compromise or say yes to any plans, and felt there needed to be more creativity.

Mr. Ikeda asked if it would be possible to use the rock from that portion of the *pu*ʻ*u* which would be cut by the highway to seal the tube openings. In that way the removed stones from the *pu*ʻ*u* could become part of the burial. Mr. Medeiros indicated that this would be a "worst case" scenario, that he would prefer not to damage the *pu*ʻ*u* in the first place.

At the close of the meeting, the decision of the Trust staff was that they and the planners would return to the drawing board and that once alternative avenues were explored the group would reconvene for a future meeting.

KEAHUOLŪ DESCENDANT MEETING, 18 APRIL 2018

Attendees

Ms. LeeAnn Crabbe, Liliʻuokalani Trust
Mr. Mana Purdy, Liliʻuokalani Trust
Mr. Morgan Leleiwi, Liliʻuokalani Trust
Mr. Mike Ikeda, Liliʻuokalani Trust

Mr. Rowland Reeve, Pacific Legacy, Inc.
Ms. Nicole Kealohaokalani Lui (Cultural Descendant)
Mr. Aaron Joseph Lui (Cultural Descendant)
Mr. Jim Medeiros (Consulting Party)

On April 18, 2018 the Liliʻuokalani Trust held a fourth meeting with recognized cultural descendants and additional individuals with family connections to Keahuolū to present design plan changes developed to address concerns raised at the previous meeting (held on March 1, 2018). The April 18th meeting was held at the Trust offices in Kona. The purpose of the meeting was for Liliʻuokalani Trust staff to present to the descendants and other attendees revised road designs that would serve to protect the entire extent of the lava pressure ridge (*puʻu*) within which the Site 50-10-27-18511, Feature C lava tube burial is located.

Concerns had been raised during the March 1, 2018 meeting that the existing design plan called for the realigned route of the Kuakini Highway to pass northeast of the burial site, an alignment which would necessitate the removal of roughly 30 feet from the eastern edge of the *puʻu*. This alignment was felt by the descendants and other attendees to be unacceptable, and they requested that Liliʻuokalani Trust staff consult with their experts to come up with one or more alternative alignments that would avoid impacting the entire *puʻu*.

Following an introductory *pule*, Mr. Mana Purdy of Liliʻuokalani Trust presented a review of the results of the previous meetings held regarding the Burial Treatment Plan for the Site 50-10-27-18511, Feature C lava tube burial. The initial meetings had resulted in the general agreement that the permanent preservation buffer surrounding the burial should include not only the lava tube itself, but also the low *puʻu* (lava pressure ridge) containing the lava tube. Mr. Purdy expressed the Trust's appreciation to the descendants for sharing their *manaʻo* that a cultural site consists not only of a structure (or in this case a burial), but the land form that encompasses it (in this case the *puʻu*), and how important it is to preserve the entirety of the land form.

Mr. Purdy then discussed the results of the previous meeting and the rejection of the plan put forth by the Trust that would necessitate the removal of a portion of the *puʻu*. He then explained that following the meeting, Liliʻuokalani Trust staff had met with their planners and technical professionals to discuss possible solutions. A number of alternatives were broached, and two possible options were agreed upon. Both of these options realigned the streets in the area to avoid impacting the *puʻu*.

Mr. Purdy then showed plans depicting the two options. In the first option, the route of the proposed realigned Kuakini Highway was redesigned so as to pass further northeast of the burial site, thereby avoiding impacting the *puʻu*. This option required that the realigned highway encroach 10 feet onto the lot presently occupied by the BMW dealership and 24 feet into the Target parking area. This option would require negotiation with both Target and the BMW dealership.

The second option kept Kuakini Highway along its present alignment south of the Kona Commons area and then had it swing north to the west of the current Makala Boulevard. In both options, the area surrounding the *puʻu* would be framed by roads and by a

bicycle/walking path. Both options ensured that the *puʻu* containing the burial was not impacted by construction activities.

The descendants and other attendees were happy with the two new options. They expressed their appreciation to the Trust for its willingness to go back to the drawing board and come up with a plan to preserve the *puʻu*. Although both options were agreeable to the group, Mr. Medeiros preferred the second option as it would not require any discussions with Target or the BMW dealership. Mr. Medeiros explained that he supports the second option and that he would also support this through the Burial Council process. The primary purpose of the first option to realign Kuakini Highway was to create a pedestrian and bicycle promenade next to the park area along the present alignment of the highway. Mr. Medeiros did not care about bikers or a walkway. Mr. Lui said to let the County worry about bike lanes. He and Ms. Lui agreed that they felt the second option was best.

Mr. Reeve, the archaeologist from Pacific Legacy, then went over with the descendants and other attendees the treatment recommendations previously agreed upon.

<u>Sealing the Tube</u>: The descendants expressed their desire to be involved in the sealing of the lava tube entrances. Ms. Lui requested that Mr. Medeiros be hired to seal the entrances. The descendants want to be present during the sealing of the tube, and to have representatives of Liliʻuokalani Trust present, to ensure that the proper protocols are followed.

<u>Encircling Wall</u>: Ms. Lui and Mr. Medeiros both felt that the low stacked stone wall enclosing the burial and marking the visible buffer should follow the perimeter of the lava pressure ridge. On the northern edge, however, the wall should run straight across from one point of the crescent-shaped lava pressure ridge to the other, allowing for an entrance area. Mr. Medeiros reiterated that the wall should be approximately two and a half feet high and that it have a four-foot-wide entrance opening to allow access for maintenance and site visitation. When not in use, this opening would be closed off by means of a simple chain or rope.

<u>Signage</u>: It was agreed that one of the brass signs originally created for burial sites located alongside the route of the Ane Keohokālole Highway and presently in the possession of Ms. Lui be used to mark the Site 50-10-27-18511 burial.

<u>Vegetation</u>: It was generally agreed that all non-native vegetation should be removed from within the walled burial area, and that only native species be allowed to grow there. If native vegetation was planted within the burial area it should be appropriate to the dry climate of coastal Keahuolū. The decision as to what, if any, native vegetation was to be planted within the buffer wall would be determined once invasive vegetation was cleared and the area was given a chance to recover. It was agreed upon that the option of planting native vegetation outside of the enclosing wall to provide a visual buffer for the burial would be considered based upon the future use of the surrounding area.

At the close of the meeting the descendants and others in attendance again thanked the Trust staff for their willingness to come up with alternative design plans that made it possible to preserve the burial and the surrounding *puʻu* in their entirety.

SHPD ACCEPTANCE LETTER OF HISTORIC PRESERVATION PLAN FOR SITE NOS. 50-10-13260, 50-10-27-13261, AND 50-10-27-30287 DATED MARCH 6, 2023

APPENDIX I-1

STATE OF HAWAII | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

March 6, 2023

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2303NM03
Archaeology

Zendo Kern, Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District Archaeological Preservation Plan
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por.; (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi Makalapua Project District (MPD) and the supporting document titled *Revised Draft Preservation Plan for SIHP 50-10-27-13260, 50-10-27-13261, and 50-10-27-30287, Liliʻuokalani Trust Lands in the Ahupuaʻa of Keahuolū, North Kona District, Island of Hawaiʻi, [TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015]* (Mulrooney and Cleghorn, March 2023). Our office received the initial draft preservation plan (PP) on August 15, 2022; requested revisions on November 2, 2022 and March 1, 2023; and received the revised PP on March 6, 2023.

The County of Hawaiʻi Planning Department, on behalf of the Liliʻuokalani Trust, has provided the SHPD with a cover letter dated March 15, 2019 describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original project submittal on March 25, 2019 (Log No. 2019.00636).

The Liliʻuokalani Trust proposes the development of the MPD which is a 67.2-acre property. The MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. Additional improvements may include a Kuakini Highway extension.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD (see Attachment). SHPD made a project effect determination of "Effect, with agreed upon mitigation commitments" for the project and requested an archaeological monitoring plan, an archaeological data recovery plan, and an archaeological preservation plan (July 26, 2022; Project No. 2020PR34163, Doc. No. 2207NM07). Subsequently, SHPD accepted the data recovery plan (Mulrooney and Cleghorn, December 2022) on December 20, 2022 (Project No. 2020PR34163, Doc. No. 2212NM06), and the archaeological monitoring plan (Tuitavuki and Mulrooney, December 2022) on the February 24, 2023 (Project No. 2020PR34163, Doc. No. 2302NM06). For previous SHPD correspondence related to this project see the Attachment in HICRIS Project No. 2020PR34163.

The PP (Mulrooney and Cleghorn, December 2022) meets the requirements of HAR §13-277. **It is accepted.** Please send one hard copy of the document, clearly marked FINAL, along with a copy of this letter and a text-searchable PDF version of the AMP to the Kapolei SHPD office, attention SHPD Library. In addition, please send a copy of the AMP to the Hawaiʻi Island SHPD Office attn, Sean Naleimaile. Also, submit a text-searchable PDF copy of the final

AMP to HICRIS Project No. 2020PR34163 using the Project Supplement option and a PDF copy of the PP to lehua.k.soares@hawaii.gov.

SHPD requests via email and HICRIS written and photographic verification that the interim protection measures for the preservation sites have been implemented prior to project initiation.

SHPD shall notify the County and LT when the data recovery report has been accepted by SHPD and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawaiʻi Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Alan Arakawa, aarakawa@onipaa.org
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Rick Gmirkin, rick_gmirkin@nps.gov

Attachment
SHPD Reviews of Previous Archaeological Studies Related to Current Proposed Project

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites. The report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted this AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented archaeological sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was conducted for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

ARCHAEOLOGICAL MONITORING PLAN

APPENDIX J

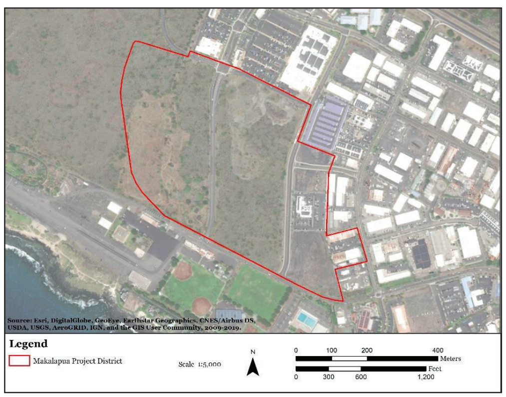
Pacific Legacy

Historic Preservation

FINAL

**ARCHAEOLOGICAL MONITORING PLAN
FOR THE MAKALAPUA PROJECT DISTRICT,
LILIʻUOKALANI TRUST LANDS
IN THE AHUPUAʻA OF KEAHUOLŪ,
NORTH KONA DISTRICT, HAWAIʻI ISLAND**

**[TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010;
(3) 7-4-025:001–003, 005, 015, 021]**



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FINAL

ARCHAEOLOGICAL MONITORING PLAN FOR THE MAKALAPUA PROJECT DISTRICT, LILIʻUOKALANI TRUST LANDS IN THE AHUPUAʻA OF KEAHUOLŪ, NORTH KONA DISTRICT, HAWAIʻI ISLAND

[TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010; (3) 7-4-025:001–003, 005, 015, 021]

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Note: *In this report, the spellings and the use of diacritical marks (glottal stops and macrons) follow conventions employed by Pukui and Elbert (1986) and Pukui et al. (1974) with limited exceptions – spellings and diacritical marks in quotations, titles, and proprietary names are given as they appear in the original sources.*

Cover Image: *Map showing location of Makalapua Project District on an aerial photograph (base map: Esri World Imagery 2021).*

1.0 INTRODUCTION

At the request of Lili‘uokalani Trust, Pacific Legacy, Inc. has prepared the following archaeological monitoring plan (AMP) for the Makalapua Project District. The purpose of this plan is to propose a field methodology for mitigating adverse impacts to existing and potential resources, and to ensure that the proposed trenching and grading at the subject parcel does not adversely affect potentially significant surface and subsurface features within the Makalapua Project District, located within the *ahupua‘a* of Keahuolū, in the district of North Kona, on the island of Hawai‘i [TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009 and 010; (3) 7-4-025:001, 002, 003, 005, 015, and 021] (Figure 1, Figure 2, Figure 3, Figure 4).

The Makalapua Project District (MPD) includes further development on 67.2 acres of Lili‘uokalani Trust lands that were subjected to archaeological inventory surveys (AIS) as part of larger project areas, including the Kona Commons Project Area and the Urban Phase III Project Area, which were both zoned for commercial use by the County of Hawai‘i. The MPD includes the southern portion of the Kona Commons Project Area, which was subjected to an AIS in 1992 (O'Hare and Rosendahl 1993) and a supplemental AIS (SAIS), which was completed in 2015 (McIntosh et al. 2015). The MPD also includes a small portion of the southeastern portion of the Urban Phase III Project Area, which was the subject of an AIS completed in 2019 (Reeve et al. 2019). Two additional parcels were subjected to a field inspection in 2020 and are currently fully developed with commercial warehouses. The State Historic Preservation Division (SHPD) approved the SAIS report for the Kona Commons Project Area in 2015 (Log No. 2015.02142; Doc. No. 1508MV17) and the AIS report for the Urban Phase III Project Area in 2019 (Log No. 2019.01679; Doc. No. 1909AM05). SHPD agreed with the recommendation that an archaeological monitoring plan be developed and implemented during all ground-disturbing construction activities in each of the project areas; see Appendix A. Additional correspondence relating to the MPD is included in Appendix B.

This Archaeological Monitoring Plan has been developed in consultation with cultural descendants from the area, the Office of Hawaiian Affairs (OHA), State Historic Preservation Division (SHPD) staff, and Lili‘uokalani Trust.

1.1 Project Description

The MPD Area is located within the lands of Lili‘uokalani Trust, in the *ahupua‘a* of Keahuolū in the *moku* (district) of North Kona on the island of Hawai‘i. Lili‘uokalani Trust is proposing the development, enhancement, and refinement of approximately 67.2 acres of land that includes portions of the 110-acre Kona Commons property and the adjacent 213-acre Urban Phase III parcel, as well as a small section of the previously developed land known as the "Kona Industrial Area" east of the Kona Commons parcel (Figure 1 and Figure 2). The area is at the northern edge of Kailua town in the coastal portion of the *ahupua‘a* of Keahuolū.

The MPD responds to the need for housing and provides economic growth opportunities for the County of Hawai‘i's growing population. Though mostly undeveloped at present, portions of the MPD Area have been disturbed by bulldozing, and by landscaping associated with the construction of the surrounding area. Although the land plan for the MPD is still being envisioned, future developments in the MPD include potential residential, hotel, retail, commercial, civic/community uses, and open space. Related modification of the landscape would include grubbing, grading, and trenching for building pads and utilities.

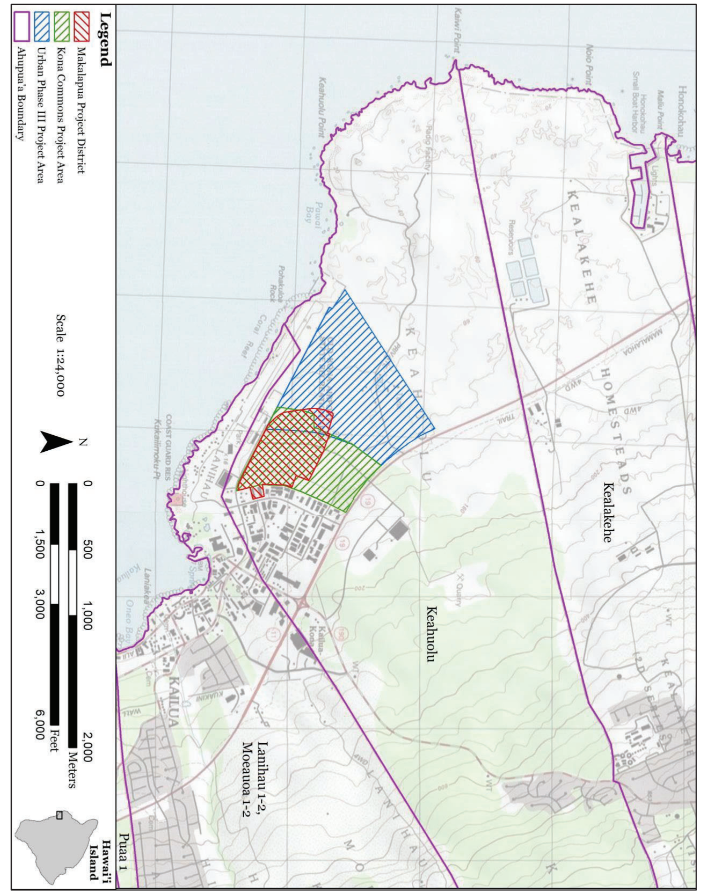

Figure 1. Location of Makalapua Project District Area relative to the Urban Phase III and Kona Commons Project Areas on USGS Keahole Point and Kailua Quadrangles 1996.

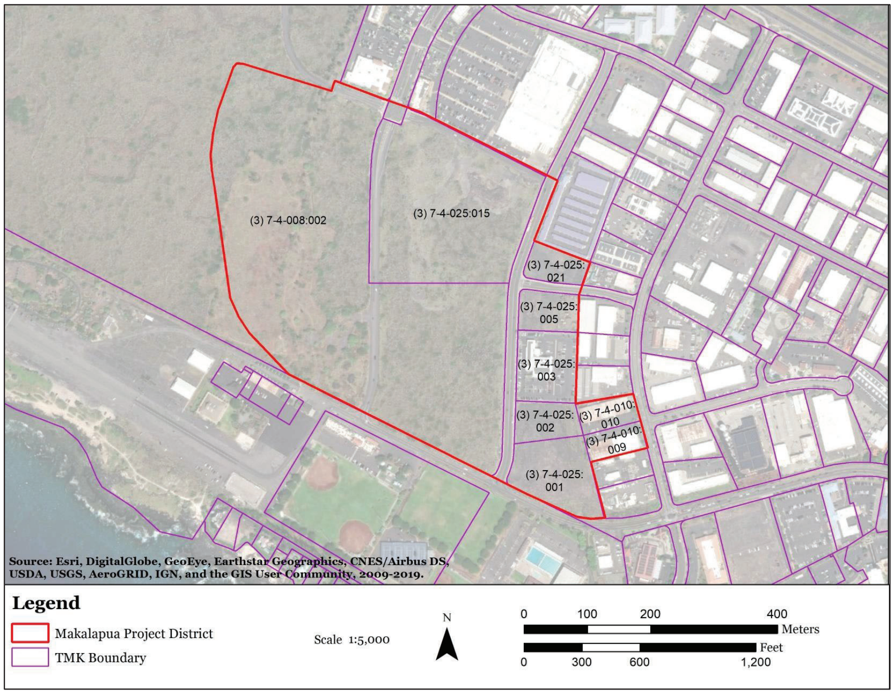

Figure 3. Location of TMKs within Makalapua Project District Area (base map: Esri World Imagery 2021).

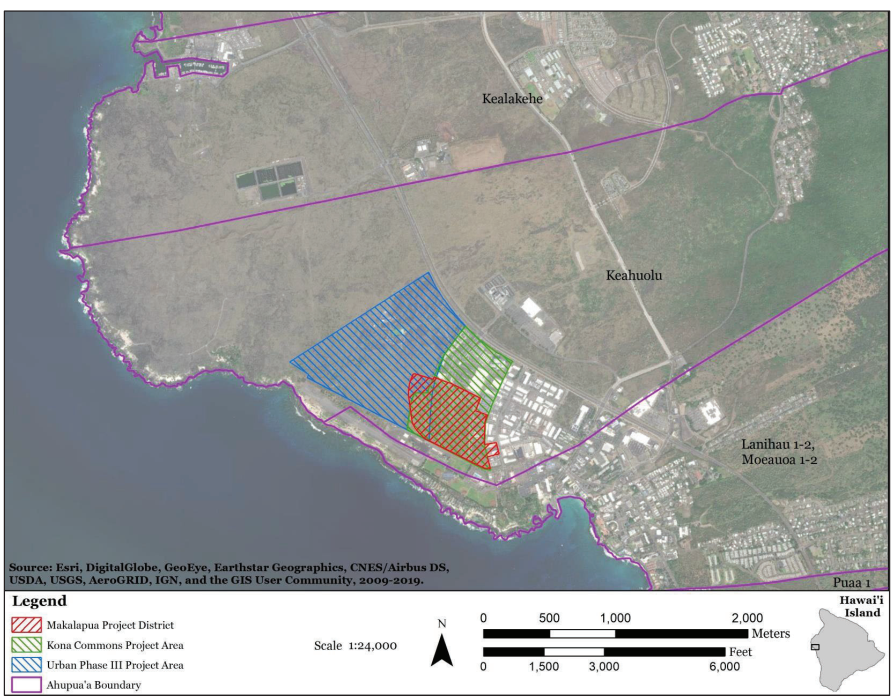

Figure 2. Location of Makalapua Project District Area relative to the Urban Phase III and Kona Commons Project Areas on an aerial photo (base map: Esri World Imagery 2021).

1.2 STATUTORY REQUIREMENTS

Hawai'i Administrative Rules (HAR), §13-279-4 specifies the components to be included within an AMP. It also indicates that the AMP will need to be reviewed and approved by SHPD before the implementation of the plan and the initiation of any ground-disturbing activities related to the specific project. HAR §13-279-4 states that:

(a) Archaeological monitoring shall be based on a written plan, which specifies:

(1) what kinds of archaeological remains or historic properties are anticipated;
(2) where in the construction area these properties are likely to be found;
(3) needed fieldwork, which may include, but not be limited to, profile documentation of cultural layers' stratigraphy, drawings, photographs, excavation of exposed features;
(4) a provision that the archaeologist conducting the monitoring has the authority to halt construction in the immediate area of a find, in order to carry out the plan. Construction can shift to other areas in such a case;
(5) a coordination meeting with the construction team and archaeologist, so the construction team is aware of the plan;
(6) any laboratory work expected to be done;
(7) report preparation; and
(8) archiving of collections.

(b) This plan shall be reviewed and approved by the SHPD prior to initiation of the monitoring project, pursuant to HAR §13-284.

2.0 BACKGROUND

Multiple archaeological inventory surveys were conducted that included the majority of the Makalapua Project District, which includes portions of the Kona Commons Project Area and a portion of the Urban Phase III Project Area. The AIS investigations were undertaken in order to identify historic properties within the project areas, assess the integrity and significance of identified historic properties, and provide mitigation recommendations. A brief environmental, historical, and archaeological background summary, and a summary of the findings of the AIS investigations within the MPD, are included below.

2.1 ENVIRONMENTAL AND HISTORICAL BACKGROUND SUMMARY

2.1.1 Environmental Background

The Makalapua Project District is located at the foot of the volcanic peak of Hualālai, on the drier leeward side of the island of Hawai'i. The geology underlying most of the area consists of gently undulating *pāhoehoe* lava flows laid down sometime between 1,500 and 3,000 years ago (Wolfe and Morris 1996). These *pāhoehoe* flows add very little in terms of surface soils, most of which consist of aeolian sediments that have accumulated in depressions and low-lying areas (soil type rLW in Sato et al. 1973). The lava is scarred by upthrust pressure ridges, fissures, collapsed blisters, and lava sinks. Subsurface lava tubes and blisters are also present within the flow.

Along this stretch of the Kona coast, annual rainfall is less than 750 millimeters (c. 29.5 inches), allowing for sparse vegetation to populate the area (Giambelluca et al. 1986). Undisturbed *pāhoehoe* flows within the Makalapua Project District are covered in surface vegetation of introduced fountain grass (*Pennisetum setaceum*), with occasional stunted *kiawe* (*Prosopis pallida*), and Christmas berry (*Schinus terebinthifolius*) trees, as well as *koa haole* (*Leucaena leucocephala*), klu (*Acacia farnesiana*), lantana (*Lantana camara*), and bougainvillea (*Bougainvillea* spp.) shrubs. Scatters of native shrubs such as *'uhaloa* (*Waltheria indica*) are also present, with Polynesian-introduced *noni* (*Morinda citrifolia*) trees growing out of lava sinks and other natural depressions in the terrain. During the pre-Contact period, the dominant vegetation throughout this area would probably have been *pili* (*Heteropogon contortus*) grass.

2.1.2 Historical Background

The *ahupua'a* of Keahuolū possesses a rich cultural history that has been investigated as part of the various cultural and archaeological studies undertaken for the Lili'uokalani Trust by Pacific Legacy. A detailed narrative of the cultural and historical background of the *ahupua'a*, with emphasis on its coastal region, is provided in the SAIS report for the Kona Commons property (McIntosh et al. 2015) as well as the AIS report for work undertaken in the Urban Phase III parcel (Reeve et al. 2019).

2.1.3 Traditional Settlement

Archaeological studies and historic research suggest that the primary centers of population within the *ahupua'a* of Keahuolū during the pre-Contact period were located at the coast and in the well-watered uplands (McIntosh et al. 2015:23–26). The main areas of coastal settlement were located at the small crescent bays of Halepa'o and Pawai (also known as Papawai, according to Clark 2003:287), as well as along the sandy beach immediately south of Pawai in the area known as Makā'eo. The fishing village of Makā'eo was likely the closest settlement to the Makalapua Project District. Although the Makalapua Project District area shows some evidence of human activity during the pre-Contact period, this activity appears to have been of a temporary nature and the area did not likely support a permanent pre-Contact population (McIntosh et al. 2015).

Evidence suggests that the coconut grove which is known historically to have fringed Pawai Bay stretched further south along the shoreline to shade the fishing settlement of Makāʻeo. Boundary Commission testimony, collected in the latter half of the 19th century, indicates that there was "an old village, on Lanihau, called Makaeo" (Boundary Commission Vol. A, No. 1:354). Makāʻeo was located along the shoreline to the south and east of the prominent outcropping of lava known as Pōhakuloa, which rises from the sea near the northern end of the Old Kona Airport runway and marks the boundary point along the shore between the *ahupuaʻa* of Keahuolū and Lanihau. The fishing village of Makāʻeo appears to have been the closest settlement to the Kona Commons property. Although the Kona Commons itself shows some evidence of traditional human activity (see Section 2.2), this activity all appears to have been of a temporary nature and the area does not look to have supported a permanent pre-Contact population (McIntosh et al. 2015:183–184).

2.1.4 Post-Contact Period

In the early years following Western contact, little changed in the lives of the inhabitants of coastal Keahuolū. With time, however, the introduction of foreign diseases for which the *kamaʻāina* (native-born residents) possessed no natural resistance, as well as population shifts caused by changing economic conditions, resulted in a general decrease in the coastal population of the *ahupuaʻa* (McIntosh et al. 2015:28). Despite this general population decline, the fishing settlements of Pawai and Makāʻeo continued to be occupied by local *ʻohana* (families) into the 1940s, when the village of Makāʻeo and its attendant coconut grove was destroyed to make way for the Kona Airport (Clark 1985:110 and McIntosh et al. 2015:25–26).

At the time of the Māhele ʻĀina (land division) of the 1840s, the entire *ahupuaʻa* of Keahuolū was awarded to the *aliʻi wahine* (chiefess) Analea (Ane) Keohokālole under Land Commission Award 8452: Apana 12 (Royal Patent 6851). Only six smaller *kuleana* claims were awarded to *makaʻāinana* (commoners) within the *ahupuaʻa* of Keahuolū. All of these were located within the upland portion of the *ahupuaʻa*, well away from the coast. Two historic-era trails (the Māmalahoa Trail and a smaller horse trail) are known to have crossed the Kona Commons property during the post-Contact period (McIntosh et al. 2015:28–29, 182–183). These trails represent the only known post-Contact sites in the area. As with the pre-Contact period, there does not appear to have been any permanent occupation on the property during the post-Contact period (McIntosh et al. 2015:183–184). Development of the Kona Commons for commercial purposes only took place after 1992.

2.2 Archaeological Background Summary

The *ahupuaʻa* of Keahuolū has been the subject of several archaeological investigations beginning in the first decade of the twentieth century, when Bishop Museum archaeologist John F.G. Stokes began documenting the *heiau* (shrines) of Hawaiʻi Island (Stokes 1991). The earliest investigations formed part of larger regional or island-wide surveys, and as a result were not as detailed as later studies. These initial surveys were concentrated along the coast, which was the main area of settlement during the pre-Contact period. A detailed review of these early archaeological studies, as well as those later investigations undertaken within the broader *ahupuaʻa* as a whole, is provided in the SAIS report of the Kona Commons property (McIntosh

et al. 2015:51–69). The following sections provide information on the two most recent archaeological studies undertaken within the Kona Commons project area as well as previous studies in the adjacent Urban Phase III project area, portions of which are within the Makalapua Project District.

2.2.1 PHRI Inventory Survey of the Kona Commons Project Area, 1992

In 1992, Paul H. Rosendahl Ph.D., Inc. (PHRI) conducted an AIS of the 100-acre Kona Commons property (O'Hare and Rosendahl 1993). The 1992 survey identified a total of 18 archaeological sites containing 38 component features (Figure 4). These sites included a segment of the historic Māmalahoa Trail, as well as lava excavations, modified outcrops, filled depressions, stone alignments, stone mounds, terraces, walls, hearths, walled overhangs, an enclosure, a modified depression, a cairn, a cave shelter, and a lava tube burial (O'Hare and Rosendahl 1993:ii). The 1992 inventory did not identify the Site 50-10-27-30210 complex. The 1992 AIS provided substantial evidence of human activity within the Kona Commons project area during the pre-Contact period. These activities, however, all appear to have been primarily short-term in nature, undertaken by individuals visiting or passing through the area rather than residing within it.

2.2.2 Pacific Legacy Supplemental Archaeological Inventory Survey of the Kona Commons Project Area, 2014

In 2014, Pacific Legacy, Inc. conducted an SAIS of the Kona Commons property (McIntosh et al. 2015) that included both the original 100 acres surveyed by PHRI in 1992 and an additional 10 acres extending off of its southwest corner in the area formerly occupied by the Swing Zone driving range (Figure 4). This SAIS was undertaken to assist the Liliʻuokalani Trust in planning for the future development of the area. The purpose of this survey was to assess the current state of the historic properties initially identified during the 1992 survey and to determine if any additional historic properties existed on the property.

During the course of the SAIS, 11 archaeological sites consisting of 21 component features were identified. These sites consist primarily of small and crudely constructed features or modified natural features, including stone mounds, modified depressions, modified overhangs, C-shaped walls and alignments, small enclosures, a historic petroglyph, and a historic trail. Of the 11 sites identified, four had been previously recorded (SIHP 50-10-27-18502, 50-10-27-18508, 50-10-27-18509, 50-10-27-18511), while seven sites were newly identified (SIHP 50-10-27-30207, 50-10-27-30208, 50-10-27-30209, 50-10-27-30210, 50-10-27-30211, 50-10-27-30212, 50-10-27-30287). These features appear to have served a range of functions. Among these were temporary habitation, storage, travel, visual markers, possibly stone quarrying and/or crop cultivation (in the case of the lava excavations), communication (in the case of the historic petroglyph), and burial.

The results of the 2014 survey indicated that the majority of the sites located within the Kona Commons survey area dated from the pre-Contact period. Three sites, the Site 50-10-27-18502 modified depression, the Site 50-10-27-30211 petroglyph (which consists of two English letters, possibly representing personal initials), and the Site 50-10-27-30287 trail appeared to date from the post-Contact or modern periods. The remainder of the sites possessed a more traditional style of construction, suggesting that they were pre-Contact in age.

All of the sites identified during the 2014 survey appeared to have been associated with relatively short-term activities. Among these activities was the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, and burial crypts. Small stone enclosures and walled shelters appeared to have been erected to serve as temporary camping areas. Low stone mounds were built to serve as markers. Rough excavations were created in the lava surface, either to supply stone for the construction of nearby surface features, or to open pits that could be filled with mulch and used to grow dryland crops (McIntosh et al. 2015).

2.2.3 Archaeological Surveys of the Urban Phase III Project Area

The Urban Phase III project area was the subject of a reconnaissance survey by the Archaeological Research Center Hawai‘i (ARCH; Ching 1978), an Archaeological Inventory Survey (AIS) undertaken by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1989–1990 (Donham 1990), and an AIS undertaken by Pacific Legacy in 2011 (Reeve et al. 2019). Haun & Associates (Haun and Henry 2006) also completed an archaeological survey that included a road corridor through a portion of the Urban Phase III project area. Stasack and Stasack completed detailed recording and analysis of petroglyph sites throughout Lili‘uokalani Trust lands in Keahuolū, including 14 of the 18 identified sites containing petroglyphs within the Urban Phase III project area (Stasack and Stasack 2012).

In 1978, Francis Ching of Archaeological Research Center Hawai‘i, Inc. (ARCH) conducted a reconnaissance survey of 987 acres within the *ahupua‘a* of Keahuolū. This survey covered much of the coastal portion of the *ahupua‘a*, extending from the shoreline up to the Queen Ka‘ahumanu Highway. The survey resulted in the recording of a total of 59 archaeological sites containing 140 individual component features. Nine of the sites appeared to be located within the Urban Phase III survey area.

In 1990, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an AIS and test excavations of sites situated within a 1,100-acre portion of Lili‘uokalani Trust lands within Keahuolū (Donham 1990). The designated survey area covered lands located both *mauka* and *makai* of the Queen Ka‘ahumanu Highway. This survey was the most extensive archaeological investigation to be undertaken within the *ahupua‘a* up to that time. Included within the survey was a 212-acre parcel located *makai* of the Ka‘ahumanu Highway that had formed part of Ching's original 1978 survey area and included the Urban Phase III project area. The PHRI survey recorded a total of 239 sites (composed of 1,810+ component features) within its survey area. Of these, 55 sites were located within the 212-acre parcel located *makai* of Ka‘ahumanu Highway, which roughly corresponds to the Urban Phase III project area. Among the numerous features documented within this portion of the 1,100-acre survey area were excavated areas within the *pāhoehoe* lava, stone mounds, rock walls, cave shelters containing marine shell midden, stone platforms and terraces, and petroglyphs.

In 2006, archaeologists from Haun & Associates conducted an archaeological inventory survey of the proposed Kona Kai Ola project, which consisted of two parcels encompassing a total of ca. 370.5 acres in the *ahupua‘a* of Kealakehe located immediately north of coastal Keahuolū (Haun and Henry 2006). Their survey area also included a road corridor that extended south into Keahuolū and crossed through the Urban Phase III project area. They identified eight sites within the Urban Phase III road corridor, one of which had been previously recorded during the 1990 PHRI survey (Site 50-10-27-13271), while the remaining seven were assigned new State Inventory of Historic Places site numbers (Sites 50-10-27-25644 to 50-10-27-25650). The sites

identified within the Keahuolū corridor consisted of stone alignments, stone mounds, and a lava blister.

In 2011, Pacific Legacy, Inc. conducted an AIS for the Urban Phase III project, which included the recording of 120 archaeological sites containing 214 component features (Reeve et al. 2019). The survey also identified and recorded the locations of 540 lava excavations. Excavations of this type were distributed throughout the survey area. While each lava excavation was individually recorded, all were grouped together under one State Inventory of Historic Places site number: SIHP 50-10-27-29175. These lava excavations bring the total number of sites recorded up to 121.

Of the 121 sites identified in the Urban Phase III project area during the 2019 AIS, 36 had been previously recorded, either during the 1978 ARCH reconnaissance survey (seven sites, four of which had been assigned new site numbers by the 1990 survey; Ching 1978), the 1990 PHRI inventory survey (27 sites and five lava excavations; Donham 1990), or the 2006 Haun & Associates survey (six sites; Haun and Henry 2006). A total of 85 sites were newly identified during the 2019 AIS (Reeve et al. 2019).

Nine of the sites documented in 1978 by the ARCH (Ching 1978) reconnaissance survey appear to have been located within the limits of the present survey area. Only two of these sites were positively re-identified during the 2011 AIS. Five additional sites (one of which may be a lava excavation) were tentatively identified. The remaining two sites were not re-located and appear to have been destroyed, as they were recorded in the area formerly occupied by the Swing Zone driving range.

During the course of the 2011 survey, an effort was also made to re-locate and re-identify all of the structural features recorded during the 1990 PHRI survey and the 2006 Haun & Associates survey. The 2011 survey was able to identify 36 of the 55 sites that were previously documented during the 1990 PHRI inventory survey. Five of these sites (SIHP 50-10-27-13276, 50-10-27-13277, 50-10-27-13285, 50-10-27-13296, and 50-10-27- 13352) were lava excavations and were recorded under SIHP 50-10-27-29175. It also re-located seven sites recorded by Haun & Associates (along with two features possessing site tags with temporary site numbers, most likely assigned by the 2006 survey, that did not appear on the final site map). Several of the sites recorded during the 1990 survey that were not re-identified during the 2011 survey consist of what the 1990 survey report refers to as "pahoehoe excavations" and which the 2011 survey identified simply as "lava excavations." Some of the sites recorded during the 1990 survey were located toward the southeastern corner of the survey area. These sites were likely destroyed by ground-disturbing activities associated with the transformation of the Old Kona Airport into a beach park and the construction and landscaping of the Swing Zone driving range. All 14 of the sites containing petroglyphs that were documented by Stasack and Stasack (2012) were re-located during the 2011 survey. An additional four sites containing petroglyphs were also documented.

2.2.4 Identified Sites within the Makalapua Project District

A total of 16 historic properties have been identified within in the Makalapua Project District (Figure 4, Table 1). Many of the sites identified during previous surveys of the Kona Commons and Urban Phase III project areas appear to have been associated with relatively short-term activities. Among these activities is the modification and use of natural overhangs and lava tubes to serve as temporary shelters, storage areas, water catchment areas, and burial crypts. Small stone enclosures and walled shelters were likely erected to serve as temporary habitation areas or small shrines (*heiau*). People traveled across these areas on trails, low stone mounds were built to serve as markers, and concentrations of petroglyphs were created to mark *wahi pana* (storied places) or trails that people used to traverse the landscape. Rough excavations were created in the lava surface, either to supply stone for the construction of nearby surface features, or to open pits that could be filled with mulch and used to grow dryland crops.

Five of the previously identified sites were documented during the AIS of the Urban Phase III project area (Donham 1990; Reeve et al. 2019). These include SIHP 50-10-27-13260, a complex of modified collapsed sinks used for water collection that was assessed as significant under Criteria c and d and recommended for preservation by Reeve et al. (2019). SIHP 50-10-27-13261, an enclosure interpreted as a ceremonial structure, was assessed as significant under Criteria d and e and was also recommended for preservation. A preservation plan has been prepared for these sites (Mulrooney and Cleghorn 2022a). Three additional sites were identified within the portion of the Urban Phase III project area that is within the Makalapua Project District. These include Site 50-10-27-29111, a C-shaped wall; Site 50-10-27-29112, a C-shaped wall; and Site 50-10-27-29143, Features E and F, which are modified overhangs. All three of these historic properties were assessed as significant under Criterion d and recommended for no further work.

The remaining 11 sites were documented during the AIS and/or SAIS of the Kona Commons project area. These include eight sites that were assessed as significant under Criterion d and recommended for no further work: Site 50-10-27-18502, a modified depression used for temporary habitation; Site 50-10-27-18508, a walled overhang used for temporary habitation; Site 50-10-27-30207, a lava excavation with an uncertain function; Site 50-10-27-30208, a stone mound used as a marker; Site 50-10-27-30209, an enclosure used for temporary habitation; Site 50-10-27-30211, a post-Contact petroglyph; and Site 50-10-27-30212, a C-shaped wall used for temporary habitation. Site 50-10-27-30287 is a post-Contact trail segment with a spatially associated petroglyph that has been assessed as significant under Criteria d and e and has been recommended for preservation (Mulrooney and Cleghorn 2022a). At Site 50-10-27-30210, three features used for temporary habitation (Feature A, a modified overhang; Feature C, a C-shaped wall; and Feature D, an enclosure) were assessed as significant under Criterion d and recommended for no further work during the SAIS for Kona Commons. The fourth feature, Feature B, a lava excavation, was assessed as significant under Criterion d and recommended for data recovery. A data recovery plan has been developed to guide data recovery investigations at this feature (Mulrooney and Cleghorn 2022b). Site 50-10-27-18511 contains five features. Feature A is a modified overhang that was used for temporary habitation; Feature B is a lava excavation interpreted as an agricultural feature; Feature C is a modified lava tube containing *iwi kupuna*; and Features D and E are lava excavations interpreted as quarrying areas. Features A, B, D, and E were assessed as significant under Criterion d and recommended for no further work. The Feature C burial was assessed as significant under Criteria d and e and was recommended for preservation in place; a burial treatment plan has been implemented (Reeve and Cleghorn 2019).

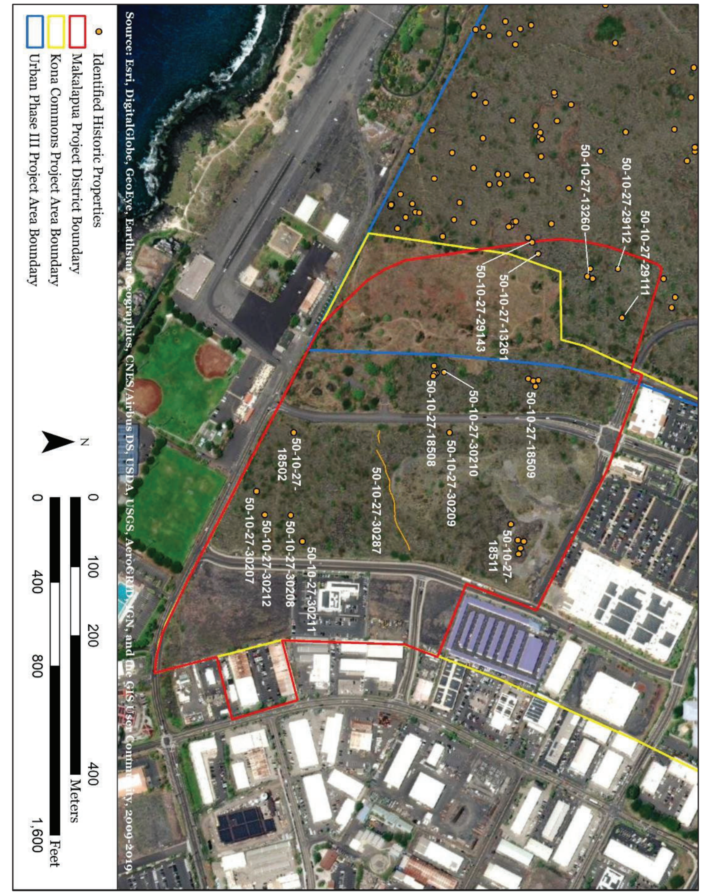

Figure 4. Locations of previously identified sites in the Makalapua Project District and in the adjacent portion of the Urban Phase III Project Area (base map: Esri World Imagery 2021).

Table 1. Summary of Historic Properties Identified within the Makalapua Project District, Recorded during AIS and SAIS of Kona Commons and Urban Phase III Project Areas

SIHP #	Site/Feature Type	Significance	Treatment	Study
50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work/ Data Recovery	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/ No Further Work/ Burial Treatment	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS (Reeve et al. 2019)
50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS (McIntosh et al. 2015)
50-10-27-30287	Trail, petroglyph	d, e	Preservation	Kona Commons SAIS (McIntosh et al. 2015)

2.4 Historic Properties Anticipated

Given the archaeological findings in the project area, there is the possibility that additional surface or subsurface sites could be encountered during project construction. This may include lava tubes containing cultural materials that do not have an accessible opening within the project area. Archaeological monitoring of all ground-disturbing activities is warranted.

3.0 PROPOSED CONSTRUCTION ACTIVITIES

The proposed project will consist of mechanical clearing, grubbing, grading, and excavations for the major components of the project. These mechanized construction activities will be confined to the project area shown in Figure 1 and have the potential to impact historic properties.

4.0 ARCHAEOLOGICAL MONITORING PLAN COMPONENTS

To ensure appropriate identification, documentation, and significance assessments of any subsurface historic properties (e.g., cultural deposits, features) that may be encountered during construction activities, the following monitoring measures will be implemented. Any changes to the provisions within this plan will only occur with prior written approval from SHPD. A copy of this plan will be provided to the construction manager and shall be kept on site during project construction.

4.1 Pre-Construction Briefing

Before the initiation of construction activities, the archaeological monitor will meet with the construction crew on-site to discuss the archaeological monitoring procedures. The pre-construction archaeological awareness briefing will cover the following topics:

1.) The archaeological monitor's responsibility to identify cultural deposits and artifacts, and authority to halt work.

2.) The types of historic properties and archaeological materials that may be encountered.

3.) If the archaeological monitor identifies a subsurface cultural deposit or feature(s), construction personnel shall cease work in the immediate vicinity. The archaeological monitor will inspect the find and SHPD shall be contacted for consultation regarding the find. All appropriate documentation shall be completed by the archaeological monitor prior to resuming work, which will be determined in consultation with SHPD.

4.) If a backhoe operator or other construction personnel exposes or disturbs a human burial or isolated human remains, they must immediately stop work, move away from the burial site to allow the archaeological monitor to inspect and secure the find, to make the necessary notifications, and to conduct appropriate treatment. Notifications will be made to SHPD's Archaeology and History and Culture branches.

5.) If a backhoe operator or other construction personnel finds an isolated artifact, they shall report the find to the archaeological monitor.

6.) Construction personnel shall not pick up artifacts or remove them from the worksite.

7.) All cultural materials found during construction activities, including Hawaiian artifacts and historic glass bottles, are the property of the landowner and may not be collected by anyone other than the archaeological monitor.

8.) Review of construction sheets with supervisors and crew will be carried out to ensure awareness of preserve areas and areas where no work can occur. The monitor will physically point out the preservation buffers delineated with orange construction fencing and indicate that no construction activities or land-altering activities shall occur inside the interim protective fencing.

4.2 Protective Barriers

Protective barriers will be established prior to project construction around the three sites slated for preservation and the burial preserve, as stipulated in the preservation plan (Mulrooney and Cleghorn 2022a). This will ensure that these sites are not adversely impacted by construction activities and are avoided. No construction or project work shall occur within preserve/avoidance areas (Figure 5). It is the archaeological monitor’s responsibility to help ensure that that these barriers are not breached. The archaeological monitor will be responsible for checking protective barriers on a daily basis to ensure they are intact and have not been damaged or encroached upon by construction activities. If protective barriers are breached, any damage within the preserve areas will be assessed by the archaeological monitor to determine when and how the breach occurred. The monitor will report the damage to SHPD in writing within 24 hours. An appropriate action plan will be developed by the archaeological monitor and SHPD to ensure the protective barriers are not breached again.

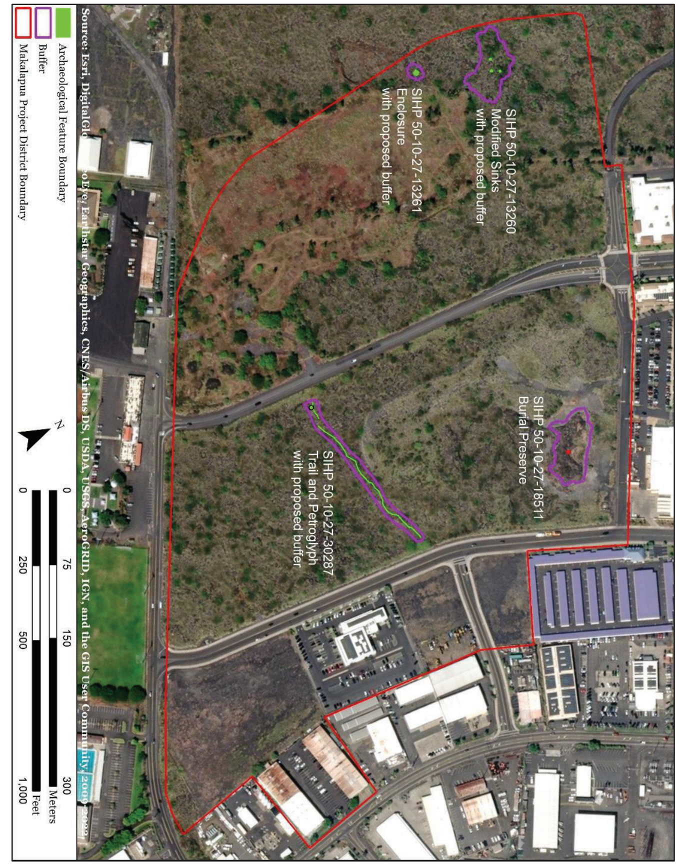

Figure 5. Archaeological and burial preserves within the Makalapua Project District showing buffers where interim protective fencing will be installed during project construction.

4.3 Archaeological Monitoring

The possibility that surface and subsurface cultural deposits may be present within the project area necessitates the presence of an archaeological monitor on-site full-time to observe all ground-disturbing activities (i.e., during all bulldozing, grading, and trenching activities). In instances where multiple ground-disturbing activities are concurrently occurring in multiple locations, a separate monitor will be at each location to observe each piece of heavy machinery in operation. If any subsurface cultural deposits, features, or human remains are encountered, all work shall be halted in the area and the archaeological monitor will proceed to investigate the find.

The purpose of archaeological monitoring will be to ensure that:

1.) any potential historic properties (e.g., cultural deposits, features, human remains) exposed by ground-disturbing activities will be appropriately identified, documented, and assessed for significance;

2.) any artifacts encountered are appropriately documented (descriptions and close-up photographs with scale) either in the field or in the archaeological consultants' laboratory; and

3.) any human remains encountered are treated appropriately in accordance with Hawai'i Revised Statutes (HRS) §6E-43 and HAR §13-300, and any SHPD directives shall be followed.

A daily archaeological monitoring log (AML) will be completed every day that archaeological monitoring work is conducted on-site. The AML shall serve as the official record of archaeological activities performed and shall specify who was working on-site, times of work, and what was done. Also, data will be recorded regarding field methods and all subsurface deposits, features, or human remains encountered, as well as representative profiles of project area stratigraphy and photo documentation of the work and findings. Photographs and profiles of excavations will be collected from across the project area even if no significant historic properties are encountered.

4.4 Intact Cultural Deposits and Features

Should any subsurface cultural deposits or features be discovered during construction, the archaeological monitor has the authority to halt construction in the immediate vicinity of the find. Construction can be shifted to other areas. If such a finding is made, the SHPD archaeological staff shall be notified and briefed as to the extent, content, and associations of the discovery. The potential significance of the discovery will be agreed upon and mitigation needs, as appropriate for non-burial sites, will be discussed and resolved with the SHPD archaeological staff. The finds shall be fully documented. This documentation will include GPS recording, describing the cultural layer's stratigraphy and contents (United States Department of Agriculture [USDA] nomenclature and Munsell color notations shall be used), scaled profile drawings, photographs, and (if deemed necessary) the excavation, sampling, and/or screening of exposed cultural layers and features. The stratigraphic context of subsurface deposits or

features will be determined, and any important associations with other natural or cultural strata will be recorded. Where appropriate, samples will be collected for further analyses.

The data recorded in the field, combined with documentary data, will be used to assess the significance of the findings as per HAR §13-284 (Rules Governing Procedures for Historic Preservation Review to Comment on Chapter 6E-42 Projects). These significance assessments will be presented in the archaeological monitoring report.

4.5 Artifacts and Samples

Any traditional Hawaiian artifacts and faunal samples (including midden) that are encountered during construction will be collected for further analysis. Diagnostic historic artifacts that are more than 50 years old will also be collected for further analysis. Non-diagnostic and recent artifacts will be documented in the field, including recording of context, relative abundance, and close-up photographs with scale. The provenience of the finds will be plotted on a project map of the area, and any observed associations with cultural or natural strata will be noted.

4.6 Human Skeletal Remains

If human remains are inadvertently encountered during trenching or any other construction-related activity, all work in the immediate vicinity shall cease and SHPD archaeology and burial sites staff shall be notified. Burial finds will be treated in accordance with HRS §6E-43 and HAR §13-300 and any SHPD directives. SHPD will assume the lead in consulting with recognized descendants and the Hawai'i Island Burial Council.

4.7 Treatment of Recovered Archaeological Remains

All collected artifactual remains and associated samples will be transported to the archaeological consultant's offices for processing. Laboratory processing will consist of cleaning, sorting, identifying, and documenting the collected materials. A project catalog shall be generated and presented in the final report.

Artifacts collected will be identified and recorded by measuring, photographing, and/or sketching. Midden material shall be identified minimally by major class and recorded on standard laboratory forms by weight. This material will be presented in table format in the final report. All samples (soil, charcoal, etc.) will be initially processed and cataloged in the archaeological consultant's laboratory before being sent to specialist laboratories for detailed analyses. Any charred wood samples selected for radiocarbon dating will be submitted first for wood identification to identifiable short-lived species for dating.

4.8 Curation

Suitable temporary curation facilities for archaeological samples collected during archaeological monitoring will be provided by the archaeological consultant. Final curation of recovered materials in a suitable archive shall be determined in consultation with the landowner and the SHPD.

4.9 Reporting

Brief verbal or email progress reports shall be provided to the SHPD and the client upon the discovery of any significant findings, and on completion of on-site monitoring activities, laboratory analyses, and report preparation. SHPD shall be notified in writing via email and HICRIS prior to the initiation of archaeological monitoring. The following written reports shall also be submitted:

- Letter Report at the completion of on-site monitoring within 30 days of completion of monitoring fieldwork, to be submitted to SHPD via HICRIS and email;
- Draft Archaeological Monitoring Report within 180 days of completion of monitoring fieldwork; and
- Final Archaeological Monitoring Report within 60 days of receipt of SHPD review comments.

The archaeological monitoring report will be prepared upon the completion of all archaeological monitoring activities. The components of this report will conform to the specifications outlined in HAR §13-279 (Rules Governing Standards for Archaeological Monitoring Studies and Reports).

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APPENDIX A

SHPD ACCEPTANCE LETTERS FOR AIS AND SAIS REPORTS

DAVID Y. IGE
GOVERNOR OF HAWAII

CARTY S. CHANG
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DANIEL S. QUINN
INTERIM FIRST DEPUTY

W. ROY HARDY
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
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ENGINEERING
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HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555

March 23, 2015

Dr. Paul L. Cleghorn, Senior Archaeologist
Pacific Basin Division, Pacific Legacy, Inc.
30 Aulike Street, Suite 301
Kailua, Hawaii 96734

LOG NO: 2014.04866
DOC NO: 1503MV20
Archaeology

Subject: **HRS Chapter 6E-42 Historic Preservation Review -**
Supplemental Archaeological Inventory Survey of the 100 Acre
Queen Liliuokalani Trust Kona Commons Parcel
Keahuolu Ahupua'a, North Nona District, Island of Hawai'i
TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022

Thank you for the opportunity to review the draft report titled: *Supplemental Archaeological Inventory Survey of the 100 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolu, North Kona, Island of Hawai'i TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022* (J. McIntosh, T. Lizama, R. Reeve, J. Cleghorn and P. Cleghorn October 2014). This document was received by our office on October 28, 2014. We apologize for the delayed review, and thank you for your patience. This survey was undertaken in order to supplement the previous archaeological survey undertaken Rosendahl (1992). The survey utilized a 100% pedestrian survey with transects spaced at 10-15 meters. In addition, excavation in the form of test borings was conducted in five locations. The archaeological survey documented a total of ten archaeological sites comprised of 20 component features in the project area. Four of these historic properties a modified depression (SIHP 50-10-27-18502), a modified overhang (SIHP 18508), a complex (SIHP 18509), and a complex that contains a burial feature (SIHP 18511) were previously recorded during the Rosendahl (1992) archaeological survey. However, it is important to note that previously unrecorded features of SIHP 18509 (feature D) and 18511 (features D and E) were newly identified during the current supplemental inventory survey. In addition to these features, the supplemental AIS identified and recorded 6 previously unrecorded historic properties. The newly recorded historic properties include: a lava excavation (SIHP 30207), a stone mound (SIHP 30208), an enclosure (SIHP 30209), a complex (SIHP 30210), a petroglyph (SIHP 30211), and a C-shaped alignment (SIHP 30212). With the exception of the burial feature (SIHP 18511fea. C) that is assessed as significant under criteria D and E, all of these sites have been assessed as significant under criteria D only. The report indicates that SIHP 18511fea. C has been recommended for preservation, SIHP 30210 fea. B has been recommended for Data Recovery and the remaining sites are recommended for no further work. SHPD agrees with the significance assessments and treatment recommendations presented in this report.

This report also documents multiple historic properties that were previously recorded in the project area by Rosendahl (1992) and Reinecke (1930) and were not re-identified in the current supplemental AIS. The majority of these sites appear to have been destroyed by development activities, but SHPD has some questions about certain sites that were not re-identified in the current study. These questions and other comments are presented in the subsequent attachment. Please consider these revision requests and resubmit this report with a cover letter specifying the revisions made and their page numbers. Please contact Mike Vitousek at (808) 692-8029 or Michael.Vitousek@hawaii.gov for any questions or concerns relating to this letter.

Aloha,

Mike Vitousek

Michael Vitousek,
Lead Archaeologist Hawaii Island Section
Historic Preservation Division

ATTACHMENT

Comments and Questions: *Supplemental Archaeological Inventory Survey of the 100 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolu, North Kona, Island of Hawai'i TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022*
(J. McIntosh, T. Lizama, R. Reeve, J. Cleghorn and P. Cleghorn October 2014).

Methods

1. Pg. 71. Please include a description of the method used to determine a site and its boundaries pursuant to HAR 13-276-5(c)(8). This is significant because there are multiple historic features within this project area however, some features are listed as sub features, and others are given individual site numbers.

Field Investigations

2. Page 91 indicates that a lava tube containing cultural material (SIHP 18506) that was originally recorded by Rosendahl (1992) could not be relocated in the current survey. The report states that the tube is possibly destroyed but it is possible that the entrance is buried ant the remainder of the tube is intact. We request subsurface testing in the area of the former tube entrance in order to determine of the subsurface component of the tube remains intact within the project area.

3. Pg. 171 indicates that the mauka makai trail identified by Reinecke could not be identified in the current project area as it may not have left enough of an imprint on the pahoehoe. SHPD requests the opportunity to conduct a field visit with archaeologists from Ala Kahakai National Historic Trail in order to determine if the trail remains intact within the project area.

Recommendations

4. SHPD agrees with the recommendation an archaeological monitoring plan be in place during construction activities within this project area.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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DEPARTMENT OF LAND AND NATURAL RESOURCES

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August 11, 2015

Dr. Paul L. Cleghorn, Senior Archaeologist
Pacific Basin Division, Pacific Legacy, Inc.
30 Aulike Street, Suite 301
Kailua, Hawaii 96734

LOG NO: 2015.02142
DOC NO: 1508MV17
Archaeology

Subject: **HRS Chapter 6E-42 Historic Preservation Review -**
Supplemental Archaeological Inventory Survey of the 110 Acre
Queen Liliuokalani Trust Kona Commons Parcel
Keahuolu Ahupua'a, North Nona District, Island of Hawai'i
TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022

Thank you for the opportunity to review the revised draft report titled: *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolu, North Kona, Island of Hawai'i TMK: (3) 7-4-008:002 Por; (3) 7-4-025:001, :002, :003, :005, :007, :010, through :022* (J. McIntosh, T. Lizama, R. Reeve, J. Cleghorn and P. Cleghorn May 2015). This document was received by our office on June 1, 2015. This survey was undertaken in order to supplement the previous archaeological survey undertaken Rosendahl (1992). The survey utilized a 100% pedestrian survey with transects spaced at 10-15 meters. In addition, excavation in the form of test borings was conducted in five locations. The archaeological survey documented a total of 11 archaeological sites comprised of 20 component features in the project area. Four of these historic properties a modified depression (SIHP 50-10-27-18502), a modified overhang (SIHP 18508), a complex (SIHP 18509), and a complex that contains a burial feature (SIHP 18511) were previously recorded during the Rosendahl (1992) archaeological survey. However, it is important to note that previously unrecorded features of SIHP 18509 (feature D) and 18511 (features D and E) were newly identified during the current supplemental inventory survey. In addition to these features, the supplemental AIS identified and recorded 6 previously unrecorded historic properties. The newly recorded historic properties include: a lava excavation (SIHP 30207), a stone mound (*SIHP* 30208), an enclosure (SIHP 30209), a complex (SIHP 30210), a petroglyph (SIHP 30211), a C-shaped alignment (SIHP 30212) and a trail (SIHP 30287). With the exception of the burial feature (SIHP 18511fea. C) that is assessed as significant under criteria D and E, all of these sites have been assessed as significant under criteria D only. The report indicates that SIHP 18511fea. C and SIHP 30287 have been recommended for preservation, SIHP 30210 fea. B has been recommended for Data Recovery and the remaining sites are recommended for no further work. SHPD agrees with the significance assessments and treatment recommendations presented in this report. We believe that the entire trail (SIHP 30287) should be preserved until it can be confirmed with Na Ala Hele whether or not this trail is eligible for inclusion as a state trail. However it is possible that the trail may be breached in accordance with an approved preservation plan. The changes that were made to the report are the result of the SHPD review of a previous draft (Log No. 2015.04866, Doc No. 1503MV20). The report has been revised in response to the SHPD review of a previous draft of this report (Log 2012.3111, Doc. 1210MV40). The revisions and explanations have adequately addressed our concerns. This report meets the requirements of Hawaii Administrative Rule (HAR) §13-276 and is accepted. Please send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office. Please contact Mike Vitousek at (808) 692-8029 or Michael.Vitousek@hawaii.gov for any questions or concerns relating to this letter.

Aloha,

Mike Vitousek

Michael Vitousek,
Lead Archaeologist Hawaii Island Section
Historic Preservation Division

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September 9, 2019

IN REPLY REFER TO:
Log No.: 2019.01679
Doc. No.: 1909AM05
Archaeology

Michael Shibata, Development Manager
Liliʻuokalani Trust
1100 Alakea Street Suite 1100
Honolulu HI 96813
Email: mshibata@onipaa.org

Dear Mr. Shibata:

SUBJECT: **Hawaii Revised Statutes (HRS) Chapter 6E-42 Historic Preservation Review –**
Archaeological Inventory Survey of Urban Phase III Parcel
Liliʻuokalani Trust Lands
Keahuolū Ahupuaʻa North Kona District Island of Hawaiʻi
TMK: (3) 7-4-008:002 por.

This letter provides the State Historic Preservation Division's (SHPD's) review comments concerning the report titled *Revised Draft Archaeological Inventory Survey of Urban Phase III Parcel Queen Liliʻuokalani Trust Lands in Keahuolū, North Kona Island of Hawaiʻi [TMK: (3) 7-4-008:002 por.]* (Reeve et al., July 2019). The SHPD received this revised draft on July 31, 2019. Previously, the SHPD requested revision of the initial draft in a letter dated August 16, 2018 (Log No. 2016.00071, Doc. No. 1808SL04).

Pacific Legacy, Inc., conducted the archaeological inventory survey (AIS) in support of the of the Liliʻuokalani Trust (LT) Urban Phase III project, for which a master plan is being prepared for future residential, commercial, and civic/community areas, and open space. The Urban Phase III project area, totaling 213 acres, is owned by LT, a non-profit organization dedicated to the welfare of Hawaiʻi's children. The Urban Phase III project will involve grubbing, grading, and trench excavation for building construction and installation of utilities.

The letter that accompanies this revised draft AIS report also mentions a separate project, the Makalapua Project District (MPD) project, whose project area totals approximately 67.2 acres and includes multiple TMK parcels. An *Environmental Impact Statement* is being prepared for the MPD, which will create residential, hotel, retail, commercial, office, and civic/community areas.

The 213-acre Urban Phase III project area is bounded on the southwest by the old Kona Airport, now a State Recreation Area; on the northwest by a 628-acre conservation parcel belonging to LT; on the northeast by Queen Kaʻahumanu Highway; and on the southeast by the Kona Commons Shopping Center and undeveloped land along Makala Boulevard. The project area begins a short distance north of the north edge of the Kailua-Kona town core.

Previous correspondence concerning earlier, related projects, cited and summarized in the current AIS report (page 100) includes the following, concerning the Keahuolū project, as proposed at the time of Paul H. Rosendahl, Ph.D., Inc.'s AIS (PHRI 1994) and AMP (PHRI 1993):

- March 5, 1993 – SHPD to PHRI (Log No. 6851, Doc. No. 9303RC03), limiting data recovery to two sample blocks plus a few sites outside the project area;
- June 10, 1993 – PHRI to SHPD (not available);

- July 28, 1993 – DLNR to Belt, Collins & Associates (Log No. 8976, Doc. No. 9307RC40), stating that June 10, 2993, addendum to mitigation plan was not received; and
- December 21, 1993 – DLNR to PHRI (Log No. 10383, Doc No. 9312RC30), accepting sampling strategy for mitigation phase.

More recent correspondence in SHPD's files concerns archaeological studies conducted in support of shoreline-improvement removal in the LT Keahuolū campgrounds. The following letters were sent to Pacific Legacy:

- March 15, 2012 – SHPD's review letter (Log No. 2010.2686, Doc. No. 1203TD09) accepting campgrounds AIS report, and agreeing with recommendations for preservation of 87 sites, and data recovery for 235 sites;
- April 2, 2014 – SHPD's review letter (Log No 2014.0913, Doc. No. 1404MV01), accepting an archaeological monitoring plan for the campgrounds project; and
- June 3, 2015 – SHPD's review letter (Log No. 2015.01602, Doc. No. 1506MV14), accepting archaeological monitoring report for campgrounds project.

One additional letter, also to Pacific Legacy, concerns an AIS of the 25-acre LT Historic Preserve Area, adjacent to the current project area:

- March 23, 2012 – SHPD's review letter (Log No. 2012.0682, Doc. No. 1203MV33), accepting an AIS report that documents 96 archaeological sites containing 489 features. Twenty-three of the sites had been recorded earlier; 73 are newly identified. Significance is recommended for the entire preserve under Criteria a, c, d, and e; listing on the National Register of Historic Places (NRHP) is also recommended.

The current AIS identified 121 sites, 36 previously recorded and 85 newly identified. These consist of State Inventory of Historic Places [SIHP] Sites 50-10-27-13256 through 13258, 13260 through 13262, 13269, 13271, 13272, 13274, 13275, 13280 through 13282, 18286 through 13288, 13293, 13294, 13298 through 13302, 13351, 13353, 13386, 25655, 25644, 25646 through 25649, and 29088 through 29176. Of these, one site, Site 29175, consists of 540 excavated lava pits.

The 121 historic sites documented during the current AIS survey are assessed for site integrity and for significance according to Hawaii Administrative Rules (HAR) §13-284-6 Criteria a-e. All the sites are considered significant for their information content (Criterion d). Six sites are considered significant for their distinctive characteristics or high artistic value (Criterion c). Twenty-one sites are considered significant for their cultural importance to the Native Hawaiian community (Criterion e). The four sites considered significant under Criterion e include probable small shrines, a lava tube containing human skeletal remains, possible burial mounds, and 17 petroglyph fields.

SHPD agrees with the project effect determination of "Effect, with agreed upon mitigation commitments." The agreed upon mitigations includes no further work for 83 sites (120 features), mitigative archaeological data recovery for 28 sites (40 features), preservation (conservation) for 20 sites (55 features), and burial treatment for Site 50-10-27-18511. Mitigation plans will include a data recovery plan, a preservation plan, and archaeological monitoring plan for the project, and a burial treatment plan.

No Further Work

Sites 50-10-27-13256, 13257, 13258, 13269, 13271, 13272, 13282, 13286, 13288, 13293, 13298, 13300, 13301, 13302, 13351, 25644, 25646, 25647, 25648, 29089, 29093, 29094, 29096, 29097, 29099, 29100, 29101, 29102, 29103, 29104, 29105, 29106, 29107, 29108, 29109, 29110, 29111, 29112, 29113, 29114, 29115, 29116, 29117, 29119, 29120, 29121, 29122, 29123, 29126, 29127, 29128, 29129, 29131, 29132, 29133, 29134, 29136, 29137, 29138, 29139, 29140, 29141, 29143, 29145, 29146, 29147, 29151, 29153, 29154, 29155, 29156, 29157, 29161, 29162, 29163, 29164, 29166, 29169, 29171, 29172, 29173, 29174, and 29176.

Data Recovery

Sites 50-10-27-13258, 13262, 13272, 13274, 13280, 13351, 13386, 25649, 29088, 29095, 29099, 29104, 29118, 29124, 29125, 29130, 29135, 29144, 29146, 29148, 29149, 29150, 29152, 29158, 29165, 29168, 29170, and 29175.

Preservation

Sites 50-10-27-13260, 13261, 13272, 13274, 13275, 13280, 13281, 13287, 13294, 13299, 13353, 29090, 29091, 29092, 29098, 29142, 29144, 29159, 29160, and 29167.

The AIS report meets the requirements of HAR §13-276-5. **It is accepted.** Please send two hard copies of the document, clearly marked FINAL, and a text-searchable PDF version, to the Kapolei office, attention SHPD Library. Additionally, please include a copy of this acceptance letter with the hard copies of the report.

Pursuant to HAR §13-284-3, Steps (1) through (4) of the historic preservation review process are complete. As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "Effect, with agreed upon mitigation commitments," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD looks forward to receiving for review and acceptance, a data recovery plan meeting the requirements of HAR §13-278-4, an archaeological preservation plan meeting the requirements of HAR §13-277, and an archaeological monitoring plan meeting the requirements of HAR §13-279-4 for the current project and a Burial Treatment Plan (BTP) for Site 50-10-27-18511.

SHPD shall notify the County and the Liliʻuokalani Trust when the afore-mentioned mitigation plans have been reviewed and accepted and the permit issuance process may proceed.

Please contact Andrew McCallister, Archaeologist III, at (808) 692-8010 or at Andrew.McCallister@hawaii.gov if you have any questions, or if we can be of assistance in any way.

Aloha,
Alan Downer

Alan S. Downer, Ph.D.
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

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APPENDIX B

SHPD CORRESPONDENCE
RELATED TO MAKALAPUA PROJECT DISTRICT

DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

February 27, 2020

IN REPLY REFER TO:
Log No. 2019.00636
Doc. No. 2002SN04
Archaeology

Michael Yee, Planning Director
County of Hawaii – Planning Department
101 Pauahi Street, Suite 3
Hilo, Hawaiʻi 96720

Dear Mr Yee:

SUBJECT: **Chapter 6E-8 Historic Preservation Review –
Request for Concurrence with a Determination of Effect for the Makalapua Project District
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002**

This letter provides the State Historic Preservation Division's (SHPD's) comments on the request for concurrence with an HRS 6E project effect determination for the proposed Makalapua Project District (MPD). Liliʻuokalani Trust (LT) is proposing the development of the 67.2-acre property. The County of Hawaiʻi (County) has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received this submittal on March 25, 2019.

The County of Hawaii Planning Department letter indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment (EA) for the project.

Several archaeological inventory surveys (AIS) studies have been conducted that include portions of the MPD. These include the following:

1993 O'Hare and Rosendahl (1993), titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015), titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaii [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS in a letter dated August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019), titled, *Archaeological Inventory Survey of Urban Phase III Parcel Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaii [TMK: (3) 7-4-008:002 por.]*. The archaeological inventory survey (AIS) totaled 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS in a letter dated September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05).

Mr.Yee
February 27, 2020
Page 2

The County's letter further indicates that of these three AIS, two were conducted in support of the current MPD: McIntosh et al. (2015) and Reeve et al. (2019) and provides the following summary of historic properties within the MPD (Table 1).

Table 1. Previously documented dites within the boundaries of the MPD.

SIHP#	Feat.	Site/Feature Type	Possible Function	Significance	Treatment	Study
Site 50-10-27-13260	A	Modified Sink	Water Catchment	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13260	B	Modified Sink	Water Catchment	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13260	C	Modified Sink	Water Catchment	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261		Enclosure	Ceremonial	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502		Modified Depression	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508		Wailed Overhang	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	A	Stone Mound	Agriculture	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	B	Filled Depression	None		No Further Work	Kona Commons SAIS
Site 50-10-27-18509	C	Stone Mound	Agriculture	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	D	Lava Excavation	Agriculture	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	A	Modified Overhang	Habitation	d	Preservation	Kona Commons SAIS
Site 50-10-27-18511	B	Lava Excavation	Agriculture	d	Preservation	Kona Commons SAIS
Site 50-10-27-18511	C	Modified Lava Tube	Burial	d, e	Preservation (burial treatment)	Kona Commons SAIS
Site 50-10-27-18511	D	Lava Excavation	Quarry	d	Preservation	Kona Commons SAIS
Site 50-10-27-18511	E	Lava Excavation	Quarry	d	Preservation	Kona Commons SAIS
Site 50-10-27-29111		C-Shaped Wall	Habitation	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112		C-Shaped Wall	Habitation/ Processing	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	E	Modified Overhang	Storage	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	F	Modified Overhang	Storage	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207		Lava Excavation	Uncertain	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208		Stone Mound	Marker	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209		Enclosure	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	A	Modified Overhang	Storage	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	B	Lava Excavation	Uncertain	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	C	C-Shaped Wall	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	D	Enclosure	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30211		Petroglyph	Communication	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212		C-Shaped Wall	Habitation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287		Trail	Travel	d	Partial Preservation	Kona Commons SAIS

Mr.Yee
February 27, 2020
Page 2

The County's letter identifies the remaining outstanding previously agreed-upon mitigation commitments still need to be addressed for documented historic properties in the MPD:

(1) Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
(2) Data recovery of Site 50-10-27-30210 Feature B;
(3) Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261 (enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
(4) Archaeological monitoring during ground disturbing construction activities.

Subsequent to the County's letter, the Hawaii Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019. Additionally, the HIBC recommended that SHPD accepted the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

Also subsequent to the County's letter, SHPD (Susan Lebo) consulted with the archaeological consulting firm, Pacific Legacy staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020 regarding the un-surveyed portions of the MPD and updating the results and recommendations of the two MPD studies (McIntosh et al. 2015 and Reeve et al. 2019). **SHPD requested the following**:

(1) A literature review and field inspection be conducted for areas not previously surveyed within the boundaries of the MPD. SHPD approved during the consultation that this work could be initiated immediately;
(2) Site integrity and site significance assessments be updated and that this update include consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised; and
(3) Following completion of #1 and #2, SHPD concur with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "**Effect, with agreed upon mitigation commitments**," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD shall notify the County when the agreed upon mitigation plans have been reviewed and accepted and the permit issuance process may continue.

Please contact Sean Nāleimaile at (808) 933-7653 or at Sean.P.Naleimaile@hawaii.gov for questions regarding archaeological resources or this letter.

Aloha,
Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc. Melissa Dacayanan, Melissa.dacayanan@hawaiicounty.gov
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Mara Mulrooney, mulrooney@pacificlegacy.com
Paul Cleghorn, cleghorn@pacificlegacy.com

DAVID Y. IGE
GOVERNOR OF HAWAII

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CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
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KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

June 25, 2020

Michael Yee, Planning Director
County of Hawaii
101 Pauahi Street, Suite 3
Hilo, HI 96720

IN REPLY REFER TO:
Log No. 2020.000607
Doc. No. 2006SN05
Archaeology

Dear Mr. Yee:

SUBJECT: **Chapter 6E-8 Historic Preservation Review –**
Request for Concurrence for the Development at the Makalapua Project District
Archaeological Field Inspection for Two Parcels in the Makalapua Project District
Keahuolū Ahupua‘a, North Kona District, Island of Hawai‘i
TMK: (3) 7-2-010:009 and 010

This letter updates the State Historic Preservation Division's (SHPD's) review of a County of Hawaii request for concurrence with a determination of effect for the Makalapua Project District (MPD). Lili‘uokalani Trust (LT) is proposing the development of the MPD which is a 67.2-acre property. The County of Hawai‘i (County) has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received this submittal on March 25, 2019.

In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated that via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] the two un-surveyed subject parcels within the MPD project area needed the following:

1. additional investigation that includes a literature review and field inspection and;
2. that site integrity and site significance assessments for sites within the MPD be updated following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals.

The current submittal included a literature review and field inspection report titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua‘a of Keahuolū, District of North Kona, Island of Hawaii (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020).

Project Description
The two parcels, which cover an area of 2.1 acres and encompass the entirety of TMK: (3) 7-4-010:009 and TMK: (3) 7-4-010:010, are located between Loloku Street and Kaiwi Street. The current project area is with the larger MPD. The parcels have been previously developed and are currently in use for commercial/industrial purposes. Two parallel warehouse buildings and a paved parking lot cover nearly all the subject area.

Findings
A review of our records indicate that the current project area has not been subject to an adequate archaeological inventory survey. The current submittal indicates that according to Hawaii County tax records, the warehouses within the current project area were both built in 1972. The larger Kona Commons project area, located adjacent to the western boundary of the parcels of interest, was subjected to an archaeological inventory survey, the report for which was accepted in 1993 (O‘Hare and Rosendahl, 1993; *Archaeological Inventory Survey Queen Lili‘uokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawai‘i (TMK: 3-7-4-008:Por. 2)*, as well as a supplemental AIS, which was accepted in 2015 (McIntosh et al., 2015; *Supplemental*

Archaeological Inventory Survey of the 119 Acre Kona Commons Parcel of Queen Lili‘uokalani Trust Lands in Keahuolū, North Kona, Island of Hawaii [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]).
The field inspection included photographic documentation of the existing buildings. No historic properties were identified during the field inspection on the subject parcels.

Determination
This letter informs the County that the current submittal satisfies SHPD's first request and that SHPD accepts the field inspection report as adequate for the two subject parcels. **SHPD's looks forward** to receiving additional information relating to SHPD's second request for site integrity and site significance assessments for sites within the overall MPD project area. **SHPD will notify the County when** this requirement has been completed and when the project may move forward.

Please contact Sean Nāleimaile at (808) 933-7651 or at Sean.P.Naleimaile@Hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

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DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
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SUZANNE D. CASE
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ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

March 29, 2021

IN REPLY REFER TO:
Project No. 2020PR34163
Log. No. 2020.02056
Doc. No. 2103NM08
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Request for Concurrence with a Determination of Effect for Makalapua Project District
Additional Information Regarding Site Integrity and Significance Assessments
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por., (3) 7-4-010:009, 010, and (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi request for concurrence with a determination of effect for the Makalapua Project District (MPD). Liliʻuokalani Trust (LT) is proposing the development of the MPD within their 67.2-acre privately owned property. The County of Hawaiʻi has provided the SHPD with a cover letter describing the proposed LT project and the County's HRS 6E effect determination for the project on behalf of LT. The SHPD received the original submittal on March 25, 2019. The current submittal was received by SHPD on September 4, 2020 and includes two previous SHPD correspondence letters and a letter from Pacific Legacy, Inc. detailing additional consultation regarding the site integrity and site significance assessments and mitigation committments for 15 sites.

The County of Hawaiʻi Planning Department letter, on behalf of Liliʻuokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment (EA) for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD. These include the following:

1993 O'Hare and Rosendahl (1993) report titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This AIS documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) report titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS in a letter dated August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) report titled, *Archaeological Inventory Survey of Urban Phase III Parcel Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK:(3) 7-4-008:002 por.]*. The AIS totaled 213 acres, portions of which were previously surveyed by earlier studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS in a letter dated September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05).

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were documented in the MPD (Table 1).

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection was conducted for a 2.1-acre portion of the project area not previously subject to an AIS. The report is titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney, March 2020) The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

The County's letter identifies the remaining outstanding previously agreed-upon mitigation commitments still need to be addressed for documented historic properties in the MPD:

1. Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
2. Data recovery of Site 50-10-27-30210 Feature B;
3. Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261(enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
4. Archaeological monitoring during ground disturbing construction activities.

Subsequent to the County's letter, the Hawaiʻi Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019.

Zendo Kern
March 29, 2021
Page 2

Additionally, the HIBC recommended that SHPD accept the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] that the two un-surveyed subject parcels within the MPD project area needed the following:

1. Additional investigation that includes a literature review and field inspection;
2. Updating of the site integrity and site significance assessments for sites within the MPD following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals; and
3. Following completion of #1 and #2, SHPD concurrence with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

In a letter dated June 25, 2020 (Log No. 2020.000607, Doc. No. 2006SN05), SHPD accepted the field inspection report and determined that stipulation #1 (above) requested in the previous letter was adequately addressed; however, the additional information, stipulation #2, regarding the site integrity, site significance assessments and mitigation commitments for the 15 sites in the MPD project area had not yet been addressed.

The current submittal indicates consultation efforts were conducted by Pacific Legacy Inc., at the request of SHPD and on behalf of the Lili'uokalani Trust. Pacific Legacy contacted Lauren Morawski and Kamakana Ferreira from Office of Hawaiian Affairs (OHA) and Keahuolū cultural descendant Nicole Lui. OHA presented a general comment recommending CRM firms to apply Criteria "e" to a larger range of Hawaiian cultural and historic sites. Nicole Lui agreed with OHA regarding the larger application of Criteria "e" to sites other than just burial and heiau and agreed with the current site integrity, significance assessments, and mitigation commitments for the sites in the current project area. Based on the additional consultation, Lili'uokalani Trust recommended that no changes to the site integrity and significance assessments or mitigation commitments are necessary for any of the 15 identified sites in the Makalapua Project District.

SHPD appreciates the efforts to conduct additional consultation with OHA and cultural descendants; however, SHPD does not believe these efforts fully address stipulation #2 (above) requested by SHPD in previous letters (Log No. 2019.00636, Doc. No. 2002SN04; Log No. 2020.000607, Doc. No. 2006SN05). The AIS reports that include sites within the project area determine site significance and site integrity of the individual features. In accordance with HAR §13-284-6, site significance and integrity are based on the overall site, not the individual features. Additionally, SHPD requests additional consultation efforts, potential application of Criterion "e" to the trail site, and other clarifications.

Based on the current information, SHPD does not concur with the "no change" for the site integrity and significance assessments or mitigation committments for the 16 identified sites in the Makalapua Project District. SHPD requests the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.

Zendo Kern
March 29, 2021
Page 2

5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

When completed, please submit the additional information to SHPD via HICRIS to Project No. 2020PR34163 using the Project Supplement option.

SHPD shall notify the County when the additional information has been reviewed and approved and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: County of Hawaii Public Works, public_works@hawaiicounty.gov
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HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

July 21, 2021

IN REPLY REFER TO:
Project No. 2020PR34163
Submission No. 2020PR34163.002
Log No. 2020.02056
Doc. No. 2107NM05
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Request for Concurrence with a Determination of Effect for Makalapua Project District
Additional Information Regarding Site Integrity and Significance Assessments
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por., (3) 7-4-010:009, 010, and (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi request for concurrence with a determination of effect for the Makalapua Project District (MPD). Liliʻuokalani Trust (LT) is proposing the development of the MPD within their 67.2-acre privately owned property. The County of Hawaiʻi has provided the SHPD with a cover letter describing the proposed LT project and the County's HRS 6E effect determination for the project on behalf of LT. The SHPD received the original submittal on March 25, 2019. An additional submittal was received by SHPD on September 4, 2020 and included two previous SHPD correspondence letters and a letter from Pacific Legacy, Inc. detailing additional consultation regarding the site integrity and site significance assessments and mitigation committments for 15 sites. The current submittal consists of an updated letter from Pacific Legacy received by SHPD on May 19, 2021.

The County of Hawaiʻi Planning Department letter, on behalf of Liliʻuokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment (EA) for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD. These include the following:

1993 O'Hare and Rosendahl (1993) report titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This AIS documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) report titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS in a letter dated August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) report titled, *Archaeological Inventory Survey of Urban Phase III Parcel Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK:(3) 7-4-008:002 por.]*. The AIS totaled 213 acres, portions of which were previously surveyed by earlier studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS in a letter dated September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05).

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were documented in the MPD (Table 1).

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection was conducted for a 2.1-acre portion of the project area not previously subject to an AIS. The report is titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney, March 2020) The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

The County's letter identifies the remaining outstanding previously agreed-upon mitigation commitments that still need to be addressed for the documented historic properties in the MPD:

1. Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
2. Data recovery of Site 50-10-27-30210 Feature B;
3. Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261(enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
4. Archaeological monitoring during ground disturbing construction activities.

Subsequent to the County's letter, the Hawaiʻi Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019.

Zendo Kern
July 21, 2021
Page 2

Additionally, the HIBC recommended that SHPD accept the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] that the two un-surveyed subject parcels within the MPD project area needed the following:

1. Additional investigation that includes a literature review and field inspection;
2. Updating of the site integrity and site significance assessments for sites within the MPD following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals; and
3. Following completion of #1 and #2, SHPD concurrence with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

In a letter dated June 25, 2020 (Log No. 2020.000607, Doc. No. 2006SN05), SHPD accepted the field inspection report and determined that stipulation #1 (above) requested in the previous letter was adequately addressed; however, the additional information, stipulation #2, regarding the site integrity, site significance assessments and mitigation commitments for the 15 sites in the MPD project area had not yet been addressed.

Pacific Legacy, Inc. sent a letter dated September 4, 2020 (Log No. 2020.02056) to SHPD to address SHPD concerns. The submittal indicated consultation efforts were conducted by Pacific Legacy Inc., at the request of SHPD and on behalf of the Lili'uokalani Trust. Pacific Legacy contacted Lauren Morawski and Kamakana Ferreira from the Office of Hawaiian Affairs (OHA) and Keahuolū cultural descendant Nicole Lui. OHA presented a general comment recommending CRM firms to apply Criteria "e" to a larger range of Hawaiian cultural and historic sites. Nicole Lui agreed with the current significance assessments, and mitigation commitments for the sites in the current project area. Based on the additional consultation, Lili'uokalani Trust recommended that no changes to the site integrity and significance assessments or mitigation commitments are necessary for any of the 15 identified sites in the Makalapua Project District.

In a letter dated March 29, 2021 (Project No. 2020PR34163, Doc. No. 2103NM08), SHPD responded to the previous letter and requested the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.
5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

The current submittal addresses Stipulation #s 1-4; however, due to the time that has passed since the previous consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association, SHPD requests that additional consultation occurs to ensure they are in current agreement with the significance assessments and mitigation commitments for the trail. Additional consultation is also requested as the guidelines for trails have recently been updated (April 2020) and these trail groups have indicated they would like all trails to be considered for Criterion e significance. SHPD (Nicole Mello) reached out to Rick Gmirkin from Ala Kahakai Trail Association and Jackson Bauer from Nā Ala Hele Trail and Access to ask if they had any concerns regarding the trail (Email correspondence between Nicole Mello [SHPD] and Rick Gmirkin [Ala Kahakai Trail Association] and Jackson Bauer [Nā Ala Hele

Zendo Kern
July 21, 2021
Page 2

Trail and Access] on July 20-21, 2021). Rick indicated that the trail site was probably in use during the mid-1800s as it is believed to have been in use at the same time as the Māmalahoa Trail. Additionally, he indicated that "the trail should be significant under 6E criterion e and broader consultation with the descendent community should occur." Both indicated they would like additional consultation and that the trail is likely a Highways Act trail.

Based on the current information, SHPD does not concur with the "no change" for the site integrity and significance assessments or mitigation committments for the 16 identified sites in the Makalapua Project District. SHPD requests the following:

1. Please conduct additional consultation with Nā Ala Hele Trail and Access, Ala Kahakai Trail Association and any other interested cultural/lineal descendants with regards to the trail Site 50-10-27-30287. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate. Additionally, please confirm that all interested parties agree with only partial preservation of the trail.

When completed, please submit the additional information to SHPD via HICRIS to Project No. 2020PR34163 using the Project Supplement option.

SHPD shall notify the County when the additional information has been reviewed and approved and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

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Kamakana Ferreira, kamakanaf@oha.org
Jackson Bauer, Nā Ala Hele Trail and Access, jackson.m.bauer@hawaii.gov
Rick Gmirkin, Ala Kahakai Trail Association, rick_gmirkin@nps.gov

APPENDIX C

SHPD EFFECT DETERMINATION LETTER REQUESTING A DATA RECOVERY PLAN, PRESERVATION PLAN, AND ARCHAEOLOGICAL MONITORING PLAN

DAVID Y. IGE
GOVERNOR OF HAWAII

State of Hawaii
Department of Land and Natural Resources

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
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SUZANNE D. CASE
CHAIRPERSON
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COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

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

July 26, 2022

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2207NM07
Archaeology

Zendo Kern, Planning Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District
Additional Consultation Regarding Archaeological Sites
Request for Concurrence with Effect Determination
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por., (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi request for concurrence with a determination of effect for the Makalapua Project District (MPD) and the supporting document titled *Additional consultation regarding archaeological sites located in the Liliʻuokalani Trust Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi, TMK: (3) 7-4-008:002 por., (3) 7-4-025:001-003, 005, 012, 015, (3) 7-4-010:009, 010* (Mulrooney, April 2022). Liliʻuokalani Trust (LT) is proposing the development of the MPD which is a 67.2-acre property. The County of Hawaiʻi has provided the SHPD with a cover letter describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original submittal on March 25, 2019 (Log No. 2019.00636). The current submittal was received on April 21, 2022 and includes a letter from Pacific Legacy (archaeological consultant) regarding the additional consultation that was requested by SHPD on July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05). Previous SHPD correspondence related to this project is provided in the Attachment.

The County of Hawaiʻi Planning Department letter, on behalf of Liliʻuokalani Trust, indicates that the MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. The proposed mixed-use project will include approximately 300 residential units; 220 rooms across two hotels; a 50,000-square-foot community facility; and 470,000 square feet of commercial use and a variety of open space features. Additional improvements may include a Kuakini Highway extension included in an Environmental Assessment for the project.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD:

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites and the report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

Zendo Kern
July 26, 2022
Page 2

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Lili'uokalani Trust Lands in Keahuolū, North Kona, Island of Hawai'i [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted the Reeve et al. (2019) AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

A field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupua'a of Keahuolū, District of North Kona, Island of Hawai'i (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was conducted for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

The County's letter identifies the previously agreed-upon mitigation commitments that still need to be addressed for documented historic properties in the MPD:

1. Burial Treatment of Site 50-10-27-18511 Feature C (burial in modified lava tube);
2. Archaeological data recovery of Site 50-10-27-30210 Feature B;
3. Preservation of Site 50-10-27-13260 Features A-C (modified sinks); Site 50-27-10-13261 (enclosure), Site 50-10-27-18511 Features A (modified overhang), B (lava excavation), and D and E (lava excavations), and Site 50-27-10-30287 (trail segment); and
4. Archaeological monitoring during ground disturbing construction activities.

The Attachment below includes a summary of the SHPD correspondence associated with the current MPD project. In a letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05), SHPD indicated that previously

requested items #1-4 had been completed but request item #5, additional consultation, was still needed. The recent letter from Pacific Legacy to SHPD dated April 21, 2022, includes the additional consultation efforts which were conducted between August 2021 and April 2022 and included consultation with the Ala Kahakai Trail Association, Nā Ala Hele Trail and Access, and cultural descendant Nicole Lui. The additional consultation resulted in assessing trail Site 50-10-27-30287 as additionally significant under Criterion "e" and changing the site mitigation from partial preservation to preservation with agreed upon potential breaches. During consultation, representatives from Ala Kahakai Trail Association and Nā Ala Hele Trail and Access recommended a 30-ft.-wide buffer from the outer edges of the trail. Nicole Lui agreed with the current 10-foot buffer on either side of the trail. Additionally, a petroglyph associated with the trail was identified during trail clearing and it will be added to the archaeological preserve.

Based on the additional consultation efforts, SHPD agrees with (1) Site 50-10-27-30287 being additionally assessed significant under Criterion e, (2) the preservation of Site 50-10-27-30287 being changed from partial to full preservation with allowance for agreed-upon breaches, and (3) preservation of the newly identified petroglyph. Lastly, SHPD indicates that the additional consultation efforts conducted by Pacific Legacy (August 2021 to April 2022) meet the requested item #5 detailed in SHPD's letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05).

SHPD's effect determination is "Effect, with agreed upon mitigation commitments" for the current project. As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "Effect, with agreed upon mitigation commitments," then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project work commencing.

SHPD looks forward to receiving for review and acceptance a data recovery plan for Site 50-10-30210, Feature B meeting the requirements of HAR §13-278-3; a preservation plan meeting the requirements of HAR §13-277 for Site 50-27-13260, Site 50-10-27-13261, Site 50-10-27-18511 Feature A, Feature B, Feature D and Feature E, and Site 50-10-27-30287; and an archaeological monitoring plan meeting the requirements of HAR §13-279-4. Please upload a text-searchable PDF version of each document and their associated filing review fee to HICRIS Project No. 2020PR34163, in response to the new attachment request.

SHPD shall notify the County and LT when the mitigation commitments have been completed and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawai'i Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

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Attachment
SHPD Project Correspondence

November 8, 2019
Subsequent to the County's letter, the Hawai'i Island Burial Council (HIBC) made a determination to preserve in place Site 50-10-27-18511 [Feature C burial in modified lava tube] at its monthly meeting on October 17, 2019. Additionally, the HIBC recommended that SHPD accepted the draft Burial Treatment Plan (BTP). Following this recommendation, SHPD accepted the BTP and requested the title be changed to a Burial Site Component of a Preservation Plan (BSCPP) as indicated in SHPD's letter dated November 8, 2019 (Log No. 2019.01526, Doc. No. 1911CJ001).

February 27, 2020
In a letter dated February 27, 2020 (Log No. 2019.00636, Doc. No. 2002SN04), SHPD indicated via consultation [SHPD (Susan Lebo) and Pacific Legacy Staff (Mara Mulrooney and Paul Cleghorn) on January 7, 2020] that the two un-surveyed subject parcels within the MPD project area needed the following:

1. Additional investigation that includes a literature review and field inspection and;
2. that site integrity and site significance assessments for sites within the MPD be updated following consultation with OHA and other interested parties and, if appropriate, mitigation commitments be revised. Once these stipulations were addressed, SHPD would provide concurrence with any changes to mitigation commitments and look forward to the appropriate submittals.
3. Following completion of #1 and #2, SHPD concur with any changes to the previously agreed upon mitigation commitments, and the appropriate mitigation plans be submitted to SHPD for review and acceptance.

June 25, 2020
In a letter dated June 25, 2020 (Log No. 2020.000607, Doc. No. 2006SN05), SHPD accepted the field inspection report and determined the #1 request in the previous letter was adequately addressed; however, the additional information (#2) regarding the site integrity, site significance assessments and mitigation commitments for the 15 sites in the MPD project area had not yet been addressed.

September 4, 2020
Pacific Legacy, Inc. sent a letter dated September 4, 2020 (Log No. 2020.02056) to SHPD to address SHPD concerns. The submittal indicated consultation efforts were conducted by Pacific Legacy Inc., at the request of SHPD and on behalf of the Lili'uokalani Trust. Based on the additional consultation, Lili'uokalani Trust recommended that no changes to the site integrity and significance assessments or mitigation commitments are necessary for any of the 15 identified sites in the Makalapua Project District.

March 29, 2021
In a letter dated March 29, 2021 (Project No. 2020PR34163, Doc. No. 2103NM08), SHPD responded to the previous letter and requested the following:

1. Update site integrity and significance to properly reflect site rather than individual features. Please update this in any tables and/or recommendations.
2. If mitigation includes only a portion of a site, the integrity of the site is diminished. This needs to be addressed.
3. Please clarify that all 16 sites were addressed in the most recent consultation. The letter states only 15 sites are located within the project area; however, there are 16 sites.
4. Why is trail Site 50-10-27-30287 only recommended for partial preservation? Please elaborate on the rationale for this and what is being proposed that will impact a part of the trail. If possible, SHPD recommends full preservation.
5. Please conduct consultation with Nā Ala Hele Trail and Access and Ala Kahakai Trail Association with regards to the trail Site 50-10-27-30287 and the plans for preservation. Please inquire if adding significance Criterion "e" to trail Site 50-10-27-30287 is appropriate.

July 21, 2021
In a letter dated July 21, 2021 (Project No. 2020PR34163, Doc. No. 2107NM05), SHPD indicated that requested items 1-4 had been completed but request #5, additional consultation, was still needed.

SHPD ACCEPTANCE LETTER FOR ARCHAEOLOGICAL MONITORING PLAN, DATED FEBRUARY 24, 2023

APPENDIX J-1

STATE OF HAWAII | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

February 24, 2023

IN REPLY REFER TO:
Project No. 2020PR34163
Doc. No. 2302NM06
Archaeology

Zendo Kern, Director
County of Hawaii, Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
planning@hawaiicounty.gov

Dear Zendo Kern:

SUBJECT**:** **Chapter 6E-42 Historic Preservation Review –**
Makalapua Project District
Archaeological Monitoring Plan
Keahuolū Ahupuaʻa, North Kona District, Island of Hawaiʻi
TMK: (3) 7-4-008:002 por.; (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject County of Hawaiʻi Makalapua Project District (MPD) and the supporting document titled *Revised Draft Archaeological Monitoring Plan for the Makalapua Project District, Liliʻuokalani Trust Lands in the Ahupuaʻa of Keahuolū, North Kona District, Island of Hawaiʻi, [TMK: (3) 7-4-008:002 (por.); (3) 7-4-010:009, 010; (3) 7-4-025:001-003, 005, 012, 015]* (Tuitavuki and Mulrooney, December 2022). The archaeological monitoring plan (AMP) was originally submitted on August 10, 2022. SHPD requested revisions on October 24, 2022 and received the revised AMP with an attached letter from Pacific Legacy (archaeological consultant) on December 19, 2022.

The County of Hawaiʻi Planning Department, on behalf of the Liliʻuokalani Trust, has provided the SHPD with a cover letter dated March 15, 2019 describing the proposed project and the County's HRS 6E effect determination for the project. The SHPD received the original project submittal on March 25, 2019 (Log No. 2019.00636).

The Liliʻuokalani Trust proposes the development of the MPD within a 67.2-acre project area. The MPD will consist of residential, hotel, retail, commercial, office, and civic/community facilities. Additional improvements may include a Kuakini Highway extension.

Three archaeological inventory surveys (AIS) have been conducted that include portions of the MPD (see Attachment). SHPD made a project effect determination of "Effect, with agreed upon mitigation commitments" for the project and requested an archaeological monitoring plan, an archaeological data recovery plan, and an archaeological preservation plan (July 26, 2022; Project No. 2020PR34163, Doc. No. 2207NM07). In a letter dated December 20, 2022 (Project No. 2020PR34163, Doc. No. 2212NM06), SHPD accepted the data recovery plan (Mulrooney and Cleghorn, December 2022). The preservation plan is currently under review by SHPD. For previous SHPD correspondence related to this project see the Attachment in HICRIS Project No. 2020PR34163.

The AMP (Tuitavuki and Mulrooney, December 2022) meets the requirements of HAR §13-279-4. **It is accepted.** Please send one hard copy of the document, clearly marked FINAL, along with a copy of this letter and a text-searchable PDF version of the AMP to the Kapolei SHPD office, attention SHPD Library. In addition, please send a copy of the AMP to the Hawaiʻi Island SHPD Office, Attn: Sean Naleimaile. Also, submit a text-searchable PDF copy of the Final AMP to HICRIS Project No. 2020PR34163 using the Project Supplement option and a PDF copy of the AMP to lehua.k.soares@hawaii.gov.

SHPD requests to be notified at the start of archaeological monitoring via HICRIS and email. Within 60 days of completion of archaeological monitoring fieldwork, SHPD looks forward to reviewing an archaeological monitoring report (AMR) meeting the requirements of HAR §13-279-5.

SHPD shall notify the County and LT when the additional mitigation commitments have been completed and the permit issuance process may continue.

Please contact Nicole A. Mello, Hawaiʻi Island Archaeologist IV, at Nicole.Mello@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Alan Arakawa, aarakawa@onipaa.org
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Rick Gmirkin, rick_gmirkin@nps.gov

Attachment
SHPD Reviews of Previous Archaeological Studies Related to Current Proposed Project

1993 O'Hare and Rosendahl (1993) titled, *Archaeological Inventory Survey Queen Liliʻuokalani Trust 100-Acre KIS Expansion Site, Land of Keahuolū, North Kona District, Island of Hawaiʻi (TMK: 3-7-4-008:Por. 2)*. This survey documented 18 sites. The report was accepted with revisions to be included in the final in a letter dated July 27, 1993 (Log No. 7441, Doc. No. 9307RC35).

2015 McIntosh et al. (2015) titled, *Supplemental Archaeological Inventory Survey of the 110 Acre Kona Commons Parcel of Queen Liliuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK (3) 7-4-008:002 por.; (3) 7-4-025:001-003, 005, 007, 010-022]*. The majority of this 110-acre project area was previously surveyed as part of the O'Hare and Rosendahl (1993) survey. SHPD accepted this Supplemental AIS 0n August 15, 2015 (Log No. 2015.02142, Doc. No. 1508MV17).

2019 Reeve et al. (2019) titled, *Archaeological Inventory Survey of Urban Phase III Parcel Liliʻuokalani Trust Lands in Keahuolū, North Kona, Island of Hawaiʻi [TMK:(3) 7-4-008:002 por.]*. The AIS comprised 213 acres and was partially previously surveyed by several studies, including Donham (1990). SHPD accepted this AIS on September 9, 2019 (Log No. 2019.01679, Doc. No. 1909AM05)

McIntosh et al. (2015) and Reeve et al. (2019) were conducted in support of the current MPD. A total of 16 sites were identified in the MPD (Table 1).

Table 1. Previously documented sites within the boundaries of the MPD.

SIHP#	Site/Feature Type	Significance	Treatment	Study
Site 50-10-27-13260	Modified Sink (A, B, C)	c, d	Preservation	Urban Phase III AIS
Site 50-10-27-13261	Enclosure	d, e	Preservation	Urban Phase III AIS
Site 50-10-27-18502	Modified Depression	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18508	Walled Overhang	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18509	Stone Mound (A and C), Filled Depression (B), Lava Excavation (D)	d	No Further Work	Kona Commons SAIS
Site 50-10-27-18511	Modified Overhang (A), Lava Excavation (B, D, E), Modified Lava Tube (C)	d, e	Preservation/Burial Treatment	Kona Commons SAIS
Site 50-10-27-29111	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29112	C-Shaped Wall	d	No Further Work	Urban Phase III AIS
Site 50-10-27-29143	Modified Overhang (E, F)	d	No Further Work	Urban Phase III AIS
Site 50-10-27-30207	Lava Excavation	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30208	Stone Mound	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30209	Enclosure	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30210	Modified Overhang (A), Lava Excavation (B), C-Shaped Wall (C), Enclosure (D)	d	No Further Work/Data Recovery (Fea B)	Kona Commons SAIS
Site 50-10-27-30211	Petroglyph	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30212	C-Shaped Wall	d	No Further Work	Kona Commons SAIS
Site 50-10-27-30287	Trail	d	Partial Preservation	Kona Commons SAIS

Most recently, a field inspection titled, *Field Inspection of two parcels proposed for inclusion in the Liliuokalani Trust's Makalapua Project District, Ahupuaʻa of Keahuolū, District of North Kona, Island of Hawaiʻi (TMK [3] 7-4-010:009; [3] 7-4-010:010)* (Mulrooney March 2020) was completed for a 2.1-acre portion of the MPD project area not previously subject to an AIS. The field inspection included photographic documentation of the existing buildings. No historic properties were newly identified.

CULTURAL IMPACT ASSESSMENT

APPENDIX K

Cultural Impact Assessment for the Makalapua Project District
Liliʻuokalani Trust Lands
Keahuolū, North Kona
Island of Hawaiʻi

TMK: (3)7-4-008:002 (por.), (3)7-4-010:009, (3)7-4-010:010, (3)7-4-025:001, (3)7-4-025:002, (3)7-4-025:003,(3)7-4-025:005, (3)7-4-025:015, (3)7-4-025:021

Helen Wong Smith, MLIS, CA, FSAA
Archival & Historical Consultant
1961 Kaiwiki Road
Hilo, Hawaiʻi 96720

June 2024

Abstract

At the request of Bryan Esmeralda, Land Planning Manager for Lili'uokalani Trust (LT), Helen Wong Smith, MLIS, CA, FSAA was engaged to prepare a cultural impact assessment (CIA) for the *ahupua`a* of Keauholū, North Kona. Wong Smith previously prepared CIAs for similar project areas in 2007 and 2016. Unlike coverage for archaeological surveys, this assessment provides a broader view of cultural activities of the landscape rather than focusing on a specific project area. Although the information provided in this assessment is on a broader scope, the purpose of this assessment is to identify and minimize potential impacts resulting from the Makalapua Project District project. LT is a nonprofit public benefit organization dedicated to improving the welfare of orphan and other destitute children in Hawai`i. The Trust manages its landholdings to provide a financial foundation for the perpetual benefit of its beneficiaries.

The Makalapua Project District project is to be developed on approximately 69.1 acres, along with potential offsite improvements, of land located within the *ahupuaʻa* of Keahuolū in the district of North Kona on the island of Hawaiʻi. The proposed project is positioned north of the Kailua-Kona village core and *ma kai* (toward the ocean, in this case, west) of the existing Kona Commons Shopping Center. The project is bordered by the Kona Commons Shopping Center to the north and east, vacant lands to the north, the existing Kona Industrial Subdivision (KIS) to the south and east, and the County's Kailua Park (also known as Old Airport Park) to the south and west. Due to the instrusion of Lanihau ahupuaʻa along the coastline of Keahuolū, in keeping with the landscape viewpoint, cultural and historical coverage of Lanihau is included in this report.

The assessment is based on a review of a wide range of written material – archaeological reports, government and other historical records, Hawaiian language sources translated into English, and interviews of long-term residents, both native Hawaiians and those familiar with the cultural history and resources of Keauholū, Lanihau, and environs were conducted for previous and the current project

A previous cultural impact assessment for LT's lands in Keauholū was performed in 2007 based on the resources of the Hawai`i State Archives, Edwin H. Mookini Library at the University of Hawai`i at Hilo, and the Hilo Public Library in addition to online resources, i.e. Ulukau, Papakilo Database. Resources at the Kona Historical Society and resources not previously available in 2007 and 2016, i.e. Kīpuka Database and the Historic Sites Database, have been added to this report in addition to succeeding works, specicially those held by the the State Historic Preservation Division.

Table of Contents

I. INTRODUCTION

The historical and archival research conducted for this study were performed in a manner consistent with Federal and State laws and guidelines for such studies. Among the pertinent laws and guidelines are the National Historic Preservation Act (NHPA) of 1966, as amended in 1992 (36 CFR Part 800); the Advisory Council on Historic Preservation's "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (ACHP 1985); National Register Bulletin 38, "Guidelines for Evaluating and Documenting Traditional Cultural Properties" (Parker and King 1990); the Hawaiʻi State Historic Preservation Statue (Chapter 6E), which affords protection to historic sites, including traditional cultural properties of on-going cultural significance; the criteria, standards, and guidelines of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) for the evaluation and documentation of cultural sites and practices, Title 13 Sub-Title 13:275-284 (October 21, 2002); and the November 1997 guidelines for cultural impact assessment studies, adopted by the Office of Environmental Quality Control (which also facilitate the standardized approach to compliance with Act 50 amending HRS Chapter 343; April 26, 2000). While conducting the research, primary references included, but were not limited to—land use records, including an extensive review of Hawaiian Land Commission Award (L.C.A.) records from the Māhele ʻĀina (Land Division) of 1848; Boundary Commission Testimonies and Survey records of the Kingdom and Territory of Hawaiʻi; and historical texts authored or compiled by—D. Malo (1951); J.P. Iʻi (1959); S. M. Kamakau (1961, 1964, 1976, and 1991); Wm. Ellis (1963); J. Goodrich (1826); Chas. Wilkes (1845); and A. Fornander (1916-1919 and 1996). The study also includes several native accounts from Hawaiian language newspapers (compiled and translated from Hawaiian to English, by the author), and historical records authored by nineteenth century visitors to the region. Archival-historical resources were located in the collections of the Hawaiʻi State Archives, Land Management Division, Survey Division, and Bureau of Conveyances; the Bishop Museum Archives; University of Hawaiʻi-Hilo Moʻokini Library. This information is generally cited in categories by chronological order of the period depicted in the narratives. The historical record—including oral testimonies of elder native residents of lands in the Keahuolū and Lanihau vicinity—provide readers with detailed descriptions of traditional and customary practices, the nature of land use, and the types of features to be expected on the landscape. The descriptions of land use and subsistence practices range from antiquity to the 1990s, and represent the knowledge of *kamaʻāina* (natives) of the land.

The methodology to developing the Cultural Impact Assessment is as follows:

1. Gather Best Information Available
   - 1.1. Gather historic cultural information from stories and other oral histories about the project area and environs to provide cultural foundation for the report;
   - 1.2. Inventory as much information as can be identified about as many known cultural, historic, and natural resources, including previous archaeological inventory surveys, CIAs, etc. that may have been completed for the possible range of areas;
   - 1.3. Update the information from interviews with cultural or lineal descendants or other knowledgeable cultural practitioners.

2. Identification of Potential Impacts to Cultural Resources

3. Develop Reasonable Mitigation Measures to Reduce Potential Impacts
   1.1. Involve the community and cultural experts in developing culturally appropriate mitigation measures);
   1.2. Develop specific Best Management Practices (BMPs), if any are required, for conducting the project in a culturally appropriate and/or sensitive manner as the mitigation and/or reduce any impacts to cultural practices and/or resources.

II. MOʻOLELO ʻĀINA: NATIVE TRADITIONS AND HISTORICAL ACCOUNTS OF KEAHUOLŪ AND LANIHAU

Keahuolū has been written in several ways in historic records. In *Place Names of Hawai`i*[1] it is written as "Ke-ahu-o-Lū" given the interpretive translation of "the heap [cairn] of Lū" without an explanation of who Lū may be. Tangarō translates the name as "Shrine of Lū, a legendary voyager" but does not provide a reference for this translation[2]. The place name has also been written "Ke-`ohu-`olu," which can be translated as "the cool mists." Kaiokekoa, a native Hawaiian resident of the Kekaha region relayed to Kepā Maly in 1994 he recalled his elders pronouncing the place name the second way[3]. Pukui et al. provide the translation "cool heaven" for Lanihau[4] the *ahupuaʻa* adjoining Keahuolū to the south.

Located in the *moku o loko* (district) of Kona, this northern section of Kona was divided into two regions, *Kona kai `opua* (Maly provides the interpretive translations "Kona of the distant horizon clouds above the ocean[5]) and *Kekaha-wai-`ole* (the waterless place). Kekaha-wai-`ole-o-nā-Kona spans from Kalaoa *ahupua`a* (Keāhole Point) to Kealakehe *ahupua`a*. Keahuolū falls within Kekaha which was described as "a dry, sun-baked land[6]." Sheltered by the abrupt rise of Hualālai, Kekaha receives very little rain below the 1,000-ft elevation contour. Maly provides the following description of residential movement within Kekaha-wai-`ole-o-nā-Kona during the late 1800s and early 1900s in the Hawaiian Newspaper *Ke Hōkū o Hawai`i:*

> *"O ia ka wāe ne`e `ana ka lā iā Kona, hele a malo`o ka `āina i ka `ai kupakupa `ia e ka lā, a o nā kānaka, nā li`I o Kona, pūhe`e aku la a noho i kahakai kāhi o ka wai e ola ai nā kānaka. (It was during the season, when the sun moved over Kona, drying and devouring the land, that the chiefs and people fled from the uplands to dwell along the shore where water could be found to give life to the people*[7].

Hawaiian authority and *kumu hula* Pualani Kanaka`ole Kanahele states "This clearly communicates that the natives of Kekaha-wai-`ole-o-nā-Kona had great knowledge of their land's cycles and its productive abilities. There were springs and brackish water ponds inland from the shore and the ocean was abundant. They planted in the ma uka or upland forest and had sufficient amount of rain for their crop. When the rainy season passed, they camped at the shore, grew sweet potato, and fished. Their basic needs were satisfied.[8]"

Kekaha has been streaked with ancient and recent (1801 and 1859) lava flows, which contribute to its desolate appearance. Emerson surveyed the area in the 1880s and his map (Reg. Map 1280) denotes "rough pahoehoe [*pāhoehoe],* little vegetation" within Keahuolū.

Ka`iwi Point is the boundary between Keahuolū and Kealakehe. Kanahele reports that fishermen of the area, "Kaiwi Point houses a mamamo ko`a[9] [a shrine to increase the catch of *mamo* or sergeant fish *Abudefduf abdominalis*]. A stone in this area is attributed as the embodiment of the priest Kalualapauila:

> *When the priest was about to be burned at `Ōhiki, a legendary hero, Ka-miki, prayed to Pele and a terrible storm arose. The priest's shark form was turned to stone as it tried to enter the heiau to save the human form of the priest. One of Pele's sisters, Hi`iaka-noho-lae (Hi`iaka living [at the] point), came to live here, making the place sacred and forbidden to Pele. In the story of Punia, the shark Kae-`ale`ale, who had swallowed Punia, came here and was cut open by the people; Punia came out alive but was bald (For. Sel. 15)*[10].

Mahaihale is the southern boundary of Keahuolū, some 1.8 km north of Kūkā`ilimoku Point – named after the deity of victory in battle. Between Kūkā`ilimoku and the Keahuolū boundary is a narrow strip of land belonging to *ahupua`a* of Lanihau reducing Keahuolū shoreline dramatically. Kūkā`ilimoku Point and the surrounding sand dunes were used in both pre-contact and early historic periods as burial grounds. The 1883 map below depicts graves at Kūkā`ilimoku and larger cluster at Kaliliki Point to the south.

---

[1] Pukui, Elbert & Mookini 1974:101
[2] Tangarō et al. 2006:19. A search in Beckwith's *Hawaiian Mythology* revealed a voyager by the name of Kaulu but none by the name of Lū.
[3] Maly IN Wulzen et al. 1996:12
[4] Pukui, Elbert & Mookini 1974:128
[5] Maly IN O'Hare 1993:Appensix B1
[6] Kelly 1971:2
[7] Hawaiian orthography will be employed in this report except when directly quoting. For this reason many of the quotations will lack diacritical and other marks as they are presented verbatim.
[8] Kanahele 2001:4
[9] Kanahele 2001:10
[10] Pukui, Elbert & Mookini 1974:70

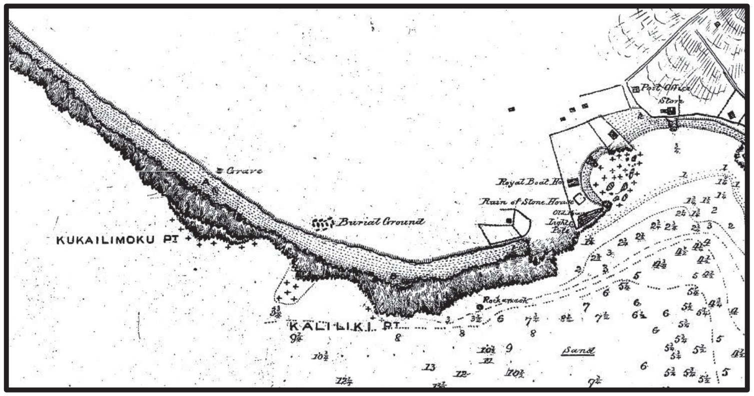

Figure 1 – Portion of Reg Map 1325 by G.E.G Jackson, June 1883

According to archaeologist Earl Neller, Jackson identified a massive masonry tomb as "Kamehameha's Tomb[11]" however such is not identified on this copy. A 1930 survey identified graves in Lanihau and Keahuolū as do subsequent surveys. Neller reported four locations of exposed human remains at the Lanihau/ Keahuolū boundary and historic burials were identified at Pāwai Bay by Neighbor Island Consultants in 1973[12].

Kekāhi Mo`olelo Hawai`i (Selected Hawaiian Traditions)

Legendary references to Keahuolū and Lanihau are limited. *Native Planters in Old Hawaii* provides for the Kona district in general:

> *The most interesting mythological and legendary materials relating to Kona have to do directly or indirectly with Lono…The story of the origin of the Makahiki rain and harvest festival…bring Lono from Kahiki, wither he returns….From Kona we have written record of a myth of Kumuhonua, whose writer says that Lono was a fisherman and yet ends his story by stating that the events related occurred before men peopled the earth….Disregarding the inconsistencies in orally transmitted lore, the point of interest with respect to Lono is that he is plainly identified with Kona, Hawaii, and is said to have introduced the main food plants, taro, sweet potato, yams, sugar cane and bananas to Hawaii, and also `awa. Hogs were likewise identified with Lono, but there is no mention of his having brought them to Hawaii[13].*

In his report of a reconnaissance survey of the Old Kona Airport area, now a County park within

[11] Neller 1980:5
[12] Ibid.:11-13
[13] Handy, Handy, and Pukui 1972:522

Keahuolū, Earl Neller erroneously ascribes the O'ahu chief Kuali'i to Keahuolū:

> *The area around the old Kona airport may also have some connection with the legendary Hawaiian chief Kuali`i. He was said to have been born at Kalapawai in Kailua, and defied the oppression of Lono-ikaika during the dedication of the heiau at Kawaluna. He is associated with Ku-kaili- moku, the god of victory in battle. Perhaps by coincidence, all of these place names are found in the beach park area[14].*

Neller reference is Beckwith who states the Kailua referred to in this account is on O'ahu[15]. As Kalapawai is the name of the beach in Kailua, O`ahu, (and memorialized by the Kalapawai Store at the entrance of Kailua Beach Park) it is unlikely Neller's references has anything to do with Kailua on Hawai`i Island. The *heiau* at Kawaluna is located in Waiolani in upper Nu'uanu Valley[16].

An accurate legendary reference to Keahuolū is found in *Ka`ao Ho`oniua Pu`uwai No Ka-Miki* (The Heart Stirring Story of Ka-Miki) translated by Kepā Maly, a legendary account of two super-natural brothers, Ka-Miki and Maka-`iole, who traveled around Hawai`i Island set in the period when Pili-a-Ka`aiea was chief of Kona, ca. 12th – 13th century). It was originally published in serial form between 1914 and 1917 in the Hilo based Hawaiian language newspaper *Ka Hōkū o Hawai`i* by Hawaiian historians John H. Wise and John Whalley Hermosa Isaac Kihe. Excerpts from Maly's translation:

> *…Within the lands of Keahuolu you saw Hale-pa`u which is also near Ka- pā-wai (The water enclosure). Kapāwai is also known as Makā`eo (Look with anger), and a coconut grove encircled those places. Further on, between the lands of Keahuolu and Kealakehe was the āhua (Hillock- plantation mound) of Lae-oniau…[17]*

> *…The priest who officiated over rituals of Keahuolu and Kealakehe was named Kalua`ōlapauila. He was the priest of the temple Kalihi, which is also called Kalua`ōlapauila. This temple is in the coastal area[18] along the border of Keahuolu and Kealakehe, near the old road into Kailua….[19]*

> *…The district of Keahuolu and divisions of Lanihau (1 and 2) were under the rule of Kapohuku`imaile (kāne) and Papalūlā (wahine), and Papaumauma was their warriors champion. When Papaumauma competed with Ka-Miki at the contest site `Iwa`awa`a (at Kohana-iki), he was defeated. Papumauma was honorable, and he greatly admired the superior skills of Ka-Miki and asked to turn his status and land rights over to Ka-Miki, but Ka-Miki declined…[20]*

[14] Neller 1980:15
[15] Beckwith 1972:395
[16] Pukui et al. 1974:226
[17] April 2 and 9, 1914
[18] Boundary Commission Testimony references this place at the midpoint of Keahuolū rather than the coast.
[19] April 30, 1914
[20] May 21, 1914

Ka-noenoe (The mist, fogginess) – The mound-hill called Pu`u-o-Kaloa sits upon the plain of Kanoenoe which is associated with both Keahuolu and Kealakeha. The setline of mists upon Pu`u-o-Kaloa was a sign of pending rains; thus the traditional farmers of this area would prepare their fields. This plain was referenced by Pili when he described to Ka-Miki the extent of the lands which Ka-Miki would oversee upon marrying the sacred chiefess Paehala of Honokōhau. The inheritance lands included everything from the uplands of Hikuhia above Nāpu`u and the lands of the waterless Kekaha, which spanned from the rocky plain of Kanikū (Keahualono) to the plain of Kanoenoe at Pu`uokaloa[21].

Ka Hōkū o Hawai`i* published another legendary account provided by J.W.H.I. Kihe entitled *"Nā Ho`onanea o ka Manawa, Kekāhi mau wahi pana o Kekaha ma Kona" (A pleasant passing of time, [stories from] some of famous places of Kekaha in Kona]. Here, Pu`uokaloa is mentioned again:

Pu'uokaloa i ka malo o Ka'eha e waiho ala...
Pu'uokaloa where Ka'eha's loin cloth (symbolic of the mists) was spread out[22]."

The mound-hill called Pu'u-o-Kaloa sits upon the plain of Kanoenoe which is associated with both Keahuolu and Kealakehe. The settling of mists upon Pu'u-o-Kaloa was a sign of pending rains; thus the traditional farmers of this area would prepare their fields. This plain was referenced by Pili when he described to Ka-Miki the extent of the lands which Ka-Miki would oversee upon marrying the sacred chiefess Paehala of Honokōhau. The inheritance lands included everything from the uplands of Hikuhia above Nāpu'u and the lands of the waterless Kekaha, which spanned from the rocky plain of Kanikū (Keahualono) to the plain of Kanoenoe at Pu'ukaloa[23].

Pu`uokaloa is referenced in a political turning point in the 1600s. The 'Umialiloa, 17th century chief who ruled the entire island bequeathed the island to his two sons, Keli'iokaloaa'umi who resided in Kona and his younger brother Keawenuia'umi who resided in Hilo. Animosity between the two brothers led to warfare and Keawenuia'umi's forces marched across the mountains to do battle on the lava plains of Kona:

When the armies of Hilo reached the shore of Kona the war canoes arrived from Ka-'u and from Hilo. The battle was [both] from the upland and from the sea. Ke-li'i-o-kaloa fled and was killed on a lava bed. The spot where he was killed was called Pu'u-o-Kaloa (Kaloa's hill), situated between Kailua and Honokohau[24].

Royal retainer John Papa 'Ī'ī, writing in the Hawaiian language newspaper *Kuokoa Ka Nupepa* noted Pu'u o Kaloa was located along the trail that led from Kamakahonu, Kamehameha I's royal residence in Kailua in the ahupua'a of Lanihau, north "to Puu o Kaloa

[21] October 25, 1917
[22] Wise and Kihe in *Ka Hoku o Hawaii* October 25, 1917; transcribed and translated in Maly 1994: A-4
[23] Ibid.
[24] Kamakau 1961:36

and on as far as Kiholo [in the ahupua'a of Pu'u Wa'awa'a], where it joins the road from the upland that is called Kealaehu[25]." "An Ancient foot-Trail is identified as described in Henry P. Kekahuna's 1955 map *Sketch of Old Kailua Bay (Kaiakeakua)[26]*.

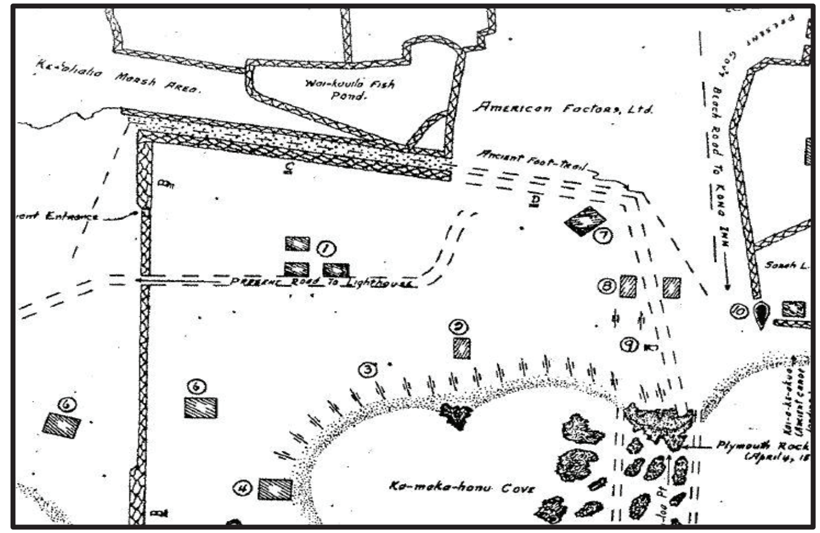

Figure 2 – Portion of Kekahuna's May 1, 1955 Sketch of Old Kailua Bay (Kaiakeakua)

This section describing agricultural practices as related to Pu`uokaloa is translated by Maly:

Pu`u-o-kaloa is a mound-hill site in the lands of Keahuolu – Kealakehe, not far from the shore of Kaiwi and Hi`iakanoholae. During periods of dry weather (ka lā malo`o) when planted crops, from the grassy plains to the `āma`auma`u (fern forest zone), and even the ponds (ki`o waī) were dry, people would watch this hill for signs of coming rains. When the lihau (light dew mists) sat atop the hill of Pu`u-o-kaloa, rains were on the way.

Planters of the districts agricultural fields watched for omens at Pu`uokaloa, and it was from keen observation and diligent work that people prospered on the land. If a native of the land was hungry, and came asking for food, the person would be asked:

Ua ka ua i Pu`uokaloa, ihea `oe?

[25] 'Ī'ī 1959:120
[26] http://papakilodatabase.com/main/imageserver.php?path=H/A/S/H/9/4/8/0/6&file=Sketch+of+Old+Kailua+Bay.pdf

When rains fell at Pu`uokaloa, where were you?
[If the answer was…]
I Kona nei no!
In Kona!
[There would be no sweet potatoes for this person.]
[But if the answer was…]
I Kohala nei no! In Kohala!
[The person would be given food to eat for they had been away, thus unable to accomplish the planting[27]*Within S.N. Hale`ole's epic* Ka Mo`olelo o Lā`ieikawai *(The Hawaiian Romance of Lā`ieikawai a short reference to Keahuolū and Lanihau as parents is found in the story of* Hiku and Kawelu*:*

The son of Keaauolu [sic] and Lanihau, who live in Kaumalumalu, Kona, once sends his arrow, called Puane, into the hut of Kawelu, a chiefess of Kona. She falls violently in love with the stranger who follows to seek it, and will not let him depart. He escapes, and she dies of grief for him, her spirit descending to Milu. Hiku, hearing of her death, determines to fetch her thence. He goes out into mid-ocean, lets down a koali vine, smears himself with rancid kukui oil to cover the smell of a live person, and lowers himself on another vine. Arrived in the lower world, he tempts the spirits to swing on his vines. At last he catches Kawelu, signals to his friends above, and brings her back with him to the upper world. Arrived at the house where the body lies, he crowds the spirit in from the feet up. After some days the spirit gets clear in. Kawelu crows like a rooster and is taken up, warmed, and restored[28]*.*

Fornander provides a longer version of this tradition providing the father's name as Keahuolu[29].

The origin of the place name Ka`iwi on the shoreline on the boundary of Keahuolū and Kealakehe is presented in this excerpt:

Ka`iwī (The bone) is also called Ka-lae-o-ka-iwi (The point of Ka-iwi) and is the name of a shark shaped stone near heiau of Kalua`ōlapauila. The priest Kalua`ōlapauila had two body forms, one human, as the priest, and the other body form as a shark in which he swam along the shore of Kealakehe and Keahuolu, attacking people. The shark form was named Kaiwi, and the point Ka-lae-o-Kaiwi is named after him[30]*.*

Kanahele provides additional insight to this story adding that Ka`iwi and Kalua`ōlapauila are destroyed by "their" grandmother, Kauluhenuihihikolo who teaches her grandchildren to call up the fires of Pele to rid the land of this man eating shark.

---

[27] May 19, 1914; Maly 1996:13
[28] Hale`ole 1997:660
[29] Fornander 1919 v5:182-184
[30] Maly IN Wulzen 1996:14

"Hi`iakanoholae, known today as Ka Lae Keahuolū, was the boundary direction for the lava flow. The protocol for lava is that a course of flow is given and Hi`iakanoholae is the southern limit of the flow. The flow did exactly what it was asked to do with Kaiwi and the characteristic of a Hi`iakaikeale`ī and Hi`iakaikealemoe flow is seen at Kaiwi Point[31]*."*

The errata "Place Names of Hawai`i" in the biography of Joseph Nāwahī provides the following note:

Hi'iaka-noho-lae. This description seems to be garbled. There is a rock in the location given, 'Okole-pohupohu, which marks the boundary between Keopu 2 and Keopu 3 but Hiiakanoholae is a point in Keahuolū, now called Keahuolu Point on the United States Geological Survey (USGS) (quad) map of this area[32]*.*

Hiiakanoholae is seen in the 1952 tracing of J.S. Emerson's 1880 map:

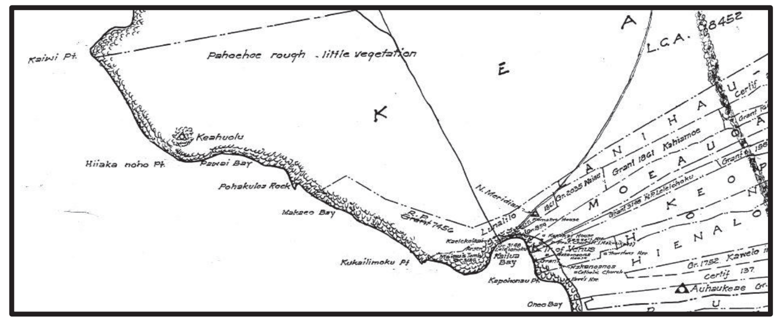

Figure 3 – Portion of Reg. Map 1280 Tracing of 1880 map by J.S. Emerson

Lanihau is mentioned in "Legend of Kaipalaoa, the Hoopapa Youngster" collected by Fornander. Kaipalaoa challenges the masters of *ho`opapa* (a profession…wherein the interpretations of and play on words afford occasions of witticisms in contests for entertainment or on a wager[33]) on Kaua`i to avenge the death of his father who entered in such a contest with the master Kalanialiiloa. During a protracted challenge Kaipaloa offered this riddle:

A land of many hau trees in Kona.
I have counted [out of] one hau tree
And have found seven hau.
Honokohau makes one,
Lanihau makes two,
Puuohau makes three,

---

[31] Kanahele 2001:10
[32] Sheldon 1999:291
[33] Fornander 1916-17 IV:574

Kahauloa makes four,
Auhaukea makes five,
Kahauiki makes six,
The kehau, which drives the Kona canoe, makes seven.
"There are seven hau, ye men with the yellow teeth.

At this Kalanialiiloa said: "You have indeed found some more hau. I had thought that these people had them all, but I see they did not have them all. Take the boy as a friend; be friends[34]*.*

Keahuolū and Lanihau Described in the Journals and Logs of Historic Visitors (1774 to 1840)

Lanihau's unusual boundary encroaching into Keahuolū makes it the northernmost *ahupua`a* connected to Kailua Bay, the most documented landing in the vicinity. The earliest Western observation to Kailua concerns Kamehameha I's residence there after his unification of the islands:

> *In 1812, two years after all the islands and finally been united under his rule, Kamehameha returned to Hawai'i island from O`ahu, where he had lived for the past nine years. Kamehameha lived most of his remaining years in Kailua, at his principal residence at Kamakahonu in Lanihau ahupua`a….Regrettably, nearly all documentation dwells on the immediate environs at Kamakahonu, and we have little in the way of description of the uplands or of the life of the people outside the court circles*[35]*.*
>
> *The accounts of early visitors at Kailua were, in the main, those of explorers…The Columbia came to Kailua Bay five times between 1815 and 1818, and then was sold to Kamehameha for sandalwood. The ship [was] renamed the Laholile…*[36]
>
> *On its first visit to Kailua, in January of 1815, the Columbia took on board "hogs, vegetables, rope, and cloth of the country" (Corney 1896:35). Peter Corney, one of its officers, who remained in Hawai'i when the ship was sold and left descendants here, remarked that "island rope", made excellent running rigging… Corney noted that the American ship Milwood was then at Kailua, "purchasing sandalwood at the rate of 7 dollars for 133 pounds (a picul)"*[37]*.*
>
> *It was at Kailua in November 1819, approximately six months after the death of Kamehameha, that the "free eating" (`ai noa) incident took place, symbolizing the end of the kapu system….The act of "free eating" at Kailua was followed by a general purging and burning of god images from the large heiau*[38]*.*

[34] Ibid.:592
[35] Kelly 1983:2
[36] Ibid:5
[37] Ibid.

Hawaiian historian Samuel Kamakau offers this reference to the life in the area at the time of Kamehameha II (Liholiho) who participated in the *`ai noa*:

> *Many of the old chiefs were alive in Liholiho's day…The sands of Kaiakeakua were worn down like a dromedary's back by the many feet of chiefs and chiefesses tramping over them, and at Kamakahonu could be seen at night the sparkle of lights reflected in the sea like diamonds, from the homes of the chiefs from Kahelo [in Puapua`a ahupua`a] to Lanihau. The number of chiefs and lesser chiefs reached into the thousands*[39]*.*

At this time M. Gaimard, a member of de Freycinet's expedition, wrote the following description of the Kailua environs:

> *In order to reach the mountain that lies to the southeast of the village…we first went across dry fields, where hardly any young growth was visible; but, after reaching a certain elevation; we found much richer terrain where the paper mulberry, breadfruit tree, the mountain apple, tobacco, cabbage, sweet potatoes and yams were cultivated. We were given water of a delicious coolness*[40]*.*

Missionary settlement of Hawai'i had its beginnings at Kailua. Kelly notes that:

> *Liholiho…[was] at Kailua when the first band of Protestant missionaries arrived there in April of 1820…the missionaries were granted permission to remain in the kingdom on trial for a year. Two missionary families remained in Kailua, while the rest went on to Honolulu*[41]

It was at Kailua Liholiho entrusted the island to Kuakini, younger brother of Ka`ahumanu and faithful aide of Kamehameha I. Three years into Kuakini's stewardship, the Reverend William Ellis began his tour around the island at Kailua in 1823. This passage from his journal reflects the population and resources of Kailua:

> *Kairua, though healthy and populous, is destitute of fresh water, except what is found in pools, or small streams, in the mountains, four or five miles from the shore*[42]*.*

Rev. William Ellis reports the observations made by Reverends Thurston and Bishop who walked the coastline from Kailua toward Ka`iwi Point crossing the entire coastline of Keahuolū and Lanihau:

[38] Ibid.:6
[39] Kamakau 1961:221-222
[40] de Freycinet 1978:8
[41] Kelly 1983:7
[42] Ellis 1963:29

The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses were built, wherever soil could be found sufficient to nourish the sweet potato, the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots.

The next morning, Messrs. Thurston, Goodrich, and Harwood, walked towards the mountains, to visit the high cultivated parts of the district. After traveling over the lava for about a mile, the hollows of the rocks began to be filled with a light brown soil; and about half a mile further, the surface was entirely covered with a rich mould, formed by decayed vegetable matter and decomposed lava.

Here they enjoyed the agreeable shade of bread-fruit and ohia trees; the latter is a deciduous plant, a variety of Eugenia, resembling the Eugenia malaccensis, bearing red pulpy fruit, of the size and consistence of an apple, juicy, but rather insipid to the taste. The trees are elegant in form, and grow to the height of twenty or thirty feet; the leaf is oblong and pointed, and the flowers are attached to the branches by a short stem. The fruit is abundant, and is generally ripe, either on different places in the same island, or on different islands, during all the summer months[43].

This type of gardening in lava is called *makaili*[44] when even small pockets of semidisintegrated lava are utilized, and potatoes are grown by fertilizing with rubbish and by heaping up fine gravel and stones around the vines. Handy writes, "Such cultivation produces inferior potatoes; they are said to be rather tasteless and ridged (*`awa`awa*) or wrinkled[45].

Commodore Wilkes of the U.S. Exploring Expedition made these comments about the environs of Kailua in 1840:

The natives during the rainy season…plant, in excavations among the lava rocks, sweet potatoes, melons, and pineapples… The…staple commodities are sweet potatoes, upland taro, and yams. Sugar cane, bananas…bread-fruit, cocoa-nuts, and melons, are also cultivated. The Irish potato, Indian corn, beans, coffee, cotton, figs, oranges, guavas, and grapes, have been introduced….[Two miles from the coast in a belt half a mile wide, the bread-fruit is met with in abundance, and above this the taro is cultivated with success…A considerable trade is kept up between the south and north end of this district. The inhabitants of the barren portion of the latter are principally occupied in fishing and the manufacture of salt, which articles are bartered with those who live in the more fertile regions of other south, for food and clothing[46].

Little has been written describing the landscape in Keahuolū and Lanihau owing to the inhospitable conditions of much of the terrain, most travel among foreigner between Kawaihae and Kailua was conducted by ship or by canoe, with short stops along the coast as needed[47].

[43] Ellis 1963:31-32
[44] Fornander 1919-1920, Vol.6:164
[45] Handy, Handy and Pukui 1972:523-4, 526-8
[46] Wilkes 1854:4, 91-2, 95-7 IN Kelly 1983:19

Handy and Handy comment on the cultivation and preservation of gardens in North Kona:

In North Kona dry taro flourishes only in the uplands, which are now largely given over to ranching, though some Hawaiians still have taro plantations above Kalaoa…

The walls (pā `āina), seen today in Kona lowlands running across old boundary lines, were built to keep cattle out of the planting areas after they became a pest early in the 19th century.

Kona, like eastern Maui, with its decamping lava mixed with humus and with intermittent rainfall which soaks away quickly in the porous soil and rock, is ideal for sweet potato cultivation…

Today sweet potatoes are planted by many Hawaiian living along the coast of Kona, either in the sandy soil near the shore at places like Ho`okena, Keālia, and Hōnaunau, or in spots where there is sufficient soil in the midst of the dry lava. Two sizable plantations were visited in 1935 on the dry slopes half to a mile inland in the Kailua section. Sweet potato flourished at the government experiment station at Kainaliu, at an altitude of 1,500 feet in North Kona; and patches were seen at various points both above and below the "Belt Road," in North and South Kona at altitudes of 1,800 feet. On the plantation zone up to altitudes of more than 2,000 feet, no sweet potatoes were seen[48].

2. CHRONOLOGICAL HISTORY OF RESIDENCY AND LAND OWNERSHIP IN KEAHUOLŪ AND LANIHAU

The above description of subsistence farming and trading within the land divisions was the standard practice in pre-contact Hawaiian culture. Early demographics for Keahuolū and Lanihau are difficult to ascertain. Schilt based her chronology of settlement and land-use in Kona on chronologies for the entire archipelago comprised by other archaeologists and applied it to subzones[49]. She suggested that the *kula* or coastal area extended from sea level to c. 500 feet in elevation, the *kaluulu* or seaward slope from c. 500 to 1,000 feet, the *'āpa'a* or upland slope from c. 1,000 to 2,500 feet, and the *'ama'u* or upland forest from c. 2,500 to 4,000[50].

Native Planters in Old Hawaii ascribe land use by zones as well while they differ slightly in elevation zones:

In the time of intensive native cultivation, South Kona was planted in zones determined

[47] Silva 1987:7
[48] Handy, Handy and Pukui 1972:523-4, 526-8
[49] Schilt 1984:276-283
[50] Ibid.:6

by rainfall and moisture. Near the dry seacoast potatoes were grown in quantity, and coconuts where sand or soil among the lava near the shore favored their growth. Up to 1,000 feet grew small bananas which rarely fruited and poor cane; from 1,000 to 3,000 feet, they prospered increasingly. From approximately 1,000 to 2,000 feet, breadfruit flourished. Taro was planted dry from an altitude of 1,000 feet to approximately 3,000 feet[51].

Kelly presents population demographics for North Kona between 1836-1910 reflecting what she suspects the reflection successes and failures of various commercial agriculture ventures dependent on the rise and fall of world prices of crops[52]:

Year	Population	% Increase/Decrease
1836	5,957	----
1853	4,110	-31.0
1860	3,488	-15.1
1866	3,268	-6.3
1872	2,218	-32.1
1878	1.967	-11.3
1884	1,773	-9.8
1890	1,753	-1.1
1896	3,061	+74.6
1900	3,819	-24.7
1910	3,377	-11.5

Table 1 – Population 1836-1910 by Marion Kelly

With the introduction of a market system and the call for labor to harvest sandalwood, agriculture in the Kailua area changed greatly as did the native population. Schmitt recorded epidemics for the years 1848 and 1849 as follows:

Four devastating epidemics occurred in rapid succession in 1848 and 1849: measles, whooping cough, diarrhea, and influenza. Together, these four diseases killed more than 10,000 of the perhaps 87,000 persons in little more than a twelve-month period[53].

On November 27, 1875 a letter was published in the Hawaiian language newspaper *Kuokoa* by J.P. Pu`uokapu, a *kama`āina* of the Kekaha region (northern-most portion of North Kona was called "Kekaha" (descriptive of an arid coastal place) responding to a letter which suggested drought and famine in Kekaha:

[51] Handy, Handy and Pukui 1972:525
[52] Kelly 1983:92
[53] Schmitt 1968:37

The people who live in the area around Kailua are not bothered by the famine. They all have food. There are sweet potatoes and taro. These are the foods of these lands. There are at this time, breadfruit bearing fruit at Honokohau on the side of Kailua, and at Kaloko, Kohanaiki, Ooma and the Kalaoas where lives J.P. [the author]. All of these lands are cultivated. There is land on which coffee is cultivated, where taro and sweet potatoes are cultivated, and land livestock is raised. All of us living from Kailua to Kalaoa are not in a famine, there is nothing we lack for the well being of our bodies. …As was said earlier, coffee is the plant of value on this land, and so is the raising of livestock. From the payments for those products, the people are well off and they have built wooden houses. If you come here you shall see that it is true. Fish are also something which benefits the people. The people who make the pai ai [cakes of hard, pounded but undiluted poi, the common form in which poi was carried over long distances or exchanged for other foods] on Maui bring it to Kona and trade it. Some people also trade their poi for the coffee of the natives here…[54]

During Kuakini's stewardship of the island, walls were built to protect the cultivated lands from the ravages of free-roaming dogs and pigs kept near the coastal habitations[55]. One of these walls was recorded by John Papa `Ī`ī at Honua`ula (adjoining Lanihau) in 1812; `Ī`ī writes, "A stone wall to protect food plots stretched back of the village from one end to the other and beyond[56]." Kelly postulates this wall was later incorporated into what became known as the Kuakini Wall, which may be traced from its starting point at Palani Road above Kailua Bay to beyond Kahalu`u Bay. It has long been presumed this wall built sometime during Kuakini's governorship (1820-1844) to protect the cultivated uplands from the depredations of cattle, introduced to the island by Captain George Vancouver in 1793. It was not known by this name until after 1855. Until that time it was consistently referred to as the Great Wall or the Great Stone Wall by surveyors. The Emerson-Kanakanui map of Kailua Town & Vicinity (Reg. Map No. 1676, dated ca.1880) identifies it as the "Kuakini Great Wall." The following reference to what is no doubt Kuakini Wall was made by the Reverend Albert Baker:

Just a little above [the stone church at Kahaluu], and continuing all the way to Kailua, is the huge stone wall built in Kuakini's time to keep pigs from the cultivated lands above[57].

In his reconnaissance survey of Keahuolū, Rosendahl notes, "…the Great Wall of Kuakini…is a historic period structure built during the period A.D. 1830-1840 at the direction of Kuakini, Governor of the Island of Hawaii…[58]" Kelly writes of the Kuakini Wall:

It has long been presumed that this wall was built sometime during the governorship of John Adam Kuakini (1820-1844) to protect the cultivated uplands from the depredations of cattle. However, as the wall is at all points less than a mile from the

[54] *Kuakoa*, November 27, 1875, as translated by Maly 2000
[55] *Ke Au `Ōkoa*, March 19, 1868
[56] `Ī`ī 1959:111
[57] Baker 1915:83-84 IN Kelly 1983:75
[58] Rosendahl 1972

seacoast, only the food plots in the coastal region would have been protected by it. It probably would have only kept cattle and horses grazing on the kula away from the houselots and small gardens along the shoreline[59].

…the Kuakini wall may have been the Pa'aina named as the makai boundary in several claims to land along its course. At times, the wall reaches a height of 8 or 9 feet, which seems unnecessarily high as a barrier to roaming cattle or pigs…The fact that the term used in the register of claims is "papipi," which refers to a wall or enclosure for cattle, not pigs, should answer the question of what kind of animal the wall was meant to restrict in the 1840s. Perhaps in more recent years it served other purposes. Why it is located between the grazing land and the gardens, or why it is so high in places, we can only surmise…[60]

In addition to this notable structure were smaller historic walls for similar and boundary purposes. In her report of subsistence lifestyles in Kona, Schilt writes of the *ahupua`a* in this vicinity:

62 historic walls listed….23 walls trending mauka-makai pass through the ROW [right-of-way], defining ahupua`a boundaries. All are double-faced and core-filled, in good to excellent states of repair. Functioning today as portions of cattle range boundaries, these walls probably originated in historic times, as early as the mid-1800s, having been built for that purpose[61].

Ala hele (walking trail) narrow paths following the contours of the terrain extended both laterally along the shoreline and from *ma uka* to *ma kai*. Trails running inland were referred to as *ala pi'i* (ascending path) or *ala pi'i uka* (path ascending inland) or *ala pi'i mauna* (path ascending toward the mountain) and connected areas of coastal habitation with the more inland settlements and planting areas and with the upper forest zones. Coastal trails were referred to as *ala kahakai* (coastal path) serving to link the settlements along the shoreline. The *ala loa* (long trails) held regional significance that covered extensive distances and connected major settlements. Two major *ala loa* appear to have passed through Keahuolū. One, the *ala kahakai* which may be the trail mentioned by John Papa 'Ī'ī that led from Kamakahonu, cited above[62]. An "Old Hawaiian Trail" identified in Kekahuna's 1955 sketch below[63]:

[59] Kelly 1983:75
[60] Ibid.:76
[61] Schilt 1984:44
[62] 'Ī'ī 1959:120
[63] http://papakilodatabase.com/main/imageserver.php?file=SP201851.jpg&path=H/A/S/H/9/4/7/1/9

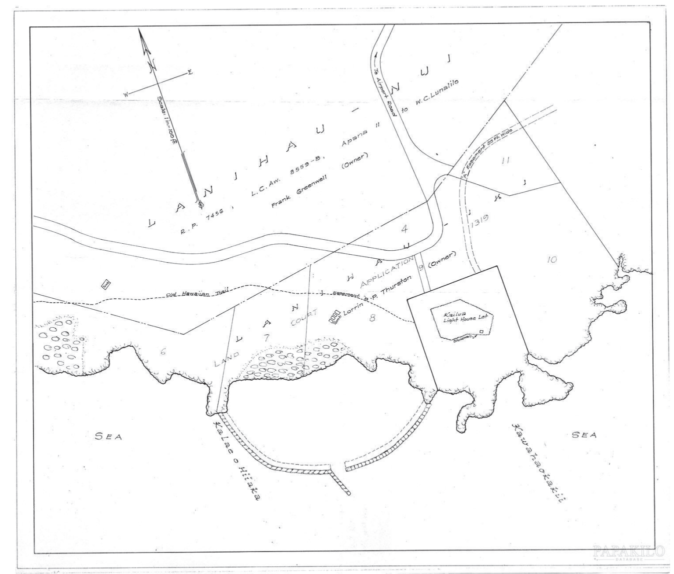

Figure 4 – Kekahuna's *Sketch of Lanihau-nui including Ka lae o Hiiaka and Kawahaokakii; Kona Hawai'i*

Māhele 'Āina

In 1848, during the reign of Kamehameha III, the traditional Hawaiian land ownership system was replaced with a more Western-style system. This radical restructuring was called The Great *Māhele* (division). The *Mahele* separated and defined the undivided land interests of the King and the high-ranking chiefs, and the *konohiki*, who were originally in charge of tracts of land on behalf of the king or a chief[64]. More than 240 of the highest-ranking chiefs and *konohiki* in the kingdom joined Kamehameha III in this land division.

The *māhele* did not convey any title to land and the chiefs and *konohiki* were required to present their claims the Land Commission and receive awards for the lands quitclaimed to them by Kamehameha III. Until an award for these lands were issued, title remained with the government. Due to the lack of surveyors at the time of the *Māhele,* the lands were divided by name only, with the understanding the ancient boundaries would remain in effect until a survey was made. This was done to expedite the work of the Land Commission in awarding the lands to the chiefs and *konohiki.* However, they were required to pay commutations to

[64] Originally *konohiki* referred to the person in charge of a tract of land on behalf of the king or chief; in later statues, the chiefs or landlords were referred to as *konohiki*. Chinen 1958:vii, Chinen 1961:13

the government for them to receive Royal Patents on their awards. These became known as "Konohiki Lands[65]."

Lands were identified and categorized in 1848 as "Crown Lands" (for the occupant of the throne), "Government Lands" and the above defined "Konohiki Lands." All three were "subject to the rights of the native tenants[66]". These rights were brought into question when the King, government, and *konohiki* began selling their lands. To address the situation, the Privy Council, on December 21, 1849, adopted four resolutions as a means of protecting the rights of the native tenants[67]. These resolutions authorized the Land Commission to award fee simple title to all native tenants who occupied and improved any portion of the Crown, Government, or Konohiki Lands sans houselots in Honolulu, Lahaina, and Hilo, and such awards free of commutation[68]. The native tenants were required to prove they cultivated those lands and were not permitted to acquire waste lands or lands "with the seeming intention of enlarging theirs lots." Upon its dissolution on March 31, 1855, the Land Commission issued thousands of awards to native tenants although they totaled less than 30,000 acres in the kingdom.

Keahuolū

Keahuolū was awarded to Analea (Ane) Keohokālole (c.1814-1869) daughter of `Aikanaka (k) and Kama`eokalani (w). Keohokālole was a great-granddaughter of siblings Keaweaheulu[69] and Kame`eiamoku, two of the five Kona chiefs who assisted Kamehameha I in uniting the islands[70]. (Kame`eiamoku, with his twin, Kamanawa are represented on the monarchy's coat of arms.) Keohokālole's lineage was of the ʻĪ lineage of Hilo. Kameʻeleihiwa states, "Keohokālole was regarded by the Kamehameha clan as an *Aliʻi Nui* in honor of the great courage and loyalty proffered by her ancestors in their support of Kamehameha[71]. Keohokālole union with her first cousin Caesar Kaluaiku Kamaka`ehukai Kahana Keola Kapa`akea produced Kaliokalani David La`amea Kamanakapu`u Mahinuilani Nalaiaehuokalani Lumialani Kalākaua, Lydia Lili`u Loloku Walania Wewehi Kamaka`ehā, Miriam Kapili Kekāuluohi Likelike, and William Pitt Leleiōhoku (adopted by Ruth Keʻelikōlani). As *Aliʻi Nui* Keohokālole held the fifth largest number of *ʻāina* after the *Māhele* with 50 parcels[72]. She relinquished 48% of her original 96 *ʻāina* to the *Mōʻī* [King] retaining 23 parcels on Hawaiʻi, 25 on Maui, and two on Oʻahu. Of her lands on the island of Hawaiʻi two-thirds were located in the Kona District[73].

Keohokālole's award for the *ahupua`a* of Keahuolū is part of Land Commission Award 8452, Apana 12 (Royal Patent 6851). This award had a total area of 4,071 acres. Keohokālole

[65] Chinen 1961:13
[66] Laws of Hawaii 1848:22
[67] Chinen 1958:29
[68] Ibid.
[69] Kame`eleihiwa 1992:106-7
[70] Kelly 1983:31
[71] Ibid.
[72] Kame`eilihiwa 1992:245
[73] Kelly 1983:31

conveyed 15,000-20,000 acres of lands with the balance going to her heir, Lili`uokalani. Attached to the following letter is a list of lands including Keahuolū:

> *To Highness, John Young Minister of*
> *Interior*
> *Greetings:*
>
> *This is to inform you and the Privy Council of my desire to convey some of my lands for the Governments one-third in the land which remain as mine. Grant me this, of course, with the approval of the Privy Council Below is a list of the lands I wish to convey to the government[74].*
>
> *To Your Highness, John Young Minister of*
> *Interior*
> *Greetings:*
>
> *Here is a list of names of my lands which has been left for me pending for an approval of its distribution….Keahuolu ahupuaa, Kona, Hawaii…*
>
> *With appreciation,*
> *A. Keohokalole*

The following testimony was given by Awahua, to verify Keohokālole's holding for LCA 8452 in Kona:

> *Awahua, sworn, says he knows the house lots claimed by Keohokalole at Kaawaloa, Hawaii. The first one is fenced all round with a stone wall. It is bounded makai by the sea shore, on Kailua side by the Government land, mauka by the land of Nahaku, and Awahua, and on the other side by the road. Claimant derived this lot from her ancestors, who held it from very ancient times. There is a stonehouse and several grass houses in it belonging to claimant, besides a tomb.*
>
> *The second lot is called "Awili," and is fenced all round. It is bounded makai by government road, on Kailua side by the same, mauka the same, on the side next [to] the pali by the road.*
>
> *Claimant derived this lot from her ancestors, who held it from older times.*
>
> *Witness knows the three house lots in Kealakekua, claimed by Keohokalole. The first lot is called "Kulou" and is fenced in. It is bounded makai by the sea beach, Kaawaloa side by government land, mauka by the road, south Kona side by a lot belonging to T. Cummings.*
>
> *The second lot is called "Kaahaloa" [and] it is enclosed all round, and bounded on Kona Hema by a lot belongning to T. Cummings, mauka by the lot of Nakoko, North Kona by an old heiau, makai by the road.*

[74] Native Testimony v10:326

The third lot is called "Wailokoalii" and is bounded on the South Kona side by an old Heiau, mauka by a Government lot and the lot of Ialua, makai by the sea beach, on the other side by a pali.

Claimant inherited these lots from her ancestors by the mother's side, who possessed them from ancient times. Kekaalua, sworn, says he knows these lots perfectly and confirms in full the testimony by Awahua[75].

When *aliʻi* received an *ahupuaʻa*, they were bound to respect the rights of the existing tenants. These tenants, if they filed a claim to The Board of Commissioners to Quiet Land Titles, could continue to cultivate and reside on their parcels. The following testimonies are for the awards granted within Keahuolū to six tenants:

Land Commission Award (LCA) 11071 to Aki for .60 acres
Kuia sworn, He has seen Aki's land that which he had cultivated himself; it is in the ili land of Pauaaiki of Keohoeolu [sic] ahupuaa in Hawaii. Section 1, five cultivated kihapais [kīhāpai][76]. Section 2, one kihapai not cultivated. Section 6, four cultivated kihapai. Section 7, one cultivated kihapai.

These interests have been made from Kaea, Nahaalualu and Kalekahi at the time of Kamehameha[77].

LCA 10303 to Maa for 2.25 acres
Mahu sworn, He had seen a whole section of land, however, it is just as he has indicated in his claim that there are eleven taro kihapais, and ten potato kihapais in the ili land of Maili of Keahuolu ahupuaa. That land is not cultivated completely, but, Maa had planted seven palm trees. The fruit is for Samuela, both Maa and Samuela have joint interest in the seven fan palm trees. There is also a coconut grove which had been planted by Maa's grandparents for the Chings who owned the land, they were the caretakers. The same had applied to Maa's parents and to him at the present time. The coconuts went to Keohokalole upon the death of Keoua and it has been that way to the present time.

One whole section is salt land and it is still yielding salt…Land passed down to Maa's parents, these to him now. Maa's grandparents received the ili land Maili of Keahuolu during the time of Kamehameha I. Kamauoha had given to Maa the land section of Lanihau ahupuaa in 1848, no one had object to him[78].

LCA 10345 to Nahaalualu (Naalualu) for 2 acres
Kuia sowrn, He had seen Naalualu) place that he had cultivated himself in the ili land of Puuokaliu of Keahuolu ahupuaa in Hawaii. Section 1 (boundaries given) one section cultivated. Section 2, four cultivated kihapai, Section 3, one cultivated kihapai, Section 4,

[75] Foreign Testimony v3:573
[76] cultivated patch, garden, orchard, field, small farm
[77] Native Testimony v4:527
[78] Native Testimony v4:526

four cultivated kihapais…[79]

LCA 10198 to Hailewalewa (Kailewalewa) for 1.30 acres
Mahu sworn, He has seen the place on which Hailewalewa had cultivated with his own hands, it is in Ulelele ili of Keahuolu ahupuaa. Section 1 taro. Section 2, Kaluulu. Land has been cultivated, one land section. On land from Hailewalewa's parents to him. Uncertainty for one section[80].

LCA 8012 to Apiki for 1.10 acres
Mahu, sworn, says he knows the kuleana of Claimant in Kailua, Kona. It consists of five patches of Kalo and a lot of patches of potatoes. The kalo patches form one piece, bounded on Kau side by Lanihau, makai by Papaula's land, Kohala side the same, mauka by Hai's land. The potato land is bounded mauka by Haino's land, Kau side by Lanihau, makai by Kahili's land, Kohala side the same. Claimant derived the land from the Konohiki, before the death of Kuakini, and has held it ever since without disputes[81].

LCA 7351 to Kahuanui for 2.90 acres
Papaula, sworn says I know the claim of Kahuanui. It is in the ahupuaa of Keahuolu, Kona. It consists of one piece of kalo land, five patches—all lying together. One of these patches if planted with coffee. It is bounded mauka by the land of Kahookohukaneole, Kau by Lanihau, makai by the land Nahaalualu, Kohala by the konohiki. Claimant received this land from his brother in 1846, and his title has never been disputed[82].

Not all applicants were awarded land through this process. Below is a list of claimants indicating Hailewalewa's failure to be awarded:

LCA#	Claimant	*Ili*	Disposition
10345	Nahaalualu		Awarded
10303	Maa	Maili	Awarded
10198	Mailewalewa	Ululele	Awarded
10198B	Hailewalewa	Ululele	Not awarded
10672	Paia	Puuokaliu	Awarded
11071	Aki	Pauaaiki	Awarded
07351	Kahuenui		Awarded

Table 2 – Claimants for land in Keahuolū

Five of these kuleana appear on County Tax Maps as being located *ma uka* of the Upper Government Road (now the Māmalahoa Highway) along the boundary with the *ahupuaʻa* of Lanihau (Figure 3). This area appears to correspond to the *ʻili ʻāina* of Maili described in Boundary

[79] Native Testimony v4:527
[80] Native Testimony v:525
[81] Foreign Testimony v8:676
[82] Foreign Testimony v8:682

Commission testimony as, "an old village at Puu o Kaliu a *palipali ahua* [precipitous mound or hillock], where houses used to stand[83]". The above testimonies indicate successful cultivation of *kalo* (taro) and *`uala* (sweet potatoes) near the upper Government Road. No kuleana claims were awarded within the coastal portions of Keahuolū.

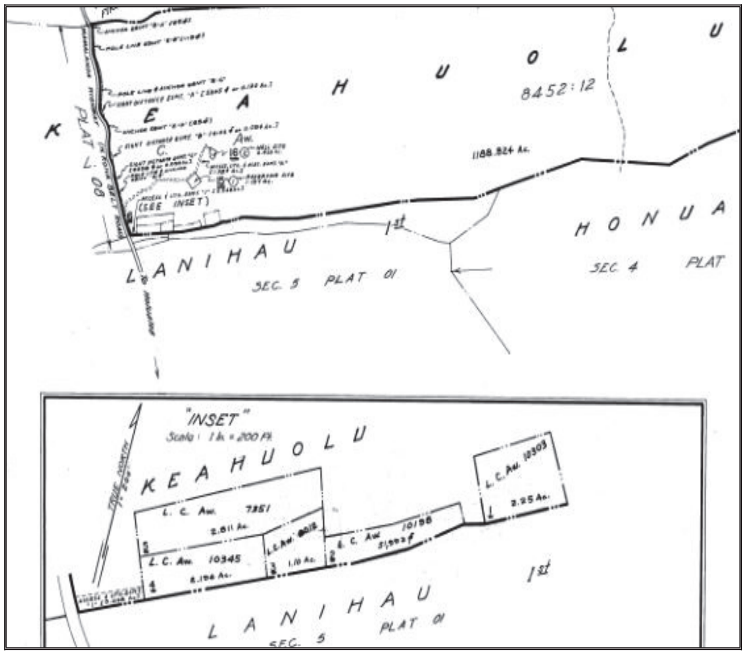

Figure 5 – Portion of Hawaii County Tax Map Zone 7, Section 4, Plat 2 showing Land Commission Awards in Keahuolū

Correspondence to the Minister of Interior often provides insights to land use and transactions.

> **Interior Department – August 3, 1853**
> *In letter from the Governor of Hawai`i (Kapeau) to the Land Commission giving a list of names of persons who have paid for their Land Claims…*
> **Interior Department – April 25, 1866**
> *In report by J.H. Kalaiheana showing that the above ahupuaa belongs to Keohokālole.*

In a report by J.H. Kalaiheana, dated April 25, 1866, lists Keahuolū belonging to Keohokālole. In

[83] Boundary Commission Testimony 1:355

a letter dated July 8, 1869 from David K. Kalākaua to his sister, Lili'uokalani, a detailed description of Keahuolū is provided. Kalākaua writes:

> *This land is situated in the District of North Kona, bounded by the ahupuaa of Lanihau (in Kailua) belonging to Prince Lunalilo on the Kau side, and on the Kohala side, by Kealakeha, a government land and Honokohaniki belonging to Keelikolani. Keahuolu runs clear up to the mountains and includes a portion of nearly one half of Hualalai mountains. On the mountains the koa, kukui and ohia abounds in vast quantities. The upper land or inland is arable, and suitable for growing coffee, oranges, taro, potatoes, bananas &c. Breadfruit trees grow wild as well as the Koli oil seed. The lower land is adopted for grazing cattle, sheep, goat &c. The fishery is very extensive and a fine grove of cocoanut [sic] trees of about 200 to 300 grows on the beach. The flat land near the sea beach is composed chiefly of lava, but herbs and shrubbery grows on it and [it is] suitable for feed of sheep and goats. It is estimated at 15,000 to 20,000 acres or more.*

> **Interior Department – 1873**
> *In report by the Commissioner of Boundaries (Hoapili) showing that $4 had been paid to witnesses who testified at the hearing on the settlement of the boundaries of a piece of land in the above place belonging to J.O. Dominis. [Spouse of Lili`ūokalani]*

> **Interior Department – October 6, 1894**
> *Liliuokalani to Minister of Interior*
> *Allowing to run a road through the above land, also that the Government to fence in both sides of said road &c.*

A letter written by Lili'uokalani to the Minister of the Interior, dated October 6, 1894, gives permission for a road to run through Keahuolū, and includes orders for the Government to fence both sides of this road.

Lanihau

Lanihau was divided into Lanihaunui (1) and Lanihauiki (2) with the former adjoining Keahuolū. 302 acres of Lanihaunui was retained by William Charles Lunalilo in Land Commission Award 8559-B[84] while the latter was returned by Kaopua and kept by the Government. Lunalilo's parents were Kekauluohi and Kana`ina. Kekauluohi was the firstborn child of Kaheiheimālie (the sister of Ka`ahumanu) and the chief Kaleimamahu (half-brother of Kamehameha I)[85]. Prior to becoming the wife of Kana`ina Kekauluohi had been a wife to both Kamehameha I and II[86] and served as *kuhina nui* from 1839-1845 representing Victoria Kamāmalu, who was too young to take the office upon the death of her mother Kīna`u[87].
Soon after the death of Kamehameha V Lunalilo became the first popularly elected Hawaiian king on January 1, 1873[88] winning over David Kalākaua. One of Lunalilo's proposed amendments to the Constitution of 1864 was to abolish the property qualification for voting[89]. Lunalilo died of

[84] Indices 1929:483
[85] Kamakau 1961:208
[86] Ibid.
[87] Kelly 1983:35
[88] Kuykendall 1953 v2:244
[89] Day 1984:88

tuberculosis February 8, 1874 and is known as the first *ali`i* to leave his estate to charity for "poor, destitute and infirm people of Hawaiian blood or extraction, giving preference to old people[90]" Of note, Lunalilo spent his last days at Kailua with the hope of regaining his health there[91].

Testimony for one of the claims in Lanihaunui provides insight to land use:

> **Native Testimony Vol 8:680**
> *Kahue 7468*
> *Mahu, sworn, says I know the claim of Kahue. It is in the ili of Kohalaia (?), Lanihau 1. It consists of 18 kihapais, one of which is a garden of coffee. Another consists of a lot of garden trees. These kihapais lie in 4 distinct pieces.*
> *No 1, is 5 patches of potato lands…*
> *No, 2 is 6 kalo patches…*
> *No. 3 is 5 pieces of kalo land and one coffee patch…*
> *No 4 is a garden of banana trees far inland…*
> *Claimant received these lands from Hoapili wahine before Kuakini's time, and his claim has never been disputed.*

LCA#	Claimant	Land	Disposition
3541	Kanewalawala	Lanihau	Not awarded
8749	Kaawa	Lanihau	Not awarded
2453	Kaopua	Lanihau	Not awarded
10068	Mahi	Lanihau, Kealakehe 6, Keopu	Not awarded
11071	Aki	Keahuolu, Lanihau 1	Awarded
10303	Maa	Lanihau 1 Keahuolu	Awarded
2453	Kaopua	Lanihau	Not awarded
5258	Kaopua	Lanihaunui	Awarded
3983	Hoopio, John	Lanihau 1	Awarded
5317	Kaaawa	Lanihau 1	Awarded
5635	Kaumuloa	Lanihau	Not awarded
9251	Kaea	Lanihau 1	Awarded
7426	Kahue 1	Lanihau 1	Awarded
7367	Kauko	Lanihau 1	Awarded
7910	Keoni	Lanihau 1	Awarded
10007	Luhai	Lanihau 1	Awarded
10250	Mahu	Lanihau 1	Awarded

Table 3 – Claimants for land in Lanihau 1

A claimant listed as Laioha[92] for an *`ili* called Piilani in Lanihaunui and another in Keopu. The witness cited eight patches there but did not specify the crop. However, it was not awarded as the claimant, "She has forsaken it. Claimant has been in Oahu for the last 3 years[93]."

[90] Kuykendall 1953: v2:262
[91] Ibid.:261
[92] Another name for the claimant is Helekahi
[93] Native Testimony v8:671

Land records at the Hawai`i State Archive often do not distinguish between the two Lanihau:

> **Interior Department. Lands Doc. #385**
> *List showing that 50 acres in Lanihau, North Kona was leased by the Minister of Interior.*
>
> **Interior Department. Land Matters Doc. #391**
> *List of lands of M. Kekauonohi disposed to King, shows (inter alia)…Lanihau*
>
> **Interior Department. Land Matters 1847 December 16**
> *List of lands of the King as reported by Ione Ii, shows, (inter alia;)*
> *LANIHAU, KONA HAWAII. There remains to others certain Ilis.*
>
> **Interior Department. 1851**
> *In communication by J. Z. Waiau to the Min. of Interior (Keoni Ana) acknowledging receipt of a letter informing him that the above land is not for sale – giving reasons why his application will be considered, that he has under cultivation to coffee fields.*
>
> **Public Instruction. 1852 February 11**
> *Wahineiki to Minister of Public Instruction*
> *Desires to secure 300 acres of land in the above tract &c in settlement of debt due him &c.*
>
> **Interior Department. 1852 September 24**
> *In letter by J. Fuller stating that Pupule wishes to rent one or both fish ponds in the above place.*
>
> **Interior Department. Int. Dept. Book 6:25. 1852 October 7**
> *In letter from Min. of Interior to J. Fuller, informing him that His Highness is willing to lease the two fishponds in above locality.*
>
> **Interior Department. 1853 August 3**
> *In letter from Governor of Hawaii (Kapeau) to Land Commission giving a list of names of persons who have paid for their land claims in the above place.*
>
> **Interior Department. 1854 April**
> *In statement of land sales giving the names of persons and the amount they paid in with the number of acres they bought in the above place.*
>
> **Interior Department. 1854 September 28**
> *Chas. Kanaina to Min. of Interior*
> *In re above land of which he mentioned to Min. of Interior that a portion of his land had encroached on said land which portion was promised to be given him. To write to Fuller the surveyor, so that the said surveyor may know, that said portion is his, that no dispute may arise between him & Waiau.*
>
> **Interior Department. 1893 March 9**
> *J. W. Keaweualani to Min. of Interior*
> *In re his application on land in the above place dated Nov. 29, 1892. Said land was sold to him by Greenwell by mistake. Requesting that Royal Patent be issued to perfect tile on same, &c.*

Here, Lanihau 1 is listed as belonging to the Crown:

> **Interior Department. Doc. #375**
> *In list showing that above Ahupuaa in Kona Hawaii was set aside to Kamehameha III, in the division made between Leleiohoku & the King.*
>
> **Interior Department. 1866 April 25**
> In report by J. H. Kalaiheana showing that th above ahupuaa belongs to Kanaina.
>
> **Interior Department. 1873**
> In report by the Commissioner of Boundaries (Hoapili) showing that $1 had been paid to the witnesses who testified at the hearing on the settlement of the boundaries of a piece of land in the above place belonging to Lunalilo.

On August 12 of the same year the Commission of Boundaries heard testimony regarding the application of Charles Reed Bishop on behalf of His Majesty Lunalilo on the boundaries of North and South Kona:

> *J.T. Waiau (k) Sworn:*
> *I was born at Honuaula North Kona Hawaii at the time Keakuakalani lived on Lanihauike* [sic]*, know the boundaries of Lanihaunui. It is bounded on the North side by Keahuolu and on the South side by Lanihauike the land has ancient fishing rights extending out to sea. The boundary at shore between Lanihaunui and Lanihauiki is Kuhauapaio an awaawa kai* [crevice] *in the rocks, thence mauka to Kuaaona between the fish ponds, outside the fort. I think one good sized fish ponds in on Lanihauike* [sic]*; called Waikaniula, Waihonu is on Lanihaunaui, thence to a cocoanut tree on the inside the old fort, thence to a long stone above the fort buried in sand, some of the kamaainas say, it used to reach to wet sand. Thence mauka to Kaopuowaua; thence to wall of Kaholii, Makai of the Government road, thence to Kahue (the two last named points are both on Lanihauike* [sic]*. Thence along Lanihauike along lands sold to Pukalua a punawai, and thence along the Government portion, to Kaopapa Mohonakeaa which is the mauka corner of Lanihaunui and junction of Keahualu* [sic]*and Lanihauike* [sic][94]*.*
>
> *S.K. Kaai (k) Sworn:*
> *I was born here at Kailua, have lived at Oahu and have not been back here about…years know the land of Lanihau 1st and part of its boundaries, was told them by father in law Kapaa (now lolo)* [*lōlō :* feeble-minded] *who once had charge of the land…other kamaaina have also told me. The boundary at shore between the two Lanihaus is at a place Kukanapaio an awaawa kai, between two points, the point nearest the land of Lanihau…is said to be on that land, and the water is on Lanihau 1st; thence the boundary …Southeastery [sic], the sand on Lanihau 2nd and the pahoehoe on Lanihau 1st to a hale kupapau* [literally corpse house]*, a tomb called Kaluanaiau, thence a little more towards the east to Puupalena South side of this place is Puupohau, thence the boundary runs to the South side of Waiopae. Thence to the ponds Waikauwila and Waihonu, passing between said pond and running along the middle of the wall, thence into this yard to a cocoanut tree near the wall, thence mauka to the mauka side of the old fort; My father in law told me that the land was surveyed on the outside of the fort and not on the boundary. I have heard that wet sand is on Lanihau 2nd my father in law also told me that it was surveyed to a place called Kaopuaona, thence mauka to Kaopua and Keeliikolani's kuleana, thence mauka to Kaholiis wall, to Kahiamoe's land. I have been told that Pukalua is on Lanihau 1st my father in law told me, Lanihaunui runs through the young koa trees. Have not heard where it ends. Have heard from the kamaaina that it ends where the banana trees grow, and does not run far into the woods*[95]*.*
>
> *Mahu k. Sworn:*
> *I have lived at Lanihau and Keahuolu and know the boundaries of both lands. I now live at Ooma. The mauka corner of Lanihaunui is in the woods at Nohoanaoa boundary of Lanihauike and Keahuolu, thence the boundary runs makai between the lands of Lanihaunui and Lanihauike to Pukalua, mauka corner of Waiau's land. Thence Makai to Piilani this place is below the woods, where Sleeper commenced his survey of Lanihaunui. Kapae, Kaai's father in law, myself, and others went with Mr. Sleeper as kamaaina, and he surveyed the boundaries as we pointed them out. He surveyed the line between Lanihaunui and Lanihauike thence across to Keahuolu in several places. Down to the beach we surveyed around the fort, and not through it, and between the ponds Waikauwila and Waihonu, the former being on Lanihauke; thence makai to Puupalena thence to Kahooleaakane, thence to Makaio, and thence to Pohakuloa. At Puupalena we surveyed across to Keahuolu and went down on that line. The cross lines were surveyed across to iwi aina of Keahuolu. From the mauka corner of Lanihaunui the boundary between that land and Keahuolu runs Makai to Kaopapa, thence to Piilani, thence to Puukaike, thence to Paeheo. Keanawai is on Keahuolu, thence to Huehuenui a kihapai* [cultivated patch, garden] *on the south side, thence to Keahupuaa at the Government road. Thence Makai to Puuokahii thence to Kaaialii on the South side of ulu halau. Thence to Kekaulele a puu pahoehoe, thence makai to Pia aina; the high ground being on Keahuolu and the low ground on Lanihau. Thence to Puuhoe. Maili is an ili aina on Keahuolu near the boundary at Puuhoe (Hoenui). Thence to Kahinihinihiula and from thence to Puuopalena*[96]*.*

As the result of the testimonies R.A. Lyman, Commissioner of Boundaries, 3rd J.C. established the boundaries of Lanihau, "Commencing at the shore at a place called Kuhanapio (an awaawa kai[97]) marked X on rock, thence along boundary between Lanihaunui and Lanihauike South 62 45' East[98]."

The following places the royal enclave Kamakahonu in Lanihau 2:

> **Interior Department. 1884 December 18**
> *In letter from E. Kahulanu to the Min. of Interior desiring to purchase the above land [Kamokuhonu [sic] in Lanihau 2]- Memorandum relative to the same, attached.*

Figure 4 above shows the boundary of Lanihau 1 and 2 along the coast. Jean Greenwell identifies land areas or sections for Lanihau:

---

[94] Boundary Commission A305

[95]Boundary Commission – Continued from Folio 306

[96] August 13, 1873

[97] crevice

[98] Boundary Commission No. 25, March 4, 1874

Kealaehu (possibly a name for an upper road)
Kaluulu are where potatotes grow
Kula
Ai Malaehu – section
Moeanoa land – Moeaiwa
Kahakanahe land
Eamai – section in the mountain area[99]

Greenwell and Lloyd Soehren compiled place names from testimonies for Land Commission Awards and Boundary Commission and a myriad of other resources. These have been georeferenced here:

Figure 6 – Place names of Keahuolū, Lanihaunui adjoining *ahupua`a* as collected by by Greenwell &

[99] Jean Greenwell land files, Lanihau

Soehren

On a map drafted by 19th century government surveyor J.S. Emerson in the 1880s (Reg. Map 1280), a narrow band of shading running in a north-south direction crosses Keahuolū and Lanihau. This band is at the approximate elevation of 6,250 to 7,250 ft. In Emerson's Field Notebook sketches, this line is identified as the "Commencement of the Forest." The notebook notes that *ma uka* of the forest line, the land is "lava covered with scattering forest and dense masses of *ki* [ti] root[100]." *Ma kai* of the forest line he described as "rocks covered with long grass[101]. Kelly approximates this forest edge at an average elevation of 550 to 650 ft. from Kailua south[102].

Emerson's verbatim notes of a survey of lands in Kona:

> *Friday Sept 4 [1885]…with one brave native, your bro. & I pushed boldly into the fog…to the very summit… We set a huge signal a great distance down the mountain to command the southern part of Keauhou… Another equally fine signal we set on the summit ridge of the crater commanding (1) a large portion of the interior & base of the crater, (2) the opposite side of the crater, (3) M. Kea, (4) Ahu Moa, (5) Puu ka Pele, (6) Puu Waawaa, (7) W. Hualalai, (8) Puu Laalaau, (9) Keahuolu. Thus the problem of locating the crater will be solved…[103]*

[100] Kelly 1983:58
[101] Ibid.:59
[102] Ibid.:58
[103] Maly 2005:501

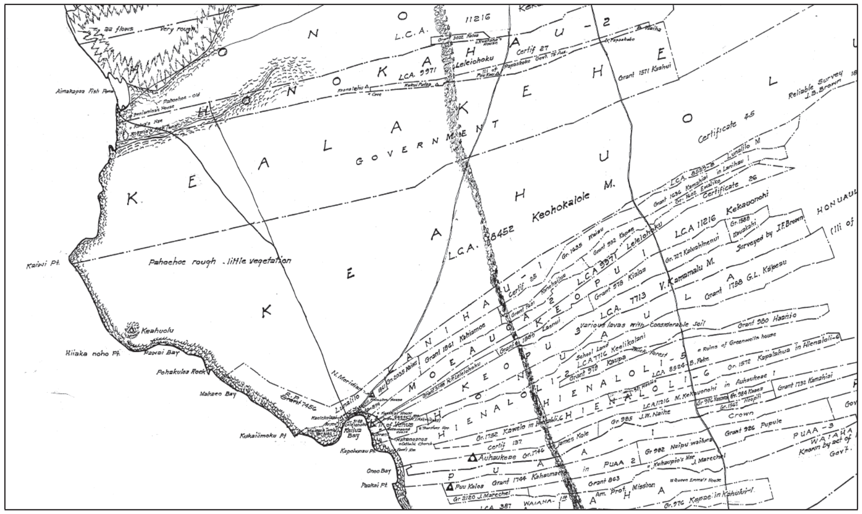

Figure 7 – Portion of Reg. Map 1280 by Emerson ca. 1880

References to Keahuolū in digitized Hawaiian language newspapers available in *Ulukau: Hawaiian Digital Library*[104] provides an obituary (for a Tataio Kaa and two notices. Unfortunately, they provide little insight to land use:

> *Olelo Hoolaha.*
>
> *O MAUA NA MEA NONA NA INOA Malalo nei, ke hai aku nei maua i na mea a pau; e kii mai i ko oukou mau holoholona, e hele ana Ma Keahuolu a me Lanihau, iloko o keia malama o Dekemaba, 1862, me ka uku kupono. A o na holoholona e loaa ia maua mahope o keia makahiki, e hoopaa ana maua ma kahi kupono, a e uku mai ka mea nana ka holoholona, a o ke kahu paha nana e malama $5 00. A oi aku paha no ke komo hewa, a me ka poino, a me ka luhi i ka ho-a ana; no ka mea, ua pilikia na hoaaina i ka oukou holoholona.*
>
> *P. KAPAE.*
> J. NAKEWIKI.[105]
> *Kailua, Hawaii, Nov. 28. 1862. 56-3t*[106]
>
> *Announcement.*
>
> *We are the ones whose names are below, we would like to let everyone know to come and collect your animals that are moving about in the Keahuolu and Lanihau areas in*

[104] www.ulukau.org
[105] These names are most likely aliases.
[106] *Nupepa Kuakoa*, Vol.1 No. 56, 20 December 1862

> *December 1862, with the proper payment. And as for those animals that still remain with us after this year, we will secure them in the proper area, and owner of the animal will pay us, and his keeper will profit $5.00 or more for trespassing and danger, and for roam and the trouble it caused to the land for these animals*
>
> *Olelo Hoolaha*
>
> *EIA MA KO'U LIMA KEKAHI WAA UUKU, ua loaa ia'u ma ka moana, ma kahi e kokoke ana I ke awa poe o Pawai, aole he aina, he mau ia kono nae, ua loaa ia'u kela Waa, iloko o na la hope o ka malama o Maraki i hala ae nei. E kii kokie mai ka mea nona keia Waa, me ka uku mai he $15.00, ina aole e kii mai ka mea nona keia Waa, alaila, e lilo no ia'u keia waa, e like me na laau pae.*
>
> *MAA.*
> *Keahuolu, Kona A., Hawaii, Mei 16, 1865. 5-2t*[107]
>
> *Announcement.*
> *I have a small canoe that I got in the deep ocean, near the round bay of Pawai, not near land, but it did have some fish in the last days of this past March. Whoever this canoe belongs to should come and get it quickly and pay $15.00, if you don't claim your canoe I will possess this canoe as my own like the pieces of wood that just wash ashore.*

As recently as the 20th century existed a small village of *ʻōpelu* (Mackerel scad) fishermen resided at a coconut grove in Keahuolū. Behind this village, known as Makā`eo, were several large brackish water ponds where *ʻōpaeʻula* (*Crangon ventrosus)* thrived. These shrimps were used to mix in the *palu* or chum, used for catching *`ōpelu.* Several springs and one well provided potable water. The village, coconut grove and all the pools but one was destroyed during the construction of the Old Kona Airport[108].

[107] *Ke au Okoa* Vol.1 No.6, 29 May 1865
[108] Clark 1985:110

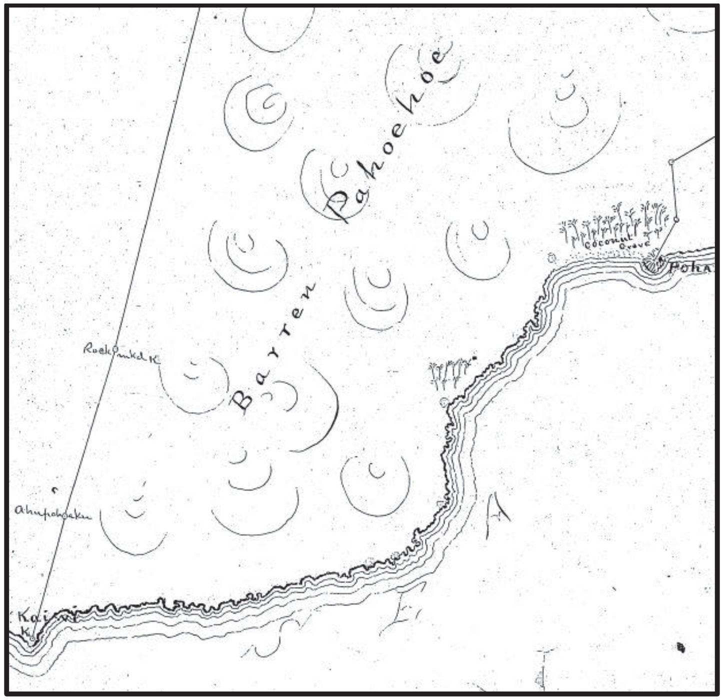

Figure 8 – Portion of Register Map 512 showing coconut grove at Pāwai

Reg. Map 512 (c.1875) depicting Keahuolū notes a *kukui* tree, coconut grove and a grave at Pōhakuloa[109] *ma kai* of the "Road to Kailua". This coconut grove extends south from Pāwai Bay and marks the site of the fishing settlement of Māka'eo, "a small Hawaiian community of 'Ōpelu fishermen…in a cluster of homes in a large coconut grove[110]."A 1929 U.S.G.S. topographic quadrangle, however, indicates a sisal (*Agave sislana*) mill located in Keahuolū. Kelly briefly discusses this crop in her 1983 history of the *Gardens of Kona*. She places its cultivation in Kona with the following quote from Thrum in 1905: "The McWayne sisal tract consisted of about 500 acres at or near Kailua[111]." Kelly adds, "…how much of this acreage was actually planted in sisal is unclear[112]." In an attempt to locate the cultivated area, various articles were consulted and informant interviews conducted.

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[109] *Ahupuaa Keahuolu in N. Kona Hawaii*, J.F. Brown
[110] Clark 1985:110
[111] Thrum 1905:185
[112] Kelly 1983:89

Accounts in early 20th century periodicals focus on sisal cultivating efforts on O'ahu. However, the earliest mention of McWayne's efforts were found in the *Honolulu Advertiser's* column "History from our Files," which reports for 1918 that "[t]en tons of baled sisal, first of an estimated crop of 200 tons from the McWayne Estate, Kailua, Kona, reached Honolulu for transshipment to San Francisco[113]." Herman D. Nichols, vice-president of Tubbs Cordage Co., suggested in a 1949 editorial that utilization of sisal fiber of wild plants throughout the Territory be explored[114].

Mr. Minoru Inaba was interviewed by the author in February 1990 as he worked at the sisal mill after finishing the 8th grade in 1921. He shared the mill was owned and operated by Luther S. Aungst from 1917 until its closing in 1924. Inaba recollects there were over 1,000 acres in cultivation in the *ahupua'a* of Kealakehe and Keahuolū. The mill, abutting Palani Road, was surrounded by the sisal fields. The challenge, Mr. Inaba relayed, was getting the sisal from the fields to the mill, as it was very bulky and sharp. Field workers cut the sisal in the field, then bundled and transported it on donkeys to the mill. At the mill the sisal was thrashed, dried, and baled. From Kailua Bay, the bales of dried sisal would be shipped to San Francisco on steamers. Mr. Inaba's job was to dispose of the by-products. Working with the sisal "made his skin itchy," and he wore protective clothing.

According to Mr. Inaba, Mr. Aungst played an important role in the development of the Kona district. He started the telephone company that connected Kona with Waimea, and later added Volcano to its line. This phone systems was eventually sold to Mutual Telephone Co., Aungst was also the postmasters and owned a garage in Kona[115].

This serial KA WAIWAI O KA AINA – Helu 3 (The riches of the land) compares Lanihau to the lands to the south:

> *Ke moe nei ka apana o Kona ma ke aoao komohana o ka mokupuni o Hawaii mai Puuanahulu a i Kaulanamauna. He 90 paha na mile ka loa, ke ana ia ma ke alanui aupuni. He aina aa a kupono ole no ka mahiai ka nui o ua apana nei; he aina momona loa no nae kekahi hapa, oia hoi kela mau aina e waiho ana ma kela aoaoa keia aaao o ke alanui mauka, maiLanihau a hiki i Hookena. He mau aina maikai mawaena o Lanihau a me Mahaiula, a pela no mawaena o Hookena a me Kapua, aole nae e like ia me ka aina mauka o Kainaliu a me Kailua, oia na aina momona loa o Kona[116].*
> [Describing] *the district of Kona which lies on the west side of the island of Hawaii and stretches from Puuanahulu to Kaulanamauna. Its length is about 90 miles in length by the government road. It is mostly lava lands and not good for farmers but there are parts that are rich/prosperous—on both sides of the government road here and there, from Lanihau until Kookena. There are good lands between Lanihau and Mahaiula and between Hookena and Kapua, but they are nothing like the very prosperous lands mauna of Kainaliu and Kailua, these are the prime lands of Kona[117].*

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[113] *Honolulu Advertiser* July 31, 1948, editorial page
[114] *Honolulu Advertiser* September 20, 1949
[115] Pers. Comm. February 1 and 8, 1990
[116] *KA HAE HAWAII*, September 30, 1857
[117] Translation R. Williams February 19, 2016

In the following legal announcement by the Trustee for Kalea requests people file a claim by March 10 for Kauko (wahine) who has died at Lanihau who died without a will:

> *HOOPONOPONO WAIWAI.*
> *NO KA MEA, ua noi ia mai au e J. K. Kalea, e hooponopono ia ka waiwai o Kauko w, i make aku nei ma Lanihau, Kona Akau, me ke kauoha ole; Nolaila, ke hoike ia nei i na mea a pau, i pili o ka poaono, oia ka la 10 o Maraki e hiki mai ana, i ka hora 9 o kakahi8aka, oia ka la a me ka hora i olelo ia e hoolohe ai i ka pono o keia noi ana mai, a me na mea hoole, i hoikeia, aia ma ko'u keena ma Holualoa, Kona Akau.*
>
> *H. L. SHELDON.*
> *Lunakanawai Kaapuni, Apana 3.*
> *Kona Akau, Hawaii, Feb. 10, 1862. 22-2t*[118]

3. SELECTED DOCUMENTATION OF THE HISTORY AND ARCHAEOLOGY OF KEAHUOLŪ AND LANIHAU

An island-wide description of sites was published by Henry Kinney in the earlier part of the 20th century. Kinney writes of the Keahuolū shoreline:

> *From the point where the Honokohau Trail leaves Kailua a poor trail leads makai over the lava to the lighthouse. Hence it continues along the beach for a couple of miles. After passing several old stone mausoleums, the trail passes an abandoned grass house where is a stone wall, the remnants of the heiau Keohuulu [sic]. Still further north is a coconut grove, where there were several kuula here, one particularly powerful one, the idol of which is still remembered as having been in a fair state of preservation, only one arm missing, when a Christian pries took it from the cave where it was kept. Since then, say the inhabitants, the fishing has been comparatively poor. In the grove are two cocoanut stumps which served as gallows for the first execution conducted by hanging in Hawaii. A chief, Kekuakahaku was the victim.*
>
> *Beyond the main [coconut] grove are a few isolated trees near the edge of the flow. Here was the heiau of Pauai, and here the trail ends*[119]*.*

The area in which Pauai *heiau* is located is known as Pāwai. Research by the Lili'uokalani Trust has determined that Pāwai is an abbreviation of Papawai and this is the name the Trust uses. Papawai's literal meaning is water stratum. It is also known as Bean's Beach[120].

In his 1919 report on *heiau* on the island, J.F.G. Stokes reports the following sites within Keahuolū:

> *Koʻa of Halepau, in Halepaʻu Section…A small fishing heiau on the pahoehoe, 100 feet north-west of Keahuolu. Well preserved walls, 4 feet high (Site #10-27-2139)*
>
> *Heiau of Kawaluna…on the beach, a quarter mile from the boundary of Lanihau, in a section (ili) called Pawai. An enclosure, the walls of which have been carefully rebuilt, without opening. The interior was filled with loose stones piled up without arrangement. The local informant stated that an old fisherman was in the habit of offering fish in this heiau. Asked as to the resulting luck, the answer was that it was not as much as that of other fishermen, perhaps because the offering was made at a heiau instead of the koʻa (Halepaʻu) nearby.*
>
> *Heiau of Palihiolo, at Waikilohi, at or near the boundary of Keahuolu and Lanihau, North Kona; on the beach in an old coco-palm grove; this is an insignificant pen, 25 by 29 feet in size with small, thin walls built on the upper slopes of the beach. Coral has been spread over the floor as a paving. The only interest attaching to the place is the account given by a very old native living in the grove. He said that Palihiolo was formerly a heiau for human sacrifice [luakini], and that it was rebuilt by Kalakaua's orders before the latter left for the United States (ca 1890)*[121]*. The old native also said that Kalakaua promised to have a sacrifice at Palihiolo on his return from America, but that he died in that country. The old native was very insistent on the truth of his statements. It might be mentioned that the surrounding grove of palms is where Kalakaua's grandfather was hanged for murder*[122]*. Other information from the old native is given here for convenience, that this king ordered the rebuilding of the two heiaus of Kawaluna and Palihiolo where human sacrifices were formerly offered, and the koʻas of Halepaʻu and Makaʻeo….It might be remarked that these four structures have the appearance of having been rebuilt in recent times*[123]*. Koʻa of Makaʻeo…This is a small pen, 200 feet from the sea and about half a mile to the southeast of Palihiolo.*

In 1930 John Reinecke conducted a survey of Hawaiian sites on the Island and reported on sites in Keahuolū. Comments for these sites were provided by Earl Neller (EN) in 1980:

> *Site 4. A group of masonry platform graves on the sand beach. (Referred to as "graves of chiefs" in Jackson's 1883 Field Notes, p.32 – EN)*
>
> *Site 5. Remains of a platform of large stones. Near this is a notable group of petroglyphs. There is also a hole with a ring around it, a form of carving which I have found elsewhere, but what it represented is hard to say— perhaps a kohe. There are also papamū*[124]*: a clear one 16 x 13; a very fine one with evenly arranged holes 1½ in diameter; and a third too dime to make out the rows, but there must have been about 12 each way.*
>
> *Site 6. A large masonry tomb or powder magazine, with very massive walls. (Note;*

[118] *KA HOKU O KA PAKIPIKA* February 27, 1862
[119] Kinney 1913
[120] Clark 2002

[121] Kalākaua died on January 20, 1891 in San Francisco attributed to Bright's disease. Baliley:1975:302
[122] Kamanawa, Kalākaua's paternal grandfather was hung for murdering his ex-wife Kamokuʻiki by giving her poison in a cup of *ʻawa.* Kamanawa was the first public execution under the 1840 laws.
[123] Stokes 1991
[124] Stone on which the checker-like game *kōnani* is played

This is probably the strcutre referred to as "Kamehameha's Tomb" in George Jackson's 1883 Field Notes, p.30 – EN)

Site 7. ON the beach, the ruins of a platform and pen of boulders; on the pāhoehoe back of this, a small house platform of pāhoehoe fragments. (This could be Stoke's "Ko'a of Maka'eo" – EN)

Site 8. Remains of a medium-sized platform, sand-covered. From its position, it may be a fishing heiau. By it is an old papamū, 12 x 11. (This could be Stoke's "Ko'a of Maka'eo" – EN)

Site 9. Group of ruins centering about the ponds of Makeo. (This site has been largely destroyed by construction of the old Kona Airport – EN) About 200' NW of Site 8 is a modern pen, and by it a large coral-strewn platform (perhaps Stoke's "Heiau of Palihiolo" –EN) and the remains of a very old pen. Back of that, among kiawe, are five house platforms, all but one being coral-strewn, two enclosures which seem to be walled house sites, and two very old house platforms. The small fishpond is divided into seven sections. It is now shallow and muddy, but was once carefully walled up—a feature common to the brackish ponds along this coast.
Even yet they are occasionally cleansed of their scum. Between it and the large pond is a small platform like a puoa [pū'o'a][125]. The marsh contains one large pond, with many small pools land waterholes, some of them walled round.

Site 10. Well-built walled platform walls 3½' wide and 3' high; inside dimensions 12 x 11½; floor about 6" off the ground. A small platform near. (This site destroyed by construction of old Kona Airport – EN)

Site 11. Near the house at Makeo, on the beach: a very dim papamū, 7 x 6, and a petroglpyh. (This site probably destroyed – EN)

Site 12. A series of yard walls by the house of Makeo:
3.1. *House site in the yard of the present residence. (This site probably destroyed –EN)*
3.2. *Modern house site with brackish pool behind.*
3.3. *Pen, probably once surrounding a water pool.*
3.4. *House, platform and pool.*
3.5. *Old, small house platform on a knoll. Farther on is a pen and three old, small house platforms, and perhaps a puoa.*

Site 13. Modern house platform and graveyard. (This could be Stoke's Kawaluna Heiau –EN)
Site 14. Three small old house platforms; canoe landing; a modern house platform with a dim old house site in the same lot; a pen (about 50' x 35') containing a platform, chiefly a mass of rough, large stones—uses unknown.

[125] Tower, steeple, pyramid, peak; house for depositing a corpse

In 1970 Kenneth Emory prepared an inventory of known sites for parts of Hawai'i Island including Keahuolū.

3841 (D9-4) Lanihau, Kailua-Kona, SW of old airport. Petroglyphs, located in three clusters, totaling 75 units, includes dots, circles, diagrams, and triangular and linear figures. (This site is probably the one southeast of the old airport –EN)

3842 (D10-1) Waikilohi beach at Keahuolu. Palihiolu Heiau, and enclosure 25 by 29 feet with a coral pavement, not located.

3843 (D10-2) Pawai beach at Keahuolu. Kawaluna Heiau, an enclosure used until recently by fishermen as a ko'a or fishing shrine, not located.

Also in 1970 Thomas Stell Newman made a field inspection for State Parks and reported on a few sites:

10-27-2000 Lanihau Petroglyphs. Southeast of runway. Traditional Hawaiian stick figures; about 15 figures, on a pāhoehoe blister.Recommend valuable (This site on fringe of Bishop Museum's Site #3841 –EN)

10-27-2001 Lanihau Papamu. 50 meters ma kai of runway. A single human stick figure petroglyph holding something in right hand. A large pāpamu of 11 by 12 rows of holes. Nearby is a very small kōnane board of 3 by 4 rows of holes. Condition good. This site is important. (This seems to be part of Reinecke's "Site 8" –EN

10-24-2002 House & burials. Located 100 meters west of pāpamu, site 2001. 25 meters ma kai of the runway. Rectangular enclosure, 5 by 6 meters, stacked stone walls about.5 meters high, walls partly collapsed, artifact collectors have excavated a portion of the interior; no midden seen. 10 meters north of enclosure are two graves, slab-lined crypts barely visible, about 2 x 4 meters. The central area of both graves is filled with small rubble (This could be part of Reinecke's "Site 9." It could also be Stokes' Palihiolo Heiau –EN)[126]

[No site number] A modern burial area lies off the west end of the main runway and I suspect there are still living relatives for those buried there. Numerous bait cups or holes ground in the rocks just back of the high tide mark are to be found all along the beach but it would not appear to be in any danger from construction. (This is probably Reinecke's "Site 13." –EN)

A walk-through archaeological survey of the Queen Lili'uokalani Village – Unit 3 Tract[127], some 100 acres, was conducted in September 1972 by Paul Rosendahl. The subject parcel is located on the *ma kai* side of Palani Road. Fourteen archaeological features were found including five

[126] Palihiolo Heiau was later placed within Lanihau and assigned SIHP Site #2002 with several burials identified by Newman.
[127] TMK 7-4-08

stone walls, two platforms, two stone mounds, two stone- walled enclosures, one foot trail, one small cave shelter, and one road causeway.

Rosendahl judged the features to be of “little or no archaeological value—none have any real excavation potential, none are features of outstanding structural or other characteristics, and none have any real known historical interest, value, or significance[128].” Two stone walls were recommended to be preserved for their scenic value.

In 1975 Aki Sinoto surveyed a road corridor in coastal Keahuolū. He identified seven sites, all small, semi-permanent or temporary structures associated with coastal marine activities[129].

Lloyd Soehren conducted a reconnaissance survey of two parcels near Kamakahonu in Lanihau 1st August 1976, Soehren identified a “*kuaiwi* or low mounding of small stones into a row containing scattered pebbles of waterworn coral” which he considered an *ahupua‘a* boundary marker between Lanihau and Keahuolū[98]. This “windrow extended some 300 yards eastward before it is obliterated, and is coincident with the present boundary It continues to the west, prolonging the line toward the shore rather than following the present, deviant boundary which parallels the shore for some distance. The antiquity of the feature is unknown, but almost certainly predates European contact[130].”

An archaeological survey of a section *ma kai* of the Queen Ka‘ahumanu Highway near the Old Kona Airport also owned by Lili‘ūokalani Trust was conducted in November 1978. Fifty-nine sites were discovered which included 140 separate features. Most of the features were concentrated along the coast subject to ocean damage. Although small cave shelters along the coast and slightly inland contained cultural deposits and were deemed to have value for excavation and subsequent historic interpretation, it was noted the inland portion of the parcel was devoid of significant remains. The single exception was site 6540, which consisted of a cluster of occupation features including platforms, paved areas and cave shelters[131].

An additional reconnaissance survey of a c.20-acre parcel where the LT Education Center is located was conducted by Folk in 1980, revealing no sites. However within three *kīpuka* near the shore Folk documented seven pavements, three caves, two platforms, four historic campsites, a burial or shrine, a historic animal enclosure, and three habitation areas[132].

In January 1983, Lloyd Soehren conducted an archaeological survey on a Keahuolū parcel (TMK 7-4-08:001) *ma uka* of the Queen Ka`ahumanu Highway and adjoining Queen Lili`ūokalani Village between 800 and 1000 feet elevation. Soehren identifies the parcel as part of the former sisal plantation. He did not identify any archaeological sites save the entrance to a small lava tube near the west boundary which he deemed void of any Hawaiian cultural activity.

[128] Rosendahl 1972:7
[129] Sinoto 1875:3
[130] Soehren 1976:1
[131] Archaeological Research Center Hawaii (Ching) 1978:1
[132] Folk 1980:21-22

Theresa Donham working for Paul H. Rosendahl, Inc. (PHRI) conducted an archaeological inventory survey for a portion of the current project area, namely TMK 3- 7-04-08:Por 2, 12 between 1989 and 1990. Two hundred thirty-seven newly identified and two previously recorded sites containing a total of 1,810+ component features were identified. Twenty-five sites were assessed as having value as examples of site types and were recommended for interpretive development. All but two of the 25 sites are within an area designated as an archaeological preserve by LT. Eight of the 25 sites were assessed as having provisional cultural value due to the possible presence of burials. Two of the 25 sites, Māmalahoa Trail and Kuakini Wall, were assessed as having interpretive and cultural values. Six cave sites were recommended for preservation the due to the presence of human skeletal remains[133].

Surveys by Haun & Associates were conducted for two small LT parcels, TMK 7-4- 015:15, a c.5-acre parcel in March 2007 and TMK 7-4-015:14, a 3.982-acre parcel in May 2007. No archaeological sites were identified in the former survey and five sites with seven features were identified in the latter. The features were interpreted as agricultural, temporary and permanent habitation but not recommended for preservation[134].

The following table summarizes archaeological finding with Keahuolū:

Year	Author	Scope	Zone	Findings
1919	Stokes	*Heiau* Survey	Coastal/Inland	3 *heiau*
1930	Reinecke	Reconnaissance Survey	Coastal	12 sites primarily habitation platforms & enclosed yards
1970	Emory	Site Inventory	Coastal/Inland	2 *heiau* discussed
1970a	Newman	Inspection	Coastal	Historic burials and “bait cups”
1972	Bevacqua	Reconnaissance Survey	Coastal	9 sites
1973	Neighbor Island Consultants	Reconnaissance Survey	Coastal	Historic burials located
1975	Sinoto	Reconnaissance Survey	Coastal	7 sites – temporary structures
1978	Ching	Reconnaissance Survey	Coastal	59 sites – salt pans, cave shelters, paving, cairns
1979	Rosendahl	Reconnaissance Survey	Coastal	4 comlexes, 2 modified sinkholes, 2 wall sections, 1 cairn, 1 rock shelter, 2 petroglyph areas, 1 walled enclosure
1980	Estioko-Griffin & Lovelace	Reconnaissance Survey	Coastal	35 sites – caves, petroglyphs, burials, house sites

[133] Jensen 1992:1
[134] Haun May 2007:ii

1980	Folk	Reconnaissance Survey & Test Excavations	Coastal	21 sites in 3 *kipuka* – 7 pavements, 3 caves, 2 platforms, 4 historic/recent campsites, 1 burial/shrine, animal enclosure, 3 habitation areas
1980	Neller	Reconnaissance Survey	Coastal	
1983	Soehren	Survey	Inland	Sisal plantation remnants
1983	Rosendahl	Survey	Inland	2 sites – agricultural and habitations, possible ceremonial and burial. One site was later found destroyed
1984	Schilt	Field Work	Coastal/Inland	Kuakini Highway realignment crossing 24 *ahupua`a.* Within Keahuolū – cairn and modified outcrop
1990	Donham	Reconnaissance Survey	Coastal/Inland	239 sites – *pāhoehoe* quarry, agricultural excavations, rock mounds, modified blisters or outcrop, the majority interpreted as agricultural features
1989	PHRI	Inventory Survey	Inland	Sites indicate relatively intensive agricultural activities
1990	PHRI	Inventory Survey	Inland	32 sites – agricultural/boundary-related, temporary habitation
1993	O`Hare & Rosendahl	Inventory Survey	Inland	18 sites – agricultural, temporary habitation, burial, historic dump, transportation feature, quarry and marker
1993	PHRI	Field Inspection	Inland	16 sites – ceremonial and burials
2007	PHRI	Inventory Survey	Inland	6 sites (2 new) – agricultural complex, boundary wall, 3 cairns, multi-feature site
2006	PHRI	Inventory Survey	Inland	One of three previously identified sites, 21253, located with 13334 and 13341 assumed to be destroyed by recent land modification
2007	Haun	Inventory Survey and Assessment	Inland	5 sites – agricultural, temporary and permanent habitation
2008	PHRI	Inventory Survey	Inland	Nine previously identified historic properties reidentified; a new feature of a previously identified historic property (SIHP # -6302, Kuakini Wall) also identified
2009	Pacific Legacy, Inc. (PLI)	Inventory Surveys	Coastal	325 site, 139 lava excavations including shrines and residential complexes
2011	PLI	Inventory Survey	Inland	82 sites including habitation complexes, cairns, trail segments, petroglyphs, boundary walls, lava tubes with human remains; 256 lava excavations
2015	PLI	Inventoy Survey and Monitoring	Coastal	Buried cultural deposit (Site 50-10-27-30224) associated with the pre-Contact settlement of Halepa'o Bay.
2015	PLI	Supplemental Inventory Survey	Inland (includes current project area)	11 sites including lava tube containing human remains (Site 50-10-27-18511, Feature C) initially identified during the 1992 PHRI survey; remnants of a historic trail (50-10-27-30287).

Table 4 – Summary of the archaeological findings within Keahuolū

The fishing village at Pāwai northwest of the former airport continued into the 1900s with a canoe landing[135]. A large brackish pond was present *ma uka* of the bay with several planting depressions accompanied by multiple housesites until the construction of the airport in 1948 which ceased operations in 1970 with the opening of the Keahole Airport[136]. The coconut grove at Makaʻeo was still evident as was the coastal trail from Kailua which pivoted *ma uka* at Makaʻeo to join the Māmalahoa Trail[137].

Tax Map Branch history sheets dated 1950 to 1983 reveal a navigation easement for TMK 3-7-

[135] Yent 1993:4
[136] Magat, et al, 2010:27
[137] Pers. Communication Bobby Camara, September 5, 2023.

008:Por.2 (1950). In 1953 the Queen Lili'ūokalani Trustees allowed access to the government to enter the land for purposes of securing the needed engineering and surveying data. In 1969 a centerline for a 10-ft. sewer easement is noted. In 1972, a setup for a 325-ft. elevation reservoir site is noted. The Kona Industrial Subdivision appears in 1973, for an area of 22.981 acres. In 1975, a lease to Pay 'N Save Corp., et al. commenced for a period of twenty years.

In the 1981 Status Report for the Trust, expansion of the industrial section is discussed:

> *A two-year option agreement with Kuakini Corp., which was selected in May as having the most attractive proposal of the five submitted to develop 100 acre expansion of the industrial area, was executed December 8, 1981. The Trust received $50,000 in payment for the option which allows the developer to prepare his plans to create approximately 76 one-acre industrial lots and to apply to the County for rezoning.*

In 1985, the Trust's 74th Annual Report gives an update for Keahuolū:

> *The survey of the mauka Kona farmlots was completed by Austin, Tsutsumi & Assoc. As the leased areas on the map differ from the property description in most of the leases, the lessees will be asked to confirm the area leased so that new leases can be prepared.*
>
> *There were only two responses to the Trustees' request for proposals to develop the entire Keahuolu parcel. The proposal by Santa Cruz Properties, Inc. for a residential development was rejected by the Trustees. It was agreed that a proposal made by the Gentry Companies was unique and that discussions regarding their proposal should continue.*
>
> *The Kona Industrial Subdivision Unit 5 area was cleared and grubbed, which created a renewed interest in the five unleased lots*[138]*.*

4. INFORMANT INTERVIEWS

Kama'āina of Keahuolū and environs interviewed over the years by the author and others are presented here.

Lui 'ohana

The author interviewed recognized lineal descendant Nicole Lui and her parents Raymond Kealohaokalani and Mary Agnes Kaelemakule Lui, on the shores of Pāwai Bay in 2016. Nicole provided the following:

> *Solomon Kaelemakule son of John (k) Kaelemakule Jr son of John Kaelemakule Sr son of Keakaonaalii (w) daughter of Kinimaka son of Kapiiwi and Kahikoloa. Kahikoloa was married first to Kameeiamoku one of the Taboo twins his brother being Kamanawa. Two of four Kona Uncles and advisors to Kamehameha I. They had a son Hoolulu. Hoolulu was half brother to Kinimaka. Hoolulu is famous for carrying the bones of Kamehameha across the a'a plains of Honokohau.*
>
> *Kinimaka and his wife Kaniu Haaheo were the hanai makua of David Kalakaua and raised him until he entered the royal school at Lahainaluna. It was Kinimaka who instilled in Kalakaua the desire to preserve the old ways and to restore the Hale Naua or genealogy houses.*
>
> *John Kaelemakule Jr was married to Lucy Lincoln of the famous Lincoln ohana of North and South Kohala. She was the daughter of John George Lincoln and Wailaahia Mioi. They lived on the border of Keahuolu and Lanihau directly in line with the pohaku piko known as Pohakuloa.*
>
> *Maa was the son of Kauhiamahi. It was Maa grandparents who planted the coconut Grove at Keohuolu for Keoua wife of Kuakini and they were the caretakers of this Grove and the coconuts went to Keoua. In 1848 Ane Keohokalole was granted Keahuolu and the Grove and coconut went to her and the Maa family continued to care for Grove. Maa granddaughter Luika Kaihe married Kaua Kaihemakawalu and they settled at Pawai and continued to care for not only the Grove but also the Kawaluna heiau. It was after the overthrow that the caretaking of the Grove and the heiau was no longer needed. The gathering of coconuts, opaeula, fishing, maintaining the Koa continued into the time of my grandfather Solomon Kaelemakule, the ohana Kunewa and the ohana Kailiwai and others. My family burial plot is there at Pawai. Aunty Mele Kunewa Kekai ohana buried at Halepa'o. When we moved to Kona from Honolulu in 1967 my Dad was very curious about the fishing customs as he was raised more paniolo way. There were actually three kupuna who taught my Dad and took my Dad to all the known places of Kona and taught him the fishing customs of Kona these were Uncle Kaneakala Springer, my mother Agnes' God brother, my Mothers Uncle Michael Samson Pelekane and my Mother's father Solomon Kaelemakule. These kupuna taught him a lot about Kona's past.*
>
> *There are two burial places in the area back of the shore of Pawai Bay. The first is surrounded by a wall that is in need of repair. This burial site contains the ancestors of my mother's mother's side. My Grandmother Margaret Pelekane's grandmother Luisa Kaihe, her grand uncle Kaleo Kaua, her grand Aunt Hina Kaua and other family members are buried there.*
>
> *A few yards back of Pawai bay in a kipuka is the burial place of my 6th great grandfather Kalawaiahakuole Mioi and his wife Kauhane and a child Lucy Aiu. Also buried there is my 7th great grandfather Mioi. These kupuna are ancestors on my mother's father's side.*
>
> *The mookuauhau on my mother's mother's side:*
> *Kauhiamahi (k) and wife had Maa*
> *Maa (k) Pili (w) had Malaka (w)*
> *Malaka marry Ewaliko Kaihe had Luika Kaihe*

[138] Lili`ūokalani Children's Center 1985

Luika Kaihe marry Kaua Kaihemakawalu (he later removed Kaihemakawalu and the children carried the Kaua)
Luika and Kaua had Malia Kaua
Malia Kaua married Kapahu Pelekane (later took the name Samson) and they had my grandmother Margaret Pelekane born at Pawai, Michael Samson Pelekane and Agnes Pelekane 3 keiki.
Margaret Pelekane married Solomon Kaelemakule and had my Mama AGNES MARY KAELEMAKULE.

The Mookuauhau on my mother's father's mother's side:

Lorenzo Lincoln married Kaaea Kuawalu and bore George Washington Lincoln
G. W. Lincoln married Rebecca Bell 1st wife. (He also took Maryann Bell she is the ancestress of my cousins the Lims and others.)
They bore John George Lincoln.
John George married Wailaahia Mioi and had Lucy Lincoln b 1888
Lucy Lincoln married John Kaelemakule Jr. and had Solomon Kaelemakule
Solomon Kaelemakule married Margaret Pelekane and had AGNES KAELEMAKULE

Fact: Aunty Lei Collins' father was George Kawaihoolana Lincoln brother to John George Lincoln, George married Jane Kaliko Haili they had Violet Leinaala Lincoln born 1916.

Aunty Lei and Lucy are 1st cousins. Anyhow Lucy married John Kaelemakule Jr. And Lei married Joseph Kaelemakule. 1st cousins married brothers.
Lei and Joseph had two children, Winona and John both are in their 90's. Live here in Kona.

Michael Ikeda

Uncle Mike retired as Community Engagement Coordinator for LT after forty years at Pāwai. In response to a project at the Old Kona Airport, he shared:

> *There are several areas of concern that I have regarding that area outlines on the map. I'm not sure if there is much information regarding Palihiolo and Kawaluna heiau that was said to be located at Makaeo. Is it possible to try and locate its location and functions? Another concern is that on the northeast side end of the runway there are a number of petroglyphs as well as anchaline ponds there. These are located within the Queen Liliʻuokalani Trust boundaries…Finally, following hurricane Iwa or Iniki, there was a lot of iwi that was unearthed along the coastline from the high waves. It is not appropriate to allow any kind of activity in those areas and should be protected.*[139]

When discussing the current project, he emphasized the tradition of Hiʻiaka o ka Lae Keahuolū as a transitional ʻāina, between the lands of Kona kai opua and Kekaha wai ʻole, and that mana of Keahuolū ʻāina is that of transition a characteristic which can be applied to the project by creating skills-building opportunities beyond hourly employment. The proverb Uncle Mike relayed "Where were you when the mist covered Puʻu o Kaloa?" to signify if a person had helped during the planting season. He believes this is the foundation of creating opportunities to foster a sense of belonging and kinship within the ʻāina of Keahuolū.

When a person would ask the people of this area for food. The response from the people would be, "where were you when the mist covered Puu O Kaloa? If they said that they were in another district, the people would feed them. If the said they were in the area, they would go hungry. If a person was in area when the mist covered Puʻu O Kaloa and they didn't have any food it meant that the person was not paying attention to the signs or that they were lazy.

Uncle Mike considers this development akin to the mist covers Puʻu O Kaloa. It can create an opportunity to holistically feed our families. It may not be a panacea for all of our beneficiaries and community's woes; however, it could serve as a catalyst that could change how developers approach development in a positive way. A way that uplifts and bonds businesses and communities. This is not a new concept, this is the foundation in which the traditional bartering system was based on. We need to intentionally and strategically create those spaces for the exchange of knowledge, skill and aloha to take place between our community and the businesses. Businesses are welcomed and our community belongs, and vice versa.[140]

Wally Lau

Former Hawaiʻi County Managing Director, Uncle Wally established the nonprofit Neighborhood Place of Kona in 1998s. His concern is that LT has not involved more Hawaiians in the consultation process, i.e. Royal Order of Kamehameha believes that preponderance of *wahi pana* necessitates for a cultural monitor during any land modifications. He learned from Aunty Elizabeth Lee, Makāeʻo refers to the need to call out while being watchful when entering this ʻāina in consideration of the burials including the possibility of its being the final resting place of the bones of Kamehameha I.[141] He also encourages the *ahupuaʻa* rather than project district management viewpoint when considering relations and cooperation between land owners and activities which promote opportunities for cultural spaces and activities.

Reggie Lee

Recognized cultural practitioner and advisor, Reggie is the son of Elizabeth Lee, who while the daughter of Jamea and Lily Ako, was hānaʻi by the Lees of Honokōhau. The mists referred to in the proverb mentioned by Mike Ikeda allowed for the cultivation of dryland crops. Charlie Akau and Buddy Keala were the caretakes of the anchaline ponds which formerly held abundant ʻōpae ʻula. He relayed fishing and diving was extensive here which will be covered in depth by his uncle, Valentine Ako. George Kahananui of Huʻehuʻe Ranch situated in Puakō traversed from Kailua north near Alula beach. Extensive study of the trails north of Keahuolū at Lae ʻŌpua by Lokelani Brandt reinforces the occurrence of historic trailed through the project area.

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[139] Personal comunication to Cultural Surveys Hawaiʻi, July 9, 2009

[140] Personal communication with author, September 29, 2023

[141] Personal communication with author, October 10, 2023

Valentine K. Ako

Valentine K. Ako was born at Hōlualoa on July 10, 1926 a descendant of generations residing in North Kona. Both parents were from Ka`ūpūlehu, he father, James Ako Sr. was a member of the Hawai`i County Board of Supervisors and Territorial Representative, a descendant from the Ka`iliuaua-Nāpu`u line. His mother, Lily Keahi`āloa Kanoholani, is a descendant from the Kanoholani-Kaiamakini lines. His parents held interests in several *kuleana* and grants between Kailua and Keauhou. Tūtū Ako has shared his vast knowledge of the North Kona District for several cultural impact assessments in addition to other studies on fishing practices and other cultural practices in Kona and Kaua`i where he has resided since the 1950s.

In his youth Tūtū Ako fished around Makā`eo and Pāwai Bays. He recalls the *kāheka* (tidepools) and wild pineapple, while small were extremely sweet that grew in the area. He ascribes the orange-sized pineapples' sweetness to the lack of rain. Two-thirds of the old Kona airport runway was *kāheka* which were filled with rock during construction. The *kāheka* were teeming with *'ōpae 'ula*, used for bait. The *'ohana* of George Kailiwai and Solomon Kaelemakule lived there and he described how Kaelemakule would net the *ōpae 'ula* to make chum to catch *`ōpelu* (*Decapterus pinnulatus*) between October and December. Kaelemakule gathered the *ōpae 'ula* in buckets with *limu 'ele'ele* to keep them alive and then scooped them with a net to avoid handling. To attract the *`ōpelu ōpae 'ula* was thrown followed by a circle net some 40 to 50 feet. When the *`ōpelu* began feeding the fishermen placed chum and mud in the middle the latter making a cloud distracting the fish. According to Tūtū Ako this method is still practiced in Ho`okena and Miloli`i.

Growing near the *kāheka* grew *`ākulikuli* (*Batis maritima*) used by the *kūpuna* to *kalua* pigs instead of *tī*. This substitution was due to the lack of rain or fresh water required for *tī* to thrive.

Tūtū Ako relayed a phenomena of the sacks of *manini* (*Acanthurus triostegus*) being washed ashore near Makā`eo at the boundary of Keahuolū and Lanihau. Tūtū was told by the *kūpuna* the *piaea* or *'ōhua*[142] (*manini* embryo) where within a *hūpē koholā* (whale mucus). These sacks containing multitudes of *manini* washed ashore in the months of January through April[143]. Upon being broken open by crashing on the rocks and shoreline, all one could see of the transparent fish were two black dots, the eye and the *`ōpū* which turned green as the sun shone on them. Tūtū Ako would gather the baby *manini* in the tide pools. Despite the sharp fins of the one-inch *manini* that would often cut the tongue when eaten these were sought after by the *kūpuna.* Tūtū Ako addressed the sharp fins of the small fish by cutting off each fin then his grandfather would dry, salt, or fry them[144].

Tūtū Ako relayed at Ka`iwī Point were four blowholes which produced sprays up to 300' feet during the winter months. Due to the salt water damage to cane in the Keōpū fields of the Kona Sugar Co. manager Hackfeld ordered the blowholes be demolished via dynamite. While this effort destroyed three of the holes, the thickest one was not destroyed by this method. According to Tūtū Ako, the task of plugging the *puka* was given to Tūtū Aalona who placed a

[142] In Kona and all other islands the embryo of the *manini* were called *`ōhua* whereas on Kaua`i referred to as *piaea* (Pers. Comm. January 13, 2016)
[143] Maly 1999:15
[144] Pers. Comm. February 10, 2016

large piece of *kauila* (*Alphitonia ponderosa*). Years later Tūtū Ako's brother Herbert dove to retrieve a body viewing the plug in situ. Years later, Herbert's son observed coral covering the plug[145]. Tūtū Ako relayed that during the winter months, *limu pahe`e* (Porphyra) was to be found at Ka`iwī Point[146].

During a 2008 interview for the Ane Keohokalole Highway which traverses Kaloko, Honokōhau, Kealakehe and Keahuolū Tūtū Ako stated:

> *The highway is going to cross some graves, a lot of graves. A lot of lava tubes. I'm curious about what is going on in Kona. That particular area has graves in lava tubes. One time, in Kona alone, there were 100,000 people. There were a lot of people in that particular area.*

In a 2009 interview with Cultural Surveys Hawai`i, Tūtū Ako relayed two cement tombs at the south end of the old Kona Airport. He postulates they were for higher ranking people[147].

Tūtū Ako shared the location of the QLCC recreation center is incorrectly called Pāpawai Bay with the correct name being Halepa`o due to the crevices and the *`o`opu* (*Govioidei*) found therein[148]. Comparing Halepa`o to a swimming pool with a crevice, when the tide was high there was a stream. Here they would catch salt water *`o`opu* also known as *pa`o* which was used as bait for *ulua* (*Carangidae*).

Unlike the meaning of "angry eyes" given in the Hawaiian Dictionary, Tūtū Ako translates Makā`eo as "wandering eye." As mentioned previously his sister, Elizabeth Lee interpreted Makā'eo as the the calling out while being watchful when traversing the 'āina.

> *We old timers always named it Maka`eo, after the little stone island. Maka`eo is the northern part of Keahuolu. Maka`eo and Pawai, if you look at the map, at the location of the old Kona Airport, Pawai is considered part of Maka`eo.*

In addition to the *kāheka* at Makā`eo mentioned above Tūtū Ako shared more of information:

> *Past the stone of Maka`eo, at the end of the park and runway area, is that little cove; that's where Ka`iliwai and then Pai lived. The cove there was also a canoe landing, but during rough water, it was pretty treacherous. When landing in rough water, the canoes were sometimes cracked open[149].*

Maly adds Mrs. Ruby Keana`āina-McDonals recalls her elders called the small canoe landing Pā-wa`i (Struck and broken), though the name is now pronounced "Pawai[150]."

[145] Ibid.
[146] Ibid.
[147] MS provided by Valentine Ako
[148] Pers. Comm. January 27, 2016
[149] Maly Pers. Comm. January 9, 1996
[150] Maly Per Comm. March 13, 1996

Mahealani Pai

The author interviewed Mahealani Pai in 2008 regarding the lands of Keahuolū and Kealakehe impacted by extension of the Ane Keohokāleloe Highway[151]. Pai, former Cultural Resource Specialist for Kamehameha Schools and founder of the education programs Kia`i `Āina Kualoloa, is a descendent of an *`ohana* who trace their residence in the Kona district to the eighteenth century, specifically to Honokōhau-Kaloko. He is widely recognized as a cultural practitioner and authority representing the Royal Order of Kamehameha at many public hearings; a contributor to published works i.e. *Islands in Captivity: The International Tribunal on the Rights of Indigenous Hawaiians and All Our Relations: Native Struggles for Land and Life*[152]; and tireless advocate for the preservation of Hawaiian sites and practices.

Mahealani's *`ohana* resided near the shoreline boundary of Keahuolū during the 1930s moving there from Honokōhau. They fished these waters for *`ōpelu* and *aku* (*Katsuwonus pelamis*) selling their catch to George Kailiwai mā, indicating the abundance from these waters. He also assigned Makā`eo as the place name for the stretch of area formerly known as the Kailua Kona Airport where cattle were held before being shipped out on the steamer *Humu`ula*. Makā`eo was identifiable by a large coconut grove. A landmark known as Pohakūloa, stands as a lone sentinel for locating a nearby *`ōpelu ko`a*. To the north are patches of sand beaches owned by Queen Lili`ūokalani Trust. The *`ōpelu ko`a* known as *Halepao'o* ,for the jumping fish *`o`opu* (general name for fishes included in the families *Eleotridae*, *Gobiidae*, and *Blennidae*) could be found.

Although the Pai *`ohana* resided *ma kai* within Keahuolū, Mahealani's grandfather utilized sisal for the making of *kaula* and dyeing them to secure and hang fishing implements while his young father found temporary employment at the sisal mill *ma uka* of the present Queen Ka`ahumanu Highway.

Another cultural resource, *alahe`e* (Canthium odoratum) which was used for the batten of traditional thatched structures, was gathered in the *ma uka* lands of Keahuolū.
Mahealani cited a trail his mother would utilize as recent as the 1950s. Starting in Kailua between the current Taco Bell and Car rental agency office, the trail went through Keahuolū onto Kealakehe and Honokōhau. When the seas were *mālie* (calm) they would take the canoe to reach Honokōhau, but when the seas were rough, they would take this trail. The home of Kaelemakule was located at the Kailua end of this trail.

Mahealani's concern is the cultural resources i.e *kauila, uhiuhi*, and *alahe`e* be preserved. He places Kalualapauila *heiau* on the northern *ma uka* boundary of the Kealakehe and Honokohauiki in the vicinity of La`iopua near the Kealakehe Homestead. If this *heiau* can be identified, it too should be preserved. Boundary Commission testimony places this *heiau* at the Kealakehe/Keahuolū boundary[153].

[151] Corbin and Wong Smith 2008
[152] Churchill, W. et al. 2005; Laduke, W, 1999
[153] BCT 1:355

Clarence A. Medeiros, Jr.

The author interviewed Clarence A. Medeiros, Jr. is a descendant of several well-known *kama`āina* families of the Kona region in 2008. The son of Clarence A. Medeiros, Sr. and Pansy Wiwoole Hua Medeiros, his grandparents include Frank C. Medeiros and Violet Mokuohai Parker and Charles Hua, Sr. and Annie Man Sing Zen Hua Weeks. He has familial ties to the lands of Honokua, South Kona and Haleki`i and Kanāueue, North Kona. Both of his parents were native speakers, his mother an accomplished weaver is a descendent of native fishermen and canoe builders; his father descended from two renowned canoe builders, John Mokuohai and Charlie Mokuohai Parker. Clarence Sr. repaired rock walls in Kona and Kohala including the walls of National Parks of Pu`uhonua o Hōnaunau and Pu`ukoholā. Clarence Sr. was recognized as a cultural and historical resource and it was from him and Earl Leslie, Sr. Clarence Jr. learned much of his knowledge of cultural practices and history.

Clarence Jr. continues to harvest *maiapilo* or *pilo* (capparis sandwichiana) within Keahuolū for medicinal properties. During a conversation on December 17, 2007 he stated the *pilo* grew readily on the area currently being cleared by Queen Lili`ūokalani Trust near the Queen Ka`ahumanu Highway as it crept along the *pāhoehoe*. According to Clarence *pilo* does grow on *ma uka* of the Highway and up to the 300' elevation, but at these elevations it is mixed in with other shrubs and harder to procure. Clarence Jr. also referred to the sisal plants in Keahuolū used to make rope. Provided with maps of the highway corridor of the Ane Keohokālole Highway Clarence voiced his concern the ecological environment will be compromised and the pilo will be endangered. Clarence Jr. referred to Clarence Rapoza whose family has resided in the area for at least two or three generations. He also referred to the Kanuha `Ohana[154].

Clement Kanuha

Clement "Junior" Kanuha is also a *kama`āina* of Kona active in perpetuating Hawaiian practices. He has represented cultural practitioners and cultural descendants on the west side of the island as a member of the West Hawai`i Fisheries Council, cultural descendent at Burial Council hearings and many other culturally and environmentally- based organizations. He has assumed the role of caretaker of Keolonāhihi *heiau* in Kailua[155].

Ulalia Ka`ai-Berman

Ulalia Ka`ai-Berman is a *kupuna* with the Department of Education's Kūpuna Hawaiian Studies Program. A child of Ernest Kakihoku Ka`ai and Josephine Ulalia `Ikuwā Ka`ai, her family has over 70 years of residential ties with North Kona conducting cultural practices of i.e. gathering grasses for thatching and building a *hālau* at Pāwai in Keahuolū. She learned of the *mo`olelo* of Keahuolū from A`ala Roy Akoa between 1970-1981 fishing and farming traditions of the area[156].

Minoru Inaba

Mr. Inaba was interviewed by the author in Feburary 1990 was he worked for at the sisal mill after finishing the 8th grade in 1921. He related the mill was owned and operated by Luther S.

[154] Ibid.
[155] Ibid.
[156] Ibid.

Aungst from 1917 until its closing in 1924. Inaba recalls there over 1,000 acres in cultivation in the *ahupuaʻa* of Kealakehe and Keahuol. Sisal fields surrounded the mill abutting Palani Road. The challenge, Mr. Inaba relayed, was getting the sisal from the fields to the mill, as it was very bulky and sharp. Field wokers cut the sisal in the field, then bundled and transported them on donkeys to the mill. At the mill the sisal was thrashed, dried, and baled. From Kailua Bay, the bales of dried sisal were shipped on steamers to San Francisco. Mr. Inaba's task was to dispose of the by-products. Working with the sisal "made his skin itchy" requiring protective clothing[157].

Peter Keka

Mr. Keka was the only informant the author did not personally interview. Keka was interviewed for a report on Kealakehe and only information regarding Keahuolū is provided in the table below.

Paul Bucher

A notice seeking cultural impacts was posted in the November 2023 issue of *Ka Wai o OHA* resulting in one call from Paul Bucher, who frequents the shoreline almost daily and several years ago uncovered *iwi* in the exposed sand after a storm. The State Historic Preservation Division was notified and he is unaware to the disposition of the *iwi*. Upon being provided a map of the project area, he indicated his discovery occurred further north and west and not in this vicinity.

Table 5 provides a summary of knowledge of Keahuolū and environs *shared* by informants either interviewed by the author or by others:

Informant	Relation	Interviewer	Site	Notes
Lui ʻOhana	Lineal descendants	Wong Smith	Historical burials of their ʻohana Coconut grove Trail	
Mike Ikeda	40+ years managing LT lands here	Wong Smith	Petroglyphs anchaline ponds unidentified *heiau*	Existing project does not incorporate opportunities to highlight the transitional characteristic of the *ahupuaʻa*
Wally Lau	Long-term resident and former County Managing Director	Wong Smith		Recommends cultural monitor for any land modfications. Promotes increased cooperation between landowners for more cohesive land use.
Reggie Lee	*Kamaʻāina*	Wong Smith	anchaline ponds trails	
Valentine Ako	Kona *kamaʻāina*	Maly[158] Mitchell[159] Wong Smith	Four blowholes once located at Kaʻiwī Pt. Two cement tombs at south end of Old Kona Airport. Canoe landing past the stone of Makāʻeo	The *kāheka* which were filled in by the construction of the Old Kona Aiport teemed with *ʻōpae ʻula* and *limu ʻeleʻele*. *ʻĀkulikuli* grew along *kāheka* which was used in *imu* in place of *tī*. Correct name of site where LT Recreation Center is located where *ʻōhua* is Halepaʻo for the *paʻo* caught there.
Mahealani Pai	ʻOhana traces residency in vicinity to 1700s	Wong Smith[160]	Makāʻeo, Pohakūloa near a *ʻōpelu koʻa,* Kalualapauila *heiau.* Plants in area: *alaheʻe, kauila, uhiuhii*	Kalualapauila heiau on the boundary of Kealakehe and Honokōhauiki at Laʻiopua
Minoru Inaba	Lifetime resident	Wong Smith[161]	1,000 acres of sisal cultivation in Kealakehe and Keahuolū. Mill closed in 1974	Worked at sisal mill upon completeing the 8th grade in 1921
Peter Keka	Kona *kamaʻāina*	Kanehele[162]	Maliu Point Kaukauholo is the	AKA Puʻuonia A small *ahu* near a

[157] Donham 1990

[158] Haun et al. 1998
[159] Ms. provided by Valentine Ako
[160] Corbin & Wong Smith 2008
[161] Ibid.
[162] Kanahele 2001:30-31

			name of the beach and cliff area within Keahuolū Hale Laʻī o Hiʻiaka is synonymous with Hiʻiakanoholae and Keahuolū Point Puʻukaloa Hale o Paoʻo Kaʻiwī Point	guava tree in Keahuolū Considers Pāwai and Papawai different locations. The latter is a flat area *ma uka* of Makaeau rock outside of the old airport made of red cinders. There was an abundance of *pili* grass here.
Clarence Mederios Jr.	Kona *kamaʻāina*	Wong Smith[163]	From 300 ft. elevation and below is found the endemic plant *Maiapilo* or *pilo* (*capparis sandwichiana*) Sisal plants also remain in Keahuolū Repaired boundary and retainer walls in 1974 during the widening and resurfacing of Palani Road from Palani Junction to Kuakini Hwy.	Plant used for medicinal purposes and is vulnerable. He continues to gather there. His father was employed by QLCC and harvested sisal for thatching

Table 5 – Summary of cultural knowledge of Informants

5. CULTURAL IMPACTS

The cultural impacts to any locale in Hawai`i are not always readily evident. What is assessed by Western eyes as "barren land" often contain rich resources to Hawaiians i.e. pili grass, maiapilo, and as evident in Keahuolū and Lanihau, rich marine resources. The cultural resources of the fishponds and tidal pools here have been noted throughout the years, especially those at Makāʻeo. Such resources are intertwined with religions sites i.e. koʻa and heiau. While the heiau Palihiolo is credited as once being of the luakini class, little remains today. The fact that heiau Kawaluna was rebuilt before Stokes 1919 survey reflects its value by residents.

[163] Corbin & Wong Smith 2008

Documentary resources and archaeological surveys reveal the preponderance of burials in the sand dunes and other coastal areas of Keahuolū and Lanihau. Further inland, caves, lava blisters and other modified features revealed human remains as evidenced in the current project area (SIHP 50-27-18511).

Based on previous and the current research adaptations in Keahuolū and Lanihau and the permanent populations along the coast especially at Makā`eo, the midlands were used for temporary habitation and were crossed by trails linking the coast to the uplands, and the uplands were used for agricultural cultivation. The coconut grove at Pāwai was a frequently mentioned resource on the coast.

The proximity of the royal enclave of Kamakahonu in Lanihauiki gave rise to trails and associated features and activities. A section of the pre-contact and historic trail (SIHP 50-27-30287) reflects the possibility of additional trails in the project area.

The identification of four historical cultural resources the Makalapua Project District project and the cultural practices of gathering native resources care should be taken to preserve the habitat of endemic plants, i.e. pilo in addition to access for these gathering activities. Agricultural, temporary habitation sites, or burials may reveal themselves during development as they have been identified in other areas of Keahuolū and Lanihau. For this reason, cultural monitoring is recommended during land-altering activities associated with construction, work in the immediate area of the discovery should be halted and DLNR-SHPD contacted as outlined in draft Hawaii Administrative Rules 13§13-280.

6. SUMMARY & RECOMMENDATIONS

Reviewing the information presented in this cultural impact assessment – historical documentation, archaeological surveys and research, and oral reminiscences Keahuolū and Lanihaunui were valued for its marine resources and to a limited extent, subsistence crops. Contemporary or continuing cultural practices include gathering activities of the ocean resources and specific plants from the 300 ft. elevation seaward.

Along with several *heiau* along the coast, previous researchers have located several probable permanent residential sites with enclosed yards. Further inland, there are sites and features indicative of dry land agricultural activities substantiated by Māhele testimonies of *kalo*, potato, and limited coffee cultivation. Features indicating temporary habitation were also identified. In the upper elevations, there was a substantial increase in rock mounds, particularly faced mounds and modified lava blisters collaborating to the tradition of increased agricultural activities *ma uka* where the moisture increases.

Keahuolū's and Lanihaunui's rich coastal resources, while severely modified in the past, should be recognized and celebrated. Historic uses reveal Keahuolū and Lanihaunui were impacted far less to livestock grazing than its northern neighbor Kealakehe. The absence of grazing activity increases the likelihood of cultural sites to remain intact or to suffer less degradation.

Based on the findings of this assessment, the Makalapua Project District project will have limited impact on Hawaiian cultural resources, beliefs and practices. Care should be taken to preserve the habitat of endemic plants, i.e. *pilo* in addition to access for gathering activities. Agricultural, temporary habitation sites, or burials may reveal themselves during development as they have been identified in other areas of Keahuolū and Lanihau. In the event such archaeological resources are encountered during land-altering activities associated with construction, work in the immediate area of the discovery should be halted and DLNR-SHPD contacted as outlined in *draft* Hawaii Administrative Rules 13§13-280.

7. Ka Pa'akai Analysis

Regulatory Context

A 2016 Cultural Impact Assessment (CIA) for the Makalapua Project District (Wong Smith 2023) assumed a cultural landscape approach, integrating information from the ahupua`a (traditional land division) of Keauholū and Lanihau, North Kona in order to assess impacts on cultural resources in the proposed project area. The CIA informed a Draft Environmental Assessment (DEA) that was reviewed by the Land Use Commission (LUC). A March 28, 2024 letter from the Land Use Commission (LUC) requested in part:

> Section II A- 10-11: Archeological, Historical, and Cultural Resources The DEA includes an archaeological study which was accepted by the State Historic Preservation Division in 2019. However, based on LUC Staff review, the DEA does not include a clearly labeled and identified Ka Pa'akai Analysis. Please include a Ka Pa'akai Analysis that includes the following:
>
> 1. The identity and scope of "valued cultural, historical, or natural resources" including the extent to which traditional customary Native Hawaiian rights are exercised in the petition area;
> 2. The extent to which those resources, including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed action;
> 3. The feasible action, if any, to be taken to reasonably protect Native Hawaiian rights if they are found to exist.

Therefore, at the request of Bryan Esmeralda, Land Planning Manager for the LT, Helen Wong Smith, MLIS, CA, FSAA was engaged to prepare a Ka Pa'akai Analysis for the LT's Makalapua Project District project.

Ka Pa'akai Framework Analysis Context

Privately-owned land in Hawai'i, such as the LT landholdings and proposed project area, is subject to native tenants' rights. This section identifies and discusses the Hawai'i State constitutional mandates and Hawai'i State laws requiring protections of the exercise of Hawaiian traditional and customary practices and the cultural resources they rely upon. Primary amongst them are rights to gathering, access, and the continued right to exercise traditional and customary practices.

Specific provisions within the Constitution of the State of Hawai'i recognize, uphold, and regulate Native Hawaiian traditional and customary rights, including the right to exercise them in the present. Article XI section 1 acknowledges and protects Native Hawaiian traditional and customary rights:

> For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State.
>
> All public natural resources are held in trust by the State for the benefit of the people (Haw. Const. art. XI, § 1).

The public trust doctrine ensures public right to access and utilize biocultural resources. Dual obligations within the public trust doctrine are the protection of biocultural resources and "[m]aximum reasonable and beneficial use," both of which must be taken into account "in the planning and allocation of water resources, and to protect public trust whenever feasible," (Haw. Const. art. XI, § 7; Legislative Reference Bureau 2024). Native Hawaiian traditional and customary rights, typically including iwi kūpuna (*Native Hawaiian ancestral remains*), are components of the public trust doctrine and (see Kaleikini v. Thielen at 31, 237 P.3d at 1097).

Article XII, Section 7 contains explicit protections for Hawaiian traditional and customary practices:

> The State reaffirms and shall protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupua'a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights (Haw. Const. art. XII, § 7; Legislative Reference Bureau 2024).

Recognition and protection of Hawaiian traditional and customary practices and the cultural resources they rely upon are reiterated in the Hawai'i Revised Statutes (HRS). HRS § 1-1, "Common Law of the State; exemptions," safeguards the exercise of traditional and customary practices, extends those rights to the gathering of materials that are essential to a tenants' lifestyle, and may even protect limited upland subsistence farming as practiced by Native Hawaiians (HRS § 1-1). HRS § 7-1, "Miscellaneous Rights of the People – Building materials, water, etc.; landlords' titles subject to tenants' use," protects the right to gather for personal, non-commercial use, and a right to "drinking water, and running water, and the right of way," (HRS § 1-1).

Additionally, 2015 case law established the constitutional rights of cultural practitioners to participate in contested case hearings involving proposed used that may affect their practices (see Mauna Kea Anaina Hou v. Bd. of Land and Nat. Res).

The Ka Pa'akai Framework Analysis is rooted in case law. In 2010, the Hawai'i Supreme Court decided Ka Pa'akai 0 Ka 'Āina v. Land Use Commission, and determined that Article XII, Section 7 of the Hawai'i State Constitution "places an affirmative duty on the State and its agencies to preserve and protect traditional and customary native Hawaiian rights, and confers upon the State and its agencies 'the power to protect these rights and to prevent any interference with the exercise of these rights," (Ka Pa'akai). Additional relevant components of the Hawai'i Supreme Court ruling read:

> (1) the state and its agencies are obligated to protect the reasonable exercise of

customarily and traditionally exercised rights of Native Hawaiians to the extent feasible;
(2) agencies are obligated to make an assessment, independent of the developer or applicant, of impacts on customary and traditional practices of Native Hawaiians;
and (3) the independent assessment must include the three factors (A, B, and C) listed above, otherwise known as the "Ka Paʻakai framework [Ka Paʻakai]

The ruling mandated the State must minimally make specific findings and conclusions on:

(1) the identity and scope of 'valued cultural historical, or natural resources' in the petition area, including the extent to which traditional customary native Hawaiian rights are exercised in the petition area;
(2) the extent to which those resources-including traditional and customary native Hawaiian rights-will be affected or impaired by the proposed action;
and (3) the feasible action, if any, to be taken by the LUC to reasonably protect native Hawaiian rights if they are found to exist [Ka Paʻakai].

Ka Paʻakai Framework Analysis Purpose

The purpose of the Ka Paʻakai Framework Analysis is to ensure the proposed project complies with Article VII, Section 7 of Hawaiʻi's Constitution, described in detail above, which "places an affirmative duty on the State and its agencies to preserve and protect traditional and customary native Hawaiian rights, and confers upon the State and its agencies "the power to protect these rights and to prevent any interference with the exercise of these rights," (Ka Paʻakai 2000). The mitigation measures identified through this analysis will be integrated into the Draft EA and reviewed by the LUC.

Methods

Introduction

This Ka Paʻakai Framework Analysis contains information gathered from consultation performed for the Cultural Impact Assessment (CIA) associated with the proposed project (Wong Smith 2023), utilized with consultees' free and informed consent, empirical data gathered from a site visit and field inspection, and the background research conducted for the CIA (Wong Smith 2023).

Background Research

The wide range of written material – archaeological reports, government and other historical records, Hawaiian language sources translated into English – collated for the project CIA was utilized in this Ka Paʻakai Framework Analysis. The CIA background research contextualized the project area within its greater cultural landscape context in the ahupuaʻa of Keauholū and Lanihau, North Kona, and the study identified potential impacts from that place of contextualization. Utilizing the same approach and background research for this related Ka Paʻakai Framework Analysis for the same proposed project was deemed appropriate.

Site Visit and Field Inspection

On May 18, 2024, a site visit and field inspection was conducted in order to inform the Ka Paʻakai Framework Analysis with empirical observations of the project area and vicinity. Its purpose was familiarization with the characteristics and resources contained within the project area and surrounding landscape. The goals of the site visit and field inspection were:

1) Pedestrian visual inspection of the safely accessible portions of the proposed project area, and its greater cultural landscape context;
2) Preliminary assessment of cultural resources and practices observed to be present; and,
3) Documentation of evidence for cultural resources and practices potentially associated with the project area and vicinity.

Consultation

Per professional best practices, informed consent was secured from consultees featured in the CIA related to this project (Wong Smith 2023) to apply their intellectual property to this Ka Paʻakai Framework Analysis: the Lui *ʻohana* - Keahuolū lineal descendants that include parents Raymond Kealohaokalani and Mary Agnes Kaelemakule Lui (née Maʻa) and their daughter Nicole as well as Wally Lau, and Michael Ikeda. Also per professional best practices, consultees were provided a clear and accurate understanding of how their manaʻo (*perspectives*) and ʻike (*knowledge*) shared during consultation would be applied, their right to withdraw their contributions until published as part of the public record, and where their intellectual property may be made publicly available (Appendix A). Consultees were also invited to contribute Ka Paʻakai Framework Analysis-specific *manaʻo* (perspectives) and *ʻike* (knowledge), if desired.

Recommended mitigations are drawn from two sources: 1) *manaʻo* and ʻike shared during consultation for the CIA for the proposed project, and used here with express written permission from consultees, and 2) from the author as an experienced archival and historical consultant.

Approach

The LUC requested LT submit for review (See March 28, 2024 LUC letter, Appendix B):

"….a Ka Paʻakai Analysis that includes the following:
1. The identity and scope of "valued cultural, historical, or natural resources" including the extent to which traditional customary Native Hawaiian rights are exercised in the petition area;
2. The extent to which those resources, including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed action;
3. The feasible action, if any, to be taken to reasonably protect Native Hawaiian rights if they are found to exist."

In fulfillment of the LUC's request, this Ka Paʻakai Framework Analysis was structured around the following questions:

1) What are the cultural resources associated the project area and greater vicinity?
2) What are the practices reliant on those resources that may get impacted by the proposed project?
3) Will the cultural resources and practices, including Native Hawaiian rights, get impacted? If so, what mitigation is recommended by consultees and professionals to make it pono?

Ka Paʻakai Framework Analysis

Introduction

This section addresses the identity and scope of “valued cultural, historical, or natural resources,” including the extent to which traditional customary Native Hawaiian rights are exercised in the petition area.

Analysis

Background Research Results

Native traditions and historical accounts discussed in the background research performed for the CIA affiliated with this Ka Paʻakai Framework Analysis (Wong Smith 2016) identify “valued cultural, historical, or natural resources,” associated with the project area within its cultural landscape context in the ahupuaʻa of Keahuolū and Lanihau, North Kona, Island of Hawaiʻi. These include:

- Water in its many forms (freshwater seeps and springs; brackish water ponds; freshwater that could be collected from porous basaltic caves, rock shelters and depressions; mists, fog, and clouds) (Pukui, Elbert, and Mookini 1974:101), inclusive of the late 19th through early 20th century cultural practice of mauka-makai migration of chiefs and commoners to access water resources during the dry season (Maly in O’Hare 1993: Appendix 81; Maly in Wulzen et al. 1996:12) and the lihau (light dew mists) that would sit atop the mound-hill of Puʻu-o-kaloa, on the plane of Ka-noenoe in Keahuolū-Kealakehe and portend coming rain (Wise and Kihea in *Ka Hoku o Hawaii* October 25, 1917; transcribed and translated in Maly 1994: A-4)
- Hau trees (Fornander 1916-17 IV:574)
- Wahi kūpuna (Hawaiian ancestral places and spaces), including but as wahi kūpuna are continuously being researched, understood and revealed, not limited to:
    - A mamamo koʻa [a shrine to increase the catch of *mamo* or sergeant fish *Abudefduf abdominalisi*] at Kaʻiwi Point (Kanahele 2001:10)
    - A stone that is the embodiment of the priest Kalualapauila (Pukui, Elbert, and Mookini 1974:70)
    - The plain of Ka-noenoe [the mist, fogginess] (Wise and Kihea in *Ka Hoku o Hawaii* October 25, 1917; transcribed and translated in Maly 1994: A-4)
    - The traditional through historical era burial grounds of Kūkāʻilimoku Point and the surrounding sand dunes that include surface gravemarkers (Neller 1980:5; Register Map 1325 by Jackson 1883)
    - Additional tombs and graves (Foreign Testimony v3:573)
- Upland resources like paper mulberry, mountain apple, sweet potatoes, and yams as well as foreign-introduced tobacco, cabbage, and watermelons (de Freycinet 1978:8; Ellis 1963:29)
- Banana, taro, potato, and coffee cultivation by Native claimants in the late 19th century (Native Testimony, Volume 8:680, Kahui 7468)
- In the late 19th century, the ahupuaʻa of Keahuolū‘s forested mauka lands were described as rich in koa, kukui, and ʻōhiʻa, the midlands breadfruit and koli oil seed, and its coastal resources included an abundant fishery, 200 to 300 tree coconut gove (July 8, 1869 letter correspondence between King David Kalākaua and Queen Liliʻuokalani)
- Ti (Emerson field notebook and cross-referenced Registered Map 1280), c. 1880
- The temple of Kalihi (Kaluaʻōlapauila), officiated by the kahuna also called Kaluaʻolapauila who officiated rituals for the ahupuaʻa of Keahuolū and Kealakehe (Wise and Kihea in *Ka Hoku o Hawaii* October 25, 1917; transcribed and translated in Maly 1994: A-4)
- Halepau koʻa (*fishing shrine)*, Kawaluna Heiau, Palihiolo Heiau (Stokes 1991)
- Platform graves on a sand beach, a large masonry tomb, a platform and enclosure, ruins around the ponds of Makeo (Neller 1980)
- *Ma kai* kipuka containing seven pavements, three caves, two platforms, four historic campsites, a burial or shrine, historical animal enclosure, and three habitation areas (Folk 1980:21,22)
- *Ma uka* or upland forest planting and cultivation (Kanahele 2001:4)
- *Ma kai* sweet potato cultivation and fishing (Kanahele 2001:4)

A lineal descendant of North Kona interviewed for the CIA associated with this study (Wong Smith 2023) also shared insights regarding “valued cultural, historical, or natural resources,” associated with the proposed project area within its greater cultural landscape context. Since the CIA is part of the public record and the consultee did not provide informed consent for their contributions to be utilized in this study, their *ʻike* and *manaʻo* are featured here and have been anonymized:

- *kāheka* (tidepools) and *ʻōpae ʻula*, used for fishing bait in order to catch *`ōpelu* (*Decapterus pinnulatus*)
- an intermittent stream containing salt water *`o`opu* also known as *pa`o* which was used as bait for *ulua* (*Carangidae*)
- specialized throw net fishing for *`ōpelu,* still practiced today in Ho`okena and Miloli`i
- gathering *limu ʻeleʻele*
- *`ākulikuli* (*Batis maritima*) grown for roasting pig instead of *tī* due to lack of freshwater resources
- gathering of *manini* (*Acanthurus triostegus)* egg sacks washed ashore on the boundary of Keahuolū and Lanihau from *hūpē koholā* (whale mucus)
- *limu pahe`e* (Porphyra) found at Ka`iwī Point

Academic archaeological studies generated primarily by foreigners to Hawaiʻi for research purposes and technical archaeological reports commissioned by agencies, entities, and individuals in satisfaction of historic preservation compliance requirements also provide information regarding “valued cultural, historical, or natural resources,” associated with the project area. Previously-identified historic properties within the project area are featured in Table 6, below. The existence of these resources, and their potential interpretations, evince Hawaiian practice and resources associated with the project area, including but not limited to burials, other ceremonial and ritual functions, water catchment, habitation, agriculture, cultivation, gathering, and travel.

Table 6. Previously-identified historic properties within the project area (adapted from Munekiyo-Hiraga 2024:35)

State Inventory of Historic Places (SIHP) #	Location in Project Area (PA)	Description	Functional Interpretation	Reference
50-10-27-13260	Northwestern	Human-modified naturally-occuring lava sinkholes	Water catchment	Munekiyo-Hiraga 2024:35
50-10-27-13261	Northwestern	Enclosure	Possible ceremonial structure	Munekiyo-Hiraga 2024:122; Reeve et al. 2019:248

50-10-27-18502	South central	Modified depression	Habitation	Munekiyo-Hiraga 2024:35
50-10-27-18508	Central	Walled Overhang	Habitation	Munekiyo-Hiraga 2024:35
50-10-27-18509	North central	Stone mounds, filled depression, and lava excavation	Habitation	Munekiyo-Hiraga 2024:35
50-10-27-18511	Northeastern	Modified overhang, lava excavations, modified lava tube	Burial, agriculture, habitation	Munekiyo-Hiraga 2024:35
50-10-27-29111	Northwestern	C-shaped wall	Uncertain	Munekiyo-Hiraga 2024:625
50-10-27-29112	Northwestern	C-shaped wall	Uncertain	Munekiyo-Hiraga 2024:625
50-10-27-29143	West central	Modified overhang	Habitation	Munekiyo-Hiraga 2024:625
50-10-27-30207	Southeastern	Lava excavation	Uncertain	Munekiyo-Hiraga 2024:35
50-10-27-30208	Southeastern	Stone mound	Marker	Munekiyo-Hiraga 2024:35
50-10-27-30209	Central	Enclosure	Habitation	Munekiyo-Hiraga 2024:35
50-10-27-30210	Central	Modified overhang, lava excavation, c-shaped wall, enclosure	Storage, habitation, uncertain	Munekiyo-Hiraga 2024:35
50-10-27-30211	Southeastern	Petroglyph	Communication	Munekiyo-Hiraga 2024:35
50-10-27-30212	Southeastern	C-shaped wall	Habitation	Munekiyo-Hiraga 2024:35
50-10-27-30287	Central	Trail	Travel	Munekiyo-Hiraga 2024:35

A multitude of additional historic properties are distributed through the cultural landscape adjoining the project area (Munekiyo-Hiraga 2024:622-627).

Considered collectively and in light of the information aggregated in the CIA portion of this study, it is clear the project area occupies a component of a greater cultural landscape modified and utilized by Native Hawaiians in the traditional through the historical eras.

Consultation Results

Of the informants interviewed for the CIA associated with the proposed project and this Ka Paʻakai Analysis (Wong Smith 2023), the Lui *ʻohana*, Uncle Wally Lau, and Uncle Michael Ikeda provided informed consent for their *ʻike* and *manaʻo* to be applied to this analysis.

The Lui ʻohana are Keahuolū lineal descendants that include parents Raymond Kealohaokalani and Mary Agnes Kaelemakule Lui (née Maʻa) and their daughter Nicole. *ʻIke* and *manaʻo* shared by the Lui *ʻohana* relay cultural, historical, or natural resources associated with the project area and vicinity with traditional through contemporary living cultural value. These include:

- Mioi and Aiu *ʻohana* burials at Makaeʻo interred *ma uka* of the runway including her grandfather Thomas Lincoln the child of Lucy Lincoln who married Wailaʻalia Mioi and Aiu, which they continued to care for.
    - Family burials were also located at Pāwai.
- The coconut grove on LT lands in Keahuolū planted by Keao and Kuakini, grandparents of Mary Agnes Kalemakula Maʻa Lui
- At Pāwai, cultural gathering practices occurred focused on but not limited to harvesting *wana*, *ʻopihi*, *limu ʻeleʻele,* and *limu kohu*
- Cultural fishing practices and resources associated with Pāwai included but are not limited to: *ʻōpelu*, *akule,* and Kona crab
    - Also associated with fishing were coastal sand deposits more plentiful than today that allowed fishing skiffs to sail onto the shore
- Existing trail systems used to access Pāwai from Kailua
- The gathering of plants for food and medicine, including morning glory, *noni* that would be placed on hot rocks in Keahuolū and eaten as a treat.
- The root of the *hualoa*, which was skinned, boiled, and taken for sore throats

Uncle Mike Ikeda, retired Community Building Facilitator at the QLT Children's Center, and 40-year resident of Keahuolū, shared a *moʻolelo* (tradition) applicable to the proposed development, as well as its intentions and what it can do for the community. When discussing the current project, he emphasized the tradition of Hiʻiaka o ka Lae Keahuolū as a transitional ʻāina, between the lands of Kona kai opua and Kekaha wai ʻole. He noted the mana of Keahuolū ʻāina as that of a transitional character can be applied to the project by creating skills-building opportunities beyond hourly employment. The proverb Uncle Mike relayed "Where were you when the mist covered Puʻu o Kaloa?" signifies if a person had helped during the planting season. Uncle Mike elaborated that when a person would ask the people of this area for food, the response from the people would be, "where were you when the mist covered Puʻu O Kaloa?" If they said that they were in another district, the people would feed them. If the said they were in the area, they would go hungry. If a person was in area when the mist covered Puu O Kaloa and they didn't have any food it meant that the person was not paying attention to the signs or that they were lazy. He believes this is the foundation of creating opportunities to foster a sense of belonging and kinship within the ʻāina of Keahuolū. He stated:

> This development is that mist that will cover Puʻu O Kaloa. It can create an opportunity to holistically feed our families. It may not be a panacea for all of our beneficiaries and community's woes; however, it could serve as a catalyst that could change how developers approach development in a positive way. A way that uplifts and bonds businesses and communities. This is not a new concept; this is the foundation in which the traditional bartering system was based on. We need to intentionally and strategically create those spaces for the exchange of knowledge, skill and aloha to take place between our community and the businesses. Businesses are welcomed and our community belongs, and vice versa. [Uncle Mike Ikeda, personal interview for the Wong Smith 2023 CIA for this project)

Uncle Wally Lau, former Hawaiʻi County Managing Director, and founder of the nonprofit Neighborhood Place of Kona shared the concern that LT has not involved more Hawaiians in the consultation process (e.g. the Royal Order of Kamehameha). He believes that preponderance of *wahi pana* (named places) necessitates a cultural monitor during any land modifications. He learned from Aunty Elizabeth Lee that Makāeʻo refers to the need of being watchful and calling out when entering this ʻāina when considering the final resting place of the bones of Kamehameha I is unknown and it's proximity to Kamakahonu. He also encourages the ahupuaʻa rather than project district management viewpoint when considering relations and cooperation between landowners and activities which promote opportunities for cultural spaces and activities.

Site Visit Results

A May 18, 2024 site visit confirmed some characteristics and resources associated with the project area identified during background research (see Figure 9 through Figure 21). The majority of the roughly 70-acre project area consists of undeveloped lands bisected by Makala Boulevard and Loloku Street. The southeastern project area includes already-developed land parcels (TMKs (3) 7-4-010-009 and -010). Commercial development bounds the project area to the north, east, and south. Additional Liliʻuokalani Trust lands are located to the west of the project area. Pāhoehoe flows in various stages of disintegration, punctuated by lava blisters and ʻaʻa, were observed throughout the project area. Native *naupaka*, endemic noni, and invasive saw grass, ironwood, and *kīawe* were also observed throughout the project area. An extensive berm of what appeared to be base course was observed in the makai project area lands between Makala Boulevard and Loloku Street (see Figure 19). Ground disturbance and landscape modification consistent with road installation, including berms of pahoehoe slabs bounding *ma kai* Makala Boulevard and segments of Loluku Street were noted.

Figure 9. Overview of the northwestern project area, view to the northwest

Figure 10. Overview of the western project area, view to the west from Makala Boulevard

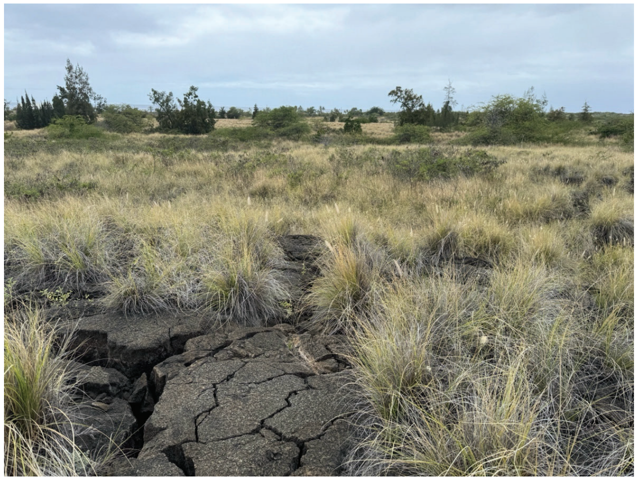

Figure 11. Overview of the south-southwestern project area, *ma kai* view to the southwest

Figure 12. Overview of the southern project area, *ma kai* view to the south

Figure 13. Overview of the northeast project area, *ma uka* view to the northeast

Figure 14. Overview of the eastern project area, view to the northeast from Makala Boulevard

Figure 15. Overview of the eastern project area, view to the east

Figure 16. Overview of the eastern periphery of the project area, *ma uka* view to the east

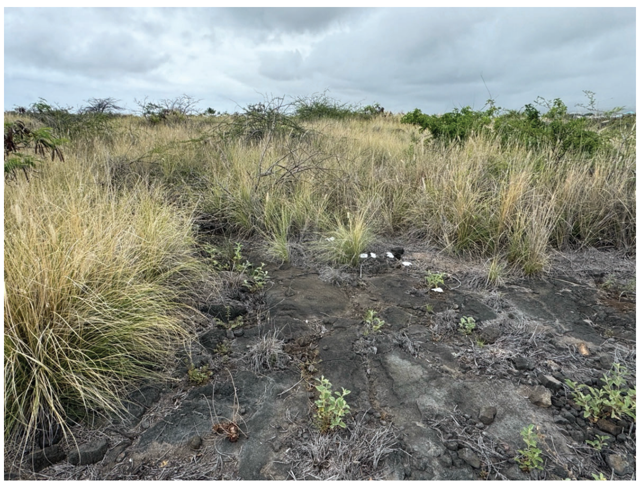

Figure 17. Overview of the north central project area, *ma uka* view to the north

Figure 18. Overview of the south-central project area, *ma kai* view to the south

Figure 19. Overview of an extensive berm of what appeared to be base course in the makai project area lands between Makala Boulevard and Loloku Street, *ma uka* view to the north

Figure 20. The single rock engraving (petroglyph) observed during the site visit (3.5" x 3" Band-Aid for scale) in the central project area just off Makala Boulevard, view to the southeast

Figure 21. Close-up overview of the single rock engraving (petroglyph) observed during the site visit in the central project area just off Makala Boulevard

Analysis Results

Summary Overview: Identity and Scope of "Valued Cultural, Historical, or Natural Resources"

Information drawn from background research and consultation conducted for the CIA associated with the proposed project (Wong Smith 2023), as well as a site visit performed for this analysis revealed myriad cultural, historical, and natural resources associated the project area and greater vicinity that continue to be valued by lineal descendants of the area today. These include:

- **Water** in its many forms (freshwater seeps and springs; brackish water ponds; freshwater that could be collected from porous basaltic caves, rock shelters and depressions; mists, fog, and clouds) as well as access to it
- **Wahi kūpuna** that include but are not limited to traditional through historical era burials and marked graves, trail systems, temples, shrines, stones that embody legendary figures, named places, and petroglyphs, some of which are officially recorded as historic properties (see Table 4)
- **A coconut grove** planted during the historical era by members of the Lui ʻohana
- Ocean resources such as *wana*, *ʻopihi*, *limu ʻeleʻele, limu kohu, limu pahe`e, manini* (*Acanthurus triostegus),* and the gathering practices associated with them
- **Fresh and saltwater animals** such as *`ōpelu, `o`opu, ʻōpae ʻula, manini*, *akule,* and Kona crab, and their habitats ranging from deep to coastal waters, brackish water pools, and intermittent streams, and the harvesting practices associated with them
- **Plant resources** like *noni*, *`ākulikuli* (*Batis maritima*), *hualoa, hau,* and *ti* and the gathering practices associated with them for both food and medicine
- **Hawaiian oral traditions** including but not limited to Hiʻiaka o ka Lae Keahuolū as a transitional ʻāina, between the lands of Kona kai opua and Kekaha wai ʻole

The above listed cultural resources are directly or tangentially associated with the project area in that what occurs in the project area will impact *ma kai* and *ma uka* resources, especially regarding water (Fukunaga and Associates 2017) and the plants, animals, and natural processes that rely on it. Wahi kūpuna, plant resources and Hawaiian oral traditions are directly associated with the project area. Burials are found within the northeastern project area at SIHP # 50-10-27-18511, which is slated for preservation. Additional burials may be associated with the project area based on the noted presence of wahi kūpuna throughout the project area and previous archaeological studies. Findings from the associated CIA study (Wong Smith 2023) summarize this possibility:

> Documentary resources and archaeological surveys reveal the preponderance of burials in the sand dunes and other coastal areas of Keahuolū and Lanihau. Further inland, caves, lava blisters and other modified features revealed human remains less frequently. Based on previous and the current research, adaptations similar to those have been observed further north in North Kona, are likely to have occurred in Keahuolū and Lanihau.[Wong Smith 2023: 50]

Background research and consultation performed for the CIA study associated with this analysis (Wong Smith 2023) address the extent to which traditional customary Native Hawaiian rights are exercised in the petition area. Water, burials and other wahi kūpuna, and plant resources associated with cultural practices persist in the project area, and are still valued by lineal descendants today.

Potential Impacts from the Proposed Project

This section discusses the extent to which valued cultural, historical, or natural resources, including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed project. Development in the project area will impact Hawaiian cultural resources and practices within the project area such as water, other wahi kūpuna, and plant resources associated with cultural practices as well as resources reliant on water both *ma kai* and *ma uka*. The proposed project has the potential to impact additional undocumented burials and wahi kupuna in the project area.

Recommended Mitigations and Best Practices

This section identifies feasible actions to be taken to reasonably protect Native Hawaiian rights, and is appropriate to begin with a reiteration of Uncle Mike Ikeda's input:

> This development is that mist that will cover Puu O Kaloa. It can create an opportunity to holistically feed our families. It may not be a panacea for all of our beneficiaries and community's woes; however, it could serve as a catalyst that could change how developers approach development in a positive way. A way that uplifts and bonds businesses and communities. This is not a new concept; this is the foundation in which the traditional bartering system was based on. We need to intentionally and strategically create those spaces for the exchange of knowledge, skill and aloha to take place between our community and the businesses. Businesses are welcomed and our community belongs, and vice versa. [Uncle Mike Ikeda, personal interview for the Wong-Smith 2023 CIA for this project]

Mitigation recommendations drawn from consultation include:

- Cultural monitors present for any land modifications, with special vigilance for *wahi pana* (named places)
- Greater engagement and consultation with the Hawaiian community and organizations such as the Royal Order of Kamehameha I
- An ahupua'a-approach to the proposed project that promotes opportunities for cultural spaces and activities
- A foundational, community-based approach to creating opportunities to foster a sense of belonging and kinship within the *ʻāina* of Keahuolū by:
    - uplifting and bonding business and communities
    - intentionally and strategically creating spaces for the exchange of knowledge, skill, and aloha to occur between community and businesses

Mitigation recommendations drawn from the author's extensive professional experience in archival research, ethnography, environmental review, and historic preservation compliance include:

- Per the state constitution which mandates conservation of resources (Haw. Const. art. XI, § 1), utilizing the information contained in this analysis and the associated CIA (Wong Smith 2023) to produce design plans that conserve as much of the cultural landscape as possible. Wahi kūpuna are anchors to cultural identity, place, and encourage relationships that foster cultural connection and well-being (The Kali'uokapa'akai Collective 2021).

- The scope of cultural monitoring should be expanded to include vigilance for additional iwi kūpuna, which are present in the project area and surrounding landscape
- Archaeological monitoring to avoid impact to known and potential historic properties, and to preserve (e.g. keep intact, not destroy) as much of the cultural landscape as possible (per Haw. Const. art. XI, § 1 and Hawai'i Revised Statutes §6E). Evidence of adherance to this is LT's preserving the petroglyph indicated in Figure 21 in place.
- Avoiding negative impacts to native plants
- In recognition of Hawaiian traditional and customary rights to water, increased breadth and depth of data around water alongside consistent monitoring to better understand the impacts of the proposed development on freshwater resources in Kona, and everything that relies on them.

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Appendix A.

Aloha e CONSULTEE,

I hope this finds you in good health and spirits!

This email is seeking your permission to utilize the manaʻo and ʻike you so generously provided for the Cultural Impact Assessment (CIA) study for the Makalapua Project District Queen Lili'uokalani Trust Lands, Keahuolu, North Kona Island of Hawai'i, for a required companion study (attached).

In March 2024, the Land Use Commission (LUC) reviewed the Draft Environmental Assessment (EA) associated with the project. The LUC requested a Ka Paʻakai Analysis including:

1. The identity and scope of "valued cultural, historical, or natural resources" including the extent to which traditional customary Native Hawaiian rights are exercised in the petition area;
2. The extent to which those resources, including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed action;
3. The feasible action, if any, to be taken to reasonably protect Native Hawaiian rights if they are found to exist.

Information that may help you decide whether or not you wish to contribute includes:

- The Ka Paʻakai Analysis will be reviewed by the LUC and discussed during one of their meetings.
- The study may eventually be published online on the Environmental Review Program's website (https://planning.hawaii.gov/erp/) as part of the Environmental Assessment and in the public record.
- Consultees have the option to remain anonymous, and can rescind their manaʻo and ʻike until it is published as part of the public record.

If you are open to the manaʻo and ʻike you so generously provided also informing the Ka Paʻakai Analysis, please let me know. Likewise, if you'd like to provide additional thoughts regarding any of the following:

- Cultural resources, practices, and traditional customary Hawaiian rights (fishing, gathering, etc.) associated with the cultural landscape of the project area, specifically water?
- Are there any impacts you foresee to cultural resources, practices, and traditional customary Hawaiian rights by the proposed project?
- Are there any desired steps you would like to share that should be taken in order to protect Native Hawaiian rights in this place?
- Is there anything else you wish to share or communicate?
- Do you have any recommendations for additional individuals who should be contacted?

What you have already so kindly shared, as well as your time and consideration are very greatly appreciated.

Mahalo piha,

Helen Wong Smith, MLIS, CA, FSAA

Appendix B.

LAND USE COMMISSION
Komikina Hoʻohana ʻĀina
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
Ka ʻOihana Hoʻomōhala Pāʻoihana, ʻImi Wai wai a Hoʻomākaʻikaʻi

JOSH GREEN, M.D.
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SUBJECT: Draft Environmental Assessment Makalapua Project District TMKs. (3)7-4-008:002 (por.), (3)7-4-010:009 and 010, (3)7-4-025:001, 002, 003, 005, 015, and 021

Dear Ms.Uchiyama and Mr.Kern:

Thank you for providing the Land Use Commission ("LUC" or Commission") with the Draft Environmental Assessment ("DEA") for the Makalapua Project District. LUC staff has reviewed the DEA and provides the following comments and questions:

Sections I and III: State Land Use Commission District Boundary Amendment
The DEA indicates that most of the project site for the proposed Makalapua Project District has been previously designated Urban by the LUC, and the additional 14.96 acres currently designated Agricultural land.

Please provide a table that includes the breakdown of proposed uses with their respective acreage which are to be included in the 14.96 acre district boundary amendment.

The LUC Staff suggests that the County Planning Commission make detailed findings with regard to the justification for the boundary of the 14.96 acres, otherwise it may appear that the proposed project is parceling in order to circumvent appearing before the Land Use Commission.

Section II A- 10-11: Archeological, Historical, and Cultural Resources
The DEA includes an archaeological study which was accepted by the State Historic Preservation Division in 2019. However, based on LUC Staff review, the DEA does not include a clearly labeled and identified Ka Pa'akai Analysis.

Please include a Ka Pa'akai Analysis that includes the following:

1. The identity and scope of "valued cultural, historical, or natural resources" including the extent to which traditional customary Native Hawaiian rights are exercised in the petition area;

2. The extent to which those resources, including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed action;

3. The feasible action, if any, to be taken to reasonably protect Native Hawaiian rights if they are found to exist.

Section II A- 14-15: Green House Gas and Climate Change
The proposed development is described as a "sustainable mixed-use community," please ensure collaboration with the State Sustainability Coordinator of the Statewide Sustainability Program within the Office of Planning and Sustainable Development to solicit review and comment.

Section II D: Infrastructure- Water and Other Allocated Resources
The DEA indicates that water units are not yet secured for the proposed development, and in the letter from the Department of Water Supply asks for a revised development plan or water master plan for review and approval of water credits.

The DEA indicates that the Makalapua Project District is within the Keauhou Aquifer System, and it is Staff's understanding that the Keauhou Aquifer is strained and non-regenerative. Staff is concerned that continuous and overuse may increase the salinity of the water, thus impacting future developments, Native Hawaiian resources and practices, and coastal and nearshore environments.

Land Use Commission Staff has concerns that the water allocations associated with pre-approved developments facilitated by Lili'uokalani Trust may be used or traded for the allotment in this proposed development. The same concern is applicable to other allocated resources associated with Lili'uokalani Trust Developments in Kona.

Please provide a more detailed discussion identifying the potential options available for securing water for the proposed project.

GREENHOUSE GAS EMISSIONS IMPACT STUDY

APPENDIX

L

MAKALAPUA PROJECT DISTRICT

Greenhouse Gas Emissions Impact Study

Prepared for:
Lili'uokalani Trust

Prepared by:
Terry A. Hayes Associates Inc.

October 2023

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1.0 SUMMARY OF FINDINGS

Terry A. Hayes Associates Inc. (TAHA) completed a Greenhouse Gas (GHG) Emissions Study for the Makalapua Project District (proposed project). The proposed project would generate short-term GHG emissions during construction activities (e.g., exhaust from off-road equipment and on-road trucks) and permanent GHG emissions during operational activities (e.g., exhaust from passenger vehicles and emissions from electricity generation). Construction activities would generate approximately 1,745 metric tons of GHG emissions and permanent emissions would be approximately 14,919 metric tons per year. In 2019, total GHG emissions in Hawaii were approximately 22 million per year. GHG emissions generated by the proposed project would be negligible when compared to existing emissions. The proposed project includes sustainability features (e.g., passive energy and water conservation strategies) and would not interfere with the development of clean energy supplies.

2.0 INTRODUCTION

2.1 PURPOSE

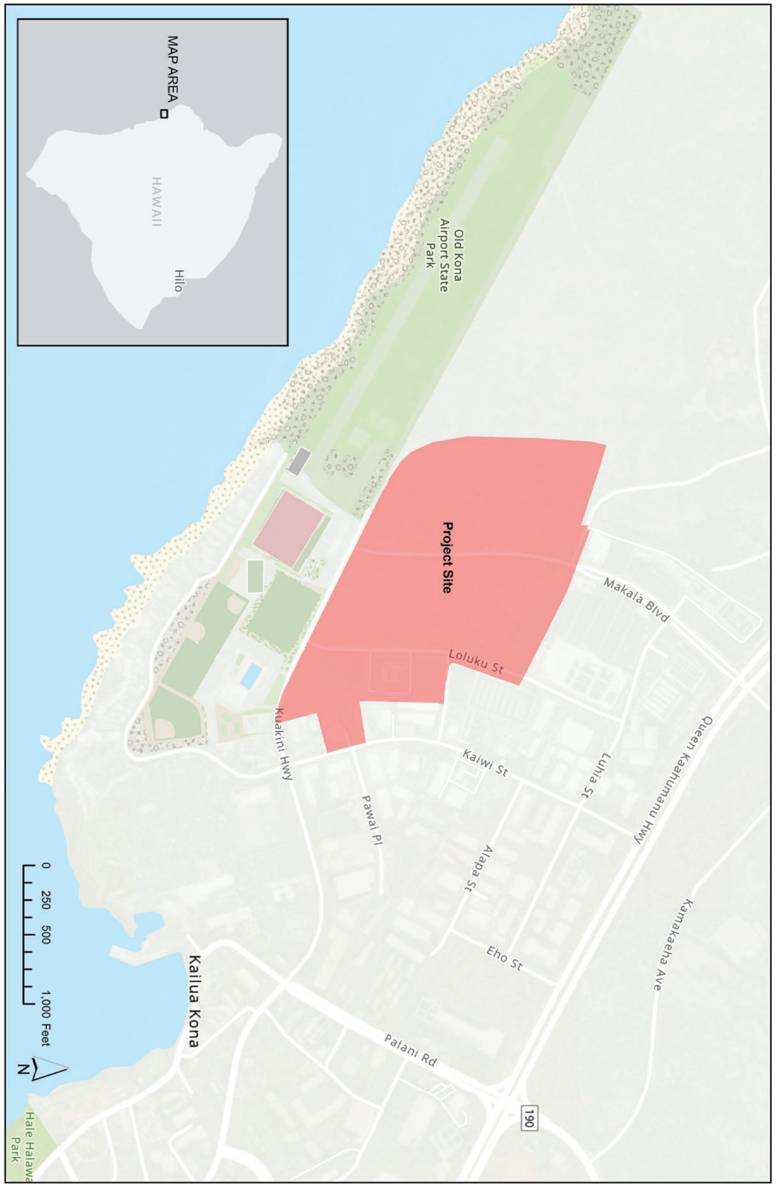
The purpose of this Study is to evaluate the potential for GHG impacts associated with the proposed project. Pollutant emissions have been estimated for construction and operational activities.

2.2 PROJECT DESCRIPTION

The proposed mixed-use development is located on 69.54 acres in Kailua-Kona on the island of Hawaii. The project site is bounded by Kona Commons Shopping Center to the northeast, vacant lands to the north, the existing Kona Industrial Subdivision to the east, and the County's Kailua Park (also known as Old Airport Park) to the south and west (**Figure 2-1**). The project site is currently vacant and undeveloped with the exception of a former recreational sports facility on Makala Boulevard, a BMW car dealership on Loloku Street, temporary storage and staging areas on parcels located along Loloku Street, and light industrial warehouses and businesses on Kaiwi Street.

The proposed project is a development endeavor aimed at creating a vibrant and sustainable mixed-use community that enhances the local landscape while offering a blend of residential, commercial, and recreational uses. The mixed-use development would be organized around an interconnected, pedestrian-oriented street network where homes, businesses, and entertainment are intermingled to provide a diverse experience for residents and visitors. Development would include a mix of approximately 600 single- and multi-family residential units, 220,900 square feet of commercial uses, two hotels totaling up to 150 hotel rooms, and open space features. Sustainability features are likely to include passive energy and water conservation strategies; on-site storm water management; use of native and drought tolerant plant species; and the creation of a walkable/bikable community to reduce automobile dependency.

The street network may include the realignment of Makala Boulevard below the Kona Commons Shopping Center to align with the Kailua Park's (Old Airport Park) main access. Two north-south extensions (Pawai Place and Maʻa Way) would be developed and improved within the interconnected street network. Potential offsite improvements include the widening and restriping of portions of Kuakini Highway and Queen Kaʻahumanu Highway.



Source: TAHA, 2023.

TAHA 2023-47

Makalapua Project District
Greenhouse Gas Emissions Impacts Study
LILI'UOKALANI TRUST

FIGURE 2-1
PROJECT LOCATION

3.0 TOPICAL BACKGROUND & REGULATORY FRAMEWORK

This section provides a discussion of GHG emissions, how they contribute to climate change, and the regulatory framework developed to reduce GHG emissions.

3.1 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

Cumulative GHG emissions are believed to contribute to an increased greenhouse effect and global climate change, which may result in sea level rise and changes in precipitation, habitats, temperature, wildfires, air pollution levels, and in the frequency and intensity of weather-related-events. While criteria pollutants and TACs are pollutants of regional and local concern, GHG are global pollutants. The primary land-use related GHGs are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The individual pollutant's ability to retain infrared radiation represents its "global warming potential" and is expressed in terms of CO_2 equivalents (denoted CO_2e); therefore, CO_2 is the benchmark having a global warming potential of one. Methane has a global warming potential of 28 and thus has a 28 times greater global warming effect per metric ton of CH_4 than CO_2. N_2O has a global warming potential of 265. GHG emissions are generally expressed in units of annual metric tons of CO_2 equivalents (i.e., $MTCO_2e$/year).

3.2 CLIMATE CHANGE REGULATORY FRAMEWORK

International Regulations

An international climate change agreement was adopted at the Paris United Nations Framework Convention on Climate Change conference in December 2015. The last two climate conferences in Warsaw (2013) and Lima (2014) decided that countries were to submit their proposed emissions reduction targets for the 2015 conference as "intended nationally determined contributions" prior to the Paris conference. The European Union has committed to an economy-wide domestic GHG reduction target of 40 percent below 1990 levels by 2030. These targets are set with the goal of limiting global temperature rise to well below 2 degrees Celsius and getting to the 80 percent emission reduction by 2050. On November 4, 2019, the United States President Donald Trump gave a formal notice of intention to withdraw, which takes 12 months to take effect. The withdrawal took effect on November 4, 2020, one day after the 2020 United States presidential election. The United States President Joe Biden rejoined the Paris Agreement in February 2021.

The governors of several United States' states, including Hawaii, formed the United States Climate Alliance to continue to advance the objectives of the Paris Agreement at the State level. The Alliance is a bipartisan group of states that have pledged to uphold the 2016 Paris Agreement on climate change within their borders. The goal of the Alliance is to reduce their CO_2 emissions 26-28 percent from 2005 levels by 2025 and to meet or exceed the targets of the United States Clean Power Plan (a 32 percent reduction of CO_2 emissions by 2030). These actions would help fulfill the global community's goal, as set forth in the Paris Climate Agreement, to keep global warming below 2 degrees Celsius (3.6 degrees Fahrenheit). The Alliance provides a forum for its members to further develop and strengthen their existing Climate Action Plans through the sharing of information and best practices.

Federal Regulations

The United States Supreme Court has ruled that CO_2 and other GHGs are pollutants under the Clean Air Act, which the United States Environmental Protection Agency (USEPA) must regulate if it determines they pose an endangerment to public health or welfare. The USEPA has made two distinct findings. One, the current and projected concentrations of the six key GHGs (CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride) in the atmosphere threaten the public health and welfare of current and future generations. Two, the combined emissions of these GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution which threatens public health and welfare.

The United States Supreme Court has further ruled that the USEPA exceeded its statutory authority under the Clean Air Act when it determined that stationary source emissions of GHGs would trigger permitting obligations under the Prevention of Significant Deterioration program and Title V of the Clean Air Act. The Court, however, upheld those portions of USEPA rulemaking that require a source to apply best available control technology to GHG emissions where the source would otherwise trigger Prevention of Significant Deterioration permitting on account of its emissions of other pollutants. The Supreme Court's decision was limited to USEPA's regulation of GHG emissions under the Prevention of Significant Deterioration and Title V provisions of the Clean Air Act, and it left unanswered other questions regarding USEPA permitting and best available control technology authority under the Prevention of Significant Deterioration program, and efforts to regulate GHG emissions from stationary sources.

The federal government administers a wide array of public-private partnerships to reduce the GHG intensity generated in the United States. These programs focus on energy efficiency, renewable energy, CH_4 and other non-CO_2 gases, agricultural practices, and implementation of technologies to achieve GHG reductions. USEPA implements numerous voluntary programs that contribute to the reduction of GHG emissions. These programs (e.g., the ENERGY STAR labeling system for energy-efficient products) play a significant role in encouraging voluntary reductions from large corporations, consumers, industrial and commercial buildings, and many major industrial sectors.

The United States Department of Transportation's National Highway Traffic Safety Administration regulates fuel economy standards. The Corporate Average Fuel Economy standards regulate how far our vehicles must travel on a gallon of fuel. A more fuel-efficient vehicle fleet reduces mobile source GHG emissions. The standards require passenger cars, light-duty trucks, and medium-duty passenger vehicles to meet an estimated combined average fuel economy of 48.7 to 49.7 miles per gallon or higher by 2025. The standards provide flexibility to manufacturers, including the ability to earn credits for alternative fuel vehicles.

State Regulations

In 2007, Hawaii became the second State in the nation to set a binding cap on GHG emissions through Act 234: Hawaii's Climate Change Law, which declared a policy to reduce GHG emissions statewide to 1990 levels by the year 2020. Act 234 served as the foundation for the Hawaii GHG Program, which was established by the Department of Health (DOH) to combat the threat of climate change and sea level rise. This Program utilizes the Air Pollution Control Permit process of DOH's Clean Air Branch to regulate GHG emissions statewide, in conjunction with other federal and State programs to mitigate GHGs. Parts of Act 234 are codified in Chapter 342B (Air Pollution Control) of the Hawaii Revised Statutes.

Senate Bill 559, which was signed into law on June 8, 2017, expands strategies and mechanisms to reduce GHG emissions in alignment with the principles and goals adopted in the Paris Agreement, discussed above. Senate Bill 559 documents the State's commitment to combat climate change by systematically reducing GHG emissions and improving resiliency to climate change aligned with the principles and goals set by the Paris Agreement. It expands on strategies and mechanisms to reduce GHG emissions through the reduction of energy use, adoption of renewable energy, and control of air pollution among all agencies, departments, industries, and sectors, including transportation. Senate Bill 559 states that, "Such strategies and mechanisms shall utilize the best available science, technologies, and policies to reduce GHG emissions and shall be closely aligned with the climate change principles and goals adopted in the Paris Agreement and Hawaii's share of obligations within the expectations apportioned to the United States in the Paris Agreement, regardless of federal action. In addition, "The State shall strive to formulate and communicate long-term low greenhouse gas emission development strategies and shall take actions to conserve and enhance long-term sinks and reservoirs of greenhouse gases, by prioritizing the development of parks, greenways, and restoration of native upland and coastal forests and wetlands."

In 2018, the State Legislature passed Act 15, to establish a permanent Greenhouse Gas Sequestration Task Force within the Office of Planning (now the Office of Planning and Sustainable Development). The Task Force will work to establish a baseline for GHG and short- and long-term benchmarks for increasing GHG sequestration in the agricultural and natural environment. The Act also establishes a statewide carbon net-negative goal by 2045.

In 2022, the State Legislature passed Act 238, which tasks the Hawaii State Energy Office to "analyze pathways and develop recommendations for achieving the State's economy-wide decarbonization goals." Additionally, the study will evaluate emission reduction pathways from all emitting sectors economy wide. Act 238 establishes a goal for the level of statewide GHG emissions to be at least 50 percent below 2005 levels by 2030 (including airplane emissions).

The DOH established the Hawaii GHG Program to combat the threat of climate change and sea level rise. The program utilizes the Air Pollution Control Permit process of the Clean Air Branch to regulate GHG emissions statewide. The Hawaii GHG Program works in conjunction with other federal and Hawaii programs to mitigate GHG emissions. This includes the Priority Climate Action Plan, which, when completed in 2024, will identify the most pressing areas in need of GHG reduction, and determine fitting implementation-ready measures. The Priority Climate Action Plan will use the most recent statewide GHG inventory, which was completed in 2019, to produce an updated, more accurate inventory. The Priority Climate Action Plan will be developed based on community engagement, and collaboration between the commission and community members throughout the planning process. The commission will host workshops to support community and stakeholder engagement and plan them in conjunction with neighborhood boards and councils. Information from these meetings will be pivotal in both gathering information to be used for the plan, developing the plan, and revising existing plans.

The Comprehensive Climate Action Plan, when completed in 2025, will build upon the Priority Climate Action Plan and identify all major sources and sinks of GHGs, establish short- and long-term reduction goals, and fitting strategies and measures. The Comprehensive Climate Action Plan will examine current GHG emissions, and projected emissions without any changes to status quo activities, and compare these to projected emissions with economy-wide GHG reduction activities fully carried out.

4.0 EXISTING ENVIRONMENTAL SETTING

4.1 CLIMATOLOGY

Hawaii climate is warm and tropical. Its outstanding features are the persistence of the trade winds, the remarkable variability in rainfall over short distances, the sunniness of the leeward lowlands in contrast to the persistent cloudiness over nearby mountain crests, the equable temperature, and the general infrequency of severe storms. The prevailing wind throughout the year is the northeasterly trade wind, which varies from over 90 percent during the summer to only 50 percent in January. When the trade winds diminish or give way to southerly winds the humidity may become oppressively high. Intense rains in the October to April winter season sometimes cause serious flash flooding. Thunderstorms are infrequent and usually mild, and hail seldom occurs. Only a few tropical cyclones have struck Hawaii, although others have come near enough for their outlying winds, waves, clouds, and rain to affect the Islands.

4.2 STATEWIDE GHG EMISSIONS

The State published the Hawaii GHG Emissions Report for 2005, 2018 and 2019 in April 2023. The purpose of the report is to track progress toward achieving the State's 2020, 2030, and 2045 GHG reduction goals. Based on the analysis in the report, net GHG emissions (excluding aviation) in 2020 are projected to be lower than net GHG emissions (excluding aviation) in 1990. Net GHG emissions (including aviation) in 2030 are projected to be greater than the target emissions level of 50 below 2005 levels (including aviation), and in 2045 are projected to be greater than the target of net-negative levels. While the development of future inventory reports as well as ongoing quantitative assessment of uncertainties will further inform whether Hawaii met the 2020 statewide target and is going to meet the 2030 and 2045 statewide targets, the report finds that, under existing policies and economic projections, Hawaii is currently expected to meet the 2020 target, but is not expected to meet the 2030 and 2045 targets.

In 2019, total GHG emissions in Hawaii were 22.01 million $MTCO_2e$/year. Emissions from the energy sector accounted for the largest portion (88.4 percent) of total emissions in Hawaii, followed by the agriculture, forestry, and other land use sector (6.0 percent), the industrial processes and product use sector (3.8 percent), and the waste sector (1.9 percent).

Total GHG emissions in Hawaii grew by 18.0 percent between 1990 and 2007 before decreasing by about 18.6 percent between 2007 and 2019. Compared to 1990, total emissions in Hawaii in 2019 were roughly 3.9 percent lower, while net emissions were lower by roughly 11.7 percent. As the largest source of emissions in Hawaii, the Energy sector is a major driver of the overall emissions trends. Relative to 1990, emissions from the Energy sector in 2019 were lower by 4.0 percent. Transportation emissions—which increased between 1990 and 2007, decreased between 2007 and 2015, and then increased again between 2015 and 2019—accounted for the largest share of Energy sector emissions in all inventory years. The trend in transportation emissions is largely driven by domestic aviation and ground transportation emissions, which together account for roughly 82 percent of transportation emissions. Stationary combustion emissions—which increased between 1990 and 2005, before consistently decreasing between 2005 and 2016, and then slightly increasing again between 2016 and 2019—is the second largest share of Energy sector emissions. This trend is driven by emissions from energy industries as well as industrial and commercial emissions. Overall, the decrease in Energy sector emissions between 1990 and 2019 is due to a decrease in stationary combustion emissions from commercial and industrial sources, a decrease in domestic marine, military aviation, and military non-aviation

emissions, and a decrease in emissions from oil and natural gas systems. Together, these reductions outweigh overall increases in emissions from energy industries, ground transportation, domestic aviation, and incineration of waste observed over the same period.

Emissions from the waste sector also contributed to the overall reduction in emissions from 2007 to 2019, falling by about 49.6 percent, during that period, primarily driven by a decrease in emissions from landfills. These reductions more than offset growing emissions from the industrial processes and product use sector, which increased by 44.0 percent from 2007 to 2019. Relative to 1990, 2019 emissions were more than three times higher, due entirely to the growth in refrigeration and air conditioning substances. Carbon removals from agriculture, forestry, and other land use sinks have also increased since 1990, growing by roughly 6.5 percent between 1990 and 2019.

Total GHG emissions are projected to be 18.44 million $MTCO_2e$/year in 2025, 17.49 million $MTCO_2e$/year in 2030, and 13.88 million $MTCO_2e$/year in 2045. Net emissions, which take into account carbon sinks and are relevant for tracking progress toward the 2030 GHG target pursuant to Act 238 of 2022 are projected to be 15.94 million $MTCO_2e$/year in 2025, 15.03 million $MTCO_2e$/year in 2030, and 11.25 million $MTCO_2e$/year in 2045. Net emissions, which include carbon sinks, exclude aviation, and are relevant for tracking the progress toward the 2020 GHG target pursuant to Act 234 of 2007, are projected to be 11.58 million $MTCO_2e$/year in 2020. Relative to 2019, total emissions under the baseline scenario are projected to decrease by 16 percent by 2025, 21 percent by 2030, and 37 percent by 2045. Over the same period, net emissions are projected to decrease by 18 percent, 23 percent, and 42 percent, respectively. This trend is largely driven by the projected trend in emissions from energy industries (i.e., electric power plants and petroleum refineries), which are expected to decrease substantially between 2019 and 2045.

5.0 SIGNIFICANCE CRITERIA

Neither the Hawaii Environmental Policy Act nor the USEPA has established quantitative significance criteria related to GHG emissions. Section 11-200.1-13(b)(13) (Significance Criteria) of the Hawaii Environmental Impact Statement Rules includes, "In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed action, the expected impacts, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action. In most instances, an action shall be determined to have a significant effect on the environment if it is likely to: require substantial energy consumption or emit substantial greenhouse gases."

6.0 ENVIRONMENTAL EFFECTS

6.1 GREENHOUSE GAS EMISSIONS

The State of Hawaii, through Act 234 and Senate Bill 559, has acknowledged that GHG emissions are a statewide impact. The proposed project would generate GHG emissions through construction activities, energy use, and new vehicle trips. Neither Hawaii nor the USEPA have created a predictive model for efficiently estimating construction and operational emissions from land use development projects. Equipment inventories for each phase of construction were populated in the California Emissions Estimator Model (CalEEMod, Version 2022.1.1.20), and the model was used to produce maximum annual emissions of CO_2, CH_4, N_2O, and CO_2e. This model provides a reasonable estimation of emissions in Hawaii for planning only purposes as the equipment fleet in the model includes varying levels of engine emission controls.

Regarding construction activities, the proposed project would be developed in four phases over at least ten years. Construction is anticipated to begin in 2025. Specific construction assumptions were not available when this analysis was prepared. In order to disclose a reasonable emissions estimate, it was assumed that the construction of the proposed project would occur over at least ten years using a broad mix of equipment (e.g., dozers, loaders, cranes, and lifts). Additional sources of construction emissions include worker vehicle trips and truck trips associated with demolition debris, earthwork, and materials delivery. Emissions modeling demonstrates that the construction activities would generate a total of approximately 15,840 $MTCO_2e$ with a maximum annual GHG emissions of 1,779 $MTCO_2e$ as shown in **Table 6-1**.

TABLE 6-1: ESTIMATED GHG EMISSIONS

	Annual Emissions (Tons/Year)			
Parameter	**CO_2**	**CH_4**	**N_2O**	**$MTCO_2e$**
Maximum Annual Construction Emissions	1,742	0.1	0.1	1,779
Maximum Annual Operational Emissions	18,781	8.9	0.7	19,257

SOURCE: TAHA, 2023.

The primary sources of operational GHG emissions include on-road vehicles, energy consumption, and waste generation. The development team estimates that the proposed project would generate approximately 16,510 weekday vehicle trips. Limited energy use information was available when this analysis was prepared, and energy use assumptions were obtained from default land use assumptions in the emissions model. The emission estimates are based on approximately 5,414,000 kilowatt-hours per year of electricity use. The proposed project would generate approximately 750 tons per of waste, which would result in emissions from waste transfer and landfill decomposition. **Table 6-1** shows that operational activities would generate approximately 19,257 $MTCO_2e$ per year.

As previously discussed, total GHG emissions in Hawaii are projected to be 18.44 million $MTCO_2e$/year in 2025, and 17.49 million $MTCO_2e$/year in 2030. The proposed project would not substantially contribute to statewide emissions. In addition, the proposed development would be a sustainable mixed-use community that enhances the local landscape while offering a blend of residential, commercial, and recreational uses. The mixed-use development would be organized around an interconnected, pedestrian-oriented street network where homes, businesses, and entertainment are intermingled to provide a diverse experience for residents and visitors. This would create a walkable/bikeable community designed to reduce automobile dependency and associated GHG emissions. Furthermore, sustainability features are likely to include passive energy and water conservation strategies; on-site storm water management; and the use of native and drought tolerant plant species.

7.0 CUMULATIVE EFFECTS

Section 11-200.1-2 of the Hawaii Administrative Rules contains the definition of a cumulative impact. A cumulative impact is defined as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes the other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The State, through Act 234 and Senate Bill 559, has acknowledged that GHG emissions are a statewide impact. Permanent emissions generated by the proposed project in combination with past, present, and reasonably probable future related projects could contribute to this impact. Although climate change is cumulative in nature, not every individual project that emits GHGs must necessarily be found to contribute to a significant cumulative impact on the environment. The mix of land uses proposed for the proposed project would be consistent with the existing dense urban environment and encourage a walkable community. In addition, Hawaii is committed to renewable energy production, which does not generate GHG emissions. Hawaii has enacted a law that mandates that all of the State's electricity comes from renewable sources no later than 2045, by which time the proposed project would be fully built out. Energy-related emissions would decline as the State moves toward a fully renewable supply of energy. The proposed project would not interfere with the development of clean energy supplies. Therefore, there is no potential for a significant contribution to a cumulative GHG impact.

Appendix

Makalapua Project Detailed Report

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Makalapua Project Detailed Report, 10/26/2023

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Makalapua Project
Construction Start Date	1/6/2025
Operational Year	2035
Lead Agency	—
Land Use Scale	Plan/community
Analysis Level for Defaults	Statewide
Windspeed (m/s)	0.50
Precipitation (days)	16.8
Location	34.09737452237604, -118.32710512146018
County	Los Angeles-South Coast
City	Los Angeles
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	4351
EDFZ	16
Electric Utility	Statewide Average
Gas Utility	Southern California Gas
App Version	2022.1.1.20

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
Condo/Townhouse	600	Dwelling Unit	36.4	636,000	0.00	—	1,776	—
Strip Mall	221	1000sqft	17.1	220,900	0.00	—	—	—
Hotel	150	Room	5.00	85,000	0.00	—	—	—
City Park	1.60	Acre	1.60	0.00	1.60	1.60	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Construction	C-2*	Limit Heavy-Duty Diesel Vehicle Idling

* Qualitative or supporting measure. Emission reductions not included in the mitigated emissions results.

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	4.53	3.85	33.0	58.8	0.06	1.39	8.29	9.56	1.28	4.07	5.35	—	15,387	15,387	0.59	0.98	41.2	15,734
Mit.	4.53	3.85	33.0	58.8	0.06	1.39	8.29	9.56	1.28	4.07	5.35	—	15,387	15,387	0.59	0.98	41.2	15,734
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	4.42	360	33.1	51.4	0.06	1.39	8.29	9.56	1.28	4.07	5.35	—	14,843	14,843	0.61	0.99	1.07	15,154
Mit.	4.42	360	33.1	51.4	0.06	1.39	8.29	9.56	1.28	4.07	5.35	—	14,843	14,843	0.61	0.99	1.07	15,154
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.03	50.4	17.8	35.7	0.05	0.60	5.88	6.37	0.56	1.85	2.41	—	10,521	10,521	0.35	0.69	11.7	10,744
Mit.	3.03	50.4	17.8	35.7	0.05	0.60	5.88	6.37	0.56	1.85	2.41	—	10,521	10,521	0.35	0.69	11.7	10,744
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.55	9.20	3.25	6.52	0.01	0.11	1.07	1.16	0.10	0.34	0.44	—	1,742	1,742	0.06	0.11	1.93	1,779
Mit.	0.55	9.20	3.25	6.52	0.01	0.11	1.07	1.16	0.10	0.34	0.44	—	1,742	1,742	0.06	0.11	1.93	1,779
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.53	3.85	33.0	58.8	0.06	1.39	8.29	9.56	1.28	4.07	5.35	—	15,387	15,387	0.59	0.98	41.2	15,734
2026	4.31	3.65	20.0	55.9	0.06	0.54	8.29	8.83	0.50	2.00	2.50	—	15,150	15,150	0.58	0.95	37.9	15,486
2027	4.16	3.50	19.0	53.3	0.06	0.49	8.29	8.78	0.45	2.00	2.45	—	14,916	14,916	0.35	0.95	34.4	15,241
2028	4.00	3.39	18.2	51.1	0.06	0.44	8.29	8.73	0.41	2.00	2.41	—	14,672	14,672	0.32	0.92	31.1	14,985
2029	3.64	3.24	17.4	49.0	0.06	0.41	8.29	8.70	0.38	2.00	2.38	—	14,428	14,428	0.31	0.91	27.9	14,736
2030	3.52	2.91	16.7	47.2	0.06	0.39	8.29	8.68	0.33	2.00	2.33	—	14,186	14,186	0.30	0.89	24.8	14,483
2031	3.39	2.81	16.2	45.3	0.06	0.37	8.29	8.66	0.31	2.00	2.31	—	13,948	13,948	0.30	0.66	22.0	14,174
2032	3.27	2.70	15.5	43.7	0.06	0.32	8.29	8.61	0.29	2.00	2.29	—	13,723	13,723	0.29	0.63	19.3	13,938
2033	2.96	2.62	15.1	42.4	0.06	0.29	8.29	8.58	0.27	2.00	2.26	—	13,515	13,515	0.29	0.63	16.8	13,725
2034	2.87	2.53	14.6	41.1	0.06	0.27	8.29	8.57	0.25	2.00	2.25	—	13,319	13,319	0.29	0.60	14.6	13,520

Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.42	3.72	33.1	51.4	0.06	1.39	8.29	9.56	1.28	4.07	5.35	—	14,843	14,843	0.61	0.99	1.07	15,154
2026	4.21	3.53	20.8	48.8	0.06	0.54	8.29	8.83	0.50	2.00	2.50	—	14,617	14,617	0.37	0.96	0.98	14,915
2027	4.05	3.40	19.8	46.8	0.06	0.49	8.29	8.78	0.45	2.00	2.45	—	14,394	14,394	0.37	0.96	0.89	14,689
2028	3.70	3.29	18.8	44.9	0.06	0.44	8.29	8.73	0.41	2.00	2.41	—	14,161	14,161	0.33	0.92	0.81	14,444
2029	3.57	2.93	17.9	43.2	0.06	0.41	8.29	8.70	0.38	2.00	2.38	—	13,926	13,926	0.33	0.91	0.72	14,207
2030	3.45	2.83	17.2	41.8	0.06	0.39	8.29	8.68	0.33	2.00	2.33	—	13,693	13,693	0.31	0.89	0.64	13,966
2031	3.32	2.73	16.7	40.3	0.06	0.37	8.29	8.66	0.31	2.00	2.31	—	13,463	13,463	0.31	0.88	0.57	13,734
2032	3.22	2.64	16.1	39.0	0.06	0.32	8.29	8.61	0.29	2.00	2.29	—	13,246	13,246	0.30	0.85	0.50	13,508
2033	2.92	2.57	15.6	37.9	0.06	0.29	8.29	8.58	0.27	2.00	2.26	—	13,043	13,043	0.30	0.63	0.44	13,238
2034	2.83	360	15.1	36.7	0.06	0.27	8.29	8.57	0.25	2.00	2.25	—	12,854	12,854	0.30	0.60	0.38	13,041
2035	0.37	360	0.99	4.40	< 0.005	0.01	1.41	1.41	0.01	0.33	0.34	—	1,327	1,327	0.02	0.01	0.05	1,329
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.03	2.54	17.8	32.4	0.04	0.60	5.77	6.37	0.56	1.85	2.41	—	8,699	8,699	0.35	0.53	8.97	8,874
2026	3.02	2.53	14.7	35.7	0.05	0.39	5.86	6.25	0.36	1.41	1.77	—	10,521	10,521	0.27	0.69	11.7	10,744
2027	2.91	2.43	13.9	34.2	0.05	0.35	5.86	6.21	0.32	1.41	1.73	—	10,360	10,360	0.26	0.68	10.6	10,578
2028	2.64	2.34	13.4	32.9	0.05	0.32	5.88	6.19	0.29	1.41	1.71	—	10,219	10,219	0.24	0.66	9.60	10,431
2029	2.55	2.26	12.7	31.6	0.05	0.29	5.86	6.15	0.27	1.41	1.68	—	10,023	10,023	0.23	0.65	8.59	10,231
2030	2.46	2.02	12.3	30.4	0.05	0.28	5.86	6.14	0.24	1.41	1.65	—	9,855	9,855	0.22	0.63	7.65	10,057
2031	2.37	1.95	11.9	29.4	0.05	0.26	5.86	6.12	0.22	1.41	1.63	—	9,689	9,689	0.22	0.63	6.78	9,889
2032	2.31	1.89	11.4	28.5	0.05	0.23	5.88	6.11	0.21	1.41	1.62	—	9,559	9,559	0.22	0.45	5.95	9,705
2033	2.07	1.83	11.0	27.6	0.05	0.21	5.86	6.07	0.19	1.41	1.60	—	9,388	9,388	0.22	0.45	5.19	9,531
2034	1.25	50.4	7.09	16.6	0.03	0.14	3.31	3.45	0.13	0.80	0.93	—	5,469	5,469	0.13	0.25	2.56	5,550
2035	0.02	23.3	0.06	0.29	< 0.005	< 0.005	0.09	0.09	< 0.005	0.02	0.02	—	86.9	86.9	< 0.005	< 0.005	0.05	87.2
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.55	0.46	3.25	5.92	0.01	0.11	1.05	1.16	0.10	0.34	0.44	—	1,440	1,440	0.06	0.09	1.48	1,469

2026	0.55	0.46	2.68	6.52	0.01	0.07	1.07	1.14	0.07	0.26	0.32	—	1,742	1,742	0.04	0.11	1.93	1,779
2027	0.53	0.44	2.54	6.24	0.01	0.06	1.07	1.13	0.06	0.26	0.32	—	1,715	1,715	0.04	0.11	1.75	1,751
2028	0.48	0.43	2.44	6.00	0.01	0.06	1.07	1.13	0.05	0.26	0.31	—	1,692	1,692	0.04	0.11	1.59	1,727
2029	0.47	0.41	2.32	5.77	0.01	0.05	1.07	1.12	0.05	0.26	0.31	—	1,659	1,659	0.04	0.11	1.42	1,694
2030	0.45	0.37	2.24	5.56	0.01	0.05	1.07	1.12	0.04	0.26	0.30	—	1,632	1,632	0.04	0.10	1.27	1,665
2031	0.43	0.36	2.17	5.37	0.01	0.05	1.07	1.12	0.04	0.26	0.30	—	1,604	1,604	0.04	0.10	1.12	1,637
2032	0.42	0.35	2.09	5.20	0.01	0.04	1.07	1.11	0.04	0.26	0.30	—	1,583	1,583	0.04	0.08	0.99	1,607
2033	0.38	0.33	2.00	5.03	0.01	0.04	1.07	1.11	0.03	0.26	0.29	—	1,554	1,554	0.04	0.07	0.86	1,578
2034	0.23	9.20	1.29	3.03	0.01	0.03	0.60	0.63	0.02	0.15	0.17	—	906	906	0.02	0.04	0.42	919
2035	< 0.005	4.25	0.01	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	< 0.005	—	14.4	14.4	< 0.005	< 0.005	0.01	14.4

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.53	3.85	33.0	58.8	0.06	1.39	8.29	9.56	1.28	4.07	5.35	—	15,387	15,387	0.59	0.98	41.2	15,734
2026	4.31	3.65	20.0	55.9	0.06	0.54	8.29	8.83	0.50	2.00	2.50	—	15,150	15,150	0.58	0.95	37.9	15,486
2027	4.16	3.50	19.0	53.3	0.06	0.49	8.29	8.78	0.45	2.00	2.45	—	14,916	14,916	0.35	0.95	34.4	15,241
2028	4.00	3.39	18.2	51.1	0.06	0.44	8.29	8.73	0.41	2.00	2.41	—	14,672	14,672	0.32	0.92	31.1	14,985
2029	3.64	3.24	17.4	49.0	0.06	0.41	8.29	8.70	0.38	2.00	2.38	—	14,428	14,428	0.31	0.91	27.9	14,736
2030	3.52	2.91	16.7	47.2	0.06	0.39	8.29	8.68	0.33	2.00	2.33	—	14,186	14,186	0.30	0.89	24.8	14,483
2031	3.39	2.81	16.2	45.3	0.06	0.37	8.29	8.66	0.31	2.00	2.31	—	13,948	13,948	0.30	0.66	22.0	14,174
2032	3.27	2.70	15.5	43.7	0.06	0.32	8.29	8.61	0.29	2.00	2.29	—	13,723	13,723	0.29	0.63	19.3	13,938
2033	2.96	2.62	15.1	42.4	0.06	0.29	8.29	8.58	0.27	2.00	2.26	—	13,515	13,515	0.29	0.63	16.8	13,725
2034	2.87	2.53	14.6	41.1	0.06	0.27	8.29	8.57	0.25	2.00	2.25	—	13,319	13,319	0.29	0.60	14.6	13,520

Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.42	3.72	33.1	51.4	0.06	1.39	8.29	9.56	1.28	4.07	5.35	—	14,843	14,843	0.61	0.99	1.07	15,154
2026	4.21	3.53	20.8	48.8	0.06	0.54	8.29	8.83	0.50	2.00	2.50	—	14,617	14,617	0.37	0.96	0.98	14,915
2027	4.05	3.40	19.8	46.8	0.06	0.49	8.29	8.78	0.45	2.00	2.45	—	14,394	14,394	0.37	0.96	0.89	14,689
2028	3.70	3.29	18.8	44.9	0.06	0.44	8.29	8.73	0.41	2.00	2.41	—	14,161	14,161	0.33	0.92	0.81	14,444
2029	3.57	2.93	17.9	43.2	0.06	0.41	8.29	8.70	0.38	2.00	2.38	—	13,926	13,926	0.33	0.91	0.72	14,207
2030	3.45	2.83	17.2	41.8	0.06	0.39	8.29	8.68	0.33	2.00	2.33	—	13,693	13,693	0.31	0.89	0.64	13,966
2031	3.32	2.73	16.7	40.3	0.06	0.37	8.29	8.66	0.31	2.00	2.31	—	13,463	13,463	0.31	0.88	0.57	13,734
2032	3.22	2.64	16.1	39.0	0.06	0.32	8.29	8.61	0.29	2.00	2.29	—	13,246	13,246	0.30	0.85	0.50	13,508
2033	2.92	2.57	15.6	37.9	0.06	0.29	8.29	8.58	0.27	2.00	2.26	—	13,043	13,043	0.30	0.63	0.44	13,238
2034	2.83	360	15.1	36.7	0.06	0.27	8.29	8.57	0.25	2.00	2.25	—	12,854	12,854	0.30	0.60	0.38	13,041
2035	0.37	360	0.99	4.40	< 0.005	0.01	1.41	1.41	0.01	0.33	0.34	—	1,327	1,327	0.02	0.01	0.05	1,329
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.03	2.54	17.8	32.4	0.04	0.60	5.77	6.37	0.56	1.85	2.41	—	8,699	8,699	0.35	0.53	8.97	8,874
2026	3.02	2.53	14.7	35.7	0.05	0.39	5.86	6.25	0.36	1.41	1.77	—	10,521	10,521	0.27	0.69	11.7	10,744
2027	2.91	2.43	13.9	34.2	0.05	0.35	5.86	6.21	0.32	1.41	1.73	—	10,360	10,360	0.26	0.68	10.6	10,578
2028	2.64	2.34	13.4	32.9	0.05	0.32	5.88	6.19	0.29	1.41	1.71	—	10,219	10,219	0.24	0.66	9.60	10,431
2029	2.55	2.26	12.7	31.6	0.05	0.29	5.86	6.15	0.27	1.41	1.68	—	10,023	10,023	0.23	0.65	8.59	10,231
2030	2.46	2.02	12.3	30.4	0.05	0.28	5.86	6.14	0.24	1.41	1.65	—	9,855	9,855	0.22	0.63	7.65	10,057
2031	2.37	1.95	11.9	29.4	0.05	0.26	5.86	6.12	0.22	1.41	1.63	—	9,689	9,689	0.22	0.63	6.78	9,889
2032	2.31	1.89	11.4	28.5	0.05	0.23	5.88	6.11	0.21	1.41	1.62	—	9,559	9,559	0.22	0.45	5.95	9,705
2033	2.07	1.83	11.0	27.6	0.05	0.21	5.86	6.07	0.19	1.41	1.60	—	9,388	9,388	0.22	0.45	5.19	9,531
2034	1.25	50.4	7.09	16.6	0.03	0.14	3.31	3.45	0.13	0.80	0.93	—	5,469	5,469	0.13	0.25	2.56	5,550
2035	0.02	23.3	0.06	0.29	< 0.005	< 0.005	0.09	0.09	< 0.005	0.02	0.02	—	86.9	86.9	< 0.005	< 0.005	0.05	87.2
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.55	0.46	3.25	5.92	0.01	0.11	1.05	1.16	0.10	0.34	0.44	—	1,440	1,440	0.06	0.09	1.48	1,469

2026	0.55	0.46	2.68	6.52	0.01	0.07	1.07	1.14	0.07	0.26	0.32	—	1,742	1,742	0.04	0.11	1.93	1,779
2027	0.53	0.44	2.54	6.24	0.01	0.06	1.07	1.13	0.06	0.26	0.32	—	1,715	1,715	0.04	0.11	1.75	1,751
2028	0.48	0.43	2.44	6.00	0.01	0.06	1.07	1.13	0.05	0.26	0.31	—	1,692	1,692	0.04	0.11	1.59	1,727
2029	0.47	0.41	2.32	5.77	0.01	0.05	1.07	1.12	0.05	0.26	0.31	—	1,659	1,659	0.04	0.11	1.42	1,694
2030	0.45	0.37	2.24	5.56	0.01	0.05	1.07	1.12	0.04	0.26	0.30	—	1,632	1,632	0.04	0.10	1.27	1,665
2031	0.43	0.36	2.17	5.37	0.01	0.05	1.07	1.12	0.04	0.26	0.30	—	1,604	1,604	0.04	0.10	1.12	1,637
2032	0.42	0.35	2.09	5.20	0.01	0.04	1.07	1.11	0.04	0.26	0.30	—	1,583	1,583	0.04	0.08	0.99	1,607
2033	0.38	0.33	2.00	5.03	0.01	0.04	1.07	1.11	0.03	0.26	0.29	—	1,554	1,554	0.04	0.07	0.86	1,578
2034	0.23	9.20	1.29	3.03	0.01	0.03	0.60	0.63	0.02	0.15	0.17	—	906	906	0.02	0.04	0.42	919
2035	< 0.005	4.25	0.01	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	< 0.005	—	14.4	14.4	< 0.005	< 0.005	0.01	14.4

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	62.9	79.8	43.0	499	1.28	1.06	128	129	1.01	32.6	33.6	490	139,979	140,470	54.7	5.13	296	143,661
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	55.6	72.7	47.2	404	1.20	1.02	128	129	0.98	32.6	33.6	490	132,545	133,036	55.0	5.43	143	136,171
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	48.4	66.2	39.0	361	1.01	0.93	105	106	0.89	26.6	27.5	490	112,947	113,438	54.0	4.46	195	116,314
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	8.83	12.1	7.12	65.9	0.18	0.17	19.1	19.3	0.16	4.86	5.02	81.2	18,700	18,781	8.95	0.74	32.3	19,257

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	56.9	52.4	38.1	450	1.25	0.66	128	129	0.62	32.6	33.2	—	127,149	127,149	4.42	4.86	157	128,865
Area	5.48	27.2	0.43	47.5	< 0.005	0.04	—	0.04	0.03	—	0.03	0.00	146	146	0.01	< 0.005	—	146
Energy	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	12,443	12,443	0.99	0.07	—	12,489
Water	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Waste	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Total	62.9	79.8	43.0	499	1.28	1.06	128	129	1.01	32.6	33.6	490	139,979	140,470	54.7	5.13	296	143,661
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	55.1	50.4	42.7	402	1.17	0.66	128	129	0.62	32.6	33.2	—	119,861	119,861	4.72	5.16	4.08	121,522
Area	0.00	22.0	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Energy	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	12,443	12,443	0.99	0.07	—	12,489
Water	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Waste	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Total	55.6	72.7	47.2	404	1.20	1.02	128	129	0.98	32.6	33.6	490	132,545	133,036	55.0	5.43	143	136,171
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	45.2	41.4	34.3	335	0.98	0.55	105	105	0.51	26.6	27.1	—	100,191	100,191	3.80	4.20	56.1	101,593
Area	2.70	24.6	0.21	23.4	< 0.005	0.02	—	0.02	0.01	—	0.01	0.00	71.9	71.9	< 0.005	< 0.005	—	72.1
Energy	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	12,443	12,443	0.99	0.07	—	12,489
Water	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584

Waste	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Total	48.4	66.2	39.0	361	1.01	0.93	105	106	0.89	26.6	27.5	490	112,947	113,438	54.0	4.46	195	116,314
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	8.24	7.55	6.26	61.2	0.18	0.10	19.1	19.2	0.09	4.86	4.95	—	16,588	16,588	0.63	0.69	9.29	16,820
Area	0.49	4.48	0.04	4.28	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	0.00	11.9	11.9	< 0.005	< 0.005	—	11.9
Energy	0.09	0.05	0.82	0.41	0.01	0.07	—	0.07	0.07	—	0.07	—	2,060	2,060	0.16	0.01	—	2,068
Water	—	—	—	—	—	—	—	—	—	—	—	13.2	40.0	53.2	1.35	0.03	—	96.7
Waste	—	—	—	—	—	—	—	—	—	—	—	68.0	0.00	68.0	6.80	0.00	—	238
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23.0	23.0
Total	8.83	12.1	7.12	65.9	0.18	0.17	19.1	19.3	0.16	4.86	5.02	81.2	18,700	18,781	8.95	0.74	32.3	19,257

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	56.9	52.4	38.1	450	1.25	0.66	128	129	0.62	32.6	33.2	—	127,149	127,149	4.42	4.86	157	128,865
Area	5.48	27.2	0.43	47.5	< 0.005	0.04	—	0.04	0.03	—	0.03	0.00	146	146	0.01	< 0.005	—	146
Energy	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	12,443	12,443	0.99	0.07	—	12,489
Water	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Waste	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Total	62.9	79.8	43.0	499	1.28	1.06	128	129	1.01	32.6	33.6	490	139,979	140,470	54.7	5.13	296	143,661
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	55.1	50.4	42.7	402	1.17	0.66	128	129	0.62	32.6	33.2	—	119,861	119,861	4.72	5.16	4.08	121,522

Area	0.00	22.0	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Energy	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	12,443	12,443	0.99	0.07	—	12,489
Water	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Waste	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Total	55.6	72.7	47.2	404	1.20	1.02	128	129	0.98	32.6	33.6	490	132,545	133,036	55.0	5.43	143	136,171
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	45.2	41.4	34.3	335	0.98	0.55	105	105	0.51	26.6	27.1	—	100,191	100,191	3.80	4.20	56.1	101,593
Area	2.70	24.6	0.21	23.4	< 0.005	0.02	—	0.02	0.01	—	0.01	0.00	71.9	71.9	< 0.005	< 0.005	—	72.1
Energy	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	12,443	12,443	0.99	0.07	—	12,489
Water	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Waste	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Total	48.4	66.2	39.0	361	1.01	0.93	105	106	0.89	26.6	27.5	490	112,947	113,438	54.0	4.46	195	116,314
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	8.24	7.55	6.26	61.2	0.18	0.10	19.1	19.2	0.09	4.86	4.95	—	16,588	16,588	0.63	0.69	9.29	16,820
Area	0.49	4.48	0.04	4.28	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	0.00	11.9	11.9	< 0.005	< 0.005	—	11.9
Energy	0.09	0.05	0.82	0.41	0.01	0.07	—	0.07	0.07	—	0.07	—	2,060	2,060	0.16	0.01	—	2,068
Water	—	—	—	—	—	—	—	—	—	—	—	13.2	40.0	53.2	1.35	0.03	—	96.7
Waste	—	—	—	—	—	—	—	—	—	—	—	68.0	0.00	68.0	6.80	0.00	—	238
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23.0	23.0
Total	8.83	12.1	7.12	65.9	0.18	0.17	19.1	19.3	0.16	4.86	5.02	81.2	18,700	18,781	8.95	0.74	32.3	19,257

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.94	3.31	31.6	30.2	0.05	1.37	—	1.37	1.26	—	1.26	—	5,295	5,295	0.21	0.04	—	5,314
Dust From Material Movement	—	—	—	—	—	—	7.67	7.67	—	3.94	3.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.94	3.31	31.6	30.2	0.05	1.37	—	1.37	1.26	—	1.26	—	5,295	5,295	0.21	0.04	—	5,314
Dust From Material Movement	—	—	—	—	—	—	7.67	7.67	—	3.94	3.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.86	0.73	6.93	6.61	0.01	0.30	—	0.30	0.28	—	0.28	—	1,161	1,161	0.05	0.01	—	1,165
Dust From Material Movement	—	—	—	—	—	—	1.68	1.68	—	0.86	0.86	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.13	1.27	1.21	< 0.005	0.05	—	0.05	0.05	—	0.05	—	192	192	0.01	< 0.005	—	193
Dust From Material Movement	—	—	—	—	—	—	0.31	0.31	—	0.16	0.16	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.08	0.07	0.08	1.26	0.00	0.00	0.23	0.23	0.00	0.05	0.05	—	245	245	0.01	0.01	0.93	249
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.06	0.02	1.28	0.39	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,046	1,046	0.04	0.16	2.54	1,098
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.08	0.07	0.09	1.01	0.00	0.00	0.23	0.23	0.00	0.05	0.05	—	227	227	0.01	0.01	0.02	230
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.06	0.02	1.35	0.40	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,047	1,047	0.04	0.16	0.07	1,096
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.02	0.23	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	50.6	50.6	< 0.005	< 0.005	0.09	51.3
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	0.01	0.29	0.09	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	229	229	0.01	0.04	0.24	240
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	8.38	8.38	< 0.005	< 0.005	0.01	8.50
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.05	0.02	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	38.0	38.0	< 0.005	0.01	0.04	39.8

3.2. Site Preparation (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.94	3.31	31.6	30.2	0.05	1.37	—	1.37	1.26	—	1.26	—	5,295	5,295	0.21	0.04	—	5,314
Dust From Material Movement	—	—	—	—	—	—	7.67	7.67	—	3.94	3.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.94	3.31	31.6	30.2	0.05	1.37	—	1.37	1.26	—	1.26	—	5,295	5,295	0.21	0.04	—	5,314
Dust From Material Movement	—	—	—	—	—	—	7.67	7.67	—	3.94	3.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.86	0.73	6.93	6.61	0.01	0.30	—	0.30	0.28	—	0.28	—	1,161	1,161	0.05	0.01	—	1,165
Dust From Material Movement	—	—	—	—	—	—	1.68	1.68	—	0.86	0.86	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.13	1.27	1.21	< 0.005	0.05	—	0.05	0.05	—	0.05	—	192	192	0.01	< 0.005	—	193
Dust From Material Movement	—	—	—	—	—	—	0.31	0.31	—	0.16	0.16	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.08	0.07	0.08	1.26	0.00	0.00	0.23	0.23	0.00	0.05	0.05	—	245	245	0.01	0.01	0.93	249
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.06	0.02	1.28	0.39	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,046	1,046	0.04	0.16	2.54	1,098
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.08	0.07	0.09	1.01	0.00	0.00	0.23	0.23	0.00	0.05	0.05	—	227	227	0.01	0.01	0.02	230
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.06	0.02	1.35	0.40	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,047	1,047	0.04	0.16	0.07	1,096
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.02	0.23	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	50.6	50.6	< 0.005	< 0.005	0.09	51.3
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	0.01	0.29	0.09	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	229	229	0.01	0.04	0.24	240
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	8.38	8.38	< 0.005	< 0.005	0.01	8.50
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	< 0.005	< 0.005	0.05	0.02	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	38.0	38.0	< 0.005	0.01	0.04	39.8

3.3. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.68	1.41	13.3	18.0	0.03	0.54	—	0.54	0.50	—	0.50	—	3,160	3,160	0.13	0.03	—	3,171
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.68	1.41	13.3	18.0	0.03	0.54	—	0.54	0.50	—	0.50	—	3,160	3,160	0.13	0.03	—	3,171
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.68	6.47	8.76	0.01	0.26	—	0.26	0.24	—	0.24	—	1,534	1,534	0.06	0.01	—	1,539
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.12	1.18	1.60	< 0.005	0.05	—	0.05	0.04	—	0.04	—	254	254	0.01	< 0.005	—	255
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.57	2.30	2.36	38.6	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	7,538	7,538	0.31	0.26	28.7	7,650
Vendor	0.22	0.11	4.32	1.70	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,643	3,643	0.10	0.53	9.92	3,815
Hauling	0.06	0.02	1.28	0.39	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,046	1,046	0.04	0.16	2.54	1,098
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.46	2.18	2.84	31.2	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,991	6,991	0.34	0.27	0.74	7,079
Vendor	0.21	0.10	4.56	1.76	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,645	3,645	0.11	0.53	0.26	3,807
Hauling	0.06	0.02	1.35	0.40	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,047	1,047	0.04	0.16	0.07	1,096
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.18	1.05	1.27	15.7	0.00	0.00	3.38	3.38	0.00	0.79	0.79	—	3,449	3,449	0.16	0.13	6.02	3,497
Vendor	0.11	0.05	2.19	0.84	0.01	0.02	0.47	0.50	0.02	0.13	0.15	—	1,769	1,769	0.05	0.26	2.09	1,849
Hauling	0.03	0.01	0.65	0.19	< 0.005	0.01	0.13	0.14	0.01	0.04	0.05	—	508	508	0.02	0.08	0.53	532
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.22	0.19	0.23	2.86	0.00	0.00	0.62	0.62	0.00	0.14	0.14	—	571	571	0.03	0.02	1.00	579
Vendor	0.02	0.01	0.40	0.15	< 0.005	< 0.005	0.09	0.09	< 0.005	0.02	0.03	—	293	293	0.01	0.04	0.35	306
Hauling	0.01	< 0.005	0.12	0.03	< 0.005	< 0.005	0.02	0.03	< 0.005	0.01	0.01	—	84.1	84.1	< 0.005	0.01	0.09	88.1

3.4. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.68	1.41	13.3	18.0	0.03	0.54	—	0.54	0.50	—	0.50	—	3,160	3,160	0.13	0.03	—	3,171
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.68	1.41	13.3	18.0	0.03	0.54	—	0.54	0.50	—	0.50	—	3,160	3,160	0.13	0.03	—	3,171
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.68	6.47	8.76	0.01	0.26	—	0.26	0.24	—	0.24	—	1,534	1,534	0.06	0.01	—	1,539
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.12	1.18	1.60	< 0.005	0.05	—	0.05	0.04	—	0.04	—	254	254	0.01	< 0.005	—	255
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.57	2.30	2.36	38.6	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	7,538	7,538	0.31	0.26	28.7	7,650
Vendor	0.22	0.11	4.32	1.70	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,643	3,643	0.10	0.53	9.92	3,815
Hauling	0.06	0.02	1.28	0.39	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,046	1,046	0.04	0.16	2.54	1,098
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.46	2.18	2.84	31.2	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,991	6,991	0.34	0.27	0.74	7,079

Vendor	0.21	0.10	4.56	1.76	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,645	3,645	0.11	0.53	0.26	3,807
Hauling	0.06	0.02	1.35	0.40	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,047	1,047	0.04	0.16	0.07	1,096
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.18	1.05	1.27	15.7	0.00	0.00	3.38	3.38	0.00	0.79	0.79	—	3,449	3,449	0.16	0.13	6.02	3,497
Vendor	0.11	0.05	2.19	0.84	0.01	0.02	0.47	0.50	0.02	0.13	0.15	—	1,769	1,769	0.05	0.26	2.09	1,849
Hauling	0.03	0.01	0.65	0.19	< 0.005	0.01	0.13	0.14	0.01	0.04	0.05	—	508	508	0.02	0.08	0.53	532
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.22	0.19	0.23	2.86	0.00	0.00	0.62	0.62	0.00	0.14	0.14	—	571	571	0.03	0.02	1.00	579
Vendor	0.02	0.01	0.40	0.15	< 0.005	< 0.005	0.09	0.09	< 0.005	0.02	0.03	—	293	293	0.01	0.04	0.35	306
Hauling	0.01	< 0.005	0.12	0.03	< 0.005	< 0.005	0.02	0.03	< 0.005	0.01	0.01	—	84.1	84.1	< 0.005	0.01	0.09	88.1

3.5. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.60	1.34	12.6	18.0	0.03	0.47	—	0.47	0.43	—	0.43	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.60	1.34	12.6	18.0	0.03	0.47	—	0.47	0.43	—	0.43	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.14	0.95	8.98	12.8	0.02	0.34	—	0.34	0.31	—	0.31	—	2,257	2,257	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.17	1.64	2.34	< 0.005	0.06	—	0.06	0.06	—	0.06	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.44	2.18	2.11	35.9	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	7,388	7,388	0.31	0.26	26.1	7,498
Vendor	0.22	0.11	4.11	1.62	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,577	3,577	0.10	0.51	9.33	3,741
Hauling	0.06	0.02	1.24	0.39	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,025	1,025	0.03	0.16	2.41	1,077
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.34	2.08	2.60	28.8	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,853	6,853	0.11	0.27	0.68	6,936
Vendor	0.21	0.10	4.34	1.67	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,580	3,580	0.10	0.51	0.24	3,734
Hauling	0.06	0.02	1.31	0.39	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,026	1,026	0.03	0.16	0.06	1,075
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.68	1.49	1.69	21.4	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,976	4,976	0.08	0.19	8.05	5,043
Vendor	0.15	0.08	3.08	1.17	0.02	0.04	0.69	0.73	0.04	0.19	0.23	—	2,556	2,556	0.07	0.36	2.86	2,669
Hauling	0.04	0.01	0.93	0.28	< 0.005	0.01	0.20	0.21	0.01	0.05	0.07	—	732	732	0.02	0.12	0.74	769
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.27	0.31	3.91	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	824	824	0.01	0.03	1.33	835

Vendor	0.03	0.01	0.56	0.21	< 0.005	0.01	0.13	0.13	0.01	0.03	0.04	—	423	423	0.01	0.06	0.47	442
Hauling	0.01	< 0.005	0.17	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	121	121	< 0.005	0.02	0.12	127

3.6. Building Construction (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.60	1.34	12.6	18.0	0.03	0.47	—	0.47	0.43	—	0.43	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.60	1.34	12.6	18.0	0.03	0.47	—	0.47	0.43	—	0.43	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.14	0.95	8.98	12.8	0.02	0.34	—	0.34	0.31	—	0.31	—	2,257	2,257	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.17	1.64	2.34	< 0.005	0.06	—	0.06	0.06	—	0.06	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.44	2.18	2.11	35.9	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	7,388	7,388	0.31	0.26	26.1	7,498
Vendor	0.22	0.11	4.11	1.62	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,577	3,577	0.10	0.51	9.33	3,741
Hauling	0.06	0.02	1.24	0.39	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,025	1,025	0.03	0.16	2.41	1,077
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.34	2.08	2.60	28.8	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,853	6,853	0.11	0.27	0.68	6,936
Vendor	0.21	0.10	4.34	1.67	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,580	3,580	0.10	0.51	0.24	3,734
Hauling	0.06	0.02	1.31	0.39	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,026	1,026	0.03	0.16	0.06	1,075
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.68	1.49	1.69	21.4	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,976	4,976	0.08	0.19	8.05	5,043
Vendor	0.15	0.08	3.08	1.17	0.02	0.04	0.69	0.73	0.04	0.19	0.23	—	2,556	2,556	0.07	0.36	2.86	2,669
Hauling	0.04	0.01	0.93	0.28	< 0.005	0.01	0.20	0.21	0.01	0.05	0.07	—	732	732	0.02	0.12	0.74	769
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.27	0.31	3.91	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	824	824	0.01	0.03	1.33	835
Vendor	0.03	0.01	0.56	0.21	< 0.005	0.01	0.13	0.13	0.01	0.03	0.04	—	423	423	0.01	0.06	0.47	442
Hauling	0.01	< 0.005	0.17	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	121	121	< 0.005	0.02	0.12	127

3.7. Building Construction (2027) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.53	1.28	12.0	18.0	0.03	0.41	—	0.41	0.38	—	0.38	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.53	1.28	12.0	18.0	0.03	0.41	—	0.41	0.38	—	0.38	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.10	0.92	8.57	12.8	0.02	0.30	—	0.30	0.27	—	0.27	—	2,257	2,257	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.20	0.17	1.56	2.34	< 0.005	0.05	—	0.05	0.05	—	0.05	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.34	2.09	1.87	33.5	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	7,251	7,251	0.08	0.26	23.6	7,353
Vendor	0.22	0.11	3.94	1.56	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,503	3,503	0.10	0.51	8.49	3,666
Hauling	0.06	0.02	1.20	0.38	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,002	1,002	0.03	0.16	2.23	1,052
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.27	1.99	2.37	26.9	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,726	6,726	0.11	0.27	0.61	6,809

Vendor	0.19	0.10	4.15	1.58	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,506	3,506	0.10	0.51	0.22	3,660
Hauling	0.06	0.02	1.26	0.38	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,003	1,003	0.03	0.16	0.06	1,050
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.62	1.42	1.52	19.9	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,884	4,884	0.07	0.18	7.29	4,947
Vendor	0.15	0.07	2.94	1.13	0.02	0.04	0.69	0.73	0.04	0.19	0.23	—	2,503	2,503	0.07	0.36	2.62	2,616
Hauling	0.04	0.01	0.90	0.27	< 0.005	0.01	0.20	0.21	0.01	0.05	0.07	—	716	716	0.02	0.11	0.69	751
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.29	0.26	0.28	3.64	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	809	809	0.01	0.03	1.21	819
Vendor	0.03	0.01	0.54	0.21	< 0.005	0.01	0.13	0.13	0.01	0.03	0.04	—	414	414	0.01	0.06	0.43	433
Hauling	0.01	< 0.005	0.16	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	119	119	< 0.005	0.02	0.11	124

3.8. Building Construction (2027) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.53	1.28	12.0	18.0	0.03	0.41	—	0.41	0.38	—	0.38	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.53	1.28	12.0	18.0	0.03	0.41	—	0.41	0.38	—	0.38	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.10	0.92	8.57	12.8	0.02	0.30	—	0.30	0.27	—	0.27	—	2,257	2,257	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.20	0.17	1.56	2.34	< 0.005	0.05	—	0.05	0.05	—	0.05	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.34	2.09	1.87	33.5	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	7,251	7,251	0.08	0.26	23.6	7,353
Vendor	0.22	0.11	3.94	1.56	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,503	3,503	0.10	0.51	8.49	3,666
Hauling	0.06	0.02	1.20	0.38	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,002	1,002	0.03	0.16	2.23	1,052
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.27	1.99	2.37	26.9	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,726	6,726	0.11	0.27	0.61	6,809
Vendor	0.19	0.10	4.15	1.58	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,506	3,506	0.10	0.51	0.22	3,660
Hauling	0.06	0.02	1.26	0.38	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	1,003	1,003	0.03	0.16	0.06	1,050
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.62	1.42	1.52	19.9	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,884	4,884	0.07	0.18	7.29	4,947
Vendor	0.15	0.07	2.94	1.13	0.02	0.04	0.69	0.73	0.04	0.19	0.23	—	2,503	2,503	0.07	0.36	2.62	2,616
Hauling	0.04	0.01	0.90	0.27	< 0.005	0.01	0.20	0.21	0.01	0.05	0.07	—	716	716	0.02	0.11	0.69	751
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.29	0.26	0.28	3.64	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	809	809	0.01	0.03	1.21	819

Vendor	0.03	0.01	0.54	0.21	< 0.005	0.01	0.13	0.13	0.01	0.03	0.04	—	414	414	0.01	0.06	0.43	433
Hauling	0.01	< 0.005	0.16	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	119	119	< 0.005	0.02	0.11	124

3.9. Building Construction (2028) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.48	1.24	11.4	18.0	0.03	0.37	—	0.37	0.34	—	0.34	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.48	1.24	11.4	18.0	0.03	0.37	—	0.37	0.34	—	0.34	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.06	0.89	8.20	12.9	0.02	0.26	—	0.26	0.24	—	0.24	—	2,263	2,263	0.09	0.02	—	2,271
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.50	2.35	< 0.005	0.05	—	0.05	0.04	—	0.04	—	375	375	0.02	< 0.005	—	376
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.27	2.02	1.86	31.3	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	7,118	7,118	0.08	0.26	21.3	7,218
Vendor	0.19	0.11	3.77	1.50	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,417	3,417	0.08	0.48	7.68	3,571
Hauling	0.06	0.02	1.16	0.37	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	977	977	0.03	0.16	2.06	1,027
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.98	1.93	2.12	25.0	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,604	6,604	0.09	0.26	0.55	6,683
Vendor	0.18	0.10	3.98	1.52	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,420	3,420	0.08	0.48	0.20	3,566
Hauling	0.06	0.02	1.23	0.37	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	978	978	0.03	0.16	0.05	1,025
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.40	1.37	1.50	18.7	0.00	0.00	4.99	4.99	0.00	1.17	1.17	—	4,808	4,808	0.07	0.18	6.59	4,871
Vendor	0.13	0.07	2.81	1.07	0.02	0.04	0.69	0.73	0.04	0.19	0.23	—	2,448	2,448	0.06	0.35	2.37	2,555
Hauling	0.04	0.01	0.87	0.26	< 0.005	0.01	0.20	0.21	0.01	0.05	0.07	—	700	700	0.02	0.11	0.64	735
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.26	0.25	0.27	3.41	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	796	796	0.01	0.03	1.09	806
Vendor	0.02	0.01	0.51	0.20	< 0.005	0.01	0.13	0.13	0.01	0.04	0.04	—	405	405	0.01	0.06	0.39	423
Hauling	0.01	< 0.005	0.16	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	116	116	< 0.005	0.02	0.11	122

3.10. Building Construction (2028) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.48	1.24	11.4	18.0	0.03	0.37	—	0.37	0.34	—	0.34	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.48	1.24	11.4	18.0	0.03	0.37	—	0.37	0.34	—	0.34	—	3,159	3,159	0.13	0.03	—	3,170
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.06	0.89	8.20	12.9	0.02	0.26	—	0.26	0.24	—	0.24	—	2,263	2,263	0.09	0.02	—	2,271
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.50	2.35	< 0.005	0.05	—	0.05	0.04	—	0.04	—	375	375	0.02	< 0.005	—	376
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	2.27	2.02	1.86	31.3	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	7,118	7,118	0.08	0.26	21.3	7,218
Vendor	0.19	0.11	3.77	1.50	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,417	3,417	0.08	0.48	7.68	3,571
Hauling	0.06	0.02	1.16	0.37	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	977	977	0.03	0.16	2.06	1,027
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.98	1.93	2.12	25.0	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,604	6,604	0.09	0.26	0.55	6,683

Vendor	0.18	0.10	3.98	1.52	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,420	3,420	0.08	0.48	0.20	3,566
Hauling	0.06	0.02	1.23	0.37	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	978	978	0.03	0.16	0.05	1,025
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.40	1.37	1.50	18.7	0.00	0.00	4.99	4.99	0.00	1.17	1.17	—	4,808	4,808	0.07	0.18	6.59	4,871
Vendor	0.13	0.07	2.81	1.07	0.02	0.04	0.69	0.73	0.04	0.19	0.23	—	2,448	2,448	0.06	0.35	2.37	2,555
Hauling	0.04	0.01	0.87	0.26	< 0.005	0.01	0.20	0.21	0.01	0.05	0.07	—	700	700	0.02	0.11	0.64	735
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.26	0.25	0.27	3.41	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	796	796	0.01	0.03	1.09	806
Vendor	0.02	0.01	0.51	0.20	< 0.005	0.01	0.13	0.13	0.01	0.04	0.04	—	405	405	0.01	0.06	0.39	423
Hauling	0.01	< 0.005	0.16	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	116	116	< 0.005	0.02	0.11	122

3.11. Building Construction (2029) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.45	1.21	11.0	17.9	0.03	0.34	—	0.34	0.31	—	0.31	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.45	1.21	11.0	17.9	0.03	0.34	—	0.34	0.31	—	0.31	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.03	0.86	7.88	12.8	0.02	0.24	—	0.24	0.22	—	0.22	—	2,256	2,256	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.44	2.34	< 0.005	0.04	—	0.04	0.04	—	0.04	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.96	1.93	1.63	29.3	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,994	6,994	0.07	0.26	19.1	7,091
Vendor	0.19	0.08	3.59	1.42	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,324	3,324	0.08	0.48	6.87	3,476
Hauling	0.05	0.02	1.13	0.36	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	952	952	0.03	0.15	1.89	999
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.89	1.63	1.88	23.4	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,489	6,489	0.09	0.26	0.50	6,568
Vendor	0.18	0.08	3.81	1.46	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,326	3,326	0.08	0.48	0.18	3,472
Hauling	0.05	0.02	1.19	0.36	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	953	953	0.03	0.15	0.05	998
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.35	1.32	1.34	17.5	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,711	4,711	0.06	0.18	5.90	4,773
Vendor	0.13	0.06	2.68	1.03	0.02	0.04	0.69	0.73	0.04	0.19	0.23	—	2,375	2,375	0.05	0.34	2.11	2,481
Hauling	0.04	0.01	0.84	0.26	< 0.005	0.01	0.20	0.21	0.01	0.05	0.07	—	680	680	0.02	0.11	0.58	713
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.25	0.24	0.24	3.20	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	780	780	0.01	0.03	0.98	790

Vendor	0.02	0.01	0.49	0.19	< 0.005	0.01	0.13	0.13	0.01	0.03	0.04	—	393	393	0.01	0.06	0.35	411
Hauling	0.01	< 0.005	0.15	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	113	113	< 0.005	0.02	0.10	118

3.12. Building Construction (2029) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.45	1.21	11.0	17.9	0.03	0.34	—	0.34	0.31	—	0.31	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.45	1.21	11.0	17.9	0.03	0.34	—	0.34	0.31	—	0.31	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.03	0.86	7.88	12.8	0.02	0.24	—	0.24	0.22	—	0.22	—	2,256	2,256	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.44	2.34	< 0.005	0.04	—	0.04	0.04	—	0.04	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.96	1.93	1.63	29.3	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,994	6,994	0.07	0.26	19.1	7,091
Vendor	0.19	0.08	3.59	1.42	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,324	3,324	0.08	0.48	6.87	3,476
Hauling	0.05	0.02	1.13	0.36	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	952	952	0.03	0.15	1.89	999
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.89	1.63	1.88	23.4	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,489	6,489	0.09	0.26	0.50	6,568
Vendor	0.18	0.08	3.81	1.46	0.03	0.05	0.98	1.03	0.05	0.27	0.32	—	3,326	3,326	0.08	0.48	0.18	3,472
Hauling	0.05	0.02	1.19	0.36	0.01	0.02	0.28	0.30	0.02	0.08	0.10	—	953	953	0.03	0.15	0.05	998
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.35	1.32	1.34	17.5	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,711	4,711	0.06	0.18	5.90	4,773
Vendor	0.13	0.06	2.68	1.03	0.02	0.04	0.69	0.73	0.04	0.19	0.23	—	2,375	2,375	0.05	0.34	2.11	2,481
Hauling	0.04	0.01	0.84	0.26	< 0.005	0.01	0.20	0.21	0.01	0.05	0.07	—	680	680	0.02	0.11	0.58	713
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.25	0.24	0.24	3.20	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	780	780	0.01	0.03	0.98	790
Vendor	0.02	0.01	0.49	0.19	< 0.005	0.01	0.13	0.13	0.01	0.03	0.04	—	393	393	0.01	0.06	0.35	411
Hauling	0.01	< 0.005	0.15	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	113	113	< 0.005	0.02	0.10	118

3.13. Building Construction (2030) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.41	1.18	10.8	17.9	0.03	0.32	—	0.32	0.29	—	0.29	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.41	1.18	10.8	17.9	0.03	0.32	—	0.32	0.29	—	0.29	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.01	0.84	7.72	12.8	0.02	0.23	—	0.23	0.21	—	0.21	—	2,256	2,256	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.18	0.15	1.41	2.34	< 0.005	0.04	—	0.04	0.04	—	0.04	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.88	1.63	1.38	27.5	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,877	6,877	0.07	0.26	17.0	6,972
Vendor	0.19	0.08	3.45	1.39	0.03	0.05	0.98	1.03	0.03	0.27	0.30	—	3,224	3,224	0.08	0.46	6.06	3,368
Hauling	0.05	0.02	1.09	0.35	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	927	927	0.03	0.15	1.72	974
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.82	1.56	1.65	22.0	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,380	6,380	0.08	0.26	0.44	6,459

Vendor	0.18	0.08	3.64	1.43	0.03	0.05	0.98	1.03	0.03	0.27	0.30	—	3,226	3,226	0.08	0.46	0.16	3,365
Hauling	0.05	0.02	1.15	0.36	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	928	928	0.03	0.15	0.04	973
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.29	1.11	1.17	16.4	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,633	4,633	0.06	0.18	5.25	4,694
Vendor	0.13	0.06	2.57	1.00	0.02	0.04	0.69	0.73	0.02	0.19	0.21	—	2,304	2,304	0.05	0.33	1.87	2,404
Hauling	0.04	0.01	0.82	0.25	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	662	662	0.02	0.11	0.53	695
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.24	0.20	0.21	2.99	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	767	767	0.01	0.03	0.87	777
Vendor	0.02	0.01	0.47	0.18	< 0.005	0.01	0.13	0.13	< 0.005	0.03	0.04	—	381	381	0.01	0.05	0.31	398
Hauling	0.01	< 0.005	0.15	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	110	110	< 0.005	0.02	0.09	115

3.14. Building Construction (2030) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.41	1.18	10.8	17.9	0.03	0.32	—	0.32	0.29	—	0.29	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.41	1.18	10.8	17.9	0.03	0.32	—	0.32	0.29	—	0.29	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.01	0.84	7.72	12.8	0.02	0.23	—	0.23	0.21	—	0.21	—	2,256	2,256	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.18	0.15	1.41	2.34	< 0.005	0.04	—	0.04	0.04	—	0.04	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.88	1.63	1.38	27.5	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,877	6,877	0.07	0.26	17.0	6,972
Vendor	0.19	0.08	3.45	1.39	0.03	0.05	0.98	1.03	0.03	0.27	0.30	—	3,224	3,224	0.08	0.46	6.06	3,368
Hauling	0.05	0.02	1.09	0.35	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	927	927	0.03	0.15	1.72	974
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.82	1.56	1.65	22.0	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,380	6,380	0.08	0.26	0.44	6,459
Vendor	0.18	0.08	3.64	1.43	0.03	0.05	0.98	1.03	0.03	0.27	0.30	—	3,226	3,226	0.08	0.46	0.16	3,365
Hauling	0.05	0.02	1.15	0.36	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	928	928	0.03	0.15	0.04	973
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.29	1.11	1.17	16.4	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,633	4,633	0.06	0.18	5.25	4,694
Vendor	0.13	0.06	2.57	1.00	0.02	0.04	0.69	0.73	0.02	0.19	0.21	—	2,304	2,304	0.05	0.33	1.87	2,404
Hauling	0.04	0.01	0.82	0.25	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	662	662	0.02	0.11	0.53	695
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.24	0.20	0.21	2.99	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	767	767	0.01	0.03	0.87	777

Vendor	0.02	0.01	0.47	0.18	< 0.005	0.01	0.13	0.13	< 0.005	0.03	0.04	—	381	381	0.01	0.05	0.31	398
Hauling	0.01	< 0.005	0.15	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	110	110	< 0.005	0.02	0.09	115

3.15. Building Construction (2031) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.38	1.15	10.5	17.9	0.03	0.30	—	0.30	0.27	—	0.27	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.38	1.15	10.5	17.9	0.03	0.30	—	0.30	0.27	—	0.27	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.98	0.82	7.48	12.8	0.02	0.21	—	0.21	0.19	—	0.19	—	2,256	2,256	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.18	0.15	1.37	2.33	< 0.005	0.04	—	0.04	0.04	—	0.04	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.80	1.56	1.37	25.8	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,768	6,768	0.07	0.04	15.1	6,796
Vendor	0.16	0.08	3.30	1.33	0.03	0.05	0.98	1.03	0.03	0.27	0.30	—	3,119	3,119	0.08	0.45	5.29	3,261
Hauling	0.05	0.02	1.06	0.34	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	903	903	0.03	0.14	1.56	947
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.74	1.49	1.64	20.7	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,280	6,280	0.08	0.26	0.39	6,359
Vendor	0.16	0.08	3.49	1.37	0.03	0.05	0.98	1.03	0.03	0.27	0.30	—	3,121	3,121	0.08	0.46	0.14	3,259
Hauling	0.05	0.02	1.12	0.35	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	903	903	0.03	0.14	0.04	946
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.24	1.06	1.15	15.4	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,560	4,560	0.05	0.18	4.67	4,620
Vendor	0.11	0.06	2.47	0.96	0.02	0.04	0.69	0.73	0.02	0.19	0.21	—	2,228	2,228	0.05	0.33	1.63	2,329
Hauling	0.04	0.01	0.80	0.24	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	645	645	0.02	0.10	0.48	676
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.23	0.19	0.21	2.81	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	755	755	0.01	0.03	0.77	765
Vendor	0.02	0.01	0.45	0.18	< 0.005	0.01	0.13	0.13	< 0.005	0.03	0.04	—	369	369	0.01	0.05	0.27	386
Hauling	0.01	< 0.005	0.15	0.04	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	107	107	< 0.005	0.02	0.08	112

3.16. Building Construction (2031) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.38	1.15	10.5	17.9	0.03	0.30	—	0.30	0.27	—	0.27	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.38	1.15	10.5	17.9	0.03	0.30	—	0.30	0.27	—	0.27	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.98	0.82	7.48	12.8	0.02	0.21	—	0.21	0.19	—	0.19	—	2,256	2,256	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.18	0.15	1.37	2.33	< 0.005	0.04	—	0.04	0.04	—	0.04	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.80	1.56	1.37	25.8	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,768	6,768	0.07	0.04	15.1	6,796
Vendor	0.16	0.08	3.30	1.33	0.03	0.05	0.98	1.03	0.03	0.27	0.30	—	3,119	3,119	0.08	0.45	5.29	3,261
Hauling	0.05	0.02	1.06	0.34	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	903	903	0.03	0.14	1.56	947
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.74	1.49	1.64	20.7	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,280	6,280	0.08	0.26	0.39	6,359

Vendor	0.16	0.08	3.49	1.37	0.03	0.05	0.98	1.03	0.03	0.27	0.30	—	3,121	3,121	0.08	0.46	0.14	3,259
Hauling	0.05	0.02	1.12	0.35	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	903	903	0.03	0.14	0.04	946
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.24	1.06	1.15	15.4	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,560	4,560	0.05	0.18	4.67	4,620
Vendor	0.11	0.06	2.47	0.96	0.02	0.04	0.69	0.73	0.02	0.19	0.21	—	2,228	2,228	0.05	0.33	1.63	2,329
Hauling	0.04	0.01	0.80	0.24	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	645	645	0.02	0.10	0.48	676
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.23	0.19	0.21	2.81	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	755	755	0.01	0.03	0.77	765
Vendor	0.02	0.01	0.45	0.18	< 0.005	0.01	0.13	0.13	< 0.005	0.03	0.04	—	369	369	0.01	0.05	0.27	386
Hauling	0.01	< 0.005	0.15	0.04	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	107	107	< 0.005	0.02	0.08	112

3.17. Building Construction (2032) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.34	1.13	10.2	17.8	0.03	0.27	—	0.27	0.25	—	0.25	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.34	1.13	10.2	17.8	0.03	0.27	—	0.27	0.25	—	0.25	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.96	0.81	7.30	12.8	0.02	0.20	—	0.20	0.18	—	0.18	—	2,262	2,262	0.09	0.02	—	2,270
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.18	0.15	1.33	2.33	< 0.005	0.04	—	0.04	0.03	—	0.03	—	375	375	0.02	< 0.005	—	376
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.72	1.48	1.14	24.3	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,670	6,670	0.06	0.04	13.3	6,696
Vendor	0.16	0.08	3.18	1.30	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	3,015	3,015	0.08	0.43	4.56	3,149
Hauling	0.04	0.02	1.04	0.33	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	879	879	0.03	0.14	1.40	924
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.67	1.42	1.39	19.5	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,190	6,190	0.07	0.26	0.35	6,268
Vendor	0.16	0.08	3.37	1.31	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	3,018	3,018	0.08	0.43	0.12	3,148
Hauling	0.04	0.02	1.09	0.34	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	880	880	0.03	0.14	0.04	923
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.20	1.02	0.99	14.5	0.00	0.00	4.99	4.99	0.00	1.17	1.17	—	4,507	4,507	0.05	0.03	4.12	4,520
Vendor	0.11	0.06	2.37	0.95	0.02	0.02	0.69	0.71	0.02	0.19	0.21	—	2,160	2,160	0.05	0.31	1.41	2,255
Hauling	0.03	0.01	0.77	0.24	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	630	630	0.02	0.10	0.43	661
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.22	0.19	0.18	2.65	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	746	746	0.01	< 0.005	0.68	748

Vendor	0.02	0.01	0.43	0.17	< 0.005	< 0.005	0.13	0.13	< 0.005	0.04	0.04	—	358	358	0.01	0.05	0.23	373
Hauling	0.01	< 0.005	0.14	0.04	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	104	104	< 0.005	0.02	0.07	109

3.18. Building Construction (2032) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.34	1.13	10.2	17.8	0.03	0.27	—	0.27	0.25	—	0.25	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.34	1.13	10.2	17.8	0.03	0.27	—	0.27	0.25	—	0.25	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.96	0.81	7.30	12.8	0.02	0.20	—	0.20	0.18	—	0.18	—	2,262	2,262	0.09	0.02	—	2,270
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.18	0.15	1.33	2.33	< 0.005	0.04	—	0.04	0.03	—	0.03	—	375	375	0.02	< 0.005	—	376
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.72	1.48	1.14	24.3	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,670	6,670	0.06	0.04	13.3	6,696
Vendor	0.16	0.08	3.18	1.30	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	3,015	3,015	0.08	0.43	4.56	3,149
Hauling	0.04	0.02	1.04	0.33	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	879	879	0.03	0.14	1.40	924
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.67	1.42	1.39	19.5	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,190	6,190	0.07	0.26	0.35	6,268
Vendor	0.16	0.08	3.37	1.31	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	3,018	3,018	0.08	0.43	0.12	3,148
Hauling	0.04	0.02	1.09	0.34	0.01	0.02	0.28	0.30	0.01	0.08	0.09	—	880	880	0.03	0.14	0.04	923
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.20	1.02	0.99	14.5	0.00	0.00	4.99	4.99	0.00	1.17	1.17	—	4,507	4,507	0.05	0.03	4.12	4,520
Vendor	0.11	0.06	2.37	0.95	0.02	0.02	0.69	0.71	0.02	0.19	0.21	—	2,160	2,160	0.05	0.31	1.41	2,255
Hauling	0.03	0.01	0.77	0.24	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	630	630	0.02	0.10	0.43	661
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.22	0.19	0.18	2.65	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	746	746	0.01	< 0.005	0.68	748
Vendor	0.02	0.01	0.43	0.17	< 0.005	< 0.005	0.13	0.13	< 0.005	0.04	0.04	—	358	358	0.01	0.05	0.23	373
Hauling	0.01	< 0.005	0.14	0.04	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	104	104	< 0.005	0.02	0.07	109

3.19. Building Construction (2033) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.32	1.10	9.95	17.8	0.03	0.25	—	0.25	0.23	—	0.23	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.32	1.10	9.95	17.8	0.03	0.25	—	0.25	0.23	—	0.23	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.94	0.79	7.10	12.7	0.02	0.18	—	0.18	0.16	—	0.16	—	2,256	2,256	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.17	0.14	1.30	2.32	< 0.005	0.03	—	0.03	0.03	—	0.03	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.44	1.42	1.13	23.0	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,583	6,583	0.06	0.04	11.7	6,606
Vendor	0.16	0.08	3.07	1.25	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	2,915	2,915	0.08	0.43	3.90	3,049
Hauling	0.04	0.02	1.01	0.33	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	858	858	0.03	0.14	1.23	901
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.41	1.37	1.38	18.4	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,108	6,108	0.07	0.04	0.30	6,121

Vendor	0.16	0.08	3.23	1.29	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	2,918	2,918	0.08	0.43	0.10	3,048
Hauling	0.04	0.02	1.07	0.33	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	859	859	0.03	0.14	0.03	900
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.99	0.97	0.82	13.7	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,435	4,435	0.05	0.03	3.61	4,448
Vendor	0.11	0.06	2.28	0.90	0.02	0.02	0.69	0.71	0.02	0.19	0.21	—	2,083	2,083	0.05	0.31	1.20	2,177
Hauling	0.03	0.01	0.75	0.24	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	613	613	0.02	0.10	0.38	643
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.18	0.18	0.15	2.50	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	734	734	0.01	< 0.005	0.60	736
Vendor	0.02	0.01	0.42	0.16	< 0.005	< 0.005	0.13	0.13	< 0.005	0.03	0.04	—	345	345	0.01	0.05	0.20	360
Hauling	0.01	< 0.005	0.14	0.04	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	102	102	< 0.005	0.02	0.06	106

3.20. Building Construction (2033) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.32	1.10	9.95	17.8	0.03	0.25	—	0.25	0.23	—	0.23	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.32	1.10	9.95	17.8	0.03	0.25	—	0.25	0.23	—	0.23	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.94	0.79	7.10	12.7	0.02	0.18	—	0.18	0.16	—	0.16	—	2,256	2,256	0.09	0.02	—	2,264
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.17	0.14	1.30	2.32	< 0.005	0.03	—	0.03	0.03	—	0.03	—	374	374	0.02	< 0.005	—	375
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.44	1.42	1.13	23.0	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,583	6,583	0.06	0.04	11.7	6,606
Vendor	0.16	0.08	3.07	1.25	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	2,915	2,915	0.08	0.43	3.90	3,049
Hauling	0.04	0.02	1.01	0.33	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	858	858	0.03	0.14	1.23	901
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.41	1.37	1.38	18.4	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,108	6,108	0.07	0.04	0.30	6,121
Vendor	0.16	0.08	3.23	1.29	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	2,918	2,918	0.08	0.43	0.10	3,048
Hauling	0.04	0.02	1.07	0.33	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	859	859	0.03	0.14	0.03	900
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.99	0.97	0.82	13.7	0.00	0.00	4.97	4.97	0.00	1.16	1.16	—	4,435	4,435	0.05	0.03	3.61	4,448
Vendor	0.11	0.06	2.28	0.90	0.02	0.02	0.69	0.71	0.02	0.19	0.21	—	2,083	2,083	0.05	0.31	1.20	2,177
Hauling	0.03	0.01	0.75	0.24	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	613	613	0.02	0.10	0.38	643
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.18	0.18	0.15	2.50	0.00	0.00	0.91	0.91	0.00	0.21	0.21	—	734	734	0.01	< 0.005	0.60	736

Vendor	0.02	0.01	0.42	0.16	< 0.005	< 0.005	0.13	0.13	< 0.005	0.03	0.04	—	345	345	0.01	0.05	0.20	360
Hauling	0.01	< 0.005	0.14	0.04	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	102	102	< 0.005	0.02	0.06	106

3.21. Building Construction (2034) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.30	1.09	9.77	17.8	0.03	0.23	—	0.23	0.22	—	0.22	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.30	1.09	9.77	17.8	0.03	0.23	—	0.23	0.22	—	0.22	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.48	0.40	3.60	6.55	0.01	0.09	—	0.09	0.08	—	0.08	—	1,162	1,162	0.05	0.01	—	1,166
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.07	0.66	1.19	< 0.005	0.02	—	0.02	0.01	—	0.01	—	192	192	0.01	< 0.005	—	193
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.37	1.35	0.90	21.8	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,501	6,501	0.06	0.04	10.2	6,524
Vendor	0.16	0.08	2.97	1.22	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	2,820	2,820	0.07	0.40	3.31	2,945
Hauling	0.04	0.02	0.99	0.32	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	839	839	0.03	0.14	1.08	882
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.34	1.30	1.15	17.4	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,033	6,033	0.07	0.04	0.26	6,045
Vendor	0.16	0.07	3.14	1.26	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	2,823	2,823	0.07	0.40	0.09	2,945
Hauling	0.04	0.02	1.04	0.32	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	840	840	0.02	0.14	0.03	881
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.48	0.42	6.67	0.00	0.00	2.56	2.56	0.00	0.60	0.60	—	2,256	2,256	0.02	0.01	1.62	2,262
Vendor	0.06	0.03	1.14	0.45	0.01	0.01	0.36	0.37	0.01	0.10	0.11	—	1,038	1,038	0.03	0.15	0.53	1,083
Hauling	0.02	0.01	0.38	0.12	< 0.005	< 0.005	0.10	0.11	< 0.005	0.03	0.03	—	309	309	0.01	0.05	0.17	324
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.09	0.09	0.08	1.22	0.00	0.00	0.47	0.47	0.00	0.11	0.11	—	374	374	< 0.005	< 0.005	0.27	375
Vendor	0.01	0.01	0.21	0.08	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	172	172	< 0.005	0.02	0.09	179
Hauling	< 0.005	< 0.005	0.07	0.02	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	51.1	51.1	< 0.005	0.01	0.03	53.7

3.22. Building Construction (2034) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.30	1.09	9.77	17.8	0.03	0.23	—	0.23	0.22	—	0.22	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.30	1.09	9.77	17.8	0.03	0.23	—	0.23	0.22	—	0.22	—	3,158	3,158	0.13	0.03	—	3,169
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.48	0.40	3.60	6.55	0.01	0.09	—	0.09	0.08	—	0.08	—	1,162	1,162	0.05	0.01	—	1,166
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.07	0.66	1.19	< 0.005	0.02	—	0.02	0.01	—	0.01	—	192	192	0.01	< 0.005	—	193
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.37	1.35	0.90	21.8	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,501	6,501	0.06	0.04	10.2	6,524
Vendor	0.16	0.08	2.97	1.22	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	2,820	2,820	0.07	0.40	3.31	2,945
Hauling	0.04	0.02	0.99	0.32	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	839	839	0.03	0.14	1.08	882
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	1.34	1.30	1.15	17.4	0.00	0.00	7.04	7.04	0.00	1.65	1.65	—	6,033	6,033	0.07	0.04	0.26	6,045

Vendor	0.16	0.07	3.14	1.26	0.03	0.03	0.98	1.00	0.03	0.27	0.30	—	2,823	2,823	0.07	0.40	0.09	2,945
Hauling	0.04	0.02	1.04	0.32	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	840	840	0.02	0.14	0.03	881
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.48	0.42	6.67	0.00	0.00	2.56	2.56	0.00	0.60	0.60	—	2,256	2,256	0.02	0.01	1.62	2,262
Vendor	0.06	0.03	1.14	0.45	0.01	0.01	0.36	0.37	0.01	0.10	0.11	—	1,038	1,038	0.03	0.15	0.53	1,083
Hauling	0.02	0.01	0.38	0.12	< 0.005	< 0.005	0.10	0.11	< 0.005	0.03	0.03	—	309	309	0.01	0.05	0.17	324
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.09	0.09	0.08	1.22	0.00	0.00	0.47	0.47	0.00	0.11	0.11	—	374	374	< 0.005	< 0.005	0.27	375
Vendor	0.01	0.01	0.21	0.08	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	172	172	< 0.005	0.02	0.09	179
Hauling	< 0.005	< 0.005	0.07	0.02	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	51.1	51.1	< 0.005	0.01	0.03	53.7

3.23. Paving (2034) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.68	0.58	5.86	9.82	0.01	0.18	—	0.18	0.16	—	0.16	—	1,511	1,511	0.06	0.01	—	1,516
Paving	—	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.68	0.58	5.86	9.82	0.01	0.18	—	0.18	0.16	—	0.16	—	1,511	1,511	0.06	0.01	—	1,516
Paving	—	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.12	1.20	2.02	< 0.005	0.04	—	0.04	0.03	—	0.03	—	310	310	0.01	< 0.005	—	311
Paving	—	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.22	0.37	< 0.005	0.01	—	0.01	0.01	—	0.01	—	51.4	51.4	< 0.005	< 0.005	—	51.6
Paving	—	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.02	0.61	0.00	0.00	0.20	0.20	0.00	0.05	0.05	—	181	181	< 0.005	< 0.005	0.28	182
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	0.02	0.99	0.32	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	839	839	0.03	0.14	1.08	882
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.48	0.00	0.00	0.20	0.20	0.00	0.05	0.05	—	168	168	< 0.005	< 0.005	0.01	168
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	0.02	1.04	0.32	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	840	840	0.02	0.14	0.03	881
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.1	35.1	< 0.005	< 0.005	0.03	35.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.01	< 0.005	0.21	0.07	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	173	173	0.01	0.03	0.10	181
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.81	5.81	< 0.005	< 0.005	< 0.005	5.83
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.01	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	28.6	28.6	< 0.005	< 0.005	0.02	30.0

3.24. Paving (2034) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.68	0.58	5.86	9.82	0.01	0.18	—	0.18	0.16	—	0.16	—	1,511	1,511	0.06	0.01	—	1,516
Paving	—	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.68	0.58	5.86	9.82	0.01	0.18	—	0.18	0.16	—	0.16	—	1,511	1,511	0.06	0.01	—	1,516
Paving	—	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.12	1.20	2.02	< 0.005	0.04	—	0.04	0.03	—	0.03	—	310	310	0.01	< 0.005	—	311
Paving	—	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.22	0.37	< 0.005	0.01	—	0.01	0.01	—	0.01	—	51.4	51.4	< 0.005	< 0.005	—	51.6
Paving	—	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.02	0.61	0.00	0.00	0.20	0.20	0.00	0.05	0.05	—	181	181	< 0.005	< 0.005	0.28	182
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	0.02	0.99	0.32	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	839	839	0.03	0.14	1.08	882
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.48	0.00	0.00	0.20	0.20	0.00	0.05	0.05	—	168	168	< 0.005	< 0.005	0.01	168
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	0.02	1.04	0.32	0.01	0.01	0.28	0.29	0.01	0.08	0.09	—	840	840	0.02	0.14	0.03	881
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.1	35.1	< 0.005	< 0.005	0.03	35.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.21	0.07	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	173	173	0.01	0.03	0.10	181
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.81	5.81	< 0.005	< 0.005	< 0.005	5.83
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.01	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	28.6	28.6	< 0.005	< 0.005	0.02	30.0

3.25. Architectural Coating (2034) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.76	1.10	< 0.005	0.01	—	0.01	0.01	—	0.01	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	—	360	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.10	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.3	18.3	< 0.005	< 0.005	—	18.4
Architectural Coatings	—	49.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.03	3.03	< 0.005	< 0.005	—	3.04
Architectural Coatings	—	9.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.27	0.26	0.23	3.47	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,207	1,207	0.01	0.01	0.05	1,209
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.50	0.00	0.00	0.19	0.19	0.00	0.04	0.04	—	168	168	< 0.005	< 0.005	0.12	168
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	27.8	27.8	< 0.005	< 0.005	0.02	27.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.26. Architectural Coating (2034) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.76	1.10	< 0.005	0.01	—	0.01	0.01	—	0.01	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	—	360	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.10	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.3	18.3	< 0.005	< 0.005	—	18.4
Architectural Coatings	—	49.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.03	3.03	< 0.005	< 0.005	—	3.04
Architectural Coatings	—	9.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.27	0.26	0.23	3.47	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,207	1,207	0.01	0.01	0.05	1,209

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.50	0.00	0.00	0.19	0.19	0.00	0.04	0.04	—	168	168	< 0.005	< 0.005	0.12	168
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	27.8	27.8	< 0.005	< 0.005	0.02	27.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.27. Architectural Coating (2035) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.76	1.10	< 0.005	0.01	—	0.01	0.01	—	0.01	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	—	360	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	8.62	8.62	< 0.005	< 0.005	—	8.65
Architectural Coatings	—	23.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.43	1.43	< 0.005	< 0.005	—	1.43
Architectural Coatings	—	4.24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.26	0.26	0.23	3.30	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,193	1,193	0.01	0.01	0.05	1,195
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.22	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	78.3	78.3	< 0.005	< 0.005	0.05	78.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	13.0	13.0	< 0.005	< 0.005	0.01	13.0

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.28. Architectural Coating (2035) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.76	1.10	< 0.005	0.01	—	0.01	0.01	—	0.01	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	—	360	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	8.62	8.62	< 0.005	< 0.005	—	8.65
Architectural Coatings	—	23.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.43	1.43	< 0.005	< 0.005	—	1.43

Architectural Coatings	—	4.24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.26	0.26	0.23	3.30	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,193	1,193	0.01	0.01	0.05	1,195
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.22	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	78.3	78.3	< 0.005	< 0.005	0.05	78.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	13.0	13.0	< 0.005	< 0.005	0.01	13.0
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.1.2. Mitigated

Mobile source emissions results are presented in Sections 2.5. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	2,833	2,833	0.21	0.03	—	2,846
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	2,731	2,731	0.20	0.02	—	2,743
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	1,233	1,233	0.09	0.01	—	1,239
City Park	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	6,797	6,797	0.49	0.06	—	6,827
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	2,833	2,833	0.21	0.03	—	2,846
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	2,731	2,731	0.20	0.02	—	2,743
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	1,233	1,233	0.09	0.01	—	1,239
City Park	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	6,797	6,797	0.49	0.06	—	6,827
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	469	469	0.03	< 0.005	—	471
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	452	452	0.03	< 0.005	—	454
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	204	204	0.01	< 0.005	—	205
City Park	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	1,125	1,125	0.08	0.01	—	1,130

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	2,833	2,833	0.21	0.03	—	2,846
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	2,731	2,731	0.20	0.02	—	2,743
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	1,233	1,233	0.09	0.01	—	1,239
City Park	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	6,797	6,797	0.49	0.06	—	6,827
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	2,833	2,833	0.21	0.03	—	2,846
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	2,731	2,731	0.20	0.02	—	2,743
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	1,233	1,233	0.09	0.01	—	1,239
City Park	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

Total	—	—	—	—	—	—	—	—	—	—	—	—	6,797	6,797	0.49	0.06	—	6,827
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	469	469	0.03	< 0.005	—	471
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	452	452	0.03	< 0.005	—	454
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	204	204	0.01	< 0.005	—	205
City Park	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	1,125	1,125	0.08	0.01	—	1,130

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	0.43	0.21	3.65	1.55	0.02	0.30	—	0.30	0.30	—	0.30	—	4,638	4,638	0.41	0.01	—	4,651
Strip Mall	0.03	0.02	0.29	0.25	< 0.005	0.02	—	0.02	0.02	—	0.02	—	349	349	0.03	< 0.005	—	350
Hotel	0.06	0.03	0.55	0.46	< 0.005	0.04	—	0.04	0.04	—	0.04	—	660	660	0.06	< 0.005	—	661
City Park	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	5,646	5,646	0.50	0.01	—	5,662
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	0.43	0.21	3.65	1.55	0.02	0.30	—	0.30	0.30	—	0.30	—	4,638	4,638	0.41	0.01	—	4,651
Strip Mall	0.03	0.02	0.29	0.25	< 0.005	0.02	—	0.02	0.02	—	0.02	—	349	349	0.03	< 0.005	—	350

Hotel	0.06	0.03	0.55	0.46	< 0.005	0.04	—	0.04	0.04	—	0.04	—	660	660	0.06	< 0.005	—	661
City Park	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	5,646	5,646	0.50	0.01	—	5,662
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	0.08	0.04	0.67	0.28	< 0.005	0.05	—	0.05	0.05	—	0.05	—	768	768	0.07	< 0.005	—	770
Strip Mall	0.01	< 0.005	0.05	0.04	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	57.7	57.7	0.01	< 0.005	—	57.9
Hotel	0.01	0.01	0.10	0.08	< 0.005	0.01	—	0.01	0.01	—	0.01	—	109	109	0.01	< 0.005	—	109
City Park	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.09	0.05	0.82	0.41	0.01	0.07	—	0.07	0.07	—	0.07	—	935	935	0.08	< 0.005	—	937

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	0.43	0.21	3.65	1.55	0.02	0.30	—	0.30	0.30	—	0.30	—	4,638	4,638	0.41	0.01	—	4,651
Strip Mall	0.03	0.02	0.29	0.25	< 0.005	0.02	—	0.02	0.02	—	0.02	—	349	349	0.03	< 0.005	—	350
Hotel	0.06	0.03	0.55	0.46	< 0.005	0.04	—	0.04	0.04	—	0.04	—	660	660	0.06	< 0.005	—	661
City Park	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	5,646	5,646	0.50	0.01	—	5,662
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Condo/Townhouse	0.43	0.21	3.65	1.55	0.02	0.30	—	0.30	0.30	—	0.30	—	4,638	4,638	0.41	0.01	—	4,651
Strip Mall	0.03	0.02	0.29	0.25	< 0.005	0.02	—	0.02	0.02	—	0.02	—	349	349	0.03	< 0.005	—	350
Hotel	0.06	0.03	0.55	0.46	< 0.005	0.04	—	0.04	0.04	—	0.04	—	660	660	0.06	< 0.005	—	661
City Park	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.52	0.26	4.50	2.26	0.03	0.36	—	0.36	0.36	—	0.36	—	5,646	5,646	0.50	0.01	—	5,662
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	0.08	0.04	0.67	0.28	< 0.005	0.05	—	0.05	0.05	—	0.05	—	768	768	0.07	< 0.005	—	770
Strip Mall	0.01	< 0.005	0.05	0.04	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	57.7	57.7	0.01	< 0.005	—	57.9
Hotel	0.01	0.01	0.10	0.08	< 0.005	0.01	—	0.01	0.01	—	0.01	—	109	109	0.01	< 0.005	—	109
City Park	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.09	0.05	0.82	0.41	0.01	0.07	—	0.07	0.07	—	0.07	—	935	935	0.08	< 0.005	—	937

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hearths	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Consumer Products	—	20.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	1.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Landscape Equipment	5.48	5.13	0.43	47.5	< 0.005	0.04	—	0.04	0.03	—	0.03	—	146	146	0.01	< 0.005	—	146
Total	5.48	27.2	0.43	47.5	< 0.005	0.04	—	0.04	0.03	—	0.03	0.00	146	146	0.01	< 0.005	—	146
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hearths	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Consumer Products	—	20.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	1.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	0.00	22.0	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hearths	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Consumer Products	—	3.68	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.34	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.49	0.46	0.04	4.28	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.9	11.9	< 0.005	< 0.005	—	11.9
Total	0.49	4.48	0.04	4.28	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	0.00	11.9	11.9	< 0.005	< 0.005	—	11.9

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hearths	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Consumer Products	—	20.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	1.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	5.48	5.13	0.43	47.5	< 0.005	0.04	—	0.04	0.03	—	0.03	—	146	146	0.01	< 0.005	—	146
Total	5.48	27.2	0.43	47.5	< 0.005	0.04	—	0.04	0.03	—	0.03	0.00	146	146	0.01	< 0.005	—	146
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hearths	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Consumer Products	—	20.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	1.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	0.00	22.0	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hearths	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Consumer Products	—	3.68	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.34	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Landscape	0.49	0.46	0.04	4.28	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.9	11.9	< 0.005	< 0.005	—	11.9
Total	0.49	4.48	0.04	4.28	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	0.00	11.9	11.9	< 0.005	< 0.005	—	11.9

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	40.9	124	165	4.20	0.10	—	300
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	31.4	95.4	127	3.22	0.08	—	230
Hotel	—	—	—	—	—	—	—	—	—	—	—	7.29	22.2	29.5	0.75	0.02	—	53.6
City Park	—	—	—	—	—	—	—	—	—	—	—	0.00	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005
Total	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	40.9	124	165	4.20	0.10	—	300
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	31.4	95.4	127	3.22	0.08	—	230
Hotel	—	—	—	—	—	—	—	—	—	—	—	7.29	22.2	29.5	0.75	0.02	—	53.6
City Park	—	—	—	—	—	—	—	—	—	—	—	0.00	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005
Total	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Condo/T	—	—	—	—	—	—	—	—	—	—	—	6.77	20.6	27.3	0.70	0.02	—	49.7
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	5.19	15.8	21.0	0.53	0.01	—	38.1
Hotel	—	—	—	—	—	—	—	—	—	—	—	1.21	3.67	4.88	0.12	< 0.005	—	8.87
City Park	—	—	—	—	—	—	—	—	—	—	—	0.00	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005
Total	—	—	—	—	—	—	—	—	—	—	—	13.2	40.0	53.2	1.35	0.03	—	96.7

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	40.9	124	165	4.20	0.10	—	300
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	31.4	95.4	127	3.22	0.08	—	230
Hotel	—	—	—	—	—	—	—	—	—	—	—	7.29	22.2	29.5	0.75	0.02	—	53.6
City Park	—	—	—	—	—	—	—	—	—	—	—	0.00	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005
Total	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	40.9	124	165	4.20	0.10	—	300
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	31.4	95.4	127	3.22	0.08	—	230
Hotel	—	—	—	—	—	—	—	—	—	—	—	7.29	22.2	29.5	0.75	0.02	—	53.6
City Park	—	—	—	—	—	—	—	—	—	—	—	0.00	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005
Total	—	—	—	—	—	—	—	—	—	—	—	79.5	242	321	8.17	0.20	—	584
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Condo/T	—	—	—	—	—	—	—	—	—	—	—	6.77	20.6	27.3	0.70	0.02	—	49.7
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	5.19	15.8	21.0	0.53	0.01	—	38.1
Hotel	—	—	—	—	—	—	—	—	—	—	—	1.21	3.67	4.88	0.12	< 0.005	—	8.87
City Park	—	—	—	—	—	—	—	—	—	—	—	0.00	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005
Total	—	—	—	—	—	—	—	—	—	—	—	13.2	40.0	53.2	1.35	0.03	—	96.7

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	242	0.00	242	24.1	0.00	—	845
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	125	0.00	125	12.5	0.00	—	437
Hotel	—	—	—	—	—	—	—	—	—	—	—	44.3	0.00	44.3	4.42	0.00	—	155
City Park	—	—	—	—	—	—	—	—	—	—	—	0.07	0.00	0.07	0.01	0.00	—	0.26
Total	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	242	0.00	242	24.1	0.00	—	845
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	125	0.00	125	12.5	0.00	—	437
Hotel	—	—	—	—	—	—	—	—	—	—	—	44.3	0.00	44.3	4.42	0.00	—	155
City Park	—	—	—	—	—	—	—	—	—	—	—	0.07	0.00	0.07	0.01	0.00	—	0.26

Total	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	40.0	0.00	40.0	4.00	0.00	—	140
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	20.7	0.00	20.7	2.07	0.00	—	72.4
Hotel	—	—	—	—	—	—	—	—	—	—	—	7.33	0.00	7.33	0.73	0.00	—	25.6
City Park	—	—	—	—	—	—	—	—	—	—	—	0.01	0.00	0.01	< 0.005	0.00	—	0.04
Total	—	—	—	—	—	—	—	—	—	—	—	68.0	0.00	68.0	6.80	0.00	—	238

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	242	0.00	242	24.1	0.00	—	845
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	125	0.00	125	12.5	0.00	—	437
Hotel	—	—	—	—	—	—	—	—	—	—	—	44.3	0.00	44.3	4.42	0.00	—	155
City Park	—	—	—	—	—	—	—	—	—	—	—	0.07	0.00	0.07	0.01	0.00	—	0.26
Total	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	242	0.00	242	24.1	0.00	—	845
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	125	0.00	125	12.5	0.00	—	437

Hotel	—	—	—	—	—	—	—	—	—	—	—	44.3	0.00	44.3	4.42	0.00	—	155
City Park	—	—	—	—	—	—	—	—	—	—	—	0.07	0.00	0.07	0.01	0.00	—	0.26
Total	—	—	—	—	—	—	—	—	—	—	—	411	0.00	411	41.1	0.00	—	1,438
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	40.0	0.00	40.0	4.00	0.00	—	140
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	20.7	0.00	20.7	2.07	0.00	—	72.4
Hotel	—	—	—	—	—	—	—	—	—	—	—	7.33	0.00	7.33	0.73	0.00	—	25.6
City Park	—	—	—	—	—	—	—	—	—	—	—	0.01	0.00	0.01	< 0.005	0.00	—	0.04
Total	—	—	—	—	—	—	—	—	—	—	—	68.0	0.00	68.0	6.80	0.00	—	238

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.56	4.56
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.38	1.38
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	133	133
City Park	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Condo/T	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.56	4.56
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.38	1.38
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	133	133
City Park	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.75	0.75
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.23	0.23
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	22.0	22.0
City Park	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23.0	23.0

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.56	4.56
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.38	1.38
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	133	133
City Park	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Condo/T	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.56	4.56
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.38	1.38
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	133	133
City Park	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	139	139
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Condo/Townhouse	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.75	0.75
Strip Mall	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.23	0.23
Hotel	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	22.0	22.0
City Park	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23.0	23.0

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	1/6/2025	4/25/2025	5.00	80.0	—
Building Construction	Building Construction	4/28/2025	7/7/2034	5.00	2,400	—
Paving	Paving	7/10/2034	10/20/2034	5.00	75.0	—
Architectural Coating	Architectural Coating	10/23/2034	2/2/2035	5.00	75.0	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Average	3.00	8.00	367	0.40
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	4.00	8.00	84.0	0.37

Building Construction	Cranes	Diesel	Average	1.00	7.00	367	0.29
Building Construction	Forklifts	Diesel	Average	3.00	8.00	82.0	0.20
Building Construction	Generator Sets	Diesel	Average	1.00	8.00	14.0	0.74
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	6.00	7.00	84.0	0.37
Building Construction	Welders	Diesel	Average	1.00	8.00	46.0	0.45
Paving	Pavers	Diesel	Average	2.00	8.00	81.0	0.42
Paving	Paving Equipment	Diesel	Average	2.00	8.00	89.0	0.36
Paving	Rollers	Diesel	Average	2.00	8.00	36.0	0.38
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Average	3.00	8.00	367	0.40
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	4.00	8.00	84.0	0.37
Building Construction	Cranes	Diesel	Average	1.00	7.00	367	0.29
Building Construction	Forklifts	Diesel	Average	3.00	8.00	82.0	0.20
Building Construction	Generator Sets	Diesel	Average	1.00	8.00	14.0	0.74
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	6.00	7.00	84.0	0.37
Building Construction	Welders	Diesel	Average	1.00	8.00	46.0	0.45
Paving	Pavers	Diesel	Average	2.00	8.00	81.0	0.42
Paving	Paving Equipment	Diesel	Average	2.00	8.00	89.0	0.36
Paving	Rollers	Diesel	Average	2.00	8.00	36.0	0.38
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—
Site Preparation	Worker	17.5	18.5	LDA,LDT1,LDT2
Site Preparation	Vendor	—	10.2	HHDT,MHDT
Site Preparation	Hauling	15.0	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	538	18.5	LDA,LDT1,LDT2
Building Construction	Vendor	114	10.2	HHDT,MHDT
Building Construction	Hauling	15.0	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	15.0	18.5	LDA,LDT1,LDT2
Paving	Vendor	—	10.2	HHDT,MHDT
Paving	Hauling	15.0	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	108	18.5	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	10.2	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—

Site Preparation	Worker	17.5	18.5	LDA,LDT1,LDT2
Site Preparation	Vendor	—	10.2	HHDT,MHDT
Site Preparation	Hauling	15.0	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	538	18.5	LDA,LDT1,LDT2
Building Construction	Vendor	114	10.2	HHDT,MHDT
Building Construction	Hauling	15.0	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	15.0	18.5	LDA,LDT1,LDT2
Paving	Vendor	—	10.2	HHDT,MHDT
Paving	Hauling	15.0	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	108	18.5	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	10.2	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Architectural Coating	1,287,900	429,300	458,850	152,950	—

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (cy)	Material Exported (cy)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	—	120	0.00	—
Paving	0.00	0.00	0.00	0.00	0.00

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	2	61%	61%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Condo/Townhouse	—	0%
Strip Mall	0.00	0%
Hotel	0.00	0%
City Park	0.00	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	453	0.03	< 0.005
2026	0.00	453	0.03	< 0.005
2027	0.00	453	0.03	< 0.005

2028	0.00	453	0.03	< 0.005
2029	0.00	453	0.03	< 0.005
2030	0.00	453	0.03	< 0.005
2031	0.00	453	0.03	< 0.005
2032	0.00	453	0.03	< 0.005
2033	0.00	453	0.03	< 0.005
2034	0.00	453	0.03	< 0.005
2035	0.00	453	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	16,510	18,905	7,758	5,694,678	158,496	181,488	74,477	54,668,918

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	16,510	18,905	7,758	5,694,678	158,496	181,488	74,477	54,668,918

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

Hearth Type	Unmitigated (number)
Condo/Townhouse	—
Wood Fireplaces	0
Gas Fireplaces	0
Propane Fireplaces	0
Electric Fireplaces	0
No Fireplaces	0
Conventional Wood Stoves	0
Catalytic Wood Stoves	0
Non-Catalytic Wood Stoves	0
Pellet Wood Stoves	0

5.10.1.2. Mitigated

Hearth Type	Unmitigated (number)
Condo/Townhouse	—
Wood Fireplaces	0
Gas Fireplaces	0
Propane Fireplaces	0
Electric Fireplaces	0
No Fireplaces	0
Conventional Wood Stoves	0
Catalytic Wood Stoves	0
Non-Catalytic Wood Stoves	0
Pellet Wood Stoves	0

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
1287900	429,300	458,850	152,950	—

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Condo/Townhouse	2,281,592	453	0.0330	0.0040	14,471,406
Strip Mall	2,199,399	453	0.0330	0.0040	1,087,743
Hotel	993,046	453	0.0330	0.0040	2,057,905
City Park	0.00	453	0.0330	0.0040	0.00

5.11.2. Mitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Condo/Townhouse	2,281,592	453	0.0330	0.0040	14,471,406
Strip Mall	2,199,399	453	0.0330	0.0040	1,087,743
Hotel	993,046	453	0.0330	0.0040	2,057,905
City Park	0.00	453	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Condo/Townhouse	21,325,902	0.00
Strip Mall	16,362,620	0.00
Hotel	3,805,016	0.00
City Park	0.00	46.1

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Condo/Townhouse	21,325,902	0.00
Strip Mall	16,362,620	0.00
Hotel	3,805,016	0.00
City Park	0.00	46.1

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Condo/Townhouse	448	—
Strip Mall	232	—
Hotel	82.1	—
City Park	0.14	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Condo/Townhouse	448	—
Strip Mall	232	—
Hotel	82.1	—
City Park	0.14	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced
Condo/Townhouse	Average room A/C & Other residential A/C and heat pumps	R-410A	2,088	< 0.005	2.50	2.50	10.0
Condo/Townhouse	Household refrigerators and/or freezers	R-134a	1,430	0.12	0.60	0.00	1.00
Strip Mall	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0
Strip Mall	Stand-alone retail refrigerators and freezers	R-134a	1,430	0.04	1.00	0.00	1.00
Strip Mall	Walk-in refrigerators and freezers	R-404A	3,922	< 0.005	7.50	7.50	20.0
Hotel	Household refrigerators and/or freezers	R-134a	1,430	0.00	0.60	0.00	1.00
Hotel	Other commercial A/C and heat pumps	R-410A	2,088	1.80	4.00	4.00	18.0
Hotel	Walk-in refrigerators and freezers	R-404A	3,922	< 0.005	7.50	7.50	20.0
City Park	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0
City Park	Stand-alone retail refrigerators and freezers	R-134a	1,430	0.04	1.00	0.00	1.00

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced
Condo/Townhouse	Average room A/C & Other residential A/C and heat pumps	R-410A	2,088	< 0.005	2.50	2.50	10.0
Condo/Townhouse	Household refrigerators and/or freezers	R-134a	1,430	0.12	0.60	0.00	1.00
Strip Mall	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0
Strip Mall	Stand-alone retail refrigerators and freezers	R-134a	1,430	0.04	1.00	0.00	1.00
Strip Mall	Walk-in refrigerators and freezers	R-404A	3,922	< 0.005	7.50	7.50	20.0
Hotel	Household refrigerators and/or freezers	R-134a	1,430	0.00	0.60	0.00	1.00
Hotel	Other commercial A/C and heat pumps	R-410A	2,088	1.80	4.00	4.00	18.0
Hotel	Walk-in refrigerators and freezers	R-404A	3,922	< 0.005	7.50	7.50	20.0
City Park	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0
City Park	Stand-alone retail refrigerators and freezers	R-134a	1,430	0.04	1.00	0.00	1.00

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	0.00	annual days of extreme heat
Extreme Precipitation	0.00	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	0.00	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (Radke et al., 2017, CEC-500-2017-008), and consider inundation location and depth for the San Francisco Bay, the Sacramento-San Joaquin River Delta and California coast resulting different increments of sea level rise coupled with extreme storm events. Users may select from four scenarios to view the range in potential inundation depth for the grid cell. The four scenarios are: No rise, 0.5 meter, 1.0 meter, 1.41 meters
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	59.7
AQ-PM	73.4
AQ-DPM	82.5
Drinking Water	92.5
Lead Risk Housing	65.2
Pesticides	0.00
Toxic Releases	72.1
Traffic	66.0
Effect Indicators	—
CleanUp Sites	83.1

Groundwater	87.1
Haz Waste Facilities/Generators	73.1
Impaired Water Bodies	0.00
Solid Waste	42.3
Sensitive Population	—
Asthma	60.7
Cardio-vascular	57.4
Low Birth Weights	43.5
Socioeconomic Factor Indicators	—
Education	77.1
Housing	93.1
Linguistic	87.6
Poverty	81.4
Unemployment	79.7

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	19.79982035
Employed	85.83344027
Median HI	10.32978314
Education	—
Bachelor's or higher	64.6862569
High school enrollment	100
Preschool enrollment	5.684588733
Transportation	—

Auto Access	2.502245605
Active commuting	93.81496215
Social	—
2-parent households	80.6236366
Voting	5.41511613
Neighborhood	—
Alcohol availability	17.56704735
Park access	8.045682022
Retail density	94.5078917
Supermarket access	94.25125112
Tree canopy	34.64647761
Housing	—
Homeownership	3.849608623
Housing habitability	12.07493905
Low-inc homeowner severe housing cost burden	71.74387271
Low-inc renter severe housing cost burden	17.41306301
Uncrowded housing	28.58976004
Health Outcomes	—
Insured adults	17.41306301
Arthritis	71.8
Asthma ER Admissions	42.3
High Blood Pressure	52.5
Cancer (excluding skin)	63.4
Asthma	58.2
Coronary Heart Disease	54.4
Chronic Obstructive Pulmonary Disease	50.7
Diagnosed Diabetes	47.0

Life Expectancy at Birth	86.1
Cognitively Disabled	25.4
Physically Disabled	54.0
Heart Attack ER Admissions	48.3
Mental Health Not Good	42.4
Chronic Kidney Disease	55.3
Obesity	37.0
Pedestrian Injuries	99.7
Physical Health Not Good	40.7
Stroke	51.7
Health Risk Behaviors	—
Binge Drinking	29.5
Current Smoker	40.7
No Leisure Time for Physical Activity	50.7
Climate Change Exposures	—
Wildfire Risk	0.0
SLR Inundation Area	0.0
Children	76.4
Elderly	80.0
English Speaking	6.3
Foreign-born	93.9
Outdoor Workers	42.6
Climate Change Adaptive Capacity	—
Impervious Surface Cover	4.7
Traffic Density	87.6
Traffic Access	87.4
Other Indices	—

Hardship	54.8
Other Decision Support	—
2016 Voting	18.2

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	91.0
Healthy Places Index Score for Project Location (b)	24.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	Yes
Project Located in a Low-Income Community (Assembly Bill 1550)	Yes
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Characteristics: Project Details	Adjusted for Hawaii project
Characteristics: Utility Information	Adjusted for Hawaii project
Land Use	Site specific adjustments
Construction: Construction Phases	project specific estimates

Construction: Off-Road Equipment	project specific estimates
Construction: Trips and VMT	project specific estimates

ECONOMIC AND FISCAL IMPACT ANALYSIS REPORT

APPENDIX M

Economic and Fiscal Impact Study

PROPOSED MAKALAPUA PROJECT DISTRICT

Prepared for:

LILI‘UOKALANI TRUST

December 2023

MUNEKIYO HIRAGA

Planning. Project Management. Sustainable Solutions.

Economic and Fiscal Impact Study

PROPOSED MAKALAPUA PROJECT DISTRICT

Prepared for:

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December 2023

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MUNEKIYO HIRAGA

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INTRODUCTION

I

I. INTRODUCTION

This Economic and Fiscal Impact Study (Study) has been prepared to provide an overview of economic and fiscal impacts of the proposed Makalapua Project District during the development and operational periods. The Liliʻuokalani Trust (LT) proposes the development, enhancement, and refinement of approximately 69.5 acres of land in Kailua-Kona on the island of Hawaiʻi as the Makalapua Project District. LT is a nonprofit public benefit organization dedicated to improving the welfare of orphan and other destitute children in Hawaiʻi. LT manages its landholdings to provide a financial foundation for the perpetual benefit of its beneficiaries.

A. PROJECT OVERVIEW

The Makalapua Project District is a transformative development endeavor aimed at creating a vibrant and sustainable mixed-use community that enhances the local landscape while offering a harmonious blend of residential, commercial, and recreational uses. The Project District will be organized around an interconnected, pedestrian-oriented street network where homes, businesses, and open spaces are intermingled to provide a diverse experience for residents and visitors. The proposed mixed-use project will include approximately 600 residential units with a mix of single-family and multi-family product types including both for-sale and rental units; approximately 220,900 square feet of commercial use which may include grocery, office, retail, civic/community, and food and beverage uses; two (2) hotels providing approximately 150 hotel rooms; and open space features. The project will meet the Kona Village Design Guidelines' open space requirement whereby at least five (5) percent of the project will be open space.

The Makalapua Project District's street network may include the realignment of Makala Boulevard below the Kona Commons Shopping Center to align with the Kailua Park's (Old Airport Park) main access, contingent upon discussions with County agencies. Two (2) north-south extensions (Pawai Place and Maʻa Way) are also planned to be developed and improved within the Project District's interconnected street network. Potential offsite improvements include the widening and restriping of portions of Kuakini Highway and Queen Kaʻahumanu Highway and will be considered in conjunction with the Makalapua Project District.

LT's mission is to serve orphan and destitute children, with preference given to Native Hawaiian children. LT serves approximately 12,000 children annually, providing individual casework, counseling, and assistance through direct and group services and indirectly reaches thousands more through a variety of group and community building projects and collaborations with other community partners. LT intends to be the master developer of the project and will entitle the land for its planned uses and will develop all required infrastructure for the project. At this time, LT intends to sell parcels of land planned for residential uses to home builders and retain parcels planned for commercial uses to be

ground-leased in the future. The Makalapua Project District will create both short-term and long-term values for the Trust and provide financial support in the form of residential sales and ground lease revenue to expand the reach of the programs and services offered.

B. METHODOLOGY

As will be detailed below, the project will generate construction-related spending during the estimated 10-year construction period. Once completed, the project will support the local economy by directly creating jobs and generating new spending. It is noted that LT would bear the costs for infrastructure development and open space facilities, while developer partners would construct individual commercial and hotel buildings under long-term ground leases. LT will also partner with residential developers to develop the planned residential units. The economic and fiscal impact analysis presented herein focuses on the impacts associated with the construction and operation of the proposed Makalapua Project District. As previously noted, sales revenue from for-sale residential parcels and ground lease revenue will provide short-term and long-term revenue sources to support Trust programs for orphan and destitute children. However, the ground lease revenue is not included in the quantitative analysis presented in this analysis.

The development and operational economic impacts of the Makalapua Project District were analyzed using multipliers derived from the *Hawaii State Input-Output Study*: 2017 *Benchmark Report* (State Department of Business, Economic Development, and Tourism, 2022). The State Input-Output Study provides multipliers for direct, indirect, and induced effects for output (dollars), employment, and labor income resulting from an exogenous change in an industry's final demand. Direct effects refer to immediate effects associated with a change in the economy. Indirect effects relate to inter-industry spending or the secondary impacts of a change (i.e. contractor expenditures on construction materials). Induced effects capture household spending impacts generated when people who benefit from direct or indirect impacts spend their income on local goods and services. For the purposes of this analysis, indirect effects and induced effects are combined and referred to collectively as "indirect effects".

Fiscal impacts were analyzed for the State of Hawaiʻi and County of Hawaiʻi general funds during both the construction period and at full build-out of the project. This analysis identifies the key revenues, namely taxes, that the State and County would collect from the proposed project. In addition, the cost of providing government services at the full build-out, which is largely linked to the number of persons served, was also calculated based on the projected increase of onsite population (including visitors and residents).

A summary of the anticipated economic and fiscal impacts for the project during construction and at full build-out is presented in this report. Detailed tables are provided in **Appendix "A"**.

ECONOMIC AND FISCAL IMPACTS FOR DEVELOPMENT

II

II. ECONOMIC AND FISCAL IMPACTS FOR DEVELOPMENT

A. ECONOMIC IMPACTS

The proposed project is estimated to cost approximately $457.0 million for construction over a 10-year development period, including onsite and offsite infrastructure and vertical improvements. The total construction cost translates into average construction expenditures of approximately $45.7 million per year. However, in practice, construction expenditures will vary from year to year. The project is anticipated to create approximately 117 full-time equivalent (FTE) construction related jobs on average per year, with an annual payroll of $9.1 million. In addition to construction expenditures, development activities will generate indirect sales associated with supplying goods and services to construction companies and to the families of construction workers. These indirect sales are expected to average about $36.5 million per year. The project is anticipated to create approximately 180 FTE indirect jobs on average per year, with an annual payroll of $10.0 million. See **Table 1**.

Table 1. Development-Related Economic Impacts

Development Period	10	Years
Construction Cost		
Infrastructure (Onsite/Offsite)	$58,100,000	
Buildings	$398,899,000	
Total Construction Cost	$456,999,500	
Construction Cost, Annual Average	$45,699,900	Per year
Indirect Sales		
Indirect Sales	$36,468,500	Per year
Employment		
Direct Construction Jobs	117	Jobs per year
Indirect Jobs Generated by Construction	180	Jobs per year
Total	297	Jobs per year
Payroll		
Direct Construction Payroll	$9,126,000	Per year
Indirect Jobs Payroll	$10,080,000	Per year
Total	$19,206,000	Per year

B. FISCAL IMPACTS

The primary fiscal impacts during the development period will be related to tax revenues, including General Excise Tax (GET), corporate income tax, personal Income tax, and conveyance tax for the State of Hawai'i and GET surcharge for the County of Hawai'i. Inasmuch as the County and State are not anticipated to bear additional costs as a result of project construction, the project will generate a positive fiscal impact for the State and County during the development period. See **Table 2**.

With regard to fiscal impacts to the State of Hawaiʻi, the project-related construction expenditures would result in GET revenue of $2.4 million per year. Profits of construction companies would result in approximately $201,100.00 in annual Corporate Income Tax revenue, and salaries and wages from construction activities would result in approximately $1.3 million of annual Personal Income Tax revenue for the State.

In addition, conveyance tax is assessed by the State on the sale of real property. The tax rate is based on the sale amount and, for residential developments, whether the property is the buyer's primary residence. For the purpose of this analysis, all for-sale residential units are assumed to be purchased by full-time residents at the Makalapua Project District and are assumed to qualify for the homeowner exemption. With the conveyance tax rates, ranging from 0.10 percent (affordable housing units) to 0.20 percent (market price housing), an annual conveyance tax revenue for the State is anticipated to be $50,200.00 per year over the development period for the for-sale residential product. The cumulative net impact to the State of Hawaiʻi over the 10-year construction period is anticipated to be approximately $39.9 million. Refer to **Table 2**.

Project-related construction expenditures would result in a GET surcharge revenue (0.5 percent) of about $286,100.00 per year or $2.9 million over the 10-year development periods for the County. While not quantified in this analysis, it is noted that the County will also collect permit fees associated with land use and construction permits for the project. Refer to **Table 2**.

Table 2. Development-Related Fiscal Impact

State of Hawaiʻi		
Revenues		
GET	$2,413,600	Per year
Corporate Income Tax	$201,100	Per year
Personal Income Tax	$1,325,200	Per year
Conveyance Tax	$50,200	Per year
Expenditure	n.e.	
Net Impact, Annual Average	$3,990,100	Per year
Net Impact, Cumulative	$39,901,000	
County of Hawaiʻi		
Revenues		
GET Surcharge (0.5%)	$286,100	Per year
Permit Fees	n.e.	
Expenditures	n.e.	
Net Impact, Annual Average	$286,100	Per year
Net Impact, Cumulative	$2,861,000	
n.e. – Not Estimated		

ECONOMIC AND FISCAL IMPACTS AT FULL BUILD-OUT

III

III. ECONOMIC AND FISCAL IMPACTS AT FULL BUILD-OUT

A. ECONOMIC IMPACTS

From a long-term perspective, the project will provide affordable and market-rate housing for residents as well as create new jobs and generate new spending in the local economy. Of 600 units of single-family and multi-family residential units proposed within the Makalapua Project District, approximately 480 units will be market rate units (384 for-sale units and 96 rental units) and 120 units will be affordable units (96 for sale units and 24 rental units) pursuant to Section 11, Hawai'i County Code (HCC). It is noted that the breakdown of rental and for-sale units assessed in this study is preliminary and may be subject to change depending on market conditions. It is anticipated that about 1,685 new residents will be supported by the proposed residential units. In addition, the Makalapua Project District will include two (2) hotels providing approximately 150 hotel rooms. Approximately 226 new visitors will be supported by the proposed hotel rooms at any given day. See **Table 3**. At full build-out, onsite economic activities within the Makalapua Project District are expected to generate about $146.6 million per year in rent revenues and direct sales of commercial, residential, and hotel uses, and consumption expenditures by new residents and visitors of the project. Corresponding profits will amount to about $14.7 million per year. While not quantified herein, it is noted that beyond the direct economic activity that will occur within the Makalapua Project District, additional indirect economic activity will be generated associated with inter-industry spending and household spending by those employed onsite. Thus, the total economic impact associated with the Makalapua Project District would exceed just the direct impacts presented here.

Onsite operating employment is expected to total about 225 FTE jobs, including jobs at commercial and residential uses and hotels. Total payroll for onsite jobs is estimated at about $12.6 million per year. Refer to **Table 3**. Similar to the economic activity, total employment and payroll benefits of the Makalapua Project District will exceed the direct onsite operating employment and payroll when indirect economic activity is accounted for.

Table 3. Economic Impacts at Full Build-Out

Housing Units[1]		
Market Rate Units	480	Units
For Sale Units	384	Units
Rental Units	96	Units
Affordable Units	120	Units
For Sale Units	96	Units
Rental Units	24	Units
Total Housing Units	600	Units
Hotel		
Hotel Rooms	150	Rooms
Increased Onsite Population		
Total New Residents	1,685	People
Average Daily Visitors	226	People
Total	1,911	People
Economic Activities		
Rent Revenue (inc. Residential and Commercial)	$5,578,000	Per year
Direct Sales of New Businesses (incl. Commercial and Hotel Revenues)	$106,476,000	Per year
Net Expenditure by New Residents	$28,224,000	Per year
Net Expenditure by New Visitors	$6,310,500	Per year
Total	$146,588,500	Per year
Employment		
Total Jobs	225	Jobs
Payroll		
Total Payroll	$12,600,000	Per year

[1] It is noted that the breakdown of rental and for-sale units assessed in this study is preliminary and may be subject to change depending on market conditions.

B. FISCAL IMPACTS

At full build-out, the project will generate increased tax revenues to the State of Hawai'i general fund of about $8.3 million. State revenues will include GET, corporate income tax, personal income tax, recurring conveyance tax from resale of residential units (with an assumption that resale occurs every 10 years on average), and Transient Accommodation Tax (TAT) from the hotel room revenues. Increased residents and visitors in the area may translate to increased cost of government. These costs are difficult to estimate as government spending is not linearly related to population and the proposed project is also anticipated to accommodate projected population growth that is anticipated for the County. Nevertheless, an increase in government expenditures is estimated for the purposes of this analysis. Based on conservative assumptions of State General Fund expenditures per defacto population (residents and visitors), the increased onsite population of 1,911 people may increase State general fund expenditures by approximately $7.2 million per year. The increase in tax revenue to the State would exceed anticipated State expenditures for public services. The project will generate a net positive fiscal impact for the State of Hawai'i of approximately $1.1 million per year. See **Table 4**.

The County of Hawai'i will realize increased property tax revenues from the proposed Makalapua Project District. At full build-out, the project is expected to generate approximately $4.5 million in net new property taxes for the County per year. In addition, beginning January 1, 2022, the County of Hawai'i imposes the Hawai'i County Transient Accommodations Tax (HCTAT) on all transient accommodation rentals, including hotels, at a rate of 3.0 percent. The HCTAT revenue for the County is expected to be approximately $278,400.00. The revenue from the onsite sales would result in a GET surcharge revenue of about $732,900.00 per year. It is noted that the proposed project will increase the number of residents and visitors to the County of Hawai'i. As was the case with the State of Hawai'i, the increased onsite population of 1,911 people may increase County general fund expenditures. Using similarly conservative assumptions as was applied with the State, the proposed project may result in an increase of County expenditures of $3.6 million per year. The increase in tax revenue to the County from property taxes, HCTAT, and GET surcharge would exceed anticipated increased County expenditures for various public services such as police, fire, parks and recreation, etc. The Makalapua Project District will generate a net positive fiscal impact for the County of Hawai'i of approximately $1.9 million per year. Refer to **Table 4**.

Table 4. Fiscal Impacts at Full Build-Out

State of Hawai'i		
Revenues		
GET	$5,863,500	Per year
Corporate Income Tax	$645,000	Per year
Personal Income Tax	$869,400	Per year
Recurring Conveyance Tax	$46,500	Per year
Transient Accommodation Tax (TAT) (Revenue to State General Fund)	$831,300	Per year
Total Revenues	$8,255,700	Per year
Expenditure		
State General Fund	($7,172,100)	Per year
Net Impact (Annual)	$1,083,600	Per year
County of Hawai'i		
Revenues		
Property Tax Net Increase	$4,522,400	Per year
Hawai'i County TAT	$278,400	Per year
GET Surcharge (0.5%)	$732,900	Per year
Total Revenues	$5,533,700	Per year
Expenditures		
County General Fund	$(3,638,600)	Per year
Net Impact (Annual)	$1,895,100	Per year

CONCLUSION IV

IV. CONCLUSION

Based on the foregoing sections, the proposed Makalapua Project District will provide a vibrant and sustainable mixed-use community with much needed housing units in the Kailua-Kona region, and is anticipated to have positive economic and fiscal impacts resulting from increased economic activities and employment as well as tax revenues for the State and County. Beyond the impacts quantified herein, the Makalapua Project District will provide significant short-term and long-term revenue sources to support Trust programs for orphan and destitute children.

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V

V. REFERENCES

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APPENDIX A

ECONOMIC AND FISCAL IMPACT ANALYSIS TABLES

Table 1. Proposed Development
(Values in 2023 dollars)

Item	Source or Multiplier	Amount	Units
1.a. LAND AREA			
Commercial	Liliuokalani Trust	15.2	acres
Residential	Liliuokalani Trust	20.7	acres
Mixed Use	Liliuokalani Trust	9.6	acres
Open Space	Liliuokalani Trust	3.5	acres
Roadways/Other	Liliuokalani Trust	20.5	acres
Subtotal Area Developed		**69.5**	**acres**
1.b. BUILDING SQUARE FOOTAGE			
Commercial	Liliuokalani Trust	220,900	sq. ft.
Residential			
Residential Unit	Liliuokalani Trust	600	units
For Sale		480	units
Rental		120	units
Residential Square Footage	910 sq ft per unit	546,000	sq. ft.
Community	Liliuokalani Trust	30,000	sq. ft.
Hotel			
Hotel Rooms	Liliuokalani Trust	150	rooms
Hotel Square Footage	Liliuokalani Trust	125,000	sq. ft.

Table 2. Economic Impacts of Development Activities
(Values in 2023 dollars)

Item	Source or Multiplier	Amount	Units
2.a. DEVELOPMENT PERIOD			
Duration of Construction	Liliuokalani Trust	10	years
Initiation of Construction	Liliuokalani Trust	2026	
Completion of Construction	Liliuokalani Trust	2034	
2.b. CONSTRUCTION EXPENDITURES AND RELATED SALES			
Construction Costs			
Infrastructure		**$ 58,100,000**	
Onsite Infrastructure	Liliuokalani Trust	$ 47,000,000	
Offsite Infrastructure	Liliuokalani Trust	$ 11,100,000	
Buildings			
Commercial	$410 per sq. ft.	$ 90,569,000	
Residential	$430 per sq. ft.	$ 234,780,000	
Community	$410 per sq. ft.	$ 12,300,000	
Hotel	$490 per sq. ft.	$ 61,250,000	
Total for Buildings		$ 398,899,000	
Total Construction Costs		**$ 456,999,000**	
Construction Expenditures, Annual Average			
Infrastructure		$ 5,810,000	per year
Hawaii	70%	$ 4,067,000	per year
Imports	30%	$ 1,743,000	per year
Buildings		$ 39,889,900	per year
Hawaii	70%	$ 27,922,900	per year
Imports	30%	$ 11,967,000	per year
Total Construction Expenditures, Annual Average		**$ 45,699,900**	**per year**
Indirect Sales			
Indirect Sales, Annual Average	1.14 x Hawaii exp.	$ 36,468,500	per year
Total Direct and Indirect Sales, Annual Average		**$ 82,168,400**	**per year**
2.c. RESIDENTIAL PROPERTY SALES AND VALUES			
Initial Sales Period		10	years
For Sale Market Housing		384	units
Residents	2.81 residents per HH	1,079	residents
Sales Price	$ 605,000 per unit	$ 232,320,000	
For Sale Affordable Housing		96	units
Residents	2.81 residents per HH	270	residents
Sales Price	$ 381,000 per unit	$ 36,576,000	
Total Property Sales		$ 268,896,000	
Annual Property Sales		**$ 26,889,600**	**per year**

Table 2. Economic Impacts of Development Activities (Continued)
(Values in 2023 dollars)

Item	Source or Multiplier	Amount	Units
2.d. PROFITS			
Risk Premium for Construction	10.0%	$ 4,570,000	per year
Total Profit from Construction & Related Activity		**$ 4,570,000**	**per year**
2.e. EMPLOYMENT (on-site & off-site)			
Construction Jobs	2.56 x sales/$1 mil	117	jobs/year
Indirect Jobs Generated by Construction	1.54 x direct jobs	180	jobs/year
Total Employment		**297**	**jobs/year**
2.f. PAYROLL			
Construction Payroll	$ 78,000 per job	$ 9,126,000	per year
Payroll for Indirect Employment	$ 56,000 per job	$ 10,080,000	per year
Total Payroll		**$ 19,206,000**	**per year**

Table 3. Economic Impacts of Operations at Full Development
(Values in 2023 dollars)

Item	Source or Multiplier	Amount	Units
3.a. ON-SITE ECONOMIC ACTIVITIES SQUARE FOOTAGE			
Commercial	Liliuokalani Trust	220,900	sq. ft.
Residential			
Residential Unit	Liliuokalani Trust	600	units
For Sale	80%	480	units
Rental	20%	120	units
Residential Square Footage	910 sq ft per unit	546,000	sq. ft.
Hotel			
Hotel Rooms	Liliuokalani Trust	150	rooms
Hotel Square Footage	Liliuokalani Trust	125,000	sq. ft.
3.b RESIDENTIAL & HOTEL USE ASUMPTIONS			
Rental Residential			
Market Housing		96	units
Residents	2.81 residents per HH	270	residents
Rents	$ 2,400 per unit per month	$ 230,400	per year
Affordable Housing	20% of rental units	24	units
Residents	2.81 residents per HH	67	residents
Rents	$ 1,900 per unit per month	$ 46,000	per year
Hotel (Limited-Service Hotel)			
Total Rooms	Table 3, Section 3.a.	150	rooms
Occupied Rooms	75%	113	rooms
Visitors	2.00 per room	226	per day
Revenue			
Hotel Room Revenue	$ 225.00 per room per day	$ 9,280,000	per year
3.c. ECONOMIC ACTIVITIES			
Rent Revenue			
Commercial	$ 2.00 per sq.ft.per month	$ 5,301,600	per year
Residential			
Market Housing	Table 3, Section 3.b.	$ 230,400	per year
Affordable Housing	Table 3, Section 3.b.	$ 46,000	per year
Total Rent Revenue		**$ 5,578,000**	**per year**
Direct Sales of New Businesses			
Commercial	$ 440 per sq.ft. per year	$ 97,196,000	per year
Hotel Rooms	Table 3, Section 3.b.	$ 9,280,000	per year
Total Direct Sales		**$ 106,476,000**	per year

Table 3. Economic Impacts of Operations at Full Development (Continued)
(Values in 2023 dollars)

Item	Source or Multiplier	Amount	Units
Expenditure by New Residents			
Total New Household			
Market Housing	Table 2, Section 2c. & Table 3, Section 3.b.	480	HH
Affordable Housing	Table 2, Section 2c. & Table 3, Section 3.b.	120	HH
Household Income			
Market Housing	$ 120,000 per household	$ 57,600,000	per year
Affordable Housing	$ 80,000 per household	$ 9,600,000	per year
Total Household Income		$ 67,200,000	per year
Consumption Expenditure by New Residents	60% of HH Income	$ 40,320,000	per year
Less Consumption Expenditure within Project	30% of resident consumption	$ (12,096,000)	per year
Net Consumption Expenditure by New Residents		**$ 28,224,000**	per year
Expenditure by New Visitors			
Total New Visitors	Table 3, Section 3.b.	226	per day
Visitor Consumption Expenditure (less lodging cost)	$90 per visitor per day	$ 7,424,100	per year
Less Other Consumption Expenditure within Project	15% of visitor consumption	$ (1,113,600)	
Net Consumption Expenditure by New Visitors		**$ 6,310,500**	per year
Total Revenue		**$ 146,588,500**	per year
3.d. PROFIT			
Annual Profit	10% of revenues	**$ 14,658,850**	**per year**
3.e. EMPLOYMENT			
Commercial	17.22 per acre	85	jobs
Residential	2.7 per acre	35	jobs
Hotel	0.7 per room	105	jobs
Total Employment		**225**	**jobs**
3.f. PAYROLL			
Commercial	$ 56,000 per job	$ 4,760,000	per year
Residential	$ 56,000 per job	$ 1,960,000	per year
Hotel	$ 56,000 per job	$ 5,880,000	per year
Total Payroll		**$ 12,600,000**	**per year**

Table 4. Impacts on State Revenues and Expenditures
(Values in 2023 dollars)

Item	Source or Multiplier	Amount	Units
4.a. DEVELOPMENT ACTIVITIES			
Tax and Expenditure Base			
Duration	Table 2, Section 2.a	10	years
Final Sales (taxed at 4.5%)		**$ 57,223,500**	**per year**
Construction Expenditures	Table 2, Section 2.b	$ 45,699,900	per year
Consumption	60% of payroll	$ 11,523,600	per year
Intermediate Sales (taxed at 0.5 %)		**$ 24,944,900**	**per year**
Indirect Sales Related to Construction		$ 36,468,500	per year
Less Consumption		$ (11,523,600)	per year
Profits	Table 2, Section 2.d	$ 4,570,000	per year
Payroll	Table 2, Section 2.f	$ 19,206,000	per year
Revenues, Average Annual			
Excise Tax		$ 2,413,600	per year
Final Sales	4.0% of sales	$ 2,288,900	per year
Intermediate Sales	0.5% of sales	$ 124,700	per year
Corporate Income Taxes	4.4% of profits	$ 201,100	per year
Personal Income Taxes	6.9% of income	$ 1,325,200	per year
Conveyance Tax		$ 50,200	per year
Market Housing	0.20% of sales price	46,500	per year
Affordable Housing	0.10% of sales price	3,700	per year
Total Revenues		**$ 3,990,100**	**per year**
Revenues, Cumulative		**$ 39,901,000**	
Expenditures			
Total Expenditures		n.e.	
Net Impact, Annual Average		**$ 3,990,100**	**per year**
Net Impact, Cumulative		**$ 39,901,000**	
4.b. OPERATIONS AT FULL DEVELOPMENT			
Tax and Expenditure Base			
Final sales	Table 3, Section 3.c	$ 146,588,500	per year
Profits (on-site activities)	Table 3, Section 3.d	$ 14,658,850	per year
Employment	Table 3, Section 3.e	225	jobs/year
Payroll	Table 3, Section 3.f	$ 12,600,000	per year

Table 4. Impacts on State Revenues and Expenditures (Continued)
(Values in 2023 dollars)

Item	Source or Multiplier	Amount	Units
Revenues, Annual			
Excise Tax	4.0% of Final Sales	$ 5,863,500	per year
Corporate Income Tax	4.4% of Profit	$ 645,000	per year
Personal Income Tax	6.9% of Income	$ 869,400	per year
Recurring Conveyance Tax (Market Housing Only)	Homes re-sell avg. every 10 yrs	$ 46,500	per year
Transient Accomodation Tax (TAT)	10.25% of Hotel Revenue	$ 951,200	per year
Revenue to State of Hawaii General Fund	87.4% of TAT	$ 831,300	per year
Total Tax Revenue		**$ 8,255,700**	**per year**
Expenditures, Annual			
Onsite Population			
Visitors	Table 3, Section 3.b	225	people
Residents	Section 2.b. and Section 3.b	1,685	people
Total Onsite Population (defacto population)		1,910	people
State General Fund Expenditure	$ 3,755.00 per defacto population	$ (7,172,100)	per year
Net Impact, Annual		**$ 1,083,600**	**per year**

Table 5. Impacts on County Revenues and Expenditures (Values in 2023 dollars)			
Item	**Source or Multiplier**	**Amount**	**Units**
5.a. DEVELOPMENT ACTIVITIES			
Revenues, Annual Average			
General Exercise Tax (GET) Surcharge			
Final Sales	Table 2, Section 2.g	$ 57,223,500	per year
GET Surcharge	0.5% of Final Sales	$ 286,100	per year
Expenditures, Annual Average			
Total Expenditures		n.e.	
Net Impact, Annual Average		**$ 286,100**	per year
Net Impact, Cumulative		**$ 2,861,000**	
5.b. OPERATIONS AT FULL DEVELOPMENT			
Tax and Expenditure Base			
Taxable Property Value			
Commercial		$ 150,948,333	
Land	1.50 Improvement to Land Value Ratio	$ 60,379,333	
Improvements	Table 2, Section 2.b.	$ 90,569,000	
Residential For Sale	80% of total residential units	$ 480	units
Assessed Value (Sales Price)	Table 2, Section 2.c.	$ 268,896,000	
Less Homeowner Exemption	$40,000 per home	$ (19,200,000)	
Net Assessment Value		$ 249,696,000	
Residential For Rental	20% of total residential units	$ 70,434,000	
Land	2.00 Improvement to Land Value Ratio	$ 23,478,000	
Improvements	Table 2, Section 2.b.	$ 46,956,000	
Hotel		$ 81,666,667	
Land	3.00 Improvement to Land Value Ratio	$ 20,416,667	
Improvements	Table 2, Section 2.b.	$ 61,250,000	
Open Space		$ -	
Land	Exempt pursuant to HCC Section 19-77. (6)	$ -	
Improvements	Exempt pursuant to HCC Section 19-77. (6)	$ -	
Total Taxable Property Value		**$ 552,745,000**	
Property Taxes			
Commercial	$10.70 per $1,000	$ 1,615,147	per year
Residential For Sale	$6.15 per $1,000	$ 1,535,630	per year
Residential For Rental	$11.70 per $1,000	$ 824,078	per year
Hotel	$11.55 per $1,000	$ 943,250	per year
Open Space	$9.35 per $1,000	$ -	per year
Total Property Taxes		**$ 4,918,000**	per year
Less Existing Property Tax	COH Real Property Tax Records	$ (395,600)	per year
Net Property Tax		**$ 4,522,400**	per year

Table 5. Impacts on County Revenues and Expenditures (Continued) (Values in 2023 dollars)			
Item	**Source or Multiplier**	**Amount**	**Units**
Hawai'i County Transient Accommodations Tax (HCTAT)			
Hotel Revenue		$ 9,280,000	
HCTAT	3.00% of Hotel Revenue	$ 278,400	
General Exercise Tax (GET) Surcharge			
Final Sales	Table 3, Section 3.c	$ 146,588,500	per year
GET Surcharge	0.50% of Final Sales	$ 732,900	per year
Total Tax Revenue		**$ 5,533,700**	per year
Expenditures, Annual			
Onsite Population			
Visitors	Table 3, Section 3.b	226	people
Residents	Section 2.b. and Section 3.b	1,685	people
Total Onsite Population (defacto population)		1,911	
County General Fund Expenditure	$ 1,905.00 per defacto population	$ (3,640,500)	per year
Net Impact, Annual		**$ 1,893,200**	**per year**

APPENDIX

N

TRAFFIC IMPACT ANALYSIS REPORT

TRAFFIC IMPACT ANALYSIS REPORT
MAKALAPUA PROJECT DISTRICT
KAILUA-KONA, ISLAND OF HAWAII, HAWAII

DRAFT FINAL

May 9, 2024

Prepared for:

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TRAFFIC IMPACT ANALYSIS REPORT
MAKALAPUA PROJECT DISTRICT
Kailua-Kona, Island of Hawaii, Hawaii

DRAFT FINAL

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May 9, 2024

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CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TERRANCE S. ARASHIRO, P.E.
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TRAFFIC IMPACT ANALYSIS REPORT

MAKALAPUA PROJECT DISTRICT

Kailua-Kona, Island of Hawaii, Hawaii

1. INTRODUCTION

This report documents the findings of a traffic study conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to evaluate the potential traffic impacts resulting from the proposed Makalapua Project District (hereinafter referred to as the "Project").

1.1 Location

The project site is bordered by the Kona Commons Shopping Center to the northeast, vacant lands to the north, existing Kona Industrial Subdivision (KIS) to the east, and the County's Kailua Park (also known as Old Airport Park) to the south and west. See Figure 1.1 for the Project location.

1.2 Project Description

The Project will be built in the Kailua-Kona business area and proposes to build a mix of residential, hotel, office, and commercial development. The Project proposes to construct up to 600 dwelling units, a 150-key hotel, and 220,900 SF of office, retail and restaurant space. Construction of the Project will occur in phases, with the first phase to be completed by 2027 and the final phase completed by 2032.

See Figure 1.2 for the Project site plan.

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HILO, HAWAII

MAKALAPUA PROJECT
DISTRICT TIAR

Austin Tsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

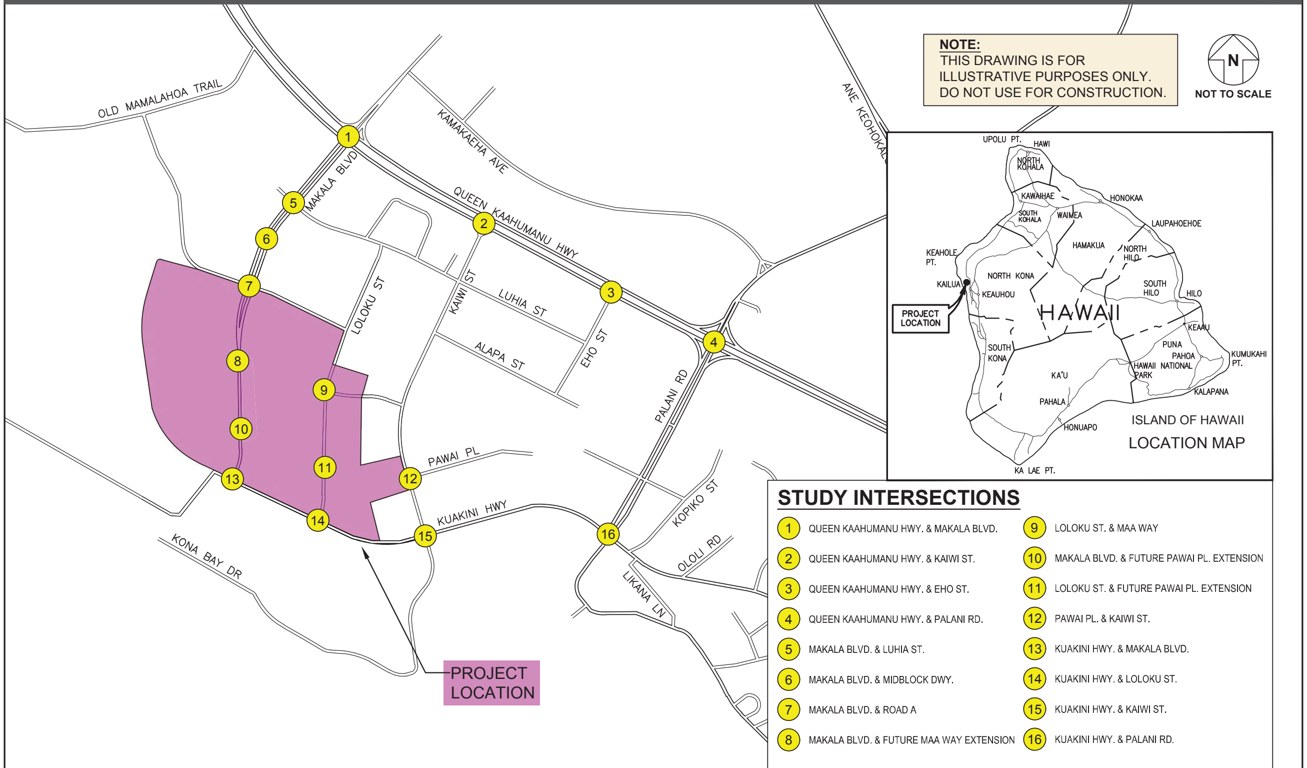

FIGURE 1.1

LOCATION MAP

MAKALAPUA PROJECT
DISTRICT TIAR

Austin Tsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

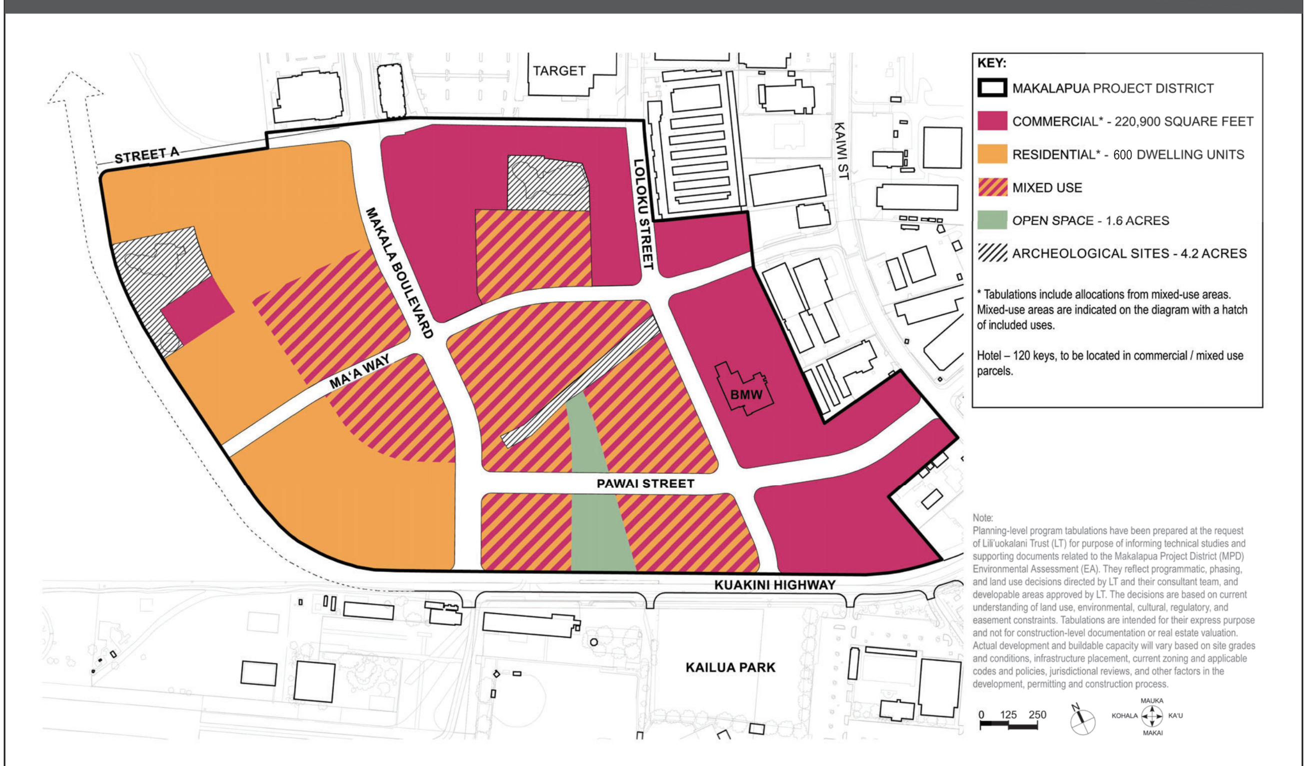

FIGURE 1.2

PROJECT SITE PLAN

2. METHODOLOGY

2.1 Study Methodology

This study will address the following:

- Existing traffic operating conditions at key intersections within the study area.
- Traffic projections for Base Years 2027, 2032 and 2042 (without the Project) including traffic generated by other known developments in the vicinity of the Project in addition to an ambient growth rate. These other known developments are projects that are currently under construction or known new/future developments that are anticipated to affect traffic demand and operations within the study area.
- Trip generation and traffic assignment characteristics for the proposed Project.
- Traffic projections for Future Years 2027, 2032 and 2042 (with the Project), which includes Base Year traffic volumes in addition to traffic volumes generated by the Project.
- Recommendations for Future Year roadway improvements or other mitigative measures, as appropriate, to reduce or eliminate the adverse impacts resulting from traffic generated by known developments in the region or the Project.

2.2 Intersection Analysis

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 (HCM), 7th Edition, includes methods for calculating volume to capacity ratios, delays, and corresponding Levels of Service that were utilized in this study. LOS definitions for signalized and unsignalized intersections are provided in Appendix B.

Analyses for the study intersections were performed using the traffic analysis software Synchro, which is able to prepare reports based on the methodologies described in the HCM. These reports contain control delay results as based on intersection lane geometry, signal timing, and hourly traffic volumes. Based on the vehicular delay at each intersection, an LOS is assigned to each approach and intersection movement 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.

3. EXISTING CONDITIONS

3.1 Roadway System

The following are brief descriptions of the existing roadways in the vicinity of the Project at the time of observations:

Queen Kaahumanu Highway – is a north-south, two-way major State highway that provides for regional travel between Kawaihae and Kailua-Kona. This roadway is generally a two-lane highway from its northern terminus in Kawaihae to Keahole Airport Road in Kailua-Kona. Queen Kaahumanu Highway then widens to four lanes between Keahole Airport Road and Malulani Drive, and then tapers back down to two lanes from Malulani Drive to its intersection with Kuakini Highway. The posted speed limit of this roadway is generally 35 miles per hour (mph).

Kuakini Highway – is generally a north-south, two-way, County roadway that provides for access through Kailua-Kona. This roadway begins to the north at its intersection with Makala Boulevard then continues to the south generally following the Kailua-Kona coast before connecting to Queen Kaahumanu Highway. This roadway is a two-lane undivided roadway between Makala Boulevard and Palani Road. Between Palani Road and Hualalai Road this roadway widens to a four-lane roadway before narrowing back down to a two-lane roadway to the south of Hualalai Road. The posted speed limit of this roadway is generally 25 mph.

Luhia Street – is a north-south, two-way, two-lane County roadway. This roadway begins to the north at its intersection with Makala Boulevard opposite of the Kona Commons Shopping Center Driveway and terminates to the south as a T-intersection with Eho Street. The posted speed limit of this roadway is generally 25 mph.

Road A – is an unnamed roadway providing additional access to Target and the Kona Commons Shopping Center. This roadway is referred to as “Road A ” based on the proposed naming convention with the Project. Road A is a north-south, two-way, two-lane privately owned roadway beginning to the north at its intersection with Old Mamalahoa Trail and terminating to the south at Loloku Street. There is no posted speed limit along this roadway.

Makala Boulevard – is an east-west, two-way County and privately owned roadway. This roadway begins to the east at its intersection with Kamakaeha Avenue and terminates to the west at its intersection with Kuakini Highway. Between Kamakaeha Avenue and Queen Kaahumanu Highway, this road is a three lane roadway. Between Queen Kaahumanu Highway and Road A, this road is a four-lane divided roadway. West of Road A, Makala Boulevard narrows to a two-lane undivided private roadway. The posted speed limit of this roadway is generally 25 mph.

Loloku Street – is an east-west, two-way, two-lane undivided County roadway. This roadway begins to the east as a T-intersection with Luhia Street and terminates to the west as a T-intersection with Kuakini Highway. The posted speed limit along this roadway is generally 25 mph.

Kaiwi Street – is an east-west, two-way, two-lane County roadway. This roadway begins to the east as a T-intersection with Queen Kaahumanu Highway and terminates to the west at its intersection with Kuakini Highway opposite of Kona Bay Drive. A two-way, left-turn median is provided along this roadway between Luhia Street and Kuakini Highway. The posted speed limit of this roadway is generally 25 mph.

Eho Street – is an east-west County roadway. This roadway begins to the east as a T-intersection with Queen Kaahumanu Highway and terminates to the west as a T-intersection with Alapa Street. This roadway provides one-way access in the westbound direction between Queen Kaahumanu Highway and Luhia Street. Between Luhia Street and Alapa Street, this roadway is a two-way, two-lane undivided roadway. The posted speed limit of this roadway is generally 25 mph.

Palani Road – is an east-west, two-way, County roadway. This roadway begins to the east at its intersection with Mamalahoa Highway and terminates to the west at Kaahumanu Place where it transitions into Alii Drive. This roadway is generally a four-lane roadway to the east of Kuakini Highway and a two-lane roadway to the west of Kuakini Highway. The posted speed limit of this roadway ranges between 15 and 25 mph.

Maa Way – is a north-south, two-way County roadway spanning approximately 600-feet between its intersections with Loloku Street and Kaiwi Street. The posted speed limit along this roadway is 25 mph.

Pawai Place – is a north-south, two-way County roadway that begins to the north at its intersection with Kaiwi Street and continues south until it ends at Kona Brewing Company. There is no posted speed limit along this roadway.

3.2 Existing Traffic Volumes

The hourly turning movement data utilized in this report were collected in 2022 on September 7, 8, and 10. Based on the proximity to the proposed Project site the following intersections were studied in the existing conditions scenario:

- [1] Queen Kaahumanu Highway/Makala Boulevard (Signalized)
- [2] Queen Kaahumanu Highway/Kaiwi Street (Unsignalized)
- [3] Queen Kaahumanu Highway/Eho Street (Unsignalized)
- [4] Queen Kaahumanu Highway/Palani Road (Signalized)
- [5] Makala Boulevard/Luhia Street (Signalized)
- [6] Makala Boulevard/Midblock Driveway (Signalized)
- [7] Makala Boulevard/Road A (Signalized)
- [9] Loloku Street/Maa Way (Unsignalized)
- [12] Pawai Place/Kaiwi Street (Unsignalized)
- [13] Kuakini Highway/Makala Boulevard (Unsignalized)
- [14] Kuakini Highway/Loloku Street (Unsignalized)
- [15] Kuakini Highway/Kaiwi Street (Unsignalized)
- [16] Kuakini Highway/Palani Road (Signalized)

Based on traffic count data, the weekday morning (AM) and afternoon (PM) peak hours of traffic were determined to occur between 8:30 AM and 9:30 AM and between 3:30 PM to 4:30 PM, respectively. The Saturday midday (WE) peak hour of traffic was determined to occur between 11:30 AM and 12:30 PM.

The traffic count data is provided in Appendix A.

3.3 Existing Traffic Conditions Analysis and Observations

3.3.1 Regional Observations

The Project is generally located in the Kailua-Kona region. In the vicinity of the Project, Queen Kaahumanu Highway is the major regional north-south corridor and is supplemented by Ane Keohokalole Highway and Kuakini Highway. During the AM and WE peak hours of traffic, the volumes are relatively balanced in the northbound and southbound directions, whereas during the PM peak hour of traffic, the southbound direction is considerably heavier (approximately 63 percent greater than northbound). The Project region currently provides commercial, industrial, and warehouse facilities for various businesses. In addition, several big box stores anchor various retail areas throughout the region.

3.3.2 Study Area Observations

The analysis and observations described below are based on prevailing conditions during the time at which the data was collected. Hereinafter, observations that are expressed as ongoing and current shall represent the conditions that prevailed at the time at which the data was collected.

In the Project vicinity, Queen Kaahumanu Highway and Kuakini Highway provide north-south regional access:

Queen Kaahumanu Highway

During the AM peak hour of traffic, Queen Kaahumanu Highway was observed to experience relatively moderate traffic with some queuing at intersections. However, queues were generally observed to clear within a single cycle. Throughout the study area between Malulani Road and Kealakehe Parkway, high left-lane utilization was observed in the northbound direction which is likely attributed to motorists avoiding westbound right-turn merges. Despite queuing to the south of the study area, traffic along Queen Kaahumanu Highway in the vicinity of the Project operated relatively smoothly without delay.

During the PM and WE peak hour of traffic, southbound traffic and turning movement volumes increased. Intersections generally ran smoothly, and no major congestion was observed at study intersections. It should be noted that southbound queueing along Queen Kaahumanu Highway, just south of the study area near Malulani Road, occurs as a result of the downstream merge from two (2) southbound lanes to one (1).

Kuakini Highway

During the AM peak hour of traffic, Kuakini Highway experienced relatively light traffic volumes. Some queuing was observed at Palani Road, but queues typically cleared within a single cycle. Study intersections north of Palani Road generally operated smoothly with little delay.

During the PM and WE peak hours of traffic, traffic along Kuakini Highway generally increased. However, operations at study intersections were generally similar to the peak AM with the exception of Kaiwi Street. Queuing occurred in the northbound direction from Palani Road towards Kaiwi Street due to the intersection being an all-way stop.

Makala Boulevard

During the AM peak hour of traffic, Makala Boulevard was observed to experience relatively light traffic since most of the surrounding commercial businesses were not open yet.

During the PM and WE peak hours of traffic, eastbound left-turn movements at the Makala Boulevard/Queen Kaahumanu Highway intersection were observed to experience moderate delay and queuing, however, vehicle queues were typically able to clear during a single cycle. Additionally, traffic along Makala Boulevard fronting the existing Kona Commons Shopping Center and Target was observed to typically operate smoothly without significant delay.

Loloku Street

Traffic along Loloku Street was observed to be relatively light during the AM, PM and WE peak hours of traffic. Existing driveways fronting Loloku Street are limited to a storage facility, commercial laundry service, a BMW dealership and the rear entrance to the Target parking lot.

3.3.3 Existing Intersection Analysis

Below are descriptions of the observed intersection operations during the AM, PM and WE peak hours of traffic at the time of data collection.

[1] Queen Kaahumanu Highway/Makala Boulevard

This intersection is heavily utilized during the AM, PM and WE peak hours of traffic as Makala Boulevard provides access to the Kona Commons Shopping Center and Target which are located to the west of Queen Kaahumanu Highway. Although the southbound left-turn movement operates at LOS F during the AM and PM peak hours, the volume is very low at less than 15 vehicles within either hour. The northbound left-turn movement, eastbound approach, and westbound approach operate at LOS E during the AM and PM peak hours. Overall, the intersection currently operates at LOS D or better during the AM, PM and WE periods of traffic.

[2] Queen Kaahumanu Highway/Kaiwi Street

Due to the presence of long acceleration and deceleration lanes as well as restricting access to right-in, right-out movements only, there is negligible delay at all movements and the intersection typically operates at LOS A. Based upon field observations, this right-in, intersection operates with low delay and minimal queuing along southbound Queen Kaahumanu Highway.

[3] Queen Kaahumanu Highway/Eho Street

Due to restricting access to right-in only movements, the intersection typically operates at LOS A. Based upon field observations, this right-in intersection operates with low delay and minimal queuing along southbound Queen Kaahumanu Highway.

[4] Queen Kaahumanu Highway/Palani Road

This intersection is heavily utilized during the AM, PM and WE peak hours of traffic. Palani Road provides connectivity between the Kailua-Kona and Kalaoa regions. The turning movements on all approaches experience LOS E or better conditions for all peak periods. Overall, the intersection operates at LOS D or better during all peaks.

[5] Makala Boulevard/Luhia Street

All movements at this signalized intersection operate at LOS C or better during all peak hours of traffic.

[6] Makala Boulevard/Midblock Driveway

All movements at this signalized intersection operate at LOS C or better during all peak hours of traffic.

[7] Makala Boulevard/Road A

All movements at this signalized intersection operate at LOS C or better during all peak hours of traffic.

[9] Loloku Street/Maa Way

This stop controlled “T” intersection carries relatively low volumes and therefore operates at LOS B or better on all movements during all study peak hours of traffic.

[12] Pawai Place/Kaiwi Street

This stop controlled “T” intersection operates at LOS D or better on all movements during all study peak hours of traffic. This intersection was analyzed as a four-leg intersection due to the driveway across from Pawai Place.

[13] Kuakini Highway/Makala Boulevard

This all-way stop controlled “T” intersection carries low volumes and therefore operates at LOS B or better on all movements during all study peak hours of traffic.

[14] Kuakini Highway/Loloku Street

This stop controlled “T” intersection carries relatively low volumes and therefore operates at LOS C or better on all movements during all study peak hours of traffic.

[15] Kuakini Highway/Kaiwi Street

This all-way stop controlled intersection carries moderate volumes and experiences long delays during the critical PM peak hour of traffic. As a result, the northbound approach operates at LOS E during the PM peak hour. All other approaches operate at LOS D or better during all peak hours of traffic.

[16] Kuakini Highway/Palani Road

This signalized intersection was observed to operate with moderate delays, However, all movements operate at LOS D or better, except for the eastbound through movement which operates at LOS E during the PM peak hour of traffic.

Figure 3.1 illustrates the existing lane configurations, volumes and LOS. See Table 3.1 for a summary of the existing conditions analysis. LOS worksheets are included in Appendix C.

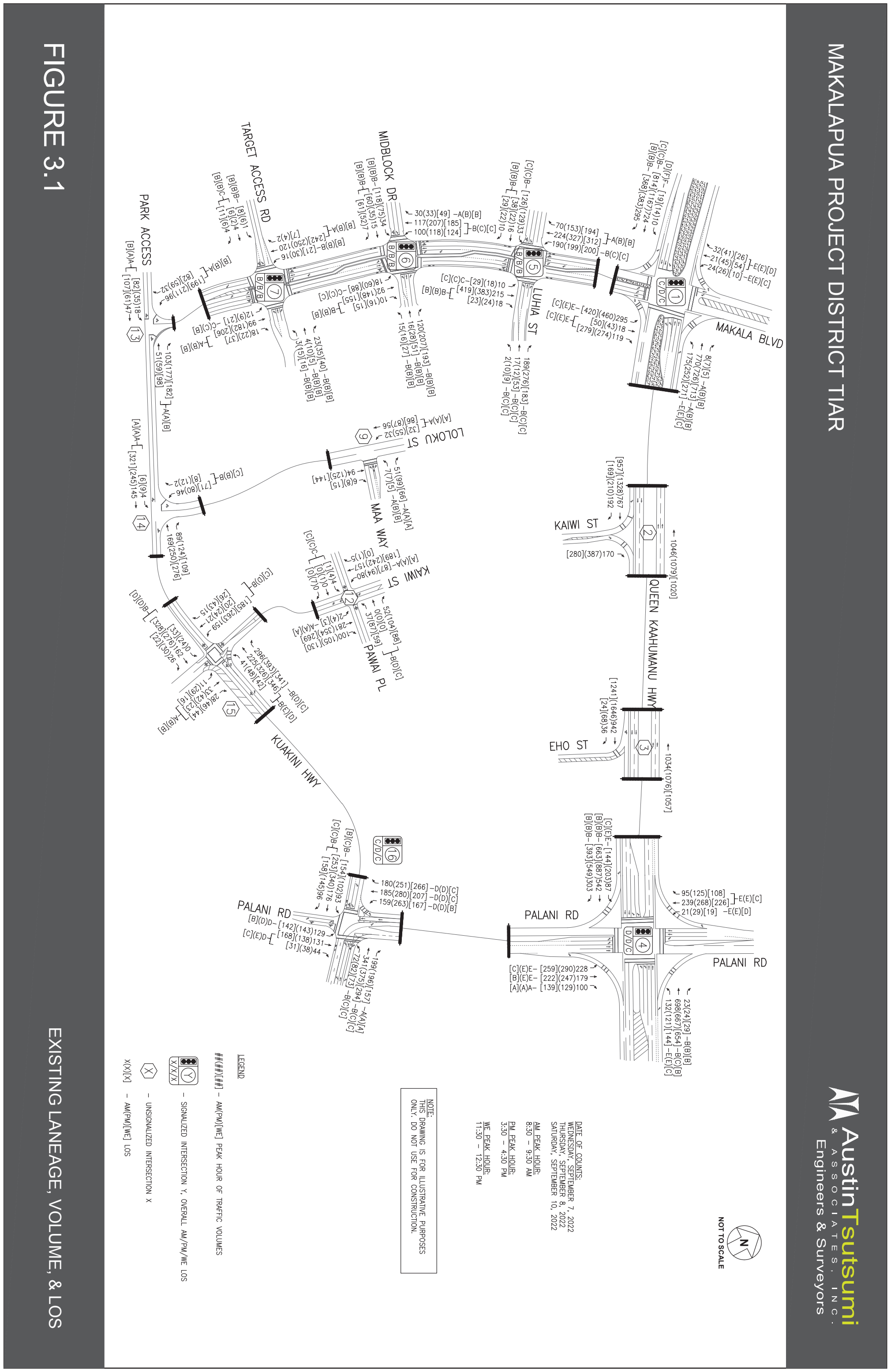

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TABLE 3.1: LOS SUMMARY TABLE
EXISTING CONDITIONS

	Intersection / Signalized: Overall LOS / Unsignalized: Critical Movement LOS / LOS [X / X / X] / DELAY [X / X / X]	Existing Conditions (AM / PM / WE) HCM Delay	v/c Ratio	LOS
1	**1: Queen Kaahumanu Highway & Makala Boulevard** *Discussion: This intersection operates satisfactorily. The long delays experienced are on the lower volume minor movements except for the northbound left-turn.*	Queen Kaahumanu Hwy / Makala Boulevard		
		C / D / C - / - / - 28 / 37 / 22		
	NB LT	80 / 79 / 33	0.76 / 0.83 / 0.69	E / E / C
	NB TH	10 / 14 / 14	0.34 / 0.35 / 0.48	A / B / B
	NB RT	7 / 11 / 11	0.01 / 0 / 0	A / B / B
	EB LT	76 / 71 / 28	0.84 / 0.86 / 0.67	E / E / C
	EB TH/RT	66 / 59 / 24	0.1 / 0.15 / 0.15	E / E / C
	WB LT	76 / 76 / 33	0.27 / 0.27 / 0.12	E / E / C
	WB TH/RT	76 / 78 / 40	0.23 / 0.45 / 0.61	E / E / D
	SB LT	99 / 98 / 44	0.51 / 0.56 / 0.5	F / F / D
	SB TH	14 / 27 / 21	0.35 / 0.64 / 0.71	B / C / C
	SB RT	12 / 19 / 17	0.18 / 0.22 / 0.22	B / B / B
2	**2: Queen Kaahumanu Highway & Kaiwi Street** *Discussion: The free EB RT doesn't experience any delay*	Queen Kaahumanu Hwy / Kaiwi Street		
3	**3: Queen Kaahumanu Highway & Eho Street** *Discussion: The SB RT operates un-impeded.*	Queen Kaahumanu Hwy / Eho Street		
4	**4: Queen Kaahumanu Highway & Palani Road** *Discussion: This intersection operates satisfactorily. The long delays experienced are on the minor movements.*	Queen Kaahumanu Hwy / Palani Road		
		D / D / C - / - / - 36 / 40 / 22		
	NB LT	80 / 79 / 30	0.68 / 0.63 / 0.59	E / E / C
	NB TH	17 / 21 / 19	0.51 / 0.37 / 0.64	B / C / B
	NB RT	11 / 17 / 15	0.01 / 0.01 / 0.02	B / B / B
	EB LT	79 / 78 / 28	0.82 / 0.85 / 0.67	E / E / C
	EB TH	64 / 62 / 20	0.37 / 0.44 / 0.29	E / E / B
	EB RT	0 / 0 / 0	0 / 0 / 0	A / A / A
	WB LT	80 / 79 / 38	0.33 / 0.39 / 0.48	E / E / D
	WB TH/RT	75 / 74 / 26	0.73 / 0.74 / 0.51	E / E / C
	SB LT	77 / 71 / 30	0.46 / 0.59 / 0.59	E / E / C
	SB TH	14 / 19 / 19	0.26 / 0.45 / 0.65	B / B / B
	SB RT	13 / 18 / 16	0.17 / 0.38 / 0.22	B / B / B

#	Intersection Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Existing Conditions (AM / PM / WE) HCM Delay	v/c Ratio	LOS
5	**5: Makala Boulevard & Luhia Street** *Discussion:* *This intersection operates satisfactorily.*	Luhia Street / Makala Boulevard		
		B / B / B - / - / - 14 / 16 / 18		
	NB LT	17 / 22 / 22	0.03 / 0.17 / 0.09	B / C / C
	NB TH	19 / 22 / 25	0.28 / 0.19 / 0.48	B / C / C
	NB RT	18 / 21 / 21	0.15 / 0.14 / 0.06	B / C / C
	EB LT	28 / 28 / 29	0.43 / 0.45 / 0.5	C / C / C
	EB TH/RT	13 / 16 / 17	0.39 / 0.53 / 0.54	B / B / B
	WB LT	18 / 22 / 24	0.74 / 0.76 / 0.77	B / C / C
	WB TH/RT	9 / 11 / 12	0.26 / 0.38 / 0.37	A / B / B
	SB LT	18 / 22 / 24	0.35 / 0.68 / 0.65	B / C / C
	SB TH/RT	16 / 18 / 20	0.16 / 0.12 / 0.23	B / B / B
6	**6: Makala Boulevard & Midblock Driveway** *Discussion:* *This intersection operates satisfactorily.*	Midblock Driveway / Makala Boulevard		
		B / B / B - / - / - 14 / 16 / 18		
	NB LT	16 / 16 / 18	0.22 / 0.15 / 0.18	B / B / B
	NB TH	16 / 17 / 19	0.22 / 0.24 / 0.33	B / B / B
	NB RT	15 / 17 / 18	0.03 / 0.16 / 0.1	B / B / B
	EB LT	22 / 20 / 24	0.44 / 0.55 / 0.67	C / C / C
	EB TH/RT	12 / 15 / 17	0.16 / 0.33 / 0.34	B / B / B
	WB LT	18 / 21 / 24	0.63 / 0.72 / 0.75	B / C / C
	WB TH/RT	10 / 14 / 16	0.16 / 0.39 / 0.39	A / B / B
	SB LT	16 / 15 / 16	0.33 / 0.34 / 0.39	B / B / B
	SB TH/RT	15 / 14 / 15	0.14 / 0.18 / 0.31	B / B / B
7	**7: Makala Boulevard & Road A** *Discussion:* *This intersection operates satisfactorily.*	Road A / Makala Boulevard		
		B / B / B - / - / - 11 / 11 / 11		
	NB LT	15 / 15 / 17	0.11 / 0.23 / 0.33	B / B / B
	NB TH	15 / 14 / 14	0.14 / 0.15 / 0.09	B / B / B
	NB RT	14 / 14 / 13	0.04 / 0.02 / 0.02	B / B / B
	EB LT	22 / 26 / 19	0.42 / 0.42 / 0.44	C / C / B
	EB TH/RT	9 / 11 / 10	0.17 / 0.31 / 0.34	A / B / B
	WB LT	20 / 18 / 19	0.43 / 0.46 / 0.44	B / B / B
	WB TH/RT	9 / 10 / 10	0.18 / 0.35 / 0.36	A / B / B
	SB LT	15 / 14 / 16	0.07 / 0.1 / 0.23	B / B / B
	SB TH/RT	26 / 14 / 16	0.34 / 0.06 / 0.2	C / B / B

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#	Intersection Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Existing Conditions (AM / PM / WE) HCM Delay	v/c Ratio	LOS
9	**9: Loloku Street & Maa Way** *Discussion:* *This intersection operates satisfactorily.*	Maa Way / Loloku Street		
		A / B / B 0.01 / 0.01 / 0.01 10 / 11 / 11		
	NB LT	10 / 11 / 11	0.01 / 0.01 / 0.01	A / B / B
	NB RT	9 / 10 / 10	0.06 / 0.12 / 0.08	A / A / A
	WB LT/TH	8 / 8 / 8	0.02 / 0.04 / 0.03	A / A / A
12	**12: Pawai Place & Kaiwi Street** *Discussion:* *This intersection operates satisfactorily.*	Pawai Place / Kaiwi Street		
		B / D / C 0.21 / 0.62 / 0.36 15 / 31 / 18		
	NB LT/TH/RT	15 / 31 / 18	0.21 / 0.62 / 0.36	B / D / C
	EB LT	8 / 8 / 8	0 / 0 / 0	A / A / A
	WB LT	8 / 9 / 9	0.08 / 0.1 / 0.08	A / A / A
	SB LT/TH/RT	17 / 16 / 18	0.01 / 0.04 / 0	C / C / C
13	**13: Kuakini Highway & Makala Boulevard** *Discussion:* *This intersection operates satisfactorily.*	Kuakini Highway / Makala Boulevard		
		A / B / B 0.17 / 0.39 / 0.43 8 / 11 / 12		
	NB TH/RT	8 / 9 / 11	0.18 / 0.31 / 0.39	A / A / B
	WB LT/RT	8 / 11 / 12	0.17 / 0.39 / 0.43	A / B / B
	SB LT/TH	8 / 9 / 11	0.09 / 0.15 / 0.3	A / A / B
14	**14: Kuakini Highway & Loloku Street** *Discussion:* *This intersection operates satisfactorily.*	Kuakini Highway / Loloku Street		
		B / B / C 0.09 / 0.21 / 0.21 12 / 15 / 16		
	WB LT/RT	12 / 15 / 16	0.09 / 0.21 / 0.21	B / B / C
	SB LT/TH	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A

	Intersection / ▯Signalized: Overall LOS / Unsignalized: Critical Movement LOS / LOS [X / X / X] / DELAY [X / X / X]	Existing Conditions (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS
15	**15: Kuakini Highway & Kaiwi Street** *Discussion: This intersection operates satisfactorily.*	Kuakini Highway / Kaiwi Street		N
		B / E / D **0.47 / 0.87 / 0.77** **14 / 43 / 29**		
	NB LT/TH	14 / 43 / 29	0.47 / 0.87 / 0.77	B / E / D
	NB RT	12 / 29 / 17	0.45 / 0.78 / 0.6	B / D / C
	EB LT/TH/RT	10 / 15 / 12	0.13 / 0.29 / 0.19	A / B / B
	WB LT/TH/RT	12 / 29 / 17	0.36 / 0.74 / 0.5	B / D / C
	SB LT/TH/RT	11 / 27 / 25	0.32 / 0.72 / 0.74	B / D / D
16	**16: Kuakini Highway & Palani Road** *Discussion: This intersection operates satisfactorily. The longer delays experienced are on the minor movements.*	Kuakini Highway / Palani Road		N
		C / D / C **- / - / -** **31 / 39 / 24**		
	NB LT	13 / 24 / 21	0.14 / 0.3 / 0.33	B / C / C
	NB TH	18 / 29 / 26	0.41 / 0.52 / 0.67	B / C / C
	NB RT	0 / 0 / 0	0 / 0 / 0	A / A / A
	EB LT	41 / 45 / 19	0.55 / 0.56 / 0.38	D / D / B
	EB TH/RT	50 / 56 / 26	0.62 / 0.62 / 0.52	D / E / C
	WB LT	45 / 42 / 19	0.65 / 0.75 / 0.44	D / D / B
	WB TH	50 / 51 / 24	0.67 / 0.71 / 0.48	D / D / C
	WB RT	43 / 42 / 21	0.08 / 0.14 / 0.09	D / D / C
	SB LT	13 / 21 / 19	0.2 / 0.28 / 0.47	B / C / B
	SB TH/RT	17 / 35 / 28	0.33 / 0.68 / 0.85	B / C / C

3.3.4 Public Transit

The Hele-On Bus is the primary provider of public transit for the Island of Hawaii. The Hilo – Kona, Intra Kona, Honokaa – Kailua Kona, and North Kohala – Hilo – Pahala bus routes provide service in the vicinity of the Project. All routes travel along Makala Boulevard and Luhia Street, with the Intra Kona route additionally servicing Kuakini Highway and Palani Road.

Buses generally run Monday through Sunday with service generally starting around 5:00 AM and ending around 10:30 PM. Nine (9) bus routes service the intra-Kona area with varying headways generally around 1 hour.

See Figure 3.2 for the Existing Transit Accessibility Plan.

3.3.5 Bicycle Facilities

In the vicinity of the Project, bicycle lanes are provided along the following roadways:

- Queen Kaahumanu Highway – Bike lanes are provided on both sides of the roadway between Makala Boulevard and Henry Street.
- Makala Boulevard – Bike lanes are provided on both sides of the roadway between Queen Kaahumanu Highway and Road A.
- Luhia Street – Bike lanes are provided on both sides of the roadway between Makala Boulevard and Eho Street.
- Kuakini Highway – Bike lanes are provided on both sides of the roadway between Kaiwi Street and Kalani Street. The northbound bike lane extends an extra block past Kalani Street to Hualalai Road, whereas the southbound bike lane terminates near Kalani Street.
- Maa Way – Bike lanes are provided on both sides of the roadway between Loloku Street and Kaiwi Street.

The Project's dedicated roadways are proposed to follow County standards and include cross-sections with bicycle lanes. Thus, bicycle lanes are proposed along the following roadways:

- Makala Boulevard – Bike lanes are proposed between Road A and Kuakini Highway.
- Loloku Street – Bike lanes are proposed between Road A and Kuakini Highway.
- Road A – Bike lanes are proposed along Road A between Loloku Street and the northern edge of the Project site.
- Maa Way – Bike lanes are proposed between Loloku Street and the northern edge of the Project site.
- Kuakini Highway – Bike lanes are proposed between Kaiwi Street and Makala Boulevard. According to the Bike Plan of Hawaii Masterplan, bike lanes are also proposed between Hualalai Road and Lako Street.

See Figure 3.3 for the Existing and Proposed Bicycle Accessibility Plan.

3.3.6 Pedestrian Facilities

In the vicinity of the Project, sidewalks are provided along the following roadways:

- Queen Kaahumanu Highway – Sidewalks are provided adjacent to the Queen Kaahumanu Highway southbound lanes between Makala Boulevard and Henry Street.

- Kuakini Highway – Sidewalks are not provided between Makala Boulevard and Kaiwi Street. Between Kaiwi Street and Palani Road, disjointed sidewalk segments are provided adjacent to southbound Kuakini Highway.
- Luhia Street – Sidewalks are provided on both sides of the roadway between Makala Boulevard and midblock between Loloku Street and Kaiwi Street.
- Makala Boulevard – Sidewalks are provided on both sides of the roadway between Queen Kaahumanu Highway and Road A.
- Loloku Street – Sidewalks are provided on both sides of the roadway between Luhia Street and Kuakini Highway.
- Kaiwi Street – No sidewalks are provided along Kaiwi Street.
- Eho Street – Sidewalks are provided on both sides of the roadway between Queen Kaahumanu Highway and Luhia Street.
- Palani Road – Sidewalks are provided on both sides of the roadway between Queen Kaahumanu Highway and Kuakini Highway. Between Kuakini Highway and Kaahumanu Place, sidewalks are provided adjacent to westbound Palani Road.

The Project's dedicated roadways are proposed to follow County standards and include cross-sections with sidewalks.

See Figure 3.5 for the Existing and Proposed Pedestrian Plan.

MAKALAPUA PROJECT
DISTRICT TIAR

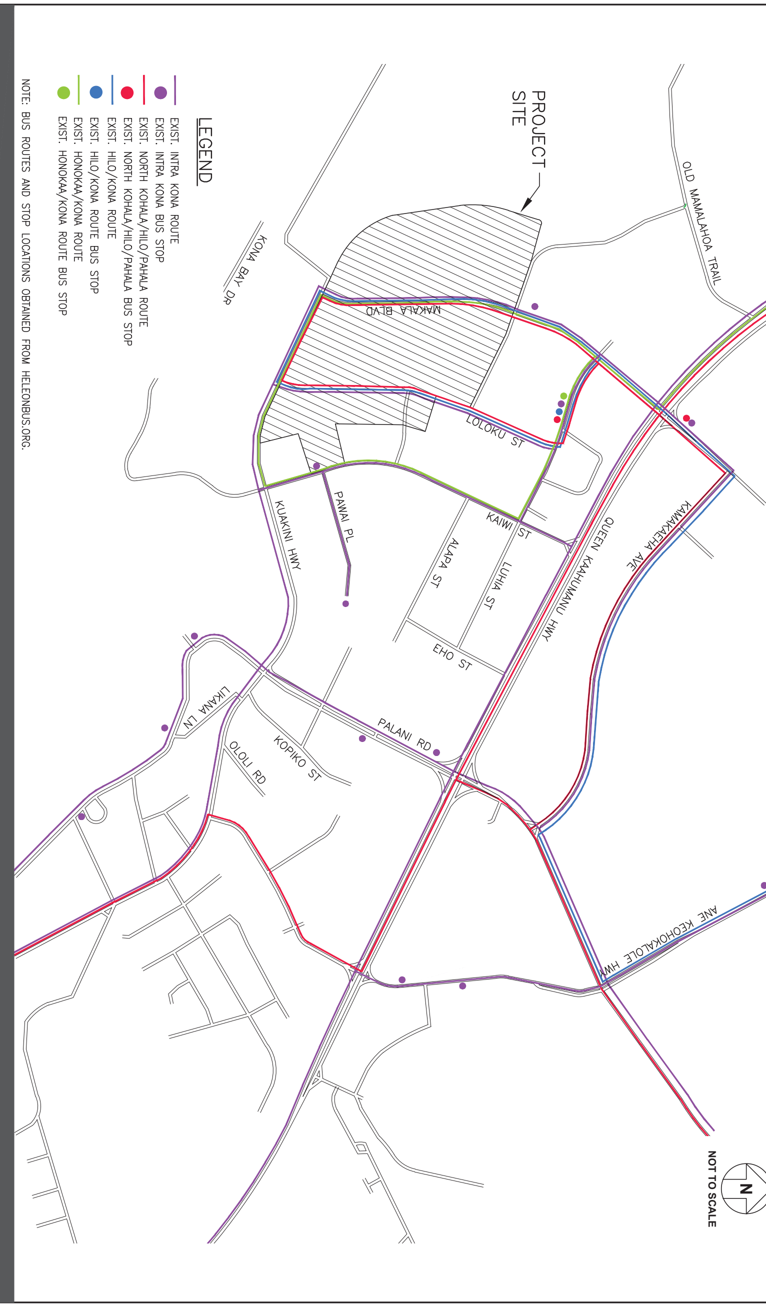

FIGURE 3.2

EXISTING TRANSIT ACCESSIBILITY PLAN

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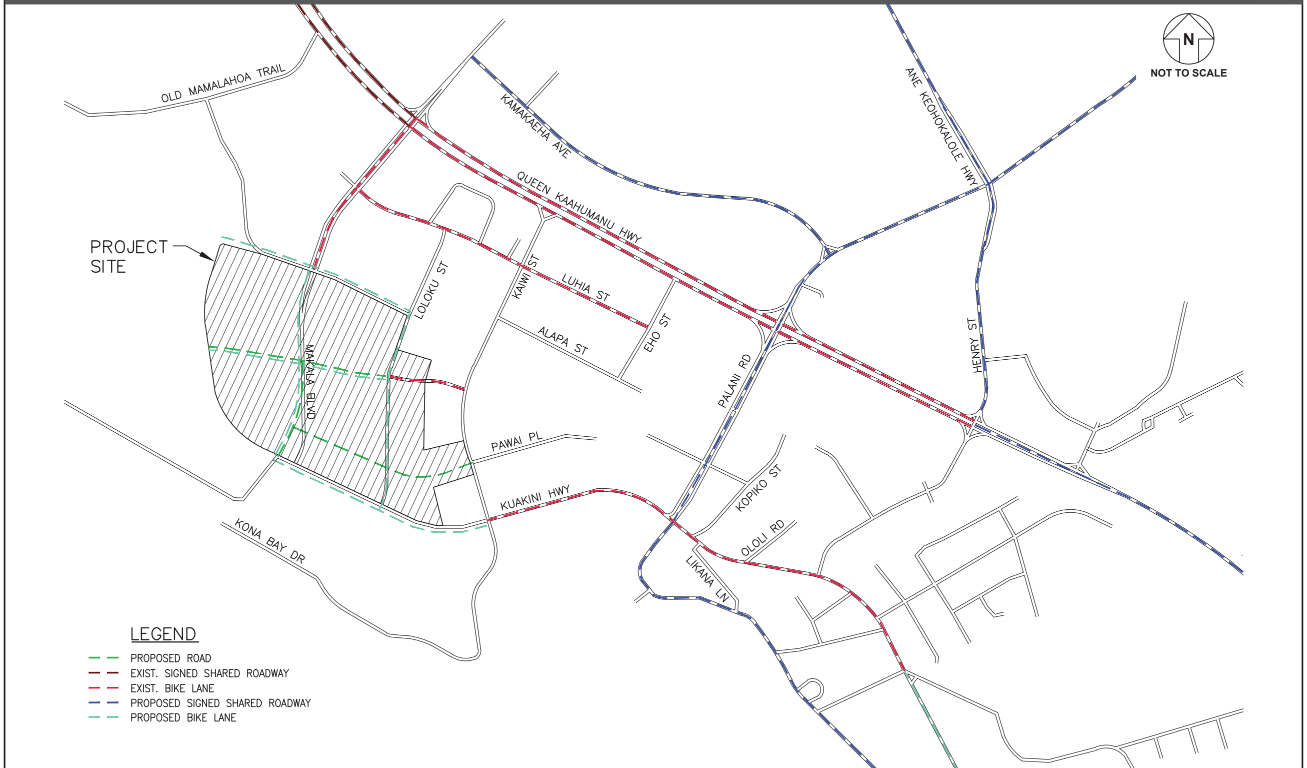

FIGURE 3.3

EXISTING AND PROPOSED BIKE ACCESSIBILITY PLAN

MAKALAPUA PROJECT
DISTRICT TIAR

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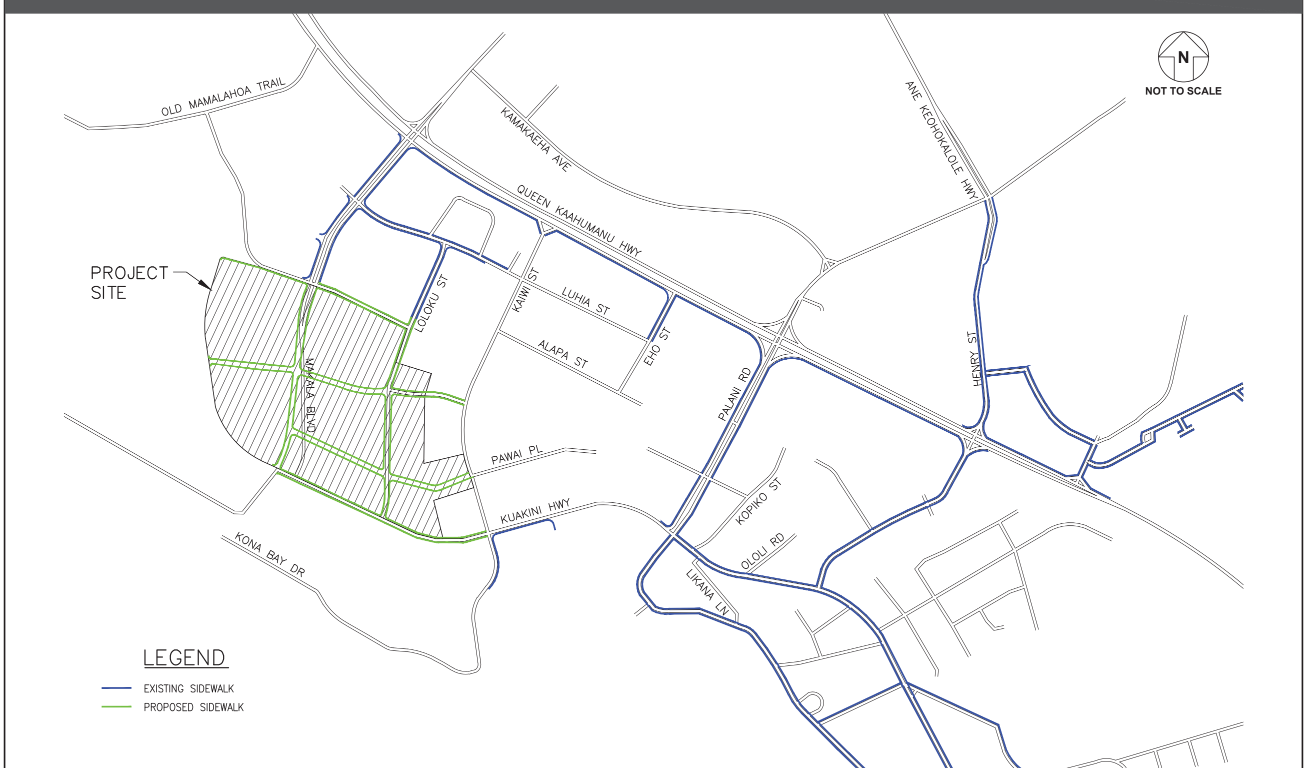

FIGURE 3.4

EXISTING AND PROPOSED PEDESTRIAN PLAN

4. WITHOUT PROJECT SCENARIOS

Consistent with Hawaii County Code concurrency requirement which states: "The TIAR shall include projections for future growth in traffic, for a minimum of five, ten and twenty years, and shall include other approved or proposed development that is expected to impact the project area, with reasonable assumptions about the build-out of such development"; the years 2027, 2032 and 2042 were studied to reflect the completion years of the Project. Inclusion of other approved of and/or proposed developments is discussed in the following sections.

4.1 Background Projection Methodology

At the time of this study, the most recently available Travel Demand Forecasting Model (TDFM) for the Kona region was completed by the Hawaii Department of Transportation (HDOT) in 2014 and projected traffic conditions from 2007 to Year 2035. Typical forecasting models take into account both existing and future land uses and distribute the associated vehicular trips across predetermined Traffic Analysis Zones (TAZs) based upon various factors specific to the region. The TDFM uses data from 2007 as its baseline.

However, since the completion of the TDFM, several large developments included in the model have either stalled out or have not been substantially completed in line with initial development plans. In addition, some known developments are not accounted for in the model since plans were not known at the time the TDFM was developed. In order to account for the changing development landscape in the Kona region, trips were generated independently for known background developments and added to the study network based on the most recent available project plans and/or traffic studies as discussed in Section 3.2.

In order to account for smaller infill development and growth not accounted for with specific development projects, an ambient annual growth rate of 0.5 percent was also applied universally to all study intersection movements.

4.1.1 Background Projects

Due to the proximity to the Project, the following known developments in the region were added to existing traffic data to reflect Base Year conditions. Note that the level of completion of background projects reflects the conditions when traffic count data was collected.

1. Palamanui – Palamanui is proposed to be a 725-acre master planned community located northeast of Kona International Airport. The development plans to provide single family detached dwelling units, residential condominium/townhouse units, a hotel, industrial park, commercial space, and meeting space that will integrate into the development of the adjacent University of Hawaii West Hawaii Campus. Construction of Palamanui has not yet begun at the time of this report; however, based on the latest County Ordinance from 2021, full development of Palamanui must occur in 20 years.

2. University of Hawaii – Hawaii Community College - Palamanui – The University of Hawaii – Hawaii Community College - Palamanui campus is located north of Kaiminani Drive and across from the planned Palamanui development. At the time of data collection, approximately 500 students were enrolled at the college. Ultimately, the college plans to support 1,500 students on a proposed 330,000 SF campus.

3. NELHA Innovation Center and Hale Wawaloli Visitor Center – The Natural Energy Laboratory of Hawaii Authority (NELHA) proposes to expand existing research facilities by approximately 20,000 SF and develop a new 2,250 SF visitor education center. The project includes offices, conference spaces, laboratories, and meeting areas. Project generated trip volumes were obtained from the TIAR for the project prepared by Stantec in November 2021.

4. DLNR North Kona Administration Building and Base Yard – The Department of Land and Natural Resources (DLNR) proposes a new administration building and base yard located in North Kona. The proposed 5-acre facility will include three (3) separate buildings including storage areas, a conference room, a secured base yard, and parking areas. The Final Environmental Assessment was published in 2021.

5. Kula Nei – Kula Nei is a proposed development located east of Queen Kaahumanu Highway between Hina Lani Street and Kaiminani Drive. In 2019, the State Land Use Commission (LUC) reverted the classification of the property back to agriculture from the previous urban designation. Current plans for Kula Nei include developing a 26-lot agricultural subdivision.

6. Kaloko Heights – Kaloko Heights is a proposed residential development located north and south of Hina Lani Street and west of residential areas along Mamalahoa Highway. Kaloko Heights ultimately proposes to construct approximately 1,300 single family and multi-family dwelling units over the course of two (2) phases. As part of the Phase 1 affordable housing requirement, construction has begun on the Kaloko Heights Affordable Housing Project, which is expected to be occupied in 2025. Currently, the LUC has only approved the first phase of development with the second phase land still classified as agricultural. Because the land for Phase 2 has not been reclassified to urban at the time of this study, it was assumed that the development of Phase 2 will occur beyond the study horizon.

7. Kaloko Industrial Park Phases III and IV – Kaloko Industrial Park Phases III and IV is proposed to expand the existing Kaloko Industrial Park for a total of 102 acres of mixed commercial and industrial development. Phases III and IV of the development will be to the east of the existing Phases I and II. Development of Phase III has commenced with several tenants already occupying lots within the development.

8. West Hawaii Business Park – West Hawaii Business Park is proposed to be a 280-acre commercial-industrial development located east of Queen Kaahumanu Highway immediately across the Kaloko-Honokohau National Park. It is estimated that the development will consist of approximately 56 acres of commercial, 76 acres of light industrial, and 42 acres of heavy industrial. Subdivision work for the Project, including the construction of two (2) new accesses to Queen Kaahumanu Highway and the extension of Kanalani Street through the development, is currently ongoing. The project is expected to be developed in three (3) phases over a 20-year period.

9. Villages of Laiopua – Villages of Laiopua is a proposed 980-acre, 1,740-unit master planned community located east of Queen Kaahumanu Highway and directly north of the proposed Keahuolu Project. The Villages of Laiopua will consist of a number of villages which may include single and multi-family residential units, recreational facilities, community facilities, neighborhood-commercial complexes, parks, and

preservation sites. The majority of land within the Villages of Laiopua is owned by the Department of Hawaiian Homelands (DHHL) with several parcels owned by other State agencies. Portions of the development are completed and occupied with construction of new villages ongoing. Based on available plans for the development, Village 1, Village 2, Village 4, Village 5, Village 9 (including the Kukuiola Village emergency shelter), and the expansion of the Laiopua 2020 community center are expected to be completed within the studied timeframe.

10. Honuaula Living Community – Honuaula Living Community is a proposed 112-unit affordable rental development located northeast of the intersection between Manawalea Street and Kealakaa Street. The project will consist of 1-4 bedroom apartment units and will include a community center as well as a children's play area. This project is anticipated to be completed in 2024.

11. Keahuolu – Keahuolu is bound by Ane Keohokalole Highway to the east, Kailua Village to the south, the Old Kona Airport State Recreation Area and the Pacific Ocean to the west, and mostly undeveloped land to the north. This master planned development will include single family and multi-family homes, commercial space, office space, civic/cultural space, a school, and resort accommodations. In total, Keahuolu is anticipated to include approximately 6,427 residential units, 839,000 square feet of commercial and office space, 279,000 square feet of retail space, an 80-room hotel and 250,000 square feet of community space. No movement has commenced on this project; however a portion of the development was assumed to occur within the study horizon.

12. Kamakana Villages – Kamakana Villages is a proposed 272-acre master planned residential-commercial development located directly east of Ane Keohokalole Highway and north of Palani Road. The project is expected to consist of approximately 2,330 single-family and multi-family dwelling units, an elementary school, a charter/private school, and 197,000 square feet of commercial development. The Kamakana Senior and Kamakana Family affordable rental apartments, which satisfy a portion of the development's affordable housing requirements, was completed in 2018. Currently no other development of the site has occurred. For the purposes of this study, Increment I, which initially planned to include approximately 1,700 residential units, 100,000 square feet of commercial and the proposed schools, was assumed to be constructed within the study horizon.

13. Kealakehe Regional Park – This project is bounded by the existing Kealakehe Parkway and Hale Makai Place to the north and south, respectively, and Ane Keohokalole Highway and Queen Kaahumanu Highway to the east and west, respectively. This development proposes to construct a 190 acre public park complex that includes tennis courts, community gardens, softball/baseball fields, a football field, soccer fields, basketball courts, an amphitheater, a dog park, and general purpose fields. The project is expected to be completed by Year 2042.

14. Niumalu Marketplace – Niumalu Marketplace is a recently constructed strip mall that is approximately 187,000 square feet. It is currently only occupied by Safeway and Kona Diamond Company and has several vacant buildings available. Continued expansion of the site is planned to include additional retail, restaurants, and a gas station.

15. Kona Bay Hotel Renovation – The Kona Bay Hotel is a proposed renovation to the existing hotel, which is currently unoccupied. The renovation does not plan to increase hotel capacity beyond the previous 122 rooms but rather upgrade hotel features to meet current market demands. This includes upgrading the front desk, adjacent public areas, roofing throughout the complex, installing new entry doors in guest rooms, and replacing open flame tiki torches with LED fixtures. Because the hotel was not operational at the time of data collection, the renovation is included as a background development. The project is anticipated to be completed by 2024.

16. Pualani Makai – Pualani Makai is a proposed mixed-use development located between Kuakini Highway and Queen Kaahumanu Highway opposite Pualani Estates. Development will include 386 residential units, roughly 76,600 SF of commercial space, a car wash, gas station, and bus transfer station. According to the 2019 TIAR prepared by the Traffic Management Consultant, a total of 321(175) trips are expected to be generated. The project is expected to be completed by 2024.

17. Royal Vistas – Royal Vistas is a proposed 70-acre multifamily residential subdivision located north of the intersection between Kuakini Highway and Queen Kaahumanu Highway. Phase 1 of the project proposes to include 258 multifamily units, and Phase 2 proposes to include 192 multifamily units for a total of 450 units. This project is anticipated to be completed in 2029. Project generated trip volumes were obtained from the TIAR published by SSFM in May 2020.

The above background projects are in various stages in the approval process. Although included in this study, not all projects may be approved as a whole or in part of what has been assumed and may not necessarily begin construction once approved. Therefore, the background project assumptions are considered conservative. As a standard of practice, TIARs are required to take into account all known projects planned which could affect traffic operations at the study intersections. However, from historical statewide projections and analyses, traffic growth used in TIARs are generally highly conservative when compared to realized traffic growth. The background projects are shown in Figure 4.1.

MAKALAPUA PROJECT
DISTRICT TIAR

Austin Tsutsumi & Associates, Inc.
Engineers & Surveyors

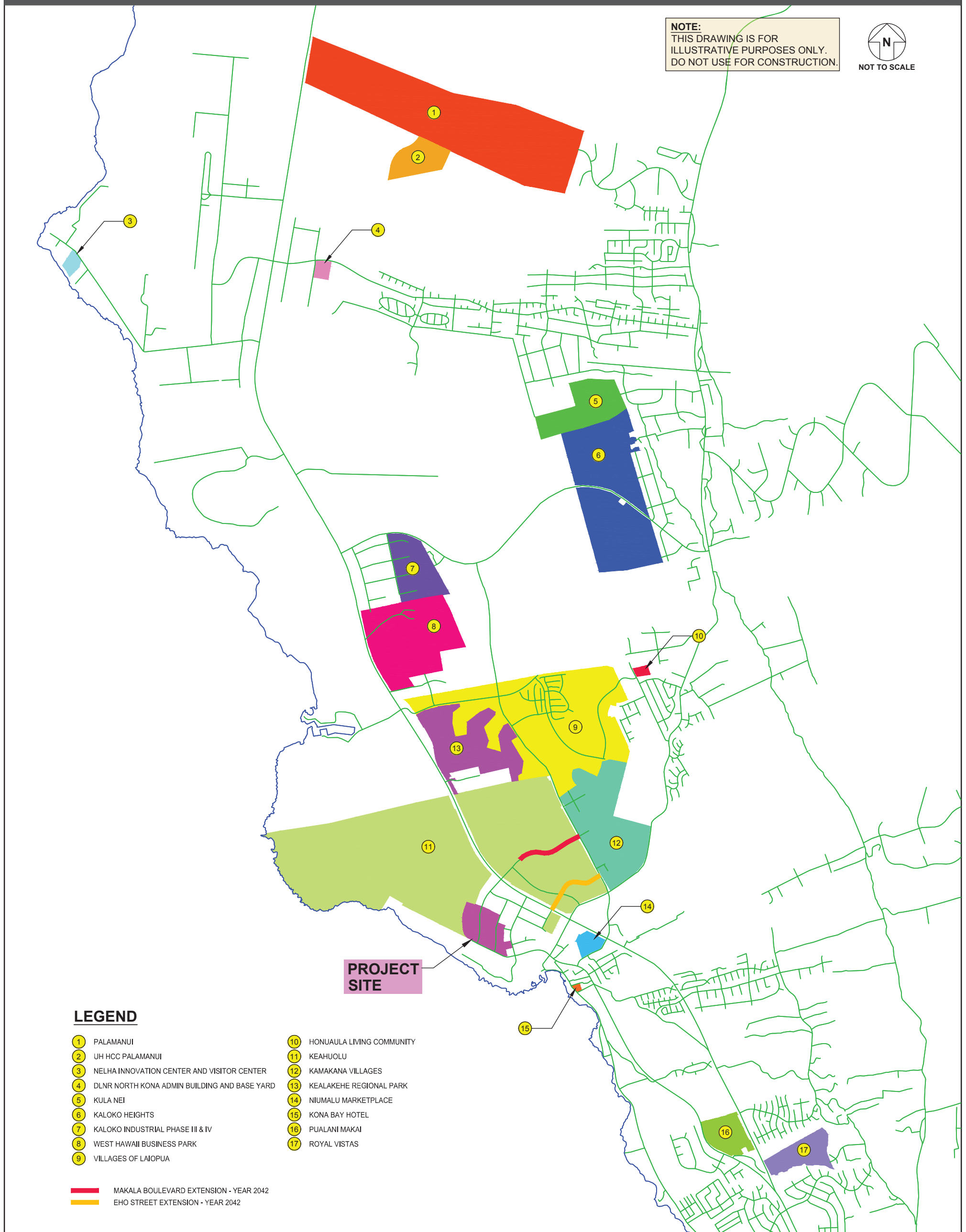

FIGURE 4.1

BACKGROUND DEVELOPMENTS
AND PLANNED ROADWAY
IMPROVEMENTS

4.1.2 Trip Generation

The Institute of Transportation Engineers (ITE) publishes a book based on empirical data compiled from a body of more than 4,250 trip generation studies submitted by public agencies, developers, consulting firms, and associations. This publication, titled Trip Generation, 11th Edition, provides trip rates and/or formulae based on graphs that correlate vehicular trips with independent variables. The independent variables can range from Dwelling Units (DU) for single-family attached homes to Gross Floor Area (GFA) for commercial or office development.

Trip generation for the above background projects came from two sources. When available, trips generated from their respective TIARs were used in this report. If a TIAR did not generate traffic, or if a TIAR was never completed, trips were manually generated using trip generation rates contained in the Trip Generation, 11th Edition.

4.1.3 Trip Reductions

Due to the large size and proposed land uses of some of the projects, trip reductions as described below were applied to specific projects to more accurately reflect the projections.

4.1.3.1 Internal Capture

The various background projects included in the without Project scenarios traffic projections propose to develop several different land uses that interact to create vehicle trips that can be considered internal to their respective developments. Calculation of internal trip capture rates was done using the ITE Trip Generation Handbook, 3rd Edition.

4.1.3.2 Pass-by/Diverted Trip Reduction

Pass-by and diverted trip reductions were applied to the various developments where applicable. These developments are proposed to be located along major arterials and, as a result, a percentage of existing users are expected to take short detours into the various project sites on their way to their destinations. Estimations for pass-by and diverted trip reductions were based upon information within the ITE Trip Generation Handbook, 3rd Edition. As a conservative measure, pass-by/diverted trip reductions were capped at 20% for all land uses.

4.1.3.3 Regional Capture

Due to the nature of the North Kona District and the proximity of the known background projects to one another within the Kailua-Kona region, a regional capture rate was applied to areas spanning from the Kona International Airport to the Kona Industrial area. A regional capture assumes that trips either produced or attracted by a specific background project will remain internal to the region and will likely travel from one project to another. The purpose of regional capture is to reduce double counting once a trip leaves its origin project (production) and once when it arrives at its destination project (attraction).

After all trip generation reductions are applied, background projects are expected to increase existing traffic volumes between 19 to 65 percent by Year 2042.

4.1.4 Background Roadway Projects

No roadway improvements were assumed to be constructed as part of Year 2027 and 2032 without the Project.

2042 Roadway Projects

The following roadway projects are based on an expected development timeline for the Keahuolu Project, so actual construction of these roadways is subject to change.

- Makala Boulevard extension that extends from Queen Kaahumanu Highway to Ane Keohokalole Highway.
- Eho Street extension that adds a fourth leg to the Queen Kaahumanu Highway/Eho Street intersection. The new leg is assumed to be RIRO with northbound traffic to mirror the existing side.

The background roadway projects are shown in Figure 4.1.

4.2 Year 2027 without Project Analysis

It is anticipated that by Year 2027 without Project, traffic will have increased over existing conditions due to the development in the Kailua-Kona region. Actual growth within the study region may vary based upon the approval process of the various projects.

4.2.1 Year 2027 without Project Intersection Analysis

As a result of ongoing development of background projects assumed by Year 2027, some intersections are forecast to worsen compared to Existing conditions. Intersections where traffic increases affect intersection operations beyond acceptable levels are discussed below:

[15] Kuakini Highway/Kaiwi Street

As a result of heavy growth within the Kailua-Kona region, this 4-way stop controlled intersection is projected to experience substantial increases to queuing and delay in the northbound direction with near capacity conditions at LOS F experienced during the PM peak hour of traffic. The southbound approach is also anticipated to have increased delay with LOS E during the peak PM hour.

Figure 4.2 illustrates the Year 2027 without Project lane configurations, volumes and LOS. See Table 4.1 for a summary of the Year 2027 without Project analysis. LOS worksheets are included in Appendix C.

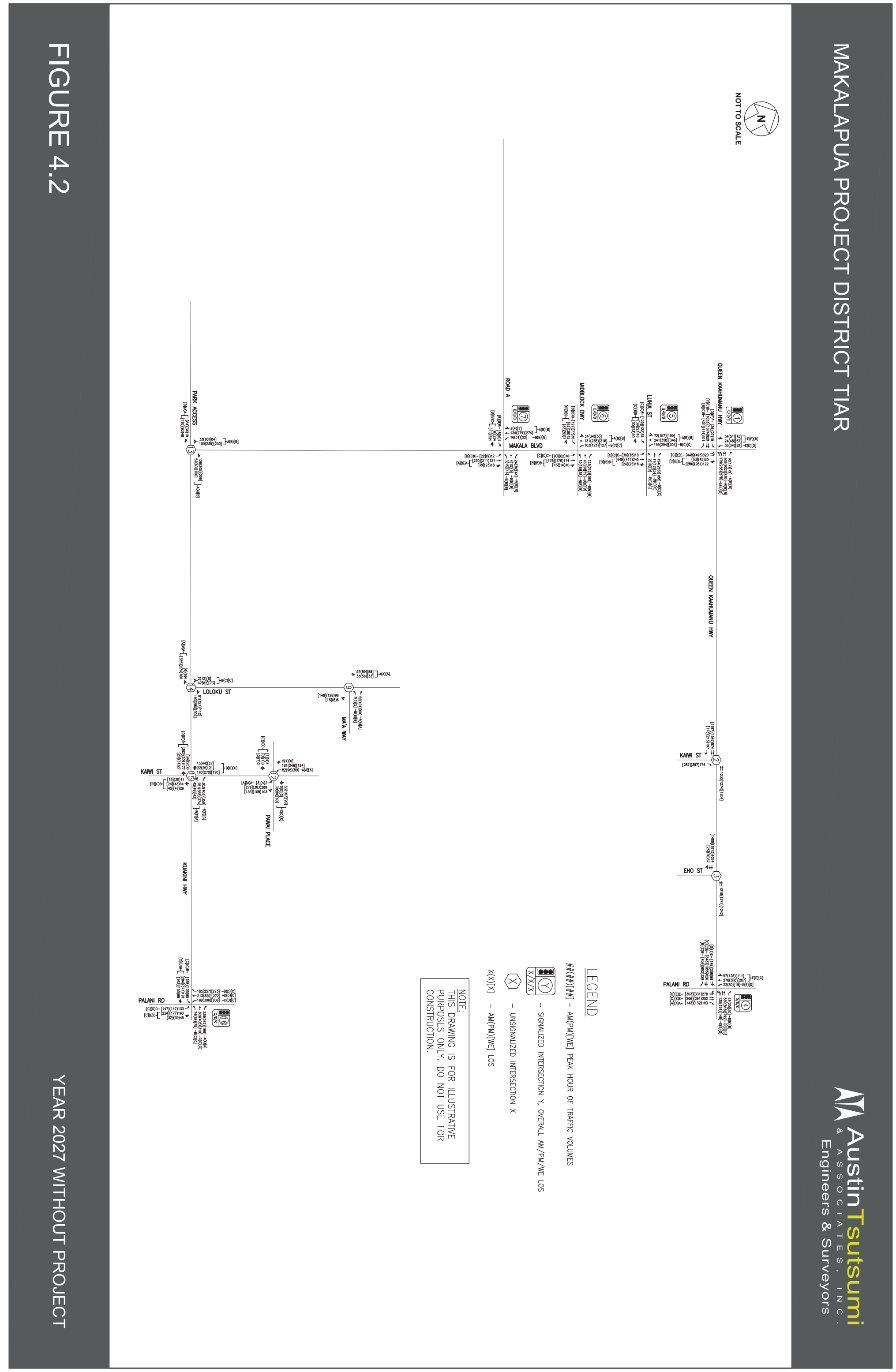

TABLE 4.1: LOS SUMMARY TABLE
EXISTING CONDITIONS AND YEAR 2027 WITHOUT PROJECT

	Intersection / Signalized: Overall LOS / Unsignalized: Critical Movement LOS / LOS [X / X / X] / DELAY [X / X / X]	Existing Conditions (AM / PM / WE)			Year 2027 without Project (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1	**1: Queen Kaahumanu Highway & Makala Boulevard** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*	Queen Kaahumanu / Makala Boulevard			See Existing		
		C / D / C - / - / - 28 / 37 / 22			C / D / C - / - / - 29 / 39 / 26		
	NB LT	80 / 79 / 33	0.76 / 0.83 / 0.69	E / E / C	76 / 79 / 40	0.67 / 0.84 / 0.74	E / E / D
	NB TH	10 / 14 / 14	0.34 / 0.35 / 0.48	A / B / B	12 / 17 / 16	0.42 / 0.45 / 0.55	B / B / B
	NB RT	7 / 11 / 11	0.01 / 0 / 0	A / B / B	8 / 12 / 12	0.01 / 0.01 / 0.01	A / B / B
	EB LT	76 / 71 / 28	0.84 / 0.86 / 0.67	E / E / C	76 / 71 / 34	0.85 / 0.87 / 0.71	E / E / C
	EB TH/RT	66 / 59 / 24	0.1 / 0.15 / 0.15	E / E / C	65 / 57 / 29	0.1 / 0.15 / 0.16	E / E / C
	WB LT	76 / 76 / 33	0.27 / 0.27 / 0.12	E / E / C	77 / 77 / 42	0.37 / 0.35 / 0.32	E / E / D
	WB TH/RT	76 / 78 / 40	0.23 / 0.45 / 0.61	E / E / D	76 / 78 / 48	0.24 / 0.47 / 0.64	E / E / D
	SB LT	99 / 98 / 44	0.51 / 0.56 / 0.5	F / F / D	98 / 108 / 52	0.63 / 0.73 / 0.65	F / F / D
	SB TH	14 / 27 / 21	0.35 / 0.64 / 0.71	B / C / C	17 / 33 / 24	0.41 / 0.77 / 0.78	B / C / C
	SB RT	12 / 19 / 17	0.18 / 0.22 / 0.22	B / B / B	14 / 20 / 17	0.19 / 0.23 / 0.24	B / C / B
2	**2: Queen Kaahumanu Highway & Kaiwi Street** *Discussion: The EB RT movement is provided with an acceleration lane, therefore no delays are anticipated.*	Queen Kaahumanu Hwy / Kaiwi Street			See Existing		
3	**3: Queen Kaahumanu Highway & Eho Street** *Discussion: The SB RT movement is not anticipated to experience any delays.*	Queen Kaahumanu Hwy / Eho Street			See Existing		
4	**4: Queen Kaahumanu Highway & Palani Road** *Discussion: The projected increase in traffic is anticipated to increase the movements delay at this intersection, most notably during the PM and WE peak hours.*	Queen Kaahumanu Hwy / Palani Road			See Existing		
		D / D / C - / - / - 36 / 40 / 22			D / D / C - / - / - 39 / 41 / 25		
	NB LT	80 / 79 / 30	0.68 / 0.63 / 0.59	E / E / C	76 / 79 / 37	0.59 / 0.65 / 0.63	E / E / D
	NB TH	17 / 21 / 19	0.51 / 0.37 / 0.64	B / C / B	18 / 25 / 21	0.42 / 0.47 / 0.66	B / C / C
	NB RT	11 / 17 / 15	0.01 / 0.01 / 0.02	B / B / B	13 / 19 / 15	0.01 / 0.01 / 0.02	B / B / B
	EB LT	79 / 78 / 28	0.82 / 0.85 / 0.67	E / E / C	78 / 79 / 34	0.85 / 0.87 / 0.73	E / E / C
	EB TH	64 / 62 / 20	0.37 / 0.44 / 0.29	E / E / B	60 / 59 / 24	0.36 / 0.46 / 0.33	E / E / C
	EB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
	WB LT	80 / 79 / 38	0.33 / 0.39 / 0.48	E / E / D	80 / 79 / 46	0.33 / 0.39 / 0.5	E / E / D
	WB TH/RT	75 / 74 / 26	0.73 / 0.74 / 0.51	E / E / C	74 / 73 / 32	0.76 / 0.76 / 0.58	E / E / C
	SB LT	77 / 71 / 30	0.46 / 0.59 / 0.59	E / E / C	77 / 72 / 37	0.47 / 0.6 / 0.63	E / E / D
	SB TH	14 / 19 / 19	0.26 / 0.45 / 0.65	B / B / B	17 / 23 / 21	0.32 / 0.56 / 0.71	B / C / C
	SB RT	13 / 18 / 16	0.17 / 0.38 / 0.22	B / B / B	16 / 22 / 18	0.18 / 0.47 / 0.38	B / C / B
5	**5: Makala Boulevard & Luhia Street** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*	Luhia Street / Makala Boulevard			See Existing		
		B / B / B - / - / - 14 / 16 / 18			B / B / B - / - / - 14 / 16 / 18		
	NB LT	17 / 22 / 22	0.03 / 0.17 / 0.09	B / C / C	17 / 22 / 22	0.03 / 0.17 / 0.09	B / C / C
	NB TH	19 / 22 / 25	0.28 / 0.19 / 0.48	B / C / C	19 / 23 / 26	0.28 / 0.19 / 0.49	B / C / C
	NB RT	18 / 21 / 21	0.15 / 0.14 / 0.06	B / C / C	18 / 22 / 22	0.15 / 0.12 / 0.06	B / C / C
	EB LT	28 / 28 / 29	0.43 / 0.45 / 0.5	C / C / C	28 / 29 / 30	0.43 / 0.46 / 0.5	C / C / C
	EB TH/RT	13 / 16 / 17	0.39 / 0.53 / 0.54	B / B / B	14 / 16 / 17	0.41 / 0.55 / 0.56	B / B / B
	WB LT	18 / 22 / 24	0.74 / 0.76 / 0.77	B / C / C	18 / 22 / 25	0.74 / 0.76 / 0.77	B / C / C
	WB TH/RT	9 / 11 / 12	0.26 / 0.38 / 0.37	A / B / B	9 / 11 / 12	0.27 / 0.39 / 0.4	A / B / B
	SB LT	18 / 22 / 24	0.35 / 0.68 / 0.65	B / C / C	18 / 23 / 24	0.36 / 0.68 / 0.66	B / C / C
	SB TH/RT	16 / 18 / 20	0.16 / 0.12 / 0.23	B / B / B	17 / 18 / 21	0.16 / 0.12 / 0.24	B / B / C
6	**6: Makala Boulevard & Midblock Driveway** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*	Midblock Driveway / Makala Boulevard			See Existing		
		B / B / B - / - / - 14 / 16 / 18			B / B / B - / - / - 14 / 16 / 19		
	NB LT	16 / 16 / 18	0.22 / 0.15 / 0.18	B / B / B	16 / 17 / 18	0.22 / 0.14 / 0.19	B / B / B
	NB TH	16 / 17 / 19	0.22 / 0.24 / 0.33	B / B / B	16 / 17 / 19	0.22 / 0.26 / 0.34	B / B / B
	NB RT	15 / 17 / 18	0.03 / 0.16 / 0.1	B / B / B	15 / 17 / 18	0.02 / 0.15 / 0.12	B / B / B
	EB LT	22 / 20 / 24	0.44 / 0.55 / 0.67	C / C / C	22 / 20 / 25	0.44 / 0.56 / 0.68	C / C / C
	EB TH/RT	12 / 15 / 17	0.16 / 0.33 / 0.34	B / B / B	12 / 15 / 17	0.21 / 0.38 / 0.37	B / B / B
	WB LT	18 / 21 / 24	0.63 / 0.72 / 0.75	B / C / C	18 / 21 / 25	0.64 / 0.73 / 0.75	B / C / C
	WB TH/RT	10 / 14 / 16	0.16 / 0.39 / 0.39	A / B / B	10 / 14 / 17	0.18 / 0.44 / 0.44	A / B / B
	SB LT	16 / 15 / 16	0.33 / 0.34 / 0.39	B / B / B	16 / 15 / 16	0.34 / 0.35 / 0.4	B / B / B
	SB TH/RT	15 / 14 / 15	0.14 / 0.18 / 0.31	B / B / B	15 / 14 / 16	0.13 / 0.19 / 0.32	B / B / B
7	**7: Makala Boulevard & Road A** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*	Road A / Makala Boulevard			See Existing		
		B / B / B - / - / - 11 / 11 / 11			B / B / B - / - / - 11 / 11 / 11		
	NB LT	15 / 15 / 17	0.11 / 0.23 / 0.33	B / B / B	15 / 15 / 17	0.11 / 0.23 / 0.31	B / B / B
	NB TH	15 / 14 / 14	0.14 / 0.15 / 0.09	B / B / B	15 / 14 / 14	0.14 / 0.15 / 0.09	B / B / B
	NB RT	14 / 14 / 13	0.04 / 0.02 / 0.02	B / B / B	14 / 14 / 14	0.04 / 0.02 / 0.04	B / B / B
	EB LT	22 / 26 / 19	0.42 / 0.42 / 0.44	C / C / B	22 / 26 / 19	0.42 / 0.42 / 0.44	C / C / B
	EB TH/RT	9 / 11 / 10	0.17 / 0.31 / 0.34	A / B / B	9 / 11 / 10	0.2 / 0.35 / 0.35	A / B / A
	WB LT	20 / 18 / 19	0.43 / 0.46 / 0.44	B / B / B	20 / 18 / 19	0.43 / 0.46 / 0.44	B / B / B
	WB TH/RT	9 / 10 / 10	0.18 / 0.35 / 0.36	A / B / B	9 / 10 / 10	0.2 / 0.38 / 0.38	A / B / B
	SB LT	15 / 14 / 16	0.07 / 0.1 / 0.23	B / B / B	16 / 14 / 17	0.08 / 0.11 / 0.24	B / B / B
	SB TH/RT	26 / 14 / 16	0.34 / 0.06 / 0.2	C / B / B	26 / 14 / 16	0.31 / 0.03 / 0.18	C / B / B
9	**9: Loloku Street & Maa Way** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*	Maa Way / Loloku Street			See Existing		
		A / B / B 0.01 / 0.01 / 0.01 10 / 11 / 11			B / B / B 0.01 / 0.01 / 0.01 10 / 11 / 11		
	NB LT	10 / 11 / 11	0.01 / 0.01 / 0.01	A / B / B	10 / 11 / 11	0.01 / 0.01 / 0.01	B / B / B
	NB RT	9 / 10 / 10	0.06 / 0.12 / 0.08	A / A / A	9 / 10 / 10	0.06 / 0.12 / 0.09	A / A / A
	WB LT/TH	8 / 8 / 8	0.02 / 0.04 / 0.03	A / A / A	8 / 8 / 8	0.02 / 0.04 / 0.03	A / A / A
12	**12: Pawai Place & Kaiwi Street** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*	Pawai Place / Kaiwi Street			See Existing		
		B / D / C 0.21 / 0.62 / 0.36 15 / 31 / 18			C / D / C 0.22 / 0.65 / 0.38 15 / 34 / 18		
	NB LT/TH/RT	15 / 31 / 18	0.21 / 0.62 / 0.36	B / D / C	15 / 34 / 18	0.22 / 0.65 / 0.38	C / D / C
	EB LT	8 / 8 / 8	0 / 0 / 0	A / A / A	8 / 8 / 8	0 / 0 / 0	A / A / A
	WB LT	8 / 9 / 9	0.08 / 0.1 / 0.08	A / A / A	9 / 9 / 9	0.08 / 0.1 / 0.09	A / A / A
	SB LT/TH/RT	17 / 16 / 18	0.01 / 0.04 / 0	C / C / C	17 / 16 / 19	0.01 / 0.04 / 0	C / C / C
13	**13: Kuakini Highway & Makala Boulevard** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*	Kuakini Highway / Makala Boulevard			See Existing		
		A / B / B 0.17 / 0.39 / 0.43 8 / 11 / 12			A / B / B 0.19 / 0.44 / 0.50 9 / 12 / 14		
	NB TH/RT	8 / 9 / 11	0.18 / 0.31 / 0.39	A / A / B	8 / 10 / 12	0.21 / 0.36 / 0.45	A / A / B
	WB LT/RT	8 / 11 / 12	0.17 / 0.39 / 0.43	A / B / B	9 / 12 / 14	0.19 / 0.44 / 0.5	A / B / B
	SB LT/TH	8 / 9 / 11	0.09 / 0.15 / 0.3	A / A / B	8 / 9 / 11	0.09 / 0.16 / 0.32	A / A / B
14	**14: Kuakini Highway & Loloku Street** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*	Kuakini Highway / Loloku Street			See Existing		
		B / B / C 0.09 / 0.21 / 0.21 12 / 15 / 16			B / C / C 0.09 / 0.24 / 0.24 12 / 16 / 18		
	WB LT/RT	12 / 15 / 16	0.09 / 0.21 / 0.21	B / B / C	12 / 16 / 18	0.09 / 0.24 / 0.24	B / C / C
	SB LT/TH	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A

	Intersection	Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Existing Conditions (AM / PM / WE) HCM Delay	Existing v/c Ratio	Existing LOS	Year 2027 without Project (AM / PM / WE) HCM Delay	Year 2027 v/c Ratio	Year 2027 LOS
15	**15: Kuakini Highway & Kaiwi Street** *Discussion: The projected increase in traffic is anticipated to increase the movements delay at this intersection. During the PM peak hour, the shared NB LT/TH is expected to operate at LOS F.*		Kuakini Highway / Kaiwi Street / N			See Existing		
			B / E / D 0.47 / 0.87 / 0.77 14 / 43 / 29			B / F / E 0.52 / 0.93 / 0.86 15 / 57 / 38		
		NB LT/TH	14 / 43 / 29	0.47 / 0.87 / 0.77	B / E / D	15 / 57 / 38	0.52 / 0.93 / 0.86	B / F / E
		NB RT	12 / 29 / 17	0.45 / 0.78 / 0.6	B / D / C	12 / 36 / 19	0.47 / 0.83 / 0.64	B / E / C
		EB LT/TH/RT	10 / 15 / 12	0.13 / 0.29 / 0.19	A / B / B	10 / 16 / 13	0.14 / 0.31 / 0.2	B / C / B
		WB LT/TH/RT	12 / 29 / 17	0.36 / 0.74 / 0.5	B / D / C	13 / 33 / 19	0.37 / 0.79 / 0.53	B / D / C
		SB LT/TH/RT	11 / 27 / 25	0.32 / 0.72 / 0.74	B / D / D	12 / 37 / 34	0.35 / 0.81 / 0.82	B / E / D
16	**16: Kuakini Highway & Palani Road** *Discussion: The intersection is expected to continue operating at conditions similar to exisitng.*		Kuakini Highway / Palani Road / N			See Existing		
			C / D / C - / - / - 31 / 39 / 24			C / D / C - / - / - 32 / 43 / 28		
		NB LT	13 / 24 / 21	0.14 / 0.3 / 0.33	B / C / C	15 / 28 / 23	0.16 / 0.38 / 0.38	B / C / C
		NB TH	18 / 29 / 26	0.41 / 0.52 / 0.67	B / C / C	22 / 34 / 29	0.48 / 0.6 / 0.69	C / C / C
		NB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
		EB LT	41 / 45 / 19	0.55 / 0.56 / 0.38	D / D / B	38 / 45 / 22	0.52 / 0.58 / 0.44	D / D / C
		EB TH/RT	50 / 56 / 26	0.62 / 0.62 / 0.52	D / E / C	51 / 62 / 32	0.71 / 0.75 / 0.67	D / E / C
		WB LT	45 / 42 / 19	0.65 / 0.75 / 0.44	D / D / B	43 / 47 / 22	0.71 / 0.85 / 0.59	D / D / C
		WB TH	50 / 51 / 24	0.67 / 0.71 / 0.48	D / D / C	48 / 51 / 29	0.67 / 0.75 / 0.6	D / D / C
		WB RT	43 / 42 / 21	0.08 / 0.14 / 0.09	D / D / C	40 / 40 / 23	0.09 / 0.17 / 0.14	D / D / C
		SB LT	13 / 21 / 19	0.2 / 0.28 / 0.47	B / C / B	16 / 24 / 20	0.24 / 0.34 / 0.5	B / C / C
		SB TH/RT	17 / 35 / 28	0.33 / 0.68 / 0.85	B / C / C	20 / 42 / 32	0.37 / 0.78 / 0.87	B / D / C

4.3 Year 2032 without Project Analysis

It is anticipated that by Year 2032 without Project, traffic will have increased over Year 2027 without Project conditions due to the large number of planned developments. Actual growth within the study region may vary based upon the approval process of the various projects.

4.3.1 Year 2032 without Project Intersection Analysis

Traffic operations by Year 2032 without Project with the background projects are forecast to worsen compared to Year 2027 without Project conditions. As a result of the assumed partial completion of several significant background projects by Year 2032, the following intersections are expected to worsen compared to Year 2027 without Project conditions:

<u>[15] Kuakini Highway/Kaiwi Street</u>

Delay is expected to further increase in the northbound direction which is expected to operate at LOS F and over capacity conditions during the PM peak hour of traffic and LOS F at near capacity conditions during the peak WE hour. The southbound and westbound approach are also expected to operate at LOS E during various peaks.

Figure 4.3 illustrates the Year 2032 without Project lane configurations, volumes and LOS. See Table 4.2 for a summary of the Year 2032 without Project analysis. LOS worksheets are included in Appendix C.

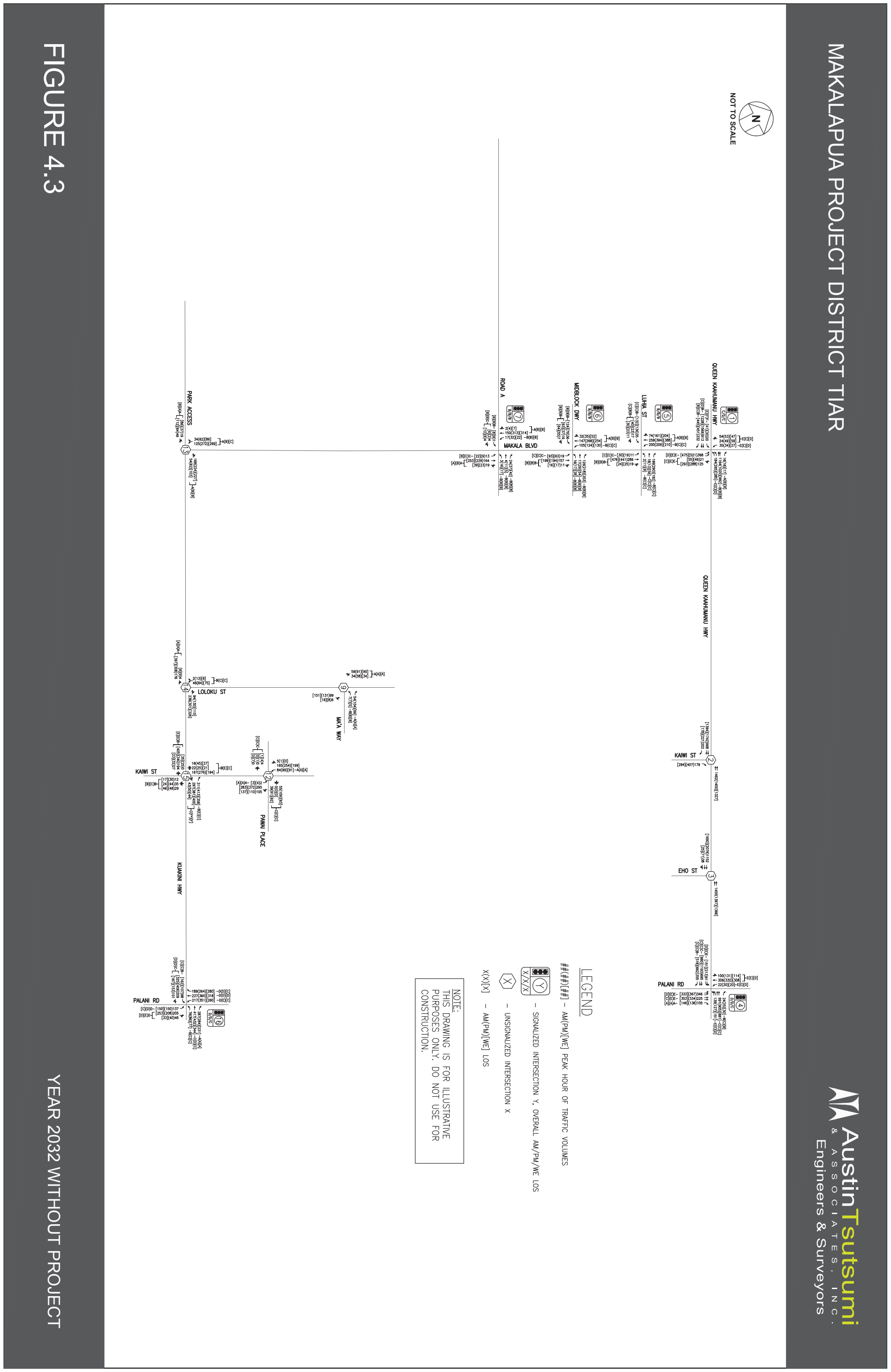

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TABLE 4.2: LOS SUMMARY TABLE
YEAR 2027 WITHOUT PROJECT AND YEAR 2032 WITHOUT PROJECT

	Intersection	Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2027 without Project (AM / PM / WE)			Year 2032 without Project (AM / PM / WE)		
			HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1	**1: Queen Kaahumanu Highway & Makala Boulevard** *Discussion: This intersection is expected to operate similar to Year 2027 without the Project. The long delays experienced are on the minor movements.*		Queen Kaahumanu Hwy / Makala Boulevard			See Year 2027 without Project		
			C / D / C - / - / - 29 / 39 / 26			C / D / C - / - / - 30 / 43 / 30		
		NB LT	76 / 79 / 40	0.67 / 0.84 / 0.74	E / E / D	76 / 79 / 46	0.68 / 0.84 / 0.76	E / E / D
		NB TH	12 / 17 / 16	0.42 / 0.45 / 0.55	B / B / B	15 / 19 / 17	0.53 / 0.51 / 0.59	B / B / B
		NB RT	8 / 12 / 12	0.01 / 0.01 / 0.01	A / B / B	9 / 13 / 12	0.01 / 0.01 / 0.01	A / B / B
		EB LT	76 / 71 / 34	0.85 / 0.87 / 0.71	E / E / C	74 / 71 / 39	0.86 / 0.88 / 0.75	E / E / D
		EB TH/RT	65 / 57 / 29	0.1 / 0.15 / 0.16	E / E / C	63 / 56 / 33	0.09 / 0.14 / 0.16	E / E / C
		WB LT	77 / 77 / 42	0.37 / 0.35 / 0.32	E / E / D	77 / 76 / 48	0.37 / 0.35 / 0.31	E / E / D
		WB TH/RT	76 / 78 / 48	0.24 / 0.47 / 0.64	E / E / D	76 / 78 / 54	0.24 / 0.48 / 0.66	E / E / D
		SB LT	98 / 108 / 52	0.63 / 0.73 / 0.65	F / F / D	99 / 106 / 61	0.64 / 0.78 / 0.71	F / F / E
		SB TH	17 / 33 / 24	0.41 / 0.77 / 0.78	B / C / C	19 / 42 / 31	0.46 / 0.9 / 0.87	B / D / C
		SB RT	14 / 20 / 17	0.19 / 0.23 / 0.24	B / C / B	15 / 22 / 18	0.2 / 0.27 / 0.24	B / C / B
2	**2: Queen Kaahumanu Highway & Kaiwi Street** *Discussion: The EB RT movement is provided with an acceleration lane, therefore no delays are experienced.*		Queen Kaahumanu Hwy / Kaiwi Street			See Year 2027 without Project		
3	**3: Queen Kaahumanu Highway & Eho Street** *Discussion: The SB RT movement is not anticipated to experience any delays.*		Queen Kaahumanu Hwy / Eho Street			See Year 2027 without Project		
4	**4: Queen Kaahumanu Highway & Palani Road** *Discussion: While delay is expected to increase for all movements, this intersection is expected to operate similar to Year 2027 without the Project. The long delays experienced are on the minor movements.*		Queen Kaahumanu Hwy / Palani Road			See Year 2027 without Project		
			D / D / C - / - / - 39 / 41 / 25			D / D / C - / - / - 40 / 43 / 28		
		NB LT	76 / 79 / 37	0.59 / 0.65 / 0.63	E / E / D	77 / 79 / 44	0.6 / 0.66 / 0.66	E / E / D
		NB TH	18 / 25 / 21	0.42 / 0.47 / 0.66	B / C / C	23 / 29 / 23	0.53 / 0.55 / 0.67	C / C / C
		NB RT	13 / 19 / 15	0.01 / 0.01 / 0.02	B / B / B	15 / 20 / 16	0.01 / 0.01 / 0.02	B / C / B
		EB LT	78 / 79 / 34	0.85 / 0.87 / 0.73	E / E / C	75 / 75 / 41	0.86 / 0.87 / 0.78	E / E / D
		EB TH	60 / 59 / 24	0.36 / 0.46 / 0.33	E / E / C	56 / 57 / 28	0.33 / 0.47 / 0.36	E / E / C
		EB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
		WB LT	80 / 79 / 46	0.33 / 0.39 / 0.5	E / E / D	80 / 79 / 53	0.33 / 0.39 / 0.53	E / E / D
		WB TH/RT	74 / 73 / 32	0.76 / 0.76 / 0.58	E / E / C	73 / 72 / 37	0.77 / 0.77 / 0.64	E / E / D
		SB LT	77 / 72 / 37	0.47 / 0.6 / 0.63	E / E / D	77 / 72 / 44	0.48 / 0.62 / 0.66	E / E / D
		SB TH	17 / 23 / 21	0.32 / 0.56 / 0.71	B / C / C	21 / 28 / 24	0.38 / 0.66 / 0.75	C / C / C
		SB RT	16 / 22 / 18	0.18 / 0.47 / 0.38	B / C / B	19 / 26 / 21	0.2 / 0.56 / 0.48	B / C / C
5	**5: Makala Boulevard & Luhia Street** *Discussion: This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.*		Luhia Street / Makala Boulevard			See Year 2027 without Project		
			B / B / B - / - / - 14 / 16 / 18			B / B / B - / - / - 14 / 16 / 18		
		NB LT	17 / 22 / 22	0.03 / 0.17 / 0.09	B / C / C	18 / 23 / 23	0.03 / 0.18 / 0.09	B / C / C
		NB TH	19 / 23 / 26	0.28 / 0.19 / 0.49	B / C / C	20 / 23 / 26	0.31 / 0.21 / 0.5	C / C / C
		NB RT	18 / 22 / 22	0.15 / 0.12 / 0.06	B / C / C	18 / 22 / 23	0.13 / 0.1 / 0.06	B / C / C
		EB LT	28 / 29 / 30	0.43 / 0.46 / 0.5	C / C / C	28 / 29 / 30	0.43 / 0.46 / 0.51	C / C / C
		EB TH/RT	14 / 16 / 17	0.41 / 0.55 / 0.56	B / B / B	14 / 17 / 18	0.44 / 0.56 / 0.57	B / B / B
		WB LT	18 / 22 / 25	0.74 / 0.76 / 0.77	B / C / C	19 / 23 / 25	0.74 / 0.77 / 0.78	B / C / C
		WB TH/RT	9 / 11 / 12	0.27 / 0.39 / 0.4	A / B / B	9 / 11 / 12	0.27 / 0.42 / 0.44	A / B / B
		SB LT	18 / 23 / 24	0.36 / 0.68 / 0.66	B / C / C	19 / 23 / 25	0.36 / 0.69 / 0.66	B / C / C
		SB TH/RT	17 / 18 / 21	0.16 / 0.12 / 0.24	B / B / C	17 / 18 / 21	0.16 / 0.12 / 0.25	B / B / C

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Intersection	Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2027 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2032 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS
6	**6: Makala Boulevard & Midblock Driveway** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.*	Midblock Driveway / Makala Boulevard			See Year 2027 without Project		
6		**B / B / B** **- / - / -** **14 / 16 / 19**			**B / B / B** **- / - / -** **14 / 16 / 19**		
6	*NB LT*	16 / 17 / 18	0.22 / 0.14 / 0.19	B / B / B	16 / 17 / 19	0.22 / 0.16 / 0.19	B / B / B
6	*NB TH*	16 / 17 / 19	0.22 / 0.26 / 0.34	B / B / B	16 / 18 / 20	0.23 / 0.27 / 0.35	B / B / B
6	*NB RT*	15 / 17 / 18	0.02 / 0.15 / 0.12	B / B / B	15 / 17 / 19	0.01 / 0.13 / 0.13	B / B / B
6	*EB LT*	22 / 20 / 25	0.44 / 0.56 / 0.68	C / C / C	22 / 21 / 26	0.44 / 0.56 / 0.7	C / C / C
6	*EB TH/RT*	12 / 15 / 17	0.21 / 0.38 / 0.37	B / B / B	12 / 15 / 17	0.29 / 0.39 / 0.39	B / B / B
6	*WB LT*	18 / 21 / 25	0.64 / 0.73 / 0.75	B / C / C	18 / 22 / 25	0.65 / 0.75 / 0.75	B / C / C
6	*WB TH/RT*	10 / 14 / 17	0.18 / 0.44 / 0.44	A / B / B	10 / 14 / 17	0.21 / 0.46 / 0.47	A / B / B
6	*SB LT*	16 / 15 / 16	0.34 / 0.35 / 0.4	B / B / B	16 / 15 / 17	0.34 / 0.35 / 0.41	B / B / B
6	*SB TH/RT*	15 / 14 / 16	0.13 / 0.19 / 0.32	B / B / B	15 / 15 / 16	0.14 / 0.21 / 0.33	B / B / B
7	**7: Makala Boulevard & Road A** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.*	Road A / Makala Boulevard			See Year 2027 without Project		
7		**B / B / B** **- / - / -** **11 / 11 / 11**			**B / B / B** **- / - / -** **10 / 11 / 11**		
7	*NB LT*	15 / 15 / 17	0.11 / 0.23 / 0.31	B / B / B	15 / 15 / 18	0.11 / 0.23 / 0.33	B / B / B
7	*NB TH*	15 / 14 / 14	0.14 / 0.15 / 0.09	B / B / B	15 / 15 / 15	0.14 / 0.16 / 0.09	B / B / B
7	*NB RT*	14 / 14 / 14	0.04 / 0.02 / 0.04	B / B / B	14 / 14 / 14	0.04 / 0.02 / 0.02	B / B / B
7	*EB LT*	22 / 26 / 19	0.42 / 0.42 / 0.44	C / C / B	21 / 26 / 20	0.43 / 0.42 / 0.44	C / C / B
7	*EB TH/RT*	9 / 11 / 10	0.2 / 0.35 / 0.35	A / B / A	9 / 11 / 10	0.27 / 0.37 / 0.36	A / B / A
7	*WB LT*	20 / 18 / 19	0.43 / 0.46 / 0.44	B / B / B	20 / 18 / 20	0.43 / 0.47 / 0.44	B / B / B
7	*WB TH/RT*	9 / 10 / 10	0.2 / 0.38 / 0.38	A / B / B	9 / 10 / 10	0.22 / 0.41 / 0.41	A / B / B
7	*SB LT*	16 / 14 / 17	0.08 / 0.11 / 0.24	B / B / B	16 / 15 / 17	0.08 / 0.11 / 0.24	B / B / B
7	*SB TH/RT*	26 / 14 / 16	0.31 / 0.03 / 0.18	C / B / B	26 / 14 / 16	0.31 / 0.03 / 0.18	C / B / B
9	**9: Loloku Street & Maa Way** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.*	Maa Way / Loloku Street			See Year 2027 without Project		
9		**B / B / B** **0.01 / 0.01 / 0.01** **10 / 11 / 11**			**B / B / B** **0.01 / 0.01 / 0.01** **10 / 11 / 11**		
9	*NB LT*	10 / 11 / 11	0.01 / 0.01 / 0.01	B / B / B	10 / 11 / 11	0.01 / 0.01 / 0.01	B / B / B
9	*NB RT*	9 / 10 / 10	0.06 / 0.12 / 0.09	A / A / A	9 / 10 / 10	0.06 / 0.13 / 0.09	A / A / A
9	*WB LT/TH*	8 / 8 / 8	0.02 / 0.04 / 0.03	A / A / A	8 / 8 / 8	0.03 / 0.04 / 0.03	A / A / A
12	**12: Pawai Place & Kaiwi Street** *Discussion:* *This intersection is generally expected to operate satisfactorily similar to Year 2027 without the Project. The NB approach is anticipated to operate at LOS E during the peak PM hour of traffic.*	Pawai Place / Kaiwi Street			See Year 2027 without Project		
12		**C / D / C** **0.22 / 0.65 / 0.38** **15 / 34 / 18**			**C / E / C** **0.23 / 0.69 / 0.40** **16 / 38 / 19**		
12	*NB LT/TH/RT*	15 / 34 / 18	0.22 / 0.65 / 0.38	C / D / C	16 / 38 / 19	0.23 / 0.69 / 0.4	C / E / C
12	*EB LT*	8 / 8 / 8	0 / 0 / 0	A / A / A	8 / 8 / 8	0 / 0 / 0	A / A / A
12	*WB LT*	9 / 9 / 9	0.08 / 0.1 / 0.09	A / A / A	9 / 9 / 9	0.08 / 0.1 / 0.09	A / A / A
12	*SB LT/TH/RT*	17 / 16 / 19	0.01 / 0.04 / 0	C / C / C	17 / 16 / 19	0.02 / 0.04 / 0	C / C / C
13	**13: Kuakini Highway & Makala Boulevard** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.*	Kuakini Highway / Makala Boulevard			See Year 2027 without Project		
13		**A / B / B** **0.19 / 0.44 / 0.50** **9 / 12 / 14**			**A / B / C** **0.22 / 0.50 / 0.58** **9 / 13 / 16**		
13	*NB TH/RT*	8 / 10 / 12	0.21 / 0.36 / 0.45	A / A / B	9 / 11 / 13	0.27 / 0.4 / 0.5	A / B / B
13	*WB LT/RT*	9 / 12 / 14	0.19 / 0.44 / 0.5	A / B / B	9 / 13 / 16	0.22 / 0.5 / 0.58	A / B / C
13	*SB LT/TH*	8 / 9 / 11	0.09 / 0.16 / 0.32	A / A / B	8 / 9 / 12	0.1 / 0.17 / 0.34	A / A / B
14	**14: Kuakini Highway & Loloku Street** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.*	Kuakini Highway / Loloku Street			See Year 2027 without Project		
14		**B / C / C** **0.09 / 0.24 / 0.24** **12 / 16 / 18**			**B / C / C** **0.10 / 0.27 / 0.27** **13 / 17 / 20**		
14	*WB LT/RT*	12 / 16 / 18	0.09 / 0.24 / 0.24	B / C / C	13 / 17 / 20	0.1 / 0.27 / 0.27	B / C / C
14	*SB LT/TH*	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A

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Intersection	Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2027 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2032 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS
15	**15: Kuakini Highway & Kaiwi Street** *Discussion:* *The projected increase in traffic is anticipated to increase the movements delay at this intersection. The shared NB LT/TH lane is expected to operate at LOS F during the peak PM and WE hours. It is also expected to be overcapacity during the peak PM hour.*	Kuakini Highway / Kaiwi Street			See Year 2027 without Project		
15		**B / F / E** **0.52 / 0.93 / 0.86** **15 / 57 / 38**			**C / F* / F** **0.61 / 1.02 / 0.94** **18 / 81 / 52**		
15	*NB LT/TH*	15 / 57 / 38	0.52 / 0.93 / 0.86	B / F / E	18 / 81 / 52	0.61 / 1.02 / 0.94	C / F* / F
15	*NB RT*	12 / 36 / 19	0.47 / 0.83 / 0.64	B / E / C	13 / 45 / 21	0.49 / 0.89 / 0.68	B / E / C
15	*EB LT/TH/RT*	10 / 16 / 13	0.14 / 0.31 / 0.2	B / C / B	11 / 16 / 13	0.15 / 0.33 / 0.22	B / C / B
15	*WB LT/TH/RT*	13 / 33 / 19	0.37 / 0.79 / 0.53	B / D / C	14 / 39 / 20	0.39 / 0.82 / 0.56	B / E / C
15	*SB LT/TH/RT*	12 / 37 / 34	0.35 / 0.81 / 0.82	B / E / D	13 / 50 / 50	0.39 / 0.91 / 0.93	B / E / E
16	**16: Kuakini Highway & Palani Road** *Discussion:* *The projected increase in traffic is anticipated to increase the movements delay at this intersection. The long delays expected are on the minor movements.*	Kuakini Highway / Palani Road			See Year 2027 without Project		
16		**C / D / C** **- / - / -** **32 / 43 / 28**			**D / D / C** **- / - / -** **35 / 50 / 35**		
16	*NB LT*	15 / 28 / 23	0.16 / 0.38 / 0.38	B / C / C	17 / 34 / 26	0.19 / 0.51 / 0.43	B / C / C
16	*NB TH*	22 / 34 / 29	0.48 / 0.6 / 0.69	C / C / C	28 / 40 / 31	0.58 / 0.67 / 0.68	C / D / C
16	*NB RT*	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
16	*EB LT*	38 / 45 / 22	0.52 / 0.58 / 0.44	D / D / C	37 / 45 / 27	0.51 / 0.6 / 0.5	D / D / C
16	*EB TH/RT*	51 / 62 / 32	0.71 / 0.75 / 0.67	D / E / C	54 / 72 / 46	0.8 / 0.86 / 0.8	D / E / D
16	*WB LT*	43 / 47 / 22	0.71 / 0.85 / 0.59	D / D / C	46 / 58 / 33	0.79 / 0.95 / 0.77	D / E / C
16	*WB TH*	48 / 51 / 29	0.67 / 0.75 / 0.6	D / D / C	45 / 50 / 35	0.65 / 0.78 / 0.69	D / D / D
16	*WB RT*	40 / 40 / 23	0.09 / 0.17 / 0.14	D / D / C	37 / 38 / 26	0.09 / 0.18 / 0.15	D / D / C
16	*SB LT*	16 / 24 / 20	0.24 / 0.34 / 0.5	B / C / C	19 / 27 / 22	0.29 / 0.4 / 0.52	B / C / C
16	*SB TH/RT*	20 / 42 / 32	0.37 / 0.78 / 0.87	B / D / C	23 / 54 / 41	0.43 / 0.88 / 0.9	C / D / D

4.4 Year 2042 without Project Analysis

It is anticipated that by Year 2042 without Project, traffic volumes will have further increased on select roadways over Year 2032 without Project conditions due to the continued development of the Kailua-Kona region. Actual growth within the study region may vary based upon the approval process of the various projects, however, as a conservative measure, the full extent of all background projects are included for the purpose of the report.

4.4.1 Year 2042 without Project Intersection Analysis

Traffic operations by Year 2042 without Project with the background projects are forecast to worsen compared to Year 2032 without Project at the following intersections:

[1] Queen Kaahumanu Highway/Makala Boulevard

By Year 2042 without Project, this intersection is anticipated to operate with overall LOS E/F during the PM and WE peak hours of traffic. The southbound through movement is expected to operate at over capacity LOS F during various peak hours of traffic.

[4] Queen Kaahumanu Highway/Palani Road

By Year 2042 without Project, this intersection is anticipated to operate with overall LOS E during the peak PM hour of traffic. The majority of movements at this intersection are anticipated to operate at LOS E/F during all peak hours.

[15] Kuakini Highway/Kaiwi Street

By Year 2042 without Project, the northbound and southbound approaches are expected to operate at over capacity LOS F during the PM and WE peak hours.

[16] Kuakini Highway/Palani Road

By Year 2042 without Project, this intersection is anticipated to operate with overall LOS F during the PM and WE peak hours of traffic. Various movements at this intersection are anticipated to operate at over capacity LOS F during the PM and WE peak hours.

Figure 4.4 illustrates the Year 2042 without Project lane configurations, volumes and LOS. See Table 4.3 for a summary of the Year 2042 without Project analysis. LOS worksheets are included in Appendix C.

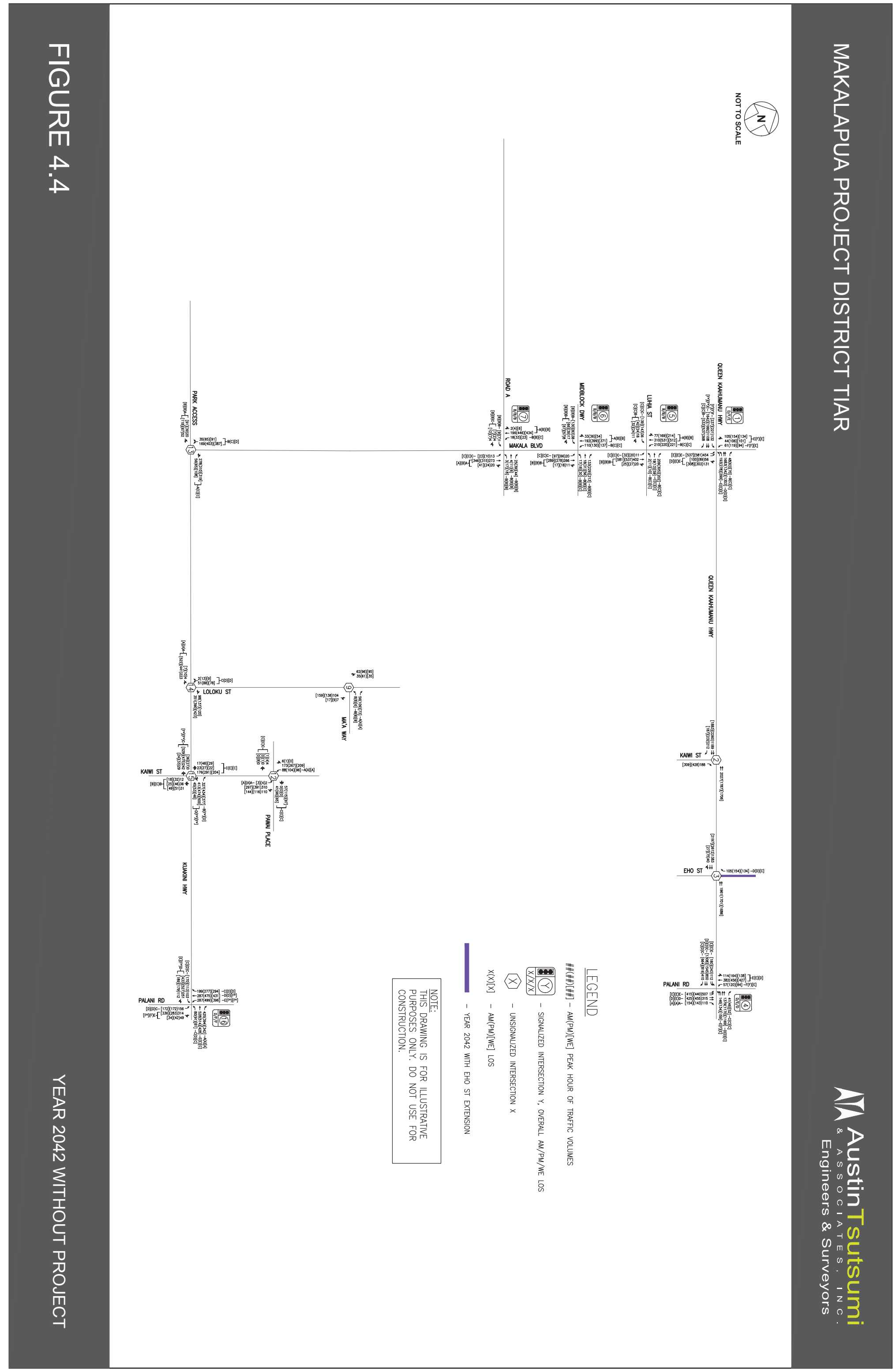

TABLE 4.3: LOS SUMMARY TABLE
YEAR 2032 WITHOUT PROJECT AND YEAR 2042 WITHOUT PROJECT

	Intersection — Signalized: Overall LOS; Unsignalized: Critical Movement LOS; LOS [X / X / X]; DELAY [X / X / X]	Year 2032 without Project (AM / PM / WE)			Year 2042 without Project (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1	**1: Queen Kaahumanu Highway & Makala Boulevard** *Discussion: By Year 2042, increased delays are expected for all movements. The SB TH approach is expected to operate at LOS F and over capacity during various peak hours. Several other movements are also expected to operate at LOS F.*	C / D / C - / - / - 30 / 43 / 30			D / F / E - / - / - 44 / 102 / 66		
1	NB LT	76 / 79 / 46	0.68 / 0.84 / 0.76	E / E / D	77 / 78 / 67	0.72 / 0.84 / 0.83	E / E / E
1	NB TH	15 / 19 / 17	0.53 / 0.51 / 0.59	B / B / B	40 / 54 / 51	0.91 / 0.92 / 0.94	D / D / D
1	NB RT	9 / 13 / 12	0.01 / 0.01 / 0.01	A / B / B	16 / 26 / 24	0.03 / 0.05 / 0.04	B / C / C
1	EB LT	74 / 71 / 39	0.86 / 0.88 / 0.75	E / E / D	73 / 71 / 58	0.87 / 0.89 / 0.83	E / E / E
1	EB TH/RT	63 / 56 / 33	0.09 / 0.14 / 0.16	E / E / C	60 / 55 / 49	0.2 / 0.25 / 0.29	E / E / D
1	WB LT	77 / 76 / 48	0.37 / 0.35 / 0.31	E / E / D	83 / 112 / 73	0.61 / 0.86 / 0.76	F / F / E
1	WB TH/RT	76 / 78 / 54	0.24 / 0.48 / 0.66	E / E / D	77 / 90 / 74	0.43 / 0.73 / 0.78	E / F / E
1	SB LT	99 / 106 / 61	0.64 / 0.78 / 0.71	F / F / E	113 / 104 / 92	0.88 / 0.93 / 0.92	F / F / F
1	SB TH	19 / 42 / 31	0.46 / 0.9 / 0.87	B / D / C	24 / 161 / 83	0.59 / 1.25 / 1.07	C / F* / F*
1	SB RT	15 / 22 / 18	0.2 / 0.27 / 0.24	B / C / B	18 / 29 / 24	0.22 / 0.42 / 0.34	B / C / C
2	**2: Queen Kaahumanu Highway & Kaiwi Street** *Discussion: The EB RT movement is provided with an acceleration lane, therefore no delays are experienced.*	Queen Kaahumanu Hwy / Kaiwi Street			See Year 2032 without Project		
3	**3: Queen Kaahumanu Highway & Eho Street** *Discussion: By Year 2042, the Eho Street expansion mauka of Queen Kaahumanu Highway is assumed to be constructed. This intersection is expected to operate satisfactorily. The SB RT movement is not anticipated to experience any delays.*	/ / / / / /			D / D / C 0.27 / 0.35 / 0.26 29 / 26.5 / 24		
3	WB RT				29 / 27 / 24	0.27 / 0.35 / 0.26	D / D / C
4	**4: Queen Kaahumanu Highway & Palani Road** *Discussion: By Year 2042, the majority of movements at this intersection are anticipated to operate at LOS E/F conditions during all peak hours of traffic.*	D / D / C - / - / - 40 / 43 / 28			D / E / D - / - / - 49 / 56 / 44		
4	NB LT	77 / 79 / 44	0.6 / 0.66 / 0.66	E / E / D	78 / 80 / 66	0.63 / 0.7 / 0.75	E / F / E
4	NB TH	23 / 29 / 23	0.53 / 0.55 / 0.67	C / C / C	42 / 44 / 34	0.85 / 0.81 / 0.8	D / D / C
4	NB RT	15 / 20 / 16	0.01 / 0.01 / 0.02	B / C / B	21 / 26 / 21	0.02 / 0.02 / 0.03	C / C / C
4	EB LT	75 / 75 / 41	0.86 / 0.87 / 0.78	E / E / D	74 / 74 / 73	0.9 / 0.88 / 0.9	E / E / E
4	EB TH	56 / 57 / 28	0.33 / 0.47 / 0.36	E / E / C	50 / 56 / 43	0.36 / 0.58 / 0.52	D / E / D
4	EB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
4	WB LT	80 / 79 / 53	0.33 / 0.39 / 0.53	E / E / D	82 / 87 / 73	0.61 / 0.85 / 0.8	F / F / E
4	WB TH/RT	73 / 72 / 37	0.77 / 0.77 / 0.64	E / E / D	72 / 72 / 55	0.81 / 0.83 / 0.77	E / E / D
4	SB LT	77 / 72 / 44	0.48 / 0.62 / 0.66	E / E / D	79 / 75 / 65	0.58 / 0.7 / 0.77	E / E / E
4	SB TH	21 / 28 / 24	0.38 / 0.66 / 0.75	C / C / C	31 / 54 / 39	0.54 / 0.96 / 0.88	C / D / D
4	SB RT	19 / 26 / 21	0.2 / 0.56 / 0.48	B / C / C	27 / 46 / 31	0.29 / 0.83 / 0.69	C / D / C
5	**5: Makala Boulevard & Luhia Street** *Discussion: This intersection is expected to operate satisfactorily similar to Year 2032 without the Project.*	B / B / B - / - / - 14 / 16 / 18			B / B / B - / - / - 14 / 17 / 19		
5	NB LT	18 / 23 / 23	0.03 / 0.18 / 0.09	B / C / C	19 / 25 / 25	0.03 / 0.19 / 0.1	B / C / C
5	NB TH	20 / 23 / 26	0.31 / 0.21 / 0.5	C / C / C	22 / 25 / 30	0.34 / 0.21 / 0.54	C / C / C
5	NB RT	18 / 22 / 23	0.13 / 0.1 / 0.06	B / C / C	20 / 25 / 25	0.09 / 0.11 / 0.06	B / C / C
5	EB LT	28 / 29 / 30	0.43 / 0.46 / 0.51	C / C / C	30 / 32 / 33	0.43 / 0.47 / 0.53	C / C / C
5	EB TH/RT	14 / 17 / 18	0.44 / 0.56 / 0.57	B / B / B	14 / 17 / 19	0.51 / 0.61 / 0.62	B / B / B
5	WB LT	19 / 23 / 25	0.74 / 0.77 / 0.78	B / C / C	20 / 25 / 27	0.75 / 0.78 / 0.8	B / C / C
5	WB TH/RT	9 / 11 / 12	0.27 / 0.42 / 0.44	A / B / B	9 / 11 / 13	0.28 / 0.5 / 0.52	A / B / B
5	SB LT	19 / 23 / 25	0.36 / 0.69 / 0.66	B / C / C	21 / 26 / 27	0.37 / 0.7 / 0.68	C / C / C
5	SB TH/RT	17 / 18 / 21	0.16 / 0.12 / 0.25	B / B / C	19 / 20 / 23	0.18 / 0.12 / 0.26	B / C / C

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	Intersection — Signalized: Overall LOS; Unsignalized: Critical Movement LOS; LOS [X / X / X]; DELAY [X / X / X]	Year 2032 without Project (AM / PM / WE)			Year 2042 without Project (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
6	**6: Makala Boulevard & Midblock Driveway** *Discussion: This intersection is expected to operate satisfactorily similar to Year 2032 without the Project.*	B / B / B - / - / - 14 / 16 / 19			B / B / B - / - / - 14 / 17 / 20		
6	NB LT	16 / 17 / 19	0.22 / 0.16 / 0.19	B / B / B	17 / 19 / 21	0.2 / 0.17 / 0.21	B / B / C
6	NB TH	16 / 18 / 20	0.23 / 0.27 / 0.35	B / B / B	17 / 19 / 22	0.21 / 0.28 / 0.37	B / B / C
6	NB RT	15 / 17 / 19	0.01 / 0.13 / 0.13	B / B / B	16 / 18 / 21	0.08 / 0.12 / 0.12	B / B / C
6	EB LT	22 / 21 / 26	0.44 / 0.56 / 0.7	C / C / C	23 / 23 / 29	0.45 / 0.59 / 0.75	C / C / C
6	EB TH/RT	12 / 15 / 17	0.29 / 0.39 / 0.39	B / B / B	13 / 15 / 18	0.41 / 0.43 / 0.46	B / B / B
6	WB LT	18 / 22 / 25	0.65 / 0.75 / 0.75	B / C / C	19 / 24 / 26	0.68 / 0.75 / 0.75	B / C / C
6	WB TH/RT	10 / 14 / 17	0.21 / 0.46 / 0.47	A / B / B	10 / 14 / 17	0.24 / 0.53 / 0.55	A / B / B
6	SB LT	16 / 15 / 17	0.34 / 0.35 / 0.41	B / B / B	17 / 17 / 18	0.34 / 0.38 / 0.43	B / B / B
6	SB TH/RT	15 / 15 / 16	0.14 / 0.21 / 0.33	B / B / B	16 / 16 / 18	0.14 / 0.24 / 0.35	B / B / B
7	**7: Makala Boulevard & Road A** *Discussion: This intersection is expected to operate satisfactorily similar to Year 2032 without the Project.*	B / B / B - / - / - 10 / 11 / 11			B / B / B - / - / - 10 / 11 / 11		
7	NB LT	15 / 15 / 18	0.11 / 0.23 / 0.33	B / B / B	15 / 17 / 18	0.11 / 0.24 / 0.33	B / B / B
7	NB TH	15 / 15 / 15	0.14 / 0.16 / 0.09	B / B / B	16 / 16 / 16	0.14 / 0.15 / 0.11	B / B / B
7	NB RT	14 / 14 / 14	0.04 / 0.02 / 0.02	B / B / B	14 / 15 / 15	0.04 / 0.02 / 0.02	B / B / B
7	EB LT	21 / 26 / 20	0.43 / 0.42 / 0.44	C / C / B	22 / 26 / 21	0.43 / 0.42 / 0.45	C / C / C
7	EB TH/RT	9 / 11 / 10	0.27 / 0.37 / 0.36	A / B / A	10 / 11 / 10	0.39 / 0.4 / 0.41	A / B / A
7	WB LT	20 / 18 / 20	0.43 / 0.47 / 0.44	B / B / B	20 / 19 / 21	0.44 / 0.47 / 0.45	B / B / C
7	WB TH/RT	9 / 10 / 10	0.22 / 0.41 / 0.41	A / B / B	9 / 10 / 10	0.26 / 0.48 / 0.47	A / B / B
7	SB LT	16 / 15 / 17	0.08 / 0.11 / 0.24	B / B / B	16 / 16 / 18	0.08 / 0.12 / 0.24	B / B / B
7	SB TH/RT	26 / 14 / 16	0.31 / 0.03 / 0.18	C / B / B	27 / 15 / 17	0.31 / 0.03 / 0.18	C / B / B
9	**9: Loloku Street & Maa Way** *Discussion: This intersection is expected to operate satisfactorily similar to Year 2032 without the Project.*	B / B / B 0.01 / 0.01 / 0.01 10 / 11 / 11			B / B / B 0.01 / 0.02 / 0.01 10.2 / 11.3 / 11		
9	NB LT	10 / 11 / 11	0.01 / 0.01 / 0.01	B / B / B	10 / 11 / 11	0.01 / 0.02 / 0.01	B / B / B
9	NB RT	9 / 10 / 10	0.06 / 0.13 / 0.09	A / A / A	9 / 10 / 10	0.07 / 0.13 / 0.09	A / A / A
9	WB LT/TH	8 / 8 / 8	0.03 / 0.04 / 0.03	A / A / A	8 / 8 / 8	0.03 / 0.05 / 0.03	A / A / A
12	**12: Pawai Place & Kaiwi Street** *Discussion: This intersection is expected to operate similar to Year 2032 without the Project.*	C / E / C 0.23 / 0.69 / 0.40 16 / 38 / 19			C / E / C 0.25 / 0.78 / 0.44 17 / 50 / 21		
12	NB LT/TH/RT	16 / 38 / 19	0.23 / 0.69 / 0.4	C / E / C	17 / 50 / 21	0.25 / 0.78 / 0.44	C / E / C
12	EB LT	8 / 8 / 8	0 / 0 / 0	A / A / A	8 / 8 / 8	0 / 0 / 0	A / A / A
12	WB LT	9 / 9 / 9	0.08 / 0.1 / 0.09	A / A / A	9 / 9 / 9	0.09 / 0.11 / 0.1	A / A / A
12	SB LT/TH/RT	17 / 16 / 19	0.02 / 0.04 / 0	C / C / C	18 / 17 / 20	0.02 / 0.04 / 0.01	C / C / C
13	**13: Kuakini Highway & Makala Boulevard** *Discussion: Although projected traffic is anticipated to increase delay for all approaches, this intersection is expected to operate satisfactorily similar to Year 2032 without the Project.*	A / B / C 0.22 / 0.50 / 0.58 9 / 13 / 16			B / C / D 0.31 / 0.76 / 0.86 10 / 24 / 34		
13	NB TH/RT	9 / 11 / 13	0.27 / 0.4 / 0.5	A / B / B	10 / 15 / 22	0.42 / 0.58 / 0.72	A / C / C
13	WB LT/RT	9 / 13 / 16	0.22 / 0.5 / 0.58	A / B / C	10 / 24 / 34	0.31 / 0.76 / 0.86	B / C / D
13	SB LT/TH	8 / 9 / 12	0.1 / 0.17 / 0.34	A / A / B	9 / 11 / 14	0.11 / 0.2 / 0.41	A / B / B
14	**14: Kuakini Highway & Loloku Street** *Discussion: This intersection is expected to operate satisfactorily similar to Year 2032 without the Project.*	B / C / C 0.10 / 0.27 / 0.27 13 / 17 / 20			C / D / D 0.14 / 0.39 / 0.39 15 / 25 / 29		
14	WB LT/RT	13 / 17 / 20	0.1 / 0.27 / 0.27	B / C / C	15 / 25 / 29	0.14 / 0.39 / 0.39	C / D / D
14	SB LT/TH	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A

	Intersection — Signalized: Overall LOS; Unsignalized: Critical Movement LOS; LOS [X / X / X]; DELAY [X / X / X]	Year 2032 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2042 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS
15	**15: Kuakini Highway & Kaiwi Street** *Discussion: The projected increase in traffic is anticipated to increase the movements delay at this intersection. The NB and SB approaches are anticipated to operate at LOS F and overcapacity during PM and WE peak hours.*	Kuakini Highway	Kaiwi Street	N	See Year 2032 without Project		
		18 / 81 / 52	0.61 / 1.02 / 0.94	C / F* / F	35 / 170 / 124	0.85 / 1.35 / 1.22	D / F* / F*
	NB LT/TH	18 / 81 / 52	0.61 / 1.02 / 0.94	C / F* / F	35 / 170 / 124	0.85 / 1.35 / 1.22	D / F* / F*
	NB RT	13 / 45 / 21	0.49 / 0.89 / 0.68	B / E / C	14 / 60 / 25	0.53 / 1.02 / 0.76	B / F* / D
	EB LT/TH/RT	11 / 16 / 13	0.15 / 0.33 / 0.22	B / C / B	12 / 18 / 15	0.17 / 0.39 / 0.25	B / C / B
	WB LT/TH/RT	14 / 39 / 20	0.39 / 0.82 / 0.56	B / E / C	15 / 50 / 23	0.45 / 0.94 / 0.63	C / E / C
	SB LT/TH/RT	13 / 50 / 50	0.39 / 0.91 / 0.93	B / E / E	15 / 156 / 130	0.51 / 1.25 / 1.21	C / F* / F*
16	**16: Kuakini Highway & Palani Road** *Discussion: The projected increase in traffic is anticipated to increase the movements delay at this intersection. Various movements are anticipated to operate at LOS E/F and overcapacity during PM and WE peak hours.*	Kuakini Highway	Palani Road	N	See Year 2032 without Project		
		35 / 50 / 35	- / - / -	D / D / C	50 / 113 / 103	- / - / -	D / F / F
	NB LT	17 / 34 / 26	0.19 / 0.51 / 0.43	B / C / C	26 / 50 / 33	0.29 / 0.75 / 0.59	C / D / C
	NB TH	28 / 40 / 31	0.58 / 0.67 / 0.68	C / D / C	61 / 64 / 33	0.93 / 0.91 / 0.7	E / E / C
	NB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
	EB LT	37 / 45 / 27	0.51 / 0.6 / 0.5	D / D / C	31 / 54 / 41	0.47 / 0.77 / 0.79	C / D / D
	EB TH/RT	54 / 72 / 46	0.8 / 0.86 / 0.8	D / E / D	70 / 85 / 134	0.93 / 0.94 / 1.13	E / F / F*
	WB LT	46 / 58 / 33	0.79 / 0.95 / 0.77	D / E / C	58 / 210 / 285	0.94 / 1.36 / 1.52	E / F* / F*
	WB TH	45 / 50 / 35	0.65 / 0.78 / 0.69	D / D / D	37 / 52 / 118	0.58 / 0.92 / 1.1	D / D / F*
	WB RT	37 / 38 / 26	0.09 / 0.18 / 0.15	D / D / C	30 / 36 / 35	0.1 / 0.29 / 0.25	C / D / D
	SB LT	19 / 27 / 22	0.29 / 0.4 / 0.52	B / C / C	34 / 42 / 24	0.62 / 0.67 / 0.56	C / D / C
	SB TH/RT	23 / 54 / 41	0.43 / 0.88 / 0.9	C / D / D	37 / 179 / 61	0.64 / 1.27 / 0.98	D / F* / E

5. WITH PROJECT SCENARIOS

The Project will be built in the Kailua-Kona business area and proposes to build a mix of residential, hotel, office, and commercial development. The Project proposes to construct up to 600 dwelling units, a 150-key hotel, and 220,900 SF of office, retail and restaurant space. Construction of the Project will occur in phases, with the first phase estimated to begin in 2025 and the final phase aiming to reach completion by 2032. The anticipated phasing is as follows:

- Phase 1: Completion by 2027. Includes development of 56 multifamily dwelling units, 60 hotel units, and 169,500 SF of commercial shopping space.
- Phase 2: Completion by 2032. Cumulative with Phase 1 and includes 100 detached housing units, 500 multifamily housing units, a 150-key hotel, and 220,900 SF of commercial shopping space.
- Phase 3: Completion by 2042. Project is fully constructed with no additions to previous phases. Year 2042 was evaluated for consistency with Hawaii County concurrency requirements as described in Section 4.

5.1 Trip Generation

The Institute of Transportation Engineers (ITE) publishes a book based on empirical data compiled from a body of more than 4,250 trip generation studies submitted by public agencies, developers, consulting firms, and associations. This publication, titled Trip Generation, 11th Edition, provides trip rates and/or formulae based on graphs that correlate vehicular trips with independent variables. The independent variables can range from Dwelling Units (DU) for single-family attached homes to Gross Floor Area (GFA) for commercial or office development. These trip rates/formulae and their associated directional distributions were used to estimate the increase in the number of vehicular trips generated by the proposed Project. The rates selected were based on the land use description.

See Tables 5.1 and 5.2 for Trip Generation formulae and projections.

5.2 Trip Reductions

Similar to the without Project conditions and methodology in Section 4.1, various trip reduction methods were applied to the raw trip generation numbers as seen in Table 5.2. All trip reductions and rates are based upon the ITE Handbook.

5.3 Trip Distribution/Assignment

Trips generated by the Project were assigned onto the roadway network based upon existing trip distribution and future land uses and roadways. The overall trip distribution was done following the approximations below:

- 29% to/from the north via Queen Kaahumanu Highway.
- 28% to/from the south via Queen Kaahumanu Highway.
- 19% to/from the north via Mamalahoa Highway.
- 16% to/from the south via Kuakini Highway.
- 8% to/from the south via Alii Drive.

Table 5.1: Trip Generation Rates

Land Use (ITE Code)	Independent Variable	AM Peak Hour		PM Peak Hour		WE Peak Hour	
		Trip Rate	% Enter	Trip Rate	% Enter	Trip Rate	% Enter
Single Family Detached Housing (210)	Dwelling Units	[a]	25%	[b]	63%	[c]	54%
Low-Rise Multifamily Housing (220)	Dwelling Units	[d]	24%	[e]	63%	0.41	51%*
Business Hotel (312)	Rooms	[f]	39%	[g]	55%	[h]	48%
Shopping Center (820)	1000 SF GFA	[i]	62%	[j]	48%	[k]	52%

* Based on Mid-Rise MF housing rates because data not available for Low-Rise

[a] T=exp(0.91Ln(X)+0.12)
[b] T=exp(0.94Ln(X)+0.27)
[c] T=0.86(X)+9.72
[d] T=0.31(X)+22.85
[e] T=0.43(X)+20.55
[f] T=0.30(X)+6.94
[g] T=0.21(X)+12.03
[h] T=0.42(X)+3.74
[i] T=0.59(X)+133.55
[j] T=exp(0.72Ln(X)+3.02)
[k] T=exp(0.76Ln(X)+3.00)

Table 5.2: Project-Generated Trips

Year	Land Use	Units	AM Peak Hour			PM Peak Hour			WE Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Phase 1 (Year 2027)	Single Family Housing	0 units	0	0	0	0	0	0	0	0	0
	Multi-Family Housing	56 units	5	15	20	9	6	15	6	6	13
	Business Hotel	60 rooms	9	11	20	7	7	14	10	12	22
	Shopping Center	169.5 1000 SF GFA	121	76	197	264	260	524	359	314	673
		Subtotal	135	102	237	280	273	553	375	332	708
Phase 2 Cumulative (Year 2032)	Single Family Housing	100 units	19	55	74	34	22	56	28	24	53
	Multi-Family Housing	500 units	42	134	176	80	51	131	57	56	112
	Business Hotel	150 rooms	20	28	48	17	17	34	23	29	52
	Shopping Center	220.9 1000 SF GFA	158	99	257	346	334	680	465	405	870
		Subtotal	239	316	555	477	424	901	573	514	1087
Phase 3 Cumulative (Year 2042)	Single Family Housing	100 units	19	55	74	34	22	56	28	24	53
	Multi-Family Housing	500 units	42	134	176	80	51	131	57	56	112
	Business Hotel	150 rooms	20	28	48	17	17	34	23	29	52
	Shopping Center	220.9 1000 SF GFA	158	99	257	346	334	680	465	405	870
		Subtotal	239	316	555	477	424	901	573	514	1087

Note: Project-generated trips in this table account for trip reductions, including internal capture and pass-by/diverted trips.

5.4 Year 2027 with Project Analysis

By Year 2027 the Project is projected to generate a total of 237(553)[708] net external trips during the AM(PM)[WE] peak hours of traffic. The following growth is expected along major roadways in the study area.

5.4.1 Year 2027 Roadway Projects

The following roadway projects were assumed to be implemented by Year 2027 with Project:

Pawai Place Extension – Extension of Pawai Place north through the Project from its existing terminus at Kaiwi Street to Loloku Street.

As a result of these roadway projects, the following intersections were added/modified for the Future Year 2027 scenario:

- [11] Pawai Place/Loloku Street

5.4.2 Year 2027 with Project Intersection Analysis

Traffic operations by Year 2027 with the Project with the inclusion of the assumed roadway projects are forecast to worsen compared to Year 2027 without Project conditions at the following intersections:

[1] Queen Kaahumanu Highway/Makala Boulevard

All left-turn movements and minor through movements are anticipated to operate at LOS E/F during various peak hours of traffic. Similar to Year 2027 without Project conditions, movements operating at LOS F are expected to be low-volume movements.

[15] Kuakini Highway/Kaiwi Street

The northbound and southbound approaches are anticipated to operate over capacity at LOS F during the PM and WE peak hours of traffic by Year 2027 with Project. Mitigation at this intersection is discussed below.

Figure 5.2 illustrates the Year 2027 with Project lane configurations, volumes and LOS. See Table 5.3 for a summary of the Year 2027 with Project analysis. LOS worksheets are included in Appendix C.

5.4.3 Year 2027 with Project and Mitigation Intersection Analysis

The following improvements are recommended by Year 2027 with Project. Note that the roadway improvements recommended in this section are currently not funded but are anticipated to be required as a result of both projected background development traffic and Project traffic. The Project developer and/or regional developers in the area may be required to pay pro-rata share contributions for the improvements.

[15] Kuakini Highway/Kaiwi Street

- Construct a new traffic signal when warranted.

The Manual on Uniform Traffic Control Devices (MUTCD) is a document issued by the Federal Highway Administration that specifies various standards regarding traffic signage and markings. As per the request of HDOT, this report conforms to the MUTCD 11th Edition, which is the most recent version available at the time of writing and is planned to be adopted by HDOT on October 1, 2024.[1] Based on guidance provided in the MUTCD 11th Edition Four-Hour Vehicular Volume warrant, a traffic signal should be considered at the Kuakini Highway/Kaiwi Street intersection by Year 2027 with Project. Traffic signal warrants are included in Appendix D. Following the above mitigations, all movements are anticipated to operate at LOS B or better for all peak periods. Overall LOS for the intersection is expected to improve to LOS B or better during all peak hours.

Figure 5.3 illustrates the Year 2027 with Project and Mitigation lane configurations, volumes and LOS. See Table 5.3 for a summary of the Year 2027 with Project and Mitigation analysis. LOS worksheets are included in Appendix C.

[1] According to memorandum sent by State of Hawaii Department of Transportation on January 24, 2024.

MAKALAPUA PROJECT DISTRICT TIAR

Austin Tsutsumi & Associates, Inc.
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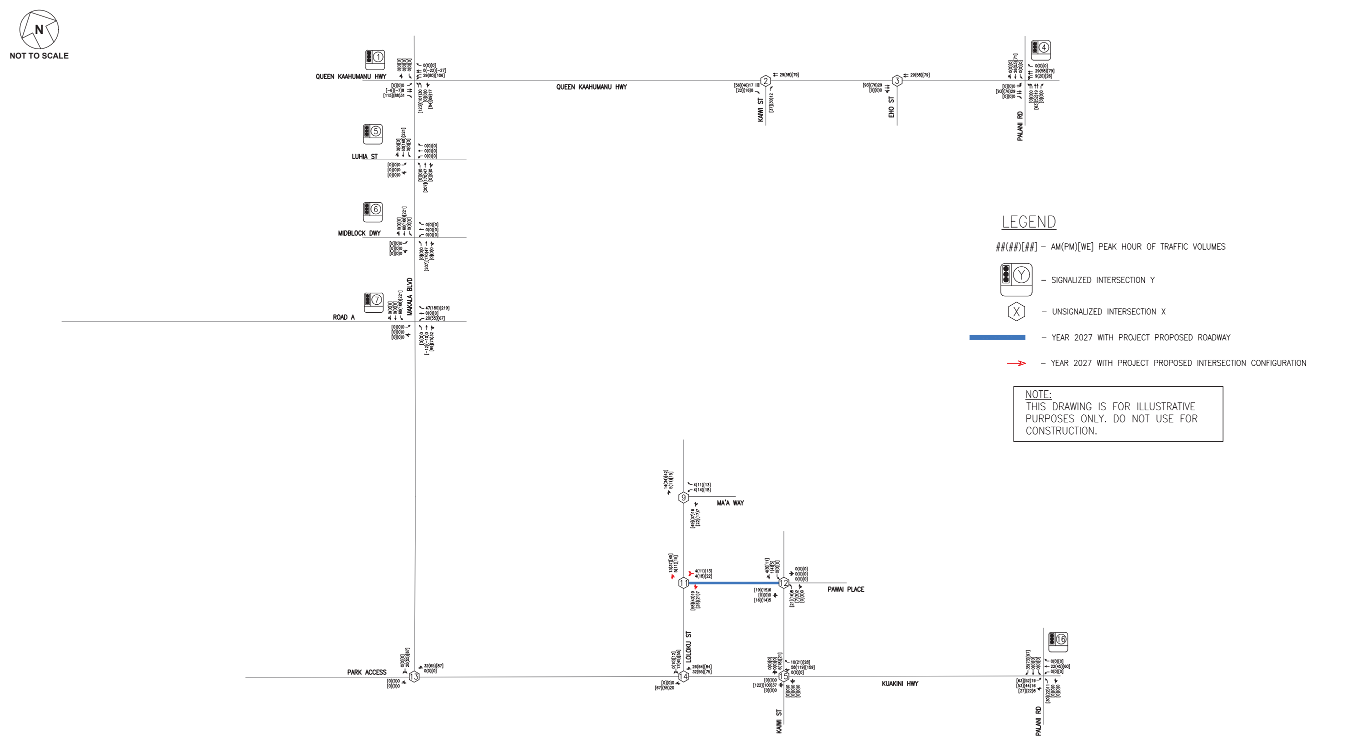

FIGURE 5.1

YEAR 2027 PROJECT-ONLY GENERATED TRIPS

MAKALAPUA PROJECT DISTRICT TIAR

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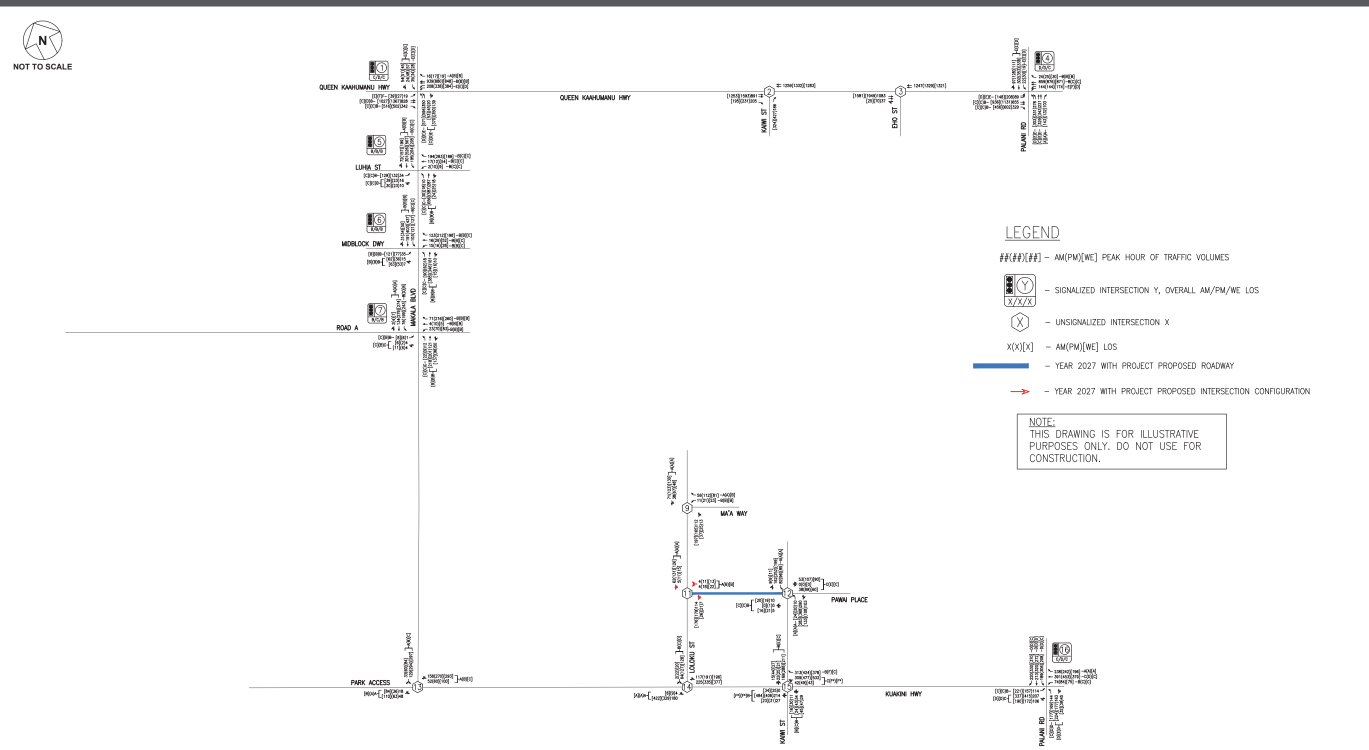

FIGURE 5.2

YEAR 2027 WITH PROJECT

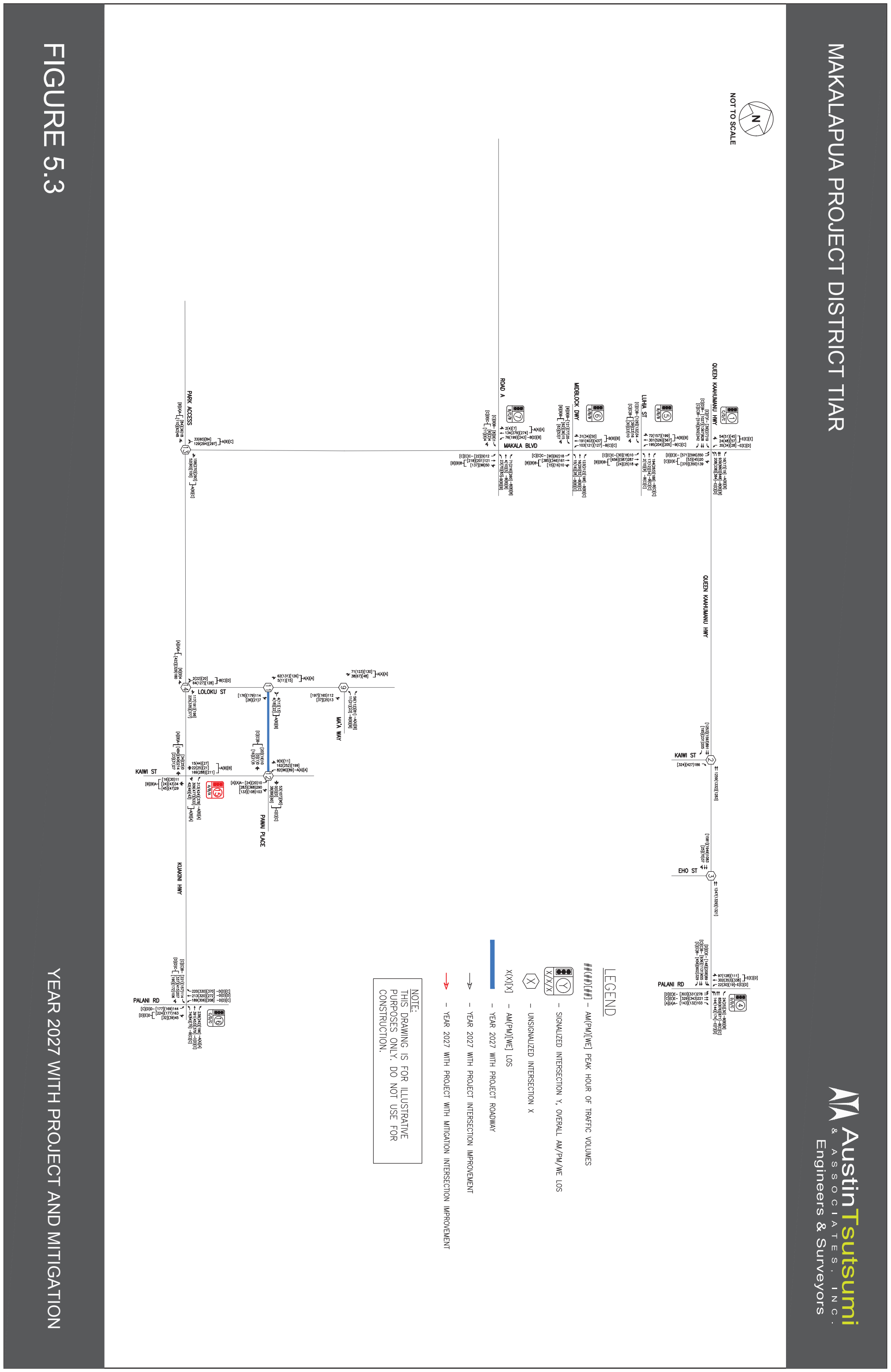

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TABLE 5.3: LOS SUMMARY TABLE
YEAR 2027 WITHOUT PROJECT, YEAR 2027 WITH PROJECT, AND YEAR 2027 WITH PROJECT AND MITIGATION

#	Intersection — Signalized: Overall LOS; Unsignalized: Critical Movement LOS; LOS [X / X / X]; DELAY [X / X / X]	Year 2027 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2027 with Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2027 with Project and Mitigation (AM / PM / WE) HCM Delay	v/c Ratio	LOS
1	**1: Queen Kaahumanu Highway & Makala Boulevard** *Discussion: By Year 2027 with the Project, this intersection is expected to operate similar to Year 2027 without the Project. The long delays experienced are on the minor movements.*	Queen Kaahumanu Hwy / Makala Boulevard			See Year 2027 without Project			See Year 2027 without Project		
		C / D / C - / - / - 29 / 38.9 / 25.5			C / D / C - / - / - 30 / 45.7 / 32			C / D / C - / - / - 30 / 45.7 / 31.8		
	NB LT	76 / 79 / 40	0.67 / 0.84 / 0.74	E / E / D	78 / 78 / 46	0.77 / 0.87 / 0.81	E / E / D	78 / 78 / 46	0.77 / 0.87 / 0.81	E / E / D
	NB TH	12 / 17 / 16	0.42 / 0.45 / 0.55	B / B / B	13 / 20 / 18	0.43 / 0.46 / 0.52	B / B / B	13 / 20 / 18	0.43 / 0.46 / 0.52	B / B / B
	NB RT	8 / 12 / 12	0.01 / 0.01 / 0.01	A / B / B	9 / 14 / 13	0.01 / 0.01 / 0.01	A / B / B	9 / 14 / 13	0.01 / 0.01 / 0.01	A / B / B
	EB LT	76 / 71 / 34	0.85 / 0.87 / 0.71	E / E / C	75 / 70 / 40	0.85 / 0.89 / 0.79	E / E / D	75 / 70 / 40	0.85 / 0.89 / 0.79	E / E / D
	EB TH/RT	65 / 57 / 29	0.1 / 0.15 / 0.16	E / E / C	64 / 53 / 32	0.09 / 0.13 / 0.14	E / D / C	64 / 53 / 32	0.09 / 0.13 / 0.14	E / D / C
	WB LT	77 / 77 / 42	0.37 / 0.35 / 0.32	E / E / D	77 / 77 / 50	0.37 / 0.35 / 0.33	E / E / D	77 / 77 / 50	0.37 / 0.35 / 0.33	E / E / D
	WB TH/RT	76 / 78 / 48	0.24 / 0.47 / 0.64	E / E / D	76 / 78 / 56	0.24 / 0.47 / 0.66	E / E / E	76 / 78 / 56	0.24 / 0.47 / 0.66	E / E / E
	SB LT	98 / 108 / 52	0.63 / 0.73 / 0.65	F / F / D	98 / 108 / 64	0.63 / 0.73 / 0.7	F / F / E	98 / 108 / 64	0.63 / 0.73 / 0.7	F / F / E
	SB TH	17 / 33 / 24	0.41 / 0.77 / 0.78	B / C / C	18 / 43 / 32	0.42 / 0.86 / 0.82	B / D / C	18 / 43 / 32	0.42 / 0.86 / 0.82	B / D / C
	SB RT	14 / 20 / 17	0.19 / 0.23 / 0.24	B / C / B	15 / 26 / 23	0.2 / 0.27 / 0.29	B / C / C	15 / 26 / 23	0.2 / 0.27 / 0.29	B / C / C
2	**2: Queen Kaahumanu Highway & Kaiwi Street** *Discussion: The EB RT movement is provided with an acceleration lane, therefore no delays are experienced.*	Queen Kaahumanu Hwy / Kaiwi Street			See Year 2027 without Project			See Year 2027 without Project		
3	**3: Queen Kaahumanu Highway & Eho Street** *Discussion: The SB RT movement is not anticipated to experience any delays.*	Queen Kaahumanu Hwy / Eho Street			See Year 2027 without Project			See Year 2027 without Project		
4	**4: Queen Kaahumanu Highway & Palani Road** *Discussion: By Year 2027 with the Project, this intersection is anticipated to experience increases in delay. However, all movements are expected to operate under capacity.*	Queen Kaahumanu Hwy / Palani Road			See Year 2027 without Project			See Year 2027 without Project		
		D / D / C - / - / - 39 / 41 / 25.1			D / D / C - / - / - 39 / 42.8 / 28			D / D / C - / - / - 39 / 42.8 / 28.2		
	NB LT	76 / 79 / 37	0.59 / 0.65 / 0.63	E / E / D	78 / 82 / 42	0.63 / 0.75 / 0.68	E / F / D	78 / 82 / 42	0.63 / 0.75 / 0.68	E / F / D
	NB TH	18 / 25 / 21	0.42 / 0.47 / 0.66	B / C / C	19 / 28 / 23	0.44 / 0.52 / 0.68	B / C / C	19 / 28 / 23	0.44 / 0.52 / 0.68	B / C / C
	NB RT	13 / 19 / 15	0.01 / 0.01 / 0.02	B / B / B	14 / 20 / 16	0.01 / 0.01 / 0.02	B / B / B	14 / 20 / 16	0.01 / 0.01 / 0.02	B / B / B
	EB LT	78 / 79 / 34	0.85 / 0.87 / 0.73	E / E / C	78 / 79 / 40	0.85 / 0.87 / 0.76	E / E / D	78 / 79 / 40	0.85 / 0.87 / 0.76	E / E / D
	EB TH	60 / 59 / 24	0.36 / 0.46 / 0.33	E / E / C	59 / 58 / 27	0.37 / 0.5 / 0.39	E / E / C	59 / 58 / 27	0.37 / 0.5 / 0.39	E / E / C
	EB RT	0 / **0** / 0	0 / **0** / 0	A / **A** / A	0 / **0** / 0	0 / **0** / 0	A / **A** / A	0 / **0** / 0	0 / **0** / 0	A / **A** / A
	WB LT	80 / 79 / 46	0.33 / 0.39 / 0.5	E / E / D	80 / 79 / 52	0.33 / 0.39 / 0.52	E / E / D	80 / 79 / 52	0.33 / 0.39 / 0.52	E / E / D
	WB TH/RT	74 / 73 / 32	0.76 / 0.76 / 0.58	E / E / C	73 / 72 / 36	0.77 / 0.78 / 0.65	E / E / D	73 / 72 / 36	0.77 / 0.78 / 0.65	E / E / D
	SB LT	77 / 72 / 37	0.47 / 0.6 / 0.63	E / E / D	77 / 72 / 43	0.47 / 0.6 / 0.66	E / E / D	77 / 72 / 43	0.47 / 0.6 / 0.66	E / E / D
	SB TH	17 / 23 / 21	0.32 / 0.56 / 0.71	B / C / C	18 / 26 / 24	0.34 / 0.62 / 0.74	B / C / C	18 / 26 / 24	0.34 / 0.62 / 0.74	B / C / C
	SB RT	16 / 22 / 18	0.18 / 0.47 / 0.38	B / C / B	17 / 24 / 20	0.18 / 0.49 / 0.41	B / C / C	17 / 24 / 20	0.18 / 0.49 / 0.41	B / C / C
5	**5: Makala Boulevard & Luhia Street** *Discussion: This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.*	Luhia Street / Makala Boulevard			See Year 2027 without Project			See Year 2027 without Project		
		B / B / B - / - / - 14 / 16 / 18			B / B / B - / - / - 13 / 16 / 18			B / B / B - / - / - 13 / 16 / 18		
	NB LT	17 / 22 / 22	0.03 / 0.17 / 0.09	B / C / C	17 / 25 / 26	0.03 / 0.19 / 0.09	B / C / C	17 / 25 / 26	0.03 / 0.19 / 0.09	B / C / C
	NB TH	19 / 23 / 26	0.28 / 0.19 / 0.49	B / C / C	20 / 26 / 30	0.28 / 0.21 / 0.53	B / C / C	20 / 26 / 30	0.28 / 0.21 / 0.53	B / C / C
	NB RT	18 / 22 / 22	0.15 / 0.12 / 0.06	B / C / C	19 / 25 / 26	0.15 / 0.1 / 0.04	B / C / C	19 / 25 / 26	0.15 / 0.1 / 0.04	B / C / C
	EB LT	28 / 29 / 30	0.43 / 0.46 / 0.5	C / C / C	29 / 32 / 34	0.43 / 0.46 / 0.52	C / C / C	29 / 32 / 34	0.43 / 0.46 / 0.52	C / C / C
	EB TH/RT	14 / 16 / 17	0.41 / 0.55 / 0.56	B / B / B	14 / 17 / 18	0.44 / 0.62 / 0.64	B / B / B	14 / 17 / 18	0.44 / 0.62 / 0.64	B / B / B
	WB LT	18 / 22 / 25	0.74 / 0.76 / 0.77	B / C / C	19 / 25 / 28	0.74 / 0.78 / 0.79	B / C / C	19 / 25 / 28	0.74 / 0.78 / 0.79	B / C / C
	WB TH/RT	9 / 11 / 12	0.27 / 0.39 / 0.4	A / B / B	9 / 11 / 12	0.31 / 0.47 / 0.53	A / B / B	9 / 11 / 12	0.31 / 0.47 / 0.53	A / B / B
	SB LT	18 / 23 / 24	0.36 / 0.68 / 0.66	B / C / C	19 / 26 / 28	0.36 / 0.69 / 0.68	B / C / C	19 / 26 / 28	0.36 / 0.69 / 0.68	B / C / C
	SB TH/RT	17 / 18 / 21	0.16 / 0.12 / 0.24	B / B / C	17 / 20 / 24	0.16 / 0.13 / 0.25	B / C / C	17 / 20 / 24	0.16 / 0.13 / 0.25	B / C / C
6	**6: Makala Boulevard & Midblock Driveway** *Discussion: This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.*	Midblock Driveway / Makala Boulevard			See Year 2027 without Project			See Year 2027 without Project		
		B / B / B - / - / - 14 / 16 / 19			B / B / B - / - / - 13 / 16 / 20			B / B / B - / - / - 13 / 16 / 20		
	NB LT	16 / 17 / 18	0.22 / 0.14 / 0.19	B / B / B	16 / 19 / 21	0.22 / 0.16 / 0.2	B / B / C	16 / 19 / 21	0.22 / 0.16 / 0.2	B / B / C
	NB TH	16 / 17 / 19	0.22 / 0.26 / 0.34	B / B / B	16 / 19 / 23	0.22 / 0.29 / 0.36	B / B / C	16 / 19 / 23	0.22 / 0.29 / 0.36	B / B / C
	NB RT	15 / 17 / 18	0.02 / 0.15 / 0.12	B / B / B	15 / 18 / 21	0.02 / 0.1 / 0.11	B / B / C	15 / 18 / 21	0.02 / 0.1 / 0.11	B / B / C
	EB LT	22 / 20 / 25	0.44 / 0.56 / 0.68	C / C / C	22 / 23 / 29	0.44 / 0.57 / 0.73	C / C / C	22 / 23 / 29	0.44 / 0.57 / 0.73	C / C / C
	EB TH/RT	12 / 15 / 17	0.21 / 0.38 / 0.37	B / B / B	12 / 15 / 18	0.29 / 0.51 / 0.53	B / B / B	12 / 15 / 18	0.29 / 0.51 / 0.53	B / B / B
	WB LT	18 / 21 / 25	0.64 / 0.73 / 0.75	B / C / C	18 / 24 / 27	0.64 / 0.75 / 0.75	B / C / C	18 / 24 / 27	0.64 / 0.75 / 0.75	B / C / C
	WB TH/RT	10 / 14 / 17	0.18 / 0.44 / 0.44	A / B / B	10 / 14 / 17	0.26 / 0.53 / 0.57	B / B / B	10 / 14 / 17	0.26 / 0.53 / 0.57	B / B / B
	SB LT	16 / 15 / 16	0.34 / 0.35 / 0.4	B / B / B	16 / 17 / 19	0.34 / 0.36 / 0.42	B / B / B	16 / 17 / 19	0.34 / 0.36 / 0.42	B / B / B
	SB TH/RT	15 / 14 / 16	0.13 / 0.19 / 0.32	B / B / B	15 / 16 / 18	0.13 / 0.21 / 0.33	B / B / B	15 / 16 / 18	0.13 / 0.21 / 0.33	B / B / B

Intersection	Signalized: Overall LOS / Unsignalized: Critical Movement LOS / LOS [X / X / X] / DELAY [X / X / X]	Year 2027 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2027 with Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2027 with Project and Mitigation (AM / PM / WE) HCM Delay	v/c Ratio	LOS
7	**7: Makala Boulevard & Road A** *Discussion:* This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.	Road A / Makala Boulevard			See Year 2027 without Project			See Year 2027 without Project		
7	Overall LOS / v/c / Delay	B / B / B; - / - / -; 11 / 11 / 11			B / C / B; - / - / -; 12 / 21 / 15			B / C / B; - / - / -; 12 / 21 / 15		
7	NB LT	15 / 15 / 17	0.11 / 0.23 / 0.31	B / B / B	16 / 17 / 19	0.32 / 0.44 / 0.54	B / B / B	16 / 17 / 19	0.32 / 0.44 / 0.54	B / B / B
7	NB TH	15 / 14 / 14	0.14 / 0.15 / 0.09	B / B / B	14 / 15 / 16	0.05 / 0.06 / 0.03	B / B / B	14 / 15 / 16	0.05 / 0.06 / 0.03	B / B / B
7	NB RT	14 / 14 / 14	0.04 / 0.02 / 0.04	B / B / B	14 / 16 / 17	0.04 / 0.17 / 0.17	B / B / B	14 / 16 / 17	0.04 / 0.17 / 0.17	B / B / B
7	EB LT	22 / 26 / 19	0.42 / 0.42 / 0.44	C / C / B	23 / 30 / 24	0.43 / 0.43 / 0.46	C / C / C	23 / 30 / 24	0.43 / 0.43 / 0.46	C / C / C
7	EB TH/RT	9 / 11 / 10	0.2 / 0.35 / 0.35	A / B / A	11 / 14 / 16	0.23 / 0.41 / 0.49	B / B / B	11 / 14 / 16	0.23 / 0.41 / 0.49	B / B / B
7	WB LT	20 / 18 / 19	0.43 / 0.46 / 0.44	B / B / B	16 / 46 / 18	0.55 / 0.89 / 0.77	B / D / B	16 / 46 / 18	0.55 / 0.89 / 0.77	B / D / B
7	WB TH/RT	9 / 10 / 10	0.2 / 0.38 / 0.38	A / B / B	9 / 10 / 10	0.16 / 0.27 / 0.25	A / A / A	9 / 10 / 10	0.16 / 0.27 / 0.25	A / A / A
7	SB LT	16 / 14 / 17	0.08 / 0.11 / 0.24	B / B / B	17 / 18 / 22	0.08 / 0.11 / 0.25	B / B / C	17 / 18 / 22	0.08 / 0.11 / 0.25	B / B / C
7	SB TH/RT	26 / 14 / 16	0.31 / 0.03 / 0.18	C / B / B	28 / 17 / 21	0.31 / 0.03 / 0.18	C / B / C	28 / 17 / 21	0.31 / 0.03 / 0.18	C / B / C
9	**9: Loloku Street & Maa Way** *Discussion:* This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.	Maa Way / Loloku Street			See Year 2027 without Project			See Year 2027 with Project		
9	Overall LOS / v/c / Delay	B / B / B; 0.01 / 0.01 / 0.01; 10 / 11 / 11			B / B / B; 0.02 / 0.04 / 0.05; 10 / 12 / 12			B / B / B; 0.02 / 0.04 / 0.05; 10 / 12 / 12		
9	NB LT	10 / 11 / 11	0.01 / 0.01 / 0.01	B / B / B	10 / 12 / 12	0.02 / 0.04 / 0.05	B / B / B	10 / 12 / 12	0.02 / 0.04 / 0.05	B / B / B
9	NB RT	9 / 10 / 10	0.06 / 0.12 / 0.09	A / A / A	9 / 10 / 10	0.07 / 0.14 / 0.11	A / A / B	9 / 10 / 10	0.07 / 0.14 / 0.11	A / A / B
9	WB LT/TH	8 / 8 / 8	0.02 / 0.04 / 0.03	A / A / A	8 / 8 / 8	0.03 / 0.05 / 0.04	A / A / A	8 / 8 / 8	0.03 / 0.05 / 0.04	A / A / A
11	**11: Pawai Place & Loloku Street** *Discussion:* This intersection is expected to operate satisfactorily.				Pawai Place / Loloku Street			See Year 2027 with Project		
11	Overall LOS / v/c / Delay	/ /			/ /			/ /		
11	NB LT/RT				9 / 11 / 11	0.01 / 0.05 / 0.06	A / B / B	9 / 11 / 11	0.01 / 0.05 / 0.06	A / B / B
11	WB LT/TH				8 / 8 / 8	0 / 0.01 / 0.01	A / A / A	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A
12	**12: Pawai Place & Kaiwi Street** *Discussion:* This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.	Pawai Place / Kaiwi Street			See Year 2027 without Project			See Year 2027 without Project		
12	Overall LOS / v/c / Delay	C / D / C; 0.22 / 0.65 / 0.38; 15 / 34 / 18			C / E / C; 0.23 / 0.70 / 0.41; 16 / 41 / 20			C / E / C; 0.23 / 0.70 / 0.41; 16 / 41 / 20		
12	NB LT/TH/RT	15 / 34 / 18	0.22 / 0.65 / 0.38	C / D / C	16 / 41 / 20	0.23 / 0.7 / 0.41	C / E / C	16 / 41 / 20	0.23 / 0.7 / 0.41	C / E / C
12	EB LT	8 / 8 / 8	0 / 0 / 0	A / A / A	8 / 8 / 8	0.01 / 0.02 / 0.02	A / A / A	8 / 8 / 8	0.01 / 0.02 / 0.02	A / A / A
12	WB LT	9 / 9 / 9	0.08 / 0.1 / 0.09	A / A / A	9 / 9 / 9	0.08 / 0.1 / 0.09	A / A / A	9 / 9 / 9	0.08 / 0.1 / 0.09	A / A / A
12	SB LT/TH/RT	17 / 16 / 19	0.01 / 0.04 / 0	C / C / C	15 / 20 / 17	0.04 / 0.16 / 0.11	B / C / C	15 / 20 / 17	0.04 / 0.16 / 0.11	B / C / C
13	**13: Kuakini Highway & Makala Boulevard** *Discussion:* This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.	Kuakini Highway / Makala Boulevard			See Year 2027 without Project			See Year 2027 without Project		
13	Overall LOS / v/c / Delay	A / B / B; 0.19 / 0.44 / 0.50; 9 / 11.7 / 13.5			A / B / C; 0.23 / 0.55 / 0.65; 9 / 14.3 / 19			A / B / C; 0.23 / 0.55 / 0.65; 9 / 14.3 / 18.5		
13	NB TH/RT	8 / 10 / 12	0.21 / 0.36 / 0.45	A / A / B	8 / 12 / 16	0.25 / 0.47 / 0.61	A / B / C	8 / 12 / 16	0.25 / 0.47 / 0.61	A / B / C
13	WB LT/RT	9 / 12 / 14	0.19 / 0.44 / 0.5	A / B / B	9 / 14 / 19	0.23 / 0.55 / 0.65	A / B / C	9 / 14 / 19	0.23 / 0.55 / 0.65	A / B / C
13	SB LT/TH	8 / 9 / 11	0.09 / 0.16 / 0.32	A / A / B	8 / 10 / 12	0.09 / 0.17 / 0.35	A / A / B	8 / 10 / 12	0.09 / 0.17 / 0.35	A / A / B
14	**14: Kuakini Highway & Loloku Street** *Discussion:* This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.	Kuakini Highway / Loloku Street			See Year 2027 without Project			See Year 2027 without Project		
14	Overall LOS / v/c / Delay	B / C / C; 0.09 / 0.24 / 0.24; 12 / 16 / 18			B / C / D; 0.14 / 0.46 / 0.55; 13 / 24 / 32			B / C / D; 0.14 / 0.46 / 0.55; 13 / 24 / 32		
14	WB LT/RT	12 / 16 / 18	0.09 / 0.24 / 0.24	B / C / C	13 / 24 / 32	0.14 / 0.46 / 0.55	B / C / D	13 / 24 / 32	0.14 / 0.46 / 0.55	B / C / D
14	SB LT/TH	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A
15	**15: Kuakini Highway & Kaiwi Street** *Discussion:* The projected increase in traffic is anticipated to increase the movements delay at this intersection. The NB and SB approaches are anticipated to operate at LOS F and overcapacity during PM and WE peak hours.	Kuakini Highway / Kaiwi Street			See Year 2027 without Project			Kuakini Highway / Kaiwi Street		
15	*Mitigation:* Signalize the intersection when warranted. The intersection is expected to operate satisfactorily once signalized.	B / F / E; 0.52 / 0.93 / 0.86; 15 / 57 / 38			C / F* / F*; 0.63 / 1.28 / 1.25; 19 / 161 / 144			A / B / A; - / - / -; 7 / 11 / 9		
15	NB LT/TH	15 / 57 / 38	0.52 / 0.93 / 0.86	B / F / E	19 / 161 / 144	0.63 / 1.28 / 1.25	C / F* / F*	7 / 11 / 9	0.44 / 0.66 / 0.65	A / B / A
15	NB RT	12 / 36 / 19	0.47 / 0.83 / 0.64	B / E / C	13 / 51 / 25	0.49 / 0.94 / 0.75	B / F / C	7 / 11 / 8	0.55 / 0.69 / 0.57	A / B / A
15	EB LT/TH/RT	10 / 16 / 13	0.14 / 0.31 / 0.2	B / C / B	11 / 17 / 14	0.15 / 0.34 / 0.22	B / C / B	9 / 10 / 11	0.14 / 0.19 / 0.17	A / B / B
15	WB LT/TH/RT	13 / 33 / 19	0.37 / 0.79 / 0.53	B / D / C	14 / 44 / 22	0.4 / 0.88 / 0.63	B / E / C	10 / 14 / 14	0.38 / 0.61 / 0.51	A / B / B
15	SB LT/TH/RT	12 / 37 / 34	0.35 / 0.81 / 0.82	B / E / D	13 / 87 / 93	0.43 / 1.08 / 1.11	B / F* / F*	6 / 10 / 9	0.36 / 0.62 / 0.66	A / B / A

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Intersection	Signalized: Overall LOS / Unsignalized: Critical Movement LOS / LOS [X / X / X] / DELAY [X / X / X]	Year 2027 without Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2027 with Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2027 with Project and Mitigation (AM / PM / WE) HCM Delay	v/c Ratio	LOS
16	**16: Kuakini Highway & Palani Road** *Discussion:* This intersection is expected to operate satisfactorily similar to Year 2027 without the Project.	Kuakini Highway / Palani Road			See Year 2027 without Project			See Year 2027 with Project		
16	Overall LOS / v/c / Delay	C / D / C; - / - / -; 32 / 43.2 / 27.5			C / D / C; - / - / -; 33 / 46.6 / 34			C / D / C; - / - / -; 33 / 45.7 / 33.8		
16	NB LT	15 / 28 / 23	0.16 / 0.38 / 0.38	B / C / C	16 / 33 / 25	0.17 / 0.49 / 0.42	B / C / C	16 / 33 / 25	0.17 / 0.49 / 0.42	B / C / C
16	NB TH	22 / 34 / 29	0.48 / 0.6 / 0.69	C / C / C	24 / 39 / 31	0.51 / 0.69 / 0.72	C / D / C	24 / 39 / 31	0.51 / 0.69 / 0.72	C / D / C
16	NB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
16	EB LT	38 / 45 / 22	0.52 / 0.58 / 0.44	D / D / C	39 / 48 / 27	0.56 / 0.66 / 0.57	D / D / C	39 / 48 / 27	0.56 / 0.66 / 0.57	D / D / C
16	EB TH/RT	51 / 62 / 32	0.71 / 0.75 / 0.67	D / E / C	51 / 62 / 41	0.71 / 0.75 / 0.73	D / E / D	51 / 62 / 41	0.71 / 0.75 / 0.73	D / E / D
16	WB LT	43 / 47 / 22	0.71 / 0.85 / 0.59	D / D / C	43 / 47 / 28	0.71 / 0.85 / 0.65	D / D / C	43 / 47 / 28	0.71 / 0.85 / 0.65	D / D / C
16	WB TH	48 / 51 / 29	0.67 / 0.75 / 0.6	D / D / C	49 / 53 / 38	0.69 / 0.78 / 0.69	D / D / D	49 / 53 / 38	0.69 / 0.78 / 0.69	D / D / D
16	WB RT	40 / 40 / 23	0.09 / 0.17 / 0.14	D / D / C	41 / 43 / 30	0.11 / 0.31 / 0.25	D / D / C	41 / 43 / 30	0.11 / 0.31 / 0.25	D / D / C
16	SB LT	16 / 24 / 20	0.24 / 0.34 / 0.5	B / C / C	16 / 28 / 27	0.29 / 0.55 / 0.7	B / C / C	16 / 27 / 27	0.29 / 0.55 / 0.7	B / C / C
16	SB TH/RT	20 / 42 / 32	0.37 / 0.78 / 0.87	B / D / C	21 / 51 / 40	0.41 / 0.88 / 0.91	C / D / D	21 / 48 / 40	0.41 / 0.88 / 0.91	C / D / D

5.5 Year 2032 with Project Analysis

By Year 2032 the Project is projected to generate a total of 555(901)[1,087] net cumulative external trips during the AM(PM)[WE] peak hours of traffic. The following growth is expected along major roadways in the study area.

5.5.1 Year 2032 Roadway Projects

The following roadway projects were assumed to be implemented by Year 2032 with Project:

Makala Boulevard Realignment – Realignment of Makala Boulevard from Maa Way to Kuakini Highway is proposed to align Makala Boulevard with the Old Kona Airport State Recreation Area Access, hereinafter referred to as Park Access.

Maa Way Extension – Extension of Maa Way north through the Project from its existing terminus at Loloku Street to Makala Boulevard.

Pawai Place Extension – Extension of Pawai Place north through the Project from its future terminus at Loloku Street to Makala Boulevard.

As a result of these roadway projects, the following intersections were added/modified for the Future Year 2032 scenario:

- [8] Makala Boulevard/Maa Way
- [9] Loloku Street/Maa Way
- [10] Makala Boulevard/Pawai Place
- [11] Pawai Place/Loloku Street
- [13] Kuakini Highway/Makala Boulevard

5.5.2 Year 2032 with Project Intersection Analysis

Traffic operations by Year 2032 with Project are forecast to worsen to unacceptable conditions compared to Year 2027 with Project and Mitigation at the following intersections.

[1] Queen Kaahumanu Highway/Makala Boulevard

By Year 2032 with Project, the intersection is expected to operate similar to Year 2027 with Project with Mitigation conditions. However, the intersection is anticipated to experience an increase in delay with an overall LOS E during the PM and WE peak hours of traffic. The southbound through movement is anticipated to operate at overcapacity LOS F during the peak PM hour of traffic. Mitigation at this intersection is discussed below.

[16] Kuakini Highway/Palani Road

By Year 2032 with Project, delay at this intersection is expected to increase for all peak hours of traffic. Several movements are anticipated to operate at LOS E during the PM and WE peak hours, and the southbound through movement is expected to operate at overcapacity LOS F during the peak PM hour. Mitigation at this intersection is discussed below.

Figure 5.5 illustrates the Year 2032 with Project lane configurations, volumes and LOS. See Table 5.4 for a summary of the Year 2032 with Project analysis. LOS worksheets are included in Appendix C.

5.5.3 Year 2032 with Project and Mitigation Intersection Analysis

The following improvements are recommended by Year 2032 with Project. Note that the roadway improvements recommended in this section are currently not funded but are anticipated to be required as a result of both projected background development traffic and Project traffic. Regional developers in the area may be required to pay pro-rata share contributions for the improvements.

[1-3] Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the southbound direction from the Makala Boulevard intersection to the Eho Street intersection.

[15-16] Widen Kuakini Highway from one (1) through lanes to two (2) through lanes in the southbound direction between Palani Road and Kaiwi Street.

[1] Queen Kaahumanu Highway/Makala Boulevard

- Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the southbound direction.

Following the above mitigations, major through movements are anticipated to operate at LOS D or better for all peak periods while all minor movements will operate under capacity at LOS E or better for all peak hours of traffic. The low-volume southbound left-turn movement is still anticipated to operate at LOS F during the PM and WE peak hours. Overall LOS for the intersection shall improve to LOS D or better during all peak hours of traffic.

[16] Kuakini Highway/Palani Road

- Widen the southbound approach to provide an additional through lane.

Following mitigation, this intersection is anticipated to operate at an overall LOS D or better for all peak hours of traffic. In addition, all movements are anticipated to operate at LOS D or better during all peak hours of traffic.

Figure 5.6 illustrates the Year 2032 with Project and Mitigation lane configurations, volumes and LOS. See Table 5.4 for a summary of the Year 2032 with Project and Mitigation analysis. LOS worksheets are included in Appendix C.

MAKALAPUA PROJECT DISTRICT TIAR

AustinTsutsumi & ASSOCIATES, INC. Engineers & Surveyors

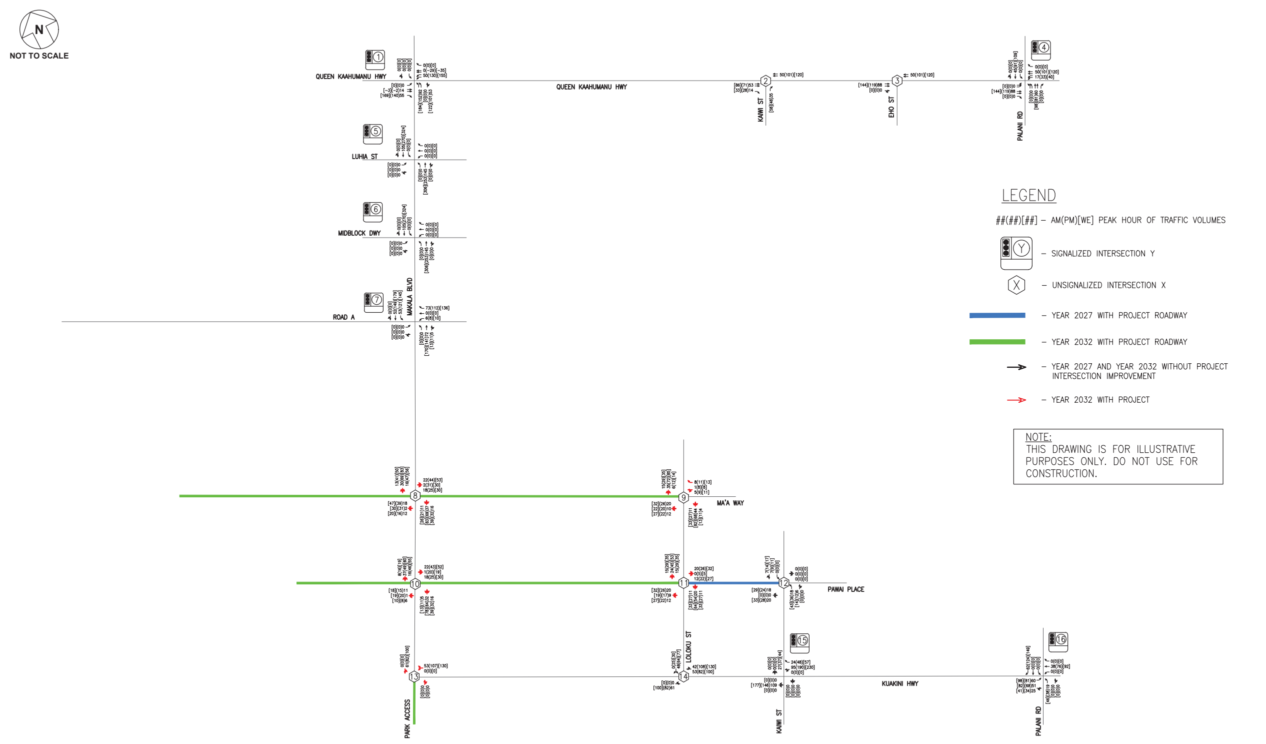

FIGURE 5.4

YEAR 2032 PROJECT-ONLY GENERATED TRIPS

MAKALAPUA PROJECT DISTRICT TIAR

AustinTsutsumi & ASSOCIATES, INC. Engineers & Surveyors

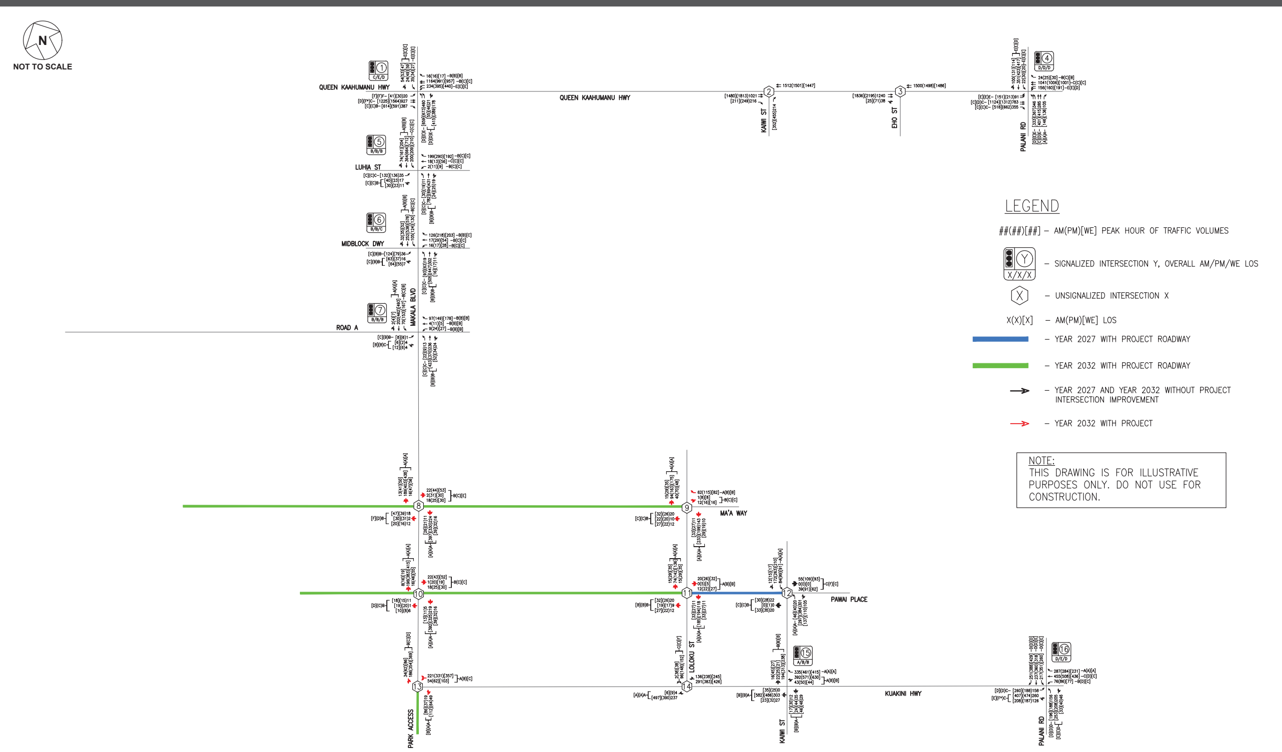

FIGURE 5.5

YEAR 2032 WITH PROJECT

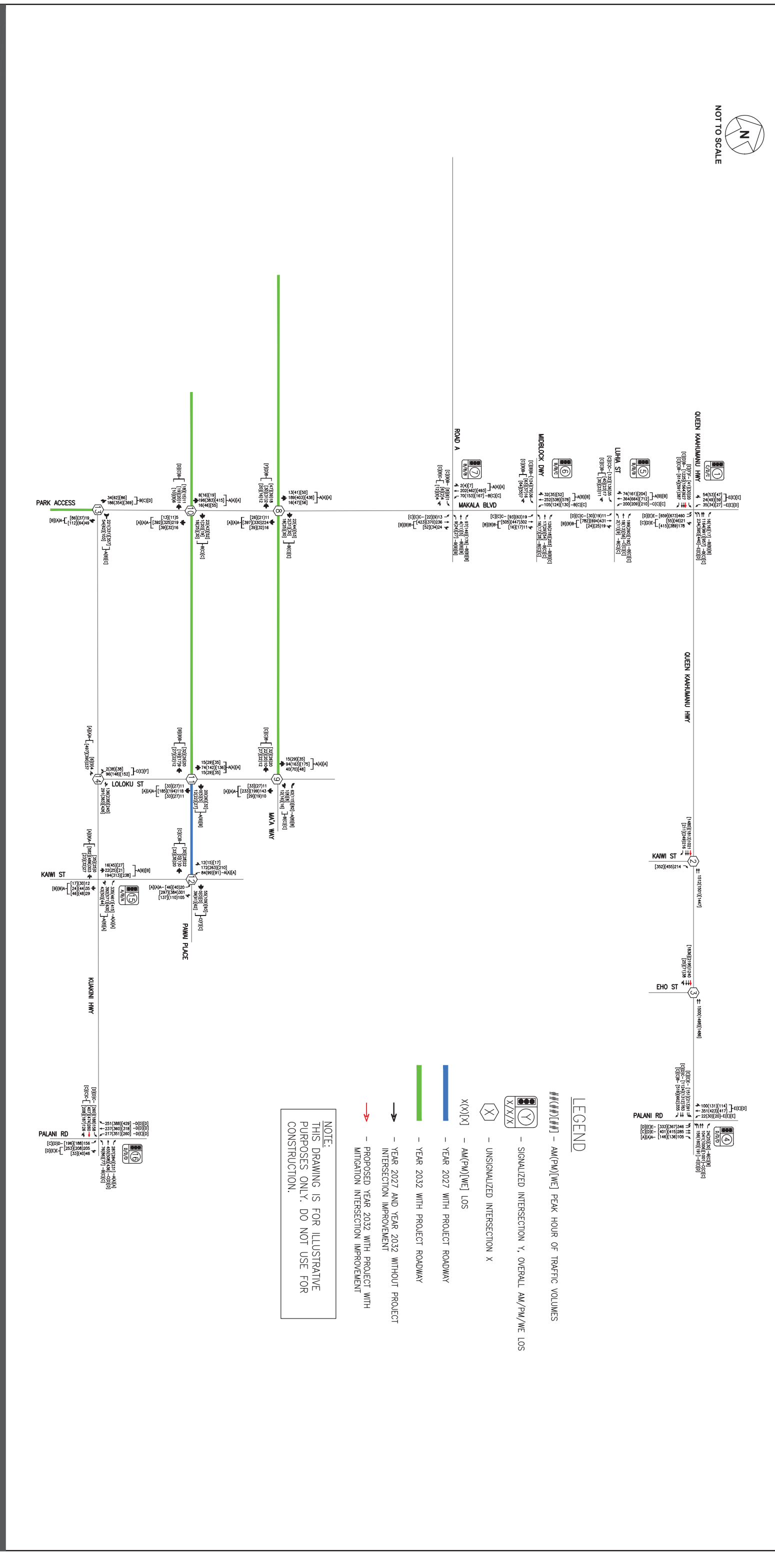

FIGURE 5.6

YEAR 2032 WITH PROJECT AND MITIGATION

MAKALAPUA PROJECT DISTRICT TIAR

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TABLE 5.4: LOS SUMMARY TABLE
YEAR 2027 WITH PROJECT AND MITIGATION, YEAR 2032 WITH PROJECT, AND YEAR 2032 WITH PROJECT AND MITIGATION

#	Intersection Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2027 with Project and Mitigation (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2032 with Project (AM / PM / WE) HCM Delay	v/c Ratio	LOS	Year 2032 with Project and Mitigation (AM / PM / WE) HCM Delay	v/c Ratio	LOS
1	**1: Queen Kaahumanu Highway & Makala Boulevard** *Discussion:* By Year 2032 with Project, several minor and turning movements are expected to operate at LOS E/F for all peak hours of traffic. The SB TH movement is expected to operate at LOS F and overcapacity during the peak PM hour.	Queen Kaahumanu Hwy / Makala Boulevard			See Year 2027 with Project and Mitigation			Queen Kaahumanu Hwy / Makala Boulevard		
1	*Mitigation:* Add an additional SB TH lane. Minor and LT movements still expected to operate at LOS E/F.	C / D / C - / - / - 30 / 46 / 32			C / E / D - / - / - 34 / 65 / 44			C / D / C - / - / - 33 / 46 / 34		
1	NB LT	78 / 78 / 46	0.77 / 0.87 / 0.81	E / E / D	79 / 80 / 60	0.82 / 0.88 / 0.86	E / E / E	80 / 78 / 48	0.83 / 0.88 / 0.83	E / E / D
1	NB TH	13 / 20 / 18	0.43 / 0.46 / 0.52	B / B / B	18 / 24 / 21	0.56 / 0.54 / 0.56	B / C / C	18 / 23 / 21	0.56 / 0.54 / 0.61	B / C / C
1	NB RT	9 / 14 / 13	0.01 / 0.01 / 0.01	A / B / B	11 / 16 / 15	0.01 / 0.01 / 0.01	B / B / B	11 / 16 / 15	0.01 / 0.01 / 0.01	B / B / B
1	EB LT	75 / 70 / 40	0.85 / 0.89 / 0.79	E / E / D	73 / 70 / 52	0.88 / 0.91 / 0.86	E / E / D	73 / 73 / 42	0.88 / 0.92 / 0.82	E / E / D
1	EB TH/RT	64 / 53 / 32	0.09 / 0.13 / 0.14	E / D / C	58 / 50 / 39	0.07 / 0.12 / 0.13	E / D / D	58 / 51 / 32	0.07 / 0.12 / 0.13	E / D / C
1	WB LT	77 / 77 / 50	0.37 / 0.35 / 0.33	E / E / D	77 / 76 / 62	0.37 / 0.35 / 0.33	E / E / E	77 / 76 / 52	0.37 / 0.35 / 0.32	E / E / D
1	WB TH/RT	76 / 78 / 56	0.24 / 0.47 / 0.66	E / E / E	76 / 78 / 70	0.24 / 0.48 / 0.69	E / E / E	76 / 78 / 59	0.24 / 0.48 / 0.67	E / E / E
1	SB LT	98 / 108 / 64	0.63 / 0.73 / 0.7	F / F / E	99 / 106 / 82	0.64 / 0.78 / 0.78	F / F / F	99 / 105 / 69	0.64 / 0.78 / 0.74	F / F / E
1	SB TH	18 / 43 / 32	0.42 / 0.86 / 0.82	B / D / C	22 / 90 / 52	0.5 / 1.07 / 0.95	C / F* / D	20 / 40 / 33	0.35 / 0.74 / 0.75	B / D / C
1	SB RT	15 / 26 / 23	0.2 / 0.27 / 0.29	B / C / C	18 / 32 / 28	0.22 / 0.36 / 0.35	B / C / C	18 / 31 / 28	0.22 / 0.35 / 0.4	B / C / C
2	**2: Queen Kaahumanu Highway & Kaiwi Street** *Discussion:* The EB RT movement is provided with an acceleration lane, therefore no delays are experienced. *Mitigation:* Carry over the Queen Kaahumanu Highway widening through the intersection.	Queen Kaahumanu Hwy / Kaiwi Street			See Year 2027 with Project and Mitigation			Queen Kaahumanu Hwy / Kaiwi Street		
3	**3: Queen Kaahumanu Highway & Eho Street** *Discussion:* The SB RT movement is not anticipated to experience any delays. *Mitigation:* Carry over the Queen Kaahumanu Highway widening through the intersection.	Queen Kaahumanu Hwy / Eho Street			See Year 2027 with Project and Mitigation			Queen Kaahumanu Hwy / Eho Street		
4	**4: Queen Kaahumanu Highway & Palani Road** *Discussion:* This intersection is expected to operate similar to Year 2027 with Project and Mitigation conditions.	Queen Kaahumanu Hwy / Palani Road			See Year 2027 with Project and Mitigation			See Year 2027 with Project and Mitigation		
4		D / D / C - / - / - 39 / 43 / 28			D / D / D - / - / - 42 / 47 / 35			D / D / D - / - / - 42 / 47 / 35		
4	NB LT	78 / 82 / 42	0.63 / 0.75 / 0.68	E / F / D	80 / 79 / 55	0.68 / 0.69 / 0.75	E / E / E	78 / 78 / 55	0.68 / 0.69 / 0.75	E / E / E
4	NB TH	19 / 28 / 23	0.44 / 0.52 / 0.68	B / C / C	25 / 34 / 27	0.57 / 0.64 / 0.7	C / C / C	25 / 34 / 27	0.57 / 0.64 / 0.7	C / C / C
4	NB RT	14 / 20 / 16	0.01 / 0.01 / 0.02	B / B / B	16 / 23 / 18	0.01 / 0.01 / 0.02	B / C / B	16 / 23 / 18	0.01 / 0.01 / 0.02	B / C / B
4	EB LT	78 / 79 / 40	0.85 / 0.87 / 0.76	E / E / D	75 / 74 / 55	0.86 / 0.87 / 0.83	E / E / D	79 / 78 / 55	0.87 / 0.88 / 0.83	E / E / D
4	EB TH	59 / 58 / 27	0.37 / 0.5 / 0.39	E / E / C	55 / 54 / 34	0.39 / 0.52 / 0.44	E / D / C	55 / 55 / 34	0.4 / 0.52 / 0.44	E / D / C
4	EB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
4	WB LT	80 / 79 / 52	0.33 / 0.39 / 0.52	E / E / D	80 / 79 / 67	0.33 / 0.39 / 0.56	E / E / E	80 / 79 / 67	0.33 / 0.39 / 0.56	E / E / E
4	WB TH/RT	73 / 72 / 36	0.77 / 0.78 / 0.65	E / E / D	72 / 71 / 46	0.79 / 0.81 / 0.73	E / E / D	72 / 71 / 46	0.79 / 0.81 / 0.73	E / E / D
4	SB LT	77 / 72 / 43	0.47 / 0.6 / 0.66	E / E / D	77 / 72 / 56	0.48 / 0.62 / 0.71	E / E / E	77 / 72 / 56	0.48 / 0.62 / 0.71	E / E / E
4	SB TH	18 / 26 / 24	0.34 / 0.62 / 0.74	B / C / C	23 / 36 / 31	0.44 / 0.78 / 0.81	C / D / C	23 / 36 / 31	0.44 / 0.78 / 0.81	C / D / C
4	SB RT	17 / 24 / 20	0.18 / 0.49 / 0.41	B / C / C	20 / 32 / 25	0.22 / 0.61 / 0.5	C / C / C	20 / 32 / 25	0.22 / 0.61 / 0.5	B / C / C
5	**5: Makala Boulevard & Luhia Street** *Discussion:* This intersection is expected to operate similar to Year 2027 with Project and Mitigation conditions.	Luhia Street / Makala Boulevard			See Year 2027 with Project and Mitigation			See Year 2027 with Project and Mitigation		
5		B / B / B - / - / - 13 / 16 / 18			B / B / B - / - / - 14 / 17 / 19			B / B / B - / - / - 14 / 17 / 19		
5	NB LT	17 / 25 / 26	0.03 / 0.19 / 0.09	B / C / C	19 / 28 / 29	0.03 / 0.21 / 0.1	B / C / C	19 / 28 / 29	0.03 / 0.21 / 0.1	B / C / C
5	NB TH	20 / 26 / 30	0.28 / 0.21 / 0.53	B / C / C	23 / 28 / 34	0.33 / 0.23 / 0.56	C / C / C	23 / 28 / 34	0.33 / 0.23 / 0.56	C / C / C
5	NB RT	19 / 25 / 26	0.15 / 0.1 / 0.04	B / C / C	20 / 27 / 28	0.1 / 0.06 / 0.04	B / C / C	20 / 27 / 28	0.1 / 0.06 / 0.04	B / C / C
5	EB LT	29 / 32 / 34	0.43 / 0.46 / 0.52	C / C / C	30 / 35 / 37	0.43 / 0.47 / 0.53	C / C / D	30 / 35 / 37	0.43 / 0.47 / 0.53	C / C / D
5	EB TH/RT	14 / 17 / 18	0.44 / 0.62 / 0.64	B / B / B	14 / 17 / 19	0.52 / 0.65 / 0.69	B / B / B	14 / 17 / 19	0.52 / 0.65 / 0.69	B / B / B
5	WB LT	19 / 25 / 28	0.74 / 0.78 / 0.79	B / C / C	20 / 27 / 31	0.75 / 0.79 / 0.8	C / C / C	20 / 27 / 31	0.75 / 0.79 / 0.8	C / C / C
5	WB TH/RT	9 / 11 / 12	0.31 / 0.47 / 0.53	A / B / B	9 / 11 / 13	0.32 / 0.54 / 0.59	A / B / B	9 / 11 / 13	0.32 / 0.54 / 0.59	A / B / B
5	SB LT	19 / 26 / 28	0.36 / 0.69 / 0.68	B / C / C	21 / 28 / 31	0.37 / 0.71 / 0.69	C / C / C	21 / 28 / 31	0.37 / 0.71 / 0.69	C / C / C
5	SB TH/RT	17 / 20 / 24	0.16 / 0.13 / 0.25	B / C / C	19 / 22 / 26	0.17 / 0.12 / 0.25	B / C / C	19 / 22 / 26	0.17 / 0.12 / 0.25	B / C / C
6	**6: Makala Boulevard & Midblock Driveway** *Discussion:* This intersection is expected to operate similar to Year 2027 with Project and Mitigation conditions.	Midblock Driveway / Makala Boulevard			See Year 2027 with Project and Mitigation			See Year 2027 with Project and Mitigation		
6		B / B / B - / - / - 13 / 16 / 20			B / B / C - / - / - 13 / 17 / 20			B / B / C - / - / - 13 / 17 / 20		
6	NB LT	16 / 19 / 21	0.22 / 0.16 / 0.2	B / B / C	17 / 20 / 24	0.21 / 0.17 / 0.21	B / C / C	17 / 20 / 24	0.21 / 0.17 / 0.21	B / C / C
6	NB TH	16 / 19 / 23	0.22 / 0.29 / 0.36	B / B / C	17 / 21 / 25	0.21 / 0.29 / 0.39	B / C / C	17 / 21 / 25	0.21 / 0.29 / 0.39	B / C / C
6	NB RT	15 / 18 / 21	0.02 / 0.1 / 0.11	B / B / C	16 / 20 / 23	0.07 / 0.1 / 0.1	B / B / C	16 / 20 / 23	0.07 / 0.1 / 0.1	B / B / C
6	EB LT	22 / 23 / 29	0.44 / 0.57 / 0.73	C / C / C	23 / 25 / 34	0.45 / 0.59 / 0.77	C / C / C	23 / 25 / 34	0.45 / 0.59 / 0.77	C / C / C
6	EB TH/RT	12 / 15 / 18	0.29 / 0.51 / 0.53	B / B / B	13 / 15 / 18	0.43 / 0.54 / 0.58	B / B / B	13 / 15 / 18	0.43 / 0.54 / 0.58	B / B / B
6	WB LT	18 / 24 / 27	0.64 / 0.75 / 0.75	B / C / C	20 / 25 / 30	0.67 / 0.75 / 0.76	B / C / C	20 / 25 / 30	0.67 / 0.75 / 0.76	B / C / C
6	WB TH/RT	10 / 14 / 17	0.26 / 0.53 / 0.57	B / B / B	10 / 14 / 18	0.29 / 0.58 / 0.64	A / B / B	10 / 14 / 18	0.29 / 0.58 / 0.64	A / B / B
6	SB LT	16 / 17 / 19	0.34 / 0.36 / 0.42	B / B / B	17 / 19 / 21	0.34 / 0.38 / 0.43	B / B / C	17 / 19 / 21	0.34 / 0.38 / 0.43	B / B / C
6	SB TH/RT	15 / 16 / 18	0.13 / 0.21 / 0.33	B / B / B	16 / 18 / 20	0.14 / 0.22 / 0.35	B / B / C	16 / 18 / 20	0.14 / 0.22 / 0.35	B / B / C

Intersection	Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2027 with Project and Mitigation (AM / PM / WE)			Year 2032 with Project (AM / PM / WE)			Year 2032 with Project and Mitigation (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
7	**7: Makala Boulevard & Road A** *Discussion:* This intersection is expected to operate similar to Year 2027 with Project and Mitigation conditions. Delay is anticipated to improve due to rerouting with the Project.	Road A / Makala Boulevard			See Year 2027 with Project and Mitigation			See Year 2027 with Project and Mitigation		
		B / C / B - / - / - 12 / 21 / 15			B / B / B - / - / - 11 / 14 / 13			B / B / B - / - / - 11 / 14 / 14		
	NB LT	16 / 17 / 19	0.32 / 0.44 / 0.54	B / B / B	15 / 18 / 19	0.16 / 0.24 / 0.34	B / B / B	15 / 18 / 20	0.16 / 0.24 / 0.34	B / B / B
	NB TH	14 / 15 / 16	0.05 / 0.06 / 0.03	B / B / B	14 / 17 / 17	0.06 / 0.11 / 0.06	B / B / B	14 / 17 / 17	0.06 / 0.11 / 0.06	B / B / B
	NB RT	14 / 16 / 17	0.04 / 0.17 / 0.17	B / B / B	15 / 17 / 17	0.18 / 0.16 / 0.11	B / B / B	15 / 17 / 18	0.18 / 0.16 / 0.11	B / B / B
	EB LT	23 / 30 / 24	0.43 / 0.43 / 0.46	C / C / C	23 / 30 / 23	0.43 / 0.43 / 0.46	C / C / C	23 / 30 / 24	0.43 / 0.43 / 0.46	C / C / C
	EB TH/RT	11 / 14 / 16	0.23 / 0.41 / 0.49	B / B / B	11 / 13 / 13	0.39 / 0.5 / 0.58	B / B / B	11 / 13 / 13	0.39 / 0.5 / 0.53	B / B / B
	WB LT	16 / 46 / 18	0.55 / 0.89 / 0.77	B / D / B	16 / 30 / 20	0.54 / 0.79 / 0.75	B / C / B	16 / 30 / 32	0.54 / 0.79 / 0.79	B / C / C
	WB TH/RT	9 / 10 / 10	0.16 / 0.27 / 0.25	A / A / A	9 / 10 / 9	0.24 / 0.4 / 0.43	A / A / A	9 / 10 / 9	0.24 / 0.4 / 0.4	A / A / A
	SB LT	17 / 18 / 22	0.08 / 0.11 / 0.25	B / B / C	17 / 18 / 21	0.08 / 0.11 / 0.25	B / B / C	17 / 18 / 22	0.08 / 0.11 / 0.25	B / B / C
	SB TH/RT	28 / 17 / 21	0.31 / 0.03 / 0.18	C / B / C	28 / 17 / 20	0.31 / 0.03 / 0.18	C / B / B	28 / 17 / 20	0.31 / 0.03 / 0.18	C / B / C
8	**8: Makala Boulevard & Maa Way** *Discussion:* This intersection is expected to operate satisfactorily.				Maa Way / Makala Boulevard			See Year 2032 with Project		
		/ / / / / /			B / D / F 0.07 / 0.44 / 0.65 12 / 34 / 61			B / D / F 0.07 / 0.44 / 0.65 12 / 34 / 61		
	NB LT/TH/RT				12 / 25 / 38	0.08 / 0.38 / 0.54	B / D / E	12 / 25 / 38	0.08 / 0.38 / 0.54	B / D / E
	EB LT/TH/RT				8 / 8 / 9	0.01 / 0.02 / 0.03	A / A / A	8 / 8 / 9	0.01 / 0.02 / 0.03	A / A / A
	WB LT/TH/RT				8 / 8 / 9	0.01 / 0.04 / 0.06	A / A / A	8 / 8 / 9	0.01 / 0.04 / 0.06	A / A / A
	SB LT/TH/RT				12 / 34 / 61	0.07 / 0.44 / 0.65	B / D / F	12 / 34 / 61	0.07 / 0.44 / 0.65	B / D / F
9	**9: Loloku Street & Maa Way** *Discussion:* This intersection is expected to operate similar to Year 2027 with Project and Mitigation conditions.	Maa Way / Loloku Street			Maa Way / Loloku Street			See Year 2027 with Project and Mitigation		
		B / B / B 0.02 / 0.04 / 0.05 10 / 12 / 12			B / C / C 0.03 / 0.08 / 0.08 12 / 17 / 17			B / C / C 0.03 / 0.08 / 0.08 12 / 17 / 17		
	NB LT	10 / 12 / 12	0.02 / 0.04 / 0.05	B / B / B						
	NB LT/TH				12 / 17 / 17	0.03 / 0.08 / 0.08	B / C / C	12 / 17 / 17	0.03 / 0.08 / 0.08	B / C / C
	NB RT	9 / 10 / 10	0.07 / 0.14 / 0.11	A / A / B	9 / 10 / 10	0.08 / 0.15 / 0.12	A / B / B	9 / 10 / 10	0.08 / 0.15 / 0.12	A / B / B
	EB LT/TH/RT				8 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A
	WB LT/TH	8 / 8 / 8	0.03 / 0.05 / 0.04	A / A / A						
	WB LT/TH/RT				8 / 8 / 8	0.03 / 0.06 / 0.04	A / A / A	8 / 8 / 8	0.03 / 0.06 / 0.04	A / A / A
	SB LT/TH/RT				12 / 16 / 16	0.08 / 0.18 / 0.22	B / C / C	12 / 16 / 16	0.08 / 0.18 / 0.22	B / C / C
10	**10: Makala Boulevard & Pawai Place** *Discussion:* This intersection is expected to operate satisfactorily.				Pawai Place / Makala Boulevard			See Year 2032 with Project		
		/ / / / / /			B / C / D 0.04 / 0.18 / 0.25 12 / 22 / 28			B / C / D 0.04 / 0.18 / 0.25 12 / 22 / 28		
	NB LT/TH/RT				12 / 20 / 26	0.08 / 0.29 / 0.39	B / C / D	12 / 20 / 26	0.08 / 0.29 / 0.39	B / C / D
	EB LT/TH/RT				8 / 8 / 8	0 / 0.01 / 0.01	A / A / A	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A
	WB LT/TH/RT				8 / 8 / 9	0.01 / 0.04 / 0.06	A / A / A	8 / 8 / 9	0.01 / 0.04 / 0.06	A / A / A
	SB LT/TH/RT				12 / 22 / 28	0.04 / 0.18 / 0.25	B / C / D	12 / 22 / 28	0.04 / 0.18 / 0.25	B / C / D
11	**11: Pawai Place & Loloku Street** *Discussion:* With the Project, a SB approach is added to this intersection and all other approaches are modified accordingly. This intersection is still expected to have satisfactory operations.	Pawai Place / Loloku Street			Pawai Place / Loloku Street			See Year 2032 with Project		
		/ / / / / /			B / B / B 0.06 / 0.14 / 0.17 10 / 13 / 14			B / B / B 0.06 / 0.14 / 0.17 10 / 13 / 14		
	NB LT/TH/RT				10 / 12 / 13	0.04 / 0.1 / 0.13	A / B / B	10 / 12 / 13	0.04 / 0.1 / 0.13	A / B / B
	NB LT/RT	9 / 11 / 11	0.01 / 0.05 / 0.06	A / B / B						
	EB LT/TH/RT				7 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A	7 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A
	WB LT/TH	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A						
	WB LT/TH/RT				8 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A
	SB LT/TH/RT				10 / 13 / 14	0.06 / 0.14 / 0.17	B / B / B	10 / 13 / 14	0.06 / 0.14 / 0.17	B / B / B
12	**12: Pawai Place & Kaiwi Street** *Discussion:* By Year 2032 with Project, the NB approach is expected to operate at LOS F during the peak PM hour. However, operations for all other approaches are LOS C or better.	Pawai Place / Kaiwi Street			See Year 2027 with Project and Mitigation			See Year 2027 with Project and Mitigation		
		C / E / C 0.23 / 0.70 / 0.41 16 / 41 / 20			C / F / C 0.25 / 0.82 / 0.48 17 / 60 / 24			C / F / C 0.25 / 0.82 / 0.48 17 / 60 / 24		
	NB LT/TH/RT	16 / 41 / 20	0.23 / 0.7 / 0.41	C / E / C	17 / 60 / 24	0.25 / 0.82 / 0.48	C / F / C	17 / 60 / 24	0.25 / 0.82 / 0.48	C / F / C
	EB LT	8 / 8 / 8	0.01 / 0.02 / 0.02	A / A / A	8 / 8 / 8	0.02 / 0.04 / 0.04	A / A / A	8 / 8 / 8	0.02 / 0.04 / 0.04	A / A / A
	WB LT	9 / 9 / 9	0.08 / 0.1 / 0.09	A / A / A	9 / 9 / 9	0.08 / 0.11 / 0.09	A / A / A	9 / 9 / 9	0.08 / 0.11 / 0.09	A / A / A
	SB LT/TH/RT	15 / 20 / 17	0.04 / 0.16 / 0.11	B / C / C	15 / 24 / 19	0.12 / 0.27 / 0.21	C / C / C	15 / 24 / 19	0.12 / 0.27 / 0.21	C / C / C
13	**13: Kuakini Highway & Makala Boulevard** *Discussion:* With the Project, the SB approach is reoriented as the EB approach of the intersection, and other approaches are modified accordingly. With this change, the intersection is still expected to operate satisfactorily.	Kuakini Highway / Makala Boulevard			Kuakini Highway / Makala Boulevard			See Year 2032 with Project		
		A / B / C 0.23 / 0.55 / 0.65 9 / 14 / 19			B / C / D 0.32 / 0.68 / 0.82 10 / 19 / 30			B / C / D 0.32 / 0.68 / 0.82 10 / 19 / 30		
	NB LT/RT				10 / 15 / 25	0.35 / 0.59 / 0.77	A / C / C	10 / 15 / 25	0.35 / 0.59 / 0.77	A / C / C
	NB TH/RT	8 / 12 / 16	0.25 / 0.47 / 0.61	A / B / C						
	EB TH/RT				8 / 10 / 12	0.09 / 0.17 / 0.36	A / A / B	8 / 10 / 12	0.09 / 0.17 / 0.36	A / A / B
	WB LT/RT	9 / 14 / 19	0.23 / 0.55 / 0.65	A / B / C						
	WB LT/TH				10 / 19 / 30	0.32 / 0.68 / 0.82	B / C / D	10 / 19 / 30	0.32 / 0.68 / 0.82	B / C / D
	SB LT/TH/RT	8 / 10 / 12	0.09 / 0.17 / 0.35	A / A / B						

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Intersection	Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2027 with Project and Mitigation (AM / PM / WE)			Year 2032 with Project (AM / PM / WE)			Year 2032 with Project and Mitigation (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
14	**14: Kuakini Highway & Loloku Street** *Discussion:* By Year 2032 with the Project, delay is expected to increase for the WB approach, which is anticipated to operate at LOS E/F during the PM/WE peak hour.	Kuakini Highway / Loloku Street			See Year 2027 with Project and Mitigation			See Year 2027 with Project and Mitigation		
		B / C / D 0.14 / 0.46 / 0.55 13 / 24 / 32			C / E / F 0.25 / 0.67 / 0.85 16 / 39 / 68			C / E / F 0.25 / 0.67 / 0.85 16 / 39 / 68		
	WB LT/RT	13 / 24 / 32	0.14 / 0.46 / 0.55	B / C / D	16 / 39 / 68	0.25 / 0.67 / 0.85	C / E / F	16 / 39 / 68	0.25 / 0.67 / 0.85	C / E / F
	SB LT/TH	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A
15	**15: Kuakini Highway & Kaiwi Street** *Discussion:* This intersection is expected to operate similar to Year 2027 with Project and Mitigation conditions. *Mitigation:* Add an additional SB receiving lane.	Kuakini Highway / Kaiwi Street			See Year 2027 with Project and Mitigation			See Year 2027 with Project and Mitigation		
		A / B / A - / - / - 7 / 11 / 9			A / B / B - / - / - 8 / 14 / 12			A / B / A - / - / - 7 / 11 / 9		
	NB LT/TH	7 / 11 / 9	0.44 / 0.66 / 0.65	A / B / A	8 / 14 / 11	0.54 / 0.76 / 0.72	A / B / B	6 / 11 / 9	0.51 / 0.72 / 0.7	A / B / A
	NB RT	7 / 11 / 8	0.55 / 0.69 / 0.57	A / B / A	6 / 9 / 7	0.25 / 0.1 / 0.29	A / A / A	5 / 8 / 6	0.24 / 0.29 / 0.28	A / A / A
	EB LT/TH/RT	9 / 10 / 11	0.14 / 0.19 / 0.17	A / B / B	9 / 12 / 13	0.1 / 0.14 / 0.1	A / B / B	8 / 11 / 12	0.09 / 0.14 / 0.09	A / B / B
	WB LT/TH/RT	10 / 14 / 14	0.38 / 0.61 / 0.51	A / B / B	10 / 16 / 17	0.42 / 0.66 / 0.58	A / B / B	9 / 15 / 15	0.39 / 0.64 / 0.54	A / B / B
	SB LT/TH/RT	6 / 10 / 9	0.36 / 0.62 / 0.66	A / B / A	7 / 14 / 12	0.47 / 0.76 / 0.77	A / B / B	6 / 11 / 9	0.44 / 0.67 / 0.72	A / B / A
16	**16: Kuakini Highway & Palani Road** *Discussion:* By Year 2032 with Project, the SB approach is expected to operate at LOS F and overcapacity during the peak PM hour. Various minor and LT movements also operate at LOS E. *Mitigation:* Add an additional SB TH lane. The intersection is expected to operate satisfactorily if implemented.	Kuakini Highway / Palani Road			See Year 2027 with Project and Mitigation			Kuakini Highway / Palani Road		
		C / D / C - / - / - 33 / 46 / 34			D / E / D - / - / - 36 / 60 / 51			D / D / D - / - / - 35 / 48 / 41		
	NB LT	16 / 33 / 25	0.17 / 0.49 / 0.42	B / C / C	19 / 48 / 31	0.22 / 0.74 / 0.55	B / D / C	18 / 27 / 24	0.18 / 0.32 / 0.28	B / C / C
	NB TH	24 / 39 / 31	0.51 / 0.69 / 0.72	C / D / C	32 / 49 / 34	0.66 / 0.82 / 0.73	C / D / C	32 / 54 / 50	0.66 / 0.85 / 0.91	C / D / D
	NB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
	EB LT	39 / 48 / 27	0.56 / 0.66 / 0.57	D / D / C	37 / 54 / 37	0.57 / 0.76 / 0.73	D / D / D	41 / 54 / 31	0.59 / 0.76 / 0.68	D / D / C
	EB TH/RT	51 / 62 / 41	0.71 / 0.75 / 0.73	D / E / D	54 / 72 / 66	0.8 / 0.86 / 0.88	D / E / E	57 / 70 / 54	0.8 / 0.85 / 0.84	E / E / D
	WB LT	43 / 47 / 28	0.71 / 0.85 / 0.65	D / D / C	46 / 57 / 59	0.79 / 0.95 / 0.9	D / E / E	45 / 55 / 41	0.79 / 0.94 / 0.81	D / E / D
	WB TH	49 / 53 / 38	0.69 / 0.78 / 0.69	D / D / D	47 / 51 / 59	0.68 / 0.8 / 0.86	D / D / E	44 / 51 / 47	0.63 / 0.8 / 0.79	D / D / D
	WB RT	41 / 43 / 30	0.11 / 0.31 / 0.25	D / D / C	39 / 44 / 43	0.13 / 0.54 / 0.62	D / D / D	37 / 44 / 37	0.12 / 0.54 / 0.56	D / D / D
	SB LT	16 / 27 / 27	0.29 / 0.55 / 0.7	B / C / C	22 / 48 / 52	0.5 / 0.84 / 0.88	C / D / D	21 / 44 / 55	0.5 / 0.82 / 0.91	C / D / E
	SB TH/RT	21 / 48 / 40	0.41 / 0.88 / 0.91	C / D / D	26 / 81 / 59	0.54 / 1.05 / 0.97	C / F* / E	21 / 33 / 26	0.27 / 0.54 / 0.54	C / C / C

5.6 Year 2042 with Project Analysis

The full build-out of the Project is expected to be completed by 2032. Thus, no additions or modifications to Project trips are anticipated by 2042.

5.6.1 Year 2042 Roadway Projects

No additional roadway projects were assumed to be implemented by Year 2042 with Project.

5.6.2 Year 2042 with Project Intersection Analysis

Traffic operations by Year 2042 with the Project are forecast to worsen to unacceptable conditions compared to Year 2032 with Project at the following intersections:

[1] Queen Kaahumanu Highway/Makala Boulevard

By Year 2042 with the Project, the major northbound through movement is anticipated to operate at near capacity LOS E conditions during the PM and WE peak hours of traffic with the projected background growth in the area. In addition, the northbound left-turn is expected to operate over capacity at LOS F during the PM peak hour. The westbound approach is anticipated to operate at LOS E/F during all peak hours. As a result of increased delay to the above movements, the intersection is expected to operate with overall LOS E during the PM and WE peak hours. Mitigation at this intersection is discussed below.

[4] Queen Kaahumanu Highway/Palani Road

By Year 2042 with Project conditions, the major southbound through movement is anticipated to operate at over capacity LOS F during peak PM and WE hours of traffic. In addition, all left-turn movements are expected to operate at LOS E/F during all peak hours. Overall, the intersection is anticipated to operate at LOS E during PM and WE peak hours of traffic. Mitigation at this intersection is discussed below.

[13] Kuakini Highway/Makala Boulevard

With the increase in through traffic projected along Kuakini Highway, the westbound left-turn is expected to operate at over capacity LOS F during the WE peak hour of traffic, and the northbound approach is expected to operate at LOS F during the WE peak hour. Mitigation at this intersection is discussed below.

[14] Kuakini Highway/Loloku Street

With the projected increase in traffic along Kuakini Highway, the westbound approach is expected to operate at overcapacity LOS F during the peak PM and WE hours of traffic. Mitigation at this intersection is discussed below.

[16] Kuakini Highway/Palani Road

Due to the large amount of growth within the region, as well as the accessibility provided by the intersection, this intersection expects to see increased usage as a result of the continued vehicular traffic growth in the area. By Year 2042 with Project, the eastbound through movement and westbound left-turn movement are anticipated to operate at over capacity LOS F

during all peak hours of traffic. The northbound through movement and southbound left-turn movement are also expected to operate at overcapacity LOS F during the PM and WE peak hours. Mitigation at this intersection is discussed below.

Figure 5.8 illustrates the Year 2042 with Project lane configurations, volumes and LOS. See Table 5.5 for a summary of the Year 2042 with Project analysis. LOS worksheets are included in Appendix C.

5.6.3 Year 2042 with Project and Mitigation Intersection Analysis

Although the Project is expected to be fully constructed by Year 2032 and is not anticipated to contribute additional trips by Year 2042, the following improvements are recommended by Year 2042 with Project. Note that the roadway improvements recommended in this section are currently not funded but are anticipated to be required as a result of both projected background development traffic and Project traffic. Regional developers in the area may be required to pay pro-rata share contributions for the improvements.

[1-4] Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the northbound direction from the Makala Boulevard intersection to the Palani Road intersection. Extend the southbound widening to Palani Road.

[13-15] Extend the Kuakini Highway widening from one (1) through lanes to two (2) through lanes in the southbound direction from Kaiwi Street to Makala Boulevard.

[15-16] Widen Kuakini Highway from three (3) through lanes to four (4) through lanes from Palani Road to Kaiwi Street.

[1] Queen Kaahumanu Highway/Makala Boulevard

- Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the northbound direction.

Following the above mitigation, major through movements are anticipated to operate at LOS D or better for all peak periods. The minor approaches and southbound left-turn movement are still anticipated to operate at LOS E/F during various peak hours of traffic. The northbound left-turn movement is still expected to operate at LOS E during the peak AM and WE hours and overcapacity LOS F during the peak PM hour. Additional mitigation at this intersection is not recommended due to ROW limitations.

[3] Queen Kaahumanu Highway/Eho Street

- Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the northbound direction.

Following the above mitigation, major through movements are anticipated to continue operating at free flow conditions. The minor westbound approach is expected to change from LOS D to LOS E during the AM and PM peak hours of traffic. However, delay is only projected to increase by 5-7 seconds.

[4] Queen Kaahumanu Highway/Palani Road

- Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the northbound direction.

Following the above mitigations, major through movements are anticipated to operate at LOS D or better for all peak periods. Although not over capacity, left-turn movements and minor approaches are still expected to operate at LOS E/F during all peak hours of traffic. Additional mitigation at this intersection is not recommended due to ROW limitations.

[13] Kuakini Highway/Makala Boulevard

- Widen Kuakini Highway in the vicinity of the intersection to provide an exclusive northbound left-turn lane and an exclusive northbound right-turn lane.
- Convert from an all-way stop intersection to a T-intersection with stop-control along Kuakini Highway.

Following the above mitigations, overall delay and operations are anticipated to improve. All movements are expected to operate at LOS C or better, except for the northbound left-turn movement which is anticipated to operate at LOS F during the peak PM hour of traffic and overcapacity LOS F during the peak WE hour. Due to the relatively low northbound left-turn volume, a traffic signal is not expected to be warranted per the MUTCD 11th Edition. However, monitoring the intersection is recommended to determine if a traffic signal should be considered in the future.

[14] Kuakini Highway/Loloku Street

- Widen Kuakini Highway in the vicinity of the intersection to provide an additional southbound through lane.

Following the above mitigations, all movements are expected to be undercapacity for all peak hours. However, the westbound approach is still anticipated to operate at LOS E/F during the peak PM and WE hours of traffic. A traffic signal is not expected to be warranted per the MUTCD 11th Edition and therefore was not included as a mitigation.

[15] Kuakini Highway/Kaiwi Street

- Widen Kuakini Highway in the vicinity of the intersection to provide an additional southbound lane.
- Modify southbound approach to have a shared left-turn/through lane and a shared through/right-turn lane.

Following the above mitigations, all movements are expected to operate at LOS C or better for all peak hours.

[16] Kuakini Highway/Palani Road

- Widen Kuakini Highway north of Palani Road to accommodate two (2) northbound receiving lanes.

- Modify the northbound approach to restripe the dedicated right-turn lane to a shared through/right-turn lane.

Following the above mitigations, the intersection operations improve from an overall LOS E/F during all peak hours to LOS E during only the peak PM hour of traffic. All movements are expected to operate under capacity, except for the eastbound through movement and westbound left-turn movement which are anticipated to continue operating at overcapacity LOS F during all peak hours of traffic. Due to right-of-way (ROW) limitations at this intersection, no further mitigation is proposed beyond recommendations in previous scenarios.

Figure 5.9 illustrates the Year 2042 with Project and Mitigation lane configurations, volumes and LOS. See Table 5.5 for a summary of the Year 2042 with Project and Mitigation analysis. LOS worksheets are included in Appendix C.

MAKALAPUA PROJECT DISTRICT TIAR

AustinTsutsumi & ASSOCIATES, INC. Engineers & Surveyors

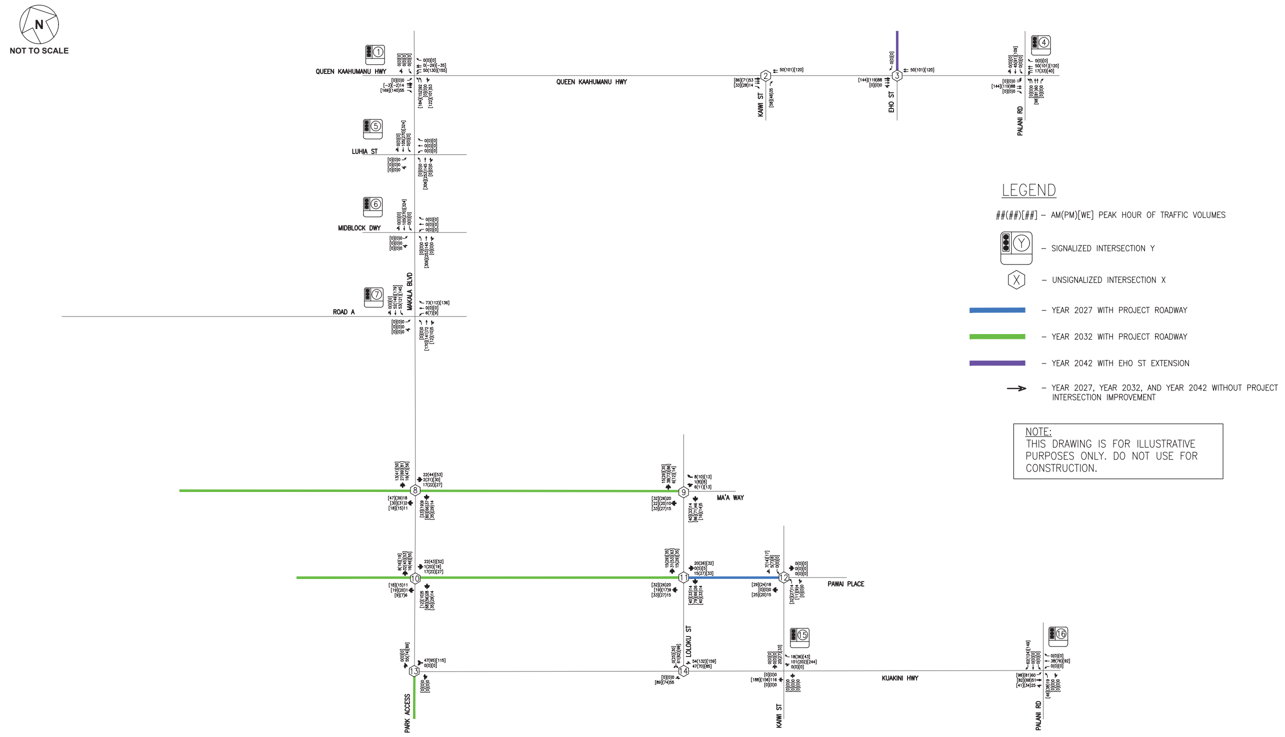


FIGURE 5.7

YEAR 2042 PROJECT-ONLY GENERATED TRIPS

MAKALAPUA PROJECT DISTRICT TIAR

AustinTsutsumi & ASSOCIATES, INC. Engineers & Surveyors

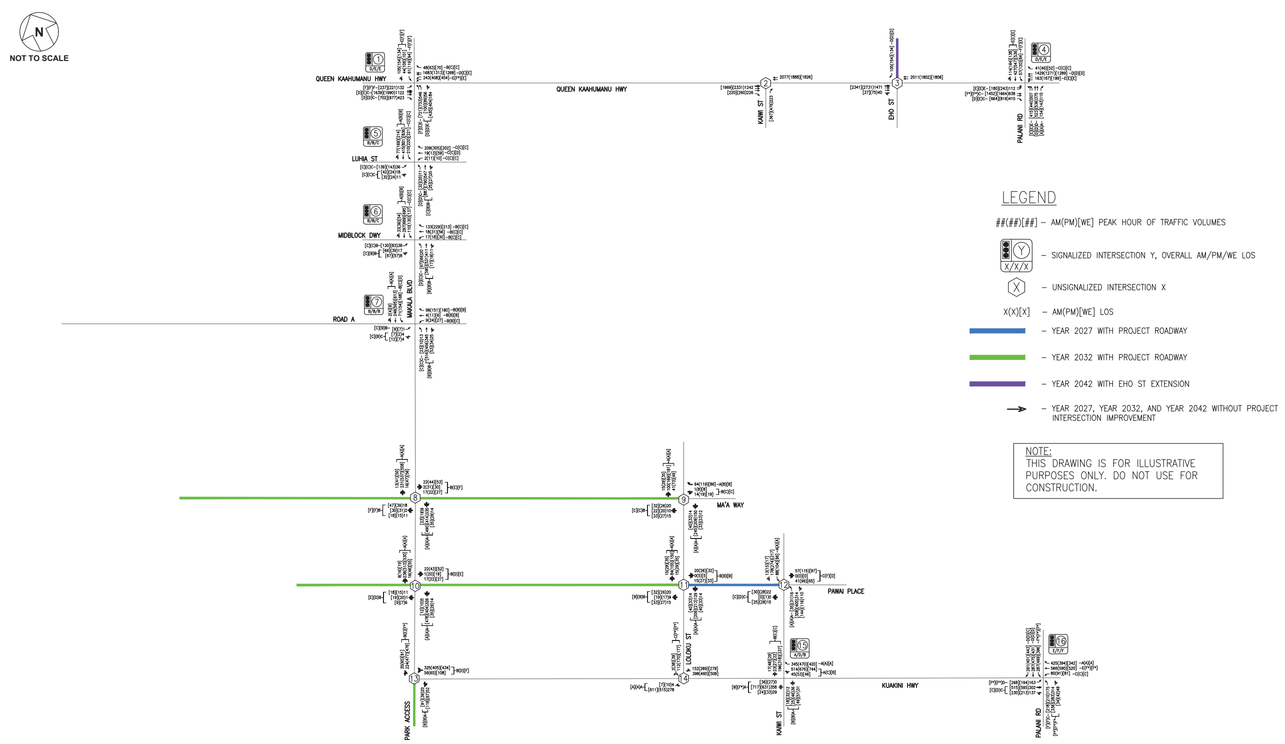
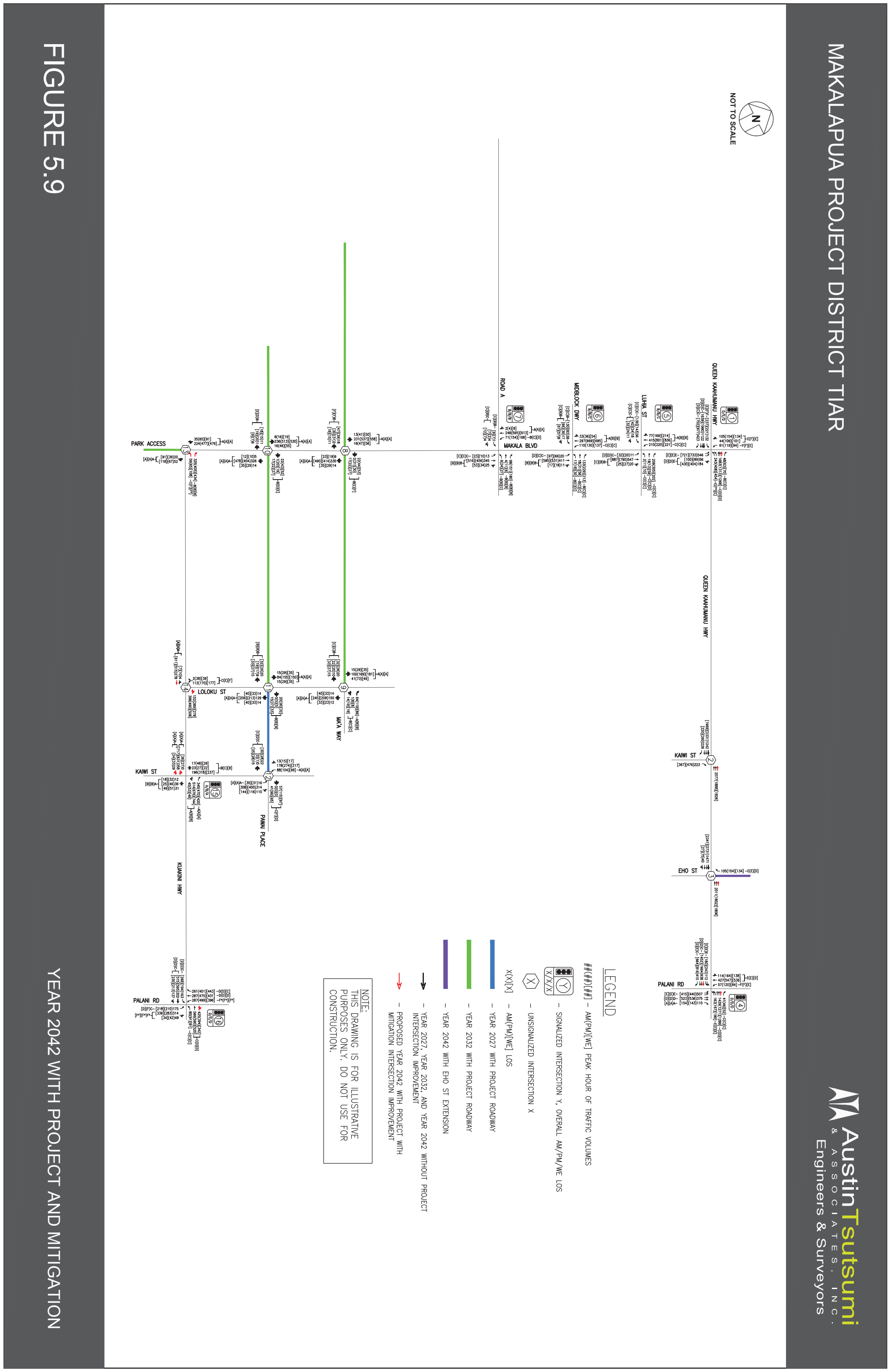


FIGURE 5.8

YEAR 2042 WITH PROJECT



AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

TABLE 5.5: LOS SUMMARY TABLE
YEAR 2032 WITH PROJECT AND MITIGATION, YEAR 2042 WITH PROJECT, AND YEAR 2042 WITH PROJECT AND MITIGATION

	Intersection Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2032 with Project and Mitigation (AM / PM / WE)			Year 2042 with Project (AM / PM / WE)			Year 2042 with Project and Mitigation (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1	**1: Queen Kaahumanu Highway & Makala Boulevard** *Discussion:* By Year 2042 with the Project, this intersection is expected to operate with several movements at LOS E/F during all peak hours.				See Year 2032 with Project and Mitigation					
	Mitigation: Widen Queen Kaahumanu Highway to three TH lanes in the NB direction. However, minor and LT movements are still LOS E/F, and the NB LT is expected to remain overcapacity during the peak PM hour.	33 / 46 / 34	- / - / -	C / D / C	48 / 71 / 61	- / - / -	D / E / E	40 / 65 / 53	- / - / -	D / E / D
	NB LT	80 / 78 / 48	0.83 / 0.88 / 0.83	E / E / D	79 / 117 / 74	0.83 / 1.01 / 0.89	E / F* / E	79 / 177 / 66	0.83 / 1.18 / 0.87	E / F* / E
	NB TH	18 / 23 / 21	0.56 / 0.54 / 0.61	B / C / C	49 / 67 / 58	0.96 / 0.98 / 0.95	D / E / E	29 / 42 / 39	0.67 / 0.68 / 0.71	C / D / D
	NB RT	11 / 16 / 15	0.01 / 0.01 / 0.01	B / B / B	18 / 29 / 28	0.03 / 0.05 / 0.05	B / C / C	18 / 30 / 28	0.03 / 0.05 / 0.05	B / C / C
	EB LT	73 / 73 / 42	0.88 / 0.92 / 0.82	E / E / D	77 / 75 / 84	0.91 / 0.95 / 0.97	E / E / F	77 / 75 / 69	0.91 / 0.95 / 0.93	E / E / E
	EB TH/RT	58 / 51 / 32	0.07 / 0.12 / 0.13	E / D / C	56 / 50 / 49	0.17 / 0.21 / 0.25	E / D / D	56 / 50 / 44	0.17 / 0.21 / 0.24	E / D / D
	WB LT	77 / 76 / 52	0.37 / 0.35 / 0.32	E / E / D	81 / 128 / 84	0.61 / 0.92 / 0.78	F / F / F	81 / 128 / 75	0.61 / 0.92 / 0.77	F / F / E
	WB TH/RT	76 / 78 / 59	0.24 / 0.48 / 0.67	E / E / E	77 / 98 / 85	0.43 / 0.78 / 0.8	E / F / F	77 / 98 / 76	0.43 / 0.78 / 0.79	E / F / E
	SB LT	99 / 105 / 69	0.64 / 0.78 / 0.74	F / F / E	89 / 104 / 101	0.87 / 0.93 / 0.93	F / F / F	89 / 80 / 71	0.87 / 0.91 / 0.9	F / F / E
	SB TH	20 / 40 / 33	0.35 / 0.74 / 0.75	B / D / C	24 / 63 / 47	0.44 / 0.99 / 0.86	C / E / D	24 / 54 / 50	0.44 / 0.95 / 0.92	C / D / D
	SB RT	18 / 31 / 28	0.22 / 0.35 / 0.4	B / C / C	21 / 37 / 36	0.24 / 0.52 / 0.52	C / D / D	21 / 35 / 37	0.24 / 0.49 / 0.55	C / C / D
2	**2: Queen Kaahumanu Highway & Kaiwi Street** *Discussion:* The EB RT movement is provided with an acceleration lane, therefore no delays are experienced.				See Year 2032 with Project and Mitigation					
	Mitigation: Carry over the Queen Kaahumanu Highway widening through the intersection.									
3	**3: Queen Kaahumanu Highway & Eho Street** *Discussion:* This intersection is expected to operate satisfactorily. The SB RT movement is not anticipated to experience any delays.									
	Mitigation: Carry over the Queen Kaahumanu Highway widening through the intersection. The WB RT is expected to operate at LOS E during peak AM and PM hours.	/ /	/ /	/ /	30 / 29 / 27	0.28 / 0.38 / 0.28	D / D / D	36 / 36 / 32	0.33 / 0.45 / 0.33	E / E / D
	WB RT				30 / 29 / 27	0.28 / 0.38 / 0.28	D / D / D	36 / 36 / 32	0.33 / 0.45 / 0.33	E / E / D
4	**4: Queen Kaahumanu Highway & Palani Road** *Discussion:* By Year 2042 with the Project, this intersection is anticipated to operate with various movements at LOS E/F conditions during all peak hours of traffic.				See Year 2032 with Project and Mitigation					
	Mitigation: Carry over the Queen Kaahumanu Highway widening through the intersection.	42 / 47 / 35	- / - / -	D / D / D	51 / 74 / 60	- / - / -	D / E / E	45 / 52 / 43	- / - / -	D / D / D
	NB LT	78 / 78 / 55	0.68 / 0.69 / 0.75	E / E / E	78 / 79 / 71	0.7 / 0.72 / 0.8	E / E / E	78 / 79 / 65	0.7 / 0.72 / 0.78	E / E / E
	NB TH	25 / 34 / 27	0.57 / 0.64 / 0.7	C / C / C	46 / 55 / 47	0.89 / 0.91 / 0.91	D / D / D	32 / 38 / 33	0.62 / 0.63 / 0.67	C / D / C
	NB RT	16 / 23 / 18	0.01 / 0.01 / 0.02	B / C / B	22 / 28 / 24	0.02 / 0.02 / 0.03	C / C / C	22 / 27 / 24	0.02 / 0.02 / 0.03	C / C / C
	EB LT	79 / 78 / 55	0.87 / 0.88 / 0.83	E / E / D	72 / 75 / 79	0.9 / 0.91 / 0.9	E / E / E	68 / 72 / 70	0.9 / 0.93 / 0.89	E / E / E
	EB TH	55 / 55 / 34	0.4 / 0.52 / 0.44	E / D / C	50 / 55 / 46	0.42 / 0.63 / 0.57	D / D / D	49 / 55 / 41	0.42 / 0.64 / 0.56	D / D / D
	EB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A
	WB LT	80 / 79 / 67	0.33 / 0.39 / 0.56	E / E / E	82 / 87 / 80	0.61 / 0.85 / 0.8	F / F / E	82 / 87 / 73	0.61 / 0.86 / 0.79	F / F / E
	WB TH/RT	72 / 71 / 46	0.79 / 0.81 / 0.73	E / E / D	78 / 74 / 61	0.86 / 0.87 / 0.83	E / E / E	78 / 74 / 54	0.86 / 0.87 / 0.81	E / E / D
	SB LT	77 / 72 / 56	0.48 / 0.62 / 0.71	E / E / E	79 / 75 / 72	0.58 / 0.7 / 0.78	E / E / E	79 / 75 / 66	0.58 / 0.7 / 0.77	E / E / E
	SB TH	23 / 36 / 31	0.44 / 0.78 / 0.81	C / D / C	33 / 100 / 75	0.6 / 1.1 / 1.04	C / F* / F*	29 / 39 / 36	0.42 / 0.76 / 0.76	C / D / D
	SB RT	20 / 32 / 25	0.22 / 0.61 / 0.5	B / C / C	28 / 58 / 40	0.32 / 0.91 / 0.75	C / E / D	28 / 57 / 40	0.32 / 0.9 / 0.79	C / E / D
5	**5: Makala Boulevard & Luhia Street** *Discussion:* This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions.				See Year 2032 with Project and Mitigation			See Year 2032 with Project and Mitigation		
		14 / 17 / 19	- / - / -	B / B / B	14 / 18 / 20	- / - / -	B / B / C	14 / 18 / 20	- / - / -	B / B / C
	NB LT	19 / 28 / 29	0.03 / 0.21 / 0.1	B / C / C	21 / 30 / 32	0.04 / 0.16 / 0.11	C / C / C	21 / 30 / 32	0.04 / 0.16 / 0.11	C / C / C
	NB TH	23 / 28 / 34	0.33 / 0.23 / 0.56	C / C / C	25 / 30 / 38	0.35 / 0.18 / 0.62	C / C / D	25 / 30 / 38	0.35 / 0.18 / 0.62	C / C / D
	NB RT	20 / 27 / 28	0.1 / 0.06 / 0.04	B / C / C	22 / 31 / 32	0.08 / 0.26 / 0.03	C / C / C	22 / 31 / 32	0.08 / 0.26 / 0.03	C / C / C
	EB LT	30 / 35 / 37	0.43 / 0.47 / 0.53	C / C / D	32 / 38 / 41	0.44 / 0.49 / 0.56	C / D / D	32 / 38 / 41	0.44 / 0.49 / 0.56	C / D / D
	EB TH/RT	14 / 17 / 19	0.52 / 0.65 / 0.69	B / B / B	14 / 19 / 20	0.57 / 0.69 / 0.72	B / B / C	14 / 19 / 20	0.57 / 0.69 / 0.72	B / B / C
	WB LT	20 / 27 / 31	0.75 / 0.79 / 0.8	C / C / C	22 / 31 / 34	0.76 / 0.81 / 0.83	C / C / C	22 / 31 / 34	0.76 / 0.81 / 0.83	C / C / C
	WB TH/RT	9 / 11 / 13	0.32 / 0.54 / 0.59	A / B / B	8 / 12 / 13	0.33 / 0.59 / 0.63	A / B / B	8 / 12 / 13	0.33 / 0.59 / 0.63	A / B / B
	SB LT	21 / 28 / 31	0.37 / 0.71 / 0.69	C / C / C	23 / 31 / 34	0.38 / 0.73 / 0.72	C / C / C	23 / 31 / 34	0.38 / 0.73 / 0.72	C / C / C
	SB TH/RT	19 / 22 / 26	0.17 / 0.12 / 0.25	B / C / C	21 / 25 / 29	0.18 / 0.13 / 0.27	C / C / C	21 / 25 / 29	0.18 / 0.13 / 0.27	C / C / C
6	**6: Makala Boulevard & Midblock Driveway** *Discussion:* This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions.				See Year 2032 with Project and Mitigation			See Year 2032 with Project and Mitigation		
		13 / 17 / 20	- / - / -	B / B / C	14 / 17 / 21	- / - / -	B / B / C	14 / 17 / 21	- / - / -	B / B / C
	NB LT	17 / 20 / 24	0.21 / 0.17 / 0.21	B / C / C	18 / 22 / 26	0.21 / 0.19 / 0.24	B / C / C	18 / 22 / 26	0.21 / 0.19 / 0.24	B / C / C
	NB TH	17 / 21 / 25	0.21 / 0.29 / 0.39	B / C / C	18 / 23 / 28	0.22 / 0.31 / 0.42	B / C / C	18 / 23 / 28	0.22 / 0.31 / 0.42	B / C / C
	NB RT	16 / 20 / 23	0.07 / 0.1 / 0.1	B / B / C	17 / 22 / 26	0.07 / 0.1 / 0.1	B / C / C	17 / 22 / 26	0.07 / 0.1 / 0.1	B / C / C
	EB LT	23 / 25 / 34	0.45 / 0.59 / 0.77	C / C / C	24 / 27 / 35	0.45 / 0.63 / 0.77	C / C / D	24 / 27 / 35	0.45 / 0.63 / 0.77	C / C / D
	EB TH/RT	13 / 15 / 18	0.43 / 0.54 / 0.58	B / B / B	13 / 15 / 19	0.49 / 0.56 / 0.61	B / B / B	13 / 15 / 19	0.49 / 0.56 / 0.61	B / B / B
	WB LT	20 / 25 / 30	0.67 / 0.75 / 0.76	B / C / C	22 / 27 / 32	0.71 / 0.75 / 0.76	C / C / C	22 / 27 / 32	0.71 / 0.75 / 0.76	C / C / C
	WB TH/RT	10 / 14 / 18	0.29 / 0.58 / 0.64	A / B / B	10 / 15 / 18	0.3 / 0.63 / 0.68	A / B / B	10 / 15 / 18	0.3 / 0.63 / 0.68	A / B / B
	SB LT	17 / 19 / 21	0.34 / 0.38 / 0.43	B / B / C	19 / 21 / 23	0.35 / 0.41 / 0.45	B / C / C	19 / 21 / 23	0.35 / 0.41 / 0.45	B / C / C
	SB TH/RT	16 / 18 / 20	0.14 / 0.22 / 0.35	B / B / C	17 / 20 / 22	0.15 / 0.25 / 0.37	B / B / C	17 / 20 / 22	0.15 / 0.25 / 0.37	B / B / C

#	Intersection Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2032 with Project and Mitigation (AM / PM / WE)			Year 2042 with Project (AM / PM / WE)			Year 2042 with Project and Mitigation (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
7	**7: Makala Boulevard & Road A** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions.*	Road A / Makala Boulevard / N			See Year 2032 with Project and Mitigation			See Year 2032 with Project and Mitigation		
		11 / 14 / 14	**- / - / -**	**B / B / B**	**11 / 14 / 15**	**- / - / -**	**B / B / B**	**11 / 14 / 15**	**- / - / -**	**B / B / B**
	NB LT	15 / 18 / 20	0.16 / 0.24 / 0.34	B / B / B	16 / 19 / 20	0.16 / 0.24 / 0.32	B / B / C	16 / 19 / 20	0.16 / 0.24 / 0.32	B / B / C
	NB TH	14 / 17 / 17	0.06 / 0.11 / 0.06	B / B / B	15 / 18 / 18	0.06 / 0.11 / 0.07	B / B / B	15 / 18 / 18	0.06 / 0.11 / 0.07	B / B / B
	NB RT	15 / 17 / 18	0.18 / 0.16 / 0.11	B / B / B	16 / 18 / 19	0.2 / 0.16 / 0.14	B / B / B	16 / 18 / 19	0.2 / 0.16 / 0.14	B / B / B
	EB LT	23 / 30 / 24	0.43 / 0.43 / 0.46	C / C / C	24 / 30 / 25	0.43 / 0.43 / 0.46	C / C / C	24 / 30 / 25	0.43 / 0.43 / 0.46	C / C / C
	EB TH/RT	11 / 13 / 13	0.39 / 0.5 / 0.53	B / B / B	11 / 13 / 13	0.46 / 0.54 / 0.57	B / B / B	11 / 13 / 13	0.46 / 0.54 / 0.57	B / B / B
	WB LT	16 / 30 / 32	0.54 / 0.79 / 0.79	B / C / C	17 / 32 / 38	0.55 / 0.79 / 0.82	B / C / D	17 / 32 / 38	0.55 / 0.79 / 0.82	B / C / D
	WB TH/RT	9 / 10 / 9	0.24 / 0.4 / 0.4	A / A / A	9 / 10 / 10	0.25 / 0.48 / 0.47	A / A / A	9 / 10 / 10	0.25 / 0.48 / 0.47	A / A / A
	SB LT	17 / 18 / 22	0.08 / 0.11 / 0.25	B / B / C	18 / 19 / 22	0.08 / 0.12 / 0.25	B / B / C	18 / 19 / 22	0.08 / 0.12 / 0.25	B / B / C
	SB TH/RT	28 / 17 / 20	0.31 / 0.03 / 0.18	C / B / C	29 / 18 / 21	0.31 / 0.03 / 0.19	C / B / C	29 / 18 / 21	0.31 / 0.03 / 0.19	C / B / C
8	**8: Makala Boulevard & Maa Way** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions. Although several movements are projected to operate at LOS E/F, these approaches have low vehicle volumes.*	Maa Way / Makala Boulevard / N			See Year 2032 with Project and Mitigation			See Year 2032 with Project and Mitigation		
		12 / 34 / 61	**0.07 / 0.44 / 0.65**	**B / D / F**	**14 / 68 / 158**	**0.08 / 0.65 / 0.98**	**B / F / F**	**14 / 68 / 158**	**0.08 / 0.65 / 0.98**	**B / F / F**
	NB LT/TH/RT	12 / 25 / 38	0.08 / 0.38 / 0.54	B / D / E	13 / 39 / 70	0.1 / 0.51 / 0.73	B / E / F	13 / 39 / 70	0.1 / 0.51 / 0.73	B / E / F
	EB LT/TH/RT	8 / 8 / 9	0.01 / 0.02 / 0.03	A / A / A	8 / 9 / 9	0.01 / 0.02 / 0.03	A / A / A	8 / 9 / 9	0.01 / 0.02 / 0.03	A / A / A
	WB LT/TH/RT	8 / 8 / 9	0.01 / 0.04 / 0.06	A / A / A	8 / 9 / 9	0.02 / 0.05 / 0.06	A / A / A	8 / 9 / 9	0.02 / 0.05 / 0.06	A / A / A
	SB LT/TH/RT	12 / 34 / 61	0.07 / 0.44 / 0.65	B / D / F	14 / 68 / 158	0.08 / 0.65 / 0.98	B / F / F	14 / 68 / 158	0.08 / 0.65 / 0.98	B / F / F
9	**9: Loloku Street & Maa Way** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions.*	Maa Way / Loloku Street / N			See Year 2032 with Project and Mitigation			See Year 2032 with Project and Mitigation		
		12 / 17 / 17	**0.03 / 0.08 / 0.08**	**B / C / C**	**12 / 18 / 18**	**0.03 / 0.09 / 0.10**	**B / C / C**	**12 / 18 / 18**	**0.03 / 0.09 / 0.10**	**B / C / C**
	NB LT/TH	12 / 17 / 17	0.03 / 0.08 / 0.08	B / C / C	12 / 18 / 18	0.03 / 0.09 / 0.1	B / C / C	12 / 18 / 18	0.03 / 0.09 / 0.1	B / C / C
	NB RT	9 / 10 / 10	0.08 / 0.15 / 0.12	A / B / B	10 / 10 / 11	0.08 / 0.16 / 0.12	A / B / B	10 / 10 / 11	0.08 / 0.16 / 0.12	A / B / B
	EB LT/TH/RT	8 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.03 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.03 / 0.03	A / A / A
	WB LT/TH/RT	8 / 8 / 8	0.03 / 0.06 / 0.04	A / A / A	8 / 8 / 8	0.03 / 0.06 / 0.04	A / A / A	8 / 8 / 8	0.03 / 0.06 / 0.04	A / A / A
	SB LT/TH/RT	12 / 16 / 16	0.08 / 0.18 / 0.22	B / C / C	12 / 17 / 17	0.08 / 0.2 / 0.24	B / C / C	12 / 17 / 17	0.08 / 0.2 / 0.24	B / C / C
10	**10: Makala Boulevard & Pawai Place** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions.*	Pawai Place / Makala Boulevard / N			See Year 2032 with Project and Mitigation			See Year 2032 with Project and Mitigation		
		12 / 22 / 28	**0.04 / 0.18 / 0.25**	**B / C / D**	**14 / 32 / 43**	**0.05 / 0.26 / 0.35**	**B / D / E**	**14 / 32 / 43**	**0.05 / 0.26 / 0.35**	**B / D / E**
	NB LT/TH/RT	12 / 20 / 26	0.08 / 0.29 / 0.39	B / C / D	13 / 27 / 39	0.09 / 0.37 / 0.51	B / D / E	13 / 27 / 39	0.09 / 0.37 / 0.51	B / D / E
	EB LT/TH/RT	8 / 8 / 8	0 / 0.01 / 0.01	A / A / A	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A
	WB LT/TH/RT	8 / 8 / 9	0.01 / 0.04 / 0.06	A / A / A	8 / 9 / 9	0.02 / 0.05 / 0.06	A / A / A	8 / 9 / 9	0.02 / 0.05 / 0.06	A / A / A
	SB LT/TH/RT	12 / 22 / 28	0.04 / 0.18 / 0.25	B / C / D	14 / 32 / 43	0.05 / 0.26 / 0.35	B / D / E	14 / 32 / 43	0.05 / 0.26 / 0.35	B / D / E
11	**11: Pawai Place & Loloku Street** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions.*	Pawai Place / Loloku Street / N			See Year 2032 with Project and Mitigation			See Year 2032 with Project and Mitigation		
		10 / 13 / 14	**0.06 / 0.14 / 0.17**	**B / B / B**	**11 / 14 / 14**	**0.07 / 0.15 / 0.19**	**B / B / B**	**11 / 14 / 14**	**0.07 / 0.15 / 0.19**	**B / B / B**
	NB LT/TH/RT	10 / 12 / 13	0.04 / 0.1 / 0.13	A / B / B	10 / 13 / 14	0.05 / 0.13 / 0.16	B / B / B	10 / 13 / 14	0.05 / 0.13 / 0.16	B / B / B
	EB LT/TH/RT	7 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.03 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.03 / 0.03	A / A / A
	WB LT/TH/RT	8 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.02 / 0.03	A / A / A
	SB LT/TH/RT	10 / 13 / 14	0.06 / 0.14 / 0.17	B / B / B	11 / 14 / 14	0.07 / 0.15 / 0.19	B / B / B	11 / 14 / 14	0.07 / 0.15 / 0.19	B / B / B
12	**12: Pawai Place & Kaiwi Street** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions.*	Pawai Place / Kaiwi Street / N			See Year 2032 with Project and Mitigation			See Year 2032 with Project and Mitigation		
		17 / 60 / 24	**0.25 / 0.82 / 0.48**	**C / F / C**	**17 / 73 / 25**	**0.27 / 0.89 / 0.51**	**C / F / D**	**17 / 73 / 25**	**0.27 / 0.89 / 0.51**	**C / F / D**
	NB LT/TH/RT	17 / 60 / 24	0.25 / 0.82 / 0.48	C / F / C	17 / 73 / 25	0.27 / 0.89 / 0.51	C / F / D	17 / 73 / 25	0.27 / 0.89 / 0.51	C / F / D
	EB LT	8 / 8 / 8	0.02 / 0.04 / 0.04	A / A / A	8 / 8 / 8	0.01 / 0.03 / 0.03	A / A / A	8 / 8 / 8	0.01 / 0.03 / 0.03	A / A / A
	WB LT	9 / 9 / 9	0.08 / 0.11 / 0.09	A / A / A	9 / 9 / 9	0.09 / 0.11 / 0.1	A / A / A	9 / 9 / 9	0.09 / 0.11 / 0.1	A / A / A
	SB LT/TH/RT	15 / 24 / 19	0.12 / 0.27 / 0.21	C / C / C	16 / 26 / 20	0.11 / 0.27 / 0.2	C / D / C	16 / 26 / 20	0.11 / 0.27 / 0.2	C / D / C
13	**13: Kuakini Highway & Makala Boulevard** *Discussion:* *By Year 2042 with the Project, the NB and WB approaches are expected to operate at LOS F and near capacity if not overcapacity.*	Kuakini Highway / Makala Boulevard / N			See Year 2032 with Project and Mitigation			Kuakini Highway / Makala Boulevard / N		
	Mitigation : Construct a NB LT pocket and convert from AWSC to TWSC. NB LT still overcapacity and LOS F. Install a traffic signal when warranted.	**10 / 19 / 30**	**0.32 / 0.68 / 0.82**	**B / C / D**	**12 / 49 / 93**	**0.41 / 0.94 / 1.10**	**B / E / F***	**16 / 60 / 198**	**0.15 / 0.54 / 1.11**	**C / F / F***
	NB LT							16 / 60 / 198	0.15 / 0.54 / 1.11	C / F / F*
	NB LT/RT	10 / 15 / 25	0.35 / 0.59 / 0.77	A / C / C	12 / 25 / 52	0.5 / 0.78 / 0.99	B / D / F			
	NB RT							10 / 12 / 14	0.35 / 0.45 / 0.54	B / B / B
	EB TH/RT	8 / 10 / 12	0.09 / 0.17 / 0.36	A / A / B	9 / 11 / 15	0.11 / 0.2 / 0.43	A / B / B	0 / 0 / 0	0 / 0 / 0	A / A / A
	WB LT/TH	10 / 19 / 30	0.32 / 0.68 / 0.82	B / C / D	12 / 49 / 93	0.41 / 0.94 / 1.1	B / E / F*	8 / 9 / 9	0.16 / 0.35 / 0.39	A / A / A
14	**14: Kuakini Highway & Loloku Street** *Discussion:* *This intersection is expected to operate satisfactorily similar to Year 2032 with Project conditions.*	Kuakini Highway / Loloku Street / N			See Year 2032 with Project and Mitigation			Kuakini Highway / Loloku Street / N		
	Mitigation : Add an additional SB TH lane. WB approach is expected to operate at LOS E/F during the peak PM/WE hours of traffic.	**16 / 39 / 68**	**0.25 / 0.67 / 0.85**	**C / E / F**	**22 / 121 / 234**	**0.36 / 1.05 / 1.33**	**C / F* / F***	**18 / 49 / 81**	**0.31 / 0.77 / 0.92**	**C / E / F**
	WB LT/RT	16 / 39 / 68	0.25 / 0.67 / 0.85	C / E / F	22 / 121 / 234	0.36 / 1.05 / 1.33	C / F* / F*	18 / 49 / 81	0.31 / 0.77 / 0.92	C / E / F
	SB LT/TH	8 / 9 / 9	0 / 0.01 / 0.01	A / A / A	9 / 9 / 10	0 / 0.01 / 0.01	A / A / A	9 / 9 / 10	0 / 0.01 / 0.01	A / A / A

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#	Intersection Signalized: Overall LOS Unsignalized: Critical Movement LOS LOS [X / X / X] DELAY [X / X / X]	Year 2032 with Project and Mitigation (AM / PM / WE)			Year 2042 with Project (AM / PM / WE)			Year 2042 with Project and Mitigation (AM / PM / WE)		
		HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
15	**15: Kuakini Highway & Kaiwi Street** *Discussion:* *By Year 2042 with the Project, the SB approach is expected to operate at LOS F and overcapacity during the peak PM hour.*	Kuakini Highway / Kaiwi Street / N			See Year 2032 with Project and Mitigation			Kuakini Highway / Kaiwi Street / N		
	Mitigation: Add an additional SB lane and modify the existing lane accordingly. The intersection is expected to operate satisfactorily and Mitigations.	**7 / 11 / 9**	**- / - / -**	**A / B / A**	**7 / 46 / 14**	**- / - / -**	**A / D / B**	**7 / 14 / 10**	**- / - / -**	**A / B / A**
	NB LT/TH	6 / 11 / 9	0.51 / 0.72 / 0.7	A / B / A	7 / 28 / 12	0.6 / 0.91 / 0.77	A / C / B	7 / 15 / 11	0.6 / 0.8 / 0.78	A / B / B
	NB RT	5 / 8 / 6	0.24 / 0.29 / 0.28	A / A / A	5 / 10 / 6	0.24 / 0.35 / 0.34	A / A / A	5 / 9 / 6	0.24 / 0.37 / 0.35	A / A / A
	EB LT/TH/RT	8 / 11 / 12	0.09 / 0.14 / 0.09	A / B / B	9 / 19 / 18	0.1 / 0.18 / 0.11	A / B / B	9 / 15 / 15	0.1 / 0.17 / 0.11	A / B / B
	WB LT/TH/RT	9 / 15 / 15	0.39 / 0.64 / 0.54	A / B / B	11 / 29 / 24	0.44 / 0.76 / 0.64	B / C / C	11 / 21 / 19	0.44 / 0.71 / 0.6	B / C / B
	SB LT/TH							5 / 10 / 7	0.23 / 0.47 / 0.47	A / A / A
	SB TH/RT							5 / 9 / 7	0.24 / 0.41 / 0.43	A / A / A
	SB LT/TH/RT	6 / 11 / 9	0.44 / 0.67 / 0.72	A / B / A	6 / 93 / 15	0.46 / 1.13 / 0.85	A / F* / B			
16	**16: Kuakini Highway & Palani Road** *Discussion:* *By Year 2042 with the Project, delay is expected to increase for most movements. Various approaches are expected to operate at LOS F with overcapacity conditions during all peak hours.*	Kuakini Highway / Palani Road / N			See Year 2032 with Project and Mitigation			Kuakini Highway / Palani Road / N		
	Mitigation : Convert the existing NB RT lane into a shared TH/RT lane and add a receiving NB lane. Minor movements still expected to be overcapacity/LOS F. No other improvements considered due to ROW	**35 / 48 / 41**	**- / - / -**	**D / D / D**	**60 / 88 / 85**	**- / - / -**	**E / F / F**	**50 / 69 / 51**	**- / - / -**	**D / E / D**
	NB LT	18 / 27 / 24	0.18 / 0.32 / 0.28	B / C / C	22 / 35 / 28	0.21 / 0.48 / 0.35	C / C / C	22 / 35 / 32	0.21 / 0.48 / 0.44	C / C / C
	NB TH	32 / 54 / 50	0.66 / 0.85 / 0.91	C / D / D	64 / 135 / 107	0.96 / 1.15 / 1.09	E / F* / F*			
	NB TH/RT							31 / 43 / 41	0.5 / 0.61 / 0.8	C / D / D
	NB RT	0 / 0 / 0	0 / 0 / 0	A / A / A	0 / 0 / 0	0 / 0 / 0	A / A / A			
	EB LT	41 / 54 / 31	0.59 / 0.76 / 0.68	D / D / C	35 / 81 / 93	0.59 / 0.91 / 0.98	C / F / F	35 / 81 / 37	0.59 / 0.91 / 0.75	C / F / D
	EB TH/RT	57 / 70 / 54	0.8 / 0.85 / 0.84	E / E / D	112 / 144 / 135	1.06 / 1.12 / 1.13	F* / F* / F*	112 / 144 / 86	1.06 / 1.12 / 1.01	F* / F* / F*
	WB LT	45 / 55 / 41	0.79 / 0.94 / 0.81	D / E / D	86 / 129 / 142	1.04 / 1.18 / 1.18	F* / F* / F*	87 / 130 / 89	1.04 / 1.18 / 1.05	F* / F* / F*
	WB TH	44 / 51 / 47	0.63 / 0.8 / 0.79	D / D / D	44 / 48 / 50	0.69 / 0.89 / 0.86	D / D / D	44 / 48 / 39	0.69 / 0.89 / 0.8	D / D / D
	WB RT	37 / 44 / 37	0.12 / 0.54 / 0.56	D / D / D	35 / 39 / 34	0.17 / 0.59 / 0.53	D / D / C	35 / 39 / 28	0.17 / 0.57 / 0.49	D / D / C
	SB LT	21 / 44 / 55	0.5 / 0.82 / 0.91	C / D / D	49 / 124 / 137	0.85 / 1.16 / 1.15	D / F* / F*	23 / 39 / 53	0.49 / 0.71 / 0.89	C / D / D
	SB TH/RT	21 / 33 / 26	0.27 / 0.54 / 0.54	C / C / C	26 / 43 / 33	0.33 / 0.76 / 0.65	C / D / C	26 / 49 / 40	0.33 / 0.76 / 0.82	C / D / D

6. CONCLUSION

The Project will be built in the Kailua-Kona business area and proposes to build a mix of residential, hotel, office, and commercial development. The Project proposes to construct up to 600 dwelling units, a 150-key hotel, and 220,900 SF of office, retail and restaurant space. Construction of the Project will occur in phases, with the first phase estimated to begin in 2025 and the final phase aiming to reach completion in 2032.

The Project is anticipated to generate approximately 555(901)[1,087] net external trips during the AM(PM)[WE] peak hours of traffic at full buildout.

6.1 Existing Conditions

The Project is generally located in the Kailua-Kona region of the North Kona district on the island of Hawaii. Over the studied timeline the Kailua-Kona region is anticipated to experience extensive development as a result of numerous planned projects of various uses.

In the vicinity of the Project, Queen Kaahumanu Highway services the area as the main thoroughfare that connects the western coast of the island, with additional north/south access provided by Kuakini Highway.

Queen Kaahumanu Highway

During the AM peak hour of traffic, Queen Kaahumanu Highway was observed to experience relatively moderate traffic with some queuing at intersections. However, queues were generally observed to clear within a single cycle. Throughout the study area between Malulani Road and Kealakehe Parkway, high left-lane utilization was observed in the northbound direction which is likely attributed to motorists avoiding westbound right-turn merges. Despite queuing to the south of the study area, traffic along Queen Kaahumanu Highway in the vicinity of the Project operated relatively smoothly without delay.

During the PM and WE peak hour of traffic, southbound traffic and turning movement volumes increased. Intersections generally ran smoothly, and no major congestion was observed at study intersections. It should be noted that southbound queueing along Queen Kaahumanu Highway, just south of the study area near Malulani Road, occurs as a result of the downstream merge from two (2) southbound lanes to one (1). Southbound queuing at this merge was heaviest during the PM peak hour which experiences high southbound volumes compared to relatively balanced northbound and southbound volumes during other peak hours.

Kuakini Highway

During the AM peak hour of traffic, Kuakini Highway experienced relatively light traffic volumes. Some queuing was observed at Palani Road, but queues typically cleared within a single cycle. Study intersections north of Palani Road generally operated smoothly with little delay.

During the PM and WE peak hours of traffic, traffic along Kuakini Highway generally increased. However, operations at study intersections were generally similar to the peak AM with the exception of Kaiwi Street. Queuing occurred in the northbound direction from Palani Road towards Kaiwi Street due to the intersection being an all-way stop.

Makala Boulevard

During the AM peak hour of traffic, Makala Boulevard was observed to experience relatively light traffic since most of the surrounding commercial businesses were not open yet.

During the PM and WE peak hours of traffic, eastbound left-turn movements at the Makala Boulevard/Queen Kaahumanu Highway intersection were observed to experience moderate delay and queuing, however, vehicle queues were typically able to clear during a single cycle. Additionally, traffic along Makala Boulevard fronting the existing Kona Commons Shopping Center and Target was observed to typically operate smoothly without significant delay.

Loloku Street

Traffic along Loloku Street was observed to be relatively light during the AM, PM and WE peak hours of traffic. Existing driveways fronting Loloku Street are limited to a storage facility, commercial laundry service, a BMW dealership and the rear entrance to the Target parking lot.

6.2 Without Project Scenarios

The traffic projections within this report for the Without Project scenarios are based upon traffic generated from known background projects in the region added to a universally applied 0.5 percent growth rate, which accounts for any unanticipated infill growth as a result of smaller developments. Since several large developments included in the HDOT TDFM have either stalled out or have not been substantially completed in line with initial development plans and other new developments not accounted for in the model have since been made known, the background project trips were generated independently in lieu of using a general growth rate.

As a result of traffic generated by planned developments in the region, traffic volumes at the study intersections may increase by 19-65% by Year 2042 for all studied intersection turning movements if all background developments are constructed within the studied timeframe. As a result of the background development growth, the following intersections are expected to operate with movements at overcapacity conditions:

- Queen Kaahumanu Highway/Makala Boulevard
- Kuakini Highway/Kaiwi Street
- Kuakini Highway/Palani Road

6.3 With Project Scenarios

Traffic projections for the With Project scenarios include traffic expected to be generated by the Project in addition to the traffic generated in the Without Project scenarios. The Project is expected to generate a total of 555(901)[1,087] trips during the AM(PM)[WE] peak hours of traffic by Year 2042.

As a result of traffic generated by the Project and background developments, traffic is expected to grow significantly by 2042. However, forecast traffic conditions may not be realized based on the progression of developments in the region. Updates to the TIAR may be required to determine actual traffic growth and required improvements in the study area.

By 2042 with the Project, the following intersections are expected to operate with movements at overcapacity conditions if mitigation at the intersections is not completed:

- Queen Kaahumanu Highway/Makala Boulevard
- Queen Kaahumanu Highway/Palani Road
- Kuakini Highway/Makala Boulevard
- Kuakini Highway/Loloku Street
- Kuakini Highway/Kaiwi Street
- Kuakini Highway/Palani Road

Recommended improvements in the study area to mitigate both Project and background project traffic are described in the following section.

7. RECOMMENDATIONS

The improvements described below are recommended for implementation following each of the study years. A summary of the recommended improvements is shown in Table 7.1.

7.1 Year 2027 Roadway Improvements

7.1.1 Year 2027 Planned Roadway Improvements

The following improvements are planned with the Project by Year 2027.

Pawai Place Extension – Extension of Pawai Place north through the Project from its existing terminus at Kaiwi Street to Loloku Street.

7.1.2 Year 2027 Recommended Roadway Improvements

The following improvements are recommended as a result of traffic increases due to the Project and other future developments in the Kailua-Kona region by Year 2027.

[15] Kuakini Highway/Kaiwi Street

- Construct a new traffic signal when warranted.

7.2 Year 2032 Roadway Improvements

7.2.1 Year 2032 Planned Roadway Improvements

The following roadway projects were assumed to be implemented by Year 2032 with Project:

Makala Boulevard Realignment – Realignment of Makala Boulevard from Maa Way to Kuakini Highway is proposed to align Makala Boulevard with the Old Kona Airport State Recreation Area Access (Park Access).

Maa Way Extension – Extension of Maa Way north through the Project from its existing terminus at Loloku Street to Makala Boulevard.

Pawai Place Extension – Extension of Pawai Place north through the Project from its future terminus at Loloku Street to Makala Boulevard.

7.2.2 Year 2032 Recommended Roadway Improvements

In addition to those stated above as part of Year 2027 mitigations, the following improvements are recommended as a result of traffic increases due to the Project and other future developments in the Kailua-Kona region by Year 2032.

[1-3] Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the southbound direction from the Makala Boulevard intersection to the Eho Street intersection.

[15-16] Widen Kuakini Highway from one (1) through lanes to two (2) through lanes in the southbound direction between Palani Road and Kaiwi Street.

[1] Queen Kaahumanu Highway/Makala Boulevard

- Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the southbound direction.

[16] Kuakini Highway/Palani Road

- Widen the southbound approach to provide an additional through lane.

7.3 Year 2042 Roadway Improvements

7.3.1 Year 2042 Planned Roadway Improvements

The following roadway projects were assumed to be implemented by Year 2042 without the Project. Actual completion will depend on the associated background development timeline.

Makala Boulevard Extension – Extension of Makala Boulevard from terminus mauka of Queen Kaahumanu Highway to Ane Keohokalole Highway.

Eho Street Extension – Provision of a fourth leg to the Queen Kaahumanu Highway/Eho Street intersection. The new leg is assumed to be RIRO with northbound traffic to mirror the existing side.

7.3.2 Year 2042 Recommended Roadway Improvements

In addition to those stated above as part of Year 2027 and Year 2032 mitigations, the following improvements are recommended as a result of traffic increases due to the Project and other future developments in the Kailua-Kona region by Year 2042.

[1-4] Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the northbound direction from the Makala Boulevard intersection to the Palani Road intersection. Extend the southbound widening to Palani Road.

[13-15] Extend the Kuakini Highway widening from one (1) through lanes to two (2) through lanes in the southbound direction from Kaiwi Street to Makala Boulevard.

[15-16] Widen Kuakini Highway from three (3) through lanes to four (4) through lanes from Palani Road to Kaiwi Street.

[1] Queen Kaahumanu Highway/Makala Boulevard

- Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the northbound direction.

[3] Queen Kaahumanu Highway/Eho Street

- Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the northbound direction.

[4] Queen Kaahumanu Highway/Palani Road

- Widen Queen Kaahumanu Highway from two (2) through lanes to three (3) through lanes in the northbound direction.

[13] Kuakini Highway/Makala Boulevard

- Widen Kuakini Highway in the vicinity of the intersection to provide an exclusive northbound left-turn lane and an exclusive northbound right-turn lane.
- Convert from an all-way stop intersection to a T-intersection with stop-control along Kuakini Highway.

[14] Kuakini Highway/Loloku Street

- Widen Kuakini Highway in the vicinity of the intersection to provide an additional southbound through lane.

[15] Kuakini Highway/Kaiwi Street

- Widen Kuakini Highway in the vicinity of the intersection to provide an additional southbound lane.
- Modify southbound approach to have a shared left-turn/through lane and a shared through/right-turn lane.

[16] Kuakini Highway/Palani Road

- Widen Kuakini Highway north of Palani Road to accommodate two (2) northbound receiving lanes.
- Modify the northbound approach to restripe the dedicated right-turn lane to a shared through/right-turn lane.

Table 7.1: Intersection Mitigation Summary

ID	Intersection	Existing 2022	Year 2027 without Project	Year 2032 without Project	Year 2042 without Project	Year 2027 with Project and Mitigation	Year 2032 with Project and Mitigation	Year 2042 with Project and Mitigation
1	Queen Kaahumanu Highway & Makala Boulevard	#1 Queen Kaahumanu Highway / Makala Blvd. C/D/C	#1 Queen Kaahumanu Highway / Makala Blvd. C/D/C	#1 Queen Kaahumanu Highway / Makala Blvd. C/D/C	#1 Queen Kaahumanu Highway / Makala Blvd. D/F/E	#1 Queen Kaahumanu Highway / Makala Blvd. C/D/C	#1 Queen Kaahumanu Highway / Makala Blvd. C/D/C	#1 Queen Kaahumanu Highway / Makala Blvd. D/E/D
2	Queen Kaahumanu Highway & Kaiwi Street	#2 Queen Kaahumanu Highway / Kaiwi Street	#2 Queen Kaahumanu Highway / Kaiwi Street	#2 Queen Kaahumanu Highway / Kaiwi Street	#2 Queen Kaahumanu Highway / Kaiwi Street	#2 Queen Kaahumanu Highway / Kaiwi Street	#2 Queen Kaahumanu Highway / Kaiwi Street	#2 Queen Kaahumanu Highway / Kaiwi Street
3	Queen Kaahumanu Highway & Eho Street	#3 Queen Kaahumanu Highway / Eho Street	#3 Queen Kaahumanu Highway / Eho Street	#3 Queen Kaahumanu Highway / Eho Street	#3 Queen Kaahumanu Highway / Eho Street	#3 Queen Kaahumanu Highway / Eho Street	#3 Queen Kaahumanu Highway / Eho Street	#3 Queen Kaahumanu Highway / Eho Street
4	Queen Kaahumanu Highway & Palani Road	#4 Queen Kaahumanu Highway / Palani Road D/D/C	#4 Queen Kaahumanu Highway / Palani Road D/D/C	#4 Queen Kaahumanu Highway / Palani Road D/D/C	#4 Queen Kaahumanu Highway / Palani Road D/E/D	#4 Queen Kaahumanu Highway / Palani Road D/D/C	#4 Queen Kaahumanu Highway / Palani Road D/D/D	#4 Queen Kaahumanu Highway / Palani Road D/D/D
5	Makala Boulevard & Luhia Street	#5 Luhia Street / Makala Boulevard B/B/B	#5 Luhia Street / Makala Boulevard B/B/B	#5 Luhia Street / Makala Boulevard B/B/B	#5 Luhia Street / Makala Boulevard B/B/B	#5 Luhia Street / Makala Boulevard B/B/B	#5 Luhia Street / Makala Boulevard B/B/B	#5 Luhia Street / Makala Boulevard B/B/C
6	Makala Boulevard & Midblock Driveway	#6 Midblock Driveway / Makala Boulevard B/B/B	#6 Midblock Driveway / Makala Boulevard B/B/B	#6 Midblock Driveway / Makala Boulevard B/B/B	#6 Midblock Driveway / Makala Boulevard B/B/B	#6 Midblock Driveway / Makala Boulevard B/B/B	#6 Midblock Driveway / Makala Boulevard B/B/C	#6 Midblock Driveway / Makala Boulevard B/B/C
7	Makala Boulevard & Road A	#7 Road A / Makala Boulevard B/B/B	#7 Road A / Makala Boulevard B/B/B	#7 Road A / Makala Boulevard B/B/B	#7 Road A / Makala Boulevard B/B/B	#7 Road A / Makala Boulevard B/C/B	#7 Road A / Makala Boulevard B/B/B	#7 Road A / Makala Boulevard B/B/B
8	Makala Boulevard & Maa Way						#8 Maa Way / Makala Boulevard B/D/F	#8 Maa Way / Makala Boulevard B/F/F
9	Loloku Street & Maa Way	#9 Maa Way / Loloku Street A/B/B	#9 Maa Way / Loloku Street B/B/B	#9 Maa Way / Loloku Street B/B/B	#9 Maa Way / Loloku Street B/B/B	#9 Maa Way / Loloku Street B/B/B	#9 Maa Way / Loloku Street B/C/C	#9 Maa Way / Loloku Street B/C/C
10	Makala Boulevard & Pawai Place						#10 Pawai Place / Makala Boulevard B/C/D	#10 Pawai Place / Makala Boulevard B/D/E

Notes:
- Mitigation or improvements from previous year or scenario
- Proposed mitigative measure or intersection improvement.
- No change from previous year or scenario

Intersection comparisons are made between:
- Year 2027 without Project vs Existing 2022
- Year 2032 without Project vs Year 2027 without Project
- Year 2042 without Project vs Year 2032 without Project
- Year 2027 with Project with Mitigation vs Year 2027 without Project
- Year 2032 with Project with Mitigation vs Year 2027 with Project with Mitigation
- Year 2042 with Project with Mitigation vs Year 2032 with Project with Mitigation

Table 7.1: Intersection Mitigation Summary continued

ID	Intersection	Existing 2022	Year 2027 without Project	Year 2032 without Project	Year 2042 without Project	Year 2027 with Project and Mitigation	Year 2032 with Project and Mitigation	Year 2042 with Project and Mitigation
11	Loloku Street & Pawai Place					#11 Pawai Place / Loloku Street A/B/B	#11 Pawai Place / Loloku Street B/B/B	#11 Pawai Place / Loloku Street B/B/B
12	Kaiwi Street & Pawai Place	#12 Pawai Place / Kaiwi Street B/D/C	#12 Pawai Place / Kaiwi Street C/D/C	#12 Pawai Place / Kaiwi Street C/E/C	#12 Pawai Place / Kaiwi Street C/E/C	#12 Pawai Place / Kaiwi Street C/E/C	#12 Pawai Place / Kaiwi Street C/F/C	#12 Pawai Place / Kaiwi Street C/F/D
13	Kuakini Highway & Makala Boulevard	#13 Kuakini Highway / Makala Boulevard A/B/B	#13 Kuakini Highway / Makala Boulevard A/B/B	#13 Kuakini Highway / Makala Boulevard A/B/C	#13 Kuakini Highway / Makala Boulevard B/C/D	#13 Kuakini Highway / Makala Boulevard A/B/C	#13 Kuakini Highway / Makala Boulevard B/C/D	#13 Kuakini Highway / Makala Boulevard B/E/F*
14	Kuakini Highway & Loloku Street	#14 Kuakini Highway / Loloku Street B/B/C	#14 Kuakini Highway / Loloku Street B/C/C	#14 Kuakini Highway / Loloku Street B/C/C	#14 Kuakini Highway / Loloku Street C/D/D	#14 Kuakini Highway / Loloku Street B/C/D	#14 Kuakini Highway / Loloku Street C/E/F	#14 Kuakini Highway / Loloku Street C/E/F
15	Kuakini Highway & Kaiwi Street	#15 Kuakini Highway / Kaiwi Street B/E/D	#15 Kuakini Highway / Kaiwi Street B/F/E	#15 Kuakini Highway / Kaiwi Street C/F*/F	#15 Kuakini Highway / Kaiwi Street D/F*/F*	#15 Kuakini Highway / Kaiwi Street A/B/A	#15 Kuakini Highway / Kaiwi Street A/B/B	#15 Kuakini Highway / Kaiwi Street A/B/A
16	Kuakini Highway & Palani Road	#16 Kuakini Highway / Palani Road C/D/C	#16 Kuakini Highway / Palani Road C/D/C	#16 Kuakini Highway / Palani Road C/D/C	#16 Kuakini Highway / Palani Road D/F/F	#16 Kuakini Highway / Palani Road C/D/C	#16 Kuakini Highway / Palani Road C/D/D	#16 Kuakini Highway / Palani Road D/E/E

Notes:
- Mitigation or improvements from previous year or scenario
- Proposed mitigative measure or intersection improvement.
- No change from previous year or scenario

Intersection comparisons are made between:
- Year 2027 without Project vs Existing 2022
- Year 2032 without Project vs Year 2027 without Project
- Year 2042 without Project vs Year 2032 without Project
- Year 2027 with Project with Mitigation vs Year 2027 without Project
- Year 2032 with Project with Mitigation vs Year 2027 with Project with Mitigation
- Year 2042 with Project with Mitigation vs Year 2032 with Project with Mitigation

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APPENDICES

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
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APPENDIX A
LEVEL OF SERVICE CRITERIA

APPENDIX A – LEVEL OF SERVICE (LOS) CRITERIA

VEHICULAR LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (HCM 7th EDITION)

Level of service for vehicles at 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 the 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.

VEHICULAR LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 7th EDITION)

The level of service criteria for vehicles at 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

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APPENDIX B

TRAFFIC COUNT DATA

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File Name : Eho St - Quenn Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	Southbound				Westbound Approach Westbound				EHO ST Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	0	0	0	0	0	248	0	0	0	0	0	1	0	190	7	0	446
07:45 AM	0	0	0	0	0	251	0	0	0	0	0	2	0	184	12	0	449
Total	0	0	0	0	0	499	0	0	0	0	0	3	0	374	19	0	895
08:00 AM	0	0	0	0	0	249	0	0	0	0	0	3	0	208	7	0	467
08:15 AM	0	0	0	0	0	282	0	0	0	0	0	0	0	210	9	0	501
08:30 AM	0	0	0	0	0	260	0	0	0	0	0	0	0	235	9	0	504
08:45 AM	0	0	0	0	0	280	0	0	0	0	0	1	0	256	10	0	547
Total	0	0	0	0	0	1071	0	0	0	0	0	4	0	909	35	0	2019
09:00 AM	0	0	0	0	0	258	0	0	0	0	0	0	0	232	11	0	501
09:15 AM	0	0	0	0	0	236	0	0	0	0	0	1	0	219	6	0	462
Grand Total	0	0	0	0	0	2064	0	0	0	0	0	8	0	1734	71	0	3877
Apprch %	0	0	0	0	0	100	0	0	0	0	0	100	0	96.1	3.9	0	
Total %	0	0	0	0	0	53.2	0	0	0	0	0	0.2	0	44.7	1.8	0	
Motorcycles	0	0	0	0	0	12	0	0	0	0	0	0	0	4	0	0	16
% Motorcycles	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0.2	0	0	0.4
Cars & Light Goods	0	0	0	0	0	2002	0	0	0	0	0	0	0	1680	70	0	3752
% Cars & Light Goods	0	0	0	0	0	97	0	0	0	0	0	0	0	96.9	98.6	0	96.8
Buses	0	0	0	0	0	15	0	0	0	0	0	0	0	6	0	0	21
% Buses	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0.3	0	0	0.5
Single-Unit Trucks	0	0	0	0	0	30	0	0	0	0	0	0	0	38	1	0	69
% Single-Unit Trucks	0	0	0	0	0	1.5	0	0	0	0	0	0	0	2.2	1.4	0	1.8
Articulated Trucks	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	6
% Articulated Trucks	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0.1	0	0	0.2
Bicycles on Road	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	5
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	8
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0.2

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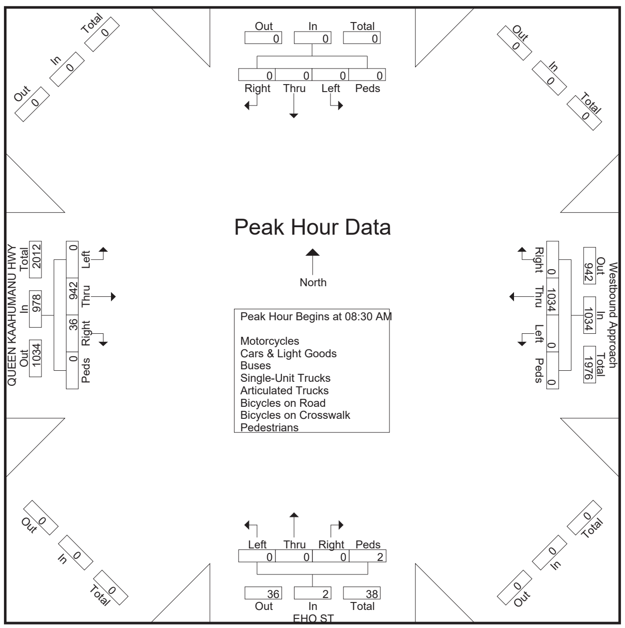
File Name : Eho St - Quenn Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022
Page No : 2

	Southbound					Westbound Approach Westbound					EHO ST Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 08:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	0	0	0	0	0	0	260	0	0	260	0	0	0	0	0	0	235	9	0	244	504
08:45 AM	0	0	0	0	0	0	**280**	0	0	**280**	0	0	0	**1**	**1**	0	**256**	10	0	**266**	**547**
09:00 AM	0	0	0	0	0	0	258	0	0	258	0	0	0	0	0	0	232	**11**	0	243	501
09:15 AM	0	0	0	0	0	0	236	0	0	236	0	0	0	1	1	0	219	6	0	225	462
Total Volume	0	0	0	0	0	0	1034	0	0	1034	0	0	0	2	2	0	942	36	0	978	2014
% App. Total	0	0	0	0		0	100	0	0		0	0	0	100		0	96.3	3.7	0		
PHF	.000	.000	.000	.000	.000	.000	.923	.000	.000	.923	.000	.000	.000	.500	.500	.000	.920	.818	.000	.919	.920



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File Name : Eho St - Quenn Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	Southbound				Westbound Approach Westbound				EHO ST Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	0	0	0	0	308	0	0	0	0	0	2	0	350	12	0	672
03:15 PM	0	0	0	0	0	270	0	0	0	0	0	2	0	396	11	0	679
03:30 PM	0	0	0	0	0	256	0	0	0	0	0	1	0	372	19	0	648
03:45 PM	0	0	0	0	0	298	0	0	0	0	0	0	0	417	16	0	731
Total	0	0	0	0	0	1132	0	0	0	0	0	5	0	1535	58	0	2730
04:00 PM	0	0	0	0	0	243	0	0	0	0	0	0	0	443	21	0	707
04:15 PM	0	0	0	0	0	279	0	1	0	0	0	0	0	414	12	0	706
04:30 PM	0	0	0	0	0	243	0	0	0	0	0	0	0	420	10	0	673
04:45 PM	0	0	0	0	0	263	0	0	0	0	0	0	0	397	13	0	673
Total	0	0	0	0	0	1028	0	1	0	0	0	0	0	1674	56	0	2759
Grand Total	0	0	0	0	0	2160	0	1	0	0	0	5	0	3209	114	0	5489
Apprch %	0	0	0	0	0	100	0	0	0	0	0	100	0	96.6	3.4	0	
Total %	0	0	0	0	0	39.4	0	0	0	0	0	0.1	0	58.5	2.1	0	
Motorcycles	0	0	0	0	0	7	0	0	0	0	0	0	0	16	1	0	24
% Motorcycles	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0.5	0.9	0	0.4
Cars & Light Goods	0	0	0	0	0	2106	0	0	0	0	0	0	0	3160	109	0	5375
% Cars & Light Goods	0	0	0	0	0	97.5	0	0	0	0	0	0	0	98.5	95.6	0	97.9
Buses	0	0	0	0	0	11	0	0	0	0	0	0	0	6	0	0	17
% Buses	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0.2	0	0	0.3
Single-Unit Trucks	0	0	0	0	0	27	0	0	0	0	0	0	0	16	3	0	46
% Single-Unit Trucks	0	0	0	0	0	1.2	0	0	0	0	0	0	0	0.5	2.6	0	0.8
Articulated Trucks	0	0	0	0	0	8	0	0	0	0	0	0	0	10	1	0	19
% Articulated Trucks	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0.3	0.9	0	0.3
Bicycles on Road	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	1	0	0	0	5	0	0	0	0	6
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	100	0	0	0	0	0.1

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Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022
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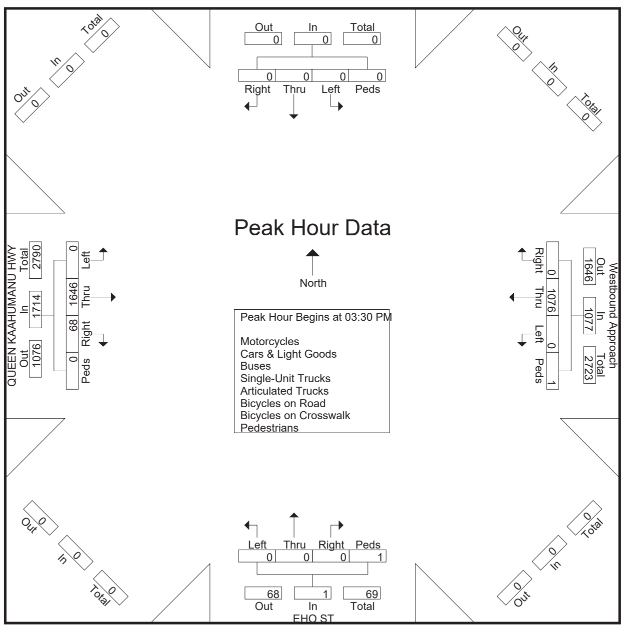
	Southbound					Westbound Approach Westbound					EHO ST Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	0	0	0	256	0	0	256	0	0	0	**1**	**1**	0	372	19	0	391	648
03:45 PM	0	0	0	0	0	0	**298**	0	0	**298**	0	0	0	0	0	0	417	16	0	433	**731**
04:00 PM	0	0	0	0	0	0	243	0	0	243	0	0	0	0	0	0	**443**	**21**	0	**464**	707
04:15 PM	0	0	0	0	0	0	279	0	**1**	280	0	0	0	0	0	0	414	12	0	426	706
Total Volume	0	0	0	0	0	0	1076	0	1	1077	0	0	0	1	1	0	1646	68	0	1714	2792
% App. Total	0	0	0	0		0	99.9	0	0.1		0	0	0	100		0	96	4	0		
PHF	.000	.000	.000	.000	.000	.000	.903	.000	.250	.904	.000	.000	.000	.250	.250	.000	.929	.810	.000	.923	.955



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File Name : Eho St - Quenn Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	Southbound				Westbound Approach Westbound				EHO ST Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	0	0	0	0	0	296	0	0	0	0	0	1	0	275	4	0	576
11:15 AM	0	0	0	0	0	252	0	0	0	0	0	2	0	249	8	0	511
11:30 AM	0	0	0	0	0	286	0	0	0	0	0	0	0	330	5	0	621
11:45 AM	0	0	0	0	0	275	0	0	0	0	0	0	0	290	9	0	574
Total	0	0	0	0	0	1109	0	0	0	0	0	3	0	1144	26	0	2282
12:00 PM	0	0	0	0	0	258	0	0	0	0	0	0	0	291	6	0	555
12:15 PM	0	0	0	0	0	238	0	0	0	0	0	2	0	330	4	0	574
12:30 PM	0	0	0	0	0	274	0	0	0	0	0	2	0	306	3	0	585
12:45 PM	0	0	0	0	0	247	0	0	0	0	0	1	0	287	11	0	546
Total	0	0	0	0	0	1017	0	0	0	0	0	5	0	1214	24	0	2260
Grand Total	0	0	0	0	0	2126	0	0	0	0	0	8	0	2358	50	0	4542
Apprch %	0	0	0	0	0	100	0	0	0	0	0	100	0	97.9	2.1	0	
Total %	0	0	0	0	0	46.8	0	0	0	0	0	0.2	0	51.9	1.1	0	
Motorcycles	0	0	0	0	0	12	0	0	0	0	0	0	0	9	1	0	22
% Motorcycles	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0.4	2	0	0.5
Cars & Light Goods	0	0	0	0	0	2101	0	0	0	0	0	0	0	2326	43	0	4470
% Cars & Light Goods	0	0	0	0	0	98.8	0	0	0	0	0	0	0	98.6	86	0	98.4
Buses	0	0	0	0	0	2	0	0	0	0	0	0	0	7	0	0	9
% Buses	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.3	0	0	0.2
Single-Unit Trucks	0	0	0	0	0	10	0	0	0	0	0	0	0	8	6	0	24
% Single-Unit Trucks	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0.3	12	0	0.5
Articulated Trucks	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	5
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0.1
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	6
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0.1

Austin Tsutsumi & Associates

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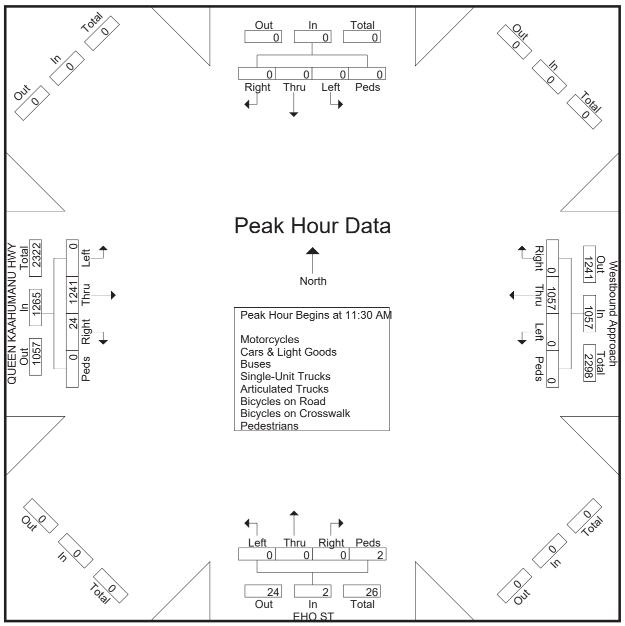
File Name : Eho St - Quenn Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022

	Southbound					Westbound Approach Westbound					EHO ST Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	0	0	0	0	0	0	**286**	0	0	**286**	0	0	0	0	0	0	**330**	5	0	**335**	**621**
11:45 AM	0	0	0	0	0	0	275	0	0	275	0	0	0	0	0	0	290	**9**	0	299	574
12:00 PM	0	0	0	0	0	0	258	0	0	258	0	0	0	0	0	0	291	6	0	297	555
12:15 PM	0	0	0	0	0	0	238	0	0	238	0	0	0	**2**	**2**	0	330	4	0	334	574
Total Volume	0	0	0	0	0	0	1057	0	0	1057	0	0	0	2	2	0	1241	24	0	1265	2324
% App. Total	0	0	0	0		0	100	0	0		0	0	0	100		0	98.1	1.9	0		
PHF	.000	.000	.000	.000	.000	.000	.924	.000	.000	.924	.000	.000	.000	.250	.250	.000	.940	.667	.000	.944	.936



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File Name : Kaiwi St - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KAIWI ST Southbound				KUAKINI HWY Westbound				KAIWI ST Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	27	0	1	0	7	59	62	0	5	3	6	5	3	29	4	0	211
07:45 AM	26	5	0	0	9	60	102	1	2	4	2	4	2	20	3	0	240
Total	53	5	1	0	16	119	164	1	7	7	8	9	5	49	7	0	451
08:00 AM	37	4	4	0	17	51	97	0	5	3	11	3	3	26	3	0	264
08:15 AM	35	3	6	0	11	60	80	0	5	4	3	0	8	45	5	2	267
08:30 AM	42	6	1	0	7	55	71	1	2	10	7	2	0	25	6	0	235
08:45 AM	36	5	3	0	16	46	80	0	1	8	8	0	0	37	4	0	244
Total	150	18	14	0	51	212	328	1	13	25	29	5	11	133	18	2	1010
09:00 AM	34	4	6	0	8	56	69	2	2	8	5	5	0	49	7	2	257
09:15 AM	47	6	5	0	10	68	76	1	6	7	8	1	0	51	9	2	297
Grand Total	284	33	26	0	85	455	637	5	28	47	50	20	16	282	41	6	2015
Apprch %	82.8	9.6	7.6	0	7.2	38.5	53.9	0.4	19.3	32.4	34.5	13.8	4.6	81.7	11.9	1.7	
Total %	14.1	1.6	1.3	0	4.2	22.6	31.6	0.2	1.4	2.3	2.5	1	0.8	14	2	0.3	
Motorcycles	7	0	0	0	2	7	7	0	0	0	2	0	0	2	0	0	27
% Motorcycles	2.5	0	0	0	2.4	1.5	1.1	0	0	0	4	0	0	0.7	0	0	1.3
Cars & Light Goods	260	32	24	0	82	436	622	0	28	46	46	0	16	265	39	0	1896
% Cars & Light Goods	91.5	97	92.3	0	96.5	95.8	97.6	0	100	97.9	92	0	100	94	95.1	0	94.1
Buses	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	4
% Buses	0.4	0	3.8	0	0	0.2	0	0	0	0	0	0	0	0.4	0	0	0.2
Single-Unit Trucks	13	1	0	0	1	6	8	0	0	1	2	0	0	4	1	0	37
% Single-Unit Trucks	4.6	3	0	0	1.2	1.3	1.3	0	0	2.1	4	0	0	1.4	2.4	0	1.8
Articulated Trucks	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
% Articulated Trucks	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0.1
Bicycles on Road	2	0	1	0	0	5	0	0	0	0	0	0	0	9	1	0	18
% Bicycles on Road	0.7	0	3.8	0	0	1.1	0	0	0	0	0	0	0	3.2	2.4	0	0.9
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	5
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	66.7	0.2
Pedestrians	0	0	0	0	0	0	0	5	0	0	0	19	0	0	0	2	26
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	95	0	0	0	33.3	1.3

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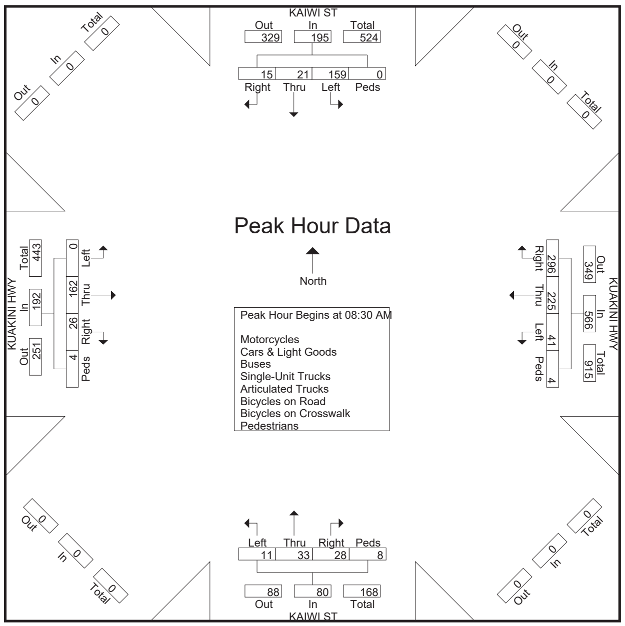
File Name : Kaiwi St - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 2

	KAIWI ST Southbound					KUAKINI HWY Westbound					KAIWI ST Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	42	**6**	1	0	49	7	55	71	1	134	2	**10**	7	2	21	0	25	6	0	31	235
08:45 AM	36	5	3	0	44	**16**	46	**80**	0	142	1	8	**8**	0	17	0	37	4	0	41	244
09:00 AM	34	4	**6**	0	44	8	56	69	**2**	135	2	8	5	**5**	20	0	49	7	**2**	58	257
09:15 AM	**47**	6	5	0	**58**	10	**68**	76	1	**155**	**6**	7	8	1	**22**	0	**51**	**9**	2	**62**	**297**
Total Volume	159	21	15	0	195	41	225	296	4	566	11	33	28	8	80	0	162	26	4	192	1033
% App. Total	81.5	10.8	7.7	0		7.2	39.8	52.3	0.7		13.8	41.2	35	10		0	84.4	13.5	2.1		
PHF	.846	.875	.625	.000	.841	.641	.827	.925	.500	.913	.458	.825	.875	.400	.909	.000	.794	.722	.500	.774	.870



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File Name : Kaiwi St - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/7/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KAIWI ST Southbound				KUAKINI HWY Westbound				KAIWI ST Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	59	6	12	0	8	85	90	0	3	4	10	3	5	67	8	0	360
03:15 PM	67	5	11	0	14	69	93	1	6	4	14	5	7	76	5	1	378
03:30 PM	71	5	12	0	13	82	96	0	6	17	11	2	6	64	8	1	394
03:45 PM	51	9	11	0	16	83	103	0	5	6	15	1	7	73	6	0	386
Total	248	25	46	0	51	319	382	1	20	31	50	11	25	280	27	2	1518
04:00 PM	75	7	10	0	11	85	91	2	9	9	12	5	7	80	8	0	411
04:15 PM	66	3	10	0	8	76	103	2	9	10	8	1	4	59	8	1	368
04:30 PM	77	6	10	0	13	88	83	0	5	9	11	1	13	72	8	1	397
04:45 PM	54	6	7	1	9	86	84	1	5	8	14	3	12	64	9	0	363
Total	272	22	37	1	41	335	361	5	28	36	45	10	36	275	33	2	1539
Grand Total	520	47	83	1	92	654	743	6	48	67	95	21	61	555	60	4	3057
Apprch %	79.9	7.2	12.7	0.2	6.2	43.7	49.7	0.4	20.8	29	41.1	9.1	9	81.6	8.8	0.6	
Total %	17	1.5	2.7	0	3	21.4	24.3	0.2	1.6	2.2	3.1	0.7	2	18.2	2	0.1	
Motorcycles	12	0	1	0	1	7	8	0	0	0	0	0	0	14	0	0	43
% Motorcycles	2.3	0	1.2	0	1.1	1.1	1.1	0	0	0	0	0	0	2.5	0	0	1.4
Cars & Light Goods	504	44	79	0	91	644	727	0	48	67	95	0	61	540	60	0	2960
% Cars & Light Goods	96.9	93.6	95.2	0	98.9	98.5	97.8	0	100	100	100	0	100	97.3	100	0	96.8
Buses	0	0	2	0	0	1	0	0	0	0	0	0	0	1	0	0	4
% Buses	0	0	2.4	0	0	0.2	0	0	0	0	0	0	0	0.2	0	0	0.1
Single-Unit Trucks	3	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	9
% Single-Unit Trucks	0.6	2.1	1.2	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.3
Articulated Trucks	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	1	2	0	0	0	2	3	0	0	0	0	0	0	0	0	0	8
% Bicycles on Road	0.2	4.3	0	0	0	0.3	0.4	0	0	0	0	0	0	0	0	0	0.3
Bicycles on Crosswalk	0	0	0	0	0	0	0	2	0	0	0	3	0	0	0	1	6
% Bicycles on Crosswalk	0	0	0	0	0	0	0	33.3	0	0	0	14.3	0	0	0	25	0.2
Pedestrians	0	0	0	1	0	0	0	4	0	0	0	18	0	0	0	3	26
% Pedestrians	0	0	0	100	0	0	0	66.7	0	0	0	85.7	0	0	0	75	0.9

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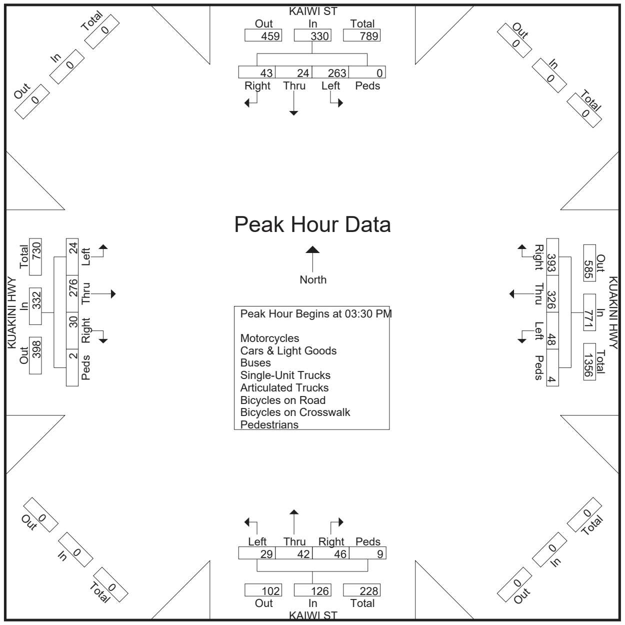
File Name : Kaiwi St - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/7/2022
Page No : 2

	KAIWI ST Southbound					KUAKINI HWY Westbound					KAIWI ST Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	71	5	**12**	0	88	13	82	96	0	191	6	**17**	11	2	**36**	6	64	**8**	**1**	79	394
03:45 PM	51	**9**	11	0	71	**16**	83	**103**	0	**202**	5	6	**15**	1	27	**7**	73	6	0	86	386
04:00 PM	**75**	7	10	0	**92**	11	**85**	91	**2**	189	**9**	9	12	**5**	35	7	**80**	8	0	**95**	**411**
04:15 PM	66	3	10	0	79	8	76	103	2	189	9	10	8	1	28	4	59	8	1	72	368
Total Volume	263	24	43	0	330	48	326	393	4	771	29	42	46	9	126	24	276	30	2	332	1559
% App. Total	79.7	7.3	13	0		6.2	42.3	51	0.5		23	33.3	36.5	7.1		7.2	83.1	9	0.6		
PHF	.877	.667	.896	.000	.897	.750	.959	.954	.500	.954	.806	.618	.767	.450	.875	.857	.863	.938	.500	.874	.948



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File Name : Kaiwi St - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KAIWI ST Southbound				KUAKINI HWY Westbound				KAIWI ST Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	31	8	7	0	8	95	78	0	5	6	7	12	7	62	2	0	328
11:15 AM	49	2	3	6	7	70	80	6	5	4	7	7	9	76	6	4	341
11:30 AM	42	6	6	1	10	98	82	0	1	5	11	18	11	81	6	0	378
11:45 AM	46	4	4	1	6	84	109	1	4	8	8	2	9	78	4	1	369
Total	168	20	20	8	31	347	349	7	15	23	33	39	36	297	18	5	1416
12:00 PM	40	5	8	0	12	91	77	0	7	2	11	6	8	80	9	0	356
12:15 PM	57	5	8	3	14	73	73	4	4	8	14	16	5	89	3	1	377
12:30 PM	45	3	13	0	17	77	76	2	4	6	14	3	15	72	7	0	354
12:45 PM	55	4	7	0	11	93	97	3	6	6	11	4	8	83	6	0	394
Total	197	17	36	3	54	334	323	9	21	22	50	29	36	324	25	1	1481
Grand Total	365	37	56	11	85	681	672	16	36	45	83	68	72	621	43	6	2897
Apprch %	77.8	7.9	11.9	2.3	5.8	46.8	46.2	1.1	15.5	19.4	35.8	29.3	9.7	83.7	5.8	0.8	
Total %	12.6	1.3	1.9	0.4	2.9	23.5	23.2	0.6	1.2	1.6	2.9	2.3	2.5	21.4	1.5	0.2	
Motorcycles	12	3	1	0	1	10	14	0	0	1	2	0	0	13	0	0	57
% Motorcycles	3.3	8.1	1.8	0	1.2	1.5	2.1	0	0	2.2	2.4	0	0	2.1	0	0	2
Cars & Light Goods	352	34	54	0	82	666	654	0	36	44	80	0	70	601	43	0	2716
% Cars & Light Goods	96.4	91.9	96.4	0	96.5	97.8	97.3	0	100	97.8	96.4	0	97.2	96.8	100	0	93.8
Buses	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	2.8	0	0	0	0.1
Single-Unit Trucks	1	0	1	0	2	2	3	0	0	0	1	0	0	1	0	0	11
% Single-Unit Trucks	0.3	0	1.8	0	2.4	0.3	0.4	0	0	0	1.2	0	0	0.2	0	0	0.4
Articulated Trucks	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	2	1	0	0	0	0	0	0	6	0	0	9
% Bicycles on Road	0	0	0	0	0	0.3	0.1	0	0	0	0	0	0	1	0	0	0.3
Bicycles on Crosswalk	0	0	0	2	0	0	0	0	0	0	0	11	0	0	0	0	13
% Bicycles on Crosswalk	0	0	0	18.2	0	0	0	0	0	0	0	16.2	0	0	0	0	0.4
Pedestrians	0	0	0	9	0	0	0	16	0	0	0	57	0	0	0	6	88
% Pedestrians	0	0	0	81.8	0	0	0	100	0	0	0	83.8	0	0	0	100	3

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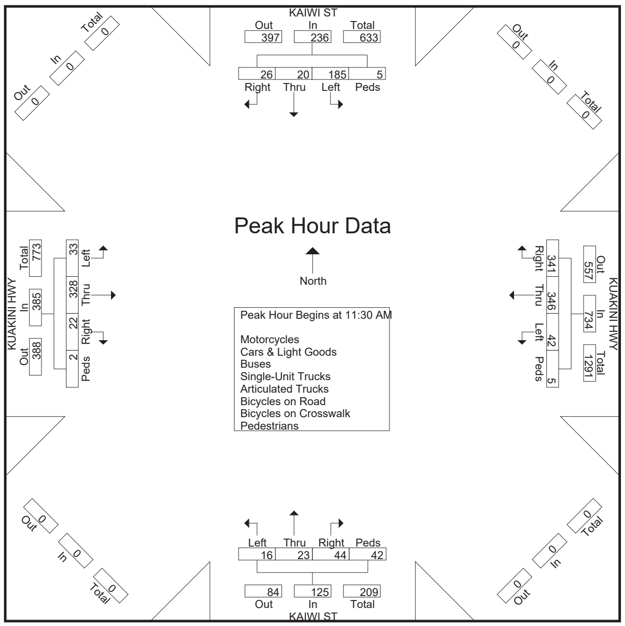
File Name : Kaiwi St - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022

	KAIWI ST Southbound					KUAKINI HWY Westbound					KAIWI ST Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	42	**6**	6	1	55	10	**98**	82	0	190	1	5	11	**18**	35	**11**	81	6	0	**98**	**378**
11:45 AM	46	4	4	1	55	6	84	**109**	1	**200**	4	**8**	8	2	22	9	78	4	**1**	92	369
12:00 PM	40	5	**8**	0	53	12	91	77	0	180	**7**	2	11	6	26	8	80	**9**	0	97	356
12:15 PM	**57**	5	8	**3**	**73**	**14**	73	73	**4**	164	4	8	**14**	16	**42**	5	**89**	3	1	98	377
Total Volume	185	20	26	5	236	42	346	341	5	734	16	23	44	42	125	33	328	22	2	385	1480
% App. Total	78.4	8.5	11	2.1		5.7	47.1	46.5	0.7		12.8	18.4	35.2	33.6		8.6	85.2	5.7	0.5		
PHF	.811	.833	.813	.417	.808	.750	.883	.782	.313	.918	.571	.719	.786	.583	.744	.750	.921	.611	.500	.982	.979



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File Name : Kaiwi St - Pawai Pl
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KAIWI ST Southbound				PAWAI PL Westbound				KAIWI ST Northbound				PRIVATE DWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	8	26	0	0	3	1	9	0	3	52	12	1	1	0	0	0	116
07:45 AM	12	25	1	0	5	0	7	0	4	76	28	0	0	0	2	0	160
Total	20	51	1	0	8	1	16	0	7	128	40	1	1	0	2	0	276
08:00 AM	24	38	1	0	6	0	5	0	1	78	31	1	2	1	1	0	189
08:15 AM	10	35	1	0	8	0	10	0	0	70	27	0	0	0	0	0	161
08:30 AM	18	40	1	0	9	0	17	1	1	76	25	0	0	0	0	0	188
08:45 AM	23	37	1	0	7	0	8	1	0	67	31	1	2	0	0	0	178
Total	75	150	4	0	30	0	40	2	2	291	114	2	4	1	1	0	716
09:00 AM	21	37	2	0	8	0	7	0	0	66	22	0	2	0	0	0	165
09:15 AM	18	43	1	0	13	0	20	1	1	72	22	0	0	0	0	2	193
Grand Total	134	281	8	0	59	1	83	3	10	557	198	3	7	1	3	2	1350
Apprch %	31.7	66.4	1.9	0	40.4	0.7	56.8	2.1	1.3	72.5	25.8	0.4	53.8	7.7	23.1	15.4	
Total %	9.9	20.8	0.6	0	4.4	0.1	6.1	0.2	0.7	41.3	14.7	0.2	0.5	0.1	0.2	0.1	
Motorcycles	1	4	0	0	2	0	0	0	0	3	7	0	0	0	0	0	17
% Motorcycles	0.7	1.4	0	0	3.4	0	0	0	0	0.5	3.5	0	0	0	0	0	1.3
Cars & Light Goods	119	262	8	0	53	1	77	0	10	542	189	0	7	1	3	0	1272
% Cars & Light Goods	88.8	93.2	100	0	89.8	100	92.8	0	100	97.3	95.5	0	100	100	100	0	94.2
Buses	3	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	7
% Buses	2.2	0	0	0	1.7	0	3.6	0	0	0	0	0	0	0	0	0	0.5
Single-Unit Trucks	8	6	0	0	2	0	2	0	0	9	0	0	0	0	0	0	27
% Single-Unit Trucks	6	2.1	0	0	3.4	0	2.4	0	0	1.6	0	0	0	0	0	0	2
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	3	9	0	0	1	0	1	0	0	3	2	0	0	0	0	0	19
% Bicycles on Road	2.2	3.2	0	0	1.7	0	1.2	0	0	0.5	1	0	0	0	0	0	1.4
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	2	8
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	100	0	0	0	100	0.6

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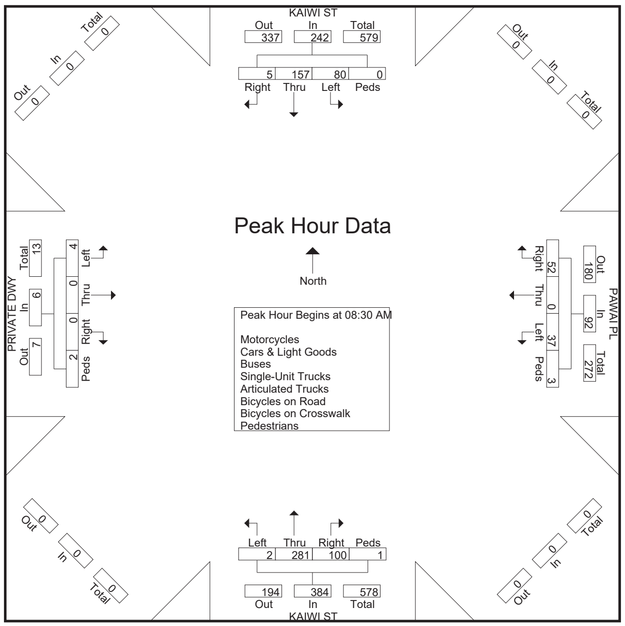
File Name : Kaiwi St - Pawai Pl
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 2

	KAIWI ST Southbound					PAWAI PL Westbound					KAIWI ST Northbound					PRIVATE DWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	18	40	1	0	59	9	0	17	**1**	27	**1**	**76**	25	0	**102**	0	0	0	0	0	188
08:45 AM	**23**	37	1	0	61	7	0	8	1	16	0	67	**31**	**1**	99	**2**	0	0	0	**2**	178
09:00 AM	21	37	**2**	0	60	8	0	7	0	15	0	66	22	0	88	2	0	0	0	2	165
09:15 AM	18	**43**	1	0	**62**	**13**	0	**20**	1	**34**	1	72	22	0	95	0	0	0	**2**	2	**193**
Total Volume	80	157	5	0	242	37	0	52	3	92	2	281	100	1	384	4	0	0	2	6	724
% App. Total	33.1	64.9	2.1	0		40.2	0	56.5	3.3		0.5	73.2	26	0.3		66.7	0	0	33.3		
PHF	.870	.913	.625	.000	.976	.712	.000	.650	.750	.676	.500	.924	.806	.250	.941	.500	.000	.000	.250	.750	.938



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File Name : Kaiwi St - Pawai Pl
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/7/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KAIWI ST Southbound				PAWAI PL Westbound				KAIWI ST Northbound				PRIVATE DWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	20	62	0	0	19	0	29	2	1	82	25	2	0	0	0	0	242
03:15 PM	26	58	0	0	23	0	31	1	0	85	30	0	0	0	0	2	256
03:30 PM	18	70	0	0	22	0	34	0	2	90	24	1	2	1	2	3	269
03:45 PM	25	51	0	0	19	0	20	1	1	101	22	1	1	0	2	1	245
Total	89	241	0	0	83	0	114	4	4	358	101	4	3	1	4	6	1012
04:00 PM	34	68	1	0	23	0	19	2	0	76	26	0	1	0	2	1	253
04:15 PM	17	53	0	1	23	0	31	0	1	87	33	2	0	0	1	1	250
04:30 PM	24	73	1	0	20	0	23	0	1	89	24	2	2	0	2	4	265
04:45 PM	27	47	0	0	15	0	27	1	1	74	25	0	0	0	0	9	226
Total	102	241	2	1	81	0	100	3	3	326	108	4	3	0	5	15	994
Grand Total	191	482	2	1	164	0	214	7	7	684	209	8	6	1	9	21	2006
Apprch %	28.3	71.3	0.3	0.1	42.6	0	55.6	1.8	0.8	75.3	23	0.9	16.2	2.7	24.3	56.8	
Total %	9.5	24	0.1	0	8.2	0	10.7	0.3	0.3	34.1	10.4	0.4	0.3	0	0.4	1	
Motorcycles	1	10	0	0	3	0	2	0	0	10	1	0	0	0	0	0	27
% Motorcycles	0.5	2.1	0	0	1.8	0	0.9	0	0	1.5	0.5	0	0	0	0	0	1.3
Cars & Light Goods	183	460	2	0	155	0	207	0	7	663	202	0	5	1	9	0	1894
% Cars & Light Goods	95.8	95.4	100	0	94.5	0	96.7	0	100	96.9	96.7	0	83.3	100	100	0	94.4
Buses	5	1	0	0	1	0	4	0	0	1	0	0	0	0	0	0	12
% Buses	2.6	0.2	0	0	0.6	0	1.9	0	0	0.1	0	0	0	0	0	0	0.6
Single-Unit Trucks	0	6	0	0	2	0	1	0	0	7	2	0	1	0	0	0	19
% Single-Unit Trucks	0	1.2	0	0	1.2	0	0.5	0	0	1	1	0	16.7	0	0	0	0.9
Articulated Trucks	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
Bicycles on Road	2	5	0	0	3	0	0	0	0	2	4	0	0	0	0	0	16
% Bicycles on Road	1	1	0	0	1.8	0	0	0	0	0.3	1.9	0	0	0	0	0	0.8
Bicycles on Crosswalk	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	3	5
% Bicycles on Crosswalk	0	0	0	100	0	0	0	0	0	0	0	12.5	0	0	0	14.3	0.2
Pedestrians	0	0	0	0	0	0	0	7	0	0	0	7	0	0	0	18	32
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	87.5	0	0	0	85.7	1.6

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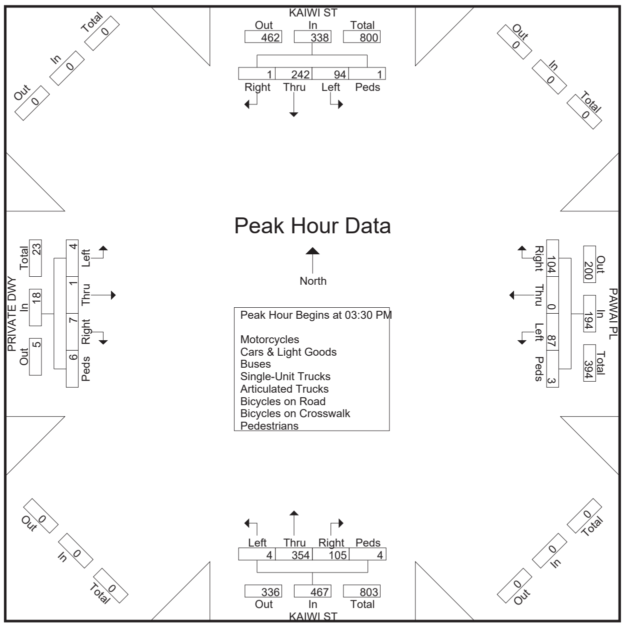
File Name : Kaiwi St - Pawai Pl
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/7/2022
Page No : 2

	KAIWI ST Southbound					PAWAI PL Westbound					KAIWI ST Northbound					PRIVATE DWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	18	**70**	0	0	88	22	0	**34**	0	**56**	**2**	90	24	1	117	**2**	**1**	**2**	**3**	**8**	**269**
03:45 PM	25	51	0	0	76	19	0	20	1	40	1	**101**	22	1	**125**	1	0	2	1	4	245
04:00 PM	**34**	68	**1**	0	**103**	**23**	0	19	**2**	44	0	76	26	0	102	1	0	2	1	4	253
04:15 PM	17	53	0	**1**	71	23	0	31	0	54	1	87	**33**	**2**	123	0	0	1	1	2	250
Total Volume	94	242	1	1	338	87	0	104	3	194	4	354	105	4	467	4	1	7	6	18	1017
% App. Total	27.8	71.6	0.3	0.3		44.8	0	53.6	1.5		0.9	75.8	22.5	0.9		22.2	5.6	38.9	33.3		
PHF	.691	.864	.250	.250	.820	.946	.000	.765	.375	.866	.500	.876	.795	.500	.934	.500	.250	.875	.500	.563	.945



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File Name : Kaiwi St - Pawai Pl
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KAIWI ST Southbound				PAWAI PL Westbound				KAIWI ST Northbound				PRIVATE DWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	16	36	0	0	11	0	12	0	0	70	23	0	0	0	0	0	168
11:15 AM	18	39	0	0	13	0	10	0	0	71	25	0	0	0	0	0	176
11:30 AM	23	50	0	0	6	0	13	0	0	58	33	1	0	0	0	3	187
11:45 AM	19	39	0	0	19	0	23	0	0	94	39	0	1	0	0	2	236
Total	76	164	0	0	49	0	58	0	0	293	120	1	1	0	0	5	767
12:00 PM	28	42	0	0	14	0	28	0	2	59	28	0	0	0	0	1	202
12:15 PM	17	58	0	0	20	0	24	0	1	58	30	0	0	0	0	0	208
12:30 PM	27	49	0	0	20	0	32	2	0	71	30	0	1	0	1	4	237
12:45 PM	26	52	1	0	16	0	24	0	0	85	30	0	0	0	0	4	238
Total	98	201	1	0	70	0	108	2	3	273	118	0	1	0	1	9	885
Grand Total	174	365	1	0	119	0	166	2	3	566	238	1	2	0	1	14	1652
Apprch %	32.2	67.6	0.2	0	41.5	0	57.8	0.7	0.4	70	29.5	0.1	11.8	0	5.9	82.4	
Total %	10.5	22.1	0.1	0	7.2	0	10	0.1	0.2	34.3	14.4	0.1	0.1	0	0.1	0.8	
Motorcycles	1	13	0	0	2	0	2	0	0	12	5	0	0	0	0	0	35
% Motorcycles	0.6	3.6	0	0	1.7	0	1.2	0	0	2.1	2.1	0	0	0	0	0	2.1
Cars & Light Goods	171	348	1	0	116	0	161	0	3	546	230	0	2	0	1	0	1579
% Cars & Light Goods	98.3	95.3	100	0	97.5	0	97	0	100	96.5	96.6	0	100	0	100	0	95.6
Buses	2	0	0	0	0	0	2	0	0	3	0	0	0	0	0	0	7
% Buses	1.1	0	0	0	0	0	1.2	0	0	0.5	0	0	0	0	0	0	0.4
Single-Unit Trucks	0	0	0	0	1	0	1	0	0	3	1	0	0	0	0	0	6
% Single-Unit Trucks	0	0	0	0	0.8	0	0.6	0	0	0.5	0.4	0	0	0	0	0	0.4
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	4	0	0	0	0	0	0	0	2	2	0	0	0	0	0	8
% Bicycles on Road	0	1.1	0	0	0	0	0	0	0	0.4	0.8	0	0	0	0	0	0.5
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.1	0.1
Pedestrians	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	13	16
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	100	0	0	0	92.9	1

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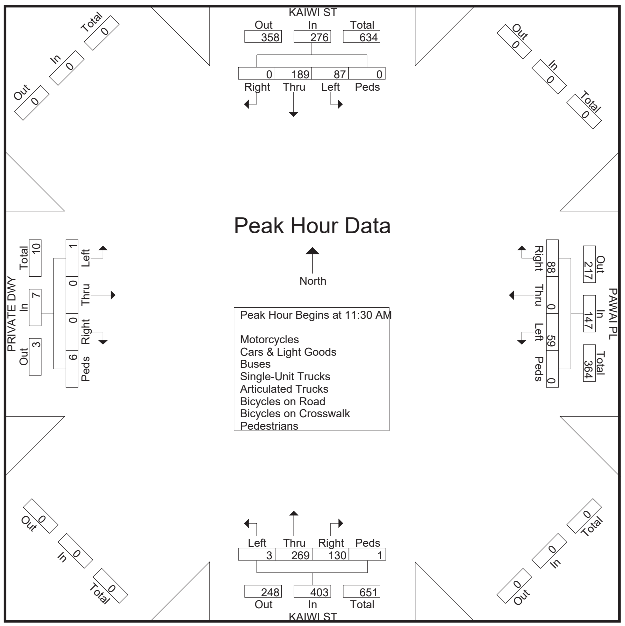
File Name : Kaiwi St - Pawai Pl
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
Page No : 2

	KAIWI ST Southbound					PAWAI PL Westbound					KAIWI ST Northbound					PRIVATE DWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	23	50	0	0	73	6	0	13	0	19	0	58	33	**1**	92	0	0	0	**3**	**3**	187
11:45 AM	19	39	0	0	58	19	0	23	0	42	0	**94**	**39**	0	**133**	**1**	0	0	2	3	**236**
12:00 PM	**28**	42	0	0	70	14	0	**28**	0	42	**2**	59	28	0	89	0	0	0	1	1	202
12:15 PM	17	**58**	0	0	**75**	**20**	0	24	0	**44**	1	58	30	0	89	0	0	0	0	0	208
Total Volume	87	189	0	0	276	59	0	88	0	147	3	269	130	1	403	1	0	0	6	7	833
% App. Total	31.5	68.5	0	0		40.1	0	59.9	0		0.7	66.7	32.3	0.2		14.3	0	0	85.7		
PHF	.777	.815	.000	.000	.920	.738	.000	.786	.000	.835	.375	.715	.833	.250	.758	.250	.000	.000	.500	.583	.882



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File Name : Kaiwi St - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	Southbound				Westbound Approach Westbound				KAIWI ST Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	0	0	0	0	0	224	0	0	0	0	32	1	0	165	26	0	448
07:45 AM	0	0	0	0	0	259	0	0	0	0	33	1	0	164	50	0	507
Total	0	0	0	0	0	483	0	0	0	0	65	2	0	329	76	0	955
08:00 AM	0	0	0	0	0	246	0	0	0	0	35	4	0	186	66	0	537
08:15 AM	0	0	0	0	0	282	0	0	0	0	49	0	0	162	39	0	532
08:30 AM	0	0	0	0	0	262	0	0	0	0	40	0	0	206	43	0	551
08:45 AM	0	0	0	0	0	256	0	0	0	0	46	1	0	213	44	0	560
Total	0	0	0	0	0	1046	0	0	0	0	170	5	0	767	192	0	2180
09:00 AM	0	0	0	0	0	237	0	0	0	0	48	0	0	196	37	0	518
09:15 AM	0	0	0	0	0	218	0	0	0	0	55	0	0	170	45	0	488
Grand Total	0	0	0	0	0	1984	0	0	0	0	338	7	0	1462	350	0	4141
Apprch %	0	0	0	0	0	100	0	0	0	0	98	2	0	80.7	19.3	0	
Total %	0	0	0	0	0	47.9	0	0	0	0	8.2	0.2	0	35.3	8.5	0	
Motorcycles	0	0	0	0	0	7	0	0	0	0	0	0	0	3	2	0	12
% Motorcycles	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0.2	0.6	0	0.3
Cars & Light Goods	0	0	0	0	0	1926	0	0	0	0	326	0	0	1419	341	0	4012
% Cars & Light Goods	0	0	0	0	0	97.1	0	0	0	0	96.4	0	0	97.1	97.4	0	96.9
Buses	0	0	0	0	0	9	0	0	0	0	4	0	0	1	0	0	14
% Buses	0	0	0	0	0	0.5	0	0	0	0	1.2	0	0	0.1	0	0	0.3
Single-Unit Trucks	0	0	0	0	0	30	0	0	0	0	7	0	0	30	7	0	74
% Single-Unit Trucks	0	0	0	0	0	1.5	0	0	0	0	2.1	0	0	2.1	2	0	1.8
Articulated Trucks	0	0	0	0	0	7	0	0	0	0	1	0	0	5	0	0	13
% Articulated Trucks	0	0	0	0	0	0.4	0	0	0	0	0.3	0	0	0.3	0	0	0.3
Bicycles on Road	0	0	0	0	0	5	0	0	0	0	0	0	0	4	0	0	9
% Bicycles on Road	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0.3	0	0	0.2
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	7
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0.2

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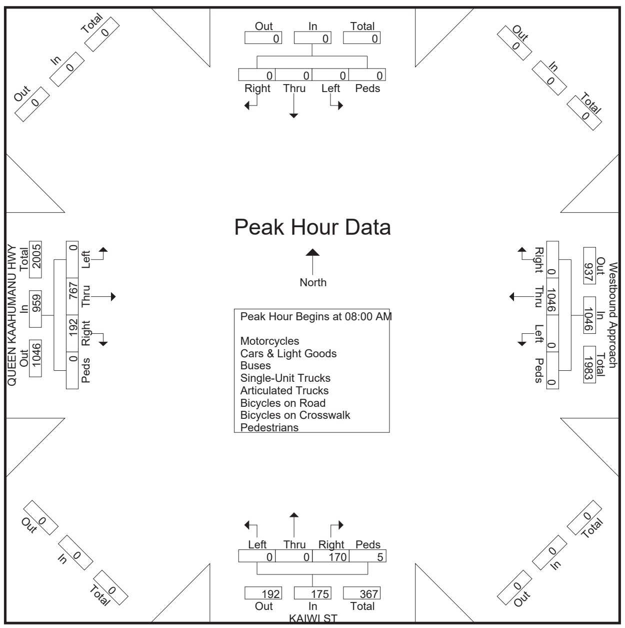
File Name : Kaiwi St - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022

	Southbound					Westbound Approach Westbound					KAIWI ST Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	0	0	0	0	0	246	0	0	246	0	0	35	**4**	39	0	186	**66**	0	252	537
08:15 AM	0	0	0	0	0	0	**282**	0	0	**282**	0	0	**49**	0	**49**	0	162	39	0	201	532
08:30 AM	0	0	0	0	0	0	262	0	0	262	0	0	40	0	40	0	206	43	0	249	551
08:45 AM	0	0	0	0	0	0	256	0	0	256	0	0	46	1	47	0	**213**	44	0	**257**	**560**
Total Volume	0	0	0	0	0	0	1046	0	0	1046	0	0	170	5	175	0	767	192	0	959	2180
% App. Total	0	0	0	0		0	100	0	0		0	0	97.1	2.9		0	80	20	0		
PHF	.000	.000	.000	.000	.000	.000	.927	.000	.000	.927	.000	.000	.867	.313	.893	.000	.900	.727	.000	.933	.973



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File Name : Kaiwi St - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	Southbound				Westbound Approach Westbound				KAIWI ST Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	0	0	0	0	300	0	0	0	0	84	0	0	284	38	0	706
03:15 PM	0	0	0	0	0	275	0	0	0	0	66	0	0	314	49	0	704
03:30 PM	0	0	0	0	0	276	0	0	0	0	86	0	0	302	52	0	716
03:45 PM	0	0	0	0	0	291	0	0	0	0	96	0	0	326	61	0	774
Total	0	0	0	0	0	1142	0	0	0	0	332	0	0	1226	200	0	2900
04:00 PM	0	0	0	0	0	244	0	0	0	0	104	0	0	363	56	0	767
04:15 PM	0	0	0	0	0	268	0	0	0	0	101	0	0	337	41	0	747
04:30 PM	0	0	0	0	0	245	0	0	0	0	125	0	0	286	38	0	694
04:45 PM	0	0	0	0	0	256	0	0	0	0	93	0	0	325	54	0	728
Total	0	0	0	0	0	1013	0	0	0	0	423	0	0	1311	189	0	2936
Grand Total	0	0	0	0	0	2155	0	0	0	0	755	0	0	2537	389	0	5836
Apprch %	0	0	0	0	0	100	0	0	0	0	100	0	0	86.7	13.3	0	
Total %	0	0	0	0	0	36.9	0	0	0	0	12.9	0	0	43.5	6.7	0	
Motorcycles	0	0	0	0	0	6	0	0	0	0	5	0	0	9	2	0	22
% Motorcycles	0	0	0	0	0	0.3	0	0	0	0	0.7	0	0	0.4	0.5	0	0.4
Cars & Light Goods	0	0	0	0	0	2112	0	0	0	0	742	0	0	2502	382	0	5738
% Cars & Light Goods	0	0	0	0	0	98	0	0	0	0	98.3	0	0	98.6	98.2	0	98.3
Buses	0	0	0	0	0	8	0	0	0	0	6	0	0	0	1	0	15
% Buses	0	0	0	0	0	0.4	0	0	0	0	0.8	0	0	0	0.3	0	0.3
Single-Unit Trucks	0	0	0	0	0	18	0	0	0	0	1	0	0	10	3	0	32
% Single-Unit Trucks	0	0	0	0	0	0.8	0	0	0	0	0.1	0	0	0.4	0.8	0	0.5
Articulated Trucks	0	0	0	0	0	9	0	0	0	0	1	0	0	14	1	0	25
% Articulated Trucks	0	0	0	0	0	0.4	0	0	0	0	0.1	0	0	0.6	0.3	0	0.4
Bicycles on Road	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	4
% Bicycles on Road	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.1	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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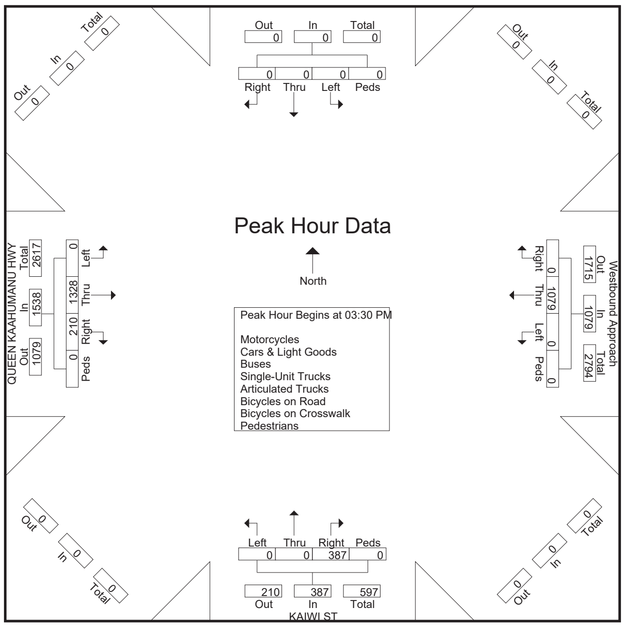
File Name : Kaiwi St - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022
Page No : 2

	Southbound					Westbound Approach Westbound					KAIWI ST Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	0	0	0	276	0	0	276	0	0	86	0	86	0	302	52	0	354	716
03:45 PM	0	0	0	0	0	0	**291**	0	0	**291**	0	0	96	0	96	0	326	**61**	0	387	**774**
04:00 PM	0	0	0	0	0	0	244	0	0	244	0	0	**104**	0	**104**	0	**363**	56	0	**419**	767
04:15 PM	0	0	0	0	0	0	268	0	0	268	0	0	101	0	101	0	337	41	0	378	747
Total Volume	0	0	0	0	0	0	1079	0	0	1079	0	0	387	0	387	0	1328	210	0	1538	3004
% App. Total	0	0	0	0		0	100	0	0		0	0	100	0		0	86.3	13.7	0		
PHF	.000	.000	.000	.000	.000	.000	.927	.000	.000	.927	.000	.000	.930	.000	.930	.000	.915	.861	.000	.918	.970



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File Name : Kaiwi St - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	Southbound				Westbound Approach Westbound				KAIWI ST Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	0	0	0	0	0	313	0	0	0	0	56	0	0	208	40	0	617
11:15 AM	0	0	0	0	0	259	0	0	0	0	54	2	0	210	46	0	571
11:30 AM	0	0	0	0	0	291	0	0	0	0	67	0	0	256	38	0	652
11:45 AM	0	0	0	0	0	284	0	0	0	0	67	0	0	235	47	0	633
Total	0	0	0	0	0	1147	0	0	0	0	244	2	0	909	171	0	2473
12:00 PM	0	0	0	0	0	219	0	0	0	0	75	0	0	225	44	0	563
12:15 PM	0	0	0	0	0	226	0	0	0	0	71	2	0	241	40	0	580
12:30 PM	0	0	0	0	0	259	0	0	0	0	57	0	0	262	47	0	625
12:45 PM	0	0	0	0	1	235	0	0	0	0	59	0	0	255	50	0	600
Total	0	0	0	0	1	939	0	0	0	0	262	2	0	983	181	0	2368
Grand Total	0	0	0	0	1	2086	0	0	0	0	506	4	0	1892	352	0	4841
Apprch %	0	0	0	0	0	100	0	0	0	0	99.2	0.8	0	84.3	15.7	0	
Total %	0	0	0	0	0	43.1	0	0	0	0	10.5	0.1	0	39.1	7.3	0	
Motorcycles	0	0	0	0	0	14	0	0	0	0	3	0	0	7	0	0	24
% Motorcycles	0	0	0	0	0	0.7	0	0	0	0	0.6	0	0	0.4	0	0	0.5
Cars & Light Goods	0	0	0	0	1	2050	0	0	0	0	495	0	0	1864	351	0	4761
% Cars & Light Goods	0	0	0	0	100	98.3	0	0	0	0	97.8	0	0	98.5	99.7	0	98.3
Buses	0	0	0	0	0	4	0	0	0	0	6	0	0	2	0	0	12
% Buses	0	0	0	0	0	0.2	0	0	0	0	1.2	0	0	0.1	0	0	0.2
Single-Unit Trucks	0	0	0	0	0	13	0	0	0	0	2	0	0	12	1	0	28
% Single-Unit Trucks	0	0	0	0	0	0.6	0	0	0	0	0.4	0	0	0.6	0.3	0	0.6
Articulated Trucks	0	0	0	0	0	3	0	0	0	0	0	0	0	4	0	0	7
% Articulated Trucks	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.2	0	0	0.1
Bicycles on Road	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	5
% Bicycles on Road	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.2	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0.1

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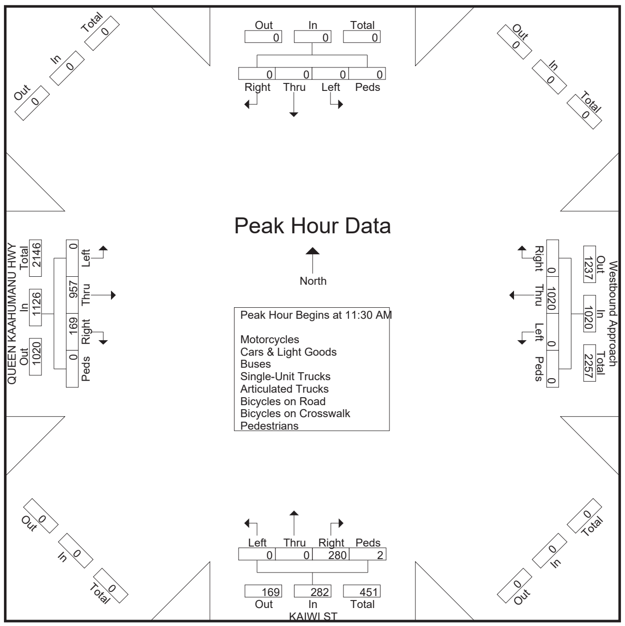
File Name : Kaiwi St - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022
Page No : 2

	Southbound					Westbound Approach Westbound					KAIWI ST Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	0	0	0	0	0	0	**291**	0	0	**291**	0	0	67	0	67	0	**256**	38	0	**294**	**652**
11:45 AM	0	0	0	0	0	0	284	0	0	284	0	0	67	0	67	0	235	**47**	0	282	633
12:00 PM	0	0	0	0	0	0	219	0	0	219	0	0	**75**	0	**75**	0	225	44	0	269	563
12:15 PM	0	0	0	0	0	0	226	0	0	226	0	0	71	**2**	73	0	241	40	0	281	580
Total Volume	0	0	0	0	0	0	1020	0	0	1020	0	0	280	2	282	0	957	169	0	1126	2428
% App. Total	0	0	0	0		0	100	0	0		0	0	99.3	0.7		0	85	15	0		
PHF	.000	.000	.000	.000	.000	.000	.876	.000	.000	.876	.000	.000	.933	.250	.940	.000	.935	.899	.000	.957	.931



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File Name : Kuakini Hwy - Loloku St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	LOLOKU ST Southbound				KUAKINI HWY Westbound				Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	3	0	2	0	0	41	17	0	0	0	0	0	1	25	0	0	89
07:45 AM	4	0	0	0	0	40	19	0	0	0	0	0	2	25	0	0	90
Total	7	0	2	0	0	81	36	0	0	0	0	0	3	50	0	0	179
08:00 AM	9	0	4	1	0	40	18	0	0	0	0	0	5	32	0	0	109
08:15 AM	9	0	2	0	0	46	24	0	0	0	0	0	1	43	0	0	125
08:30 AM	9	0	0	0	0	45	16	0	0	0	0	0	2	28	0	0	100
08:45 AM	10	0	0	0	0	29	21	0	0	0	0	0	2	30	0	0	92
Total	37	0	6	1	0	160	79	0	0	0	0	0	10	133	0	0	426
09:00 AM	16	0	0	0	0	43	18	1	0	0	0	0	0	43	0	0	121
09:15 AM	11	0	2	1	0	52	34	0	0	0	0	0	0	44	0	0	144
Grand Total	71	0	10	2	0	336	167	1	0	0	0	0	13	270	0	0	870
Apprch %	85.5	0	12	2.4	0	66.7	33.1	0.2	0	0	0	0	4.6	95.4	0	0	
Total %	8.2	0	1.1	0.2	0	38.6	19.2	0.1	0	0	0	0	1.5	31	0	0	
Motorcycles	0	0	0	0	0	5	2	0	0	0	0	0	0	1	0	0	8
% Motorcycles	0	0	0	0	0	1.5	1.2	0	0	0	0	0	0	0.4	0	0	0.9
Cars & Light Goods	64	0	10	0	0	323	160	0	0	0	0	0	12	261	0	0	830
% Cars & Light Goods	90.1	0	100	0	0	96.1	95.8	0	0	0	0	0	92.3	96.7	0	0	95.4
Buses	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3
% Buses	1.4	0	0	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0.3
Single-Unit Trucks	4	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	7
% Single-Unit Trucks	5.6	0	0	0	0	0.3	0.6	0	0	0	0	0	0	0.4	0	0	0.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0.1
Bicycles on Road	2	0	0	0	0	7	2	0	0	0	0	0	1	6	0	0	18
% Bicycles on Road	2.8	0	0	0	0	2.1	1.2	0	0	0	0	0	7.7	2.2	0	0	2.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	3
% Pedestrians	0	0	0	100	0	0	0	100	0	0	0	0	0	0	0	0	0.3

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File Name : Kuakini Hwy - Loloku St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
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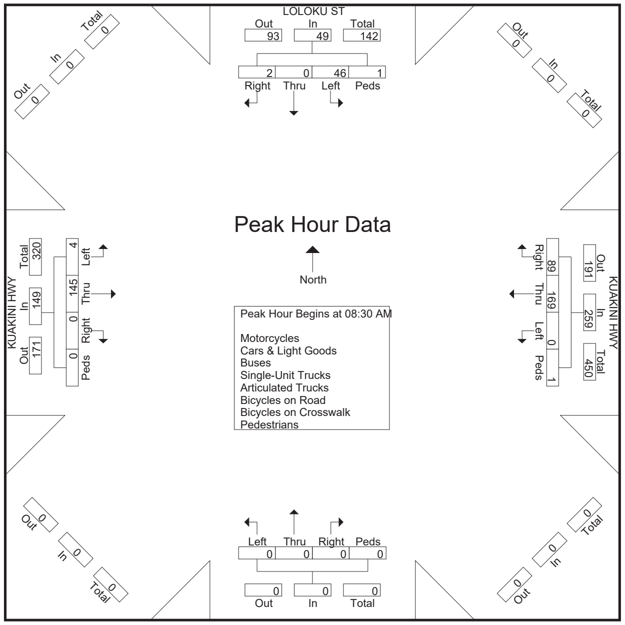
	LOLOKU ST Southbound					KUAKINI HWY Westbound					Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	9	0	0	0	9	0	45	16	0	61	0	0	0	0	0	**2**	28	0	0	30	100
08:45 AM	10	0	0	0	10	0	29	21	0	50	0	0	0	0	0	2	30	0	0	32	92
09:00 AM	**16**	0	0	0	**16**	0	43	18	**1**	62	0	0	0	0	0	0	43	0	0	43	121
09:15 AM	11	0	**2**	**1**	14	0	**52**	**34**	0	**86**	0	0	0	0	0	0	**44**	0	0	**44**	**144**
Total Volume	46	0	2	1	49	0	169	89	1	259	0	0	0	0	0	4	145	0	0	149	457
% App. Total	93.9	0	4.1	2		0	65.3	34.4	0.4		0	0	0	0		2.7	97.3	0	0		
PHF	.719	.000	.250	.250	.766	.000	.813	.654	.250	.753	.000	.000	.000	.000	.000	.500	.824	.000	.000	.847	.793



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File Name : Kuakini Hwy - Loloku St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/7/2022
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	LOLOKU ST Southbound				KUAKINI HWY Westbound				Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	21	0	3	1	0	59	34	0	0	0	0	0	3	60	0	0	181
03:15 PM	28	0	2	0	0	55	20	1	0	0	0	0	4	61	0	0	171
03:30 PM	25	0	2	0	0	65	28	0	0	0	0	0	1	61	0	0	182
03:45 PM	23	0	2	0	0	53	34	0	0	0	0	0	2	70	0	0	184
Total	97	0	9	1	0	232	116	1	0	0	0	0	10	252	0	0	718
04:00 PM	16	0	5	0	0	73	26	0	0	0	0	0	2	56	0	0	178
04:15 PM	16	0	3	0	0	59	36	0	0	0	0	0	4	58	0	0	176
04:30 PM	16	0	0	0	0	59	27	0	0	0	0	0	2	67	0	0	171
04:45 PM	21	0	1	1	0	61	28	0	0	0	0	0	4	75	0	0	191
Total	69	0	9	1	0	252	117	0	0	0	0	0	12	256	0	0	716
Grand Total	166	0	18	2	0	484	233	1	0	0	0	0	22	508	0	0	1434
Apprch %	89.2	0	9.7	1.1	0	67.4	32.5	0.1	0	0	0	0	4.2	95.8	0	0	
Total %	11.6	0	1.3	0.1	0	33.8	16.2	0.1	0	0	0	0	1.5	35.4	0	0	
Motorcycles	2	0	0	0	0	9	3	0	0	0	0	0	2	9	0	0	25
% Motorcycles	1.2	0	0	0	0	1.9	1.3	0	0	0	0	0	9.1	1.8	0	0	1.7
Cars & Light Goods	160	0	18	0	0	470	229	0	0	0	0	0	20	498	0	0	1395
% Cars & Light Goods	96.4	0	100	0	0	97.1	98.3	0	0	0	0	0	90.9	98	0	0	97.3
Buses	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	4
% Buses	0.6	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0.3
Single-Unit Trucks	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
% Single-Unit Trucks	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0.1
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	3	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	6
% Bicycles on Road	1.8	0	0	0	0	0.2	0.4	0	0	0	0	0	0	0.2	0	0	0.4
Bicycles on Crosswalk	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Pedestrians	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.1

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File Name : Kuakini Hwy - Loloku St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/7/2022
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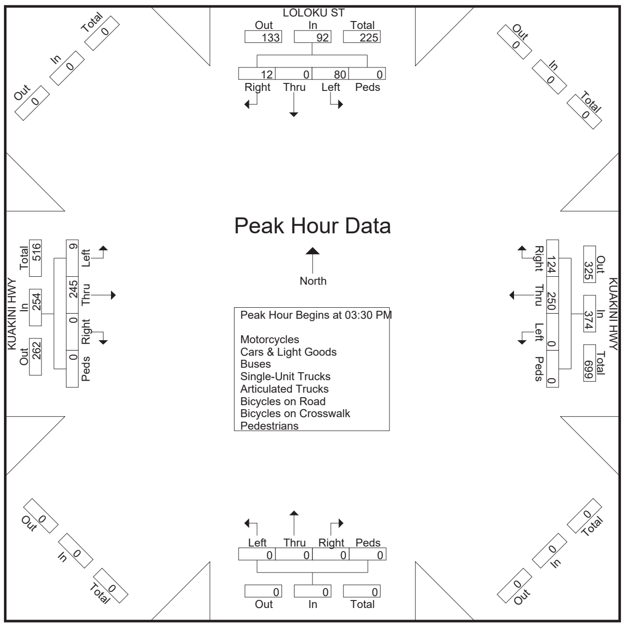
	LOLOKU ST Southbound					KUAKINI HWY Westbound					Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**25**	0	2	0	**27**	0	65	28	0	93	0	0	0	0	0	1	61	0	0	62	182
03:45 PM	23	0	2	0	25	0	53	34	0	87	0	0	0	0	0	2	**70**	0	0	**72**	**184**
04:00 PM	16	0	**5**	0	21	0	**73**	26	0	**99**	0	0	0	0	0	2	56	0	0	58	178
04:15 PM	16	0	3	0	19	0	59	**36**	0	95	0	0	0	0	0	**4**	58	0	0	62	176
Total Volume	80	0	12	0	92	0	250	124	0	374	0	0	0	0	0	9	245	0	0	254	720
% App. Total	87	0	13	0		0	66.8	33.2	0		0	0	0	0		3.5	96.5	0	0		
PHF	.800	.000	.600	.000	.852	.000	.856	.861	.000	.944	.000	.000	.000	.000	.000	.563	.875	.000	.000	.882	.978



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File Name : Kuakini Hwy - Loloku St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	LOLOKU ST Southbound				KUAKINI HWY Westbound				Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	9	0	0	1	0	85	22	0	0	0	0	0	2	52	0	0	171
11:15 AM	16	0	2	0	0	62	26	0	0	0	0	0	1	66	0	0	173
11:30 AM	17	0	3	0	0	72	33	0	0	0	0	0	2	85	0	0	212
11:45 AM	19	0	3	0	0	74	19	1	0	0	0	0	2	67	0	1	186
Total	61	0	8	1	0	293	100	1	0	0	0	0	7	270	0	1	742
12:00 PM	19	0	1	0	0	70	32	0	0	0	0	0	1	85	0	0	208
12:15 PM	16	0	1	0	0	60	25	0	0	0	0	0	1	84	0	0	187
12:30 PM	14	0	2	0	0	61	30	0	0	0	0	0	3	68	0	0	178
12:45 PM	13	0	3	0	0	69	27	0	0	0	0	0	2	93	0	0	207
Total	62	0	7	0	0	260	114	0	0	0	0	0	7	330	0	0	780
Grand Total	123	0	15	1	0	553	214	1	0	0	0	0	14	600	0	1	1522
Apprch %	88.5	0	10.8	0.7	0	72	27.9	0.1	0	0	0	0	2.3	97.6	0	0.2	
Total %	8.1	0	1	0.1	0	36.3	14.1	0.1	0	0	0	0	0.9	39.4	0	0.1	
Motorcycles	1	0	0	0	0	6	1	0	0	0	0	0	0	8	0	0	16
% Motorcycles	0.8	0	0	0	0	1.1	0.5	0	0	0	0	0	0	1.3	0	0	1.1
Cars & Light Goods	116	0	14	0	0	543	209	0	0	0	0	0	14	584	0	0	1480
% Cars & Light Goods	94.3	0	93.3	0	0	98.2	97.7	0	0	0	0	0	100	97.3	0	0	97.2
Buses	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
% Buses	1.6	0	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
Single-Unit Trucks	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	3
% Single-Unit Trucks	0.8	0	0	0	0	0.2	0.5	0	0	0	0	0	0	0	0	0	0.2
Articulated Trucks	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	3	0	0	0	0	2	3	0	0	0	0	0	0	8	0	0	16
% Bicycles on Road	2.4	0	0	0	0	0.4	1.4	0	0	0	0	0	0	1.3	0	0	1.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.1
Pedestrians	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2
% Pedestrians	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	100	0.1

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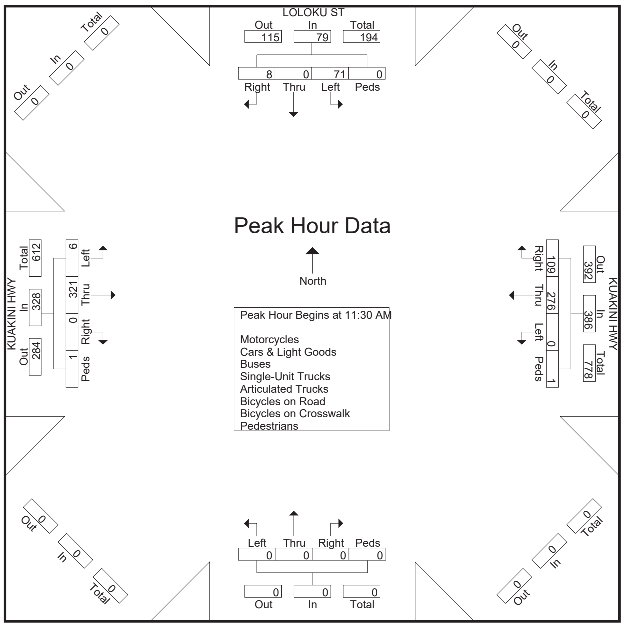
	LOLOKU ST Southbound					KUAKINI HWY Westbound					Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	17	0	**3**	0	20	0	72	**33**	0	**105**	0	0	0	0	0	**2**	**85**	0	0	**87**	**212**
11:45 AM	**19**	0	3	0	**22**	0	**74**	19	**1**	94	0	0	0	0	0	2	67	0	**1**	70	186
12:00 PM	19	0	1	0	20	0	70	32	0	102	0	0	0	0	0	1	85	0	0	86	208
12:15 PM	16	0	1	0	17	0	60	25	0	85	0	0	0	0	0	1	84	0	0	85	187
Total Volume	71	0	8	0	79	0	276	109	1	386	0	0	0	0	0	6	321	0	1	328	793
% App. Total	89.9	0	10.1	0		0	71.5	28.2	0.3		0	0	0	0		1.8	97.9	0	0.3		
PHF	.934	.000	.667	.000	.898	.000	.932	.826	.250	.919	.000	.000	.000	.000	.000	.750	.944	.000	.250	.943	.935



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File Name : Makala Blvd - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				KUAKINI HWY Westbound				Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	15	0	9	0	0	9	31	2	0	0	0	0	5	13	0	0	84
07:45 AM	18	0	6	0	0	9	25	0	0	0	0	0	7	8	0	0	73
Total	33	0	15	0	0	18	56	2	0	0	0	0	12	21	0	0	157
08:00 AM	20	0	6	1	0	10	26	0	0	0	0	0	7	14	0	0	84
08:15 AM	30	0	4	2	0	15	26	0	0	0	0	0	6	14	0	0	97
08:30 AM	17	0	5	0	0	14	26	1	0	0	0	0	6	10	0	0	79
08:45 AM	23	0	9	0	0	11	14	0	0	0	0	0	7	8	0	1	73
Total	90	0	24	3	0	50	92	1	0	0	0	0	26	46	0	1	333
09:00 AM	27	0	14	0	0	11	30	0	0	0	0	0	4	14	0	0	100
09:15 AM	29	0	4	1	0	15	33	0	0	0	0	0	1	15	0	0	98
Grand Total	179	0	57	4	0	94	211	3	0	0	0	0	43	96	0	1	688
Apprch %	74.6	0	23.8	1.7	0	30.5	68.5	1	0	0	0	0	30.7	68.6	0	0.7	
Total %	26	0	8.3	0.6	0	13.7	30.7	0.4	0	0	0	0	6.2	14	0	0.1	
Motorcycles	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	5
% Motorcycles	0	0	0	0	0	1.1	1.9	0	0	0	0	0	0	0	0	0	0.7
Cars & Light Goods	174	0	57	0	0	93	201	0	0	0	0	0	42	92	0	0	659
% Cars & Light Goods	97.2	0	100	0	0	98.9	95.3	0	0	0	0	0	97.7	95.8	0	0	95.8
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single-Unit Trucks	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
% Single-Unit Trucks	0.6	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.3
Articulated Trucks	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	3	0	0	0	0	0	5	0	0	0	0	0	1	4	0	0	13
% Bicycles on Road	1.7	0	0	0	0	0	2.4	0	0	0	0	0	2.3	4.2	0	0	1.9
Bicycles on Crosswalk	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2
% Bicycles on Crosswalk	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	100	0.3
Pedestrians	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	6
% Pedestrians	0	0	0	75	0	0	0	100	0	0	0	0	0	0	0	0	0.9

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Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
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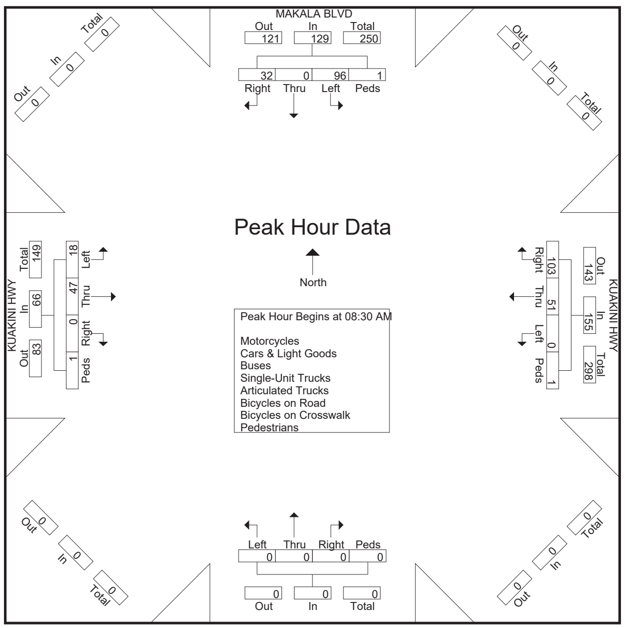
	MAKALA BLVD Southbound					KUAKINI HWY Westbound					Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	17	0	5	0	22	0	14	26	**1**	41	0	0	0	0	0	6	10	0	0	16	79
08:45 AM	23	0	9	0	32	0	11	14	0	25	0	0	0	0	0	**7**	8	0	**1**	16	73
09:00 AM	27	0	**14**	0	**41**	0	11	30	0	41	0	0	0	0	0	4	14	0	0	**18**	**100**
09:15 AM	**29**	0	4	**1**	34	0	**15**	**33**	0	**48**	0	0	0	0	0	1	**15**	0	0	16	98
Total Volume	96	0	32	1	129	0	51	103	1	155	0	0	0	0	0	18	47	0	1	66	350
% App. Total	74.4	0	24.8	0.8		0	32.9	66.5	0.6		0	0	0	0		27.3	71.2	0	1.5		
PHF	.828	.000	.571	.250	.787	.000	.850	.780	.250	.807	.000	.000	.000	.000	.000	.643	.783	.000	.250	.917	.875



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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				KUAKINI HWY Westbound				Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	50	0	8	0	0	15	46	0	0	0	0	0	6	12	0	0	137
03:15 PM	44	0	9	0	0	15	36	0	0	0	0	0	4	18	0	0	126
03:30 PM	55	0	12	0	0	17	44	0	0	0	0	0	8	19	0	0	155
03:45 PM	53	0	21	0	0	10	38	0	0	0	0	0	9	13	0	0	144
Total	202	0	50	0	0	57	164	0	0	0	0	0	27	62	0	0	562
04:00 PM	51	0	14	0	0	16	56	0	0	0	0	0	6	20	0	0	163
04:15 PM	52	0	12	0	0	16	39	0	0	0	0	0	12	9	0	0	140
04:30 PM	54	0	13	0	0	22	32	0	0	0	0	0	12	18	0	0	151
04:45 PM	51	0	15	0	0	14	42	0	0	0	0	0	9	21	0	0	152
Total	208	0	54	0	0	68	169	0	0	0	0	0	39	68	0	0	606
Grand Total	410	0	104	0	0	125	333	0	0	0	0	0	66	130	0	0	1168
Apprch %	79.8	0	20.2	0	0	27.3	72.7	0	0	0	0	0	33.7	66.3	0	0	
Total %	35.1	0	8.9	0	0	10.7	28.5	0	0	0	0	0	5.7	11.1	0	0	
Motorcycles	6	0	1	0	0	8	1	0	0	0	0	0	0	4	0	0	20
% Motorcycles	1.5	0	1	0	0	6.4	0.3	0	0	0	0	0	0	3.1	0	0	1.7
Cars & Light Goods	404	0	101	0	0	116	328	0	0	0	0	0	66	125	0	0	1140
% Cars & Light Goods	98.5	0	97.1	0	0	92.8	98.5	0	0	0	0	0	100	96.2	0	0	97.6
Buses	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
% Buses	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0.2
Single-Unit Trucks	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
% Single-Unit Trucks	0	0	0	0	0	0.8	0.3	0	0	0	0	0	0	0	0	0	0.2
Articulated Trucks	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	3
% Bicycles on Road	0	0	1	0	0	0	0.3	0	0	0	0	0	0	0.8	0	0	0.3
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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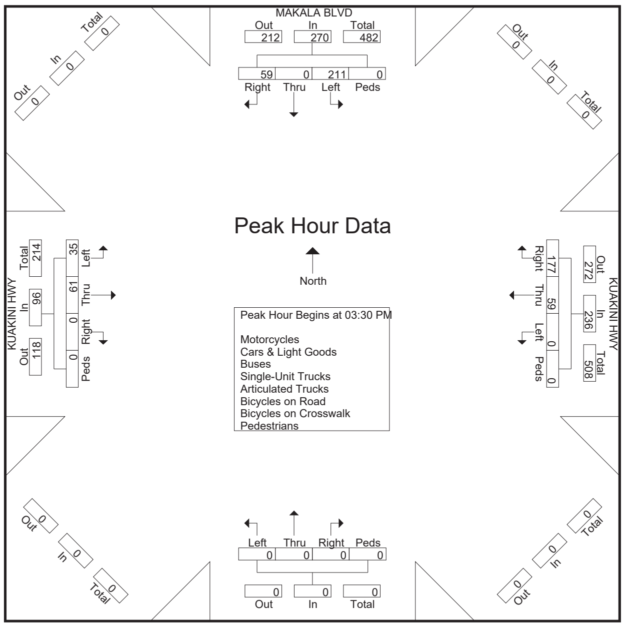
Start Date : 9/7/2022

	MAKALA BLVD Southbound					KUAKINI HWY Westbound					Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**55**	0	12	0	67	0	**17**	44	0	61	0	0	0	0	0	8	19	0	0	**27**	155
03:45 PM	53	0	**21**	0	**74**	0	10	38	0	48	0	0	0	0	0	9	13	0	0	22	144
04:00 PM	51	0	14	0	65	0	16	**56**	0	**72**	0	0	0	0	0	6	**20**	0	0	26	**163**
04:15 PM	52	0	12	0	64	0	16	39	0	55	0	0	0	0	0	**12**	9	0	0	21	140
Total Volume	211	0	59	0	270	0	59	177	0	236	0	0	0	0	0	35	61	0	0	96	602
% App. Total	78.1	0	21.9	0		0	25	75	0		0	0	0	0		36.5	63.5	0	0		
PHF	.959	.000	.702	.000	.912	.000	.868	.790	.000	.819	.000	.000	.000	.000	.000	.729	.763	.000	.000	.889	.923



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File Name : Makala Blvd - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				KUAKINI HWY Westbound				Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	36	0	14	0	0	23	62	0	0	0	0	0	18	14	0	0	167
11:15 AM	39	0	17	0	0	12	43	0	0	0	0	0	14	23	0	0	148
11:30 AM	43	0	20	0	0	28	51	1	0	0	0	0	19	28	0	0	190
11:45 AM	46	0	27	0	0	27	47	0	0	0	0	0	16	23	0	3	189
Total	164	0	78	0	0	90	203	1	0	0	0	0	67	88	0	3	694
12:00 PM	58	0	18	0	0	28	44	0	0	0	0	0	27	31	0	0	206
12:15 PM	52	0	17	0	0	15	40	0	0	0	0	0	20	25	0	0	169
12:30 PM	49	0	11	0	0	20	36	0	0	0	0	0	15	28	0	0	159
12:45 PM	66	0	16	0	0	18	57	0	0	0	0	0	17	29	0	0	203
Total	225	0	62	0	0	81	177	0	0	0	0	0	79	113	0	0	737
Grand Total	389	0	140	0	0	171	380	1	0	0	0	0	146	201	0	3	1431
Apprch %	73.5	0	26.5	0	0	31	68.8	0.2	0	0	0	0	41.7	57.4	0	0.9	
Total %	27.2	0	9.8	0	0	11.9	26.6	0.1	0	0	0	0	10.2	14	0	0.2	
Motorcycles	5	0	3	0	0	6	2	0	0	0	0	0	2	4	0	0	22
% Motorcycles	1.3	0	2.1	0	0	3.5	0.5	0	0	0	0	0	1.4	2	0	0	1.5
Cars & Light Goods	376	0	136	0	0	165	374	0	0	0	0	0	143	197	0	0	1391
% Cars & Light Goods	96.7	0	97.1	0	0	96.5	98.4	0	0	0	0	0	97.9	98	0	0	97.2
Buses	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
% Buses	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0.1
Single-Unit Trucks	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	3
% Single-Unit Trucks	0	0	0.7	0	0	0	0.3	0	0	0	0	0	0.7	0	0	0	0.2
Articulated Trucks	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	8	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	9
% Bicycles on Road	2.1	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0.6
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	4
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100	0.3

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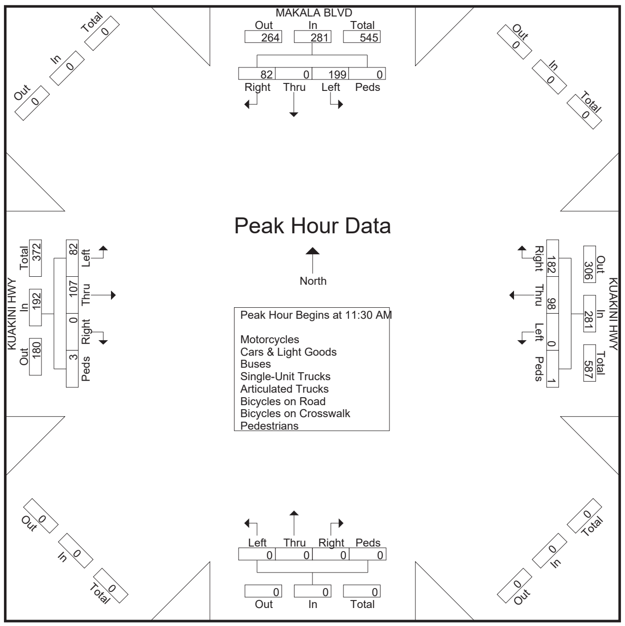
File Name : Makala Blvd - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
Page No : 2

	MAKALA BLVD Southbound					KUAKINI HWY Westbound					Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	43	0	20	0	63	0	**28**	**51**	**1**	**80**	0	0	0	0	0	19	28	0	0	47	190
11:45 AM	46	0	**27**	0	73	0	27	47	0	74	0	0	0	0	0	16	23	0	**3**	42	189
12:00 PM	**58**	0	18	0	**76**	0	28	44	0	72	0	0	0	0	0	**27**	**31**	0	0	**58**	**206**
12:15 PM	52	0	17	0	69	0	15	40	0	55	0	0	0	0	0	20	25	0	0	45	169
Total Volume	199	0	82	0	281	0	98	182	1	281	0	0	0	0	0	82	107	0	3	192	754
% App. Total	70.8	0	29.2	0		0	34.9	64.8	0.4		0	0	0	0		42.7	55.7	0	1.6		
PHF	.858	.000	.759	.000	.924	.000	.875	.892	.250	.878	.000	.000	.000	.000	.000	.759	.863	.000	.250	.828	.915



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File Name : Makala Blvd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				QUEEN KAAHUMANU HWY Westbound				MAKALA BLVD Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	2	4	9	0	29	170	12	0	66	1	13	1	2	160	50	0	519
07:45 AM	2	4	1	0	49	188	6	0	60	5	15	0	10	190	52	0	582
Total	4	8	10	0	78	358	18	0	126	6	28	1	12	350	102	0	1101
08:00 AM	8	5	2	0	46	180	3	0	68	5	16	1	1	185	57	0	577
08:15 AM	6	10	5	0	40	229	4	2	83	2	26	1	2	155	61	0	626
08:30 AM	8	6	9	0	38	206	5	0	70	5	29	0	4	197	68	0	645
08:45 AM	9	7	6	0	45	186	1	0	74	3	24	1	3	194	78	0	631
Total	31	28	22	0	169	801	13	2	295	15	95	3	10	731	264	0	2479
09:00 AM	2	4	10	0	40	185	2	0	71	6	29	0	1	176	91	0	617
09:15 AM	5	4	7	0	52	193	0	0	80	4	37	0	2	157	58	0	599
Grand Total	42	44	49	0	339	1537	33	2	572	31	189	4	25	1414	515	0	4796
Apprch %	31.1	32.6	36.3	0	17.7	80.4	1.7	0.1	71.9	3.9	23.7	0.5	1.3	72.4	26.4	0	
Total %	0.9	0.9	1	0	7.1	32	0.7	0	11.9	0.6	3.9	0.1	0.5	29.5	10.7	0	
Motorcycles	0	0	0	0	1	10	0	0	5	1	1	0	1	5	0	0	24
% Motorcycles	0	0	0	0	0.3	0.7	0	0	0.9	3.2	0.5	0	4	0.4	0	0	0.5
Cars & Light Goods	40	44	46	0	332	1479	33	0	541	25	184	0	23	1363	495	0	4605
% Cars & Light Goods	95.2	100	93.9	0	97.9	96.2	100	0	94.6	80.6	97.4	0	92	96.4	96.1	0	96
Buses	0	0	0	0	6	10	0	0	3	2	0	0	0	1	3	0	25
% Buses	0	0	0	0	1.8	0.7	0	0	0.5	6.5	0	0	0	0.1	0.6	0	0.5
Single-Unit Trucks	2	0	2	0	0	31	0	0	19	3	3	0	0	38	12	0	110
% Single-Unit Trucks	4.8	0	4.1	0	0	2	0	0	3.3	9.7	1.6	0	0	2.7	2.3	0	2.3
Articulated Trucks	0	0	1	0	0	5	0	0	1	0	0	0	1	4	2	0	14
% Articulated Trucks	0	0	2	0	0	0.3	0	0	0.2	0	0	0	4	0.3	0.4	0	0.3
Bicycles on Road	0	0	0	0	0	2	0	0	3	0	1	0	0	3	3	0	12
% Bicycles on Road	0	0	0	0	0	0.1	0	0	0.5	0	0.5	0	0	0.2	0.6	0	0.3
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	2	0	0	0	3	0	0	0	0	5
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	75	0	0	0	0	0.1

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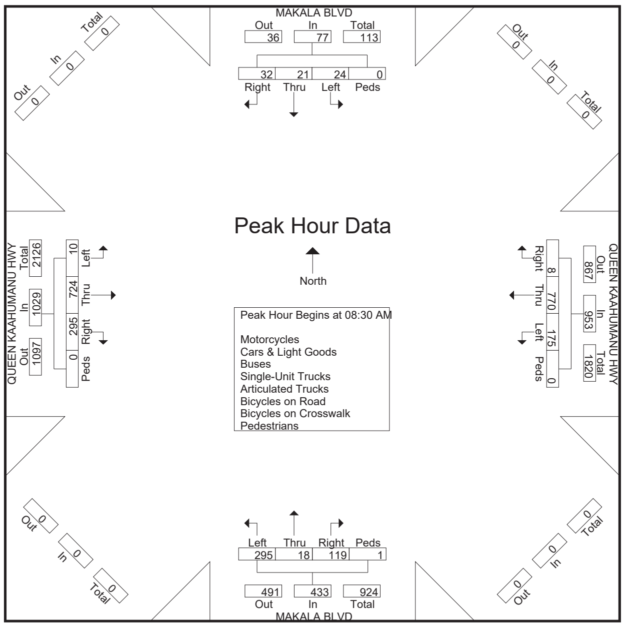
File Name : Makala Blvd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022

	MAKALA BLVD Southbound					QUEEN KAAHUMANU HWY Westbound					MAKALA BLVD Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 08:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	8	6	9	0	**23**	38	**206**	**5**	0	**249**	70	5	29	0	104	**4**	**197**	68	0	269	**645**
08:45 AM	**9**	**7**	6	0	22	45	186	1	0	232	74	3	24	**1**	102	3	194	78	0	**275**	631
09:00 AM	2	4	**10**	0	16	40	185	2	0	227	71	**6**	29	0	106	1	176	**91**	0	268	617
09:15 AM	5	4	7	0	16	**52**	193	0	0	245	**80**	4	**37**	0	**121**	2	157	58	0	217	599
Total Volume	24	21	32	0	77	175	770	8	0	953	295	18	119	1	433	10	724	295	0	1029	2492
% App. Total	31.2	27.3	41.6	0		18.4	80.8	0.8	0		68.1	4.2	27.5	0.2		1	70.4	28.7	0		
PHF	.667	.750	.800	.000	.837	.841	.934	.400	.000	.957	.922	.750	.804	.250	.895	.625	.919	.810	.000	.935	.966



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File Name : Makala Blvd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				QUEEN KAAHUMANU HWY Westbound				MAKALA BLVD Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	4	8	5	0	57	206	2	1	119	6	49	0	4	281	98	0	840
03:15 PM	4	11	8	0	53	184	2	0	128	17	65	0	3	262	97	0	834
03:30 PM	6	11	9	0	68	207	2	0	106	4	64	0	7	292	91	0	867
03:45 PM	8	16	7	1	61	163	1	1	124	11	67	0	1	264	96	0	821
Total	22	46	29	1	239	760	7	2	477	38	245	0	15	1099	382	0	3362
04:00 PM	7	13	12	0	68	183	0	0	115	14	80	0	4	329	94	0	919
04:15 PM	5	5	13	0	55	173	4	0	115	14	63	0	2	282	102	0	833
04:30 PM	11	7	16	1	65	173	1	1	128	13	53	0	2	242	83	0	796
04:45 PM	1	14	8	0	53	168	1	0	82	5	64	1	3	292	92	0	784
Total	24	39	49	1	241	697	6	1	440	46	260	1	11	1145	371	0	3332
Grand Total	46	85	78	2	480	1457	13	3	917	84	505	1	26	2244	753	0	6694
Apprch %	21.8	40.3	37	0.9	24.6	74.6	0.7	0.2	60.8	5.6	33.5	0.1	0.9	74.2	24.9	0	
Total %	0.7	1.3	1.2	0	7.2	21.8	0.2	0	13.7	1.3	7.5	0	0.4	33.5	11.2	0	
Motorcycles	1	0	0	0	2	7	1	0	4	0	1	0	0	11	6	0	33
% Motorcycles	2.2	0	0	0	0.4	0.5	7.7	0	0.4	0	0.2	0	0	0.5	0.8	0	0.5
Cars & Light Goods	44	84	73	0	473	1411	12	0	904	81	504	0	25	2203	734	0	6548
% Cars & Light Goods	95.7	98.8	93.6	0	98.5	96.8	92.3	0	98.6	96.4	99.8	0	96.2	98.2	97.5	0	97.8
Buses	0	1	0	0	5	6	0	0	2	2	0	0	0	1	5	0	22
% Buses	0	1.2	0	0	1	0.4	0	0	0.2	2.4	0	0	0	0	0.7	0	0.3
Single-Unit Trucks	0	0	2	0	0	22	0	0	3	1	0	0	1	18	5	0	52
% Single-Unit Trucks	0	0	2.6	0	0	1.5	0	0	0.3	1.2	0	0	3.8	0.8	0.7	0	0.8
Articulated Trucks	1	0	3	0	0	10	0	0	3	0	0	0	0	10	2	0	29
% Articulated Trucks	2.2	0	3.8	0	0	0.7	0	0	0.3	0	0	0	0	0.4	0.3	0	0.4
Bicycles on Road	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	4
% Bicycles on Road	0	0	0	0	0	0.1	0	0	0.1	0	0	0	0	0	0.1	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0
Pedestrians	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	5
% Pedestrians	0	0	0	100	0	0	0	100	0	0	0	0	0	0	0	0	0.1

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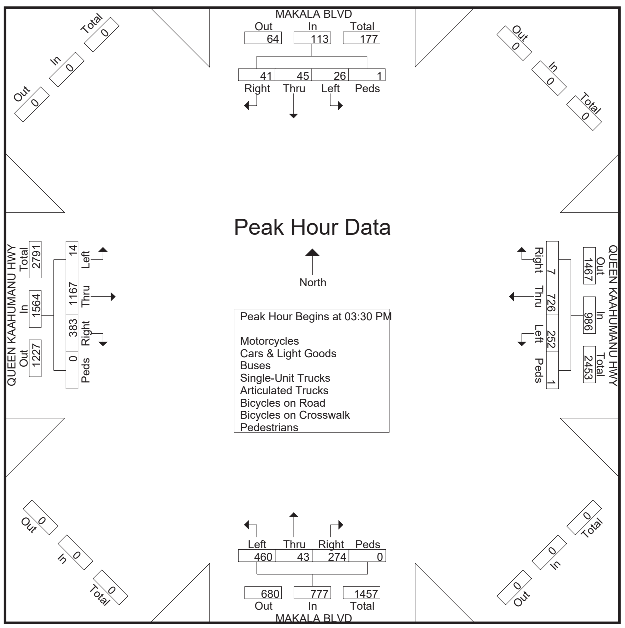
File Name : Makala Blvd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022

	MAKALA BLVD Southbound					QUEEN KAAHUMANU HWY Westbound					MAKALA BLVD Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	6	11	9	0	26	**68**	**207**	2	0	**277**	106	4	64	0	174	**7**	292	91	0	390	867
03:45 PM	**8**	**16**	7	**1**	**32**	61	163	1	**1**	226	**124**	11	67	0	202	1	264	96	0	361	821
04:00 PM	7	13	12	0	32	68	183	0	0	251	115	**14**	**80**	0	**209**	4	**329**	94	0	**427**	**919**
04:15 PM	5	5	**13**	0	23	55	173	**4**	0	232	115	14	63	0	192	2	282	**102**	0	386	833
Total Volume	26	45	41	1	113	252	726	7	1	986	460	43	274	0	777	14	1167	383	0	1564	3440
% App. Total	23	39.8	36.3	0.9		25.6	73.6	0.7	0.1		59.2	5.5	35.3	0		0.9	74.6	24.5	0		
PHF	.813	.703	.788	.250	.883	.926	.877	.438	.250	.890	.927	.768	.856	.000	.929	.500	.887	.939	.000	.916	.936



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File Name : WE_Makala Blvd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				QUEEN KAAHUMANU HWY Westbound				MAKALA BLVD Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	0	11	10	0	70	220	1	0	82	7	56	1	7	184	82	0	731
11:15 AM	1	13	5	0	75	167	2	0	110	6	59	0	1	154	94	0	687
11:30 AM	3	15	2	0	69	206	0	0	99	10	72	0	3	224	91	0	794
11:45 AM	2	12	6	0	74	168	2	0	125	12	68	2	5	151	100	0	727
Total	6	51	23	0	288	761	5	0	416	35	255	3	16	713	367	0	2939
12:00 PM	3	15	12	3	68	164	2	4	106	15	79	0	8	198	97	0	774
12:15 PM	2	12	6	0	60	175	1	1	90	13	60	0	3	241	80	0	744
12:30 PM	5	15	8	0	60	173	3	1	115	10	78	0	3	192	87	0	750
12:45 PM	5	8	7	0	66	178	1	0	135	8	66	0	4	200	86	0	764
Total	15	50	33	3	254	690	7	6	446	46	283	0	18	831	350	0	3032
Grand Total	21	101	56	3	542	1451	12	6	862	81	538	3	34	1544	717	0	5971
Apprch %	11.6	55.8	30.9	1.7	27	72.2	0.6	0.3	58.1	5.5	36.3	0.2	1.5	67.3	31.2	0	
Total %	0.4	1.7	0.9	0.1	9.1	24.3	0.2	0.1	14.4	1.4	9	0.1	0.6	25.9	12	0	
Motorcycles	0	0	0	0	4	11	0	0	5	2	5	0	0	2	2	0	31
% Motorcycles	0	0	0	0	0.7	0.8	0	0	0.6	2.5	0.9	0	0	0.1	0.3	0	0.5
Cars & Light Goods	20	99	56	0	533	1425	12	0	849	79	531	0	34	1524	703	0	5865
% Cars & Light Goods	95.2	98	100	0	98.3	98.2	100	0	98.5	97.5	98.7	0	100	98.7	98	0	98.2
Buses	0	2	0	0	2	0	0	0	1	0	1	0	0	0	2	0	8
% Buses	0	2	0	0	0.4	0	0	0	0.1	0	0.2	0	0	0	0.3	0	0.1
Single-Unit Trucks	1	0	0	0	3	11	0	0	5	0	0	0	0	13	8	0	41
% Single-Unit Trucks	4.8	0	0	0	0.6	0.8	0	0	0.6	0	0	0	0	0.8	1.1	0	0.7
Articulated Trucks	0	0	0	0	0	3	0	0	1	0	1	0	0	3	2	0	10
% Articulated Trucks	0	0	0	0	0	0.2	0	0	0.1	0	0.2	0	0	0.2	0.3	0	0.2
Bicycles on Road	0	0	0	0	0	1	0	0	1	0	0	0	0	2	0	0	4
% Bicycles on Road	0	0	0	0	0	0.1	0	0	0.1	0	0	0	0	0.1	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	5
% Bicycles on Crosswalk	0	0	0	0	0	0	0	50	0	0	0	66.7	0	0	0	0	0.1
Pedestrians	0	0	0	3	0	0	0	3	0	0	0	1	0	0	0	0	7
% Pedestrians	0	0	0	100	0	0	0	50	0	0	0	33.3	0	0	0	0	0.1

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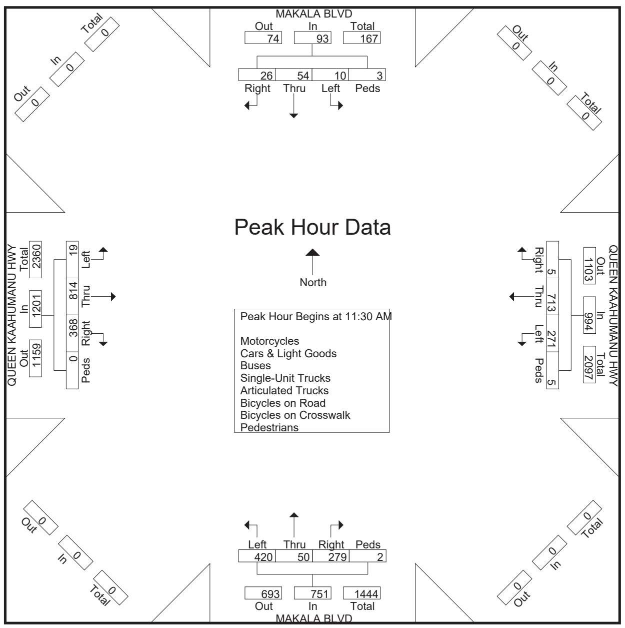
File Name : WE_Makala Blvd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022
Page No : 2

	MAKALA BLVD Southbound					QUEEN KAAHUMANU HWY Westbound					MAKALA BLVD Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	**3**	**15**	2	0	20	69	**206**	0	0	**275**	99	10	72	0	181	3	224	91	0	318	**794**
11:45 AM	2	12	6	0	20	**74**	168	**2**	0	244	**125**	12	68	**2**	**207**	5	151	**100**	0	256	727
12:00 PM	3	15	**12**	**3**	**33**	68	164	2	**4**	238	106	**15**	**79**	0	200	**8**	198	97	0	303	774
12:15 PM	2	12	6	0	20	60	175	1	1	237	90	13	60	0	163	3	**241**	80	0	**324**	744
Total Volume	10	54	26	3	93	271	713	5	5	994	420	50	279	2	751	19	814	368	0	1201	3039
% App. Total	10.8	58.1	28	3.2		27.3	71.7	0.5	0.5		55.9	6.7	37.2	0.3		1.6	67.8	30.6	0		
PHF	.833	.900	.542	.250	.705	.916	.865	.625	.313	.904	.840	.833	.883	.250	.907	.594	.844	.920	.000	.927	.957



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File Name : Makala Blvd - Luhia St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				LUHIA ST Westbound				MAKALA BLVD Northbound				LUHIA ST Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	37	44	5	0	0	2	36	0	3	39	0	0	0	2	0	0	168
07:45 AM	42	54	6	0	0	3	42	0	3	39	1	0	0	1	0	0	191
Total	79	98	11	0	0	5	78	0	6	78	1	0	0	3	0	0	359
08:00 AM	38	64	12	0	0	3	47	1	2	47	2	0	3	0	1	0	220
08:15 AM	38	53	16	0	1	2	48	3	1	52	2	0	7	8	3	1	235
08:30 AM	49	54	21	0	0	5	56	2	0	54	3	0	5	2	2	0	253
08:45 AM	42	62	15	0	0	4	35	1	3	37	7	0	11	6	3	2	228
Total	167	233	64	0	1	14	186	7	6	190	14	0	26	16	9	3	936
09:00 AM	59	56	17	0	2	5	43	0	3	54	3	0	11	4	3	0	260
09:15 AM	40	52	17	0	0	3	55	0	4	70	5	0	6	4	2	0	258
Grand Total	345	439	109	0	3	27	362	7	19	392	23	0	43	27	14	3	1813
Apprch %	38.6	49.2	12.2	0	0.8	6.8	90.7	1.8	4.4	90.3	5.3	0	49.4	31	16.1	3.4	
Total %	19	24.2	6	0	0.2	1.5	20	0.4	1	21.6	1.3	0	2.4	1.5	0.8	0.2	
Motorcycles	1	2	0	0	0	0	2	0	0	2	0	0	0	0	0	0	7
% Motorcycles	0.3	0.5	0	0	0	0	0.6	0	0	0.5	0	0	0	0	0	0	0.4
Cars & Light Goods	329	431	106	0	2	26	330	0	19	382	20	0	43	27	14	0	1729
% Cars & Light Goods	95.4	98.2	97.2	0	66.7	96.3	91.2	0	100	97.4	87	0	100	100	100	0	95.4
Buses	8	0	2	0	0	0	4	0	0	1	2	0	0	0	0	0	17
% Buses	2.3	0	1.8	0	0	0	1.1	0	0	0.3	8.7	0	0	0	0	0	0.9
Single-Unit Trucks	4	2	1	0	1	1	24	0	0	3	0	0	0	0	0	0	36
% Single-Unit Trucks	1.2	0.5	0.9	0	33.3	3.7	6.6	0	0	0.8	0	0	0	0	0	0	2
Articulated Trucks	1	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
% Articulated Trucks	0.3	0.5	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.2
Bicycles on Road	2	2	0	0	0	0	2	0	0	3	1	0	0	0	0	0	10
% Bicycles on Road	0.6	0.5	0	0	0	0	0.6	0	0	0.8	4.3	0	0	0	0	0	0.6
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66.7	0.1
Pedestrians	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	1	8
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	33.3	0.4

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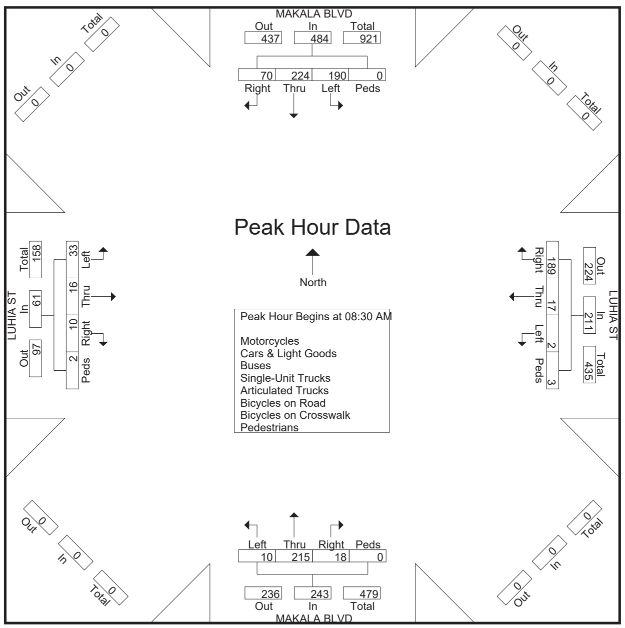
File Name : Makala Blvd - Luhia St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 2

	MAKALA BLVD Southbound					LUHIA ST Westbound					MAKALA BLVD Northbound					LUHIA ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	49	54	**21**	0	124	0	**5**	**56**	**2**	**63**	0	54	3	0	57	5	2	2	0	9	253
08:45 AM	42	**62**	15	0	119	0	4	35	1	40	3	37	**7**	0	47	**11**	**6**	**3**	**2**	**22**	228
09:00 AM	**59**	56	17	0	**132**	**2**	5	43	0	50	3	54	3	0	60	11	4	3	0	18	**260**
09:15 AM	40	52	17	0	109	0	3	55	0	58	**4**	**70**	5	0	**79**	6	4	2	0	12	258
Total Volume	190	224	70	0	484	2	17	189	3	211	10	215	18	0	243	33	16	10	2	61	999
% App. Total	39.3	46.3	14.5	0		0.9	8.1	89.6	1.4		4.1	88.5	7.4	0		54.1	26.2	16.4	3.3		
PHF	.805	.903	.833	.000	.917	.250	.850	.844	.375	.837	.625	.768	.643	.000	.769	.750	.667	.833	.250	.693	.961



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File Name : Makala Blvd - Luhia St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/7/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				LUHIA ST Westbound				MAKALA BLVD Northbound				LUHIA ST Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	63	66	37	0	6	8	80	0	6	75	5	0	30	10	8	0	394
03:15 PM	46	74	43	0	1	13	62	0	4	96	9	0	39	6	7	0	400
03:30 PM	44	92	34	0	2	11	63	0	0	95	10	0	27	6	5	0	389
03:45 PM	56	87	31	0	6	9	65	0	8	93	3	0	35	3	4	0	400
Total	209	319	145	0	15	41	270	0	18	359	27	0	131	25	24	0	1583
04:00 PM	56	75	49	0	2	6	74	1	5	109	4	0	34	5	9	1	430
04:15 PM	43	73	39	0	2	12	74	0	5	86	7	0	33	8	4	0	386
04:30 PM	53	65	39	0	0	10	70	0	4	90	11	0	25	5	6	2	380
04:45 PM	44	82	34	0	1	12	59	0	8	97	8	0	21	8	9	0	383
Total	196	295	161	0	5	40	277	1	22	382	30	0	113	26	28	3	1579
Grand Total	405	614	306	0	20	81	547	1	40	741	57	0	244	51	52	3	3162
Apprch %	30.6	46.3	23.1	0	3.1	12.5	84.3	0.2	4.8	88.4	6.8	0	69.7	14.6	14.9	0.9	
Total %	12.8	19.4	9.7	0	0.6	2.6	17.3	0	1.3	23.4	1.8	0	7.7	1.6	1.6	0.1	
Motorcycles	1	3	0	0	0	1	4	0	0	0	1	0	1	0	0	0	11
% Motorcycles	0.2	0.5	0	0	0	1.2	0.7	0	0	0	1.8	0	0.4	0	0	0	0.3
Cars & Light Goods	391	609	298	0	19	80	535	0	40	736	52	0	242	51	51	0	3104
% Cars & Light Goods	96.5	99.2	97.4	0	95	98.8	97.8	0	100	99.3	91.2	0	99.2	100	98.1	0	98.2
Buses	9	0	2	0	0	0	1	0	0	3	4	0	0	0	0	0	19
% Buses	2.2	0	0.7	0	0	0	0.2	0	0	0.4	7	0	0	0	0	0	0.6
Single-Unit Trucks	2	1	2	0	0	0	4	0	0	1	0	0	1	0	0	0	11
% Single-Unit Trucks	0.5	0.2	0.7	0	0	0	0.7	0	0	0.1	0	0	0.4	0	0	0	0.3
Articulated Trucks	1	0	2	0	1	0	2	0	0	0	0	0	0	0	0	0	6
% Articulated Trucks	0.2	0	0.7	0	5	0	0.4	0	0	0	0	0	0	0	0	0	0.2
Bicycles on Road	1	1	2	0	0	0	1	0	0	1	0	0	0	0	1	0	7
% Bicycles on Road	0.2	0.2	0.7	0	0	0	0.2	0	0	0.1	0	0	0	0	1.9	0	0.2
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	4
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100	0.1

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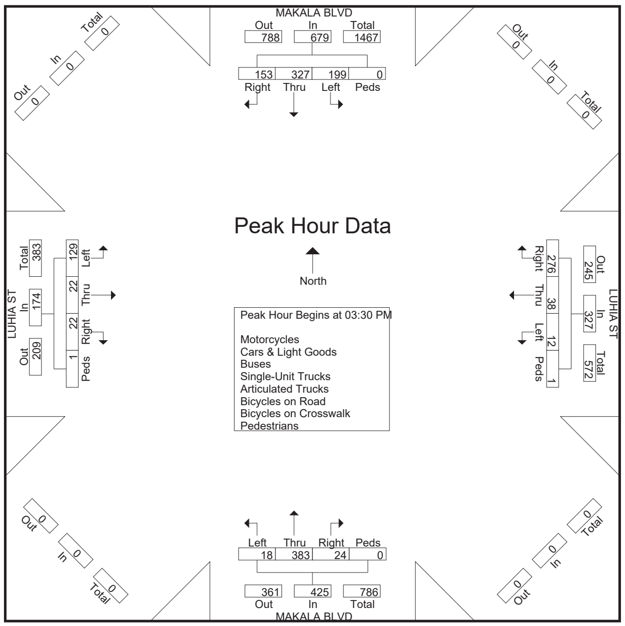
File Name : Makala Blvd - Luhia St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/7/2022
Page No : 2

	MAKALA BLVD Southbound					LUHIA ST Westbound					MAKALA BLVD Northbound					LUHIA ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	44	**92**	34	0	170	2	11	63	0	76	0	95	**10**	0	105	27	6	5	0	38	389
03:45 PM	**56**	87	31	0	174	**6**	9	65	0	80	**8**	93	3	0	104	**35**	3	4	0	42	400
04:00 PM	56	75	**49**	0	**180**	2	6	**74**	**1**	83	5	**109**	4	0	**118**	34	5	**9**	**1**	**49**	**430**
04:15 PM	43	73	39	0	155	2	**12**	74	0	**88**	5	86	7	0	98	33	**8**	4	0	45	386
Total Volume	199	327	153	0	679	12	38	276	1	327	18	383	24	0	425	129	22	22	1	174	1605
% App. Total	29.3	48.2	22.5	0		3.7	11.6	84.4	0.3		4.2	90.1	5.6	0		74.1	12.6	12.6	0.6		
PHF	.888	.889	.781	.000	.943	.500	.792	.932	.250	.929	.563	.878	.600	.000	.900	.921	.688	.611	.250	.888	.933



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File Name : Makala Blvd - Luhia St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				LUHIA ST Westbound				MAKALA BLVD Northbound				LUHIA ST Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	43	65	33	0	3	5	34	0	7	93	7	0	26	10	7	0	333
11:15 AM	50	76	50	0	3	15	30	0	8	93	14	0	33	7	2	3	384
11:30 AM	44	78	56	0	4	16	41	1	7	113	8	0	28	9	3	0	408
11:45 AM	51	76	51	0	2	12	46	0	4	106	5	0	36	13	8	2	412
Total	188	295	190	0	12	48	151	1	26	405	34	0	123	39	20	5	1537
12:00 PM	57	91	44	0	1	10	48	3	9	113	7	0	35	7	12	0	437
12:15 PM	48	67	43	0	2	15	48	0	9	87	3	0	27	9	6	5	369
12:30 PM	41	72	49	0	6	11	44	0	6	98	2	0	35	16	10	0	390
12:45 PM	48	77	36	0	7	11	55	0	11	108	5	0	31	7	13	0	409
Total	194	307	172	0	16	47	195	3	35	406	17	0	128	39	41	5	1605
Grand Total	382	602	362	0	28	95	346	4	61	811	51	0	251	78	61	10	3142
Apprch %	28.4	44.7	26.9	0	5.9	20.1	73.2	0.8	6.6	87.9	5.5	0	62.8	19.5	15.2	2.5	
Total %	12.2	19.2	11.5	0	0.9	3	11	0.1	1.9	25.8	1.6	0	8	2.5	1.9	0.3	
Motorcycles	2	6	2	0	0	1	0	0	2	6	1	0	2	1	3	0	26
% Motorcycles	0.5	1	0.6	0	0	1.1	0	0	3.3	0.7	2	0	0.8	1.3	4.9	0	0.8
Cars & Light Goods	370	586	359	0	27	94	344	0	59	799	47	0	247	77	57	0	3066
% Cars & Light Goods	96.9	97.3	99.2	0	96.4	98.9	99.4	0	96.7	98.5	92.2	0	98.4	98.7	93.4	0	97.6
Buses	6	1	1	0	0	0	0	0	0	2	3	0	0	0	0	0	13
% Buses	1.6	0.2	0.3	0	0	0	0	0	0	0.2	5.9	0	0	0	0	0	0.4
Single-Unit Trucks	1	0	0	0	1	0	2	0	0	2	0	0	0	0	0	0	6
% Single-Unit Trucks	0.3	0	0	0	3.6	0	0.6	0	0	0.2	0	0	0	0	0	0	0.2
Articulated Trucks	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	4
% Articulated Trucks	0.3	0.2	0	0	0	0	0	0	0	0.1	0	0	0.4	0	0	0	0.1
Bicycles on Road	2	8	0	0	0	0	0	0	0	1	0	0	1	0	1	0	13
% Bicycles on Road	0.5	1.3	0	0	0	0	0	0	0	0.1	0	0	0.4	0	1.6	0	0.4
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	10	14
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100	0.4

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File Name : Makala Blvd - Luhia St
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
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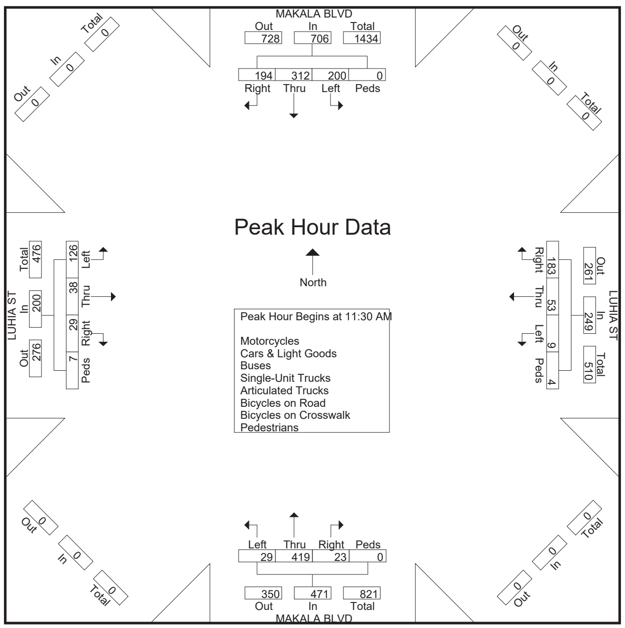
	MAKALA BLVD Southbound					LUHIA ST Westbound					MAKALA BLVD Northbound					LUHIA ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	44	78	**56**	0	178	**4**	**16**	41	1	62	7	**113**	**8**	0	128	28	9	3	0	40	408
11:45 AM	51	76	51	0	178	2	12	46	0	60	4	106	5	0	115	**36**	**13**	8	2	**59**	412
12:00 PM	**57**	**91**	44	0	**192**	1	10	**48**	**3**	62	**9**	113	7	0	**129**	35	7	**12**	0	54	**437**
12:15 PM	48	67	43	0	158	2	15	48	0	**65**	9	87	3	0	99	27	9	6	**5**	47	369
Total Volume	200	312	194	0	706	9	53	183	4	249	29	419	23	0	471	126	38	29	7	200	1626
% App. Total	28.3	44.2	27.5	0		3.6	21.3	73.5	1.6		6.2	89	4.9	0		63	19	14.5	3.5		
PHF	.877	.857	.866	.000	.919	.563	.828	.953	.333	.958	.806	.927	.719	.000	.913	.875	.731	.604	.350	.847	.930



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File Name : Makala Blvd - Midblock Dwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				TARGET DWY Westbound				MAKALA BLVD Northbound				PRIVATE DWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	22	22	0	0	5	0	14	0	0	25	5	2	2	1	0	0	98
07:45 AM	31	24	2	0	3	1	16	0	1	26	3	0	2	2	0	0	111
Total	53	46	2	0	8	1	30	0	1	51	8	2	4	3	0	0	209
08:00 AM	26	30	7	0	3	7	20	0	6	27	1	1	4	2	1	0	135
08:15 AM	22	31	7	0	1	2	25	2	1	27	3	2	3	2	1	3	132
08:30 AM	29	23	5	0	4	3	32	0	6	20	2	1	6	3	2	0	136
08:45 AM	31	33	6	0	2	3	21	3	4	16	1	0	8	3	1	1	133
Total	108	117	25	0	10	15	98	5	17	90	7	4	21	10	5	4	536
09:00 AM	21	33	11	0	5	4	30	0	6	24	4	0	7	4	1	0	150
09:15 AM	19	28	8	0	4	6	37	1	2	32	3	0	13	5	3	0	161
Grand Total	201	224	46	0	27	26	195	6	26	197	22	6	45	22	9	4	1056
Apprch %	42.7	47.6	9.8	0	10.6	10.2	76.8	2.4	10.4	78.5	8.8	2.4	56.2	27.5	11.2	5	
Total %	19	21.2	4.4	0	2.6	2.5	18.5	0.6	2.5	18.7	2.1	0.6	4.3	2.1	0.9	0.4	
Motorcycles	1	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	5
% Motorcycles	0.5	0.4	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0	0.5
Cars & Light Goods	199	217	46	0	27	26	194	0	26	186	22	0	43	22	9	0	1017
% Cars & Light Goods	99	96.9	100	0	100	100	99.5	0	100	94.4	100	0	95.6	100	100	0	96.3
Buses	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	3
% Buses	0	0	0	0	0	0	0	0	0	0.5	0	0	4.4	0	0	0	0.3
Single-Unit Trucks	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	5
% Single-Unit Trucks	0	0.9	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0	0.5
Articulated Trucks	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
% Articulated Trucks	0.5	0.4	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.3
Bicycles on Road	0	3	0	0	0	0	1	0	0	3	0	0	0	0	0	0	7
% Bicycles on Road	0	1.3	0	0	0	0	0.5	0	0	1.5	0	0	0	0	0	0	0.7
Bicycles on Crosswalk	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	33.3	0	0	0	0	0	0	0	0	0.2
Pedestrians	0	0	0	0	0	0	0	4	0	0	0	6	0	0	0	4	14
% Pedestrians	0	0	0	0	0	0	0	66.7	0	0	0	100	0	0	0	100	1.3

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File Name : Makala Blvd - Midblock Dwy
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Start Date : 9/8/2022
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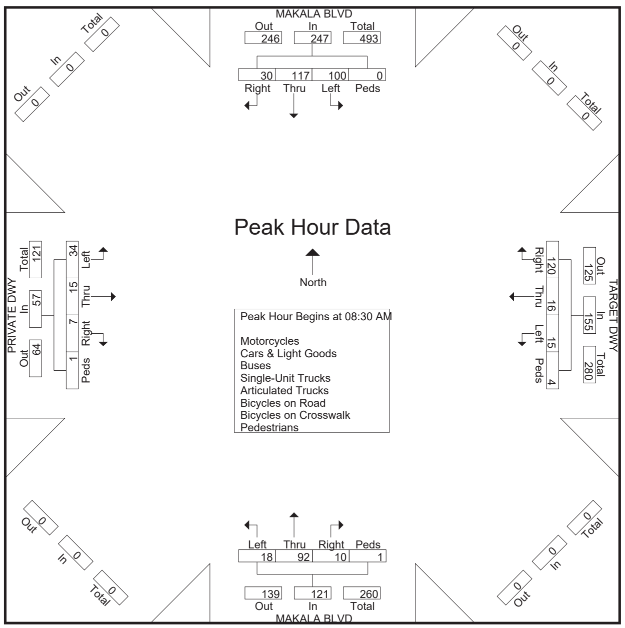
	MAKALA BLVD Southbound					TARGET DWY Westbound					MAKALA BLVD Northbound					PRIVATE DWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	29	23	5	0	57	4	3	32	0	39	**6**	20	2	**1**	29	6	3	2	0	11	136
08:45 AM	**31**	**33**	6	0	**70**	2	3	21	**3**	29	4	16	1	0	21	8	3	1	**1**	13	133
09:00 AM	21	33	**11**	0	65	**5**	4	30	0	39	6	24	**4**	0	34	7	4	1	0	12	150
09:15 AM	19	28	8	0	55	4	**6**	**37**	1	**48**	2	**32**	3	0	**37**	**13**	**5**	**3**	0	**21**	**161**
Total Volume	100	117	30	0	247	15	16	120	4	155	18	92	10	1	121	34	15	7	1	57	580
% App. Total	40.5	47.4	12.1	0		9.7	10.3	77.4	2.6		14.9	76	8.3	0.8		59.6	26.3	12.3	1.8		
PHF	.806	.886	.682	.000	.882	.750	.667	.811	.333	.807	.750	.719	.625	.250	.818	.654	.750	.583	.250	.679	.901



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File Name : Makala Blvd - Midblock Dwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				TARGET DWY Westbound				MAKALA BLVD Northbound				PRIVATE DWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	29	43	9	0	4	7	32	0	9	41	3	0	15	9	10	0	211
03:15 PM	34	38	9	0	6	7	41	0	7	35	1	1	32	7	16	0	234
03:30 PM	31	52	13	0	1	11	52	0	17	34	3	2	21	5	16	0	258
03:45 PM	37	57	7	0	6	4	51	0	13	35	1	0	20	8	15	0	254
Total	131	190	38	0	17	29	176	0	46	145	8	3	88	29	57	0	957
04:00 PM	23	49	7	0	5	9	57	0	15	48	6	5	16	13	10	1	264
04:15 PM	27	49	6	0	4	4	47	0	15	31	6	2	18	9	11	0	229
04:30 PM	15	49	7	0	7	3	58	0	13	35	2	0	15	6	13	2	225
04:45 PM	28	47	15	0	5	9	39	0	5	40	3	2	29	10	12	0	244
Total	93	194	35	0	21	25	201	0	48	154	17	9	78	38	46	3	962
Grand Total	224	384	73	0	38	54	377	0	94	299	25	12	166	67	103	3	1919
Apprch %	32.9	56.4	10.7	0	8.1	11.5	80.4	0	21.9	69.5	5.8	2.8	49	19.8	30.4	0.9	
Total %	11.7	20	3.8	0	2	2.8	19.6	0	4.9	15.6	1.3	0.6	8.7	3.5	5.4	0.2	
Motorcycles	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	4
% Motorcycles	0.4	0.3	0	0	0	0	0	0	0	0.3	0	0	0	0	1	0	0.2
Cars & Light Goods	223	381	72	0	38	54	376	0	94	292	25	0	164	67	102	0	1888
% Cars & Light Goods	99.6	99.2	98.6	0	100	100	99.7	0	100	97.7	100	0	98.8	100	99	0	98.4
Buses	0	0	0	0	0	0	1	0	0	4	0	0	2	0	0	0	7
% Buses	0	0	0	0	0	0	0.3	0	0	1.3	0	0	1.2	0	0	0	0.4
Single-Unit Trucks	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
% Single-Unit Trucks	0	0.3	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.1
Articulated Trucks	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2
% Bicycles on Road	0	0	1.4	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	3	15
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	100	0.8

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File Name : Makala Blvd - Midblock Dwy
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Start Date : 9/7/2022
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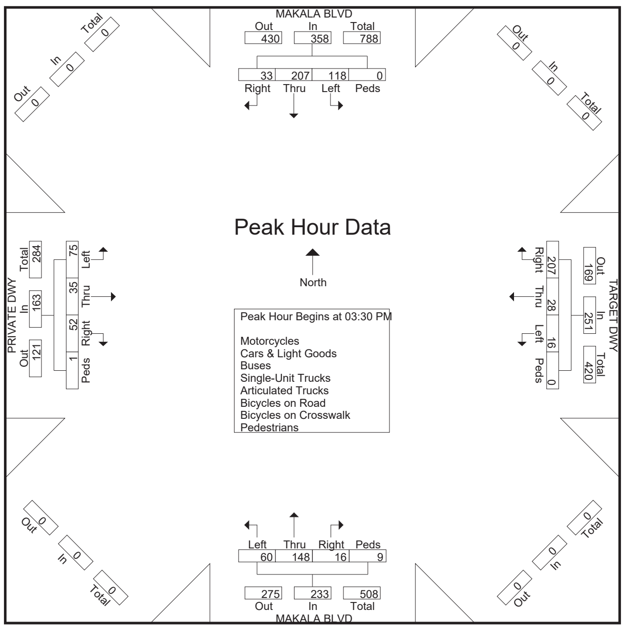
	MAKALA BLVD Southbound					TARGET DWY Westbound					MAKALA BLVD Northbound					PRIVATE DWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	31	52	**13**	0	96	1	**11**	52	0	64	**17**	34	3	2	56	**21**	5	**16**	0	42	258
03:45 PM	**37**	**57**	7	0	**101**	**6**	4	51	0	61	13	35	1	0	49	20	8	15	0	**43**	254
04:00 PM	23	49	7	0	79	5	9	**57**	0	**71**	15	**48**	**6**	**5**	**74**	16	**13**	10	**1**	40	**264**
04:15 PM	27	49	6	0	82	4	4	47	0	55	15	31	6	2	54	18	9	11	0	38	229
Total Volume	118	207	33	0	358	16	28	207	0	251	60	148	16	9	233	75	35	52	1	163	1005
% App. Total	33	57.8	9.2	0		6.4	11.2	82.5	0		25.8	63.5	6.9	3.9		46	21.5	31.9	0.6		
PHF	.797	.908	.635	.000	.886	.667	.636	.908	.000	.884	.882	.771	.667	.450	.787	.893	.673	.813	.250	.948	.952



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File Name : Makala Blvd - Midblock Dwy
Site Code : 22-209 Makalua Project District (MPD)
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				TARGET DWY Westbound				MAKALA BLVD Northbound				PRIVATE DWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	36	27	18	0	5	14	39	1	20	45	5	3	28	12	23	2	278
11:15 AM	39	33	11	0	5	15	46	0	11	42	2	2	26	16	17	0	265
11:30 AM	34	42	13	0	9	9	53	0	29	44	2	4	35	17	15	3	309
11:45 AM	28	43	12	0	8	16	45	0	19	35	6	4	26	15	19	1	277
Total	137	145	54	0	27	54	183	1	79	166	15	13	115	60	74	6	1129
12:00 PM	34	54	19	0	3	11	53	1	17	47	3	2	34	14	12	2	306
12:15 PM	28	46	5	2	7	15	42	0	23	29	4	7	23	14	15	0	260
12:30 PM	30	47	9	0	5	15	40	0	18	39	0	6	25	13	10	4	261
12:45 PM	33	55	12	0	11	16	54	0	12	45	6	5	31	15	18	0	313
Total	125	202	45	2	26	57	189	1	70	160	13	20	113	56	55	6	1140
Grand Total	262	347	99	2	53	111	372	2	149	326	28	33	228	116	129	12	2269
Apprch %	36.9	48.9	13.9	0.3	9.9	20.6	69.1	0.4	27.8	60.8	5.2	6.2	47	23.9	26.6	2.5	
Total %	11.5	15.3	4.4	0.1	2.3	4.9	16.4	0.1	6.6	14.4	1.2	1.5	10	5.1	5.7	0.5	
Motorcycles	4	6	0	0	0	1	0	0	1	5	1	0	2	0	2	0	22
% Motorcycles	1.5	1.7	0	0	0	0.9	0	0	0.7	1.5	3.6	0	0.9	0	1.6	0	1
Cars & Light Goods	255	329	96	0	53	110	372	0	148	314	27	0	223	116	127	0	2170
% Cars & Light Goods	97.3	94.8	97	0	100	99.1	100	0	99.3	96.3	96.4	0	97.8	100	98.4	0	95.6
Buses	2	0	0	0	0	0	0	0	0	3	0	0	2	0	0	0	7
% Buses	0.8	0	0	0	0	0	0	0	0	0.9	0	0	0.9	0	0	0	0.3
Single-Unit Trucks	0	2	0	0	0	0	0	0	0	2	0	0	1	0	0	0	5
% Single-Unit Trucks	0	0.6	0	0	0	0	0	0	0	0.6	0	0	0.4	0	0	0	0.2
Articulated Trucks	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.1
Bicycles on Road	1	9	3	0	0	0	0	0	0	1	0	0	0	0	0	0	14
% Bicycles on Road	0.4	2.6	3	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.6
Bicycles on Crosswalk	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	3
% Bicycles on Crosswalk	0	0	0	100	0	0	0	0	0	0	0	3	0	0	0	0	0.1
Pedestrians	0	0	0	0	0	0	0	2	0	0	0	32	0	0	0	12	46
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	97	0	0	0	100	2

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File Name : Makala Blvd - Midblock Dwy
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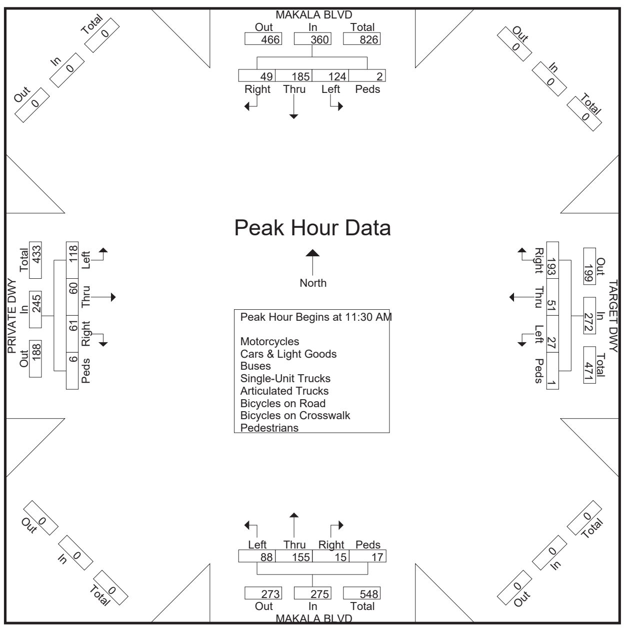
	MAKALA BLVD Southbound					TARGET DWY Westbound					MAKALA BLVD Northbound					PRIVATE DWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	**34**	42	13	0	89	**9**	9	**53**	0	**71**	**29**	44	2	4	**79**	**35**	**17**	15	**3**	**70**	**309**
11:45 AM	28	43	12	0	83	8	**16**	45	0	69	19	35	**6**	4	64	26	15	**19**	1	61	277
12:00 PM	34	**54**	**19**	0	**107**	3	11	53	**1**	68	17	**47**	3	2	69	34	14	12	2	62	306
12:15 PM	28	46	5	**2**	81	7	15	42	0	64	23	29	4	**7**	63	23	14	15	0	52	260
Total Volume	124	185	49	2	360	27	51	193	1	272	88	155	15	17	275	118	60	61	6	245	1152
% App. Total	34.4	51.4	13.6	0.6		9.9	18.8	71	0.4		32	56.4	5.5	6.2		48.2	24.5	24.9	2.4		
PHF	.912	.856	.645	.250	.841	.750	.797	.910	.250	.958	.759	.824	.625	.607	.870	.843	.882	.803	.500	.875	.932



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File Name : Makala Blvd - Road A
Site Code : 22-209 Makalua Project District (MPD)
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				ROAD A Westbound				MAKALA BLVD Northbound				OLD MAMALAHOE TRAIL Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	1	23	1	0	2	0	1	3	3	28	5	0	0	2	0	0	69
07:45 AM	3	24	0	0	1	0	4	0	4	26	4	0	0	1	0	0	67
Total	4	47	1	0	3	0	5	3	7	54	9	0	0	3	0	0	136
08:00 AM	7	28	0	0	0	0	9	0	2	25	4	0	0	0	1	0	76
08:15 AM	3	29	1	0	0	2	7	0	2	24	3	0	0	1	1	2	75
08:30 AM	6	23	0	0	0	1	4	0	3	24	6	0	0	2	1	1	71
08:45 AM	3	30	1	1	1	1	3	1	3	20	1	0	1	0	1	0	67
Total	19	110	2	1	1	4	23	1	10	93	14	0	1	3	4	3	289
09:00 AM	2	37	0	0	2	1	8	0	4	26	4	0	0	0	1	0	85
09:15 AM	5	30	1	0	0	1	8	0	2	29	7	0	0	2	1	1	87
Grand Total	30	224	4	1	6	6	44	4	23	202	34	0	1	8	6	4	597
Apprch %	11.6	86.5	1.5	0.4	10	10	73.3	6.7	8.9	78	13.1	0	5.3	42.1	31.6	21.1	
Total %	5	37.5	0.7	0.2	1	1	7.4	0.7	3.9	33.8	5.7	0	0.2	1.3	1	0.7	
Motorcycles	0	1	0	0	0	0	0	0	1	3	0	0	0	0	0	0	5
% Motorcycles	0	0.4	0	0	0	0	0	0	4.3	1.5	0	0	0	0	0	0	0.8
Cars & Light Goods	27	218	4	0	6	6	41	0	22	193	33	0	1	8	6	0	565
% Cars & Light Goods	90	97.3	100	0	100	100	93.2	0	95.7	95.5	97.1	0	100	100	100	0	94.6
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single-Unit Trucks	3	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	6
% Single-Unit Trucks	10	0.4	0	0	0	0	2.3	0	0	0.5	0	0	0	0	0	0	1
Articulated Trucks	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
% Articulated Trucks	0	0.4	0	0	0	0	2.3	0	0	0	0	0	0	0	0	0	0.3
Bicycles on Road	0	3	0	0	0	0	1	0	0	5	1	0	0	0	0	0	10
% Bicycles on Road	0	1.3	0	0	0	0	2.3	0	0	2.5	2.9	0	0	0	0	0	1.7
Bicycles on Crosswalk	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2
% Bicycles on Crosswalk	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	25	0.3
Pedestrians	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	3	7
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	75	1.2

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File Name : Makala Blvd - Road A
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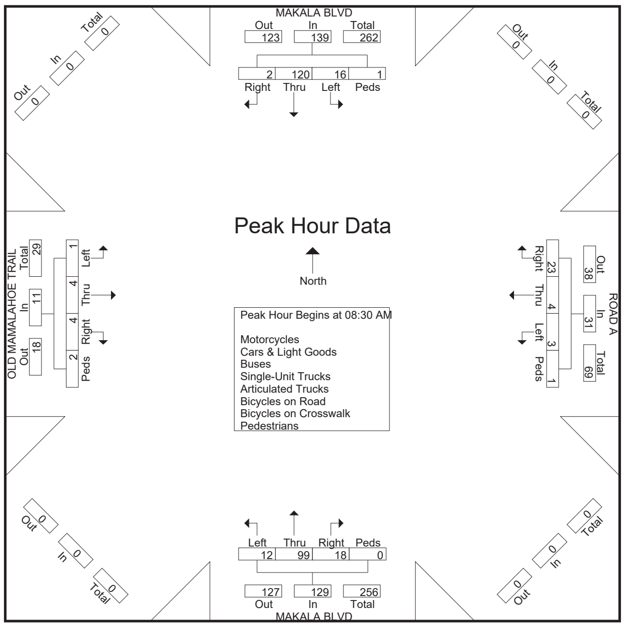
	MAKALA BLVD Southbound					ROAD A Westbound					MAKALA BLVD Northbound					OLD MAMALAHOE TRAIL Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	**6**	23	0	0	29	0	**1**	4	0	5	3	24	6	0	33	0	**2**	**1**	**1**	**4**	71
08:45 AM	3	30	**1**	**1**	35	1	1	3	**1**	6	3	20	1	0	24	**1**	0	1	0	2	67
09:00 AM	2	**37**	0	0	**39**	**2**	1	**8**	0	**11**	**4**	26	4	0	34	0	0	1	0	1	85
09:15 AM	5	30	1	0	36	0	1	8	0	9	2	**29**	**7**	0	**38**	0	2	1	1	4	**87**
Total Volume	16	120	2	1	139	3	4	23	1	31	12	99	18	0	129	1	4	4	2	11	310
% App. Total	11.5	86.3	1.4	0.7		9.7	12.9	74.2	3.2		9.3	76.7	14	0		9.1	36.4	36.4	18.2		
PHF	.667	.811	.500	.250	.891	.375	1.00	.719	.250	.705	.750	.853	.643	.000	.849	.250	.500	1.00	.500	.688	.891



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File Name : Makala Blvd - Road A
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				ROAD A Westbound				MAKALA BLVD Northbound				OLD MAMALAHOE TRAIL Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	5	50	0	0	4	8	7	0	3	40	8	0	3	1	3	0	132
03:15 PM	9	46	1	0	4	3	12	0	3	32	6	0	0	2	1	0	119
03:30 PM	7	67	0	0	3	3	7	4	1	45	7	3	1	0	2	0	150
03:45 PM	11	65	2	0	3	1	9	3	1	40	6	3	0	0	1	0	145
Total	32	228	3	0	14	15	35	7	8	157	27	6	4	3	7	0	546
04:00 PM	8	59	0	0	7	3	10	0	1	56	4	0	4	2	1	0	155
04:15 PM	4	59	2	1	2	3	9	0	6	41	5	0	1	0	2	0	135
04:30 PM	3	59	0	0	4	3	12	0	4	35	3	0	1	0	2	1	127
04:45 PM	6	64	0	0	4	2	5	0	3	42	2	0	4	0	0	0	132
Total	21	241	2	1	17	11	36	0	14	174	14	0	10	2	5	1	549
Grand Total	53	469	5	1	31	26	71	7	22	331	41	6	14	5	12	1	1095
Apprch %	10	88.8	0.9	0.2	23	19.3	52.6	5.2	5.5	82.8	10.2	1.5	43.8	15.6	37.5	3.1	
Total %	4.8	42.8	0.5	0.1	2.8	2.4	6.5	0.6	2	30.2	3.7	0.5	1.3	0.5	1.1	0.1	
Motorcycles	0	3	0	0	1	2	0	0	0	1	0	0	0	0	2	0	9
% Motorcycles	0	0.6	0	0	3.2	7.7	0	0	0	0.3	0	0	0	0	16.7	0	0.8
Cars & Light Goods	52	465	5	0	29	21	70	0	22	326	41	0	13	5	10	0	1059
% Cars & Light Goods	98.1	99.1	100	0	93.5	80.8	98.6	0	100	98.5	100	0	92.9	100	83.3	0	96.7
Buses	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	3
% Buses	0	0	0	0	0	0	1.4	0	0	0.6	0	0	0	0	0	0	0.3
Single-Unit Trucks	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	4
% Single-Unit Trucks	1.9	0	0	0	0	3.8	0	0	0	0.3	0	0	7.1	0	0	0	0.4
Articulated Trucks	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	0	0	0	0	1	2	0	0	0	1	0	0	0	0	0	0	4
% Bicycles on Road	0	0	0	0	3.2	7.7	0	0	0	0.3	0	0	0	0	0	0	0.4
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	1	0	0	0	7	0	0	0	6	0	0	0	1	15
% Pedestrians	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0	1	100	1.4

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File Name : Makala Blvd - Road A
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Start Date : 9/7/2022
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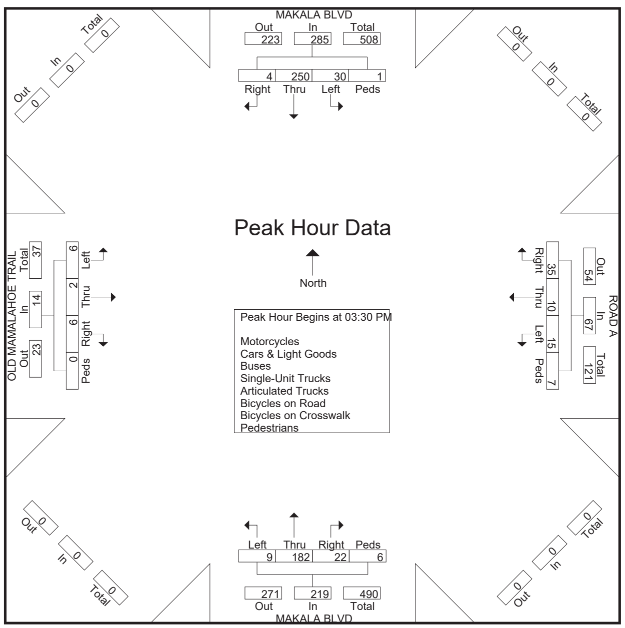
	MAKALA BLVD Southbound					ROAD A Westbound					MAKALA BLVD Northbound					OLD MAMALAHOE TRAIL Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	7	**67**	0	0	74	3	**3**	7	**4**	17	1	45	**7**	**3**	56	1	0	**2**	0	3	150
03:45 PM	**11**	65	**2**	0	**78**	3	1	9	3	16	1	40	6	3	50	0	0	1	0	1	145
04:00 PM	8	59	0	0	67	**7**	3	**10**	0	**20**	1	**56**	4	0	**61**	**4**	**2**	1	0	**7**	**155**
04:15 PM	4	59	2	**1**	66	2	3	9	0	14	**6**	41	5	0	52	1	0	2	0	3	135
Total Volume	30	250	4	1	285	15	10	35	7	67	9	182	22	6	219	6	2	6	0	14	585
% App. Total	10.5	87.7	1.4	0.4		22.4	14.9	52.2	10.4		4.1	83.1	10	2.7		42.9	14.3	42.9	0		
PHF	.682	.933	.500	.250	.913	.536	.833	.875	.438	.838	.375	.813	.786	.500	.898	.375	.250	.750	.000	.500	.944



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File Name : Makala Blvd - Road A
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	MAKALA BLVD Southbound				ROAD A Westbound				MAKALA BLVD Northbound				OLD MAMALAHOE TRAIL Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	9	48	1	1	5	1	10	3	8	61	6	0	0	1	2	0	156
11:15 AM	7	47	0	0	8	2	5	0	6	46	5	0	4	0	0	0	130
11:30 AM	6	60	0	0	4	2	12	2	3	58	11	0	5	2	1	3	169
11:45 AM	6	59	1	0	4	2	8	0	6	52	7	0	1	3	3	0	152
Total	28	214	2	1	21	7	35	5	23	217	29	0	10	6	6	3	607
12:00 PM	4	64	1	0	6	1	12	1	5	50	11	0	0	1	3	1	160
12:15 PM	5	59	5	0	2	0	8	0	7	46	8	0	2	0	4	0	146
12:30 PM	2	62	1	0	2	0	9	0	5	42	6	0	3	0	2	0	134
12:45 PM	3	81	0	0	2	0	11	0	7	53	11	0	1	1	3	4	177
Total	14	266	7	0	12	1	40	1	24	191	36	0	6	2	12	5	617
Grand Total	42	480	9	1	33	8	75	6	47	408	65	0	16	8	18	8	1224
Apprch %	7.9	90.2	1.7	0.2	27	6.6	61.5	4.9	9	78.5	12.5	0	32	16	36	16	
Total %	3.4	39.2	0.7	0.1	2.7	0.7	6.1	0.5	3.8	33.3	5.3	0	1.3	0.7	1.5	0.7	
Motorcycles	1	6	0	0	0	0	2	0	0	4	0	0	0	0	0	0	13
% Motorcycles	2.4	1.2	0	0	0	0	2.7	0	0	1	0	0	0	0	0	0	1.1
Cars & Light Goods	37	465	8	0	33	8	72	0	46	402	65	0	14	8	18	0	1176
% Cars & Light Goods	88.1	96.9	88.9	0	100	100	96	0	97.9	98.5	100	0	87.5	100	100	0	96.1
Buses	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	3
% Buses	0	0	11.1	0	0	0	1.3	0	0	0.2	0	0	0	0	0	0	0.2
Single-Unit Trucks	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
% Single-Unit Trucks	2.4	0.2	0	0	0	0	0	0	0	0	0	0	6.2	0	0	0	0.2
Articulated Trucks	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2
% Articulated Trucks	0	0	0	0	0	0	0	0	2.1	0	0	0	6.2	0	0	0	0.2
Bicycles on Road	3	8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	12
% Bicycles on Road	7.1	1.7	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.5	0.1
Pedestrians	0	0	0	1	0	0	0	6	0	0	0	0	0	0	0	7	14
% Pedestrians	0	0	0	100	0	0	0	100	0	0	0	0	0	0	0	87.5	1.1

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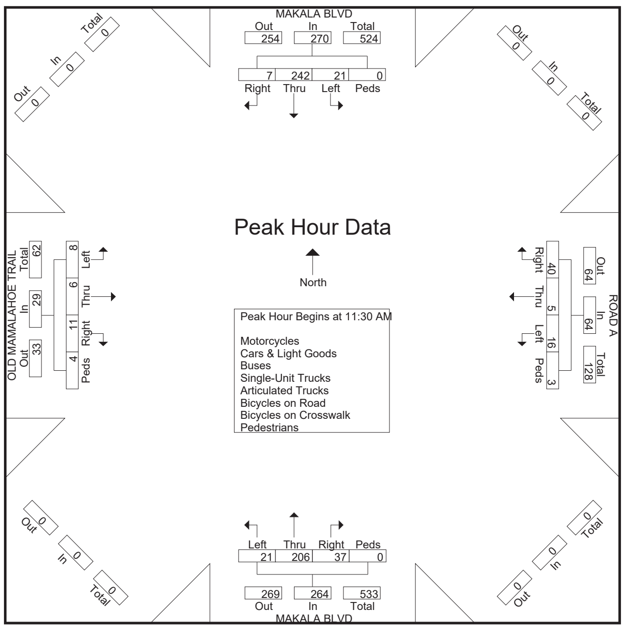
Start Date : 9/10/2022
Page No : 2

	MAKALA BLVD Southbound					ROAD A Westbound					MAKALA BLVD Northbound					OLD MAMALAHOE TRAIL Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	**6**	60	0	0	66	4	**2**	**12**	**2**	**20**	3	**58**	**11**	0	**72**	**5**	2	1	**3**	**11**	**169**
11:45 AM	6	59	1	0	66	4	2	8	0	14	6	52	7	0	65	1	**3**	3	0	7	152
12:00 PM	4	**64**	1	0	**69**	**6**	1	12	1	20	5	50	11	0	66	0	1	3	1	5	160
12:15 PM	5	59	**5**	0	69	2	0	8	0	10	**7**	46	8	0	61	2	0	**4**	0	6	146
Total Volume	21	242	7	0	270	16	5	40	3	64	21	206	37	0	264	8	6	11	4	29	627
% App. Total	7.8	89.6	2.6	0		25	7.8	62.5	4.7		8	78	14	0		27.6	20.7	37.9	13.8		
PHF	.875	.945	.350	.000	.978	.667	.625	.833	.375	.800	.750	.888	.841	.000	.917	.400	.500	.688	.333	.659	.928



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File Name : Palani Rd - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	PALANI RD Southbound				KUAKINI HWY Westbound				PALANI RD Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	19	29	42	1	12	77	45	5	33	38	6	7	12	34	21	31	412
07:45 AM	33	38	42	0	18	101	47	7	36	36	4	2	11	36	8	4	423
Total	52	67	84	1	30	178	92	12	69	74	10	9	23	70	29	35	835
08:00 AM	36	46	48	0	11	91	48	1	38	49	3	4	13	42	24	5	459
08:15 AM	40	33	41	1	17	76	53	2	39	36	6	1	14	43	20	4	426
08:30 AM	29	46	37	0	16	87	42	3	33	39	12	7	31	37	23	6	448
08:45 AM	42	47	47	0	13	103	55	2	32	25	11	1	19	45	23	4	469
Total	147	172	173	1	57	357	198	8	142	149	32	13	77	167	90	19	1802
09:00 AM	41	42	47	0	15	76	54	4	30	34	6	3	28	39	22	5	446
09:15 AM	47	50	49	0	28	75	48	6	34	33	15	2	15	55	28	6	491
Grand Total	287	331	353	2	130	686	392	30	275	290	63	27	143	331	169	65	3574
Apprch %	29.5	34	36.3	0.2	10.5	55.4	31.7	2.4	42	44.3	9.6	4.1	20.2	46.8	23.9	9.2	
Total %	8	9.3	9.9	0.1	3.6	19.2	11	0.8	7.7	8.1	1.8	0.8	4	9.3	4.7	1.8	
Motorcycles	2	3	1	0	8	12	4	0	6	5	1	0	1	6	2	0	51
% Motorcycles	0.7	0.9	0.3	0	6.2	1.7	1	0	2.2	1.7	1.6	0	0.7	1.8	1.2	0	1.4
Cars & Light Goods	280	315	343	0	114	667	383	0	264	281	60	0	134	315	155	0	3311
% Cars & Light Goods	97.6	95.2	97.2	0	87.7	97.2	97.7	0	96	96.9	95.2	0	93.7	95.2	91.7	0	92.6
Buses	2	2	0	0	1	1	2	0	0	2	0	0	0	1	0	0	11
% Buses	0.7	0.6	0	0	0.8	0.1	0.5	0	0	0.7	0	0	0	0.3	0	0	0.3
Single-Unit Trucks	2	9	9	0	4	3	3	0	1	1	1	0	7	4	7	0	51
% Single-Unit Trucks	0.7	2.7	2.5	0	3.1	0.4	0.8	0	0.4	0.3	1.6	0	4.9	1.2	4.1	0	1.4
Articulated Trucks	0	2	0	0	0	0	0	0	0	0	1	0	1	1	0	0	5
% Articulated Trucks	0	0.6	0	0	0	0	0	0	0	0	1.6	0	0.7	0.3	0	0	0.1
Bicycles on Road	1	0	0	0	3	3	0	0	4	1	0	0	0	4	5	0	21
% Bicycles on Road	0.3	0	0	0	2.3	0.4	0	0	1.5	0.3	0	0	0	1.2	3	0	0.6
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	11.1	0	0	0	0	0.1
Pedestrians	0	0	0	2	0	0	0	30	0	0	0	24	0	0	0	65	121
% Pedestrians	0	0	0	100	0	0	0	100	0	0	0	88.9	0	0	0	100	3.4

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File Name : Palani Rd - Kuakini Hwy
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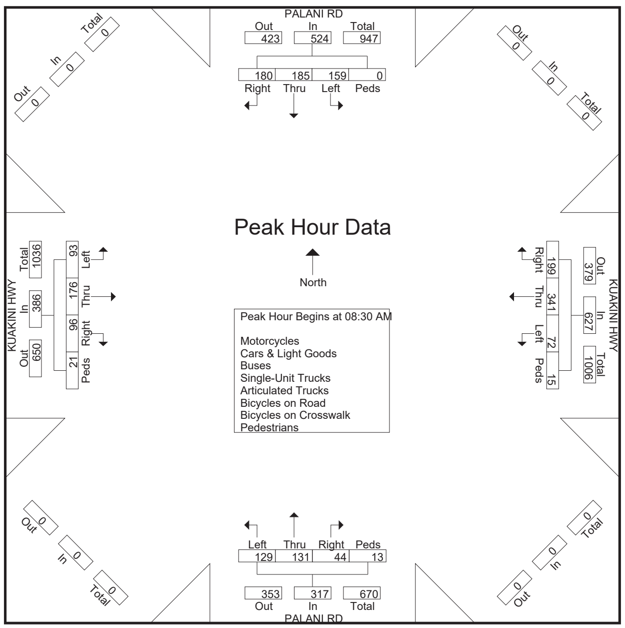
	PALANI RD Southbound					KUAKINI HWY Westbound					PALANI RD Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	29	46	37	0	112	16	87	42	3	148	33	**39**	12	**7**	**91**	**31**	37	23	**6**	97	448
08:45 AM	42	47	47	0	136	13	**103**	**55**	2	**173**	32	25	11	1	69	19	45	23	4	91	469
09:00 AM	41	42	47	0	130	15	76	54	4	149	30	34	6	3	73	28	39	22	5	94	446
09:15 AM	**47**	**50**	**49**	0	**146**	**28**	75	48	**6**	157	**34**	33	**15**	2	84	15	**55**	**28**	6	**104**	**491**
Total Volume	159	185	180	0	524	72	341	199	15	627	129	131	44	13	317	93	176	96	21	386	1854
% App. Total	30.3	35.3	34.4	0		11.5	54.4	31.7	2.4		40.7	41.3	13.9	4.1		24.1	45.6	24.9	5.4		
PHF	.846	.925	.918	.000	.897	.643	.828	.905	.625	.906	.949	.840	.733	.464	.871	.750	.800	.857	.875	.928	.944



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File Name : Palani Rd - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	PALANI RD Southbound				KUAKINI HWY Westbound				PALANI RD Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	59	50	61	1	20	94	49	1	38	42	14	3	35	73	34	8	582
03:15 PM	53	49	50	0	20	82	48	0	33	59	8	2	24	53	35	35	551
03:30 PM	67	42	59	0	16	84	48	2	32	32	9	1	11	96	32	28	559
03:45 PM	56	68	81	0	29	114	56	0	29	31	11	7	32	87	32	9	642
Total	235	209	251	1	85	374	201	3	132	164	42	13	102	309	133	80	2334
04:00 PM	64	75	55	0	19	81	52	0	37	40	9	3	36	88	37	14	610
04:15 PM	76	95	56	0	18	96	40	2	45	35	9	4	23	69	44	7	619
04:30 PM	70	73	55	0	21	80	39	0	22	29	6	3	30	88	37	5	558
04:45 PM	62	62	51	0	22	87	47	2	35	32	10	5	23	69	36	20	563
Total	272	305	217	0	80	344	178	4	139	136	34	15	112	314	154	46	2350
Grand Total	507	514	468	1	165	718	379	7	271	300	76	28	214	623	287	126	4684
Apprch %	34	34.5	31.4	0.1	13	56.6	29.9	0.6	40.1	44.4	11.3	4.1	17.1	49.8	23	10.1	
Total %	10.8	11	10	0	3.5	15.3	8.1	0.1	5.8	6.4	1.6	0.6	4.6	13.3	6.1	2.7	
Motorcycles	10	8	1	0	2	9	0	0	13	4	1	0	2	9	5	0	64
% Motorcycles	2	1.6	0.2	0	1.2	1.3	0	0	4.8	1.3	1.3	0	0.9	1.4	1.7	0	1.4
Cars & Light Goods	492	502	465	0	162	705	376	0	255	292	75	0	210	610	278	1	4423
% Cars & Light Goods	97	97.7	99.4	0	98.2	98.2	99.2	0	94.1	97.3	98.7	0	98.1	97.9	96.9	0.8	94.4
Buses	0	3	0	0	1	1	1	0	0	3	0	0	0	1	0	0	10
% Buses	0	0.6	0	0	0.6	0.1	0.3	0	0	1	0	0	0	0.2	0	0	0.2
Single-Unit Trucks	5	1	1	0	0	1	1	0	3	1	0	0	1	2	1	0	17
% Single-Unit Trucks	1	0.2	0.2	0	0	0.1	0.3	0	1.1	0.3	0	0	0.5	0.3	0.3	0	0.4
Articulated Trucks	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2
% Articulated Trucks	0	0	0.2	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0
Bicycles on Road	0	0	0	0	0	2	1	0	0	0	0	0	0	1	3	0	7
% Bicycles on Road	0	0	0	0	0	0.3	0.3	0	0	0	0	0	0	0.2	1	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1	6
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	17.9	0	0	0	0.8	0.1
Pedestrians	0	0	0	1	0	0	0	7	0	0	0	23	0	0	0	124	155
% Pedestrians	0	0	0	100	0	0	0	100	0	0	0	82.1	0	0	0	98.4	3.3

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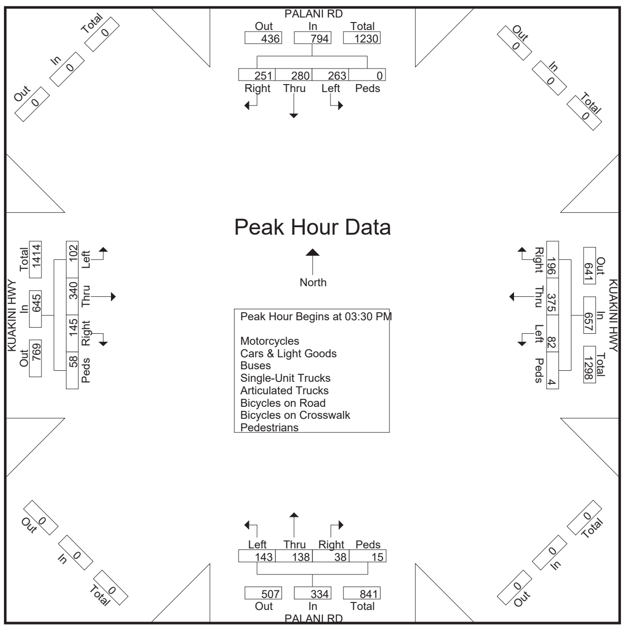
File Name : Palani Rd - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 2

	PALANI RD Southbound					KUAKINI HWY Westbound					PALANI RD Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	67	42	59	0	168	16	84	48	**2**	150	32	32	9	1	74	11	**96**	32	**28**	167	559
03:45 PM	56	68	**81**	0	205	**29**	**114**	**56**	0	**199**	29	31	**11**	**7**	78	32	87	32	9	160	**642**
04:00 PM	64	75	55	0	194	19	81	52	0	152	37	**40**	9	3	89	**36**	88	37	14	**175**	610
04:15 PM	**76**	**95**	56	0	**227**	18	96	40	2	156	**45**	35	9	4	**93**	23	69	**44**	7	143	619
Total Volume	263	280	251	0	794	82	375	196	4	657	143	138	38	15	334	102	340	145	58	645	2430
% App. Total	33.1	35.3	31.6	0		12.5	57.1	29.8	0.6		42.8	41.3	11.4	4.5		15.8	52.7	22.5	9		
PHF	.865	.737	.775	.000	.874	.707	.822	.875	.500	.825	.794	.863	.864	.536	.898	.708	.885	.824	.518	.921	.946



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File Name : Palani Rd - Kuakini Hwy
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	PALANI RD Southbound				KUAKINI HWY Westbound				PALANI RD Northbound				KUAKINI HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	52	36	66	0	31	73	43	16	27	42	8	10	34	51	25	15	529
11:15 AM	40	52	53	0	15	87	34	4	28	43	2	0	36	65	31	3	493
11:30 AM	44	50	77	0	22	63	41	5	44	41	7	12	39	63	29	16	553
11:45 AM	43	64	65	0	19	81	45	2	38	48	10	7	43	54	42	14	575
Total	179	202	261	0	87	304	163	27	137	174	27	29	152	233	127	48	2150
12:00 PM	38	45	71	0	16	83	42	2	29	33	5	6	28	67	44	0	509
12:15 PM	42	48	53	1	16	67	29	4	31	46	9	6	44	69	43	8	516
12:30 PM	47	42	55	1	13	84	36	4	31	46	4	6	36	70	49	39	563
12:45 PM	50	50	74	0	21	82	35	1	40	36	4	2	36	69	43	5	548
Total	177	185	253	2	66	316	142	11	131	161	22	20	144	275	179	52	2136
Grand Total	356	387	514	2	153	620	305	38	268	335	49	49	296	508	306	100	4286
Apprch %	28.3	30.7	40.8	0.2	13.7	55.6	27.3	3.4	38.2	47.8	7	7	24.5	42	25.3	8.3	
Total %	8.3	9	12	0	3.6	14.5	7.1	0.9	6.3	7.8	1.1	1.1	6.9	11.9	7.1	2.3	
Motorcycles	3	8	6	0	3	11	2	0	7	6	1	0	8	10	7	0	72
% Motorcycles	0.8	2.1	1.2	0	2	1.8	0.7	0	2.6	1.8	2	0	2.7	2	2.3	0	1.7
Cars & Light Goods	352	374	505	0	150	606	299	0	256	324	48	0	288	494	290	0	3986
% Cars & Light Goods	98.9	96.6	98.2	0	98	97.7	98	0	95.5	96.7	98	0	97.3	97.2	94.8	0	93
Buses	0	3	0	0	0	0	0	0	0	3	0	0	0	0	2	0	8
% Buses	0	0.8	0	0	0	0	0	0	0	0.9	0	0	0	0	0.7	0	0.2
Single-Unit Trucks	1	0	0	0	0	1	0	0	5	1	0	0	0	1	1	0	10
% Single-Unit Trucks	0.3	0	0	0	0	0.2	0	0	1.9	0.3	0	0	0	0.2	0.3	0	0.2
Articulated Trucks	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	1	3	0	0	2	4	0	0	1	0	0	0	3	6	0	20
% Bicycles on Road	0	0.3	0.6	0	0	0.3	1.3	0	0	0.3	0	0	0	0.6	2	0	0.5
Bicycles on Crosswalk	0	0	0	0	0	0	0	5	0	0	0	4	0	0	0	0	9
% Bicycles on Crosswalk	0	0	0	0	0	0	0	13.2	0	0	0	8.2	0	0	0	0	0.2
Pedestrians	0	0	0	2	0	0	0	33	0	0	0	45	0	0	0	100	180
% Pedestrians	0	0	0	100	0	0	0	86.8	0	0	0	91.8	0	0	0	100	4.2

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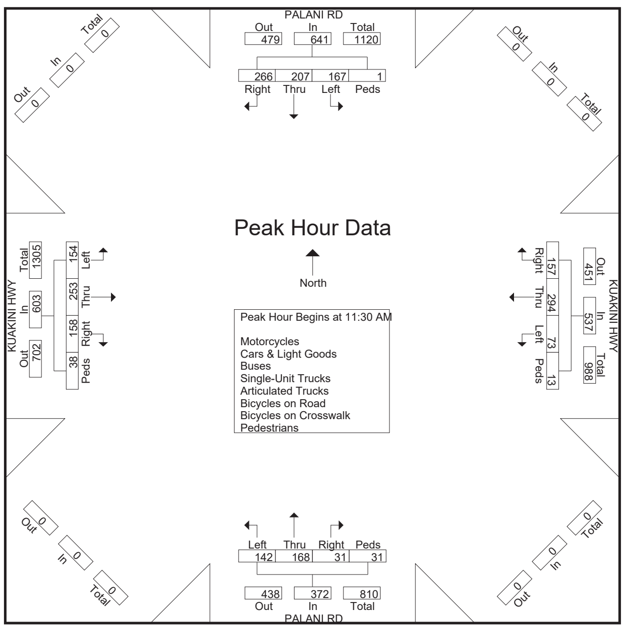
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/10/2022
Page No : 2

	PALANI RD Southbound					KUAKINI HWY Westbound					PALANI RD Northbound					KUAKINI HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	**44**	50	**77**	0	171	**22**	63	41	**5**	131	**44**	41	7	**12**	**104**	39	63	29	**16**	147	553
11:45 AM	43	**64**	65	0	**172**	19	81	**45**	2	**147**	38	**48**	**10**	7	103	43	54	42	14	153	**575**
12:00 PM	38	45	71	0	154	16	**83**	42	2	143	29	33	5	6	73	28	67	**44**	0	139	509
12:15 PM	42	48	53	**1**	144	16	67	29	4	116	31	46	9	6	92	**44**	**69**	43	8	**164**	516
Total Volume	167	207	266	1	641	73	294	157	13	537	142	168	31	31	372	154	253	158	38	603	2153
% App. Total	26.1	32.3	41.5	0.2		13.6	54.7	29.2	2.4		38.2	45.2	8.3	8.3		25.5	42	26.2	6.3		
PHF	.949	.809	.864	.250	.932	.830	.886	.872	.650	.913	.807	.875	.775	.646	.894	.875	.917	.898	.594	.919	.936



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File Name : Palani Rd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	PALANI RD Southbound				QUEEN KAAHUMANU HWY Westbound				PALANI RD Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	5	74	34	0	11	173	10	0	44	30	17	1	8	131	49	0	587
07:45 AM	5	99	45	0	19	122	7	1	62	49	14	0	16	124	51	1	615
Total	10	173	79	0	30	295	17	1	106	79	31	1	24	255	100	1	1202
08:00 AM	7	90	47	0	28	177	13	1	44	44	19	0	12	126	57	1	666
08:15 AM	4	70	21	0	29	178	3	0	64	41	20	0	24	128	66	0	648
08:30 AM	4	75	27	0	31	171	4	0	60	50	26	1	16	129	68	1	663
08:45 AM	3	50	26	0	32	202	7	0	51	48	21	1	20	152	100	0	713
Total	18	285	121	0	120	728	27	1	219	183	86	2	72	535	291	2	2690
09:00 AM	8	57	17	1	32	539	6	0	60	29	27	0	24	132	74	1	1007
09:15 AM	6	57	25	0	37	142	6	0	57	52	26	3	27	129	61	0	628
Grand Total	42	572	242	1	219	1704	56	2	442	343	170	6	147	1051	526	4	5527
Apprch %	4.9	66.7	28.2	0.1	11.1	86	2.8	0.1	46	35.7	17.7	0.6	8.5	60.8	30.4	0.2	
Total %	0.8	10.3	4.4	0	4	30.8	1	0	8	6.2	3.1	0.1	2.7	19	9.5	0.1	
Motorcycles	0	4	0	0	2	5	0	0	5	0	0	0	1	1	2	0	20
% Motorcycles	0	0.7	0	0	0.9	0.3	0	0	1.1	0	0	0	0.7	0.1	0.4	0	0.4
Cars & Light Goods	42	565	238	0	213	1662	55	0	424	336	166	0	143	1018	503	0	5365
% Cars & Light Goods	100	98.8	98.3	0	97.3	97.5	98.2	0	95.9	98	97.6	0	97.3	96.9	95.6	0	97.1
Buses	0	1	2	0	0	11	0	0	3	1	0	0	0	4	5	0	27
% Buses	0	0.2	0.8	0	0	0.6	0	0	0.7	0.3	0	0	0	0.4	1	0	0.5
Single-Unit Trucks	0	1	1	0	2	23	1	0	7	2	3	0	3	19	15	0	77
% Single-Unit Trucks	0	0.2	0.4	0	0.9	1.3	1.8	0	1.6	0.6	1.8	0	2	1.8	2.9	0	1.4
Articulated Trucks	0	0	0	0	2	2	0	0	2	2	1	0	0	6	1	0	16
% Articulated Trucks	0	0	0	0	0.9	0.1	0	0	0.5	0.6	0.6	0	0	0.6	0.2	0	0.3
Bicycles on Road	0	1	1	0	0	1	0	0	1	2	0	0	0	3	0	0	9
% Bicycles on Road	0	0.2	0.4	0	0	0.1	0	0	0.2	0.6	0	0	0	0.3	0	0	0.2
Bicycles on Crosswalk	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	3	6
% Bicycles on Crosswalk	0	0	0	100	0	0	0	0	0	0	0	33.3	0	0	0	75	0.1
Pedestrians	0	0	0	0	0	0	0	2	0	0	0	4	0	0	0	1	7
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	66.7	0	0	0	25	0.1

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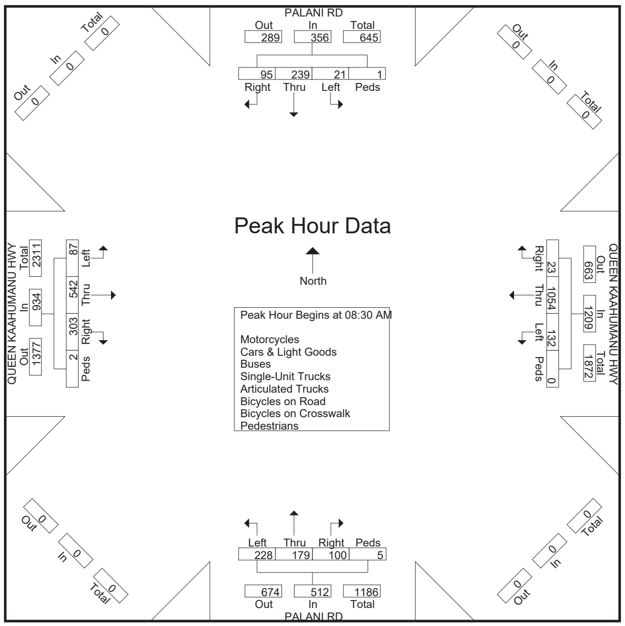
File Name : Palani Rd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/8/2022
Page No : 2

	PALANI RD Southbound					QUEEN KAAHUMANU HWY Westbound					PALANI RD Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 08:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	4	**75**	**27**	0	**106**	31	171	4	0	206	**60**	50	26	1	137	16	129	68	**1**	214	663
08:45 AM	3	50	26	0	79	32	202	**7**	0	241	51	48	21	1	121	20	**152**	**100**	0	**272**	713
09:00 AM	**8**	57	17	**1**	83	32	**539**	6	0	**577**	60	29	**27**	0	116	24	132	74	1	231	**1007**
09:15 AM	6	57	25	0	88	**37**	142	6	0	185	57	**52**	26	**3**	**138**	**27**	129	61	0	217	628
Total Volume	21	239	95	1	356	132	1054	23	0	1209	228	179	100	5	512	87	542	303	2	934	3011
% App. Total	5.9	67.1	26.7	0.3		10.9	87.2	1.9	0		44.5	35	19.5	1		9.3	58	32.4	0.2		
PHF	.656	.797	.880	.250	.840	.892	.489	.821	.000	.524	.950	.861	.926	.417	.928	.806	.891	.758	.500	.858	.748



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File Name : Palani Rd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	PALANI RD Southbound				QUEEN KAAHUMANU HWY Westbound				PALANI RD Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	5	61	32	0	36	189	4	0	62	63	32	0	57	210	100	0	851
03:15 PM	5	71	24	0	34	168	3	0	77	77	32	1	39	206	135	1	873
03:30 PM	6	76	23	0	40	163	5	1	77	52	30	1	53	211	132	0	870
03:45 PM	7	61	35	0	29	181	6	1	85	68	32	0	40	201	146	0	892
Total	23	269	114	0	139	701	18	2	301	260	126	2	189	828	513	1	3486
04:00 PM	7	73	35	0	25	146	6	1	63	66	31	0	70	246	148	0	917
04:15 PM	9	58	32	0	27	177	7	0	65	61	36	0	40	229	123	0	864
04:30 PM	14	78	31	0	44	145	7	0	63	74	34	0	67	215	128	0	900
04:45 PM	9	57	29	0	20	179	5	0	59	57	38	0	48	260	122	0	883
Total	39	266	127	0	116	647	25	1	250	258	139	0	225	950	521	0	3564
Grand Total	62	535	241	0	255	1348	43	3	551	518	265	2	414	1778	1034	1	7050
Apprch %	7.4	63.8	28.8	0	15.5	81.7	2.6	0.2	41.2	38.8	19.8	0.1	12.8	55.1	32	0	
Total %	0.9	7.6	3.4	0	3.6	19.1	0.6	0	7.8	7.3	3.8	0	5.9	25.2	14.7	0	
Motorcycles	0	3	0	0	3	6	0	0	3	4	3	0	0	5	4	0	31
% Motorcycles	0	0.6	0	0	1.2	0.4	0	0	0.5	0.8	1.1	0	0	0.3	0.4	0	0.4
Cars & Light Goods	61	517	238	0	251	1306	42	0	539	510	261	0	410	1749	1023	0	6907
% Cars & Light Goods	98.4	96.6	98.8	0	98.4	96.9	97.7	0	97.8	98.5	98.5	0	99	98.4	98.9	0	98
Buses	0	2	0	0	0	8	0	0	2	2	0	0	1	3	1	0	19
% Buses	0	0.4	0	0	0	0.6	0	0	0.4	0.4	0	0	0.2	0.2	0.1	0	0.3
Single-Unit Trucks	1	10	1	0	1	20	1	0	6	2	1	0	2	12	4	0	61
% Single-Unit Trucks	1.6	1.9	0.4	0	0.4	1.5	2.3	0	1.1	0.4	0.4	0	0.5	0.7	0.4	0	0.9
Articulated Trucks	0	1	2	0	0	7	0	0	1	0	0	0	1	7	1	0	20
% Articulated Trucks	0	0.2	0.8	0	0	0.5	0	0	0.2	0	0	0	0.2	0.4	0.1	0	0.3
Bicycles on Road	0	2	0	0	0	1	0	0	0	0	0	0	0	2	1	0	6
% Bicycles on Road	0	0.4	0	0	0	0.1	0	0	0	0	0	0	0	0.1	0.1	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	1	6
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	100	0	0	0	100	0.1

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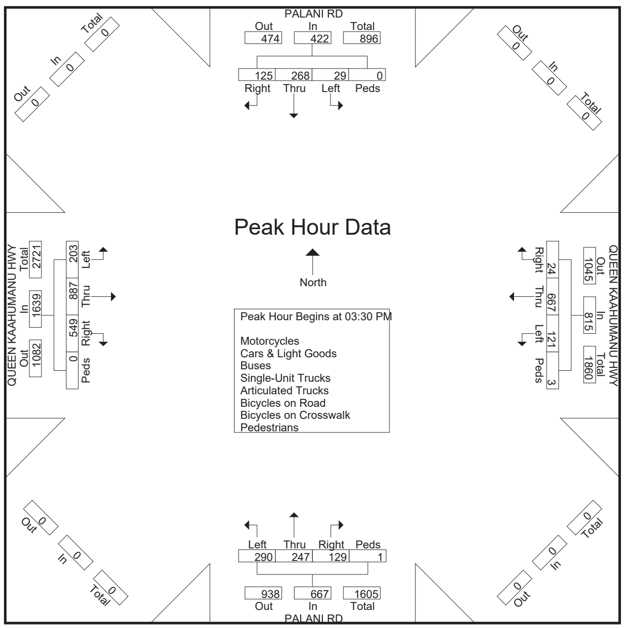
File Name : Palani Rd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/7/2022
Page No : 2

	PALANI RD Southbound					QUEEN KAAHUMANU HWY Westbound					PALANI RD Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	6	**76**	23	0	105	**40**	163	5	**1**	209	77	52	30	**1**	160	53	211	132	0	396	870
03:45 PM	7	61	**35**	0	103	29	**181**	6	1	**217**	**85**	**68**	32	0	**185**	40	201	146	0	387	892
04:00 PM	7	73	35	0	**115**	25	146	6	1	178	63	66	31	0	160	**70**	**246**	**148**	0	**464**	**917**
04:15 PM	**9**	58	32	0	99	27	177	**7**	0	211	65	61	**36**	0	162	40	229	123	0	392	864
Total Volume	29	268	125	0	422	121	667	24	3	815	290	247	129	1	667	203	887	549	0	1639	3543
% App. Total	6.9	63.5	29.6	0		14.8	81.8	2.9	0.4		43.5	37	19.3	0.1		12.4	54.1	33.5	0		
PHF	.806	.882	.893	.000	.917	.756	.921	.857	.750	.939	.853	.908	.896	.250	.901	.725	.901	.927	.000	.883	.966



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File Name : Palani Rd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	PALANI RD Southbound				QUEEN KAAHUMANU HWY Westbound				PALANI RD Northbound				QUEEN KAAHUMANU HWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	3	47	26	0	40	195	9	2	74	52	38	1	30	155	82	0	754
11:15 AM	8	79	22	0	43	182	5	0	53	45	17	1	30	118	91	0	694
11:30 AM	8	70	29	0	32	174	10	0	71	62	26	0	36	169	108	0	795
11:45 AM	5	66	35	0	42	168	5	0	72	50	38	0	47	150	88	0	766
Total	24	262	112	0	157	719	29	2	270	209	119	2	143	592	369	0	3009
12:00 PM	4	37	22	0	36	191	9	2	45	58	38	3	32	174	86	0	737
12:15 PM	2	53	22	0	34	121	5	0	71	52	37	0	29	170	111	1	708
12:30 PM	7	49	25	0	53	192	3	0	52	51	35	0	28	193	95	0	783
12:45 PM	3	53	17	0	42	184	5	0	66	49	39	1	39	163	92	0	753
Total	16	192	86	0	165	688	22	2	234	210	149	4	128	700	384	1	2981
Grand Total	40	454	198	0	322	1407	51	4	504	419	268	6	271	1292	753	1	5990
Apprch %	5.8	65.6	28.6	0	18	78.9	2.9	0.2	42.1	35	22.4	0.5	11.7	55.8	32.5	0	
Total %	0.7	7.6	3.3	0	5.4	23.5	0.9	0.1	8.4	7	4.5	0.1	4.5	21.6	12.6	0	
Motorcycles	0	10	0	0	2	10	0	0	1	4	4	0	3	5	2	0	41
% Motorcycles	0	2.2	0	0	0.6	0.7	0	0	0.2	1	1.5	0	1.1	0.4	0.3	0	0.7
Cars & Light Goods	39	441	197	0	317	1380	49	0	499	411	262	0	262	1278	744	0	5879
% Cars & Light Goods	97.5	97.1	99.5	0	98.4	98.1	96.1	0	99	98.1	97.8	0	96.7	98.9	98.8	0	98.1
Buses	0	2	0	0	1	3	0	0	1	0	1	0	2	2	2	0	14
% Buses	0	0.4	0	0	0.3	0.2	0	0	0.2	0	0.4	0	0.7	0.2	0.3	0	0.2
Single-Unit Trucks	0	1	0	0	2	12	2	0	1	3	0	0	2	7	2	0	32
% Single-Unit Trucks	0	0.2	0	0	0.6	0.9	3.9	0	0.2	0.7	0	0	0.7	0.5	0.3	0	0.5
Articulated Trucks	0	0	0	0	0	2	0	0	1	1	1	0	2	0	1	0	8
% Articulated Trucks	0	0	0	0	0	0.1	0	0	0.2	0.2	0.4	0	0.7	0	0.1	0	0.1
Bicycles on Road	1	0	1	0	0	0	0	0	1	0	0	0	0	0	2	0	5
% Bicycles on Road	2.5	0	0.5	0	0	0	0	0	0.2	0	0	0	0	0	0.3	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	25	0	0	0	16.7	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	3	0	0	0	5	0	0	0	1	9
% Pedestrians	0	0	0	0	0	0	0	75	0	0	0	83.3	0	0	0	100	0.2

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File Name : Palani Rd - Queen Kaahumanu Hwy
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 9/10/2022
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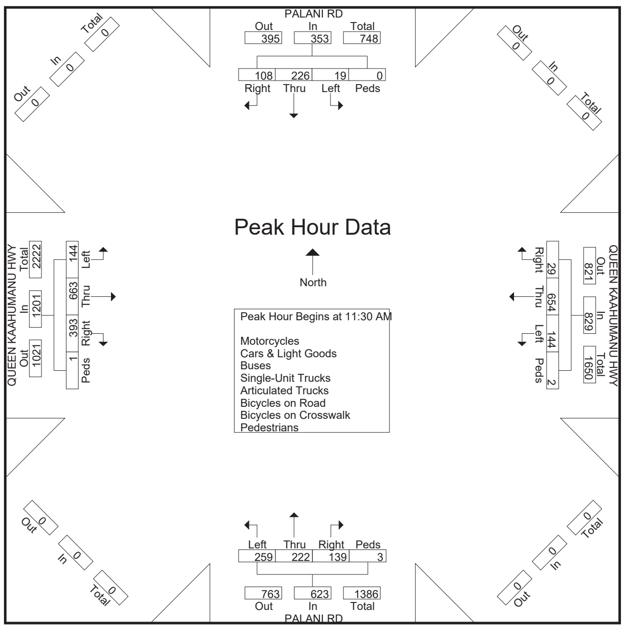
	PALANI RD Southbound					QUEEN KAAHUMANU HWY Westbound					PALANI RD Northbound					QUEEN KAAHUMANU HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	**8**	**70**	29	0	**107**	32	174	**10**	0	216	71	**62**	26	0	159	36	169	108	0	**313**	**795**
11:45 AM	5	66	**35**	0	106	**42**	168	5	0	215	**72**	50	**38**	0	**160**	**47**	150	88	0	285	766
12:00 PM	4	37	22	0	63	36	**191**	9	**2**	**238**	45	58	38	**3**	144	32	**174**	86	0	292	737
12:15 PM	2	53	22	0	77	34	121	5	0	160	71	52	37	0	160	29	170	**111**	**1**	311	708
Total Volume	19	226	108	0	353	144	654	29	2	829	259	222	139	3	623	144	663	393	1	1201	3006
% App. Total	5.4	64	30.6	0		17.4	78.9	3.5	0.2		41.6	35.6	22.3	0.5		12	55.2	32.7	0.1		
PHF	.594	.807	.771	.000	.825	.857	.856	.725	.250	.871	.899	.895	.914	.250	.973	.766	.953	.885	.250	.959	.945



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File Name : Loloku St - Maa Way
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	LOLOKU ST Southbound				MAA WAY Westbound				LOLOKU ST Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:30 AM	3	7	0	0	0	0	6	0	0	15	2	0	0	0	0	0	33
07:45 AM	5	5	0	0	0	0	8	0	0	21	1	0	0	0	0	0	40
Total	8	12	0	0	0	0	14	0	0	36	3	0	0	0	0	0	73
08:00 AM	7	19	0	0	4	0	14	0	0	22	1	0	0	0	0	0	67
08:15 AM	8	11	0	0	2	0	7	0	0	25	1	0	0	0	0	0	54
08:30 AM	10	11	0	0	2	0	17	0	0	18	2	0	0	0	0	0	60
08:45 AM	9	12	0	0	1	0	12	1	0	20	2	0	0	0	0	0	57
Total	34	53	0	0	9	0	50	1	0	85	6	0	0	0	0	0	238
09:00 AM	6	20	0	0	3	0	10	0	0	18	1	0	0	0	0	0	58
09:15 AM	7	13	0	0	1	0	12	2	0	38	1	0	0	0	0	0	74
Grand Total	55	98	0	0	13	0	86	3	0	177	11	0	0	0	0	0	443
Apprch %	35.9	64.1	0	0	12.7	0	84.3	2.9	0	94.1	5.9	0	0	0	0	0	
Total %	12.4	22.1	0	0	2.9	0	19.4	0.7	0	40	2.5	0	0	0	0	0	
Motorcycles	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3
% Motorcycles	1.8	0	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0.7
Cars & Light Goods	49	90	0	0	13	0	83	0	0	168	11	0	0	0	0	0	414
% Cars & Light Goods	89.1	91.8	0	0	100	0	96.5	0	0	94.9	100	0	0	0	0	0	93.5
Buses	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3
% Buses	0	1	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0.7
Single-Unit Trucks	2	5	0	0	0	0	3	0	0	2	0	0	0	0	0	0	12
% Single-Unit Trucks	3.6	5.1	0	0	0	0	3.5	0	0	1.1	0	0	0	0	0	0	2.7
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	3	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	8
% Bicycles on Road	5.5	2	0	0	0	0	0	0	0	1.7	0	0	0	0	0	0	1.8
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.7

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File Name : Loloku St - Maa Way
Site Code : 22-209 Makalapua Project District (MPD)
Start Date : 9/8/2022
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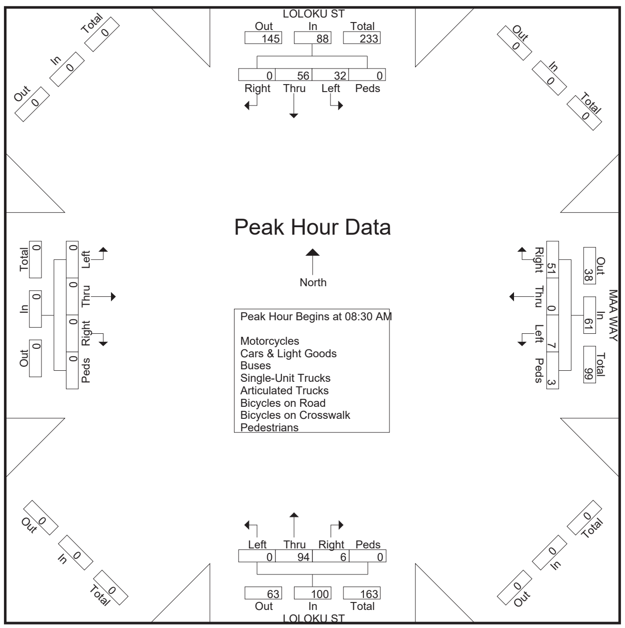
	LOLOKU ST Southbound					MAA WAY Westbound					LOLOKU ST Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:30 AM																					
08:30 AM	**10**	11	0	0	21	2	0	**17**	0	**19**	0	18	**2**	0	20	0	0	0	0	0	60
08:45 AM	9	12	0	0	21	1	0	12	1	14	0	20	2	0	22	0	0	0	0	0	57
09:00 AM	6	**20**	0	0	**26**	**3**	0	10	0	13	0	18	1	0	19	0	0	0	0	0	58
09:15 AM	7	13	0	0	20	1	0	12	**2**	15	0	**38**	1	0	**39**	0	0	0	0	0	**74**
Total Volume	32	56	0	0	88	7	0	51	3	61	0	94	6	0	100	0	0	0	0	0	249
% App. Total	36.4	63.6	0	0		11.5	0	83.6	4.9		0	94	6	0		0	0	0	0		
PHF	.800	.700	.000	.000	.846	.583	.000	.750	.375	.803	.000	.618	.750	.000	.641	.000	.000	.000	.000	.000	.841



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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	LOLOKU ST Southbound				MAA WAY Westbound				LOLOKU ST Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	7	19	0	0	1	0	20	0	0	33	3	0	0	0	0	0	83
03:15 PM	7	29	0	0	2	0	20	2	0	26	2	0	0	0	0	0	88
03:30 PM	15	22	0	0	2	0	28	0	0	26	1	0	0	0	0	0	94
03:45 PM	15	25	0	0	1	0	27	0	0	33	4	0	0	0	0	0	105
Total	44	95	0	0	6	0	95	2	0	118	10	0	0	0	0	0	370
04:00 PM	15	24	0	0	2	0	25	1	0	27	3	0	0	0	0	0	97
04:15 PM	10	16	0	0	2	0	19	0	0	39	0	0	0	0	0	0	86
04:30 PM	4	17	0	0	0	0	20	0	0	31	1	1	0	0	0	0	74
04:45 PM	9	20	0	0	0	0	14	0	0	28	5	0	0	0	0	0	76
Total	38	77	0	0	4	0	78	1	0	125	9	1	0	0	0	0	333
Grand Total	82	172	0	0	10	0	173	3	0	243	19	1	0	0	0	0	703
Apprch %	32.3	67.7	0	0	5.4	0	93	1.6	0	92.4	7.2	0.4	0	0	0	0	
Total %	11.7	24.5	0	0	1.4	0	24.6	0.4	0	34.6	2.7	0.1	0	0	0	0	
Motorcycles	1	3	0	0	0	0	3	0	0	4	3	0	0	0	0	0	14
% Motorcycles	1.2	1.7	0	0	0	0	1.7	0	0	1.6	15.8	0	0	0	0	0	2
Cars & Light Goods	77	166	0	0	10	0	166	0	0	238	16	0	0	0	0	0	673
% Cars & Light Goods	93.9	96.5	0	0	100	0	96	0	0	97.9	84.2	0	0	0	0	0	95.7
Buses	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Buses	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Single-Unit Trucks	2	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	6
% Single-Unit Trucks	2.4	0	0	0	0	0	2.3	0	0	0	0	0	0	0	0	0	0.9
Articulated Trucks	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	1	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
% Bicycles on Road	1.2	1.2	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.6
Bicycles on Crosswalk	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	66.7	0	0	0	0	0	0	0	0	0.3
Pedestrians	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
% Pedestrians	0	0	0	0	0	0	0	33.3	0	0	0	100	0	0	0	0	0.3

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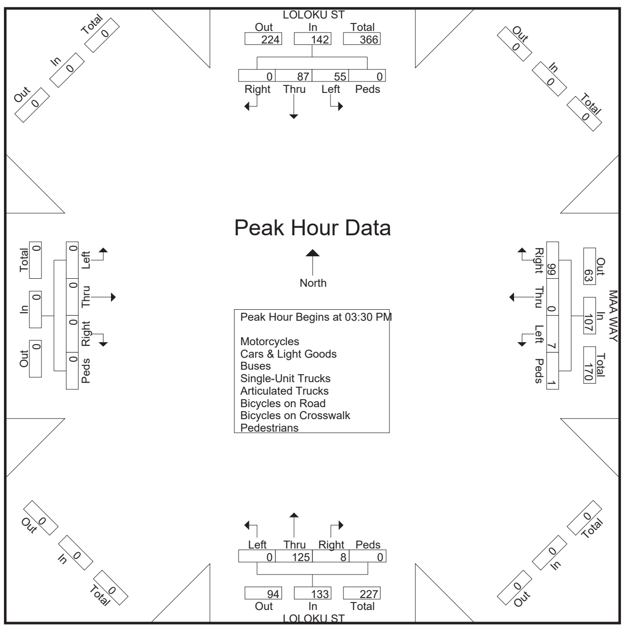
	LOLOKU ST Southbound					MAA WAY Westbound					LOLOKU ST Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**15**	22	0	0	37	**2**	0	**28**	0	**30**	0	26	1	0	27	0	0	0	0	0	94
03:45 PM	15	**25**	0	0	**40**	1	0	27	0	28	0	33	**4**	0	37	0	0	0	0	0	**105**
04:00 PM	15	24	0	0	39	2	0	25	**1**	28	0	27	3	0	30	0	0	0	0	0	97
04:15 PM	10	16	0	0	26	2	0	19	0	21	0	**39**	0	0	**39**	0	0	0	0	0	86
Total Volume	55	87	0	0	142	7	0	99	1	107	0	125	8	0	133	0	0	0	0	0	382
% App. Total	38.7	61.3	0	0		6.5	0	92.5	0.9		0	94	6	0		0	0	0	0		
PHF	.917	.870	.000	.000	.888	.875	.000	.884	.250	.892	.000	.801	.500	.000	.853	.000	.000	.000	.000	.000	.910



Austin Tsutsumi & Associates

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File Name : Loloku St - Maa Way WE
Site Code : 22-209 Makalua Project District (MPD)
Start Date : 10/15/2022
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	LOLOKU ST SOUTHBOUND				MAA WAY WESTBOUND				LOLOKU ST NORTHBOUND				EASTBOUND				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
11:00 AM	6	16	0	0	0	0	26	0	0	47	1	0	0	0	0	0	96
11:15 AM	13	19	0	0	4	0	15	1	0	25	2	2	0	0	0	0	81
11:30 AM	6	21	0	0	0	0	13	0	0	31	2	0	0	0	0	0	73
11:45 AM	10	16	0	0	1	0	21	0	0	41	5	0	0	0	0	0	94
Total	35	72	0	0	5	0	75	1	0	144	10	2	0	0	0	0	344
12:00 PM	11	28	0	0	1	0	16	0	0	34	3	0	0	0	0	0	93
12:15 PM	5	21	0	0	3	0	16	3	0	38	5	0	0	0	0	0	91
12:30 PM	10	22	0	0	2	0	21	1	0	30	1	0	0	0	0	0	87
12:45 PM	12	19	0	0	0	0	12	3	0	31	2	0	0	0	0	0	79
Total	38	90	0	0	6	0	65	7	0	133	11	0	0	0	0	0	350
Grand Total	73	162	0	0	11	0	140	8	0	277	21	2	0	0	0	0	694
Apprch %	31.1	68.9	0	0	6.9	0	88.1	5	0	92.3	7	0.7	0	0	0	0	
Total %	10.5	23.3	0	0	1.6	0	20.2	1.2	0	39.9	3	0.3	0	0	0	0	
Motorcycles	1	2	0	0	0	0	3	0	0	4	0	0	0	0	0	0	10
% Motorcycles	1.4	1.2	0	0	0	0	2.1	0	0	1.4	0	0	0	0	0	0	1.4
Cars & Light Goods	68	151	0	0	11	0	135	0	0	267	21	0	0	0	0	0	653
% Cars & Light Goods	93.2	93.2	0	0	100	0	96.4	0	0	96.4	100	0	0	0	0	0	94.1
Buses	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Buses	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Single-Unit Trucks	1	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
% Single-Unit Trucks	1.4	1.2	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.6
Articulated Trucks	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Articulated Trucks	0	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3
Bicycles on Road	3	4	0	0	0	0	2	0	0	5	0	0	0	0	0	0	14
% Bicycles on Road	4.1	2.5	0	0	0	0	1.4	0	0	1.8	0	0	0	0	0	0	2
Bicycles on Crosswalk	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
% Bicycles on Crosswalk	0	0	0	0	0	0	0	37.5	0	0	0	0	0	0	0	0	0.4
Pedestrians	0	0	0	0	0	0	0	5	0	0	0	2	0	0	0	0	7
% Pedestrians	0	0	0	0	0	0	0	62.5	0	0	0	100	0	0	0	0	1

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File Name : Loloku St - Maa Way WE
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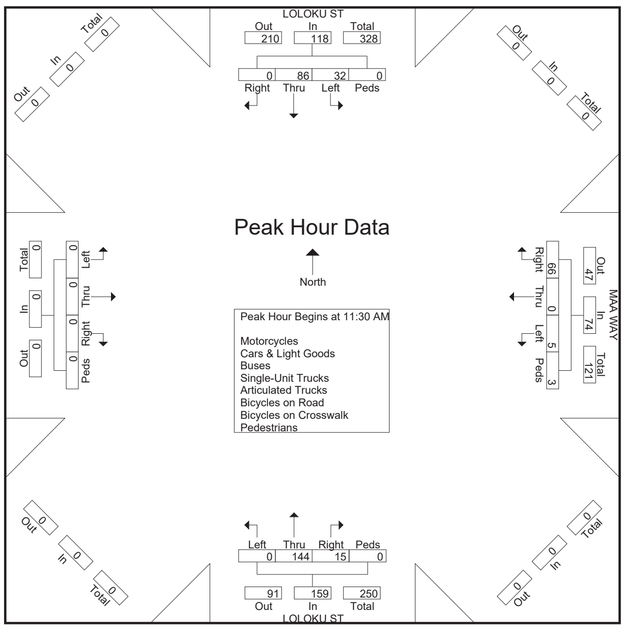
Start Date : 10/15/2022
Page No : 2

	LOLOKU ST SOUTHBOUND					MAA WAY WESTBOUND					LOLOKU ST NORTHBOUND					EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	6	21	0	0	27	0	0	13	0	13	0	31	2	0	33	0	0	0	0	0	73
11:45 AM	10	16	0	0	26	1	0	**21**	0	**22**	0	**41**	**5**	0	**46**	0	0	0	0	0	**94**
12:00 PM	**11**	**28**	0	0	**39**	1	0	16	0	17	0	34	3	0	37	0	0	0	0	0	93
12:15 PM	5	21	0	0	26	**3**	0	16	**3**	22	0	38	5	0	43	0	0	0	0	0	91
Total Volume	32	86	0	0	118	5	0	66	3	74	0	144	15	0	159	0	0	0	0	0	351
% App. Total	27.1	72.9	0	0		6.8	0	89.2	4.1		0	90.6	9.4	0		0	0	0	0		
PHF	.727	.768	.000	.000	.756	.417	.000	.786	.250	.841	.000	.878	.750	.000	.864	.000	.000	.000	.000	.000	.934



AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LOS WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	295	18	119	24	21	32	175	770	8	10	724	295
Future Volume (veh/h)	295	18	119	24	21	32	175	770	8	10	724	295
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	321	20	0	26	23	0	190	837	6	11	787	185
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	383	207		97	101		251	2494	1112	21	2278	1015
Arrive On Green	0.11	0.11	0.00	0.05	0.05	0.00	0.07	0.70	0.70	0.01	0.64	0.64
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	3554	1584
Grp Volume(v), veh/h	321	20	0	26	23	0	190	837	6	11	787	185
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1777	1584
Q Serve(g_s), s	15.0	1.6	0.0	2.3	1.9	0.0	8.9	15.2	0.2	1.0	16.8	7.8
Cycle Q Clear(g_c), s	15.0	1.6	0.0	2.3	1.9	0.0	8.9	15.2	0.2	1.0	16.8	7.8
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	383	207		97	101		251	2494	1112	21	2278	1015
V/C Ratio(X)	0.84	0.10		0.27	0.23		0.76	0.34	0.01	0.51	0.35	0.18
Avail Cap(c_a), veh/h	859	465		119	125		670	2494	1112	54	2278	1015
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.91	0.91	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	71.9	65.9	0.0	74.9	74.7	0.0	75.1	9.6	7.4	81.0	13.7	12.0
Incr Delay (d2), s/veh	4.5	0.2	0.0	1.5	1.1	0.0	4.6	0.4	0.0	17.8	0.4	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.0	0.8	0.0	1.1	1.0	0.0	4.1	5.9	0.1	0.6	6.9	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	76.4	66.1	0.0	76.4	75.8	0.0	79.7	10.0	7.4	98.9	14.1	12.4
LnGrp LOS	E	E		E	E		E	A	A	F	B	B
Approach Vol, veh/h		341			49			1033			983	
Approach Delay, s/veh		75.8			76.1			22.8			14.7	
Approach LOS		E			E			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.0	120.8		13.9	17.0	110.8		23.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	88.0		11.0	32.0	61.0		41.0
Max Q Clear Time (g_c+I1), s	3.0	17.2		4.3	10.9	18.8		17.0
Green Ext Time (p_c), s	0.0	7.0		0.1	0.6	7.1		1.3

Intersection Summary	
HCM 7th Control Delay, s/veh	28.1
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	228	179	100	21	239	95	132	1054	23	87	542	303
Future Volume (veh/h)	228	179	100	21	239	95	132	1054	23	87	542	303
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	248	195	0	23	260	0	143	1146	13	95	589	170
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	301	524		70	354		209	2246	1001	207	2244	998
Arrive On Green	0.09	0.15	0.00	0.04	0.10	0.00	0.06	0.63	0.63	0.06	0.63	0.63
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1581
Grp Volume(v), veh/h	248	195	0	23	260	0	143	1146	13	95	589	170
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1581
Q Serve(g_s), s	11.6	8.2	0.0	2.1	11.7	0.0	6.7	28.9	0.5	4.4	12.1	7.3
Cycle Q Clear(g_c), s	11.6	8.2	0.0	2.1	11.7	0.0	6.7	28.9	0.5	4.4	12.1	7.3
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	301	524		70	354		209	2246	1001	207	2244	998
V/C Ratio(X)	0.82	0.37		0.33	0.73		0.68	0.51	0.01	0.46	0.26	0.17
Avail Cap(c_a), veh/h	607	969		238	818		293	2246	1001	230	2244	998
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.92	0.92	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	74.1	63.5	0.0	77.1	72.2	0.0	76.0	16.5	11.3	75.0	13.4	12.6
Incr Delay (d2), s/veh	5.2	0.4	0.0	2.7	3.0	0.0	3.9	0.8	0.0	1.6	0.3	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.5	3.8	0.0	1.0	5.6	0.0	3.1	11.9	0.2	2.0	5.0	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	79.2	63.9	0.0	79.8	75.1	0.0	79.9	17.3	11.3	76.6	13.7	12.9
LnGrp LOS	E	E		E	E		E	B	B	E	B	B
Approach Vol, veh/h		443			283			1302			854	
Approach Delay, s/veh		72.5			75.5			24.1			20.6	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	109.3	11.5	29.3	15.0	109.2	19.4	21.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	67.0	22.0	45.0	14.0	64.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	16.4	30.9	4.1	10.2	8.7	14.1	13.6	13.7
Green Ext Time (p_c), s	0.1	10.3	0.0	1.4	0.2	5.1	0.7	1.7

Intersection Summary	
HCM 7th Control Delay, s/veh	35.5
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

5: Luhia St & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	215	18	190	224	70	2	17	189	33	16	10
Future Volume (veh/h)	10	215	18	190	224	70	2	17	189	33	16	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	234	15	207	243	54	2	18	8	36	17	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	26	603	38	280	930	203	61	64	54	103	108	0
Arrive On Green	0.01	0.18	0.18	0.16	0.32	0.32	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3390	216	1781	2899	632	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	11	122	127	207	147	150	2	18	8	36	17	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1829	1781	1777	1754	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.2	2.1	2.1	3.9	2.1	2.2	0.0	0.3	0.2	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.2	2.1	2.1	3.9	2.1	2.2	0.0	0.3	0.2	0.7	0.3	0.0
Prop In Lane	1.00		0.12	1.00		0.36	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	26	316	326	280	570	563	61	64	54	103	108	0
V/C Ratio(X)	0.43	0.39	0.39	0.74	0.26	0.27	0.03	0.28	0.15	0.35	0.16	0.00
Avail Cap(c_a), veh/h	459	2801	2883	970	3310	3268	970	1018	863	1634	1715	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.1	12.7	12.7	14.0	8.8	8.8	16.3	16.4	16.4	15.8	15.6	0.0
Incr Delay (d2), s/veh	10.7	0.8	0.8	3.8	0.2	0.3	0.2	2.4	1.2	2.0	0.7	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.8	0.8	1.6	0.7	0.7	0.0	0.2	0.1	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	27.8	13.4	13.4	17.8	9.0	9.1	16.5	18.8	17.6	17.9	16.3	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		260			504			28			53	
Approach Delay, s/veh		14.0			12.6			18.3			17.4	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.5	11.2		7.0	5.5	16.2		6.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	5.9	4.1		2.7	2.2	4.2		2.3
Green Ext Time (p_c), s	0.5	1.6		0.1	0.0	2.0		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.6
HCM 7th LOS	B

6: Midblock Driveway & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	92	10	100	117	30	15	16	120	34	15	7
Future Volume (veh/h)	18	92	10	100	117	30	15	16	120	34	15	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	100	4	109	127	17	16	17	2	37	16	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	45	604	24	173	773	102	74	78	66	113	111	7
Arrive On Green	0.03	0.17	0.17	0.10	0.24	0.24	0.04	0.04	0.04	0.06	0.06	0.06
Sat Flow, veh/h	1781	3482	138	1781	3156	415	1781	1870	1585	1781	1742	109
Grp Volume(v), veh/h	20	51	53	109	71	73	16	17	2	37	0	17
Grp Sat Flow(s),veh/h/ln	1781	1777	1844	1781	1777	1795	1781	1870	1585	1781	0	1851
Q Serve(g_s), s	0.4	0.8	0.8	1.9	1.0	1.0	0.3	0.3	0.0	0.6	0.0	0.3
Cycle Q Clear(g_c), s	0.4	0.8	0.8	1.9	1.0	1.0	0.3	0.3	0.0	0.6	0.0	0.3
Prop In Lane	1.00		0.08	1.00		0.23	1.00		1.00	1.00		0.06
Lane Grp Cap(c), veh/h	45	308	320	173	435	440	74	78	66	113	0	118
V/C Ratio(X)	0.44	0.16	0.17	0.63	0.16	0.17	0.22	0.22	0.03	0.33	0.00	0.14
Avail Cap(c_a), veh/h	556	1691	1755	945	2079	2100	1751	1839	1558	1751	0	1819
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.4	11.3	11.3	13.9	9.5	9.5	14.8	14.8	14.7	14.3	0.0	14.2
Incr Delay (d2), s/veh	6.6	0.2	0.2	3.8	0.2	0.2	1.4	1.4	0.2	1.7	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.3	0.3	0.8	0.3	0.3	0.1	0.1	0.0	0.3	0.0	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.0	11.5	11.5	17.7	9.7	9.7	16.3	16.2	14.9	16.0	0.0	14.7
LnGrp LOS	C	B	B	B	A	A	B	B	B	B		B
Approach Vol, veh/h		124			253			35			54	
Approach Delay, s/veh		13.2			13.1			16.2			15.6	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	10.6		7.0	5.8	12.9		6.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	3.9	2.8		2.6	2.4	3.0		2.3
Green Ext Time (p_c), s	0.2	0.5		0.1	0.0	0.9		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.7
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	99	18	16	120	2	3	4	23	1	4	4
Future Volume (veh/h)	12	99	18	16	120	2	3	4	23	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	13	108	10	17	130	1	3	4	1	1	4	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	31	647	59	40	729	6	27	28	24	15	12	3
Arrive On Green	0.02	0.20	0.20	0.02	0.20	0.20	0.01	0.01	0.01	0.01	0.01	0.01
Sat Flow, veh/h	1781	3291	301	1781	3614	28	1781	1870	1583	1781	1444	361
Grp Volume(v), veh/h	13	58	60	17	64	67	3	4	1	1	0	5
Grp Sat Flow(s),veh/h/ln	1781	1777	1815	1781	1777	1865	1781	1870	1583	1781	0	1805
Q Serve(g_s), s	0.2	0.7	0.7	0.2	0.8	0.8	0.0	0.1	0.0	0.0	0.0	0.1
Cycle Q Clear(g_c), s	0.2	0.7	0.7	0.2	0.8	0.8	0.0	0.1	0.0	0.0	0.0	0.1
Prop In Lane	1.00		0.17	1.00		0.01	1.00		1.00	1.00		0.20
Lane Grp Cap(c), veh/h	31	349	357	40	358	376	27	28	24	15	0	15
V/C Ratio(X)	0.42	0.17	0.17	0.43	0.18	0.18	0.11	0.14	0.04	0.07	0.00	0.34
Avail Cap(c_a), veh/h	338	1684	1720	338	1684	1767	2025	2127	1799	2025	0	2053
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.8	8.8	8.8	12.7	8.7	8.7	12.8	12.8	12.8	13.0	0.0	13.0
Incr Delay (d2), s/veh	9.0	0.2	0.2	7.2	0.2	0.2	1.8	2.3	0.7	2.0	0.0	13.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	21.8	9.0	9.0	19.9	9.0	8.9	14.7	15.1	13.5	15.0	0.0	26.0
LnGrp LOS	C	A	A	B	A	A	B	B	B	B		C
Approach Vol, veh/h		131			148			8			6	
Approach Delay, s/veh		10.3			10.2			14.7			24.2	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.6	10.2		5.2	5.5	10.3		5.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	2.2	2.7		2.1	2.2	2.8		2.1
Green Ext Time (p_c), s	0.0	0.6		0.0	0.0	0.7		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	10.7
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	3.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	94	6	32	56	7	51
Future Vol, veh/h	94	6	32	56	7	51
Conflicting Peds, #/hr	0	3	3	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	102	7	35	61	8	55

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	112	0	239	108
Stage 1	-	-	-	-	108	-
Stage 2	-	-	-	-	130	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1478	-	749	945
Stage 1	-	-	-	-	916	-
Stage 2	-	-	-	-	896	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1474	-	729	943
Mov Cap-2 Maneuver	-	-	-	-	729	-
Stage 1	-	-	-	-	913	-
Stage 2	-	-	-	-	874	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.73	9.17
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	729	943	-	-	1474	-
HCM Lane V/C Ratio	0.01	0.059	-	-	0.024	-
HCM Control Delay (s/veh)	10	9.1	-	-	7.5	0
HCM Lane LOS	A	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	281	100	80	157	5	37	0	52	4	0	0
Future Vol, veh/h	2	281	100	80	157	5	37	0	52	4	0	0
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	305	109	87	171	5	40	0	57	4	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	178	0	0	417	0	0	713	719	363	659	771	176
Stage 1	-	-	-	-	-	-	367	367	-	349	349	-
Stage 2	-	-	-	-	-	-	346	352	-	310	421	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1398	-	-	1142	-	-	347	354	682	377	331	867
Stage 1	-	-	-	-	-	-	652	622	-	667	633	-
Stage 2	-	-	-	-	-	-	670	632	-	700	589	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1395	-	-	1139	-	-	319	325	680	318	304	864
Mov Cap-2 Maneuver	-	-	-	-	-	-	319	325	-	318	304	-
Stage 1	-	-	-	-	-	-	650	619	-	665	584	-
Stage 2	-	-	-	-	-	-	618	582	-	641	586	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.04	2.78	14.84	16.47
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	462	1395	-	-	1139	-	-	318
HCM Lane V/C Ratio	0.209	0.002	-	-	0.076	-	-	0.014
HCM Control Delay (s/veh)	14.8	7.6	-	-	8.4	-	-	16.5
HCM Lane LOS	B	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.8	0	-	-	0.2	-	-	0

Intersection	
Intersection Delay, s/veh	8
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	96	32	51	103	18	47
Future Vol, veh/h	96	32	51	103	18	47
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	104	35	55	112	20	51
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	8.4	7.8	7.9
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	75%	28%
Vol Thru, %	33%	0%	72%
Vol Right, %	67%	25%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	154	128	65
LT Vol	0	96	18
Through Vol	51	0	47
RT Vol	103	32	0
Lane Flow Rate	167	139	71
Geometry Grp	1	1	1
Degree of Util (X)	0.183	0.172	0.088
Departure Headway (Hd)	3.94	4.452	4.482
Convergence, Y/N	Yes	Yes	Yes
Cap	914	811	802
Service Time	1.95	2.452	2.495
HCM Lane V/C Ratio	0.183	0.171	0.089
HCM Control Delay, s/veh	7.8	8.4	7.9
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.7	0.6	0.3

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	46	2	169	89	4	145
Future Vol, veh/h	46	2	169	89	4	145
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	50	2	184	97	4	158

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	400	233	0	0	281	0
Stage 1	233	-	-	-	-	-
Stage 2	167	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	606	806	-	-	1281	-
Stage 1	806	-	-	-	-	-
Stage 2	862	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	602	805	-	-	1280	-
Mov Cap-2 Maneuver	602	-	-	-	-	-
Stage 1	805	-	-	-	-	-
Stage 2	858	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	11.47	0	0.21
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	608	1280	-
HCM Lane V/C Ratio	-	-	0.086	0.003	-
HCM Control Delay (s/veh)	-	-	11.5	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Intersection Delay, s/veh	12.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	33	28	159	21	15	41	225	296	0	162	26
Future Vol, veh/h	11	33	28	159	21	15	41	225	296	0	162	26
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	36	30	173	23	16	45	245	322	0	176	28
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	10	12.4	12.6	11.3
HCM LOS	A	B	B	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	15%	0%	15%	82%	0%
Vol Thru, %	85%	0%	46%	11%	86%
Vol Right, %	0%	100%	39%	8%	14%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	266	296	72	195	188
LT Vol	41	0	11	159	0
Through Vol	225	0	33	21	162
RT Vol	0	296	28	15	26
Lane Flow Rate	289	322	78	212	204
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.465	0.447	0.131	0.356	0.318
Departure Headway (Hd)	5.792	5.006	6.046	6.043	5.602
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	622	717	592	596	642
Service Time	3.528	2.741	4.099	4.085	3.644
HCM Lane V/C Ratio	0.465	0.449	0.132	0.356	0.318
HCM Control Delay, s/veh	13.5	11.8	10	12.4	11.3
HCM Lane LOS	B	B	A	B	B
HCM 95th-tile Q	2.5	2.3	0.4	1.6	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	129	131	44	159	185	180	72	341	199	93	176	96
Future Volume (veh/h)	129	131	44	159	185	180	72	341	199	93	176	96
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.98		0.94	0.97		0.94	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	140	142	35	173	201	19	78	371	0	101	191	91
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	253	228	56	265	299	238	557	908		498	585	279
Arrive On Green	0.08	0.18	0.18	0.08	0.18	0.18	0.04	0.54	0.00	0.04	0.55	0.55
Sat Flow, veh/h	1603	1286	317	1603	1683	1342	1603	1683	1427	1603	1073	511
Grp Volume(v), veh/h	140	0	177	173	201	19	78	371	0	101	0	282
Grp Sat Flow(s),veh/h/ln	1603	0	1603	1603	1683	1342	1603	1683	1427	1603	0	1584
Q Serve(g_s), s	8.9	0.0	12.8	10.0	13.9	1.5	2.7	16.3	0.0	3.5	0.0	12.3
Cycle Q Clear(g_c), s	8.9	0.0	12.8	10.0	13.9	1.5	2.7	16.3	0.0	3.5	0.0	12.3
Prop In Lane	1.00		0.20	1.00		1.00	1.00		1.00	1.00		0.32
Lane Grp Cap(c), veh/h	253	0	284	265	299	238	557	908		498	0	864
V/C Ratio(X)	0.55	0.00	0.62	0.65	0.67	0.08	0.14	0.41		0.20	0.00	0.33
Avail Cap(c_a), veh/h	253	0	449	265	471	376	625	908		557	0	864
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.83	0.83	0.83	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	38.7	0.0	47.5	40.7	48.0	42.9	12.4	17.0	0.0	12.8	0.0	15.7
Incr Delay (d2), s/veh	2.6	0.0	2.2	4.7	2.2	0.1	0.1	1.4	0.0	0.2	0.0	1.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	5.3	1.1	6.1	0.5	1.0	6.7	0.0	1.3	0.0	4.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	41.3	0.0	49.8	45.4	50.2	43.0	12.5	18.4	0.0	13.0	0.0	16.7
LnGrp LOS	D		D	D	D	D	B	B		B		B
Approach Vol, veh/h		317			393			449			383	
Approach Delay, s/veh		46.0			47.8			17.4			15.7	
Approach LOS		D			D			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.4	72.4	15.0	27.2	9.7	73.2	15.0	27.2
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	10.0	35.0	10.0	50.0	10.0	35.0
Max Q Clear Time (g_c+I1), s	5.5	18.3	12.0	14.8	4.7	14.3	10.9	15.9
Green Ext Time (p_c), s	0.1	2.6	0.0	1.0	0.1	2.0	0.0	1.1

Intersection Summary	
HCM 7th Control Delay, s/veh	30.6
HCM 7th LOS	C

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	460	43	274	26	45	41	252	726	7	14	1167	383
Future Volume (veh/h)	460	43	274	26	45	41	252	726	7	14	1167	383
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	500	47	0	28	49	0	274	789	5	15	1268	191
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	578	313		105	110		329	2265	1010	27	1981	884
Arrive On Green	0.17	0.17	0.00	0.06	0.06	0.00	0.10	0.64	0.64	0.02	0.56	0.56
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	3554	1585
Grp Volume(v), veh/h	500	47	0	28	49	0	274	789	5	15	1268	191
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1777	1585
Q Serve(g_s), s	23.2	3.5	0.0	2.5	4.2	0.0	12.9	17.1	0.2	1.4	40.5	10.0
Cycle Q Clear(g_c), s	23.2	3.5	0.0	2.5	4.2	0.0	12.9	17.1	0.2	1.4	40.5	10.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	578	313		105	110		329	2265	1010	27	1981	884
V/C Ratio(X)	0.86	0.15		0.27	0.45		0.83	0.35	0.00	0.56	0.64	0.22
Avail Cap(c_a), veh/h	922	499		119	125		670	2265	1010	54	1981	884
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.76	0.76	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	66.9	58.7	0.0	74.2	75.0	0.0	73.4	13.9	10.9	80.7	25.1	18.4
Incr Delay (d2), s/veh	4.0	0.2	0.0	1.3	2.8	0.0	5.5	0.4	0.0	16.9	1.6	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.7	1.7	0.0	1.2	2.1	0.0	6.0	7.0	0.1	0.8	17.4	3.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	70.9	58.8	0.0	75.6	77.9	0.0	78.9	14.4	10.9	97.6	26.7	18.9
LnGrp LOS	E	E		E	E		E	B	B	F	C	B
Approach Vol, veh/h		547			77			1068			1474	
Approach Delay, s/veh		69.8			77.0			30.9			26.4	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.5	110.2		14.7	20.7	97.0		32.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	85.0		11.0	32.0	58.0		44.0
Max Q Clear Time (g_c+I1), s	3.4	19.1		6.2	14.9	42.5		25.2
Green Ext Time (p_c), s	0.0	6.5		0.1	0.8	8.6		2.1

Intersection Summary	
HCM 7th Control Delay, s/veh	36.7
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
Makalapua Project District TIAR

4: Queen Kaahumanu Hwy & Palani Rd
10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	290	247	129	29	268	125	121	667	24	203	887	549
Future Volume (veh/h)	290	247	129	29	268	125	121	667	24	203	887	549
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	315	268	0	32	291	0	132	725	12	221	964	364
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	370	610		83	396		209	1959	874	377	2132	950
Arrive On Green	0.11	0.17	0.00	0.05	0.11	0.00	0.06	0.55	0.55	0.11	0.60	0.60
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	315	268	0	32	291	0	132	725	12	221	964	364
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	14.8	11.1	0.0	2.9	13.1	0.0	6.2	19.0	0.6	10.0	24.6	19.7
Cycle Q Clear(g_c), s	14.8	11.1	0.0	2.9	13.1	0.0	6.2	19.0	0.6	10.0	24.6	19.7
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	370	610		83	396		209	1959	874	377	2132	950
V/C Ratio(X)	0.85	0.44		0.39	0.74		0.63	0.37	0.01	0.59	0.45	0.38
Avail Cap(c_a), veh/h	607	969		238	818		335	1959	874	440	2132	950
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.89	0.89	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	72.4	61.2	0.0	76.4	71.0	0.0	75.7	20.9	16.7	70.0	18.1	17.1
Incr Delay (d2), s/veh	5.6	0.4	0.0	2.9	2.7	0.0	3.1	0.5	0.0	1.5	0.7	1.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.9	5.2	0.0	1.4	6.2	0.0	2.8	8.1	0.2	4.5	10.3	7.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	78.0	61.6	0.0	79.3	73.6	0.0	78.9	21.4	16.8	71.4	18.8	18.3
LnGrp LOS	E	E		E	E		E	C	B	E	B	B
Approach Vol, veh/h		583			323			869			1549	
Approach Delay, s/veh		70.5			74.2			30.1			26.2	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	96.0	12.7	33.3	15.0	104.0	22.7	23.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	57.0	22.0	45.0	16.0	62.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	12.0	21.0	4.9	13.1	8.2	26.6	16.8	15.1
Green Ext Time (p_c), s	0.5	5.6	0.0	1.9	0.2	10.0	0.9	1.9

Intersection Summary	
HCM 7th Control Delay, s/veh	39.6
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
Makalapua Project District TIAR

5: Luhia St & Makala Blvd
10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	383	24	199	327	153	10	12	276	129	22	22
Future Volume (veh/h)	18	383	24	199	327	153	10	12	276	129	22	22
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	416	22	216	355	125	11	13	8	140	24	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	44	780	41	285	938	325	66	69	58	206	197	16
Arrive On Green	0.02	0.23	0.23	0.16	0.36	0.36	0.04	0.04	0.04	0.12	0.12	0.12
Sat Flow, veh/h	1781	3433	181	1781	2587	897	1781	1870	1585	1781	1703	142
Grp Volume(v), veh/h	20	215	223	216	242	238	11	13	8	140	0	26
Grp Sat Flow(s),veh/h/ln	1781	1777	1837	1781	1777	1707	1781	1870	1585	1781	0	1845
Q Serve(g_s), s	0.5	4.6	4.6	5.0	4.4	4.5	0.3	0.3	0.2	3.3	0.0	0.5
Cycle Q Clear(g_c), s	0.5	4.6	4.6	5.0	4.4	4.5	0.3	0.3	0.2	3.3	0.0	0.5
Prop In Lane	1.00		0.10	1.00		0.53	1.00		1.00	1.00		0.08
Lane Grp Cap(c), veh/h	44	403	417	285	644	619	66	69	58	206	0	213
V/C Ratio(X)	0.45	0.53	0.54	0.76	0.38	0.38	0.17	0.19	0.14	0.68	0.00	0.12
Avail Cap(c_a), veh/h	369	2249	2326	779	2658	2555	779	818	693	1312	0	1359
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.9	14.8	14.8	17.4	10.2	10.3	20.3	20.3	20.3	18.4	0.0	17.2
Incr Delay (d2), s/veh	7.2	1.1	1.1	4.1	0.4	0.4	1.2	1.3	1.1	3.9	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.7	1.8	2.2	1.5	1.5	0.1	0.1	0.1	1.4	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.1	15.9	15.8	21.5	10.6	10.6	21.5	21.6	21.3	22.4	0.0	17.5
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		B
Approach Vol, veh/h		458			696			32			166	
Approach Delay, s/veh		16.4			14.0			21.5			21.6	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.0	14.9		10.0	6.1	20.8		6.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	17.0	6.6		5.3	2.5	6.5		2.3
Green Ext Time (p_c), s	0.5	3.1		0.5	0.0	3.5		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	15.9
HCM 7th LOS	B

6: Midblock Driveway & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	148	16	118	207	33	16	28	207	75	35	52
Future Volume (veh/h)	60	148	16	118	207	33	16	28	207	75	35	52
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	65	161	10	128	225	25	17	30	17	82	38	5
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	118	486	30	179	571	63	117	123	104	238	216	28
Arrive On Green	0.07	0.14	0.14	0.10	0.18	0.18	0.07	0.07	0.07	0.13	0.13	0.13
Sat Flow, veh/h	1781	3400	210	1781	3227	355	1781	1870	1585	1781	1615	212
Grp Volume(v), veh/h	65	84	87	128	123	127	17	30	17	82	0	43
Grp Sat Flow(s),veh/h/ln	1781	1777	1833	1781	1777	1805	1781	1870	1585	1781	0	1827
Q Serve(g_s), s	1.3	1.5	1.5	2.5	2.2	2.2	0.3	0.5	0.4	1.5	0.0	0.7
Cycle Q Clear(g_c), s	1.3	1.5	1.5	2.5	2.2	2.2	0.3	0.5	0.4	1.5	0.0	0.7
Prop In Lane	1.00		0.11	1.00		0.20	1.00		1.00	1.00		0.12
Lane Grp Cap(c), veh/h	118	254	262	179	314	319	117	123	104	238	0	244
V/C Ratio(X)	0.55	0.33	0.33	0.72	0.39	0.40	0.15	0.24	0.16	0.34	0.00	0.18
Avail Cap(c_a), veh/h	497	1511	1558	844	1857	1887	1564	1642	1392	1564	0	1604
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.2	13.8	13.8	15.6	13.1	13.1	15.8	15.9	15.8	14.1	0.0	13.8
Incr Delay (d2), s/veh	3.9	0.7	0.7	5.2	0.8	0.8	0.6	1.0	0.7	0.9	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.6	0.6	1.1	0.8	0.8	0.1	0.2	0.1	0.5	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	20.2	14.6	14.6	20.9	13.8	13.9	16.4	16.9	16.6	15.0	0.0	14.1
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		236			378			64			125	
Approach Delay, s/veh		16.1			16.2			16.7			14.7	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.6	10.1		9.8	7.4	11.3		7.4				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5				
Max Q Clear Time (g_c+I1), s	4.5	3.5		3.5	3.3	4.2		2.5				
Green Ext Time (p_c), s	0.2	1.0		0.4	0.1	1.6		0.2				
Intersection Summary												
HCM 7th Control Delay, s/veh			16.0									
HCM 7th LOS			B									

7: Road A & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	182	22	30	250	4	15	10	35	6	2	6
Future Volume (veh/h)	9	182	22	30	250	4	15	10	35	6	2	6
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	10	198	17	33	272	3	16	11	1	7	2	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	24	627	53	72	779	9	69	73	62	70	34	34
Arrive On Green	0.01	0.19	0.19	0.04	0.22	0.22	0.04	0.04	0.04	0.04	0.04	0.04
Sat Flow, veh/h	1781	3309	281	1781	3600	40	1781	1870	1582	1781	853	853
Grp Volume(v), veh/h	10	105	110	33	134	141	16	11	1	7	0	4
Grp Sat Flow(s),veh/h/ln	1781	1777	1813	1781	1777	1863	1781	1870	1582	1781	0	1706
Q Serve(g_s), s	0.2	1.5	1.5	0.5	1.8	1.9	0.3	0.2	0.0	0.1	0.0	0.1
Cycle Q Clear(g_c), s	0.2	1.5	1.5	0.5	1.8	1.9	0.3	0.2	0.0	0.1	0.0	0.1
Prop In Lane	1.00		0.16	1.00		0.02	1.00		1.00	1.00		0.50
Lane Grp Cap(c), veh/h	24	337	344	72	385	403	69	73	62	70	0	67
V/C Ratio(X)	0.42	0.31	0.32	0.46	0.35	0.35	0.23	0.15	0.02	0.10	0.00	0.06
Avail Cap(c_a), veh/h	308	1536	1568	308	1536	1611	1848	1941	1642	1848	0	1771
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.2	10.1	10.1	13.6	9.6	9.6	13.5	13.4	13.4	13.4	0.0	13.4
Incr Delay (d2), s/veh	11.4	0.5	0.5	4.5	0.5	0.5	1.7	0.9	0.1	0.6	0.0	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.5	0.5	0.3	0.6	0.6	0.1	0.1	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	25.5	10.6	10.6	18.1	10.1	10.1	15.1	14.4	13.5	14.0	0.0	13.7
LnGrp LOS	C	B	B	B	B	B	B	B	B	B		B
Approach Vol, veh/h		225			308			28			11	
Approach Delay, s/veh		11.3			11.0			14.8			13.9	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.2	10.5		6.1	5.4	11.3		6.1				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0				
Max Q Clear Time (g_c+I1), s	2.5	3.5		2.1	2.2	3.9		2.3				
Green Ext Time (p_c), s	0.0	1.2		0.0	0.0	1.6		0.1				
Intersection Summary												
HCM 7th Control Delay, s/veh			11.3									
HCM 7th LOS			B									

Intersection	
Int Delay, s/veh	3.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	125	8	55	87	7	99
Future Vol, veh/h	125	8	55	87	7	99
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	136	9	60	95	8	108

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	146	0	355	141
Stage 1	-	-	-	-	141	-
Stage 2	-	-	-	-	214	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1437	-	643	907
Stage 1	-	-	-	-	886	-
Stage 2	-	-	-	-	822	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1435	-	614	906
Mov Cap-2 Maneuver	-	-	-	-	614	-
Stage 1	-	-	-	-	885	-
Stage 2	-	-	-	-	785	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.95	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	614	906	-	-	1435	-
HCM Lane V/C Ratio	0.012	0.119	-	-	0.042	-
HCM Control Delay (s/veh)	10.9	9.5	-	-	7.6	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.4	-	-	0.1	-

Intersection	
Int Delay, s/veh	7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	354	105	94	242	1	87	0	104	4	1	7
Future Vol, veh/h	4	354	105	94	242	1	87	0	104	4	1	7
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	385	114	102	263	1	95	0	113	4	1	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	270	0	0	502	0	0	925	928	446	868	985	274
Stage 1	-	-	-	-	-	-	454	454	-	474	474	-
Stage 2	-	-	-	-	-	-	472	474	-	394	511	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1293	-	-	1062	-	-	249	268	612	273	248	765
Stage 1	-	-	-	-	-	-	586	570	-	571	558	-
Stage 2	-	-	-	-	-	-	573	558	-	631	537	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1286	-	-	1059	-	-	220	239	610	199	222	758
Mov Cap-2 Maneuver	-	-	-	-	-	-	220	239	-	199	222	-
Stage 1	-	-	-	-	-	-	582	566	-	566	501	-
Stage 2	-	-	-	-	-	-	509	501	-	512	534	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.07	2.44	31.34	15.55
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	337	1286	-	-	1059	-	-	354
HCM Lane V/C Ratio	0.616	0.003	-	-	0.096	-	-	0.037
HCM Control Delay (s/veh)	31.3	7.8	-	-	8.8	-	-	15.6
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	3.9	0	-	-	0.3	-	-	0.1

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	211	59	59	177	35	61
Future Vol, veh/h	211	59	59	177	35	61
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	229	64	64	192	38	66
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	10.9	9.4	9
HCM LOS	B	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	78%	36%
Vol Thru, %	25%	0%	64%
Vol Right, %	75%	22%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	236	270	96
LT Vol	0	211	35
Through Vol	59	0	61
RT Vol	177	59	0
Lane Flow Rate	257	293	104
Geometry Grp	1	1	1
Degree of Util (X)	0.31	0.389	0.146
Departure Headway (Hd)	4.352	4.768	5.032
Convergence, Y/N	Yes	Yes	Yes
Cap	823	751	710
Service Time	2.393	2.819	3.085
HCM Lane V/C Ratio	0.312	0.39	0.146
HCM Control Delay, s/veh	9.4	10.9	9
HCM Lane LOS	A	B	A
HCM 95th-tile Q	1.3	1.8	0.5

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	80	12	250	124	9	245
Future Vol, veh/h	80	12	250	124	9	245
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	87	13	272	135	10	266

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	625	339	0	0	407	0
Stage 1	339	-	-	-	-	-
Stage 2	286	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	449	703	-	-	1152	-
Stage 1	722	-	-	-	-	-
Stage 2	763	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	444	703	-	-	1152	-
Mov Cap-2 Maneuver	444	-	-	-	-	-
Stage 1	722	-	-	-	-	-
Stage 2	755	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	14.81	0	0.29
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	467	1152	-
HCM Lane V/C Ratio	-	-	0.214	0.008	-
HCM Control Delay (s/veh)	-	-	14.8	8.2	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0	-

Intersection	
Intersection Delay, s/veh	31
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	42	46	263	24	43	48	346	393	24	276	30
Future Vol, veh/h	29	42	46	263	24	43	48	346	393	24	276	30
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	32	46	50	286	26	47	52	376	427	26	300	33
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	14.5	28.9	36	27.1
HCM LOS	B	D	E	D

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	12%	0%	25%	80%	7%
Vol Thru, %	88%	0%	36%	7%	84%
Vol Right, %	0%	100%	39%	13%	9%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	394	393	117	330	330
LT Vol	48	0	29	263	24
Through Vol	346	0	42	24	276
RT Vol	0	393	46	43	30
Lane Flow Rate	428	427	127	359	359
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.875	0.78	0.288	0.74	0.722
Departure Headway (Hd)	7.356	6.574	8.143	7.429	7.249
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	493	547	439	484	499
Service Time	5.137	4.355	6.242	5.497	5.324
HCM Lane V/C Ratio	0.868	0.781	0.289	0.742	0.719
HCM Control Delay, s/veh	43	29	14.5	28.9	27.1
HCM Lane LOS	E	D	B	D	D
HCM 95th-tile Q	9.4	7.2	1.2	6.1	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	143	138	38	263	280	251	82	375	196	102	340	145
Future Volume (veh/h)	143	138	38	263	280	251	82	375	196	102	340	145
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.97		0.84	0.93		0.89	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	155	150	32	286	304	46	89	408	0	111	370	149
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	275	242	52	382	425	319	294	789		391	541	218
Arrive On Green	0.09	0.19	0.19	0.16	0.25	0.25	0.04	0.47	0.00	0.05	0.48	0.48
Sat Flow, veh/h	1603	1297	277	1603	1683	1263	1603	1683	1427	1603	1135	457
Grp Volume(v), veh/h	155	0	182	286	304	46	89	408	0	111	0	519
Grp Sat Flow(s),veh/h/ln	1603	0	1574	1603	1683	1263	1603	1683	1427	1603	0	1592
Q Serve(g_s), s	11.2	0.0	15.4	20.2	23.9	4.1	4.2	24.6	0.0	5.2	0.0	36.7
Cycle Q Clear(g_c), s	11.2	0.0	15.4	20.2	23.9	4.1	4.2	24.6	0.0	5.2	0.0	36.7
Prop In Lane	1.00		0.18	1.00		1.00	1.00		1.00	1.00		0.29
Lane Grp Cap(c), veh/h	275	0	294	382	425	319	294	789		391	0	759
V/C Ratio(X)	0.56	0.00	0.62	0.75	0.71	0.14	0.30	0.52		0.28	0.00	0.68
Avail Cap(c_a), veh/h	295	0	380	462	580	435	337	789		422	0	759
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.72	0.72	0.72	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.7	0.0	54.2	37.9	49.4	42.0	23.3	27.0	0.0	20.5	0.0	29.5
Incr Delay (d2), s/veh	2.1	0.0	2.1	3.9	1.9	0.1	0.6	2.4	0.0	0.4	0.0	5.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	0.0	6.4	8.5	10.4	1.3	1.7	10.6	0.0	2.0	0.0	15.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	44.8	0.0	56.3	41.8	51.3	42.2	23.9	29.4	0.0	20.9	0.0	34.5
LnGrp LOS	D		E	D	D	D	C	C		C		C
Approach Vol, veh/h		337			636			497			630	
Approach Delay, s/veh		51.0			46.4			28.4			32.1	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.2	73.0	27.8	32.1	11.1	74.1	18.2	41.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	30.0	35.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	7.2	26.6	22.2	17.4	6.2	38.7	13.2	25.9
Green Ext Time (p_c), s	0.1	2.7	0.5	1.0	0.1	2.8	0.1	2.1

Intersection Summary	
HCM 7th Control Delay, s/veh	38.6
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

1: Queen Kaahumanu Hwy & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	420	50	279	10	54	26	271	713	5	19	814	368
Future Volume (veh/h)	420	50	279	10	54	26	271	713	5	19	814	368
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	457	54	0	11	59	0	295	775	2	21	885	122
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	684	370		93	97		425	1600	712	42	1247	555
Arrive On Green	0.20	0.20	0.00	0.05	0.05	0.00	0.12	0.45	0.45	0.02	0.35	0.35
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	3554	1581
Grp Volume(v), veh/h	457	54	0	11	59	0	295	775	2	21	885	122
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1777	1581
Q Serve(g_s), s	8.9	1.7	0.0	0.4	2.2	0.0	5.9	11.1	0.1	0.8	15.6	3.9
Cycle Q Clear(g_c), s	8.9	1.7	0.0	0.4	2.2	0.0	5.9	11.1	0.1	0.8	15.6	3.9
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	684	370		93	97		425	1600	712	42	1247	555
V/C Ratio(X)	0.67	0.15		0.12	0.61		0.69	0.48	0.00	0.50	0.71	0.22
Avail Cap(c_a), veh/h	2002	1083		442	464		1668	3774	1680	197	2450	1090
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.9	24.0	0.0	32.8	33.6	0.0	30.5	14.0	11.0	35.0	20.3	16.5
Incr Delay (d2), s/veh	1.1	0.2	0.0	0.6	5.9	0.0	2.0	0.2	0.0	8.7	0.8	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.8	0.0	0.2	1.2	0.0	2.5	4.0	0.0	0.5	6.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.0	24.2	0.0	33.3	39.6	0.0	32.5	14.2	11.0	43.7	21.1	16.7
LnGrp LOS	C	C		C	D		C	B	B	D	C	B
Approach Vol, veh/h		511			70			1072			1028	
Approach Delay, s/veh		27.6			38.6			19.3			21.0	
Approach LOS		C			D			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.7	37.6		8.8	13.9	30.5		19.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	8.0	77.0		18.0	35.0	50.0		42.0
Max Q Clear Time (g_c+I1), s	2.8	13.1		4.2	7.9	17.6		10.9
Green Ext Time (p_c), s	0.0	6.3		0.2	1.0	7.6		2.1

Intersection Summary	
HCM 7th Control Delay, s/veh	22.0
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

4: Queen Kaahumanu Hwy & Palani Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	259	222	139	19	226	108	144	654	29	144	663	393
Future Volume (veh/h)	259	222	139	19	226	108	144	654	29	144	663	393
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	282	241	0	21	246	0	157	711	8	157	721	109
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	423	833		44	485		266	1107	494	266	1106	492
Arrive On Green	0.12	0.23	0.00	0.02	0.14	0.00	0.08	0.31	0.31	0.08	0.31	0.31
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1580
Grp Volume(v), veh/h	282	241	0	21	246	0	157	711	8	157	721	109
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1580
Q Serve(g_s), s	4.9	3.5	0.0	0.7	4.0	0.0	2.7	10.7	0.2	2.7	10.9	3.2
Cycle Q Clear(g_c), s	4.9	3.5	0.0	0.7	4.0	0.0	2.7	10.7	0.2	2.7	10.9	3.2
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	423	833		44	485		266	1107	494	266	1106	492
V/C Ratio(X)	0.67	0.29		0.48	0.51		0.59	0.64	0.02	0.59	0.65	0.22
Avail Cap(c_a), veh/h	1136	2137		586	2137		1136	3733	1665	1081	3676	1635
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.2	19.6	0.0	30.0	25.0	0.0	27.8	18.5	14.9	27.8	18.5	15.9
Incr Delay (d2), s/veh	1.8	0.2	0.0	8.0	0.8	0.0	2.1	0.6	0.0	2.1	0.7	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	1.4	0.0	0.4	1.7	0.0	1.1	4.0	0.1	1.1	4.1	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.0	19.8	0.0	38.1	25.8	0.0	29.9	19.1	14.9	29.9	19.2	16.1
LnGrp LOS	C	B		D	C		C	B	B	C	B	B
Approach Vol, veh/h		523			267			876			987	
Approach Delay, s/veh		24.2			26.8			21.0			20.6	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.3	24.9	7.0	20.1	10.3	24.9	13.1	14.0
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	65.5	20.5	37.5	20.5	64.5	20.5	37.5
Max Q Clear Time (g_c+I1), s	4.7	12.7	2.7	5.5	4.7	12.9	6.9	6.0
Green Ext Time (p_c), s	0.4	5.6	0.0	1.7	0.4	6.1	0.8	1.7

Intersection Summary	
HCM 7th Control Delay, s/veh	22.1
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

5: Luhia St & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	419	23	200	312	194	9	53	183	126	38	29
Future Volume (veh/h)	29	419	23	200	312	194	9	53	183	126	38	29
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	32	455	22	217	339	138	10	58	6	137	41	9
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	64	843	41	283	907	362	116	122	103	210	175	38
Arrive On Green	0.04	0.24	0.24	0.16	0.37	0.37	0.07	0.07	0.07	0.12	0.12	0.12
Sat Flow, veh/h	1781	3449	166	1781	2471	987	1781	1870	1585	1781	1486	326
Grp Volume(v), veh/h	32	234	243	217	242	235	10	58	6	137	0	50
Grp Sat Flow(s),veh/h/ln	1781	1777	1839	1781	1777	1681	1781	1870	1585	1781	0	1812
Q Serve(g_s), s	0.9	5.5	5.6	5.6	4.8	5.0	0.3	1.4	0.2	3.6	0.0	1.2
Cycle Q Clear(g_c), s	0.9	5.5	5.6	5.6	4.8	5.0	0.3	1.4	0.2	3.6	0.0	1.2
Prop In Lane	1.00		0.09	1.00		0.59	1.00		1.00	1.00		0.18
Lane Grp Cap(c), veh/h	64	434	449	283	652	617	116	122	103	210	0	214
V/C Ratio(X)	0.50	0.54	0.54	0.77	0.37	0.38	0.09	0.48	0.06	0.65	0.00	0.23
Avail Cap(c_a), veh/h	332	2022	2093	700	2390	2261	700	735	623	1179	0	1200
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.9	15.9	15.9	19.5	11.2	11.3	21.2	21.8	21.2	20.4	0.0	19.3
Incr Delay (d2), s/veh	5.8	1.0	1.0	4.4	0.4	0.4	0.3	2.9	0.2	3.4	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	2.1	2.2	2.5	1.7	1.7	0.1	0.7	0.1	1.6	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.7	16.9	16.9	23.8	11.6	11.6	21.6	24.7	21.4	23.7	0.0	19.9
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		B
Approach Vol, veh/h		509			694			74			187	
Approach Delay, s/veh		17.7			15.4			24.0			22.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.7	16.8		10.7	6.7	22.7		8.1
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	7.6	7.6		5.6	2.9	7.0		3.4
Green Ext Time (p_c), s	0.5	3.4		0.7	0.0	3.5		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	17.6
HCM 7th LOS	B

6: Midblock Driveway & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	88	155	15	124	185	49	27	51	193	118	60	61
Future Volume (veh/h)	88	155	15	124	185	49	27	51	193	118	60	61
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	96	168	9	135	201	31	29	55	14	128	65	33
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	144	497	26	180	510	77	159	167	141	326	212	107
Arrive On Green	0.08	0.14	0.14	0.10	0.17	0.17	0.09	0.09	0.09	0.18	0.18	0.18
Sat Flow, veh/h	1781	3431	183	1781	3085	468	1781	1870	1577	1781	1157	588
Grp Volume(v), veh/h	96	86	91	135	114	118	29	55	14	128	0	98
Grp Sat Flow(s),veh/h/ln	1781	1777	1837	1781	1777	1776	1781	1870	1577	1781	0	1745
Q Serve(g_s), s	2.2	1.8	1.8	3.1	2.4	2.5	0.6	1.1	0.3	2.6	0.0	2.0
Cycle Q Clear(g_c), s	2.2	1.8	1.8	3.1	2.4	2.5	0.6	1.1	0.3	2.6	0.0	2.0
Prop In Lane	1.00		0.10	1.00		0.26	1.00		1.00	1.00		0.34
Lane Grp Cap(c), veh/h	144	257	266	180	293	293	159	167	141	326	0	319
V/C Ratio(X)	0.67	0.34	0.34	0.75	0.39	0.40	0.18	0.33	0.10	0.39	0.00	0.31
Avail Cap(c_a), veh/h	429	1306	1350	730	1606	1605	1352	1420	1197	1352	0	1325
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.5	15.9	16.0	18.1	15.5	15.5	17.5	17.7	17.4	14.9	0.0	14.7
Incr Delay (d2), s/veh	5.3	0.8	0.8	6.2	0.8	0.9	0.5	1.1	0.3	0.8	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.7	0.7	1.4	0.9	0.9	0.2	0.5	0.1	1.0	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.8	16.7	16.7	24.3	16.3	16.4	18.0	18.9	17.7	15.7	0.0	15.2
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		273			367			98			226	
Approach Delay, s/veh		19.2			19.3			18.4			15.5	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.2	11.0		12.6	8.3	11.9		8.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	5.1	3.8		4.6	4.2	4.5		3.1
Green Ext Time (p_c), s	0.3	1.0		0.9	0.1	1.5		0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	18.3
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	206	37	21	242	7	16	5	40	8	6	11
Future Volume (veh/h)	21	206	37	21	242	7	16	5	40	8	6	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	23	224	29	23	263	6	17	5	1	9	7	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	52	657	84	52	736	17	52	55	46	39	35	5
Arrive On Green	0.03	0.21	0.21	0.03	0.21	0.21	0.03	0.03	0.03	0.02	0.02	0.02
Sat Flow, veh/h	1781	3166	405	1781	3551	81	1781	1870	1585	1781	1601	229
Grp Volume(v), veh/h	23	124	129	23	131	138	17	5	1	9	0	8
Grp Sat Flow(s),veh/h/ln	1781	1777	1794	1781	1777	1855	1781	1870	1585	1781	0	1829
Q Serve(g_s), s	0.4	1.7	1.7	0.4	1.8	1.8	0.3	0.1	0.0	0.1	0.0	0.1
Cycle Q Clear(g_c), s	0.4	1.7	1.7	0.4	1.8	1.8	0.3	0.1	0.0	0.1	0.0	0.1
Prop In Lane	1.00		0.23	1.00		0.04	1.00		1.00	1.00		0.13
Lane Grp Cap(c), veh/h	52	368	372	52	368	385	52	55	46	39	0	40
V/C Ratio(X)	0.44	0.34	0.35	0.44	0.36	0.36	0.33	0.09	0.02	0.23	0.00	0.20
Avail Cap(c_a), veh/h	317	1581	1597	317	1581	1651	1902	1998	1693	1902	0	1954
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.4	9.5	9.5	13.4	9.5	9.5	13.4	13.3	13.2	13.5	0.0	13.5
Incr Delay (d2), s/veh	5.8	0.5	0.6	5.8	0.6	0.6	3.6	0.7	0.2	2.9	0.0	2.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.5	0.5	0.2	0.6	0.6	0.1	0.0	0.0	0.1	0.0	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	19.2	10.0	10.1	19.2	10.1	10.1	16.9	14.0	13.4	16.4	0.0	15.8
LnGrp LOS	B	B	B	B	B	B	B	B	B	B		B
Approach Vol, veh/h		276			292			23			17	
Approach Delay, s/veh		10.8			10.8			16.1			16.1	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.8	10.8		5.6	5.8	10.8		5.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	2.4	3.7		2.1	2.4	3.8		2.3
Green Ext Time (p_c), s	0.0	1.4		0.0	0.0	1.5		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	11.2
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	2.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	144	15	32	86	5	66
Future Vol, veh/h	144	15	32	86	5	66
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	157	16	35	93	5	72

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	174	0	329	166
Stage 1	-	-	-	-	166	-
Stage 2	-	-	-	-	163	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1403	-	666	879
Stage 1	-	-	-	-	864	-
Stage 2	-	-	-	-	866	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1401	-	648	878
Mov Cap-2 Maneuver	-	-	-	-	648	-
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	843	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.07	9.55
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	648	878	-	-	1401	-
HCM Lane V/C Ratio	0.008	0.082	-	-	0.025	-
HCM Control Delay (s/veh)	10.6	9.5	-	-	7.6	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	269	130	87	189	0	59	0	88	1	0	0
Future Vol, veh/h	3	269	130	87	189	0	59	0	88	1	0	0
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	292	141	95	205	0	64	0	96	1	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	211	0	0	434	0	0	765	770	363	699	841	212
Stage 1	-	-	-	-	-	-	370	370	-	401	401	-
Stage 2	-	-	-	-	-	-	396	401	-	299	440	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1359	-	-	1126	-	0	320	331	682	354	301	828
Stage 1	-	-	-	-	-	0	650	620	-	626	601	-
Stage 2	-	-	-	-	-	0	630	601	-	710	577	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1351	-	-	1126	-	-	292	301	682	277	274	822
Mov Cap-2 Maneuver	-	-	-	-	-	-	292	301	-	277	274	-
Stage 1	-	-	-	-	-	-	649	619	-	621	548	-
Stage 2	-	-	-	-	-	-	576	548	-	609	576	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.06	2.68	17.59	18.06
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	444	1351	-	-	1126	-	277
HCM Lane V/C Ratio	0.36	0.002	-	-	0.084	-	0.004
HCM Control Delay (s/veh)	17.6	7.7	-	-	8.5	-	18.1
HCM Lane LOS	C	A	-	-	A	-	C
HCM 95th %tile Q(veh)	1.6	0	-	-	0.3	-	0

Intersection	
Intersection Delay, s/veh	11.1
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	199	82	98	182	82	107
Future Vol, veh/h	199	82	98	182	82	107
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	216	89	107	198	89	116
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	12	10.7	10.5
HCM LOS	B	B	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	71%	43%
Vol Thru, %	35%	0%	57%
Vol Right, %	65%	29%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	280	281	189
LT Vol	0	199	82
Through Vol	98	0	107
RT Vol	182	82	0
Lane Flow Rate	304	305	205
Geometry Grp	1	1	1
Degree of Util (X)	0.39	0.43	0.295
Departure Headway (Hd)	4.611	5.071	5.178
Convergence, Y/N	Yes	Yes	Yes
Cap	773	703	686
Service Time	2.688	3.16	3.267
HCM Lane V/C Ratio	0.393	0.434	0.299
HCM Control Delay, s/veh	10.7	12	10.5
HCM Lane LOS	B	B	B
HCM 95th-tile Q	1.9	2.2	1.2

Intersection						
Int Delay, s/veh	1.7					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	71	8	276	108	6	321
Future Vol, veh/h	71	8	276	108	6	321
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	77	9	300	117	7	349

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	722	360	0	0	417	0
Stage 1	359	-	-	-	-	-
Stage 2	363	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	394	685	-	-	1142	-
Stage 1	707	-	-	-	-	-
Stage 2	704	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	391	684	-	-	1142	-
Mov Cap-2 Maneuver	391	-	-	-	-	-
Stage 1	707	-	-	-	-	-
Stage 2	698	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	16.15	0	0.15
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	408	1142	-
HCM Lane V/C Ratio	-	-	0.21	0.006	-
HCM Control Delay (s/veh)	-	-	16.1	8.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0	-

Intersection	
Intersection Delay, s/veh	22.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	23	44	185	20	26	42	346	341	33	328	22
Future Vol, veh/h	16	23	44	185	20	26	42	346	341	33	328	22
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	25	48	201	22	28	46	376	371	36	357	24
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	12.2	17.2	23.2	25.3
HCM LOS	B	C	C	D

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	11%	0%	19%	80%	9%
Vol Thru, %	89%	0%	28%	9%	86%
Vol Right, %	0%	100%	53%	11%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	388	341	83	231	383
LT Vol	42	0	16	185	33
Through Vol	346	0	23	20	328
RT Vol	0	341	44	26	22
Lane Flow Rate	422	371	90	251	416
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.775	0.602	0.187	0.499	0.738
Departure Headway (Hd)	6.617	5.848	7.448	7.159	6.379
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	548	615	481	505	566
Service Time	4.359	3.589	5.507	5.202	4.418
HCM Lane V/C Ratio	0.77	0.603	0.187	0.497	0.735
HCM Control Delay, s/veh	28.6	17.1	12.2	17.2	25.3
HCM Lane LOS	D	C	B	C	D
HCM 95th-tile Q	7.1	4	0.7	2.7	6.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	142	168	31	167	207	266	73	294	157	154	253	158
Future Volume (veh/h)	142	168	31	167	207	266	73	294	157	154	253	158
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.96		0.92	0.96		0.93	0.98		1.00	0.99		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	154	183	27	182	225	32	79	320	0	167	275	154
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	407	353	52	409	465	367	237	477		356	324	182
Arrive On Green	0.10	0.25	0.25	0.11	0.28	0.28	0.05	0.28	0.00	0.10	0.33	0.33
Sat Flow, veh/h	1603	1416	209	1603	1683	1328	1603	1683	1427	1603	994	557
Grp Volume(v), veh/h	154	0	210	182	225	32	79	320	0	167	0	429
Grp Sat Flow(s),veh/h/ln	1603	0	1625	1603	1683	1328	1603	1683	1427	1603	0	1550
Q Serve(g_s), s	5.3	0.0	8.5	6.3	8.5	1.4	2.6	12.9	0.0	5.5	0.0	19.7
Cycle Q Clear(g_c), s	5.3	0.0	8.5	6.3	8.5	1.4	2.6	12.9	0.0	5.5	0.0	19.7
Prop In Lane	1.00		0.13	1.00		1.00	1.00		1.00	1.00		0.36
Lane Grp Cap(c), veh/h	407	0	406	409	465	367	237	477		356	0	506
V/C Ratio(X)	0.38	0.00	0.52	0.44	0.48	0.09	0.33	0.67		0.47	0.00	0.85
Avail Cap(c_a), veh/h	672	0	531	569	484	382	278	1012		412	0	1013
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.5	0.0	24.7	18.3	23.1	20.5	19.7	24.3	0.0	17.6	0.0	24.0
Incr Delay (d2), s/veh	0.6	0.0	1.0	0.8	0.8	0.1	0.8	1.6	0.0	1.0	0.0	4.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	3.3	2.3	3.4	0.4	1.0	5.2	0.0	2.0	0.0	7.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	19.0	0.0	25.8	19.1	23.9	20.6	20.5	25.9	0.0	18.6	0.0	28.1
LnGrp LOS	B		C	B	C	C	C	C		B		C
Approach Vol, veh/h		364			439			399			596	
Approach Delay, s/veh		22.9			21.7			24.8			25.4	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.4	26.7	13.4	24.1	9.1	30.0	11.3	26.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	10.0	46.0	16.0	25.0	6.0	50.0	20.0	22.0
Max Q Clear Time (g_c+I1), s	7.5	14.9	8.3	10.5	4.6	21.7	7.3	10.5
Green Ext Time (p_c), s	0.1	2.2	0.3	1.0	0.0	3.2	0.3	1.1

Intersection Summary	
HCM 7th Control Delay, s/veh	23.9
HCM 7th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	320	20	122	35	24	54	179	939	16	19	820	311
Future Volume (veh/h)	320	20	122	35	24	54	179	939	16	19	820	311
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	348	22	0	38	26	0	195	1021	10	21	891	186
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	411	223		102	107		293	2429	1084	33	2194	978
Arrive On Green	0.12	0.12	0.00	0.06	0.06	0.00	0.08	0.68	0.68	0.02	0.62	0.62
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	3554	1584
Grp Volume(v), veh/h	348	22	0	38	26	0	195	1021	10	21	891	186
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1777	1584
Q Serve(g_s), s	16.3	1.7	0.0	3.4	2.2	0.0	9.0	21.0	0.3	1.9	21.1	8.4
Cycle Q Clear(g_c), s	16.3	1.7	0.0	3.4	2.2	0.0	9.0	21.0	0.3	1.9	21.1	8.4
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	411	223		102	107		293	2429	1084	33	2194	978
V/C Ratio(X)	0.85	0.10		0.37	0.24		0.67	0.42	0.01	0.63	0.41	0.19
Avail Cap(c_a), veh/h	859	465		119	125		670	2429	1084	54	2194	978
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.90	0.90	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	71.2	64.8	0.0	74.9	74.3	0.0	73.2	11.6	8.3	80.4	16.1	13.7
Incr Delay (d2), s/veh	4.4	0.2	0.0	2.2	1.2	0.0	2.6	0.5	0.0	17.9	0.6	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.5	0.9	0.0	1.6	1.1	0.0	4.1	8.3	0.1	1.1	8.8	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	75.6	65.0	0.0	77.1	75.5	0.0	75.8	12.1	8.3	98.3	16.7	14.1
LnGrp LOS	E	E		E	E		E	B	A	F	B	B
Approach Vol, veh/h		370			64			1226			1098	
Approach Delay, s/veh		75.0			76.5			22.2			17.8	
Approach LOS		E			E			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	117.8		14.5	19.0	106.9		24.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	88.0		11.0	32.0	61.0		41.0
Max Q Clear Time (g_c+I1), s	3.9	23.0		5.4	11.0	23.1		18.3
Green Ext Time (p_c), s	0.0	9.4		0.1	0.6	8.2		1.4

Intersection Summary	
HCM 7th Control Delay, s/veh	28.8
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

4: Queen Kaahumanu Hwy & Palani Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	278	202	103	22	276	97	135	830	24	89	626	329
Future Volume (veh/h)	278	202	103	22	276	97	135	830	24	89	626	329
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	302	220	0	24	300	0	147	902	13	97	680	171
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	357	620		72	396		251	2147	957	207	2102	935
Arrive On Green	0.10	0.17	0.00	0.04	0.11	0.00	0.07	0.60	0.60	0.06	0.59	0.59
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1581
Grp Volume(v), veh/h	302	220	0	24	300	0	147	902	13	97	680	171
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1581
Q Serve(g_s), s	14.2	9.0	0.0	2.2	13.5	0.0	6.8	22.2	0.5	4.5	16.0	8.2
Cycle Q Clear(g_c), s	14.2	9.0	0.0	2.2	13.5	0.0	6.8	22.2	0.5	4.5	16.0	8.2
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	357	620		72	396		251	2147	957	207	2102	935
V/C Ratio(X)	0.85	0.36		0.33	0.76		0.59	0.42	0.01	0.47	0.32	0.18
Avail Cap(c_a), veh/h	607	969		238	818		293	2147	957	230	2102	935
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.88	0.88	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	72.7	60.0	0.0	77.0	71.1	0.0	74.1	17.3	13.0	75.0	17.0	15.4
Incr Delay (d2), s/veh	4.9	0.3	0.0	2.7	3.0	0.0	2.2	0.6	0.0	1.6	0.4	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.6	4.2	0.0	1.1	6.4	0.0	3.1	9.3	0.2	2.0	6.7	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	77.6	60.3	0.0	79.7	74.1	0.0	76.3	17.9	13.1	76.7	17.4	15.9
LnGrp LOS	E	E		E	E		E	B	B	E	B	B
Approach Vol, veh/h		522			324			1062			948	
Approach Delay, s/veh		70.3			74.5			26.0			23.2	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	104.7	11.7	33.8	17.0	102.6	22.0	23.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	67.0	22.0	45.0	14.0	64.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	16.5	24.2	4.2	11.0	8.8	18.0	16.2	15.5
Green Ext Time (p_c), s	0.1	7.6	0.0	1.6	0.2	5.9	0.9	2.0

Intersection Summary	
HCM 7th Control Delay, s/veh	38.7
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

5: Luhia St & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	240	18	195	241	72	2	17	194	34	16	10
Future Volume (veh/h)	10	240	18	195	241	72	2	17	194	34	16	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	261	16	212	262	58	2	18	8	37	17	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	26	637	39	286	967	211	60	64	54	103	109	0
Arrive On Green	0.01	0.19	0.19	0.16	0.33	0.33	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3401	207	1781	2900	631	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	11	136	141	212	159	161	2	18	8	37	17	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1831	1781	1777	1755	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.2	2.4	2.4	4.1	2.3	2.4	0.0	0.3	0.2	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.2	2.4	2.4	4.1	2.3	2.4	0.0	0.3	0.2	0.7	0.3	0.0
Prop In Lane	1.00		0.11	1.00		0.36	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	26	333	343	286	593	585	60	64	54	103	109	0
V/C Ratio(X)	0.43	0.41	0.41	0.74	0.27	0.28	0.03	0.28	0.15	0.36	0.16	0.00
Avail Cap(c_a), veh/h	449	2736	2820	948	3234	3193	948	995	843	1596	1676	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.5	12.8	12.8	14.3	8.7	8.7	16.7	16.8	16.8	16.2	16.0	0.0
Incr Delay (d2), s/veh	10.8	0.8	0.8	3.8	0.2	0.3	0.2	2.4	1.3	2.1	0.7	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.9	0.9	1.7	0.7	0.7	0.0	0.2	0.1	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.2	13.6	13.6	18.0	8.9	9.0	16.9	19.2	18.0	18.3	16.7	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		288			532			28			54	
Approach Delay, s/veh		14.1			12.6			18.7			17.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.7	11.7		7.1	5.5	16.9		6.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	6.1	4.4		2.7	2.2	4.4		2.3
Green Ext Time (p_c), s	0.5	1.8		0.2	0.0	2.2		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.6
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑	↱	↰	↱	
Traffic Volume (veh/h)	18	114	10	103	131	31	15	16	123	35	15	7
Future Volume (veh/h)	18	114	10	103	131	31	15	16	123	35	15	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	124	6	112	142	21	16	17	1	38	16	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	45	598	29	175	767	111	73	76	65	113	119	0
Arrive On Green	0.03	0.17	0.17	0.10	0.25	0.25	0.04	0.04	0.04	0.06	0.06	0.00
Sat Flow, veh/h	1781	3449	166	1781	3112	452	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	20	63	67	112	80	83	16	17	1	38	16	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1838	1781	1777	1788	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	1.0	1.0	1.9	1.1	1.2	0.3	0.3	0.0	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.4	1.0	1.0	1.9	1.1	1.2	0.3	0.3	0.0	0.7	0.3	0.0
Prop In Lane	1.00		0.09	1.00		0.25	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	45	308	319	175	438	441	73	76	65	113	119	0
V/C Ratio(X)	0.44	0.21	0.21	0.64	0.18	0.19	0.22	0.22	0.02	0.34	0.13	0.00
Avail Cap(c_a), veh/h	556	1690	1749	944	2078	2091	1750	1837	1557	1750	1837	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.4	11.4	11.4	13.9	9.5	9.5	14.9	14.9	14.8	14.4	14.2	0.0
Incr Delay (d2), s/veh	6.6	0.3	0.3	3.8	0.2	0.2	1.5	1.5	0.1	1.7	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.3	0.4	0.8	0.4	0.4	0.1	0.1	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.0	11.7	11.7	17.7	9.7	9.8	16.4	16.3	14.9	16.1	14.7	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		150			275			34			54	
Approach Delay, s/veh		13.1			13.0			16.3			15.7	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	8.2	10.6	7.0	5.8	12.9	6.3
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	3.9	3.0	2.7	2.4	3.2	2.3
Green Ext Time (p_c), s	0.2	0.7	0.1	0.0	1.0	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.5
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑	↱	↰	↱	
Traffic Volume (veh/h)	12	121	18	16	134	2	3	4	24	1	4	4
Future Volume (veh/h)	12	121	18	16	134	2	3	4	24	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	13	132	12	17	146	2	3	4	1	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	31	649	58	40	725	10	27	28	24	12	13	0
Arrive On Green	0.02	0.20	0.20	0.02	0.20	0.20	0.01	0.01	0.01	0.01	0.01	0.00
Sat Flow, veh/h	1781	3297	296	1781	3589	49	1781	1870	1583	1781	1870	0
Grp Volume(v), veh/h	13	70	74	17	72	76	3	4	1	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1816	1781	1777	1861	1781	1870	1583	1781	1870	0
Q Serve(g_s), s	0.2	0.9	0.9	0.2	0.9	0.9	0.0	0.1	0.0	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	0.9	0.9	0.2	0.9	0.9	0.0	0.1	0.0	0.0	0.1	0.0
Prop In Lane	1.00		0.16	1.00		0.03	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	31	350	358	40	359	376	27	28	24	12	13	0
V/C Ratio(X)	0.42	0.20	0.21	0.43	0.20	0.20	0.11	0.14	0.04	0.08	0.31	0.00
Avail Cap(c_a), veh/h	338	1686	1723	338	1686	1766	2028	2130	1802	2028	2130	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	12.8	8.8	8.9	12.7	8.7	8.7	12.8	12.8	12.8	13.0	13.0	0.0
Incr Delay (d2), s/veh	9.0	0.3	0.3	7.2	0.3	0.3	1.8	2.3	0.7	2.9	13.4	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.3	0.3	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	21.8	9.1	9.1	19.9	9.0	9.0	14.6	15.1	13.5	15.9	26.4	0.0
LnGrp LOS	C	A	A	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		157			165			8			5	
Approach Delay, s/veh		10.2			10.1			14.7			24.3	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	5.6	10.2	5.2	5.5	10.3	5.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	2.2	2.9	2.1	2.2	2.9	2.1
Green Ext Time (p_c), s	0.0	0.7	0.0	0.0	0.8	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	10.5
HCM 7th LOS	B

Intersection						
Int Delay, s/veh	3.1					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	96	6	33	57	7	52
Future Vol, veh/h	96	6	33	57	7	52
Conflicting Peds, #/hr	0	3	3	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	104	7	36	62	8	57

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	114	0	244	111
Stage 1	-	-	-	-	111	-
Stage 2	-	-	-	-	134	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1475	-	744	943
Stage 1	-	-	-	-	914	-
Stage 2	-	-	-	-	893	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1471	-	723	940
Mov Cap-2 Maneuver	-	-	-	-	723	-
Stage 1	-	-	-	-	911	-
Stage 2	-	-	-	-	870	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.75	9.19
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	723	940	-	-	1471	-
HCM Lane V/C Ratio	0.011	0.06	-	-	0.024	-
HCM Control Delay (s/veh)	10	9.1	-	-	7.5	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.2	-	-	0.1	-

Intersection												
Int Delay, s/veh	2.9											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	288	103	82	161	5	38	0	53	4	0	0
Future Vol, veh/h	2	288	103	82	161	5	38	0	53	4	0	0
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	313	112	89	175	5	41	0	58	4	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	182	0	0	428	0	0	731	737	372	675	790	181
Stage 1	-	-	-	-	-	-	376	376	-	358	358	-
Stage 2	-	-	-	-	-	-	354	361	-	317	432	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1393	-	-	1131	-	-	338	346	674	368	322	862
Stage 1	-	-	-	-	-	-	645	616	-	660	628	-
Stage 2	-	-	-	-	-	-	663	626	-	694	582	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1390	-	-	1128	-	-	309	317	672	308	295	860
Mov Cap-2 Maneuver	-	-	-	-	-	-	309	317	-	308	295	-
Stage 1	-	-	-	-	-	-	642	613	-	658	577	-
Stage 2	-	-	-	-	-	-	610	575	-	633	579	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.04	2.8	15.21	16.84
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	451	1390	-	-	1128	-	-	308
HCM Lane V/C Ratio	0.219	0.002	-	-	0.079	-	-	0.014
HCM Control Delay (s/veh)	15.2	7.6	-	-	8.5	-	-	16.8
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.8	0	-	-	0.3	-	-	0

Intersection	
Intersection Delay, s/veh	8.2
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	109	33	52	126	18	48
Future Vol, veh/h	109	33	52	126	18	48
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	118	36	57	137	20	52
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	8.6	8	8
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	77%	27%
Vol Thru, %	29%	0%	73%
Vol Right, %	71%	23%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	178	142	66
LT Vol	0	109	18
Through Vol	52	0	48
RT Vol	126	33	0
Lane Flow Rate	193	154	72
Geometry Grp	1	1	1
Degree of Util (X)	0.213	0.193	0.091
Departure Headway (Hd)	3.961	4.51	4.55
Convergence, Y/N	Yes	Yes	Yes
Cap	909	796	790
Service Time	1.971	2.529	2.565
HCM Lane V/C Ratio	0.212	0.193	0.091
HCM Control Delay, s/veh	8	8.6	8
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.8	0.7	0.3

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	47	2	193	91	4	160
Future Vol, veh/h	47	2	193	91	4	160
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	51	2	210	99	4	174

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	444	260	0	0	310	0
Stage 1	260	-	-	-	-	-
Stage 2	184	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	572	778	-	-	1251	-
Stage 1	783	-	-	-	-	-
Stage 2	848	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	568	778	-	-	1250	-
Mov Cap-2 Maneuver	568	-	-	-	-	-
Stage 1	783	-	-	-	-	-
Stage 2	844	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	11.9	0	0.19
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	575	1250	-
HCM Lane V/C Ratio	-	-	0.093	0.003	-
HCM Control Delay (s/veh)	-	-	11.9	7.9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Intersection Delay, s/veh	12.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	34	29	163	22	15	42	251	303	0	177	27
Future Vol, veh/h	11	34	29	163	22	15	42	251	303	0	177	27
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	37	32	177	24	16	46	273	329	0	192	29
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	10.3	12.9	13.5	11.8
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	15%	82%	0%
Vol Thru, %	86%	0%	46%	11%	87%
Vol Right, %	0%	100%	39%	8%	13%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	293	303	74	200	204
LT Vol	42	0	11	163	0
Through Vol	251	0	34	22	177
RT Vol	0	303	29	15	27
Lane Flow Rate	318	329	80	217	222
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.519	0.465	0.139	0.373	0.351
Departure Headway (Hd)	5.864	5.083	6.2	6.174	5.698
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	615	708	576	583	630
Service Time	3.604	2.823	4.261	4.223	3.747
HCM Lane V/C Ratio	0.517	0.465	0.139	0.372	0.352
HCM Control Delay, s/veh	14.8	12.2	10.3	12.9	11.8
HCM Lane LOS	B	B	B	B	B
HCM 95th-tile Q	3	2.5	0.5	1.7	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	133	163	45	189	213	185	74	369	238	95	191	98
Future Volume (veh/h)	133	163	45	189	213	185	74	369	238	95	191	98
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.98		0.94	0.97		0.95	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	145	177	39	205	232	24	80	401	0	103	208	94
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	276	250	55	289	346	278	499	842		436	556	251
Arrive On Green	0.09	0.19	0.19	0.10	0.21	0.21	0.04	0.50	0.00	0.05	0.51	0.51
Sat Flow, veh/h	1603	1320	291	1603	1683	1354	1603	1683	1427	1603	1093	494
Grp Volume(v), veh/h	145	0	216	205	232	24	80	401	0	103	0	302
Grp Sat Flow(s),veh/h/ln	1603	0	1611	1603	1683	1354	1603	1683	1427	1603	0	1587
Q Serve(g_s), s	9.0	0.0	15.7	13.0	15.9	1.8	3.0	19.5	0.0	3.9	0.0	14.4
Cycle Q Clear(g_c), s	9.0	0.0	15.7	13.0	15.9	1.8	3.0	19.5	0.0	3.9	0.0	14.4
Prop In Lane	1.00		0.18	1.00		1.00	1.00		1.00	1.00		0.31
Lane Grp Cap(c), veh/h	276	0	305	289	346	278	499	842		436	0	807
V/C Ratio(X)	0.52	0.00	0.71	0.71	0.67	0.09	0.16	0.48		0.24	0.00	0.37
Avail Cap(c_a), veh/h	302	0	451	289	471	379	566	842		489	0	807
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.81	0.81	0.81	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	36.8	0.0	47.5	37.0	45.8	40.2	14.8	20.5	0.0	15.4	0.0	18.6
Incr Delay (d2), s/veh	1.5	0.0	3.0	6.4	1.8	0.1	0.1	1.9	0.0	0.3	0.0	1.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	6.6	5.6	6.9	0.6	1.1	8.2	0.0	1.5	0.0	5.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	38.4	0.0	50.5	43.4	47.6	40.3	14.9	22.4	0.0	15.7	0.0	20.0
LnGrp LOS	D		D	D	D	D	B	C		B		B
Approach Vol, veh/h		361			461			481			405	
Approach Delay, s/veh		45.6			45.4			21.2			18.9	
Approach LOS		D			D			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.8	67.6	18.0	28.6	9.8	68.6	16.0	30.7
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	47.0	13.0	35.0	10.0	47.0	13.0	35.0
Max Q Clear Time (g_c+I1), s	15.9	21.5	15.0	17.7	5.0	16.4	11.0	17.9
Green Ext Time (p_c), s	0.1	2.7	0.0	1.2	0.1	2.1	0.1	1.3

Intersection Summary	
HCM 7th Control Delay, s/veh	32.3
HCM 7th LOS	C

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	495	45	281	34	48	51	258	902	17	27	1374	414
Future Volume (veh/h)	495	45	281	34	48	51	258	902	17	27	1374	414
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	538	49	0	37	52	0	280	980	9	29	1493	200
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	617	334		106	111		335	2198	980	40	1933	862
Arrive On Green	0.18	0.18	0.00	0.06	0.06	0.00	0.10	0.62	0.62	0.02	0.54	0.54
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	3554	1585
Grp Volume(v), veh/h	538	49	0	37	52	0	280	980	9	29	1493	200
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1777	1585
Q Serve(g_s), s	25.0	3.6	0.0	3.3	4.4	0.0	13.1	24.0	0.4	2.7	54.5	10.9
Cycle Q Clear(g_c), s	25.0	3.6	0.0	3.3	4.4	0.0	13.1	24.0	0.4	2.7	54.5	10.9
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	617	334		106	111		335	2198	980	40	1933	862
V/C Ratio(X)	0.87	0.15		0.35	0.47		0.84	0.45	0.01	0.73	0.77	0.23
Avail Cap(c_a), veh/h	922	499		119	125		670	2198	980	54	1933	862
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.74	0.74	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.9	57.2	0.0	74.5	75.0	0.0	73.2	16.6	12.1	80.2	29.6	19.6
Incr Delay (d2), s/veh	4.7	0.1	0.0	1.9	3.0	0.0	5.5	0.7	0.0	27.5	3.1	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.6	1.8	0.0	1.6	2.3	0.0	6.1	9.9	0.1	1.5	23.7	4.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	70.7	57.3	0.0	76.5	78.1	0.0	78.7	17.2	12.1	107.7	32.7	20.3
LnGrp LOS	E	E		E	E		E	B	B	F	C	C
Approach Vol, veh/h		587			89			1269			1722	
Approach Delay, s/veh		69.6			77.4			30.8			32.5	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.7	107.0		14.8	21.0	94.7		34.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	85.0		11.0	32.0	58.0		44.0
Max Q Clear Time (g_c+I1), s	4.7	26.0		6.4	15.1	56.5		27.0
Green Ext Time (p_c), s	0.0	8.8		0.1	0.8	1.3		2.2

Intersection Summary	
HCM 7th Control Delay, s/veh	38.9
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	331	291	132	30	300	128	124	818	25	208	1055	602
Future Volume (veh/h)	331	291	132	30	300	128	124	818	25	208	1055	602
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	360	316	0	33	326	0	135	889	11	226	1147	427
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	416	691		84	431		209	1877	837	377	2049	914
Arrive On Green	0.12	0.19	0.00	0.05	0.12	0.00	0.06	0.53	0.53	0.11	0.58	0.58
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	360	316	0	33	326	0	135	889	11	226	1147	427
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	16.9	13.0	0.0	3.0	14.6	0.0	6.3	26.0	0.5	10.3	33.3	25.8
Cycle Q Clear(g_c), s	16.9	13.0	0.0	3.0	14.6	0.0	6.3	26.0	0.5	10.3	33.3	25.8
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	416	691		84	431		209	1877	837	377	2049	914
V/C Ratio(X)	0.87	0.46		0.39	0.76		0.65	0.47	0.01	0.60	0.56	0.47
Avail Cap(c_a), veh/h	607	969		238	818		335	1877	837	440	2049	914
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.84	0.84	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	71.3	58.8	0.0	76.3	70.1	0.0	75.8	24.5	18.5	70.1	21.8	20.2
Incr Delay (d2), s/veh	7.6	0.4	0.0	2.9	2.7	0.0	3.3	0.9	0.0	1.7	1.1	1.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.0	6.0	0.0	1.4	6.9	0.0	2.9	11.2	0.2	4.7	14.1	10.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	78.9	59.2	0.0	79.2	72.8	0.0	79.1	25.4	18.5	71.7	22.9	22.0
LnGrp LOS	E	E		E	E		E	C	B	E	C	C
Approach Vol, veh/h		676			359			1035			1800	
Approach Delay, s/veh		69.7			73.4			32.3			28.8	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	92.1	12.8	37.1	15.0	100.2	24.8	25.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	57.0	22.0	45.0	16.0	62.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	12.3	28.0	5.0	15.0	8.3	35.3	18.9	16.6
Green Ext Time (p_c), s	0.5	6.9	0.0	2.3	0.2	11.5	1.0	2.2

Intersection Summary	
HCM 7th Control Delay, s/veh	41.0
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary — Makalapua Project District TIAR
5: Luhia St & Makala Blvd — 10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	417	25	204	358	157	10	12	283	132	23	23
Future Volume (veh/h)	18	417	25	204	358	157	10	12	283	132	23	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	453	23	222	389	134	11	13	7	143	25	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	44	821	42	291	982	334	64	67	57	209	201	16
Arrive On Green	0.02	0.24	0.24	0.16	0.38	0.38	0.04	0.04	0.04	0.12	0.12	0.12
Sat Flow, veh/h	1781	3441	174	1781	2602	885	1781	1870	1585	1781	1709	137
Grp Volume(v), veh/h	20	233	243	222	264	259	11	13	7	143	0	27
Grp Sat Flow(s),veh/h/ln	1781	1777	1839	1781	1777	1710	1781	1870	1585	1781	0	1846
Q Serve(g_s), s	0.5	5.2	5.2	5.4	4.9	5.0	0.3	0.3	0.2	3.5	0.0	0.6
Cycle Q Clear(g_c), s	0.5	5.2	5.2	5.4	4.9	5.0	0.3	0.3	0.2	3.5	0.0	0.6
Prop In Lane	1.00		0.09	1.00		0.52	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	44	424	438	291	671	645	64	67	57	209	0	217
V/C Ratio(X)	0.46	0.55	0.55	0.76	0.39	0.40	0.17	0.19	0.12	0.68	0.00	0.12
Avail Cap(c_a), veh/h	357	2173	2249	753	2568	2471	753	790	670	1268	0	1313
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.6	15.0	15.0	18.0	10.2	10.3	21.0	21.1	21.0	19.0	0.0	17.8
Incr Delay (d2), s/veh	7.3	1.1	1.1	4.1	0.4	0.4	1.3	1.4	1.0	3.9	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	2.0	2.0	2.3	1.7	1.6	0.1	0.1	0.1	1.5	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.9	16.1	16.1	22.1	10.6	10.7	22.3	22.5	22.0	22.9	0.0	18.0
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		B
Approach Vol, veh/h		496			745			31			170	
Approach Delay, s/veh		16.6			14.1			22.3			22.2	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.4	15.7		10.3	6.1	22.0		6.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	7.4	7.2		5.5	2.5	7.0		2.3
Green Ext Time (p_c), s	0.5	3.4		0.5	0.0	3.9		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	16.1
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary — Makalapua Project District TIAR
6: Midblock Driveway & Makala Blvd — 10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	62	176	16	121	235	34	16	29	212	77	36	53
Future Volume (veh/h)	62	176	16	121	235	34	16	29	212	77	36	53
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	67	191	10	132	255	27	17	32	16	84	39	8
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	121	497	26	181	579	61	118	124	105	241	203	42
Arrive On Green	0.07	0.14	0.14	0.10	0.18	0.18	0.07	0.07	0.07	0.14	0.14	0.14
Sat Flow, veh/h	1781	3436	179	1781	3244	340	1781	1870	1585	1781	1500	308
Grp Volume(v), veh/h	67	98	103	132	139	143	17	32	16	84	0	47
Grp Sat Flow(s),veh/h/ln	1781	1777	1838	1781	1777	1808	1781	1870	1585	1781	0	1808
Q Serve(g_s), s	1.3	1.8	1.8	2.6	2.5	2.6	0.3	0.6	0.3	1.5	0.0	0.8
Cycle Q Clear(g_c), s	1.3	1.8	1.8	2.6	2.5	2.6	0.3	0.6	0.3	1.5	0.0	0.8
Prop In Lane	1.00		0.10	1.00		0.19	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	121	257	266	181	317	322	118	124	105	241	0	244
V/C Ratio(X)	0.56	0.38	0.39	0.73	0.44	0.44	0.14	0.26	0.15	0.35	0.00	0.19
Avail Cap(c_a), veh/h	492	1497	1549	836	1841	1873	1550	1627	1379	1550	0	1573
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.3	14.0	14.0	15.8	13.3	13.3	15.9	16.1	15.9	14.2	0.0	13.9
Incr Delay (d2), s/veh	4.0	0.9	0.9	5.6	0.9	1.0	0.6	1.1	0.7	0.9	0.0	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.7	0.7	1.2	0.9	1.0	0.1	0.2	0.1	0.6	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	20.3	15.0	14.9	21.3	14.2	14.2	16.5	17.1	16.6	15.1	0.0	14.3
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		268			414			65			131	
Approach Delay, s/veh		16.3			16.5			16.8			14.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.7	10.2		9.9	7.5	11.5		7.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	4.6	3.8		3.5	3.3	4.6		2.6
Green Ext Time (p_c), s	0.3	1.2		0.5	0.1	1.8		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	16.2
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	211	23	31	279	4	15	10	36	6	2	6
Future Volume (veh/h)	9	211	23	31	279	4	15	10	36	6	2	6
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	10	229	20	34	303	3	16	11	1	7	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	24	642	56	74	801	8	69	73	62	66	69	0
Arrive On Green	0.01	0.19	0.19	0.04	0.22	0.22	0.04	0.04	0.04	0.04	0.04	0.00
Sat Flow, veh/h	1781	3304	286	1781	3605	36	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	10	122	127	34	149	157	16	11	1	7	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1813	1781	1777	1864	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	1.7	1.8	0.5	2.1	2.1	0.3	0.2	0.0	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.2	1.7	1.8	0.5	2.1	2.1	0.3	0.2	0.0	0.1	0.0	0.0
Prop In Lane	1.00		0.16	1.00		0.02	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	24	345	352	74	395	414	69	73	62	66	69	0
V/C Ratio(X)	0.42	0.35	0.36	0.46	0.38	0.38	0.23	0.15	0.02	0.11	0.03	0.00
Avail Cap(c_a), veh/h	307	1529	1560	307	1529	1604	1840	1932	1634	1840	1932	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	14.2	10.1	10.1	13.6	9.6	9.6	13.5	13.5	13.4	13.5	13.5	0.0
Incr Delay (d2), s/veh	11.4	0.6	0.6	4.5	0.6	0.6	1.7	0.9	0.1	0.7	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.6	0.6	0.3	0.6	0.7	0.1	0.1	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	25.6	10.7	10.8	18.1	10.2	10.2	15.2	14.4	13.5	14.2	13.7	0.0
LnGrp LOS	C	B	B	B	B	B	B	B	B	B	B	
Approach Vol, veh/h		259			340			28			9	
Approach Delay, s/veh		11.3			11.0			14.9			14.1	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.2	10.6		6.1	5.4	11.5		6.1
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	2.5	3.8		2.1	2.2	4.1		2.3
Green Ext Time (p_c), s	0.0	1.4		0.0	0.0	1.8		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	11.3
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	3.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	128	8	56	89	7	101
Future Vol, veh/h	128	8	56	89	7	101
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	139	9	61	97	8	110

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	149	0	363	144
Stage 1	-	-	-	-	144	-
Stage 2	-	-	-	-	218	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1433	-	636	903
Stage 1	-	-	-	-	883	-
Stage 2	-	-	-	-	818	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1431	-	607	902
Mov Cap-2 Maneuver	-	-	-	-	607	-
Stage 1	-	-	-	-	882	-
Stage 2	-	-	-	-	781	-

Approach	EB		WB		NB	
HCM Control Delay, s/v	0		2.95		9.64	
HCM LOS					A	

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	607	902	-	-	1431	-
HCM Lane V/C Ratio	0.013	0.122	-	-	0.043	-
HCM Control Delay (s/veh)	11	9.5	-	-	7.6	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.4	-	-	0.1	-

Intersection	
Int Delay, s/veh	7.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	363	108	96	248	1	89	0	107	4	1	7
Future Vol, veh/h	4	363	108	96	248	1	89	0	107	4	1	7
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	395	117	104	270	1	97	0	116	4	1	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	277	0	0	515	0	0	948	950	457	889	1008	280
Stage 1	-	-	-	-	-	-	465	465	-	485	485	-
Stage 2	-	-	-	-	-	-	483	485	-	404	524	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1286	-	-	1051	-	-	241	260	603	264	240	759
Stage 1	-	-	-	-	-	-	578	563	-	564	552	-
Stage 2	-	-	-	-	-	-	565	551	-	623	530	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1279	-	-	1048	-	-	211	231	601	190	214	752
Mov Cap-2 Maneuver	-	-	-	-	-	-	211	231	-	190	214	-
Stage 1	-	-	-	-	-	-	574	559	-	558	494	-
Stage 2	-	-	-	-	-	-	500	494	-	500	527	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.07	2.45	34.36	15.94
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	327	1279	-	-	1048	-	-	342
HCM Lane V/C Ratio	0.651	0.003	-	-	0.1	-	-	0.038
HCM Control Delay (s/veh)	34.4	7.8	-	-	8.8	-	-	15.9
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	4.3	0	-	-	0.3	-	-	0.1

Intersection	
Intersection Delay, s/veh	10.6
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	239	60	60	205	36	63
Future Vol, veh/h	239	60	60	205	36	63
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	260	65	65	223	39	68
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	11.7	9.9	9.2
HCM LOS	B	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	80%	36%
Vol Thru, %	23%	0%	64%
Vol Right, %	77%	20%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	265	299	99
LT Vol	0	239	36
Through Vol	60	0	63
RT Vol	205	60	0
Lane Flow Rate	288	325	108
Geometry Grp	1	1	1
Degree of Util (X)	0.355	0.439	0.154
Departure Headway (Hd)	4.438	4.867	5.168
Convergence, Y/N	Yes	Yes	Yes
Cap	807	735	689
Service Time	2.488	2.931	3.236
HCM Lane V/C Ratio	0.357	0.442	0.157
HCM Control Delay, s/veh	9.9	11.7	9.2
HCM Lane LOS	A	B	A
HCM 95th-tile Q	1.6	2.2	0.5

Intersection						
Int Delay, s/veh	2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	82	12	280	127	9	274
Future Vol, veh/h	82	12	280	127	9	274
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	89	13	304	138	10	298

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	691	373	0	0	442	0
Stage 1	373	-	-	-	-	-
Stage 2	317	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	411	673	-	-	1118	-
Stage 1	696	-	-	-	-	-
Stage 2	738	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	406	673	-	-	1118	-
Mov Cap-2 Maneuver	406	-	-	-	-	-
Stage 1	696	-	-	-	-	-
Stage 2	730	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	16.03	0	0.26
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	428	1118	-
HCM Lane V/C Ratio	-	-	0.239	0.009	-
HCM Control Delay (s/veh)	-	-	16	8.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.9	0	-

Intersection	
Intersection Delay, s/veh	39.4
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	43	47	270	25	44	49	358	403	25	306	31
Future Vol, veh/h	30	43	47	270	25	44	49	358	403	25	306	31
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	33	47	51	293	27	48	53	389	438	27	333	34
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	15.5	33.4	46.7	36.7
HCM LOS	C	D	E	E

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	12%	0%	25%	80%	7%
Vol Thru, %	88%	0%	36%	7%	85%
Vol Right, %	0%	100%	39%	13%	9%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	407	403	120	339	362
LT Vol	49	0	30	270	25
Through Vol	358	0	43	25	306
RT Vol	0	403	47	44	31
Lane Flow Rate	442	438	130	368	393
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.946	0.841	0.311	0.782	0.822
Departure Headway (Hd)	7.696	6.913	8.587	7.757	7.52
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	473	526	420	468	484
Service Time	5.42	4.637	6.62	5.757	5.52
HCM Lane V/C Ratio	0.934	0.833	0.31	0.786	0.812
HCM Control Delay, s/veh	56.9	36.4	15.5	33.4	36.7
HCM Lane LOS	F	E	C	D	E
HCM 95th-tile Q	11.4	8.6	1.3	6.9	7.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	147	177	39	306	320	257	84	408	242	105	371	150
Future Volume (veh/h)	147	177	39	306	320	257	84	408	242	105	371	150
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.98		0.85	0.95		0.89	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	160	192	35	333	348	58	91	443	0	114	403	153
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	274	255	46	390	463	351	239	742		338	520	197
Arrive On Green	0.09	0.19	0.19	0.18	0.28	0.28	0.04	0.44	0.00	0.05	0.45	0.45
Sat Flow, veh/h	1603	1342	245	1603	1683	1276	1603	1683	1427	1603	1156	439
Grp Volume(v), veh/h	160	0	227	333	348	58	91	443	0	114	0	556
Grp Sat Flow(s),veh/h/ln	1603	0	1587	1603	1683	1276	1603	1683	1427	1603	0	1595
Q Serve(g_s), s	11.5	0.0	19.6	23.5	27.4	5.0	4.5	28.9	0.0	5.6	0.0	42.7
Cycle Q Clear(g_c), s	11.5	0.0	19.6	23.5	27.4	5.0	4.5	28.9	0.0	5.6	0.0	42.7
Prop In Lane	1.00		0.15	1.00		1.00	1.00		1.00	1.00		0.28
Lane Grp Cap(c), veh/h	274	0	301	390	463	351	239	742		338	0	717
V/C Ratio(X)	0.58	0.00	0.75	0.85	0.75	0.17	0.38	0.60		0.34	0.00	0.78
Avail Cap(c_a), veh/h	290	0	383	435	580	440	279	742		365	0	717
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.66	0.66	0.66	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.3	0.0	55.5	37.3	48.0	39.9	27.1	30.7	0.0	23.4	0.0	33.7
Incr Delay (d2), s/veh	2.7	0.0	6.3	9.8	2.8	0.1	1.0	3.5	0.0	0.6	0.0	8.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	0.0	8.5	10.4	12.0	1.6	1.8	12.7	0.0	2.2	0.0	18.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	45.1	0.0	61.8	47.1	50.8	40.1	28.1	34.3	0.0	23.9	0.0	41.8
LnGrp LOS	D		E	D	D	D	C	C		C		D
Approach Vol, veh/h		387			739			534			670	
Approach Delay, s/veh		54.9			48.3			33.2			38.7	
Approach LOS		D			D			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.6	69.0	30.9	32.5	11.4	70.2	18.6	44.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	30.0	35.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	17.6	30.9	25.5	21.6	6.5	44.7	13.5	29.4
Green Ext Time (p_c), s	0.1	2.8	0.5	1.1	0.1	1.8	0.1	2.4

Intersection Summary	
HCM 7th Control Delay, s/veh	43.2
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	448	53	286	28	57	45	278	875	19	39	1033	401
Future Volume (veh/h)	448	53	286	28	57	45	278	875	19	39	1033	401
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	487	58	0	30	62	0	302	951	9	42	1123	152
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	681	369		93	97		411	1729	770	65	1437	639
Arrive On Green	0.20	0.20	0.00	0.05	0.05	0.00	0.12	0.49	0.49	0.04	0.40	0.40
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	3554	1581
Grp Volume(v), veh/h	487	58	0	30	62	0	302	951	9	42	1123	152
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1777	1581
Q Serve(g_s), s	11.6	2.3	0.0	1.4	2.9	0.0	7.4	16.5	0.3	2.0	24.2	5.6
Cycle Q Clear(g_c), s	11.6	2.3	0.0	1.4	2.9	0.0	7.4	16.5	0.3	2.0	24.2	5.6
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	681	369		93	97		411	1729	770	65	1437	639
V/C Ratio(X)	0.71	0.16		0.32	0.64		0.74	0.55	0.01	0.65	0.78	0.24
Avail Cap(c_a), veh/h	1652	894		365	383		1377	3115	1387	162	2023	900
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.9	29.2	0.0	40.1	40.8	0.0	37.4	15.8	11.6	41.8	22.8	17.2
Incr Delay (d2), s/veh	1.4	0.2	0.0	2.0	6.8	0.0	2.6	0.3	0.0	10.3	1.3	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	1.0	0.0	0.7	1.5	0.0	3.2	6.2	0.1	1.1	9.7	2.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	34.4	29.4	0.0	42.1	47.6	0.0	39.9	16.1	11.6	52.0	24.1	17.4
LnGrp LOS	C	C		D	D		D	B	B	D	C	B
Approach Vol, veh/h		545			92			1262			1317	
Approach Delay, s/veh		33.8			45.8			21.8			24.2	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.2	47.7		9.6	15.4	40.5		22.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	8.0	77.0		18.0	35.0	50.0		42.0
Max Q Clear Time (g_c+I1), s	4.0	18.5		4.9	9.4	26.2		13.6
Green Ext Time (p_c), s	0.0	8.4		0.3	1.0	9.3		2.2

Intersection Summary	
HCM 7th Control Delay, s/veh	25.5
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	303	266	143	19	267	111	148	792	30	148	843	456
Future Volume (veh/h)	303	266	143	19	267	111	148	792	30	148	843	456
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	329	289	0	21	290	0	161	861	10	161	916	217
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	449	879		42	502		257	1299	579	256	1298	578
Arrive On Green	0.13	0.25	0.00	0.02	0.14	0.00	0.07	0.37	0.37	0.07	0.37	0.37
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1581
Grp Volume(v), veh/h	329	289	0	21	290	0	161	861	10	161	916	217
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1581
Q Serve(g_s), s	7.0	5.1	0.0	0.9	5.8	0.0	3.4	15.4	0.3	3.4	16.8	7.7
Cycle Q Clear(g_c), s	7.0	5.1	0.0	0.9	5.8	0.0	3.4	15.4	0.3	3.4	16.8	7.7
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	449	879		42	502		257	1299	579	256	1298	578
V/C Ratio(X)	0.73	0.33		0.50	0.58		0.63	0.66	0.02	0.63	0.71	0.38
Avail Cap(c_a), veh/h	932	1753		480	1753		932	3061	1365	886	3015	1341
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.8	23.4	0.0	36.7	30.5	0.0	34.2	20.2	15.4	34.2	20.6	17.7
Incr Delay (d2), s/veh	2.3	0.2	0.0	8.9	1.1	0.0	2.5	0.6	0.0	2.5	0.7	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	2.1	0.0	0.5	2.5	0.0	1.5	6.0	0.1	1.5	6.5	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	34.2	23.7	0.0	45.6	31.6	0.0	36.7	20.8	15.4	36.7	21.3	18.2
LnGrp LOS	C	C		D	C		D	C	B	D	C	B
Approach Vol, veh/h		618			311			1032			1294	
Approach Delay, s/veh		29.2			32.5			23.2			22.7	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.1	33.3	7.3	24.3	11.2	33.3	15.4	16.2
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	65.5	20.5	37.5	20.5	64.5	20.5	37.5
Max Q Clear Time (g_c+I1), s	5.4	17.4	2.9	7.1	5.4	18.8	9.0	7.8
Green Ext Time (p_c), s	0.4	7.2	0.0	2.1	0.4	8.8	0.9	2.1

Intersection Summary	
HCM 7th Control Delay, s/veh	25.1
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	449	24	205	346	199	9	54	188	129	39	30
Future Volume (veh/h)	30	449	24	205	346	199	9	54	188	129	39	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	488	23	223	376	154	10	59	6	140	42	10
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	66	874	41	288	932	376	115	121	103	213	175	42
Arrive On Green	0.04	0.25	0.25	0.16	0.38	0.38	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3454	162	1781	2464	994	1781	1870	1585	1781	1460	348
Grp Volume(v), veh/h	33	251	260	223	270	260	10	59	6	140	0	52
Grp Sat Flow(s),veh/h/ln	1781	1777	1840	1781	1777	1681	1781	1870	1585	1781	0	1808
Q Serve(g_s), s	0.9	6.1	6.1	6.0	5.6	5.7	0.3	1.5	0.2	3.7	0.0	1.3
Cycle Q Clear(g_c), s	0.9	6.1	6.1	6.0	5.6	5.7	0.3	1.5	0.2	3.7	0.0	1.3
Prop In Lane	1.00		0.09	1.00		0.59	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	66	450	466	288	672	635	115	121	103	213	0	217
V/C Ratio(X)	0.50	0.56	0.56	0.77	0.40	0.41	0.09	0.49	0.06	0.66	0.00	0.24
Avail Cap(c_a), veh/h	321	1957	2026	678	2313	2188	678	712	603	1142	0	1159
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.6	16.2	16.2	20.0	11.4	11.4	22.0	22.5	21.9	21.0	0.0	19.9
Incr Delay (d2), s/veh	5.9	1.1	1.1	4.4	0.4	0.4	0.3	3.0	0.2	3.4	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	2.4	2.5	2.6	2.0	1.9	0.1	0.7	0.1	1.7	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.5	17.3	17.3	24.5	11.8	11.8	22.3	25.6	22.2	24.4	0.0	20.5
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		544			753			75			192	
Approach Delay, s/veh		18.0			15.6			24.8			23.3	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	13.1	17.6	11.0	6.8	23.9	8.2
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	19.0	55.0	32.0	9.0	65.0	19.0
Max Q Clear Time (g_c+I1), s	8.0	8.1	5.7	2.9	7.7	3.5
Green Ext Time (p_c), s	0.5	3.6	0.7	0.0	4.0	0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	17.8
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	178	15	127	216	50	28	52	198	121	62	63
Future Volume (veh/h)	90	178	15	127	216	50	28	52	198	121	62	63
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	98	193	11	138	235	37	30	57	17	132	67	35
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	144	513	29	184	531	82	162	170	143	329	212	110
Arrive On Green	0.08	0.15	0.15	0.10	0.17	0.17	0.09	0.09	0.09	0.18	0.18	0.18
Sat Flow, veh/h	1781	3418	194	1781	3075	477	1781	1870	1577	1781	1145	598
Grp Volume(v), veh/h	98	100	104	138	134	138	30	57	17	132	0	102
Grp Sat Flow(s),veh/h/ln	1781	1777	1835	1781	1777	1775	1781	1870	1577	1781	0	1743
Q Serve(g_s), s	2.3	2.1	2.2	3.2	2.9	3.0	0.7	1.2	0.4	2.8	0.0	2.2
Cycle Q Clear(g_c), s	2.3	2.1	2.2	3.2	2.9	3.0	0.7	1.2	0.4	2.8	0.0	2.2
Prop In Lane	1.00		0.11	1.00		0.27	1.00		1.00	1.00		0.34
Lane Grp Cap(c), veh/h	144	267	276	184	307	307	162	170	143	329	0	322
V/C Ratio(X)	0.68	0.37	0.38	0.75	0.44	0.45	0.19	0.34	0.12	0.40	0.00	0.32
Avail Cap(c_a), veh/h	419	1276	1317	713	1568	1567	1321	1387	1169	1321	0	1292
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.0	16.3	16.3	18.5	15.7	15.8	17.9	18.1	17.7	15.2	0.0	15.0
Incr Delay (d2), s/veh	5.6	0.9	0.9	6.0	1.0	1.0	0.5	1.1	0.4	0.8	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.8	0.9	1.5	1.1	1.1	0.3	0.5	0.1	1.0	0.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	24.6	17.1	17.1	24.5	16.7	16.8	18.4	19.3	18.1	16.0	0.0	15.6
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		302			410			104			234	
Approach Delay, s/veh		19.5			19.4			18.8			15.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	9.4	11.4	12.8	8.4	12.3	8.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	5.2	4.2	4.8	4.3	5.0	3.2
Green Ext Time (p_c), s	0.3	1.2	0.9	0.1	1.8	0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	18.6
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	230	38	22	274	7	16	5	41	8	6	11
Future Volume (veh/h)	22	230	38	22	274	7	16	5	41	8	6	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	24	250	32	24	298	7	17	5	2	9	7	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	54	699	88	54	783	18	54	57	48	37	39	0
Arrive On Green	0.03	0.22	0.22	0.03	0.22	0.22	0.03	0.03	0.03	0.02	0.02	0.00
Sat Flow, veh/h	1781	3171	401	1781	3548	83	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	24	139	143	24	149	156	17	5	2	9	7	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1795	1781	1777	1854	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	1.9	1.9	0.4	2.0	2.1	0.3	0.1	0.0	0.1	0.1	0.0
Cycle Q Clear(g_c), s	0.4	1.9	1.9	0.4	2.0	2.1	0.3	0.1	0.0	0.1	0.1	0.0
Prop In Lane	1.00		0.22	1.00		0.04	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	54	392	396	54	392	409	54	57	48	37	39	0
V/C Ratio(X)	0.44	0.35	0.36	0.44	0.38	0.38	0.31	0.09	0.04	0.24	0.18	0.00
Avail Cap(c_a), veh/h	311	1550	1566	311	1550	1618	1865	1958	1659	1865	1958	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	13.7	9.4	9.5	13.7	9.5	9.5	13.6	13.5	13.5	13.8	13.8	0.0
Incr Delay (d2), s/veh	5.6	0.5	0.6	5.6	0.6	0.6	3.3	0.7	0.4	3.3	2.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.6	0.6	0.2	0.6	0.7	0.1	0.0	0.0	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	19.3	10.0	10.0	19.3	10.1	10.1	16.9	14.2	13.8	17.1	16.0	0.0
LnGrp LOS	B	A	B	B	B	B	B	B	B	B	B	
Approach Vol, veh/h		306			329			24			16	
Approach Delay, s/veh		10.7			10.8			16.1			16.6	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	5.9	11.3	5.6	5.9	11.3	5.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	2.4	3.9	2.1	2.4	4.1	2.3
Green Ext Time (p_c), s	0.0	1.6	0.0	0.0	1.8	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	11.1
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	2.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	148	15	33	88	5	68
Future Vol, veh/h	148	15	33	88	5	68
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	161	16	36	96	5	74

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	178	0	337	170
Stage 1	-	-	-	-	170	-
Stage 2	-	-	-	-	167	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1398	-	658	874
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	862	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1396	-	640	873
Mov Cap-2 Maneuver	-	-	-	-	640	-
Stage 1	-	-	-	-	859	-
Stage 2	-	-	-	-	839	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.09	9.58
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	640	873	-	-	1396	-
HCM Lane V/C Ratio	0.008	0.085	-	-	0.026	-
HCM Control Delay (s/veh)	10.7	9.5	-	-	7.6	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	276	133	89	194	0	60	0	90	1	0	0
Future Vol, veh/h	3	276	133	89	194	0	60	0	90	1	0	0
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	300	145	97	211	0	65	0	98	1	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	217	0	0	445	0	0	784	789	372	717	861	218
Stage 1	-	-	-	-	-	-	379	379	-	410	410	-
Stage 2	-	-	-	-	-	-	405	410	-	307	451	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1353	-	-	1116	-	0	311	323	674	345	293	822
Stage 1	-	-	-	-	-	0	643	615	-	618	595	-
Stage 2	-	-	-	-	-	0	622	595	-	703	571	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1345	-	-	1116	-	-	283	292	674	267	265	816
Mov Cap-2 Maneuver	-	-	-	-	-	-	283	292	-	267	265	-
Stage 1	-	-	-	-	-	-	641	613	-	613	541	-
Stage 2	-	-	-	-	-	-	568	541	-	600	570	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.06	2.68	18.21	18.54
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	434	1345	-	-	1116	-	267
HCM Lane V/C Ratio	0.376	0.002	-	-	0.087	-	0.004
HCM Control Delay (s/veh)	18.2	7.7	-	-	8.5	-	18.5
HCM Lane LOS	C	A	-	-	A	-	C
HCM 95th %tile Q(veh)	1.7	0	-	-	0.3	-	0

Intersection	
Intersection Delay, s/veh	12.2
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	230	84	100	206	84	110
Future Vol, veh/h	230	84	100	206	84	110
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	250	91	109	224	91	120
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	13.5	11.7	11
HCM LOS	B	B	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	73%	43%
Vol Thru, %	33%	0%	57%
Vol Right, %	67%	27%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	306	314	194
LT Vol	0	230	84
Through Vol	100	0	110
RT Vol	206	84	0
Lane Flow Rate	333	341	211
Geometry Grp	1	1	1
Degree of Util (X)	0.448	0.501	0.319
Departure Headway (Hd)	4.847	5.288	5.445
Convergence, Y/N	Yes	Yes	Yes
Cap	748	683	660
Service Time	2.847	3.321	3.479
HCM Lane V/C Ratio	0.445	0.499	0.32
HCM Control Delay, s/veh	11.7	13.5	11
HCM Lane LOS	B	B	B
HCM 95th-tile Q	2.3	2.8	1.4

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	73	8	302	112	6	355
Future Vol, veh/h	73	8	302	112	6	355
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	79	9	328	122	7	386

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	789	390	0	0	450	0
Stage 1	389	-	-	-	-	-
Stage 2	400	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	359	658	-	-	1110	-
Stage 1	685	-	-	-	-	-
Stage 2	677	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	356	658	-	-	1110	-
Mov Cap-2 Maneuver	356	-	-	-	-	-
Stage 1	685	-	-	-	-	-
Stage 2	671	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	17.59	0	0.14
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	373	1110	-
HCM Lane V/C Ratio	-	-	0.236	0.006	-
HCM Control Delay (s/veh)	-	-	17.6	8.3	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.9	0	-

Intersection	
Intersection Delay, s/veh	27.8
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	24	45	190	21	27	43	374	350	34	362	23
Future Vol, veh/h	16	24	45	190	21	27	43	374	350	34	362	23
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	26	49	207	23	29	47	407	380	37	393	25
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	12.8	18.5	29.3	33.5
HCM LOS	B	C	D	D

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	10%	0%	19%	80%	8%
Vol Thru, %	90%	0%	28%	9%	86%
Vol Right, %	0%	100%	53%	11%	5%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	417	350	85	238	419
LT Vol	43	0	16	190	34
Through Vol	374	0	24	21	362
RT Vol	0	350	45	27	23
Lane Flow Rate	453	380	92	259	455
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.857	0.638	0.199	0.53	0.826
Departure Headway (Hd)	6.803	6.035	7.761	7.38	6.526
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	530	597	461	489	556
Service Time	4.554	3.785	5.832	5.431	4.571
HCM Lane V/C Ratio	0.855	0.637	0.2	0.53	0.818
HCM Control Delay, s/veh	38	18.9	12.8	18.5	33.5
HCM Lane LOS	E	C	B	C	D
HCM 95th-tile Q	9.1	4.5	0.7	3.1	8.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	147	224	32	208	272	273	75	319	196	158	284	163
Future Volume (veh/h)	147	224	32	208	272	273	75	319	196	158	284	163
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.97		0.92	0.96		0.93	0.99		1.00	0.99		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	160	243	30	226	296	54	82	347	0	172	309	156
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	364	362	45	382	489	388	215	501		341	354	179
Arrive On Green	0.10	0.25	0.25	0.13	0.29	0.29	0.05	0.30	0.00	0.09	0.34	0.34
Sat Flow, veh/h	1603	1454	180	1603	1683	1333	1603	1683	1427	1603	1037	523
Grp Volume(v), veh/h	160	0	273	226	296	54	82	347	0	172	0	465
Grp Sat Flow(s),veh/h/ln	1603	0	1634	1603	1683	1333	1603	1683	1427	1603	0	1560
Q Serve(g_s), s	6.3	0.0	13.0	8.7	13.1	2.6	3.0	15.8	0.0	6.2	0.0	24.1
Cycle Q Clear(g_c), s	6.3	0.0	13.0	8.7	13.1	2.6	3.0	15.8	0.0	6.2	0.0	24.1
Prop In Lane	1.00		0.11	1.00		1.00	1.00		1.00	1.00		0.34
Lane Grp Cap(c), veh/h	364	0	407	382	489	388	215	501		341	0	533
V/C Ratio(X)	0.44	0.00	0.67	0.59	0.60	0.14	0.38	0.69		0.50	0.00	0.87
Avail Cap(c_a), veh/h	580	0	473	475	489	388	246	896		375	0	903
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.1	0.0	29.3	20.5	26.4	22.7	22.0	26.8	0.0	19.3	0.0	26.6
Incr Delay (d2), s/veh	0.8	0.0	3.0	1.5	2.1	0.2	1.1	1.7	0.0	1.2	0.0	5.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.0	5.4	3.3	5.4	0.8	1.2	6.4	0.0	2.4	0.0	9.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.0	0.0	32.2	22.0	28.5	22.8	23.1	28.6	0.0	20.4	0.0	31.7
LnGrp LOS	C		C	C	C	C	C	C		C		C
Approach Vol, veh/h		433			576			429			637	
Approach Delay, s/veh		28.4			25.4			27.5			28.7	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.2	30.7	16.0	26.5	9.3	34.5	12.4	30.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	10.0	46.0	16.0	25.0	6.0	50.0	20.0	22.0
Max Q Clear Time (g_c+I1), s	8.2	17.8	10.7	15.0	5.0	26.1	8.3	15.1
Green Ext Time (p_c), s	0.1	2.3	0.3	1.1	0.0	3.4	0.3	1.1

Intersection Summary	
HCM 7th Control Delay, s/veh	27.5
HCM 7th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	368	21	125	35	24	54	184	1164	16	20	913	332
Future Volume (veh/h)	368	21	125	35	24	54	184	1164	16	20	913	332
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	400	23	0	38	26	0	200	1265	10	22	992	191
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	466	252		102	107		293	2372	1058	34	2139	953
Arrive On Green	0.13	0.13	0.00	0.06	0.06	0.00	0.08	0.67	0.67	0.02	0.60	0.60
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	3554	1584
Grp Volume(v), veh/h	400	23	0	38	26	0	200	1265	10	22	992	191
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1777	1584
Q Serve(g_s), s	18.7	1.8	0.0	3.4	2.2	0.0	9.3	30.3	0.3	2.0	25.4	9.0
Cycle Q Clear(g_c), s	18.7	1.8	0.0	3.4	2.2	0.0	9.3	30.3	0.3	2.0	25.4	9.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	466	252		102	107		293	2372	1058	34	2139	953
V/C Ratio(X)	0.86	0.09		0.37	0.24		0.68	0.53	0.01	0.64	0.46	0.20
Avail Cap(c_a), veh/h	859	465		119	125		670	2372	1058	54	2139	953
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.88	0.88	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	69.8	62.5	0.0	74.9	74.3	0.0	73.3	14.2	9.2	80.3	18.1	14.9
Incr Delay (d2), s/veh	4.2	0.1	0.0	2.2	1.2	0.0	2.8	0.9	0.0	18.2	0.7	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.6	0.9	0.0	1.6	1.1	0.0	4.2	12.2	0.1	1.1	10.6	3.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.0	62.7	0.0	77.1	75.5	0.0	76.1	15.0	9.2	98.6	18.9	15.3
LnGrp LOS	E	E		E	E		E	B	A	F	B	B
Approach Vol, veh/h		423			64			1475			1205	
Approach Delay, s/veh		73.4			76.5			23.3			19.8	
Approach LOS		E			E			C			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	8.2	115.1	14.5	19.0	104.3	27.2
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	88.0	11.0	32.0	61.0	41.0
Max Q Clear Time (g_c+I1), s	4.0	32.3	5.4	11.3	27.4	20.7
Green Ext Time (p_c), s	0.0	13.1	0.1	0.6	9.2	1.5

Intersection Summary	
HCM 7th Control Delay, s/veh	29.7
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	346	225	105	22	306	100	139	991	24	91	695	355
Future Volume (veh/h)	346	225	105	22	306	100	139	991	24	91	695	355
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	376	245	0	24	333	0	151	1077	12	99	755	173
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	436	736		72	431		251	2030	905	207	1985	883
Arrive On Green	0.13	0.21	0.00	0.04	0.12	0.00	0.07	0.57	0.57	0.06	0.56	0.56
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1581
Grp Volume(v), veh/h	376	245	0	24	333	0	151	1077	12	99	755	173
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1581
Q Serve(g_s), s	17.6	9.7	0.0	2.2	15.0	0.0	7.0	30.8	0.5	4.6	19.6	8.9
Cycle Q Clear(g_c), s	17.6	9.7	0.0	2.2	15.0	0.0	7.0	30.8	0.5	4.6	19.6	8.9
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	436	736		72	431		251	2030	905	207	1985	883
V/C Ratio(X)	0.86	0.33		0.33	0.77		0.60	0.53	0.01	0.48	0.38	0.20
Avail Cap(c_a), veh/h	754	969		313	818		293	2030	905	230	1985	883
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.83	0.83	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	70.7	55.7	0.0	77.0	70.3	0.0	74.2	21.8	15.3	75.1	20.4	18.0
Incr Delay (d2), s/veh	4.3	0.2	0.0	2.7	3.0	0.0	2.6	1.0	0.0	1.7	0.6	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.1	4.5	0.0	1.1	7.1	0.0	3.2	13.1	0.2	2.1	8.4	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	75.0	55.9	0.0	79.7	73.3	0.0	76.7	22.8	15.3	76.8	21.0	18.5
LnGrp LOS	E	E		E	E		E	C	B	E	C	B
Approach Vol, veh/h		621			357			1240			1027	
Approach Delay, s/veh		67.5			73.7			29.3			25.9	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	99.3	11.7	39.2	17.0	97.2	25.8	25.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	60.0	29.0	45.0	14.0	57.0	36.0	38.0
Max Q Clear Time (g_c+I1), s	16.6	32.8	4.2	11.7	9.0	21.6	19.6	17.0
Green Ext Time (p_c), s	0.1	8.7	0.0	1.8	0.2	6.5	1.2	2.2

Intersection Summary	
HCM 7th Control Delay, s/veh	40.4
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	286	19	200	259	74	2	18	199	35	17	11
Future Volume (veh/h)	11	286	19	200	259	74	2	18	199	35	17	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	12	311	17	217	282	63	2	20	7	38	18	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	28	700	38	291	1020	224	62	65	55	105	110	0
Arrive On Green	0.02	0.20	0.20	0.16	0.35	0.35	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3426	186	1781	2894	636	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	12	161	167	217	171	174	2	20	7	38	18	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1835	1781	1777	1754	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.2	2.9	3.0	4.3	2.6	2.6	0.0	0.4	0.2	0.8	0.3	0.0
Cycle Q Clear(g_c), s	0.2	2.9	3.0	4.3	2.6	2.6	0.0	0.4	0.2	0.8	0.3	0.0
Prop In Lane	1.00		0.10	1.00		0.36	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	28	363	375	291	626	618	62	65	55	105	110	0
V/C Ratio(X)	0.43	0.44	0.45	0.74	0.27	0.28	0.03	0.31	0.13	0.36	0.16	0.00
Avail Cap(c_a), veh/h	431	2629	2716	911	3107	3067	911	956	810	1534	1610	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	18.1	12.9	12.9	14.8	8.6	8.7	17.3	17.5	17.4	16.8	16.6	0.0
Incr Delay (d2), s/veh	10.1	0.8	0.8	3.8	0.2	0.2	0.2	2.6	1.0	2.1	0.7	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.1	1.1	1.8	0.8	0.8	0.0	0.2	0.1	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.2	13.8	13.8	18.6	8.9	8.9	17.5	20.1	18.4	18.9	17.3	0.0
LnGrp LOS	C	B	B	B	A	A	B	C	B	B	B	
Approach Vol, veh/h		340			562			29			56	
Approach Delay, s/veh		14.3			12.6			19.5			18.4	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.1	12.6		7.2	5.6	18.1		6.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	6.3	5.0		2.8	2.2	4.6		2.4
Green Ext Time (p_c), s	0.5	2.2		0.2	0.0	2.4		0.1

Intersection Summary		
HCM 7th Control Delay, s/veh		13.7
HCM 7th LOS		B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	157	11	105	147	32	16	17	126	36	16	7
Future Volume (veh/h)	19	157	11	105	147	32	16	17	126	36	16	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	171	9	114	160	23	17	18	1	39	17	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	47	592	31	177	766	108	76	80	68	116	122	0
Arrive On Green	0.03	0.17	0.17	0.10	0.25	0.25	0.04	0.04	0.04	0.07	0.07	0.00
Sat Flow, veh/h	1781	3433	180	1781	3125	442	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	21	88	92	114	90	93	17	18	1	39	17	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1836	1781	1777	1790	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	1.4	1.4	2.0	1.3	1.3	0.3	0.3	0.0	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.4	1.4	1.4	2.0	1.3	1.3	0.3	0.3	0.0	0.7	0.3	0.0
Prop In Lane	1.00		0.10	1.00		0.25	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	47	307	317	177	436	439	76	80	68	116	122	0
V/C Ratio(X)	0.44	0.29	0.29	0.65	0.21	0.21	0.22	0.23	0.01	0.34	0.14	0.00
Avail Cap(c_a), veh/h	552	1681	1736	939	2066	2081	1740	1827	1548	1740	1827	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.5	11.6	11.6	14.0	9.7	9.7	14.9	14.9	14.8	14.4	14.2	0.0
Incr Delay (d2), s/veh	6.4	0.5	0.5	3.9	0.2	0.2	1.5	1.4	0.1	1.7	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.5	0.5	0.9	0.4	0.4	0.1	0.1	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	21.8	12.1	12.1	17.9	9.9	9.9	16.4	16.3	14.9	16.1	14.7	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		201			297			36			56	
Approach Delay, s/veh		13.1			13.0			16.3			15.7	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.2	10.6		7.1	5.9	12.9		6.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	4.0	3.4		2.7	2.4	3.3		2.3
Green Ext Time (p_c), s	0.2	1.0		0.2	0.0	1.1		0.1

Intersection Summary		
HCM 7th Control Delay, s/veh		13.5
HCM 7th LOS		B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	164	19	17	150	2	3	4	24	1	4	4
Future Volume (veh/h)	13	164	19	17	150	2	3	4	24	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	14	178	16	18	163	2	3	4	1	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	649	58	42	725	9	27	28	24	12	13	0
Arrive On Green	0.02	0.20	0.20	0.02	0.20	0.20	0.01	0.01	0.01	0.01	0.01	0.00
Sat Flow, veh/h	1781	3300	294	1781	3595	44	1781	1870	1583	1781	1870	0
Grp Volume(v), veh/h	14	95	99	18	80	85	3	4	1	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1817	1781	1777	1862	1781	1870	1583	1781	1870	0
Q Serve(g_s), s	0.2	1.2	1.2	0.3	1.0	1.0	0.0	0.1	0.0	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	1.2	1.2	0.3	1.0	1.0	0.0	0.1	0.0	0.0	0.1	0.0
Prop In Lane	1.00		0.16	1.00		0.02	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	33	350	357	42	358	375	27	28	24	12	13	0
V/C Ratio(X)	0.43	0.27	0.28	0.43	0.22	0.23	0.11	0.14	0.04	0.08	0.31	0.00
Avail Cap(c_a), veh/h	338	1684	1721	338	1684	1765	2026	2127	1800	2026	2127	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	12.8	9.0	9.0	12.7	8.8	8.8	12.8	12.8	12.8	13.0	13.0	0.0
Incr Delay (d2), s/veh	8.5	0.4	0.4	6.9	0.3	0.3	1.8	2.3	0.7	2.9	13.4	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.4	0.4	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	21.3	9.4	9.4	19.6	9.1	9.1	14.7	15.1	13.5	15.9	26.4	0.0
LnGrp LOS	C	A	A	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		208			183			8			5	
Approach Delay, s/veh		10.2			10.1			14.7			24.3	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	5.6	10.2	5.2	5.5	10.3	5.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	2.3	3.2	2.1	2.2	3.0	2.1
Green Ext Time (p_c), s	0.0	1.1	0.0	0.0	0.9	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	10.4
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	3.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	99	6	34	59	7	54
Future Vol, veh/h	99	6	34	59	7	54
Conflicting Peds, #/hr	0	3	3	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	108	7	37	64	8	59

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	117	0	252	114
Stage 1	-	-	-	-	114	-
Stage 2	-	-	-	-	138	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1471	-	737	939
Stage 1	-	-	-	-	911	-
Stage 2	-	-	-	-	889	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1467	-	715	936
Mov Cap-2 Maneuver	-	-	-	-	715	-
Stage 1	-	-	-	-	908	-
Stage 2	-	-	-	-	865	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.75	9.22
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	715	936	-	-	1467	-
HCM Lane V/C Ratio	0.011	0.063	-	-	0.025	-
HCM Control Delay (s/veh)	10.1	9.1	-	-	7.5	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.2	-	-	0.1	-

Intersection												
Int Delay, s/veh	3											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	295	105	84	165	5	39	0	55	4	0	0
Future Vol, veh/h	2	295	105	84	165	5	39	0	55	4	0	0
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	321	114	91	179	5	42	0	60	4	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	187	0	0	438	0	0	748	754	381	692	809	185
Stage 1	-	-	-	-	-	-	385	385	-	367	367	-
Stage 2	-	-	-	-	-	-	363	369	-	325	442	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1388	-	-	1122	-	-	329	338	666	358	314	857
Stage 1	-	-	-	-	-	-	638	611	-	653	622	-
Stage 2	-	-	-	-	-	-	656	621	-	687	576	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1385	-	-	1119	-	-	300	308	664	299	287	855
Mov Cap-2 Maneuver	-	-	-	-	-	-	300	308	-	299	287	-
Stage 1	-	-	-	-	-	-	635	608	-	651	570	-
Stage 2	-	-	-	-	-	-	602	569	-	625	574	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.04	2.81	15.58	17.24
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	442	1385	-	-	1119	-	-	299
HCM Lane V/C Ratio	0.231	0.002	-	-	0.082	-	-	0.015
HCM Control Delay (s/veh)	15.6	7.6	-	-	8.5	-	-	17.2
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.9	0	-	-	0.3	-	-	0

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	125	34	54	168	19	49
Future Vol, veh/h	125	34	54	168	19	49
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	136	37	59	183	21	53
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	9	8.5	8.2
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	79%	28%
Vol Thru, %	24%	0%	72%
Vol Right, %	76%	21%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	222	159	68
LT Vol	0	125	19
Through Vol	54	0	49
RT Vol	168	34	0
Lane Flow Rate	241	173	74
Geometry Grp	1	1	1
Degree of Util (X)	0.267	0.222	0.096
Departure Headway (Hd)	3.989	4.629	4.654
Convergence, Y/N	Yes	Yes	Yes
Cap	902	776	771
Service Time	2.005	2.655	2.676
HCM Lane V/C Ratio	0.267	0.223	0.096
HCM Control Delay, s/veh	8.5	9	8.2
HCM Lane LOS	A	A	A
HCM 95th-tile Q	1.1	0.8	0.3

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	48	2	238	94	4	176
Future Vol, veh/h	48	2	238	94	4	176
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	52	2	259	102	4	191

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	512	311	0	0	362	0
Stage 1	311	-	-	-	-	-
Stage 2	201	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	522	729	-	-	1197	-
Stage 1	743	-	-	-	-	-
Stage 2	833	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	519	729	-	-	1196	-
Mov Cap-2 Maneuver	519	-	-	-	-	-
Stage 1	742	-	-	-	-	-
Stage 2	829	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	12.65	0	0.18
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	525	1196	-
HCM Lane V/C Ratio	-	-	0.104	0.004	-
HCM Control Delay (s/veh)	-	-	12.6	8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Intersection Delay, s/veh	14.2
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	35	29	167	22	16	43	297	311	0	194	27
Future Vol, veh/h	12	35	29	167	22	16	43	297	311	0	194	27
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	38	32	182	24	17	47	323	338	0	211	29
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	10.6	13.5	15.3	12.6
HCM LOS	B	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	13%	0%	16%	81%	0%
Vol Thru, %	87%	0%	46%	11%	88%
Vol Right, %	0%	100%	38%	8%	12%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	340	311	76	205	221
LT Vol	43	0	12	167	0
Through Vol	297	0	35	22	194
RT Vol	0	311	29	16	27
Lane Flow Rate	370	338	83	223	240
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.61	0.485	0.147	0.392	0.389
Departure Headway (Hd)	5.942	5.169	6.413	6.341	5.825
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	606	696	556	566	615
Service Time	3.689	2.915	4.485	4.397	3.879
HCM Lane V/C Ratio	0.611	0.486	0.149	0.394	0.39
HCM Control Delay, s/veh	17.6	12.7	10.6	13.5	12.6
HCM Lane LOS	C	B	B	B	B
HCM 95th-tile Q	4.1	2.7	0.5	1.9	1.8

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

Makalapua Project District TIAR
10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	137	205	46	217	237	189	76	417	287	98	209	101
Future Volume (veh/h)	137	205	46	217	237	189	76	417	287	98	209	101
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.95	0.98		0.96	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	149	223	42	236	258	28	83	453	0	107	227	97
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	294	278	52	298	396	320	446	784		364	529	226
Arrive On Green	0.09	0.20	0.20	0.12	0.24	0.24	0.04	0.47	0.00	0.05	0.47	0.47
Sat Flow, veh/h	1603	1364	257	1603	1683	1363	1603	1683	1427	1603	1114	476
Grp Volume(v), veh/h	149	0	265	236	258	28	83	453	0	107	0	324
Grp Sat Flow(s),veh/h/ln	1603	0	1621	1603	1683	1363	1603	1683	1427	1603	0	1590
Q Serve(g_s), s	9.1	0.0	19.4	14.4	17.3	2.0	3.4	24.6	0.0	4.3	0.0	16.8
Cycle Q Clear(g_c), s	9.1	0.0	19.4	14.4	17.3	2.0	3.4	24.6	0.0	4.3	0.0	16.8
Prop In Lane	1.00		0.16	1.00		1.00	1.00		1.00	1.00		0.30
Lane Grp Cap(c), veh/h	294	0	331	298	396	320	446	784		364	0	755
V/C Ratio(X)	0.51	0.00	0.80	0.79	0.65	0.09	0.19	0.58		0.29	0.00	0.43
Avail Cap(c_a), veh/h	344	0	454	298	471	382	508	784		412	0	755
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.78	0.78	0.78	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	35.3	0.0	47.3	35.0	43.2	37.3	17.1	24.4	0.0	18.5	0.0	21.6
Incr Delay (d2), s/veh	1.4	0.0	7.1	10.9	1.9	0.1	0.2	3.1	0.0	0.4	0.0	1.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	8.6	6.6	7.5	0.7	1.3	10.5	0.0	1.7	0.0	6.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	36.6	0.0	54.4	45.9	45.1	37.4	17.3	27.5	0.0	18.9	0.0	23.4
LnGrp LOS	D		D	D	D	D	B	C		B		C
Approach Vol, veh/h		414			522			536			431	
Approach Delay, s/veh		48.0			45.0			25.9			22.3	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.2	63.2	20.0	30.5	10.1	64.4	16.1	34.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	45.0	15.0	35.0	10.0	45.0	15.0	35.0
Max Q Clear Time (g_c+I1), s	16.3	26.6	16.4	21.4	5.4	18.8	11.1	19.3
Green Ext Time (p_c), s	0.1	2.9	0.0	1.3	0.1	2.2	0.1	1.4

Intersection Summary	
HCM 7th Control Delay, s/veh	35.1
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

Makalapua Project District TIAR
10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	521	46	288	34	49	53	265	1020	16	30	1566	451
Future Volume (veh/h)	521	46	288	34	49	53	265	1020	16	30	1566	451
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	566	50	0	37	53	0	288	1109	9	33	1702	229
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	645	349		106	112		343	2163	965	42	1895	845
Arrive On Green	0.19	0.19	0.00	0.06	0.06	0.00	0.10	0.61	0.61	0.02	0.53	0.53
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	3554	1585
Grp Volume(v), veh/h	566	50	0	37	53	0	288	1109	9	33	1702	229
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1777	1585
Q Serve(g_s), s	26.3	3.7	0.0	3.3	4.5	0.0	13.5	29.3	0.4	3.0	70.8	13.0
Cycle Q Clear(g_c), s	26.3	3.7	0.0	3.3	4.5	0.0	13.5	29.3	0.4	3.0	70.8	13.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	645	349		106	112		343	2163	965	42	1895	845
V/C Ratio(X)	0.88	0.14		0.35	0.48		0.84	0.51	0.01	0.78	0.90	0.27
Avail Cap(c_a), veh/h	922	499		119	125		670	2163	965	76	1895	845
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.73	0.73	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.3	56.1	0.0	74.5	75.1	0.0	73.0	18.4	12.7	80.1	34.5	21.0
Incr Delay (d2), s/veh	5.3	0.1	0.0	1.9	3.1	0.0	5.5	0.9	0.0	25.5	7.2	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.2	1.8	0.0	1.6	2.3	0.0	6.3	12.2	0.1	1.7	31.7	5.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	70.6	56.2	0.0	76.4	78.2	0.0	78.5	19.2	12.7	105.5	41.7	21.8
LnGrp LOS	E	E		E	E		E	B	B	F	D	C
Approach Vol, veh/h		616			90			1406			1964	
Approach Delay, s/veh		69.4			77.5			31.3			40.5	
Approach LOS		E			E			C			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.9	105.5		14.8	21.4	93.0		35.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	7.0	83.0		11.0	32.0	58.0		44.0
Max Q Clear Time (g_c+I1), s	5.0	31.3		6.5	15.5	72.8		28.3
Green Ext Time (p_c), s	0.0	10.5		0.1	0.9	0.0		2.2

Intersection Summary	
HCM 7th Control Delay, s/veh	42.5
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	367	334	136	30	332	131	127	905	25	213	1193	662
Future Volume (veh/h)	367	334	136	30	332	131	127	905	25	213	1193	662
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	399	363	0	33	361	0	138	984	11	232	1297	490
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	461	773		84	467		209	1795	801	377	1967	877
Arrive On Green	0.13	0.22	0.00	0.05	0.13	0.00	0.06	0.51	0.51	0.11	0.55	0.55
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	399	363	0	33	361	0	138	984	11	232	1297	490
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	18.7	14.7	0.0	3.0	16.2	0.0	6.4	31.3	0.6	10.6	42.3	33.0
Cycle Q Clear(g_c), s	18.7	14.7	0.0	3.0	16.2	0.0	6.4	31.3	0.6	10.6	42.3	33.0
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	461	773		84	467		209	1795	801	377	1967	877
V/C Ratio(X)	0.87	0.47		0.39	0.77		0.66	0.55	0.01	0.62	0.66	0.56
Avail Cap(c_a), veh/h	775	969		324	818		335	1795	801	440	1967	877
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.79	0.79	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	70.1	56.3	0.0	76.3	69.3	0.0	75.8	28.0	20.4	70.2	25.9	23.8
Incr Delay (d2), s/veh	4.5	0.4	0.0	2.9	2.8	0.0	3.5	1.2	0.0	2.0	1.8	2.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.6	6.8	0.0	1.4	7.6	0.0	3.0	13.6	0.2	4.8	18.2	13.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.5	56.6	0.0	79.2	72.1	0.0	79.4	29.2	20.4	72.2	27.6	26.4
LnGrp LOS	E	E		E	E		E	C	C	E	C	C
Approach Vol, veh/h		762			394			1133			2019	
Approach Delay, s/veh		66.0			72.7			35.2			32.4	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	88.3	12.8	40.9	15.0	96.3	27.0	26.7
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	49.0	30.0	45.0	16.0	54.0	37.0	38.0
Max Q Clear Time (g_c+I1), s	12.6	33.3	5.0	16.7	8.4	44.3	20.7	18.2
Green Ext Time (p_c), s	0.5	6.2	0.1	2.6	0.2	6.8	1.3	2.4

Intersection Summary	
HCM 7th Control Delay, s/veh	42.8
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	441	25	209	394	161	11	13	290	136	23	23
Future Volume (veh/h)	19	441	25	209	394	161	11	13	290	136	23	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	479	23	227	428	143	12	14	6	148	25	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	46	847	41	296	1012	335	65	68	58	215	206	16
Arrive On Green	0.03	0.25	0.25	0.17	0.39	0.39	0.04	0.04	0.04	0.12	0.12	0.12
Sat Flow, veh/h	1781	3452	165	1781	2622	868	1781	1870	1585	1781	1709	137
Grp Volume(v), veh/h	21	246	256	227	289	282	12	14	6	148	0	27
Grp Sat Flow(s),veh/h/ln	1781	1777	1840	1781	1777	1713	1781	1870	1585	1781	0	1846
Q Serve(g_s), s	0.5	5.6	5.7	5.6	5.5	5.6	0.3	0.3	0.2	3.7	0.0	0.6
Cycle Q Clear(g_c), s	0.5	5.6	5.7	5.6	5.5	5.6	0.3	0.3	0.2	3.7	0.0	0.6
Prop In Lane	1.00		0.09	1.00		0.51	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	46	436	452	296	686	661	65	68	58	215	0	223
V/C Ratio(X)	0.46	0.56	0.57	0.77	0.42	0.43	0.18	0.21	0.10	0.69	0.00	0.12
Avail Cap(c_a), veh/h	346	2108	2183	730	2491	2401	730	766	650	1229	0	1274
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.3	15.3	15.3	18.5	10.4	10.5	21.7	21.7	21.6	19.5	0.0	18.2
Incr Delay (d2), s/veh	7.1	1.1	1.1	4.2	0.4	0.4	1.4	1.5	0.8	3.9	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	2.1	2.2	2.4	1.9	1.9	0.1	0.2	0.1	1.6	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.4	16.5	16.5	22.6	10.8	10.9	23.0	23.2	22.4	23.4	0.0	18.4
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		B
Approach Vol, veh/h		523			798			32			175	
Approach Delay, s/veh		17.0			14.2			23.0			22.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.7	16.4		10.6	6.2	22.9		6.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	7.6	7.7		5.7	2.5	7.6		2.3
Green Ext Time (p_c), s	0.5	3.6		0.6	0.0	4.3		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	16.3
HCM 7th LOS	B

6: Midblock Driveway & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	63	194	17	124	268	35	17	29	218	79	37	55
Future Volume (veh/h)	63	194	17	124	268	35	17	29	218	79	37	55
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	68	211	13	135	291	29	18	32	13	86	40	12
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	121	540	33	180	627	62	115	120	102	243	187	56
Arrive On Green	0.07	0.16	0.16	0.10	0.19	0.19	0.06	0.06	0.06	0.14	0.14	0.14
Sat Flow, veh/h	1781	3401	208	1781	3265	323	1781	1870	1585	1781	1374	412
Grp Volume(v), veh/h	68	110	114	135	157	163	18	32	13	86	0	52
Grp Sat Flow(s),veh/h/ln	1781	1777	1833	1781	1777	1811	1781	1870	1585	1781	0	1786
Q Serve(g_s), s	1.4	2.1	2.1	2.7	2.9	3.0	0.4	0.6	0.3	1.6	0.0	1.0
Cycle Q Clear(g_c), s	1.4	2.1	2.1	2.7	2.9	3.0	0.4	0.6	0.3	1.6	0.0	1.0
Prop In Lane	1.00		0.11	1.00		0.18	1.00		1.00	1.00		0.23
Lane Grp Cap(c), veh/h	121	282	291	180	341	348	115	120	102	243	0	243
V/C Ratio(X)	0.56	0.39	0.39	0.75	0.46	0.47	0.16	0.27	0.13	0.35	0.00	0.21
Avail Cap(c_a), veh/h	481	1462	1508	817	1797	1832	1514	1589	1347	1514	0	1518
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.7	14.0	14.0	16.2	13.3	13.3	16.4	16.5	16.4	14.5	0.0	14.2
Incr Delay (d2), s/veh	4.0	0.9	0.9	6.1	1.0	1.0	0.6	1.2	0.6	0.9	0.0	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.8	0.8	1.3	1.1	1.1	0.1	0.3	0.1	0.6	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	20.8	14.9	14.9	22.3	14.2	14.3	17.0	17.7	16.9	15.4	0.0	14.7
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		292			455			63			138	
Approach Delay, s/veh		16.2			16.6			17.3			15.1	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.8	10.9		10.0	7.5	12.1		7.4				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5				
Max Q Clear Time (g_c+I1), s	4.7	4.1		3.6	3.4	5.0		2.6				
Green Ext Time (p_c), s	0.3	1.3		0.5	0.1	2.1		0.2				
Intersection Summary												
HCM 7th Control Delay, s/veh			16.3									
HCM 7th LOS			B									

7: Road A & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	229	23	32	313	4	16	11	37	6	2	6
Future Volume (veh/h)	9	229	23	32	313	4	16	11	37	6	2	6
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	10	249	20	35	340	3	17	12	1	7	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	24	677	54	75	839	7	73	77	65	66	69	0
Arrive On Green	0.01	0.20	0.20	0.04	0.23	0.23	0.04	0.04	0.04	0.04	0.04	0.00
Sat Flow, veh/h	1781	3329	265	1781	3610	32	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	10	132	137	35	167	176	17	12	1	7	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1817	1781	1777	1865	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	1.9	1.9	0.6	2.4	2.4	0.3	0.2	0.0	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.2	1.9	1.9	0.6	2.4	2.4	0.3	0.2	0.0	0.1	0.0	0.0
Prop In Lane	1.00		0.15	1.00		0.02	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	24	362	370	75	413	433	73	77	65	66	69	0
V/C Ratio(X)	0.42	0.37	0.37	0.47	0.41	0.41	0.23	0.16	0.02	0.11	0.03	0.00
Avail Cap(c_a), veh/h	301	1502	1536	301	1502	1576	1807	1897	1605	1807	1897	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	14.5	10.1	10.1	13.8	9.6	9.6	13.7	13.7	13.6	13.8	13.7	0.0
Incr Delay (d2), s/veh	11.4	0.6	0.6	4.4	0.6	0.6	1.6	0.9	0.1	0.7	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.6	0.6	0.3	0.7	0.8	0.1	0.1	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	25.9	10.8	10.8	18.2	10.3	10.2	15.3	14.6	13.7	14.5	13.9	0.0
LnGrp LOS	C	B	B	B	B	B	B	B	B	B	B	
Approach Vol, veh/h		279			378			30			9	
Approach Delay, s/veh		11.3			11.0			15.0			14.3	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.2	11.0		6.1	5.4	11.9		6.2				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0				
Max Q Clear Time (g_c+I1), s	2.6	3.9		2.1	2.2	4.4		2.3				
Green Ext Time (p_c), s	0.0	1.5		0.0	0.0	2.0		0.1				
Intersection Summary												
HCM 7th Control Delay, s/veh			11.3									
HCM 7th LOS			B									

Intersection						
Int Delay, s/veh	3.8					
Movement	**EBT**	**EBR**	**WBL**	**WBT**	**NBL**	**NBR**
Lane Configurations						
Traffic Vol, veh/h	131	8	58	91	7	104
Future Vol, veh/h	131	8	58	91	7	104
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	142	9	63	99	8	113

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	152	0	373	148
Stage 1	-	-	-	-	148	-
Stage 2	-	-	-	-	225	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1429	-	628	899
Stage 1	-	-	-	-	880	-
Stage 2	-	-	-	-	812	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1427	-	598	898
Mov Cap-2 Maneuver	-	-	-	-	598	-
Stage 1	-	-	-	-	879	-
Stage 2	-	-	-	-	774	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.97	9.68
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	598	898	-	-	1427	-
HCM Lane V/C Ratio	0.013	0.126	-	-	0.044	-
HCM Control Delay (s/veh)	11.1	9.6	-	-	7.6	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.4	-	-	0.1	-

Intersection												
Int Delay, s/veh	8.3											
Movement	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**
Lane Configurations												
Traffic Vol, veh/h	4	372	110	99	254	1	91	0	109	4	1	7
Future Vol, veh/h	4	372	110	99	254	1	91	0	109	4	1	7
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	404	120	108	276	1	99	0	118	4	1	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	283	0	0	527	0	0	972	974	468	912	1033	287
Stage 1	-	-	-	-	-	-	476	476	-	498	498	-
Stage 2	-	-	-	-	-	-	496	498	-	414	536	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1279	-	-	1040	-	-	232	252	595	255	232	752
Stage 1	-	-	-	-	-	-	570	557	-	554	544	-
Stage 2	-	-	-	-	-	-	556	544	-	615	524	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1272	-	-	1037	-	-	203	223	593	181	206	745
Mov Cap-2 Maneuver	-	-	-	-	-	-	203	223	-	181	206	-
Stage 1	-	-	-	-	-	-	566	553	-	549	485	-
Stage 2	-	-	-	-	-	-	490	485	-	490	520	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.06	2.48	38.12	16.36
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	316	1272	-	-	1037	-	-	330
HCM Lane V/C Ratio	0.688	0.003	-	-	0.104	-	-	0.04
HCM Control Delay (s/veh)	38.1	7.8	-	-	8.9	-	-	16.4
HCM Lane LOS	E	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	4.8	0	-	-	0.3	-	-	0.1

Intersection	
Intersection Delay, s/veh	11.5
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	272	62	62	224	37	64
Future Vol, veh/h	272	62	62	224	37	64
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	296	67	67	243	40	70
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	12.9	10.6	9.4
HCM LOS	B	B	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	81%	37%
Vol Thru, %	22%	0%	63%
Vol Right, %	78%	19%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	286	334	101
LT Vol	0	272	37
Through Vol	62	0	64
RT Vol	224	62	0
Lane Flow Rate	311	363	110
Geometry Grp	1	1	1
Degree of Util (X)	0.393	0.499	0.162
Departure Headway (Hd)	4.549	4.949	5.318
Convergence, Y/N	Yes	Yes	Yes
Cap	786	722	667
Service Time	2.613	3.027	3.404
HCM Lane V/C Ratio	0.396	0.503	0.165
HCM Control Delay, s/veh	10.6	12.9	9.4
HCM Lane LOS	B	B	A
HCM 95th-tile Q	1.9	2.8	0.6

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	84	13	301	130	9	308
Future Vol, veh/h	84	13	301	130	9	308
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	91	14	327	141	10	335

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	752	398	0	0	468	0
Stage 1	398	-	-	-	-	-
Stage 2	354	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	378	652	-	-	1093	-
Stage 1	679	-	-	-	-	-
Stage 2	710	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	374	652	-	-	1093	-
Mov Cap-2 Maneuver	374	-	-	-	-	-
Stage 1	679	-	-	-	-	-
Stage 2	702	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	17.34	0	0.24
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	396	1093	-
HCM Lane V/C Ratio	-	-	0.266	0.009	-
HCM Control Delay (s/veh)	-	-	17.3	8.3	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0	-

Intersection	
Intersection Delay, s/veh	51.8
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	44	48	276	25	45	50	381	413	25	340	32
Future Vol, veh/h	30	44	48	276	25	45	50	381	413	25	340	32
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	33	48	52	300	27	49	54	414	449	27	370	35
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	16.2	38.5	63.2	49.9
HCM LOS	C	E	F	E

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	12%	0%	25%	80%	6%
Vol Thru, %	88%	0%	36%	7%	86%
Vol Right, %	0%	100%	39%	13%	8%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	431	413	122	346	397
LT Vol	50	0	30	276	25
Through Vol	381	0	44	25	340
RT Vol	0	413	48	45	32
Lane Flow Rate	468	449	133	376	432
Geometry Grp	7	7	2	2	5
Degree of Util (X)	1.037	0.896	0.325	0.823	0.909
Departure Headway (Hd)	7.97	7.188	8.959	7.875	7.582
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	459	507	404	459	475
Service Time	5.67	4.888	6.959	5.965	5.681
HCM Lane V/C Ratio	1.02	0.886	0.329	0.819	0.909
HCM Control Delay, s/veh	80.5	45.2	16.2	38.5	49.9
HCM Lane LOS	F	E	C	E	E
HCM 95th-tile Q	14.3	10.1	1.4	7.8	10.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	208	40	351	360	264	86	432	284	107	406	153
Future Volume (veh/h)	150	208	40	351	360	264	86	432	284	107	406	153
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.98		0.85	0.97		0.90	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	163	226	38	382	391	69	93	470	0	116	441	157
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	272	262	44	402	501	384	182	698		293	499	178
Arrive On Green	0.09	0.19	0.19	0.20	0.30	0.30	0.05	0.41	0.00	0.05	0.42	0.42
Sat Flow, veh/h	1603	1364	229	1603	1683	1288	1603	1683	1427	1603	1179	420
Grp Volume(v), veh/h	163	0	264	382	391	69	93	470	0	116	0	598
Grp Sat Flow(s),veh/h/ln	1603	0	1594	1603	1683	1288	1603	1683	1427	1603	0	1599
Q Serve(g_s), s	11.7	0.0	23.3	26.9	30.8	5.8	4.8	32.9	0.0	6.0	0.0	50.0
Cycle Q Clear(g_c), s	11.7	0.0	23.3	26.9	30.8	5.8	4.8	32.9	0.0	6.0	0.0	50.0
Prop In Lane	1.00		0.14	1.00		1.00	1.00		1.00	1.00		0.26
Lane Grp Cap(c), veh/h	272	0	306	402	501	384	182	698		293	0	677
V/C Ratio(X)	0.60	0.00	0.86	0.95	0.78	0.18	0.51	0.67		0.40	0.00	0.88
Avail Cap(c_a), veh/h	286	0	385	412	580	444	218	698		315	0	677
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.57	0.57	0.57	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.1	0.0	56.7	36.4	46.6	37.8	31.7	34.5	0.0	26.3	0.0	38.5
Incr Delay (d2), s/veh	3.2	0.0	15.1	21.9	3.4	0.1	2.2	5.1	0.0	0.9	0.0	15.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.0	0.0	10.7	13.1	13.5	1.9	2.0	14.7	0.0	2.4	0.0	22.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	45.3	0.0	71.8	58.3	50.0	37.9	34.0	39.6	0.0	27.2	0.0	54.1
LnGrp LOS	D		E	E	D	D	C	D		C		D
Approach Vol, veh/h		427			842			563			714	
Approach Delay, s/veh		61.7			52.8			38.7			49.8	
Approach LOS		E			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.0	65.1	34.1	32.8	11.7	66.4	18.7	48.2
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	30.0	35.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	8.0	34.9	28.9	25.3	6.8	52.0	13.7	32.8
Green Ext Time (p_c), s	0.0	2.8	0.2	1.1	0.1	0.0	0.1	2.6

Intersection Summary	
HCM 7th Control Delay, s/veh	50.3
HCM 7th LOS	D

Notes
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

Makalapua Project District TIAR
10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	475	55	293	27	59	47	285	992	17	41	1228	445
Future Volume (veh/h)	475	55	293	27	59	47	285	992	17	41	1228	445
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	516	60	0	29	64	0	310	1078	8	45	1335	166
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	689	373		93	98		406	1823	812	64	1532	682
Arrive On Green	0.20	0.20	0.00	0.05	0.05	0.00	0.12	0.51	0.51	0.04	0.43	0.43
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	3554	1581
Grp Volume(v), veh/h	516	60	0	29	64	0	310	1078	8	45	1335	166
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1777	1581
Q Serve(g_s), s	14.1	2.7	0.0	1.6	3.4	0.0	8.7	21.2	0.2	2.5	34.3	6.7
Cycle Q Clear(g_c), s	14.1	2.7	0.0	1.6	3.4	0.0	8.7	21.2	0.2	2.5	34.3	6.7
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	689	373		93	98		406	1823	812	64	1532	682
V/C Ratio(X)	0.75	0.16		0.31	0.66		0.76	0.59	0.01	0.71	0.87	0.24
Avail Cap(c_a), veh/h	1450	785		374	392		1208	2627	1170	142	1668	742
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.7	33.1	0.0	45.7	46.6	0.0	42.8	17.0	11.9	47.8	25.9	18.1
Incr Delay (d2), s/veh	1.7	0.2	0.0	1.9	7.2	0.0	3.0	0.3	0.0	13.5	5.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	1.2	0.0	0.7	1.8	0.0	3.8	8.1	0.1	1.3	14.7	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	39.4	33.3	0.0	47.6	53.8	0.0	45.8	17.4	11.9	61.2	31.0	18.3
LnGrp LOS	D	C		D	D		D	B	B	E	C	B
Approach Vol, veh/h		576			93			1396			1546	
Approach Delay, s/veh		38.7			51.9			23.6			30.5	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.6	56.3		10.2	16.8	48.2		25.0
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	8.0	74.0		21.0	35.0	47.0		42.0
Max Q Clear Time (g_c+I1), s	4.5	23.2		5.4	10.7	36.3		16.1
Green Ext Time (p_c), s	0.0	10.0		0.3	1.1	6.9		2.3

Intersection Summary	
HCM 7th Control Delay, s/veh	29.7
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

Makalapua Project District TIAR
10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	333	303	146	20	308	114	151	881	30	151	980	518
Future Volume (veh/h)	333	303	146	20	308	114	151	881	30	151	980	518
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	362	329	0	22	335	0	164	958	11	164	1065	303
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	463	917		42	525		248	1429	637	248	1428	636
Arrive On Green	0.13	0.26	0.00	0.02	0.15	0.00	0.07	0.40	0.40	0.07	0.40	0.40
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1582
Grp Volume(v), veh/h	362	329	0	22	335	0	164	958	11	164	1065	303
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1582
Q Serve(g_s), s	9.1	6.8	0.0	1.1	8.0	0.0	4.2	19.8	0.4	4.2	23.0	12.7
Cycle Q Clear(g_c), s	9.1	6.8	0.0	1.1	8.0	0.0	4.2	19.8	0.4	4.2	23.0	12.7
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	463	917		42	525		248	1429	637	248	1428	636
V/C Ratio(X)	0.78	0.36		0.53	0.64		0.66	0.67	0.02	0.66	0.75	0.48
Avail Cap(c_a), veh/h	788	1482		406	1482		788	2588	1154	749	2548	1134
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.7	27.3	0.0	43.4	36.1	0.0	40.7	22.0	16.2	40.7	23.0	19.9
Incr Delay (d2), s/veh	2.9	0.2	0.0	9.8	1.3	0.0	3.0	0.6	0.0	3.0	0.8	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	2.9	0.0	0.6	3.5	0.0	1.8	7.9	0.1	1.8	9.2	4.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	40.6	27.5	0.0	53.3	37.4	0.0	43.7	22.6	16.2	43.7	23.8	20.5
LnGrp LOS	D	C		D	D		D	C	B	D	C	C
Approach Vol, veh/h		691			357			1133			1532	
Approach Delay, s/veh		34.4			38.3			25.6			25.2	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.9	41.7	7.6	28.7	12.0	41.7	17.5	18.8
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	65.5	20.5	37.5	20.5	64.5	20.5	37.5
Max Q Clear Time (g_c+I1), s	11.1	21.8	3.1	8.8	6.2	25.0	11.1	10.0
Green Ext Time (p_c), s	0.4	8.3	0.0	2.4	0.4	11.1	0.9	2.4

Intersection Summary	
HCM 7th Control Delay, s/veh	28.3
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	476	24	210	388	204	9	56	192	132	40	30
Future Volume (veh/h)	30	476	24	210	388	204	9	56	192	132	40	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	517	23	228	422	171	10	61	6	143	43	11
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	65	901	40	293	958	384	116	121	103	216	175	45
Arrive On Green	0.04	0.26	0.26	0.16	0.39	0.39	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3464	154	1781	2469	989	1781	1870	1585	1781	1437	368
Grp Volume(v), veh/h	33	265	275	228	302	291	10	61	6	143	0	54
Grp Sat Flow(s),veh/h/ln	1781	1777	1841	1781	1777	1682	1781	1870	1585	1781	0	1804
Q Serve(g_s), s	0.9	6.7	6.7	6.3	6.5	6.6	0.3	1.6	0.2	3.9	0.0	1.4
Cycle Q Clear(g_c), s	0.9	6.7	6.7	6.3	6.5	6.6	0.3	1.6	0.2	3.9	0.0	1.4
Prop In Lane	1.00		0.08	1.00		0.59	1.00		1.00	1.00		0.20
Lane Grp Cap(c), veh/h	65	462	479	293	689	653	116	121	103	216	0	219
V/C Ratio(X)	0.51	0.57	0.57	0.78	0.44	0.45	0.09	0.50	0.06	0.66	0.00	0.25
Avail Cap(c_a), veh/h	312	1901	1970	658	2247	2127	658	691	586	1109	0	1123
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.3	16.5	16.5	20.6	11.6	11.6	22.6	23.2	22.6	21.6	0.0	20.4
Incr Delay (d2), s/veh	6.0	1.1	1.1	4.5	0.4	0.5	0.3	3.2	0.2	3.4	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	2.6	2.7	2.8	2.3	2.2	0.1	0.8	0.1	1.7	0.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.3	17.6	17.6	25.1	12.0	12.1	22.9	26.4	22.8	25.0	0.0	21.0
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		573			821			77			197	
Approach Delay, s/veh		18.4			15.7			25.7			23.9	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.4	18.4		11.2	6.9	24.9		8.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	8.3	8.7		5.9	2.9	8.6		3.6
Green Ext Time (p_c), s	0.5	3.9		0.7	0.0	4.6		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	18.0
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	93	199	16	130	254	52	28	54	203	124	63	64
Future Volume (veh/h)	93	199	16	130	254	52	28	54	203	124	63	64
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	101	216	12	141	276	41	30	59	18	135	68	37
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	144	556	31	188	581	85	162	170	143	330	209	114
Arrive On Green	0.08	0.16	0.16	0.11	0.19	0.19	0.09	0.09	0.09	0.19	0.19	0.19
Sat Flow, veh/h	1781	3423	189	1781	3102	455	1781	1870	1577	1781	1127	613
Grp Volume(v), veh/h	101	112	116	141	157	160	30	59	18	135	0	105
Grp Sat Flow(s),veh/h/ln	1781	1777	1836	1781	1777	1780	1781	1870	1577	1781	0	1740
Q Serve(g_s), s	2.4	2.5	2.5	3.4	3.4	3.5	0.7	1.3	0.5	2.9	0.0	2.3
Cycle Q Clear(g_c), s	2.4	2.5	2.5	3.4	3.4	3.5	0.7	1.3	0.5	2.9	0.0	2.3
Prop In Lane	1.00		0.10	1.00		0.26	1.00		1.00	1.00		0.35
Lane Grp Cap(c), veh/h	144	289	298	188	333	333	162	170	143	330	0	323
V/C Ratio(X)	0.70	0.39	0.39	0.75	0.47	0.48	0.19	0.35	0.13	0.41	0.00	0.33
Avail Cap(c_a), veh/h	406	1235	1276	690	1519	1521	1279	1343	1132	1279	0	1249
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.7	16.4	16.4	19.1	15.9	15.9	18.4	18.7	18.3	15.7	0.0	15.5
Incr Delay (d2), s/veh	6.1	0.8	0.8	5.9	1.0	1.1	0.5	1.2	0.4	0.8	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	1.0	1.0	1.6	1.3	1.4	0.3	0.6	0.2	1.1	0.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	25.8	17.3	17.3	25.0	16.9	17.0	19.0	19.9	18.7	16.6	0.0	16.1
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		329			458			107			240	
Approach Delay, s/veh		19.9			19.4			19.5			16.3	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.6	12.1		13.1	8.5	13.2		9.0
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	5.4	4.5		4.9	4.4	5.5		3.3
Green Ext Time (p_c), s	0.3	1.3		1.0	0.1	2.1		0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	18.9
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

Makalapua Project District TIAR
10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	253	39	22	314	7	17	5	42	8	6	12
Future Volume (veh/h)	22	253	39	22	314	7	17	5	42	8	6	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	24	275	33	24	341	7	18	5	1	9	7	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	54	754	90	54	840	17	54	57	48	37	39	0
Arrive On Green	0.03	0.24	0.24	0.03	0.24	0.24	0.03	0.03	0.03	0.02	0.02	0.00
Sat Flow, veh/h	1781	3196	380	1781	3560	73	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	24	152	156	24	170	178	18	5	1	9	7	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1799	1781	1777	1856	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	2.1	2.1	0.4	2.4	2.4	0.3	0.1	0.0	0.1	0.1	0.0
Cycle Q Clear(g_c), s	0.4	2.1	2.1	0.4	2.4	2.4	0.3	0.1	0.0	0.1	0.1	0.0
Prop In Lane	1.00		0.21	1.00		0.04	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	54	419	425	54	419	438	54	57	48	37	39	0
V/C Ratio(X)	0.44	0.36	0.37	0.44	0.41	0.41	0.33	0.09	0.02	0.24	0.18	0.00
Avail Cap(c_a), veh/h	304	1516	1535	304	1516	1584	1824	1915	1623	1824	1915	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	14.0	9.3	9.4	14.0	9.5	9.5	13.9	13.8	13.8	14.1	14.1	0.0
Incr Delay (d2), s/veh	5.7	0.5	0.5	5.7	0.6	0.6	3.6	0.7	0.2	3.3	2.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.6	0.7	0.2	0.7	0.8	0.1	0.0	0.0	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	19.6	9.9	9.9	19.6	10.1	10.1	17.5	14.5	14.0	17.4	16.3	0.0
LnGrp LOS	B	A	A	B	B	B	B	B	B	B	B	
Approach Vol, veh/h		332			372			24			16	
Approach Delay, s/veh		10.6			10.7			16.7			16.9	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.9	11.9		5.6	5.9	11.9		5.9
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	2.4	4.1		2.1	2.4	4.4		2.3
Green Ext Time (p_c), s	0.0	1.8		0.0	0.0	2.0		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	11.0
HCM 7th LOS	B

HCM 7th TWSC
9: Maa Way & Loloku St

Makalapua Project District TIAR
10/27/2023

Intersection	
Int Delay, s/veh	2.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	151	16	34	90	5	69
Future Vol, veh/h	151	16	34	90	5	69
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	164	17	37	98	5	75

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	183	0	346	174
Stage 1	-	-	-	-	174	-
Stage 2	-	-	-	-	172	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1393	-	651	870
Stage 1	-	-	-	-	856	-
Stage 2	-	-	-	-	858	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1391	-	632	869
Mov Cap-2 Maneuver	-	-	-	-	632	-
Stage 1	-	-	-	-	856	-
Stage 2	-	-	-	-	834	-

Approach	EB		WB		NB
HCM Control Delay, s/v	0		2.1		9.62
HCM LOS					A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	632	869	-	-	1391	-
HCM Lane V/C Ratio	0.009	0.086	-	-	0.027	-
HCM Control Delay (s/veh)	10.7	9.5	-	-	7.7	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	283	137	91	199	0	62	0	93	1	0	0
Future Vol, veh/h	3	283	137	91	199	0	62	0	93	1	0	0
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	308	149	99	216	0	67	0	101	1	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	222	0	0	457	0	0	804	809	382	734	883	223
Stage 1	-	-	-	-	-	-	389	389	-	420	420	-
Stage 2	-	-	-	-	-	-	415	420	-	314	463	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1347	-	-	1104	-	0	301	314	665	336	285	816
Stage 1	-	-	-	-	-	0	635	609	-	611	589	-
Stage 2	-	-	-	-	-	0	615	589	-	697	564	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1339	-	-	1104	-	-	273	284	665	257	257	811
Mov Cap-2 Maneuver	-	-	-	-	-	-	273	284	-	257	257	-
Stage 1	-	-	-	-	-	-	634	607	-	606	533	-
Stage 2	-	-	-	-	-	-	559	533	-	589	563	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.05	2.69	19.04	19.07
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	423	1339	-	-	1104	-	257
HCM Lane V/C Ratio	0.398	0.002	-	-	0.09	-	0.004
HCM Control Delay (s/veh)	19	7.7	-	-	8.6	-	19.1
HCM Lane LOS	C	A	-	-	A	-	C
HCM 95th %tile Q(veh)	1.9	0	-	-	0.3	-	0

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	269	86	103	227	86	112
Future Vol, veh/h	269	86	103	227	86	112
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	292	93	112	247	93	122
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	15.7	12.9	11.6
HCM LOS	C	B	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	76%	43%
Vol Thru, %	31%	0%	57%
Vol Right, %	69%	24%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	330	355	198
LT Vol	0	269	86
Through Vol	103	0	112
RT Vol	227	86	0
Lane Flow Rate	359	386	215
Geometry Grp	1	1	1
Degree of Util (X)	0.497	0.581	0.338
Departure Headway (Hd)	4.989	5.423	5.662
Convergence, Y/N	Yes	Yes	Yes
Cap	721	664	635
Service Time	3.027	3.457	3.706
HCM Lane V/C Ratio	0.498	0.581	0.339
HCM Control Delay, s/veh	12.9	15.7	11.6
HCM Lane LOS	B	C	B
HCM 95th-tile Q	2.8	3.8	1.5

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	75	8	326	115	6	397
Future Vol, veh/h	75	8	326	115	6	397
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	82	9	354	125	7	432

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	862	418	0	0	479	0
Stage 1	417	-	-	-	-	-
Stage 2	446	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	325	635	-	-	1083	-
Stage 1	665	-	-	-	-	-
Stage 2	645	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	322	634	-	-	1083	-
Mov Cap-2 Maneuver	322	-	-	-	-	-
Stage 1	665	-	-	-	-	-
Stage 2	640	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	19.46	0	0.12
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	338	1083	-
HCM Lane V/C Ratio	-	-	0.267	0.006	-
HCM Control Delay (s/veh)	-	-	19.5	8.3	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0	-

Intersection	
Intersection Delay, s/veh	37.5
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	17	24	46	194	21	27	44	400	358	35	405	23
Future Vol, veh/h	17	24	46	194	21	27	44	400	358	35	405	23
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	26	50	211	23	29	48	435	389	38	440	25
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	13.4	19.9	38.4	49.5
HCM LOS	B	C	E	E

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	10%	0%	20%	80%	8%
Vol Thru, %	90%	0%	28%	9%	87%
Vol Right, %	0%	100%	53%	11%	5%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	444	358	87	242	463
LT Vol	44	0	17	194	35
Through Vol	400	0	24	21	405
RT Vol	0	358	46	27	23
Lane Flow Rate	483	389	95	263	503
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.939	0.674	0.213	0.557	0.931
Departure Headway (Hd)	7.006	6.238	8.096	7.628	6.662
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	516	576	442	473	544
Service Time	4.769	4.001	6.181	5.687	4.715
HCM Lane V/C Ratio	0.936	0.675	0.215	0.556	0.925
HCM Control Delay, s/veh	52.4	21	13.4	19.9	49.5
HCM Lane LOS	F	C	B	C	E
HCM 95th-tile Q	11.6	5.1	0.8	3.3	11.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	253	33	260	318	280	77	344	231	162	325	167
Future Volume (veh/h)	150	253	33	260	318	280	77	344	231	162	325	167
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.98		0.92	0.97		0.94	1.00		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	163	275	32	283	346	59	84	374	0	176	353	164
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	327	344	40	366	499	396	195	547		336	392	182
Arrive On Green	0.10	0.24	0.24	0.15	0.30	0.30	0.05	0.33	0.00	0.09	0.37	0.37
Sat Flow, veh/h	1603	1465	170	1603	1683	1335	1603	1683	1427	1603	1071	497
Grp Volume(v), veh/h	163	0	307	283	346	59	84	374	0	176	0	517
Grp Sat Flow(s),veh/h/ln	1603	0	1635	1603	1683	1335	1603	1683	1427	1603	0	1568
Q Serve(g_s), s	7.5	0.0	17.6	12.7	18.2	3.2	3.5	19.2	0.0	7.1	0.0	31.1
Cycle Q Clear(g_c), s	7.5	0.0	17.6	12.7	18.2	3.2	3.5	19.2	0.0	7.1	0.0	31.1
Prop In Lane	1.00		0.10	1.00		1.00	1.00		1.00	1.00		0.32
Lane Grp Cap(c), veh/h	327	0	384	366	499	396	195	547		336	0	574
V/C Ratio(X)	0.50	0.00	0.80	0.77	0.69	0.15	0.43	0.68		0.52	0.00	0.90
Avail Cap(c_a), veh/h	492	0	410	384	499	396	212	776		351	0	786
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.6	0.0	35.9	24.2	31.1	25.8	24.7	29.2	0.0	21.0	0.0	29.9
Incr Delay (d2), s/veh	1.2	0.0	10.1	9.1	4.1	0.2	1.5	1.5	0.0	1.3	0.0	10.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	8.1	5.7	7.9	1.1	1.4	7.9	0.0	2.7	0.0	13.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	26.8	0.0	46.1	33.3	35.2	26.0	26.2	30.7	0.0	22.3	0.0	40.6
LnGrp LOS	C		D	C	D	C	C	C		C		D
Approach Vol, veh/h		470			688			458			693	
Approach Delay, s/veh		39.4			33.6			29.9			35.9	
Approach LOS		D			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	37.4	19.9	28.5	9.9	41.5	13.7	34.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	10.0	46.0	16.0	25.0	6.0	50.0	20.0	22.0
Max Q Clear Time (g_c+I1), s	9.1	21.2	14.7	19.6	5.5	33.1	9.5	20.2
Green Ext Time (p_c), s	0.0	2.5	0.1	0.8	0.0	3.4	0.3	0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	34.8
HCM 7th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	454	56	131	61	44	105	193	1683	48	132	1108	368
Future Volume (veh/h)	454	56	131	61	44	105	193	1683	48	132	1108	368
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	493	61	0	66	48	0	210	1829	29	143	1204	196
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	565	306		107	113		293	2004	894	162	2026	903
Arrive On Green	0.16	0.16	0.00	0.06	0.06	0.00	0.08	0.56	0.56	0.09	0.57	0.57
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	3554	1584
Grp Volume(v), veh/h	493	61	0	66	48	0	210	1829	29	143	1204	196
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1777	1584
Q Serve(g_s), s	23.0	4.7	0.0	6.0	4.1	0.0	9.8	76.3	1.3	13.1	36.3	10.0
Cycle Q Clear(g_c), s	23.0	4.7	0.0	6.0	4.1	0.0	9.8	76.3	1.3	13.1	36.3	10.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	565	306		107	113		293	2004	894	162	2026	903
V/C Ratio(X)	0.87	0.20		0.61	0.43		0.72	0.91	0.03	0.88	0.59	0.22
Avail Cap(c_a), veh/h	859	465		119	125		670	2004	894	162	2026	903
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.81	0.81	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	67.3	59.7	0.0	75.7	74.8	0.0	73.6	32.3	16.0	74.1	23.1	17.4
Incr Delay (d2), s/veh	5.3	0.3	0.0	7.8	2.5	0.0	3.3	7.8	0.1	39.3	1.3	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.7	2.3	0.0	3.0	2.1	0.0	4.5	34.0	0.5	7.8	15.5	3.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	72.7	59.9	0.0	83.4	77.3	0.0	76.8	40.1	16.0	113.4	24.4	18.0
LnGrp LOS	E	E		F	E		E	D	B	F	C	B
Approach Vol, veh/h		554			114			2068			1543	
Approach Delay, s/veh		71.3			80.8			43.5			31.8	
Approach LOS		E			F			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	20.0	98.1		14.9	19.0	99.1		32.0
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	15.0	78.0		11.0	32.0	61.0		41.0
Max Q Clear Time (g_c+I1), s	15.1	78.3		8.0	11.8	38.3		25.0
Green Ext Time (p_c), s	0.0	0.0		0.1	0.6	10.1		2.0

Intersection Summary	
HCM 7th Control Delay, s/veh	43.9
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th TWSC
3: Queen Kaahumanu Hwy & Eho St

10/27/2023

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	52	0	1961	53	0	1383	40
Future Vol, veh/h	0	0	0	0	0	52	0	1961	53	0	1383	40
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	57	0	2132	58	0	1503	43

Major/Minor				Minor1			Major1			Major2		
Conflicting Flow All				-	-	1095	1505	0	0	2132	-	0
Stage 1				-	-	-	-	-	-	-	-	-
Stage 2				-	-	-	-	-	-	-	-	-
Critical Hdwy				-	-	6.94	-	-	-	-	-	-
Critical Hdwy Stg 1				-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2				-	-	-	-	-	-	-	-	-
Follow-up Hdwy				-	-	3.32	-	-	-	-	-	-
Pot Cap-1 Maneuver				0	0	209	0	-	-	0	-	-
Stage 1				0	0	-	0	-	-	0	-	-
Stage 2				0	0	-	0	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver				-	0	209	-	-	-	-	-	-
Mov Cap-2 Maneuver				-	0	-	-	-	-	-	-	-
Stage 1				-	0	-	-	-	-	-	-	-
Stage 2				-	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	28.52	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	209	-	-
HCM Lane V/C Ratio	-	-	0.271	-	-
HCM Control Delay (s/veh)	-	-	28.5	-	-
HCM Lane LOS	-	-	D	-	-
HCM 95th %tile Q(veh)	-	-	1.1	-	-

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	507	315	110	57	382	114	146	1379	41	112	850	410
Future Volume (veh/h)	507	315	110	57	382	114	146	1379	41	112	850	410
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	551	342	0	62	415	0	159	1499	18	122	924	224
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	611	941		102	515		251	1765	787	209	1721	765
Arrive On Green	0.18	0.26	0.00	0.06	0.14	0.00	0.07	0.50	0.50	0.06	0.48	0.48
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1580
Grp Volume(v), veh/h	551	342	0	62	415	0	159	1499	18	122	924	224
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1580
Q Serve(g_s), s	25.8	12.9	0.0	5.6	18.7	0.0	7.4	60.6	1.0	5.7	29.9	14.1
Cycle Q Clear(g_c), s	25.8	12.9	0.0	5.6	18.7	0.0	7.4	60.6	1.0	5.7	29.9	14.1
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	611	941		102	515		251	1765	787	209	1721	765
V/C Ratio(X)	0.90	0.36		0.61	0.81		0.63	0.85	0.02	0.58	0.54	0.29
Avail Cap(c_a), veh/h	754	969		313	818		293	1765	787	230	1721	765
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.59	0.59	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	66.5	49.3	0.0	76.0	68.3	0.0	74.4	36.2	21.1	75.5	29.7	25.6
Incr Delay (d2), s/veh	7.8	0.1	0.0	5.8	3.2	0.0	3.4	5.3	0.1	3.1	1.2	1.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.2	5.9	0.0	2.8	8.8	0.0	3.4	27.2	0.4	2.6	13.1	5.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.3	49.5	0.0	81.8	71.5	0.0	77.8	41.5	21.2	78.6	30.9	26.5
LnGrp LOS	E	D		F	E		E	D	C	E	C	C
Approach Vol, veh/h		893			477			1676			1270	
Approach Delay, s/veh		64.8			72.8			44.7			34.7	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	86.9	14.4	48.7	17.0	84.9	34.2	28.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	60.0	29.0	45.0	14.0	57.0	36.0	38.0
Max Q Clear Time (g_c+I1), s	7.7	62.6	7.6	14.9	9.4	31.9	27.8	20.7
Green Ext Time (p_c), s	0.1	0.0	0.1	2.5	0.2	7.9	1.4	2.6

Intersection Summary	
HCM 7th Control Delay, s/veh	49.0
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd 10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	402	20	210	310	77	2	19	209	36	18	11
Future Volume (veh/h)	11	402	20	210	310	77	2	19	209	36	18	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	12	437	19	228	337	70	2	21	5	39	20	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	28	853	37	302	1174	241	59	62	53	107	112	0
Arrive On Green	0.02	0.25	0.25	0.17	0.40	0.40	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3469	150	1781	2935	602	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	12	223	233	228	202	205	2	21	5	39	20	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1842	1781	1777	1760	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.3	4.4	4.4	5.0	3.1	3.2	0.0	0.4	0.1	0.9	0.4	0.0
Cycle Q Clear(g_c), s	0.3	4.4	4.4	5.0	3.1	3.2	0.0	0.4	0.1	0.9	0.4	0.0
Prop In Lane	1.00		0.08	1.00		0.34	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	28	437	453	302	711	704	59	62	53	107	112	0
V/C Ratio(X)	0.43	0.51	0.51	0.75	0.28	0.29	0.03	0.34	0.09	0.37	0.18	0.00
Avail Cap(c_a), veh/h	394	2400	2489	831	2837	2810	831	873	740	1400	1470	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	19.9	13.2	13.2	16.1	8.3	8.3	19.0	19.2	19.1	18.4	18.2	0.0
Incr Delay (d2), s/veh	10.3	0.9	0.9	3.8	0.2	0.2	0.2	3.1	0.8	2.1	0.8	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.6	1.7	2.1	1.0	1.0	0.0	0.2	0.1	0.4	0.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.1	14.2	14.1	19.9	8.5	8.5	19.3	22.4	19.9	20.5	18.9	0.0
LnGrp LOS	C	B	B	B	A	A	B	C	B	C	B	
Approach Vol, veh/h		468			635			28			59	
Approach Delay, s/veh		14.6			12.6			21.7			20.0	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.9	15.0		7.4	5.6	21.3		6.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	7.0	6.4		2.9	2.3	5.2		2.4
Green Ext Time (p_c), s	0.5	3.2		0.2	0.0	2.9		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	14.0
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd 10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	266	11	110	192	33	17	18	133	38	17	8
Future Volume (veh/h)	20	266	11	110	192	33	17	18	133	38	17	8
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	289	10	120	209	27	18	20	6	41	18	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	49	702	24	177	863	110	89	93	79	119	125	0
Arrive On Green	0.03	0.20	0.20	0.10	0.27	0.27	0.05	0.05	0.05	0.07	0.07	0.00
Sat Flow, veh/h	1781	3503	121	1781	3169	404	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	22	146	153	120	116	120	18	20	6	41	18	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1847	1781	1777	1797	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	2.5	2.5	2.2	1.7	1.8	0.3	0.4	0.1	0.8	0.3	0.0
Cycle Q Clear(g_c), s	0.4	2.5	2.5	2.2	1.7	1.8	0.3	0.4	0.1	0.8	0.3	0.0
Prop In Lane	1.00		0.07	1.00		0.22	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	49	356	370	177	484	489	89	93	79	119	125	0
V/C Ratio(X)	0.45	0.41	0.41	0.68	0.24	0.25	0.20	0.21	0.08	0.34	0.14	0.00
Avail Cap(c_a), veh/h	520	1581	1644	883	1944	1966	1637	1719	1457	1637	1719	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	16.4	11.9	11.9	14.9	9.7	9.7	15.6	15.6	15.5	15.3	15.1	0.0
Incr Delay (d2), s/veh	6.3	0.8	0.7	4.5	0.3	0.3	1.1	1.1	0.4	1.7	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.9	0.9	1.0	0.6	0.6	0.1	0.2	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.7	12.7	12.7	19.4	10.0	10.0	16.7	16.8	15.9	17.0	15.6	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		321			356			44			59	
Approach Delay, s/veh		13.4			13.2			16.6			16.6	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.4	11.9		7.3	5.9	14.3		6.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	4.2	4.5		2.8	2.4	3.8		2.4
Green Ext Time (p_c), s	0.2	1.8		0.2	0.0	1.5		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.7
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	273	20	18	196	2	3	4	25	1	4	4
Future Volume (veh/h)	13	273	20	18	196	2	3	4	25	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	14	297	19	20	213	2	3	4	1	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	753	48	46	828	8	27	28	24	12	13	0
Arrive On Green	0.02	0.22	0.22	0.03	0.23	0.23	0.01	0.01	0.01	0.01	0.01	0.00
Sat Flow, veh/h	1781	3392	216	1781	3607	34	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	14	155	161	20	105	110	3	4	1	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1831	1781	1777	1864	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	2.0	2.1	0.3	1.3	1.3	0.0	0.1	0.0	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	2.0	2.1	0.3	1.3	1.3	0.0	0.1	0.0	0.0	0.1	0.0
Prop In Lane	1.00		0.12	1.00		0.02	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	33	395	407	46	408	428	27	28	24	12	13	0
V/C Ratio(X)	0.43	0.39	0.40	0.44	0.26	0.26	0.11	0.14	0.04	0.08	0.31	0.00
Avail Cap(c_a), veh/h	325	1622	1671	325	1622	1702	1951	2049	1734	1951	2049	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	13.3	9.1	9.1	13.1	8.6	8.6	13.3	13.3	13.3	13.5	13.5	0.0
Incr Delay (d2), s/veh	8.5	0.6	0.6	6.4	0.3	0.3	1.8	2.3	0.7	2.9	13.4	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.6	0.6	0.2	0.4	0.4	0.0	0.0	0.0	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	21.8	9.7	9.7	19.5	9.0	9.0	15.1	15.6	14.0	16.4	26.9	0.0
LnGrp LOS	C	A	A	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		330			235			8			5	
Approach Delay, s/veh		10.2			9.9			15.2			24.8	
Approach LOS		B			A			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	5.7	11.1	5.2	5.5	11.3	5.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	2.3	4.1	2.1	2.2	3.3	2.1
Green Ext Time (p_c), s	0.0	1.8	0.0	0.0	1.2	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	10.3
HCM 7th LOS	B

HCM 7th TWSC
9: Maa Way & Loloku St

10/27/2023

Intersection	
Int Delay, s/veh	3.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	104	7	35	62	8	56
Future Vol, veh/h	104	7	35	62	8	56
Conflicting Peds, #/hr	0	3	3	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	113	8	38	67	9	61

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	124	0	263	120
Stage 1	-	-	-	-	120	-
Stage 2	-	-	-	-	143	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1463	-	726	932
Stage 1	-	-	-	-	905	-
Stage 2	-	-	-	-	884	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1459	-	704	929
Mov Cap-2 Maneuver	-	-	-	-	704	-
Stage 1	-	-	-	-	903	-
Stage 2	-	-	-	-	860	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.72	9.28
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	704	929	-	-	1459	-
HCM Lane V/C Ratio	0.012	0.066	-	-	0.026	-
HCM Control Delay (s/veh)	10.2	9.1	-	-	7.5	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	310	110	88	173	6	41	0	57	4	0	0
Future Vol, veh/h	2	310	110	88	173	6	41	0	57	4	0	0
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	337	120	96	188	7	45	0	62	4	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	197	0	0	460	0	0	784	792	400	726	848	194
Stage 1	-	-	-	-	-	-	404	404	-	385	385	-
Stage 2	-	-	-	-	-	-	380	388	-	341	464	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1376	-	-	1101	-	-	311	322	650	340	298	847
Stage 1	-	-	-	-	-	-	623	599	-	638	611	-
Stage 2	-	-	-	-	-	-	642	609	-	674	564	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1374	-	-	1098	-	-	282	292	648	280	270	845
Mov Cap-2 Maneuver	-	-	-	-	-	-	282	292	-	280	270	-
Stage 1	-	-	-	-	-	-	620	596	-	636	557	-
Stage 2	-	-	-	-	-	-	585	555	-	608	561	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.04	2.83	16.46	18.07
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	420	1374	-	-	1098	-	-	280
HCM Lane V/C Ratio	0.254	0.002	-	-	0.087	-	-	0.016
HCM Control Delay (s/veh)	16.5	7.6	-	-	8.6	-	-	18.1
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1	0	-	-	0.3	-	-	0

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	169	35	56	278	20	52
Future Vol, veh/h	169	35	56	278	20	52
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	184	38	61	302	22	57
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	10.1	10	8.6
HCM LOS	B	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	83%	28%
Vol Thru, %	17%	0%	72%
Vol Right, %	83%	17%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	334	204	72
LT Vol	0	169	20
Through Vol	56	0	52
RT Vol	278	35	0
Lane Flow Rate	363	222	78
Geometry Grp	1	1	1
Degree of Util (X)	0.414	0.304	0.107
Departure Headway (Hd)	4.107	4.935	4.944
Convergence, Y/N	Yes	Yes	Yes
Cap	875	725	723
Service Time	2.134	2.985	2.988
HCM Lane V/C Ratio	0.415	0.306	0.108
HCM Control Delay, s/veh	10	10.1	8.6
HCM Lane LOS	A	B	A
HCM 95th-tile Q	2.1	1.3	0.4

HCM 7th TWSC
14: Kuakini Hwy & Loloku St 10/27/2023

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	51	2	351	98	4	223
Future Vol, veh/h	51	2	351	98	4	223
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	55	2	382	107	4	242

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	688	436	0	0	489	0
Stage 1	436	-	-	-	-	-
Stage 2	252	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	412	620	-	-	1074	-
Stage 1	652	-	-	-	-	-
Stage 2	790	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	409	620	-	-	1073	-
Mov Cap-2 Maneuver	409	-	-	-	-	-
Stage 1	651	-	-	-	-	-
Stage 2	785	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	15.07	0	0.15
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	415	1073	-
HCM Lane V/C Ratio	-	-	0.139	0.004	-
HCM Control Delay (s/veh)	-	-	15.1	8.4	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0	-

HCM 7th AWSC
15: Kuakini Hwy & Kaiwi St 10/27/2023

Intersection	
Intersection Delay, s/veh	21.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	36	31	176	23	17	45	413	327	0	242	29
Future Vol, veh/h	12	36	31	176	23	17	45	413	327	0	242	29
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	39	34	191	25	18	49	449	355	0	263	32
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	11.5	15.1	26.2	15.3
HCM LOS	B	C	D	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	10%	0%	15%	81%	0%
Vol Thru, %	90%	0%	46%	11%	89%
Vol Right, %	0%	100%	39%	8%	11%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	458	327	79	216	271
LT Vol	45	0	12	176	0
Through Vol	413	0	36	23	242
RT Vol	0	327	31	17	29
Lane Flow Rate	498	355	86	235	295
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.852	0.533	0.168	0.441	0.501
Departure Headway (Hd)	6.158	5.397	7.042	6.766	6.122
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	587	665	513	528	583
Service Time	3.934	3.173	5.042	4.847	4.206
HCM Lane V/C Ratio	0.848	0.534	0.168	0.445	0.506
HCM Control Delay, s/veh	34.8	14.2	11.5	15.1	15.3
HCM Lane LOS	D	B	B	C	C
HCM 95th-tile Q	9.3	3.2	0.6	2.2	2.8

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	314	49	287	287	199	80	528	425	103	251	112
Future Volume (veh/h)	156	314	49	287	287	199	80	528	425	103	251	112
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.96	1.00		0.97	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	170	341	49	312	312	43	87	574	0	112	273	109
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	361	366	53	333	538	441	297	617		181	430	172
Arrive On Green	0.09	0.26	0.26	0.16	0.32	0.32	0.05	0.37	0.00	0.06	0.38	0.38
Sat Flow, veh/h	1603	1430	206	1603	1683	1380	1603	1683	1427	1603	1138	454
Grp Volume(v), veh/h	170	0	390	312	312	43	87	574	0	112	0	382
Grp Sat Flow(s),veh/h/ln	1603	0	1636	1603	1683	1380	1603	1683	1427	1603	0	1592
Q Serve(g_s), s	9.6	0.0	29.1	17.8	19.3	2.7	4.2	41.0	0.0	5.4	0.0	24.6
Cycle Q Clear(g_c), s	9.6	0.0	29.1	17.8	19.3	2.7	4.2	41.0	0.0	5.4	0.0	24.6
Prop In Lane	1.00		0.13	1.00		1.00	1.00		1.00	1.00		0.29
Lane Grp Cap(c), veh/h	361	0	419	333	538	441	297	617		181	0	601
V/C Ratio(X)	0.47	0.00	0.93	0.94	0.58	0.10	0.29	0.93		0.62	0.00	0.64
Avail Cap(c_a), veh/h	465	0	458	335	538	441	349	617		215	0	601
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.69	0.69	0.69	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.1	0.0	45.4	31.5	35.5	29.8	25.0	38.0	0.0	30.0	0.0	31.9
Incr Delay (d2), s/veh	1.0	0.0	24.8	26.0	1.1	0.1	0.5	22.5	0.0	3.9	0.0	5.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	0.0	14.7	9.3	8.2	0.9	1.7	20.7	0.0	2.3	0.0	10.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	31.0	0.0	70.2	57.5	36.6	29.9	25.6	60.5	0.0	33.9	0.0	36.9
LnGrp LOS	C		E	E	D	C	C	E		C		D
Approach Vol, veh/h		560			667			661			494	
Approach Delay, s/veh		58.3			45.9			55.9			36.2	
Approach LOS		E			D			E			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.3	50.8	24.8	37.0	11.0	52.2	16.9	45.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	40.0	20.0	35.0	10.0	40.0	20.0	35.0
Max Q Clear Time (g_c+I1), s	7.4	43.0	19.8	31.1	6.2	26.6	11.6	21.3
Green Ext Time (p_c), s	0.1	0.0	0.0	0.9	0.1	2.1	0.3	1.7

Intersection Summary	
HCM 7th Control Delay, s/veh	49.6
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	581	89	303	119	106	154	278	1342	63	221	1992	537
Future Volume (veh/h)	581	89	303	119	106	154	278	1342	63	221	1992	537
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	632	97	0	129	115	0	302	1459	33	240	2165	324
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	708	383		149	157		358	1580	704	259	1730	771
Arrive On Green	0.20	0.20	0.00	0.08	0.08	0.00	0.10	0.44	0.44	0.15	0.49	0.49
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	3554	1585
Grp Volume(v), veh/h	632	97	0	129	115	0	302	1459	33	240	2165	324
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1777	1585
Q Serve(g_s), s	29.4	7.2	0.0	11.8	9.9	0.0	14.2	63.8	1.9	22.0	80.3	21.8
Cycle Q Clear(g_c), s	29.4	7.2	0.0	11.8	9.9	0.0	14.2	63.8	1.9	22.0	80.3	21.8
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	708	383		149	157		358	1580	704	259	1730	771
V/C Ratio(X)	0.89	0.25		0.86	0.73		0.84	0.92	0.05	0.93	1.25	0.42
Avail Cap(c_a), veh/h	859	465		151	159		670	1580	704	270	1730	771
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.69	0.69	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.8	55.0	0.0	74.7	73.8	0.0	72.7	43.2	26.0	69.6	42.3	27.3
Incr Delay (d2), s/veh	7.4	0.2	0.0	36.9	15.9	0.0	5.5	10.5	0.1	34.8	118.2	1.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.8	3.5	0.0	7.0	5.5	0.0	6.6	30.0	0.8	12.5	62.8	8.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	71.3	55.3	0.0	111.6	89.7	0.0	78.1	53.7	26.1	104.4	160.6	29.0
LnGrp LOS	E	E		F	F		E	D	C	F	F	C
Approach Vol, veh/h		729			244			1794			2729	
Approach Delay, s/veh		69.1			101.3			57.3			140.0	
Approach LOS		E			F			E			F	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	29.0	78.4		18.8	22.1	85.3		38.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	25.0	65.0		14.0	32.0	58.0		41.0
Max Q Clear Time (g_c+I1), s	24.0	65.8		13.8	16.2	82.3		31.4
Green Ext Time (p_c), s	0.1	0.0		0.0	0.9	0.0		2.3

Intersection Summary	
HCM 7th Control Delay, s/veh	101.9
HCM 7th LOS	F

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th TWSC
3: Queen Kaahumanu Hwy & Eho St

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	83	0	1701	67	0	2612	75
Future Vol, veh/h	0	0	0	0	0	83	0	1701	67	0	2612	75
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	90	0	1849	73	0	2839	82

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	-	-	961	2840	0	0	1849	-	0
Stage 1	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	256	0	-	-	0	-	-
Stage 1	0	0	-	0	-	-	0	-	-
Stage 2	0	0	-	0	-	-	0	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	-	0	256	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-	-	-	-
Stage 1	-	0	-	-	-	-	-	-	-
Stage 2	-	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	26.47	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	256	-	-
HCM Lane V/C Ratio	-	-	0.352	-	-
HCM Control Delay (s/veh)	-	-	26.5	-	-
HCM Lane LOS	-	-	D	-	-
HCM 95th %tile Q(veh)	-	-	1.5	-	-

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	440	455	143	120	456	164	134	1170	46	243	1545	816
Future Volume (veh/h)	440	455	143	120	456	164	134	1170	46	243	1545	816
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	478	495	0	130	496	0	146	1272	16	264	1679	645
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	541	851		152	599		209	1580	705	377	1752	781
Arrive On Green	0.16	0.24	0.00	0.09	0.17	0.00	0.06	0.44	0.44	0.11	0.49	0.49
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	478	495	0	130	496	0	146	1272	16	264	1679	645
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	22.3	20.3	0.0	11.9	22.3	0.0	6.8	51.1	0.9	12.2	74.9	57.4
Cycle Q Clear(g_c), s	22.3	20.3	0.0	11.9	22.3	0.0	6.8	51.1	0.9	12.2	74.9	57.4
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	541	851		152	599		209	1580	705	377	1752	781
V/C Ratio(X)	0.88	0.58		0.85	0.83		0.70	0.81	0.02	0.70	0.96	0.83
Avail Cap(c_a), veh/h	775	969		324	818		335	1580	705	440	1752	781
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.60	0.60	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.1	55.4	0.0	74.4	66.3	0.0	76.0	39.6	25.7	70.9	40.2	35.8
Incr Delay (d2), s/veh	5.5	0.4	0.0	12.4	5.2	0.0	4.2	4.5	0.1	4.0	13.6	9.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.4	9.3	0.0	6.0	10.6	0.0	3.2	23.1	0.4	5.6	35.4	24.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	73.6	55.8	0.0	86.8	71.5	0.0	80.2	44.1	25.8	74.9	53.8	45.5
LnGrp LOS	E	E		F	E		F	D	C	E	D	D
Approach Vol, veh/h		973			626			1434			2588	
Approach Delay, s/veh		64.6			74.7			47.6			53.9	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	78.4	19.1	44.5	15.0	86.4	30.8	32.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	49.0	30.0	45.0	16.0	54.0	37.0	38.0
Max Q Clear Time (g_c+I1), s	14.2	53.1	13.9	22.3	8.8	76.9	24.3	24.3
Green Ext Time (p_c), s	0.5	0.0	0.3	3.5	0.2	0.0	1.5	2.9

Intersection Summary	
HCM 7th Control Delay, s/veh	56.4
HCM 7th LOS	E

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	537	27	220	531	169	11	13	305	143	24	24
Future Volume (veh/h)	20	537	27	220	531	169	11	13	305	143	24	24
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	584	26	239	577	163	12	14	6	155	26	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	47	959	43	306	1155	325	64	67	57	221	213	16
Arrive On Green	0.03	0.28	0.28	0.17	0.42	0.42	0.04	0.04	0.04	0.12	0.12	0.12
Sat Flow, veh/h	1781	3465	154	1781	2736	771	1781	1870	1585	1781	1715	132
Grp Volume(v), veh/h	22	299	311	239	374	366	12	14	6	155	0	28
Grp Sat Flow(s),veh/h/ln	1781	1777	1842	1781	1777	1731	1781	1870	1585	1781	0	1847
Q Serve(g_s), s	0.6	7.5	7.5	6.6	7.9	7.9	0.3	0.4	0.2	4.3	0.0	0.7
Cycle Q Clear(g_c), s	0.6	7.5	7.5	6.6	7.9	7.9	0.3	0.4	0.2	4.3	0.0	0.7
Prop In Lane	1.00		0.08	1.00		0.45	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	47	492	510	306	750	730	64	67	57	221	0	229
V/C Ratio(X)	0.47	0.61	0.61	0.78	0.50	0.50	0.19	0.21	0.11	0.70	0.00	0.12
Avail Cap(c_a), veh/h	314	1915	1986	663	2263	2204	663	696	590	1117	0	1158
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.5	16.0	16.1	20.2	10.8	10.8	23.9	23.9	23.8	21.4	0.0	19.9
Incr Delay (d2), s/veh	7.2	1.2	1.2	4.4	0.5	0.5	1.4	1.5	0.8	4.0	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	2.9	3.0	2.9	2.7	2.7	0.2	0.2	0.1	1.9	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	31.7	17.3	17.2	24.6	11.3	11.3	25.3	25.4	24.6	25.5	0.0	20.1
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		632			979			32			183	
Approach Delay, s/veh		17.8			14.6			25.2			24.6	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.8	19.1		11.3	6.3	26.5		6.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	8.6	9.5		6.3	2.6	9.9		2.4
Green Ext Time (p_c), s	0.5	4.5		0.6	0.0	6.0		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	16.9
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	278	18	130	399	36	18	31	229	83	39	57
Future Volume (veh/h)	66	278	18	130	399	36	18	31	229	83	39	57
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	72	302	16	141	434	34	20	34	12	90	42	14
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	122	705	37	188	810	63	115	121	102	237	177	59
Arrive On Green	0.07	0.21	0.21	0.11	0.24	0.24	0.06	0.06	0.06	0.13	0.13	0.13
Sat Flow, veh/h	1781	3433	181	1781	3339	261	1781	1870	1585	1781	1335	445
Grp Volume(v), veh/h	72	156	162	141	230	238	20	34	12	90	0	56
Grp Sat Flow(s),veh/h/ln	1781	1777	1838	1781	1777	1823	1781	1870	1585	1781	0	1779
Q Serve(g_s), s	1.6	3.1	3.1	3.1	4.6	4.6	0.4	0.7	0.3	1.9	0.0	1.1
Cycle Q Clear(g_c), s	1.6	3.1	3.1	3.1	4.6	4.6	0.4	0.7	0.3	1.9	0.0	1.1
Prop In Lane	1.00		0.10	1.00		0.14	1.00		1.00	1.00		0.25
Lane Grp Cap(c), veh/h	122	365	377	188	431	442	115	121	102	237	0	236
V/C Ratio(X)	0.59	0.43	0.43	0.75	0.53	0.54	0.17	0.28	0.12	0.38	0.00	0.24
Avail Cap(c_a), veh/h	438	1332	1378	744	1638	1680	1379	1448	1227	1379	0	1378
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.4	14.1	14.1	17.7	13.4	13.4	18.0	18.1	17.9	16.1	0.0	15.8
Incr Delay (d2), s/veh	4.5	0.8	0.8	5.9	1.0	1.0	0.7	1.3	0.5	1.0	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	1.2	1.2	1.4	1.7	1.7	0.2	0.3	0.1	0.7	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.9	14.9	14.9	23.5	14.4	14.4	18.7	19.4	18.4	17.1	0.0	16.3
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		390			609			66			146	
Approach Delay, s/veh		16.4			16.5			19.0			16.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.3	13.3		10.4	7.8	14.9		7.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	5.1	5.1		3.9	3.6	6.6		2.7
Green Ext Time (p_c), s	0.3	2.0		0.5	0.1	3.2		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	16.6
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	315	24	33	446	4	17	11	39	7	2	7
Future Volume (veh/h)	10	315	24	33	446	4	17	11	39	7	2	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	342	22	36	485	3	18	12	1	8	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	26	856	55	76	1017	6	74	78	66	68	71	0
Arrive On Green	0.01	0.25	0.25	0.04	0.28	0.28	0.04	0.04	0.04	0.04	0.04	0.00
Sat Flow, veh/h	1781	3388	217	1781	3621	22	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	11	179	185	36	238	250	18	12	1	8	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1828	1781	1777	1866	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	2.7	2.7	0.6	3.6	3.6	0.3	0.2	0.0	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.2	2.7	2.7	0.6	3.6	3.6	0.3	0.2	0.0	0.1	0.0	0.0
Prop In Lane	1.00		0.12	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	26	449	462	76	499	524	74	78	66	68	71	0
V/C Ratio(X)	0.42	0.40	0.40	0.47	0.48	0.48	0.24	0.15	0.02	0.12	0.03	0.00
Avail Cap(c_a), veh/h	278	1388	1428	278	1388	1458	1670	1753	1483	1670	1753	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.6	9.9	9.9	15.0	9.6	9.6	14.8	14.8	14.7	14.9	14.8	0.0
Incr Delay (d2), s/veh	10.6	0.6	0.6	4.5	0.7	0.7	1.7	0.9	0.1	0.8	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.9	0.9	0.3	1.1	1.2	0.1	0.1	0.0	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	26.3	10.5	10.5	19.4	10.3	10.2	16.5	15.7	14.8	15.6	15.0	0.0
LnGrp LOS	C	B	B	B	B	B	B	B	B	B	B	
Approach Vol, veh/h		375			524			31			10	
Approach Delay, s/veh		11.0			10.9			16.1			15.5	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.4	13.1		6.2	5.5	14.0		6.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	2.6	4.7		2.1	2.2	5.6		2.3
Green Ext Time (p_c), s	0.0	2.1		0.0	0.0	2.9		0.1

Intersection Summary		
HCM 7th Control Delay, s/veh		11.1
HCM 7th LOS		B

HCM 7th TWSC
9: Maa Way & Loloku St

10/27/2023

Intersection	
Int Delay, s/veh	3.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	138	9	61	96	8	109
Future Vol, veh/h	138	9	61	96	8	109
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	150	10	66	104	9	118

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	161	0	393	156
Stage 1	-	-	-	-	156	-
Stage 2	-	-	-	-	237	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1418	-	612	890
Stage 1	-	-	-	-	872	-
Stage 2	-	-	-	-	802	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1417	-	581	889
Mov Cap-2 Maneuver	-	-	-	-	581	-
Stage 1	-	-	-	-	872	-
Stage 2	-	-	-	-	763	-

Approach	EB		WB		NB
HCM Control Delay, s/v	0		2.98		9.78
HCM LOS					A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	581	889	-	-	1417	-
HCM Lane V/C Ratio	0.015	0.133	-	-	0.047	-
HCM Control Delay (s/veh)	11.3	9.7	-	-	7.7	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.5	-	-	0.1	-

Intersection	
Int Delay, s/veh	10.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	391	116	104	267	1	96	0	115	4	1	8
Future Vol, veh/h	4	391	116	104	267	1	96	0	115	4	1	8
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	425	126	113	290	1	104	0	125	4	1	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	297	0	0	554	0	0	1021	1023	492	958	1086	301
Stage 1	-	-	-	-	-	-	500	500	-	523	523	-
Stage 2	-	-	-	-	-	-	521	523	-	435	563	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1264	-	-	1016	-	-	215	236	577	237	216	739
Stage 1	-	-	-	-	-	-	553	543	-	537	531	-
Stage 2	-	-	-	-	-	-	539	530	-	600	509	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1257	-	-	1013	-	-	186	207	575	163	190	732
Mov Cap-2 Maneuver	-	-	-	-	-	-	186	207	-	163	190	-
Stage 1	-	-	-	-	-	-	550	540	-	532	469	-
Stage 2	-	-	-	-	-	-	470	468	-	467	506	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.06	2.52	49.77	16.79
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	294	1257	-	-	1013	-	-	319
HCM Lane V/C Ratio	0.779	0.003	-	-	0.112	-	-	0.044
HCM Control Delay (s/veh)	49.8	7.9	-	-	9	-	-	16.8
HCM Lane LOS	E	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	6.1	0	-	-	0.4	-	-	0.1

Intersection	
Intersection Delay, s/veh	19
Intersection LOS	C

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	403	65	65	310	39	67
Future Vol, veh/h	403	65	65	310	39	67
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	438	71	71	337	42	73
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	24.1	15.1	10.7
HCM LOS	C	C	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	86%	37%
Vol Thru, %	17%	0%	63%
Vol Right, %	83%	14%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	375	468	106
LT Vol	0	403	39
Through Vol	65	0	67
RT Vol	310	65	0
Lane Flow Rate	408	509	115
Geometry Grp	1	1	1
Degree of Util (X)	0.58	0.767	0.196
Departure Headway (Hd)	5.12	5.426	6.131
Convergence, Y/N	Yes	Yes	Yes
Cap	701	666	583
Service Time	3.17	3.462	4.195
HCM Lane V/C Ratio	0.582	0.764	0.197
HCM Control Delay, s/veh	15.1	24.1	10.7
HCM Lane LOS	C	C	B
HCM 95th-tile Q	3.8	7.2	0.7

HCM 7th TWSC
14: Kuakini Hwy & Loloku St
10/27/2023

Intersection	
Int Delay, s/veh	2.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	88	13	390	137	10	441
Future Vol, veh/h	88	13	390	137	10	441
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	96	14	424	149	11	479

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	999	498	0	0	573	0
Stage 1	498	-	-	-	-	-
Stage 2	501	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	270	572	-	-	1000	-
Stage 1	610	-	-	-	-	-
Stage 2	609	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	266	572	-	-	1000	-
Mov Cap-2 Maneuver	266	-	-	-	-	-
Stage 1	610	-	-	-	-	-
Stage 2	600	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	25.29	0	0.19
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	285	1000	-
HCM Lane V/C Ratio	-	-	0.385	0.011	-
HCM Control Delay (s/veh)	-	-	25.3	8.6	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	1.7	0	-

HCM 7th AWSC
15: Kuakini Hwy & Kaiwi St
10/27/2023

Intersection	
Intersection Delay, s/veh	110.3
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	32	46	51	291	27	48	53	474	434	27	475	33
Future Vol, veh/h	32	46	51	291	27	48	53	474	434	27	475	33
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	35	50	55	316	29	52	58	515	472	29	516	36
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	18.4	49.5	120.3	156.1
HCM LOS	C	E	F	F

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	10%	0%	25%	80%	5%
Vol Thru, %	90%	0%	36%	7%	89%
Vol Right, %	0%	100%	40%	13%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	527	434	129	366	535
LT Vol	53	0	32	291	27
Through Vol	474	0	46	27	475
RT Vol	0	434	51	48	33
Lane Flow Rate	573	472	140	398	582
Geometry Grp	7	7	2	2	5
Degree of Util (X)	1.282	0.957	0.353	0.882	1.254
Departure Headway (Hd)	8.686	7.906	9.996	8.664	7.927
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	424	462	362	422	465
Service Time	6.386	5.606	7.996	6.664	5.927
HCM Lane V/C Ratio	1.351	1.022	0.387	0.943	1.252
HCM Control Delay, s/veh	169.9	60.1	18.4	49.5	156.1
HCM Lane LOS	F	F	C	E	F
HCM 95th-tile Q	23.2	11.6	1.6	9.1	23.5

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	172	283	42	499	475	277	91	514	394	113	527	179
Future Volume (veh/h)	172	283	42	499	475	277	91	514	394	113	527	179
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.87	1.00		0.91	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	187	308	42	542	516	127	99	559	0	123	573	186
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	242	327	45	397	564	436	132	613		184	452	147
Arrive On Green	0.10	0.23	0.23	0.21	0.33	0.33	0.05	0.36	0.00	0.06	0.37	0.37
Sat Flow, veh/h	1603	1422	194	1603	1683	1303	1603	1683	1427	1603	1210	393
Grp Volume(v), veh/h	187	0	350	542	516	127	99	559	0	123	0	759
Grp Sat Flow(s),veh/h/ln	1603	0	1615	1603	1683	1303	1603	1683	1427	1603	0	1603
Q Serve(g_s), s	12.8	0.0	30.9	30.0	42.6	10.4	5.6	45.9	0.0	6.9	0.0	54.2
Cycle Q Clear(g_c), s	12.8	0.0	30.9	30.0	42.6	10.4	5.6	45.9	0.0	6.9	0.0	54.2
Prop In Lane	1.00		0.12	1.00		1.00	1.00		1.00	1.00		0.25
Lane Grp Cap(c), veh/h	242	0	371	397	564	436	132	613		184	0	599
V/C Ratio(X)	0.77	0.00	0.94	1.36	0.92	0.29	0.75	0.91		0.67	0.00	1.27
Avail Cap(c_a), veh/h	244	0	390	397	580	449	160	613		197	0	599
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.24	0.24	0.24	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	40.0	0.0	54.9	41.9	46.3	35.5	36.0	43.9	0.0	34.5	0.0	45.4
Incr Delay (d2), s/veh	14.0	0.0	30.5	168.2	5.9	0.1	14.4	20.2	0.0	7.7	0.0	133.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	0.0	15.8	33.1	18.9	3.4	2.7	22.7	0.0	3.1	0.0	43.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	54.0	0.0	85.4	210.1	52.2	35.6	50.4	64.2	0.0	42.2	0.0	178.5
LnGrp LOS	D		F	F	D	D	D	E		D		F
Approach Vol, veh/h		537			1185			658			882	
Approach Delay, s/veh		74.5			122.6			62.1			159.5	
Approach LOS		E			F			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.9	57.8	35.0	38.3	12.5	59.2	19.8	53.5
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	30.0	35.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	8.9	47.9	32.0	32.9	7.6	56.2	14.8	44.6
Green Ext Time (p_c), s	0.0	0.8	0.0	0.5	0.0	0.0	0.0	1.9

Intersection Summary	
HCM 7th Control Delay, s/veh	112.5
HCM 7th LOS	F

Notes
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	537	100	308	94	101	134	299	1303	70	237	1642	533
Future Volume (veh/h)	537	100	308	94	101	134	299	1303	70	237	1642	533
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	584	109	0	102	110	0	325	1416	30	258	1785	250
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	704	381		134	141		392	1506	670	280	1661	739
Arrive On Green	0.20	0.20	0.00	0.08	0.08	0.00	0.11	0.42	0.42	0.16	0.47	0.47
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	3554	1582
Grp Volume(v), veh/h	584	109	0	102	110	0	325	1416	30	258	1785	250
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1777	1582
Q Serve(g_s), s	23.1	7.0	0.0	8.0	8.3	0.0	13.1	54.5	1.6	20.4	66.8	14.3
Cycle Q Clear(g_c), s	23.1	7.0	0.0	8.0	8.3	0.0	13.1	54.5	1.6	20.4	66.8	14.3
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	704	381		134	141		392	1506	670	280	1661	739
V/C Ratio(X)	0.83	0.29		0.76	0.78		0.83	0.94	0.04	0.92	1.07	0.34
Avail Cap(c_a), veh/h	1016	550		224	236		847	1542	687	287	1661	739
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.5	48.1	0.0	64.8	64.9	0.0	62.0	39.4	24.2	59.3	38.0	24.1
Incr Delay (d2), s/veh	3.9	0.4	0.0	8.5	9.0	0.0	4.5	11.5	0.0	33.0	45.2	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.5	3.4	0.0	4.0	4.3	0.0	6.0	25.7	0.6	11.7	38.5	5.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	58.4	48.5	0.0	73.3	73.9	0.0	66.5	50.9	24.2	92.3	83.2	24.3
LnGrp LOS	E	D		E	E		E	D	C	F	F	C
Approach Vol, veh/h		693			212			1771			2293	
Approach Delay, s/veh		56.9			73.6			53.3			77.8	
Approach LOS		E			E			D			E	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	27.4	65.5		15.8	21.2	71.8		34.1
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	23.0	62.0		18.0	35.0	50.0		42.0
Max Q Clear Time (g_c+I1), s	22.4	56.5		10.3	15.1	68.8		25.1
Green Ext Time (p_c), s	0.1	4.0		0.5	1.1	0.0		2.7

Intersection Summary	
HCM 7th Control Delay, s/veh	66.0
HCM 7th LOS	E

Notes
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th TWSC

3: Queen Kaahumanu Hwy & Eho St

10/27/2023

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	61	0	1686	76	0	2197	27
Future Vol, veh/h	0	0	0	0	0	61	0	1686	76	0	2197	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	66	0	1833	83	0	2388	29

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	-	-	958	2390	0	0	1833	-	0
Stage 1	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	258	0	-	-	0	-	-
Stage 1	0	0	-	0	-	-	0	-	-
Stage 2	0	0	-	0	-	-	0	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	-	0	258	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-	-	-	-
Stage 1	-	0	-	-	-	-	-	-	-
Stage 2	-	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	23.74	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	258	-	-
HCM Lane V/C Ratio	-	-	0.257	-	-
HCM Control Delay (s/veh)	-	-	23.7	-	-
HCM Lane LOS	-	-	C	-	-
HCM 95th %tile Q(veh)	-	-	1	-	-

HCM 7th Signalized Intersection Summary

4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	415	425	154	84	427	138	159	1169	52	180	1308	664
Future Volume (veh/h)	415	425	154	84	427	138	159	1169	52	180	1308	664
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	451	462	0	91	464	0	173	1271	21	196	1422	494
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	503	890		114	602		232	1585	707	255	1609	716
Arrive On Green	0.15	0.25	0.00	0.06	0.17	0.00	0.07	0.45	0.45	0.07	0.45	0.45
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1582
Grp Volume(v), veh/h	451	462	0	91	464	0	173	1271	21	196	1422	494
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1582
Q Serve(g_s), s	17.1	14.9	0.0	6.7	16.6	0.0	6.5	41.0	1.0	7.4	48.6	33.1
Cycle Q Clear(g_c), s	17.1	14.9	0.0	6.7	16.6	0.0	6.5	41.0	1.0	7.4	48.6	33.1
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	503	890		114	602		232	1585	707	255	1609	716
V/C Ratio(X)	0.90	0.52		0.80	0.77		0.75	0.80	0.03	0.77	0.88	0.69
Avail Cap(c_a), veh/h	532	1002		274	1002		532	1749	780	506	1723	767
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.9	42.9	0.0	61.4	52.8	0.0	61.0	31.8	20.7	60.5	33.2	29.0
Incr Delay (d2), s/veh	17.3	0.5	0.0	11.7	2.1	0.0	4.7	2.6	0.0	4.8	5.6	2.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	6.7	0.0	3.4	7.7	0.0	3.0	17.8	0.4	3.4	21.5	13.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	73.2	43.4	0.0	73.1	54.9	0.0	65.7	34.3	20.7	65.3	38.8	31.4
LnGrp LOS	E	D		E	D		E	C	C	E	D	C
Approach Vol, veh/h		913			555			1465			2112	
Approach Delay, s/veh		58.1			57.9			37.8			39.5	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.3	64.8	14.0	38.8	14.4	65.7	24.9	28.0
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	65.5	20.5	37.5	20.5	64.5	20.5	37.5
Max Q Clear Time (g_c+I1), s	9.4	43.0	8.7	16.9	8.5	50.6	19.1	18.6
Green Ext Time (p_c), s	0.4	10.0	0.1	3.2	0.4	9.7	0.3	3.1

Intersection Summary	
HCM 7th Control Delay, s/veh	44.4
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	32	581	25	221	512	214	10	59	202	139	42	32
Future Volume (veh/h)	32	581	25	221	512	214	10	59	202	139	42	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	35	632	25	240	557	200	11	64	6	151	46	13
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	67	1010	40	301	1079	386	113	119	101	222	175	49
Arrive On Green	0.04	0.29	0.29	0.17	0.42	0.42	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3484	138	1781	2558	916	1781	1870	1585	1781	1403	396
Grp Volume(v), veh/h	35	322	335	240	386	371	11	64	6	151	0	59
Grp Sat Flow(s),veh/h/ln	1781	1777	1844	1781	1777	1697	1781	1870	1585	1781	0	1799
Q Serve(g_s), s	1.1	8.9	8.9	7.3	9.1	9.2	0.3	1.9	0.2	4.6	0.0	1.7
Cycle Q Clear(g_c), s	1.1	8.9	8.9	7.3	9.1	9.2	0.3	1.9	0.2	4.6	0.0	1.7
Prop In Lane	1.00		0.07	1.00		0.54	1.00		1.00	1.00		0.22
Lane Grp Cap(c), veh/h	67	515	535	301	750	716	113	119	101	222	0	225
V/C Ratio(X)	0.53	0.62	0.63	0.80	0.52	0.52	0.10	0.54	0.06	0.68	0.00	0.26
Avail Cap(c_a), veh/h	282	1722	1787	596	2035	1943	596	626	531	1004	0	1014
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	26.8	17.5	17.5	22.6	12.1	12.1	25.0	25.8	25.0	23.8	0.0	22.5
Incr Delay (d2), s/veh	6.3	1.2	1.2	4.8	0.6	0.6	0.4	3.8	0.2	3.6	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	3.5	3.7	3.3	3.3	3.2	0.1	0.9	0.1	2.1	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	33.1	18.7	18.7	27.4	12.7	12.7	25.4	29.5	25.2	27.4	0.0	23.1
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		692			997			81			210	
Approach Delay, s/veh		19.4			16.2			28.7			26.2	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	14.6	21.5	12.1	7.1	29.0	8.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	19.0	55.0	32.0	9.0	65.0	19.0
Max Q Clear Time (g_c+I1), s	9.3	10.9	6.6	3.1	11.2	3.9
Green Ext Time (p_c), s	0.5	4.9	0.8	0.0	6.2	0.3

Intersection Summary	
HCM 7th Control Delay, s/veh	18.9
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	97	289	17	137	371	54	30	56	213	130	66	67
Future Volume (veh/h)	97	289	17	137	371	54	30	56	213	130	66	67
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	105	314	15	149	403	49	33	61	17	141	72	41
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	140	680	32	198	731	88	157	165	139	330	205	117
Arrive On Green	0.08	0.20	0.20	0.11	0.23	0.23	0.09	0.09	0.09	0.19	0.19	0.19
Sat Flow, veh/h	1781	3453	164	1781	3187	385	1781	1870	1576	1781	1106	630
Grp Volume(v), veh/h	105	161	168	149	224	228	33	61	17	141	0	113
Grp Sat Flow(s),veh/h/ln	1781	1777	1840	1781	1777	1795	1781	1870	1576	1781	0	1736
Q Serve(g_s), s	2.8	3.8	3.9	3.9	5.3	5.4	0.8	1.5	0.5	3.3	0.0	2.7
Cycle Q Clear(g_c), s	2.8	3.8	3.9	3.9	5.3	5.4	0.8	1.5	0.5	3.3	0.0	2.7
Prop In Lane	1.00		0.09	1.00		0.21	1.00		1.00	1.00		0.36
Lane Grp Cap(c), veh/h	140	350	362	198	407	412	157	165	139	330	0	322
V/C Ratio(X)	0.75	0.46	0.46	0.75	0.55	0.56	0.21	0.37	0.12	0.43	0.00	0.35
Avail Cap(c_a), veh/h	373	1133	1174	633	1394	1408	1174	1232	1038	1174	0	1144
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.6	17.0	17.0	20.6	16.2	16.3	20.2	20.5	20.1	17.2	0.0	17.0
Incr Delay (d2), s/veh	7.8	0.9	0.9	5.7	1.2	1.2	0.7	1.4	0.4	0.9	0.0	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	1.5	1.6	1.8	2.1	2.1	0.3	0.6	0.2	1.3	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.3	17.9	17.9	26.3	17.4	17.4	20.9	21.9	20.5	18.1	0.0	17.6
LnGrp LOS	C	B	B	C	B	B	C	C	C	B		B
Approach Vol, veh/h		434			601			111			254	
Approach Delay, s/veh		20.7			19.6			21.4			17.9	
Approach LOS		C			B			C			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	10.3	14.4	13.9	8.8	16.0	9.2
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	5.9	5.9	5.3	4.8	7.4	3.5
Green Ext Time (p_c), s	0.3	2.0	1.0	0.1	3.1	0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	19.8
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	346	41	23	434	8	18	6	44	9	7	12
Future Volume (veh/h)	23	346	41	23	434	8	18	6	44	9	7	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	25	376	38	25	472	8	20	7	1	10	8	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	56	911	92	56	999	17	61	64	55	41	43	0
Arrive On Green	0.03	0.28	0.28	0.03	0.28	0.28	0.03	0.03	0.03	0.02	0.02	0.00
Sat Flow, veh/h	1781	3259	327	1781	3575	61	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	25	204	210	25	234	246	20	7	1	10	8	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1809	1781	1777	1859	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	3.0	3.0	0.4	3.5	3.5	0.3	0.1	0.0	0.2	0.1	0.0
Cycle Q Clear(g_c), s	0.4	3.0	3.0	0.4	3.5	3.5	0.3	0.1	0.0	0.2	0.1	0.0
Prop In Lane	1.00		0.18	1.00		0.03	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	56	497	506	56	497	520	61	64	55	41	43	0
V/C Ratio(X)	0.45	0.41	0.42	0.45	0.47	0.47	0.33	0.11	0.02	0.24	0.18	0.00
Avail Cap(c_a), veh/h	281	1403	1429	281	1403	1468	1688	1772	1502	1688	1772	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.1	9.3	9.3	15.1	9.5	9.5	14.9	14.8	14.8	15.2	15.2	0.0
Incr Delay (d2), s/veh	5.6	0.5	0.5	5.6	0.7	0.7	3.0	0.7	0.1	3.0	2.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.9	1.0	0.2	1.1	1.1	0.2	0.1	0.0	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	20.7	9.8	9.8	20.7	10.2	10.1	18.0	15.5	14.9	18.2	17.2	0.0
LnGrp LOS	C	A	A	C	B	B	B	B	B	B	B	
Approach Vol, veh/h		439			505			28			18	
Approach Delay, s/veh		10.5			10.7			17.2			17.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	6.0	13.9	5.7	6.0	13.9	6.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	2.4	5.0	2.2	2.4	5.5	2.3
Green Ext Time (p_c), s	0.0	2.5	0.0	0.0	2.9	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	10.9
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	2.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	159	17	35	95	6	73
Future Vol, veh/h	159	17	35	95	6	73
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	173	18	38	103	7	79

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	192	0	362	183
Stage 1	-	-	-	-	183	-
Stage 2	-	-	-	-	179	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1381	-	637	859
Stage 1	-	-	-	-	848	-
Stage 2	-	-	-	-	852	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1380	-	618	859
Mov Cap-2 Maneuver	-	-	-	-	618	-
Stage 1	-	-	-	-	848	-
Stage 2	-	-	-	-	827	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.07	9.72
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	618	859	-	-	1380	-
HCM Lane V/C Ratio	0.011	0.092	-	-	0.028	-
HCM Control Delay (s/veh)	10.9	9.6	-	-	7.7	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	297	144	96	209	0	65	0	97	1	0	0
Future Vol, veh/h	3	297	144	96	209	0	65	0	97	1	0	0
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	323	157	104	227	0	71	0	105	1	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	233	0	0	479	0	0	844	849	401	771	928	234
Stage 1	-	-	-	-	-	-	408	408	-	442	442	-
Stage 2	-	-	-	-	-	-	437	442	-	329	486	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1334	-	-	1083	-	0	283	298	649	317	268	805
Stage 1	-	-	-	-	-	0	620	597	-	595	576	-
Stage 2	-	-	-	-	-	0	598	576	-	684	551	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1327	-	-	1083	-	-	255	267	649	238	240	800
Mov Cap-2 Maneuver	-	-	-	-	-	-	255	267	-	238	240	-
Stage 1	-	-	-	-	-	-	619	595	-	590	518	-
Stage 2	-	-	-	-	-	-	540	518	-	571	550	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.05	2.73	20.86	20.2
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	400	1327	-	-	1083	-	238
HCM Lane V/C Ratio	0.44	0.002	-	-	0.096	-	0.005
HCM Control Delay (s/veh)	20.9	7.7	-	-	8.7	-	20.2
HCM Lane LOS	C	A	-	-	A	-	C
HCM 95th %tile Q(veh)	2.2	0	-	-	0.3	-	0

Intersection	
Intersection Delay, s/veh	25.8
Intersection LOS	D

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	387	91	108	319	91	118
Future Vol, veh/h	387	91	108	319	91	118
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	421	99	117	347	99	128
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	34.1	22.3	14.1
HCM LOS	D	C	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	81%	44%
Vol Thru, %	25%	0%	56%
Vol Right, %	75%	19%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	427	478	209
LT Vol	0	387	91
Through Vol	108	0	118
RT Vol	319	91	0
Lane Flow Rate	464	520	227
Geometry Grp	1	1	1
Degree of Util (X)	0.729	0.852	0.414
Departure Headway (Hd)	5.652	6.009	6.56
Convergence, Y/N	Yes	Yes	Yes
Cap	645	608	550
Service Time	3.652	4.009	4.577
HCM Lane V/C Ratio	0.719	0.855	0.413
HCM Control Delay, s/veh	22.3	34.1	14.1
HCM Lane LOS	C	D	B
HCM 95th-tile Q	6.3	9.4	2

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	78	9	423	120	7	522
Future Vol, veh/h	78	9	423	120	7	522
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	85	10	460	130	8	567

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1109	526	0	0	590	0
Stage 1	525	-	-	-	-	-
Stage 2	584	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	232	552	-	-	985	-
Stage 1	593	-	-	-	-	-
Stage 2	558	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	229	551	-	-	985	-
Mov Cap-2 Maneuver	229	-	-	-	-	-
Stage 1	593	-	-	-	-	-
Stage 2	551	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	28.8	0	0.11
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	244	985	-
HCM Lane V/C Ratio	-	-	0.388	0.008	-
HCM Control Delay (s/veh)	-	-	28.8	8.7	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	1.7	0	-

Intersection	
Intersection Delay, s/veh	86.4
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	25	49	204	22	29	46	500	377	36	529	24
Future Vol, veh/h	18	25	49	204	22	29	46	500	377	36	529	24
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	20	27	53	222	24	32	50	543	410	39	575	26
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	14.6	22.6	83.4	129.8
HCM LOS	B	C	F	F

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	8%	0%	20%	80%	6%
Vol Thru, %	92%	0%	27%	9%	90%
Vol Right, %	0%	100%	53%	11%	4%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	546	377	92	255	589
LT Vol	46	0	18	204	36
Through Vol	500	0	25	22	529
RT Vol	0	377	49	29	24
Lane Flow Rate	593	410	100	277	640
Geometry Grp	7	7	2	2	5
Degree of Util (X)	1.174	0.726	0.23	0.594	1.197
Departure Headway (Hd)	7.507	6.742	8.976	8.264	6.942
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	487	541	403	441	531
Service Time	5.207	4.442	6.976	6.264	4.942
HCM Lane V/C Ratio	1.218	0.758	0.248	0.628	1.205
HCM Control Delay, s/veh	123.5	25.3	14.6	22.6	129.8
HCM Lane LOS	F	D	B	C	F
HCM 95th-tile Q	20.7	6	0.9	3.8	22.9

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	172	336	34	396	431	294	81	428	342	170	433	189
Future Volume (veh/h)	172	336	34	396	431	294	81	428	342	170	433	189
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.91	1.00		0.92	1.00		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	187	365	34	430	468	83	88	465	0	185	471	191
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	236	323	30	282	424	332	149	660		329	483	196
Arrive On Green	0.11	0.21	0.21	0.14	0.25	0.25	0.05	0.39	0.00	0.08	0.43	0.43
Sat Flow, veh/h	1603	1502	140	1603	1683	1319	1603	1683	1427	1603	1125	456
Grp Volume(v), veh/h	187	0	399	430	468	83	88	465	0	185	0	662
Grp Sat Flow(s),veh/h/ln	1603	0	1642	1603	1683	1319	1603	1683	1427	1603	0	1581
Q Serve(g_s), s	10.4	0.0	25.0	16.0	29.3	5.8	3.8	27.0	0.0	7.8	0.0	47.9
Cycle Q Clear(g_c), s	10.4	0.0	25.0	16.0	29.3	5.8	3.8	27.0	0.0	7.8	0.0	47.9
Prop In Lane	1.00		0.09	1.00		1.00	1.00		1.00	1.00		0.29
Lane Grp Cap(c), veh/h	236	0	353	282	424	332	149	660		329	0	678
V/C Ratio(X)	0.79	0.00	1.13	1.52	1.10	0.25	0.59	0.70		0.56	0.00	0.98
Avail Cap(c_a), veh/h	337	0	353	282	424	332	157	665		332	0	679
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	32.8	0.0	45.7	32.2	43.5	34.7	28.2	29.7	0.0	21.7	0.0	32.6
Incr Delay (d2), s/veh	8.0	0.0	88.5	252.9	74.6	0.4	5.2	3.4	0.0	2.1	0.0	28.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.0	18.9	26.0	21.0	1.9	1.7	11.5	0.0	3.1	0.0	23.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	40.8	0.0	134.2	285.1	118.2	35.1	33.4	33.1	0.0	23.9	0.0	61.1
LnGrp LOS	D		F	F	F	D	C	C		C		E
Approach Vol, veh/h		586			981			553			847	
Approach Delay, s/veh		104.4			184.3			33.1			53.0	
Approach LOS		F			F			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.8	50.6	21.0	30.0	10.5	54.9	16.7	34.3
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	10.0	46.0	16.0	25.0	6.0	50.0	20.0	22.0
Max Q Clear Time (g_c+I1), s	9.8	29.0	18.0	27.0	5.8	49.9	12.4	31.3
Green Ext Time (p_c), s	0.0	2.9	0.0	0.0	0.0	0.1	0.3	0.0

Intersection Summary		
HCM 7th Control Delay, s/veh		102.9
HCM 7th LOS		F

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	350	20	139	35	24	54	208	939	16	19	828	342
Future Volume (veh/h)	350	20	139	35	24	54	208	939	16	19	828	342
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	380	22	0	38	26	0	226	1021	10	21	900	197
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	445	241		102	107		293	2395	1068	33	2160	963
Arrive On Green	0.13	0.13	0.00	0.06	0.06	0.00	0.08	0.67	0.67	0.02	0.61	0.61
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	3554	1584
Grp Volume(v), veh/h	380	22	0	38	26	0	226	1021	10	21	900	197
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1777	1584
Q Serve(g_s), s	17.8	1.7	0.0	3.4	2.2	0.0	10.6	21.7	0.3	1.9	21.9	9.2
Cycle Q Clear(g_c), s	17.8	1.7	0.0	3.4	2.2	0.0	10.6	21.7	0.3	1.9	21.9	9.2
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	445	241		102	107		293	2395	1068	33	2160	963
V/C Ratio(X)	0.85	0.09		0.37	0.24		0.77	0.43	0.01	0.63	0.42	0.20
Avail Cap(c_a), veh/h	859	465		119	125		670	2395	1068	54	2160	963
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.89	0.89	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	70.4	63.4	0.0	74.9	74.3	0.0	73.9	12.3	8.8	80.4	17.0	14.5
Incr Delay (d2), s/veh	4.3	0.1	0.0	2.2	1.2	0.0	4.3	0.6	0.0	17.9	0.6	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.2	0.8	0.0	1.6	1.1	0.0	4.9	8.7	0.1	1.1	9.1	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.7	63.5	0.0	77.1	75.5	0.0	78.2	12.9	8.8	98.3	17.6	15.0
LnGrp LOS	E	E		E	E		E	B	A	F	B	B
Approach Vol, veh/h		402			64			1257			1118	
Approach Delay, s/veh		74.0			76.5			24.6			18.6	
Approach LOS		E			E			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	116.2		14.5	19.0	105.3		26.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	88.0		11.0	32.0	61.0		41.0
Max Q Clear Time (g_c+I1), s	3.9	23.7		5.4	12.6	23.9		19.8
Green Ext Time (p_c), s	0.0	9.4		0.1	0.7	8.3		1.5

Intersection Summary		
HCM 7th Control Delay, s/veh		30.4
HCM 7th LOS		C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	278	221	103	22	302	97	144	859	24	89	655	329
Future Volume (veh/h)	278	221	103	22	302	97	144	859	24	89	655	329
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	302	240	0	24	328	0	157	934	13	97	712	167
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	357	649		72	426		251	2118	944	207	2072	922
Arrive On Green	0.10	0.18	0.00	0.04	0.12	0.00	0.07	0.60	0.60	0.06	0.58	0.58
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1581
Grp Volume(v), veh/h	302	240	0	24	328	0	157	934	13	97	712	167
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1581
Q Serve(g_s), s	14.2	9.8	0.0	2.2	14.8	0.0	7.3	23.8	0.6	4.5	17.2	8.1
Cycle Q Clear(g_c), s	14.2	9.8	0.0	2.2	14.8	0.0	7.3	23.8	0.6	4.5	17.2	8.1
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	357	649		72	426		251	2118	944	207	2072	922
V/C Ratio(X)	0.85	0.37		0.33	0.77		0.63	0.44	0.01	0.47	0.34	0.18
Avail Cap(c_a), veh/h	607	969		238	818		293	2118	944	230	2072	922
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.88	0.88	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	72.7	59.1	0.0	77.0	70.4	0.0	74.3	18.3	13.6	75.0	17.9	16.0
Incr Delay (d2), s/veh	4.9	0.3	0.0	2.7	3.0	0.0	3.2	0.7	0.0	1.6	0.5	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.6	4.5	0.0	1.1	7.0	0.0	3.4	10.0	0.2	2.0	7.3	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	77.6	59.4	0.0	79.7	73.4	0.0	77.5	18.9	13.6	76.7	18.4	16.5
LnGrp LOS	E	E		E	E		E	B	B	E	B	B
Approach Vol, veh/h		542			352			1104			976	
Approach Delay, s/veh		69.6			73.8			27.2			23.8	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	103.3	11.7	35.1	17.0	101.2	22.0	24.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	67.0	22.0	45.0	14.0	64.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	6.5	25.8	4.2	11.8	9.3	19.2	16.2	16.8
Green Ext Time (p_c), s	0.1	7.9	0.0	1.7	0.2	6.2	0.9	2.2

Intersection Summary	
HCM 7th Control Delay, s/veh	39.3
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	287	18	195	301	72	2	17	194	34	16	10
Future Volume (veh/h)	10	287	18	195	301	72	2	17	194	34	16	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	312	16	212	327	64	2	18	8	37	17	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	26	706	36	285	1042	201	60	63	54	103	108	0
Arrive On Green	0.01	0.21	0.21	0.16	0.35	0.35	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3438	176	1781	2968	574	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	11	161	167	212	194	197	2	18	8	37	17	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1837	1781	1777	1765	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.2	2.9	2.9	4.2	2.9	3.0	0.0	0.3	0.2	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.2	2.9	2.9	4.2	2.9	3.0	0.0	0.3	0.2	0.7	0.3	0.0
Prop In Lane	1.00		0.10	1.00		0.33	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	26	365	377	285	624	620	60	63	54	103	108	0
V/C Ratio(X)	0.43	0.44	0.44	0.74	0.31	0.32	0.03	0.28	0.15	0.36	0.16	0.00
Avail Cap(c_a), veh/h	435	2654	2744	919	3136	3116	919	965	818	1548	1625	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	18.0	12.8	12.8	14.7	8.7	8.7	17.2	17.4	17.3	16.7	16.5	0.0
Incr Delay (d2), s/veh	10.8	0.8	0.8	3.8	0.3	0.3	0.2	2.4	1.3	2.1	0.7	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.0	1.1	1.7	0.9	0.9	0.0	0.2	0.1	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.8	13.6	13.6	18.6	9.0	9.0	17.4	19.8	18.5	18.8	17.2	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		339			603			28			54	
Approach Delay, s/veh		14.1			12.4			19.3			18.3	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.9	12.6		7.1	5.5	17.9		6.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	6.2	4.9		2.7	2.2	5.0		2.3
Green Ext Time (p_c), s	0.5	2.2		0.2	0.0	2.8		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.4
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	161	10	103	191	31	15	16	123	35	15	7
Future Volume (veh/h)	18	161	10	103	191	31	15	16	123	35	15	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	175	8	112	208	26	16	17	1	38	16	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	45	600	27	175	784	97	73	76	65	113	119	0
Arrive On Green	0.03	0.17	0.17	0.10	0.25	0.25	0.04	0.04	0.04	0.06	0.06	0.00
Sat Flow, veh/h	1781	3459	157	1781	3183	393	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	20	89	94	112	115	119	16	17	1	38	16	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1840	1781	1777	1799	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	1.4	1.4	1.9	1.7	1.7	0.3	0.3	0.0	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.4	1.4	1.4	1.9	1.7	1.7	0.3	0.3	0.0	0.7	0.3	0.0
Prop In Lane	1.00		0.09	1.00		0.22	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	45	308	319	175	438	443	73	76	65	113	119	0
V/C Ratio(X)	0.44	0.29	0.29	0.64	0.26	0.27	0.22	0.22	0.02	0.34	0.13	0.00
Avail Cap(c_a), veh/h	556	1690	1750	944	2078	2104	1750	1837	1557	1750	1837	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.4	11.5	11.5	13.9	9.7	9.7	14.9	14.9	14.8	14.4	14.2	0.0
Incr Delay (d2), s/veh	6.6	0.5	0.5	3.8	0.3	0.3	1.5	1.5	0.1	1.7	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.5	0.5	0.8	0.5	0.6	0.1	0.1	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.0	12.0	12.0	17.7	10.1	10.1	16.4	16.3	14.9	16.1	14.7	0.0
LnGrp LOS	C	B	B	B	B	B	B	B	B	B	B	
Approach Vol, veh/h		203			346			34			54	
Approach Delay, s/veh		13.0			12.5			16.3			15.7	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	8.2	10.6	7.0	5.8	12.9	6.3
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	3.9	3.4	2.7	2.4	3.7	2.3
Green Ext Time (p_c), s	0.2	1.1	0.1	0.0	1.5	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.2
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	121	50	76	134	2	23	4	71	1	4	4
Future Volume (veh/h)	12	121	50	76	134	2	23	4	71	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	13	132	19	83	146	1	25	4	3	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	31	559	79	150	889	6	77	81	68	12	13	0
Arrive On Green	0.02	0.18	0.18	0.08	0.25	0.25	0.04	0.04	0.04	0.01	0.01	0.00
Sat Flow, veh/h	1781	3124	442	1781	3618	25	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	13	74	77	83	72	75	25	4	3	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1789	1781	1777	1866	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	1.0	1.1	1.3	0.9	0.9	0.4	0.1	0.1	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	1.0	1.1	1.3	0.9	0.9	0.4	0.1	0.1	0.0	0.1	0.0
Prop In Lane	1.00		0.25	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	31	318	320	150	437	459	77	81	68	12	13	0
V/C Ratio(X)	0.43	0.23	0.24	0.55	0.16	0.16	0.32	0.05	0.04	0.08	0.31	0.00
Avail Cap(c_a), veh/h	306	1526	1537	306	1526	1602	1836	1928	1631	1836	1928	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	14.2	10.2	10.3	12.8	8.6	8.6	13.5	13.4	13.3	14.4	14.4	0.0
Incr Delay (d2), s/veh	9.1	0.4	0.4	3.2	0.2	0.2	2.4	0.3	0.3	2.9	13.4	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.3	0.4	0.5	0.3	0.3	0.2	0.0	0.0	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.3	10.6	10.6	16.0	8.8	8.8	15.9	13.6	13.6	17.2	27.8	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		164			230			32			5	
Approach Delay, s/veh		11.6			11.4			15.4			25.7	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	7.4	10.2	5.2	5.5	12.2	6.3
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	3.3	3.1	2.1	2.2	2.9	2.4
Green Ext Time (p_c), s	0.0	0.8	0.0	0.0	0.8	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	11.9
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	3.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	112	13	38	71	11	56
Future Vol, veh/h	112	13	38	71	11	56
Conflicting Peds, #/hr	0	3	3	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	122	14	41	77	12	61

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	139	0	292	132
Stage 1	-	-	-	-	132	-
Stage 2	-	-	-	-	160	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1445	-	699	918
Stage 1	-	-	-	-	894	-
Stage 2	-	-	-	-	869	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1441	-	676	915
Mov Cap-2 Maneuver	-	-	-	-	676	-
Stage 1	-	-	-	-	892	-
Stage 2	-	-	-	-	843	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.64	9.41
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	676	915	-	-	1441	-
HCM Lane V/C Ratio	0.018	0.067	-	-	0.029	-
HCM Control Delay (s/veh)	10.4	9.2	-	-	7.6	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	114	7	5	62	4	4
Future Vol, veh/h	114	7	5	62	4	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	124	8	5	67	4	4

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	132	0	206	128
Stage 1	-	-	-	-	128	-
Stage 2	-	-	-	-	78	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1454	-	782	922
Stage 1	-	-	-	-	898	-
Stage 2	-	-	-	-	945	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1454	-	779	922
Mov Cap-2 Maneuver	-	-	-	-	779	-
Stage 1	-	-	-	-	898	-
Stage 2	-	-	-	-	941	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.56	9.31
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	845	-	-	1454	-
HCM Lane V/C Ratio	0.01	-	-	0.004	-
HCM Control Delay (s/veh)	9.3	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	290	103	82	162	9	38	0	53	10	0	5
Future Vol, veh/h	10	290	103	82	162	9	38	0	53	10	0	5
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	315	112	89	176	10	41	0	58	11	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	188	0	0	430	0	0	751	762	374	698	813	184
Stage 1	-	-	-	-	-	-	396	396	-	361	361	-
Stage 2	-	-	-	-	-	-	355	366	-	337	452	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1386	-	-	1129	-	-	327	335	672	355	313	858
Stage 1	-	-	-	-	-	-	630	604	-	657	626	-
Stage 2	-	-	-	-	-	-	662	623	-	677	571	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1384	-	-	1126	-	-	296	304	670	296	284	856
Mov Cap-2 Maneuver	-	-	-	-	-	-	296	304	-	296	284	-
Stage 1	-	-	-	-	-	-	623	598	-	651	575	-
Stage 2	-	-	-	-	-	-	605	572	-	614	564	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.19	2.75	15.59	14.94
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	438	1384	-	-	1126	-	-	378
HCM Lane V/C Ratio	0.226	0.008	-	-	0.079	-	-	0.043
HCM Control Delay (s/veh)	15.6	7.6	-	-	8.5	-	-	14.9
HCM Lane LOS	C	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.9	0	-	-	0.3	-	-	0.1

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	129	33	52	158	18	48
Future Vol, veh/h	129	33	52	158	18	48
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	140	36	57	172	20	52
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	9	8.4	8.1
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	80%	27%
Vol Thru, %	25%	0%	73%
Vol Right, %	75%	20%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	210	162	66
LT Vol	0	129	18
Through Vol	52	0	48
RT Vol	158	33	0
Lane Flow Rate	228	176	72
Geometry Grp	1	1	1
Degree of Util (X)	0.253	0.225	0.093
Departure Headway (Hd)	3.995	4.607	4.647
Convergence, Y/N	Yes	Yes	Yes
Cap	902	780	773
Service Time	2.01	2.631	2.668
HCM Lane V/C Ratio	0.253	0.226	0.093
HCM Control Delay, s/veh	8.4	9	8.1
HCM Lane LOS	A	A	A
HCM 95th-tile Q	1	0.9	0.3

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	64	2	225	117	4	180
Future Vol, veh/h	64	2	225	117	4	180
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	70	2	245	127	4	196

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	515	309	0	0	373	0
Stage 1	309	-	-	-	-	-
Stage 2	205	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	520	731	-	-	1186	-
Stage 1	744	-	-	-	-	-
Stage 2	829	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	517	730	-	-	1185	-
Mov Cap-2 Maneuver	517	-	-	-	-	-
Stage 1	744	-	-	-	-	-
Stage 2	825	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	13	0	0.18
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	522	1185	-
HCM Lane V/C Ratio	-	-	0.138	0.004	-
HCM Control Delay (s/veh)	-	-	13	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0	-

Intersection	
Intersection Delay, s/veh	14.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	34	29	169	22	15	42	309	313	0	214	27
Future Vol, veh/h	11	34	29	169	22	15	42	309	313	0	214	27
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	37	32	184	24	16	46	336	340	0	233	29
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	10.7	13.7	16	13.2
HCM LOS	B	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	12%	0%	15%	82%	0%
Vol Thru, %	88%	0%	46%	11%	89%
Vol Right, %	0%	100%	39%	7%	11%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	351	313	74	206	241
LT Vol	42	0	11	169	0
Through Vol	309	0	34	22	214
RT Vol	0	313	29	15	27
Lane Flow Rate	382	340	80	224	262
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.634	0.492	0.145	0.4	0.426
Departure Headway (Hd)	5.982	5.211	6.511	6.426	5.856
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	603	691	548	558	613
Service Time	3.734	2.963	4.59	4.484	3.916
HCM Lane V/C Ratio	0.633	0.492	0.146	0.401	0.427
HCM Control Delay, s/veh	18.6	13	10.7	13.7	13.2
HCM Lane LOS	C	B	B	B	B
HCM 95th-tile Q	4.5	2.7	0.5	1.9	2.1

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	144	163	45	189	213	220	74	391	238	114	207	106
Future Volume (veh/h)	144	163	45	189	213	220	74	391	238	114	207	106
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.94	0.97		0.95	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	157	177	39	205	232	29	80	425	0	124	225	102
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	279	250	55	289	336	269	479	830		422	555	252
Arrive On Green	0.09	0.19	0.19	0.10	0.20	0.20	0.04	0.49	0.00	0.05	0.51	0.51
Sat Flow, veh/h	1603	1320	291	1603	1683	1351	1603	1683	1427	1603	1092	495
Grp Volume(v), veh/h	157	0	216	205	232	29	80	425	0	124	0	327
Grp Sat Flow(s),veh/h/ln	1603	0	1611	1603	1683	1351	1603	1683	1427	1603	0	1587
Q Serve(g_s), s	9.7	0.0	15.7	13.0	16.0	2.2	3.1	21.4	0.0	4.7	0.0	16.0
Cycle Q Clear(g_c), s	9.7	0.0	15.7	13.0	16.0	2.2	3.1	21.4	0.0	4.7	0.0	16.0
Prop In Lane	1.00		0.18	1.00		1.00	1.00		1.00	1.00		0.31
Lane Grp Cap(c), veh/h	279	0	305	289	336	269	479	830		422	0	806
V/C Ratio(X)	0.56	0.00	0.71	0.71	0.69	0.11	0.17	0.51		0.29	0.00	0.41
Avail Cap(c_a), veh/h	295	0	451	289	471	378	545	830		463	0	806
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.79	0.79	0.79	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	36.6	0.0	47.5	37.0	46.5	40.9	15.3	21.5	0.0	16.1	0.0	19.0
Incr Delay (d2), s/veh	2.2	0.0	3.0	6.2	2.0	0.1	0.2	2.3	0.0	0.4	0.0	1.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.0	6.6	5.6	6.9	0.8	1.2	9.0	0.0	1.8	0.0	6.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	38.8	0.0	50.5	43.2	48.5	41.1	15.5	23.8	0.0	16.4	0.0	20.5
LnGrp LOS	D		D	D	D	D	B	C		B		C
Approach Vol, veh/h		373			466			505			451	
Approach Delay, s/veh		45.6			45.7			22.4			19.4	
Approach LOS		D			D			C			B	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.7	66.6	18.0	28.6	9.8	68.5	16.7	29.9				
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0				
Max Green Setting (Gmax), s	10.0	47.0	13.0	35.0	10.0	47.0	13.0	35.0				
Max Q Clear Time (g_c+I1), s	6.7	23.4	15.0	17.7	5.1	18.0	11.7	18.0				
Green Ext Time (p_c), s	0.1	2.9	0.0	1.2	0.1	2.3	0.1	1.3				
Intersection Summary												
HCM 7th Control Delay, s/veh			32.5									
HCM 7th LOS			C									
Notes												
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.												

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	596	45	350	34	48	51	338	880	17	27	1367	502
Future Volume (veh/h)	596	45	350	34	48	51	338	880	17	27	1367	502
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	648	49	0	37	52	0	367	957	9	29	1486	210
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	724	392		106	111		424	2087	931	40	1730	772
Arrive On Green	0.21	0.21	0.00	0.06	0.06	0.00	0.12	0.59	0.59	0.02	0.49	0.49
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	3554	1585
Grp Volume(v), veh/h	648	49	0	37	52	0	367	957	9	29	1486	210
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1777	1585
Q Serve(g_s), s	30.1	3.5	0.0	3.3	4.4	0.0	17.2	25.1	0.4	2.7	60.8	12.9
Cycle Q Clear(g_c), s	30.1	3.5	0.0	3.3	4.4	0.0	17.2	25.1	0.4	2.7	60.8	12.9
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	724	392		106	111		424	2087	931	40	1730	772
V/C Ratio(X)	0.89	0.13		0.35	0.47		0.87	0.46	0.01	0.73	0.86	0.27
Avail Cap(c_a), veh/h	922	499		119	125		670	2087	931	54	1730	772
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.69	0.69	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.4	52.9	0.0	74.5	75.0	0.0	71.0	19.2	14.1	80.2	37.3	25.0
Incr Delay (d2), s/veh	6.8	0.1	0.0	1.9	3.0	0.0	7.1	0.7	0.0	27.5	5.8	0.9
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.1	1.7	0.0	1.6	2.3	0.0	8.0	10.6	0.1	1.5	27.5	5.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	70.3	53.0	0.0	76.5	78.1	0.0	78.1	19.9	14.1	107.7	43.1	25.9
LnGrp LOS	E	D		E	E		E	B	B	F	D	C
Approach Vol, veh/h		697			89			1333			1725	
Approach Delay, s/veh		69.1			77.4			35.9			42.1	
Approach LOS		E			E			D			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.7	101.9		14.8	25.3	85.3		39.6				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	85.0		11.0	32.0	58.0		44.0				
Max Q Clear Time (g_c+I1), s	4.7	27.1		6.4	19.2	62.8		32.1				
Green Ext Time (p_c), s	0.0	8.5		0.1	1.1	0.0		2.3				
Intersection Summary												
HCM 7th Control Delay, s/veh			45.7									
HCM 7th LOS			D									
Notes												
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.												

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	331	343	132	30	353	128	144	876	25	208	1131	602
Future Volume (veh/h)	331	343	132	30	353	128	144	876	25	208	1131	602
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	360	373	0	33	384	0	157	952	11	226	1229	432
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	416	749		84	490		209	1818	811	377	1990	887
Arrive On Green	0.12	0.21	0.00	0.05	0.14	0.00	0.06	0.51	0.51	0.11	0.56	0.56
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	360	373	0	33	384	0	157	952	11	226	1229	432
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	16.9	15.3	0.0	3.0	17.2	0.0	7.4	29.5	0.6	10.3	38.4	27.2
Cycle Q Clear(g_c), s	16.9	15.3	0.0	3.0	17.2	0.0	7.4	29.5	0.6	10.3	38.4	27.2
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	416	749		84	490		209	1818	811	377	1990	887
V/C Ratio(X)	0.87	0.50		0.39	0.78		0.75	0.52	0.01	0.60	0.62	0.49
Avail Cap(c_a), veh/h	607	969		238	818		335	1818	811	440	1990	887
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.80	0.80	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	71.3	57.4	0.0	76.3	68.7	0.0	76.3	26.9	19.8	70.1	24.4	21.9
Incr Delay (d2), s/veh	7.2	0.4	0.0	2.9	2.8	0.0	5.3	1.1	0.0	1.7	1.4	1.9
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.0	7.0	0.0	1.4	8.1	0.0	3.4	12.8	0.2	4.7	16.4	10.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	78.5	57.8	0.0	79.2	71.5	0.0	81.6	28.0	19.8	71.7	25.9	23.9
LnGrp LOS	E	E		E	E		F	C	B	E	C	C
Approach Vol, veh/h		733			417			1120			1887	
Approach Delay, s/veh		68.0			72.2			35.4			30.9	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	89.4	12.8	39.8	15.0	97.4	24.8	27.7
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	57.0	22.0	45.0	16.0	62.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	12.3	31.5	5.0	17.3	9.4	40.4	18.9	19.2
Green Ext Time (p_c), s	0.5	7.3	0.0	2.7	0.2	11.2	1.0	2.5

Intersection Summary	
HCM 7th Control Delay, s/veh	42.8
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	587	25	204	526	157	10	12	283	132	23	23
Future Volume (veh/h)	18	587	25	204	526	157	10	12	283	132	23	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	638	25	222	572	151	11	13	5	143	25	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	43	1036	41	286	1207	318	59	62	52	206	198	16
Arrive On Green	0.02	0.30	0.30	0.16	0.43	0.43	0.03	0.03	0.03	0.12	0.12	0.12
Sat Flow, veh/h	1781	3486	136	1781	2782	732	1781	1870	1585	1781	1709	137
Grp Volume(v), veh/h	20	325	338	222	365	358	11	13	5	143	0	27
Grp Sat Flow(s),veh/h/ln	1781	1777	1846	1781	1777	1738	1781	1870	1585	1781	0	1846
Q Serve(g_s), s	0.6	8.0	8.0	6.1	7.4	7.5	0.3	0.3	0.2	3.9	0.0	0.7
Cycle Q Clear(g_c), s	0.6	8.0	8.0	6.1	7.4	7.5	0.3	0.3	0.2	3.9	0.0	0.7
Prop In Lane	1.00		0.07	1.00		0.42	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	43	528	549	286	771	754	59	62	52	206	0	213
V/C Ratio(X)	0.46	0.62	0.62	0.78	0.47	0.48	0.19	0.21	0.10	0.69	0.00	0.13
Avail Cap(c_a), veh/h	315	1922	1996	666	2272	2221	666	699	592	1121	0	1162
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.5	15.4	15.4	20.5	10.3	10.3	23.9	23.9	23.8	21.6	0.0	20.2
Incr Delay (d2), s/veh	7.6	1.2	1.1	4.5	0.5	0.5	1.5	1.7	0.8	4.2	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	3.1	3.2	2.7	2.5	2.5	0.1	0.2	0.1	1.8	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	32.1	16.5	16.5	24.9	10.7	10.7	25.4	25.6	24.6	25.8	0.0	20.4
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		683			945			29			170	
Approach Delay, s/veh		17.0			14.1			25.4			24.9	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.2	20.1		10.9	6.2	27.1		6.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	10.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	8.1	10.0		5.9	2.6	9.5		2.3
Green Ext Time (p_c), s	0.5	5.0		0.5	0.0	5.8		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	16.3
HCM 7th LOS	B

6: Midblock Driveway & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	62	346	16	121	403	34	16	29	212	77	36	53
Future Volume (veh/h)	62	346	16	121	403	34	16	29	212	77	36	53
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	67	376	15	132	438	32	17	32	9	84	39	9
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	117	738	29	176	823	60	106	111	94	231	190	44
Arrive On Green	0.07	0.21	0.21	0.10	0.25	0.25	0.06	0.06	0.06	0.13	0.13	0.13
Sat Flow, veh/h	1781	3484	139	1781	3358	245	1781	1870	1585	1781	1463	338
Grp Volume(v), veh/h	67	191	200	132	231	239	17	32	9	84	0	48
Grp Sat Flow(s),veh/h/ln	1781	1777	1845	1781	1777	1826	1781	1870	1585	1781	0	1801
Q Serve(g_s), s	1.5	3.8	3.8	2.9	4.5	4.5	0.4	0.7	0.2	1.7	0.0	1.0
Cycle Q Clear(g_c), s	1.5	3.8	3.8	2.9	4.5	4.5	0.4	0.7	0.2	1.7	0.0	1.0
Prop In Lane	1.00		0.08	1.00		0.13	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	117	377	391	176	435	447	106	111	94	231	0	234
V/C Ratio(X)	0.57	0.51	0.51	0.75	0.53	0.53	0.16	0.29	0.10	0.36	0.00	0.21
Avail Cap(c_a), veh/h	445	1355	1407	757	1666	1712	1403	1473	1248	1403	0	1418
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.1	13.9	13.9	17.5	13.1	13.1	17.9	18.0	17.8	15.9	0.0	15.6
Incr Delay (d2), s/veh	4.4	1.1	1.0	6.3	1.0	1.0	0.7	1.4	0.4	1.0	0.0	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	1.4	1.5	1.4	1.6	1.7	0.2	0.3	0.1	0.7	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.5	15.0	15.0	23.8	14.1	14.1	18.6	19.4	18.2	16.8	0.0	16.0
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		458			602			58			132	
Approach Delay, s/veh		16.1			16.2			19.0			16.5	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.9	13.5		10.2	7.6	14.8		7.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	4.9	5.8		3.7	3.5	6.5		2.7
Green Ext Time (p_c), s	0.2	2.5		0.5	0.1	3.2		0.2

Intersection Summary		
HCM 7th Control Delay, s/veh		16.3
HCM 7th LOS		B

7: Road A & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	201	98	199	279	4	70	10	216	6	2	6
Future Volume (veh/h)	9	201	98	199	279	4	70	10	216	6	2	6
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	10	218	53	216	303	3	76	11	26	7	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	24	518	123	244	1104	11	173	182	154	65	69	0
Arrive On Green	0.01	0.18	0.18	0.14	0.31	0.31	0.10	0.10	0.10	0.04	0.04	0.00
Sat Flow, veh/h	1781	2837	673	1781	3605	36	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	10	135	136	216	149	157	76	11	26	7	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1734	1781	1777	1864	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	2.4	2.6	4.4	2.3	2.3	1.5	0.2	0.6	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.2	2.4	2.6	4.4	2.3	2.3	1.5	0.2	0.6	0.1	0.0	0.0
Prop In Lane	1.00		0.39	1.00		0.02	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	24	324	317	244	544	571	173	182	154	65	69	0
V/C Ratio(X)	0.43	0.41	0.43	0.89	0.27	0.27	0.44	0.06	0.17	0.11	0.03	0.00
Avail Cap(c_a), veh/h	244	1215	1185	244	1215	1274	1461	1534	1297	1461	1534	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.9	13.2	13.3	15.5	9.6	9.6	15.6	15.0	15.2	17.0	17.0	0.0
Incr Delay (d2), s/veh	11.7	0.8	0.9	30.0	0.3	0.3	1.8	0.1	0.5	0.7	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.9	0.9	3.5	0.8	0.8	0.6	0.1	0.2	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.6	14.1	14.2	45.5	9.9	9.9	17.3	15.1	15.7	17.7	17.2	0.0
LnGrp LOS	C	B	B	D	A	A	B	B	B	B	B	
Approach Vol, veh/h		281			522			113			9	
Approach Delay, s/veh		14.7			24.6			16.7			17.6	
Approach LOS		B			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	11.7		6.3	5.5	16.2		8.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	6.4	4.6		2.1	2.2	4.3		3.5
Green Ext Time (p_c), s	0.0	1.6		0.0	0.0	1.8		0.3

Intersection Summary		
HCM 7th Control Delay, s/veh		20.6
HCM 7th LOS		C

Intersection	
Int Delay, s/veh	3.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	165	25	67	123	21	112
Future Vol, veh/h	165	25	67	123	21	112
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	179	27	73	134	23	122

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	208	0	473	194
Stage 1	-	-	-	-	194	-
Stage 2	-	-	-	-	279	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1364	-	550	848
Stage 1	-	-	-	-	839	-
Stage 2	-	-	-	-	768	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1362	-	517	847
Mov Cap-2 Maneuver	-	-	-	-	517	-
Stage 1	-	-	-	-	838	-
Stage 2	-	-	-	-	724	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.75	10.33
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	517	847	-	-	1362	-
HCM Lane V/C Ratio	0.044	0.144	-	-	0.053	-
HCM Control Delay (s/veh)	12.3	10	-	-	7.8	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	0.5	-	-	0.2	-

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	179	21	11	131	18	11
Future Vol, veh/h	179	21	11	131	18	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	195	23	12	142	20	12

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	217	0	372	206
Stage 1	-	-	-	-	206	-
Stage 2	-	-	-	-	166	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1352	-	628	835
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	863	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1352	-	622	835
Mov Cap-2 Maneuver	-	-	-	-	622	-
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	855	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.6	10.48
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	689	-	-	1352	-
HCM Lane V/C Ratio	0.046	-	-	0.009	-
HCM Control Delay (s/veh)	10.5	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	368	108	96	252	9	89	0	107	19	1	21
Future Vol, veh/h	20	368	108	96	252	9	89	0	107	19	1	21
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	400	117	104	274	10	97	0	116	21	1	23

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	290	0	0	520	0	0	992	1004	463	938	1057	289
Stage 1	-	-	-	-	-	-	505	505	-	493	493	-
Stage 2	-	-	-	-	-	-	487	498	-	444	564	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1272	-	-	1046	-	-	225	242	599	245	225	750
Stage 1	-	-	-	-	-	-	549	540	-	557	547	-
Stage 2	-	-	-	-	-	-	562	544	-	593	509	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1265	-	-	1043	-	-	190	212	597	173	197	743
Mov Cap-2 Maneuver	-	-	-	-	-	-	190	212	-	173	197	-
Stage 1	-	-	-	-	-	-	538	529	-	545	489	-
Stage 2	-	-	-	-	-	-	487	487	-	468	498	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.32	2.38	40.76	19.88
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	303	1265	-	-	1043	-	-	286
HCM Lane V/C Ratio	0.703	0.017	-	-	0.1	-	-	0.156
HCM Control Delay (s/veh)	40.8	7.9	-	-	8.8	-	-	19.9
HCM Lane LOS	E	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	4.9	0.1	-	-	0.3	-	-	0.5

Intersection	
Intersection Delay, s/veh	12.6
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	294	60	60	270	36	63
Future Vol, veh/h	294	60	60	270	36	63
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	320	65	65	293	39	68
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	14.3	11.6	9.7
HCM LOS	B	B	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	83%	36%
Vol Thru, %	18%	0%	64%
Vol Right, %	82%	17%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	330	354	99
LT Vol	0	294	36
Through Vol	60	0	63
RT Vol	270	60	0
Lane Flow Rate	359	385	108
Geometry Grp	1	1	1
Degree of Util (X)	0.459	0.552	0.166
Departure Headway (Hd)	4.604	5.168	5.563
Convergence, Y/N	Yes	Yes	Yes
Cap	771	704	646
Service Time	2.703	3.168	3.587
HCM Lane V/C Ratio	0.466	0.547	0.167
HCM Control Delay, s/veh	11.6	14.3	9.7
HCM Lane LOS	B	B	A
HCM 95th-tile Q	2.4	3.4	0.6

Intersection						
Int Delay, s/veh	3.6					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	127	22	335	191	9	329
Future Vol, veh/h	127	22	335	191	9	329
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	138	24	364	208	10	358

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	845	468	0	0	572	0
Stage 1	468	-	-	-	-	-
Stage 2	377	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	333	595	-	-	1001	-
Stage 1	630	-	-	-	-	-
Stage 2	693	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	329	595	-	-	1001	-
Mov Cap-2 Maneuver	329	-	-	-	-	-
Stage 1	630	-	-	-	-	-
Stage 2	685	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	23.63	0	0.23
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	352	1001	-
HCM Lane V/C Ratio	-	-	0.46	0.01	-
HCM Control Delay (s/veh)	-	-	23.6	8.6	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	2.3	0	-

Intersection	
Intersection Delay, s/veh	87
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	43	47	288	25	44	49	477	424	25	406	31
Future Vol, veh/h	30	43	47	288	25	44	49	477	424	25	406	31
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	33	47	51	313	27	48	53	518	461	27	441	34
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	17	44.4	111.9	86.8
HCM LOS	C	E	F	F

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	9%	0%	25%	81%	5%
Vol Thru, %	91%	0%	36%	7%	88%
Vol Right, %	0%	100%	39%	12%	7%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	526	424	120	357	462
LT Vol	49	0	30	288	25
Through Vol	477	0	43	25	406
RT Vol	0	424	47	44	31
Lane Flow Rate	572	461	130	388	502
Geometry Grp	7	7	2	2	5
Degree of Util (X)	1.264	0.92	0.328	0.859	1.06
Departure Headway (Hd)	8.274	7.501	9.47	8.273	7.814
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	446	489	382	442	467
Service Time	5.974	5.201	7.47	6.273	5.814
HCM Lane V/C Ratio	1.283	0.943	0.34	0.878	1.075
HCM Control Delay, s/veh	161.1	50.8	17	44.4	86.8
HCM Lane LOS	F	F	C	E	F
HCM 95th-tile Q	23.2	10.7	1.4	8.6	15.4

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	169	177	39	306	320	330	84	453	242	157	415	172
Future Volume (veh/h)	169	177	39	306	320	330	84	453	242	157	415	172
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.85	0.95		0.89	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	184	192	35	333	348	105	91	492	0	171	451	177
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	277	255	46	390	446	337	186	715		312	513	201
Arrive On Green	0.10	0.19	0.19	0.18	0.27	0.27	0.04	0.42	0.00	0.07	0.45	0.45
Sat Flow, veh/h	1603	1342	245	1603	1683	1271	1603	1683	1427	1603	1144	449
Grp Volume(v), veh/h	184	0	227	333	348	105	91	492	0	171	0	628
Grp Sat Flow(s),veh/h/ln	1603	0	1587	1603	1683	1271	1603	1683	1427	1603	0	1593
Q Serve(g_s), s	13.3	0.0	19.6	23.5	27.8	9.6	4.6	34.5	0.0	8.7	0.0	52.0
Cycle Q Clear(g_c), s	13.3	0.0	19.6	23.5	27.8	9.6	4.6	34.5	0.0	8.7	0.0	52.0
Prop In Lane	1.00		0.15	1.00		1.00	1.00		1.00	1.00		0.28
Lane Grp Cap(c), veh/h	277	0	301	390	446	337	186	715		312	0	715
V/C Ratio(X)	0.66	0.00	0.75	0.85	0.78	0.31	0.49	0.69		0.55	0.00	0.88
Avail Cap(c_a), veh/h	277	0	383	435	580	438	225	715		312	0	715
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.62	0.62	0.62	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.2	0.0	55.5	37.3	49.4	42.7	30.9	33.9	0.0	25.9	0.0	36.4
Incr Delay (d2), s/veh	5.9	0.0	6.3	9.3	3.2	0.3	2.0	5.4	0.0	2.0	0.0	14.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	0.0	8.5	10.3	12.2	3.1	1.9	15.3	0.0	3.5	0.0	23.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	48.1	0.0	61.8	46.6	52.5	43.0	32.9	39.3	0.0	27.9	0.0	50.8
LnGrp LOS	D		E	D	D	D	C	D		C		D
Approach Vol, veh/h		411			786			583			799	
Approach Delay, s/veh		55.6			48.7			38.3			45.9	
Approach LOS		E			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	66.6	30.9	32.5	11.5	70.0	20.0	43.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	30.0	35.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	10.7	36.5	25.5	21.6	6.6	54.0	15.3	29.8
Green Ext Time (p_c), s	0.0	2.8	0.5	1.1	0.1	0.0	0.0	2.6

Intersection Summary	
HCM 7th Control Delay, s/veh	46.6
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	571	53	370	28	57	45	384	848	19	39	1027	516
Future Volume (veh/h)	571	53	370	28	57	45	384	848	19	39	1027	516
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	621	58	0	30	62	0	417	922	9	42	1116	173
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	786	425		90	94		517	1767	787	60	1356	603
Arrive On Green	0.23	0.23	0.00	0.05	0.05	0.00	0.15	0.50	0.50	0.03	0.38	0.38
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	3554	1581
Grp Volume(v), veh/h	621	58	0	30	62	0	417	922	9	42	1116	173
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1777	1581
Q Serve(g_s), s	17.7	2.6	0.0	1.7	3.4	0.0	12.2	18.4	0.3	2.4	29.6	7.9
Cycle Q Clear(g_c), s	17.7	2.6	0.0	1.7	3.4	0.0	12.2	18.4	0.3	2.4	29.6	7.9
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	786	425		90	94		517	1767	787	60	1356	603
V/C Ratio(X)	0.79	0.14		0.33	0.66		0.81	0.52	0.01	0.70	0.82	0.29
Avail Cap(c_a), veh/h	1389	752		307	322		1157	2618	1166	136	1700	756
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.0	32.2	0.0	47.9	48.7	0.0	43.0	17.8	13.3	50.0	29.1	22.4
Incr Delay (d2), s/veh	1.8	0.1	0.0	2.2	7.6	0.0	3.0	0.2	0.0	13.7	2.8	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.7	1.2	0.0	0.8	1.8	0.0	5.3	7.2	0.1	1.3	12.6	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	39.9	32.3	0.0	50.1	56.4	0.0	46.0	18.1	13.3	63.7	31.9	22.7
LnGrp LOS	D	C		D	E		D	B	B	E	C	C
Approach Vol, veh/h		679			92			1348			1331	
Approach Delay, s/veh		39.2			54.3			26.7			31.7	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	8.5	57.0	10.3	20.6	44.9	28.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	8.0	77.0	18.0	35.0	50.0	42.0
Max Q Clear Time (g_c+I1), s	4.4	20.4	5.4	14.2	31.6	19.7
Green Ext Time (p_c), s	0.0	8.0	0.2	1.4	8.3	2.7

Intersection Summary	
HCM 7th Control Delay, s/veh	31.8
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	303	329	143	19	338	111	174	871	30	148	936	456
Future Volume (veh/h)	303	329	143	19	338	111	174	871	30	148	936	456
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	329	358	0	21	367	0	189	947	11	161	1017	250
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	431	929		41	567		279	1403	626	246	1369	609
Arrive On Green	0.12	0.26	0.00	0.02	0.16	0.00	0.08	0.39	0.39	0.07	0.39	0.39
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1581
Grp Volume(v), veh/h	329	358	0	21	367	0	189	947	11	161	1017	250
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1581
Q Serve(g_s), s	8.1	7.3	0.0	1.0	8.5	0.0	4.7	19.3	0.4	4.0	21.7	10.2
Cycle Q Clear(g_c), s	8.1	7.3	0.0	1.0	8.5	0.0	4.7	19.3	0.4	4.0	21.7	10.2
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	431	929		41	567		279	1403	626	246	1369	609
V/C Ratio(X)	0.76	0.39		0.52	0.65		0.68	0.68	0.02	0.66	0.74	0.41
Avail Cap(c_a), veh/h	805	1515		415	1515		805	2645	1180	766	2605	1159
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.3	26.7	0.0	42.5	34.7	0.0	39.3	22.0	16.2	39.8	23.3	19.7
Incr Delay (d2), s/veh	2.8	0.3	0.0	9.8	1.3	0.0	2.9	0.6	0.0	2.9	0.8	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	3.1	0.0	0.6	3.8	0.0	2.0	7.6	0.1	1.8	8.6	3.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	40.1	27.0	0.0	52.3	35.9	0.0	42.2	22.5	16.2	42.8	24.1	20.2
LnGrp LOS	D	C		D	D		D	C	B	D	C	C
Approach Vol, veh/h		687			388			1147			1428	
Approach Delay, s/veh		33.2			36.8			25.7			25.5	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.8	40.2	7.5	28.5	12.6	39.4	16.5	19.5
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	65.5	20.5	37.5	20.5	64.5	20.5	37.5
Max Q Clear Time (g_c+I1), s	6.0	21.3	3.0	9.3	6.7	23.7	10.1	10.5
Green Ext Time (p_c), s	0.4	8.2	0.0	2.6	0.5	10.2	0.9	2.6

Intersection Summary	
HCM 7th Control Delay, s/veh	28.2
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	656	24	205	567	199	9	54	188	129	39	30
Future Volume (veh/h)	30	656	24	205	567	199	9	54	188	129	39	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	713	24	223	616	191	10	59	4	140	42	10
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	63	1110	37	282	1171	363	107	112	95	207	170	40
Arrive On Green	0.04	0.32	0.32	0.16	0.44	0.44	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3507	118	1781	2666	825	1781	1870	1585	1781	1460	348
Grp Volume(v), veh/h	33	361	376	223	410	397	10	59	4	140	0	52
Grp Sat Flow(s),veh/h/ln	1781	1777	1848	1781	1777	1714	1781	1870	1585	1781	0	1808
Q Serve(g_s), s	1.0	10.0	10.0	6.9	9.7	9.7	0.3	1.8	0.1	4.3	0.0	1.5
Cycle Q Clear(g_c), s	1.0	10.0	10.0	6.9	9.7	9.7	0.3	1.8	0.1	4.3	0.0	1.5
Prop In Lane	1.00		0.06	1.00		0.48	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	63	562	585	282	781	753	107	112	95	207	0	210
V/C Ratio(X)	0.52	0.64	0.64	0.79	0.53	0.53	0.09	0.53	0.04	0.68	0.00	0.25
Avail Cap(c_a), veh/h	280	1704	1773	590	2014	1943	590	620	525	994	0	1009
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	27.2	16.8	16.8	23.2	11.7	11.7	25.5	26.2	25.4	24.3	0.0	23.1
Incr Delay (d2), s/veh	6.4	1.2	1.2	4.9	0.6	0.6	0.4	3.8	0.2	3.8	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	3.9	4.1	3.1	3.5	3.4	0.1	0.9	0.1	2.0	0.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	33.6	18.0	18.0	28.1	12.3	12.3	25.9	30.0	25.6	28.1	0.0	23.7
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		770			1030			73			192	
Approach Delay, s/veh		18.7			15.7			29.2			26.9	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	14.1	23.1		11.7	7.0	30.2		8.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	8.9	12.0		6.3	3.0	11.7		3.8
Green Ext Time (p_c), s	0.5	5.7		0.7	0.0	6.7		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	18.3
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑↱		↰	↑	↱	↰	↱	
Traffic Volume (veh/h)	90	385	15	127	437	50	28	52	198	121	62	63
Future Volume (veh/h)	90	385	15	127	437	50	28	52	198	121	62	63
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	98	418	14	138	475	46	30	57	14	132	67	36
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	134	788	26	183	824	79	150	157	133	317	202	108
Arrive On Green	0.08	0.22	0.22	0.10	0.25	0.25	0.08	0.08	0.08	0.18	0.18	0.18
Sat Flow, veh/h	1781	3508	117	1781	3270	315	1781	1870	1576	1781	1132	608
Grp Volume(v), veh/h	98	211	221	138	257	264	30	57	14	132	0	103
Grp Sat Flow(s),veh/h/ln	1781	1777	1849	1781	1777	1809	1781	1870	1576	1781	0	1740
Q Serve(g_s), s	2.6	5.1	5.1	3.7	6.2	6.2	0.8	1.4	0.4	3.2	0.0	2.5
Cycle Q Clear(g_c), s	2.6	5.1	5.1	3.7	6.2	6.2	0.8	1.4	0.4	3.2	0.0	2.5
Prop In Lane	1.00		0.06	1.00		0.17	1.00		1.00	1.00		0.35
Lane Grp Cap(c), veh/h	134	399	415	183	448	456	150	157	133	317	0	310
V/C Ratio(X)	0.73	0.53	0.53	0.75	0.57	0.58	0.20	0.36	0.11	0.42	0.00	0.33
Avail Cap(c_a), veh/h	366	1112	1157	622	1368	1392	1152	1209	1019	1152	0	1125
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.0	16.6	16.6	21.3	15.9	16.0	20.8	21.1	20.6	17.8	0.0	17.5
Incr Delay (d2), s/veh	7.4	1.1	1.1	6.1	1.2	1.2	0.6	1.4	0.3	0.9	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	2.0	2.1	1.7	2.4	2.4	0.3	0.6	0.1	1.3	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.4	17.7	17.7	27.4	17.1	17.1	21.4	22.5	21.0	18.6	0.0	18.1
LnGrp LOS	C	B	B	C	B	B	C	C	C	B		B
Approach Vol, veh/h		530			659			101			235	
Approach Delay, s/veh		19.9			19.3			22.0			18.4	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	10.0	15.9	13.7	8.7	17.3	9.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	5.7	7.1	5.2	4.6	8.2	3.4
Green Ext Time (p_c), s	0.3	2.7	0.9	0.1	3.6	0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	19.5
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑↱		↰	↑	↱	↰	↱	
Traffic Volume (veh/h)	22	218	137	243	274	7	83	5	260	8	6	11
Future Volume (veh/h)	22	218	137	243	274	7	83	5	260	8	6	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	24	237	61	264	298	7	90	5	26	9	7	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	52	480	121	343	1186	28	168	177	150	36	38	0
Arrive On Green	0.03	0.17	0.17	0.19	0.33	0.33	0.09	0.09	0.09	0.02	0.02	0.00
Sat Flow, veh/h	1781	2806	706	1781	3548	83	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	24	148	150	264	149	156	90	5	26	9	7	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1736	1781	1777	1855	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.5	2.9	3.0	5.4	2.3	2.3	1.8	0.1	0.6	0.2	0.1	0.0
Cycle Q Clear(g_c), s	0.5	2.9	3.0	5.4	2.3	2.3	1.8	0.1	0.6	0.2	0.1	0.0
Prop In Lane	1.00		0.41	1.00		0.04	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	52	304	297	343	594	620	168	177	150	36	38	0
V/C Ratio(X)	0.46	0.49	0.50	0.77	0.25	0.25	0.54	0.03	0.17	0.25	0.18	0.00
Avail Cap(c_a), veh/h	232	695	679	697	1158	1209	1393	1463	1240	1393	1463	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	18.3	14.4	14.4	14.7	9.3	9.3	16.6	15.8	16.0	18.5	18.5	0.0
Incr Delay (d2), s/veh	6.1	1.2	1.3	3.6	0.2	0.2	2.6	0.1	0.5	3.5	2.3	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.1	1.1	2.2	0.8	0.8	0.8	0.0	0.2	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	24.4	15.6	15.8	18.3	9.5	9.5	19.2	15.8	16.5	22.0	20.7	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	C	C	
Approach Vol, veh/h		322			569			121			16	
Approach Delay, s/veh		16.3			13.6			18.5			21.4	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	12.4	11.6	5.8	6.1	17.8	8.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	15.0	15.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	7.4	5.0	2.2	2.5	4.3	3.8
Green Ext Time (p_c), s	0.5	1.2	0.0	0.0	1.8	0.3

Intersection Summary	
HCM 7th Control Delay, s/veh	15.1
HCM 7th LOS	B

Notes
User approved pedestrian interval to be less than phase max green.

Intersection	
Int Delay, s/veh	2.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	197	37	48	130	23	81
Future Vol, veh/h	197	37	48	130	23	81
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	214	40	52	141	25	88

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	255	0	481	235
Stage 1	-	-	-	-	235	-
Stage 2	-	-	-	-	246	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1310	-	544	804
Stage 1	-	-	-	-	804	-
Stage 2	-	-	-	-	795	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1308	-	520	803
Mov Cap-2 Maneuver	-	-	-	-	520	-
Stage 1	-	-	-	-	803	-
Stage 2	-	-	-	-	761	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.12	10.53
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	520	803	-	-	1308	-
HCM Lane V/C Ratio	0.048	0.11	-	-	0.04	-
HCM Control Delay (s/veh)	12.3	10	-	-	7.9	0
HCM Lane LOS	B	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	0.4	-	-	0.1	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	176	26	15	126	22	13
Future Vol, veh/h	176	26	15	126	22	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	191	28	16	137	24	14

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	220	0	375	205
Stage 1	-	-	-	-	205	-
Stage 2	-	-	-	-	170	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1350	-	626	835
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	860	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1350	-	618	835
Mov Cap-2 Maneuver	-	-	-	-	618	-
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	849	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.82	10.57
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	684	-	-	1350	-
HCM Lane V/C Ratio	0.056	-	-	0.012	-
HCM Control Delay (s/veh)	10.6	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0	-

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	24	283	133	89	199	11	60	0	90	20	0	16
Future Vol, veh/h	24	283	133	89	199	11	60	0	90	20	0	16
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	26	308	145	97	216	12	65	0	98	22	0	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	234	0	0	452	0	0	843	860	380	782	926	229
Stage 1	-	-	-	-	-	-	432	432	-	422	422	-
Stage 2	-	-	-	-	-	-	411	428	-	360	504	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1333	-	-	1108	-	-	284	294	667	312	269	810
Stage 1	-	-	-	-	-	-	602	582	-	610	588	-
Stage 2	-	-	-	-	-	-	618	585	-	658	541	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1326	-	-	1108	-	-	248	261	667	237	239	805
Mov Cap-2 Maneuver	-	-	-	-	-	-	248	261	-	237	239	-
Stage 1	-	-	-	-	-	-	590	571	-	594	534	-
Stage 2	-	-	-	-	-	-	551	531	-	551	530	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.42	2.55	20.18	16.76
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	398	1326	-	-	1108	-	-	345
HCM Lane V/C Ratio	0.41	0.02	-	-	0.087	-	-	0.113
HCM Control Delay (s/veh)	20.2	7.8	-	-	8.6	-	-	16.8
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	2	0.1	-	-	0.3	-	-	0.4

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	297	84	100	293	84	110
Future Vol, veh/h	297	84	100	293	84	110
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	323	91	109	318	91	120
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	18.5	15.7	12.1
HCM LOS	C	C	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	78%	43%
Vol Thru, %	25%	0%	57%
Vol Right, %	75%	22%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	393	381	194
LT Vol	0	297	84
Through Vol	100	0	110
RT Vol	293	84	0
Lane Flow Rate	427	414	211
Geometry Grp	1	1	1
Degree of Util (X)	0.604	0.647	0.346
Departure Headway (Hd)	5.087	5.623	5.906
Convergence, Y/N	Yes	Yes	Yes
Cap	705	642	607
Service Time	3.139	3.671	3.969
HCM Lane V/C Ratio	0.606	0.645	0.348
HCM Control Delay, s/veh	15.7	18.5	12.1
HCM Lane LOS	C	C	B
HCM 95th-tile Q	4.1	4.7	1.5

Intersection	
Int Delay, s/veh	4.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	128	20	377	196	6	422
Future Vol, veh/h	128	20	377	196	6	422
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	139	22	410	213	7	459

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	989	517	0	0	623	0
Stage 1	516	-	-	-	-	-
Stage 2	473	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	274	558	-	-	958	-
Stage 1	599	-	-	-	-	-
Stage 2	627	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	271	558	-	-	958	-
Mov Cap-2 Maneuver	271	-	-	-	-	-
Stage 1	599	-	-	-	-	-
Stage 2	621	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	31.64	0	0.12
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	291	958	-
HCM Lane V/C Ratio	-	-	0.553	0.007	-
HCM Control Delay (s/veh)	-	-	31.6	8.8	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	3.1	0	-

Intersection	
Intersection Delay, s/veh	81.1
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	24	45	211	21	27	43	533	378	34	484	23
Future Vol, veh/h	16	24	45	211	21	27	43	533	378	34	484	23
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	26	49	229	23	29	47	579	411	37	526	25
Number of Lanes	0	1	0	0	1	0	0	1	1	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay, s/veh	14.2	22.4	96.6	92.5
HCM LOS	B	C	F	F

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	7%	0%	19%	81%	6%
Vol Thru, %	93%	0%	28%	8%	89%
Vol Right, %	0%	100%	53%	10%	4%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	576	378	85	259	541
LT Vol	43	0	16	211	34
Through Vol	533	0	24	21	484
RT Vol	0	378	45	27	23
Lane Flow Rate	626	411	92	282	588
Geometry Grp	7	7	2	2	5
Degree of Util (X)	1.23	0.723	0.212	0.599	1.092
Departure Headway (Hd)	7.348	6.59	8.803	8.079	6.927
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	501	551	410	450	529
Service Time	5.048	4.29	6.803	6.079	4.927
HCM Lane V/C Ratio	1.25	0.746	0.224	0.627	1.112
HCM Control Delay, s/veh	143.9	24.6	14.2	22.4	92.5
HCM Lane LOS	F	C	B	C	F
HCM 95th-tile Q	23.6	6	0.8	3.8	17.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	177	224	32	208	272	370	75	379	196	221	337	190
Future Volume (veh/h)	177	224	32	208	272	370	75	379	196	221	337	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.98		0.92	0.96		0.93	1.00		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	192	243	30	226	296	85	82	412	0	240	366	189
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	338	334	41	350	429	337	193	569		343	403	208
Arrive On Green	0.11	0.23	0.23	0.13	0.25	0.25	0.05	0.34	0.00	0.10	0.39	0.39
Sat Flow, veh/h	1603	1453	179	1603	1683	1320	1603	1683	1427	1603	1030	532
Grp Volume(v), veh/h	192	0	273	226	296	85	82	412	0	240	0	555
Grp Sat Flow(s),veh/h/ln	1603	0	1632	1603	1683	1320	1603	1683	1427	1603	0	1562
Q Serve(g_s), s	8.8	0.0	15.2	10.4	15.7	5.1	3.3	21.1	0.0	9.4	0.0	33.0
Cycle Q Clear(g_c), s	8.8	0.0	15.2	10.4	15.7	5.1	3.3	21.1	0.0	9.4	0.0	33.0
Prop In Lane	1.00		0.11	1.00		1.00	1.00		1.00	1.00		0.34
Lane Grp Cap(c), veh/h	338	0	375	350	429	337	193	569		343	0	612
V/C Ratio(X)	0.57	0.00	0.73	0.65	0.69	0.25	0.42	0.72		0.70	0.00	0.91
Avail Cap(c_a), veh/h	483	0	414	405	429	337	214	786		343	0	792
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.3	0.0	35.1	25.2	33.2	29.2	24.0	28.6	0.0	20.7	0.0	28.3
Incr Delay (d2), s/veh	1.5	0.0	5.7	2.8	4.6	0.4	1.5	2.1	0.0	6.2	0.0	11.9
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	0.0	6.6	4.2	6.9	1.6	1.3	8.8	0.0	4.0	0.0	14.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	26.8	0.0	40.8	28.0	37.8	29.6	25.4	30.7	0.0	26.9	0.0	40.2
LnGrp LOS	C		D	C	D	C	C	C		C		D
Approach Vol, veh/h		465			607			494			795	
Approach Delay, s/veh		35.0			33.0			29.8			36.2	
Approach LOS		D			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	38.3	17.6	27.6	9.7	43.6	15.1	30.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	10.0	46.0	16.0	25.0	6.0	50.0	20.0	22.0
Max Q Clear Time (g_c+I1), s	11.4	23.1	12.4	17.2	5.3	35.0	10.8	17.7
Green Ext Time (p_c), s	0.0	2.7	0.2	1.0	0.0	3.5	0.4	0.8

Intersection Summary	
HCM 7th Control Delay, s/veh	33.8
HCM 7th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	350	20	139	35	24	54	208	939	16	19	828	342
Future Volume (veh/h)	350	20	139	35	24	54	208	939	16	19	828	342
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	380	22	0	38	26	0	226	1021	10	21	900	197
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	445	241		102	107		293	2395	1068	33	2160	963
Arrive On Green	0.13	0.13	0.00	0.06	0.06	0.00	0.08	0.67	0.67	0.02	0.61	0.61
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	3554	1584
Grp Volume(v), veh/h	380	22	0	38	26	0	226	1021	10	21	900	197
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1777	1584
Q Serve(g_s), s	17.8	1.7	0.0	3.4	2.2	0.0	10.6	21.7	0.3	1.9	21.9	9.2
Cycle Q Clear(g_c), s	17.8	1.7	0.0	3.4	2.2	0.0	10.6	21.7	0.3	1.9	21.9	9.2
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	445	241		102	107		293	2395	1068	33	2160	963
V/C Ratio(X)	0.85	0.09		0.37	0.24		0.77	0.43	0.01	0.63	0.42	0.20
Avail Cap(c_a), veh/h	859	465		119	125		838	2395	1068	54	2160	963
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.89	0.89	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	70.4	63.4	0.0	74.9	74.3	0.0	73.9	12.3	8.8	80.4	17.0	14.5
Incr Delay (d2), s/veh	4.3	0.1	0.0	2.2	1.2	0.0	4.3	0.6	0.0	17.9	0.6	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.2	0.8	0.0	1.6	1.1	0.0	4.9	8.7	0.1	1.1	9.1	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.7	63.5	0.0	77.1	75.5	0.0	78.2	12.9	8.8	98.3	17.6	15.0
LnGrp LOS	E	E		E	E		E	B	A	F	B	B
Approach Vol, veh/h		402			64			1257			1118	
Approach Delay, s/veh		74.0			76.5			24.6			18.6	
Approach LOS		E			E			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	116.2		14.5	19.0	105.3		26.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	88.0		11.0	40.0	53.0		41.0
Max Q Clear Time (g_c+I1), s	3.9	23.7		5.4	12.6	23.9		19.8
Green Ext Time (p_c), s	0.0	9.4		0.1	0.8	7.9		1.5

Intersection Summary	
HCM 7th Control Delay, s/veh	30.4
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	278	221	103	22	302	97	144	859	24	89	655	329
Future Volume (veh/h)	278	221	103	22	302	97	144	859	24	89	655	329
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	302	240	0	24	328	0	157	934	13	97	712	167
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	357	649		72	426		251	2118	944	207	2072	922
Arrive On Green	0.10	0.18	0.00	0.04	0.12	0.00	0.07	0.60	0.60	0.06	0.58	0.58
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1581
Grp Volume(v), veh/h	302	240	0	24	328	0	157	934	13	97	712	167
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1581
Q Serve(g_s), s	14.2	9.8	0.0	2.2	14.8	0.0	7.3	23.8	0.6	4.5	17.2	8.1
Cycle Q Clear(g_c), s	14.2	9.8	0.0	2.2	14.8	0.0	7.3	23.8	0.6	4.5	17.2	8.1
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	357	649		72	426		251	2118	944	207	2072	922
V/C Ratio(X)	0.85	0.37		0.33	0.77		0.63	0.44	0.01	0.47	0.34	0.18
Avail Cap(c_a), veh/h	607	969		238	818		293	2118	944	230	2072	922
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.88	0.88	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	72.7	59.1	0.0	77.0	70.4	0.0	74.3	18.3	13.6	75.0	17.9	16.0
Incr Delay (d2), s/veh	4.9	0.3	0.0	2.7	3.0	0.0	3.2	0.7	0.0	1.6	0.5	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.6	4.5	0.0	1.1	7.0	0.0	3.4	10.0	0.2	2.0	7.3	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	77.6	59.4	0.0	79.7	73.4	0.0	77.5	18.9	13.6	76.7	18.4	16.5
LnGrp LOS	E	E		E	E		E	B	B	E	B	B
Approach Vol, veh/h		542			352			1104			976	
Approach Delay, s/veh		69.6			73.8			27.2			23.8	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	103.3	11.7	35.1	17.0	101.2	22.0	24.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	67.0	22.0	45.0	14.0	64.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	6.5	25.8	4.2	11.8	9.3	19.2	16.2	16.8
Green Ext Time (p_c), s	0.1	7.9	0.0	1.7	0.2	6.2	0.9	2.2

Intersection Summary	
HCM 7th Control Delay, s/veh	39.3
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	287	18	195	301	72	2	17	194	34	16	10
Future Volume (veh/h)	10	287	18	195	301	72	2	17	194	34	16	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	312	16	212	327	64	2	18	8	37	17	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	26	706	36	285	1042	201	60	63	54	103	108	0
Arrive On Green	0.01	0.21	0.21	0.16	0.35	0.35	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3438	176	1781	2968	574	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	11	161	167	212	194	197	2	18	8	37	17	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1837	1781	1777	1765	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.2	2.9	2.9	4.2	2.9	3.0	0.0	0.3	0.2	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.2	2.9	2.9	4.2	2.9	3.0	0.0	0.3	0.2	0.7	0.3	0.0
Prop In Lane	1.00		0.10	1.00		0.33	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	26	365	377	285	624	620	60	63	54	103	108	0
V/C Ratio(X)	0.43	0.44	0.44	0.74	0.31	0.32	0.03	0.28	0.15	0.36	0.16	0.00
Avail Cap(c_a), veh/h	435	2654	2744	919	3136	3116	919	965	818	1548	1625	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	18.0	12.8	12.8	14.7	8.7	8.7	17.2	17.4	17.3	16.7	16.5	0.0
Incr Delay (d2), s/veh	10.8	0.8	0.8	3.8	0.3	0.3	0.2	2.4	1.3	2.1	0.7	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.0	1.1	1.7	0.9	0.9	0.0	0.2	0.1	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.8	13.6	13.6	18.6	9.0	9.0	17.4	19.8	18.5	18.8	17.2	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		339			603			28			54	
Approach Delay, s/veh		14.1			12.4			19.3			18.3	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.9	12.6		7.1	5.5	17.9		6.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	6.2	4.9		2.7	2.2	5.0		2.3
Green Ext Time (p_c), s	0.5	2.2		0.2	0.0	2.8		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.4
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	161	10	103	191	31	15	16	123	35	15	7
Future Volume (veh/h)	18	161	10	103	191	31	15	16	123	35	15	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	175	8	112	208	26	16	17	1	38	16	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	45	600	27	175	784	97	73	76	65	113	119	0
Arrive On Green	0.03	0.17	0.17	0.10	0.25	0.25	0.04	0.04	0.04	0.06	0.06	0.00
Sat Flow, veh/h	1781	3459	157	1781	3183	393	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	20	89	94	112	115	119	16	17	1	38	16	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1840	1781	1777	1799	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	1.4	1.4	1.9	1.7	1.7	0.3	0.3	0.0	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.4	1.4	1.4	1.9	1.7	1.7	0.3	0.3	0.0	0.7	0.3	0.0
Prop In Lane	1.00		0.09	1.00		0.22	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	45	308	319	175	438	443	73	76	65	113	119	0
V/C Ratio(X)	0.44	0.29	0.29	0.64	0.26	0.27	0.22	0.22	0.02	0.34	0.13	0.00
Avail Cap(c_a), veh/h	556	1690	1750	944	2078	2104	1750	1837	1557	1750	1837	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.4	11.5	11.5	13.9	9.7	9.7	14.9	14.9	14.8	14.4	14.2	0.0
Incr Delay (d2), s/veh	6.6	0.5	0.5	3.8	0.3	0.3	1.5	1.5	0.1	1.7	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.5	0.5	0.8	0.5	0.6	0.1	0.1	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.0	12.0	12.0	17.7	10.1	10.1	16.4	16.3	14.9	16.1	14.7	0.0
LnGrp LOS	C	B	B	B	B	B	B	B	B	B	B	
Approach Vol, veh/h		203			346			34			54	
Approach Delay, s/veh		13.0			12.5			16.3			15.7	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.2	10.6		7.0	5.8	12.9		6.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5				
Max Q Clear Time (g_c+I1), s	3.9	3.4		2.7	2.4	3.7		2.3				
Green Ext Time (p_c), s	0.2	1.1		0.1	0.0	1.5		0.1				
Intersection Summary												
HCM 7th Control Delay, s/veh			13.2									
HCM 7th LOS			B									

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	121	50	76	134	2	23	4	71	1	4	4
Future Volume (veh/h)	12	121	50	76	134	2	23	4	71	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	13	132	19	83	146	1	25	4	3	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	31	559	79	150	889	6	77	81	68	12	13	0
Arrive On Green	0.02	0.18	0.18	0.08	0.25	0.25	0.04	0.04	0.04	0.01	0.01	0.00
Sat Flow, veh/h	1781	3124	442	1781	3618	25	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	13	74	77	83	72	75	25	4	3	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1789	1781	1777	1866	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	1.0	1.1	1.3	0.9	0.9	0.4	0.1	0.1	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	1.0	1.1	1.3	0.9	0.9	0.4	0.1	0.1	0.0	0.1	0.0
Prop In Lane	1.00		0.25	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	31	318	320	150	437	459	77	81	68	12	13	0
V/C Ratio(X)	0.43	0.23	0.24	0.55	0.16	0.16	0.32	0.05	0.04	0.08	0.31	0.00
Avail Cap(c_a), veh/h	306	1526	1537	306	1526	1602	1836	1928	1631	1836	1928	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	14.2	10.2	10.3	12.8	8.6	8.6	13.5	13.4	13.3	14.4	14.4	0.0
Incr Delay (d2), s/veh	9.1	0.4	0.4	3.2	0.2	0.2	2.4	0.3	0.3	2.9	13.4	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.3	0.4	0.5	0.3	0.3	0.2	0.0	0.0	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.3	10.6	10.6	16.0	8.8	8.8	15.9	13.6	13.6	17.2	27.8	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		164			230			32			5	
Approach Delay, s/veh		11.6			11.4			15.4			25.7	
Approach LOS		B			B			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.4	10.2		5.2	5.5	12.2		6.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0				
Max Q Clear Time (g_c+I1), s	3.3	3.1		2.1	2.2	2.9		2.4				
Green Ext Time (p_c), s	0.0	0.8		0.0	0.0	0.8		0.1				
Intersection Summary												
HCM 7th Control Delay, s/veh			11.9									
HCM 7th LOS			B									

Intersection	
Int Delay, s/veh	3.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	112	13	38	71	11	56
Future Vol, veh/h	112	13	38	71	11	56
Conflicting Peds, #/hr	0	3	3	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	122	14	41	77	12	61

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	139	0	292	132
Stage 1	-	-	-	-	132	-
Stage 2	-	-	-	-	160	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1445	-	699	918
Stage 1	-	-	-	-	894	-
Stage 2	-	-	-	-	869	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1441	-	676	915
Mov Cap-2 Maneuver	-	-	-	-	676	-
Stage 1	-	-	-	-	892	-
Stage 2	-	-	-	-	843	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.64	9.41
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	676	915	-	-	1441	-
HCM Lane V/C Ratio	0.018	0.067	-	-	0.029	-
HCM Control Delay (s/veh)	10.4	9.2	-	-	7.6	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	114	7	5	62	4	4
Future Vol, veh/h	114	7	5	62	4	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	124	8	5	67	4	4

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	132	0	206	128
Stage 1	-	-	-	-	128	-
Stage 2	-	-	-	-	78	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1454	-	782	922
Stage 1	-	-	-	-	898	-
Stage 2	-	-	-	-	945	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1454	-	779	922
Mov Cap-2 Maneuver	-	-	-	-	779	-
Stage 1	-	-	-	-	898	-
Stage 2	-	-	-	-	941	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.56	9.31
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	845	-	-	1454	-
HCM Lane V/C Ratio	0.01	-	-	0.004	-
HCM Control Delay (s/veh)	9.3	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	290	103	82	162	9	38	0	53	10	0	5
Future Vol, veh/h	10	290	103	82	162	9	38	0	53	10	0	5
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	315	112	89	176	10	41	0	58	11	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	188	0	0	430	0	0	751	762	374	698	813	184
Stage 1	-	-	-	-	-	-	396	396	-	361	361	-
Stage 2	-	-	-	-	-	-	355	366	-	337	452	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1386	-	-	1129	-	-	327	335	672	355	313	858
Stage 1	-	-	-	-	-	-	630	604	-	657	626	-
Stage 2	-	-	-	-	-	-	662	623	-	677	571	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1384	-	-	1126	-	-	296	304	670	296	284	856
Mov Cap-2 Maneuver	-	-	-	-	-	-	296	304	-	296	284	-
Stage 1	-	-	-	-	-	-	623	598	-	651	575	-
Stage 2	-	-	-	-	-	-	605	572	-	614	564	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.19	2.75	15.59	14.94
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	438	1384	-	-	1126	-	-	378
HCM Lane V/C Ratio	0.226	0.008	-	-	0.079	-	-	0.043
HCM Control Delay (s/veh)	15.6	7.6	-	-	8.5	-	-	14.9
HCM Lane LOS	C	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.9	0	-	-	0.3	-	-	0.1

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	129	33	52	158	18	48
Future Vol, veh/h	129	33	52	158	18	48
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	140	36	57	172	20	52
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	9	8.4	8.1
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	80%	27%
Vol Thru, %	25%	0%	73%
Vol Right, %	75%	20%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	210	162	66
LT Vol	0	129	18
Through Vol	52	0	48
RT Vol	158	33	0
Lane Flow Rate	228	176	72
Geometry Grp	1	1	1
Degree of Util (X)	0.253	0.225	0.093
Departure Headway (Hd)	3.995	4.607	4.647
Convergence, Y/N	Yes	Yes	Yes
Cap	902	780	773
Service Time	2.01	2.631	2.668
HCM Lane V/C Ratio	0.253	0.226	0.093
HCM Control Delay, s/veh	8.4	9	8.1
HCM Lane LOS	A	A	A
HCM 95th-tile Q	1	0.9	0.3

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	64	2	225	117	4	180
Future Vol, veh/h	64	2	225	117	4	180
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	70	2	245	127	4	196

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	515	309	0	0	373	0
Stage 1	309	-	-	-	-	-
Stage 2	205	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	520	731	-	-	1186	-
Stage 1	744	-	-	-	-	-
Stage 2	829	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	517	730	-	-	1185	-
Mov Cap-2 Maneuver	517	-	-	-	-	-
Stage 1	744	-	-	-	-	-
Stage 2	825	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	13	0	0.18
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	522	1185	-
HCM Lane V/C Ratio	-	-	0.138	0.004	-
HCM Control Delay (s/veh)	-	-	13	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	34	29	169	22	15	42	309	313	0	214	27
Future Volume (veh/h)	11	34	29	169	22	15	42	309	313	0	214	27
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	0.99		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	12	37	32	184	24	16	46	336	340	0	233	29
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	179	219	161	508	52	25	190	669	623	0	646	80
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.40	0.40	0.40	0.00	0.40	0.40
Sat Flow, veh/h	118	914	674	1127	216	103	109	1687	1569	0	1629	203
Grp Volume(v), veh/h	81	0	0	224	0	0	382	0	340	0	0	262
Grp Sat Flow(s),veh/h/ln	1706	0	0	1447	0	0	1796	0	1569	0	0	1831
Q Serve(g_s), s	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	4.6	0.0	0.0	2.8
Cycle Q Clear(g_c), s	1.0	0.0	0.0	3.7	0.0	0.0	4.3	0.0	4.6	0.0	0.0	2.8
Prop In Lane	0.15		0.40	0.82		0.07	0.12		1.00	0.00		0.11
Lane Grp Cap(c), veh/h	559	0	0	585	0	0	859	0	623	0	0	727
V/C Ratio(X)	0.14	0.00	0.00	0.38	0.00	0.00	0.44	0.00	0.55	0.00	0.00	0.36
Avail Cap(c_a), veh/h	1487	0	0	1360	0	0	1935	0	1599	0	0	1866
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	8.3	0.0	0.0	9.3	0.0	0.0	6.3	0.0	6.4	0.0	0.0	5.8
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.7	0.0	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.9	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	8.5	0.0	0.0	9.7	0.0	0.0	6.6	0.0	7.1	0.0	0.0	6.1
LnGrp LOS	A			A			A		A			A
Approach Vol, veh/h		81			224			722			262	
Approach Delay, s/veh		8.5			9.7			6.9			6.1	
Approach LOS		A			A			A			A	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	15.9	11.6	15.9	11.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	28.0	22.0	28.0	22.0
Max Q Clear Time (g_c+I1), s	6.6	3.0	4.8	5.7
Green Ext Time (p_c), s	3.9	0.3	1.6	1.2

Intersection Summary	
HCM 7th Control Delay, s/veh	7.3
HCM 7th LOS	A

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	144	163	45	189	213	220	74	391	238	114	207	106
Future Volume (veh/h)	144	163	45	189	213	220	74	391	238	114	207	106
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.94	0.97		0.95	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	157	177	39	205	232	29	80	425	0	124	225	102
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	279	250	55	289	336	269	479	830		422	555	252
Arrive On Green	0.09	0.19	0.19	0.10	0.20	0.20	0.04	0.49	0.00	0.05	0.51	0.51
Sat Flow, veh/h	1603	1320	291	1603	1683	1351	1603	1683	1427	1603	1092	495
Grp Volume(v), veh/h	157	0	216	205	232	29	80	425	0	124	0	327
Grp Sat Flow(s),veh/h/ln	1603	0	1611	1603	1683	1351	1603	1683	1427	1603	0	1587
Q Serve(g_s), s	9.7	0.0	15.7	13.0	16.0	2.2	3.1	21.4	0.0	4.7	0.0	16.0
Cycle Q Clear(g_c), s	9.7	0.0	15.7	13.0	16.0	2.2	3.1	21.4	0.0	4.7	0.0	16.0
Prop In Lane	1.00		0.18	1.00		1.00	1.00		1.00	1.00		0.31
Lane Grp Cap(c), veh/h	279	0	305	289	336	269	479	830		422	0	806
V/C Ratio(X)	0.56	0.00	0.71	0.71	0.69	0.11	0.17	0.51		0.29	0.00	0.41
Avail Cap(c_a), veh/h	295	0	451	289	471	378	545	830		463	0	806
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.79	0.79	0.79	1.00	1.00	0.00	0.96	0.00	0.96
Uniform Delay (d), s/veh	36.6	0.0	47.5	37.0	46.5	40.9	15.3	21.5	0.0	16.1	0.0	19.0
Incr Delay (d2), s/veh	2.2	0.0	3.0	6.2	2.0	0.1	0.2	2.3	0.0	0.4	0.0	1.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.0	6.6	5.6	6.9	0.8	1.2	9.0	0.0	1.8	0.0	6.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	38.8	0.0	50.5	43.2	48.5	41.1	15.5	23.8	0.0	16.4	0.0	20.5
LnGrp LOS	D		D	D	D	D	B	C		B		C
Approach Vol, veh/h		373			466			505			451	
Approach Delay, s/veh		45.6			45.7			22.4			19.4	
Approach LOS		D			D			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.7	66.6	18.0	28.6	9.8	68.5	16.7	29.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	47.0	13.0	35.0	10.0	47.0	13.0	35.0
Max Q Clear Time (g_c+I1), s	6.7	23.4	15.0	17.7	5.1	18.0	11.7	18.0
Green Ext Time (p_c), s	0.1	2.9	0.0	1.2	0.1	2.3	0.1	1.3

Intersection Summary	
HCM 7th Control Delay, s/veh	32.5
HCM 7th LOS	C

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd 10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	596	45	350	34	48	51	338	880	17	27	1367	502
Future Volume (veh/h)	596	45	350	34	48	51	338	880	17	27	1367	502
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	648	49	0	37	52	0	367	957	9	29	1486	210
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	724	392		106	111		424	2087	931	40	1730	772
Arrive On Green	0.21	0.21	0.00	0.06	0.06	0.00	0.12	0.59	0.59	0.02	0.49	0.49
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	3554	1585
Grp Volume(v), veh/h	648	49	0	37	52	0	367	957	9	29	1486	210
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1777	1585
Q Serve(g_s), s	30.1	3.5	0.0	3.3	4.4	0.0	17.2	25.1	0.4	2.7	60.8	12.9
Cycle Q Clear(g_c), s	30.1	3.5	0.0	3.3	4.4	0.0	17.2	25.1	0.4	2.7	60.8	12.9
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	724	392		106	111		424	2087	931	40	1730	772
V/C Ratio(X)	0.89	0.13		0.35	0.47		0.87	0.46	0.01	0.73	0.86	0.27
Avail Cap(c_a), veh/h	922	499		119	125		670	2087	931	54	1730	772
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.69	0.69	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.4	52.9	0.0	74.5	75.0	0.0	71.0	19.2	14.1	80.2	37.3	25.0
Incr Delay (d2), s/veh	6.8	0.1	0.0	1.9	3.0	0.0	7.1	0.7	0.0	27.5	5.8	0.9
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.1	1.7	0.0	1.6	2.3	0.0	8.0	10.6	0.1	1.5	27.5	5.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	70.3	53.0	0.0	76.5	78.1	0.0	78.1	19.9	14.1	107.7	43.1	25.9
LnGrp LOS	E	D		E	E		E	B	B	F	D	C
Approach Vol, veh/h		697			89			1333			1725	
Approach Delay, s/veh		69.1			77.4			35.9			42.1	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.7	101.9		14.8	25.3	85.3		39.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	85.0		11.0	32.0	58.0		44.0
Max Q Clear Time (g_c+I1), s	4.7	27.1		6.4	19.2	62.8		32.1
Green Ext Time (p_c), s	0.0	8.5		0.1	1.1	0.0		2.3

Intersection Summary	
HCM 7th Control Delay, s/veh	45.7
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	331	343	132	30	353	128	144	876	25	208	1131	602
Future Volume (veh/h)	331	343	132	30	353	128	144	876	25	208	1131	602
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	360	373	0	33	384	0	157	952	11	226	1229	432
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	416	749		84	490		209	1818	811	377	1990	887
Arrive On Green	0.12	0.21	0.00	0.05	0.14	0.00	0.06	0.51	0.51	0.11	0.56	0.56
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	360	373	0	33	384	0	157	952	11	226	1229	432
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	16.9	15.3	0.0	3.0	17.2	0.0	7.4	29.5	0.6	10.3	38.4	27.2
Cycle Q Clear(g_c), s	16.9	15.3	0.0	3.0	17.2	0.0	7.4	29.5	0.6	10.3	38.4	27.2
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	416	749		84	490		209	1818	811	377	1990	887
V/C Ratio(X)	0.87	0.50		0.39	0.78		0.75	0.52	0.01	0.60	0.62	0.49
Avail Cap(c_a), veh/h	607	969		238	818		335	1818	811	440	1990	887
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.80	0.80	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	71.3	57.4	0.0	76.3	68.7	0.0	76.3	26.9	19.8	70.1	24.4	21.9
Incr Delay (d2), s/veh	7.2	0.4	0.0	2.9	2.8	0.0	5.3	1.1	0.0	1.7	1.4	1.9
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.0	7.0	0.0	1.4	8.1	0.0	3.4	12.8	0.2	4.7	16.4	10.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	78.5	57.8	0.0	79.2	71.5	0.0	81.6	28.0	19.8	71.7	25.9	23.9
LnGrp LOS	E	E		E	E		F	C	B	E	C	C
Approach Vol, veh/h		733			417			1120			1887	
Approach Delay, s/veh		68.0			72.2			35.4			30.9	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	89.4	12.8	39.8	15.0	97.4	24.8	27.7
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	57.0	22.0	45.0	16.0	62.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	12.3	31.5	5.0	17.3	9.4	40.4	18.9	19.2
Green Ext Time (p_c), s	0.5	7.3	0.0	2.7	0.2	11.2	1.0	2.5

Intersection Summary	
HCM 7th Control Delay, s/veh	42.8
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	587	25	204	526	157	10	12	283	132	23	23
Future Volume (veh/h)	18	587	25	204	526	157	10	12	283	132	23	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	638	25	222	572	151	11	13	5	143	25	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	43	1036	41	286	1207	318	59	62	52	206	198	16
Arrive On Green	0.02	0.30	0.30	0.16	0.43	0.43	0.03	0.03	0.03	0.12	0.12	0.12
Sat Flow, veh/h	1781	3486	136	1781	2782	732	1781	1870	1585	1781	1709	137
Grp Volume(v), veh/h	20	325	338	222	365	358	11	13	5	143	0	27
Grp Sat Flow(s),veh/h/ln	1781	1777	1846	1781	1777	1738	1781	1870	1585	1781	0	1846
Q Serve(g_s), s	0.6	8.0	8.0	6.1	7.4	7.5	0.3	0.3	0.2	3.9	0.0	0.7
Cycle Q Clear(g_c), s	0.6	8.0	8.0	6.1	7.4	7.5	0.3	0.3	0.2	3.9	0.0	0.7
Prop In Lane	1.00		0.07	1.00		0.42	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	43	528	549	286	771	754	59	62	52	206	0	213
V/C Ratio(X)	0.46	0.62	0.62	0.78	0.47	0.48	0.19	0.21	0.10	0.69	0.00	0.13
Avail Cap(c_a), veh/h	315	1922	1996	666	2272	2221	666	699	592	1121	0	1162
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.5	15.4	15.4	20.5	10.3	10.3	23.9	23.9	23.8	21.6	0.0	20.2
Incr Delay (d2), s/veh	7.6	1.2	1.1	4.5	0.5	0.5	1.5	1.7	0.8	4.2	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	3.1	3.2	2.7	2.5	2.5	0.1	0.2	0.1	1.8	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	32.1	16.5	16.5	24.9	10.7	10.7	25.4	25.6	24.6	25.8	0.0	20.4
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		683			945			29			170	
Approach Delay, s/veh		17.0			14.1			25.4			24.9	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.2	20.1		10.9	6.2	27.1		6.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	8.1	10.0		5.9	2.6	9.5		2.3
Green Ext Time (p_c), s	0.5	5.0		0.5	0.0	5.8		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	16.3
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	62	346	16	121	403	34	16	29	212	77	36	53
Future Volume (veh/h)	62	346	16	121	403	34	16	29	212	77	36	53
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	67	376	15	132	438	32	17	32	9	84	39	9
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	117	738	29	176	823	60	106	111	94	231	190	44
Arrive On Green	0.07	0.21	0.21	0.10	0.25	0.25	0.06	0.06	0.06	0.13	0.13	0.13
Sat Flow, veh/h	1781	3484	139	1781	3358	245	1781	1870	1585	1781	1463	338
Grp Volume(v), veh/h	67	191	200	132	231	239	17	32	9	84	0	48
Grp Sat Flow(s),veh/h/ln	1781	1777	1845	1781	1777	1826	1781	1870	1585	1781	0	1801
Q Serve(g_s), s	1.5	3.8	3.8	2.9	4.5	4.5	0.4	0.7	0.2	1.7	0.0	1.0
Cycle Q Clear(g_c), s	1.5	3.8	3.8	2.9	4.5	4.5	0.4	0.7	0.2	1.7	0.0	1.0
Prop In Lane	1.00		0.08	1.00		0.13	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	117	377	391	176	435	447	106	111	94	231	0	234
V/C Ratio(X)	0.57	0.51	0.51	0.75	0.53	0.53	0.16	0.29	0.10	0.36	0.00	0.21
Avail Cap(c_a), veh/h	445	1355	1407	757	1666	1712	1403	1473	1248	1403	0	1418
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.1	13.9	13.9	17.5	13.1	13.1	17.9	18.0	17.8	15.9	0.0	15.6
Incr Delay (d2), s/veh	4.4	1.1	1.0	6.3	1.0	1.0	0.7	1.4	0.4	1.0	0.0	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	1.4	1.5	1.4	1.6	1.7	0.2	0.3	0.1	0.7	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.5	15.0	15.0	23.8	14.1	14.1	18.6	19.4	18.2	16.8	0.0	16.0
LnGrp LOS	C	B	B	C	B	B	B	B	B	B		B
Approach Vol, veh/h		458			602			58			132	
Approach Delay, s/veh		16.1			16.2			19.0			16.5	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.9	13.5		10.2	7.6	14.8		7.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	4.9	5.8		3.7	3.5	6.5		2.7
Green Ext Time (p_c), s	0.2	2.5		0.5	0.1	3.2		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	16.3
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	201	98	199	279	4	70	10	216	6	2	6
Future Volume (veh/h)	9	201	98	199	279	4	70	10	216	6	2	6
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	10	218	53	216	303	3	76	11	26	7	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	24	518	123	244	1104	11	173	182	154	65	69	0
Arrive On Green	0.01	0.18	0.18	0.14	0.31	0.31	0.10	0.10	0.10	0.04	0.04	0.00
Sat Flow, veh/h	1781	2837	673	1781	3605	36	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	10	135	136	216	149	157	76	11	26	7	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1734	1781	1777	1864	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	2.4	2.6	4.4	2.3	2.3	1.5	0.2	0.6	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.2	2.4	2.6	4.4	2.3	2.3	1.5	0.2	0.6	0.1	0.0	0.0
Prop In Lane	1.00		0.39	1.00		0.02	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	24	324	317	244	544	571	173	182	154	65	69	0
V/C Ratio(X)	0.43	0.41	0.43	0.89	0.27	0.27	0.44	0.06	0.17	0.11	0.03	0.00
Avail Cap(c_a), veh/h	244	1215	1185	244	1215	1274	1461	1534	1297	1461	1534	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.9	13.2	13.3	15.5	9.6	9.6	15.6	15.0	15.2	17.0	17.0	0.0
Incr Delay (d2), s/veh	11.7	0.8	0.9	30.0	0.3	0.3	1.8	0.1	0.5	0.7	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.9	0.9	3.5	0.8	0.8	0.6	0.1	0.2	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.6	14.1	14.2	45.5	9.9	9.9	17.3	15.1	15.7	17.7	17.2	0.0
LnGrp LOS	C	B	B	D	A	A	B	B	B	B	B	
Approach Vol, veh/h		281			522			113			9	
Approach Delay, s/veh		14.7			24.6			16.7			17.6	
Approach LOS		B			C			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	11.7		6.3	5.5	16.2		8.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	6.4	4.6		2.1	2.2	4.3		3.5
Green Ext Time (p_c), s	0.0	1.6		0.0	0.0	1.8		0.3

Intersection Summary	
HCM 7th Control Delay, s/veh	20.6
HCM 7th LOS	C

Intersection	
Int Delay, s/veh	3.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	165	25	67	123	21	112
Future Vol, veh/h	165	25	67	123	21	112
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	179	27	73	134	23	122

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	208	0	473	194
Stage 1	-	-	-	-	194	-
Stage 2	-	-	-	-	279	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1364	-	550	848
Stage 1	-	-	-	-	839	-
Stage 2	-	-	-	-	768	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1362	-	517	847
Mov Cap-2 Maneuver	-	-	-	-	517	-
Stage 1	-	-	-	-	838	-
Stage 2	-	-	-	-	724	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.75	10.33
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	517	847	-	-	1362	-
HCM Lane V/C Ratio	0.044	0.144	-	-	0.053	-
HCM Control Delay (s/veh)	12.3	10	-	-	7.8	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	0.5	-	-	0.2	-

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	179	21	11	131	18	11
Future Vol, veh/h	179	21	11	131	18	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	195	23	12	142	20	12

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	217	0	372	206
Stage 1	-	-	-	-	206	-
Stage 2	-	-	-	-	166	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1352	-	628	835
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	863	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1352	-	622	835
Mov Cap-2 Maneuver	-	-	-	-	622	-
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	855	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.6	10.48
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	689	-	-	1352	-
HCM Lane V/C Ratio	0.046	-	-	0.009	-
HCM Control Delay (s/veh)	10.5	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	368	108	96	252	9	89	0	107	19	1	21
Future Vol, veh/h	20	368	108	96	252	9	89	0	107	19	1	21
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	400	117	104	274	10	97	0	116	21	1	23

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	290	0	0	520	0	0	992	1004	463	938	1057	289
Stage 1	-	-	-	-	-	-	505	505	-	493	493	-
Stage 2	-	-	-	-	-	-	487	498	-	444	564	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1272	-	-	1046	-	-	225	242	599	245	225	750
Stage 1	-	-	-	-	-	-	549	540	-	557	547	-
Stage 2	-	-	-	-	-	-	562	544	-	593	509	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1265	-	-	1043	-	-	190	212	597	173	197	743
Mov Cap-2 Maneuver	-	-	-	-	-	-	190	212	-	173	197	-
Stage 1	-	-	-	-	-	-	538	529	-	545	489	-
Stage 2	-	-	-	-	-	-	487	487	-	468	498	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.32	2.38	40.76	19.88
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	303	1265	-	-	1043	-	-	286
HCM Lane V/C Ratio	0.703	0.017	-	-	0.1	-	-	0.156
HCM Control Delay (s/veh)	40.8	7.9	-	-	8.8	-	-	19.9
HCM Lane LOS	E	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	4.9	0.1	-	-	0.3	-	-	0.5

Intersection	
Intersection Delay, s/veh	12.6
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	294	60	60	270	36	63
Future Vol, veh/h	294	60	60	270	36	63
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	320	65	65	293	39	68
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	14.3	11.6	9.7
HCM LOS	B	B	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	83%	36%
Vol Thru, %	18%	0%	64%
Vol Right, %	82%	17%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	330	354	99
LT Vol	0	294	36
Through Vol	60	0	63
RT Vol	270	60	0
Lane Flow Rate	359	385	108
Geometry Grp	1	1	1
Degree of Util (X)	0.459	0.552	0.166
Departure Headway (Hd)	4.604	5.168	5.563
Convergence, Y/N	Yes	Yes	Yes
Cap	771	704	646
Service Time	2.703	3.168	3.587
HCM Lane V/C Ratio	0.466	0.547	0.167
HCM Control Delay, s/veh	11.6	14.3	9.7
HCM Lane LOS	B	B	A
HCM 95th-tile Q	2.4	3.4	0.6

HCM 7th TWSC
14: Kuakini Hwy & Loloku St

10/19/2023

Intersection	
Int Delay, s/veh	3.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	127	22	335	191	9	329
Future Vol, veh/h	127	22	335	191	9	329
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	138	24	364	208	10	358

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	845	468	0	0	572	0
Stage 1	468	-	-	-	-	-
Stage 2	377	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	333	595	-	-	1001	-
Stage 1	630	-	-	-	-	-
Stage 2	693	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	329	595	-	-	1001	-
Mov Cap-2 Maneuver	329	-	-	-	-	-
Stage 1	630	-	-	-	-	-
Stage 2	685	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	23.63	0	0.23
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	352	1001	-
HCM Lane V/C Ratio	-	-	0.46	0.01	-
HCM Control Delay (s/veh)	-	-	23.6	8.6	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	2.3	0	-

HCM 7th Signalized Intersection Summary
15: Kuakini Hwy & Kaiwi St

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	43	47	288	25	44	49	477	424	25	406	31
Future Volume (veh/h)	30	43	47	288	25	44	49	477	424	25	406	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	47	51	313	27	48	53	518	461	27	441	34
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	199	262	226	539	34	59	133	731	670	105	656	49
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.43	0.43	0.43	0.43	0.43	0.43
Sat Flow, veh/h	275	779	672	1144	101	176	94	1710	1568	36	1536	114
Grp Volume(v), veh/h	131	0	0	388	0	0	571	0	461	502	0	0
Grp Sat Flow(s),veh/h/ln	1725	0	0	1421	0	0	1804	0	1568	1686	0	0
Q Serve(g_s), s	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	10.1	0.3	0.0	0.0
Cycle Q Clear(g_c), s	2.3	0.0	0.0	10.3	0.0	0.0	10.7	0.0	10.1	11.0	0.0	0.0
Prop In Lane	0.25		0.39	0.81		0.12	0.09		1.00	0.05		0.07
Lane Grp Cap(c), veh/h	688	0	0	632	0	0	864	0	670	810	0	0
V/C Ratio(X)	0.19	0.00	0.00	0.61	0.00	0.00	0.66	0.00	0.69	0.62	0.00	0.00
Avail Cap(c_a), veh/h	977	0	0	878	0	0	1262	0	1036	1195	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	10.1	0.0	0.0	12.5	0.0	0.0	10.0	0.0	9.8	9.6	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.0	0.0	0.0	0.9	0.0	1.3	0.8	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.0	2.9	0.0	0.0	3.6	0.0	2.9	3.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	10.2	0.0	0.0	13.5	0.0	0.0	10.9	0.0	11.1	10.3	0.0	0.0
LnGrp LOS	B			B			B		B	B		
Approach Vol, veh/h		131			388			1032			502	
Approach Delay, s/veh		10.2			13.5			11.0			10.3	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	23.1	19.3	23.1	19.3
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	28.0	22.0	28.0	22.0
Max Q Clear Time (g_c+I1), s	12.7	4.3	13.0	12.3
Green Ext Time (p_c), s	5.4	0.6	3.2	1.8

Intersection Summary	
HCM 7th Control Delay, s/veh	11.2
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	169	177	39	306	320	330	84	453	242	157	415	172
Future Volume (veh/h)	169	177	39	306	320	330	84	453	242	157	415	172
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.85	0.95		0.89	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	184	192	35	333	348	105	91	492	0	171	451	177
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	277	255	46	390	446	337	186	715		312	513	201
Arrive On Green	0.10	0.19	0.19	0.18	0.27	0.27	0.04	0.42	0.00	0.07	0.45	0.45
Sat Flow, veh/h	1603	1342	245	1603	1683	1271	1603	1683	1427	1603	1144	449
Grp Volume(v), veh/h	184	0	227	333	348	105	91	492	0	171	0	628
Grp Sat Flow(s),veh/h/ln	1603	0	1587	1603	1683	1271	1603	1683	1427	1603	0	1593
Q Serve(g_s), s	13.3	0.0	19.6	23.5	27.8	9.6	4.6	34.5	0.0	8.7	0.0	52.0
Cycle Q Clear(g_c), s	13.3	0.0	19.6	23.5	27.8	9.6	4.6	34.5	0.0	8.7	0.0	52.0
Prop In Lane	1.00		0.15	1.00		1.00	1.00		1.00	1.00		0.28
Lane Grp Cap(c), veh/h	277	0	301	390	446	337	186	715		312	0	715
V/C Ratio(X)	0.66	0.00	0.75	0.85	0.78	0.31	0.49	0.69		0.55	0.00	0.88
Avail Cap(c_a), veh/h	277	0	383	435	580	438	225	715		312	0	715
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.62	0.62	0.62	1.00	1.00	0.00	0.73	0.00	0.73
Uniform Delay (d), s/veh	42.2	0.0	55.5	37.3	49.4	42.7	30.9	33.9	0.0	25.9	0.0	36.4
Incr Delay (d2), s/veh	5.9	0.0	6.3	9.3	3.2	0.3	2.0	5.4	0.0	1.5	0.0	11.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	0.0	8.5	10.3	12.2	3.1	1.9	15.3	0.0	3.5	0.0	22.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	48.1	0.0	61.8	46.6	52.5	43.0	32.9	39.3	0.0	27.4	0.0	47.5
LnGrp LOS	D		E	D	D	D	C	D		C		D
Approach Vol, veh/h		411			786			583			799	
Approach Delay, s/veh		55.6			48.7			38.3			43.2	
Approach LOS		E			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	66.6	30.9	32.5	11.5	70.0	20.0	43.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	30.0	35.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	10.7	36.5	25.5	21.6	6.6	54.0	15.3	29.8
Green Ext Time (p_c), s	0.0	2.8	0.5	1.1	0.1	0.0	0.0	2.6

Intersection Summary	
HCM 7th Control Delay, s/veh	45.7
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	571	53	370	28	57	45	384	848	19	39	1027	516
Future Volume (veh/h)	571	53	370	28	57	45	384	848	19	39	1027	516
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	621	58	0	30	62	0	417	922	9	42	1116	173
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	786	425		90	94		517	1767	787	60	1356	603
Arrive On Green	0.23	0.23	0.00	0.05	0.05	0.00	0.15	0.50	0.50	0.03	0.38	0.38
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	3554	1581
Grp Volume(v), veh/h	621	58	0	30	62	0	417	922	9	42	1116	173
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1777	1581
Q Serve(g_s), s	17.7	2.6	0.0	1.7	3.4	0.0	12.2	18.4	0.3	2.4	29.6	7.9
Cycle Q Clear(g_c), s	17.7	2.6	0.0	1.7	3.4	0.0	12.2	18.4	0.3	2.4	29.6	7.9
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	786	425		90	94		517	1767	787	60	1356	603
V/C Ratio(X)	0.79	0.14		0.33	0.66		0.81	0.52	0.01	0.70	0.82	0.29
Avail Cap(c_a), veh/h	1389	752		307	322		1157	2618	1166	136	1700	756
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.0	32.2	0.0	47.9	48.7	0.0	43.0	17.8	13.3	50.0	29.1	22.4
Incr Delay (d2), s/veh	1.8	0.1	0.0	2.2	7.6	0.0	3.0	0.2	0.0	13.7	2.8	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.7	1.2	0.0	0.8	1.8	0.0	5.3	7.2	0.1	1.3	12.6	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	39.9	32.3	0.0	50.1	56.4	0.0	46.0	18.1	13.3	63.7	31.9	22.7
LnGrp LOS	D	C		D	E		D	B	B	E	C	C
Approach Vol, veh/h		679			92			1348			1331	
Approach Delay, s/veh		39.2			54.3			26.7			31.7	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.5	57.0		10.3	20.6	44.9		28.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	8.0	77.0		18.0	35.0	50.0		42.0
Max Q Clear Time (g_c+I1), s	4.4	20.4		5.4	14.2	31.6		19.7
Green Ext Time (p_c), s	0.0	8.0		0.2	1.4	8.3		2.7

Intersection Summary	
HCM 7th Control Delay, s/veh	31.8
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

4: Queen Kaahumanu Hwy & Palani Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	303	329	143	19	338	111	174	871	30	148	936	456
Future Volume (veh/h)	303	329	143	19	338	111	174	871	30	148	936	456
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	329	358	0	21	367	0	189	947	11	161	1017	250
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	431	929		41	567		279	1403	626	246	1369	609
Arrive On Green	0.12	0.26	0.00	0.02	0.16	0.00	0.08	0.39	0.39	0.07	0.39	0.39
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1581
Grp Volume(v), veh/h	329	358	0	21	367	0	189	947	11	161	1017	250
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1581
Q Serve(g_s), s	8.1	7.3	0.0	1.0	8.5	0.0	4.7	19.3	0.4	4.0	21.7	10.2
Cycle Q Clear(g_c), s	8.1	7.3	0.0	1.0	8.5	0.0	4.7	19.3	0.4	4.0	21.7	10.2
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	431	929		41	567		279	1403	626	246	1369	609
V/C Ratio(X)	0.76	0.39		0.52	0.65		0.68	0.68	0.02	0.66	0.74	0.41
Avail Cap(c_a), veh/h	805	1515		415	1515		805	2645	1180	766	2605	1159
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.3	26.7	0.0	42.5	34.7	0.0	39.3	22.0	16.2	39.8	23.3	19.7
Incr Delay (d2), s/veh	2.8	0.3	0.0	9.8	1.3	0.0	2.9	0.6	0.0	2.9	0.8	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	3.1	0.0	0.6	3.8	0.0	2.0	7.6	0.1	1.8	8.6	3.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	40.1	27.0	0.0	52.3	35.9	0.0	42.2	22.5	16.2	42.8	24.1	20.2
LnGrp LOS	D	C		D	D		D	C	B	D	C	C
Approach Vol, veh/h		687			388			1147			1428	
Approach Delay, s/veh		33.2			36.8			25.7			25.5	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.8	40.2	7.5	28.5	12.6	39.4	16.5	19.5
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	65.5	20.5	37.5	20.5	64.5	20.5	37.5
Max Q Clear Time (g_c+I1), s	6.0	21.3	3.0	9.3	6.7	23.7	10.1	10.5
Green Ext Time (p_c), s	0.4	8.2	0.0	2.6	0.5	10.2	0.9	2.6

Intersection Summary		
HCM 7th Control Delay, s/veh		28.2
HCM 7th LOS		C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

5: Luhia St & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	656	24	205	567	199	9	54	188	129	39	30
Future Volume (veh/h)	30	656	24	205	567	199	9	54	188	129	39	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	713	24	223	616	191	10	59	4	140	42	10
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	63	1110	37	282	1171	363	107	112	95	207	170	40
Arrive On Green	0.04	0.32	0.32	0.16	0.44	0.44	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3507	118	1781	2666	825	1781	1870	1585	1781	1460	348
Grp Volume(v), veh/h	33	361	376	223	410	397	10	59	4	140	0	52
Grp Sat Flow(s),veh/h/ln	1781	1777	1848	1781	1777	1714	1781	1870	1585	1781	0	1808
Q Serve(g_s), s	1.0	10.0	10.0	6.9	9.7	9.7	0.3	1.8	0.1	4.3	0.0	1.5
Cycle Q Clear(g_c), s	1.0	10.0	10.0	6.9	9.7	9.7	0.3	1.8	0.1	4.3	0.0	1.5
Prop In Lane	1.00		0.06	1.00		0.48	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	63	562	585	282	781	753	107	112	95	207	0	210
V/C Ratio(X)	0.52	0.64	0.64	0.79	0.53	0.53	0.09	0.53	0.04	0.68	0.00	0.25
Avail Cap(c_a), veh/h	280	1704	1773	590	2014	1943	590	620	525	994	0	1009
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	27.2	16.8	16.8	23.2	11.7	11.7	25.5	26.2	25.4	24.3	0.0	23.1
Incr Delay (d2), s/veh	6.4	1.2	1.2	4.9	0.6	0.6	0.4	3.8	0.2	3.8	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	3.9	4.1	3.1	3.5	3.4	0.1	0.9	0.1	2.0	0.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	33.6	18.0	18.0	28.1	12.3	12.3	25.9	30.0	25.6	28.1	0.0	23.7
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		770			1030			73			192	
Approach Delay, s/veh		18.7			15.7			29.2			26.9	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	14.1	23.1		11.7	7.0	30.2		8.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	8.9	12.0		6.3	3.0	11.7		3.8
Green Ext Time (p_c), s	0.5	5.7		0.7	0.0	6.7		0.2

Intersection Summary		
HCM 7th Control Delay, s/veh		18.3
HCM 7th LOS		B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	385	15	127	437	50	28	52	198	121	62	63
Future Volume (veh/h)	90	385	15	127	437	50	28	52	198	121	62	63
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	98	418	14	138	475	46	30	57	14	132	67	36
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	134	788	26	183	824	79	150	157	133	317	202	108
Arrive On Green	0.08	0.22	0.22	0.10	0.25	0.25	0.08	0.08	0.08	0.18	0.18	0.18
Sat Flow, veh/h	1781	3508	117	1781	3270	315	1781	1870	1576	1781	1132	608
Grp Volume(v), veh/h	98	211	221	138	257	264	30	57	14	132	0	103
Grp Sat Flow(s),veh/h/ln	1781	1777	1849	1781	1777	1809	1781	1870	1576	1781	0	1740
Q Serve(g_s), s	2.6	5.1	5.1	3.7	6.2	6.2	0.8	1.4	0.4	3.2	0.0	2.5
Cycle Q Clear(g_c), s	2.6	5.1	5.1	3.7	6.2	6.2	0.8	1.4	0.4	3.2	0.0	2.5
Prop In Lane	1.00		0.06	1.00		0.17	1.00		1.00	1.00		0.35
Lane Grp Cap(c), veh/h	134	399	415	183	448	456	150	157	133	317	0	310
V/C Ratio(X)	0.73	0.53	0.53	0.75	0.57	0.58	0.20	0.36	0.11	0.42	0.00	0.33
Avail Cap(c_a), veh/h	366	1112	1157	622	1368	1392	1152	1209	1019	1152	0	1125
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.0	16.6	16.6	21.3	15.9	16.0	20.8	21.1	20.6	17.8	0.0	17.5
Incr Delay (d2), s/veh	7.4	1.1	1.1	6.1	1.2	1.2	0.6	1.4	0.3	0.9	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	2.0	2.1	1.7	2.4	2.4	0.3	0.6	0.1	1.3	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.4	17.7	17.7	27.4	17.1	17.1	21.4	22.5	21.0	18.6	0.0	18.1
LnGrp LOS	C	B	B	C	B	B	C	C	C	B		B
Approach Vol, veh/h		530			659			101			235	
Approach Delay, s/veh		19.9			19.3			22.0			18.4	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	10.0	15.9	13.7	8.7	17.3	9.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	5.7	7.1	5.2	4.6	8.2	3.4
Green Ext Time (p_c), s	0.3	2.7	0.9	0.1	3.6	0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	19.5
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/19/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	218	137	243	274	7	83	5	260	8	6	11
Future Volume (veh/h)	22	218	137	243	274	7	83	5	260	8	6	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	24	237	61	264	298	7	90	5	26	9	7	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	52	480	121	343	1186	28	168	177	150	36	38	0
Arrive On Green	0.03	0.17	0.17	0.19	0.33	0.33	0.09	0.09	0.09	0.02	0.02	0.00
Sat Flow, veh/h	1781	2806	706	1781	3548	83	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	24	148	150	264	149	156	90	5	26	9	7	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1736	1781	1777	1855	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.5	2.9	3.0	5.4	2.3	2.3	1.8	0.1	0.6	0.2	0.1	0.0
Cycle Q Clear(g_c), s	0.5	2.9	3.0	5.4	2.3	2.3	1.8	0.1	0.6	0.2	0.1	0.0
Prop In Lane	1.00		0.41	1.00		0.04	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	52	304	297	343	594	620	168	177	150	36	38	0
V/C Ratio(X)	0.46	0.49	0.50	0.77	0.25	0.25	0.54	0.03	0.17	0.25	0.18	0.00
Avail Cap(c_a), veh/h	232	695	679	697	1158	1209	1393	1463	1240	1393	1463	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	18.3	14.4	14.4	14.7	9.3	9.3	16.6	15.8	16.0	18.5	18.5	0.0
Incr Delay (d2), s/veh	6.1	1.2	1.3	3.6	0.2	0.2	2.6	0.1	0.5	3.5	2.3	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.1	1.1	2.2	0.8	0.8	0.8	0.0	0.2	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	24.4	15.6	15.8	18.3	9.5	9.5	19.2	15.8	16.5	22.0	20.7	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	C	C	
Approach Vol, veh/h		322			569			121			16	
Approach Delay, s/veh		16.3			13.6			18.5			21.4	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	12.4	11.6	5.8	6.1	17.8	8.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	15.0	15.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	7.4	5.0	2.2	2.5	4.3	3.8
Green Ext Time (p_c), s	0.5	1.2	0.0	0.0	1.8	0.3

Intersection Summary	
HCM 7th Control Delay, s/veh	15.1
HCM 7th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Int Delay, s/veh	2.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	197	37	48	130	23	81
Future Vol, veh/h	197	37	48	130	23	81
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	214	40	52	141	25	88

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	255	0	481	235
Stage 1	-	-	-	-	235	-
Stage 2	-	-	-	-	246	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1310	-	544	804
Stage 1	-	-	-	-	804	-
Stage 2	-	-	-	-	795	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1308	-	520	803
Mov Cap-2 Maneuver	-	-	-	-	520	-
Stage 1	-	-	-	-	803	-
Stage 2	-	-	-	-	761	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	2.12	10.53
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	520	803	-	-	1308	-
HCM Lane V/C Ratio	0.048	0.11	-	-	0.04	-
HCM Control Delay (s/veh)	12.3	10	-	-	7.9	0
HCM Lane LOS	B	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	0.4	-	-	0.1	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	176	26	15	126	22	13
Future Vol, veh/h	176	26	15	126	22	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	191	28	16	137	24	14

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	220	0	375	205
Stage 1	-	-	-	-	205	-
Stage 2	-	-	-	-	170	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1350	-	626	835
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	860	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1350	-	618	835
Mov Cap-2 Maneuver	-	-	-	-	618	-
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	849	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.82	10.57
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	684	-	-	1350	-
HCM Lane V/C Ratio	0.056	-	-	0.012	-
HCM Control Delay (s/veh)	10.6	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0	-

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	24	283	133	89	199	11	60	0	90	20	0	16
Future Vol, veh/h	24	283	133	89	199	11	60	0	90	20	0	16
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	26	308	145	97	216	12	65	0	98	22	0	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	234	0	0	452	0	0	843	860	380	782	926	229
Stage 1	-	-	-	-	-	-	432	432	-	422	422	-
Stage 2	-	-	-	-	-	-	411	428	-	360	504	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1333	-	-	1108	-	-	284	294	667	312	269	810
Stage 1	-	-	-	-	-	-	602	582	-	610	588	-
Stage 2	-	-	-	-	-	-	618	585	-	658	541	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1326	-	-	1108	-	-	248	261	667	237	239	805
Mov Cap-2 Maneuver	-	-	-	-	-	-	248	261	-	237	239	-
Stage 1	-	-	-	-	-	-	590	571	-	594	534	-
Stage 2	-	-	-	-	-	-	551	531	-	551	530	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.42	2.55	20.18	16.76
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	398	1326	-	-	1108	-	-	345
HCM Lane V/C Ratio	0.41	0.02	-	-	0.087	-	-	0.113
HCM Control Delay (s/veh)	20.2	7.8	-	-	8.6	-	-	16.8
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	2	0.1	-	-	0.3	-	-	0.4

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	297	84	100	293	84	110
Future Vol, veh/h	297	84	100	293	84	110
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	323	91	109	318	91	120
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay, s/veh	18.5	15.7	12.1
HCM LOS	C	C	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	78%	43%
Vol Thru, %	25%	0%	57%
Vol Right, %	75%	22%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	393	381	194
LT Vol	0	297	84
Through Vol	100	0	110
RT Vol	293	84	0
Lane Flow Rate	427	414	211
Geometry Grp	1	1	1
Degree of Util (X)	0.604	0.647	0.346
Departure Headway (Hd)	5.087	5.623	5.906
Convergence, Y/N	Yes	Yes	Yes
Cap	705	642	607
Service Time	3.139	3.671	3.969
HCM Lane V/C Ratio	0.606	0.645	0.348
HCM Control Delay, s/veh	15.7	18.5	12.1
HCM Lane LOS	C	C	B
HCM 95th-tile Q	4.1	4.7	1.5

Intersection	
Int Delay, s/veh	4.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	128	20	377	196	6	422
Future Vol, veh/h	128	20	377	196	6	422
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	139	22	410	213	7	459

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	989	517	0	0	623	0
Stage 1	516	-	-	-	-	-
Stage 2	473	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	274	558	-	-	958	-
Stage 1	599	-	-	-	-	-
Stage 2	627	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	271	558	-	-	958	-
Mov Cap-2 Maneuver	271	-	-	-	-	-
Stage 1	599	-	-	-	-	-
Stage 2	621	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	31.64	0	0.12
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	291	958	-
HCM Lane V/C Ratio	-	-	0.553	0.007	-
HCM Control Delay (s/veh)	-	-	31.6	8.8	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	3.1	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	24	45	211	21	27	43	533	378	34	484	23
Future Volume (veh/h)	16	24	45	211	21	27	43	533	378	34	484	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	0.99		0.96	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	17	26	49	229	23	29	47	579	411	37	526	25
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	147	171	236	469	41	39	133	828	723	121	741	34
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.48	0.48	0.48	0.48	0.48	0.48
Sat Flow, veh/h	138	646	894	1136	154	148	69	1734	1515	46	1553	71
Grp Volume(v), veh/h	92	0	0	281	0	0	626	0	411	588	0	0
Grp Sat Flow(s),veh/h/ln	1678	0	0	1438	0	0	1803	0	1515	1670	0	0
Q Serve(g_s), s	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.0	7.5	0.4	0.0	0.0
Cycle Q Clear(g_c), s	1.6	0.0	0.0	6.7	0.0	0.0	10.2	0.0	7.5	10.6	0.0	0.0
Prop In Lane	0.18		0.53	0.81		0.10	0.08		1.00	0.06		0.04
Lane Grp Cap(c), veh/h	554	0	0	549	0	0	961	0	723	896	0	0
V/C Ratio(X)	0.17	0.00	0.00	0.51	0.00	0.00	0.65	0.00	0.57	0.66	0.00	0.00
Avail Cap(c_a), veh/h	915	0	0	860	0	0	1516	0	1214	1420	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	11.1	0.0	0.0	12.8	0.0	0.0	7.9	0.0	7.3	7.8	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.7	0.0	0.0	0.8	0.0	0.7	0.8	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	1.9	0.0	0.0	3.0	0.0	1.8	2.8	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	11.2	0.0	0.0	13.5	0.0	0.0	8.7	0.0	8.0	8.6	0.0	0.0
LnGrp LOS	B			B			A		A	A		
Approach Vol, veh/h		92			281			1037			588	
Approach Delay, s/veh		11.2			13.5			8.4			8.6	
Approach LOS		B			B			A			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		23.5		15.2		23.5		15.2				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		31.0		19.0		31.0		19.0				
Max Q Clear Time (g_c+I1), s		12.2		3.6		12.6		8.7				
Green Ext Time (p_c), s		6.3		0.4		4.3		1.3				

Intersection Summary	
HCM 7th Control Delay, s/veh	9.3
HCM 7th LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	177	224	32	208	272	370	75	379	196	221	337	190
Future Volume (veh/h)	177	224	32	208	272	370	75	379	196	221	337	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.98		0.92	0.96		0.93	1.00		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	192	243	30	226	296	85	82	412	0	240	366	189
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	338	334	41	350	429	337	193	569		343	403	208
Arrive On Green	0.11	0.23	0.23	0.13	0.25	0.25	0.05	0.34	0.00	0.10	0.39	0.39
Sat Flow, veh/h	1603	1453	179	1603	1683	1320	1603	1683	1427	1603	1030	532
Grp Volume(v), veh/h	192	0	273	226	296	85	82	412	0	240	0	555
Grp Sat Flow(s),veh/h/ln	1603	0	1632	1603	1683	1320	1603	1683	1427	1603	0	1562
Q Serve(g_s), s	8.8	0.0	15.2	10.4	15.7	5.1	3.3	21.1	0.0	9.4	0.0	33.0
Cycle Q Clear(g_c), s	8.8	0.0	15.2	10.4	15.7	5.1	3.3	21.1	0.0	9.4	0.0	33.0
Prop In Lane	1.00		0.11	1.00		1.00	1.00		1.00	1.00		0.34
Lane Grp Cap(c), veh/h	338	0	375	350	429	337	193	569		343	0	612
V/C Ratio(X)	0.57	0.00	0.73	0.65	0.69	0.25	0.42	0.72		0.70	0.00	0.91
Avail Cap(c_a), veh/h	483	0	414	405	429	337	214	786		343	0	792
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.3	0.0	35.1	25.2	33.2	29.2	24.0	28.6	0.0	20.7	0.0	28.3
Incr Delay (d2), s/veh	1.5	0.0	5.7	2.8	4.6	0.4	1.5	2.1	0.0	6.2	0.0	11.9
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	0.0	6.6	4.2	6.9	1.6	1.3	8.8	0.0	4.0	0.0	14.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	26.8	0.0	40.8	28.0	37.8	29.6	25.4	30.7	0.0	26.9	0.0	40.2
LnGrp LOS	C		D	C	D	C	C	C		C		D
Approach Vol, veh/h		465			607			494			795	
Approach Delay, s/veh		35.0			33.0			29.8			36.2	
Approach LOS		D			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	38.3	17.6	27.6	9.7	43.6	15.1	30.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	10.0	46.0	16.0	25.0	6.0	50.0	20.0	22.0
Max Q Clear Time (g_c+I1), s	11.4	23.1	12.4	17.2	5.3	35.0	10.8	17.7
Green Ext Time (p_c), s	0.0	2.7	0.2	1.0	0.0	3.5	0.4	0.8

Intersection Summary	
HCM 7th Control Delay, s/veh	33.8
HCM 7th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	460	21	178	35	24	54	234	1164	16	20	927	387
Future Volume (veh/h)	460	21	178	35	24	54	234	1164	16	20	927	387
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	500	23	0	38	26	0	254	1265	9	22	1008	201
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	569	308		102	107		309	2266	1011	34	2016	899
Arrive On Green	0.16	0.16	0.00	0.06	0.06	0.00	0.09	0.64	0.64	0.02	0.57	0.57
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	3554	1584
Grp Volume(v), veh/h	500	23	0	38	26	0	254	1265	9	22	1008	201
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1777	1584
Q Serve(g_s), s	23.3	1.7	0.0	3.4	2.2	0.0	11.9	33.0	0.3	2.0	28.3	10.4
Cycle Q Clear(g_c), s	23.3	1.7	0.0	3.4	2.2	0.0	11.9	33.0	0.3	2.0	28.3	10.4
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	569	308		102	107		309	2266	1011	34	2016	899
V/C Ratio(X)	0.88	0.07		0.37	0.24		0.82	0.56	0.01	0.64	0.50	0.22
Avail Cap(c_a), veh/h	859	465		119	125		838	2266	1011	54	2016	899
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.81	0.81	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	67.3	58.3	0.0	74.9	74.3	0.0	73.8	16.8	10.9	80.3	21.6	17.7
Incr Delay (d2), s/veh	5.8	0.1	0.0	2.2	1.2	0.0	5.4	1.0	0.0	18.2	0.9	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.9	0.8	0.0	1.6	1.1	0.0	5.5	13.6	0.1	1.1	12.0	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	73.2	58.4	0.0	77.1	75.5	0.0	79.2	17.8	10.9	98.6	22.4	18.3
LnGrp LOS	E	E		E	E		E	B	B	F	C	B
Approach Vol, veh/h		523			64			1528			1231	
Approach Delay, s/veh		72.5			76.5			28.0			23.1	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.2	110.2		14.5	19.8	98.6		32.1
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	88.0		11.0	40.0	53.0		41.0
Max Q Clear Time (g_c+I1), s	4.0	35.0		5.4	13.9	30.3		25.3
Green Ext Time (p_c), s	0.0	13.0		0.1	0.9	8.3		1.8

Intersection Summary	
HCM 7th Control Delay, s/veh	34.1
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	346	285	105	22	351	100	156	1041	24	91	783	355
Future Volume (veh/h)	346	285	105	22	351	100	156	1041	24	91	783	355
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	376	310	0	24	382	0	170	1132	12	99	851	191
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	436	787		72	481		251	1980	883	207	1934	860
Arrive On Green	0.13	0.22	0.00	0.04	0.14	0.00	0.07	0.56	0.56	0.06	0.54	0.54
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1581
Grp Volume(v), veh/h	376	310	0	24	382	0	170	1132	12	99	851	191
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1581
Q Serve(g_s), s	17.6	12.3	0.0	2.2	17.2	0.0	7.9	34.2	0.6	4.6	23.7	10.3
Cycle Q Clear(g_c), s	17.6	12.3	0.0	2.2	17.2	0.0	7.9	34.2	0.6	4.6	23.7	10.3
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	436	787		72	481		251	1980	883	207	1934	860
V/C Ratio(X)	0.86	0.39		0.33	0.79		0.68	0.57	0.01	0.48	0.44	0.22
Avail Cap(c_a), veh/h	754	969		313	818		293	1980	883	230	1934	860
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.80	0.80	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	70.7	54.8	0.0	77.0	69.1	0.0	74.6	23.8	16.3	75.1	22.5	19.5
Incr Delay (d2), s/veh	4.2	0.3	0.0	2.7	3.0	0.0	4.9	1.2	0.0	1.7	0.7	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.1	5.6	0.0	1.1	8.1	0.0	3.7	14.6	0.2	2.1	10.1	4.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.8	55.1	0.0	79.7	72.1	0.0	79.6	25.0	16.3	76.8	23.3	20.1
LnGrp LOS	E	E		E	E		E	C	B	E	C	C
Approach Vol, veh/h		686			406			1314			1141	
Approach Delay, s/veh		65.9			72.5			31.9			27.4	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	96.9	11.7	41.5	17.0	94.8	25.8	27.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	60.0	29.0	45.0	14.0	57.0	36.0	38.0
Max Q Clear Time (g_c+I1), s	6.6	36.2	4.2	14.3	9.9	25.7	19.6	19.2
Green Ext Time (p_c), s	0.1	8.8	0.0	2.2	0.2	7.5	1.2	2.5

Intersection Summary	
HCM 7th Control Delay, s/veh	41.7
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	431	19	200	364	74	2	18	199	35	17	11
Future Volume (veh/h)	11	431	19	200	364	74	2	18	199	35	17	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	12	468	18	217	396	66	2	20	5	38	18	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	28	899	35	289	1233	204	58	60	51	103	108	0
Arrive On Green	0.02	0.26	0.26	0.16	0.40	0.40	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3488	134	1781	3051	504	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	12	238	248	217	229	233	2	20	5	38	18	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1845	1781	1777	1778	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.3	4.7	4.7	4.7	3.6	3.7	0.0	0.4	0.1	0.8	0.4	0.0
Cycle Q Clear(g_c), s	0.3	4.7	4.7	4.7	3.6	3.7	0.0	0.4	0.1	0.8	0.4	0.0
Prop In Lane	1.00		0.07	1.00		0.28	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	28	458	475	289	718	718	58	60	51	103	108	0
V/C Ratio(X)	0.43	0.52	0.52	0.75	0.32	0.32	0.03	0.33	0.10	0.37	0.17	0.00
Avail Cap(c_a), veh/h	393	2396	2489	830	2832	2834	830	871	738	1398	1468	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	19.9	13.0	13.0	16.3	8.3	8.3	19.1	19.3	19.2	18.5	18.3	0.0
Incr Delay (d2), s/veh	10.3	0.9	0.9	3.9	0.3	0.3	0.2	3.2	0.8	2.2	0.7	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.7	1.8	2.0	1.1	1.2	0.0	0.2	0.1	0.4	0.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.2	13.9	13.9	20.2	8.6	8.6	19.4	22.5	20.0	20.7	19.0	0.0
LnGrp LOS	C	B	B	C	A	A	B	C	B	C	B	
Approach Vol, veh/h		498			679			27			56	
Approach Delay, s/veh		14.3			12.3			21.8			20.2	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.6	15.5		7.3	5.6	21.5		6.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	6.7	6.7		2.8	2.3	5.7		2.4
Green Ext Time (p_c), s	0.5	3.4		0.2	0.0	3.3		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.6
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	302	11	105	252	32	16	17	126	36	16	7
Future Volume (veh/h)	19	302	11	105	252	32	16	17	126	36	16	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	328	10	114	274	27	17	18	5	39	17	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	47	758	23	171	933	91	82	86	73	114	120	0
Arrive On Green	0.03	0.22	0.22	0.10	0.29	0.29	0.05	0.05	0.05	0.06	0.06	0.00
Sat Flow, veh/h	1781	3520	107	1781	3269	320	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	21	165	173	114	148	153	17	18	5	39	17	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1850	1781	1777	1812	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	2.8	2.8	2.1	2.2	2.3	0.3	0.3	0.1	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.4	2.8	2.8	2.1	2.2	2.3	0.3	0.3	0.1	0.7	0.3	0.0
Prop In Lane	1.00		0.06	1.00		0.18	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	47	383	399	171	507	517	82	86	73	114	120	0
V/C Ratio(X)	0.45	0.43	0.43	0.67	0.29	0.30	0.21	0.21	0.07	0.34	0.14	0.00
Avail Cap(c_a), veh/h	515	1566	1631	875	1926	1964	1622	1703	1443	1622	1703	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	16.6	11.7	11.7	15.1	9.6	9.7	15.9	15.9	15.8	15.5	15.3	0.0
Incr Delay (d2), s/veh	6.5	0.8	0.7	4.4	0.3	0.3	1.2	1.2	0.4	1.7	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.0	1.0	0.9	0.7	0.8	0.1	0.1	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.1	12.5	12.5	19.5	10.0	10.0	17.1	17.1	16.2	17.2	15.8	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		359			415			40			56	
Approach Delay, s/veh		13.1			12.6			17.0			16.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.3	12.5		7.2	5.9	14.9		6.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	4.1	4.8		2.7	2.4	4.3		2.3
Green Ext Time (p_c), s	0.2	2.1		0.2	0.0	2.0		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.3
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	236	24	70	202	2	9	4	97	1	4	4
Future Volume (veh/h)	13	236	24	70	202	2	9	4	97	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	14	257	19	76	220	1	10	4	10	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	659	48	140	931	4	61	64	54	12	13	0
Arrive On Green	0.02	0.20	0.20	0.08	0.26	0.26	0.03	0.03	0.03	0.01	0.01	0.00
Sat Flow, veh/h	1781	3356	246	1781	3628	16	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	14	135	141	76	108	113	10	4	10	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1825	1781	1777	1867	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	1.9	2.0	1.2	1.4	1.4	0.2	0.1	0.2	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	1.9	2.0	1.2	1.4	1.4	0.2	0.1	0.2	0.0	0.1	0.0
Prop In Lane	1.00		0.14	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	33	349	358	140	456	479	61	64	54	12	13	0
V/C Ratio(X)	0.43	0.39	0.39	0.54	0.24	0.24	0.16	0.06	0.18	0.08	0.31	0.00
Avail Cap(c_a), veh/h	304	1518	1560	304	1518	1596	1827	1918	1623	1827	1918	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	14.2	10.2	10.2	13.0	8.6	8.6	13.7	13.7	13.7	14.4	14.5	0.0
Incr Delay (d2), s/veh	8.6	0.7	0.7	3.2	0.3	0.3	1.2	0.4	1.6	2.9	13.4	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.6	0.7	0.5	0.4	0.4	0.1	0.0	0.1	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.8	10.9	10.9	16.2	8.9	8.9	14.9	14.1	15.3	17.3	27.9	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		290			297			24			5	
Approach Delay, s/veh		11.5			10.7			15.0			25.8	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.3	10.7		5.2	5.5	12.5		6.0
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	3.2	4.0		2.1	2.2	3.4		2.2
Green Ext Time (p_c), s	0.0	1.6		0.0	0.0	1.2		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	11.4
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	224	16	16	189	13	18	2	22	18	2	12
Future Vol, veh/h	11	224	16	16	189	13	18	2	22	18	2	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	243	17	17	205	14	20	2	24	20	2	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	220	0	0	261	0	0	517	530	252	516	532	213
Stage 1	-	-	-	-	-	-	276	276	-	247	247	-
Stage 2	-	-	-	-	-	-	241	254	-	268	285	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1350	-	-	1304	-	-	469	454	786	470	453	828
Stage 1	-	-	-	-	-	-	730	682	-	757	702	-
Stage 2	-	-	-	-	-	-	762	697	-	737	676	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1350	-	-	1304	-	-	447	443	786	442	442	828
Mov Cap-2 Maneuver	-	-	-	-	-	-	447	443	-	442	442	-
Stage 1	-	-	-	-	-	-	723	675	-	749	691	-
Stage 2	-	-	-	-	-	-	736	686	-	705	669	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.34	0.57	11.77	12.19
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	577	1350	-	-	1304	-	-	535
HCM Lane V/C Ratio	0.079	0.009	-	-	0.013	-	-	0.065
HCM Control Delay (s/veh)	11.8	7.7	0	-	7.8	0	-	12.2
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	143	10	40	94	15	12	1	62	20	10	12
Future Vol, veh/h	11	143	10	40	94	15	12	1	62	20	10	12
Conflicting Peds, #/hr	0	0	3	3	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	155	11	43	102	16	13	1	67	22	11	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	118	0	0	169	0	0	382	393	164	377	391	110
Stage 1	-	-	-	-	-	-	188	188	-	197	197	-
Stage 2	-	-	-	-	-	-	195	205	-	180	193	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1470	-	-	1408	-	-	576	543	881	580	545	943
Stage 1	-	-	-	-	-	-	814	745	-	805	738	-
Stage 2	-	-	-	-	-	-	807	732	-	822	741	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1470	-	-	1404	-	-	532	519	878	512	521	943
Mov Cap-2 Maneuver	-	-	-	-	-	-	532	519	-	512	521	-
Stage 1	-	-	-	-	-	-	804	736	-	797	713	-
Stage 2	-	-	-	-	-	-	758	707	-	751	732	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.5	2.05	9.88	11.59
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	531	878	1470	-	-	1404	-	-	592
HCM Lane V/C Ratio	0.027	0.077	0.008	-	-	0.031	-	-	0.077
HCM Control Delay (s/veh)	12	9.4	7.5	0	-	7.6	0	-	11.6
HCM Lane LOS	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0.2	0	-	-	0.1	-	-	0.2

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	219	16	16	196	8	18	1	22	11	1	6
Future Vol, veh/h	5	219	16	16	196	8	18	1	22	11	1	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	238	17	17	213	9	20	1	24	12	1	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	222	0	0	255	0	0	506	514	247	502	518	217
Stage 1	-	-	-	-	-	-	258	258	-	252	252	-
Stage 2	-	-	-	-	-	-	248	257	-	249	266	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1347	-	-	1310	-	-	477	464	792	480	461	822
Stage 1	-	-	-	-	-	-	747	695	-	752	698	-
Stage 2	-	-	-	-	-	-	756	695	-	755	688	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1347	-	-	1310	-	-	463	455	792	455	452	822
Mov Cap-2 Maneuver	-	-	-	-	-	-	463	455	-	455	452	-
Stage 1	-	-	-	-	-	-	744	691	-	748	688	-
Stage 2	-	-	-	-	-	-	737	685	-	727	685	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.16	0.57	11.54	11.99
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	595	1347	-	-	1310	-	-	535
HCM Lane V/C Ratio	0.075	0.004	-	-	0.013	-	-	0.037
HCM Control Delay (s/veh)	11.5	7.7	0	-	7.8	0	-	12
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	118	11	15	74	15	12	0	20	20	9	12
Future Vol, veh/h	11	118	11	15	74	15	12	0	20	20	9	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	128	12	16	80	16	13	0	22	22	10	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	97	0	0	140	0	0	276	288	134	273	285	89
Stage 1	-	-	-	-	-	-	158	158	-	121	121	-
Stage 2	-	-	-	-	-	-	118	129	-	152	164	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1497	-	-	1443	-	-	676	622	915	679	624	970
Stage 1	-	-	-	-	-	-	844	767	-	883	795	-
Stage 2	-	-	-	-	-	-	887	789	-	850	762	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1497	-	-	1443	-	-	643	609	915	649	611	970
Mov Cap-2 Maneuver	-	-	-	-	-	-	643	609	-	649	611	-
Stage 1	-	-	-	-	-	-	837	760	-	875	786	-
Stage 2	-	-	-	-	-	-	853	780	-	823	756	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.58	1.09	9.77	10.43
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	790	1497	-	-	1443	-	-	708
HCM Lane V/C Ratio	0.044	0.008	-	-	0.011	-	-	0.063
HCM Control Delay (s/veh)	9.8	7.4	0	-	7.5	0	-	10.4
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.2

HCM 7th TWSC
12: Pawai Pl & Kaiwi St
10/27/2023

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	301	105	84	172	12	39	0	55	22	0	20
Future Vol, veh/h	20	301	105	84	172	12	39	0	55	22	0	20
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	327	114	91	187	13	42	0	60	24	0	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	202	0	0	444	0	0	801	815	387	749	866	196
Stage 1	-	-	-	-	-	-	431	431	-	378	378	-
Stage 2	-	-	-	-	-	-	371	385	-	371	488	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1370	-	-	1116	-	-	303	312	661	328	291	845
Stage 1	-	-	-	-	-	-	603	583	-	644	615	-
Stage 2	-	-	-	-	-	-	650	611	-	650	550	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1367	-	-	1113	-	-	265	280	659	269	262	842
Mov Cap-2 Maneuver	-	-	-	-	-	-	265	280	-	269	262	-
Stage 1	-	-	-	-	-	-	592	572	-	632	564	-
Stage 2	-	-	-	-	-	-	580	560	-	581	540	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.36	2.67	16.76	15.21
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	408	1367	-	-	1113	-	-	398
HCM Lane V/C Ratio	0.251	0.016	-	-	0.082	-	-	0.115
HCM Control Delay (s/veh)	16.8	7.7	-	-	8.5	-	-	15.2
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1	0	-	-	0.3	-	-	0.4

HCM 7th AWSC
13: Kuakini Hwy & Makala Blvd
10/27/2023

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	19	49	186	34	54	221
Future Vol, veh/h	19	49	186	34	54	221
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	53	202	37	59	240
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	8	10.2	9.6
HCM LOS	A	B	A

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	20%	0%	85%
Vol Thru, %	0%	28%	15%
Vol Right, %	80%	72%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	275	68	220
LT Vol	54	0	186
Through Vol	0	19	34
RT Vol	221	49	0
Lane Flow Rate	299	74	239
Geometry Grp	1	1	1
Degree of Util (X)	0.353	0.092	0.322
Departure Headway (Hd)	4.249	4.461	4.848
Convergence, Y/N	Yes	Yes	Yes
Cap	846	799	739
Service Time	2.277	2.51	2.891
HCM Lane V/C Ratio	0.353	0.093	0.323
HCM Control Delay, s/veh	9.6	8	10.2
HCM Lane LOS	A	A	B
HCM 95th-tile Q	1.6	0.3	1.4

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	96	2	291	136	4	237
Future Vol, veh/h	96	2	291	136	4	237
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	104	2	316	148	4	258

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	659	391	0	0	465	0
Stage 1	391	-	-	-	-	-
Stage 2	267	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	429	657	-	-	1096	-
Stage 1	683	-	-	-	-	-
Stage 2	778	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	426	657	-	-	1095	-
Mov Cap-2 Maneuver	426	-	-	-	-	-
Stage 1	683	-	-	-	-	-
Stage 2	773	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	16.14	0	0.14
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	429	1095	-
HCM Lane V/C Ratio	-	-	0.248	0.004	-
HCM Control Delay (s/veh)	-	-	16.1	8.3	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	35	29	194	22	16	43	392	335	0	303	27
Future Volume (veh/h)	12	35	29	194	22	16	43	392	335	0	303	27
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	13	38	8	211	24	12	47	426	163	0	329	24
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	191	345	61	524	48	18	170	699	643	0	705	51
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.41	0.41	0.41	0.00	0.41	0.41
Sat Flow, veh/h	171	1359	240	1180	188	70	90	1706	1570	0	1721	126
Grp Volume(v), veh/h	59	0	0	247	0	0	473	0	163	0	0	353
Grp Sat Flow(s),veh/h/ln	1771	0	0	1438	0	0	1796	0	1570	0	0	1846
Q Serve(g_s), s	0.0	0.0	0.0	3.8	0.0	0.0	0.2	0.0	2.0	0.0	0.0	4.1
Cycle Q Clear(g_c), s	0.7	0.0	0.0	4.5	0.0	0.0	6.0	0.0	2.0	0.0	0.0	4.1
Prop In Lane	0.22		0.14	0.85		0.05	0.10		1.00	0.00		0.07
Lane Grp Cap(c), veh/h	597	0	0	589	0	0	869	0	643	0	0	756
V/C Ratio(X)	0.10	0.00	0.00	0.42	0.00	0.00	0.54	0.00	0.25	0.00	0.00	0.47
Avail Cap(c_a), veh/h	1419	0	0	1270	0	0	1789	0	1479	0	0	1740
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	8.5	0.0	0.0	9.9	0.0	0.0	6.9	0.0	5.8	0.0	0.0	6.4
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.2	0.0	0.0	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	1.1	0.0	0.0	1.5	0.0	0.4	0.0	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	8.6	0.0	0.0	10.3	0.0	0.0	7.5	0.0	6.0	0.0	0.0	6.9
LnGrp LOS	A			B			A		A			A
Approach Vol, veh/h		59			247			636			353	
Approach Delay, s/veh		8.6			10.3			7.1			6.9	
Approach LOS		A			B			A			A	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		17.2		12.5		17.2		12.5				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		28.0		22.0		28.0		22.0				
Max Q Clear Time (g_c+I1), s		8.0		2.7		6.1		6.5				
Green Ext Time (p_c), s		3.8		0.2		2.2		1.3				

Intersection Summary		
HCM 7th Control Delay, s/veh		7.7
HCM 7th LOS		A

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	205	46	217	237	251	76	455	287	158	260	126
Future Volume (veh/h)	156	205	46	217	237	251	76	455	287	158	260	126
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.95	0.98		0.95	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	170	223	42	236	258	40	83	495	0	172	283	124
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	298	278	52	298	378	306	382	745		346	523	229
Arrive On Green	0.10	0.20	0.20	0.12	0.22	0.22	0.04	0.44	0.00	0.07	0.47	0.47
Sat Flow, veh/h	1603	1364	257	1603	1683	1360	1603	1683	1427	1603	1104	484
Grp Volume(v), veh/h	170	0	265	236	258	40	83	495	0	172	0	407
Grp Sat Flow(s),veh/h/ln	1603	0	1621	1603	1683	1360	1603	1683	1427	1603	0	1588
Q Serve(g_s), s	10.3	0.0	19.4	14.6	17.5	2.9	3.5	29.0	0.0	7.2	0.0	22.7
Cycle Q Clear(g_c), s	10.3	0.0	19.4	14.6	17.5	2.9	3.5	29.0	0.0	7.2	0.0	22.7
Prop In Lane	1.00		0.16	1.00		1.00	1.00		1.00	1.00		0.30
Lane Grp Cap(c), veh/h	298	0	331	298	378	306	382	745		346	0	753
V/C Ratio(X)	0.57	0.00	0.80	0.79	0.68	0.13	0.22	0.66		0.50	0.00	0.54
Avail Cap(c_a), veh/h	331	0	454	298	471	381	443	745		356	0	753
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.74	0.74	0.74	1.00	1.00	0.00	0.92	0.00	0.92
Uniform Delay (d), s/veh	35.0	0.0	47.3	35.5	44.4	38.7	19.1	27.5	0.0	20.5	0.0	23.3
Incr Delay (d2), s/veh	1.9	0.0	7.1	10.4	2.2	0.1	0.3	4.6	0.0	1.0	0.0	2.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.2	0.0	8.6	6.6	7.6	1.0	1.4	12.7	0.0	2.8	0.0	9.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	36.9	0.0	54.4	45.9	46.5	38.8	19.3	32.2	0.0	21.5	0.0	25.8
LnGrp LOS	D		D	D	D	D	B	C		C		C
Approach Vol, veh/h		435			534			578			579	
Approach Delay, s/veh		47.6			45.7			30.3			24.5	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.2	60.3	20.0	30.5	10.3	64.2	17.4	33.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	45.0	15.0	35.0	10.0	45.0	15.0	35.0
Max Q Clear Time (g_c+I1), s	9.2	31.0	16.6	21.4	5.5	24.7	12.3	19.5
Green Ext Time (p_c), s	0.0	2.8	0.0	1.3	0.1	2.7	0.1	1.5

Intersection Summary	
HCM 7th Control Delay, s/veh	36.1
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	673	46	389	34	49	53	395	991	16	30	1564	591
Future Volume (veh/h)	673	46	389	34	49	53	395	991	16	30	1564	591
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	732	50	0	37	53	0	429	1077	8	33	1700	252
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	801	434		106	112		486	2002	893	42	1587	708
Arrive On Green	0.23	0.23	0.00	0.06	0.06	0.00	0.14	0.56	0.56	0.02	0.45	0.45
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	3554	1585
Grp Volume(v), veh/h	732	50	0	37	53	0	429	1077	8	33	1700	252
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1777	1585
Q Serve(g_s), s	34.1	3.5	0.0	3.3	4.5	0.0	20.1	31.3	0.4	3.0	73.7	17.3
Cycle Q Clear(g_c), s	34.1	3.5	0.0	3.3	4.5	0.0	20.1	31.3	0.4	3.0	73.7	17.3
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	801	434		106	112		486	2002	893	42	1587	708
V/C Ratio(X)	0.91	0.12		0.35	0.48		0.88	0.54	0.01	0.78	1.07	0.36
Avail Cap(c_a), veh/h	922	499		119	125		670	2002	893	76	1587	708
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.65	0.65	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.8	50.0	0.0	74.5	75.1	0.0	69.5	22.6	15.8	80.1	45.7	30.1
Incr Delay (d2), s/veh	8.6	0.1	0.0	1.9	3.1	0.0	10.1	1.0	0.0	25.5	44.4	1.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.1	1.7	0.0	1.6	2.3	0.0	9.6	13.3	0.1	1.7	41.7	6.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	70.3	50.1	0.0	76.4	78.2	0.0	79.7	23.6	15.8	105.5	90.1	31.5
LnGrp LOS	E	D		E	E		E	C	B	F	F	C
Approach Vol, veh/h		782			90			1514			1985	
Approach Delay, s/veh		69.0			77.5			39.5			82.9	
Approach LOS		E			E			D			F	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.9	98.0		14.8	28.2	78.7		43.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	7.0	83.0		11.0	32.0	58.0		44.0
Max Q Clear Time (g_c+I1), s	5.0	33.3		6.5	22.1	75.7		36.1
Green Ext Time (p_c), s	0.0	10.0		0.1	1.1	0.0		2.1

Intersection Summary	
HCM 7th Control Delay, s/veh	65.3
HCM 7th LOS	E

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑	↱	↰	↑↑↱		↰↰	↑↑	↱	↰↰	↑↑	↱
Traffic Volume (veh/h)	367	415	136	30	423	131	160	1006	25	213	1312	662
Future Volume (veh/h)	367	415	136	30	423	131	160	1006	25	213	1312	662
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	399	451	0	33	460	0	174	1093	10	232	1426	495
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	461	870		84	565		251	1697	757	377	1826	814
Arrive On Green	0.13	0.24	0.00	0.05	0.16	0.00	0.07	0.48	0.48	0.11	0.51	0.51
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	399	451	0	33	460	0	174	1093	10	232	1426	495
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	18.7	18.1	0.0	3.0	20.6	0.0	8.1	38.3	0.5	10.6	53.8	36.5
Cycle Q Clear(g_c), s	18.7	18.1	0.0	3.0	20.6	0.0	8.1	38.3	0.5	10.6	53.8	36.5
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	461	870		84	565		251	1697	757	377	1826	814
V/C Ratio(X)	0.87	0.52		0.39	0.81		0.69	0.64	0.01	0.62	0.78	0.61
Avail Cap(c_a), veh/h	775	969		324	818		335	1697	757	440	1826	814
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.67	0.67	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	70.1	53.9	0.0	76.3	67.0	0.0	74.7	32.5	22.7	70.2	32.6	28.4
Incr Delay (d2), s/veh	3.8	0.3	0.0	2.9	4.2	0.0	3.9	1.9	0.0	2.0	3.4	3.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.6	8.3	0.0	1.4	9.8	0.0	3.7	16.9	0.2	4.8	23.7	14.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	73.9	54.2	0.0	79.2	71.2	0.0	78.6	34.4	22.7	72.2	36.0	31.7
LnGrp LOS	E	D		E	E		E	C	C	E	D	C
Approach Vol, veh/h		850			493			1277			2153	
Approach Delay, s/veh		63.4			71.8			40.3			38.9	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	83.8	12.8	45.4	17.0	89.8	27.0	31.2
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	49.0	30.0	45.0	16.0	54.0	37.0	38.0
Max Q Clear Time (g_c+I1), s	12.6	40.3	5.0	20.1	10.1	55.8	20.7	22.6
Green Ext Time (p_c), s	0.5	4.7	0.1	3.3	0.3	0.0	1.3	2.8

Intersection Summary	
HCM 7th Control Delay, s/veh	47.0
HCM 7th LOS	D

Notes
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑		↰	↑↑↱		↰	↑	↱	↰	↑↱	
Traffic Volume (veh/h)	19	694	25	209	664	161	11	13	290	136	23	23
Future Volume (veh/h)	19	694	25	209	664	161	11	13	290	136	23	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	754	25	227	722	161	12	14	3	148	25	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	44	1158	38	288	1348	300	58	61	51	209	201	16
Arrive On Green	0.02	0.33	0.33	0.16	0.47	0.47	0.03	0.03	0.03	0.12	0.12	0.12
Sat Flow, veh/h	1781	3510	116	1781	2887	644	1781	1870	1585	1781	1709	137
Grp Volume(v), veh/h	21	382	397	227	444	439	12	14	3	148	0	27
Grp Sat Flow(s),veh/h/ln	1781	1777	1849	1781	1777	1754	1781	1870	1585	1781	0	1846
Q Serve(g_s), s	0.6	10.2	10.2	6.8	9.9	9.9	0.4	0.4	0.1	4.5	0.0	0.7
Cycle Q Clear(g_c), s	0.6	10.2	10.2	6.8	9.9	9.9	0.4	0.4	0.1	4.5	0.0	0.7
Prop In Lane	1.00		0.06	1.00		0.37	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	44	586	610	288	830	819	58	61	51	209	0	217
V/C Ratio(X)	0.47	0.65	0.65	0.79	0.54	0.54	0.21	0.23	0.06	0.71	0.00	0.12
Avail Cap(c_a), veh/h	287	1751	1823	607	2070	2043	607	637	540	1022	0	1059
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	26.8	15.9	15.9	22.5	10.6	10.6	26.3	26.3	26.2	23.7	0.0	22.1
Incr Delay (d2), s/veh	7.6	1.2	1.2	4.8	0.5	0.5	1.8	1.9	0.5	4.4	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	4.0	4.1	3.1	3.4	3.4	0.2	0.2	0.0	2.0	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	34.5	17.2	17.1	27.3	11.1	11.1	28.0	28.2	26.6	28.1	0.0	22.3
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		800			1110			29			175	
Approach Delay, s/veh		17.6			14.4			28.0			27.2	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	14.0	23.4		11.5	6.4	31.0		6.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	8.8	12.2		6.5	2.6	11.9		2.4
Green Ext Time (p_c), s	0.5	6.1		0.6	0.0	7.6		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	16.9
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	63	447	17	124	538	35	17	29	218	79	37	55
Future Volume (veh/h)	63	447	17	124	538	35	17	29	218	79	37	55
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	68	486	16	135	585	35	18	32	9	86	40	10
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	115	902	30	180	1000	60	104	109	93	224	181	45
Arrive On Green	0.06	0.26	0.26	0.10	0.29	0.29	0.06	0.06	0.06	0.13	0.13	0.13
Sat Flow, veh/h	1781	3511	115	1781	3407	204	1781	1870	1585	1781	1437	359
Grp Volume(v), veh/h	68	246	256	135	305	315	18	32	9	86	0	50
Grp Sat Flow(s),veh/h/ln	1781	1777	1850	1781	1777	1833	1781	1870	1585	1781	0	1796
Q Serve(g_s), s	1.6	5.2	5.2	3.2	6.4	6.4	0.4	0.7	0.2	1.9	0.0	1.1
Cycle Q Clear(g_c), s	1.6	5.2	5.2	3.2	6.4	6.4	0.4	0.7	0.2	1.9	0.0	1.1
Prop In Lane	1.00		0.06	1.00		0.11	1.00		1.00	1.00		0.20
Lane Grp Cap(c), veh/h	115	457	475	180	522	538	104	109	93	224	0	226
V/C Ratio(X)	0.59	0.54	0.54	0.75	0.58	0.59	0.17	0.29	0.10	0.38	0.00	0.22
Avail Cap(c_a), veh/h	408	1240	1291	693	1525	1573	1284	1348	1143	1284	0	1295
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.9	14.0	14.0	19.1	13.2	13.2	19.6	19.7	19.5	17.5	0.0	17.2
Incr Delay (d2), s/veh	4.8	1.0	1.0	6.2	1.0	1.0	0.8	1.5	0.5	1.1	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	1.9	2.0	1.5	2.3	2.4	0.2	0.3	0.1	0.8	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	24.7	15.0	15.0	25.3	14.2	14.2	20.3	21.2	19.9	18.6	0.0	17.7
LnGrp LOS	C	B	B	C	B	B	C	C	B	B		B
Approach Vol, veh/h		570			755			59			136	
Approach Delay, s/veh		16.1			16.2			20.7			18.3	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	16.2		10.5	7.8	17.8		7.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	5.2	7.2		3.9	3.6	8.4		2.7
Green Ext Time (p_c), s	0.3	3.2		0.5	0.1	4.4		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	16.5
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	370	34	153	462	4	24	11	149	6	2	6
Future Volume (veh/h)	9	370	34	153	462	4	24	11	149	6	2	6
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	10	402	32	166	502	3	26	12	15	7	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	24	806	64	211	1257	8	108	114	96	65	69	0
Arrive On Green	0.01	0.24	0.24	0.12	0.35	0.35	0.06	0.06	0.06	0.04	0.04	0.00
Sat Flow, veh/h	1781	3331	264	1781	3622	22	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	10	214	220	166	246	259	26	12	15	7	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1818	1781	1777	1866	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	3.8	3.9	3.3	3.9	3.9	0.5	0.2	0.3	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.2	3.8	3.9	3.3	3.9	3.9	0.5	0.2	0.3	0.1	0.0	0.0
Prop In Lane	1.00		0.15	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	24	430	440	211	617	648	108	114	96	65	69	0
V/C Ratio(X)	0.43	0.50	0.50	0.79	0.40	0.40	0.24	0.11	0.16	0.11	0.03	0.00
Avail Cap(c_a), veh/h	241	1204	1232	241	1204	1265	1449	1521	1286	1449	1521	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	18.1	12.0	12.1	15.8	9.1	9.1	16.5	16.4	16.4	17.2	17.1	0.0
Incr Delay (d2), s/veh	11.7	0.9	0.9	14.0	0.4	0.4	1.1	0.4	0.7	0.7	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.3	1.4	2.0	1.2	1.3	0.2	0.1	0.1	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.8	12.9	12.9	29.8	9.5	9.5	17.6	16.8	17.2	17.9	17.3	0.0
LnGrp LOS	C	B	B	C	A	A	B	B	B	B	B	
Approach Vol, veh/h		444			671			53			9	
Approach Delay, s/veh		13.3			14.6			17.3			17.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	13.9		6.4	5.5	17.8		7.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	5.3	5.9		2.1	2.2	5.9		2.5
Green Ext Time (p_c), s	0.0	2.6		0.0	0.0	3.0		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	14.2
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	330	32	47	403	41	25	31	44	39	31	16
Future Vol, veh/h	21	330	32	47	403	41	25	31	44	39	31	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	359	35	51	438	45	27	34	48	42	34	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	483	0	0	393	0	0	979	1007	376	984	1002	460
Stage 1	-	-	-	-	-	-	422	422	-	562	562	-
Stage 2	-	-	-	-	-	-	557	585	-	421	439	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1080	-	-	1165	-	-	229	241	670	228	243	601
Stage 1	-	-	-	-	-	-	610	588	-	511	509	-
Stage 2	-	-	-	-	-	-	515	498	-	610	578	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1080	-	-	1165	-	-	175	220	670	166	222	601
Mov Cap-2 Maneuver	-	-	-	-	-	-	175	220	-	166	222	-
Stage 1	-	-	-	-	-	-	593	572	-	497	479	-
Stage 2	-	-	-	-	-	-	437	468	-	519	562	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.46	0.79	25.07	34.22
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	286	1080	-	-	1165	-	-	214
HCM Lane V/C Ratio	0.38	0.021	-	-	0.044	-	-	0.436
HCM Control Delay (s/veh)	25.1	8.4	0	-	8.2	0	-	34.2
HCM Lane LOS	D	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	1.7	0.1	-	-	0.1	-	-	2

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	199	19	70	163	29	16	8	115	26	20	22
Future Vol, veh/h	27	199	19	70	163	29	16	8	115	26	20	22
Conflicting Peds, #/hr	0	0	1	1	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	29	216	21	76	177	32	17	9	125	28	22	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	209	0	0	238	0	0	627	647	228	624	642	193
Stage 1	-	-	-	-	-	-	286	286	-	345	345	-
Stage 2	-	-	-	-	-	-	340	361	-	279	297	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1362	-	-	1329	-	-	396	390	812	398	392	849
Stage 1	-	-	-	-	-	-	721	675	-	670	636	-
Stage 2	-	-	-	-	-	-	675	626	-	727	668	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1362	-	-	1328	-	-	331	355	811	300	357	849
Mov Cap-2 Maneuver	-	-	-	-	-	-	331	355	-	300	357	-
Stage 1	-	-	-	-	-	-	702	657	-	654	595	-
Stage 2	-	-	-	-	-	-	590	585	-	592	651	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.85	2.1	11.33	15.92
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	339	811	1362	-	-	1328	-	-	403
HCM Lane V/C Ratio	0.077	0.154	0.022	-	-	0.057	-	-	0.183
HCM Control Delay (s/veh)	16.5	10.2	7.7	0	-	7.9	0	-	15.9
HCM Lane LOS	C	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.2	0.5	0.1	-	-	0.2	-	-	0.7

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	325	32	46	383	16	25	20	43	15	20	8
Future Vol, veh/h	11	325	32	46	383	16	25	20	43	15	20	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	353	35	50	416	17	27	22	47	16	22	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	434	0	0	388	0	0	922	928	371	913	937	425
Stage 1	-	-	-	-	-	-	395	395	-	525	525	-
Stage 2	-	-	-	-	-	-	527	534	-	388	412	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1126	-	-	1170	-	-	251	268	675	254	265	629
Stage 1	-	-	-	-	-	-	631	605	-	536	529	-
Stage 2	-	-	-	-	-	-	534	525	-	636	594	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1126	-	-	1170	-	-	211	249	675	202	246	629
Mov Cap-2 Maneuver	-	-	-	-	-	-	211	249	-	202	246	-
Stage 1	-	-	-	-	-	-	622	597	-	529	499	-
Stage 2	-	-	-	-	-	-	476	495	-	562	586	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.25	0.85	19.96	22.19
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	335	1126	-	-	1170	-	-	256
HCM Lane V/C Ratio	0.285	0.011	-	-	0.043	-	-	0.183
HCM Control Delay (s/veh)	20	8.2	0	-	8.2	0	-	22.2
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	1.2	0	-	-	0.1	-	-	0.7

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	194	27	29	142	29	22	5	26	26	17	22
Future Vol, veh/h	27	194	27	29	142	29	22	5	26	26	17	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	29	211	29	32	154	32	24	5	28	28	18	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	186	0	0	240	0	0	511	533	226	505	532	170
Stage 1	-	-	-	-	-	-	284	284	-	233	233	-
Stage 2	-	-	-	-	-	-	227	249	-	272	299	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1389	-	-	1326	-	-	473	453	814	477	453	874
Stage 1	-	-	-	-	-	-	723	676	-	770	712	-
Stage 2	-	-	-	-	-	-	776	701	-	734	666	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1389	-	-	1326	-	-	419	430	814	432	430	874
Mov Cap-2 Maneuver	-	-	-	-	-	-	419	430	-	432	430	-
Stage 1	-	-	-	-	-	-	705	660	-	751	693	-
Stage 2	-	-	-	-	-	-	715	682	-	685	650	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.83	1.13	12.28	13
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	552	1389	-	-	1326	-	-	521
HCM Lane V/C Ratio	0.104	0.021	-	-	0.024	-	-	0.136
HCM Control Delay (s/veh)	12.3	7.6	0	-	7.8	0	-	13
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0.1	-	-	0.5

Intersection	
Int Delay, s/veh	12.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	384	110	99	263	15	91	0	109	28	1	35
Future Vol, veh/h	40	384	110	99	263	15	91	0	109	28	1	35
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	417	120	108	286	16	99	0	118	30	1	38

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	308	0	0	540	0	0	1073	1091	481	1021	1142	304
Stage 1	-	-	-	-	-	-	567	567	-	515	515	-
Stage 2	-	-	-	-	-	-	506	523	-	505	627	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1252	-	-	1029	-	-	198	215	585	215	200	736
Stage 1	-	-	-	-	-	-	508	507	-	542	535	-
Stage 2	-	-	-	-	-	-	549	530	-	549	476	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1245	-	-	1026	-	-	160	184	583	147	172	729
Mov Cap-2 Maneuver	-	-	-	-	-	-	160	184	-	147	172	-
Stage 1	-	-	-	-	-	-	489	488	-	521	476	-
Stage 2	-	-	-	-	-	-	463	472	-	422	458	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.6	2.34	59.88	23.66
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	265	1245	-	-	1026	-	-	262
HCM Lane V/C Ratio	0.821	0.035	-	-	0.105	-	-	0.266
HCM Control Delay (s/veh)	59.9	8	-	-	8.9	-	-	23.7
HCM Lane LOS	F	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	6.5	0.1	-	-	0.4	-	-	1

Intersection	
Intersection Delay, s/veh	16.4
Intersection LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	37	64	354	62	62	331
Future Vol, veh/h	37	64	354	62	62	331
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	40	70	385	67	67	360
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	9.5	19.3	15.1
HCM LOS	A	C	C

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	16%	0%	85%
Vol Thru, %	0%	37%	15%
Vol Right, %	84%	63%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	393	101	416
LT Vol	62	0	354
Through Vol	0	37	62
RT Vol	331	64	0
Lane Flow Rate	427	110	452
Geometry Grp	1	1	1
Degree of Util (X)	0.592	0.165	0.681
Departure Headway (Hd)	4.991	5.408	5.424
Convergence, Y/N	Yes	Yes	Yes
Cap	722	662	665
Service Time	3.03	3.454	3.454
HCM Lane V/C Ratio	0.591	0.166	0.68
HCM Control Delay, s/veh	15.1	9.5	19.3
HCM Lane LOS	C	A	C
HCM 95th-tile Q	3.9	0.6	5.3

HCM 7th TWSC
14: Kuakini Hwy & Loloku St
10/27/2023

Intersection	
Int Delay, s/veh	6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	148	38	383	238	9	390
Future Vol, veh/h	148	38	383	238	9	390
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	161	41	416	259	10	424

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	989	546	0	0	675	0
Stage 1	546	-	-	-	-	-
Stage 2	443	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	274	538	-	-	916	-
Stage 1	581	-	-	-	-	-
Stage 2	647	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	270	538	-	-	916	-
Mov Cap-2 Maneuver	270	-	-	-	-	-
Stage 1	581	-	-	-	-	-
Stage 2	638	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	38.53	0	0.2
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	300	916	-
HCM Lane V/C Ratio	-	-	0.673	0.011	-
HCM Control Delay (s/veh)	-	-	38.5	9	0
HCM Lane LOS	-	-	E	A	A
HCM 95th %tile Q(veh)	-	-	4.5	0	-

HCM 7th Signalized Intersection Summary
15: Kuakini Hwy & Kaiwi St
10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	44	48	313	25	45	50	571	461	25	486	32
Future Volume (veh/h)	30	44	48	313	25	45	50	571	461	25	486	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	0.99		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	48	16	340	27	40	54	621	217	27	528	31
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	250	336	96	534	32	47	116	775	723	87	645	37
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.46	0.46	0.46	0.46	0.46	0.46
Sat Flow, veh/h	450	999	286	1190	94	140	81	1683	1570	23	1400	79
Grp Volume(v), veh/h	97	0	0	407	0	0	675	0	217	586	0	0
Grp Sat Flow(s),veh/h/ln	1736	0	0	1424	0	0	1764	0	1570	1502	0	0
Q Serve(g_s), s	0.0	0.0	0.0	11.0	0.0	0.0	0.0	0.0	4.3	2.0	0.0	0.0
Cycle Q Clear(g_c), s	1.8	0.0	0.0	12.9	0.0	0.0	16.0	0.0	4.3	18.0	0.0	0.0
Prop In Lane	0.34		0.16	0.84		0.10	0.08		1.00	0.05		0.05
Lane Grp Cap(c), veh/h	682	0	0	613	0	0	891	0	723	768	0	0
V/C Ratio(X)	0.14	0.00	0.00	0.66	0.00	0.00	0.76	0.00	0.30	0.76	0.00	0.00
Avail Cap(c_a), veh/h	860	0	0	767	0	0	1078	0	895	955	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	11.4	0.0	0.0	14.9	0.0	0.0	11.3	0.0	8.3	10.7	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.5	0.0	0.0	2.5	0.0	0.2	2.9	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	3.9	0.0	0.0	5.6	0.0	1.2	4.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	11.5	0.0	0.0	16.4	0.0	0.0	13.9	0.0	8.5	13.6	0.0	0.0
LnGrp LOS	B			B			B		A	B		
Approach Vol, veh/h		97			407			892			586	
Approach Delay, s/veh		11.5			16.4			12.6			13.6	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	27.6	21.5	27.6	21.5
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	28.0	22.0	28.0	22.0
Max Q Clear Time (g_c+I1), s	18.0	3.8	20.0	14.9
Green Ext Time (p_c), s	4.1	0.4	2.6	1.6

Intersection Summary	
HCM 7th Control Delay, s/veh	13.6
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	188	208	40	351	360	388	86	508	284	188	474	187
Future Volume (veh/h)	188	208	40	351	360	388	86	508	284	188	474	187
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.85	0.97		0.90	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	204	226	38	382	391	202	93	552	0	204	515	193
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	270	262	44	402	487	371	125	674		243	490	184
Arrive On Green	0.10	0.19	0.19	0.20	0.29	0.29	0.05	0.40	0.00	0.07	0.42	0.42
Sat Flow, veh/h	1603	1364	229	1603	1683	1283	1603	1683	1427	1603	1161	435
Grp Volume(v), veh/h	204	0	264	382	391	202	93	552	0	204	0	708
Grp Sat Flow(s),veh/h/ln	1603	0	1594	1603	1683	1283	1603	1683	1427	1603	0	1596
Q Serve(g_s), s	14.9	0.0	23.3	26.9	31.2	19.3	4.9	42.4	0.0	10.0	0.0	61.2
Cycle Q Clear(g_c), s	14.9	0.0	23.3	26.9	31.2	19.3	4.9	42.4	0.0	10.0	0.0	61.2
Prop In Lane	1.00		0.14	1.00		1.00	1.00		1.00	1.00		0.27
Lane Grp Cap(c), veh/h	270	0	306	402	487	371	125	674		243	0	674
V/C Ratio(X)	0.76	0.00	0.86	0.95	0.80	0.54	0.74	0.82		0.84	0.00	1.05
Avail Cap(c_a), veh/h	270	0	385	412	580	443	160	674		243	0	674
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.50	0.50	0.50	1.00	1.00	0.00	0.51	0.00	0.51
Uniform Delay (d), s/veh	42.6	0.0	56.7	36.4	47.7	43.5	35.1	38.8	0.0	35.0	0.0	41.9
Incr Delay (d2), s/veh	11.5	0.0	15.1	20.0	3.5	0.6	12.9	10.7	0.0	12.6	0.0	39.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.9	0.0	10.7	12.9	13.7	6.3	2.4	19.6	0.0	5.2	0.0	31.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	54.1	0.0	71.8	56.5	51.3	44.1	48.0	49.4	0.0	47.6	0.0	81.0
LnGrp LOS	D		E	E	D	D	D	D		D		F
Approach Vol, veh/h		468			975			645			912	
Approach Delay, s/veh		64.1			51.8			49.2			73.5	
Approach LOS		E			D			D			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	63.1	34.1	32.8	11.8	66.2	20.0	46.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	30.0	35.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	12.0	44.4	28.9	25.3	6.9	63.2	16.9	33.2
Green Ext Time (p_c), s	0.0	1.8	0.2	1.1	0.1	0.0	0.0	3.1

Intersection Summary	
HCM 7th Control Delay, s/veh	59.8
HCM 7th LOS	E

Notes
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	659	55	415	27	59	47	440	957	17	41	1225	614
Future Volume (veh/h)	659	55	415	27	59	47	440	957	17	41	1225	614
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	716	60	0	29	64	0	478	1040	8	45	1332	219
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	837	453		88	92		554	1856	827	58	1403	624
Arrive On Green	0.24	0.24	0.00	0.05	0.05	0.00	0.16	0.52	0.52	0.03	0.39	0.39
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	3554	1581
Grp Volume(v), veh/h	716	60	0	29	64	0	478	1040	8	45	1332	219
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1777	1581
Q Serve(g_s), s	25.8	3.3	0.0	2.0	4.4	0.0	17.6	25.7	0.3	3.3	47.3	12.7
Cycle Q Clear(g_c), s	25.8	3.3	0.0	2.0	4.4	0.0	17.6	25.7	0.3	3.3	47.3	12.7
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	837	453		88	92		554	1856	827	58	1403	624
V/C Ratio(X)	0.86	0.13		0.33	0.69		0.86	0.56	0.01	0.78	0.95	0.35
Avail Cap(c_a), veh/h	1114	603		287	302		796	2019	899	109	1418	631
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.2	38.7	0.0	59.8	60.9	0.0	53.3	21.0	14.9	62.5	38.2	27.7
Incr Delay (d2), s/veh	5.2	0.1	0.0	2.2	8.9	0.0	6.9	0.3	0.0	19.4	13.7	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.8	1.6	0.0	1.0	2.3	0.0	8.1	10.5	0.1	1.8	22.7	4.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	52.4	38.8	0.0	62.0	69.9	0.0	60.2	21.3	14.9	82.0	51.8	28.0
LnGrp LOS	D	D		E	E		E	C	B	F	D	C
Approach Vol, veh/h		776			93			1526			1596	
Approach Delay, s/veh		51.3			67.4			33.5			49.4	
Approach LOS		D			E			C			D	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	9.2	73.1	11.4	25.9	56.4	36.5
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	8.0	74.0	21.0	30.0	52.0	42.0
Max Q Clear Time (g_c+I1), s	5.3	27.7	6.4	19.6	49.3	27.8
Green Ext Time (p_c), s	0.0	9.4	0.3	1.3	2.1	2.8

Intersection Summary	
HCM 7th Control Delay, s/veh	44.1
HCM 7th LOS	D

Notes
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	333	401	146	20	417	114	191	1001	30	151	1124	518
Future Volume (veh/h)	333	401	146	20	417	114	191	1001	30	151	1124	518
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	362	436	0	22	453	0	208	1088	12	164	1222	339
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	437	988		39	617		279	1561	696	232	1512	673
Arrive On Green	0.13	0.28	0.00	0.02	0.17	0.00	0.08	0.44	0.44	0.07	0.43	0.43
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1582
Grp Volume(v), veh/h	362	436	0	22	453	0	208	1088	12	164	1222	339
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1582
Q Serve(g_s), s	11.6	11.5	0.0	1.4	13.7	0.0	6.7	28.1	0.5	5.3	34.2	17.8
Cycle Q Clear(g_c), s	11.6	11.5	0.0	1.4	13.7	0.0	6.7	28.1	0.5	5.3	34.2	17.8
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	437	988		39	617		279	1561	696	232	1512	673
V/C Ratio(X)	0.83	0.44		0.56	0.73		0.75	0.70	0.02	0.71	0.81	0.50
Avail Cap(c_a), veh/h	623	1172		321	1172		623	2048	913	593	2017	898
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	48.4	33.8	0.0	55.0	44.5	0.0	51.1	25.8	18.0	51.9	28.6	23.9
Incr Delay (d2), s/veh	6.3	0.3	0.0	11.9	1.7	0.0	3.9	0.7	0.0	4.0	1.9	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	5.0	0.0	0.8	6.2	0.0	3.0	11.6	0.2	2.4	14.4	6.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	54.7	34.1	0.0	67.0	46.2	0.0	55.0	26.5	18.0	55.9	30.5	24.5
LnGrp LOS	D	C		E	D		E	C	B	E	C	C
Approach Vol, veh/h		798			475			1308			1725	
Approach Delay, s/veh		43.4			47.2			30.9			31.7	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.1	55.4	8.0	37.1	14.7	53.9	19.9	25.2
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	65.5	20.5	37.5	20.5	64.5	20.5	37.5
Max Q Clear Time (g_c+I1), s	7.3	30.1	3.4	13.5	8.7	36.2	13.6	15.7
Green Ext Time (p_c), s	0.4	9.5	0.0	3.1	0.5	12.1	0.8	3.2

Intersection Summary	
HCM 7th Control Delay, s/veh	35.3
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	782	24	210	712	204	9	56	192	132	40	30
Future Volume (veh/h)	30	782	24	210	712	204	9	56	192	132	40	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	850	25	228	774	205	10	61	4	143	43	10
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	62	1238	36	283	1319	349	103	108	92	206	170	40
Arrive On Green	0.03	0.35	0.35	0.16	0.48	0.48	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3524	104	1781	2774	735	1781	1870	1585	1781	1468	341
Grp Volume(v), veh/h	33	429	446	228	496	483	10	61	4	143	0	53
Grp Sat Flow(s),veh/h/ln	1781	1777	1851	1781	1777	1732	1781	1870	1585	1781	0	1809
Q Serve(g_s), s	1.2	13.1	13.1	7.8	12.8	12.8	0.3	2.0	0.2	4.9	0.0	1.7
Cycle Q Clear(g_c), s	1.2	13.1	13.1	7.8	12.8	12.8	0.3	2.0	0.2	4.9	0.0	1.7
Prop In Lane	1.00		0.06	1.00		0.42	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	62	624	650	283	845	824	103	108	92	206	0	210
V/C Ratio(X)	0.53	0.69	0.69	0.80	0.59	0.59	0.10	0.56	0.04	0.69	0.00	0.25
Avail Cap(c_a), veh/h	253	1544	1608	535	1825	1778	535	561	476	901	0	915
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.0	17.6	17.6	25.7	12.1	12.1	28.3	29.0	28.2	26.9	0.0	25.5
Incr Delay (d2), s/veh	6.9	1.4	1.3	5.3	0.7	0.7	0.4	4.5	0.2	4.1	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	5.2	5.4	3.6	4.7	4.5	0.2	1.0	0.1	2.2	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	37.0	18.9	18.9	31.0	12.7	12.7	28.7	33.6	28.4	31.0	0.0	26.1
LnGrp LOS	D	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		908			1207			75			196	
Approach Delay, s/veh		19.5			16.2			32.6			29.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	15.1	27.2		12.3	7.2	35.1		8.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	9.8	15.1		6.9	3.2	14.8		4.0
Green Ext Time (p_c), s	0.4	7.1		0.7	0.0	8.8		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	19.1
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	93	505	16	130	578	52	28	54	203	124	63	64
Future Volume (veh/h)	93	505	16	130	578	52	28	54	203	124	63	64
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	101	549	16	141	628	52	30	59	13	135	68	38
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	131	940	27	186	987	82	143	151	127	312	195	109
Arrive On Green	0.07	0.27	0.27	0.10	0.30	0.30	0.08	0.08	0.08	0.18	0.18	0.18
Sat Flow, veh/h	1781	3526	103	1781	3320	275	1781	1870	1575	1781	1114	622
Grp Volume(v), veh/h	101	276	289	141	336	344	30	59	13	135	0	106
Grp Sat Flow(s),veh/h/ln	1781	1777	1852	1781	1777	1818	1781	1870	1575	1781	0	1736
Q Serve(g_s), s	3.0	7.2	7.3	4.1	8.8	8.8	0.8	1.6	0.4	3.6	0.0	2.9
Cycle Q Clear(g_c), s	3.0	7.2	7.3	4.1	8.8	8.8	0.8	1.6	0.4	3.6	0.0	2.9
Prop In Lane	1.00		0.06	1.00		0.15	1.00		1.00	1.00		0.36
Lane Grp Cap(c), veh/h	131	474	493	186	528	541	143	151	127	312	0	304
V/C Ratio(X)	0.77	0.58	0.58	0.76	0.64	0.64	0.21	0.39	0.10	0.43	0.00	0.35
Avail Cap(c_a), veh/h	332	1011	1054	565	1244	1272	1047	1100	926	1047	0	1021
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.4	17.1	17.1	23.3	16.3	16.3	23.0	23.4	22.8	19.7	0.0	19.4
Incr Delay (d2), s/veh	9.1	1.1	1.1	6.2	1.3	1.3	0.7	1.7	0.4	0.9	0.0	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	2.9	3.0	2.0	3.4	3.5	0.4	0.7	0.2	1.5	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	33.5	18.2	18.2	29.5	17.6	17.6	23.8	25.0	23.2	20.7	0.0	20.1
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		666			821			102			241	
Approach Delay, s/veh		20.5			19.6			24.4			20.4	
Approach LOS		C			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.6	19.3		14.4	8.9	20.9		9.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	6.1	9.3		5.6	5.0	10.8		3.6
Green Ext Time (p_c), s	0.3	3.6		1.0	0.1	4.8		0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	20.3
HCM 7th LOS	C

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	423	52	167	493	7	27	5	178	8	6	12
Future Volume (veh/h)	22	423	52	167	493	7	27	5	178	8	6	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	24	460	50	182	536	8	29	5	8	9	7	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	53	789	85	243	1258	19	85	89	75	37	38	0
Arrive On Green	0.03	0.24	0.24	0.14	0.35	0.35	0.05	0.05	0.05	0.02	0.02	0.00
Sat Flow, veh/h	1781	3232	350	1781	3584	53	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	24	252	258	182	266	278	29	5	8	9	7	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1805	1781	1777	1860	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.5	4.5	4.6	3.6	4.1	4.1	0.6	0.1	0.2	0.2	0.1	0.0
Cycle Q Clear(g_c), s	0.5	4.5	4.6	3.6	4.1	4.1	0.6	0.1	0.2	0.2	0.1	0.0
Prop In Lane	1.00		0.19	1.00		0.03	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	53	434	441	243	624	653	85	89	75	37	38	0
V/C Ratio(X)	0.46	0.58	0.59	0.75	0.43	0.43	0.34	0.06	0.11	0.25	0.18	0.00
Avail Cap(c_a), veh/h	245	735	746	736	1224	1282	1473	1547	1311	1473	1547	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.3	12.1	12.1	15.1	9.0	9.0	16.7	16.5	16.5	17.5	17.5	0.0
Incr Delay (d2), s/veh	6.0	1.2	1.2	4.6	0.5	0.4	2.4	0.3	0.6	3.4	2.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.6	1.6	1.5	1.3	1.3	0.3	0.0	0.1	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.3	13.3	13.3	19.6	9.4	9.4	19.1	16.8	17.2	20.9	19.7	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	C	B	
Approach Vol, veh/h		534			726			42			16	
Approach Delay, s/veh		13.8			12.0			18.4			20.4	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	13.9		5.7	6.1	17.7		6.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	15.0	15.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	5.6	6.6		2.2	2.5	6.1		2.6
Green Ext Time (p_c), s	0.3	2.1		0.0	0.0	3.3		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.0
HCM 7th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Int Delay, s/veh	8.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	26	397	39	56	438	50	30	30	53	47	30	20
Future Vol, veh/h	26	397	39	56	438	50	30	30	53	47	30	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	28	432	42	61	476	54	33	33	58	51	33	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	530	0	0	474	0	0	1123	1161	453	1129	1155	503
Stage 1	-	-	-	-	-	-	509	509	-	625	625	-
Stage 2	-	-	-	-	-	-	614	652	-	504	530	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1037	-	-	1088	-	-	183	195	607	181	197	568
Stage 1	-	-	-	-	-	-	547	538	-	473	477	-
Stage 2	-	-	-	-	-	-	479	464	-	550	526	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1037	-	-	1088	-	-	129	173	607	120	174	568
Mov Cap-2 Maneuver	-	-	-	-	-	-	129	173	-	120	174	-
Stage 1	-	-	-	-	-	-	526	518	-	455	439	-
Stage 2	-	-	-	-	-	-	392	427	-	449	507	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.48	0.88	37.48	61.09
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	229	1037	-	-	1088	-	-	162
HCM Lane V/C Ratio	0.536	0.027	-	-	0.056	-	-	0.65
HCM Control Delay (s/veh)	37.5	8.6	0	-	8.5	0	-	61.1
HCM Lane LOS	E	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	2.9	0.1	-	-	0.2	-	-	3.7

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	233	29	48	175	35	16	8	82	32	22	27
Future Vol, veh/h	33	233	29	48	175	35	16	8	82	32	22	27
Conflicting Peds, #/hr	0	0	1	1	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	253	32	52	190	38	17	9	89	35	24	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	228	0	0	286	0	0	648	674	270	643	671	209
Stage 1	-	-	-	-	-	-	342	342	-	314	314	-
Stage 2	-	-	-	-	-	-	307	333	-	329	358	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1340	-	-	1276	-	-	383	376	769	386	378	831
Stage 1	-	-	-	-	-	-	673	638	-	697	657	-
Stage 2	-	-	-	-	-	-	703	644	-	684	628	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1340	-	-	1275	-	-	319	346	768	308	348	831
Mov Cap-2 Maneuver	-	-	-	-	-	-	319	346	-	308	348	-
Stage 1	-	-	-	-	-	-	651	617	-	675	626	-
Stage 2	-	-	-	-	-	-	622	614	-	577	607	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.87	1.48	11.8	16.32
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	328	768	1340	-	-	1275	-	-	406
HCM Lane V/C Ratio	0.08	0.116	0.027	-	-	0.041	-	-	0.217
HCM Control Delay (s/veh)	16.9	10.3	7.8	0	-	7.9	0	-	16.3
HCM Lane LOS	C	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0.4	0.1	-	-	0.1	-	-	0.8

Intersection												
Int Delay, s/veh	4.2											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	13	392	39	55	415	19	30	19	52	18	19	10
Future Vol, veh/h	13	392	39	55	415	19	30	19	52	18	19	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	426	42	60	451	21	33	21	57	20	21	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	472	0	0	468	0	0	1057	1067	447	1046	1078	461
Stage 1	-	-	-	-	-	-	476	476	-	581	581	-
Stage 2	-	-	-	-	-	-	581	591	-	465	497	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1090	-	-	1093	-	-	203	222	611	207	219	600
Stage 1	-	-	-	-	-	-	570	557	-	500	500	-
Stage 2	-	-	-	-	-	-	500	494	-	578	545	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1090	-	-	1093	-	-	164	202	611	154	199	600
Mov Cap-2 Maneuver	-	-	-	-	-	-	164	202	-	154	199	-
Stage 1	-	-	-	-	-	-	560	547	-	491	462	-
Stage 2	-	-	-	-	-	-	434	458	-	496	535	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.24	0.95	26.04	28.22
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	279	1090	-	-	1093	-	-	205
HCM Lane V/C Ratio	0.394	0.013	-	-	0.055	-	-	0.249
HCM Control Delay (s/veh)	26	8.3	0	-	8.5	0	-	28.2
HCM Lane LOS	D	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	1.8	0	-	-	0.2	-	-	0.9

Intersection												
Int Delay, s/veh	4											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	33	185	33	35	136	35	27	5	32	32	19	27
Future Vol, veh/h	33	185	33	35	136	35	27	5	32	32	19	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	201	36	38	148	38	29	5	35	35	21	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	186	0	0	237	0	0	525	553	219	518	552	167
Stage 1	-	-	-	-	-	-	291	291	-	243	243	-
Stage 2	-	-	-	-	-	-	234	262	-	276	309	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1389	-	-	1330	-	-	463	441	821	468	442	877
Stage 1	-	-	-	-	-	-	717	672	-	761	705	-
Stage 2	-	-	-	-	-	-	769	692	-	731	660	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1389	-	-	1330	-	-	401	414	821	415	415	877
Mov Cap-2 Maneuver	-	-	-	-	-	-	401	414	-	415	415	-
Stage 1	-	-	-	-	-	-	696	652	-	738	682	-
Stage 2	-	-	-	-	-	-	698	669	-	673	640	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	1.01	1.32	12.64	13.5
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	540	1389	-	-	1330	-	-	508
HCM Lane V/C Ratio	0.129	0.026	-	-	0.029	-	-	0.167
HCM Control Delay (s/veh)	12.6	7.7	0	-	7.8	0	-	13.5
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0.1	-	-	0.6

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	46	297	137	91	210	17	62	0	93	30	0	33
Future Vol, veh/h	46	297	137	91	210	17	62	0	93	30	0	33
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	50	323	149	99	228	18	67	0	101	33	0	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	253	0	0	472	0	0	924	948	397	864	1013	244
Stage 1	-	-	-	-	-	-	497	497	-	441	441	-
Stage 2	-	-	-	-	-	-	427	451	-	423	572	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1312	-	-	1090	-	-	250	261	652	274	239	794
Stage 1	-	-	-	-	-	-	555	545	-	595	577	-
Stage 2	-	-	-	-	-	-	606	571	-	609	504	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1305	-	-	1090	-	-	208	227	652	202	208	789
Mov Cap-2 Maneuver	-	-	-	-	-	-	208	227	-	202	208	-
Stage 1	-	-	-	-	-	-	534	524	-	569	521	-
Stage 2	-	-	-	-	-	-	525	517	-	495	485	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.75	2.47	24.26	18.72
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	352	1305	-	-	1090	-	-	330
HCM Lane V/C Ratio	0.479	0.038	-	-	0.091	-	-	0.207
HCM Control Delay (s/veh)	24.3	7.9	-	-	8.6	-	-	18.7
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	2.5	0.1	-	-	0.3	-	-	0.8

Intersection	
Intersection Delay, s/veh	24.7
Intersection LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	86	112	369	86	103	357
Future Vol, veh/h	86	112	369	86	103	357
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	93	122	401	93	112	388
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	12.3	30.4	24.5
HCM LOS	B	D	C

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	22%	0%	81%
Vol Thru, %	0%	43%	19%
Vol Right, %	78%	57%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	460	198	455
LT Vol	103	0	369
Through Vol	0	86	86
RT Vol	357	112	0
Lane Flow Rate	500	215	495
Geometry Grp	1	1	1
Degree of Util (X)	0.766	0.356	0.817
Departure Headway (Hd)	5.517	5.947	5.947
Convergence, Y/N	Yes	Yes	Yes
Cap	650	598	603
Service Time	3.598	4.045	4.024
HCM Lane V/C Ratio	0.769	0.36	0.821
HCM Control Delay, s/veh	24.5	12.3	30.4
HCM Lane LOS	C	B	D
HCM 95th-tile Q	7.1	1.6	8.3

Intersection	
Int Delay, s/veh	9.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	152	38	426	245	6	497
Future Vol, veh/h	152	38	426	245	6	497
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	165	41	463	266	7	540

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1150	597	0	0	729	0
Stage 1	596	-	-	-	-	-
Stage 2	554	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	219	503	-	-	875	-
Stage 1	550	-	-	-	-	-
Stage 2	575	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	216	502	-	-	875	-
Mov Cap-2 Maneuver	216	-	-	-	-	-
Stage 1	550	-	-	-	-	-
Stage 2	569	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	67.52	0	0.11
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	244	875	-
HCM Lane V/C Ratio	-	-	0.845	0.007	-
HCM Control Delay (s/veh)	-	-	67.5	9.1	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	6.8	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	24	46	238	21	27	44	630	415	35	582	23
Future Volume (veh/h)	17	24	46	238	21	27	44	630	415	35	582	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	18	26	12	259	23	22	48	685	229	38	633	23
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	204	264	100	468	29	28	114	902	792	99	769	27
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.52	0.52	0.52	0.52	0.52	0.52
Sat Flow, veh/h	385	989	375	1222	109	104	62	1733	1521	36	1478	52
Grp Volume(v), veh/h	56	0	0	304	0	0	733	0	229	694	0	0
Grp Sat Flow(s),veh/h/ln	1750	0	0	1434	0	0	1795	0	1521	1565	0	0
Q Serve(g_s), s	0.0	0.0	0.0	8.1	0.0	0.0	0.0	0.0	4.0	3.7	0.0	0.0
Cycle Q Clear(g_c), s	1.1	0.0	0.0	9.2	0.0	0.0	15.0	0.0	4.0	18.7	0.0	0.0
Prop In Lane	0.32		0.21	0.85		0.07	0.07		1.00	0.05		0.03
Lane Grp Cap(c), veh/h	568	0	0	525	0	0	1016	0	792	896	0	0
V/C Ratio(X)	0.10	0.00	0.00	0.58	0.00	0.00	0.72	0.00	0.29	0.77	0.00	0.00
Avail Cap(c_a), veh/h	787	0	0	715	0	0	1251	0	1001	1125	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	13.1	0.0	0.0	15.9	0.0	0.0	8.9	0.0	6.4	9.0	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.0	0.0	0.0	1.6	0.0	0.2	2.7	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	2.8	0.0	0.0	4.8	0.0	1.0	4.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	13.1	0.0	0.0	16.9	0.0	0.0	10.5	0.0	6.6	11.7	0.0	0.0
LnGrp LOS	B			B			B		A	B		
Approach Vol, veh/h		56			304			962			694	
Approach Delay, s/veh		13.1			16.9			9.6			11.7	
Approach LOS		B			B			A			B	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	29.5	17.6	29.5	17.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	31.0	19.0	31.0	19.0
Max Q Clear Time (g_c+I1), s	17.0	3.1	20.7	11.2
Green Ext Time (p_c), s	5.6	0.2	3.9	1.1

Intersection Summary	
HCM 7th Control Delay, s/veh	11.5
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	196	253	33	260	318	429	77	436	231	260	407	208
Future Volume (veh/h)	196	253	33	260	318	429	77	436	231	260	407	208
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.91	0.97		0.92	1.00		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	213	275	32	283	346	194	84	474	0	283	442	209
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	291	312	36	315	403	314	152	651		322	457	216
Arrive On Green	0.12	0.21	0.21	0.14	0.24	0.24	0.05	0.39	0.00	0.09	0.43	0.43
Sat Flow, veh/h	1603	1463	170	1603	1683	1313	1603	1683	1427	1603	1066	504
Grp Volume(v), veh/h	213	0	307	283	346	194	84	474	0	283	0	651
Grp Sat Flow(s),veh/h/ln	1603	0	1633	1603	1683	1313	1603	1683	1427	1603	0	1570
Q Serve(g_s), s	11.7	0.0	20.9	16.0	22.6	15.2	3.6	27.6	0.0	10.0	0.0	46.6
Cycle Q Clear(g_c), s	11.7	0.0	20.9	16.0	22.6	15.2	3.6	27.6	0.0	10.0	0.0	46.6
Prop In Lane	1.00		0.10	1.00		1.00	1.00		1.00	1.00		0.32
Lane Grp Cap(c), veh/h	291	0	348	315	403	314	152	651		322	0	672
V/C Ratio(X)	0.73	0.00	0.88	0.90	0.86	0.62	0.55	0.73		0.88	0.00	0.97
Avail Cap(c_a), veh/h	374	0	355	315	403	314	163	673		322	0	683
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	31.6	0.0	43.8	31.7	41.9	39.1	27.9	30.1	0.0	28.7	0.0	32.1
Incr Delay (d2), s/veh	5.3	0.0	21.6	27.0	16.8	3.6	3.5	3.8	0.0	23.0	0.0	26.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.0	0.0	10.6	8.5	11.3	5.2	1.5	11.9	0.0	5.9	0.0	22.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	36.8	0.0	65.5	58.7	58.7	42.7	31.4	33.9	0.0	51.6	0.0	58.6
LnGrp LOS	D		E	E	E	D	C	C		D		E
Approach Vol, veh/h		520			823			558			934	
Approach Delay, s/veh		53.7			54.9			33.6			56.5	
Approach LOS		D			D			C			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	49.5	21.0	29.5	10.2	54.2	18.0	32.5
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	10.0	46.0	16.0	25.0	6.0	50.0	20.0	22.0
Max Q Clear Time (g_c+I1), s	12.0	29.6	18.0	22.9	5.6	48.6	13.7	24.6
Green Ext Time (p_c), s	0.0	2.9	0.0	0.4	0.0	0.7	0.3	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	51.0
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	460	21	178	35	24	54	234	1164	16	20	927	387
Future Volume (veh/h)	460	21	178	35	24	54	234	1164	16	20	927	387
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	500	23	0	38	26	0	254	1265	9	22	1008	201
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	569	308		102	107		308	2266	1011	34	2899	899
Arrive On Green	0.16	0.16	0.00	0.06	0.06	0.00	0.09	0.64	0.64	0.02	0.57	0.57
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	5106	1584
Grp Volume(v), veh/h	500	23	0	38	26	0	254	1265	9	22	1008	201
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1702	1584
Q Serve(g_s), s	23.3	1.7	0.0	3.4	2.2	0.0	11.9	33.0	0.3	2.0	17.5	10.4
Cycle Q Clear(g_c), s	23.3	1.7	0.0	3.4	2.2	0.0	11.9	33.0	0.3	2.0	17.5	10.4
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	569	308		102	107		308	2266	1011	34	2899	899
V/C Ratio(X)	0.88	0.07		0.37	0.24		0.83	0.56	0.01	0.64	0.35	0.22
Avail Cap(c_a), veh/h	859	465		119	125		670	2266	1011	54	2899	899
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.81	0.81	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	67.3	58.3	0.0	74.9	74.3	0.0	73.9	16.8	10.9	80.3	19.2	17.7
Incr Delay (d2), s/veh	5.8	0.1	0.0	2.2	1.2	0.0	5.6	1.0	0.0	18.2	0.3	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.9	0.8	0.0	1.6	1.1	0.0	5.5	13.6	0.1	1.1	7.1	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	73.2	58.4	0.0	77.1	75.5	0.0	79.5	17.8	10.9	98.6	19.5	18.2
LnGrp LOS	E	E		E	E		E	B	B	F	B	B
Approach Vol, veh/h		523			64			1528			1231	
Approach Delay, s/veh		72.5			76.5			28.0			20.7	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.2	110.2		14.5	19.7	98.7		32.1
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	88.0		11.0	32.0	61.0		41.0
Max Q Clear Time (g_c+I1), s	4.0	35.0		5.4	13.9	19.5		25.3
Green Ext Time (p_c), s	0.0	13.0		0.1	0.8	9.6		1.8

Intersection Summary	
HCM 7th Control Delay, s/veh	33.2
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	346	285	105	22	351	100	156	1041	24	91	783	355
Future Volume (veh/h)	346	285	105	22	351	100	156	1041	24	91	783	355
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	376	310	0	24	382	0	170	1132	12	99	851	191
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	431	781		72	481		251	1985	885	207	1940	863
Arrive On Green	0.12	0.22	0.00	0.04	0.14	0.00	0.07	0.56	0.56	0.06	0.55	0.55
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1581
Grp Volume(v), veh/h	376	310	0	24	382	0	170	1132	12	99	851	191
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1581
Q Serve(g_s), s	17.6	12.3	0.0	2.2	17.2	0.0	7.9	34.1	0.6	4.6	23.6	10.3
Cycle Q Clear(g_c), s	17.6	12.3	0.0	2.2	17.2	0.0	7.9	34.1	0.6	4.6	23.6	10.3
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	431	781		72	481		251	1985	885	207	1940	863
V/C Ratio(X)	0.87	0.40		0.33	0.79		0.68	0.57	0.01	0.48	0.44	0.22
Avail Cap(c_a), veh/h	607	969		238	818		356	1985	885	230	1940	863
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.79	0.79	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	70.9	55.0	0.0	77.0	69.1	0.0	74.6	23.6	16.2	75.1	22.4	19.4
Incr Delay (d2), s/veh	7.9	0.3	0.0	2.7	3.0	0.0	3.2	1.2	0.0	1.7	0.7	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.4	5.6	0.0	1.1	8.1	0.0	3.6	14.6	0.2	2.1	10.1	4.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	78.8	55.3	0.0	79.7	72.1	0.0	77.8	24.8	16.2	76.8	23.1	20.0
LnGrp LOS	E	E		E	E		E	C	B	E	C	B
Approach Vol, veh/h		686			406			1314			1141	
Approach Delay, s/veh		68.2			72.5			31.6			27.2	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	97.2	11.7	41.3	17.0	95.1	25.6	27.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	67.0	22.0	45.0	17.0	61.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	16.6	36.1	4.2	14.3	9.9	25.6	19.6	19.2
Green Ext Time (p_c), s	0.1	9.7	0.0	2.2	0.3	7.6	1.0	2.5

Intersection Summary	
HCM 7th Control Delay, s/veh	41.9
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	431	19	200	364	74	2	18	199	35	17	11
Future Volume (veh/h)	11	431	19	200	364	74	2	18	199	35	17	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	12	468	18	217	396	69	2	20	5	38	18	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	28	899	35	289	1224	211	58	60	51	103	108	0
Arrive On Green	0.02	0.26	0.26	0.16	0.40	0.40	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3488	134	1781	3028	523	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	12	238	248	217	231	234	2	20	5	38	18	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1845	1781	1777	1775	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.3	4.7	4.7	4.7	3.6	3.7	0.0	0.4	0.1	0.8	0.4	0.0
Cycle Q Clear(g_c), s	0.3	4.7	4.7	4.7	3.6	3.7	0.0	0.4	0.1	0.8	0.4	0.0
Prop In Lane	1.00		0.07	1.00		0.29	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	28	458	475	289	718	717	58	60	51	103	108	0
V/C Ratio(X)	0.43	0.52	0.52	0.75	0.32	0.33	0.03	0.33	0.10	0.37	0.17	0.00
Avail Cap(c_a), veh/h	393	2396	2489	830	2832	2829	830	871	738	1398	1468	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	19.9	13.0	13.0	16.3	8.3	8.3	19.1	19.3	19.2	18.5	18.3	0.0
Incr Delay (d2), s/veh	10.3	0.9	0.9	3.9	0.3	0.3	0.2	3.2	0.8	2.2	0.7	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.7	1.8	2.0	1.1	1.2	0.0	0.2	0.1	0.4	0.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.2	13.9	13.9	20.2	8.6	8.6	19.4	22.5	20.0	20.7	19.0	0.0
LnGrp LOS	C	B	B	C	A	A	B	C	B	C	B	
Approach Vol, veh/h		498			682			27			56	
Approach Delay, s/veh		14.3			12.3			21.8			20.2	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.6	15.5		7.3	5.6	21.5		6.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	16.7	6.7		2.8	2.3	5.7		2.4
Green Ext Time (p_c), s	0.5	3.4		0.2	0.0	3.3		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.6
HCM 7th LOS	B

6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	302	11	105	252	32	16	17	126	36	16	7
Future Volume (veh/h)	19	302	11	105	252	32	16	17	126	36	16	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	328	10	114	274	28	17	18	5	39	17	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	47	758	23	171	929	94	82	86	73	114	120	0
Arrive On Green	0.03	0.22	0.22	0.10	0.29	0.29	0.05	0.05	0.05	0.06	0.06	0.00
Sat Flow, veh/h	1781	3520	107	1781	3257	330	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	21	165	173	114	148	154	17	18	5	39	17	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1850	1781	1777	1810	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.4	2.8	2.8	2.1	2.3	2.3	0.3	0.3	0.1	0.7	0.3	0.0
Cycle Q Clear(g_c), s	0.4	2.8	2.8	2.1	2.3	2.3	0.3	0.3	0.1	0.7	0.3	0.0
Prop In Lane	1.00		0.06	1.00		0.18	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	47	383	399	171	507	516	82	86	73	114	120	0
V/C Ratio(X)	0.45	0.43	0.43	0.67	0.29	0.30	0.21	0.21	0.07	0.34	0.14	0.00
Avail Cap(c_a), veh/h	515	1566	1631	875	1926	1962	1622	1703	1443	1622	1703	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	16.6	11.7	11.7	15.1	9.6	9.7	15.9	15.9	15.8	15.5	15.3	0.0
Incr Delay (d2), s/veh	6.5	0.8	0.7	4.4	0.3	0.3	1.2	1.2	0.4	1.7	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.0	1.0	0.9	0.7	0.8	0.1	0.1	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.1	12.5	12.5	19.5	10.0	10.0	17.1	17.1	16.2	17.2	15.8	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	B	
Approach Vol, veh/h		359			416			40			56	
Approach Delay, s/veh		13.1			12.6			17.0			16.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.3	12.5		7.2	5.9	14.9		6.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	4.1	4.8		2.7	2.4	4.3		2.3
Green Ext Time (p_c), s	0.2	2.1		0.2	0.0	2.0		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.3
HCM 7th LOS	B

7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	236	24	70	202	2	9	4	97	1	4	4
Future Volume (veh/h)	13	236	24	70	202	2	9	4	97	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	14	257	19	76	220	1	10	4	10	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	659	48	140	931	4	61	64	54	12	13	0
Arrive On Green	0.02	0.20	0.20	0.08	0.26	0.26	0.03	0.03	0.03	0.01	0.01	0.00
Sat Flow, veh/h	1781	3356	246	1781	3628	16	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	14	135	141	76	108	113	10	4	10	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1825	1781	1777	1867	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	1.9	2.0	1.2	1.4	1.4	0.2	0.1	0.2	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	1.9	2.0	1.2	1.4	1.4	0.2	0.1	0.2	0.0	0.1	0.0
Prop In Lane	1.00		0.14	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	33	349	358	140	456	479	61	64	54	12	13	0
V/C Ratio(X)	0.43	0.39	0.39	0.54	0.24	0.24	0.16	0.06	0.18	0.08	0.31	0.00
Avail Cap(c_a), veh/h	304	1518	1560	304	1518	1596	1827	1918	1623	1827	1918	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	14.2	10.2	10.2	13.0	8.6	8.6	13.7	13.7	13.7	14.4	14.5	0.0
Incr Delay (d2), s/veh	8.6	0.7	0.7	3.2	0.3	0.3	1.2	0.4	1.6	2.9	13.4	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.6	0.7	0.5	0.4	0.4	0.1	0.0	0.1	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.8	10.9	10.9	16.2	8.9	8.9	14.9	14.1	15.3	17.3	27.9	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		290			297			24			5	
Approach Delay, s/veh		11.5			10.7			15.0			25.8	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.3	10.7		5.2	5.5	12.5		6.0
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	3.2	4.0		2.1	2.2	3.4		2.2
Green Ext Time (p_c), s	0.0	1.6		0.0	0.0	1.2		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	11.4
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	224	16	16	189	13	18	2	22	18	2	12
Future Vol, veh/h	11	224	16	16	189	13	18	2	22	18	2	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	243	17	17	205	14	20	2	24	20	2	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	220	0	0	261	0	0	517	530	252	516	532	213
Stage 1	-	-	-	-	-	-	276	276	-	247	247	-
Stage 2	-	-	-	-	-	-	241	254	-	268	285	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1350	-	-	1304	-	-	469	454	786	470	453	828
Stage 1	-	-	-	-	-	-	730	682	-	757	702	-
Stage 2	-	-	-	-	-	-	762	697	-	737	676	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1350	-	-	1304	-	-	447	443	786	442	442	828
Mov Cap-2 Maneuver	-	-	-	-	-	-	447	443	-	442	442	-
Stage 1	-	-	-	-	-	-	723	675	-	749	691	-
Stage 2	-	-	-	-	-	-	736	686	-	705	669	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.34	0.57	11.77	12.19
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	577	1350	-	-	1304	-	-	535
HCM Lane V/C Ratio	0.079	0.009	-	-	0.013	-	-	0.065
HCM Control Delay (s/veh)	11.8	7.7	0	-	7.8	0	-	12.2
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	143	10	40	94	15	12	1	62	20	10	12
Future Vol, veh/h	11	143	10	40	94	15	12	1	62	20	10	12
Conflicting Peds, #/hr	0	0	3	3	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	155	11	43	102	16	13	1	67	22	11	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	118	0	0	169	0	0	382	393	164	377	391	110
Stage 1	-	-	-	-	-	-	188	188	-	197	197	-
Stage 2	-	-	-	-	-	-	195	205	-	180	193	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1470	-	-	1408	-	-	576	543	881	580	545	943
Stage 1	-	-	-	-	-	-	814	745	-	805	738	-
Stage 2	-	-	-	-	-	-	807	732	-	822	741	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1470	-	-	1404	-	-	532	519	878	512	521	943
Mov Cap-2 Maneuver	-	-	-	-	-	-	532	519	-	512	521	-
Stage 1	-	-	-	-	-	-	804	736	-	797	713	-
Stage 2	-	-	-	-	-	-	758	707	-	751	732	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.5	2.05	9.88	11.59
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	531	878	1470	-	-	1404	-	-	592
HCM Lane V/C Ratio	0.027	0.077	0.008	-	-	0.031	-	-	0.077
HCM Control Delay (s/veh)	12	9.4	7.5	0	-	7.6	0	-	11.6
HCM Lane LOS	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0.2	0	-	-	0.1	-	-	0.2

HCM 7th TWSC
10: Pawai Pl & Makala Blvd
10/27/2023

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	5	219	16	16	196	8	18	1	22	11	1	6
Future Vol, veh/h	5	219	16	16	196	8	18	1	22	11	1	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	238	17	17	213	9	20	1	24	12	1	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	222	0	0	255	0	0	506	514	247	502	518	217
Stage 1	-	-	-	-	-	-	258	258	-	252	252	-
Stage 2	-	-	-	-	-	-	248	257	-	249	266	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1347	-	-	1310	-	-	477	464	792	480	461	822
Stage 1	-	-	-	-	-	-	747	695	-	752	698	-
Stage 2	-	-	-	-	-	-	756	695	-	755	688	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1347	-	-	1310	-	-	463	455	792	455	452	822
Mov Cap-2 Maneuver	-	-	-	-	-	-	463	455	-	455	452	-
Stage 1	-	-	-	-	-	-	744	691	-	748	688	-
Stage 2	-	-	-	-	-	-	737	685	-	727	685	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.16	0.57	11.54	11.99
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	595	1347	-	-	1310	-	-	535
HCM Lane V/C Ratio	0.075	0.004	-	-	0.013	-	-	0.037
HCM Control Delay (s/veh)	11.5	7.7	0	-	7.8	0	-	12
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

HCM 7th TWSC
11: Pawai Pl & Loloku St
10/27/2023

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	11	118	11	15	74	15	12	0	20	20	9	12
Future Vol, veh/h	11	118	11	15	74	15	12	0	20	20	9	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	128	12	16	80	16	13	0	22	22	10	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	97	0	0	140	0	0	276	288	134	273	285	89
Stage 1	-	-	-	-	-	-	158	158	-	121	121	-
Stage 2	-	-	-	-	-	-	118	129	-	152	164	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1497	-	-	1443	-	-	676	622	915	679	624	970
Stage 1	-	-	-	-	-	-	844	767	-	883	795	-
Stage 2	-	-	-	-	-	-	887	789	-	850	762	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1497	-	-	1443	-	-	643	609	915	649	611	970
Mov Cap-2 Maneuver	-	-	-	-	-	-	643	609	-	649	611	-
Stage 1	-	-	-	-	-	-	837	760	-	875	786	-
Stage 2	-	-	-	-	-	-	853	780	-	823	756	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.58	1.09	9.77	10.43
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	790	1497	-	-	1443	-	-	708
HCM Lane V/C Ratio	0.044	0.008	-	-	0.011	-	-	0.063
HCM Control Delay (s/veh)	9.8	7.4	0	-	7.5	0	-	10.4
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	301	105	84	172	12	39	0	55	22	0	20
Future Vol, veh/h	20	301	105	84	172	12	39	0	55	22	0	20
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	327	114	91	187	13	42	0	60	24	0	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	202	0	0	444	0	0	801	815	387	749	866	196
Stage 1	-	-	-	-	-	-	431	431	-	378	378	-
Stage 2	-	-	-	-	-	-	371	385	-	371	488	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1370	-	-	1116	-	-	303	312	661	328	291	845
Stage 1	-	-	-	-	-	-	603	583	-	644	615	-
Stage 2	-	-	-	-	-	-	650	611	-	650	550	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1367	-	-	1113	-	-	265	280	659	269	262	842
Mov Cap-2 Maneuver	-	-	-	-	-	-	265	280	-	269	262	-
Stage 1	-	-	-	-	-	-	592	572	-	632	564	-
Stage 2	-	-	-	-	-	-	580	560	-	581	540	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.36	2.67	16.76	15.21
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	408	1367	-	-	1113	-	-	398
HCM Lane V/C Ratio	0.251	0.016	-	-	0.082	-	-	0.115
HCM Control Delay (s/veh)	16.8	7.7	-	-	8.5	-	-	15.2
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1	0	-	-	0.3	-	-	0.4

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	19	49	186	34	54	221
Future Vol, veh/h	19	49	186	34	54	221
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	53	202	37	59	240
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	8	10.2	9.6
HCM LOS	A	B	A

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	20%	0%	85%
Vol Thru, %	0%	28%	15%
Vol Right, %	80%	72%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	275	68	220
LT Vol	54	0	186
Through Vol	0	19	34
RT Vol	221	49	0
Lane Flow Rate	299	74	239
Geometry Grp	1	1	1
Degree of Util (X)	0.353	0.092	0.322
Departure Headway (Hd)	4.249	4.461	4.848
Convergence, Y/N	Yes	Yes	Yes
Cap	846	799	739
Service Time	2.277	2.51	2.891
HCM Lane V/C Ratio	0.353	0.093	0.323
HCM Control Delay, s/veh	9.6	8	10.2
HCM Lane LOS	A	A	B
HCM 95th-tile Q	1.6	0.3	1.4

HCM 7th TWSC
14: Kuakini Hwy & Loloku St
10/27/2023

Intersection						
Int Delay, s/veh	2.1					
Movement	**WBL**	**WBR**	**NBT**	**NBR**	**SBL**	**SBT**
Lane Configurations						
Traffic Vol, veh/h	96	2	291	136	4	237
Future Vol, veh/h	96	2	291	136	4	237
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	104	2	316	148	4	258

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	659	391	0	0	465	0
Stage 1	391	-	-	-	-	-
Stage 2	267	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	429	657	-	-	1096	-
Stage 1	683	-	-	-	-	-
Stage 2	778	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	426	657	-	-	1095	-
Mov Cap-2 Maneuver	426	-	-	-	-	-
Stage 1	683	-	-	-	-	-
Stage 2	773	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	16.14	0	0.14
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	429	1095	-
HCM Lane V/C Ratio	-	-	0.248	0.004	-
HCM Control Delay (s/veh)	-	-	16.1	8.3	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1	0	-

HCM 7th Signalized Intersection Summary
15: Kuakini Hwy & Kaiwi St
10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	35	29	194	22	16	43	392	335	0	303	27
Future Volume (veh/h)	12	35	29	194	22	16	43	392	335	0	303	27
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	13	38	8	211	24	12	47	426	163	0	329	24
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	207	362	64	557	54	19	184	749	688	0	754	55
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.44	0.44	0.44	0.00	0.44	0.44
Sat Flow, veh/h	171	1355	239	1166	203	70	88	1710	1571	0	1721	126
Grp Volume(v), veh/h	59	0	0	247	0	0	473	0	163	0	0	353
Grp Sat Flow(s),veh/h/ln	1765	0	0	1439	0	0	1798	0	1571	0	0	1846
Q Serve(g_s), s	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	1.8	0.0	0.0	3.6
Cycle Q Clear(g_c), s	0.7	0.0	0.0	4.0	0.0	0.0	5.2	0.0	1.8	0.0	0.0	3.6
Prop In Lane	0.22		0.14	0.85		0.05	0.10		1.00	0.00		0.07
Lane Grp Cap(c), veh/h	633	0	0	630	0	0	934	0	688	0	0	809
V/C Ratio(X)	0.09	0.00	0.00	0.39	0.00	0.00	0.51	0.00	0.24	0.00	0.00	0.44
Avail Cap(c_a), veh/h	2425	0	0	2116	0	0	3107	0	2663	0	0	3131
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	7.5	0.0	0.0	8.7	0.0	0.0	5.7	0.0	4.8	0.0	0.0	5.3
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.9	0.0	0.0	1.1	0.0	0.3	0.0	0.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	7.6	0.0	0.0	9.1	0.0	0.0	6.2	0.0	5.0	0.0	0.0	5.7
LnGrp LOS	A			A			A		A			A
Approach Vol, veh/h		59			247			636			353	
Approach Delay, s/veh		7.6			9.1			5.8			5.7	
Approach LOS		A			A			A			A	
Timer - Assigned Phs		**2**		**4**		**6**		**8**				
Phs Duration (G+Y+Rc), s		15.9		11.2		15.9		11.2				
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0				
Max Green Setting (Gmax), s		46.0		36.0		46.0		36.0				
Max Q Clear Time (g_c+I1), s		7.2		2.7		5.6		6.0				
Green Ext Time (p_c), s		4.3		0.3		2.5		1.7				

Intersection Summary	
HCM 7th Control Delay, s/veh	6.5
HCM 7th LOS	A

HCM 7th Signalized Intersection Summary

16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	205	46	217	237	251	76	455	287	158	260	126
Future Volume (veh/h)	156	205	46	217	237	251	76	455	287	158	260	126
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.98		0.97	0.99		0.96	0.99		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	170	223	42	236	258	40	83	495	0	172	283	124
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	287	277	52	297	408	331	470	748		347	1033	441
Arrive On Green	0.08	0.20	0.20	0.12	0.24	0.24	0.04	0.44	0.00	0.07	0.48	0.48
Sat Flow, veh/h	1603	1369	258	1603	1683	1365	1603	1683	1427	1603	2174	927
Grp Volume(v), veh/h	170	0	265	236	258	40	83	495	0	172	206	201
Grp Sat Flow(s),veh/h/ln	1603	0	1627	1603	1683	1365	1603	1683	1427	1603	1599	1501
Q Serve(g_s), s	10.0	0.0	19.4	14.3	17.1	2.9	3.5	28.9	0.0	7.1	9.7	10.1
Cycle Q Clear(g_c), s	10.0	0.0	19.4	14.3	17.1	2.9	3.5	28.9	0.0	7.1	9.7	10.1
Prop In Lane	1.00		0.16	1.00		1.00	1.00		1.00	1.00		0.62
Lane Grp Cap(c), veh/h	287	0	330	297	408	331	470	748		347	760	714
V/C Ratio(X)	0.59	0.00	0.80	0.79	0.63	0.12	0.18	0.66		0.50	0.27	0.28
Avail Cap(c_a), veh/h	287	0	391	297	471	382	531	748		358	760	714
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.74	0.74	0.74	1.00	1.00	0.00	0.92	0.92	0.92
Uniform Delay (d), s/veh	37.3	0.0	47.5	34.5	42.3	36.9	17.6	27.4	0.0	20.3	19.8	19.9
Incr Delay (d2), s/veh	3.2	0.0	10.0	10.5	1.6	0.1	0.2	4.6	0.0	1.0	0.8	0.9
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	0.0	8.8	6.5	7.4	1.0	1.3	12.6	0.0	2.8	3.8	3.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	40.6	0.0	57.4	45.0	43.9	37.1	17.8	31.9	0.0	21.4	20.6	20.8
LnGrp LOS	D		E	D	D	D	B	C		C	C	C
Approach Vol, veh/h		435			534			578			579	
Approach Delay, s/veh		50.8			43.9			29.9			20.9	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.2	60.5	20.0	30.3	10.3	64.4	15.0	35.3
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	50.0	15.0	30.0	10.0	50.0	10.0	35.0
Max Q Clear Time (g_c+I1), s	9.1	30.9	16.3	21.4	5.5	12.1	12.0	19.1
Green Ext Time (p_c), s	0.0	3.2	0.0	1.0	0.1	2.9	0.0	1.5

Intersection Summary	
HCM 7th Control Delay, s/veh	35.2
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary

1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	673	46	389	34	49	53	395	991	16	30	1564	591
Future Volume (veh/h)	673	46	389	34	49	53	395	991	16	30	1564	591
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	732	50	0	37	53	0	429	1077	8	33	1700	252
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	792	428		106	112		489	2012	897	43	2290	711
Arrive On Green	0.23	0.23	0.00	0.06	0.06	0.00	0.14	0.57	0.57	0.02	0.45	0.45
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	5106	1585
Grp Volume(v), veh/h	732	50	0	37	53	0	429	1077	8	33	1700	252
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1702	1585
Q Serve(g_s), s	34.2	3.5	0.0	3.3	4.5	0.0	20.1	31.1	0.4	3.0	45.4	17.2
Cycle Q Clear(g_c), s	34.2	3.5	0.0	3.3	4.5	0.0	20.1	31.1	0.4	3.0	45.4	17.2
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	792	428		106	112		489	2012	897	43	2290	711
V/C Ratio(X)	0.92	0.12		0.35	0.48		0.88	0.54	0.01	0.78	0.74	0.35
Avail Cap(c_a), veh/h	859	465		140	147		733	2012	897	108	2290	711
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.65	0.65	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.2	50.4	0.0	74.5	75.1	0.0	69.4	22.3	15.6	80.1	37.6	29.8
Incr Delay (d2), s/veh	10.6	0.1	0.0	1.9	3.1	0.0	8.0	1.0	0.0	25.3	2.2	1.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.3	1.7	0.0	1.6	2.3	0.0	9.4	13.2	0.1	1.7	19.3	6.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	72.8	50.5	0.0	76.4	78.2	0.0	77.5	23.3	15.6	105.4	39.8	31.2
LnGrp LOS	E	D		E	E		E	C	B	F	D	C
Approach Vol, veh/h		782			90			1514			1985	
Approach Delay, s/veh		71.4			77.5			38.6			39.8	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.9	98.4		14.8	28.3	79.0		42.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	10.0	81.0		13.0	35.0	56.0		41.0
Max Q Clear Time (g_c+I1), s	5.0	33.1		6.5	22.1	47.4		36.2
Green Ext Time (p_c), s	0.0	9.9		0.1	1.3	6.8		1.5

Intersection Summary	
HCM 7th Control Delay, s/veh	45.8
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	367	415	136	30	423	131	160	1006	25	213	1312	662
Future Volume (veh/h)	367	415	136	30	423	131	160	1006	25	213	1312	662
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	399	451	0	33	460	0	174	1093	10	232	1426	495
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	454	864		84	565		251	1704	760	377	1833	817
Arrive On Green	0.13	0.24	0.00	0.05	0.16	0.00	0.07	0.48	0.48	0.11	0.52	0.52
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	399	451	0	33	460	0	174	1093	10	232	1426	495
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	18.7	18.2	0.0	3.0	20.6	0.0	8.1	38.2	0.5	10.6	53.5	36.3
Cycle Q Clear(g_c), s	18.7	18.2	0.0	3.0	20.6	0.0	8.1	38.2	0.5	10.6	53.5	36.3
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	454	864		84	565		251	1704	760	377	1833	817
V/C Ratio(X)	0.88	0.52		0.39	0.81		0.69	0.64	0.01	0.62	0.78	0.61
Avail Cap(c_a), veh/h	607	969		238	818		440	1704	760	440	1833	817
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.67	0.67	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	70.4	54.1	0.0	76.3	67.0	0.0	74.7	32.3	22.5	70.2	32.3	28.1
Incr Delay (d2), s/veh	7.8	0.3	0.0	2.9	4.2	0.0	3.4	1.9	0.0	2.0	3.3	3.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.9	8.3	0.0	1.4	9.8	0.0	3.7	16.8	0.2	4.8	23.6	14.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	78.1	54.5	0.0	79.2	71.2	0.0	78.1	34.2	22.5	72.2	35.6	31.5
LnGrp LOS	E	D		E	E		E	C	C	E	D	C
Approach Vol, veh/h		850			493			1277			2153	
Approach Delay, s/veh		65.6			71.8			40.1			38.6	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	84.1	12.8	45.1	17.0	90.1	26.7	31.2
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	57.0	22.0	45.0	21.0	57.0	29.0	38.0
Max Q Clear Time (g_c+I1), s	12.6	40.2	5.0	20.2	10.1	55.5	20.7	22.6
Green Ext Time (p_c), s	0.5	7.2	0.0	3.3	0.4	1.3	1.0	2.8

Intersection Summary	
HCM 7th Control Delay, s/veh	47.2
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	694	25	209	664	161	11	13	290	136	23	23
Future Volume (veh/h)	19	694	25	209	664	161	11	13	290	136	23	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	754	25	227	722	161	12	14	3	148	25	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	44	1158	38	288	1348	300	58	61	51	209	201	16
Arrive On Green	0.02	0.33	0.33	0.16	0.47	0.47	0.03	0.03	0.03	0.12	0.12	0.12
Sat Flow, veh/h	1781	3510	116	1781	2887	644	1781	1870	1585	1781	1709	137
Grp Volume(v), veh/h	21	382	397	227	444	439	12	14	3	148	0	27
Grp Sat Flow(s),veh/h/ln	1781	1777	1849	1781	1777	1754	1781	1870	1585	1781	0	1846
Q Serve(g_s), s	0.6	10.2	10.2	6.8	9.9	9.9	0.4	0.4	0.1	4.5	0.0	0.7
Cycle Q Clear(g_c), s	0.6	10.2	10.2	6.8	9.9	9.9	0.4	0.4	0.1	4.5	0.0	0.7
Prop In Lane	1.00		0.06	1.00		0.37	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	44	586	610	288	830	819	58	61	51	209	0	217
V/C Ratio(X)	0.47	0.65	0.65	0.79	0.54	0.54	0.21	0.23	0.06	0.71	0.00	0.12
Avail Cap(c_a), veh/h	287	1751	1823	607	2070	2043	607	637	540	1022	0	1059
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	26.8	15.9	15.9	22.5	10.6	10.6	26.3	26.3	26.2	23.7	0.0	22.1
Incr Delay (d2), s/veh	7.6	1.2	1.2	4.8	0.5	0.5	1.8	1.9	0.5	4.4	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	4.0	4.1	3.1	3.4	3.4	0.2	0.2	0.0	2.0	0.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	34.5	17.2	17.1	27.3	11.1	11.1	28.0	28.2	26.6	28.1	0.0	22.3
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		800			1110			29			175	
Approach Delay, s/veh		17.6			14.4			28.0			27.2	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	14.0	23.4		11.5	6.4	31.0		6.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	8.8	12.2		6.5	2.6	11.9		2.4
Green Ext Time (p_c), s	0.5	6.1		0.6	0.0	7.6		0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	16.9
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary

6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	63	447	17	124	538	35	17	29	218	79	37	55
Future Volume (veh/h)	63	447	17	124	538	35	17	29	218	79	37	55
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	68	486	16	135	585	35	18	32	9	86	40	10
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	115	902	30	180	1000	60	104	109	93	224	181	45
Arrive On Green	0.06	0.26	0.26	0.10	0.29	0.29	0.06	0.06	0.06	0.13	0.13	0.13
Sat Flow, veh/h	1781	3511	115	1781	3407	204	1781	1870	1585	1781	1437	359
Grp Volume(v), veh/h	68	246	256	135	305	315	18	32	9	86	0	50
Grp Sat Flow(s),veh/h/ln	1781	1777	1850	1781	1777	1833	1781	1870	1585	1781	0	1796
Q Serve(g_s), s	1.6	5.2	5.2	3.2	6.4	6.4	0.4	0.7	0.2	1.9	0.0	1.1
Cycle Q Clear(g_c), s	1.6	5.2	5.2	3.2	6.4	6.4	0.4	0.7	0.2	1.9	0.0	1.1
Prop In Lane	1.00		0.06	1.00		0.11	1.00		1.00	1.00		0.20
Lane Grp Cap(c), veh/h	115	457	475	180	522	538	104	109	93	224	0	226
V/C Ratio(X)	0.59	0.54	0.54	0.75	0.58	0.59	0.17	0.29	0.10	0.38	0.00	0.22
Avail Cap(c_a), veh/h	408	1240	1291	693	1525	1573	1284	1348	1143	1284	0	1295
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.9	14.0	14.0	19.1	13.2	13.2	19.6	19.7	19.5	17.5	0.0	17.2
Incr Delay (d2), s/veh	4.8	1.0	1.0	6.2	1.0	1.0	0.8	1.5	0.5	1.1	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	1.9	2.0	1.5	2.3	2.4	0.2	0.3	0.1	0.8	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	24.7	15.0	15.0	25.3	14.2	14.2	20.3	21.2	19.9	18.6	0.0	17.7
LnGrp LOS	C	B	B	C	B	B	C	C	B	B		B
Approach Vol, veh/h		570			755			59			136	
Approach Delay, s/veh		16.1			16.2			20.7			18.3	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	16.2		10.5	7.8	17.8		7.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	7.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	5.2	7.2		3.9	3.6	8.4		2.7
Green Ext Time (p_c), s	0.3	3.2		0.5	0.1	4.4		0.2

Intersection Summary		
HCM 7th Control Delay, s/veh		16.5
HCM 7th LOS		B

HCM 7th Signalized Intersection Summary

7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	370	34	153	462	4	24	11	149	6	2	6
Future Volume (veh/h)	9	370	34	153	462	4	24	11	149	6	2	6
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	10	402	32	166	502	3	26	12	15	7	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	24	806	64	211	1257	8	108	114	96	65	69	0
Arrive On Green	0.01	0.24	0.24	0.12	0.35	0.35	0.06	0.06	0.06	0.04	0.04	0.00
Sat Flow, veh/h	1781	3331	264	1781	3622	22	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	10	214	220	166	246	259	26	12	15	7	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1818	1781	1777	1866	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	3.8	3.9	3.3	3.9	3.9	0.5	0.2	0.3	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.2	3.8	3.9	3.3	3.9	3.9	0.5	0.2	0.3	0.1	0.0	0.0
Prop In Lane	1.00		0.15	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	24	430	440	211	617	648	108	114	96	65	69	0
V/C Ratio(X)	0.43	0.50	0.50	0.79	0.40	0.40	0.24	0.11	0.16	0.11	0.03	0.00
Avail Cap(c_a), veh/h	241	1204	1232	241	1204	1265	1449	1521	1286	1449	1521	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	18.1	12.0	12.1	15.8	9.1	9.1	16.5	16.4	16.4	17.2	17.1	0.0
Incr Delay (d2), s/veh	11.7	0.9	0.9	14.0	0.4	0.4	1.1	0.4	0.7	0.7	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.3	1.4	2.0	1.2	1.3	0.2	0.1	0.1	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	29.8	12.9	12.9	29.8	9.5	9.5	17.6	16.8	17.2	17.9	17.3	0.0
LnGrp LOS	C	B	B	C	A	A	B	B	B	B	B	
Approach Vol, veh/h		444			671			53			9	
Approach Delay, s/veh		13.3			14.6			17.3			17.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	13.9		6.4	5.5	17.8		7.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	5.3	5.9		2.1	2.2	5.9		2.5
Green Ext Time (p_c), s	0.0	2.6		0.0	0.0	3.0		0.1

Intersection Summary		
HCM 7th Control Delay, s/veh		14.2
HCM 7th LOS		B

Intersection	
Int Delay, s/veh	5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	330	32	47	403	41	25	31	44	39	31	16
Future Vol, veh/h	21	330	32	47	403	41	25	31	44	39	31	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	359	35	51	438	45	27	34	48	42	34	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	483	0	0	393	0	0	979	1007	376	984	1002	460
Stage 1	-	-	-	-	-	-	422	422	-	562	562	-
Stage 2	-	-	-	-	-	-	557	585	-	421	439	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1080	-	-	1165	-	-	229	241	670	228	243	601
Stage 1	-	-	-	-	-	-	610	588	-	511	509	-
Stage 2	-	-	-	-	-	-	515	498	-	610	578	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1080	-	-	1165	-	-	175	220	670	166	222	601
Mov Cap-2 Maneuver	-	-	-	-	-	-	175	220	-	166	222	-
Stage 1	-	-	-	-	-	-	593	572	-	497	479	-
Stage 2	-	-	-	-	-	-	437	468	-	519	562	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.46	0.79	25.07	34.22
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	286	1080	-	-	1165	-	-	214
HCM Lane V/C Ratio	0.38	0.021	-	-	0.044	-	-	0.436
HCM Control Delay (s/veh)	25.1	8.4	0	-	8.2	0	-	34.2
HCM Lane LOS	D	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	1.7	0.1	-	-	0.1	-	-	2

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	199	19	70	163	29	16	8	115	26	20	22
Future Vol, veh/h	27	199	19	70	163	29	16	8	115	26	20	22
Conflicting Peds, #/hr	0	0	1	1	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	29	216	21	76	177	32	17	9	125	28	22	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	209	0	0	238	0	0	627	647	228	624	642	193
Stage 1	-	-	-	-	-	-	286	286	-	345	345	-
Stage 2	-	-	-	-	-	-	340	361	-	279	297	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1362	-	-	1329	-	-	396	390	812	398	392	849
Stage 1	-	-	-	-	-	-	721	675	-	670	636	-
Stage 2	-	-	-	-	-	-	675	626	-	727	668	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1362	-	-	1328	-	-	331	355	811	300	357	849
Mov Cap-2 Maneuver	-	-	-	-	-	-	331	355	-	300	357	-
Stage 1	-	-	-	-	-	-	702	657	-	654	595	-
Stage 2	-	-	-	-	-	-	590	585	-	592	651	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.85	2.1	11.33	15.92
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	339	811	1362	-	-	1328	-	-	403
HCM Lane V/C Ratio	0.077	0.154	0.022	-	-	0.057	-	-	0.183
HCM Control Delay (s/veh)	16.5	10.2	7.7	0	-	7.9	0	-	15.9
HCM Lane LOS	C	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.2	0.5	0.1	-	-	0.2	-	-	0.7

HCM 7th TWSC
10: Pawai Pl & Makala Blvd 10/27/2023

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	325	32	46	383	16	25	20	43	15	20	8
Future Vol, veh/h	11	325	32	46	383	16	25	20	43	15	20	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	353	35	50	416	17	27	22	47	16	22	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	434	0	0	388	0	0	922	928	371	913	937	425
Stage 1	-	-	-	-	-	-	395	395	-	525	525	-
Stage 2	-	-	-	-	-	-	527	534	-	388	412	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1126	-	-	1170	-	-	251	268	675	254	265	629
Stage 1	-	-	-	-	-	-	631	605	-	536	529	-
Stage 2	-	-	-	-	-	-	534	525	-	636	594	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1126	-	-	1170	-	-	211	249	675	202	246	629
Mov Cap-2 Maneuver	-	-	-	-	-	-	211	249	-	202	246	-
Stage 1	-	-	-	-	-	-	622	597	-	529	499	-
Stage 2	-	-	-	-	-	-	476	495	-	562	586	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.25	0.85	19.96	22.19
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	335	1126	-	-	1170	-	-	256
HCM Lane V/C Ratio	0.285	0.011	-	-	0.043	-	-	0.183
HCM Control Delay (s/veh)	20	8.2	0	-	8.2	0	-	22.2
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	1.2	0	-	-	0.1	-	-	0.7

HCM 7th TWSC
11: Pawai Pl & Loloku St 10/27/2023

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	27	194	27	29	142	29	22	5	26	26	17	22
Future Vol, veh/h	27	194	27	29	142	29	22	5	26	26	17	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	29	211	29	32	154	32	24	5	28	28	18	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	186	0	0	240	0	0	511	533	226	505	532	170
Stage 1	-	-	-	-	-	-	284	284	-	233	233	-
Stage 2	-	-	-	-	-	-	227	249	-	272	299	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1389	-	-	1326	-	-	473	453	814	477	453	874
Stage 1	-	-	-	-	-	-	723	676	-	770	712	-
Stage 2	-	-	-	-	-	-	776	701	-	734	666	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1389	-	-	1326	-	-	419	430	814	432	430	874
Mov Cap-2 Maneuver	-	-	-	-	-	-	419	430	-	432	430	-
Stage 1	-	-	-	-	-	-	705	660	-	751	693	-
Stage 2	-	-	-	-	-	-	715	682	-	685	650	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.83	1.13	12.28	13
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	552	1389	-	-	1326	-	-	521
HCM Lane V/C Ratio	0.104	0.021	-	-	0.024	-	-	0.136
HCM Control Delay (s/veh)	12.3	7.6	0	-	7.8	0	-	13
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0.1	-	-	0.5

HCM 7th TWSC
12: Pawai Pl & Kaiwi St
10/27/2023

Intersection	
Int Delay, s/veh	12.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	384	110	99	263	15	91	0	109	28	1	35
Future Vol, veh/h	40	384	110	99	263	15	91	0	109	28	1	35
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	417	120	108	286	16	99	0	118	30	1	38

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	308	0	0	540	0	0	1073	1091	481	1021	1142	304
Stage 1	-	-	-	-	-	-	567	567	-	515	515	-
Stage 2	-	-	-	-	-	-	506	523	-	505	627	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1252	-	-	1029	-	-	198	215	585	215	200	736
Stage 1	-	-	-	-	-	-	508	507	-	542	535	-
Stage 2	-	-	-	-	-	-	549	530	-	549	476	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1245	-	-	1026	-	-	160	184	583	147	172	729
Mov Cap-2 Maneuver	-	-	-	-	-	-	160	184	-	147	172	-
Stage 1	-	-	-	-	-	-	489	488	-	521	476	-
Stage 2	-	-	-	-	-	-	463	472	-	422	458	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.6	2.34	59.88	23.66
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	265	1245	-	-	1026	-	-	262
HCM Lane V/C Ratio	0.821	0.035	-	-	0.105	-	-	0.266
HCM Control Delay (s/veh)	59.9	8	-	-	8.9	-	-	23.7
HCM Lane LOS	F	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	6.5	0.1	-	-	0.4	-	-	1

HCM 7th AWSC
13: Kuakini Hwy & Makala Blvd
10/27/2023

Intersection	
Intersection Delay, s/veh	16.4
Intersection LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	37	64	354	62	62	331
Future Vol, veh/h	37	64	354	62	62	331
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	40	70	385	67	67	360
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	9.5	19.3	15.1
HCM LOS	A	C	C

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	16%	0%	85%
Vol Thru, %	0%	37%	15%
Vol Right, %	84%	63%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	393	101	416
LT Vol	62	0	354
Through Vol	0	37	62
RT Vol	331	64	0
Lane Flow Rate	427	110	452
Geometry Grp	1	1	1
Degree of Util (X)	0.592	0.165	0.681
Departure Headway (Hd)	4.991	5.408	5.424
Convergence, Y/N	Yes	Yes	Yes
Cap	722	662	665
Service Time	3.03	3.454	3.454
HCM Lane V/C Ratio	0.591	0.166	0.68
HCM Control Delay, s/veh	15.1	9.5	19.3
HCM Lane LOS	C	A	C
HCM 95th-tile Q	3.9	0.6	5.3

HCM 7th TWSC
14: Kuakini Hwy & Loloku St

10/27/2023

Intersection						
Int Delay, s/veh	6					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	148	38	383	238	9	390
Future Vol, veh/h	148	38	383	238	9	390
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	161	41	416	259	10	424

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	989	546	0	0	675	0
Stage 1	546	-	-	-	-	-
Stage 2	443	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	274	538	-	-	916	-
Stage 1	581	-	-	-	-	-
Stage 2	647	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	270	538	-	-	916	-
Mov Cap-2 Maneuver	270	-	-	-	-	-
Stage 1	581	-	-	-	-	-
Stage 2	638	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	38.53	0	0.2
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	300	916	-
HCM Lane V/C Ratio	-	-	0.673	0.011	-
HCM Control Delay (s/veh)	-	-	38.5	9	0
HCM Lane LOS	-	-	E	A	A
HCM 95th %tile Q(veh)	-	-	4.5	0	-

HCM 7th Signalized Intersection Summary
15: Kuakini Hwy & Kaiwi St

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	44	48	313	25	45	50	571	461	25	486	32
Future Volume (veh/h)	30	44	48	313	25	45	50	571	461	25	486	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	48	16	340	27	40	54	621	217	27	528	31
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	259	350	101	557	33	50	120	823	756	92	741	42
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.48	0.48	0.48	0.48	0.48	0.48
Sat Flow, veh/h	452	990	285	1189	94	140	82	1710	1570	30	1539	88
Grp Volume(v), veh/h	97	0	0	407	0	0	675	0	217	586	0	0
Grp Sat Flow(s),veh/h/ln	1727	0	0	1423	0	0	1792	0	1570	1656	0	0
Q Serve(g_s), s	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	4.0	0.9	0.0	0.0
Cycle Q Clear(g_c), s	1.8	0.0	0.0	12.4	0.0	0.0	14.6	0.0	4.0	15.5	0.0	0.0
Prop In Lane	0.34		0.16	0.84		0.10	0.08		1.00	0.05		0.05
Lane Grp Cap(c), veh/h	711	0	0	640	0	0	943	0	756	875	0	0
V/C Ratio(X)	0.14	0.00	0.00	0.64	0.00	0.00	0.72	0.00	0.29	0.67	0.00	0.00
Avail Cap(c_a), veh/h	1329	0	0	1174	0	0	1736	0	1486	1669	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	10.7	0.0	0.0	13.9	0.0	0.0	10.3	0.0	7.6	9.6	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.1	0.0	0.0	1.0	0.0	0.2	0.9	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	3.6	0.0	0.0	4.9	0.0	1.1	3.9	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	10.8	0.0	0.0	15.0	0.0	0.0	11.3	0.0	7.8	10.5	0.0	0.0
LnGrp LOS	B			B			B		A	B		
Approach Vol, veh/h		97			407			892			586	
Approach Delay, s/veh		10.8			15.0			10.4			10.5	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	27.4	21.2	27.4	21.2
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	46.0	36.0	46.0	36.0
Max Q Clear Time (g_c+I1), s	16.6	3.8	17.5	14.4
Green Ext Time (p_c), s	6.8	0.6	4.8	2.8

Intersection Summary	
HCM 7th Control Delay, s/veh	11.4
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	188	208	40	351	360	388	86	508	284	188	474	187
Future Volume (veh/h)	188	208	40	351	360	388	86	508	284	188	474	187
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.91	0.98		0.90	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	204	226	38	382	391	202	93	552	0	204	515	193
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	270	265	45	405	487	371	293	651		250	956	356
Arrive On Green	0.10	0.19	0.19	0.20	0.29	0.29	0.05	0.39	0.00	0.08	0.42	0.42
Sat Flow, veh/h	1603	1382	232	1603	1683	1283	1603	1683	1427	1603	2267	845
Grp Volume(v), veh/h	204	0	264	382	391	202	93	552	0	204	362	346
Grp Sat Flow(s),veh/h/ln	1603	0	1614	1603	1683	1283	1603	1683	1427	1603	1599	1513
Q Serve(g_s), s	14.9	0.0	22.9	26.9	31.2	19.3	5.0	43.4	0.0	10.9	24.6	24.8
Cycle Q Clear(g_c), s	14.9	0.0	22.9	26.9	31.2	19.3	5.0	43.4	0.0	10.9	24.6	24.8
Prop In Lane	1.00		0.14	1.00		1.00	1.00		1.00	1.00		0.56
Lane Grp Cap(c), veh/h	270	0	310	405	487	371	293	651		250	675	638
V/C Ratio(X)	0.76	0.00	0.85	0.94	0.80	0.54	0.32	0.85		0.82	0.54	0.54
Avail Cap(c_a), veh/h	270	0	390	415	580	443	327	651		250	675	638
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.50	0.50	0.50	1.00	1.00	0.00	0.64	0.64	0.64
Uniform Delay (d), s/veh	42.7	0.0	56.6	36.4	47.7	43.5	26.2	40.6	0.0	31.7	31.3	31.4
Incr Delay (d2), s/veh	11.6	0.0	13.8	18.9	3.6	0.6	0.6	12.9	0.0	12.7	2.0	2.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.9	0.0	10.6	12.8	13.7	6.3	2.0	20.4	0.0	5.1	10.0	9.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	54.2	0.0	70.4	55.3	51.3	44.1	26.8	53.5	0.0	44.4	33.3	33.5
LnGrp LOS	D		E	E	D	D	C	D		D	C	C
Approach Vol, veh/h		468			975			645			912	
Approach Delay, s/veh		63.3			51.4			49.6			35.9	
Approach LOS		E			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.0	61.1	34.1	32.8	11.9	66.2	20.0	46.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	12.0	48.0	30.0	35.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	12.9	45.4	28.9	24.9	7.0	26.8	16.9	33.2
Green Ext Time (p_c), s	0.0	1.0	0.2	1.1	0.0	5.0	0.0	3.1

Intersection Summary	
HCM 7th Control Delay, s/veh	48.2
HCM 7th LOS	D

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	659	55	415	27	59	47	440	957	17	41	1225	614
Future Volume (veh/h)	659	55	415	27	59	47	440	957	17	41	1225	614
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	716	60	0	29	64	0	478	1040	8	45	1332	219
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	869	471		91	95		576	1711	762	61	1781	551
Arrive On Green	0.25	0.25	0.00	0.05	0.05	0.00	0.17	0.48	0.48	0.03	0.35	0.35
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	5106	1581
Grp Volume(v), veh/h	716	60	0	29	64	0	478	1040	8	45	1332	219
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1702	1581
Q Serve(g_s), s	21.5	2.7	0.0	1.7	3.7	0.0	14.7	23.6	0.3	2.8	25.3	11.5
Cycle Q Clear(g_c), s	21.5	2.7	0.0	1.7	3.7	0.0	14.7	23.6	0.3	2.8	25.3	11.5
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	869	471		91	95		576	1711	762	61	1781	551
V/C Ratio(X)	0.82	0.13		0.32	0.67		0.83	0.61	0.01	0.74	0.75	0.40
Avail Cap(c_a), veh/h	1321	715		292	306		1100	2490	1108	130	2323	719
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.8	31.8	0.0	50.3	51.3	0.0	44.3	20.9	14.8	52.6	31.5	27.0
Incr Delay (d2), s/veh	2.6	0.1	0.0	2.0	7.9	0.0	3.2	0.4	0.0	16.3	1.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.4	1.3	0.0	0.8	2.0	0.0	6.4	9.4	0.1	1.5	10.2	4.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	41.5	31.9	0.0	52.3	59.2	0.0	47.5	21.2	14.9	68.9	32.5	27.5
LnGrp LOS	D	C		D	E		D	C	B	E	C	C
Approach Vol, veh/h		776			93			1526			1596	
Approach Delay, s/veh		40.7			57.1			29.4			32.8	
Approach LOS		D			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.7	57.9		10.6	23.3	43.3		32.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	8.0	77.0		18.0	35.0	50.0		42.0
Max Q Clear Time (g_c+I1), s	4.8	25.6		5.7	16.7	27.3		23.5
Green Ext Time (p_c), s	0.0	9.5		0.2	1.6	11.1		3.1

Intersection Summary	
HCM 7th Control Delay, s/veh	33.6
HCM 7th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	333	401	146	20	417	114	191	1001	30	151	1124	518
Future Volume (veh/h)	333	401	146	20	417	114	191	1001	30	151	1124	518
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	362	436	0	22	453	0	208	1088	12	164	1222	339
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	437	988		39	617		279	1561	696	232	1512	673
Arrive On Green	0.13	0.28	0.00	0.02	0.17	0.00	0.08	0.44	0.44	0.07	0.43	0.43
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1582
Grp Volume(v), veh/h	362	436	0	22	453	0	208	1088	12	164	1222	339
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1582
Q Serve(g_s), s	11.6	11.5	0.0	1.4	13.7	0.0	6.7	28.1	0.5	5.3	34.2	17.8
Cycle Q Clear(g_c), s	11.6	11.5	0.0	1.4	13.7	0.0	6.7	28.1	0.5	5.3	34.2	17.8
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	437	988		39	617		279	1561	696	232	1512	673
V/C Ratio(X)	0.83	0.44		0.56	0.73		0.75	0.70	0.02	0.71	0.81	0.50
Avail Cap(c_a), veh/h	623	1172		321	1172		623	2048	913	593	2017	898
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	48.4	33.8	0.0	55.0	44.5	0.0	51.1	25.8	18.0	51.9	28.6	23.9
Incr Delay (d2), s/veh	6.3	0.3	0.0	11.9	1.7	0.0	3.9	0.7	0.0	4.0	1.9	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	5.0	0.0	0.8	6.2	0.0	3.0	11.6	0.2	2.4	14.4	6.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	54.7	34.1	0.0	67.0	46.2	0.0	55.0	26.5	18.0	55.9	30.5	24.5
LnGrp LOS	D	C		E	D		E	C	B	E	C	C
Approach Vol, veh/h		798			475			1308			1725	
Approach Delay, s/veh		43.4			47.2			30.9			31.7	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.1	55.4	8.0	37.1	14.7	53.9	19.9	25.2
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	65.5	20.5	37.5	20.5	64.5	20.5	37.5
Max Q Clear Time (g_c+I1), s	7.3	30.1	3.4	13.5	8.7	36.2	13.6	15.7
Green Ext Time (p_c), s	0.4	9.5	0.0	3.1	0.5	12.1	0.8	3.2

Intersection Summary	
HCM 7th Control Delay, s/veh	35.3
HCM 7th LOS	D

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	782	24	210	712	204	9	56	192	132	40	30
Future Volume (veh/h)	30	782	24	210	712	204	9	56	192	132	40	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	850	25	228	774	205	10	61	4	143	43	10
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	62	1238	36	283	1319	349	103	108	92	206	170	40
Arrive On Green	0.03	0.35	0.35	0.16	0.48	0.48	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3524	104	1781	2774	735	1781	1870	1585	1781	1468	341
Grp Volume(v), veh/h	33	429	446	228	496	483	10	61	4	143	0	53
Grp Sat Flow(s),veh/h/ln	1781	1777	1851	1781	1777	1732	1781	1870	1585	1781	0	1809
Q Serve(g_s), s	1.2	13.1	13.1	7.8	12.8	12.8	0.3	2.0	0.2	4.9	0.0	1.7
Cycle Q Clear(g_c), s	1.2	13.1	13.1	7.8	12.8	12.8	0.3	2.0	0.2	4.9	0.0	1.7
Prop In Lane	1.00		0.06	1.00		0.42	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	62	624	650	283	845	824	103	108	92	206	0	210
V/C Ratio(X)	0.53	0.69	0.69	0.80	0.59	0.59	0.10	0.56	0.04	0.69	0.00	0.25
Avail Cap(c_a), veh/h	253	1544	1608	535	1825	1778	535	561	476	901	0	915
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.0	17.6	17.6	25.7	12.1	12.1	28.3	29.0	28.2	26.9	0.0	25.5
Incr Delay (d2), s/veh	6.9	1.4	1.3	5.3	0.7	0.7	0.4	4.5	0.2	4.1	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	5.2	5.4	3.6	4.7	4.5	0.2	1.0	0.1	2.2	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	37.0	18.9	18.9	31.0	12.7	12.7	28.7	33.6	28.4	31.0	0.0	26.1
LnGrp LOS	D	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		908			1207			75			196	
Approach Delay, s/veh		19.5			16.2			32.6			29.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	15.1	27.2		12.3	7.2	35.1		8.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	9.8	15.1		6.9	3.2	14.8		4.0
Green Ext Time (p_c), s	0.4	7.1		0.7	0.0	8.8		0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	19.1
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	93	505	16	130	578	52	28	54	203	124	63	64
Future Volume (veh/h)	93	505	16	130	578	52	28	54	203	124	63	64
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	101	549	16	141	628	52	30	59	13	135	68	38
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	131	940	27	186	987	82	143	151	127	312	195	109
Arrive On Green	0.07	0.27	0.27	0.10	0.30	0.30	0.08	0.08	0.08	0.18	0.18	0.18
Sat Flow, veh/h	1781	3526	103	1781	3320	275	1781	1870	1575	1781	1114	622
Grp Volume(v), veh/h	101	276	289	141	336	344	30	59	13	135	0	106
Grp Sat Flow(s),veh/h/ln	1781	1777	1852	1781	1777	1818	1781	1870	1575	1781	0	1736
Q Serve(g_s), s	3.0	7.2	7.3	4.1	8.8	8.8	0.8	1.6	0.4	3.6	0.0	2.9
Cycle Q Clear(g_c), s	3.0	7.2	7.3	4.1	8.8	8.8	0.8	1.6	0.4	3.6	0.0	2.9
Prop In Lane	1.00		0.06	1.00		0.15	1.00		1.00	1.00		0.36
Lane Grp Cap(c), veh/h	131	474	493	186	528	541	143	151	127	312	0	304
V/C Ratio(X)	0.77	0.58	0.58	0.76	0.64	0.64	0.21	0.39	0.10	0.43	0.00	0.35
Avail Cap(c_a), veh/h	332	1011	1054	565	1244	1272	1047	1100	926	1047	0	1021
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.4	17.1	17.1	23.3	16.3	16.3	23.0	23.4	22.8	19.7	0.0	19.4
Incr Delay (d2), s/veh	9.1	1.1	1.1	6.2	1.3	1.3	0.7	1.7	0.4	0.9	0.0	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	2.9	3.0	2.0	3.4	3.5	0.4	0.7	0.2	1.5	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	33.5	18.2	18.2	29.5	17.6	17.6	23.8	25.0	23.2	20.7	0.0	20.1
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		666			821			102			241	
Approach Delay, s/veh		20.5			19.6			24.4			20.4	
Approach LOS		C			B			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.6	19.3		14.4	8.9	20.9		9.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5				
Max Q Clear Time (g_c+I1), s	6.1	9.3		5.6	5.0	10.8		3.6				
Green Ext Time (p_c), s	0.3	3.6		1.0	0.1	4.8		0.4				
Intersection Summary												
HCM 7th Control Delay, s/veh			20.3									
HCM 7th LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	423	52	167	493	7	27	5	178	8	6	12
Future Volume (veh/h)	22	423	52	167	493	7	27	5	178	8	6	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	24	460	50	182	536	8	29	5	8	9	7	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	53	870	94	231	1323	20	84	88	75	36	38	0
Arrive On Green	0.03	0.27	0.27	0.13	0.37	0.37	0.05	0.05	0.05	0.02	0.02	0.00
Sat Flow, veh/h	1781	3232	350	1781	3584	53	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	24	252	258	182	266	278	29	5	8	9	7	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1805	1781	1777	1860	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.5	4.5	4.6	3.7	4.2	4.2	0.6	0.1	0.2	0.2	0.1	0.0
Cycle Q Clear(g_c), s	0.5	4.5	4.6	3.7	4.2	4.2	0.6	0.1	0.2	0.2	0.1	0.0
Prop In Lane	1.00		0.19	1.00		0.03	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	53	478	486	231	656	687	84	88	75	36	38	0
V/C Ratio(X)	0.46	0.53	0.53	0.79	0.40	0.41	0.34	0.06	0.11	0.25	0.18	0.00
Avail Cap(c_a), veh/h	238	1185	1204	238	1185	1241	1425	1497	1268	1425	1497	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.9	11.7	11.7	15.8	8.8	8.8	17.3	17.1	17.1	18.1	18.1	0.0
Incr Delay (d2), s/veh	6.1	0.9	0.9	15.8	0.4	0.4	2.4	0.3	0.6	3.5	2.3	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.6	1.6	2.3	1.3	1.3	0.3	0.0	0.1	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	24.0	12.6	12.6	31.6	9.2	9.2	19.7	17.3	17.7	21.5	20.3	0.0
LnGrp LOS	C	B	B	C	A	A	B	B	B	C	C	
Approach Vol, veh/h		534			726			42			16	
Approach Delay, s/veh		13.1			14.8			19.0			21.0	
Approach LOS		B			B			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.9	15.1		5.8	6.1	18.8		6.8				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0				
Max Q Clear Time (g_c+I1), s	5.7	6.6		2.2	2.5	6.2		2.6				
Green Ext Time (p_c), s	0.0	3.1		0.0	0.0	3.3		0.1				
Intersection Summary												
HCM 7th Control Delay, s/veh			14.3									
HCM 7th LOS			B									

Intersection	
Int Delay, s/veh	8.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	26	397	39	56	438	50	30	30	53	47	30	20
Future Vol, veh/h	26	397	39	56	438	50	30	30	53	47	30	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	28	432	42	61	476	54	33	33	58	51	33	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	530	0	0	474	0	0	1123	1161	453	1129	1155	503
Stage 1	-	-	-	-	-	-	509	509	-	625	625	-
Stage 2	-	-	-	-	-	-	614	652	-	504	530	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1037	-	-	1088	-	-	183	195	607	181	197	568
Stage 1	-	-	-	-	-	-	547	538	-	473	477	-
Stage 2	-	-	-	-	-	-	479	464	-	550	526	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1037	-	-	1088	-	-	129	173	607	120	174	568
Mov Cap-2 Maneuver	-	-	-	-	-	-	129	173	-	120	174	-
Stage 1	-	-	-	-	-	-	526	518	-	455	439	-
Stage 2	-	-	-	-	-	-	392	427	-	449	507	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.48	0.88	37.48	61.09
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	229	1037	-	-	1088	-	-	162
HCM Lane V/C Ratio	0.536	0.027	-	-	0.056	-	-	0.65
HCM Control Delay (s/veh)	37.5	8.6	0	-	8.5	0	-	61.1
HCM Lane LOS	E	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	2.9	0.1	-	-	0.2	-	-	3.7

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	233	29	48	175	35	16	8	82	32	22	27
Future Vol, veh/h	33	233	29	48	175	35	16	8	82	32	22	27
Conflicting Peds, #/hr	0	0	1	1	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	253	32	52	190	38	17	9	89	35	24	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	228	0	0	286	0	0	648	674	270	643	671	209
Stage 1	-	-	-	-	-	-	342	342	-	314	314	-
Stage 2	-	-	-	-	-	-	307	333	-	329	358	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1340	-	-	1276	-	-	383	376	769	386	378	831
Stage 1	-	-	-	-	-	-	673	638	-	697	657	-
Stage 2	-	-	-	-	-	-	703	644	-	684	628	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1340	-	-	1275	-	-	319	346	768	308	348	831
Mov Cap-2 Maneuver	-	-	-	-	-	-	319	346	-	308	348	-
Stage 1	-	-	-	-	-	-	651	617	-	675	626	-
Stage 2	-	-	-	-	-	-	622	614	-	577	607	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.87	1.48	11.8	16.32
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	328	768	1340	-	-	1275	-	-	406
HCM Lane V/C Ratio	0.08	0.116	0.027	-	-	0.041	-	-	0.217
HCM Control Delay (s/veh)	16.9	10.3	7.8	0	-	7.9	0	-	16.3
HCM Lane LOS	C	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0.4	0.1	-	-	0.1	-	-	0.8

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	392	39	55	415	19	30	19	52	18	19	10
Future Vol, veh/h	13	392	39	55	415	19	30	19	52	18	19	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	426	42	60	451	21	33	21	57	20	21	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	472	0	0	468	0	0	1057	1067	447	1046	1078	461
Stage 1	-	-	-	-	-	-	476	476	-	581	581	-
Stage 2	-	-	-	-	-	-	581	591	-	465	497	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1090	-	-	1093	-	-	203	222	611	207	219	600
Stage 1	-	-	-	-	-	-	570	557	-	500	500	-
Stage 2	-	-	-	-	-	-	500	494	-	578	545	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1090	-	-	1093	-	-	164	202	611	154	199	600
Mov Cap-2 Maneuver	-	-	-	-	-	-	164	202	-	154	199	-
Stage 1	-	-	-	-	-	-	560	547	-	491	462	-
Stage 2	-	-	-	-	-	-	434	458	-	496	535	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.24	0.95	26.04	28.22
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	279	1090	-	-	1093	-	-	205
HCM Lane V/C Ratio	0.394	0.013	-	-	0.055	-	-	0.249
HCM Control Delay (s/veh)	26	8.3	0	-	8.5	0	-	28.2
HCM Lane LOS	D	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	1.8	0	-	-	0.2	-	-	0.9

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	185	33	35	136	35	27	5	32	32	19	27
Future Vol, veh/h	33	185	33	35	136	35	27	5	32	32	19	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	201	36	38	148	38	29	5	35	35	21	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	186	0	0	237	0	0	525	553	219	518	552	167
Stage 1	-	-	-	-	-	-	291	291	-	243	243	-
Stage 2	-	-	-	-	-	-	234	262	-	276	309	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1389	-	-	1330	-	-	463	441	821	468	442	877
Stage 1	-	-	-	-	-	-	717	672	-	761	705	-
Stage 2	-	-	-	-	-	-	769	692	-	731	660	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1389	-	-	1330	-	-	401	414	821	415	415	877
Mov Cap-2 Maneuver	-	-	-	-	-	-	401	414	-	415	415	-
Stage 1	-	-	-	-	-	-	696	652	-	738	682	-
Stage 2	-	-	-	-	-	-	698	669	-	673	640	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	1.01	1.32	12.64	13.5
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	540	1389	-	-	1330	-	-	508
HCM Lane V/C Ratio	0.129	0.026	-	-	0.029	-	-	0.167
HCM Control Delay (s/veh)	12.6	7.7	0	-	7.8	0	-	13.5
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0.1	-	-	0.6

Intersection												
Int Delay, s/veh	6											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	46	297	137	91	210	17	62	0	93	30	0	33
Future Vol, veh/h	46	297	137	91	210	17	62	0	93	30	0	33
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	50	323	149	99	228	18	67	0	101	33	0	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	253	0	0	472	0	0	924	948	397	864	1013	244
Stage 1	-	-	-	-	-	-	497	497	-	441	441	-
Stage 2	-	-	-	-	-	-	427	451	-	423	572	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1312	-	-	1090	-	-	250	261	652	274	239	794
Stage 1	-	-	-	-	-	-	555	545	-	595	577	-
Stage 2	-	-	-	-	-	-	606	571	-	609	504	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1305	-	-	1090	-	-	208	227	652	202	208	789
Mov Cap-2 Maneuver	-	-	-	-	-	-	208	227	-	202	208	-
Stage 1	-	-	-	-	-	-	534	524	-	569	521	-
Stage 2	-	-	-	-	-	-	525	517	-	495	485	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.75	2.47	24.26	18.72
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	352	1305	-	-	1090	-	-	330
HCM Lane V/C Ratio	0.479	0.038	-	-	0.091	-	-	0.207
HCM Control Delay (s/veh)	24.3	7.9	-	-	8.6	-	-	18.7
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	2.5	0.1	-	-	0.3	-	-	0.8

Intersection	
Intersection Delay, s/veh	24.7
Intersection LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	86	112	369	86	103	357
Future Vol, veh/h	86	112	369	86	103	357
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	93	122	401	93	112	388
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	12.3	30.4	24.5
HCM LOS	B	D	C

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	22%	0%	81%
Vol Thru, %	0%	43%	19%
Vol Right, %	78%	57%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	460	198	455
LT Vol	103	0	369
Through Vol	0	86	86
RT Vol	357	112	0
Lane Flow Rate	500	215	495
Geometry Grp	1	1	1
Degree of Util (X)	0.766	0.356	0.817
Departure Headway (Hd)	5.517	5.947	5.947
Convergence, Y/N	Yes	Yes	Yes
Cap	650	598	603
Service Time	3.598	4.045	4.024
HCM Lane V/C Ratio	0.769	0.36	0.821
HCM Control Delay, s/veh	24.5	12.3	30.4
HCM Lane LOS	C	B	D
HCM 95th-tile Q	7.1	1.6	8.3

HCM 7th TWSC
14: Kuakini Hwy & Loloku St

10/27/2023

Intersection	
Int Delay, s/veh	9.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	152	38	426	245	6	497
Future Vol, veh/h	152	38	426	245	6	497
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	165	41	463	266	7	540

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1150	597	0	0	729	0
Stage 1	596	-	-	-	-	-
Stage 2	554	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	219	503	-	-	875	-
Stage 1	550	-	-	-	-	-
Stage 2	575	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	216	502	-	-	875	-
Mov Cap-2 Maneuver	216	-	-	-	-	-
Stage 1	550	-	-	-	-	-
Stage 2	569	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	67.52	0	0.11
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	244	875	-
HCM Lane V/C Ratio	-	-	0.845	0.007	-
HCM Control Delay (s/veh)	-	-	67.5	9.1	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	6.8	0	-

HCM 7th Signalized Intersection Summary
15: Kuakini Hwy & Kaiwi St

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	24	46	238	21	27	44	630	415	35	582	23
Future Volume (veh/h)	17	24	46	238	21	27	44	630	415	35	582	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.99	1.00		0.99	0.99		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	18	26	12	259	23	22	48	685	229	38	633	23
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	218	282	107	497	36	30	121	929	809	108	828	29
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	383	988	374	1208	125	104	62	1748	1522	39	1557	55
Grp Volume(v), veh/h	56	0	0	304	0	0	733	0	229	694	0	0
Grp Sat Flow(s),veh/h/ln	1746	0	0	1437	0	0	1810	0	1522	1651	0	0
Q Serve(g_s), s	0.0	0.0	0.0	7.3	0.0	0.0	0.0	0.0	3.6	1.8	0.0	0.0
Cycle Q Clear(g_c), s	1.0	0.0	0.0	8.3	0.0	0.0	13.3	0.0	3.6	15.0	0.0	0.0
Prop In Lane	0.32		0.21	0.85		0.07	0.07		1.00	0.05		0.03
Lane Grp Cap(c), veh/h	607	0	0	563	0	0	1050	0	809	964	0	0
V/C Ratio(X)	0.09	0.00	0.00	0.54	0.00	0.00	0.70	0.00	0.28	0.72	0.00	0.00
Avail Cap(c_a), veh/h	1471	0	0	1318	0	0	1939	0	1600	1831	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	11.5	0.0	0.0	14.0	0.0	0.0	7.9	0.0	5.7	7.8	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.8	0.0	0.0	0.9	0.0	0.2	1.0	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	2.4	0.0	0.0	3.9	0.0	0.9	3.6	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	11.6	0.0	0.0	14.8	0.0	0.0	8.8	0.0	5.8	8.8	0.0	0.0
LnGrp LOS	B			B			A		A	A		
Approach Vol, veh/h		56			304			962			694	
Approach Delay, s/veh		11.6			14.8			8.1			8.8	
Approach LOS		B			B			A			A	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	27.3	16.5	27.3	16.5
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	46.0	36.0	46.0	36.0
Max Q Clear Time (g_c+I1), s	15.3	3.0	17.0	10.3
Green Ext Time (p_c), s	7.8	0.3	6.2	2.0

Intersection Summary	
HCM 7th Control Delay, s/veh	9.4
HCM 7th LOS	A

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱	↰	↑	↱	↰	↑ ↑↱	
Traffic Volume (veh/h)	196	253	33	260	318	429	77	436	231	260	407	208
Future Volume (veh/h)	196	253	33	260	318	429	77	436	231	260	407	208
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.95	0.98		0.93	0.99		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	213	275	32	283	346	194	84	474	0	283	442	209
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	315	329	38	349	438	344	303	523		309	816	382
Arrive On Green	0.12	0.22	0.22	0.15	0.26	0.26	0.05	0.31	0.00	0.13	0.39	0.39
Sat Flow, veh/h	1603	1471	171	1603	1683	1322	1603	1683	1427	1603	2085	975
Grp Volume(v), veh/h	213	0	307	283	346	194	84	474	0	283	338	313
Grp Sat Flow(s),veh/h/ln	1603	0	1642	1603	1683	1322	1603	1683	1427	1603	1599	1460
Q Serve(g_s), s	10.8	0.0	19.2	14.2	20.6	13.7	3.8	29.0	0.0	12.4	17.5	17.8
Cycle Q Clear(g_c), s	10.8	0.0	19.2	14.2	20.6	13.7	3.8	29.0	0.0	12.4	17.5	17.8
Prop In Lane	1.00		0.10	1.00		1.00	1.00		1.00	1.00		0.67
Lane Grp Cap(c), veh/h	315	0	367	349	438	344	303	523		309	626	572
V/C Ratio(X)	0.68	0.00	0.84	0.81	0.79	0.56	0.28	0.91		0.91	0.54	0.55
Avail Cap(c_a), veh/h	419	0	382	349	438	344	313	659		309	745	680
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.3	0.0	39.8	27.5	37.0	34.5	23.6	35.5	0.0	24.6	25.2	25.3
Incr Delay (d2), s/veh	2.7	0.0	14.5	13.6	9.5	2.1	0.5	14.0	0.0	30.2	0.7	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	0.0	9.2	6.7	9.6	4.6	1.5	13.8	0.0	7.2	6.8	6.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	31.0	0.0	54.3	41.1	46.5	36.6	24.1	49.5	0.0	54.8	25.9	26.1
LnGrp LOS	C		D	D	D	D	C	D		D	C	C
Approach Vol, veh/h		520			823			558			934	
Approach Delay, s/veh		44.8			42.3			45.7			34.7	
Approach LOS		D			D			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.0	38.4	21.0	29.0	10.3	47.0	17.1	32.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	14.0	42.0	16.0	25.0	6.0	50.0	20.0	22.0
Max Q Clear Time (g_c+I1), s	14.4	31.0	16.2	21.2	5.8	19.8	12.8	22.6
Green Ext Time (p_c), s	0.0	2.4	0.0	0.6	0.0	4.9	0.3	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	40.9
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↱		↰	↑↱		↰↰	↑↑	↱	↰	↑↑↑	↱
Traffic Volume (veh/h)	546	56	184	61	44	105	243	1683	48	132	1122	423
Future Volume (veh/h)	546	56	184	61	44	105	243	1683	48	132	1122	423
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	593	61	0	66	48	0	264	1829	27	143	1220	203
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	651	352		107	113		318	1910	852	165	2747	852
Arrive On Green	0.19	0.19	0.00	0.06	0.06	0.00	0.09	0.54	0.54	0.09	0.54	0.54
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1585	1781	5106	1584
Grp Volume(v), veh/h	593	61	0	66	48	0	264	1829	27	143	1220	203
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1585	1781	1702	1584
Q Serve(g_s), s	27.7	4.5	0.0	6.0	4.1	0.0	12.4	80.9	1.3	13.1	23.9	11.2
Cycle Q Clear(g_c), s	27.7	4.5	0.0	6.0	4.1	0.0	12.4	80.9	1.3	13.1	23.9	11.2
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	651	352		107	113		318	1910	852	165	2747	852
V/C Ratio(X)	0.91	0.17		0.61	0.43		0.83	0.96	0.03	0.87	0.44	0.24
Avail Cap(c_a), veh/h	733	397		184	193		670	1910	852	270	2747	852
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.75	0.75	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.6	56.2	0.0	75.7	74.8	0.0	73.6	36.4	18.0	73.9	23.1	20.2
Incr Delay (d2), s/veh	11.5	0.2	0.0	5.6	2.5	0.0	5.5	12.8	0.1	14.9	0.5	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.4	2.2	0.0	2.9	2.1	0.0	5.7	37.5	0.5	6.7	9.8	4.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	77.1	56.3	0.0	81.3	77.3	0.0	79.2	49.1	18.0	88.8	23.7	20.9
LnGrp LOS	E	E		F	E		E	D	B	F	C	C
Approach Vol, veh/h		654			114			2120			1566	
Approach Delay, s/veh		75.2			79.6			52.5			29.2	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	20.3	93.7		14.9	20.2	93.8		36.1
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	25.0	68.0		17.0	32.0	61.0		35.0
Max Q Clear Time (g_c+I1), s	15.1	82.9		8.0	14.4	25.9		29.7
Green Ext Time (p_c), s	0.2	0.0		0.2	0.8	11.9		1.4

Intersection Summary	
HCM 7th Control Delay, s/veh	48.3
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	52	0	2011	53	0	1471	40
Future Vol, veh/h	0	0	0	0	0	52	0	2011	53	0	1471	40
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	57	0	2186	58	0	1599	43

Major/Minor				Minor1			Major1			Major2		
Conflicting Flow All				-	-	1122	1601	0	0	2186	-	0
Stage 1				-	-	-	-	-	-	-	-	-
Stage 2				-	-	-	-	-	-	-	-	-
Critical Hdwy				-	-	6.94	-	-	-	-	-	-
Critical Hdwy Stg 1				-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2				-	-	-	-	-	-	-	-	-
Follow-up Hdwy				-	-	3.32	-	-	-	-	-	-
Pot Cap-1 Maneuver				0	0	200	0	-	-	0	-	-
Stage 1				0	0	-	0	-	-	0	-	-
Stage 2				0	0	-	0	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver				-	0	200	-	-	-	-	-	-
Mov Cap-2 Maneuver				-	0	-	-	-	-	-	-	-
Stage 1				-	0	-	-	-	-	-	-	-
Stage 2				-	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	29.91	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	200	-	-
HCM Lane V/C Ratio	-	-	0.282	-	-
HCM Control Delay (s/veh)	-	-	29.9	-	-
HCM Lane LOS	-	-	D	-	-
HCM 95th %tile Q(veh)	-	-	1.1	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	507	375	110	57	427	114	163	1429	41	112	938	410
Future Volume (veh/h)	507	375	110	57	427	114	163	1429	41	112	938	410
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	551	408	0	62	464	0	177	1553	17	122	1020	243
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	613	967		102	539		251	1739	775	209	1695	754
Arrive On Green	0.18	0.27	0.00	0.06	0.15	0.00	0.07	0.49	0.49	0.06	0.48	0.48
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1584	3456	3554	1580
Grp Volume(v), veh/h	551	408	0	62	464	0	177	1553	17	122	1020	243
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1584	1728	1777	1580
Q Serve(g_s), s	25.7	15.6	0.0	5.6	21.0	0.0	8.3	65.4	0.9	5.7	34.7	15.7
Cycle Q Clear(g_c), s	25.7	15.6	0.0	5.6	21.0	0.0	8.3	65.4	0.9	5.7	34.7	15.7
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	613	967		102	539		251	1739	775	209	1695	754
V/C Ratio(X)	0.90	0.42		0.61	0.86		0.70	0.89	0.02	0.58	0.60	0.32
Avail Cap(c_a), veh/h	775	969		238	646		356	1739	775	230	1695	754
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.46	0.46	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	66.4	49.4	0.0	76.0	68.3	0.0	74.8	38.2	21.7	75.5	31.6	26.7
Incr Delay (d2), s/veh	5.8	0.1	0.0	5.8	10.0	0.0	3.6	7.5	0.1	3.1	1.6	1.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.0	7.1	0.0	2.8	10.4	0.0	3.8	29.8	0.4	2.6	15.3	6.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	72.2	49.5	0.0	81.8	78.2	0.0	78.4	45.7	21.8	78.6	33.2	27.8
LnGrp LOS	E	D		F	E		E	D	C	E	C	C
Approach Vol, veh/h		959			526			1747			1385	
Approach Delay, s/veh		62.6			78.7			48.8			36.3	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	85.7	14.4	49.9	17.0	83.7	34.3	30.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	67.0	22.0	45.0	17.0	61.0	37.0	30.0
Max Q Clear Time (g_c+I1), s	7.7	67.4	7.6	17.6	10.3	36.7	27.7	23.0
Green Ext Time (p_c), s	0.1	0.0	0.1	3.0	0.3	8.8	1.5	1.8

Intersection Summary	
HCM 7th Control Delay, s/veh	51.3
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary

5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	547	20	210	415	77	2	19	209	36	18	11
Future Volume (veh/h)	11	547	20	210	415	77	2	19	209	36	18	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	12	595	20	228	451	74	2	21	4	39	20	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	28	1041	35	298	1372	224	57	60	50	103	109	0
Arrive On Green	0.02	0.30	0.30	0.17	0.45	0.45	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3507	118	1781	3057	499	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	12	301	314	228	261	264	2	21	4	39	20	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1848	1781	1777	1779	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.3	6.4	6.5	5.5	4.3	4.3	0.0	0.5	0.1	0.9	0.5	0.0
Cycle Q Clear(g_c), s	0.3	6.4	6.5	5.5	4.3	4.3	0.0	0.5	0.1	0.9	0.5	0.0
Prop In Lane	1.00		0.06	1.00		0.28	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	28	527	548	298	797	799	57	60	50	103	109	0
V/C Ratio(X)	0.44	0.57	0.57	0.76	0.33	0.33	0.04	0.35	0.08	0.38	0.18	0.00
Avail Cap(c_a), veh/h	357	2179	2266	754	2575	2578	754	792	671	1271	1334	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	21.9	13.4	13.4	17.8	8.0	8.0	21.0	21.3	21.1	20.3	20.1	0.0
Incr Delay (d2), s/veh	10.4	1.0	0.9	4.1	0.2	0.2	0.3	3.5	0.7	2.3	0.8	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	2.4	2.4	2.4	1.3	1.4	0.0	0.3	0.0	0.4	0.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	32.3	14.3	14.3	21.9	8.2	8.2	21.3	24.8	21.7	22.6	20.9	0.0
LnGrp LOS	C	B	B	C	A	A	C	C	C	C	C	
Approach Vol, veh/h		627			753			27			59	
Approach Delay, s/veh		14.7			12.4			24.1			22.0	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	12.5	18.3	7.6	5.7	25.1	6.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	19.0	55.0	32.0	9.0	65.0	19.0
Max Q Clear Time (g_c+I1), s	7.5	8.5	2.9	2.3	6.3	2.5
Green Ext Time (p_c), s	0.5	4.5	0.2	0.0	3.8	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	14.0
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary

6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	411	11	110	297	33	17	18	133	38	17	8
Future Volume (veh/h)	20	411	11	110	297	33	17	18	133	38	17	8
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	447	11	120	323	31	18	20	5	41	18	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	49	903	22	170	1058	101	86	90	76	116	122	0
Arrive On Green	0.03	0.25	0.25	0.10	0.32	0.32	0.05	0.05	0.05	0.07	0.07	0.00
Sat Flow, veh/h	1781	3544	87	1781	3278	312	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	22	224	234	120	174	180	18	20	5	41	18	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1854	1781	1777	1814	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.5	4.0	4.0	2.4	2.7	2.8	0.4	0.4	0.1	0.8	0.3	0.0
Cycle Q Clear(g_c), s	0.5	4.0	4.0	2.4	2.7	2.8	0.4	0.4	0.1	0.8	0.3	0.0
Prop In Lane	1.00		0.05	1.00		0.17	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	49	453	472	170	574	585	86	90	76	116	122	0
V/C Ratio(X)	0.45	0.49	0.50	0.71	0.30	0.31	0.21	0.22	0.07	0.35	0.15	0.00
Avail Cap(c_a), veh/h	478	1453	1516	812	1787	1824	1505	1580	1339	1505	1580	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.9	11.8	11.9	16.4	9.5	9.5	17.1	17.1	16.9	16.7	16.4	0.0
Incr Delay (d2), s/veh	6.4	0.8	0.8	5.3	0.3	0.3	1.2	1.2	0.4	1.8	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.4	1.5	1.1	0.9	0.9	0.2	0.2	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	24.3	12.7	12.7	21.6	9.8	9.8	18.3	18.3	17.3	18.5	17.0	0.0
LnGrp LOS	C	B	B	C	A	A	B	B	B	B	B	
Approach Vol, veh/h		480			474			43			59	
Approach Delay, s/veh		13.2			12.8			18.2			18.0	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	8.6	14.5	7.4	6.0	17.0	6.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	4.4	6.0	2.8	2.5	4.8	2.4
Green Ext Time (p_c), s	0.2	2.9	0.2	0.0	2.3	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.5
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	345	25	71	248	2	9	4	98	1	4	4
Future Volume (veh/h)	13	345	25	71	248	2	9	4	98	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	14	375	23	77	270	1	10	4	11	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	817	50	139	1089	4	63	66	56	12	13	0
Arrive On Green	0.02	0.24	0.24	0.08	0.30	0.30	0.04	0.04	0.04	0.01	0.01	0.00
Sat Flow, veh/h	1781	3401	208	1781	3631	13	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	14	195	203	77	132	139	10	4	11	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1832	1781	1777	1868	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	2.9	3.0	1.3	1.8	1.8	0.2	0.1	0.2	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	2.9	3.0	1.3	1.8	1.8	0.2	0.1	0.2	0.0	0.1	0.0
Prop In Lane	1.00		0.11	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	33	427	440	139	533	560	63	66	56	12	13	0
V/C Ratio(X)	0.43	0.46	0.46	0.55	0.25	0.25	0.16	0.06	0.20	0.08	0.31	0.00
Avail Cap(c_a), veh/h	285	1421	1465	285	1421	1493	1709	1794	1518	1709	1794	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.2	10.1	10.1	13.9	8.3	8.3	14.6	14.6	14.7	15.4	15.5	0.0
Incr Delay (d2), s/veh	8.7	0.8	0.8	3.4	0.2	0.2	1.2	0.4	1.7	2.9	13.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.0	1.0	0.6	0.5	0.5	0.1	0.0	0.1	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.9	10.9	10.9	17.3	8.5	8.5	15.8	15.0	16.4	18.3	28.9	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		412			348			25			5	
Approach Delay, s/veh		11.3			10.5			15.9			26.8	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	7.4	12.5	5.2	5.6	14.4	6.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	3.3	5.0	2.1	2.2	3.8	2.2
Green Ext Time (p_c), s	0.0	2.4	0.0	0.0	1.5	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	11.2
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	335	14	16	231	13	17	2	22	18	2	11
Future Vol, veh/h	9	335	14	16	231	13	17	2	22	18	2	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	364	15	17	251	14	18	2	24	20	2	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	265	0	0	379	0	0	678	691	372	678	692	258
Stage 1	-	-	-	-	-	-	391	391	-	293	293	-
Stage 2	-	-	-	-	-	-	287	300	-	385	399	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1299	-	-	1179	-	-	366	368	674	366	367	780
Stage 1	-	-	-	-	-	-	633	607	-	715	670	-
Stage 2	-	-	-	-	-	-	720	666	-	638	602	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1299	-	-	1179	-	-	349	358	674	342	358	780
Mov Cap-2 Maneuver	-	-	-	-	-	-	349	358	-	342	358	-
Stage 1	-	-	-	-	-	-	627	601	-	708	659	-
Stage 2	-	-	-	-	-	-	695	654	-	608	596	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.2	0.5	13.43	14.12
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	471	1299	-	-	1179	-	-	428
HCM Lane V/C Ratio	0.095	0.008	-	-	0.015	-	-	0.079
HCM Control Delay (s/veh)	13.4	7.8	0	-	8.1	0	-	14.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.3

Intersection												
Int Delay, s/veh	3.8											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	150	12	41	100	15	14	1	64	20	10	15
Future Vol, veh/h	14	150	12	41	100	15	14	1	64	20	10	15
Conflicting Peds, #/hr	0	0	3	3	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	163	13	45	109	16	15	1	70	22	11	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	125	0	0	179	0	0	406	417	173	400	416	117
Stage 1	-	-	-	-	-	-	203	203	-	206	206	-
Stage 2	-	-	-	-	-	-	203	214	-	194	210	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1462	-	-	1397	-	-	555	526	871	560	528	935
Stage 1	-	-	-	-	-	-	799	733	-	796	731	-
Stage 2	-	-	-	-	-	-	799	725	-	808	729	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1462	-	-	1393	-	-	508	501	869	491	502	935
Mov Cap-2 Maneuver	-	-	-	-	-	-	508	501	-	491	502	-
Stage 1	-	-	-	-	-	-	787	723	-	787	706	-
Stage 2	-	-	-	-	-	-	746	700	-	733	718	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.6	2.02	10.04	11.69
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	508	869	1462	-	-	1393	-	-	587
HCM Lane V/C Ratio	0.032	0.08	0.01	-	-	0.032	-	-	0.083
HCM Control Delay (s/veh)	12.3	9.5	7.5	0	-	7.7	0	-	11.7
HCM Lane LOS	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0.3	0	-	-	0.1	-	-	0.3

Intersection												
Int Delay, s/veh	1.4											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	326	14	16	236	8	17	1	22	11	1	6
Future Vol, veh/h	5	326	14	16	236	8	17	1	22	11	1	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	354	15	17	257	9	18	1	24	12	1	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	265	0	0	370	0	0	665	673	362	661	676	261
Stage 1	-	-	-	-	-	-	373	373	-	296	296	-
Stage 2	-	-	-	-	-	-	292	300	-	366	380	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1299	-	-	1189	-	-	374	377	683	376	375	778
Stage 1	-	-	-	-	-	-	648	618	-	713	668	-
Stage 2	-	-	-	-	-	-	716	666	-	654	614	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1299	-	-	1189	-	-	361	368	683	353	367	778
Mov Cap-2 Maneuver	-	-	-	-	-	-	361	368	-	353	367	-
Stage 1	-	-	-	-	-	-	644	615	-	709	657	-
Stage 2	-	-	-	-	-	-	697	654	-	626	610	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.11	0.5	13.1	13.71
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	488	1299	-	-	1189	-	-	433
HCM Lane V/C Ratio	0.089	0.004	-	-	0.015	-	-	0.045
HCM Control Delay (s/veh)	13.1	7.8	0	-	8.1	0	-	13.7
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	129	14	15	84	15	15	0	20	20	9	15
Future Vol, veh/h	14	129	14	15	84	15	15	0	20	20	9	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	140	15	16	91	16	16	0	22	22	10	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	108	0	0	155	0	0	307	318	148	303	318	99
Stage 1	-	-	-	-	-	-	178	178	-	132	132	-
Stage 2	-	-	-	-	-	-	129	140	-	171	186	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1483	-	-	1425	-	-	645	598	899	650	598	956
Stage 1	-	-	-	-	-	-	824	752	-	871	787	-
Stage 2	-	-	-	-	-	-	875	781	-	831	746	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1483	-	-	1425	-	-	609	584	899	619	584	956
Mov Cap-2 Maneuver	-	-	-	-	-	-	609	584	-	619	584	-
Stage 1	-	-	-	-	-	-	814	743	-	862	777	-
Stage 2	-	-	-	-	-	-	839	771	-	802	738	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.66	0.99	10.08	10.57
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	747	1483	-	-	1425	-	-	694
HCM Lane V/C Ratio	0.051	0.01	-	-	0.011	-	-	0.069
HCM Control Delay (s/veh)	10.1	7.5	0	-	7.6	0	-	10.6
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	314	110	88	178	13	41	0	57	22	0	15
Future Vol, veh/h	16	314	110	88	178	13	41	0	57	22	0	15
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	341	120	96	193	14	45	0	62	24	0	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	210	0	0	464	0	0	825	840	404	770	893	204
Stage 1	-	-	-	-	-	-	439	439	-	394	394	-
Stage 2	-	-	-	-	-	-	386	401	-	376	499	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1361	-	-	1097	-	-	292	302	647	318	281	837
Stage 1	-	-	-	-	-	-	597	578	-	631	605	-
Stage 2	-	-	-	-	-	-	637	601	-	645	544	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1359	-	-	1094	-	-	257	270	645	258	252	835
Mov Cap-2 Maneuver	-	-	-	-	-	-	257	270	-	258	252	-
Stage 1	-	-	-	-	-	-	587	569	-	622	551	-
Stage 2	-	-	-	-	-	-	570	547	-	576	535	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.28	2.71	17.45	16.31
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	395	1359	-	-	1094	-	-	359
HCM Lane V/C Ratio	0.27	0.013	-	-	0.087	-	-	0.112
HCM Control Delay (s/veh)	17.4	7.7	-	-	8.6	-	-	16.3
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1.1	0	-	-	0.3	-	-	0.4

HCM 7th AWSC
13: Kuakini Hwy & Makala Blvd

10/27/2023

Intersection	
Intersection Delay, s/veh	11.4
Intersection LOS	B

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	20	52	224	35	56	325
Future Vol, veh/h	20	52	224	35	56	325
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	57	243	38	61	353
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	8.5	11.7	11.8
HCM LOS	A	B	B

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	15%	0%	86%
Vol Thru, %	0%	28%	14%
Vol Right, %	85%	72%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	381	72	259
LT Vol	56	0	224
Through Vol	0	20	35
RT Vol	325	52	0
Lane Flow Rate	414	78	282
Geometry Grp	1	1	1
Degree of Util (X)	0.502	0.105	0.401
Departure Headway (Hd)	4.36	4.812	5.13
Convergence, Y/N	Yes	Yes	Yes
Cap	824	735	695
Service Time	2.408	2.905	3.209
HCM Lane V/C Ratio	0.502	0.106	0.406
HCM Control Delay, s/veh	11.8	8.5	11.7
HCM Lane LOS	B	A	B
HCM 95th-tile Q	2.9	0.4	1.9

HCM 7th TWSC
14: Kuakini Hwy & Loloku St

10/27/2023

Intersection	
Int Delay, s/veh	2.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	112	2	398	152	4	278
Future Vol, veh/h	112	2	398	152	4	278
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	122	2	433	165	4	302

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	828	516	0	0	599	0
Stage 1	516	-	-	-	-	-
Stage 2	312	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	341	559	-	-	978	-
Stage 1	599	-	-	-	-	-
Stage 2	742	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	338	558	-	-	977	-
Mov Cap-2 Maneuver	338	-	-	-	-	-
Stage 1	598	-	-	-	-	-
Stage 2	738	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	21.48	0	0.12
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	341	977	-
HCM Lane V/C Ratio	-	-	0.364	0.004	-
HCM Control Delay (s/veh)	-	-	21.5	8.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.6	0	-

HCM 7th Signalized Intersection Summary
15: Kuakini Hwy & Kaiwi St

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	36	31	196	23	17	45	514	345	0	358	29
Future Volume (veh/h)	12	36	31	196	23	17	45	514	345	0	358	29
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	13	39	9	213	25	15	49	559	187	0	389	29
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	176	352	68	506	53	22	155	853	775	0	847	63
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.49	0.49	0.49	0.00	0.49	0.49
Sat Flow, veh/h	162	1345	261	1154	202	85	72	1731	1572	0	1718	128
Grp Volume(v), veh/h	61	0	0	253	0	0	608	0	187	0	0	418
Grp Sat Flow(s),veh/h/ln	1767	0	0	1442	0	0	1803	0	1572	0	0	1846
Q Serve(g_s), s	0.0	0.0	0.0	4.2	0.0	0.0	0.2	0.0	2.2	0.0	0.0	4.8
Cycle Q Clear(g_c), s	0.8	0.0	0.0	5.0	0.0	0.0	8.0	0.0	2.2	0.0	0.0	4.8
Prop In Lane	0.21		0.15	0.84		0.06	0.08		1.00	0.00		0.07
Lane Grp Cap(c), veh/h	597	0	0	581	0	0	1008	0	775	0	0	910
V/C Ratio(X)	0.10	0.00	0.00	0.44	0.00	0.00	0.60	0.00	0.24	0.00	0.00	0.46
Avail Cap(c_a), veh/h	2019	0	0	1761	0	0	2603	0	2217	0	0	2604
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	9.2	0.0	0.0	10.6	0.0	0.0	6.2	0.0	4.8	0.0	0.0	5.4
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.5	0.0	0.0	0.6	0.0	0.2	0.0	0.0	0.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	1.3	0.0	0.0	1.9	0.0	0.4	0.0	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	9.3	0.0	0.0	11.2	0.0	0.0	6.8	0.0	4.9	0.0	0.0	5.8
LnGrp LOS	A			B			A		A			A
Approach Vol, veh/h		61			253			795			418	
Approach Delay, s/veh		9.3			11.2			6.4			5.8	
Approach LOS		A			B			A			A	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	20.1	12.5	20.1	12.5
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	46.0	36.0	46.0	36.0
Max Q Clear Time (g_c+I1), s	10.0	2.8	6.8	7.0
Green Ext Time (p_c), s	5.9	0.3	3.1	1.7

Intersection Summary	
HCM 7th Control Delay, s/veh	7.1
HCM 7th LOS	A

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	314	49	287	287	261	80	566	425	163	302	137
Future Volume (veh/h)	175	314	49	287	287	261	80	566	425	163	302	137
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.97	1.00		0.96	0.99		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	190	341	48	312	312	63	87	615	0	177	328	104
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	322	322	45	301	452	368	408	643		208	997	310
Arrive On Green	0.11	0.22	0.22	0.15	0.27	0.27	0.05	0.38	0.00	0.08	0.42	0.42
Sat Flow, veh/h	1603	1438	202	1603	1683	1371	1603	1683	1427	1603	2390	744
Grp Volume(v), veh/h	190	0	389	312	312	63	87	615	0	177	217	215
Grp Sat Flow(s),veh/h/ln	1603	0	1640	1603	1683	1371	1603	1683	1427	1603	1599	1535
Q Serve(g_s), s	11.2	0.0	28.0	19.0	20.8	4.4	4.1	44.5	0.0	8.1	11.5	11.8
Cycle Q Clear(g_c), s	11.2	0.0	28.0	19.0	20.8	4.4	4.1	44.5	0.0	8.1	11.5	11.8
Prop In Lane	1.00		0.12	1.00		1.00	1.00		1.00	1.00		0.48
Lane Grp Cap(c), veh/h	322	0	367	301	452	368	408	643		208	667	641
V/C Ratio(X)	0.59	0.00	1.06	1.04	0.69	0.17	0.21	0.96		0.85	0.33	0.33
Avail Cap(c_a), veh/h	380	0	367	301	452	368	462	643		243	667	641
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.60	0.60	0.60	1.00	1.00	0.00	0.91	0.91	0.91
Uniform Delay (d), s/veh	32.9	0.0	48.5	36.7	41.0	35.1	21.8	37.6	0.0	28.8	24.6	24.7
Incr Delay (d2), s/veh	1.7	0.0	63.4	49.7	2.7	0.1	0.3	26.3	0.0	19.8	1.2	1.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.0	18.0	11.6	9.0	1.5	1.6	22.9	0.0	4.2	4.6	4.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	34.6	0.0	111.9	86.3	43.7	35.2	22.1	63.9	0.0	48.7	25.8	26.0
LnGrp LOS	C		F	F	D	D	C	E		D	C	C
Approach Vol, veh/h		579			687			702			609	
Approach Delay, s/veh		86.5			62.3			58.7			32.5	
Approach LOS		F			E			E			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.2	52.8	24.0	33.0	10.9	57.1	18.4	38.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	13.0	45.0	19.0	28.0	10.0	48.0	18.0	29.0
Max Q Clear Time (g_c+I1), s	10.1	46.5	21.0	30.0	6.1	13.8	13.2	22.8
Green Ext Time (p_c), s	0.1	0.0	0.0	0.0	0.1	3.0	0.2	1.1

Intersection Summary	
HCM 7th Control Delay, s/veh	59.7
HCM 7th LOS	E

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	733	89	404	119	106	154	408	1313	63	221	1990	677
Future Volume (veh/h)	733	89	404	119	106	154	408	1313	63	221	1990	677
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	797	97	0	129	115	0	443	1427	30	240	2163	351
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	841	455		140	147		440	1461	651	259	2193	681
Arrive On Green	0.24	0.24	0.00	0.08	0.08	0.00	0.13	0.41	0.41	0.15	0.43	0.43
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1584	1781	5106	1585
Grp Volume(v), veh/h	797	97	0	129	115	0	443	1427	30	240	2163	351
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1584	1781	1702	1585
Q Serve(g_s), s	37.4	6.8	0.0	11.9	10.0	0.0	21.0	65.2	1.9	22.0	69.2	26.8
Cycle Q Clear(g_c), s	37.4	6.8	0.0	11.9	10.0	0.0	21.0	65.2	1.9	22.0	69.2	26.8
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	841	455		140	147		440	1461	651	259	2193	681
V/C Ratio(X)	0.95	0.21		0.92	0.78		1.01	0.98	0.05	0.93	0.99	0.52
Avail Cap(c_a), veh/h	859	465		140	147		440	1461	651	270	2193	681
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.61	0.61	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.4	49.8	0.0	75.5	74.6	0.0	72.0	47.8	29.2	69.6	46.6	34.5
Incr Delay (d2), s/veh	13.4	0.1	0.0	52.3	23.1	0.0	44.7	18.6	0.1	34.8	16.3	2.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.1	3.3	0.0	7.5	5.8	0.0	12.0	32.3	0.8	12.5	32.1	10.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.8	50.0	0.0	127.7	97.7	0.0	116.7	66.5	29.3	104.4	62.9	37.3
LnGrp LOS	E	D		F	F		F	E	C	F	E	D
Approach Vol, veh/h		894			244			1900			2754	
Approach Delay, s/veh		72.1			113.6			77.6			63.2	
Approach LOS		E			F			E			E	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	29.0	72.8		18.0	26.0	75.9		45.1
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	25.0	66.0		13.0	21.0	70.0		41.0
Max Q Clear Time (g_c+I1), s	24.0	67.2		13.9	23.0	71.2		39.4
Green Ext Time (p_c), s	0.1	0.0		0.0	0.0	0.0		0.7

Intersection Summary	
HCM 7th Control Delay, s/veh	71.4
HCM 7th LOS	E

Notes
User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th TWSC
3: Queen Kaahumanu Hwy & Eho St

10/27/2023

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	83	0	1802	67	0	2731	75
Future Vol, veh/h	0	0	0	0	0	83	0	1802	67	0	2731	75
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	90	0	1959	73	0	2968	82

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	-	-	1016	2969	0	0	1959	-	0
Stage 1	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	236	0	-	-	0	-	-
Stage 1	0	0	-	0	-	-	0	-	-
Stage 2	0	0	-	0	-	-	0	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	-	0	236	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-	-	-	-
Stage 1	-	0	-	-	-	-	-	-	-
Stage 2	-	0	-	-	-	-	-	-	-

Approach	WB			NB			SB
HCM Control Delay, s/v	29.44			0			0
HCM LOS	D						

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	236	-	-
HCM Lane V/C Ratio	-	-	0.383	-	-
HCM Control Delay (s/veh)	-	-	29.4	-	-
HCM Lane LOS	-	-	D	-	-
HCM 95th %tile Q(veh)	-	-	1.7	-	-

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	440	536	143	120	547	164	167	1271	46	243	1664	816
Future Volume (veh/h)	440	536	143	120	547	164	167	1271	46	243	1664	816
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	478	583	0	130	595	0	182	1382	16	264	1809	664
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	523	919		152	684		251	1513	675	377	1642	732
Arrive On Green	0.15	0.26	0.00	0.09	0.19	0.00	0.07	0.43	0.43	0.11	0.46	0.46
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1584
Grp Volume(v), veh/h	478	583	0	130	595	0	182	1382	16	264	1809	664
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1584
Q Serve(g_s), s	22.5	24.0	0.0	11.9	26.8	0.0	8.5	60.3	1.0	12.2	76.2	64.1
Cycle Q Clear(g_c), s	22.5	24.0	0.0	11.9	26.8	0.0	8.5	60.3	1.0	12.2	76.2	64.1
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	523	919		152	684		251	1513	675	377	1642	732
V/C Ratio(X)	0.91	0.63		0.85	0.87		0.72	0.91	0.02	0.70	1.10	0.91
Avail Cap(c_a), veh/h	565	919		291	797		440	1513	675	440	1642	732
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.25	0.25	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.9	54.3	0.0	74.4	64.6	0.0	74.9	44.5	27.5	70.9	44.4	41.1
Incr Delay (d2), s/veh	6.0	0.4	0.0	12.6	9.1	0.0	3.9	10.0	0.1	4.0	55.5	17.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.5	11.0	0.0	6.0	13.1	0.0	3.9	28.4	0.4	5.6	45.6	28.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.9	54.6	0.0	87.0	73.7	0.0	78.8	54.5	27.6	74.9	99.9	58.2
LnGrp LOS	E	D		F	E		E	D	C	E	F	E
Approach Vol, veh/h		1061			725			1580			2737	
Approach Delay, s/veh		63.8			76.1			57.0			87.4	
Approach LOS		E			E			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	75.2	19.1	47.7	17.0	81.2	30.0	36.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	60.0	27.0	37.0	21.0	60.0	27.0	37.0
Max Q Clear Time (g_c+I1), s	14.2	62.3	13.9	26.0	10.5	78.2	24.5	28.8
Green Ext Time (p_c), s	0.5	0.0	0.3	3.1	0.4	0.0	0.5	2.6

Intersection Summary	
HCM 7th Control Delay, s/veh	74.1
HCM 7th LOS	E

Notes
User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	790	27	220	801	169	11	13	305	143	24	24
Future Volume (veh/h)	20	790	27	220	801	169	11	13	305	143	24	24
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	859	27	239	871	173	12	14	17	155	26	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	45	1249	39	295	1464	291	75	78	67	213	205	16
Arrive On Green	0.03	0.36	0.36	0.17	0.50	0.50	0.04	0.04	0.04	0.12	0.12	0.12
Sat Flow, veh/h	1781	3517	111	1781	2954	587	1781	1870	1585	1781	1715	132
Grp Volume(v), veh/h	22	434	452	239	524	520	12	14	17	155	0	28
Grp Sat Flow(s),veh/h/ln	1781	1777	1850	1781	1777	1764	1781	1870	1585	1781	0	1847
Q Serve(g_s), s	0.8	13.1	13.1	8.1	13.3	13.3	0.4	0.5	0.7	5.3	0.0	0.9
Cycle Q Clear(g_c), s	0.8	13.1	13.1	8.1	13.3	13.3	0.4	0.5	0.7	5.3	0.0	0.9
Prop In Lane	1.00		0.06	1.00		0.33	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	45	631	657	295	880	874	75	78	67	213	0	221
V/C Ratio(X)	0.49	0.69	0.69	0.81	0.59	0.60	0.16	0.18	0.26	0.73	0.00	0.13
Avail Cap(c_a), veh/h	254	1551	1615	537	1833	1820	537	564	478	905	0	938
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.3	17.3	17.3	25.3	11.4	11.4	29.1	29.1	29.2	26.7	0.0	24.8
Incr Delay (d2), s/veh	7.9	1.3	1.3	5.3	0.6	0.7	1.0	1.1	2.0	4.7	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	5.2	5.4	3.7	4.7	4.7	0.2	0.2	0.3	2.4	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	38.2	18.7	18.6	30.6	12.0	12.0	30.1	30.2	31.2	31.4	0.0	25.0
LnGrp LOS	D	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		908			1283			43			183	
Approach Delay, s/veh		19.1			15.5			30.6			30.4	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.4	27.4		12.5	6.6	36.2		7.6
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	10.1	15.1		7.3	2.8	15.3		2.7
Green Ext Time (p_c), s	0.5	7.2		0.6	0.0	9.6		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	18.3
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑	↱	↰	↱	
Traffic Volume (veh/h)	66	531	18	130	669	36	18	31	229	83	39	57
Future Volume (veh/h)	66	531	18	130	669	36	18	31	229	83	39	57
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	72	577	19	141	727	36	20	34	9	90	42	13
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	115	1036	34	187	1157	57	106	111	94	218	167	52
Arrive On Green	0.06	0.30	0.30	0.11	0.34	0.34	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3511	116	1781	3446	171	1781	1870	1585	1781	1362	421
Grp Volume(v), veh/h	72	292	304	141	375	388	20	34	9	90	0	55
Grp Sat Flow(s),veh/h/ln	1781	1777	1850	1781	1777	1839	1781	1870	1585	1781	0	1783
Q Serve(g_s), s	1.9	6.6	6.6	3.7	8.5	8.5	0.5	0.8	0.3	2.2	0.0	1.3
Cycle Q Clear(g_c), s	1.9	6.6	6.6	3.7	8.5	8.5	0.5	0.8	0.3	2.2	0.0	1.3
Prop In Lane	1.00		0.06	1.00		0.09	1.00		1.00	1.00		0.24
Lane Grp Cap(c), veh/h	115	524	546	187	597	618	106	111	94	218	0	218
V/C Ratio(X)	0.63	0.56	0.56	0.75	0.63	0.63	0.19	0.31	0.10	0.41	0.00	0.25
Avail Cap(c_a), veh/h	372	1133	1179	633	1393	1442	1173	1232	1044	1173	0	1174
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.8	14.2	14.2	20.8	13.4	13.4	21.4	21.6	21.3	19.4	0.0	19.0
Incr Delay (d2), s/veh	5.5	0.9	0.9	6.0	1.1	1.1	0.9	1.5	0.4	1.2	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	2.5	2.6	1.7	3.1	3.2	0.2	0.4	0.1	0.9	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	27.4	15.1	15.1	26.8	14.5	14.4	22.3	23.1	21.7	20.7	0.0	19.6
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		B
Approach Vol, veh/h		668			904			63			145	
Approach Delay, s/veh		16.4			16.4			22.6			20.3	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	19.1		10.9	8.1	21.1		7.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	30.5		31.5	10.0	37.5		31.5
Max Q Clear Time (g_c+I1), s	5.7	8.6		4.2	3.9	10.5		2.8
Green Ext Time (p_c), s	0.3	3.9		0.5	0.1	5.5		0.2

Intersection Summary		
HCM 7th Control Delay, s/veh		16.9
HCM 7th LOS		B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑	↱	↰	↱	
Traffic Volume (veh/h)	10	456	34	154	595	4	24	11	151	7	2	7
Future Volume (veh/h)	10	456	34	154	595	4	24	11	151	7	2	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	496	33	167	647	3	26	12	15	8	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	26	913	61	212	1360	6	107	112	95	67	71	0
Arrive On Green	0.01	0.27	0.27	0.12	0.37	0.37	0.06	0.06	0.06	0.04	0.04	0.00
Sat Flow, veh/h	1781	3379	224	1781	3627	17	1781	1870	1581	1781	1870	0
Grp Volume(v), veh/h	11	260	269	167	317	333	26	12	15	8	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1827	1781	1777	1867	1781	1870	1581	1781	1870	0
Q Serve(g_s), s	0.2	4.9	4.9	3.6	5.3	5.3	0.5	0.2	0.4	0.2	0.0	0.0
Cycle Q Clear(g_c), s	0.2	4.9	4.9	3.6	5.3	5.3	0.5	0.2	0.4	0.2	0.0	0.0
Prop In Lane	1.00		0.12	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	26	480	494	212	666	700	107	112	95	67	71	0
V/C Ratio(X)	0.43	0.54	0.54	0.79	0.48	0.48	0.24	0.11	0.16	0.12	0.03	0.00
Avail Cap(c_a), veh/h	228	1139	1171	228	1139	1197	1371	1439	1217	1371	1439	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	19.1	12.2	12.2	16.7	9.3	9.3	17.5	17.3	17.4	18.1	18.1	0.0
Incr Delay (d2), s/veh	10.9	1.0	0.9	15.6	0.5	0.5	1.2	0.4	0.8	0.8	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.7	1.8	2.2	1.7	1.8	0.2	0.1	0.1	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.0	13.1	13.1	32.3	9.8	9.8	18.7	17.8	18.2	18.9	18.2	0.0
LnGrp LOS	C	B	B	C	A	A	B	B	B	B	B	
Approach Vol, veh/h		540			817			53			10	
Approach Delay, s/veh		13.5			14.4			18.3			18.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.6	15.5		6.5	5.6	19.6		7.3
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	5.6	6.9		2.2	2.2	7.3		2.5
Green Ext Time (p_c), s	0.0	3.2		0.0	0.0	4.0		0.1

Intersection Summary		
HCM 7th Control Delay, s/veh		14.2
HCM 7th LOS		B

Intersection	
Int Delay, s/veh	8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	414	29	47	537	41	22	31	44	39	31	15
Future Vol, veh/h	19	414	29	47	537	41	22	31	44	39	31	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	450	32	51	584	45	24	34	48	42	34	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	628	0	0	482	0	0	1210	1238	466	1216	1231	606
Stage 1	-	-	-	-	-	-	507	507	-	708	708	-
Stage 2	-	-	-	-	-	-	703	730	-	508	523	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	954	-	-	1081	-	-	159	176	597	158	177	497
Stage 1	-	-	-	-	-	-	548	539	-	425	438	-
Stage 2	-	-	-	-	-	-	428	428	-	547	531	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	954	-	-	1081	-	-	112	158	597	105	159	497
Mov Cap-2 Maneuver	-	-	-	-	-	-	112	158	-	105	159	-
Stage 1	-	-	-	-	-	-	532	523	-	413	406	-
Stage 2	-	-	-	-	-	-	352	396	-	457	515	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.36	0.64	38.92	67.82
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	208	954	-	-	1081	-	-	143
HCM Lane V/C Ratio	0.507	0.022	-	-	0.047	-	-	0.648
HCM Control Delay (s/veh)	38.9	8.9	0	-	8.5	0	-	67.8
HCM Lane LOS	E	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	2.6	0.1	-	-	0.1	-	-	3.5

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	209	23	73	169	29	19	8	119	26	20	27
Future Vol, veh/h	33	209	23	73	169	29	19	8	119	26	20	27
Conflicting Peds, #/hr	0	0	1	1	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	227	25	79	184	32	21	9	129	28	22	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	215	0	0	253	0	0	666	686	241	661	683	199
Stage 1	-	-	-	-	-	-	312	312	-	358	358	-
Stage 2	-	-	-	-	-	-	353	374	-	303	325	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1355	-	-	1312	-	-	373	370	798	376	372	842
Stage 1	-	-	-	-	-	-	698	657	-	660	628	-
Stage 2	-	-	-	-	-	-	664	618	-	706	649	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1355	-	-	1311	-	-	305	334	797	277	335	842
Mov Cap-2 Maneuver	-	-	-	-	-	-	305	334	-	277	335	-
Stage 1	-	-	-	-	-	-	676	636	-	639	584	-
Stage 2	-	-	-	-	-	-	574	575	-	565	628	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.96	2.13	11.73	16.45
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	313	797	1355	-	-	1311	-	-	393
HCM Lane V/C Ratio	0.094	0.162	0.026	-	-	0.061	-	-	0.202
HCM Control Delay (s/veh)	17.7	10.4	7.7	0	-	7.9	0	-	16.5
HCM Lane LOS	C	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0.6	0.1	-	-	0.2	-	-	0.7

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	404	29	46	513	16	22	20	43	15	20	7
Future Vol, veh/h	10	404	29	46	513	16	22	20	43	15	20	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	439	32	50	558	17	24	22	47	16	22	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	575	0	0	471	0	0	1145	1152	455	1138	1159	566
Stage 1	-	-	-	-	-	-	477	477	-	666	666	-
Stage 2	-	-	-	-	-	-	668	675	-	472	492	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	998	-	-	1091	-	-	177	198	605	179	196	523
Stage 1	-	-	-	-	-	-	569	556	-	449	457	-
Stage 2	-	-	-	-	-	-	447	453	-	573	547	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	998	-	-	1091	-	-	142	182	605	135	180	523
Mov Cap-2 Maneuver	-	-	-	-	-	-	142	182	-	135	180	-
Stage 1	-	-	-	-	-	-	561	548	-	442	426	-
Stage 2	-	-	-	-	-	-	390	422	-	500	539	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.2	0.68	27.21	32.07
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	253	998	-	-	1091	-	-	178
HCM Lane V/C Ratio	0.365	0.011	-	-	0.046	-	-	0.257
HCM Control Delay (s/veh)	27.2	8.6	0	-	8.5	0	-	32.1
HCM Lane LOS	D	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	1.6	0	-	-	0.1	-	-	1

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	213	33	29	155	29	27	5	26	26	17	27
Future Vol, veh/h	33	213	33	29	155	29	27	5	26	26	17	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	232	36	32	168	32	29	5	28	28	18	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	200	0	0	267	0	0	562	584	249	553	586	184
Stage 1	-	-	-	-	-	-	321	321	-	247	247	-
Stage 2	-	-	-	-	-	-	241	263	-	306	339	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1372	-	-	1296	-	-	438	423	789	444	422	858
Stage 1	-	-	-	-	-	-	691	652	-	757	702	-
Stage 2	-	-	-	-	-	-	763	691	-	704	640	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1372	-	-	1296	-	-	381	399	789	398	398	858
Mov Cap-2 Maneuver	-	-	-	-	-	-	381	399	-	398	398	-
Stage 1	-	-	-	-	-	-	669	631	-	733	682	-
Stage 2	-	-	-	-	-	-	697	672	-	652	620	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.91	1.07	13.27	13.45
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	498	1372	-	-	1296	-	-	502
HCM Lane V/C Ratio	0.126	0.026	-	-	0.024	-	-	0.152
HCM Control Delay (s/veh)	13.3	7.7	0	-	7.8	0	-	13.5
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0.1	-	-	0.5

Intersection	
Int Delay, s/veh	15

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	31	400	116	104	274	15	96	0	115	28	1	28
Future Vol, veh/h	31	400	116	104	274	15	96	0	115	28	1	28
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	34	435	126	113	298	16	104	0	125	30	1	30

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	320	0	0	564	0	0	1097	1114	502	1041	1169	316
Stage 1	-	-	-	-	-	-	568	568	-	538	538	-
Stage 2	-	-	-	-	-	-	528	546	-	503	631	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1240	-	-	1008	-	-	191	208	569	208	193	724
Stage 1	-	-	-	-	-	-	508	506	-	527	522	-
Stage 2	-	-	-	-	-	-	534	518	-	551	474	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1233	-	-	1005	-	-	156	178	567	139	165	718
Mov Cap-2 Maneuver	-	-	-	-	-	-	156	178	-	139	165	-
Stage 1	-	-	-	-	-	-	492	491	-	510	461	-
Stage 2	-	-	-	-	-	-	451	457	-	417	460	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.45	2.39	73.22	26.17
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	257	1233	-	-	1005	-	-	231
HCM Lane V/C Ratio	0.891	0.027	-	-	0.112	-	-	0.268
HCM Control Delay (s/veh)	73.2	8	-	-	9	-	-	26.2
HCM Lane LOS	F	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	7.7	0.1	-	-	0.4	-	-	1

Intersection	
Intersection Delay, s/veh	35.3
Intersection LOS	E

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	39	67	477	65	65	405
Future Vol, veh/h	39	67	477	65	65	405
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	42	73	518	71	71	440
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	10.7	49	25.1
HCM LOS	B	E	D

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	14%	0%	88%
Vol Thru, %	0%	37%	12%
Vol Right, %	86%	63%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	470	106	542
LT Vol	65	0	477
Through Vol	0	39	65
RT Vol	405	67	0
Lane Flow Rate	511	115	589
Geometry Grp	1	1	1
Degree of Util (X)	0.776	0.195	0.95
Departure Headway (Hd)	5.468	6.081	5.808
Convergence, Y/N	Yes	Yes	Yes
Cap	659	584	624
Service Time	3.546	4.181	3.871
HCM Lane V/C Ratio	0.775	0.197	0.944
HCM Control Delay, s/veh	25.1	10.7	49
HCM Lane LOS	D	B	E
HCM 95th-tile Q	7.4	0.7	13

HCM 7th TWSC
14: Kuakini Hwy & Loloku St

10/27/2023

Intersection						
Int Delay, s/veh	17.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	170	38	460	269	10	515
Future Vol, veh/h	170	38	460	269	10	515
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	185	41	500	292	11	560

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1228	646	0	0	792	0
Stage 1	646	-	-	-	-	-
Stage 2	582	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	197	471	-	-	828	-
Stage 1	522	-	-	-	-	-
Stage 2	559	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	193	471	-	-	828	-
Mov Cap-2 Maneuver	193	-	-	-	-	-
Stage 1	522	-	-	-	-	-
Stage 2	548	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	20.79	0	0.18
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	216	828	-
HCM Lane V/C Ratio	-	-	1.045	0.013	-
HCM Control Delay (s/veh)	-	-	120.8	9.4	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	9.8	0	-

HCM 7th Signalized Intersection Summary
15: Kuakini Hwy & Kaiwi St

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	32	46	51	318	27	48	53	676	470	27	631	33
Future Volume (veh/h)	32	46	51	318	27	48	53	676	470	27	631	33
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	35	50	26	346	29	45	58	735	312	29	686	34
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	208	287	134	469	32	50	85	788	899	51	586	28
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.57	0.57	0.57	0.57	0.57	0.57
Sat Flow, veh/h	455	873	406	1176	99	153	64	1378	1573	8	1025	49
Grp Volume(v), veh/h	111	0	0	420	0	0	793	0	312	749	0	0
Grp Sat Flow(s),veh/h/ln	1734	0	0	1428	0	0	1442	0	1573	1082	0	0
Q Serve(g_s), s	0.0	0.0	0.0	18.7	0.0	0.0	0.0	0.0	8.5	5.4	0.0	0.0
Cycle Q Clear(g_c), s	3.6	0.0	0.0	22.3	0.0	0.0	40.6	0.0	8.5	46.0	0.0	0.0
Prop In Lane	0.32		0.23	0.82		0.11	0.07		1.00	0.04		0.05
Lane Grp Cap(c), veh/h	630	0	0	552	0	0	872	0	899	665	0	0
V/C Ratio(X)	0.18	0.00	0.00	0.76	0.00	0.00	0.91	0.00	0.35	1.13	0.00	0.00
Avail Cap(c_a), veh/h	818	0	0	714	0	0	872	0	899	665	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.3	0.0	0.0	25.2	0.0	0.0	14.3	0.0	9.2	17.7	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	3.6	0.0	0.0	13.3	0.0	0.2	75.1	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	0.0	7.8	0.0	0.0	14.0	0.0	2.7	22.4	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	19.4	0.0	0.0	28.7	0.0	0.0	27.7	0.0	9.5	92.8	0.0	0.0
LnGrp LOS	B			C			C		A	F		
Approach Vol, veh/h		111			420			1105			749	
Approach Delay, s/veh		19.4			28.7			22.5			92.8	
Approach LOS		B			C			C			F	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		50.0		30.5		50.0		30.5				
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0				
Max Green Setting (Gmax), s		46.0		36.0		46.0		36.0				
Max Q Clear Time (g_c+I1), s		42.6		5.6		48.0		24.3				
Green Ext Time (p_c), s		2.2		0.6		0.0		2.2				

Intersection Summary		
HCM 7th Control Delay, s/veh		45.6
HCM 7th LOS		D

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	283	42	499	475	401	91	590	394	194	595	213
Future Volume (veh/h)	210	283	42	499	475	401	91	590	394	194	595	213
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.91	1.00		0.92	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	228	308	42	542	516	265	99	641	0	211	647	206
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	250	276	38	459	580	451	205	557		182	855	272
Arrive On Green	0.10	0.19	0.19	0.26	0.34	0.34	0.05	0.33	0.00	0.08	0.36	0.36
Sat Flow, veh/h	1603	1430	195	1603	1683	1307	1603	1683	1427	1603	2373	755
Grp Volume(v), veh/h	228	0	350	542	516	265	99	641	0	211	436	417
Grp Sat Flow(s),veh/h/ln	1603	0	1625	1603	1683	1307	1603	1683	1427	1603	1599	1529
Q Serve(g_s), s	15.0	0.0	28.0	37.0	42.0	24.2	5.9	48.0	0.0	12.0	34.8	34.8
Cycle Q Clear(g_c), s	15.0	0.0	28.0	37.0	42.0	24.2	5.9	48.0	0.0	12.0	34.8	34.8
Prop In Lane	1.00		0.12	1.00		1.00	1.00		1.00	1.00		0.49
Lane Grp Cap(c), veh/h	250	0	314	459	580	451	205	557		182	576	551
V/C Ratio(X)	0.91	0.00	1.12	1.18	0.89	0.59	0.48	1.15		1.16	0.76	0.76
Avail Cap(c_a), veh/h	250	0	314	459	580	451	230	557		182	576	551
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.14	0.14	0.14	1.00	1.00	0.00	0.18	0.18	0.18
Uniform Delay (d), s/veh	46.1	0.0	58.5	43.6	44.9	39.0	33.2	48.5	0.0	42.1	40.8	40.8
Incr Delay (d2), s/veh	34.5	0.0	85.5	85.1	2.7	0.3	1.7	86.9	0.0	82.0	1.7	1.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	0.0	19.1	27.6	18.1	7.9	2.4	33.7	0.0	10.9	14.1	13.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	80.6	0.0	144.0	128.7	47.6	39.3	34.9	135.4	0.0	124.1	42.5	42.6
LnGrp LOS	F		F	F	D	D	C	F		F	D	D
Approach Vol, veh/h		578			1323			740			1064	
Approach Delay, s/veh		119.0			79.2			121.9			58.7	
Approach LOS		F			E			F			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.0	53.0	42.0	33.0	12.8	57.2	20.0	55.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	12.0	48.0	37.0	28.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	14.0	50.0	39.0	30.0	7.9	36.8	17.0	44.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	4.8	0.0	2.4

Intersection Summary		
HCM 7th Control Delay, s/veh		88.0
HCM 7th LOS		F

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	721	100	430	94	101	134	454	1268	70	237	1639	702
Future Volume (veh/h)	721	100	430	94	101	134	454	1268	70	237	1639	702
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	784	109	0	102	110	0	493	1378	30	258	1782	333
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	810	439		130	137		557	1456	648	278	2065	639
Arrive On Green	0.23	0.23	0.00	0.07	0.07	0.00	0.16	0.41	0.41	0.16	0.40	0.40
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	3554	1582	1781	5106	1581
Grp Volume(v), veh/h	784	109	0	102	110	0	493	1378	30	258	1782	333
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1777	1582	1781	1702	1581
Q Serve(g_s), s	35.4	7.5	0.0	8.9	9.1	0.0	22.0	59.0	1.8	22.6	50.4	25.1
Cycle Q Clear(g_c), s	35.4	7.5	0.0	8.9	9.1	0.0	22.0	59.0	1.8	22.6	50.4	25.1
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	810	439		130	137		557	1456	648	278	2065	639
V/C Ratio(X)	0.97	0.25		0.78	0.80		0.89	0.95	0.05	0.93	0.86	0.52
Avail Cap(c_a), veh/h	810	439		192	202		767	1487	662	282	2065	639
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	59.8	49.1	0.0	71.9	72.0	0.0	64.8	44.9	28.0	65.7	43.0	35.4
Incr Delay (d2), s/veh	23.8	0.3	0.0	11.8	13.4	0.0	9.3	12.7	0.0	35.0	4.0	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.3	3.6	0.0	4.5	4.9	0.0	10.4	28.2	0.7	12.9	21.7	9.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	83.6	49.4	0.0	83.6	85.4	0.0	74.1	57.6	28.1	100.8	47.0	36.2
LnGrp LOS	F	D		F	F		E	E	C	F	D	D
Approach Vol, veh/h		893			212			1901			2373	
Approach Delay, s/veh		79.4			84.6			61.4			51.4	
Approach LOS		E			F			E			D	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	29.6	69.6	16.5	30.4	68.8	42.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	25.0	66.0	17.0	35.0	56.0	37.0
Max Q Clear Time (g_c+I1), s	24.6	61.0	11.1	24.0	52.4	37.4
Green Ext Time (p_c), s	0.0	3.6	0.4	1.4	3.2	0.0

Intersection Summary		
HCM 7th Control Delay, s/veh		60.9
HCM 7th LOS		E

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th TWSC
3: Queen Kaahumanu Hwy & Eho St 10/27/2023

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	61	0	1806	76	0	2341	27
Future Vol, veh/h	0	0	0	0	0	61	0	1806	76	0	2341	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	66	0	1963	83	0	2545	29

Major/Minor												
			Minor1			Major1			Major2			
Conflicting Flow All			-	-	1023	2547	0	0	1963	-	0	
Stage 1			-	-	-	-	-	-	-	-	-	
Stage 2			-	-	-	-	-	-	-	-	-	
Critical Hdwy			-	-	6.94	-	-	-	-	-	-	
Critical Hdwy Stg 1			-	-	-	-	-	-	-	-	-	
Critical Hdwy Stg 2			-	-	-	-	-	-	-	-	-	
Follow-up Hdwy			-	-	3.32	-	-	-	-	-	-	
Pot Cap-1 Maneuver			0	0	233	0	-	-	0	-	-	
Stage 1			0	0	-	0	-	-	0	-	-	
Stage 2			0	0	-	0	-	-	0	-	-	
Platoon blocked, %							-	-		-	-	
Mov Cap-1 Maneuver			-	0	233	-	-	-	-	-	-	
Mov Cap-2 Maneuver			-	0	-	-	-	-	-	-	-	
Stage 1			-	0	-	-	-	-	-	-	-	
Stage 2			-	0	-	-	-	-	-	-	-	

Approach	WB	NB	SB
HCM Control Delay, s/v	26.46	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	233	-	-
HCM Lane V/C Ratio	-	-	0.284	-	-
HCM Control Delay (s/veh)	-	-	26.5	-	-
HCM Lane LOS	-	-	D	-	-
HCM 95th %tile Q(veh)	-	-	1.1	-	-

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd 10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	415	523	154	84	536	138	199	1289	52	180	1452	664
Future Volume (veh/h)	415	523	154	84	536	138	199	1289	52	180	1452	664
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	451	568	0	91	583	0	216	1401	21	196	1578	508
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	499	989		113	702		271	1545	689	250	1524	678
Arrive On Green	0.14	0.28	0.00	0.06	0.20	0.00	0.08	0.43	0.43	0.07	0.43	0.43
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	3554	1585	3456	3554	1582
Grp Volume(v), veh/h	451	568	0	91	583	0	216	1401	21	196	1578	508
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1777	1585	1728	1777	1582
Q Serve(g_s), s	18.7	20.0	0.0	7.3	23.0	0.0	9.0	53.6	1.1	8.1	62.5	39.4
Cycle Q Clear(g_c), s	18.7	20.0	0.0	7.3	23.0	0.0	9.0	53.6	1.1	8.1	62.5	39.4
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	499	989		113	702		271	1545	689	250	1524	678
V/C Ratio(X)	0.90	0.57		0.80	0.83		0.80	0.91	0.03	0.78	1.04	0.75
Avail Cap(c_a), veh/h	533	989		275	914		486	1548	690	462	1524	678
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.4	45.2	0.0	67.4	56.2	0.0	66.0	38.4	23.6	66.5	41.6	35.0
Incr Delay (d2), s/veh	18.0	0.8	0.0	12.3	5.1	0.0	5.3	8.1	0.0	5.4	32.8	4.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.5	9.1	0.0	3.8	10.9	0.0	4.1	24.6	0.4	3.8	33.7	16.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	79.4	46.0	0.0	79.7	61.3	0.0	71.4	46.5	23.6	71.9	74.5	39.7
LnGrp LOS	E	D		E	E		E	D	C	E	F	D
Approach Vol, veh/h		1019			674			1638			2282	
Approach Delay, s/veh		60.8			63.7			49.5			66.5	
Approach LOS		E			E			D			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.0	68.9	14.8	46.1	16.9	68.0	26.6	34.3
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	63.5	22.5	37.5	20.5	62.5	22.5	37.5
Max Q Clear Time (g_c+I1), s	10.1	55.6	9.3	22.0	11.0	64.5	20.7	25.0
Green Ext Time (p_c), s	0.4	5.4	0.2	3.6	0.5	0.0	0.3	3.3

Intersection Summary	
HCM 7th Control Delay, s/veh	60.2
HCM 7th LOS	E

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	32	887	25	221	836	214	10	59	202	139	42	32
Future Volume (veh/h)	32	887	25	221	836	214	10	59	202	139	42	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	35	964	26	240	909	218	11	64	3	151	46	12
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	63	1340	36	291	1440	345	99	104	88	211	169	44
Arrive On Green	0.04	0.38	0.38	0.16	0.51	0.51	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3534	95	1781	2839	680	1781	1870	1585	1781	1430	373
Grp Volume(v), veh/h	35	485	505	240	569	558	11	64	3	151	0	58
Grp Sat Flow(s),veh/h/ln	1781	1777	1853	1781	1777	1742	1781	1870	1585	1781	0	1803
Q Serve(g_s), s	1.4	16.4	16.4	9.2	16.4	16.4	0.4	2.4	0.1	5.8	0.0	2.1
Cycle Q Clear(g_c), s	1.4	16.4	16.4	9.2	16.4	16.4	0.4	2.4	0.1	5.8	0.0	2.1
Prop In Lane	1.00		0.05	1.00		0.39	1.00		1.00	1.00		0.21
Lane Grp Cap(c), veh/h	63	674	703	291	901	884	99	104	88	211	0	214
V/C Ratio(X)	0.56	0.72	0.72	0.83	0.63	0.63	0.11	0.62	0.03	0.72	0.00	0.27
Avail Cap(c_a), veh/h	227	1385	1444	480	1637	1605	480	504	427	808	0	818
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.5	18.7	18.7	28.5	12.6	12.6	31.7	32.6	31.5	29.9	0.0	28.3
Incr Delay (d2), s/veh	7.6	1.5	1.4	5.9	0.7	0.8	0.5	5.8	0.2	4.5	0.0	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	6.6	6.9	4.3	6.0	5.9	0.2	1.2	0.1	2.7	0.0	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	41.1	20.1	20.1	34.4	13.3	13.4	32.2	38.4	31.7	34.4	0.0	29.0
LnGrp LOS	D	C	C	C	B	B	C	D	C	C		C
Approach Vol, veh/h		1025			1367			78			209	
Approach Delay, s/veh		20.8			17.0			37.3			32.9	
Approach LOS		C			B			D			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	16.5	31.8	13.4	7.5	40.8	8.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	19.0	55.0	32.0	9.0	65.0	19.0
Max Q Clear Time (g_c+I1), s	11.2	18.4	7.8	3.4	18.4	4.4
Green Ext Time (p_c), s	0.4	8.3	0.7	0.0	10.9	0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	20.3
HCM 7th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	97	595	17	137	695	54	30	56	213	130	66	67
Future Volume (veh/h)	97	595	17	137	695	54	30	56	213	130	66	67
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	105	647	17	149	755	55	33	61	12	141	72	40
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	136	1052	28	195	1108	81	138	145	122	311	195	108
Arrive On Green	0.08	0.30	0.30	0.11	0.33	0.33	0.08	0.08	0.08	0.17	0.17	0.17
Sat Flow, veh/h	1781	3537	93	1781	3356	244	1781	1870	1574	1781	1116	620
Grp Volume(v), veh/h	105	325	339	149	400	410	33	61	12	141	0	112
Grp Sat Flow(s),veh/h/ln	1781	1777	1853	1781	1777	1824	1781	1870	1574	1781	0	1737
Q Serve(g_s), s	3.4	9.2	9.2	4.8	11.4	11.4	1.0	1.8	0.4	4.2	0.0	3.3
Cycle Q Clear(g_c), s	3.4	9.2	9.2	4.8	11.4	11.4	1.0	1.8	0.4	4.2	0.0	3.3
Prop In Lane	1.00		0.05	1.00		0.13	1.00		1.00	1.00		0.36
Lane Grp Cap(c), veh/h	136	528	551	195	587	602	138	145	122	311	0	303
V/C Ratio(X)	0.77	0.61	0.62	0.76	0.68	0.68	0.24	0.42	0.10	0.45	0.00	0.37
Avail Cap(c_a), veh/h	304	925	964	517	1137	1167	957	1005	846	957	0	933
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	26.6	17.7	17.7	25.4	17.0	17.0	25.4	25.8	25.1	21.7	0.0	21.4
Incr Delay (d2), s/veh	8.8	1.2	1.1	6.1	1.4	1.4	0.9	1.9	0.3	1.0	0.0	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	3.7	3.8	2.3	4.5	4.6	0.4	0.8	0.2	1.7	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	35.4	18.9	18.8	31.5	18.4	18.3	26.3	27.7	25.5	22.7	0.0	22.1
LnGrp LOS	D	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		769			959			106			253	
Approach Delay, s/veh		21.1			20.4			27.0			22.5	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	11.4	22.4	15.2	9.5	24.4	9.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	6.8	11.2	6.2	5.4	13.4	3.8
Green Ext Time (p_c), s	0.3	4.2	1.0	0.1	5.8	0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	21.2
HCM 7th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑↱		↰	↑	↱	↰	↑↱	
Traffic Volume (veh/h)	23	516	53	168	613	8	27	6	180	9	7	12
Future Volume (veh/h)	23	516	53	168	613	8	27	6	180	9	7	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	25	561	51	183	666	8	29	7	11	10	8	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	54	981	89	224	1414	17	91	95	81	40	42	0
Arrive On Green	0.03	0.30	0.30	0.13	0.39	0.39	0.05	0.05	0.05	0.02	0.02	0.00
Sat Flow, veh/h	1781	3293	299	1781	3596	43	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	25	302	310	183	329	345	29	7	11	10	8	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1815	1781	1777	1862	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.5	5.7	5.8	4.0	5.5	5.5	0.6	0.1	0.3	0.2	0.2	0.0
Cycle Q Clear(g_c), s	0.5	5.7	5.8	4.0	5.5	5.5	0.6	0.1	0.3	0.2	0.2	0.0
Prop In Lane	1.00		0.16	1.00		0.02	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	54	529	541	224	699	733	91	95	81	40	42	0
V/C Ratio(X)	0.46	0.57	0.57	0.82	0.47	0.47	0.32	0.07	0.14	0.25	0.19	0.00
Avail Cap(c_a), veh/h	224	1117	1140	224	1117	1170	1343	1410	1195	1343	1410	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	19.0	11.8	11.8	16.9	9.0	9.0	18.2	18.0	18.0	19.1	19.1	0.0
Incr Delay (d2), s/veh	6.0	1.0	1.0	20.5	0.5	0.5	2.0	0.3	0.8	3.1	2.1	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	2.0	2.0	2.7	1.7	1.8	0.3	0.1	0.1	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	25.0	12.8	12.8	37.5	9.5	9.5	20.2	18.3	18.8	22.2	21.2	0.0
LnGrp LOS	C	B	B	D	A	A	C	B	B	C	C	
Approach Vol, veh/h		637			857			47			18	
Approach Delay, s/veh		13.3			15.5			19.6			21.8	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	16.9		5.9	6.2	20.6		7.0
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0
Max Q Clear Time (g_c+I1), s	6.0	7.8		2.2	2.5	7.5		2.6
Green Ext Time (p_c), s	0.0	3.7		0.0	0.0	4.1		0.1

Intersection Summary		
HCM 7th Control Delay, s/veh		14.8
HCM 7th LOS		B

Intersection	
Int Delay, s/veh	16.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	23	490	35	56	558	50	27	30	53	47	30	18
Future Vol, veh/h	23	490	35	56	558	50	27	30	53	47	30	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	25	533	38	61	607	54	29	33	58	51	33	20

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	661	0	0	571	0	0	1346	1384	552	1354	1376	634
Stage 1	-	-	-	-	-	-	602	602	-	755	755	-
Stage 2	-	-	-	-	-	-	745	783	-	599	621	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	927	-	-	1002	-	-	128	143	534	127	145	479
Stage 1	-	-	-	-	-	-	487	489	-	401	416	-
Stage 2	-	-	-	-	-	-	406	405	-	488	479	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	927	-	-	1002	-	-	82	124	534	75	126	479
Mov Cap-2 Maneuver	-	-	-	-	-	-	82	124	-	75	126	-
Stage 1	-	-	-	-	-	-	467	470	-	385	376	-
Stage 2	-	-	-	-	-	-	321	365	-	389	460	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.38	0.74	70.32	158.15
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	164	927	-	-	1002	-	-	105
HCM Lane V/C Ratio	0.728	0.027	-	-	0.061	-	-	0.982
HCM Control Delay (s/veh)	70.3	9	0	-	8.8	0	-	158.2
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	4.5	0.1	-	-	0.2	-	-	6.1

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	245	33	49	181	35	19	8	86	32	22	33
Future Vol, veh/h	40	245	33	49	181	35	19	8	86	32	22	33
Conflicting Peds, #/hr	0	0	1	1	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	266	36	53	197	38	21	9	93	35	24	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	235	0	0	303	0	0	687	714	285	680	712	216
Stage 1	-	-	-	-	-	-	372	372	-	322	322	-
Stage 2	-	-	-	-	-	-	315	341	-	358	390	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1333	-	-	1258	-	-	361	357	754	365	357	824
Stage 1	-	-	-	-	-	-	648	619	-	690	651	-
Stage 2	-	-	-	-	-	-	696	638	-	660	608	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1333	-	-	1257	-	-	294	326	753	285	326	824
Mov Cap-2 Maneuver	-	-	-	-	-	-	294	326	-	285	326	-
Stage 1	-	-	-	-	-	-	622	594	-	663	619	-
Stage 2	-	-	-	-	-	-	608	607	-	547	583	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.98	1.48	12.3	16.93
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	303	753	1333	-	-	1257	-	-	396
HCM Lane V/C Ratio	0.097	0.124	0.033	-	-	0.042	-	-	0.239
HCM Control Delay (s/veh)	18.2	10.5	7.8	0	-	8	0	-	16.9
HCM Lane LOS	C	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0.4	0.1	-	-	0.1	-	-	0.9

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	478	35	55	530	19	27	19	52	18	19	9
Future Vol, veh/h	12	478	35	55	530	19	27	19	52	18	19	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	520	38	60	576	21	29	21	57	20	21	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	597	0	0	558	0	0	1271	1281	539	1262	1290	586
Stage 1	-	-	-	-	-	-	565	565	-	706	706	-
Stage 2	-	-	-	-	-	-	706	716	-	556	584	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	980	-	-	1013	-	-	145	166	543	147	164	510
Stage 1	-	-	-	-	-	-	510	508	-	427	439	-
Stage 2	-	-	-	-	-	-	427	434	-	515	498	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	980	-	-	1013	-	-	111	148	543	103	146	510
Mov Cap-2 Maneuver	-	-	-	-	-	-	111	148	-	103	146	-
Stage 1	-	-	-	-	-	-	500	498	-	418	400	-
Stage 2	-	-	-	-	-	-	362	395	-	434	489	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.2	0.8	38.79	43.37
HCM LOS			E	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	209	980	-	-	1013	-	-	142
HCM Lane V/C Ratio	0.509	0.013	-	-	0.059	-	-	0.351
HCM Control Delay (s/veh)	38.8	8.7	0	-	8.8	0	-	43.4
HCM Lane LOS	E	A	A	-	A	A	-	E
HCM 95th %tile Q(veh)	2.6	0	-	-	0.2	-	-	1.4

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	206	40	35	150	35	33	5	32	32	19	33
Future Vol, veh/h	40	206	40	35	150	35	33	5	32	32	19	33
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	224	43	38	163	38	36	5	35	35	21	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	201	0	0	267	0	0	582	610	246	572	613	182
Stage 1	-	-	-	-	-	-	333	333	-	258	258	-
Stage 2	-	-	-	-	-	-	249	277	-	314	354	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1371	-	-	1296	-	-	424	409	793	431	408	860
Stage 1	-	-	-	-	-	-	681	644	-	747	694	-
Stage 2	-	-	-	-	-	-	755	681	-	697	630	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1371	-	-	1296	-	-	359	381	793	379	380	860
Mov Cap-2 Maneuver	-	-	-	-	-	-	359	381	-	379	380	-
Stage 1	-	-	-	-	-	-	655	620	-	719	671	-
Stage 2	-	-	-	-	-	-	678	658	-	636	606	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	1.08	1.25	13.87	14.12
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	482	1371	-	-	1296	-	-	486
HCM Lane V/C Ratio	0.158	0.032	-	-	0.029	-	-	0.188
HCM Control Delay (s/veh)	13.9	7.7	0	-	7.9	0	-	14.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0.1	-	-	0.7

Intersection	
Int Delay, s/veh	6.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	35	308	144	96	217	17	65	0	97	30	0	25
Future Vol, veh/h	35	308	144	96	217	17	65	0	97	30	0	25
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	38	335	157	104	236	18	71	0	105	33	0	27

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	260	0	0	491	0	0	935	958	413	871	1027	252
Stage 1	-	-	-	-	-	-	489	489	-	460	460	-
Stage 2	-	-	-	-	-	-	446	469	-	411	567	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1304	-	-	1072	-	-	246	257	639	272	234	787
Stage 1	-	-	-	-	-	-	560	549	-	581	566	-
Stage 2	-	-	-	-	-	-	592	561	-	618	507	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1297	-	-	1072	-	-	208	224	639	198	204	781
Mov Cap-2 Maneuver	-	-	-	-	-	-	208	224	-	198	204	-
Stage 1	-	-	-	-	-	-	544	533	-	561	508	-
Stage 2	-	-	-	-	-	-	515	503	-	501	492	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.56	2.54	25.42	20.01
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	349	1297	-	-	1072	-	-	299
HCM Lane V/C Ratio	0.505	0.029	-	-	0.097	-	-	0.2
HCM Control Delay (s/veh)	25.4	7.9	-	-	8.7	-	-	20
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	2.7	0.1	-	-	0.3	-	-	0.7

Intersection	
Intersection Delay, s/veh	64
Intersection LOS	F

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	91	118	476	91	108	434
Future Vol, veh/h	91	118	476	91	108	434
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	99	128	517	99	117	472
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay, s/veh	14.6	93.4	52.2
HCM LOS	B	F	F

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	20%	0%	84%
Vol Thru, %	0%	44%	16%
Vol Right, %	80%	56%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	542	209	567
LT Vol	108	0	476
Through Vol	0	91	91
RT Vol	434	118	0
Lane Flow Rate	589	227	616
Geometry Grp	1	1	1
Degree of Util (X)	0.959	0.413	1.101
Departure Headway (Hd)	6.13	6.844	6.433
Convergence, Y/N	Yes	Yes	Yes
Cap	595	529	561
Service Time	4.13	4.844	4.511
HCM Lane V/C Ratio	0.99	0.429	1.098
HCM Control Delay, s/veh	52.2	14.6	93.4
HCM Lane LOS	F	B	F
HCM 95th-tile Q	13.1	2	19

Intersection	
Int Delay, s/veh	31.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	177	39	508	279	7	611
Future Vol, veh/h	177	39	508	279	7	611
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	192	42	552	303	8	664

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1384	705	0	0	855	0
Stage 1	704	-	-	-	-	-
Stage 2	680	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	~ 158	437	-	-	785	-
Stage 1	491	-	-	-	-	-
Stage 2	503	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 156	436	-	-	785	-
Mov Cap-2 Maneuver	~ 156	-	-	-	-	-
Stage 1	491	-	-	-	-	-
Stage 2	495	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	234.41	0	0.11
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	176	785	-
HCM Lane V/C Ratio	-	-	1.334	0.01	-
HCM Control Delay (s/veh)	-	-	234.4	9.6	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	13.7	0	-

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	25	49	237	22	29	46	744	420	36	717	24
Future Volume (veh/h)	18	25	49	237	22	29	46	744	420	36	717	24
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	27	13	258	24	25	50	809	316	39	779	25
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	189	239	98	419	29	31	94	1018	942	78	888	28
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.62	0.62	0.62	0.62	0.62	0.62
Sat Flow, veh/h	439	917	375	1212	113	117	57	1655	1531	31	1443	45
Grp Volume(v), veh/h	60	0	0	307	0	0	859	0	316	843	0	0
Grp Sat Flow(s),veh/h/ln	1731	0	0	1443	0	0	1712	0	1531	1520	0	0
Q Serve(g_s), s	0.0	0.0	0.0	11.1	0.0	0.0	0.0	0.0	6.5	8.9	0.0	0.0
Cycle Q Clear(g_c), s	1.6	0.0	0.0	12.8	0.0	0.0	23.4	0.0	6.5	32.3	0.0	0.0
Prop In Lane	0.33		0.22	0.84		0.08	0.06		1.00	0.05		0.03
Lane Grp Cap(c), veh/h	526	0	0	479	0	0	1112	0	942	994	0	0
V/C Ratio(X)	0.11	0.00	0.00	0.64	0.00	0.00	0.77	0.00	0.34	0.85	0.00	0.00
Avail Cap(c_a), veh/h	1002	0	0	897	0	0	1278	0	1092	1155	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	18.2	0.0	0.0	22.2	0.0	0.0	8.9	0.0	6.0	9.7	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.4	0.0	0.0	2.6	0.0	0.2	5.4	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	4.3	0.0	0.0	7.5	0.0	1.7	8.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	18.3	0.0	0.0	23.6	0.0	0.0	11.5	0.0	6.2	15.2	0.0	0.0
LnGrp LOS	B			C			B		A	B		
Approach Vol, veh/h		60			307			1175			843	
Approach Delay, s/veh		18.3			23.6			10.1			15.2	
Approach LOS		B			C			B			B	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	43.7	20.8	43.7	20.8
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	46.0	36.0	46.0	36.0
Max Q Clear Time (g_c+I1), s	25.4	3.6	34.3	14.8
Green Ext Time (p_c), s	8.7	0.3	5.4	1.9

Intersection Summary	
HCM 7th Control Delay, s/veh	13.8
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	218	336	34	396	431	443	81	520	342	268	515	230
Future Volume (veh/h)	218	336	34	396	431	443	81	520	342	268	515	230
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.94	0.99		1.00	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	237	365	34	430	468	233	88	565	0	291	560	203
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	242	322	30	363	547	436	251	518		253	855	309
Arrive On Green	0.09	0.21	0.21	0.19	0.32	0.32	0.05	0.31	0.00	0.12	0.38	0.38
Sat Flow, veh/h	1603	1508	140	1603	1683	1343	1603	1683	1427	1603	2272	821
Grp Volume(v), veh/h	237	0	399	430	468	233	88	565	0	291	393	370
Grp Sat Flow(s),veh/h/ln	1603	0	1649	1603	1683	1343	1603	1683	1427	1603	1599	1494
Q Serve(g_s), s	10.0	0.0	25.0	22.0	30.4	16.6	4.4	36.0	0.0	14.0	23.8	24.0
Cycle Q Clear(g_c), s	10.0	0.0	25.0	22.0	30.4	16.6	4.4	36.0	0.0	14.0	23.8	24.0
Prop In Lane	1.00		0.09	1.00		1.00	1.00		1.00	1.00		0.55
Lane Grp Cap(c), veh/h	242	0	352	363	547	436	251	518		253	601	562
V/C Ratio(X)	0.98	0.00	1.13	1.18	0.86	0.53	0.35	1.09		1.15	0.65	0.66
Avail Cap(c_a), veh/h	242	0	352	363	547	436	251	518		253	601	562
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.5	0.0	46.0	34.1	36.9	32.3	26.7	40.5	0.0	34.0	30.2	30.3
Incr Delay (d2), s/veh	52.1	0.0	89.0	107.6	12.7	1.3	0.8	66.5	0.0	102.6	2.5	2.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	0.0	18.9	19.4	14.4	5.6	1.7	24.4	0.0	11.8	9.6	9.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	92.6	0.0	135.0	141.7	49.6	33.5	27.5	107.0	0.0	136.6	32.7	33.0
LnGrp LOS	F		F	F	D	C	C	F		F	C	C
Approach Vol, veh/h		636			1131			653			1054	
Approach Delay, s/veh		119.2			81.3			96.3			61.5	
Approach LOS		F			F			F			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.0	41.0	27.0	30.0	11.0	49.0	14.0	43.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	14.0	36.0	22.0	25.0	6.0	44.0	10.0	38.0
Max Q Clear Time (g_c+I1), s	16.0	38.0	24.0	27.0	6.4	26.0	12.0	32.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	5.0	0.0	2.0

Intersection Summary	
HCM 7th Control Delay, s/veh	85.1
HCM 7th LOS	F

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd 10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	546	56	184	61	44	105	243	1683	48	132	1122	423
Future Volume (veh/h)	546	56	184	61	44	105	243	1683	48	132	1122	423
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	593	61	0	66	48	0	264	1829	27	143	1220	203
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	651	352		107	113		318	2744	852	165	2747	852
Arrive On Green	0.19	0.19	0.00	0.06	0.06	0.00	0.09	0.54	0.54	0.09	0.54	0.54
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	5106	1585	1781	5106	1584
Grp Volume(v), veh/h	593	61	0	66	48	0	264	1829	27	143	1220	203
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1702	1585	1781	1702	1584
Q Serve(g_s), s	27.7	4.5	0.0	6.0	4.1	0.0	12.4	42.6	1.3	13.1	23.9	11.2
Cycle Q Clear(g_c), s	27.7	4.5	0.0	6.0	4.1	0.0	12.4	42.6	1.3	13.1	23.9	11.2
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	651	352		107	113		318	2744	852	165	2747	852
V/C Ratio(X)	0.91	0.17		0.61	0.43		0.83	0.67	0.03	0.87	0.44	0.24
Avail Cap(c_a), veh/h	733	397		184	193		670	2744	852	270	2747	852
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.75	0.75	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.6	56.2	0.0	75.7	74.8	0.0	73.6	27.5	18.0	73.9	23.1	20.2
Incr Delay (d2), s/veh	11.5	0.2	0.0	5.6	2.5	0.0	5.5	1.3	0.1	14.9	0.5	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.4	2.2	0.0	2.9	2.1	0.0	5.7	17.5	0.5	6.7	9.8	4.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	77.1	56.3	0.0	81.3	77.3	0.0	79.2	28.8	18.0	88.8	23.7	20.9
LnGrp LOS	E	E		F	E		E	C	B	F	C	C
Approach Vol, veh/h		654			114			2120			1566	
Approach Delay, s/veh		75.2			79.6			34.9			29.2	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	20.3	93.7	14.9	20.2	93.8	36.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	25.0	68.0	17.0	32.0	61.0	35.0
Max Q Clear Time (g_c+I1), s	15.1	44.6	8.0	14.4	25.9	29.7
Green Ext Time (p_c), s	0.2	14.9	0.2	0.8	11.9	1.4

Intersection Summary	
HCM 7th Control Delay, s/veh	40.0
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th TWSC
3: Queen Kaahumanu Hwy & Eho St 10/27/2023

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	52	0	2011	53	0	1471	40
Future Vol, veh/h	0	0	0	0	0	52	0	2011	53	0	1471	40
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	57	0	2186	58	0	1599	43

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	-	-	1122	1601	0	0	2186	-	0
Stage 1	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	7.14	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.92	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	172	0	-	-	0	-	-
Stage 1	0	0	-	0	-	-	0	-	-
Stage 2	0	0	-	0	-	-	0	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	-	0	172	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-	-	-	-
Stage 1	-	0	-	-	-	-	-	-	-
Stage 2	-	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	35.87	0	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	172	-	-
HCM Lane V/C Ratio	-	-	0.329	-	-
HCM Control Delay (s/veh)	-	-	35.9	-	-
HCM Lane LOS	-	-	E	-	-
HCM 95th %tile Q(veh)	-	-	1.3	-	-

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	507	375	110	57	427	114	163	1429	41	112	938	410
Future Volume (veh/h)	507	375	110	57	427	114	163	1429	41	112	938	410
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	551	408	0	62	464	0	177	1553	17	122	1020	243
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	613	967		102	539		251	2499	775	209	2436	754
Arrive On Green	0.18	0.27	0.00	0.06	0.15	0.00	0.07	0.49	0.49	0.06	0.48	0.48
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	5106	1584	3456	5106	1580
Grp Volume(v), veh/h	551	408	0	62	464	0	177	1553	17	122	1020	243
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1702	1584	1728	1702	1580
Q Serve(g_s), s	25.7	15.6	0.0	5.6	21.0	0.0	8.3	36.8	0.9	5.7	21.5	15.7
Cycle Q Clear(g_c), s	25.7	15.6	0.0	5.6	21.0	0.0	8.3	36.8	0.9	5.7	21.5	15.7
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	613	967		102	539		251	2499	775	209	2436	754
V/C Ratio(X)	0.90	0.42		0.61	0.86		0.70	0.62	0.02	0.58	0.42	0.32
Avail Cap(c_a), veh/h	775	969		238	646		356	2499	775	230	2436	754
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.11	0.11	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	66.4	49.4	0.0	76.0	68.3	0.0	74.8	30.9	21.7	75.5	28.2	26.7
Incr Delay (d2), s/veh	1.5	0.0	0.0	5.8	10.0	0.0	3.6	1.2	0.1	3.1	0.5	1.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.6	7.1	0.0	2.8	10.4	0.0	3.8	15.4	0.4	2.6	9.0	6.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	67.9	49.4	0.0	81.8	78.2	0.0	78.4	32.1	21.8	78.6	28.7	27.8
LnGrp LOS	E	D		F	E		E	C	C	E	C	C
Approach Vol, veh/h		959			526			1747			1385	
Approach Delay, s/veh		60.1			78.7			36.7			33.0	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	85.7	14.4	49.9	17.0	83.7	34.3	30.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	11.0	67.0	22.0	45.0	17.0	61.0	37.0	30.0
Max Q Clear Time (g_c+I1), s	7.7	38.8	7.6	17.6	10.3	23.5	27.7	23.0
Green Ext Time (p_c), s	0.1	13.7	0.1	3.0	0.3	9.8	1.5	1.8

Intersection Summary	
HCM 7th Control Delay, s/veh	45.2
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	547	20	210	415	77	2	19	209	36	18	11
Future Volume (veh/h)	11	547	20	210	415	77	2	19	209	36	18	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	12	595	20	228	451	74	2	21	4	39	20	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	28	1041	35	298	1372	224	57	60	50	103	109	0
Arrive On Green	0.02	0.30	0.30	0.17	0.45	0.45	0.03	0.03	0.03	0.06	0.06	0.00
Sat Flow, veh/h	1781	3507	118	1781	3057	499	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	12	301	314	228	261	264	2	21	4	39	20	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1848	1781	1777	1779	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.3	6.4	6.5	5.5	4.3	4.3	0.0	0.5	0.1	0.9	0.5	0.0
Cycle Q Clear(g_c), s	0.3	6.4	6.5	5.5	4.3	4.3	0.0	0.5	0.1	0.9	0.5	0.0
Prop In Lane	1.00		0.06	1.00		0.28	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	28	527	548	298	797	799	57	60	50	103	109	0
V/C Ratio(X)	0.44	0.57	0.57	0.76	0.33	0.33	0.04	0.35	0.08	0.38	0.18	0.00
Avail Cap(c_a), veh/h	357	2179	2266	754	2575	2578	754	792	671	1271	1334	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	21.9	13.4	13.4	17.8	8.0	8.0	21.0	21.3	21.1	20.3	20.1	0.0
Incr Delay (d2), s/veh	10.4	1.0	0.9	4.1	0.2	0.2	0.3	3.5	0.7	2.3	0.8	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	2.4	2.4	2.4	1.3	1.4	0.0	0.3	0.0	0.4	0.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	32.3	14.3	14.3	21.9	8.2	8.2	21.3	24.8	21.7	22.6	20.9	0.0
LnGrp LOS	C	B	B	C	A	A	C	C	C	C	C	
Approach Vol, veh/h		627			753			27			59	
Approach Delay, s/veh		14.7			12.4			24.1			22.0	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.5	18.3		7.6	5.7	25.1		6.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	19.0	55.0		32.0	9.0	65.0		19.0
Max Q Clear Time (g_c+I1), s	7.5	8.5		2.9	2.3	6.3		2.5
Green Ext Time (p_c), s	0.5	4.5		0.2	0.0	3.8		0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	14.0
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑ ↑↱		↰	↑ ↑↱		↰	↑	↱	↰	↑↱	
Traffic Volume (veh/h)	20	411	11	110	297	33	17	18	133	38	17	8
Future Volume (veh/h)	20	411	11	110	297	33	17	18	133	38	17	8
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	447	11	120	323	31	18	20	5	41	18	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	49	903	22	170	1058	101	86	90	76	116	122	0
Arrive On Green	0.03	0.25	0.25	0.10	0.32	0.32	0.05	0.05	0.05	0.07	0.07	0.00
Sat Flow, veh/h	1781	3544	87	1781	3278	312	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	22	224	234	120	174	180	18	20	5	41	18	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1854	1781	1777	1814	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.5	4.0	4.0	2.4	2.7	2.8	0.4	0.4	0.1	0.8	0.3	0.0
Cycle Q Clear(g_c), s	0.5	4.0	4.0	2.4	2.7	2.8	0.4	0.4	0.1	0.8	0.3	0.0
Prop In Lane	1.00		0.05	1.00		0.17	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	49	453	472	170	574	585	86	90	76	116	122	0
V/C Ratio(X)	0.45	0.49	0.50	0.71	0.30	0.31	0.21	0.22	0.07	0.35	0.15	0.00
Avail Cap(c_a), veh/h	478	1453	1516	812	1787	1824	1505	1580	1339	1505	1580	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.9	11.8	11.9	16.4	9.5	9.5	17.1	17.1	16.9	16.7	16.4	0.0
Incr Delay (d2), s/veh	6.4	0.8	0.8	5.3	0.3	0.3	1.2	1.2	0.4	1.8	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.4	1.5	1.1	0.9	0.9	0.2	0.2	0.0	0.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	24.3	12.7	12.7	21.6	9.8	9.8	18.3	18.3	17.3	18.5	17.0	0.0
LnGrp LOS	C	B	B	C	A	A	B	B	B	B	B	
Approach Vol, veh/h		480			474			43			59	
Approach Delay, s/veh		13.2			12.8			18.2			18.0	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	8.6	14.5	7.4	6.0	17.0	6.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	4.4	6.0	2.8	2.5	4.8	2.4
Green Ext Time (p_c), s	0.2	2.9	0.2	0.0	2.3	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	13.5
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑ ↑↱		↰	↑ ↑↱		↰	↑	↱	↰	↑↱	
Traffic Volume (veh/h)	13	345	25	71	248	2	9	4	98	1	4	4
Future Volume (veh/h)	13	345	25	71	248	2	9	4	98	1	4	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	14	375	23	77	270	1	10	4	11	1	4	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	817	50	139	1089	4	63	66	56	12	13	0
Arrive On Green	0.02	0.24	0.24	0.08	0.30	0.30	0.04	0.04	0.04	0.01	0.01	0.00
Sat Flow, veh/h	1781	3401	208	1781	3631	13	1781	1870	1582	1781	1870	0
Grp Volume(v), veh/h	14	195	203	77	132	139	10	4	11	1	4	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1832	1781	1777	1868	1781	1870	1582	1781	1870	0
Q Serve(g_s), s	0.2	2.9	3.0	1.3	1.8	1.8	0.2	0.1	0.2	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.2	2.9	3.0	1.3	1.8	1.8	0.2	0.1	0.2	0.0	0.1	0.0
Prop In Lane	1.00		0.11	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	33	427	440	139	533	560	63	66	56	12	13	0
V/C Ratio(X)	0.43	0.46	0.46	0.55	0.25	0.25	0.16	0.06	0.20	0.08	0.31	0.00
Avail Cap(c_a), veh/h	285	1421	1465	285	1421	1493	1709	1794	1518	1709	1794	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.2	10.1	10.1	13.9	8.3	8.3	14.6	14.6	14.7	15.4	15.5	0.0
Incr Delay (d2), s/veh	8.7	0.8	0.8	3.4	0.2	0.2	1.2	0.4	1.7	2.9	13.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.0	1.0	0.6	0.5	0.5	0.1	0.0	0.1	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.9	10.9	10.9	17.3	8.5	8.5	15.8	15.0	16.4	18.3	28.9	0.0
LnGrp LOS	C	B	B	B	A	A	B	B	B	B	C	
Approach Vol, veh/h		412			348			25			5	
Approach Delay, s/veh		11.3			10.5			15.9			26.8	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	7.4	12.5	5.2	5.6	14.4	6.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	3.3	5.0	2.1	2.2	3.8	2.2
Green Ext Time (p_c), s	0.0	2.4	0.0	0.0	1.5	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	11.2
HCM 7th LOS	B

Intersection												
Int Delay, s/veh	1.7											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	335	14	16	231	13	17	2	22	18	2	11
Future Vol, veh/h	9	335	14	16	231	13	17	2	22	18	2	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	364	15	17	251	14	18	2	24	20	2	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	265	0	0	379	0	0	678	691	372	678	692	258
Stage 1	-	-	-	-	-	-	391	391	-	293	293	-
Stage 2	-	-	-	-	-	-	287	300	-	385	399	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1299	-	-	1179	-	-	366	368	674	366	367	780
Stage 1	-	-	-	-	-	-	633	607	-	715	670	-
Stage 2	-	-	-	-	-	-	720	666	-	638	602	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1299	-	-	1179	-	-	349	358	674	342	358	780
Mov Cap-2 Maneuver	-	-	-	-	-	-	349	358	-	342	358	-
Stage 1	-	-	-	-	-	-	627	601	-	708	659	-
Stage 2	-	-	-	-	-	-	695	654	-	608	596	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.2	0.5	13.43	14.12
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	471	1299	-	-	1179	-	-	428
HCM Lane V/C Ratio	0.095	0.008	-	-	0.015	-	-	0.079
HCM Control Delay (s/veh)	13.4	7.8	0	-	8.1	0	-	14.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.3

Intersection												
Int Delay, s/veh	3.8											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	150	12	41	100	15	14	1	64	20	10	15
Future Vol, veh/h	14	150	12	41	100	15	14	1	64	20	10	15
Conflicting Peds, #/hr	0	0	3	3	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	163	13	45	109	16	15	1	70	22	11	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	125	0	0	179	0	0	406	417	173	400	416	117
Stage 1	-	-	-	-	-	-	203	203	-	206	206	-
Stage 2	-	-	-	-	-	-	203	214	-	194	210	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1462	-	-	1397	-	-	555	526	871	560	528	935
Stage 1	-	-	-	-	-	-	799	733	-	796	731	-
Stage 2	-	-	-	-	-	-	799	725	-	808	729	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1462	-	-	1393	-	-	508	501	869	491	502	935
Mov Cap-2 Maneuver	-	-	-	-	-	-	508	501	-	491	502	-
Stage 1	-	-	-	-	-	-	787	723	-	787	706	-
Stage 2	-	-	-	-	-	-	746	700	-	733	718	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.6	2.02	10.04	11.69
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	508	869	1462	-	-	1393	-	-	587
HCM Lane V/C Ratio	0.032	0.08	0.01	-	-	0.032	-	-	0.083
HCM Control Delay (s/veh)	12.3	9.5	7.5	0	-	7.7	0	-	11.7
HCM Lane LOS	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0.3	0	-	-	0.1	-	-	0.3

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	326	14	16	236	8	17	1	22	11	1	6
Future Vol, veh/h	5	326	14	16	236	8	17	1	22	11	1	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	354	15	17	257	9	18	1	24	12	1	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	265	0	0	370	0	0	665	673	362	661	676	261
Stage 1	-	-	-	-	-	-	373	373	-	296	296	-
Stage 2	-	-	-	-	-	-	292	300	-	366	380	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1299	-	-	1189	-	-	374	377	683	376	375	778
Stage 1	-	-	-	-	-	-	648	618	-	713	668	-
Stage 2	-	-	-	-	-	-	716	666	-	654	614	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1299	-	-	1189	-	-	361	368	683	353	367	778
Mov Cap-2 Maneuver	-	-	-	-	-	-	361	368	-	353	367	-
Stage 1	-	-	-	-	-	-	644	615	-	709	657	-
Stage 2	-	-	-	-	-	-	697	654	-	626	610	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.11	0.5	13.1	13.71
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	488	1299	-	-	1189	-	-	433
HCM Lane V/C Ratio	0.089	0.004	-	-	0.015	-	-	0.045
HCM Control Delay (s/veh)	13.1	7.8	0	-	8.1	0	-	13.7
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	129	14	15	84	15	15	0	20	20	9	15
Future Vol, veh/h	14	129	14	15	84	15	15	0	20	20	9	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	140	15	16	91	16	16	0	22	22	10	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	108	0	0	155	0	0	307	318	148	303	318	99
Stage 1	-	-	-	-	-	-	178	178	-	132	132	-
Stage 2	-	-	-	-	-	-	129	140	-	171	186	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1483	-	-	1425	-	-	645	598	899	650	598	956
Stage 1	-	-	-	-	-	-	824	752	-	871	787	-
Stage 2	-	-	-	-	-	-	875	781	-	831	746	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1483	-	-	1425	-	-	609	584	899	619	584	956
Mov Cap-2 Maneuver	-	-	-	-	-	-	609	584	-	619	584	-
Stage 1	-	-	-	-	-	-	814	743	-	862	777	-
Stage 2	-	-	-	-	-	-	839	771	-	802	738	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.66	0.99	10.08	10.57
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	747	1483	-	-	1425	-	-	694
HCM Lane V/C Ratio	0.051	0.01	-	-	0.011	-	-	0.069
HCM Control Delay (s/veh)	10.1	7.5	0	-	7.6	0	-	10.6
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.2

12: Pawai Pl & Kaiwi St

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	314	110	88	178	13	41	0	57	22	0	15
Future Vol, veh/h	16	314	110	88	178	13	41	0	57	22	0	15
Conflicting Peds, #/hr	2	0	3	3	0	2	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	341	120	96	193	14	45	0	62	24	0	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	210	0	0	464	0	0	825	840	404	770	893	204
Stage 1	-	-	-	-	-	-	439	439	-	394	394	-
Stage 2	-	-	-	-	-	-	386	401	-	376	499	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1361	-	-	1097	-	-	292	302	647	318	281	837
Stage 1	-	-	-	-	-	-	597	578	-	631	605	-
Stage 2	-	-	-	-	-	-	637	601	-	645	544	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1359	-	-	1094	-	-	257	270	645	258	252	835
Mov Cap-2 Maneuver	-	-	-	-	-	-	257	270	-	258	252	-
Stage 1	-	-	-	-	-	-	587	569	-	622	551	-
Stage 2	-	-	-	-	-	-	570	547	-	576	535	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.28	2.71	17.45	16.31
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	395	1359	-	-	1094	-	-	359
HCM Lane V/C Ratio	0.27	0.013	-	-	0.087	-	-	0.112
HCM Control Delay (s/veh)	17.4	7.7	-	-	8.6	-	-	16.3
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1.1	0	-	-	0.3	-	-	0.4

13: Kuakini Hwy & Makala Blvd

Intersection	
Int Delay, s/veh	8.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	20	52	224	35	56	325
Future Vol, veh/h	20	52	224	35	56	325
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	57	243	38	61	353

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	79	0	576	52
Stage 1	-	-	-	-	51	-
Stage 2	-	-	-	-	525	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1519	-	479	1016
Stage 1	-	-	-	-	971	-
Stage 2	-	-	-	-	593	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1517	-	400	1014
Mov Cap-2 Maneuver	-	-	-	-	400	-
Stage 1	-	-	-	-	971	-
Stage 2	-	-	-	-	496	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	6.77	11.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	400	1014	-	-	1517	-
HCM Lane V/C Ratio	0.152	0.348	-	-	0.16	-
HCM Control Delay (s/veh)	15.6	10.4	-	-	7.8	0
HCM Lane LOS	C	B	-	-	A	A
HCM 95th %tile Q(veh)	0.5	1.6	-	-	0.6	-

HCM 7th TWSC
14: Kuakini Hwy & Loloku St
10/27/2023

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	112	2	398	152	4	278
Future Vol, veh/h	112	2	398	152	4	278
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	122	2	433	165	4	302

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	677	516	0	0	599	0
Stage 1	516	-	-	-	-	-
Stage 2	161	-	-	-	-	-
Critical Hdwy	6.63	6.23	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	-	-	2.219	-
Pot Cap-1 Maneuver	402	558	-	-	976	-
Stage 1	598	-	-	-	-	-
Stage 2	852	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	399	557	-	-	975	-
Mov Cap-2 Maneuver	399	-	-	-	-	-
Stage 1	597	-	-	-	-	-
Stage 2	847	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	17.93	0	0.16
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	401	975	-
HCM Lane V/C Ratio	-	-	0.309	0.004	-
HCM Control Delay (s/veh)	-	-	17.9	8.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.3	0	-

HCM 7th Signalized Intersection Summary
15: Kuakini Hwy & Kaiwi St
10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	36	31	196	23	17	45	514	345	0	358	29
Future Volume (veh/h)	12	36	31	196	23	17	45	514	345	0	358	29
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	13	39	9	213	25	15	49	559	187	0	389	29
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	176	352	68	506	53	22	155	853	775	0	1652	123
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.49	0.49	0.49	0.00	0.49	0.49
Sat Flow, veh/h	162	1345	261	1154	202	85	72	1731	1572	0	3445	249
Grp Volume(v), veh/h	61	0	0	253	0	0	608	0	187	0	205	213
Grp Sat Flow(s),veh/h/ln	1767	0	0	1442	0	0	1803	0	1572	0	1777	1823
Q Serve(g_s), s	0.0	0.0	0.0	4.2	0.0	0.0	0.2	0.0	2.2	0.0	2.2	2.2
Cycle Q Clear(g_c), s	0.8	0.0	0.0	5.0	0.0	0.0	8.0	0.0	2.2	0.0	2.2	2.2
Prop In Lane	0.21		0.15	0.84		0.06	0.08		1.00	0.00		0.14
Lane Grp Cap(c), veh/h	597	0	0	581	0	0	1008	0	775	0	876	898
V/C Ratio(X)	0.10	0.00	0.00	0.44	0.00	0.00	0.60	0.00	0.24	0.00	0.23	0.24
Avail Cap(c_a), veh/h	2019	0	0	1761	0	0	2603	0	2217	0	2506	2571
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	9.2	0.0	0.0	10.6	0.0	0.0	6.2	0.0	4.8	0.0	4.7	4.7
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.5	0.0	0.0	0.6	0.0	0.2	0.0	0.1	0.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	1.3	0.0	0.0	1.9	0.0	0.4	0.0	0.5	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	9.3	0.0	0.0	11.2	0.0	0.0	6.8	0.0	4.9	0.0	4.9	4.9
LnGrp LOS	A			B			A		A		A	A
Approach Vol, veh/h		61			253			795			418	
Approach Delay, s/veh		9.3			11.2			6.4			4.9	
Approach LOS		A			B			A			A	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	20.1	12.5	20.1	12.5
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	46.0	36.0	46.0	36.0
Max Q Clear Time (g_c+I1), s	10.0	2.8	4.2	7.0
Green Ext Time (p_c), s	5.9	0.3	2.9	1.7

Intersection Summary	
HCM 7th Control Delay, s/veh	6.9
HCM 7th LOS	A

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	314	49	287	287	261	80	566	425	163	302	137
Future Volume (veh/h)	175	314	49	287	287	261	80	566	425	163	302	137
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	0.99		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	190	341	48	312	312	63	87	615	0	177	328	104
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	322	322	45	301	452	374	408	1222		359	997	310
Arrive On Green	0.11	0.22	0.22	0.15	0.27	0.27	0.05	0.38	0.00	0.08	0.42	0.42
Sat Flow, veh/h	1603	1438	202	1603	1683	1393	1603	3282	0	1603	2390	744
Grp Volume(v), veh/h	190	0	389	312	312	63	87	615	0	177	217	215
Grp Sat Flow(s),veh/h/ln	1603	0	1640	1603	1683	1393	1603	1599	0	1603	1599	1535
Q Serve(g_s), s	11.2	0.0	28.0	19.0	20.8	4.3	4.1	18.4	0.0	8.1	11.5	11.8
Cycle Q Clear(g_c), s	11.2	0.0	28.0	19.0	20.8	4.3	4.1	18.4	0.0	8.1	11.5	11.8
Prop In Lane	1.00		0.12	1.00		1.00	1.00		0.00	1.00		0.48
Lane Grp Cap(c), veh/h	322	0	367	301	452	374	408	1222		359	667	641
V/C Ratio(X)	0.59	0.00	1.06	1.04	0.69	0.17	0.21	0.50		0.49	0.33	0.33
Avail Cap(c_a), veh/h	381	0	367	301	452	374	462	1222		394	667	641
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.62	0.62	0.62	1.00	1.00	0.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	32.9	0.0	48.5	36.7	41.0	35.0	21.8	29.6	0.0	21.4	24.6	24.7
Incr Delay (d2), s/veh	1.7	0.0	63.4	50.3	2.8	0.1	0.3	1.5	0.0	1.0	1.3	1.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.0	18.0	11.7	9.1	1.5	1.6	7.4	0.0	3.2	4.7	4.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	34.6	0.0	111.9	87.0	43.8	35.2	22.1	31.0	0.0	22.5	25.8	26.1
LnGrp LOS	C		F	F	D	D	C	C		C	C	C
Approach Vol, veh/h		579			687			702			609	
Approach Delay, s/veh		86.5			62.6			29.9			24.9	
Approach LOS		F			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.2	52.8	24.0	33.0	10.9	57.1	18.4	38.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	13.0	45.0	19.0	28.0	10.0	48.0	18.0	29.0
Max Q Clear Time (g_c+I1), s	10.1	20.4	21.0	30.0	6.1	13.8	13.2	22.8
Green Ext Time (p_c), s	0.1	4.7	0.0	0.0	0.1	3.0	0.2	1.1

Intersection Summary	
HCM 7th Control Delay, s/veh	50.2
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	733	89	404	119	106	154	408	1313	63	221	1990	677
Future Volume (veh/h)	733	89	404	119	106	154	408	1313	63	221	1990	677
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	797	97	0	129	115	0	443	1427	30	240	2163	351
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	841	455		140	147		377	2084	646	265	2285	709
Arrive On Green	0.24	0.24	0.00	0.08	0.08	0.00	0.11	0.41	0.41	0.15	0.45	0.45
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	5106	1584	1781	5106	1585
Grp Volume(v), veh/h	797	97	0	129	115	0	443	1427	30	240	2163	351
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1702	1584	1781	1702	1585
Q Serve(g_s), s	37.4	6.8	0.0	11.9	10.0	0.0	18.0	37.9	1.9	21.9	67.0	25.9
Cycle Q Clear(g_c), s	37.4	6.8	0.0	11.9	10.0	0.0	18.0	37.9	1.9	21.9	67.0	25.9
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	841	455		140	147		377	2084	646	265	2285	709
V/C Ratio(X)	0.95	0.21		0.92	0.78		1.18	0.68	0.05	0.91	0.95	0.49
Avail Cap(c_a), veh/h	859	465		140	147		377	2084	646	486	2285	709
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.61	0.61	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.4	49.8	0.0	75.5	74.6	0.0	73.5	40.1	29.5	69.1	43.7	32.3
Incr Delay (d2), s/veh	13.4	0.1	0.0	52.3	23.1	0.0	103.3	1.9	0.1	11.3	9.9	2.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.1	3.3	0.0	7.5	5.8	0.0	13.4	16.2	0.8	10.8	29.9	10.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	74.8	50.0	0.0	127.7	97.7	0.0	176.8	42.0	29.6	80.4	53.5	34.8
LnGrp LOS	E	D		F	F		F	D	C	F	D	C
Approach Vol, veh/h		894			244			1900			2754	
Approach Delay, s/veh		72.1			113.6			73.2			53.5	
Approach LOS		E			F			E			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	29.5	72.3		18.0	23.0	78.9		45.1
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	45.0	46.0		13.0	18.0	73.0		41.0
Max Q Clear Time (g_c+I1), s	23.9	39.9		13.9	20.0	69.0		39.4
Green Ext Time (p_c), s	0.6	4.3		0.0	0.0	3.7		0.7

Intersection Summary	
HCM 7th Control Delay, s/veh	65.4
HCM 7th LOS	E

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th TWSC
3: Queen Kaahumanu Hwy & Eho St

10/27/2023

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	83	0	1802	67	0	2731	75
Future Vol, veh/h	0	0	0	0	0	83	0	1802	67	0	2731	75
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	90	0	1959	73	0	2968	82

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	-	-	1016	2969	0	0	1959	-	0
Stage 1	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	7.14	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.92	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	202	0	-	-	0	-	-
Stage 1	0	0	-	0	-	-	0	-	-
Stage 2	0	0	-	0	-	-	0	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	-	0	202	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-	-	-	-
Stage 1	-	0	-	-	-	-	-	-	-
Stage 2	-	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	36.34	0	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	202	-	-
HCM Lane V/C Ratio	-	-	0.446	-	-
HCM Control Delay (s/veh)	-	-	36.3	-	-
HCM Lane LOS	-	-	E	-	-
HCM 95th %tile Q(veh)	-	-	2.1	-	-

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	440	536	143	120	547	164	167	1271	46	243	1664	816
Future Volume (veh/h)	440	536	143	120	547	164	167	1271	46	243	1664	816
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	478	583	0	130	595	0	182	1382	16	264	1809	664
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	516	912		152	684		251	2184	678	377	2370	735
Arrive On Green	0.15	0.26	0.00	0.09	0.19	0.00	0.07	0.43	0.43	0.11	0.46	0.46
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	5106	1585	3456	5106	1584
Grp Volume(v), veh/h	478	583	0	130	595	0	182	1382	16	264	1809	664
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1702	1585	1728	1702	1584
Q Serve(g_s), s	22.5	24.1	0.0	11.9	26.8	0.0	8.5	35.0	1.0	12.2	48.5	63.8
Cycle Q Clear(g_c), s	22.5	24.1	0.0	11.9	26.8	0.0	8.5	35.0	1.0	12.2	48.5	63.8
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	516	912		152	684		251	2184	678	377	2370	735
V/C Ratio(X)	0.93	0.64		0.86	0.87		0.72	0.63	0.02	0.70	0.76	0.90
Avail Cap(c_a), veh/h	524	912		270	797		440	2184	678	440	2370	735
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	69.3	54.5	0.0	74.5	64.6	0.0	74.9	37.0	27.3	70.9	36.7	40.8
Incr Delay (d2), s/veh	3.1	0.1	0.0	12.7	9.1	0.0	3.9	1.4	0.1	4.0	2.4	16.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.3	11.0	0.0	6.0	13.1	0.0	3.9	14.9	0.4	5.6	20.6	28.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	72.4	54.7	0.0	87.1	73.7	0.0	78.8	38.4	27.4	74.9	39.1	57.3
LnGrp LOS	E	D		F	E		E	D	C	E	D	E
Approach Vol, veh/h		1061			725			1580			2737	
Approach Delay, s/veh		62.7			76.1			43.0			47.0	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	75.6	19.1	47.3	17.0	81.6	29.6	36.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	21.0	62.0	25.0	37.0	21.0	62.0	25.0	37.0
Max Q Clear Time (g_c+I1), s	14.2	37.0	13.9	26.1	10.5	65.8	24.5	28.8
Green Ext Time (p_c), s	0.5	11.2	0.2	3.1	0.4	0.0	0.1	2.6

Intersection Summary	
HCM 7th Control Delay, s/veh	52.1
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	790	27	220	801	169	11	13	305	143	24	24
Future Volume (veh/h)	20	790	27	220	801	169	11	13	305	143	24	24
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	859	27	239	871	173	12	14	17	155	26	2
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	45	1249	39	295	1464	291	75	78	67	213	205	16
Arrive On Green	0.03	0.36	0.36	0.17	0.50	0.50	0.04	0.04	0.04	0.12	0.12	0.12
Sat Flow, veh/h	1781	3517	111	1781	2954	587	1781	1870	1585	1781	1715	132
Grp Volume(v), veh/h	22	434	452	239	524	520	12	14	17	155	0	28
Grp Sat Flow(s),veh/h/ln	1781	1777	1850	1781	1777	1764	1781	1870	1585	1781	0	1847
Q Serve(g_s), s	0.8	13.1	13.1	8.1	13.3	13.3	0.4	0.5	0.7	5.3	0.0	0.9
Cycle Q Clear(g_c), s	0.8	13.1	13.1	8.1	13.3	13.3	0.4	0.5	0.7	5.3	0.0	0.9
Prop In Lane	1.00		0.06	1.00		0.33	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	45	631	657	295	880	874	75	78	67	213	0	221
V/C Ratio(X)	0.49	0.69	0.69	0.81	0.59	0.60	0.16	0.18	0.26	0.73	0.00	0.13
Avail Cap(c_a), veh/h	254	1551	1615	537	1833	1820	537	564	478	905	0	938
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.3	17.3	17.3	25.3	11.4	11.4	29.1	29.1	29.2	26.7	0.0	24.8
Incr Delay (d2), s/veh	7.9	1.3	1.3	5.3	0.6	0.7	1.0	1.1	2.0	4.7	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	5.2	5.4	3.7	4.7	4.7	0.2	0.2	0.3	2.4	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	38.2	18.7	18.6	30.6	12.0	12.0	30.1	30.2	31.2	31.4	0.0	25.0
LnGrp LOS	D	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		908			1283			43			183	
Approach Delay, s/veh		19.1			15.5			30.6			30.4	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	15.4	27.4	12.5	6.6	36.2	7.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	19.0	55.0	32.0	9.0	65.0	19.0
Max Q Clear Time (g_c+I1), s	10.1	15.1	7.3	2.8	15.3	2.7
Green Ext Time (p_c), s	0.5	7.2	0.6	0.0	9.6	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	18.3
HCM 7th LOS	B

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	531	18	130	669	36	18	31	229	83	39	57
Future Volume (veh/h)	66	531	18	130	669	36	18	31	229	83	39	57
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	72	577	19	141	727	36	20	34	9	90	42	13
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	115	1036	34	187	1157	57	106	111	94	218	167	52
Arrive On Green	0.06	0.30	0.30	0.11	0.34	0.34	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3511	116	1781	3446	171	1781	1870	1585	1781	1362	421
Grp Volume(v), veh/h	72	292	304	141	375	388	20	34	9	90	0	55
Grp Sat Flow(s),veh/h/ln	1781	1777	1850	1781	1777	1839	1781	1870	1585	1781	0	1783
Q Serve(g_s), s	1.9	6.6	6.6	3.7	8.5	8.5	0.5	0.8	0.3	2.2	0.0	1.3
Cycle Q Clear(g_c), s	1.9	6.6	6.6	3.7	8.5	8.5	0.5	0.8	0.3	2.2	0.0	1.3
Prop In Lane	1.00		0.06	1.00		0.09	1.00		1.00	1.00		0.24
Lane Grp Cap(c), veh/h	115	524	546	187	597	618	106	111	94	218	0	218
V/C Ratio(X)	0.63	0.56	0.56	0.75	0.63	0.63	0.19	0.31	0.10	0.41	0.00	0.25
Avail Cap(c_a), veh/h	372	1133	1179	633	1393	1442	1173	1232	1044	1173	0	1174
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.8	14.2	14.2	20.8	13.4	13.4	21.4	21.6	21.3	19.4	0.0	19.0
Incr Delay (d2), s/veh	5.5	0.9	0.9	6.0	1.1	1.1	0.9	1.5	0.4	1.2	0.0	0.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	2.5	2.6	1.7	3.1	3.2	0.2	0.4	0.1	0.9	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	27.4	15.1	15.1	26.8	14.5	14.4	22.3	23.1	21.7	20.7	0.0	19.6
LnGrp LOS	C	B	B	C	B	B	C	C	C	C		B
Approach Vol, veh/h		668			904			63			145	
Approach Delay, s/veh		16.4			16.4			22.6			20.3	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	10.0	19.1	10.9	8.1	21.1	7.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	5.7	8.6	4.2	3.9	10.5	2.8
Green Ext Time (p_c), s	0.3	3.9	0.5	0.1	5.5	0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	16.9
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	456	34	154	595	4	24	11	151	7	2	7
Future Volume (veh/h)	10	456	34	154	595	4	24	11	151	7	2	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	496	33	167	647	3	26	12	15	8	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	26	913	61	212	1360	6	107	112	95	67	71	0
Arrive On Green	0.01	0.27	0.27	0.12	0.37	0.37	0.06	0.06	0.06	0.04	0.04	0.00
Sat Flow, veh/h	1781	3379	224	1781	3627	17	1781	1870	1581	1781	1870	0
Grp Volume(v), veh/h	11	260	269	167	317	333	26	12	15	8	2	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1827	1781	1777	1867	1781	1870	1581	1781	1870	0
Q Serve(g_s), s	0.2	4.9	4.9	3.6	5.3	5.3	0.5	0.2	0.4	0.2	0.0	0.0
Cycle Q Clear(g_c), s	0.2	4.9	4.9	3.6	5.3	5.3	0.5	0.2	0.4	0.2	0.0	0.0
Prop In Lane	1.00		0.12	1.00		0.01	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	26	480	494	212	666	700	107	112	95	67	71	0
V/C Ratio(X)	0.43	0.54	0.54	0.79	0.48	0.48	0.24	0.11	0.16	0.12	0.03	0.00
Avail Cap(c_a), veh/h	228	1139	1171	228	1139	1197	1371	1439	1217	1371	1439	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	19.1	12.2	12.2	16.7	9.3	9.3	17.5	17.3	17.4	18.1	18.1	0.0
Incr Delay (d2), s/veh	10.9	1.0	0.9	15.6	0.5	0.5	1.2	0.4	0.8	0.8	0.2	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.7	1.8	2.2	1.7	1.8	0.2	0.1	0.1	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.0	13.1	13.1	32.3	9.8	9.8	18.7	17.8	18.2	18.9	18.2	0.0
LnGrp LOS	C	B	B	C	A	A	B	B	B	B	B	
Approach Vol, veh/h		540			817			53			10	
Approach Delay, s/veh		13.5			14.4			18.3			18.8	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.6	15.5		6.5	5.6	19.6		7.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	25.0		30.0	5.0	25.0		30.0				
Max Q Clear Time (g_c+I1), s	5.6	6.9		2.2	2.2	7.3		2.5				
Green Ext Time (p_c), s	0.0	3.2		0.0	0.0	4.0		0.1				

Intersection Summary		
HCM 7th Control Delay, s/veh		14.2
HCM 7th LOS		B

Intersection	
Int Delay, s/veh	8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	414	29	47	537	41	22	31	44	39	31	15
Future Vol, veh/h	19	414	29	47	537	41	22	31	44	39	31	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	450	32	51	584	45	24	34	48	42	34	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	628	0	0	482	0	0	1210	1238	466	1216	1231	606
Stage 1	-	-	-	-	-	-	507	507	-	708	708	-
Stage 2	-	-	-	-	-	-	703	730	-	508	523	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	954	-	-	1081	-	-	159	176	597	158	177	497
Stage 1	-	-	-	-	-	-	548	539	-	425	438	-
Stage 2	-	-	-	-	-	-	428	428	-	547	531	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	954	-	-	1081	-	-	112	158	597	105	159	497
Mov Cap-2 Maneuver	-	-	-	-	-	-	112	158	-	105	159	-
Stage 1	-	-	-	-	-	-	532	523	-	413	406	-
Stage 2	-	-	-	-	-	-	352	396	-	457	515	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.36	0.64	38.92	67.82
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	208	954	-	-	1081	-	-	143
HCM Lane V/C Ratio	0.507	0.022	-	-	0.047	-	-	0.648
HCM Control Delay (s/veh)	38.9	8.9	0	-	8.5	0	-	67.8
HCM Lane LOS	E	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	2.6	0.1	-	-	0.1	-	-	3.5

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	209	23	73	169	29	19	8	119	26	20	27
Future Vol, veh/h	33	209	23	73	169	29	19	8	119	26	20	27
Conflicting Peds, #/hr	0	0	1	1	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	227	25	79	184	32	21	9	129	28	22	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	215	0	0	253	0	0	666	686	241	661	683	199
Stage 1	-	-	-	-	-	-	312	312	-	358	358	-
Stage 2	-	-	-	-	-	-	353	374	-	303	325	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1355	-	-	1312	-	-	373	370	798	376	372	842
Stage 1	-	-	-	-	-	-	698	657	-	660	628	-
Stage 2	-	-	-	-	-	-	664	618	-	706	649	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1355	-	-	1311	-	-	305	334	797	277	335	842
Mov Cap-2 Maneuver	-	-	-	-	-	-	305	334	-	277	335	-
Stage 1	-	-	-	-	-	-	676	636	-	639	584	-
Stage 2	-	-	-	-	-	-	574	575	-	565	628	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.96	2.13	11.73	16.45
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	313	797	1355	-	-	1311	-	-	393
HCM Lane V/C Ratio	0.094	0.162	0.026	-	-	0.061	-	-	0.202
HCM Control Delay (s/veh)	17.7	10.4	7.7	0	-	7.9	0	-	16.5
HCM Lane LOS	C	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0.6	0.1	-	-	0.2	-	-	0.7

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	404	29	46	513	16	22	20	43	15	20	7
Future Vol, veh/h	10	404	29	46	513	16	22	20	43	15	20	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	439	32	50	558	17	24	22	47	16	22	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	575	0	0	471	0	0	1145	1152	455	1138	1159	566
Stage 1	-	-	-	-	-	-	477	477	-	666	666	-
Stage 2	-	-	-	-	-	-	668	675	-	472	492	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	998	-	-	1091	-	-	177	198	605	179	196	523
Stage 1	-	-	-	-	-	-	569	556	-	449	457	-
Stage 2	-	-	-	-	-	-	447	453	-	573	547	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	998	-	-	1091	-	-	142	182	605	135	180	523
Mov Cap-2 Maneuver	-	-	-	-	-	-	142	182	-	135	180	-
Stage 1	-	-	-	-	-	-	561	548	-	442	426	-
Stage 2	-	-	-	-	-	-	390	422	-	500	539	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.2	0.68	27.21	32.07
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	253	998	-	-	1091	-	-	178
HCM Lane V/C Ratio	0.365	0.011	-	-	0.046	-	-	0.257
HCM Control Delay (s/veh)	27.2	8.6	0	-	8.5	0	-	32.1
HCM Lane LOS	D	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	1.6	0	-	-	0.1	-	-	1

HCM 7th TWSC
11: Pawai Pl & Loloku St
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Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	213	33	29	155	29	27	5	26	26	17	27
Future Vol, veh/h	33	213	33	29	155	29	27	5	26	26	17	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	232	36	32	168	32	29	5	28	28	18	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	200	0	0	267	0	0	562	584	249	553	586	184
Stage 1	-	-	-	-	-	-	321	321	-	247	247	-
Stage 2	-	-	-	-	-	-	241	263	-	306	339	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1372	-	-	1296	-	-	438	423	789	444	422	858
Stage 1	-	-	-	-	-	-	691	652	-	757	702	-
Stage 2	-	-	-	-	-	-	763	691	-	704	640	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1372	-	-	1296	-	-	381	399	789	398	398	858
Mov Cap-2 Maneuver	-	-	-	-	-	-	381	399	-	398	398	-
Stage 1	-	-	-	-	-	-	669	631	-	733	682	-
Stage 2	-	-	-	-	-	-	697	672	-	652	620	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.91	1.07	13.27	13.45
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	498	1372	-	-	1296	-	-	502
HCM Lane V/C Ratio	0.126	0.026	-	-	0.024	-	-	0.152
HCM Control Delay (s/veh)	13.3	7.7	0	-	7.8	0	-	13.5
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0.1	-	-	0.5

HCM 7th TWSC
12: Pawai Pl & Kaiwi St
10/27/2023

Intersection	
Int Delay, s/veh	15

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	31	400	116	104	274	15	96	0	115	28	1	28
Future Vol, veh/h	31	400	116	104	274	15	96	0	115	28	1	28
Conflicting Peds, #/hr	6	0	3	3	0	6	4	0	1	1	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	34	435	126	113	298	16	104	0	125	30	1	30

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	320	0	0	564	0	0	1097	1114	502	1041	1169	316
Stage 1	-	-	-	-	-	-	568	568	-	538	538	-
Stage 2	-	-	-	-	-	-	528	546	-	503	631	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1240	-	-	1008	-	-	191	208	569	208	193	724
Stage 1	-	-	-	-	-	-	508	506	-	527	522	-
Stage 2	-	-	-	-	-	-	534	518	-	551	474	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1233	-	-	1005	-	-	156	178	567	139	165	718
Mov Cap-2 Maneuver	-	-	-	-	-	-	156	178	-	139	165	-
Stage 1	-	-	-	-	-	-	492	491	-	510	461	-
Stage 2	-	-	-	-	-	-	451	457	-	417	460	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.45	2.39	73.22	26.17
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	257	1233	-	-	1005	-	-	231
HCM Lane V/C Ratio	0.891	0.027	-	-	0.112	-	-	0.268
HCM Control Delay (s/veh)	73.2	8	-	-	9	-	-	26.2
HCM Lane LOS	F	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	7.7	0.1	-	-	0.4	-	-	1

Intersection	
Int Delay, s/veh	11.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	39	67	477	65	65	405
Future Vol, veh/h	39	67	477	65	65	405
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	42	73	518	71	71	440

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	115	0	1186	79
Stage 1	-	-	-	-	79	-
Stage 2	-	-	-	-	1108	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1474	-	208	982
Stage 1	-	-	-	-	944	-
Stage 2	-	-	-	-	316	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1474	-	132	982
Mov Cap-2 Maneuver	-	-	-	-	132	-
Stage 1	-	-	-	-	944	-
Stage 2	-	-	-	-	200	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	7.71	18.3
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	132	982	-	-	1474	-
HCM Lane V/C Ratio	0.535	0.448	-	-	0.352	-
HCM Control Delay (s/veh)	60	11.6	-	-	8.8	0
HCM Lane LOS	F	B	-	-	A	A
HCM 95th %tile Q(veh)	2.6	2.4	-	-	1.6	-

Intersection	
Int Delay, s/veh	7.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	170	38	460	269	10	515
Future Vol, veh/h	170	38	460	269	10	515
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	185	41	500	292	11	560

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	948	646	0	0	792	0
Stage 1	646	-	-	-	-	-
Stage 2	302	-	-	-	-	-
Critical Hdwy	6.63	6.23	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	-	-	2.219	-
Pot Cap-1 Maneuver	274	471	-	-	826	-
Stage 1	521	-	-	-	-	-
Stage 2	725	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	270	471	-	-	826	-
Mov Cap-2 Maneuver	270	-	-	-	-	-
Stage 1	521	-	-	-	-	-
Stage 2	713	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	49.27	0	0.32
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	292	826	-
HCM Lane V/C Ratio	-	-	0.773	0.013	-
HCM Control Delay (s/veh)	-	-	49.3	9.4	0.1
HCM Lane LOS	-	-	E	A	A
HCM 95th %tile Q(veh)	-	-	6	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	32	46	51	318	27	48	53	676	470	27	631	33
Future Volume (veh/h)	32	46	51	318	27	48	53	676	470	27	631	33
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	35	50	26	346	29	45	58	735	312	29	686	34
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	223	305	139	506	34	52	103	885	835	79	1544	82
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	435	888	405	1173	98	153	80	1665	1572	34	2905	154
Grp Volume(v), veh/h	111	0	0	420	0	0	793	0	312	380	0	369
Grp Sat Flow(s),veh/h/ln	1727	0	0	1424	0	0	1745	0	1572	1421	0	1673
Q Serve(g_s), s	0.0	0.0	0.0	14.6	0.0	0.0	12.5	0.0	7.4	2.1	0.0	8.5
Cycle Q Clear(g_c), s	2.8	0.0	0.0	17.3	0.0	0.0	24.3	0.0	7.4	26.4	0.0	8.5
Prop In Lane	0.32		0.23	0.82		0.11	0.07		1.00	0.08		0.09
Lane Grp Cap(c), veh/h	667	0	0	592	0	0	988	0	835	816	0	889
V/C Ratio(X)	0.17	0.00	0.00	0.71	0.00	0.00	0.80	0.00	0.37	0.47	0.00	0.41
Avail Cap(c_a), veh/h	1016	0	0	892	0	0	1302	0	1129	1110	0	1202
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.7	0.0	0.0	19.2	0.0	0.0	12.4	0.0	8.8	9.3	0.0	9.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.6	0.0	0.0	2.8	0.0	0.3	0.4	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	0.0	5.6	0.0	0.0	8.7	0.0	2.3	2.8	0.0	2.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	14.8	0.0	0.0	20.8	0.0	0.0	15.2	0.0	9.0	9.7	0.0	9.3
LnGrp LOS	B			C			B		A	A		A
Approach Vol, veh/h		111			420			1105			749	
Approach Delay, s/veh		14.8			20.8			13.5			9.5	
Approach LOS		B			C			B			A	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	38.0	26.0	38.0	26.0
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	46.0	36.0	46.0	36.0
Max Q Clear Time (g_c+I1), s	26.3	4.8	28.4	19.3
Green Ext Time (p_c), s	7.7	0.7	4.9	2.7

Intersection Summary	
HCM 7th Control Delay, s/veh	13.6
HCM 7th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	283	42	499	475	401	91	590	394	194	595	213
Future Volume (veh/h)	210	283	42	499	475	401	91	590	394	194	595	213
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.91	1.00		0.95	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	228	308	42	542	516	265	99	641	0	211	647	206
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	250	276	38	459	580	467	205	1059		298	855	272
Arrive On Green	0.10	0.19	0.19	0.26	0.34	0.34	0.05	0.33	0.00	0.08	0.36	0.36
Sat Flow, veh/h	1603	1430	195	1603	1683	1355	1603	3282	0	1603	2373	755
Grp Volume(v), veh/h	228	0	350	542	516	265	99	641	0	211	436	417
Grp Sat Flow(s),veh/h/ln	1603	0	1625	1603	1683	1355	1603	1599	0	1603	1599	1529
Q Serve(g_s), s	15.0	0.0	28.0	37.0	42.0	23.1	5.9	24.3	0.0	12.0	34.8	34.8
Cycle Q Clear(g_c), s	15.0	0.0	28.0	37.0	42.0	23.1	5.9	24.3	0.0	12.0	34.8	34.8
Prop In Lane	1.00		0.12	1.00		1.00	1.00		0.00	1.00		0.49
Lane Grp Cap(c), veh/h	250	0	314	459	580	467	205	1059		298	576	551
V/C Ratio(X)	0.91	0.00	1.12	1.18	0.89	0.57	0.48	0.61		0.71	0.76	0.76
Avail Cap(c_a), veh/h	250	0	314	459	580	467	230	1059		298	576	551
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.18	0.18	0.18	1.00	1.00	0.00	0.86	0.86	0.86
Uniform Delay (d), s/veh	46.1	0.0	58.5	43.6	44.9	38.7	33.2	40.6	0.0	32.2	40.8	40.8
Incr Delay (d2), s/veh	34.5	0.0	85.5	86.0	3.5	0.3	1.7	2.6	0.0	6.5	7.8	8.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	0.0	19.1	27.7	18.2	7.8	2.4	10.1	0.0	5.5	15.1	14.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	80.6	0.0	144.0	129.6	48.3	39.0	34.9	43.1	0.0	38.8	48.6	49.0
LnGrp LOS	F		F	F	D	D	C	D		D	D	D
Approach Vol, veh/h		578			1323			740			1064	
Approach Delay, s/veh		119.0			79.7			42.0			46.8	
Approach LOS		F			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.0	53.0	42.0	33.0	12.8	57.2	20.0	55.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	12.0	48.0	37.0	28.0	10.0	50.0	15.0	50.0
Max Q Clear Time (g_c+I1), s	14.0	26.3	39.0	30.0	7.9	36.8	17.0	44.0
Green Ext Time (p_c), s	0.0	4.7	0.0	0.0	0.0	4.8	0.0	2.3

Intersection Summary	
HCM 7th Control Delay, s/veh	68.9
HCM 7th LOS	E

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
1: Queen Kaahumanu Hwy & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	721	100	430	94	101	134	454	1268	70	237	1639	702
Future Volume (veh/h)	721	100	430	94	101	134	454	1268	70	237	1639	702
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	784	109	0	102	110	0	493	1378	30	258	1782	333
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	845	457		133	140		564	1953	605	286	1939	600
Arrive On Green	0.24	0.24	0.00	0.07	0.07	0.00	0.16	0.38	0.38	0.16	0.38	0.38
Sat Flow, veh/h	3456	1870	0	1781	1870	0	3456	5106	1581	1781	5106	1581
Grp Volume(v), veh/h	784	109	0	102	110	0	493	1378	30	258	1782	333
Grp Sat Flow(s),veh/h/ln	1728	1870	0	1781	1870	0	1728	1702	1581	1781	1702	1581
Q Serve(g_s), s	32.2	6.8	0.0	8.2	8.4	0.0	20.2	33.2	1.7	20.7	48.3	24.0
Cycle Q Clear(g_c), s	32.2	6.8	0.0	8.2	8.4	0.0	20.2	33.2	1.7	20.7	48.3	24.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	845	457		133	140		564	1953	605	286	1939	600
V/C Ratio(X)	0.93	0.24		0.77	0.79		0.87	0.71	0.05	0.90	0.92	0.55
Avail Cap(c_a), veh/h	880	476		208	219		833	1953	605	503	1969	609
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	53.6	44.0	0.0	66.0	66.1	0.0	59.3	37.9	28.2	59.8	42.9	35.4
Incr Delay (d2), s/veh	15.4	0.3	0.0	8.9	9.6	0.0	7.1	1.2	0.0	11.0	7.4	1.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.9	3.3	0.0	4.1	4.4	0.0	9.4	13.9	0.7	10.2	21.3	9.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	69.0	44.3	0.0	74.8	75.6	0.0	66.4	39.1	28.3	70.8	50.3	36.5
LnGrp LOS	E	D		E	E		E	D	C	E	D	D
Approach Vol, veh/h		893			212			1901			2373	
Approach Delay, s/veh		66.0			75.2			46.0			50.6	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	28.3	60.6		15.8	28.7	60.2		40.5
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	41.0	50.0		17.0	35.0	56.0		37.0
Max Q Clear Time (g_c+I1), s	22.7	35.2		10.4	22.2	50.3		34.2
Green Ext Time (p_c), s	0.7	8.3		0.4	1.5	4.9		1.2

Intersection Summary			
HCM 7th Control Delay, s/veh			52.5
HCM 7th LOS			D

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th TWSC
3: Queen Kaahumanu Hwy & Eho St

10/27/2023

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	0	61	0	1806	76	0	2341	27
Future Vol, veh/h	0	0	0	0	0	61	0	1806	76	0	2341	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	66	0	1963	83	0	2545	29

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	-	-	1023	2547	0	0	1963	-	0
Stage 1	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	7.14	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.92	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	200	0	-	-	0	-	-
Stage 1	0	0	-	0	-	-	0	-	-
Stage 2	0	0	-	0	-	-	0	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	-	0	200	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-	-	-	-
Stage 1	-	0	-	-	-	-	-	-	-
Stage 2	-	0	-	-	-	-	-	-	-

Approach	WB			NB			SB
HCM Control Delay, s/v	31.62			0			0
HCM LOS	D						

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	200	-	-
HCM Lane V/C Ratio	-	-	0.331	-	-
HCM Control Delay (s/veh)	-	-	31.6	-	-
HCM Lane LOS	-	-	D	-	-
HCM 95th %tile Q(veh)	-	-	1.4	-	-

HCM 7th Signalized Intersection Summary
4: Queen Kaahumanu Hwy & Palani Rd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	415	523	154	84	536	138	199	1289	52	180	1452	664
Future Volume (veh/h)	415	523	154	84	536	138	199	1289	52	180	1452	664
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	451	568	0	91	583	0	216	1401	21	196	1578	508
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	510	1015		114	720		276	2102	653	255	2071	641
Arrive On Green	0.15	0.29	0.00	0.06	0.20	0.00	0.08	0.41	0.41	0.07	0.41	0.41
Sat Flow, veh/h	3456	3554	1585	1781	3647	0	3456	5106	1585	3456	5106	1582
Grp Volume(v), veh/h	451	568	0	91	583	0	216	1401	21	196	1578	508
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	0	1728	1702	1585	1728	1702	1582
Q Serve(g_s), s	17.1	18.2	0.0	6.7	20.9	0.0	8.2	29.7	1.1	7.4	35.6	37.6
Cycle Q Clear(g_c), s	17.1	18.2	0.0	6.7	20.9	0.0	8.2	29.7	1.1	7.4	35.6	37.6
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	510	1015		114	720		276	2102	653	255	2071	641
V/C Ratio(X)	0.89	0.56		0.79	0.81		0.78	0.67	0.03	0.77	0.76	0.79
Avail Cap(c_a), veh/h	581	1015		300	997		530	2425	753	504	2387	739
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.9	40.6	0.0	61.7	50.9	0.0	60.4	31.9	23.4	60.8	34.2	34.8
Incr Delay (d2), s/veh	13.9	0.7	0.0	11.7	3.6	0.0	4.8	0.6	0.0	4.8	1.3	5.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.5	8.2	0.0	3.5	9.8	0.0	3.8	12.2	0.4	3.4	14.7	15.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	69.8	41.3	0.0	73.4	54.4	0.0	65.2	32.5	23.5	65.6	35.5	40.0
LnGrp LOS	E	D		E	D		E	C	C	E	D	D
Approach Vol, veh/h		1019			674			1638			2282	
Approach Delay, s/veh		53.9			57.0			36.7			39.1	
Approach LOS		D			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.4	60.6	14.1	43.7	16.2	59.7	25.2	32.6
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	19.5	63.5	22.5	37.5	20.5	62.5	22.5	37.5
Max Q Clear Time (g_c+I1), s	9.4	31.7	8.7	20.2	10.2	39.6	19.1	22.9
Green Ext Time (p_c), s	0.4	12.7	0.2	3.8	0.5	14.6	0.6	3.6

Intersection Summary	
HCM 7th Control Delay, s/veh	43.2
HCM 7th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 7th Signalized Intersection Summary
5: Luhia St & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	32	887	25	221	836	214	10	59	202	139	42	32
Future Volume (veh/h)	32	887	25	221	836	214	10	59	202	139	42	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	35	964	26	240	909	218	11	64	3	151	46	12
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	63	1340	36	291	1440	345	99	104	88	211	169	44
Arrive On Green	0.04	0.38	0.38	0.16	0.51	0.51	0.06	0.06	0.06	0.12	0.12	0.12
Sat Flow, veh/h	1781	3534	95	1781	2839	680	1781	1870	1585	1781	1430	373
Grp Volume(v), veh/h	35	485	505	240	569	558	11	64	3	151	0	58
Grp Sat Flow(s),veh/h/ln	1781	1777	1853	1781	1777	1742	1781	1870	1585	1781	0	1803
Q Serve(g_s), s	1.4	16.4	16.4	9.2	16.4	16.4	0.4	2.4	0.1	5.8	0.0	2.1
Cycle Q Clear(g_c), s	1.4	16.4	16.4	9.2	16.4	16.4	0.4	2.4	0.1	5.8	0.0	2.1
Prop In Lane	1.00		0.05	1.00		0.39	1.00		1.00	1.00		0.21
Lane Grp Cap(c), veh/h	63	674	703	291	901	884	99	104	88	211	0	214
V/C Ratio(X)	0.56	0.72	0.72	0.83	0.63	0.63	0.11	0.62	0.03	0.72	0.00	0.27
Avail Cap(c_a), veh/h	227	1385	1444	480	1637	1605	480	504	427	808	0	818
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.5	18.7	18.7	28.5	12.6	12.6	31.7	32.6	31.5	29.9	0.0	28.3
Incr Delay (d2), s/veh	7.6	1.5	1.4	5.9	0.7	0.8	0.5	5.8	0.2	4.5	0.0	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	6.6	6.9	4.3	6.0	5.9	0.2	1.2	0.1	2.7	0.0	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	41.1	20.1	20.1	34.4	13.3	13.4	32.2	38.4	31.7	34.4	0.0	29.0
LnGrp LOS	D	C	C	C	B	B	C	D	C	C		C
Approach Vol, veh/h		1025			1367			78			209	
Approach Delay, s/veh		20.8			17.0			37.3			32.9	
Approach LOS		C			B			D			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	6.5	31.8	13.4	7.5	40.8	8.9
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	19.0	55.0	32.0	9.0	65.0	19.0
Max Q Clear Time (g_c+I1), s	11.2	18.4	7.8	3.4	18.4	4.4
Green Ext Time (p_c), s	0.4	8.3	0.7	0.0	10.9	0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	20.3
HCM 7th LOS	C

HCM 7th Signalized Intersection Summary
6: Midblock Driveway & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	97	595	17	137	695	54	30	56	213	130	66	67
Future Volume (veh/h)	97	595	17	137	695	54	30	56	213	130	66	67
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	105	647	17	149	755	55	33	61	12	141	72	40
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	136	1052	28	195	1108	81	138	145	122	311	195	108
Arrive On Green	0.08	0.30	0.30	0.11	0.33	0.33	0.08	0.08	0.08	0.17	0.17	0.17
Sat Flow, veh/h	1781	3537	93	1781	3356	244	1781	1870	1574	1781	1116	620
Grp Volume(v), veh/h	105	325	339	149	400	410	33	61	12	141	0	112
Grp Sat Flow(s),veh/h/ln	1781	1777	1853	1781	1777	1824	1781	1870	1574	1781	0	1737
Q Serve(g_s), s	3.4	9.2	9.2	4.8	11.4	11.4	1.0	1.8	0.4	4.2	0.0	3.3
Cycle Q Clear(g_c), s	3.4	9.2	9.2	4.8	11.4	11.4	1.0	1.8	0.4	4.2	0.0	3.3
Prop In Lane	1.00		0.05	1.00		0.13	1.00		1.00	1.00		0.36
Lane Grp Cap(c), veh/h	136	528	551	195	587	602	138	145	122	311	0	303
V/C Ratio(X)	0.77	0.61	0.62	0.76	0.68	0.68	0.24	0.42	0.10	0.45	0.00	0.37
Avail Cap(c_a), veh/h	304	925	964	517	1137	1167	957	1005	846	957	0	933
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	26.6	17.7	17.7	25.4	17.0	17.0	25.4	25.8	25.1	21.7	0.0	21.4
Incr Delay (d2), s/veh	8.8	1.2	1.1	6.1	1.4	1.4	0.9	1.9	0.3	1.0	0.0	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	3.7	3.8	2.3	4.5	4.6	0.4	0.8	0.2	1.7	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	35.4	18.9	18.8	31.5	18.4	18.3	26.3	27.7	25.5	22.7	0.0	22.1
LnGrp LOS	D	B	B	C	B	B	C	C	C	C		C
Approach Vol, veh/h		769			959			106			253	
Approach Delay, s/veh		21.1			20.4			27.0			22.5	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	11.4	22.4	15.2	9.5	24.4	9.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	17.0	30.5	31.5	10.0	37.5	31.5
Max Q Clear Time (g_c+I1), s	6.8	11.2	6.2	5.4	13.4	3.8
Green Ext Time (p_c), s	0.3	4.2	1.0	0.1	5.8	0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	21.2
HCM 7th LOS	C

HCM 7th Signalized Intersection Summary
7: Road A & Makala Blvd

10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	516	53	168	613	8	27	6	180	9	7	12
Future Volume (veh/h)	23	516	53	168	613	8	27	6	180	9	7	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	25	561	51	183	666	8	29	7	11	10	8	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	54	981	89	224	1414	17	91	95	81	40	42	0
Arrive On Green	0.03	0.30	0.30	0.13	0.39	0.39	0.05	0.05	0.05	0.02	0.02	0.00
Sat Flow, veh/h	1781	3293	299	1781	3596	43	1781	1870	1585	1781	1870	0
Grp Volume(v), veh/h	25	302	310	183	329	345	29	7	11	10	8	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1815	1781	1777	1862	1781	1870	1585	1781	1870	0
Q Serve(g_s), s	0.5	5.7	5.8	4.0	5.5	5.5	0.6	0.1	0.3	0.2	0.2	0.0
Cycle Q Clear(g_c), s	0.5	5.7	5.8	4.0	5.5	5.5	0.6	0.1	0.3	0.2	0.2	0.0
Prop In Lane	1.00		0.16	1.00		0.02	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	54	529	541	224	699	733	91	95	81	40	42	0
V/C Ratio(X)	0.46	0.57	0.57	0.82	0.47	0.47	0.32	0.07	0.14	0.25	0.19	0.00
Avail Cap(c_a), veh/h	224	1117	1140	224	1117	1170	1343	1410	1195	1343	1410	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	19.0	11.8	11.8	16.9	9.0	9.0	18.2	18.0	18.0	19.1	19.1	0.0
Incr Delay (d2), s/veh	6.0	1.0	1.0	20.5	0.5	0.5	2.0	0.3	0.8	3.1	2.1	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	2.0	2.0	2.7	1.7	1.8	0.3	0.1	0.1	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	25.0	12.8	12.8	37.5	9.5	9.5	20.2	18.3	18.8	22.2	21.2	0.0
LnGrp LOS	C	B	B	D	A	A	C	B	B	C	C	
Approach Vol, veh/h		637			857			47			18	
Approach Delay, s/veh		13.3			15.5			19.6			21.8	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	10.0	16.9	5.9	6.2	20.6	7.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	25.0	30.0	5.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	6.0	7.8	2.2	2.5	7.5	2.6
Green Ext Time (p_c), s	0.0	3.7	0.0	0.0	4.1	0.1

Intersection Summary	
HCM 7th Control Delay, s/veh	14.8
HCM 7th LOS	B

Intersection	
Int Delay, s/veh	16.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	23	490	35	56	558	50	27	30	53	47	30	18
Future Vol, veh/h	23	490	35	56	558	50	27	30	53	47	30	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	25	533	38	61	607	54	29	33	58	51	33	20

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	661	0	0	571	0	0	1346	1384	552	1354	1376	634
Stage 1	-	-	-	-	-	-	602	602	-	755	755	-
Stage 2	-	-	-	-	-	-	745	783	-	599	621	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	927	-	-	1002	-	-	128	143	534	127	145	479
Stage 1	-	-	-	-	-	-	487	489	-	401	416	-
Stage 2	-	-	-	-	-	-	406	405	-	488	479	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	927	-	-	1002	-	-	82	124	534	75	126	479
Mov Cap-2 Maneuver	-	-	-	-	-	-	82	124	-	75	126	-
Stage 1	-	-	-	-	-	-	467	470	-	385	376	-
Stage 2	-	-	-	-	-	-	321	365	-	389	460	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.38	0.74	70.32	158.15
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	164	927	-	-	1002	-	-	105
HCM Lane V/C Ratio	0.728	0.027	-	-	0.061	-	-	0.982
HCM Control Delay (s/veh)	70.3	9	0	-	8.8	0	-	158.2
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	4.5	0.1	-	-	0.2	-	-	6.1

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	245	33	49	181	35	19	8	86	32	22	33
Future Vol, veh/h	40	245	33	49	181	35	19	8	86	32	22	33
Conflicting Peds, #/hr	0	0	1	1	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	266	36	53	197	38	21	9	93	35	24	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	235	0	0	303	0	0	687	714	285	680	712	216
Stage 1	-	-	-	-	-	-	372	372	-	322	322	-
Stage 2	-	-	-	-	-	-	315	341	-	358	390	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1333	-	-	1258	-	-	361	357	754	365	357	824
Stage 1	-	-	-	-	-	-	648	619	-	690	651	-
Stage 2	-	-	-	-	-	-	696	638	-	660	608	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1333	-	-	1257	-	-	294	326	753	285	326	824
Mov Cap-2 Maneuver	-	-	-	-	-	-	294	326	-	285	326	-
Stage 1	-	-	-	-	-	-	622	594	-	663	619	-
Stage 2	-	-	-	-	-	-	608	607	-	547	583	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.98	1.48	12.3	16.93
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	303	753	1333	-	-	1257	-	-	396
HCM Lane V/C Ratio	0.097	0.124	0.033	-	-	0.042	-	-	0.239
HCM Control Delay (s/veh)	18.2	10.5	7.8	0	-	8	0	-	16.9
HCM Lane LOS	C	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0.4	0.1	-	-	0.1	-	-	0.9

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	478	35	55	530	19	27	19	52	18	19	9
Future Vol, veh/h	12	478	35	55	530	19	27	19	52	18	19	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	520	38	60	576	21	29	21	57	20	21	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	597	0	0	558	0	0	1271	1281	539	1262	1290	586
Stage 1	-	-	-	-	-	-	565	565	-	706	706	-
Stage 2	-	-	-	-	-	-	706	716	-	556	584	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	980	-	-	1013	-	-	145	166	543	147	164	510
Stage 1	-	-	-	-	-	-	510	508	-	427	439	-
Stage 2	-	-	-	-	-	-	427	434	-	515	498	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	980	-	-	1013	-	-	111	148	543	103	146	510
Mov Cap-2 Maneuver	-	-	-	-	-	-	111	148	-	103	146	-
Stage 1	-	-	-	-	-	-	500	498	-	418	400	-
Stage 2	-	-	-	-	-	-	362	395	-	434	489	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.2	0.8	38.79	43.37
HCM LOS			E	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	209	980	-	-	1013	-	-	142
HCM Lane V/C Ratio	0.509	0.013	-	-	0.059	-	-	0.351
HCM Control Delay (s/veh)	38.8	8.7	0	-	8.8	0	-	43.4
HCM Lane LOS	E	A	A	-	A	A	-	E
HCM 95th %tile Q(veh)	2.6	0	-	-	0.2	-	-	1.4

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	206	40	35	150	35	33	5	32	32	19	33
Future Vol, veh/h	40	206	40	35	150	35	33	5	32	32	19	33
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	224	43	38	163	38	36	5	35	35	21	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	201	0	0	267	0	0	582	610	246	572	613	182
Stage 1	-	-	-	-	-	-	333	333	-	258	258	-
Stage 2	-	-	-	-	-	-	249	277	-	314	354	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1371	-	-	1296	-	-	424	409	793	431	408	860
Stage 1	-	-	-	-	-	-	681	644	-	747	694	-
Stage 2	-	-	-	-	-	-	755	681	-	697	630	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1371	-	-	1296	-	-	359	381	793	379	380	860
Mov Cap-2 Maneuver	-	-	-	-	-	-	359	381	-	379	380	-
Stage 1	-	-	-	-	-	-	655	620	-	719	671	-
Stage 2	-	-	-	-	-	-	678	658	-	636	606	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	1.08	1.25	13.87	14.12
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	482	1371	-	-	1296	-	-	486
HCM Lane V/C Ratio	0.158	0.032	-	-	0.029	-	-	0.188
HCM Control Delay (s/veh)	13.9	7.7	0	-	7.9	0	-	14.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0.1	-	-	0.7

Intersection	
Int Delay, s/veh	6.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	35	308	144	96	217	17	65	0	97	30	0	25
Future Vol, veh/h	35	308	144	96	217	17	65	0	97	30	0	25
Conflicting Peds, #/hr	6	0	0	0	0	6	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	38	335	157	104	236	18	71	0	105	33	0	27

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	260	0	0	491	0	0	935	958	413	871	1027	252
Stage 1	-	-	-	-	-	-	489	489	-	460	460	-
Stage 2	-	-	-	-	-	-	446	469	-	411	567	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1304	-	-	1072	-	-	246	257	639	272	234	787
Stage 1	-	-	-	-	-	-	560	549	-	581	566	-
Stage 2	-	-	-	-	-	-	592	561	-	618	507	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1297	-	-	1072	-	-	208	224	639	198	204	781
Mov Cap-2 Maneuver	-	-	-	-	-	-	208	224	-	198	204	-
Stage 1	-	-	-	-	-	-	544	533	-	561	508	-
Stage 2	-	-	-	-	-	-	515	503	-	501	492	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.56	2.54	25.42	20.01
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	349	1297	-	-	1072	-	-	299
HCM Lane V/C Ratio	0.505	0.029	-	-	0.097	-	-	0.2
HCM Control Delay (s/veh)	25.4	7.9	-	-	8.7	-	-	20
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	2.7	0.1	-	-	0.3	-	-	0.7

Intersection	
Int Delay, s/veh	24.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	91	118	476	91	108	434
Future Vol, veh/h	91	118	476	91	108	434
Conflicting Peds, #/hr	0	0	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	99	128	517	99	117	472

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	228	0	1298	164
Stage 1	-	-	-	-	164	-
Stage 2	-	-	-	-	1134	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1340	-	178	881
Stage 1	-	-	-	-	865	-
Stage 2	-	-	-	-	307	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1339	-	~ 105	880
Mov Cap-2 Maneuver	-	-	-	-	~ 105	-
Stage 1	-	-	-	-	864	-
Stage 2	-	-	-	-	182	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	7.87	50.47
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	105	880	-	-	1339	-
HCM Lane V/C Ratio	1.114	0.536	-	-	0.386	-
HCM Control Delay (s/veh)	198.1	13.7	-	-	9.4	0
HCM Lane LOS	F	B	-	-	A	A
HCM 95th %tile Q(veh)	7.4	3.3	-	-	1.9	-

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	10.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	177	39	508	279	7	611
Future Vol, veh/h	177	39	508	279	7	611
Conflicting Peds, #/hr	1	1	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	192	42	552	303	8	664

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1052	705	0	0	855	0
Stage 1	704	-	-	-	-	-
Stage 2	348	-	-	-	-	-
Critical Hdwy	6.63	6.23	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	-	-	2.219	-
Pot Cap-1 Maneuver	236	436	-	-	782	-
Stage 1	489	-	-	-	-	-
Stage 2	687	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	233	435	-	-	782	-
Mov Cap-2 Maneuver	233	-	-	-	-	-
Stage 1	489	-	-	-	-	-
Stage 2	678	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	80.59	0	0.22
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	254	782	-
HCM Lane V/C Ratio	-	-	0.924	0.01	-
HCM Control Delay (s/veh)	-	-	80.6	9.6	0.1
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	8.2	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	25	49	237	22	29	46	744	420	36	717	24
Future Volume (veh/h)	18	25	49	237	22	29	46	744	420	36	717	24
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.99	1.00		0.99	0.99		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	20	27	13	258	24	25	50	809	316	39	779	25
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	203	253	102	449	31	32	103	997	890	100	1725	58
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.58	0.58	0.58	0.58	0.58	0.58
Sat Flow, veh/h	424	932	375	1211	113	117	57	1712	1528	49	2960	100
Grp Volume(v), veh/h	60	0	0	307	0	0	859	0	316	422	0	421
Grp Sat Flow(s),veh/h/ln	1731	0	0	1441	0	0	1769	0	1528	1428	0	1680
Q Serve(g_s), s	0.0	0.0	0.0	9.3	0.0	0.0	7.2	0.0	6.0	2.1	0.0	7.7
Cycle Q Clear(g_c), s	1.4	0.0	0.0	10.7	0.0	0.0	20.7	0.0	6.0	22.8	0.0	7.7
Prop In Lane	0.33		0.22	0.84		0.08	0.06		1.00	0.09		0.06
Lane Grp Cap(c), veh/h	557	0	0	512	0	0	1100	0	890	904	0	979
V/C Ratio(X)	0.11	0.00	0.00	0.60	0.00	0.00	0.78	0.00	0.35	0.47	0.00	0.43
Avail Cap(c_a), veh/h	1173	0	0	1053	0	0	1533	0	1281	1286	0	1408
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.1	0.0	0.0	18.3	0.0	0.0	8.9	0.0	6.0	6.5	0.0	6.4
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.1	0.0	0.0	1.8	0.0	0.2	0.4	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	3.4	0.0	0.0	6.4	0.0	1.5	2.1	0.0	2.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	15.1	0.0	0.0	19.4	0.0	0.0	10.7	0.0	6.3	6.9	0.0	6.7
LnGrp LOS	B			B			B		A	A		A
Approach Vol, veh/h		60			307			1175			843	
Approach Delay, s/veh		15.1			19.4			9.5			6.8	
Approach LOS		B			B			A			A	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	36.0	18.9	36.0	18.9
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	46.0	36.0	46.0	36.0
Max Q Clear Time (g_c+I1), s	22.7	3.4	24.8	12.7
Green Ext Time (p_c), s	9.3	0.3	6.3	2.0

Intersection Summary	
HCM 7th Control Delay, s/veh	10.0
HCM 7th LOS	A

HCM 7th Signalized Intersection Summary
16: Kuakini Hwy & Palani Rd	10/27/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	218	336	34	396	431	443	81	520	342	268	515	230
Future Volume (veh/h)	218	336	34	396	431	443	81	520	342	268	515	230
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	0.99		0.95	1.00		0.97	0.98		1.00	0.99		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	237	365	34	430	468	233	88	565	0	291	560	203
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	317	363	34	408	582	477	202	708		326	679	245
Arrive On Green	0.12	0.24	0.24	0.21	0.35	0.35	0.06	0.22	0.00	0.13	0.30	0.30
Sat Flow, veh/h	1603	1509	141	1603	1683	1380	1603	3282	0	1603	2265	818
Grp Volume(v), veh/h	237	0	399	430	468	233	88	565	0	291	395	368
Grp Sat Flow(s),veh/h/ln	1603	0	1650	1603	1683	1380	1603	1599	0	1603	1599	1483
Q Serve(g_s), s	11.6	0.0	25.0	22.0	26.2	13.8	4.4	17.4	0.0	14.0	23.9	24.1
Cycle Q Clear(g_c), s	11.6	0.0	25.0	22.0	26.2	13.8	4.4	17.4	0.0	14.0	23.9	24.1
Prop In Lane	1.00		0.09	1.00		1.00	1.00		0.00	1.00		0.55
Lane Grp Cap(c), veh/h	317	0	396	408	582	477	202	708		326	479	445
V/C Ratio(X)	0.75	0.00	1.01	1.05	0.80	0.49	0.44	0.80		0.89	0.82	0.83
Avail Cap(c_a), veh/h	317	0	396	408	582	477	204	1107		326	676	627
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.1	0.0	39.5	29.8	30.8	26.8	30.1	38.3	0.0	27.9	33.9	33.9
Incr Delay (d2), s/veh	9.4	0.0	46.8	59.3	8.0	0.8	1.5	2.3	0.0	25.2	5.7	6.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.3	0.0	15.2	15.1	11.8	4.6	1.8	7.0	0.0	7.7	10.0	9.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	36.5	0.0	86.4	89.1	38.8	27.5	31.6	40.6	0.0	53.0	39.6	40.3
LnGrp LOS	D		F	F	D	C	C	D		D	D	D
Approach Vol, veh/h		636			1131			653			1054	
Approach Delay, s/veh		67.8			55.6			39.4			43.5	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.0	28.0	27.0	30.0	10.9	36.2	16.0	41.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	14.0	36.0	22.0	25.0	6.0	44.0	12.0	36.0
Max Q Clear Time (g_c+I1), s	16.0	19.4	24.0	27.0	6.4	26.1	13.6	28.2
Green Ext Time (p_c), s	0.0	3.7	0.0	0.0	0.0	5.0	0.0	2.5

Intersection Summary	
HCM 7th Control Delay, s/veh	51.1
HCM 7th LOS	D

Notes
User approved pedestrian interval to be less than phase max green.
Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX D
TRAFFIC SIGNAL WARRANTS

Weekday Makala Boulevard/Kuakini Hwy 4-Hour Signal Warrant

Wednesday, September 7, 2022

Makala Boulevard | Kuakini Hwy | 0 | 100 % Warrant

Major Lanes: 1 | Minor 1 Lanes: 1, RT Reduction: 100% | Minor 2 Lanes: 1, RT Reduction: 100% | Major Threshold

Time	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
6:45	0	0	0	0	0	0	0	0	0	0	0	0	63.60423389	9.91525	0						
7:00	0	0	0	0	0	0	0	0	0	0	0	0	127.4079237	19.8305	0						
7:15	0	0	0	0	0	0	0	0	0	0	0	0	202.3136258	30.8475	0						
7:30	0	5.5714	14.279	33.839	9.9153	0	9.9153	0	0	0	0	0	296.460894	47.3729	0						
7:45	0	7.8	8.7869	40.607	6.6102	0	9.9153	0	0	0	0	0	295.1913233	52.8302	0						
8:00	0	7.8	15.377	45.118	6.6102	0	11.017	0	0	0	0	0	310.8081417	54.9934	0						
8:15	0	6.6857	15.377	67.678	4.4068	0	16.525	0	0	0	0	0	333.3049958	56.0548	0						
8:30	0	6.6667	11.064	39.135	5.4688	0	15.373	0	0	0	0	0	*328*	56	0						
8:45	0	7.7778	8.8511	52.948	9.8438	0	12.078	0	0	0	0	0	265.6653369	40.6275	0						
9:00	0	4.4444	15.489	62.156	15.313	0	12.078	0	0	0	0	0	186.2448286	28.549	0						
9:15	0	1.1111	16.596	66.76	4.375	0	16.471	0	0	0	0	0	88.84227246	16.4706	0						
9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
9:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
10:15	0	0	0	0	0	0	0	0	0	0	0	0	132.071191	25.339	0						
10:30	0	0	0	0	0	0	0	0	0	0	0	0	279.6433423	38.5593	0						
10:45	0	0	0	0	0	0	0	0	0	0	0	0	450.6075069	69.4068	0						
11:00	0	20.057	15.377	81.213	15.424	0	25.339	0	0	0	0	0	627.2166479	99.1525	0						
11:15	0	15.6	25.262	87.981	18.729	0	13.22	0	0	0	0	0	709.9544619	104.661	0						
11:30	0	21.171	30.754	97.005	22.034	0	30.847	0	0	0	0	0	748.1639117	107.966	0						
11:45	0	17.829	25.262	103.77	29.746	0	29.746	0	0	0	0	0	747.3270597	99.1525	0						
12:00	0	30.086	34.049	130.84	19.831	0	30.847	0	0	0	0	0	788.0313487	89.2373	0						
12:15	0	22.286	27.459	117.31	18.729	0	16.525	0	0	0	0	0	573.2223437	58.3898	0						
12:30	0	16.714	30.754	110.54	12.119	0	22.034	0	0	0	0	0	387.4407426	41.8644	0						
12:45	0	18.943	31.852	148.89	17.627	0	19.831	0	0	0	0	0	217.3134301	19.8305	0						
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
14:15	0	0	0	0	0	0	0	0	0	0	0	0	141.47581	16.5254	0						
14:30	0	0	0	0	0	0	0	0	0	0	0	0	274.8793624	33.0508	0						
14:45	0	0	0	0	0	0	0	0	0	0	0	0	441.958669	51.7797	0						
15:00	0	6.6857	13.18	112.8	8.8136	0	16.525	0	0	0	0	0	608.9655032	62.7966	0						
15:15	0	4.4571	19.77	99.261	9.9153	0	16.525	0	0	0	0	0	626.6184821	63.8983	0						
15:30	0	8.9143	20.869	124.08	13.22	0	18.729	0	0	0	0	0	647	65	0						
15:45	0	10.029	14.279	119.56	23.136	0	11.017	0	0	0	0	0	649.2045529	70.5085	0						
16:00	0	6.6857	21.967	115.05	15.424	0	17.627	0	0	0	0	0	646.8694204	74.9153	0						
16:15	0	13.371	9.8852	117.31	13.22	0	17.627	0	0	0	0	0	487.7406314	57.2881	0						
16:30	0	13.371	19.77	121.82	14.322	0	24.237	0	0	0	0	0	333.9555611	39.661	0						
16:45	0	10.029	23.066	115.05	16.525	0	15.424	0	0	0	0	0	164.6717016	15.4237	0						
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						

Hours Where Condition Met: 0

Signal Warranted? No

Weekday Kuakini Hwy/Loloku St 4-Hour Signal Warrant

Wednesday, September 7, 2022

Kuakini Hwy | Loloku St | 0 | 100 % Warrant

Major Lanes: 1 | Minor 1 Lanes: 1, RT Reduction: 100% | Minor 2 Lanes: 1, RT Reduction: 100% | Major Threshold

Time	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
6:45	0	0	0	0	0	0	0	0	0	0	0	0	96.07297959	6.3375	0						
7:00	0	0	0	0	0	0	0	0	0	0	0	0	191.0819592	14.7875	0						
7:15	0	0	0	0	0	0	0	0	0	0	0	0	300.7766531	33.8	0						
7:30	0	52.449	0	0	43.624	0	6.3375	0	0	0	0	0	439.932898	52.8125	0						
7:45	0	52.449	0	0	42.56	0	8.45	0	0	0	0	0	436.904195	67.8011	0						
8:00	0	67.135	0	0	42.56	0	19.013	0	0	0	0	0	424.5314121	83.0467	0						
8:15	0	90.212	0	0	48.944	0	19.013	0	0	0	0	0	434.5541229	101.947	0						
8:30	0	53.103	0	0	39.941	0	21.326	0	0	0	0	0	*425*	109	0						
8:45	0	56.897	0	0	25.74	0	23.696	0	0	0	0	0	331.9557233	87.6739	0						
9:00	0	81.552	0	0	38.166	0	37.913	0	0	0	0	0	249.3195266	63.9783	0						
9:15	0	83.448	0	0	46.154	0	26.065	0	0	0	0	0	129.602122	26.0652	0						
9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
9:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
10:15	0	0	0	0	0	0	0	0	0	0	0	0	199.5338776	19.0125	0						
10:30	0	0	0	0	0	0	0	0	0	0	0	0	403.9671837	52.8125	0						
10:45	0	0	0	0	0	0	0	0	0	0	0	0	658.9017143	88.725	0						
11:00	0	109.09	0	0	90.44	0	19.013	0	0	0	0	0	878.2009796	128.863	0	1		1		1	1
11:15	0	138.47	0	0	65.968	0	33.8	0	0	0	0	0	931.4736327	149.988	0	1		2		1	2
11:30	0	178.33	0	0	76.608	0	35.913	0	0	0	0	0	967.108898	149.988	0	1		3		1	3
11:45	0	140.56	0	0	78.736	0	40.138	0	0	0	0	0	919.7395918	143.65	0	1		4		1	4
12:00	0	178.33	0	0	74.48	0	40.138	0	0	0	0	0	968.9665306	130.975	0	1		1		1	1
12:15	0	176.23	0	0	63.84	0	33.8	0	0	0	0	0	716.16	90.8375	0			2			2
12:30	0	142.66	0	0	64.904	0	29.575	0	0	0	0	0	476.0914286	57.0375	0			3			3
12:45	0	195.11	0	0	73.416	0	27.463	0	0	0	0	0	268.5262041	27.4625	0			4			4
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
14:15	0	0	0	0	0	0	0	0	0	0	0	0	188.653551	44.3625	0						
14:30	0	0	0	0	0	0	0	0	0	0	0	0	375.1490612	103.513	0						
14:45	0	0	0	0	0	0	0	0	0	0	0	0	572.2845714	156.325	0						
15:00	0	125.88	0	0	62.776	0	44.363	0	0	0	0	0	775.5337143	204.913	0	1		1		1	1
15:15	0	127.98	0	0	58.52	0	59.15	0	0	0	0	0	782.0378776	194.35	0	1		2		1	2
15:30	0	127.98	0	0	69.16	0	52.813	0	0	0	0	0	780	169	0	1		3		1	3
15:45	0	146.86	0	0	56.392	0	48.588	0	0	0	0	0	786.2037551	149.988	0			4			4
16:00	0	117.49	0	0	77.672	0	33.8	0	0	0	0	0	805.205551	145.763	0						
16:15	0	121.68	0	0	62.776	0	33.8	0	0	0	0	0	610.0478367	111.963	0						
16:30	0	140.56	0	0	62.776	0	33.8	0	0	0	0	0	425.5902041	78.1625	0						
16:45	0	157.35	0	0	64.904	0	44.363	0	0	0	0	0	222.2509388	44.3625	0						
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						

Hours Where Condition Met: 3

Signal Warranted? No

Weekday Kuakini Hwy/Kaiwi St 4-Hour Signal Warrant

Wednesday, September 7, 2022

	Kuakini Hwy						Kaiwi St			0			100 % Warrant								
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold								
	1						1			1											
							RT Reduction: 100%			RT Reduction: 100%											
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
5:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
5:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
5:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
6:45	0	0	0	0	0	0	0	0	0	0	0	0	194.7928447	29.5665	0			0	0	0	0
7:00	0	0	0	0	0	0	0	0	0	0	0	0	363.2986234	58.038	0			0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	536.7793096	98.5551	0			0	0	0	0
7:30	6.125	50.12	56.533	3.6458	73.479	4.8906	29.567	0	0	0	0	0	788.3145743	136.882	0			0	0	0	0
7:45	4.0833	34.565	42.4	4.6875	74.724	8.0458	28.471	0	0	0	0	0	772.2251464	151.957	0			0	0	0	0
8:00	6.125	44.935	42.4	8.8542	63.515	7.6514	40.517	0	0	0	0	0	773.4956965	161.75	0	1		1	0	1	1
8:15	16.333	77.772	70.667	5.7292	74.724	6.3104	38.327	0	0	0	0	0	837.3033451	157.371	0	1		2	0	1	2
8:30	0	47.685	72.231	0	52.311	6.4764	44.642	0	0	0	0	0	*863*	169	0	1		3	0	1	3
8:45	0	70.574	48.154	0	43.751	7.2973	38.264	0	0	0	0	0	684.2965831	124.358	0			4	0	0	4
9:00	0	93.463	84.269	0	53.262	6.2939	36.138	0	0	0	0	0	514.5202545	86.0943	0			0	0	0	0
9:15	0	97.278	108.35	0	64.676	6.9324	49.956	0	0	0	0	0	277.2319196	49.956	0			0	0	0	0
9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
9:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	278.3427291	33.9468	0			0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	609.9997352	87.6046	0			0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	990.9728054	133.597	0	1		1	0	1	1
11:00	14.292	107.15	28.267	4.1667	118.31	6.1527	33.947	0	0	0	0	0	1317.021948	183.97	0	1		2	0	1	2
11:15	18.375	131.35	84.8	3.6458	87.178	6.3104	53.658	0	0	0	0	0	1446.128501	193.825	0	1		3	0	1	3
11:30	22.458	139.99	84.8	5.2083	122.05	6.4682	45.992	0	0	0	0	0	1424.859093	202.586	0	1		4	0	1	4
11:45	18.375	134.8	56.533	3.125	104.61	8.598	50.373	0	0	0	0	0	1408.623922	205.871	0	1		1	0	1	1
12:00	16.333	138.26	127.2	6.25	113.33	6.0738	43.802	0	0	0	0	0	1456.356417	215.726	0	1		2	0	1	2
12:15	10.208	153.82	42.4	7.2917	90.914	5.7583	62.418	0	0	0	0	0	1048.907134	171.924	0	1		3	0	1	3
12:30	30.625	124.43	98.933	8.8542	95.896	5.9949	49.278	0	0	0	0	0	738.5195366	109.506	0			4	0	0	4
12:45	16.333	143.45	84.8	5.7292	115.82	7.6514	60.228	0	0	0	0	0	373.7816376	60.2281	0			0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	356.1932773	64.6084	0			0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	673.0594966	137.977	0			0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	1025.450911	215.726	0	1		1	0	1	1
15:00	10.208	115.79	113.07	4.1667	105.86	7.0992	64.608	0	0	0	0	0	1370.531734	271.574	0	1		2	0	1	2
15:15	14.292	131.35	70.667	7.2917	85.933	7.3359	73.369	0	0	0	0	0	1398.723839	289.095	0	1		3	0	1	3
15:30	12.25	110.61	113.07	6.7708	102.12	7.5725	77.749	0	0	0	0	0	1412	288	0	1		4	0	1	4
15:45	14.292	126.16	84.8	8.3333	103.37	8.1247	55.848	0	0	0	0	0	1446.564701	294.57	0	1		1	0	1	1
16:00	14.292	138.26	113.07	5.7292	105.86	7.1781	82.129	0	0	0	0	0	1482.210322	297.856	0	1		2	0	1	2
16:15	8.1667	101.97	113.07	4.1667	94.65	8.1247	72.274	0	0	0	0	0	1097.824939	215.726	0	1		3	0	1	3
16:30	26.542	124.43	113.07	6.7708	109.6	6.5471	84.319	0	0	0	0	0	767.6825594	143.452	0			4	0	0	4
16:45	24.5	110.61	127.2	4.6875	107.1	6.626	59.133	0	0	0	0	0	380.7264443	59.1331	0			0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0

Hours Where Condition Met:	5
Signal Warranted?	Yes

HAWAIʻI STATE PLAN ANALYSIS

APPENDIX O

APPENDIX O

Analysis of Project Applicability to Hawai‘i State Plan

Chapter 226, HRS, also known as the Hawai‘i State Plan, is a long-range comprehensive plan which serves as a guide for the future long-term development of the State by identifying goals, objectives, policies, and priorities, as well as implementation mechanisms. The Plan consists of three (3) parts. Part I includes the Overall Theme, Goals, Objectives, and Policies; Part II includes Planning, Coordination, and Implementation; and Part III establishes Priority Guidelines. Inasmuch as Part II of the State Plan covers its administrative structure and implementation process, discussion of the proposed project's applicability to Part II is not appropriate. Below is an analysis of the project's applicability to Part I and Part III of the Hawai‘i State Plan.

The methodology for the analysis involves examining the project's applicability to the Hawai‘i State Plan's goals, objectives, and policies. "Applicability" refers to a project's need, purpose and effects, and how these advance or promote a particular set of goals, objectives and priority guidelines. In assessing the relationship between a proposed action and the Hawai‘i State Plan, an action may be categorized in one of the following groups:

1. **Directly applicable**: the action and its potential effects directly advance or promotes the objective, policy or priority guideline.

   Example: A county project to develop a new water source and related transmission facilities would be directly applicable to the objectives and policies for Facility Systems-Water (HRS 226-16) which states" *(5) Support water supply services to areas experiencing critical water problems.*

2. **Indirectly applicable**: the action and its potential effects indirectly support or advance the objective, policy or priority guideline.

   Example: The county water source project cited above supports other related objectives and policies for the economy (HRS 226-6, General), which, by example, states: *(9) Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.* In this case, the principle purpose of the project was not to create new construction activities, but nonetheless, supports this policy by creating temporary construction activity during the implementation of the project. In this instance, the proposed action may be deemed to be indirectly applicable to the objective and policy of the Hawai‘i State Plan.

3. **Not applicable**: the action and its potential effects have no direct or indirect relationship to the objectives and policies of the Hawai‘i State Plan.

Example: That same county water source improvement project referenced above, may not have direct or indirect linkage to objectives and policies for the economy-Federal Expenditures (HRS 226-9) which states: *(1) Encourage the sustained flow of federal expenditures in Hawaii that generates long-term government civilian employment*. From the standpoint of the agency proposing the water system improvement, and assuming no Federal Funding for the project, there is an unlikely intent that the proposed water source project would be connected to or reliant upon the foregoing policy. Hence, from the standpoint of judiciously applied policy analysis, the proposed action would be considered not applicable to the policy.

In general, a proposed action's applicability the objectives, policies and priority guidelines of the Hawai‘i State Plan is judged on the basis of the action's direct or indirect relationship to the respective objectives, policies and priority directions. It is recognized that the categorization of "applicability" is subject to interpretation and should be appropriately considered in the context of local and regional conditions.

Hawai‘i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies **Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable**	**DA**	**IA**	**NA**
HRS 226-1: Findings and Purpose			
HRS 226-2: Definitions			
HRS 226-3: Overall Theme			
HRS 226-4: State Goals. In order to ensure, for the present and future generations, those elements of choice and mobility that ensure that individuals and groups may approach their desired levels of self-reliance and self determination, it shall be the goal of the State to achieve: (1) A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaii's present and future generations. (2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people. (3) Physical, social, and economic well-being, for individuals and families in Hawaii, that nourishes a sense of community responsibility, of caring, and of participation in community life.			
Analysis: **The Makalapua Project District supports the State goals listed above. It will provide economic growth opportunities in an urban infill location and environment designed to foster a sense of community.**			
Chapter 226-5 Objective and Policies for Population			
Objective:			
(a) It shall be the objective in planning for the State's population to guide population growth to be consistent with the achievement of physical, economic and social objectives contained in this chapter.	✓		
Policies:			
(b) To achieve the population objective, it shall be the policy of this State to:			
(1) Manage population growth statewide in a manner that provides increased opportunities for Hawaii's people to pursue their physical, social, and economic aspirations while recognizing the unique needs of each county.	✓		

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(2) Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.	✓		
(3) Promote increased opportunities for Hawaii's people to pursue their socio-economic aspirations throughout the islands.	✓		
(4) Encourage research activities and public awareness programs to foster an understanding of Hawaii's limited capacity to accommodate population needs and to address concerns resulting from an increase in Hawaii's population.			✓
(5) Encourage federal actions and coordination among major governmental agencies to promote a more balanced distribution of immigrants among the states, provided that such actions do not prevent the reunion of immediate family members.			✓
(6) Pursue an increase in federal assistance for states with a greater proportion of foreign immigrants relative to their state's population.			✓
(7) Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.	✓		
Analysis: **The Makalapua Project District is an urban infill project that will provide much needed housing and economic growth opportunities for the County's growing population at an attractive location adjacent to Kailua Village.**			
Chapter 226-6 Objectives and policies for the economy – – in general			
Objectives:			
(a) Planning for the State's economy in general shall be directed toward achievement of the following objectives:			
(1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawaii's people, while at the same time stimulating the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.	✓		
(2) A steadily growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.	✓		
Policies:			
(b) To achieve general economic objectives, it shall be the policy of this State to:			
(1) Promote and encourage entrepreneurship within Hawaii by residents and nonresidents of the State.	✓		
(2) Expand Hawaii's national and international marketing, communication, and organizational ties, to increase the State's capacity to adjust to and capitalize upon economic changes and opportunities occurring outside the State.			✓
(3) Promote Hawaii as an attractive market for environmentally and socially sound investment activities that benefit Hawaii's people.	✓		
(4) Transform and maintain Hawaii as a place that welcomes and facilitates innovative activity that may lead to commercial opportunities.	✓		

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(5) Promote innovative activity that may pose initial risks, but ultimately contribute to the economy of Hawaii.			✓
(6) Seek broader outlets for new or expanded Hawaii business investments.			✓
(7) Expand existing markets and penetrate new markets for Hawaii's products and services.			✓
(8) Assure that the basic economic needs of Hawaii's people are maintained in the event of disruptions in overseas transportation.			✓
(9) Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.	✓		
(10) Encourage the formation of cooperatives and other favorable marketing arrangements at the local or regional level to assist Hawaii's small scale producers, manufacturers, and distributors.			✓
(11) Encourage labor-intensive activities that are economically satisfying and which offer opportunities for upward mobility.		✓	
(12) Encourage innovative activities that may not be labor-intensive, but may otherwise contribute to the economy of Hawaii.		✓	
(13) Foster greater cooperation and coordination between the government and private sectors in developing Hawaii's employment and economic growth opportunities.			✓
(14) Stimulate the development and expansion of economic activities which will benefit areas with substantial or expected employment problems.			✓
(15) Maintain acceptable working conditions and standards for Hawaii's workers.			✓
(16) Provide equal employment opportunities for all segments of Hawaii's population through affirmative action and nondiscrimination measures.			✓
(17) Stimulate the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.			✓
(18) Encourage businesses that have favorable financial multiplier effects within Hawaii's economy, particularly with respect to emerging industries in science and technology.			✓
(19) Promote and protect intangible resources in Hawaii, such as scenic beauty and the aloha spirit, which are vital to a healthy economy.			✓
(20) Increase effective communication between the educational community and the private sector to develop relevant curricula and training programs to meet future employment needs in general, and requirements of new or innovative potential growth industries in particular.			✓
(21) Foster a business climate in Hawaii--including attitudes, tax and regulatory policies, and financial and technical assistance programs-- that is conducive to the expansion of existing enterprises and the creation and attraction of new business and industry.			✓
Analysis: **The Makalapua Project District is an urban infill project that will provide much needed housing and commercial spaces adjacent to existing development in Kailua-Kona, preserving undeveloped scenic areas as well as important cultural sites for residents and visitors to enjoy and learn about. The Makalapua Project District is envisioned to create**			

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
opportunities for new businesses while continuing to support existing businesses in the region.			
Chapter 226-7 Objectives and policies for the economy – – agriculture.			
Objectives:			
(a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:			
(1) Viability of Hawaii's sugar and pineapple industries.			✓
(2) Growth and development of diversified agriculture throughout the State.			✓
(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.			✓
Policies:			
(b) To achieve the agriculture objectives, it shall be the policy of this State to:			
(1) Establish a clear direction for Hawaii's agriculture through stakeholder commitment and advocacy.			✓
(2) Encourage agriculture by making the best use of natural resources.			✓
(3) Provide the governor and the legislature with information and options needed for prudent decision-making for the development of agriculture.			✓
(4) Establish strong relationships between the agricultural and visitor industries for mutual marketing benefits.			✓
(5) Foster increased public awareness and understanding of the contributions and benefits of agriculture as a major sector of Hawaii's economy.			✓
(6) Seek the enactment and retention of federal and state legislation that benefits Hawaii's agricultural industries.			✓
(7) Strengthen diversified agriculture by developing an effective promotion, marketing, and distribution system between Hawaii's food producers and consumers in the State, nation, and world.			✓
(8) Support research and development activities that strengthen economic productivity in agriculture, stimulate greater efficiency, and enhance the development of new products and agricultural by-products.			✓
(9) Enhance agricultural growth by providing public incentives and encouraging private initiatives.			✓
(10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.			✓
(11) Increase the attractiveness and opportunities for an agricultural education and livelihood.			✓
(12) In addition to the State's priority on food, expand Hawaii's agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.			✓

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(13) Promote economically competitive activities that increase Hawaii's agricultural self-sufficiency, including the increased purchase and use of Hawaii-grown food and food products by residents, businesses, and governmental bodies as defined under section 103D-104.			✓
(14) Promote and assist in the establishment of sound financial programs for diversified agriculture.			✓
(15) Institute and support programs and activities to assist the entry of displaced agricultural workers into alternative agricultural or other employment.			✓
(16) Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.			✓
(17) Perpetuate, promote, and increase use of traditional Hawaiian farming systems, such as the use of loko i'a, māla, and irrigated lo'i, and growth of traditional Hawaiian crops, such as kalo, 'uala, and 'ulu.			✓
(18) Increase and develop small-scale farms.			✓
Analysis: **The objectives and policies for the economy related to agriculture listed above are not applicable to the proposed project.**			
Chapter 226-8 Objective and policies for the economy – – visitor industry.			
Objective:			
(a) Planning for the State's economy with regard to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawaii's economy.	✓		
Policies:			
(b) To achieve the visitor industry objective, it shall be the policy of this State to:			
(1) Support and assist in the promotion of Hawaii's visitor attractions and facilities.	✓		
(2) Ensure that visitor industry activities are in keeping with the social, economic, and physical needs and aspirations of Hawaii's people.	✓		
(3) Improve the quality of existing visitor destination areas by utilizing Hawaii's strengths in science and technology.			✓
(4) Encourage cooperation and coordination between the government and private sectors in developing and maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring communities and activities.	✓		
(5) Develop the industry in a manner that will continue to provide new job opportunities and steady employment for Hawaii's people.	✓		
(6) Provide opportunities for Hawaii's people to obtain job training and education that will allow for upward mobility within the visitor industry.			✓
(7) Foster a recognition of the contribution of the visitor industry to Hawaii's economy and the need to perpetuate the aloha spirit.	✓		
(8) Foster an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawaii's cultures and values.	✓		
Analysis: **The Makalapua Project District includes hotel uses to accommodate visitors to the Kona area. The hotels will be designed to complement the character of the surrounding community.**			

Hawai‘i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
Chapter 226-9 Objective and policies for the economy – – federal expenditures.			
Objective:			
(a) Planning for the State’s economy with regard to federal expenditures shall be directed towards achievement of the objective of a stable federal investment base as an integral component of Hawaii’s economy.			✓
Policies:			
(b) To achieve the federal expenditures objective, it shall be the policy of this State to:			
(1) Encourage the sustained flow of federal expenditures in Hawaii that generates long-term government civilian employment;			✓
(2) Promote Hawaii’s supportive role in national defense, in a manner consistent with Hawaii’s social, environmental, and cultural goals by building upon dual-use and defense applications to develop thriving ocean engineering, aerospace research and development, and related dual-use technology sectors in Hawaii’s economy;			✓
(3) Promote the development of federally supported activities in Hawaii that respect statewide economic concerns, are sensitive to community needs, and minimize adverse impacts on Hawaii’s environment;			✓
(4) Increase opportunities for entry and advancement of Hawaii’s people into federal government service;			✓
(5) Promote federal use of local commodities, services, and facilities available in Hawaii;			✓
(6) Strengthen federal-state-county communication and coordination in all federal activities that affect Hawaii; and			✓
(7) Pursue the return of federally controlled lands in Hawaii that are not required for either the defense of the nation or for other purposes of national importance, and promote the mutually beneficial exchanges of land between federal agencies, the State, and the counties.			✓
Analysis: **The objectives and policies for the economy related to federal expenditures listed above are not applicable to the proposed project.**			
Chapter 226-10 Objective and policies for the economy – – potential growth and innovative activities.			
Objective:			
(a) Planning for the State’s economy with regard to potential growth and innovative activities shall be directed towards achievement of the objective of development and expansion of potential growth and innovative activities that serve to increase and diversify Hawaii’s economic base.		✓	
Policies:			
(b) To achieve the potential growth and innovative activity objective, it shall be the policy of this State to:			
(1) Facilitate investment and employment growth in economic activities that have the potential to expand and diversify Hawaii’s economy, including but not limited to diversified agriculture, aquaculture, renewable energy development, creative media, health care, and science and technology-based sectors;			✓

Hawai‘i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(2) Facilitate investment in innovative activity that may pose risks or be less labor-intensive than other traditional business activity, but if successful, will generate revenue in Hawaii through the export of services or products or substitution of imported services or products;			✓
(3) Encourage entrepreneurship in innovative activity by academic researchers and instructors who may not have the background, skill, or initial inclination to commercially exploit their discoveries or achievements;			✓
(4) Recognize that innovative activity is not exclusively dependent upon individuals with advanced formal education, but that many self-taught, motivated individuals are able, willing, sufficiently knowledgeable, and equipped with the attitude necessary to undertake innovative activity;			✓
(5) Increase the opportunities for investors in innovative activity and talent engaged in innovative activity to personally meet and interact at cultural, art, entertainment, culinary, athletic, or visitor-oriented events without a business focus;		✓	
(6) Expand Hawaii’s capacity to attract and service international programs and activities that generate employment for Hawaii’s people;			✓
(7) Enhance and promote Hawaii’s role as a center for international relations, trade, finance, services, technology, education, culture, and the arts;			✓
(8) Accelerate research and development of new energy-related industries based on wind, solar, ocean, underground resources, and solid waste;			✓
(9) Promote Hawaii’s geographic, environmental, social, and technological advantages to attract new or innovative economic activities into the State;			✓
(10) Provide public incentives and encourage private initiative to attract new or innovative industries that best support Hawaii’s social, economic, physical, and environmental objectives;			✓
(11) Increase research and the development of ocean-related economic activities such as mining, food production, and scientific research;			✓
(12) Develop, promote, and support research and educational and training programs that will enhance Hawaii’s ability to attract and develop economic activities of benefit to Hawaii;			✓
(13) Foster a broader public recognition and understanding of the potential benefits of new or innovative growth-oriented industry in Hawaii;			✓
(14) Encourage the development and implementation of joint federal and state initiatives to attract federal programs and projects that will support Hawaii’s social, economic, physical, and environmental objectives;			✓
(15) Increase research and development of businesses and services in the telecommunications and information industries;			✓
(16) Foster the research and development of nonfossil fuel and energy efficient modes of transportation; and			✓
(17) Recognize and promote health care and health care information technology as growth industries.			✓

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
Analysis: **The Makalapua Project District will support economic development in the region, with 220,900 square feet of commercial use and two (2) hotels. The project is envisioned to create opportunities for new businesses to start while continuing to support existing businesses in the region.**			
Chapter 226-10.5 Objectives and policies for the economy – – information industry.			
Objective:			
(a) Planning for the State's economy with regard to telecommunications and information technology shall be directed toward recognizing that broadband and wireless communication capability and infrastructure are foundations for an innovative economy and positioning Hawaii as a leader in broadband and wireless communications and applications in the Pacific Region.			✓
Policies:			
(b) To achieve the information industry objective, it shall be the policy of this State to:			
(1) Promote efforts to attain the highest speeds of electronic and wireless communication within Hawaii and between Hawaii and the world, and make high speed communication available to all residents and businesses in Hawaii;			✓
(2) Encourage the continued development and expansion of the telecommunications infrastructure serving Hawaii to accommodate future growth and innovation in Hawaii's economy;			✓
(3) Facilitate the development of new or innovative business and service ventures in the information industry which will provide employment opportunities for the people of Hawaii;			✓
(4) Encourage mainland- and foreign-based companies of all sizes, whether information technology-focused or not, to allow their principals, employees, or contractors to live in and work from Hawaii, using technology to communicate with their headquarters, offices, or customers located out-of-state;			✓
(5) Encourage greater cooperation between the public and private sectors in developing and maintaining a well-designed information industry;			✓
(6) Ensure that the development of new businesses and services in the industry are in keeping with the social, economic, and physical needs and aspirations of Hawaii's people;			✓
(7) Provide opportunities for Hawaii's people to obtain job training and education that will allow for upward mobility within the information industry;			✓
(8) Foster a recognition of the contribution of the information industry to Hawaii's economy; and			✓
(9) Assist in the promotion of Hawaii as a broker, creator, and processor of information in the Pacific.			✓
Analysis: **The objectives and policies for the economy related to the information industry listed above are not applicable to the proposed project.**			
Chapter 226-11 Objectives and policies for the physical environment – – land based, shoreline, and marine resources.			
Objectives:			
(a) Planning for the State's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of the following objectives:			

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(1) Prudent use of Hawaii's land-based, shoreline, and marine resources.	✓		
(2) Effective protection of Hawaii's unique and fragile environmental resources.	✓		
Policies:			
(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:			
(1) Exercise an overall conservation ethic in the use of Hawaii's natural resources.	✓		
(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.			✓
(3) Take into account the physical attributes of areas when planning and designing activities and facilities.	✓		
(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.	✓		
(5) Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.			✓
(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.	✓		
(7) Provide public incentives that encourage private actions to protect significant natural resources from degradation or unnecessary depletion.			✓
(8) Pursue compatible relationships among activities, facilities, and natural resources.	✓		
(9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.	✓		
Analysis: **The Makalapua Project District will make prudent use of Hawai'i's land resources, as it is an urban infill project that provides housing and commercial space adjacent to Kailua Village in response to anticipated population growth in the region. Best Management Practices (BMPs) will be employed during construction, and drainage and Low Impact Development (LID) measures are being considered for implementation to mitigate potential impacts to downstream areas. While the project's Flora and Fauna Survey did not identify any rare, threatened, or endangered species, various mitigation measures will be implemented to protect Federal or State-listed species that may occur at or in the vicinity of the project site, as applicable.**			
Chapter 226-12 Objective and policies for the physical environment – – scenic, natural beauty, and historic resources.			
Objective:			
(a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historical resources.	✓		
Policies:			
(b) To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:			
(1) Promote the preservation and restoration of significant natural and historic resources.	✓		

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(2) Provide incentives to maintain and enhance historic, cultural, and scenic amenities.			✓
(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.	✓		
(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.	✓		
(5) Encourage the design of developments and activities that complement the natural beauty of the islands.	✓		
Analysis: **The Makalapua Project District is being designed to complement the character of the surrounding area. It will include three (3) historic preservation sites with signage to increase awareness of and appreciation for these sites of historic significance.**			
Chapter 226-13 Objectives and policies for the physical environment – – land, air, and water quality.			
Objectives:			
(a) Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives.			
(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.	✓		
(2) Greater public awareness and appreciation of Hawaii's environmental resources.			✓
Policies:			
(b) To achieve the land, air, and water quality objectives, it shall be the policy of this State to:			
(1) Foster educational activities that promote a better understanding of Hawaii's limited environmental resources.			✓
(2) Promote the proper management of Hawaii's land and water resources.	✓		
(3) Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters.	✓		
(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaii's people.	✓		
(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.	✓		
(6) Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.	✓		
(7) Encourage urban developments in close proximity to existing services and facilities.	✓		
(8) Foster recognition of the importance and value of the land, air, and water resources to Hawaii's people, their cultures and visitors.			✓
Analysis: **As mentioned previously, the Makalapua Project District is proposed adjacent to existing commercial and industrial areas. The subject property is located in Flood Zone X. This designation denotes an area of low flood risk and minimal flooding with no development restrictions. The subject property is located outside of the tsunami evacuation zone. The**			

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subject property is currently covered by non-native vegetation, which presents high wildfire hazard risks. Removing the vegetation and developing the Makalapua Project District will lower fire hazard risks in the area. In addition, various fire hazard mitigation measures (i.e. use of fire-resistant plants for landscaping) will also be implemented. Construction-related BMPs along with drainage improvements will be implemented to mitigate impacts to downstream areas and potential air quality impacts from construction activities to the surrounding community.			
Chapter 226-14 Objective and policies for facility systems – – in general.			
Objective:			
(a) Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, sustainable development, climate change adaptation, sea level rise adaptation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.	✓		
Policies: (b) To achieve the general facility systems objective, it shall be the policy of this State to:			
(1) Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.	✓		
(2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.			✓
(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.	✓		
(4) Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.			✓
(5) Identify existing and planned state facilities that are vulnerable to sea level rise, flooding impacts, and natural hazards.			✓
(6) Assess a range of options to mitigate the impacts of sea level rise to existing and planned state facilities.			✓
Analysis: **Technical studies, including an Infrastructure Report and a Traffic Impact Analysis Report (TIAR), were prepared to assess the project's impact on existing facility systems and ensure that anticipated impacts are appropriately mitigated.**			
Chapter 226-15 Objectives and policies for facility systems – – solid and liquid waste.			
Objectives:			
(a) Planning for the State's facility systems with regard to solid and liquid wastes shall be directed towards the achievement of the following objectives:			
(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes.	✓		
(2) Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility, and other areas.			✓
Policies:			
(b) To achieve solid and liquid waste objectives, it shall be the policy of this State to:			

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(1) Encourage the adequate development of sewerage facilities that complement planned growth.			✓
(2) Promote reuse and recycling to reduce solid and liquid wastes and employ a conservation ethic.	✓		
(3) Promote research to develop more efficient and economical treatment and disposal of solid and liquid wastes.			✓
Analysis: **The proposed project includes a connection to the County's wastewater system to support the project. Refer to Appendix "B". The Lili'uokalani Trust (LT) will encourage waste reduction and recycling to divert waste from the landfill.**			
Chapter 226-16 Objective and policies for facility systems – – water.			
Objective:			
(a) Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.	✓		
Policies:			
(b) To achieve the facility systems water objective, it shall be the policy of this State to:			
(1) Coordinate development of land use activities with existing and potential water supply.	✓		
(2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.			✓
(3) Reclaim and encourage the productive use of runoff water and wastewater discharges.	✓		
(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.	✓		
(5) Support water supply services to areas experiencing critical water problems.			✓
(6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.	✓		
Analysis: **Coordination with the Department of Water Supply (DWS) will continue regarding the water system for the proposed project. LT will utilize its available water credits from existing water commitments with the DWS for the Makalapua Project District. In addition, LT is in the process of developing a new regional water source, which will be dedicated to the County and used for LT's other projects in the Kona region as well as to provide water to DWS to be used for other projects in Kona. Bioretention swales and other Low Impact Development (LID) features will be considered for incorporation into the proposed project, as appropriate. Additionally, water conservation practices will be evaluated and implemented, as practicable.**			
Chapter 226-17 Objectives and policies for facility systems – – transportation.			
Objectives:			
(a) Planning for the State's facility systems with regard to transportation shall be directed towards the achievement of the following objectives:			

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(1) An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.	✓		
(2) A statewide transportation system that is consistent with and will accommodate planned growth objectives throughout the State.			✓
Policies:			
(b) To achieve the transportation objectives, it shall be the policy of this State to:			
(1) Design, program, and develop a multi-modal system in conformance with desired growth and physical development as stated in this chapter;	✓		
(2) Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives;	✓		
(3) Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties;	✓		
(4) Provide for improved accessibility to shipping, docking, and storage facilities;			✓
(5) Promote a reasonable level and variety of mass transportation services that adequately meet statewide and community needs;			✓
(6) Encourage transportation systems that serve to accommodate present and future development needs of communities;	✓		
(7) Encourage a variety of carriers to offer increased opportunities and advantages to interisland movement of people and goods;			✓
(8) Increase the capacities of airport and harbor systems and support facilities to effectively accommodate transshipment and storage needs;			✓
(9) Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification;			✓
(10) Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawaii's natural environment;			✓
(11) Encourage safe and convenient use of low-cost, energy-efficient, non-polluting means of transportation;	✓		
(12) Coordinate intergovernmental land use and transportation planning activities to ensure the timely delivery of supporting transportation infrastructure in order to accommodate planned growth objectives; and			✓
(13) Encourage diversification of transportation modes and infrastructure to promote alternate fuels and energy efficiency.	✓		
Analysis: **The Makalapua Project District will be designed with consideration for complete street principles, allowing for improved pedestrian and bicycle access while still maintaining space for personal vehicles and public transit such as busses. Makala Boulevard may be realigned to improve access with Kailua Park. Ma'a Way and Pawai Place will be extended through the Project District to allow increased access to the Project District and for through traffic to pass. Ma'a Way currently does and will continue to offer sidewalks and bicycle access.**			
Chapter 226-18 Objectives and policies for facility systems – – energy.			
Objectives:			

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(a) Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:			
(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;			✓
(2) Increased energy security and self-sufficiency through the reduction and ultimate elimination of Hawaii's dependence on imported fuels for electrical generation and ground transportation.			✓
(3) Greater diversification of energy generation in the face of threats to Hawaii's energy supplies and systems;			✓
(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use; and	✓		
(5) Utility models that make the social and financial interests of Hawaii's utility customers a priority.			✓
Policies:			
(b) To achieve the energy objectives, it shall be the policy of this State to ensure the short- and long-term provision of adequate, reasonably prices, and dependable energy services to accommodate demand.			✓
(c) To further achieve the energy objectives, it shall be the policy of this State to:			
(1) Support research and development as well as promote the use of renewable energy sources;			✓
(2) Ensure that the combination of energy supplies and energy-saving systems is sufficient to support the demands of growth;			✓
(3) Base decisions of least-cost supply-side and demand-side energy resource options on a comparison of their total costs and benefits when a least-cost is determined by a reasonably comprehensive, quantitative, and qualitative accounting of their long-term, direct and indirect economic, environmental, social, cultural, and public health costs and benefits;			✓
(4) Promote all cost-effective conservation of power and fuel supplies through measures, including:	✓		
(A) Development of cost-effective demand-side management programs;			✓
(B) Education;			✓
(C) Adoption of energy-efficient practices and technologies; and	✓		
(D) Increasing energy efficiency and decreasing energy use in public infrastructure			✓
(5) Ensure, to the extent that new supply-side resources are needed, that the development or expansion of energy systems uses the least-cost energy supply option and maximizes efficient technologies; and			✓
(6) Support research, development, demonstration, and use of energy efficiency, load management, and other demand-side management programs, practices, and technologies;			✓
(7) Promote alternate fuels and transportation energy efficiency;			✓

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(8) Support actions that reduce, avoid, or sequester greenhouse gases in utility, transportation, and industrial sector applications;			✓
(9) Support actions that reduce, avoid, or sequester Hawaii's greenhouse gas emissions through agriculture and forestry initiatives;			✓
(10) Provide priority handling and processing for all state and county permits required for renewable energy projects;			✓
(11) Ensure that liquefied natural gas is used only as a cost-effective transitional, limited-term replacement of petroleum for electricity generation and does not impede the development and use of other cost-effective renewable energy sources; and			✓
(12) Promote the development of indigenous geothermal energy resources that are located on public trust land as an affordable and reliable source of firm power for Hawaii.			✓
Analysis: **The Makalapua Project District will implement energy conservation and efficiency measures, as practicable.**			
Chapter 226-18.5 Objectives and policies for facility systems – – telecommunications.			
Objectives:			
(a) Planning for the State's telecommunications facility systems shall be directed towards the achievement of dependable, efficient, and economical statewide telecommunications systems capable of supporting the needs of the people.			✓
Policies:			
(b) To achieve the telecommunications objective, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable telecommunications services to accommodate demand.			✓
(c) To further achieve the telecommunications objective, it shall be the policy of this State to:			
(1) Facilitate research and development of telecommunications systems and resources;			✓
(2) Encourage public and private sector efforts to develop means for adequate, ongoing telecommunications planning;			✓
(3) Promote efficient management and use of existing telecommunications systems and services; and			✓
(4) Facilitate the development of education and training of telecommunications personnel.			✓
Analysis: **The objectives and policies for facility systems listed above related to telecommunications are not applicable to the proposed project.**			
Chapter 226-19 Objectives and policies for socio-cultural advancement – – housing.			
Objectives:			
(a) Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:			
(1) Greater opportunities for Hawaii's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals, through collaboration and cooperation between government and nonprofit and for-profit	✓		

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developers to ensure that more rental and for sale affordable housing is made available to very low-, very low-,lower-, moderate-, and above moderate-income segments of Hawaii's population.			
(2) The orderly development of residential areas sensitive to community needs and other land uses.	✓		
(3) The development and provision of affordable rental housing by the State to meet the housing needs of Hawaii's people.			✓
Policies:			
(b) To achieve the housing objectives, it shall be the policy of this State to:			
(1) Effectively accommodate the housing needs of Hawaii's people.	✓		
(2) Stimulate and promote feasible approaches that increase affordable rental and for sale housing choices for extremely low-, very low-, lower-, moderate-, and above moderate-income households.	✓		
(3) Increase homeownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.	✓		
(4) Promote appropriate improvement, rehabilitation, and maintenance of existing rental and for sale housing units and residential areas.			✓
(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.	✓		
(6) Facilitate the use of available vacant, developable, and underutilized urban lands for housing.	✓		
(7) Foster a variety of lifestyles traditional to Hawaii through the design and maintenance of neighborhoods that reflect the culture and values of the community.	✓		
(8) Promote research and development of methods to reduce the cost of housing construction in Hawaii.			✓
Analysis: **The Makalapua Project District is consistent with the above noted objectives and policies. The proposed Makalapua Project District will include approximately 600 residential units. It is an urban infill project that will provide a range of housing choices adjacent to existing commercial areas. The Makalapua Project District will comply with the County's affordable housing requirements in accordance with County regulations.**			
Chapter 226-20 Objectives and policies for socio-cultural advancement – – health.			
Objectives:			
(a) Planning for the State's socio-cultural advancement with regard to health shall be directed towards achievement of the folowing objectives:			
(1) Fulfillment of basic individual health needs of the general public.			✓
(2) Maintenance of sanitary and environmentally healthful conditions in Hawaii's communities.			✓
(3) Elimination of health disparities by identifying and addressing social determinants of health.			✓
Policies:			

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(b) To achieve the health objectives, it shall be the policy of this State to:			
(1) Provide adequate and accessible services and facilities for prevention and treatment of physical and mental health problems, including substance abuse.			✓
(2) Encourage improved cooperation among public and private sectors in the provision of health care to accommodate the total health needs of individuals throughout the State.			✓
(3) Encourage public and private efforts to develop and promote statewide and local strategies to reduce health care and related insurance costs.			✓
(4) Foster an awareness of the need for personal health maintenance and preventive health care through education and other measures.			✓
(5) Provide programs, services, and activities that ensure environmentally healthful and sanitary conditions.			✓
(6) Improve the State's capabilities in preventing contamination by pesticides and other potentially hazardous substances through increased coordination, education, monitoring, and enforcement.			✓
(7) Prioritize programs, services, interventions, and activities that address identified social determinants of health to improve native Hawaiian health and well-being consistent with the United States Congress' declaration of policy as codified in title 42 United States Code section 11702, and to reduce health disparities of disproportionately affected demographics, including native Hawaiians, other Pacific Islanders, and Filipinos. The prioritization of affected demographic groups other than native Hawaiians may be reviewed every ten years and revised based on the best available epidemiological and public health data.			✓
Analysis: **The objectives and policies for socio-cultural advancement related to health listed above are not applicable to the proposed project.**			
Chapter 226-21 Objectives and policies for socio-cultural advancement – – education.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to education shall be directed towards achievement of the objective of the provision of a variety of educational opportunities to enable individuals to fulfill their needs, responsibilities, and aspirations.			✓
Policies:			
(b) To achieve the education objective, it shall be the policy of this State to:			
(1) Support educational programs and activities that enhance personal development, physical fitness, recreation, and cultural pursuits of all groups.			✓
(2) Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.			✓
(3) Provide appropriate educational opportunities for groups with special needs.			✓
(4) Promote educational programs which enhance understanding of Hawaii's cultural heritage.			✓
(5) Provide higher educational opportunities that enable Hawaii's people to adapt to changing employment demands.			✓

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(6) Assist individuals, especially those experiencing critical employment problems or barriers, or undergoing employment transitions, by providing appropriate employment training programs and other related educational opportunities.			✓
(7) Promote programs and activities that facilitate the acquisition of basic skills, such as reading, writing, computing, listening, speaking, and reasoning.			✓
(8) Emphasize quality educational programs in Hawaii's institutions to promote academic excellence.			✓
(9) Support research programs and activities that enhance the education programs of the State.			✓
Analysis: **The objectives and policies for socio-cultural advancement related to education listed above are not applicable to the proposed project.**			
Chapter 226-22 Objective and policies for socio-cultural advancement – – social services.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to social services shall be directed towards the achievement of the objective of improved public and private social services and activities that enable individuals, families, and groups to become more self-reliant and confident to improve their well-being.			✓
Policies:			
(a) To achieve the social service objective, it shall be the policy of the State to:			
(1) Assist individuals, especially those in need of attaining a minimally adequate standard of living and those confronted by social and economic hardship conditions, through social services and activities within the State's fiscal capacities.			✓
(2) Promote coordination and integrative approaches among public and private agencies and programs to jointly address social problems that will enable individuals, families, and groups to deal effectively with social problems and to enhance their participation in society.			✓
(3) Facilitate the adjustment of new residents, especially recently arrived immigrants, into Hawaii's communities.			✓
(4) Promote alternatives to institutional care in the provision of long-term care for elder and disabled populations.			✓
(5) Support public and private efforts to prevent domestic abuse and child molestation, and assist victims of abuse and neglect.			✓
(6) Promote programs which assist people in need of family planning services to enable them to meet their needs.			✓
Analysis: **The objectives and policies for socio-cultural advancement related to social services listed above are not applicable to the proposed project.**			
Chapter 226-23 Objective and policies for socio-cultural advancement – – leisure.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.	✓		

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Policies:			
(b) To achieve the leisure objective, it shall be the policy of this State to:			
(1) Foster and preserve Hawaii's multi-cultural heritage through supportive cultural, artistic, recreational, and humanities-oriented programs and activities.	✓		
(2) Provide a wide range of activities and facilities to fulfill the cultural, artistic, and recreational needs of all diverse and special groups effectively and efficiently.	✓		
(3) Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities, and improved facility design and maintenance.	✓		
(4) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.			✓
(5) Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.			✓
(6) Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.	✓		
(7) Provide adequate and accessible physical fitness programs to promote the physical and mental well-being of Hawaii's people.			✓
(8) Increase opportunities for appreciation and participation in the creative arts, including the literary, theatrical, visual, musical, folk, and traditional art forms.	✓		
(9) Encourage the development of creative expression in the artistic disciplines to enable all segments of Hawaii's population to participate in the creative arts.			✓
(10) Assure adequate access to significant natural and cultural resources in public ownership.	✓		
Analysis: **Approximately 3.5 acres of the Makalapua Project District will be open space. This will include a 1.6-acre "Village Green", located perpendicular to Kuakini Highway and Pawai Place that is envisioned to be the center of social activities in the Makalapua Project District. Additionally, signage will be posted to direct residents and visitors to cultural sites around the Project District; these signs are intended to share valuable information about the significance of the region and the sites present.**			
Chapter 226-24 Objective and policies for socio-cultural advancement – – individual rights and personal well-being.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to individual rights and personal well-being shall be directed towards achievement of the objective of increased opportunities and protection of individual rights to enable individuals to fulfill their socio-economic needs and aspirations.			✓
Policies:			
(b) To achieve the individual rights and personal well-being objective, it shall be the policy of this State to:			
(1) Provide effective services and activities that protect individuals from criminal acts and unfair practices and that alleviate the consequences of criminal acts in order to foster a safe and secure environment.			✓

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(2) Uphold and protect the national and state constitutional rights of every individual.			✓
(3) Assure access to, and availability of, legal assistance, consumer protection, and other public services which strive to attain social justice.			✓
(4) Ensure equal opportunities for individual participation in society.			✓
Analysis: **The objective and policies listed above for socio-cultural advancement related to individual rights and personal well-being are not applicable to the proposed project.**			
Chapter 226-25 Objective and policies for socio-cultural advancement – – culture.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawaii's people.	✓		
Policies:			
(b) To achieve the culture objective, it shall be the policy of this State to:			
(1) Foster increased knowledge and understanding of Hawaii's ethnic and cultural heritages and the history of Hawaii.	✓		
(2) Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawaii's people and which are sensitive and responsive to family and community needs.	✓		
(3) Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawaii.			✓
(4) Encourage the essence of the aloha spirit in people's daily activities to promote harmonious relationships among Hawaii's people and visitors.			✓
Analysis: **The Makalapua Project District is envisioned as a place where families can connect with the spirit of Queen Liliʻuokalani and with other members of the community. A Cultural Impact Assessment (CIA) prepared for the project concluded that the project will have limited impacts on cultural resources. Three (3) archaeological sites will be preserved within the project sites, and signs will be used to share knowledge and information about the archaeological sites with visitors and residents.**			
Chapter 226-26 Objectives and policies for socio-cultural advancement – – public safety.			
Objectives:			
(a) Planning for the State's socio-cultural advancement with regard to public safety shall be directed towards the achievement of the following objectives:			
(1) Assurance of public safety and adequate protection of life and property for all people.			✓
(2) Optimum organizational readiness and capability in all phases of emergency management to maintain the strength, resources, and social and economic well-being of the community in the event of civil disruptions, wars, natural disasters, and other major disturbances.			✓
(3) Promotion of a sense of community responsibility for the welfare and safety of Hawaii's people.			✓

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Policies (Public Safety):			
(b) To achieve the public safety objectives, it shall be the policy of this State to:			
(1) Ensure that public safety programs are effective and responsive to community needs.			✓
(2) Encourage increased community awareness and participation in public safety programs.			✓
Policies (Public Safety-Criminal Justice):			
(c) To further achieve public safety objectives related to criminal justice, it shall be the policy of this State to:			
(1) Support criminal justice programs aimed at preventing and curtailing criminal activities.			✓
(2) Develop a coordinated, systematic approach to criminal justice administration among all criminal justice agencies.			✓
(3) Provide a range of correctional resources which may include facilities and alternatives to traditional incarceration in order to address the varied security needs of the community and successfully reintegrate offenders into the community.			✓
Policies (Public Safety – Emergency Management):			
(d) To further achieve public safety objectives related to emergency management, it shall be the policy of this State to:			
(1) Ensure that responsible organizations are in a proper state of readiness to respond to major war-related, natural, or technological disasters and civil disturbances at all times.			✓
(2) Enhance the coordination between emergency management programs throughout the State.			✓
Analysis: **The objectives and policies for socio-cultural advancement related to public safety listed above are not applicable to the proposed project.**			
Chapter 226-27 Objectives and policies for socio-cultural advancement – – government.			
Objectives:			
(a) Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of the following objectives:			
(1) Efficient, effective, and responsive government services at all levels in the State.			✓
(2) Fiscal integrity, responsibility, and efficiency in the state government and county governments.			✓
Policies:			
(b) To achieve the government objectives, it shall be the policy of this State to:			
(1) Provide for necessary public goods and services not assumed by the private sector.			✓
(2) Pursue an openness and responsiveness in government that permits the flow of public information, interaction, and response.			✓
(3) Minimize the size of government to that necessary to be effective.			✓

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(4) Stimulate the responsibility in citizens to productively participate in government for a better Hawaii.			✓
(5) Assure that government attitudes, actions, and services are sensitive to community needs and concerns.			✓
(6) Provide for a balanced fiscal budget.			✓
(7) Improve the fiscal budgeting and management system of the State.			✓
(8) Promote the consolidation of state and county governmental functions to increase the effective and efficient delivery of government programs and services and to eliminate duplicative services wherever feasible.			✓
Analysis: **The objectives and policies for socio-cultural advancement related to government listed above are not applicable to the proposed project.**			

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Chapter 226-101: Purpose. The purpose of this part is to establish overall priority guidelines to address areas of statewide concern.			
Chapter 226-102: Overall direction. The State shall strive to improve the quality of life for Hawaii's present and future population through the pursuit of desirable courses of action in seven major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, quality education, principles of sustainability, and climate change adaptation.			
Chapter 226-103: Economic priority guidelines.			
(a) Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawaii's people and achieve a stable and diversified economy:	✓		
(1) Seek a variety of means to increase the availability of investment capital for new and expanding enterprises.	✓		
(A) Encourage investments which:			
(i) Reflect long term commitments to the State;	✓		
(ii) Rely on economic linkages within the local economy;	✓		
(iii) Diversify the economy;	✓		
(iv) Reinvest in the local economy;	✓		
(v) Are sensitive to community needs and priorities; and	✓		
(vi) Demonstrate a commitment to provide management opportunities to Hawaii residents; and			✓
(B) Encourage investments in innovative activities that have a nexus to the State, such as:		✓	
(i) Present or former residents acting as entrepreneurs or principals;			✓
(ii) Academic support from an institution of higher education in Hawaii;			✓
(iii) Investment interest from Hawaii residents;			✓
(iv) Resources unique to Hawaii that are required for innovative activity; and			✓
(v) Complementary or supportive industries or government programs or projects.			✓
(2) Encourage the expansion of technological research to assist industry development and support the development and commercialization of technological advancements.			✓
(3) Improve the quality, accessibility, and range of services provided by government to business, including data and reference services and assistance in complying with governmental regulations.			✓
(4) Seek to ensure that state business tax and labor laws and administrative policies are equitable, rational, and predictable.			✓
(5) Streamline the processes for building and development permit and review, and telecommunication infrastructure installation approval and eliminate or consolidate other burdensome or duplicative governmental requirements imposed on business, where scientific evidence indicates that public health, safety and welfare would not be adversely affected.			✓
(6) Encourage the formation of cooperatives and other favorable marketing or distribution arrangements at the regional or local level to assist Hawaii's small-scale producers, manufacturers, and distributors.			✓

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(7) Continue to seek legislation to protect Hawaii from transportation interruptions between Hawaii and the continental United States.			✓
(8) Provide public incentives and encourage private initiative to develop and attract industries which promise long-term growth potentials and which have the following characteristics:			✓
(A) An industry that can take advantage of Hawaii's unique location and available physical and human resources.			✓
(B) A clean industry that would have minimal adverse effects on Hawaii's environment.			✓
(C) An industry that is willing to hire and train Hawaii's people to meet the industry's labor needs at all levels of employment.			✓
(D) An industry that would provide reasonable income and steady employment.			✓
(9) Support and encourage, through educational and technical assistance programs and other means, expanded opportunities for employee ownership and participation in Hawaii business.			✓
(10) Enhance the quality of Hawaii's labor force and develop and maintain career opportunities for Hawaii's people through the following actions:			✓
(A) Expand vocational training in diversified agriculture, aquaculture, information industry, and other areas where growth is desired and feasible.			✓
(B) Encourage more effective career counseling and guidance in high schools and post-secondary institutions to inform students of present and future career opportunities.			✓
(C) Allocate educational resources to career areas where high employment is expected and where growth of new industries is desired.			✓
(D) Promote career opportunities in all industries for Hawaii's people by encouraging firms doing business in the State to hire residents.			✓
(E) Promote greater public and private sector cooperation in determining industrial training needs and in developing relevant curricula and on-the-job training opportunities.			✓
(F) Provide retraining programs and other support services to assist entry of displaced workers into alternative employment.			✓
(b) Priority guidelines to promote the economic health and quality of the visitor industry:	✓		
(1) Promote visitor satisfaction by fostering an environment which enhances the aloha spirit and minimizes inconveniences to Hawaii's residents and visitors.			✓
(2) Encourage the development and maintenance of well-designed, adequately serviced hotels and resort destination areas which are sensitive to neighboring communities and activities and which provide for adequate shoreline setbacks and beach access.	✓		
(3) Support appropriate capital improvements to enhance the quality of existing resort destination areas and provide incentives to encourage investment in upgrading, repair, and maintenance of visitor facilities.			✓
(4) Encourage visitor industry practices and activities which respect, preserve, and enhance Hawaii's significant natural, scenic, historic, and cultural resources.	✓		
(5) Develop and maintain career opportunities in the visitor industry for Hawaii's people, with emphasis on managerial positions.			✓
(6) Support and coordinate tourism promotion abroad to enhance Hawaii's share of existing and potential visitor markets.			✓

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(7) Maintain and encourage a more favorable resort investment climate consistent with the objectives of this chapter.			✓
(8) Support law enforcement activities that provide a safer environment for both visitors and residents alike.			✓
(9) Coordinate visitor industry activities and promotions to business visitors through the state network of advanced data communication techniques.			✓
(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:			✓
(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.			✓
(2) Continue efforts to maintain federal support to provide stable sugar prices high enough to allow profitable operations in Hawaii.			✓
(3) Support research and development, as appropriate, to improve the quality and production of sugar and pineapple crops.			✓
(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:			✓
(1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.			✓
(2) Assist in providing adequate, reasonably priced water for agricultural activities.			✓
(3) Encourage public and private investment to increase water supply and to improve transmission, storage, and irrigation facilities in support of diversified agriculture and aquaculture.			✓
(4) Assist in the formation and operation of production and marketing associations and cooperatives to reduce production and marketing costs.			✓
(5) Encourage and assist with the development of a waterborne and airborne freight and cargo system capable of meeting the needs of Hawaii's agricultural community.			✓
(6) Seek favorable freight rates for Hawaii's agricultural products from interisland and overseas transportation operators.			✓
(7) Encourage the development and expansion of agricultural and aquacultural activities which offer long-term economic growth potential and employment opportunities.			✓
(8) Continue the development of agricultural parks and other programs to assist small independent farmers in securing agricultural lands and loans.			✓
(9) Require agricultural uses in agricultural subdivisions and closely monitor the uses in these subdivisions.			✓
(10) Support the continuation of land currently in use for diversified agriculture.			✓
(11) Encourage residents and visitors to support Hawaii's farmers by purchasing locally grown food and food products.			✓
(e) Priority guidelines for water use and development:			
(1) Maintain and improve water conservation programs to reduce the overall water consumption rate.			✓
(2) Encourage the improvement of irrigation technology and promote the use of nonpotable water for agricultural and landscaping purposes.			✓
(3) Increase the support for research and development of economically feasible alternative water sources.			✓
(4) Explore alternative funding sources and approaches to support future water development programs and water system improvements.			✓

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(f) Priority guidelines for energy use and development:			
(1) Encourage the development, demonstration, and commercialization of renewable energy sources.			✓
(2) Initiate, maintain, and improve energy conservation programs aimed at reducing energy waste and increasing public awareness of the need to conserve energy.			✓
(3) Provide incentives to encourage the use of energy conserving technology in residential, industrial, and other buildings.			✓
(4) Encourage the development and use of energy conserving and cost-efficient transportation systems.			✓
(g) Priority guidelines to promote the development of the information industry:			✓
(1) Establish an information network, with an emphasis on broadband and wireless infrastructure and capability that will serve as the foundation of and catalyst for overall economic growth and diversification in Hawaii.			✓
(2) Encourage the development of services such as financial data processing, a products and services exchange, foreign language translations, telemarketing, teleconferencing, a twenty-four-hour international stock exchange, international banking, and a Pacific Rim management center.			✓
(3) Encourage the development of small businesses in the information field such as software development; the development of new information systems, peripherals, and applications; data conversion and data entry services; and home or cottage services such as computer programming, secretarial, and accounting services.			✓
(4) Encourage the development or expansion of educational and training opportunities for residents in the information and telecommunications fields.			✓
(5) Encourage research activities, including legal research in the information and telecommunications fields.			✓
(6) Support promotional activities to market Hawaii's information industry services.			✓
(7) Encourage the location or co-location of telecommunication or wireless information relay facilities in the community, including public areas, where scientific evidence indicates that the public health, safety, and welfare would not be adversely affected.			✓
Analysis: **The Makalapua Project District will provide opportunities for economic development, housing, hotel, and open space in a convenient location adjacent to Kailua Village. The climate, environment, and special character of Kona will be considered and factored in to the design concepts for the project.**			
Chapter 226-104: Population growth and land resources priority guidelines.			
(a) Priority guidelines to effect desired statewide growth and distribution:			✓
(1) Encourage planning and resource management to ensure that population growth rates throughout the State are consistent with available and planned resource capacities and reflect the needs and desires of Hawaii's people.			✓
(2) Manage a growth rate for Hawaii's economy that will parallel future employment needs for Hawaii's people.			✓
(3) Ensure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the State.			✓
(4) Encourage major state and federal investments and services to promote economic development and private investment to the neighbor islands, as appropriate.			✓

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(5) Explore the possibility of making available urban land, low-interest loans, and housing subsidies to encourage the provision of housing to support selective economic and population growth on the neighbor islands.			✓
(6) Seek federal funds and other funding sources outside the State for research, program development, and training to provide future employment opportunities on the neighbor islands.			✓
(7) Support the development of high technology parks on the neighbor islands.			✓
(b) Priority guidelines for regional growth distribution and land resource utilization:	✓		
(1) Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures, and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.	✓		
(2) Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.	✓		
(3) Restrict development when drafting of water would result in exceeding the sustainable yield or in significantly diminishing the recharge capacity of any groundwater area.			✓
(4) Encourage restriction of new urban development in areas where water is insufficient from any source for both agricultural and domestic use.			✓
(5) In order to preserve green belts, give priority to state capital-improvement funds which encourage location of urban development within existing urban areas except where compelling public interest dictates development of a noncontiguous new urban core.			✓
(6) Seek participation from the private sector for the cost of building infrastructure and utilities, and maintaining open spaces.	✓		
(7) Pursue rehabilitation of appropriate urban areas.			✓
(8) Support the redevelopment of Kakaako into a viable residential, industrial, and commercial community.			✓
(9) Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.	✓		
(10) Identify critical environmental areas in Hawaii to include but not be limited to the following: watershed and recharge areas; wildlife habitats (on land and in the ocean); areas with endangered species of plants and wildlife; natural streams and water bodies; scenic and recreational shoreline resources; open space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.			✓
(11) Identify all areas where priority should be given to preserving rural character and lifestyle.			✓
(12) Utilize Hawaii's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations.	✓		
(13) Protect and enhance Hawaii's shoreline, open spaces, and scenic resources.	✓		

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Analysis: **The Makalapua Project District is an urban infill project that proposes development in an appropriate and convenient location in accordance with the KCDP, adjacent to Kailua-Kona and away from critical habitats or environments. The proposed action includes the necessary backbone infrastructure and utilities to support the project. The project will provide approximately 3.5 acres of open spaces throughout the Project District.**			
Chapter 226-105: Crime and criminal justice.			
Priority guidelines in the area of crime and criminal justice:			✓
(1) Support law enforcement activities and other criminal justice efforts that are directed to provide a safer environment.			✓
(2) Target state and local resources on efforts to reduce the incidence of violent crime and on programs relating to the apprehension and prosecution of repeat offenders.			✓
(3) Support community and neighborhood program initiatives that enable residents to assist law enforcement agencies in preventing criminal activities.			✓
(4) Reduce overcrowding or substandard conditions in correctional facilities through a comprehensive approach among all criminal justice agencies which may include sentencing law revisions and use of alternative sanctions other than incarceration for persons who pose no danger to their community.			✓
(5) Provide a range of appropriate sanctions for juvenile offenders, including community-based programs and other alternative sanctions.			✓
(6) Increase public and private efforts to assist witnesses and victims of crimes and to minimize the costs of victimization.			✓
Analysis: **The priority guidelines in the area of crime and criminal justice listed above are not applicable to the proposed project.**			
Chapter 226-106: Affordable housing.			
Priority guidelines for the provision of affordable housing:	✓		
(1) Seek to use marginal or nonessential agricultural land and public land to meet housing needs of extremely low-, very low-, lower-, moderate-, and above and moderate-income households.	✓		
(2) Encourage the use of alternative construction and development methods as a means of reducing production costs.			✓
(3) Improve information and analysis relative to land availability and suitability for housing.			✓
(4) Create incentives for development which would increase home ownership and rental opportunities for Hawaii's low-, very low-, lower-, and moderate-income households and residents with special needs.			✓
(5) Encourage continued support for government or private housing programs that provide low interest mortgages to Hawaii's people for the purchase of initial owner-occupied housing.			✓
(6) Encourage public and private sector cooperation in the development of rental housing alternatives.			✓
(7) Encourage improved coordination between various agencies and levels of government to deal with housing policies and regulations.			✓
(8) Give higher priority to the provision of quality housing that is affordable for Hawaii's residents and less priority to development of housing intended primarily for individuals outside of Hawaii.	✓		
Analysis: **The Makalapua Project District will provide approximately 600 residential units designed to meet the need of a variety of households. Units will include medium to high density units, including affordable housing pursuant to County regulations.**			

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Chapter 226-107: Quality education.			
Priority guidelines to promote quality education:			✓
(1) Pursue effective programs which reflect the varied district, school, and student needs to strengthen basic skills achievement;			✓
(2) Continue emphasis on general education "core" requirements to provide common background to students and essential support to other university programs;			✓
(3) Initiate efforts to improve the quality of education by improving the capabilities of the education work force;			✓
(4) Promote increased opportunities for greater autonomy and flexibility of educational institutions in their decision making responsibilities;			✓
(5) Increase and improve the use of information technology in education by the availability of telecommunications equipment for:			✓
(A) The electronic exchange of information;			✓
(B) Statewide electronic mail; and			✓
(C) Access to the Internet.			✓
(6) Encourage programs that increase the public's awareness and understanding of the impact of information technologies on our lives;			✓
(7) Pursue the establishment of Hawaii's public and private universities and colleges as research and training centers of the Pacific;			✓
(8) Develop resources and programs for early childhood education;			✓
(9) Explore alternatives for funding and delivery of educational services to improve the overall quality of education; and			✓
(10) Strengthen and expand educational programs and services for students with special needs.			✓
Analysis: **The priority guidelines related to quality education listed above are not applicable to the proposed project.**			
CHAPTER 226-108: Sustainability			
Priority guidelines and principles to promote sustainability shall include:	✓		
(1) Encouraging balanced economic, social, community, and environmental priorities;	✓		
(2) Encouraging planning that respects and promotes living within the natural resources and limits of the State;	✓		
(3) Promoting a diversified and dynamic economy;	✓		
(4) Encouraging respect for the host culture;	✓		
(5) Promoting decisions based on meeting the needs of the present without compromising the needs of future generations;	✓		
(6) Considering the principles of the ahupuaa system; and	✓		
(7) Emphasizing that everyone, including individuals, families, communities, businesses, and government, has the responsibility for achieving a sustainable Hawaii.	✓		
Analysis: **The Makalapua Project District is consistent with the above noted priority guidelines and principles related to sustainability. Sustainable design strategies are being considered for the project. The project is envisioned to be a mixed-use, walkable village center with opportunities for small and large businesses to develop, expand, and thrive, where people can gather and connect with the spirit of Queen Liliʻuokalani. Core principles for the project include fulfilling the legacy of Queen Liliʻuokalani, fostering regional economic resilience,**			

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improving regional transportation, instilling diversity, and demonstrating malama for our resources.			
CHAPTER 226-109: Climate change adaptation priority guidelines			
Priority guidelines to prepare the State to address the impacts of climate change, including impacts to the areas of agriculture; conservation lands; coastal and nearshore marine areas; natural and cultural resources; education; energy; higher education; health; historic preservation; water resources; the built environment, such as housing, recreation, transportation; and the economy shall:	✓		
(1) Ensure that Hawaii's people are educated, informed, and aware of the impacts climate change may have on their communities;			✓
(2) Encourage community stewardship groups and local stakeholders to participate in planning and implementation of climate change policies;			✓
(3) Invest in continued monitoring and research of Hawaii's climate and the impacts of climate change on the State;			✓
(4) Consider native Hawaiian traditional knowledge and practices in planning for the impacts of climate change;	✓		
(5) Encourage the preservation and restoration of natural landscape features, such as coral reefs, beaches and dunes, forests, streams, floodplains, and wetlands, that have the inherent capacity to avoid, minimize, or mitigate the impacts of climate change;			✓
(6) Explore adaptation strategies that moderate harm or exploit beneficial opportunities in response to actual or expected climate change impacts to the natural and built environments;	✓		
(7) Promote sector resilience in areas such as water, roads, airports, and public health, by encouraging the identification of climate change threats, assessment of potential consequences, and evaluation of adaptation options;			✓
(8) Foster cross-jurisdictional collaboration between county, state, and federal agencies and partnerships between government and private entities and other nongovernmental entities, including nonprofit entities;			✓
(9) Use management and implementation approaches that encourage the continual collection, evaluation, and integration of new information and strategies into new and existing practices, policies, and plans; and			✓
(10) Encourage planning and management of the natural and built environments that effectively integrate climate change policy.	✓		
Analysis: **The Makalapua Project District incorporates mitigation for potential climate change impacts through design techniques related to stormwater management, fire prevention, reducing heat impacts through building orientation and fenestration for natural ventilation. The project has also been assessed for potential sea level rise impacts resulting from climate change, and the project is located inland of the 3.2-foot sea level rise exposure area and no significant sea level rise impacts are anticipated.**			

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