Draft Environmental Assessment

Northern Leg of the Western Bypass Road

Kōloa, Kaua‘i, Hawai‘i

Tax Map Keys: (4) 2-7-003: 002 (por.) and 014, and 2-8-006: 001 (por.)

Prepared For

COUNTY OF KAUA‘I
DEPARTMENT OF PUBLIC WORKS

Prepared By

WILSON OKAMOTO CORPORATION

July 2010

DRAFT ENVIRONMENTAL ASSESSMENT

NORTHERN LEG OF THE WESTERN BYPASS ROAD

Kōloa, Kauaʻi, Hawaiʻi

Tax Map Keys: (4) 2-7-003: 002 (por.) and 014, and 2-8-006: 001 (por.)

Prepared For:

County of Kauaʻi
Department of Public Works
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July 2010

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Appendix D: Air Quality Study, Prepared by B.D. Neal & Associates, May 2010

Appendix E: Noise Study, Prepared by Y. Ebisu & Associates, May 2010

Appendix F: Archaeological Inventory Survey, Prepared by Cultural Surveys Hawaiʻi, Inc., October 2003
and
Letter from the State Department of Land and Natural Resources, Historic Preservation Division Dated January 28, 2004

Appendix G: Supplemental Archaeological Assessment and Cultural Background Study, Prepared by Cultural Surveys Hawaiʻi, Inc., March 2010
and
Letter from the State Department of Land and Natural Resources, Historic Preservation Division Dated March 19, 2010

Appendix H: Cultural Impact Assessment, Prepared by Cultural Surveys Hawaiʻi, Inc., November 2003

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PREFACE

This Draft Environmental Assessment (EA) is prepared pursuant to Chapter 343, Hawai‘i Revised Statutes (HRS), and Title 11, Chapter 200, Hawai‘i Administrative Rules (HAR), State Department of Health. Proposed is an agency action by the County of Kaua‘i Department of Public Works to construct the Northern Leg of the existing Western Bypass Road (Ala Kalanikaumaka) in the Kōloa District, Island of Kaua‘i. The Northern Leg will connect the existing Western Bypass Road, from where it presently terminates at its intersection with Kōloa Road, with the existing Ala Kinoiki (Eastern Bypass Road) at its intersection with Maluhia Road. The Northern Leg will be approximately 0.4-mile in length, and configured within a 150-foot wide right-of-way. The Northern Leg will include an approximately 520-foot long, 60-foot wide bridge that will span the Ōma‘o Stream crossing and associated floodway, and two wetland areas. The Northern Leg is initially planned to be a two-lane, two-way roadway based on current and projected traffic conditions to Year 2035. Ultimately, the Northern Leg is planned to be a four-lane, two-way roadway in the future. This EA assesses the potential impacts of the Northern Leg as a two-lane roadway. At the time that the Northern Leg is developed as a four-lane roadway, a separate environmental review would likely be required.

In conjunction with the Northern Leg, the southern segment of the existing Ōma‘o Road will be realigned to intersect with the Northern Leg, near its southern end. This proposed realignment will eliminate the existing intersection of Ōma‘o Road at Kōloa Road.

This EA is required since County funds will be used for the design and construction of the proposed improvements. A Finding of No Significant Impact (FONSI) is anticipated for the proposed Project.

In addition to County funds, Federal Highway Administration (FHWA) funds will also be used for the design and construction of the Northern Leg improvements. A separate EA will be prepared for the proposed Northern Leg improvements to satisfy the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended, (Pub. L. 91-190, 42 U.S. Code 4321-4347), Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA, (40 Code of Federal Regulations 1500-1508), and 23 Code of Federal Regulations Part 771, Environmental Impact and Related Procedures.

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PROJECT SUMMARY

Proposing Agency:	County of Kaua‘i Department of Public Works 4444 Rice Street, Suite 275 Līhu‘e, Kaua‘i, Hawai‘i 96766-1340
Approving Agency:	County of Kaua‘i Department of Public Works 4444 Rice Street, Suite 275 Līhu‘e, Kaua‘i, Hawai‘i 96766-1340
Location:	Kōloa, Kaua‘i, Hawai‘i
Tax Map Keys (TMKs):	(4) 2-7-003: 002 (por.) and 014, and 2-8-006: 001 (por.)
Recorded Fee Owners:	McBryde Sugar Company, Limited (TMKs: (4) 2-7-003: 002 and 014) CGB Partners (TMK: (4) 2-8-006: 001)
Existing Use:	Pasture land, plant nursery, agricultural cultivation, Ōma‘o Stream, and densely vegetated areas
State Land Use Classification:	Agricultural District
County General Plan:	Planned Road, Agriculture and Open
Kōloa-Po‘ipū-Kalāheo Development Plan:	Agriculture, Open and Residential
County Zoning:	Agriculture District (A)
Special Management Area (SMA):	Located outside of the SMA
Proposed Action:	The proposed action involves construction of the Northern Leg segment of the existing Western Bypass Road from its terminus at Kōloa Road, mauka to Maluhia Road at its intersection with Ala Kinoiki (Eastern Bypass Road). The Northern Leg will be approximately 0.4-mile in length, and configured within a 150-foot wide right-of-way. The Northern Leg will include an approximately 520-foot long, 60-foot wide bridge that will span the Ōma‘o Stream crossing and associated floodway, and two wetland areas. The Northern Leg is initially planned to be a two-lane, two-way

roadway based on current and projected traffic conditions to Year 2035. Ultimately, the Northern Leg is planned to be a four-lane, two-way roadway in the future. This EA assesses the potential impacts of the Northern Leg as a two-lane roadway. At the time that the Northern Leg is developed as a four-lane roadway, a separate environmental review would likely be required.

In conjunction with the Northern Leg, the southern end of the existing Ōmaʻo Road will be realigned to intersect with the Northern Leg, near its southern end. The proposed realignment will eliminate the existing Ōmaʻo Road intersection at Kōloa Road and the associated traffic movement directly between those two roads.

Roadway improvements will be undertaken at the new intersections of the Northern Leg at Maluhia Road, Kōloa Road, and Ōmaʻo Road. Development of the proposed Project improvements will require the acquisition of privately-owned property.

This Draft EA has been prepared to satisfy the requirements of Chapter 343, HRS, and Title 11, Chapter 200, HAR, State Department of Health, since County funds will be used for the design and construction of the proposed improvements.

In addition to County funds, Federal Highway Administration (FHWA) funds will also be used for the design and construction of the Northern Leg improvements. A separate EA will be prepared for the proposed Northern Leg improvements to satisfy the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended, (Pub. L. 91-190, 42 U.S. Code 4321-4347), Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA, (40 Code of Federal Regulations 1500-1508), and 23 Code of Federal Regulations Part 771, Environmental Impact and Related Procedures.

Impacts: No significant impacts are anticipated from the construction and operation of the proposed Project.

Anticipated Determination: Finding of No Significant Impact (FONSI)

Required Permits & Approvals:

<u>Federal</u>

Federal Emergency Management Agency (FEMA)

- Compliance with Executive Order 11988, Floodplain Management

State of Hawai‘i
Department of Health
- National Pollutant Discharge Elimination System (NPDES) Permit
- Community Noise Permit

Department of Land and Natural Resources, Historic Preservation Division
- Section 106, National Historic Preservation Act of 1966
- Chapter 6E, HRS Historic Preservation

DLNR, Commission on Water Resource Management
- Stream Channel Alteration Permit

Department of Business, Economic Development & Tourism, Office of State Planning
- Hawai‘i Coastal Zone Management Program Federal Consistency Certification

County of Kaua‘i
Department of Public Works
- Grubbing and Grading Permit
- Road Permit

Agencies Consulted In Pre-Assessment Process:

Federal
U.S. Army Corps of Engineers
U.S. Geological Survey
U.S. Fish and Wildlife Service
U.S. Natural Resources Conservation Service
U.S. Department of Transportation, Federal Highway Administration

State of Hawai‘i
Department of Accounting and General Services
Department of Education
Department of Business, Economic Development & Tourism
Department of Business, Economic Development & Tourism, Land Use Commission
Department of Business, Economic Development & Tourism, Office of Planning
Department of Health
Department of Health, Office of Environmental Quality Control
Department of Health, Environmental Planning Office
Department of Health, Environmental Management Division
Department of Land and Natural Resources
Department of Land and Natural Resources, Land Division

Department of Land and Natural Resources, Historic Preservation Division
Department of Transportation
Office of Hawaiian Affairs

County of Kaua‘i
Planning Department
Department of Public Works, Building Division
Department of Public Works, Solid Waste Division
Department of Public Works, Division of Wastewater Management
Department of Water
Housing Agency
Department of Parks and Recreation
Transportation Agency
Civil Defense Agency
Office of Economic Development
Police Department
Fire Department

Others
Kōloa Community Association
Po‘ipū Beach Resort Association
Kaua‘i Path, Inc.

1. INTRODUCTION

1.1 Introduction and Project Background

The County of Kaua‘i (County) Department of Public Works (DPW) proposes to construct a roadway referred to as the Northern Leg of the existing Western Bypass Road (Ala Kalanikaumaka)[1] in the Kōloa District, Island of Kaua‘i (see Figure 1-1). The Northern Leg will connect the existing Western Bypass Road, from where it presently terminates at its intersection with Kōloa Road, with the existing Ala Kinoiki (Eastern Bypass Road) at its intersection with Maluhia Road. The Northern Leg will provide the remaining road link between these two major mauka-makai collector roadways in the Kōloa-Po‘ipū region, and facilitate access and mobility in this area by providing an alternative route for motorists.

The Northern Leg represents an important component of the County’s objective to improve regional traffic flow and circulation within this South Shore region, which extends from Kōloa Town makai to the Po‘ipū and Kukui‘ula areas. Construction of the Northern Leg will also implement the recommendations of the various State and County transportation and land use planning documents that have identified the need for this road link.

The Northern Leg is initially planned to be a two-lane, two-way roadway based on current and projected traffic conditions to Year 2035. Ultimately, the Northern Leg is planned to be a four-lane, two-way roadway in the future. The timing of development of the Northern Leg to a four-lane roadway would depend on future traffic operating conditions in the area. This Environmental Assessment (EA) assesses the potential impacts of the Northern Leg as a two-lane roadway. At the time that the Northern Leg is developed as a four-lane roadway, a separate environmental review would likely be required.

In conjunction with the Northern Leg, the southern segment of the existing Ōma‘o Road will be realigned to intersect with the Northern Leg, near its southern end. This proposed realignment will eliminate the existing intersection of Ōma‘o Road at Kōloa Road.

This Draft EA has been prepared to satisfy the requirements of Chapter 343, Hawai‘i Revised Statutes (HRS), and Title 11, Chapter 200, Hawai‘i Administrative Rules (HAR), State Department of Health. This EA is required since County funds will be used for the design and construction of the proposed improvements.

In addition to County funds, Federal Highway Administration (FHWA) funds will also be used for the design and construction of the Northern Leg improvements. The FHWA, by letter dated July 7, 2009, approved the functional classification of the Northern Leg as a Rural Major Collector road. With this functional classification, the Northern Leg is eligible for federal-aid funding. A separate EA will be prepared for the proposed Northern Leg improvements to satisfy the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended, (Pub. L. 91-190, 42 U.S. Code 4321-4347), Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA, (40 Code of Federal Regulations 1500-1508), and 23 Code of Federal Regulations Part 771, Environmental Impact and Related Procedures.

[1] Although Ala Kalanikaumaka is the official street name for the Western Bypass Road, for purposes of this Environmental Assessment, this road is referred to as the Western Bypass Road since it is generally referenced as such in various State and County transportation and land use planning documents.

Northern Leg of the Western Bypass Road

LOCATION MAP

FIGURE

1-1

1.2 Purpose and Need

The purpose of the proposed action is to provide a road link between the present terminus of the Western Bypass Road at Kōloa Road, and Maluhia Road at its intersection with Ala Kinoiki as shown on Figure 1-2.

The proposed action addresses the following needs:

- Traffic operating conditions;
- Traffic circulation; and
- Implement recommendations of State and County transportation and land use planning documents.

Traffic Operating Conditions:

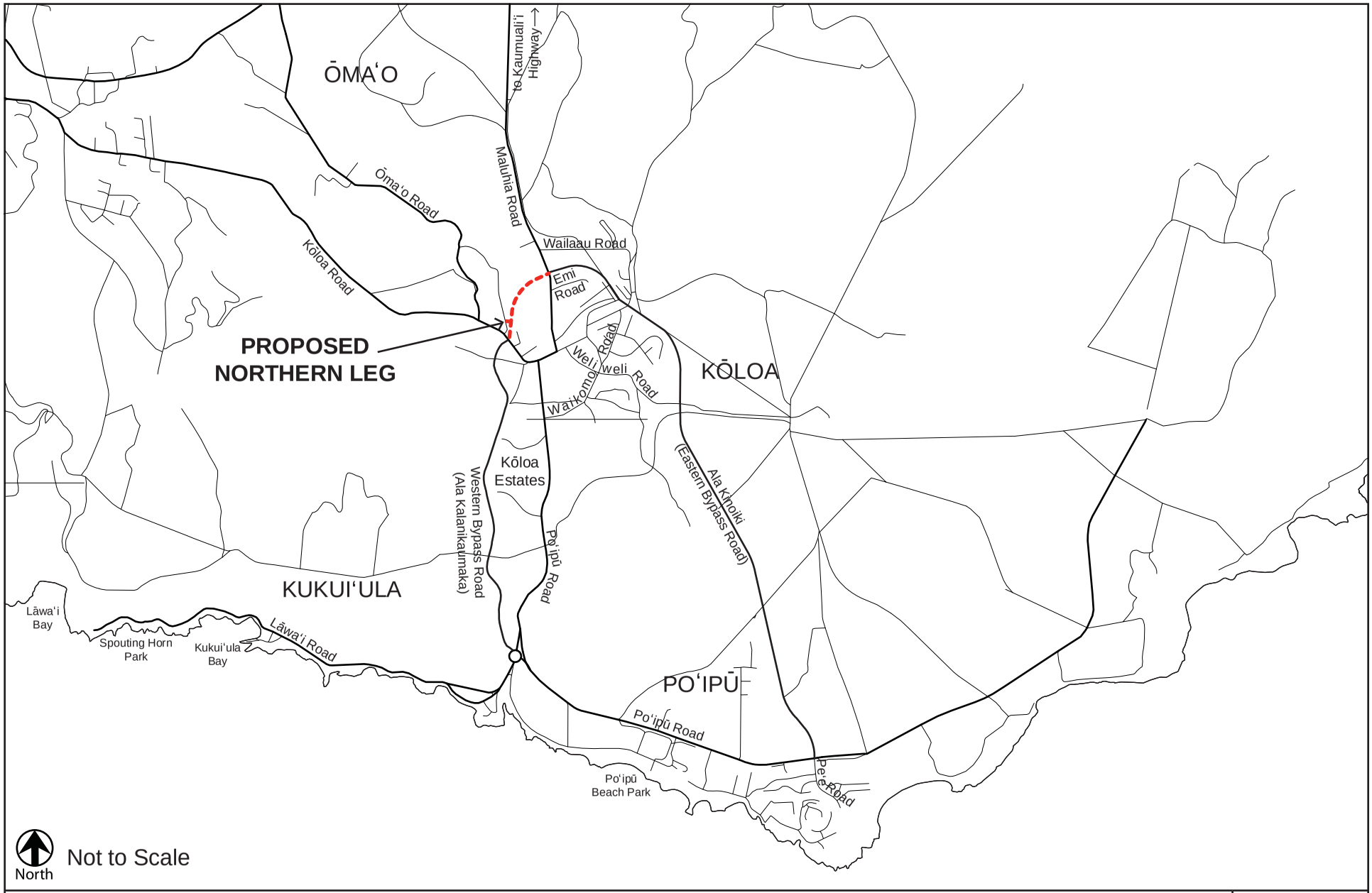
Existing Facilities: The existing roadway system serving the Project area consists of two-lane, two-way, County roadways with unsignalized intersections (see Figure 1-2). Maluhia Road serves as the main access roadway to Kōloa and Poʻipū, and provides connection between those areas and Kaumualiʻi Highway to the north. Maluhia Road intersects Kōloa Road at its southern terminus, and Ala Kinoiki 0.4-mile to the north. Ala Kinoiki provides an alternate mauka-makai route between Maluhia Road and the Poʻipū area.

Kōloa Road serves as the main east-west access roadway through Kōloa. Kōloa Road intersects Poʻipū Road west of its intersection with Maluhia Road, and the Western Bypass Road and Ōmaʻo Road further west. Poʻipū Road serves as the main access roadway to and through Poʻipū. The Western Bypass Road serves as the primary access roadway through the Kukuiʻula development. Ōmaʻo Road extends between Kōloa Road and Kaumualiʻi Highway to the north.

Future Traffic Operating Conditions: The Northern Leg is anticipated to be constructed by Year 2015. Within this timeframe, a number of resort-residential units and commercial projects are anticipated to be developed within the Kōloa-Poʻipū area as identified in the traffic assessment report (TAR) for the Project included in Appendix I.

In Year 2015, traffic operations in Kōloa are expected to deteriorate from existing conditions if the Northern Leg is not built. Along Maluhia Road, the westbound left-turn traffic movement at the Ala Kinoiki intersection is expected to deteriorate from Level of Service (LOS) “B” to LOS “E” during the PM peak period. Similarly, at the intersection with Kōloa Road, the southbound left-turn movement is expected to deteriorate from LOS “A” to LOS “D” during the AM peak period, and from LOS “C” to LOS “F” during the PM peak period.

Along Kōloa Road, the northbound left-turn traffic movement at the Poʻipū Road intersection is expected to deteriorate from LOS “B” to LOS “C” during the AM peak period, and from LOS “B” to LOS “F” during the PM peak period if the Northern Leg is not built.



Northern Leg of the Western Bypass Road

ROADWAY SYSTEM MAP

FIGURE

1-2

With the Northern Leg being built, traffic operations throughout Kōloa Town are expected to improve in Year 2015. Along Maluhia Road, the westbound left-turn traffic movement at the Ala Kinoiki intersection is expected to improve from LOS "E" to LOS "C" during the PM peak period. At the intersection with Kōloa Road, the southbound left-turn movement is expected to improve from LOS "D" to LOS "C" during the AM peak period, and from LOS "F" to LOS "D" during the PM peak period.

Along Kōloa Road, the northbound left-turn traffic movement at the Poʻipū Road intersection is expected to improve from LOS "C" to LOS "B" during the AM peak period, and from LOS "F" to LOS "C" during the PM peak period with the Northern Leg.

Traffic Circulation:

The existing roadway network within the Kōloa-Poʻipū area includes three major mauka-makai roadways connecting Kōloa and Poʻipū as shown on Figure 1-2. To the east, Ala Kinoiki provides connection between the eastern Poʻipū area and Maluhia Road, allowing motorists to bypass Kōloa Town. To the west, Poʻipū Road provides connection from Poʻipū mauka to Kōloa Road within Kōloa Town. Further west, the Western Bypass Road provides connection from areas west of Poʻipū Road to Kōloa Road. From Kōloa Road, Maluhia Road provides the primary connection to Kaumualiʻi Highway to the north.

Currently, the present terminus of the Western Bypass Road at Kōloa Road does not allow motorists traveling along that road to bypass Kōloa Town to access Maluhia Road. Instead, motorists travelling between the Western Bypass Road and Kaumualiʻi Highway must enter Kōloa Town via Kōloa Road to access Maluhia Road. The Northern Leg will complete the northern segment of the Western Bypass Road, which will allow motorists travelling between Poʻipū and Kaumualiʻi Highway to bypass Kōloa Town. The Northern Leg will complete the beltway circulation system with Ala Kinoiki, thereby resulting in improved traffic circulation within Kōloa Town.

Implement Recommendations of State and County Transportation and Land Use Planning Documents:

Kauaʻi Long-Range Land Transportation Plan: The Kauaʻi Long-Range Land Transportation Plan (KLRLTP) (May 1997) is an Islandwide regional transportation plan for Kauaʻi which identifies land transportation improvements needed to support projected growth to Year 2020. The KLRLTP was developed through the Countywide Transportation Planning Process (CTPP), a cooperative, comprehensive and continuing transportation planning effort involving the State and neighbor island counties. The KLRLTP satisfied the requirements of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the Federal transportation law, which specifies that the Statewide Transportation Plan and Program be developed within the context of a Statewide planning process.

The KLRLTP involved development of traffic forecasts through the Year 2020 based on land use projections through that year. The Kōloa district was one of two districts on Kauaʻi expected to have the largest residential growth, and was the second highest district for employment based on the projected increase of its share of employment.

Although the KLRLTP's recommended improvements for the Poʻipū/Lāwaʻi area did not include construction of the West Poʻipū Road Bypass (the Western Bypass Road and Northern Leg segment), which was one of several alternatives developed to mitigate future Year 2020 traffic deficiencies for the region, in the KLRLTP's recommended improvements, the following is noted:

> *"For the Kōloa-Poʻipū area, a circulation study of the roadways is needed to assess the local neighborhood traffic as well as traffic desiring to bypass Kōloa town. A loop roadway around Kōloa town could be formed by directly linking the East Kōloa-Poʻipū Bypass Road, the west Poʻipū Road bypass, and the proposed Port Allen-Poʻipū connector road. (The Kukuiʻula mauka project road could become a part of the Port Allen-Poʻipū connector road.)"*

In the KLRLTP's implementation plan, it states that "*a circulation study for the Kōloa-Poʻipū area has been included in the recommendations so the circulation of traffic in this region can be examined in future detail.*"

<u>County of Kauaʻi General Plan</u>: The County of Kauaʻi General Plan was adopted in November 2000 and provides broad policy statements to guide land use regulations, new developments and facilities, and planning for County facilities and services. The General Plan employs projections of employment and population to 2020 in forecasting land supply and infrastructure needs and, subsequently, in developing land use plans and long-range plans for public facilities and services.

The Northern Leg is shown as a Planned Road on the Kōloa-Poʻipū-Kalāheo Land Use Map of the General Plan (see Figure 4-2). The General Plan sets forth the following in support of this Planned Road designation:

> *6.4 KŌLOA-POʻIPŪ-KALĀHEO*
>
> *6.4.4 Land Use Map and Policies*
>
> *6.4.4.1 Land Use Map*
>
> ***New Road Corridors.*** *Also shown on the Land Use Map are corridors for two future roadways. The West Kōloa-By-Pass Road is designed to provide an alternate route for traffic between Maluhia Road and Kukuiʻula, as that project builds out. The corridor runs along the western edge of Kōloa Town and turns east to join Maluhia Road, opposite the East Kōloa By-Pass. This corridor is schematic. A specific alignment will be established based on future planning.*
>
> *6.4.4.2 Policies*
>
> *(a) Regional Growth and Public Facilities*
>
> > *(1) Assure that adequate transportation facilities are provided in conjunction with the future development of lands in the Kukuiʻula-Poʻipū area and in the Kalāheo-Ōmaʻo area.*

(b) Kōloa

(1) Improve circulation within and around Kōloa Town.

(2) In conjunction with development of the West Kōloa By-Pass Road, extend Kōloa Town to the west and provide for traffic circulation between the town and the By-Pass Road.

County of Kaua‘i Kōloa-Po‘ipū-Kalāheo Development Plan: The County’s Kōloa-Po‘ipū-Kalāheo Development Plan was adopted in 1983 and provides more detailed specifications than the General Plan for physical, social and economic measures which relate specifically to these communities.

The Northern Leg is depicted as one of several vehicular circulation systems recommended in the Kōloa-Po‘ipū-Kalāheo Development Plan. The Kōloa-Po‘ipū-Kalāheo Development Plan map depicts the Northern Leg alignment connecting Kōloa Road with Maluhia Road as shown on Figure 4-3.

Kōloa-Po‘ipū Area Circulation Plan: The Kōloa-Po‘ipū Area Circulation Plan (KPACP) (April 2007) was developed through a broad-based community planning effort to address existing traffic flow concerns, mitigate the traffic impacts of significant new development during the next 15 years (through 2020), and create a more balanced transportation system that includes all travel modes within the Kōloa-Po‘ipū-Kukui‘ula area. The KPACP was created through a partnership involving local residents, businesses, associations, developers, elected officials, and government agencies. The KPACP was donated to the County, and approved by the County Council on August 8, 2007.

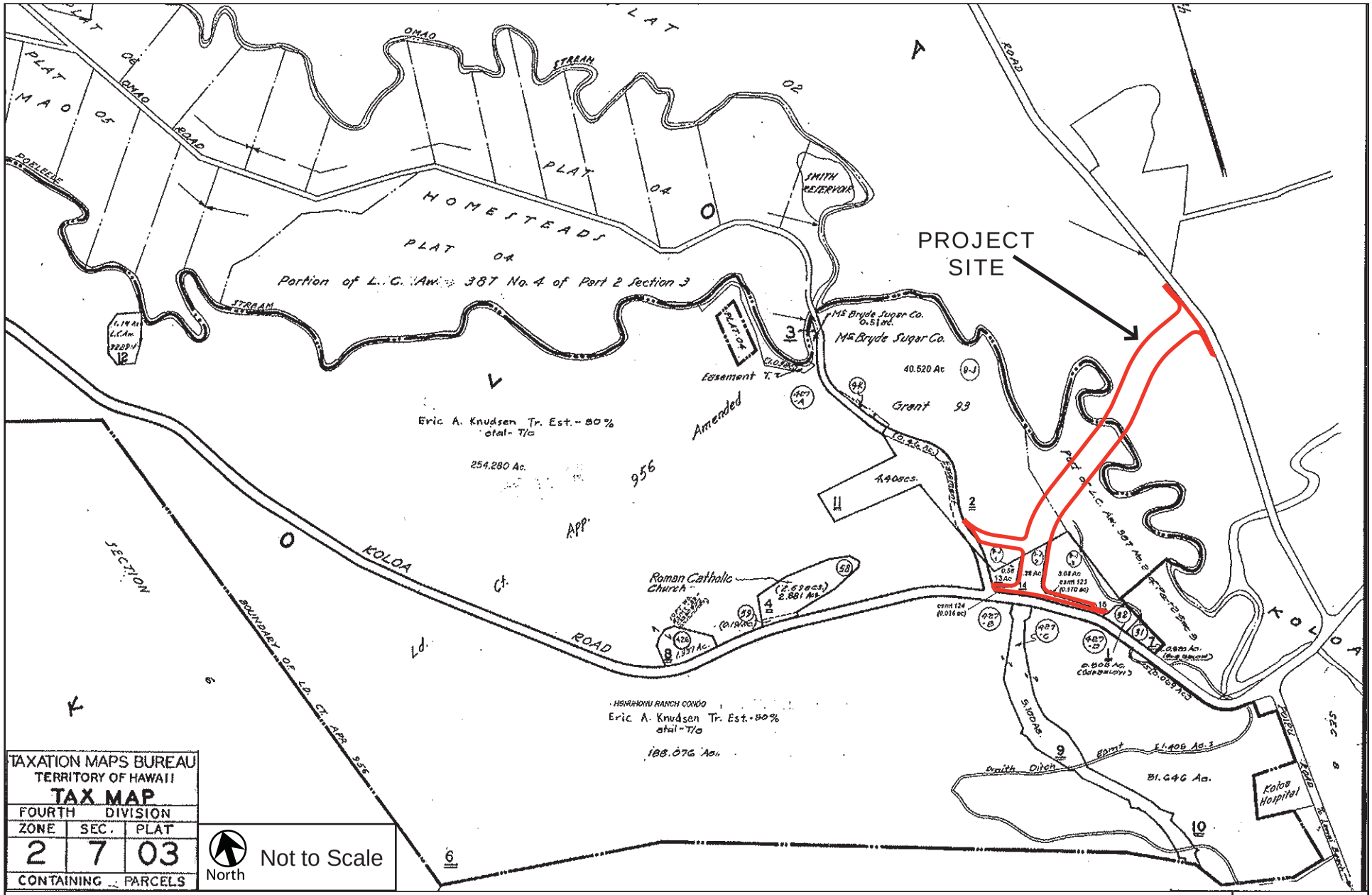
The Northern Leg is included as a recommended street connection in the KPACP, one of several projects intended to enhance the network connectivity and improve traffic flow at major intersections throughout Kōloa and Po‘ipū. The 2020 traffic forecasts in the KPACP indicates that the Northern Road could provide regional benefit, and function as an important component of the area’s major roadway network. The KPACP’s long-term recommendation for the Northern Road involves replacing its intersection at Maluhia Road with a roundabout. The KPACP also designates the Northern Leg as a primary proposed street for an emergency evacuation route.

1.3 Project Location

The Project Site is located within privately-owned, former sugar cane land, in the area west of Maluhia Road and north of Kōloa Road. The site is located mauka of Kōloa Town and the Kukui‘ula development, and approximately 2.5 miles makai of Kaumuali‘i Highway. The Project Site encompasses three parcels identified as: 1) Tax Map Keys (TMK): (4) 2-7-003: 002 (por.) and 014 owned by McBryde Sugar Company, Limited as shown on Figure 1-3; and 2) TMK: (4) 2-8-006: por. 001 owned by CGB Partners as shown on Figure 1-4.

1.4 Existing and Surrounding Uses

The existing and surrounding uses are depicted on Figure 1-5. Photos of the Project Site are included in Appendix A.

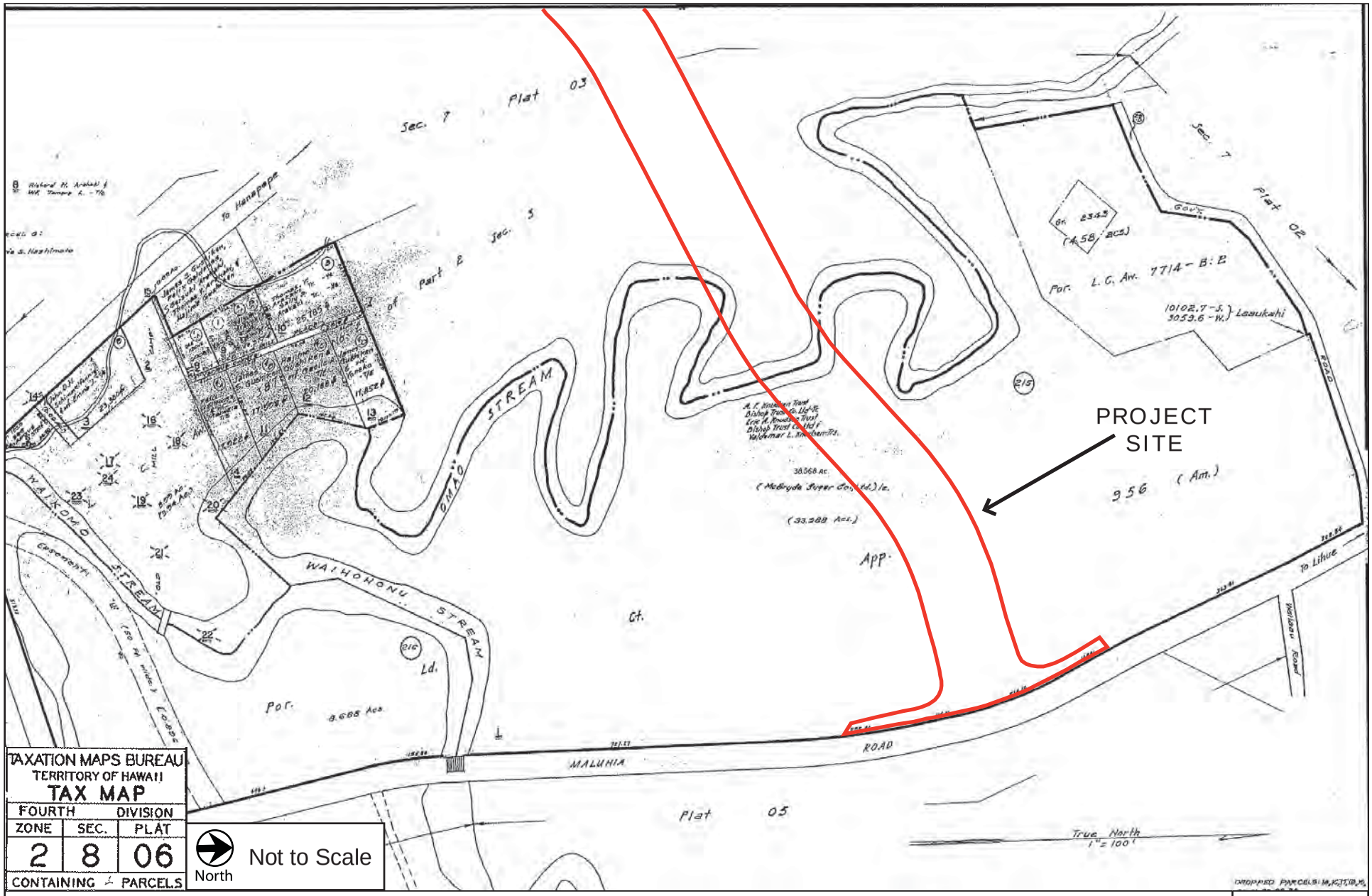


Northern Leg of the Western Bypass Road

FIGURE

1-3

TAX MAP KEYS: 2-7-003: 002 (por.) and 014



Northern Leg of the Western Bypass Road

FIGURE

1-4

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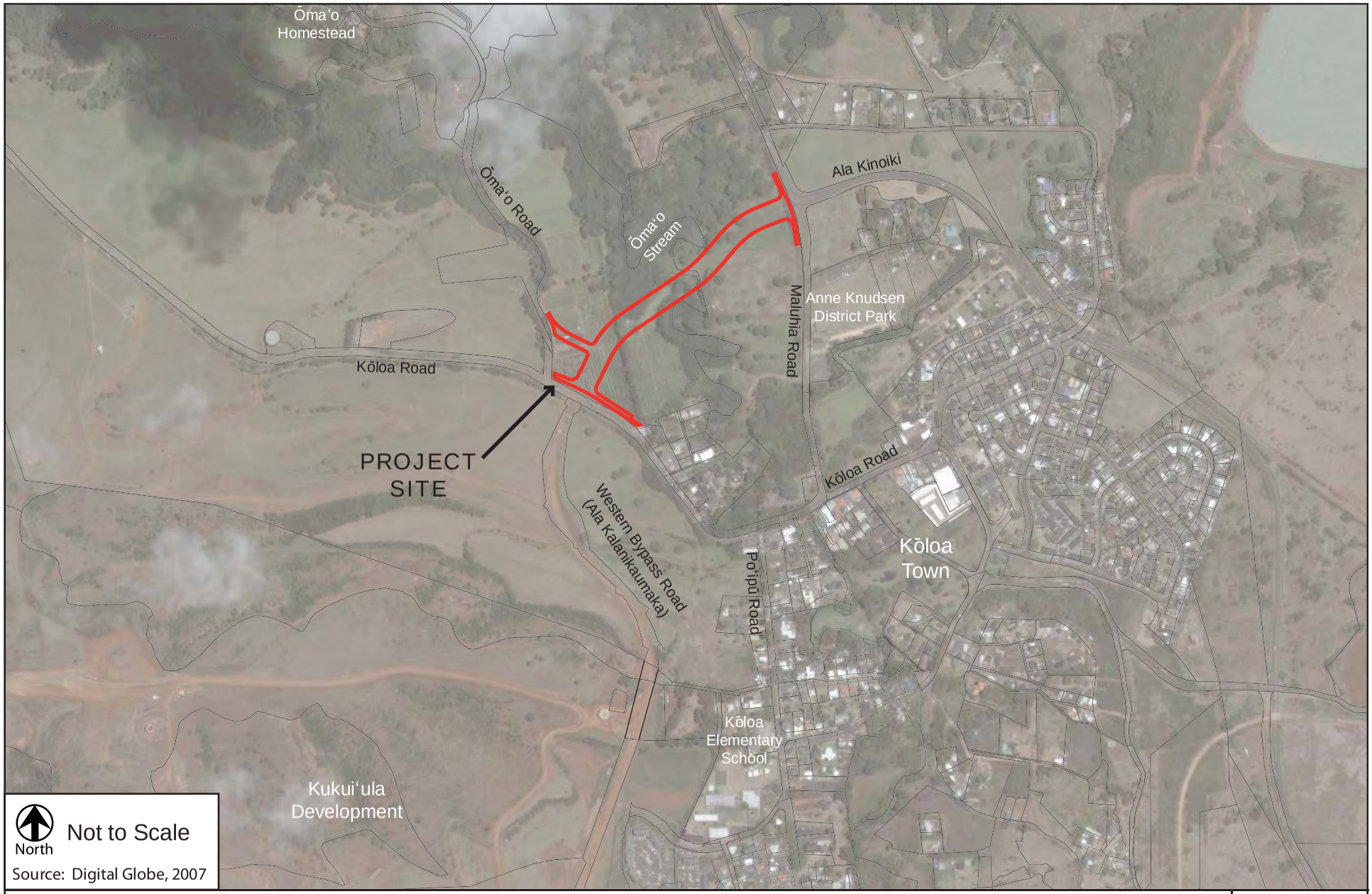

Northern Leg of the Western Bypass Road

PROJECT VICINITY MAP

FIGURE

1-5

Existing Uses: Existing uses within the Project Site include pasture land within the northern portion, and a plant nursery and agricultural cultivation consisting of banana crops within the southern portion. Ōmaʻo Stream traverses in a north-south direction through the center of the Project Site, and the adjacent area west of the stream is densely vegetated with hau and guinea grass.

Surrounding Uses: Existing uses bordering the Project Site include Maluhia Road to the northeast; pasture land, Ōmaʻo Stream and adjacent heavily vegetated areas, and agricultural cultivation to the north and south; a plant nursery and Ōmaʻo Road to the southwest; and Kōloa Road to the south. Other nearby surrounding uses include private residences to the south, mauka of Kōloa Road; the Western Bypass Road to the south; vacant, undeveloped lands to the south, west, north, and east; Ala Kinoiki to the northeast, across of Maluhia Road; and the Anne Knudsen District Park located approximately 450 feet to the southeast, across of Maluhia Road.

Other land uses in the outlying vicinity include Kōloa Town approximately 0.3-mile to the southeast; the resort community of Poʻipū further to the southeast; the Kukuiʻula development approximately 0.5-mile to the south; Kōloa Elementary School approximately 0.5-mile to the south; Ōmaʻo Homesteads to the northwest along Ōmaʻo Road; and private residences to the north, across of Maluhia Road.

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2. ALTERNATIVES CONSIDERED AND DESCRIPTION OF THE PROPOSED ACTION

2.1 Alternatives Considered

2.1.1 No Action

The no action alternative would involve no improvements to complete the Western Bypass Road connection from its terminus at Kōloa Road to Maluhia Road. Motorists travelling between the Western Bypass Road and Kaumualiʻi Highway would continue to enter Kōloa Town via Kōloa Road to access Maluhia Road. Without the Northern Leg, the beltway circulation system with Ala Kinoiki would not be completed and, therefore, traffic circulation within Kōloa Town would not be improved. Further, the no action alternative would not result in improved traffic operating conditions in the Kōloa-Poʻipū area, and would not implement the recommendations of the various State and County transportation and land use planning documents which designate the Northern Leg as an important component to improve regional traffic flow and circulation within the Kōloa-Poʻipū area. Thus, the no action alternative would not fulfill the purpose and need for the proposed action.

The no action alternative would preclude all short- and long-term beneficial and adverse physical, environmental and socio-economic impacts described in this EA.

2.1.2 Alternative Road Alignment

With regard to improving traffic circulation, alternative alignments in the general vicinity were considered that would serve a similar function of the Northern Leg corridor, as represented by various State and County transportation and land use planning documents. According to these transportation and land use planning documents, the Northern Leg would function as the final road link completing the beltway circulation system. Only this road link connecting the existing Western Bypass Road at its terminus at Kōloa Road, with Maluhia Road at its intersection with Ala Kinoiki, can complete this circulation system. With the termini of the Northern Leg corridor thus fixed, an assessment was conducted to determine the specific road alignment through the area. The assessment considered physical site constraints, most notably the course of Ōmaʻo Stream, while achieving a geometric alignment that would provide adequate sight distance by minimizing curvatures along the length of the road. The proposed road alignment was determined to be the most feasible, as it minimizes crossings of Ōmaʻo Stream, while providing the most direct alignment between the established termini.

2.1.3 Alternative Roundabout Intersections at Kōloa Road and Maluhia Road

With regard to improving traffic operations, roundabouts were considered for the intersections of the Northern Leg at both Maluhia Road and Kōloa Road, instead of the standard, four-way intersections of the proposed action. The advantage of the roundabouts is that it would allow motorists to travel through the intersections without extended delays, such as at a standard intersection. As previously indicated, the Kōloa-Poʻipū Area Circulation Plan's long-term recommendation for the Northern Leg involves replacing its intersection at Maluhia Road with a roundabout. Further, at a public informational meeting held on November 12, 2009 for the proposed Project, the possibility of including roundabouts at both intersections of the Northern Leg was raised.

An assessment was conducted to determine the potential functional and space requirements for a roundabout at each intersection, based on the ultimate four-lane configuration of the Northern Leg in the future. Such roundabouts would need to be sized and designed to function with four-lane approach roadways. A conceptual layout of a roundabout at the intersection of the Northern Leg at Maluhia Road is included in Figure 2-1. A similar roundabout concept would likely be required for the intersection of the Northern Leg at Kōloa Road.

Based on preliminary assessment, a roundabout at the Northern Leg intersection at Kōloa Road was determined to be unfeasible since additional road rights-of-way from adjacent lands would likely be required to accommodate the roundabout improvements. Acquisition of additional rights-of-way would impact the adjacent landowners, and potentially incur increased costs and delays to the development schedule. Furthermore, the Kōloa-Poʻipū Area Circulation Plan did not recommend replacing the intersection of the Northern Leg at Kōloa Road with a roundabout.

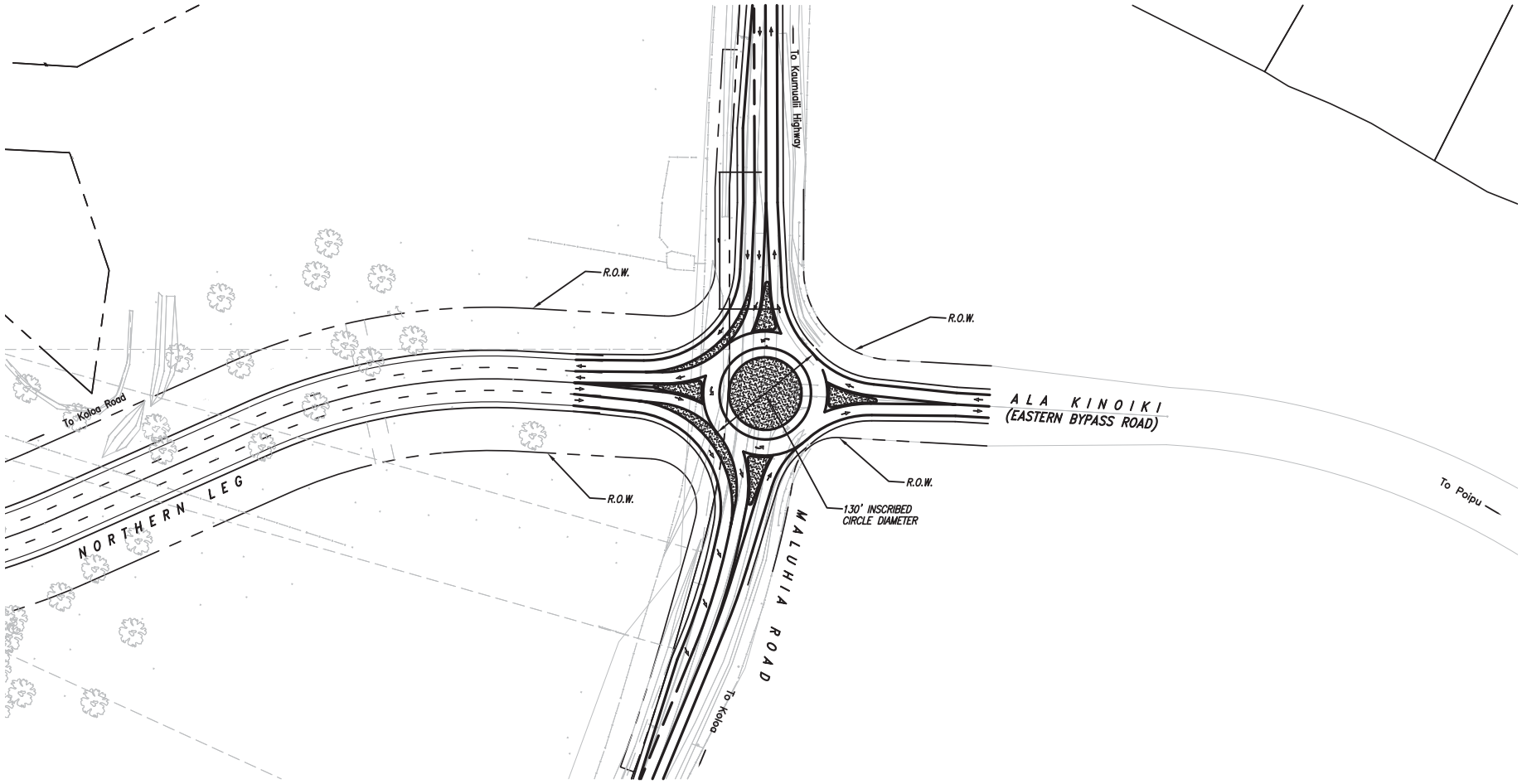
Similarly, construction of a roundabout at the Northern Leg intersection at Maluhia Road would potentially require the acquisition of additional road rights-of-way from adjacent lands to accommodate the necessary improvements. Acquisition of additional rights-of-way would impact the adjacent landowners, and potentially incur increased costs and delays to the development schedule. For these reasons, a roundabout at the Northern Leg intersection at Maluhia Road was eliminated from further consideration at this time. Should a roundabout at this intersection be considered in the future, an in-depth analysis would need to be conducted to determine the required improvements, and a separate environmental review may need to be undertaken at that time, as may be required.

2.2 Description of the Proposed Action

The proposed action involves the development of the Northern Leg segment of the existing Western Bypass Road from its terminus at Kōloa Road, mauka to Maluhia Road at its intersection with Ala Kinoiki (Eastern Bypass Road). The Northern Leg will include a bridge that will span Ōmaʻo Stream and its associated floodway area, as well as two wetland areas. At its southern end, Ōmaʻo Road will be realigned to intersect with the Northern Leg. The proposed Northern Leg and Ōmaʻo Road realignment improvements are collectively referred to as the "Project". Conceptual plans, sections and an elevation of the proposed Project improvements are included as Figures 2-2 to 2-7.

The Northern Leg will be approximately 0.4-mile in length, and configured within a 150-foot wide right-of-way. As indicated previously, the Northern Leg is initially planned to be a two-lane, two-way roadway based on current and projected traffic conditions to Year 2035. Ultimately, the Northern Leg is planned to be a four-lane, two-way roadway in the future. The 150-foot wide right-of-way is sufficient to accommodate the future four-lane roadway.

The Northern Leg roadway improvements will include two 12-foot wide asphalt-paved travel lanes in each direction, and six-foot wide asphalt-paved shoulders along both sides of the road. The unpaved areas beyond the roadway shoulders to the limits of the right-of-way will be graded to accommodate surface drainage from the road, and subsequently grassed to prevent soil erosion. Guardrails will be provided along areas of downward sloping grades along the sides of the roadway.



North Not to Scale

Northern Leg of the Western Bypass Road

CONCEPTUAL ROUNDABOUT LAYOUT

FIGURE

2-1

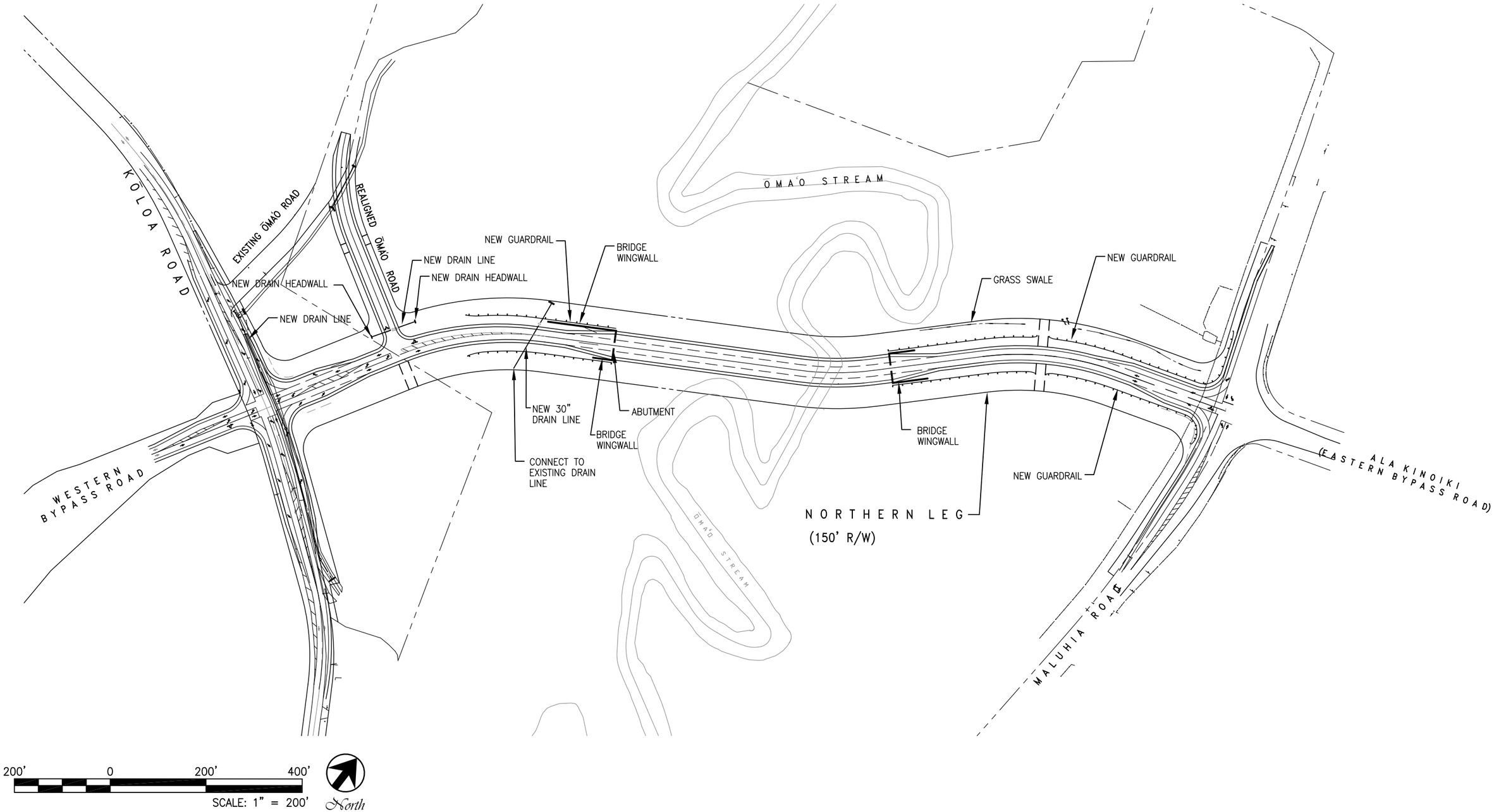
The Northern Leg will include an approximately 520-foot long bridge that will span the Ōmaʻo Stream crossing and associated floodway, and two wetland areas. A conceptual plan and elevation of the bridge is included as Figure 2-5. The bridge will be approximately 60 feet in width and will be striped to include two 12-foot wide travel lanes. Railings will be provided along both sides of the bridge. The 60-foot width of the bridge will be sufficient to accommodate the ultimate four-lane configuration of the Northern Leg. By initially designing and building the bridge to accommodate the ultimate four-lane configuration, additional construction costs and impacts associated with the bridge will be avoided when the Northern Leg is converted to four lanes in the future.

The bridge deck will be constructed of concrete and supported by concrete piers that will extend vertically into the ground. Additionally, concrete piers and abutments will be constructed at both ends of the bridge at the roadway approaches. The slope areas adjacent to the bridge abutments will be covered with reinforced material, such as grouted stone riprap, for slope protection. As may be required, retaining walls, composed of material such as concrete or concrete rubble masonry (CRM), will be constructed in areas of cut adjacent to the bridge abutments.

Specifically, the bridge improvements will be designed to avoid Ōmaʻo Stream and the two wetland areas. The concrete piers supporting the bridge deck will be strategically placed to avoid the wetlands and Ōmaʻo Stream. At the southern end of the bridge, the proposed bridge abutment and adjacent slope protection areas will be designed to avoid the wetland.

In conjunction with the Northern Leg, the southern end of the existing Ōmaʻo Road will be realigned to intersect with the Northern Leg, near its southern end. A conceptual plan of the proposed road realignment is included as Figure 2-6. Ōmaʻo Road is currently a two-lane, two-way County roadway generally oriented in the north-south direction, extending between Kaumualiʻi Highway to the north and Kōloa Road. Presently, the southern end of Ōmaʻo Road terminates at its intersection with Kōloa Road. The proposed realignment will eliminate the existing Ōmaʻo Road intersection at Kōloa Road and the associated traffic movement directly between those two roads. Thus, motorists traveling along the southern portion of Ōmaʻo Road will need to use the Northern Leg to access Kōloa Road. The realignment of Ōmaʻo Road is necessary because of the close proximity of its current intersection at Kōloa Road to the proposed Northern Leg intersection at Kōloa Road. Elimination of the current Ōmaʻo Road intersection at Kōloa Road will allow for a more efficient flow of traffic along Kōloa Road in the Project vicinity.

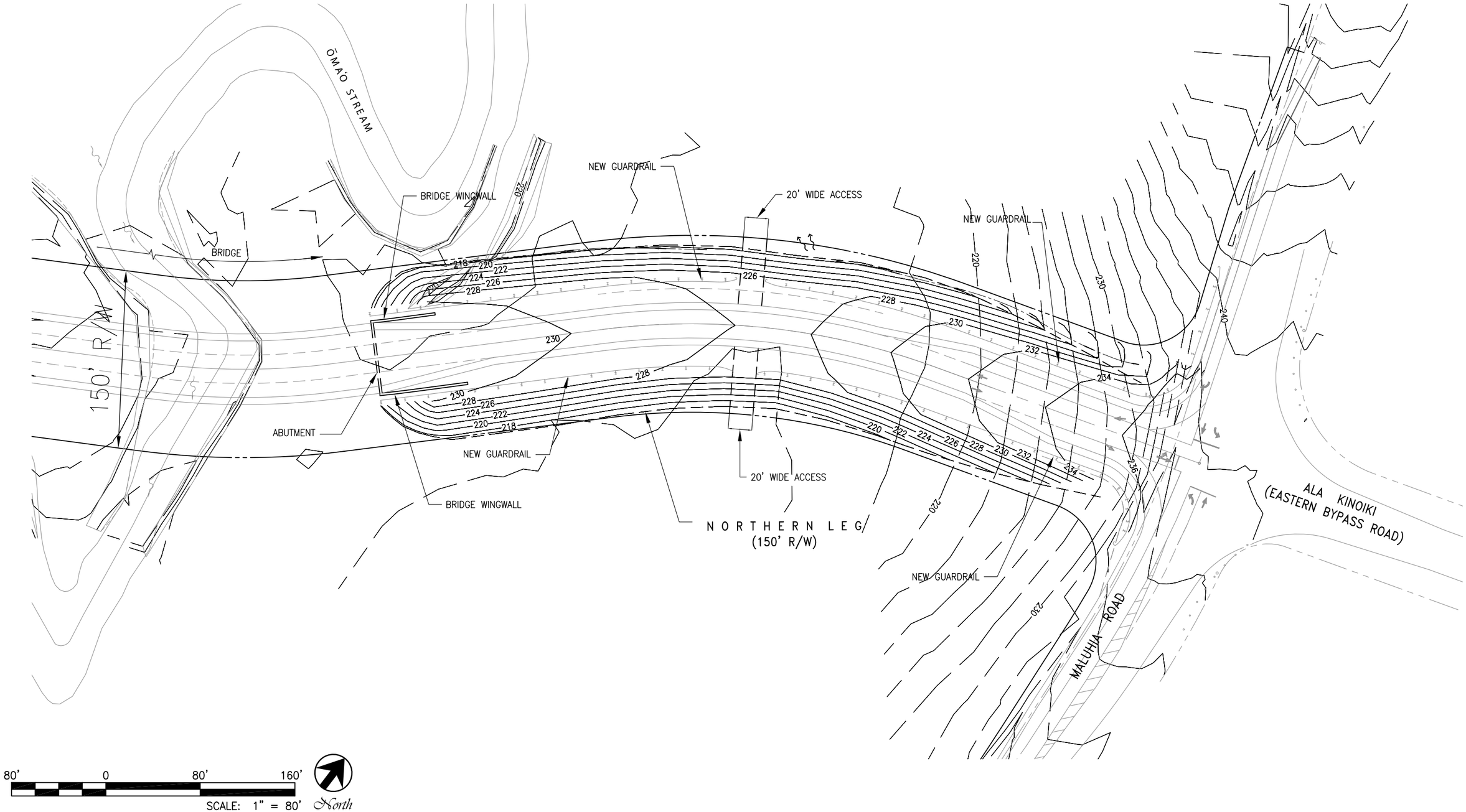
The realignment of the southern end of Ōmaʻo Road will occur approximately 250 feet mauka of its current intersection with Kōloa Road. The realigned road segment will transition from the existing Ōmaʻo Road through a gradual curve, and extend east approximately 410 feet before intersecting with the Northern Leg. The realigned Ōmaʻo Road will have a right-of-way width of 60 feet, and will include two 12-foot wide asphalt-paved travel lanes in each direction, and six-foot wide asphalt-paved shoulders along both sides of the road. The unpaved areas beyond the roadway shoulders to the limits of the right-of-way will be graded to accommodate surface drainage from the road, and subsequently grassed to prevent soil erosion.



Northern Leg of the Western Bypass Road

CONCEPTUAL ROAD PLAN

FIGURE 2-2

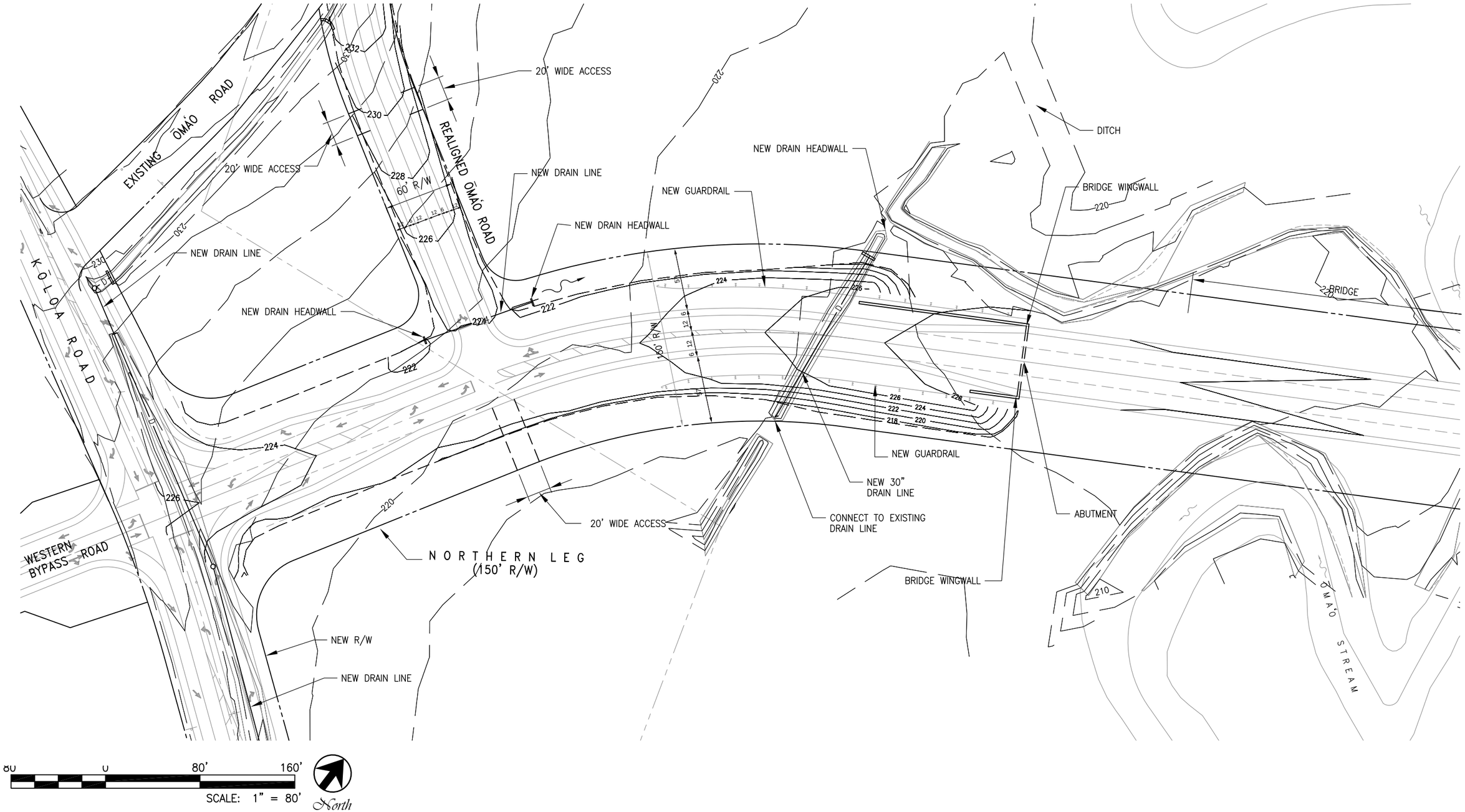


Northern Leg of the Western Bypass Road

CONCEPTUAL ROAD PLAN - NORTHERN LEG (NORTHERN PORTION)

FIGURE

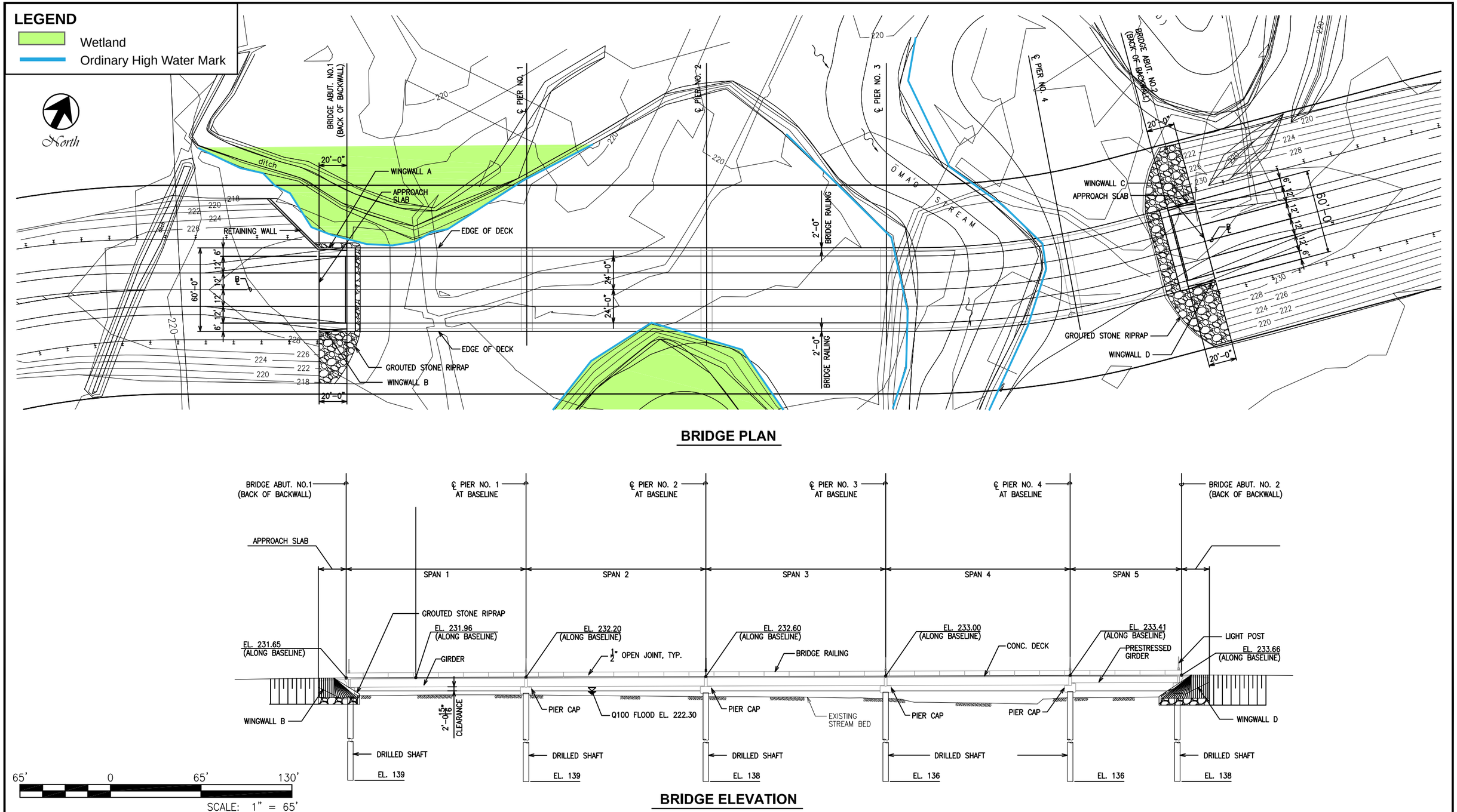
2-3



Northern Leg of the Western Bypass Road

CONCEPTUAL ROAD PLAN - NORTHERN LEG (SOUTHERN PORTION)

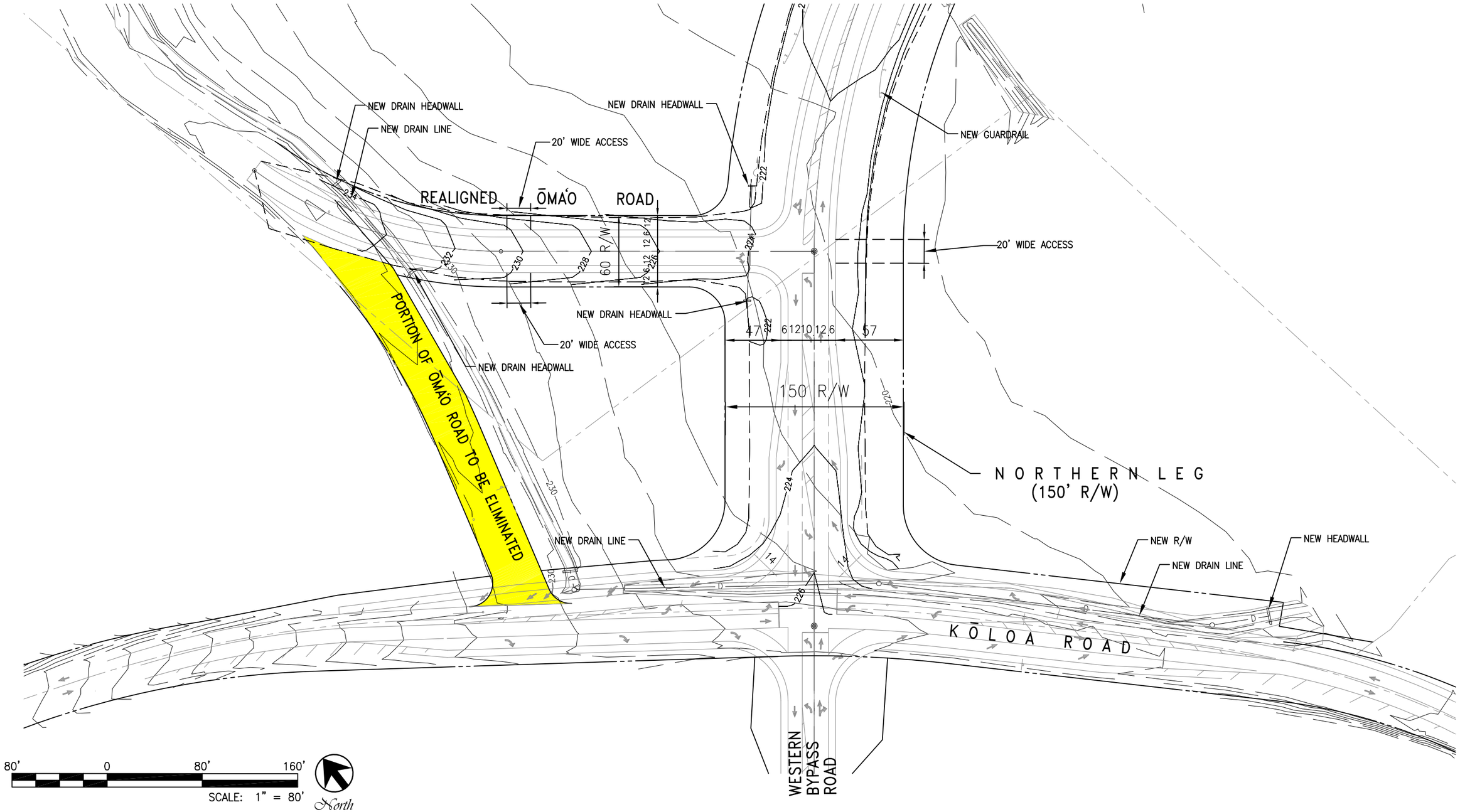
FIGURE 2-4



Northern Leg of the Western Bypass Road

CONCEPTUAL BRIDGE PLAN AND ELEVATION

FIGURE 2-5



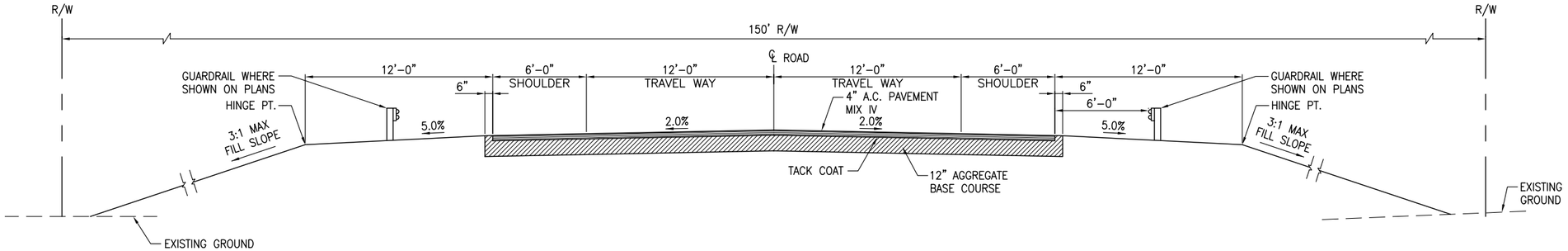
Northern Leg of the Western Bypass Road

CONCEPTUAL ROAD PLAN

Northern Leg / Koloa Road and Northern Leg / Realigned Ōmaʻo Road

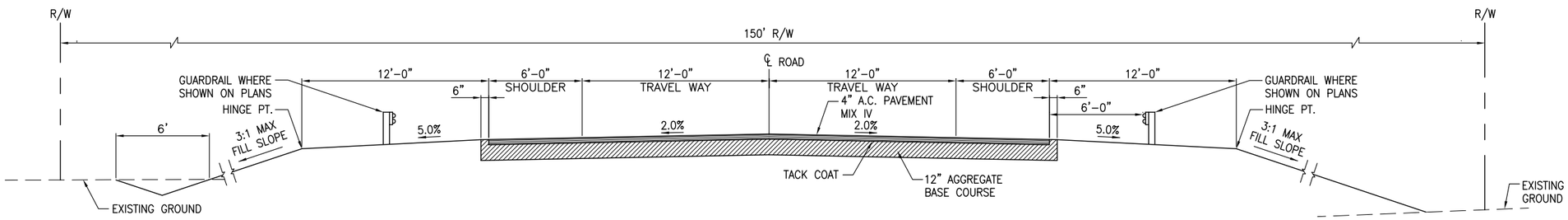
FIGURE

2-6



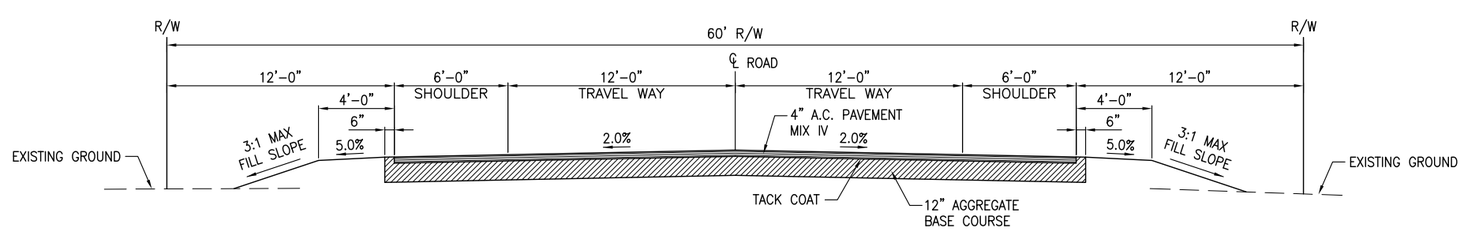
NORTHERN LEG - SOUTHERN PORTION

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



NORTHERN LEG - NORTHERN PORTION

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



REALIGNED ŌMA'O ROAD

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

Northern Leg of the Western Bypass Road

TYPICAL ROAD SECTIONS

FIGURE

2-7

Roadway improvements will be undertaken at the new intersections of the Northern Leg at Maluhia Road, Kōloa Road, and Ōmaʻo Road. At the Maluhia Road intersection, the eastbound improvements on the Northern Leg will include a shared-through and left-turn lane, and a right-turn lane onto Maluhia Road. On Maluhia Road, the northbound lane will be restriped to provide a left-turn storage lane for traffic turning into the Northern Leg. The southbound lane of Maluhia Road will be restriped to provide acceleration and deceleration lanes for traffic turning into and out of the Northern Leg. This intersection will be designed to operate as a stop-controlled intersection. The roadway improvements within the existing Maluhia Road right-of-way will consist of restriping improvements only. All other road improvements associated with this intersection will occur within the additional right-of-way to be created by the Northern Leg project.

At the Kōloa Road intersection, the southbound improvements on the Northern Leg will include a through lane, a left-turn storage lane, and a right-turn lane. On Kōloa Road, the westbound lane will be restriped to provide acceleration and deceleration lanes for traffic turning into and out of the Northern Leg. The eastbound lane of Kōloa Road will be restriped to provide for a left-turn storage lane for traffic turning into the Northern Leg. This intersection will be designed to operate as a stop-controlled intersection. The roadway improvements within the existing Kōloa Road right-of-way will consist of restriping improvements only. All other road improvements associated with this intersection will occur within the additional right-of-way to be created by the Northern Leg project.

At the intersection of the realigned Ōmaʻo Road, the southbound improvements on the Northern Leg will include a shared through and right-turn lane. The northbound improvements will include a through lane and a left-turn storage lane. On the realigned Ōmaʻo Road, the eastbound lane will include a shared left-turn and right-turn lane. This intersection will be designed to operate as a stop-controlled intersection.

The proposed Project improvements will be designed to meet Federal, State and County of Kauaʻi standards, as applicable. The provision of bikeway and pedestrian facilities along the Northern Leg corridor will be considered in the future. There is adequate right-of-way width along the Northern Leg corridor to accommodate future bikeway and pedestrian facilities. The Northern Leg will have a posted speed limit of 25 miles per hour.

The proposed Project improvements will require temporary and/or permanent relocation or removal of existing utility poles and overhead lines along the adjacent roadways in the nearby Project vicinity. Street lighting is proposed to be provided in conjunction with the proposed Project, and will be shielded or of the cut-off luminaire or indirect lighting types. New drainage improvements, including drain headwalls, drain lines, grass swales, and culverts, will be provided in conjunction with the proposed Project improvements.

<u>Right-of-Way Acquisition</u>: Development of the proposed Project improvements will require the acquisition of privately-owned property. The proposed corridor of the Northern Leg and realigned portion of Ōmaʻo Road, and the Project areas adjacent to the Maluhia Road and Kōloa Road intersections, are wholly within three privately-owned parcels under the ownership of two entities. These parcels are identified as: 1) TMKs: (4) 2-7-003: 002 (por.) and 014 owned by McBryde Sugar Company, Limited; and 2) TMK: (4) 2-8-006: 001 (por.) owned by CGB Partners. These parcels are shown on Figures 1-3 and 1-4, respectively.

Zoning Ordinance No. PM-2004-370 (Condition No. 9) for the Kukui‘ula development requires Kukui‘ula Development Company (Hawai‘i), LLC to assist the County in acquiring the Northern Leg right-of-way from the owners of the lands mentioned above. Accordingly, Kukui‘ula Development Company (Hawai‘i), LLC is currently in the process of acquiring the rights-of-way for the Northern Leg and the realigned portion of Ōma‘o Road from the respective landowners.

Construction Access and Staging Areas: Potential temporary staging areas for mobilization and storage of construction equipment and materials would be located at designated areas within the 150-foot wide Northern Leg right-of-way. The construction staging areas will be located away from the immediate vicinity of Ōma‘o Stream and the wetlands to avoid potential impacts to those areas. As may be required, construction access easements to the Project Site will be obtained from the adjacent landowners.

2.3 Project Schedule and Cost

Construction of the proposed Project is anticipated to commence by 2013, with completion by 2015, subject to funding. The Project cost is estimated at $26.0 million, which will be funded by the County and FHWA.

3. DESCRIPTION OF THE EXISTING ENVIRONMENT, PROJECT IMPACTS AND MITIGATION MEASURES

The following is a description of the existing environment, assessment of potential impacts and proposed measures to mitigate potential adverse impacts resulting from the proposed Project.

3.1 Climate

The climate of Kaua‘i, relatively moderate throughout most of the year, is characterized as semi-tropical with two seasons. The summer period from May through September is generally warm and dry, with predominantly northeast trade winds. In contrast, the winter season from October through April is associated with lower temperatures, higher rainfall and less prevalent trade winds.

The semi-arid climate of Po‘ipū and Kōloa is typically dry and sunny. Winds are predominantly trade winds from the east or northeast, with wind speeds averaging about 11 to 12 miles per hour. Occasional storms may generate strong winds from the south (Kona winds) for brief periods. Temperatures in the area are generally very moderate, with average daily temperatures ranging from about 68 degrees Fahrenheit (°F) to 81°F. Average annual rainfall in the Project area is approximately 40 to 45 inches, with the summer months being the driest.

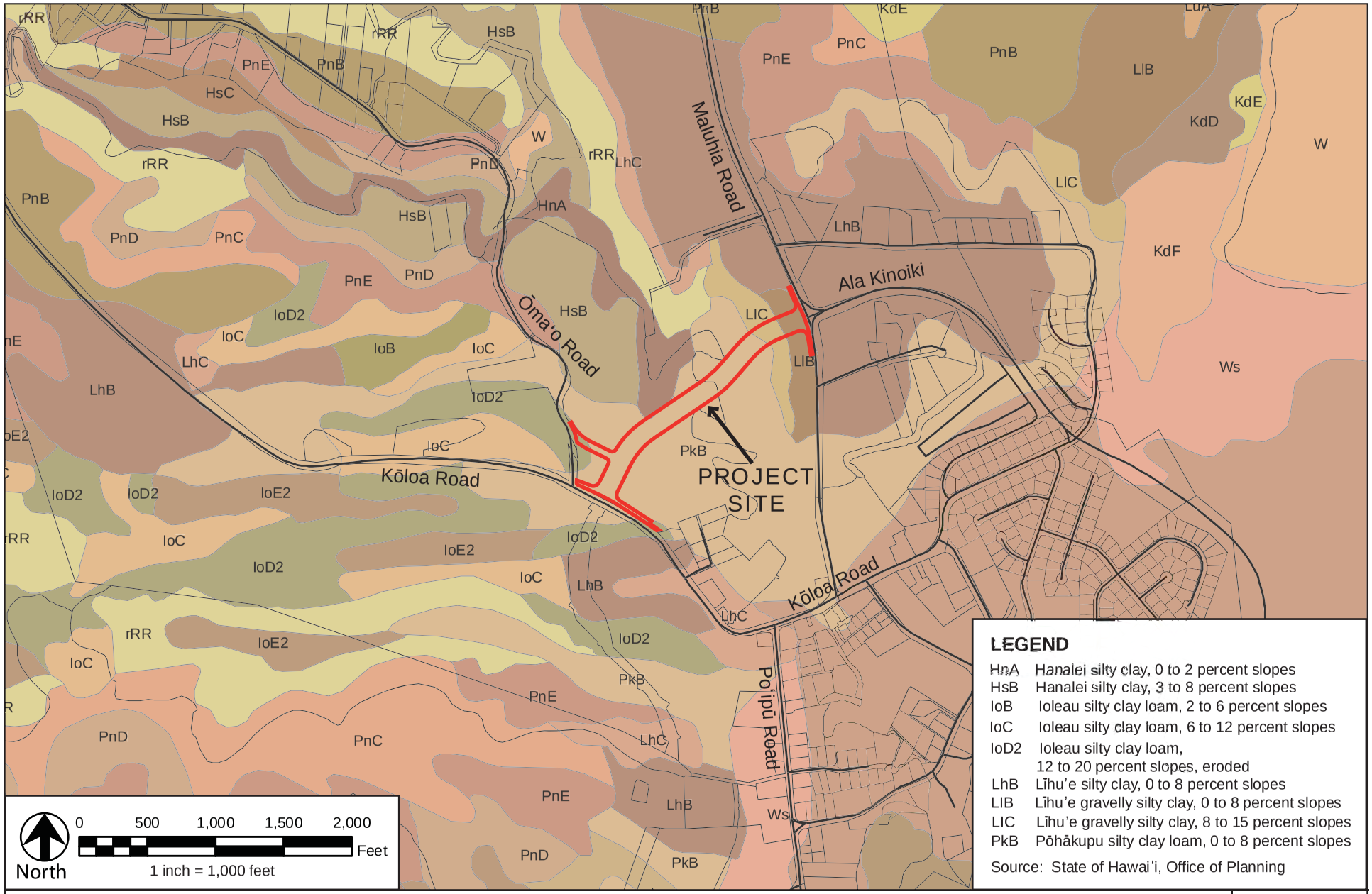
3.2 Geology, Topography and Soils

Geology: The Island of Kaua‘i is geologically one of the oldest and structurally complex islands in the State, consisting principally of a large volcano, the Kaua‘i shield, which became active approximately four million years ago. The Island’s land mass was formed by two major volcanic series identified as the Waimea Canyon Volcanic Series and the Kōloa Volcanic Series. The Waimea Volcanic Series, which is more than 3 million years old, refers to the flows that formed the original volcanic shield and caldera of the Island. The Kōloa Volcanic Series, which is less than 1.5 million years old, refers to subsequent flows that overlaid much of the Waimea Volcanic Series formations on the lower slopes of the Island. The Kōloa Volcanic Series consists of a range of formations from olivine basalt to nepheline basalt. These rocks are much less permeable than some of the rocks of the Waimea Canyon Volcanic Series as they were deposited as nearly flat layers that tend to be massive and devoid of permeability elements.

The regional geology consists of the Kōloa Volcanic Series overlying the Waimea Canyon Series. The Kōloa Volcanic Series thickens toward the south coast of the Island, and the composition ranges from alkalic olivine basalt through basanites to nephelinites and melilite nephelinites.

Topography: The topography of the Project Site is relatively level, ranging in elevation from approximately 210 feet above mean sea level (msl) at the southern end at Kōloa Road, to about 240 feet above msl at the northern end at Maluhia Road.

Soils: The U.S. Department of Agriculture Natural Resources Conservation Service classifies the soils within the Project Site as the Pohakupu series, Līhu‘e series, and Ioleau series (see Figure 3-1).



Northern Leg of the Western Bypass Road

SOILS MAP

FIGURE 3-1

The predominant soil type within the Project Site is classified as Pohakupu silty clay loam, 0 to 8 percent slopes (PkB). This soil is well-drained, has smooth slopes, and occurs on terraces and alluvial fans. The representative profile of the surface layer is dark, reddish-brown silty clay loam about 13 inches thick. The subsoil, 40 to more than 60 inches thick, is dark reddish-brown and dark-brown silty clay loam that has angular and subangular blocky structure. The substratum is strongly weathered gravel. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight.

The soil type within the northern portion of the Project Site is classified as Līhuʻe gravelly silty clay, 0 to 8 percent slopes (LIB) and Līhuʻe gravelly silty clay, 8 to 15 percent slopes (LIC). The Līhuʻe series consists of well-drained soils developed in material weathered from basic igneous rock. Within this soil type, runoff is slow and the erosion hazard is slight.

The soil type within the southwestern and southeastern portions of the Project Site is classified as Ioleau silty clay loan, 12 to 20 percent slopes, eroded (IoD2). The Ioleau series consists of well-drained soils on uplands. These soils developed in material weathered from basic igneous rock, probably mixed with volcanic ash. This soil type is similar to Ioleau silty clay loam, 6 to 12 percent slopes, except that it is moderately steep and part of the surface layer has been removed by erosion. Runoff is rapid, and the erosion hazard is moderate to severe.

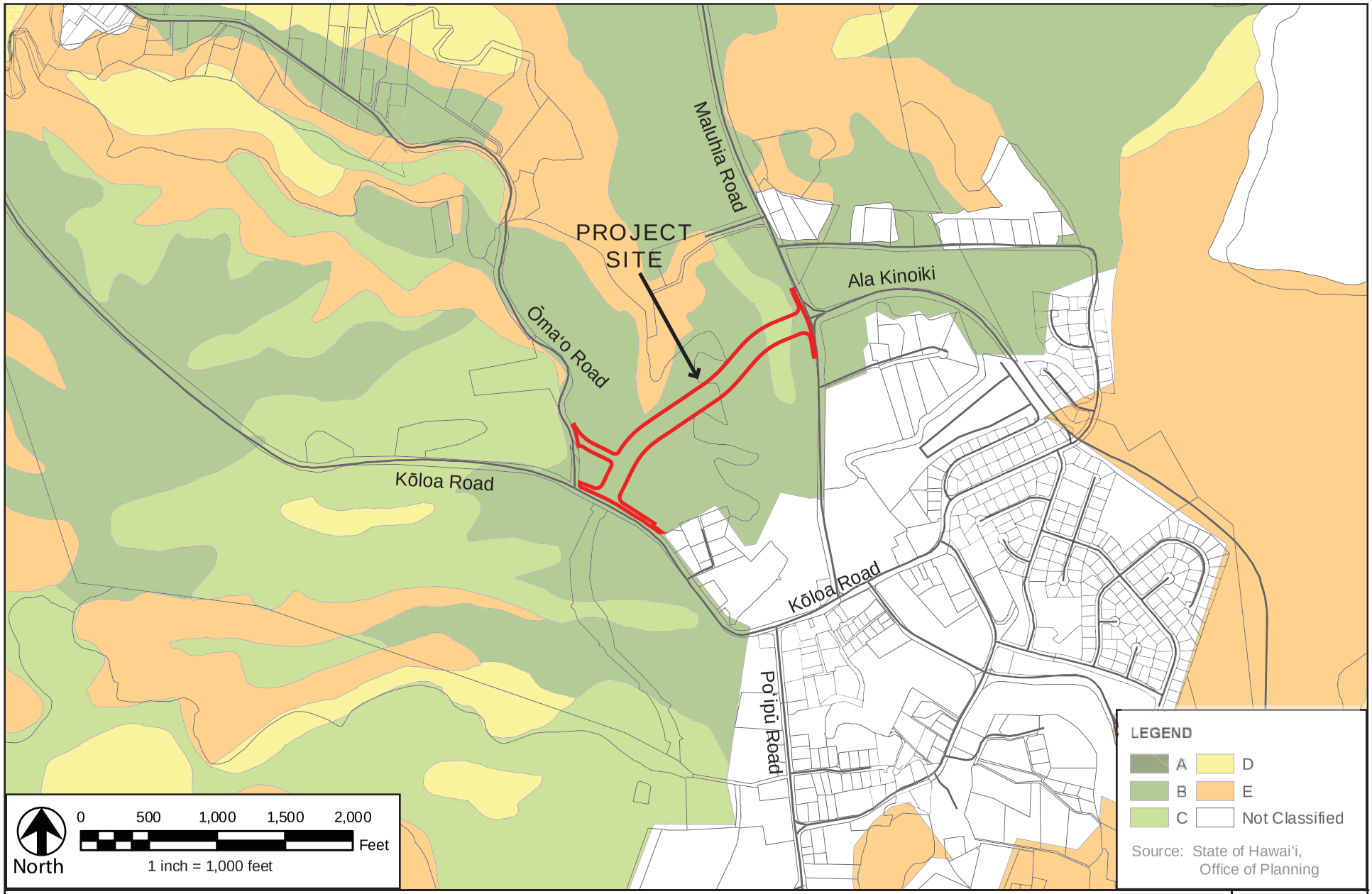
The *Detailed Land Classification - Island of Kauaʻi* published by the University of Hawaiʻi Land Study Bureau (LSB) evaluates the quality or productive capacity of certain lands on the Island for selected crops and overall suitability in agricultural use. A five-class productivity rating system was established, with “A” representing the class of highest productivity and “E” the lowest. The majority of the Project Site is classified as “B” rated soils, except for a small area within the northern portion which is classified as “C” rated soils (see Figure 3-2).

The State Department of Agriculture’s *Agricultural Lands of Importance in the State of Hawaiʻi* (ALISH) established a classification system for identification of agriculturally important lands. Three classes of lands were established for the State, primarily, but not exclusively, on the basis of soil characteristics. The three classes of ALISH lands are Prime Agricultural Land, Unique Agricultural Land, and Other Important Agricultural Land. Lands not included under this system are “unclassified”. The majority of the Project Site is classified as Prime Agricultural Land (see Figure 3-3). The remaining areas within the central, southwestern and southeastern portions of the Project Site are classified as Other Important Agricultural Land.

The Project area was previously in sugar cane cultivation by McBryde Sugar Company, Limited. In 1995, sugar cane cultivation within the Project area ceased with the closing of McBryde’s Sugar Company, Limited’s sugar plantation operations on Kauaʻi. The area in the immediate vicinity of the southern portion of the Northern Leg corridor is currently in agricultural cultivation for banana crops and an ornamental plant nursery. This use of the property is currently under an agreement between the landowner and the tenant.

Impacts and Mitigation Measures

No significant impacts to the geology, topography and soils are anticipated with the construction and operation of the proposed Project. Construction of the proposed Project improvements will involve grading and excavation of presently undeveloped and developed areas within the Project Site. Potential water quality impacts to surface and near shore coastal waters during

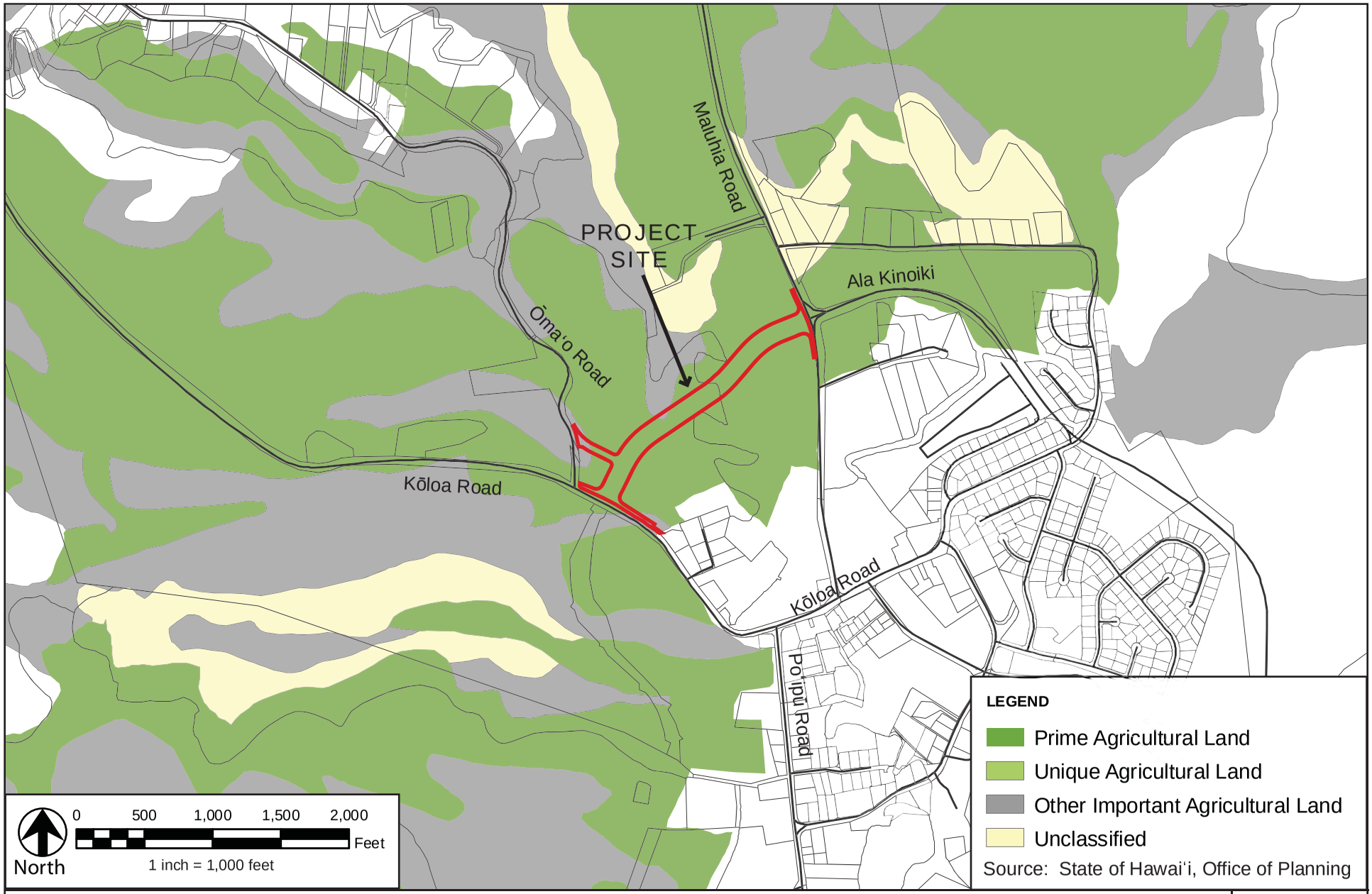


Northern Leg of the Western Bypass Road

UNIVERSITY OF HAWAI'I LAND STUDY BUREAU MAP

FIGURE

3-2



Northern Leg of the Western Bypass Road

FIGURE

3-3

AGRICULTURAL LANDS OF IMPORTANCE IN THE STATE OF HAWAI'I MAP

construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Associated with Construction Activity administered by the State Department of Health (DOH) will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural Best Management Practices (BMPs) such as silt fences and minimizing time of exposure between construction and re-vegetation. Following the associated construction activity, the excavated areas will be paved over or backfilled to its existing contours or re-vegetated to control erosion.

Construction of the proposed Project will require structural fill in areas to provide a level road surface along its alignment, and to achieve the required elevation for the bridge approaches. Approximately 34,000 cubic yards (CY) of fill will be required for the proposed Project. The slope areas adjacent to the bridge abutments will be covered with reinforced material, such as grouted stone riprap, for slope protection. As may be required, retaining walls, composed of material such as concrete or CRM, will be constructed in areas of cut adjacent to the bridge abutments.

The Project improvements will displace a portion of the agricultural cultivation currently occurring in the immediate vicinity of the southern portion of the Project Site. That such displacement would occur as a result of the Northern Leg has been documented in various State and County transportation and land use planning documents.

Coordination will be undertaken with the U.S. Department of Agriculture, Natural Resources Conservation Service to determine if a Farmland Conversion Rating Form (AD-1006) will be required for the proposed Project.

3.3 Hydrology

3.3.1 Surface Waters

A water quality survey of Ōmaʻo Stream was conducted by AECOS, Inc. in June 2010 for the proposed Project as part of a biological and water quality survey of the stream. The survey report is included in Appendix B and is summarized below.

In the vicinity of the Project Site, Ōmaʻo Stream meanders across land currently in agriculture and pasture use. Ōmaʻo Stream, along with Pōʻeleʻele Stream and Waihohonu Stream, originate in the lower slopes of the Līhuʻe-Kōloa Forest Reserve, flow through numerous reservoirs and diversion ditches, and converge makai of the Project Site to form Waikomo Stream. The Waikomo watershed is comprised of Waikomo Stream, its tributaries and reservoirs, and the lands that these water bodies drain. Previously, the Waikomo watershed was predominantly in sugar cane cultivation; however, much of that land has since been converted to diversified agriculture and pasture land.

Waikomo Stream is classified by the State Department of Land and Natural Resources, Division of Aquatic Resources (DLNR-DAR) as a perennial stream, with a total stream length of 21.6 miles. Waikomo Stream flows through the coastal flats of Poʻipū and enters the ocean at Kōloa Landing, approximately 1.8 miles makai of the Project Site.

In the immediate Project vicinity, Ōmaʻo Stream is incised from three to six feet into the floodplain, with cut-off meanders[2] present. The stream banks are moderately steep. Ōmaʻo Stream and the cut-off meanders surveyed are overgrown with hau (*Hibiscus tiliaceus*) in the general area, but the stream course is open in the area of the proposed Northern Leg crossing. Pastured horses have access to the stream in the vicinity and downstream of the proposed road crossing, and water quality may be affected by feces of these horses.

During the survey, water quality samples were collected at three locations along Ōmaʻo Stream in the vicinity of the proposed Northern Leg crossing. The locations of the three stations were: 1) just upstream from the proposed road crossing in the hau forest (Upstream station); 2) off the left bank within the proposed road crossing (Impact station); and 3) just downstream of the proposed road crossing in a short riffle zone (Downstream station).

The samples were analyzed for six basic water quality characteristics, including temperature, dissolved oxygen, pH, conductivity, turbidity, and total suspended solids, as well as four nutrient characteristics, including ammonia, nitrate+nitrite, total nitrogen, and total phosphorus. The water quality results are shown in Tables 1 and 2.

Table 1
Basic Water Quality Characteristics - Ōmaʻo Stream

Station	Temp. (^oC)	DO (mg/l)	DO sat. (%)	pH	Conductivity (µmhos/cm)	Turbidity (ntu)	TSS (mg/l)
Upstream	22.3	5.56	64	6.58	157	14.1	8.3
Impact	21.7	5.44	62	6.78	226	10.8	5.3
Downstream	22.0	6.30	72	6.81	156	15.0	8.7
Arithmetic/ Geometric Mean	**22.0**	**5.77**	**66**	**6.72**	**178**	**13.2**	**7.3**

Key: DO = Dissolved Oxygen TSS = Total Suspended Solids mg/L = milligrams per liter
µmhos/cm = micrograms per centimeter

Table 2
Nutrient Water Quality Characteristics – Ōmaʻo Stream

Station	Ammonia (µg/NL)	Nitrate+Nitrite (µg/NL)	Total Nitrogen (µg/NL)	Total Phosphorus (µg/PL)
Upstream	10	396	678	59
Impact	12	388	662	55
Downstream	6	387	648	59
Geometric Mean	**9**	**390**	**663**	**58**

Temperatures and pH measured at the three stations are typical of streams in the coastal plain. Dissolved oxygen (DO) was low at all three stations, although slightly higher at the Downstream station. Conductivity levels show some groundwater input, particularly at the Impact station. Turbidity levels were high at all three stations, although TSS was not. All nitrogen moiety concentrations (NH_3, NO_3 + NO_2, and Total N) were elevated, and total phosphorous was slightly elevated at all three stations.

[2] A "cut-off meander", also referred to as an oxbow, is a looped section of a meandering stream channel that is abandoned by the main stream flow shorting across the top of the loop.

Water quality criteria for ammonia have not been promulgated for streams. The DO saturation levels are all below the 80 percent minimum specified by the State criterion; however, the stations were located in areas with relatively sluggish flow. The pH levels were all within the criterion of >5.5 and <8.5 pH units. Stream conductivities were below the maximum allowed State criterion of 300 µmhos/cm.

Waikomo Stream is listed on the State DOH's 2006 list of impaired waters in Hawai'i, prepared under the Federal Clean Water Act, Section 303(d). This listing indicates that Waikomo Stream may not meet the State Water Quality Standards for certain parameters. Waikomo Stream is listed as exceeding the wet season water quality standards for nitrates, Total N, and turbidity.

Wetlands: Two wetlands associated with Ōma'o Stream are located within the central portion of the Project Site as shown on Figure 2-5. The wetlands were delineated by AECOS Consultants in May 2007. By letter dated June 18, 2008, the U.S. Department of the Army, Corps of Engineers issued a determination that Ōma'o Stream and the two abutting wetlands are waters of the U.S. subject to their jurisdiction. The approved jurisdictional determination is valid until June 18, 2013. Any proposed Project activities that involve the placement and/or discharge of dredged and/or fill material into these waters or any other waters of the U.S., will require a Department of the Army permit prior to conducting work.

The downstream wetland in the eastern portion of the Northern Leg corridor is within the curve of the Ōma'o Stream bed. The wetland area encompasses all of the stream bed from the bottom of the steep, high (10 to 15 feet) bank. Typical of Ōma'o Stream in the area, the stream bed in this area is overgrown with a dense stand of hau (*Hibiscus tiliaceus*). Shading by the hau severely limits other vegetation. The stream bed consists of fine sediment, with indications of anoxic conditions.

The upstream wetland in the western portion of the Northern Leg corridor includes a southward projecting cut-off meander. The cut-off meander is separated from the adjacent field by a steep soil bank approximately four feet high. The wetland is limited to the area that serves as an outlet channel for a non-wetland drainage ditch in the agriculture area west of Ōma'o Stream, directing outflow towards the stream. The outlet channel is approximately 9 to 12 feet in width and supports no vegetation. There is evidence that the channel carries water during floods. The flow could be overflow from the active stream channel of Ōma'o Stream to the north, but clearly includes local runoff because it is fed by a normally dry, non-wetland drainage ditch.

Impacts and Mitigation Measures

No significant impacts on surface waters are anticipated as a result of the construction and operation of the proposed Project.

The Project improvements will be designed and constructed to avoid Ōma'o Stream and the two abutting wetlands. The Northern Leg bridge will span across Ōma'o Stream and the abutting wetlands. The concrete piers supporting the bridge deck will be strategically placed to avoid Ōma'o Stream and the wetlands. The piers would be installed utilizing the drilled shaft construction method. Drilled shaft construction is typically employed to provide deep foundations for buildings, bridges, retaining walls, and to stabilize landslides. An auger will drill holes into the soil to the required depth for installation of the piers. A temporary casing would be used if caving or water bearing soils are encountered. Steel rebar cages would be placed

into the drilled holes to form the drilled shaft, and concrete would be poured into the drilled holes to form the piers. The excess soil material that is excavated from the drilling operations would be used as fill within the Project Site or at other locations, depending on its quality and usefulness, or transported off-site for proper disposal.

At the southern end of the bridge, the proposed bridge abutment and adjacent slope protection areas will be designed to avoid the nearby wetland. The slope areas adjacent to the bridge abutments will be covered with reinforced material, such as grouted stone riprap, for slope protection. As may be required, retaining walls, composed of material such as concrete or CRM, will be constructed in areas of cut adjacent to the bridge abutments.

Potential water quality impacts to surface waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation. No construction activities in conjunction with the Project will occur within Ōmaʻo Stream and the two abutting wetlands.

For dewatering that may be required during excavation or construction of the proposed Project improvements, a NDPES General Permit for Construction Activity Dewatering would be required for discharging dewatering effluent into waters of the U.S. The permit will require appropriate BMPs, an erosion control plan, and a water quality monitoring plan to mitigate any impacts on receiving waters.

Following construction, the Project improvements will produce no adverse effects from storm runoff to adjacent and downstream areas. New drainage improvements, including drain headwalls, drain lines, grass swales, and culverts, will be provided in conjunction with the proposed Project improvements.

3.3.2 Ground Water

Ground water occurs within portions of geologic formations called aquifers that are favorable for receiving, storing and transporting water. The Island of Kauaʻi is divided into three Aquifer Sector Areas, consisting of the Līhuʻe Aquifer Sector Area, comprising the eastern portion of the Island; the Hanalei Aquifer Sector Area, comprising the northern portion of the Island; and the Waimea Aquifer Sector Area, comprising the western portion of the Island. The Project Site is located within the Līhuʻe Aquifer Sector Area. The Aquifer Sector Areas are divided into Aquifer System Areas which are defined by hydrogeological continuity, particularly hydraulic connections among units.

The Līhuʻe Aquifer Sector Area is comprised of five Aquifer System Areas, including the Kīlauea, Anahola, Wailuā, Hanamāʻulu, and Kōloa Aquifer System Areas. The Project Site is located within the Kōloa Aquifer System Area. The State DLNR, Commission on Water Resource Management (CWRM) has adopted a sustainable yield of 30 million gallons per day (mgd) for this aquifer. Recent estimates indicate that current ground water withdrawals from the system total approximately three mgd.

The surface geology of the Kōloa Aquifer System Area consists mainly of post-erosional Kōloa Volcanics overlying older thin-bedded shield-building flank lavas of the Nāpali Member and dike-intruded caldera lava and breccia of the Haupu Members. Basal aquifers occur within the Nāpali Member Basalts and Kōloa Volcanics. Water level records of wells drilled below the Kōloa Volcanics into flank flows show head elevations ranging from 30 to 140 feet above msl, suggesting mixed basal and high-level conditions in wells and drilled holes near Lāwaʻi. Deeply buried dikes may control ground water levels. Perched ground water occurs in the Kōloa Volcanics as small, discontinuous aquifers that vary in thickness and size. Large and small streams in the Kōloa Aquifer System Area may receive a portion of flow from perched spring discharge. As most of the rainfall in the Kōloa Aquifer System Area infiltrates into the Kōloa Volcanics, much of the ground water in the System may be perched. High-level dike water has not been clearly identified, but probably exists.

Impacts and Mitigation Measures

Construction activities associated with the proposed Project are not likely to introduce any materials which could adversely affect ground water.

Following construction, operations of the Project improvements will not result in any adverse impacts on ground water.

3.3.3 Coastal Waters

The coastal waters located approximately 1.8 miles makai of the Project Site are classified as Class AA waters by the State DOH. The Class AA waters span approximately two miles of coastline between Hoai Bay, just west of the Waikomo Stream estuary, and Makahūʻena Point to the east. Class AA waters are high quality coastal waters classified by the DOH with the objective that "these waters remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions." *(Water Quality Standards, Title 11, Chapter 54, Hawaiʻi Administrative Rules)*.

Impacts and Mitigation Measures

No significant impacts on near shore coastal waters are anticipated as a result of the construction and operation of the proposed Project.

Potential water quality impacts to the near shore coastal waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation. No construction activities in conjunction with the Project will occur within Ōmaʻo Stream.

Following construction, the Project improvements will produce no adverse effects from storm runoff to adjacent and downstream areas. New drainage improvements, including drain headwalls, drain lines, grass swales, and culverts, will be provided in conjunction with the proposed Project improvements.

3.4 Natural Hazards

3.4.1 Flood Hazard

According to the Flood Insurance Rate Map (FIRM) prepared by the Federal Emergency Management Agency (FEMA), the central portion of the Project Site in the vicinity of Ōmaʻo Stream is designated "Floodway Areas in Zone AE" (see Figure 3-4). The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. The areas bordering both sides of this Floodway Area are designated Zone "AE", "Special flood hazard areas subject to inundation by the 1% annual chance flood, with base flood elevations determined." The base flood elevation for Zone "AE" within the Project Site is 220 feet above msl. By comparison, the Project Site elevation ranges from approximately 210 feet above msl at the southern end at Kōloa Road, to about 240 feet above msl at the northern end at Maluhia Road. The areas bordering both sides of Zone "AE" are designated Zone "X", "Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood." The remainder of the Project Site within the northern and southern ends is designated Zone "X", "Areas determined to be outside the 0.2% annual chance floodplain".

Impacts and Mitigation Measures

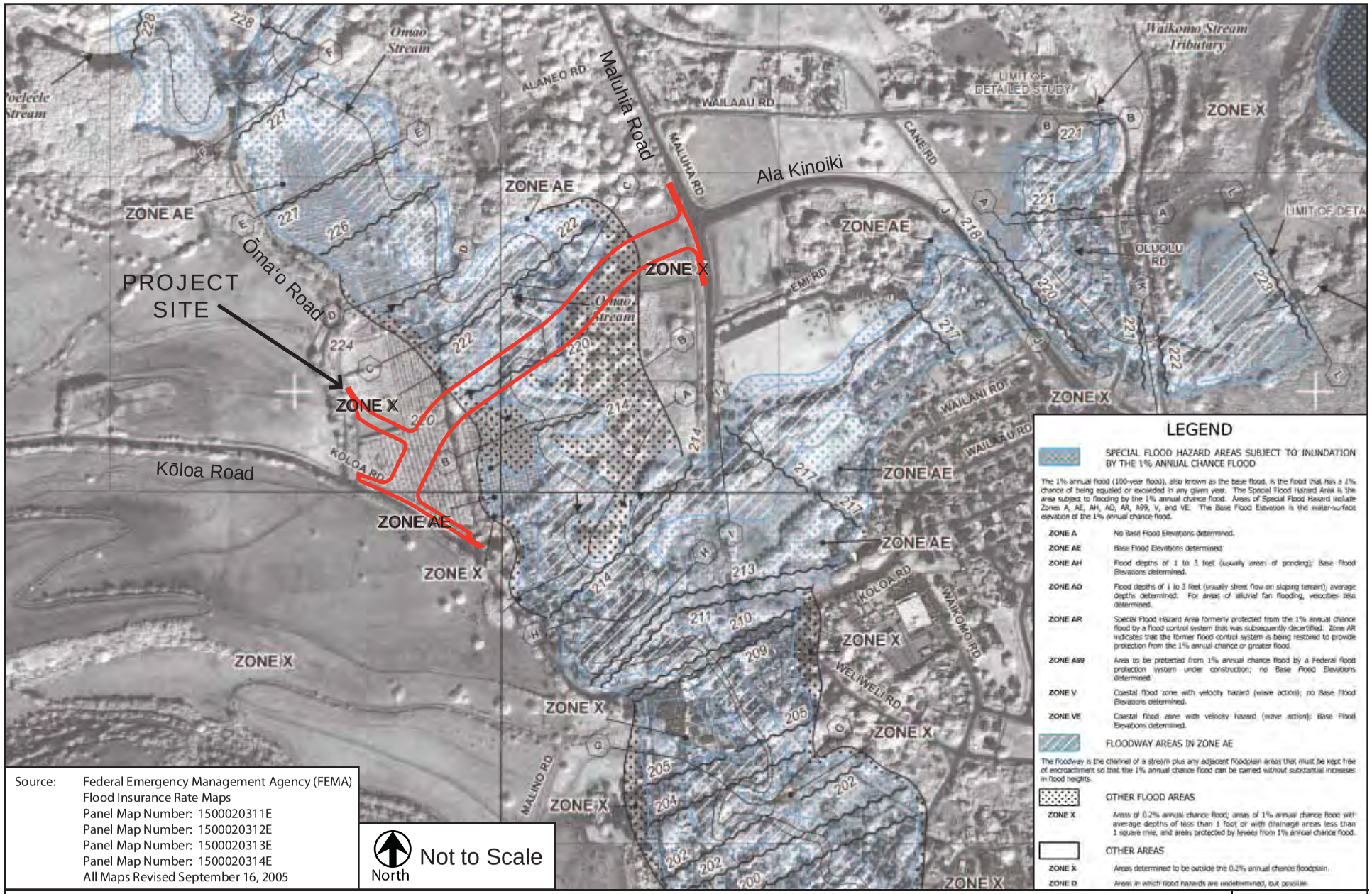
Construction and operation of the proposed Project are not anticipated to result in flooding of the Project area or to increase flood risks to properties lying uphill or downhill of the Project Site.

The Northern Leg bridge will be designed to span the Ōmaʻo Stream crossing and associated designated floodway area. Concrete piers supporting the bridge will extend vertically into the ground. The bridge will be designed and constructed to meet the current standards for flood elevation. The current standard is for a two-foot minimum freeboard from finished deck elevation to the 100-year water surface elevation. The proposed Project improvements will be designed and constructed in full compliance with the flood plain management requirements of the County. This will include certification by a registered professional civil engineer that the Project improvements will not result in any increase in base flood elevations during the occurrence of base flood discharges.

3.4.2 Seismic Activity

Earthquakes in the Hawaiian Islands are primarily associated with volcanic eruptions from the expansion or shrinkage of magma reservoirs. The Island of Kauaʻi is periodically subject to episodes of seismic activity of varying intensity, but available historical data indicates that the number of major earthquakes occurring on Kauaʻi have been generally fewer and of lower intensity compared with the other islands, such as the Big Island.

The Uniform Building Code (UBC) provides minimum design criteria to address potential for damages due to seismic disturbances. The UBC scale is rated from Seismic Zone 1 through Zone 4, with Zone 1 being the lowest level for potential seismic-induced ground movement. Kauaʻi is designated Seismic Zone 1.



Northern Leg of the Western Bypass Road

FIGURE

3-4

FLOOD ZONE MAP

Impacts and Mitigation Measures

The proposed Northern Leg bridge will be designed and constructed to meet the requirements of the latest version of the American Association of State Highway and Transportation Officials (AASHTO) load-and-resistance factor design (LRFD) to ensure that potential seismic activities do not adversely affect the bridge structure.

3.5 Flora

A botanical survey of the Project Site was conducted by AECOS Consultants in February 2009, revised June 2010. The botanical survey is included in Appendix C and is summarized below.

Existing vegetation within the Project Site largely reflects current land uses, including pasture shrubs and grasses, and edible and ornamental agriculture. The majority of the plant species found during the survey are introduced (non-native), of which many are ruderal species found in highly disturbed environments. A total of 83 species of flowering plants and two species of ferns were identified within the Project Site. Of the 83 species, only four (or 4.8 percent) are indigenous, none are endemic, and several are early Polynesian introduced, including ornamentals within the agriculture area. The native species are all commonly occurring botanical species.

As part of the biological and water quality survey of Ōmaʻo Stream conducted in June 2010, the vegetation near the stream was observed. Ōmaʻo Stream and the cut-off meanders surveyed are vegetated with a dense grove of hau (*Hibiscus tiliaceus*). The stream banks and nearby sediment bars support California grass (*Urochloa mutica*). During an ecological inspection of Ōmaʻo Stream conducted in February 2007 for the wetland delineation, other vegetation observed included ironwood (*Casuarina equisetifolia*), Java plum (*Syzygium cumini*), and albizia (*Falcataria moluccana*). As previously indicated, two wetlands associated with Ōmaʻo Stream are located within the central portion of the Project Site as shown on Figure 2-5. Further discussion of the wetlands is included in Section 3.3.1 of this EA.

No listed, candidate, or proposed threatened or endangered botanical species under either the Federal or State endangered species statutes were found within or adjacent to the Project Site during the survey.

Impacts and Mitigation Measures

As the Project Site does not provide a unique habitat, no significant impacts on botanical species are anticipated from the construction and operation of the proposed Project. No listed, candidate, or proposed threatened or endangered botanical species under either the Federal or State endangered species statutes will be disturbed as a result of the proposed Project.

3.6 Vertebrate Fauna

A faunal survey of the Project Site was conducted by Rana Productions, Ltd. in February 2009, revised June 2010. The faunal survey is included in Appendix C and is summarized below.

A total of 140 individual birds of 17 species, representing 14 separate families, were recorded during the survey. One recorded species, the Pacific Golden-Plover (*Pluvialis fulva*), is an indigenous migratory shorebird that nests in the high Arctic, returning to Hawaiʻi and the tropical Pacific during the Fall and Winter months annually. The remaining 13 species are regularly encountered alien species, common in the low- to mid-elevation areas of the Island. The

Japanese White-eye (*Zosterops japonicus*), Common Myna (*Acridotheris tristis*), and Red Junglefowl (*Gallus gallus*) were the most commonly recorded bird species. During a 2003 faunal survey conducted of the same general right-of-way, the Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*), a common native species, was observed along Ōma‘o Stream. It is likely that this avian species utilize resources within the Project Site for foraging on a regular basis.

No listed, candidate, or proposed threatened or endangered avian species under either the Federal or State endangered species statutes were recorded during the survey.

Although not detected during the survey, both the endangered Hawaiian Petrel (*Pterodroma sandwichensis*) and the threatened, endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*) have been recorded overflying the general Project area between April and the end of November each year. Additionally, the Save Our Shearwaters Program has recovered both species from the general Project area annually over the past three decades.

There are no nesting colonies or nesting habitat for either of these two listed seabird species within or in close proximity to the Project Site. The two closest, historically known Newell's Shearwater colonies to the Project Site are, or were located at Kaluahonu, approximately three miles to the northeast, and above Kalāheo, more than 4.5 miles to the northwest. The only presently known Hawaiian Petrel colonies are located in remote valleys, inland from the north and northeast shores of the Island.

The primary cause of mortality for the Hawaiian Petrels and Newell's Shearwaters is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai‘i. Nocturnally flying seabirds, especially fledglings on their way to sea in the Summer and Fall, can become disoriented by exterior lighting. When disoriented, seabirds often collide with man-made structures, and if they are not killed outright, the dazed and injured birds are easy targets of opportunity for feral mammals.

By letter dated October 8, 2008, in response to the pre-assessment consultation conducted for this Draft EA, the USFWS stated that the Band-rumped Storm Petrel (*Oceanodroma castro*), a species of concern seabird, is known to traverse the Project area.

Mammalian species detected during the survey include a dog (*Canis f. familiaris*), horses (*Equus c. caballus*), and a mule (*Equus asinus x Equus caballus*). Tracks and sign of a cat (*Felis catus*) and pig (*Sus s. scrofa*) were observed within the Project Site.

No listed, candidate, or proposed threatened or endangered mammalian species under either the Federal or State endangered species statutes were recorded during the survey.

Although no Hawaiian hoary bats (*Lasiurus cinereus semotus*) were detected during the survey, this endangered species has been recorded foraging for insects in the general vicinity of the Project Site in the recent past. Hawaiian hoary bats are widely distributed in the lowland areas of the Island, and have been documented in and around almost all areas that have some dense vegetation.

Although no rodents were observed during the survey, it is likely that the roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*), and Polynesian rat (*Rattus exulans Hawai'iensis*) use various resources within the Project Site.

Impacts and Mitigation Measures

No significant impacts on vertebrate fauna within the Project Site are anticipated from the construction and operation of the proposed Project. No listed, candidate, or proposed threatened or endangered avian and mammalian species under either the Federal or State endangered species statutes will be disturbed or adversely impacted as a result of the proposed Project. To reduce the potential for interactions between nocturnally flying Hawaiian Petrels, Newell's Shearwaters, and Band-rumped Storm Petrels with external lights, street lighting proposed for the Project will be shielded or of the cut-off luminaire or indirect lighting types. In addition, night time construction activities will not be undertaken in conjunction with the proposed Project improvements.

It is unknown whether the Hawaiian hoary bat utilizes the Project Site as a roosting site. The potential impact that construction of the proposed Project would have on the Hawaiian hoary bat is during grubbing and clearing of the dense vegetation along Ōma'o Stream. Since females carry their pups during the pupping season, which occurs between April and early August, they may be less able to quickly vacate roosting sites during clearing of such habitat. To avoid potential impacts to the Hawaiian hoary bat, it is recommended that clearing of the dense *hau* vegetation along Ōma'o Stream be conducted outside of the pupping season.

3.7 Invertebrate Fauna

Although subterranean habitat for the endemic, endangered Kaua'i cave wolf spider (*Adelocosa anops*) and the Kaua'i cave amphipod (*Spelaeorchestia Kōloana*) have been identified in the Kōloa-Po'ipū region, the Project Site is not located within any of the Critical Habitat Units designated for these two cave species by the U.S. Fish & Wildlife Service's (USFWS) Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Kaua'i Cave Wolf Spider and Kaua'i Cave Amphipod; Final Rule (50 CFR 17) published on April 9, 2003. In addition, extensive ground alteration has previously occurred within the Project Site due to prior sugar cane cultivation.

Impacts and Mitigation Measures

Since the Project Site is not located within any of the Critical Habitat Units designated for the endemic, endangered Kaua'i cave wolf spider and the Kaua'i cave amphipod by the USFWS' Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Kaua'i Cave Wolf Spider and Kaua'i Cave Amphipod; Final Rule (50 CFR 17) published on April 9, 2003, it is not anticipated that the development of the Project will have an adverse impact on both species or their habitat. In the unlikely event that either listed species is encountered during development of the Project, construction will be halted, consultation with the USFWS will be initiated, and appropriate mitigative measures will be implemented.

3.8 Aquatic Fauna

A biological survey was conducted by AECOS, Inc. in June 2010 as part of the biological and water quality survey of Ōma'o Stream. The survey report is included in Appendix B and is summarized below.

During the survey, the only aquatic species (including insects, crustaceans, amphibians, and fishes) observed in Ōmaʻo Stream in the Project vicinity were introduced species. No Federal or State listed endangered or threatened aquatic species, or native migratory (amphidromous) species were observed during the survey, and none is anticipated to utilize stream habitats in the Project area. Although none was observed during the survey, the ʻoʻopu nakea (*Awaous guamensis*), a native amphidromous species, is reported in the Waikomo watershed.

The State DLNR-DAR has conducted surveys in unspecified reservoirs in the Waikomo watershed. In addition to the species found during the survey of Ōmaʻo Stream for the proposed Project, DLNR-DAR also reports *Awaous guamensis* (*ʻoʻopu nakea*), Giant Marine Toad (*Bufo marinus*), Tahitian Prawn (*Macrobrachium lar*), Sunfish (*Lepomis* sp.), Black Bass (*Micropterus* sp.), *Tilapia* sp., and unidentified cyprinidae as being present in the watershed. *A. guamensis* is a native goby and *M. lar* is an introduced prawn, both of which are amphidromous and may migrate through the Project area.

Impacts and Mitigation Measures

No significant impacts on aquatic fauna within the Project Site are anticipated from the construction and operation of the proposed Project. No Federal or State listed endangered or threatened aquatic species will be disturbed or adversely impacted as a result of the proposed Project.

One native amphidromous species, ʻoʻopu nakea (*Awaous guamensis*), is reported in the Waikomo watershed. Chapters 13-100 and 188-43.5, HAR, regulate the taking of all ʻoʻopu in Hawaiʻi waters. No Project improvements will be constructed within the Ōmaʻo Stream bed that would impede the migration of native aquatic fauna.

3.9 Air Quality

An air quality study was conducted for the proposed Project by B.D. Neal & Associates in May 2010. The purpose of the study is to assess the potential short- and long-term air quality impacts that could occur from the construction and operation of the proposed Project, and recommend mitigative measures to reduce any potential air quality impacts, as appropriate. The air quality study is included in Appendix D and is summarized below.

Ambient concentrations of air pollution are regulated by both national and State ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaiʻi AAQS are defined in Chapter 11-59, HAR. Presently, seven parameters are regulated, including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone, and lead. Hawaiʻi air quality standards are comparable to the national standards, except those for nitrogen dioxide and carbon monoxide, which are more stringent than the national standards.

Present air quality in the Project area is mostly affected by air pollutants from motor vehicles, industrial sources, agricultural operations, and, to a lesser extent, by natural sources. Arterial roadways in the Project area, such as Kōloa Road, Maluhia Road, Poʻipū Road, and Ala Kinoiki, presently carry moderate to heavy levels of vehicle traffic during peak traffic hours. Sources of industrial air pollution are located at Port Allen, approximately eight miles to the west. Prevailing winds from the east or northeast will carry these emissions away from the Project area most of the time. Minor emissions of dust may occur from farming and ranching activities in the area.

The State DOH operates a network of air quality monitoring stations at various locations around the State, but very little data is available for Kaua‘i. Based on annual summaries of air quality measurements for particulate (as PM-10) at the Līhu‘e Monitoring Station for the period 2002 through 2006, all values reported were within the State and national AAQS.

Although very little ambient air quality data is available to characterize existing conditions, the present air quality of the Project area appears to be reasonably good. Based on available information, it appears likely that all national air quality standards are currently being met, although occasional exceedances of the more stringent State standards for carbon monoxide may occur near congested roadway intersections.

Impacts and Mitigation Measures

Short-term direct and indirect impacts on air quality could potentially occur during construction of the Project. Two potential types of air pollution emissions that could directly result in short-term air quality impacts include: 1) fugitive dust from vehicle movement and soil excavation; and 2) exhaust emissions from on-site construction equipment. Indirectly, there could also be short-term impacts from: 1) slow-moving construction equipment traveling to and from the Project Site; 2) a temporary increase in local traffic caused by commuting construction workers; and 3) the disruption of normal traffic flow caused by roadway lane closures.

Potential air quality impacts resulting from construction activities will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60, Air Pollution Control. The construction contractor(s) will be responsible for complying with the State DOH regulations that prohibit visible dust emissions at property boundaries. Thus, an effective dust control plan would be implemented during construction to ensure compliance with State regulations. Fugitive dust emissions would be controlled to a large extent by watering of active work areas, utilizing wind screens, keeping adjacent paved roads cleaned, and covering of open-bodied trucks. Other dust control measures would include limiting the area of disturbance at any given time, mulching or chemically stabilizing inactive areas that have been worked on, and paving and landscaping of Project areas early in the construction schedule. To alleviate potential obstruction of the normal flow of traffic, roadways would be kept open during peak traffic hours, and heavy construction equipment and workers would be moved to and from the construction areas during off-peak traffic hours.

After construction is completed, use of the proposed Project by motor vehicle traffic could potentially result in long-term impacts on ambient air quality in the Project area.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly, compared to a few years ago. These restrictions on emissions from new motor vehicles will lower average emissions each year as older vehicles leave the State’s roadways. It is estimated that carbon monoxide emissions, for example, will be reduced an average of about 25 to 30 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To assess the potential long-term impact of emissions from motor vehicles operating on the new roadway following completion of construction, a computerized air quality modeling study was undertaken. The air quality modeling study estimated current worst-case concentrations of carbon monoxide at the five key intersections in the Project vicinity identified in the Traffic

Assessment Report (TAR) for the Project (see Section 3.15), and predicted future levels both with and without the proposed Project. In performing the air quality impact analysis, it was assumed that all recommended traffic mitigation measures included in the TAR would be implemented.

The results of the modeling study in the form of estimated worst-case 1-hour and 8-hour morning and afternoon ambient carbon monoxide concentrations are summarized in Table 3.

Table 3
Estimated Worst-Case 1-Hour and 8-Hour Carbon Monoxide Concentrations Along Roadways of the Northern Leg of the Western Bypass Road (milligrams per cubic meter)

Roadway Intersection	1-Hour Carbon Monoxide Concentrations						8-Hour Carbon Monoxide Concentrations		
	Year/Scenario						Year/Scenario		
	2010/ Present		2015/ Without Project		2015/ With Project		2010/ Present	2015/ Without Project	2015/ With Project
	AM	PM	AM	PM	AM	PM			
Kōloa Road at Ōmaʻo Road	2.1	1.5	2.2	1.5	-	-	1.0	1.1	-
Ōmaʻo Road at Western Bypass Road	-	-	-	-	1.4	1.2	-	-	0.7
Kōloa Road at Western Bypass Road	2.2	1.3	2.5	2.1	3.0	2.2	1.1	1.2	1.5
Kōloa Road at Poʻipū Road	2.2	2.0	3.1	3.2	2.4	2.4	1.1	1.6	1.2
Kōloa Road at Maluhia Road	2.1	2.0	3.3	4.0	2.2	2.8	1.0	2.0	1.4
Maluhia Road at Ala Kinoiki	1.6	2.1	2.2	2.2	3.0	2.5	1.0	1.1	1.5
	Hawaiʻi State AAQS: 10 National AAQS: 40						Hawaiʻi National AAQS: 5 National AAQS: 10		

During worst-case conditions, model results indicate that present (Year 2010) 1-hour and 8-hour worst-case carbon monoxide concentrations are well within both the State and national ambient air quality standards. In Year 2015 without the Project, worst-case carbon monoxide concentrations are predicted to increase due to added traffic, but concentrations would still remain well within standards. With the Project in Year 2015, worst-case carbon monoxide concentrations are projected to increase compared to the without Project scenario at the intersections of the Northern Leg with Kōloa Road and with Maluhia Road, but concentrations would still remain relatively low and well within standards. Other locations studied along Kōloa Road would benefit from reduced traffic volumes and experience reduced carbon monoxide concentrations. Due to the small impact the Project is expected to have on air quality, implementing mitigation measures for long-term traffic-related air quality impacts is probably unnecessary and unwarranted.

3.10 Noise

A noise study was conducted for the proposed Project by Y. Ebisu & Associates in May 2010. The purpose of the study is to assess the potential short- and long-term noise impacts that could occur from the construction and operation of the proposed Project, and recommend noise abatement alternatives, as appropriate. The noise study is included in Appendix E and is summarized below.

The Base Year 2010 (Calendar Year (CY) 2010) was used for calculating changes in traffic and background ambient noise levels between the Base Year and the Build Alternative. The Future Year 2035 (CY 2035) was used in calculating future traffic noise levels under the Build Alternative. The CY 2035 corresponds to the Year 2035 scenario analyzed in the TAR for the Project to assess traffic operating conditions with the full build-out of currently planned projects in the Kōloa-Poʻipū area.

The FHWA Traffic Noise Model, Version 2.5 (TNM) was used as the primary method for calculating CY 2010 and future traffic noise levels, with model parameters adjusted to reflect terrain, ground cover, and local shielding conditions. The State Department of Transportation's (DOT) 66 Leq(h)[3] and 71 Leq(h)[4] noise abatement criteria and 15 dB increase criteria were applied to all noise sensitive buildings closest to the proposed Project alignment.

Existing traffic and background ambient noise levels were measured at seven locations in the Project area. The closest noise sensitive residential structures to the proposed Northern Leg corridor are located approximately 400 feet to the southeast along Kōloa Road, approximately 500 feet to the east along Ala Kinoiki, and approximately 500 feet to the north along Wailaau Road. These are identified as noise sensitive receptor locations in the noise study.

The CY 2010 traffic noise levels at the study locations during the PM peak traffic hour are shown in Table 4.

CY 2010 traffic noise levels currently exceed the 66 Leq noise abatement criteria at 50 feet from the centerline of Maluhia Road north of Ala Kinoiki, and at 50 feet from the centerline of Kōloa Road north and south of the Western Bypass Road. The 66 Leq criteria is not exceeded at 50 feet from the centerlines of Ala Kinoiki, Maluhia Road south of Ala Kinoiki, and the Western Bypass Road.

[3] Equivalent (or Average) Hourly Sound Level for noise sensitive uses.
[4] Equivalent (or Average) Hourly Sound Level for commercial/industrial uses.

Table 4 Existing (CY 2010) Traffic Volumes and Noise Levels (PM Peak Hour)			
Roadway Section	**50 FT Leq**	**100 FT Leq**	**150 FT Leq**
Ala Kinoiki Rd. East of Maluhia Rd.	64.4	59.2	56.5
Maluhia Rd. North of Ala Kinoiki Rd.	69.1	63.9	61.3
Maluhia Rd. South of Ala Kinoiki Rd.	61.4	56.2	53.4
Kōloa Rd. North of Western Bypass Rd.	70.0	64.5	61.7
Kōloa Rd. South of Western Bypass Rd.	69.2	63.8	61.0
Western Bypass Rd. West of Kōloa Rd.	60.9	55.6	52.8
1. All distances shown are from the center of roadways. 2. Calculated Leqs are for unobstructed line-of-sight conditions.			

Impacts and Mitigation Measures

Short-term noise impacts will be unavoidable during the duration of construction of the proposed Project improvements. Operation of heavy construction equipment such as trucks, compactors, generators, and pavers, will raise ambient noise levels in the Project vicinity. Unavoidable construction noise impacts will be mitigated to some degree by complying with the provisions of the State DOH Administrative Rules, Title 11, Chapter 46, "Community Noise Control" regulations which require a noise permit if the noise levels from construction activities are expected to exceed the allowable noise levels stated in the Rules. The hours of permitted construction noise operations specified in the Rules will be adhered to and enforced. It shall be the contractor's responsibility to minimize noise by properly maintaining noise mufflers and other noise-attenuating equipment, and to maintain noise levels within regulatory limits. Potential noise impacts will also be mitigated by performing construction work during daytime hours, as opposed to nighttime work.

CY 2035 traffic noise levels were developed for the Build Alternative along the Northern Leg corridor using the future PM peak hour traffic volumes from the Project's TAR. The CY 2035 traffic noise levels at the study locations during the PM peak traffic hour are shown in Table 5.

Table 5 Future (CY 2035) Traffic Volumes and Noise Levels (With Project - PM Peak Hour)			
Roadway Section	**50 FT Leq**	**100 FT Leq**	**150 FT Leq**
Ala Kinoiki Rd. East of Maluhia Rd.	65.5	60.3	57.6
Maluhia Rd. North of Ala Kinoiki Rd.	74.0	68.9	66.3
Maluhia Rd. South of Ala Kinoiki Rd.	65.9	60.7	58.0
Kōloa Rd. North of Western Bypass Rd.	71.4	65.9	63.1
Kōloa Rd. South of Western Bypass Rd.	69.9	64.4	61.6
Western Bypass Rd. West of Kōloa Rd.	68.8	63.5	60.7
Proposed Northern Leg Rd. West of Maluhia Rd.	67.6	62.4	59.7
Proposed Northern Leg Rd. East of Ōmaʻo Rd.	67.6	62.4	59.7
Proposed Northern Leg Rd. West of Ōmaʻo Rd.	68.1	62.9	60.2
Ōmaʻo Connector Rd. at Proposed Northern Leg Rd.	58.7	53.4	50.7
Proposed Northern Leg Rd. East of Kōloa Rd.	68.1	62.9	60.2
1. All distances shown are from the center of roadways. 2. Calculated Leqs are for unobstructed line-of-sight conditions.			

Future traffic noise levels are not expected to exceed the DOT's 66 or 71 Leq(h) noise abatement criteria by CY 2035 under the Build Alternative at existing noise sensitive or commercial structures within the limits of the Project. By 2035, traffic noise contributions from the proposed Project should not exceed 48 dB (Leq) at the existing noise sensitive receptors which are closest to the proposed Northern Leg. In addition, the 15 dB increase criteria should not be exceeded at any existing receptor located within the limits of the Project since no residences, public use facilities, or park lands are expected to be located along the proposed Northern Leg prior to its construction. Therefore, traffic noise mitigation measures should not be required for this Project. The Northern Leg is located relatively far from existing noise sensitive developments in the Project vicinity. Furthermore, the nearby areas surrounding the Northern Leg are presently mostly vacant and undeveloped.

It is anticipated that potential noise impacts at any new noise sensitive or commercial establishments located in the Project area may be mitigated through the inclusion of sound walls or other noise mitigation measure within those development plans. In addition, any new commercial establishments, public use facilities, or housing units which may be planned alongside the Northern Leg corridor represent areas of potential adverse noise impacts if adequate noise mitigation measures are not incorporated into the planning of those future projects. It is anticipated that the Project's roadway improvements will be completed prior to any redevelopment of the presently open areas adjacent to the Project corridor, and that noise abatement measures, such as adequate setbacks, sound-attenuating walls or berms, or closure and air-conditioning, will be incorporated into those new developments, as required.

3.11 Hazardous Materials

A Phase I Environmental Site Assessment (ESA) of the Project Site was conducted by Clayton Group Services, Inc. in November 2003. Historical research confirmed that the subject property and immediately adjoining lands were formerly utilized for agricultural and/or ranching purposes. Based on available historical records, the subject property has remained either undeveloped or fallow agricultural land since 1950.

The ESA revealed no evidence of recognized environmental conditions (RECs), as defined by the American Society for Testing and Materials (ASTM), in connection with the subject property. The following environmental issue was identified in connection with the subject property, although it is not deemed to be a *recognized environmental condition* as defined by ASTM:

> "Past use of agricultural chemicals on lands previously used for commercial agricultural purposes has the potential to impact the subject property. However, there was no evidence of storage, mixing or excessive use of agricultural chemicals at the subject property. Moreover, according to Chapter 128D, Environmental Response Law, HAR, the presence of agricultural chemicals does not constitute a release of hazardous substance. Section 128D-1, HAR, excludes "any release resulting from the legal application of a pesticide product registered under the Federal Insecticide, Fungicide, and Rodenticide Act."

This finding is not considered a recognized environmental condition because there was no evidence of a release of pesticides and/or herbicides on the subject property. In addition, according to Chapter 128D, HAR, the presence of agricultural chemicals does not constitute a release.

Impacts and Mitigation Measures

The Project is not anticipated to generate any hazardous material impacts during construction and operation of the proposed improvements.

3.12 Historic and Archaeological Resources

An archaeological inventory survey of the proposed Northern Leg corridor was conducted by Cultural Surveys Hawai‘i, Inc. in October 2003. Subsequently, a supplemental archaeological assessment and cultural background study was conducted by Cultural Surveys Hawai‘i, Inc. in March 2010. This supplemental assessment covered five small areas within the Project Site that are proposed for intersection improvements at both ends of the Northern Leg corridor, and the proposed realigned Ōma‘o Road corridor, that were not included in the archaeological inventory survey. The archaeological inventory survey and supplemental archaeological assessment and cultural background study are included in Appendix F and Appendix G, respectively, and are summarized below.

Although much of the seaward portion of Kōloa is a relatively dry area, the perennially flowing streams in the area provided a resource for the development of a rather expansive agricultural system. Accounts of the early history of Kōloa describe the lands mauka of Kōloa Town as a seemingly continuous, well-maintained, agricultural complex of taro, yams, sweet potato, and sugar cane that was irrigated by an extensive ‘auwai system siphoned off of Waikomo and Pō‘ele‘ele Streams. This system had a significant influence on later commercial endeavors in Kōloa.

Kōloa is the site of the first organized sugar plantation in Hawai‘i. Ladd and Company leased about 1,000 acres for the sole purpose of growing sugar cane. The commercialization of sugar cane in Kōloa had widespread social effects. The traditional view of the ‘āina being a responsibility of the ali‘i was being transformed.

Kōloa Town, along with Kōloa Landing located at the mouth of Waikomo Stream, became prominent commercial centers during the mid- to late-1800s, exporting a variety of products, such as sweet potatoes, sugar, and molasses. Whalers also stopped for provisions of squash, salt, salt beef, pigs, and cattle. This heightened activity dramatically altered the social structure and landscape of Kōloa.

Kōloa soon reflected the effects of a traditional social structure in conflict with commercially-impelled forces of change. Traditional settlement patterns (e.g., permanent and temporary habitation interspersed throughout the irrigated agricultural fields near the coastal zone, and along streams in the steeper valleys inland) would have been significantly changed by a flux to Kōloa Town where sugar cane milling activities were located. Later, land use in the study area (i.e., sugar cane, pasture, macadamia nut farm development, and banana cultivation) also had detrimental impacts on any surviving traditional structures.

During the inventory survey, no historic or indigenous sites or artifacts were encountered, and none are believed to exist in the area of likely impact. Any indigenous activity that could have been observed would likely have been destroyed during the years when much of this portion of Kōloa was used for sugar cane cultivation. A small concrete and iron dam, associated with sugar cane cultivation, was located in a ditch traversing through the southwest portion of the

Project Site currently being utilized for agriculture cultivation. However, the dam was not regarded as a historic property more than 50 years old.

During the supplemental field inspection, no historic properties were observed in the five small areas within the Project Site. Furthermore, none are believed to be present in subsurface deposits, given the long history of ground disturbance in this area. Four of the five small areas are narrow slivers along established roadways (Maluhia Road and Kōloa Road), and it is likely that prior subsurface disturbance associated with road-bed preparation has completely obliterated any intact subsurface deposits.

Impacts and Mitigation Measures

No significant impacts on archaeological/historic resources within the Project Site are anticipated from the construction and operation of the proposed Project. As documented during the inventory survey and supplemental archaeological assessment, no archaeological sites were identified within the Project Site. No further work is recommended for the proposed Project. Construction of the Project improvements is anticipated to have "no effect" on historical properties.

The archaeological inventory survey was accepted by the State DLNR Historic Preservation Division (SHPD) by letter dated January 28, 2004, a copy which is included in Appendix F. The supplemental archaeological assessment and cultural background study was accepted by the SHPD by letter dated March 19, 2010, a copy which is included in Appendix G. In this letter, SHPD indicated that the report meets the minimum requirements for compliance with the Hawai‘i Administrative Rules (HAR), §13-13-276, *Rules Governing Standards for Archaeological Inventory Studies and Reports.*

Should any previously unidentified burial, archaeological or historic sites be found during the course of construction of the proposed Project, the Applicant will stop work in the immediate vicinity and the SHPD will be notified immediately. The significance of these finds will then be determined and appropriate mitigation measures will be approved by the SHPD and the Kaua‘i/Ni‘ihau Islands Burial Council, as appropriate. Subsequent work will proceed after SHPD authorization has been received and mitigative measures have been implemented.

3.13 Cultural Resources

A cultural impact assessment (CIA) was undertaken of the proposed Northern Leg Project by Cultural Surveys Hawai‘i, Inc. in November 2003. The purpose of the CIA is to consider the effects the proposed Project may have on native Hawaiians, their culture, and their right to practice traditional customs. The CIA also considers cultural resources, practices and beliefs within the broader context of Kōloa that are relevant to assessing the role of the Project area within the Kōloa landscape. Subsequently, a supplemental archaeological assessment and cultural background study was conducted by Cultural Surveys Hawai‘i, Inc. in March 2010. This supplemental study covered five small areas, comprising a total area of less than one-tenth of one acre, that are proposed for intersection improvements at both ends of the Northern Leg corridor, and the proposed realigned Ōma‘o Road corridor, that were not included in the CIA. The CIA is included in Appendix H. The supplemental archaeological assessment and cultural background study is included in Appendix G. The findings of both reports are summarized below.

The Project area is in the ahupuaʻa of Kōloa in the Kona District of Kauaʻi. Hawaiian legends and traditions celebrate Kōloa ahupuaʻa's taro lands. Archaeological investigations have documented, makai of the present Project area, widespread habitation and intensive irrigated agriculture in central and coastal Kōloa in which an extensive irrigated complex (the Kōloa Field System) was developed off of Waikomo Stream. Evidence of intensive traditional Hawaiian use of lands mauka of Kōloa Town is generally lacking. Previous archaeological studies in the vicinity and mauka of the current Project area have indicated a lack of traditional Hawaiian sites. Within the portion of the Kōloa ahupuaʻa that includes the present Project area, it is likely that activities in the upper Kōloa plains included cultivation of sweet potato, piʻa, and wauke, and the gathering of hala, kukui, and other upland resources during traditional Hawaiian times. The section of Ōmaʻo Stream valley that will be crossed by the proposed Project may have also included taro loʻi.

Previous archaeological studies in the vicinity and mauka of the Project Site have indicated a lack of traditional Hawaiian sites. Remnants of traditional cultural activities in the vicinity of the present Project area have generally eluded archaeological investigation. A major constraint on the development of an archaeological record in the vicinity of the present Project area is the general absence of rock. The silty clay and silty clay loam soils in the vicinity are almost stone-free, and any traditional Hawaiian construction likely to endure in this environment would had to have been constructed of rock imported from a distant area.

Three kamaʻāina former sugar plantation employees interviewed for the CIA reported that during the decades of their work within the Project area, no traditional trails, historic or sacred sites, or burials were observed. None of the interviewees knew of any traditional place names associated with the Project area. All three interviewees reported no ongoing traditional gathering or hunting practices occurring within the Project area. The establishment of the private plantation property precluded access to the area by non-plantation personnel.

Impacts and Mitigation Measures

Based on the above findings, the proposed Project will have no adverse impact on traditional cultural properties or practices, gathering rights, or access. Thus, it is recommended that no further formal cultural impact mitigation measures are warranted.

It should be noted, however, that subsurface properties associated with former traditional Hawaiian activities in the Project area, such as artifacts and cultural layers, may be present despite the decades of sugar cultivation activities. As a precautionary measure, personnel involved in the development of the proposed Project should be informed of the possibility of inadvertent cultural finds, and should be made aware of the appropriate notification measures to follow.

3.14 Views

Existing views along the proposed Northern Leg corridor consists of open pasture land within the northern portion, and agricultural cultivation within the southern portion.

The Kōloa-Poʻipū-Kalāheo Planning District Heritage Resources Map in the County's General Plan designates Maluhia Road and the segment of Kōloa Road along the Project Site as Scenic Roadway Corridors.

Impacts and Mitigation Measures

No significant visual or aesthetic impacts are anticipated as a result of the proposed Project. Development of the proposed Project will change the appearance of the Project Site from open pasture area and agriculture cultivated lands, to a paved, maintained roadway. However, the Northern Leg will not have a substantial visual impact, and will not obstruct existing view planes.

3.15 Traffic

A traffic assessment report (TAR) was prepared for the proposed Project by Wilson Okamoto Corporation in May 2010. The purpose of the TAR is to assess traffic operating conditions resulting from the construction of the proposed Project, and to identify recommendations, if appropriate, that would alleviate anticipated traffic conditions. The TAR is included in Appendix I and is summarized below.

Existing Area Roadway System: Existing roadways within the Project area include Maluhia Road, Ala Kinoiki (also referred to as Eastern Bypass Road), Kōloa Road, Poʻipū Road, Western Bypass Road (also referred to as Ala Kalanikaumaka), and Ōmaʻo Road.

Maluhia Road is a predominantly two-lane, two-way County roadway generally oriented in the north-south direction. Maluhia Road serves as the main access roadway to Kōloa and Poʻipū, and provides connection between those areas and Kaumualiʻi Highway. Maluhia Road intersects Ala Kinoiki at the northern end of the Project Site. At this unsignalized T-intersection, the northbound approach of Maluhia Road has one through lane and an exclusive right-turn lane, while the southbound approach has an exclusive left-turn lane and one through lane.

Ala Kinoiki is a predominantly two-lane, two-way roadway with auxiliary lanes at the intersections along its alignment. Ala Kinoiki provides an alternate route between Maluhia Road and the Poʻipū area. At the intersection with Maluhia Road, the stop-controlled approach of Ala Kinoiki has exclusive left-turn and right-turn lanes. In addition, acceleration lanes are provided along Maluhia Road and Ala Kinoiki to allow right-turning vehicles to proceed freely through the intersection.

South of the intersection with Ala Kinoiki, Maluhia Road intersects Kōloa Road. At this unsignalized T-intersection, the southbound approach of Maluhia Road is stop-controlled, with exclusive left-turn and right-turn lanes. Kōloa Road is a predominantly two-lane, two-way County roadway generally oriented in the east-west direction. Kōloa Road serves as the main access roadway through Kōloa. At the intersection with Maluhia Road, the eastbound approach of Kōloa Road has an exclusive left-turn lane and one through lane, while the westbound approach has a shared through and right-turn lane.

West of the intersection with Maluhia Road, Kōloa Road intersects Poʻipū Road. At this unsignalized T-intersection, the eastbound approach of Kōloa Road has a shared through and right-turn lane, while the westbound approach has an exclusive left-turn and one through lane. Poʻipū Road is a predominantly two-lane, two-way County roadway that primarily serves as the main access roadway to and through Poʻipū. At the intersection with Kōloa Road, the Poʻipū Road approach is stop-controlled with exclusive left-turn and right-turn lanes.

Further west, Kōloa Road intersects the existing Western Bypass Road. At this unsignalized T-intersection, the eastbound approach of Kōloa Road has one through lane and an exclusive

right-turn lane, while the westbound approach has an exclusive left-turn lane and one through lane. The Western Bypass Road is a predominantly two-lane, two-way roadway generally oriented in a north-south direction that serves as the primary access roadway through the Kukuiʻula development. At the intersection with Kōloa Road, the northbound approach of the Western Bypass Road is stop-controlled, with exclusive left-turn and right-turn lanes. In addition, an acceleration lane is provided along Kōloa Road, allowing right-turning vehicles from the Western Bypass Road to proceed freely through the intersection.

At the western edge of the Project Site, Kōloa Road intersects Ōmaʻo Road. At this unsignalized T-intersection, the eastbound approach of Kōloa Road has one lane that serves left-turn and through traffic movements, while the westbound approach has one lane that serves through and right-turn traffic movements. Ōmaʻo Road is a predominantly two-lane, two-way County roadway generally oriented in the north-south direction that extends between Kaumualiʻi Highway and Kōloa Road. At the intersection with Kōloa Road, the southbound approach of Ōmaʻo Road has one stop-controlled lane that serves left-turn and right-turn traffic movements.

Traffic Volumes and Conditions: The TAR analyzed traffic conditions at the following intersections in the vicinity of the Project during the weekday AM and PM peak traffic hour periods:

- Maluhia Road and Ala Kinoiki
- Maluhia Road and Kōloa Road
- Kōloa Road and Poʻipū Road
- Kōloa Road and Western Bypass Road
- Kōloa Road and Ōmaʻo Road

The morning peak hour of traffic generally occurs between 7:00 AM and 8:00 AM in the vicinity of the Project. The afternoon peak hour of traffic generally occurs between 3:15 PM and 4:15 PM. The analysis in this TAR is based on these peak hour time periods.

The highway capacity analysis performed in this TAR is based upon procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2000, and the "Highway Capacity Software", developed by the Federal Highway Administration. The analysis is based on the concept of Level of Service (LOS) to identify the traffic impacts associated with traffic demands during the peak hours of traffic. LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F", with LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" representing unacceptable or potentially congested traffic operating conditions.

Existing Traffic Conditions: Existing peak hour traffic conditions at the study intersections are as follows:

Maluhia Road and Ala Kinoiki: At the intersection with Ala Kinoiki, Maluhia Road carries higher traffic volumes during the PM peak period versus the AM peak period. The critical movement on the Maluhia Road approaches of the intersection is the southbound left-turn traffic movement that operates at LOS "A" during both peak periods.

The left-turn traffic movement on the Ala Kinoiki approach of this intersection operates at LOS "A" and LOS "B" during the AM and PM peak periods, respectively, while the right-turn traffic movement operates at LOS "A" during both peak periods.

Maluhia Road and Kōloa Road: At the intersection with Kōloa Road, Maluhia Road carries a higher traffic volume during the PM peak period versus the AM peak period. The left-turn traffic movement on this approach operates at LOS "A" and LOS "C" during the AM and PM peak periods, respectively, while the right-turn traffic movement operates at LOS "A" during both peak periods. Traffic queues periodically formed on the Maluhia Road approach of the intersection, with average queue lengths of two to four vehicles observed during both peak periods.

The Kōloa Road approaches of this intersection carry higher traffic volumes during the PM peak period versus the AM peak period. The critical movement on the Kōloa Road approaches of the intersection was the eastbound left-turn traffic movement which operates at LOS "A" during both peak periods.

Kōloa Road and Poʻipū Road: At the intersection with Poʻipū Road, Kōloa Road carries an overall higher traffic volume during the PM peak period versus the AM peak period. The critical movement on the Kōloa Road approaches of the intersection is the westbound left-turn traffic movement which operates at LOS "A" during both peak periods.

The Poʻipū Road approach carries a higher traffic volume during the PM peak period versus the AM peak period. The critical movement on the Poʻipū Road approach is the northbound left-turn traffic movement which operates at LOS "B" during both peak periods. Traffic queues periodically formed on the Poʻipū Road approach of the intersection, with average queue lengths of one to three vehicles observed during both peak periods.

Kōloa Road and Western Bypass Road: At the intersection with the Western Bypass Road, Kōloa Road carries an overall higher traffic volume during the PM peak period versus the AM peak period. The critical movement on the Kōloa Road approaches is the westbound left-turn traffic movement which operates at LOS "A" during both peak periods.

The Western Bypass Road approach of the intersection carries a higher traffic volume during the PM peak period versus the AM peak period. The critical movement on the Western Bypass Road approach is the northbound left-turn traffic movement which operates at LOS "B" during both peak periods. Traffic queues occasionally formed on this approach, with average queue lengths of one to two vehicles observed during both peak periods.

Kōloa Road and Ōmaʻo Road: At the intersection with Ōmaʻo Road, Kōloa Road carries an overall higher traffic volume during the PM peak period versus the AM peak period. The critical movement on the Kōloa Road approaches is the eastbound left-turn and through traffic movement which operates at LOS "A" during both peak periods.

The Ōmaʻo Road approach of the intersection carries a higher traffic volume during the AM peak period. The Ōmaʻo Road approach operates at LOS "B" during both peak periods. Traffic queues occasionally formed on this approach, with average queue lengths of one to two vehicles observed during both peak periods.

Impacts and Mitigation Measures

Projected Traffic Conditions: Traffic conditions were forecast to Year 2015, the anticipated completion date of the proposed Project. An additional scenario was also analyzed in the TAR to assess traffic operating conditions with the full build-out of currently planned projects in the Kōloa-Poʻipū area. As such, the TAR also provides an assessment of traffic operations 20 years after completion of construction of the proposed Project to Year 2035.

Development of Other Projects in the Vicinity: A number of projects are anticipated to be developed within the Kōloa-Poʻipū area in the next five to 25 years. These projects are identified in Table 6 and are further described in the TAR.

Table 6
Projects To Be Developed Within Kōloa-Poʻipū Area

By Year 2015	By Year 2035
Kukuiʻula	Kukuiʻula (continuation)
Developments in Poʻipū	
Sheraton Kauaʻi Resort	Kiahuna-Pili Mai
Kiahuna-Poʻipū Beach Estate	Kiahuna Poʻipū Golf Resort
Kiahuna-Royal Palms Kauaʻi	Village at Poʻipū
Wainani at Kiahuna	
Poʻipū Beach Villas	
Poʻipū Town Center	
Developments in Kōloa	
Shops at Kōloa Town	Kōloa Creekside
Historic Village at Kōloa	
Developments Along Poʻipū Road Between Kōloa and Poʻipū	
Kukuiʻula Workforce Housing	
Paanau Development	

The directional distribution of trips associated with these projects was based on the distribution of population and activity centers on the Island. As such, approximately 80 percent were assumed to be traveling to/from areas to the east, while approximately 20 percent were assumed to be traveling to/from areas to the west. These trips were distributed throughout the surrounding roadway network based upon their assumed origin and destination.

Year 2015 Without Project: The projected Year 2015 AM and PM peak hour traffic volumes and operating conditions in the Project vicinity without the Project are summarized in Table 7.

Table 7
Existing and Projected Year 2015 (Without Project)
Traffic Operating Conditions

Intersection	Critical Movement		AM Existing	PM Year 2015 Without Project	AM Existing	PM Year 2015 Without Project
Maluhia Road/ Ala Kinoiki	WB	LT	A	B	B	E
		RT	A	A	A	B
	SB	LT	A	A	A	B
Maluhia Road/ Kōloa Road	EB	LT	A	A	A	C
	SB	LT	A	D	C	F
		RT	A	A	A	C
Kōloa Road/ Poʻipū Road	WB	LT	A	B	A	B
	NB	LT	B	C	B	F
Kōloa Road/ Western Bypass Road	WB	LT	A	A	A	A
	NB	LT	B	B	B	C
Kōloa Road/ Ōmaʻo Road	EB	LT-TH	A	A	A	A
	SB	LT-RT	B	B	B	B

Without the proposed Project in Year 2015, traffic operations in Kōloa are expected to deteriorate from existing conditions. Along Maluhia Road, the westbound left-turn traffic movement at the intersection with Ala Kinoiki is expected to deteriorate to LOS “B” and LOS “E” during the AM and PM peak periods, respectively, while other critical traffic movements are expected to deteriorate to LOS “B” during the PM peak period. Similarly, at the intersection with Kōloa Road, the southbound left-turn traffic movement is expected to deteriorate to LOS “D” and LOS “F” during the AM and PM peak periods, respectively, while the other critical traffic movements are expected to deteriorate to LOS “C” during the PM peak period. Along Kōloa Road, the westbound left-turn traffic movement is expected to deteriorate to LOS “B” during both peak periods, while the northbound left-turn traffic movement is expected to deteriorate to LOS “C” and LOS “F” during the AM and PM peak periods, respectively. At the intersection with the existing Western Bypass Road, the northbound left-turn traffic movement is expected to deteriorate to LOS “C” during the PM peak period.

Year 2015 With Project: The projected Year 2015 AM and PM peak hour traffic volumes and operating conditions in the vicinity with the Project are summarized in Table 8. Due to the anticipated high volume of traffic along the Northern Leg and shifts in traffic patterns in Kōloa, traffic signal systems are assumed to be installed at the intersections of the Northern Leg with Maluhia Road and Kōloa Road to alleviate anticipated poor levels of service at those intersections. The Year 2015 levels of service without the Project are provided for comparison purposes.

Table 8
Projected Year 2015 (Without and With Project)
Traffic Operating Conditions

Intersection	Critical Movement		AM		PM	
			Year 2015 Without Project	Year 2015 With Project	Year 2015 Without Project	Year 2015 With Project
Maluhia Road/ Ala Kinoiki/Western Bypass Road Northern Leg*	EB	LT-TH	-	B	-	C
		RT	-	B	-	B
	WB	LT-TH	B	B	E	C
		RT	A	B	B	C
	NB	LT	-	B	-	B
		TH	-	B	-	C
		RT	-	B	-	B
	SB	LT	A	B	B	C
		TH	-	B	-	C
		RT	-	B	-	B
Maluhia Road/ Kōloa Road	EB	LT	A	A	C	B
	SB	LT	D	C	F	D
		RT	A	A	C	B
Kōloa Road/ Poʻipū Road	WB	LT	B	A	B	A
	NB	LT	C	B	F	C
Kōloa Road/ Western Bypass Road*	EB	LT	-	B	-	B
		TH	-	B	-	B
		RT	-	B	-	B
	WB	LT	A	B	A	B
		TH	-	B	-	B
		RT	-	B	-	B
	NB	LT	B	B	C	B
		TH-RT	-	B	-	B
	SB	LT	-	B	-	B
		TH	-	B	-	B
		RT	-	B	-	B
Western Bypass Road Northern Leg/ Ōmaʻo Road	EB	LT-RT	-	A	-	A
	NB	LT	-	A	-	A

**Traffic signal system installed.*

With the Project in Year 2015, traffic operations through Kōloa Town are expected to improve with the Northern Leg. At the intersection of Kōloa Road with Maluhia Road, the southbound left-turn traffic movement is expected to improve from LOS "D" to LOS "C" during the AM peak period, and from LOS "F" to LOS "D" during the PM peak period. On the eastbound approach of the intersection, the left-turn traffic movement is expected to improve from LOS "C" to LOS "B" during the PM peak period. At the intersection of Kōloa Road with Poʻipū Road, the westbound left-turn traffic movement is expected to improve from LOS "B" to LOS "A" during both peak periods, while the northbound left-turn traffic movement is expected to improve from LOS "C" to LOS "B" during the AM peak period, and from LOS "F" to LOS "C" during the PM peak period.

Along the Northern Leg, traffic operations are expected to operate at acceptable levels of service, primarily due to the installation of traffic signal systems at its intersections with Maluhia

Road and Kōloa Road. At the intersections with Maluhia Road and Ala Kinoiki, the critical movements are expected to operate at LOS "B" during the AM peak period and LOS "C" or better during the PM peak period. At the intersections with Ōmaʻo Road and Kōloa Road, the critical movements are expected to operate at LOS "A" and LOS "B", respectively, during both peak periods.

Year 2035 With Project: The projected Year 2035 AM and PM peak hour traffic volumes and operating conditions in the Project vicinity with the Project are summarized in Table 9. The Year 2015 levels of service with the Project are provided for comparison purposes.

Table 9
Projected Year 2015 and Year 2035 With Project
Traffic Operating Conditions

Intersection	Critical Movement		AM		PM	
			Year 2015 With Project	Year 2035 With Project	Year 2015 With Project	Year 2035 With Project
Maluhia Road/ Ala Kinoiki/ Western Bypass Road Northern Leg	EB	LT-TH	B	C	C	D
		RT	B	B	B	B
	WB	LT-TH	B	B	C	C
		RT	B	B	C	D
	NB	LT	B	B	B	B
		TH	B	B	C	C
		RT	B	B	B	B
	SB	LT	B	B	C	D
		TH	B	B	C	D
		RT	B	B	B	C
Maluhia Road/ Kōloa Road	EB	LT	A	A	B	B
	SB	LT	C	C	D	E
		RT	A	A	B	B
Kōloa Road/ Poʻipū Road	WB	LT	A	A	A	B
	NB	LT	B	B	C	D
Kōloa Road/ Western Bypass Road	EB	LT	B	B	B	B
		TH	B	B	B	C
		RT	B	B	B	C
	WB	LT	B	B	B	B
		TH	B	B	B	C
		RT	B	B	B	B
	NB	LT	B	B	B	C
		TH-RT	B	B	B	B
	SB	LT	B	B	B	B
		TH	B	B	B	B
		RT	B	B	B	B
Western Bypass Road Northern Leg/ Ōmaʻo Road	EB	LT-RT	A	A	A	A
	NB	LT	A	A	A	A

Traffic operations in Kōloa are expected to deteriorate under Year 2035 conditions due to the continued development of other projects in the Kōloa-Poʻipū area. The critical movements at the study intersections are expected, in general, to operate at levels of service similar to Year 2015 without Project conditions during the AM peak period, and slightly lower levels of service during the PM peak period. The critical movements at the intersection of the Northern Leg with Maluhia Road and Ala Kinoiki, as well as the intersection of Kōloa Road with Poʻipū Road, are expected to operate at LOS "D" or better during the PM peak period, while those at the intersection of Kōloa Road with both sections of the Western Bypass Road are expected to operate at LOS "C" or better during that time period. At the intersection of Maluhia Road with Kōloa Road, the southbound left-turn traffic movement is expected to operate at LOS "E" during the PM peak period due to the high volume of conflicting traffic.

Based on the analysis of the traffic data, the following are recommendations of the TAR for implementation with the proposed Project:

1. Monitor traffic conditions at the intersection of the Northern Leg with Maluhia Road and Ala Kinoiki and install a traffic signal system when warranted. The placement, phasing, and timing of the system should be determined during the design of the traffic signal system. Alternate intersection control strategies, such as roundabouts, could also be considered to alleviate anticipated conditions.

2. Monitor traffic conditions at the intersection of the Northern Leg with Kōloa Road and the existing segment of the Western Bypass Road and install a traffic signal system when warranted. The placement, phasing, and timing of the system should be determined during the design of the traffic signal system.

3. Monitor traffic conditions along Kōloa Road through Kōloa Town to verify projected traffic conditions. Additional mitigative measures may be required for this segment of Kōloa Road as development in the vicinity continues to progress.

Significant increases in traffic volumes along the roadways throughout Kōloa and Poʻipū are expected due to the development of other projects in the vicinity. The construction of the Northern Leg, as well as the installation of traffic signal systems at both ends of that roadway, are expected to alleviate projected traffic operating conditions. However, as development continues to progress in Kōloa and Poʻipū over the next 25 years, additional mitigative measures such as intersection signalization or roadway widening may be required, especially through Kōloa Town. As such, traffic conditions should be monitored and periodically assessed to determine if additional measures are required.

Short-term traffic impacts will result from the construction of the proposed Project improvements. This would include impacts of construction vehicles hauling equipment and materials on roadways near the Project Site, and commuting construction workers. Construction activities and roadway improvements will also require temporary lane closures of roadways or road detours near the Project Site during various stages of construction. Traffic control measures will be implemented during construction to mitigate potential traffic impacts along the roads in the immediate Project vicinity. This would include restricting the movement of construction vehicles on roadways during peak traffic hours to limit the degree of inconvenience to motorists. Temporary lane closures and road detours on the roadways

adjacent to the Project Site will be limited to off-peak traffic hours. The respective emergency services (police, fire and ambulance) will be notified by the Project's construction contractor(s) of any road detours that may be required prior to actual implementation. Appropriate signage and/or manned traffic control will be provided during construction, as needed.

3.16 Socio-Economic Characteristics

The Project Site is located within the Poʻipū Census Tract (CT) 406. The following is an overview of the socio-economic characteristics of the Poʻipū CT as shown in Table 10.

Population and Housing: Based on the 2000 Census, the population in Poʻipū has increased just slightly since the 1990 Census. In 1990, Poʻipū (CT 406) had a population of 1,068, and in 2000 the population had increased to 1,075. During the same 10-year period, the population of the Island of Kauaʻi had increased 14.2 percent, from 51,177 to 58,463. The slight population change in Poʻipū is indicative of stability.

- The median age of the population in Poʻipū is higher than on Kauaʻi at 48.6 versus 38.4;
- By racial mix, there are more Whites and less Asians and Native Hawaiian and other Pacific Islanders in Poʻipū than Kauaʻi;
- Households in Poʻipū have a smaller average size, but slightly higher married-couple families and more non-family householders than Kauaʻi; and
- There are substantially more vacant units in Poʻipū than Kauaʻi.

Economy: According to the 2000 Census, the median household income for the Poʻipū CT was $51,442, which is greater than the median household income for Kauaʻi which was $45,020.

Table 10
Demographic Characteristics: 2000

Subject	CT 406 (Poʻipū)		Kauaʻi	
	Number	Percent	Number	Percent
Total Population	**1,075**	**100**	**58,463**	**100**
AGE				
Under 5 Years	37	3.4	3,605	6.2
5 – 19 years	151	14.0	13,147	22.5
20 – 64 years	667	62.0	33,642	57.5
65 years and over	220	20.5	8,069	13.8
Median age (years)	48.6	--	38.4	--
RACE				
White	746	69.4	17,255	29.5
Black or African American	1	0.1	177	0.3
American Indian and Alaska Native	4	0.4	212	0.4
Asian	182	16.9	21,042	36.0
Native Hawaiian and other Pacific Islander	21	2.0	5,334	9.1
Two or more races	113	10.5	13,938	23.8
Other	8	0.7	505	0.9

Table 10
Demographic Characteristics: 2000

Subject	CT 406 (Poʻipū)		Kauaʻi	
	Number	Percent	Number	Percent
Total Population	**1,075**	**100**	**58,463**	**100**
HOUSEHOLD (BY TYPE)				
Total Households	**472**	**100**	**20,183**	**100**
Family households (families)	311	65.9	14,572	72.2
With own children under 18 years	88	18.6	6,865	34.0
Married-couple family	271	57.4	10,881	53.9
With own children under 18 years	69	14.6	4,842	24.0
Female householder, no husband present	25	5.3	2,582	12.8
With own children under 18 years	14	3.0	1,424	7.1
Nonfamily households	161	34.1	5,611	27.8
Average household size	2.28	--	2.87	--
HOUSING OCCUPANCY AND TENURE				
Total Housing Units	**1,969**	**100**	**25,331**	**100**
Occupied units	472	24.0	20,183	79.7
By owner	287	60.8	12,384	61.4
By renter	185	39.2	7,799	38.6
Vacant units	1,497	76.0	5,148	20.3
SOCIAL CHARACTERISTICS				
Population 25 years and over	**885**	**100**	**38,872**	**100**
High school graduate or higher	855	96.6	32,368	83.3
Bachelor's degree or higher	306	34.6	7,551	19.4
ECONOMIC CHARACTERISTICS				
In labor force (pop. 16 & over)	573	59.7	28,355	63.1
Median household income (dollars)	51,442	--	45,020	--
Median family income (dollars)	62,396	--	51,378	--
Per capita income (dollars)	35,800	--	20,301	--

Source: U.S. Census Bureau, Census 2000 Summary

Impacts and Mitigation Measures

In the short term, the Project will confer positive benefits in the local area. Direct economic benefits will result from construction expenditures both through the purchase of material from local suppliers and through the employment of local labor, thereby stimulating that sector of the economy. Indirect economic benefits may include benefits to local retailing businesses resulting from construction activities.

Construction activities associated with the proposed Project will create some adverse short-term impacts such as temporary disruption of traffic, unavoidable noise impacts, and air quality impacts from soil excavation and grading activities in the vicinity of the Project Site. The

construction contractor(s) will be required to mitigate potential vehicular traffic impacts through appropriate traffic control measures (see Section 3.15 Traffic). Unavoidable construction noise impacts on nearby land uses in the immediate vicinity of the proposed Project will be mitigated to some degree by complying with the provisions of the State DOH Administrative Rules, Title 11, Chapter 46, Community Noise Control (see Section 3.10 Noise). Potential air quality impacts during construction of the proposed Project will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60, Air Pollution Control (see Section 3.9 Air Quality).

There are no significant adverse long-term socio-economic impacts anticipated with the proposed Project. The proposed Northern Leg is not expected to induce growth beyond that which is anticipated for the region. Rather, the proposal has long been considered part of the future of Kōloa-Poʻipū. The Kōloa-Poʻipū-Kalāheo Development Plan, which was prepared in 1978 and adopted by County ordinance in 1983, envisioned the Northern Leg as part of the circulation system for the area. The proposed Northern Leg is not anticipated to have a major influence in future land use patterns in the Kōloa area. In particular, the agriculture-designated lands abutting the proposed Northern Leg are anticipated to remain in its current state for the foreseeable future, unless State Land Use designations are revised, the Kauaʻi General Plan is amended, and the lands are rezoned.

The Northern Leg is intended to benefit the entire Kōloa-Poʻipū region without impacting a specific ethnicity or income group. Further, the Project is not located in a residential area that may otherwise directly impact residents. The proposed Project will not result in a disproportionately high adverse impact on minority and low-income populations.

Development of the proposed Project improvements will require the acquisition of privately-owned property. The proposed corridor of the Northern Leg and realigned portion of Ōmaʻo Road, and the Project areas adjacent to the Maluhia Road and Kōloa Road intersections, are wholly within three privately-owned parcels under the ownership of two entities. In accordance with Zoning Ordinance No. PM-2004-370 (Condition No. 9) for the Kukuiʻula development, Kukuiʻula Development Company (Hawaiʻi), LLC is assisting the County in acquiring the rights-of-way for the Northern Leg and the realigned portion of Ōmaʻo Road from the respective landowners. Acquisition of the properties will be based on the fair market value for the affected area.

The southern portion of the Northern Leg corridor and the realigned Ōmaʻo Road corridor will traverse through an area currently under agricultural cultivation consisting of banana crops. This use of the property is currently under an agreement between the landowner and the tenant. Development of the Project improvements will displace a portion of the agricultural cultivation within the Project Site. That such displacement would occur as a result of the Northern Leg has been documented in various State and County transportation and land use planning documents.

3.17 Schools

The Kōloa Early School, a preschool, is located south of the Project Site along Kōloa Road. Public schools serving the Project area include Kōloa Elementary School (Grades K to 5) located approximately 0.6-mile south of the Project Site along Poʻipū Road, Chiefess Kamakahelei Middle School (Grades 6 to 8) located in Puhi, and Kauaʻi High School (Grades 9 to 12) located in Līhuʻe.

Impacts and Mitigation Measures

The proposed Northern Leg will help to facilitate access to and from Kōloa Elementary School. The entrance to Kōloa Elementary School is from Poʻipū Road. The Northern Leg will allow vehicular traffic travelling between Kaumualiʻi Highway and the Poʻipū and Kukuiʻula areas to bypass Poʻipū Road, thereby reducing the amount of localized traffic along Poʻipū Road.

3.18 Recreational Facilities

Existing County parks in the region include: 1) Anne Knudsen District Park located along the east side of Maluhia Road, approximately 450 feet southeast of the Project Site; 2) Waikomo Neighborhood Park located approximately 0.6-mile southeast of the Project Site; and 3) Welieweli Neighborhood Park located approximately 1.8 miles southeast of the Project Site. County beach parks in the region include Poʻipū Beach Park and Brennecke Beach Park in Poʻipū located approximately 2.4 miles southeast of the Project Site, and the Spouting Horn Park located approximately 2.1 miles southwest of the Project Site. The State's Kukuiʻula Small Boat Harbor is located at Kukuiʻula Bay, approximately 1.8 miles southwest of the Project Site. The region has two active golf courses, including the Kiahuna Golf Club and Poʻipū Bay Golf Course located approximately 1.1 miles and 2.8 miles southeast of the Project Site, respectively.

Impacts and Mitigation Measures

Construction and operation of the Project will not impact recreational facilities in the region as development of the Project will not require the use of any public park or recreational facility.

3.19 Civil Defense

The only designated civil defense shelter in the Kōloa-Poʻipū area is Kōloa Elementary School, which can accommodate approximately 1,000 persons. The service population of the area is well in excess of this capacity, so that area residents are sent to Kalāheo and Līhuʻe for shelter during emergencies. This would create traffic problems for evacuating vehicles.

Impacts and Mitigation Measures

The proposed Northern Leg will provide the remaining link connecting the Western Bypass Road to Maluhia Road, but it would not necessarily improve evacuation access out of the area.

3.20 Police, Fire and Medical Services

Police protection service in the Project area is provided by the County Police Department's Waimea District. The Waimea Police Station is located to the northwest of the Project Site in the district of Waimea, along Kaumualiʻi Highway at the intersection with Menehune Road. Within the Kōloa Town and Poʻipū areas, the County has two mini police substations. One is located in Kōloa Town, and the other is located in Poʻipū Kai near the Peʻe Road/Poʻipū Road intersection.

Fire protection service for the Project area is provided by the County's Kōloa Fire Station, located makai of the Project Site at the intersection of Poʻipū Road and Lāwaʻi Road. The initial back-up response unit will be provided by the Kalāheo Fire Station located to the northwest of the Project Site, with the second back-up response unit to be provided by the Līhuʻe Fire Station.

The closest hospital to the Project area is Wilcox Memorial Hospital located in Līhuʻe. The only medical facility within the Kōloa District is Kōloa Clinic, located along Kōloa Road east of the Project Site. Emergency medical service in the Project area is provided by American Medical Response, a private ambulance service contracted by the County, located on Poʻipū Road across from the Kōloa Fire Station. If needed, back-up units will respond from the Līhuʻe Station and the Waimea Station.

Impacts and Mitigation Measures

Construction of the Project will not adversely impact the response time of police, fire and ambulance services in the nearby vicinity. The respective emergency services (police, fire and ambulance) will be notified by the Project's construction contractor(s) of any road detours that may be required prior to actual implementation.

3.21 Solid Waste Disposal

The County Department of Public Works (DPW) maintains an Island-wide solid waste collection and disposal system. The existing Kekaha Landfill, located 1.3 miles northwest of the town of Kekaha on the southwest side of the Island, is the primary disposal site for solid waste on the Island. The County is currently seeking a lateral expansion of the Kekaha Landfill which could extend its capacity by about 12 years. The County is also seeking another landfill site as part of its long-term planning objectives.

Impacts and Mitigation Measures

No significant impacts to solid waste disposal are anticipated from the construction and operation of the proposed Project. During construction of the Project, a trash management and recycling program will be developed and implemented to minimize impacts to the Kekaha Landfill.

Following construction, the Project will generate little, if any, solid waste, and therefore will not adversely impact the Kekaha Landfill.

3.22 Utilities

3.22.1 Water System

The County Department of Water (DOW) operates and maintains the municipal water system of the County. There are no existing County water lines or appurtenant facilities within the proposed Northern Leg corridor. In the nearby Project vicinity, existing County water system facilities may be located within Maluhia Road and Kōloa Road. The DOW has existing water mains and associated water system facilities along the section of Ōmaʻo Road proposed to be eliminated as part of the subject road realignment improvements.

Impacts and Mitigation Measures

No significant impacts are anticipated on the existing water system in the Project vicinity as a result of the construction and operation of the proposed Project. During the design phase of the Project, coordination will be undertaken with the DOW on the location and, as may be required, the relocation and/or removal of existing County water system facilities, to ensure that functions of the facilities are not impacted or impeded.

3.22.2 Wastewater System

There are no existing sewer lines or appurtenant facilities within the proposed Northern Leg corridor. By letter dated October 15, 2008, in response to the pre-assessment consultation conducted for this Draft EA, the County DPW Wastewater Management Division indicated that the proposed Project is not located within a County Wastewater service area.

Impacts and Mitigation Measures

No significant impacts are anticipated on the existing sewer system in the Project vicinity as a result of the construction and operation of the proposed Project. As noted above, the proposed Project is not located within a County Wastewater service area. Prior to construction of the Project, coordination will be undertaken to determine whether any private wastewater facilities are located within the areas of the proposed Project improvements to ensure that functions of such facilities are not impacted or impeded.

3.22.3 Drainage System

Currently, storm run-off sheet flows from the Project Site, following natural drainage patterns. In the vicinity of Ōmaʻo Stream, storm runoff from the Project Site sheet flows into the stream.

The existing drainage facilities within the Project vicinity include open drainage ditches and channels, drainage culverts, and storm drain lines within the nearby roadways.

Impacts and Mitigation Measures

No significant impacts are anticipated on the existing storm drainage system as a result of the construction and operation of the proposed Project.

Potential water quality impacts to surface waters and near shore coastal waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation.

During the design phase of the Project, coordination will be undertaken with the County DPW on the location and, as may be required, the relocation and/or removal of existing County drainage facilities, to ensure that functions of the facilities are not impacted or impeded.

Following construction, the proposed roadway improvements will result in increased impervious surface areas within the Project Site. The Project improvements, however, will produce no adverse effects from storm runoff to adjacent and downstream areas. New drainage improvements, including drain headwalls, drain lines, grass swales, and culverts, will be provided in conjunction with the proposed Project improvements.

3.22.4 Electrical, Telephone and Cable Television Service

Electrical, telephone and cable television (CATV) services in the Project vicinity are provided by Kauaʻi Island Utility Cooperative (KIUC), Hawaiian Telcom, and Oceanic Time Warner Cable, respectively.

There are no existing electrical, telephone or CATV utilities within the proposed Northern Leg corridor. In the nearby Project vicinity, existing utility poles and overhead utility lines are located along Maluhia Road, Kōloa Road, and Ōmaʻo Road.

Impacts and Mitigation Measures

No significant impacts on the existing electrical, telephone and CATV systems are anticipated as a result of the construction and operation of the proposed Project. Construction of the proposed Project improvements will require temporary and/or permanent relocation or removal of existing utility poles and overhead lines along the adjacent roadways in the nearby Project vicinity. During the design phase of the Project, coordination will be undertaken with KIUC, Hawaiian Telcom, and Oceanic Time Warner Cable on the location and, as may be required, the relocation and/or removal of the existing respective utilities, to ensure that functions of the utilities are not impacted or impeded.

Operation of the proposed Project will not result in a significant increase in energy consumption.

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4. RELATIONSHIP TO LAND USE PLANS, POLICIES AND CONTROLS

The Project's consistency with relevant State and County land use plans, policies and controls is discussed below.

4.1 State Land Use Plans and Policies

4.1.1 Hawai'i State Plan

The Hawai'i State Plan, embodied in Chapter 226, HRS, serves as a guide for goals, objectives, policies, and priorities for the State. The State Plan provides a basis for determining priorities, allocating limited resources, and improving coordination of State and County plans, policies, programs, projects, and regulatory activities. The proposed Project is consistent with the following State Plan objectives and policies.

Sec. 226-13 Objectives and policies for the physical environment – land, air, and water quality.
(b)(3) Promote effective measures to achieve desired quality in Hawai'i's surface, ground, and coastal waters.

Potential water quality impacts to Ōma'o Stream and near shore coastal waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation. No construction activities in conjunction with the Project will occur within Ōma'o Stream and the two abutting wetlands.

The Project improvements will be designed and constructed to avoid Ōma'o Stream and the two abutting wetlands. The Northern Leg bridge will span across Ōma'o Stream and the abutting wetlands, and concrete piers supporting the bridge deck will be strategically placed to avoid the stream and the wetlands. The piers would be installed utilizing the drilled shaft construction method.

The Project improvements will produce no adverse effects from storm runoff to adjacent and downstream areas. New drainage improvements, including drain headwalls, drain lines, grass swales, and culverts, will be provided in conjunction with the Project improvements.

Operations of the Project improvements will not result in any adverse impacts on ground water.

Sec. 226-14 Objectives and policies for facility systems – in general.
(b)(1) Accommodate the needs of Hawai'i's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.

Sec. 226-17 Objectives and policies for facility systems – transportation.
(b)(6) Encourage transportation systems that serve to accommodate present and future development needs of communities.

The Northern Leg represents an important component of the County's objective to improve regional traffic flow and circulation within the South Shore region of Kaua'i, which extends from Kōloa town makai to the Po'ipū and Kukui'ula areas. Construction of the Northern Leg will implement the recommendations of the various State and County transportation and land use planning documents that have identified the need for this road link.

The Northern Leg is one of several vehicular circulation systems recommended in the County's Kōloa-Po'ipū-Kalāheo Development Plan which was adopted in 1983. The County General Plan designates the proposed Northern Leg as a Planned Road. The Kaua'i Long-Range Land Transportation Plan notes that a loop roadway around Kōloa town could be formed by directly linking the Eastern Bypass Road, the Western Bypass Road, and the proposed Port Allen-Po'ipū Connector Road.

4.1.2 State Land Use District

The State Land Use Law, Chapter 205, HRS, is intended to preserve, protect and encourage the development of lands in the State for uses that are best suited to the public health and welfare of Hawai'i's people. The State Land Use Commission classifies all lands in the State into four land use districts: Urban, Agricultural, Conservation, and Rural. The Project Site is within the State Agricultural District shown on Figure 4-1. The proposed Project is consistent with the Agricultural District classification since public roadways are a permissible use within this District.

4.1.3 Hawai'i Coastal Zone Management Program

The National Coastal Zone Management (CZM) Program was created through passage of the Coastal Zone Management Act of 1972. Hawai'i's CZM Program, adopted as Chapter 205A, HRS, provides a basis for protecting, restoring and responsibly developing coastal communities and resources. A discussion of the Project's consistency with the objectives and policies of the CZM Program is provided below.

(1) <u>Recreational Resources</u>

<u>Objective:</u>

(A) Provide coastal recreational opportunities accessible to the public.

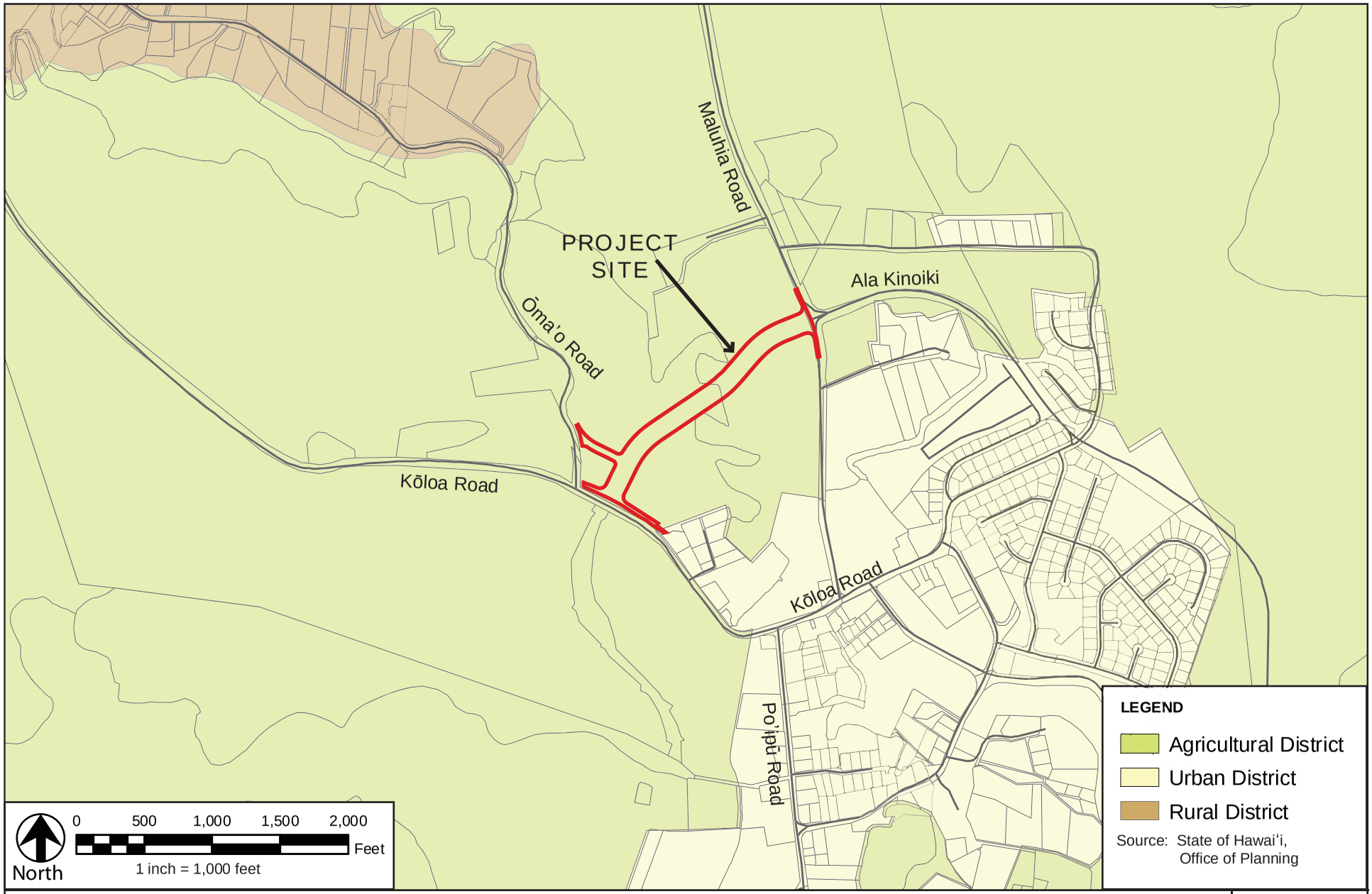
<u>Policies</u>

(A) Improve coordination and funding of coastal recreational planning and management; and

(B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

(ii) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;



Northern Leg of the Western Bypass Road

FIGURE

STATE LAND USE DISTRICTS MAP

4-1

(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

(v) Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters.

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.

The proposed Project, given its nature and location approximately 1.8 miles inland (mauka) of the coastline, will not provide or impact coastal recreational opportunities accessible to the public.

Potential water quality impacts to near shore coastal waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation.

(2) <u>Historic Resources</u>

<u>Objective:</u>

(A) Protect, preserve and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

<u>Policies:</u>

(A) Identify and analyze significant archaeological resources;

(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

No archaeological sites were identified within the Project Site as documented during the archaeological inventory survey and supplemental archaeological assessment conducted for the Project Site. No further work is recommended for the proposed Project. Construction of the Project improvements is anticipated to have "no effect" on historical properties.

The archaeological inventory survey was accepted by the SHPD by letter dated January 28, 2004. The supplemental archaeological assessment and cultural background study was accepted by the SHPD by letter dated March 19, 2010. In this letter, SHPD indicated that the report meets the minimum requirements for compliance with the Hawai‘i Administrative Rules (HAR), §13-13-276, *Rules Governing Standards for Archaeological Inventory Studies and Reports.*

Should any previously unidentified burial, archaeological or historic sites be found during the course of construction of the proposed Project, the Applicant will stop work in the immediate vicinity and the SHPD will be notified immediately. The significance of these finds will then be determined and appropriate mitigation measures will be approved by the SHPD and the Kaua‘i/Ni‘ihau Islands Burial Council, as appropriate. Subsequent work will proceed after SHPD authorization has been received and mitigative measures have been implemented.

(3) *Scenic and Open Space Resources*

Objective:

(A) Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

(A) Identify valued scenic resources in the coastal zone management area;
(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;
(C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and
(D) Encourage those developments which are not coastal dependent to locate in inland areas.

The proposed Project is located approximately 1.8 miles inland (mauka) of the coastline and, therefore, will not affect scenic resources or public views to and along the shoreline.

(4) *Coastal Ecosystems*

Objective:

(A) Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;
(B) Improve the technical basis for natural resource management;

(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;
(D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and
(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Potential water quality impacts to the near shore coastal waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation. No construction activities in conjunction with the Project will occur within Ōmaʻo Stream.

Following construction, the Project improvements will produce no adverse effects from storm runoff to adjacent and downstream areas. New drainage improvements, including drain headwalls, drain lines, grass swales, and culverts, will be provided in conjunction with the proposed Project improvements.

(5) Economic Uses

Objective:
(A) Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:
(A) Concentrate coastal dependent development in appropriate areas;
(B) Ensure that coastal dependent developments such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and
(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:
(i) Use of presently designated locations is not feasible;
(ii) Adverse environmental effects are minimized; and
(iii) The development is important to the State's economy.

The purpose and need for the proposed Project is consistent with the CZM objective of providing facilities and improvements important to the State's economy. The Northern Leg represents an important component of the County's objective to improve regional traffic flow and circulation within the South Shore region of the Island, which extends from Kōloa town makai to

the visitor destination areas of Poʻipū and Kukuiʻula. Construction of the Northern Leg will implement the recommendations of the various State and County transportation and land use planning documents that have identified the need for this road link.

(6) Coastal Hazards

Objectives:

(A) Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

Policies

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

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

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program;

(D) Prevent coastal flooding from inland projects.

Construction and operation of the proposed Project are not anticipated to result in flooding of the Project area or to increase flood risks to properties lying uphill or downhill of the Project Site.

The Northern Leg bridge will traverse through the designated floodway area. The bridge will be designed to span the Ōmaʻo Stream crossing and associated floodway. Concrete piers supporting the bridge will extend vertically into the ground. The bridge will be designed and constructed to meet the current standards for flood elevation. The current standard is for a two-foot minimum freeboard from finished deck elevation to the 100-year water surface elevation. The proposed Project improvements will be designed and constructed in full compliance with the flood plain management requirements of the County. This will include certification by a registered professional civil engineer that the Project improvements will not result in any increase in base flood elevations during the occurrence of base flood discharges.

(7) Managing Development

Objective:

(A) Improve the development review process, communication, and public participation in the management of coastal resource and hazards.

Policies:

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

(B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and

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

Government agencies, organizations, and the general public are being notified of the proposed Project and provided an opportunity to comment on the Project through this environmental review process. Further, the Project has involved outreach through a public informational meeting held on November 12, 2009.

(8) *Public Participation*

Objective:
(A) Stimulate public awareness, education, and participation in coastal management.

Policies:
(A) Promote public involvement in coastal zone management processes;
(B) *Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities*; and
(C) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

As noted above, government agencies, organizations, and the general public are being notified of the proposed Project and provided an opportunity to comment on the Project through this environmental review process. Further, the Project has involved outreach through a public informational meeting held on November 12, 2009.

(9) *Beach Protection*

Objective:
(A) Protect beaches for public use and recreation.

Policies:
(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;
(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and
(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

The proposed Project is located approximately 1.8 miles inland (mauka) from the shoreline and, therefore, does not involve the construction of improvements in the shoreline setback or require any erosion-protection structures.

(10) Marine Resources

Objective:

(A) Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

(C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

(D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

(E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

The proposed Project is not anticipated to have any adverse impact on marine and coastal resources. Potential water quality impacts to near shore coastal wasters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. Development of the proposed Project will produce no adverse effects from storm runoff to adjacent and downstream areas.

4.1.4 Kaua‘i Long-Range Land Transportation Plan

The Kaua‘i Long-Range Land Transportation Plan (KLRLTP) (May 1997) is an Islandwide regional transportation plan for Kaua‘i which identifies the land transportation improvements needed to support the projected growth to Year 2020. The KLRLTP was developed through the Countywide Transportation Planning Process (CTPP), a cooperative, comprehensive and continuing transportation planning effort involving the State and neighbor island counties. The participating agencies included the State Department of Transportation, County of Kaua‘i Department of Public Works, and County of Kaua‘i Planning Department. The KLRLTP documents the work to prepare the update of the Year 2020 regional land transportation plan for the Island of Kaua‘i. The KLRLTP also satisfied the requirements of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the Federal transportation law, which specifies that the Statewide Transportation Plan and Program be developed within the context of a Statewide planning process.

The KLRLTP involved development of traffic forecasts through the Year 2020 based on land use projections through that year. These forecasts accounted for the impacts of Hurricane Iniki on land uses as related to housing and employment. In the KLRLTP, the Eastern Bypass Road was assumed to have been completed and was viewed as a necessary component for future long-range planning.

The KLRLTP's recommended improvements for the Poʻipū/Lāwaʻi area did not include construction of the West Poʻipū Road Bypass (the Western Bypass Road and Northern Leg segment), which was one of several alternatives developed to mitigate future Year 2020 traffic deficiencies for the region. The West Poʻipū Road Bypass alternative was for a four-lane, undivided roadway between Maluhia Road and Poʻipū Road through the Kukuiʻula project. However, in the KLRLTP's recommended improvements, the following is noted:

> *"For the Kōloa-Poʻipū area, a circulation study of the roadways is needed to assess the local neighborhood traffic as well as traffic desiring to bypass Kōloa town. A loop roadway around Kōloa town could be formed by directly linking the East Kōloa-Poʻipū Bypass Road, the west Poʻipū Road bypass, and the proposed Port Allen-Poʻipū connector road. (The Kukuiʻula mauka project road could become a part of the Port Allen-Poʻipū connector road.)"*

In the KLRLTP's implementation plan, it states that "*a circulation study for the Kōloa-Poʻipū area has been included in the recommendations so the circulation of traffic in this region can be examined in future detail.*"

4.2 County of Kauaʻi Land Use Plans and Policies

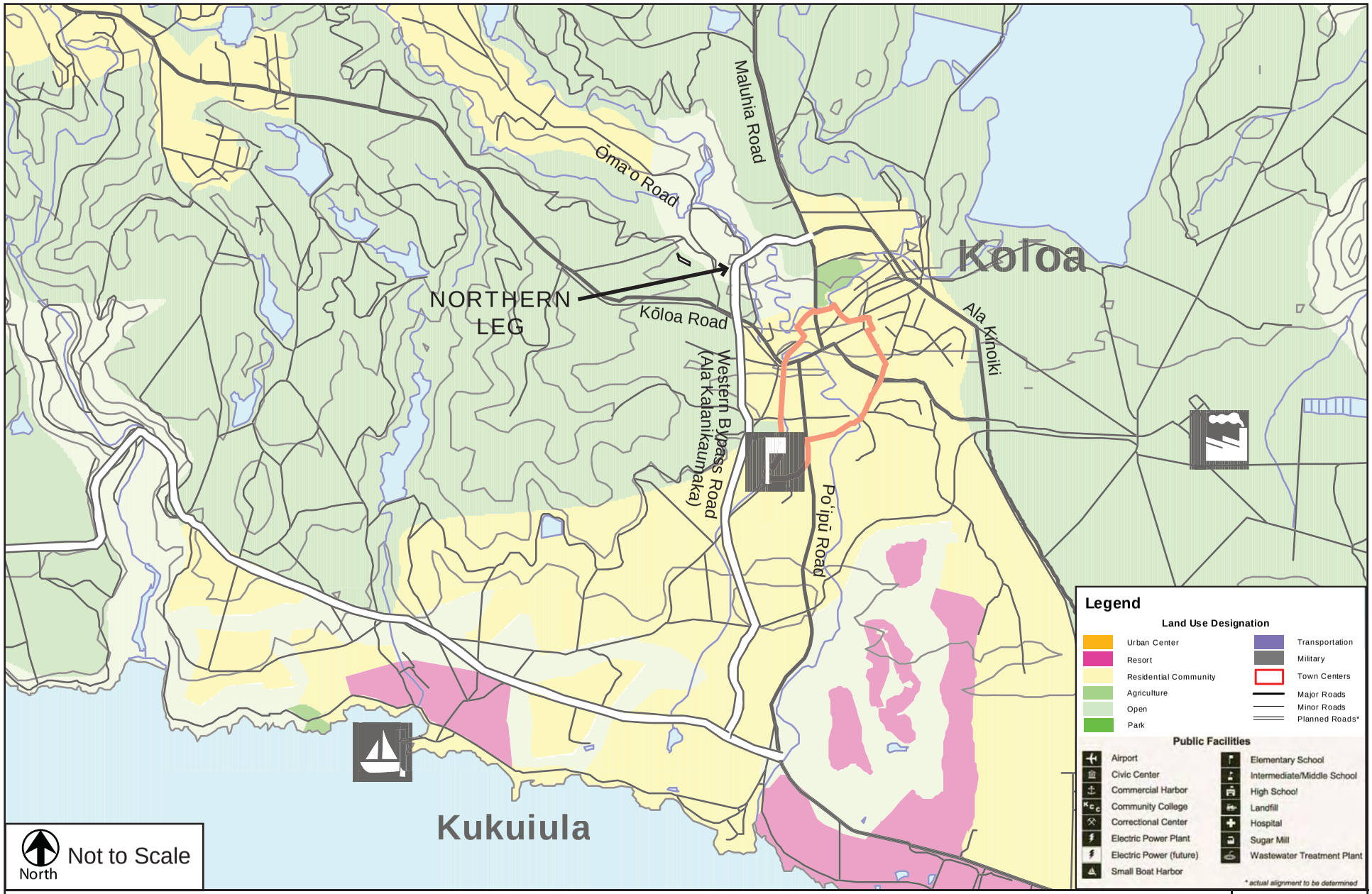
4.2.1 County of Kauaʻi General Plan

The County of Kauaʻi General Plan (November 2000) provides broad policy statements to guide land use regulations, new developments and facilities, and planning for County facilities and services. Relevant sections of the General Plan and their consistency with the proposed Project are as follows:

General Plan Land Use Map and Policies: The Project Site is located within the Kōloa-Poʻipū-Kalāheo Planning District of the General Plan. The policies relating to the Kōloa-Poʻipū-Kalāheo District are found in the Land Use Map and text statements of the General Plan.

The Kōloa-Poʻipū-Kalāheo Land Use Map designates the proposed Northern Leg as a Planned Road as shown in Figure 4-2. The General Plan sets forth the following in support of this designation:

> *6.4 KŌLOA-POʻIPŪ-KALĀHEO*
>
> *6.4.2 Preliminary Planning District Vision*
>
> *The following is a preliminary vision for the planning district in 2020, based on community and CAC input. While it is intended to provide some guidance for specific areas, it did not have the benefit of a detailed community planning effort.*



Northern Leg of the Western Bypass Road

FIGURE

4-2

COUNTY OF KAUA'I GENERAL PLAN LAND USE MAP

*Developing under a community master plan, **Kukui‘ula** has a mix of resort units and residential neighborhoods built around a golf course and wetland/lagoon. New urban development in the region is focused here, retaining other productive agricultural lands in cultivation. The roadway system within Kukui‘ula provides an alternative route for traveling west to Kalāheo and Port Allen, **as well as a mauka-makai road paralleling Po‘ipū Road and joining Kōloa Road and Maluhia Road bypassing Kōloa Town**.* [emphasis added]

6.4.4 Land Use Map and Policies

6.4.4.1 Land Use Map

***New Road Corridors.** Also shown on the Land Use Map are corridors for two future roadways. The West Kōloa-By-Pass Road is designed to provide an alternate route for traffic between Maluhia Road and Kukui‘ula, as that project builds out. The corridor runs along the western edge of Kōloa Town and turns east to join Maluhia Road, opposite the East Kōloa By-Pass. This corridor is schematic. A specific alignment will be established based on future planning.*

6.4.4.2 Policies

(a) Regional Growth and Public Facilities

(1) Assure that adequate transportation facilities are provided in conjunction with the future development of lands in the Kukui‘ula-Po‘ipū area and in the Kalāheo-Ōma‘o area.

(b) Kōloa

(1) Improve circulation within and around Kōloa Town.

(2) In conjunction with development of the West Kōloa By-Pass Road, extend Kōloa Town to the west and provide for traffic circulation between the town and the By-Pass Road.

The proposed Northern Leg will provide the remaining road link necessary to provide an alternate route for traffic between Maluhia Road and Kukui‘ula. The Northern Leg represents an important component of the County’s objective to improve regional traffic flow and circulation with the South Shore region, which extends from Kōloa town makai to the Po‘ipū and Kukui‘ula areas.

In consonance with the land use element of the General Plan, land use designations are delineated on the land use maps for the various Planning Districts on Kaua‘i. The land use designations for the immediate Project area are Agriculture and Open as shown in Figure 4-2.

The General Plan policy for the Agriculture designation is as follows (Section 5.2.1 Policy):

> *(g) To implement the Agriculture designation, specific controls on the subdivision and alteration of designated lands shall be formulated to prevent the dissipation of agricultural potential, the loss of rural character, and the dispersal of residential and other urban uses.*

The General Plan policy for the Open designation is as follows (Section 5.3.1 Policy):

> *(a) The intent of the Open designation is to preserve, maintain or improve the natural characteristics of non-urban land and water areas that:*
> *(1) are of significant value to the public as scenic or recreation resources;*
> *(2) perform essential physical and ecological functions important to the welfare of surrounding lands, waters, and biological resources;*
> *(3) have the potential to create or exacerbate soil erosion or flooding on adjacent lands;*
> *(4) are potentially susceptible to natural hazards such as flood, hurricane, tsunami, coastal erosion, landslide or subsidence; or*
> *(5) form a cultural, historic or archaeological resource of significant public value.*
>
> *(c) Lands designated Open shall remain predominantly free of development involving buildings, paving and other construction. With the exception of kuleanas and other small lots of record, any construction that is permitted shall be clearly incidental to the use and open character of the surrounding lands*

The General Plan's Planned Road designation for the proposed Northern Leg traverses through the Agriculture and Open designated areas in the immediate Project vicinity.

<u>Other General Plan Policies Applicable to the Project</u>: The proposed Project is consistent with the following applicable policies of the General Plan:

3.1.1 Heritage Resources Maps

The General Plan contains a set of Heritage Resources Maps – an island map and five district maps at a larger scale. These maps are intended to document important natural, scenic and historic features, particularly in relation to the urban and agricultural lands which are developed or may be developed in the future. The maps document the following heritage resources:

- *Scenic roadway corridors. (Sources: 1971 General Plan maps, Development Plans, GP public meetings, literature)*

3.1.1.1 Policy

> *(a) The Heritage Resources Map depicts natural, cultural and scenic resources that are important to the County of Kaua'i and that are intended to be conserved. The mapping of important landforms, streams and other physical elements represents the general location of the resource. The mapping of historic and archaeological*

sites, other features and Scenic Roadway Corridors is intended to be representational, not precise.

(c) The Heritage Resources Map shall be used as a guide in preparing Development Plans and in preparing or revising land use ordinances and rules, including but not limited to the following: revisions to the Comprehensive Zoning Ordinance or the Zoning Maps; zone change ordinances; revisions to the Special Management Area (SMA) rules or boundaries; revisions to the Subdivision Ordinance; and the preparation of new ordinances or rules, such as a Scenic Roadway Corridor ordinance.

(d) Projects undertaken with State or County lands or funds shall be designed to conserve heritage resources.

The Kōloa-Poʻipū-Kalāheo Planning District Heritage Resources Map designates Maluhia Road and the segment of Kōloa Road along the Project Site as Scenic Roadway Corridors. The proposed Northern Leg will not have a substantial visual impact, and will not obstruct existing view planes.

3.4 Watersheds, Streams and Water Quality

3.4.2 Policy

(b) Site Development. Plan, design and develop sites to:

(1) Protect areas that provide important water quality benefits – i.e., wetlands;

(2) Protect areas that are particularly susceptible to erosion and sediment loss – i.e., stream banks;

(4) Limit land disturbance activities such as clearing and grading, and cut and fill to reduce erosion and sediment loss;

(c) Construction Site Erosion and Sediment control

(1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction.

(2) Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.

The Project improvements will be designed and constructed to avoid Ōmaʻo Stream and the two abutting wetlands. The Northern Leg bridge will span across Ōmaʻo Stream and the abutting wetlands. The concrete piers supporting the bridge deck will be strategically placed to avoid Ōmaʻo Stream and the wetlands.

At the southern end of the bridge, the proposed bridge abutment and adjacent slope protection areas will be designed to avoid the nearby wetland. The slope areas adjacent to the bridge abutments will be covered with reinforced material, such as grouted stone riprap, for slope protection. As may be required, retaining walls, composed of material such as concrete or CRM, will be constructed in areas of cut adjacent to the bridge abutments.

Potential water quality impacts to surface waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation. No construction activities in conjunction with the Project will occur within Ōmaʻo Stream and the two abutting wetlands.

5.5 Scenic Roadway Corridors

5.5.1 Policy

(a) The purpose of designating Scenic Roadway Corridors is to conserve open space, scenic features, and views within and along Kauaʻi's most heavily-traveled routes. The policy of conservation recognizes the vital function of these roadways in meeting the public need for transportation. It also recognizes the legitimate desire of private landowners to make economic use of their lands. The intent of this policy is to establish basic principles for roadway design and land use within these scenic corridors and to provide a basis for County action to establish programs and regulations to implement them.

(b) Scenic Roadway Corridors are primarily designated in areas between towns where the surrounding lands are primarily designated Agriculture and Open. Where a Scenic Roadway Corridor is designated within a town or adjoins an area planned for urban use, the primary intent is to promote setbacks, landscaping, and views of scenic features. Scenic Roadway Corridors are intended to provide design guidance but not to restrict the principal land uses of urban areas.

The Kōloa-Poʻipū-Kalāheo Planning District Heritage Resources Map designates Maluhia Road and the segment of Kōloa Road along the Project Site as Scenic Roadway Corridors. The proposed Northern Leg will not have a substantial visual impact, and will not obstruct existing view planes.

7.1 Regional Highways and Roads

7.1.5 Policy

(e) Reserve corridors for future roadways as shown on the General Plan Land Use Map. The corridors are conceptual only and are subject to environmental assessment and evaluation of alternative alignments.

Alternative alignments were considered within the context of the general location and function of the Northern Leg corridor as recommended by the various State and County transportation and land use planning documents. According to these recommendations, the Northern Leg would function as the remaining road link connecting the existing Western Bypass Road at its terminus at Kōloa Road, with Maluhia Road at its intersection with Ala Kinoiki. With the termini of the Northern Leg corridor thus fixed, an assessment was conducted to determine the specific road alignment through the area. The assessment considered physical site constraints, most notably the course of Ōmaʻo Stream, while achieving a geometric alignment that would provide adequate sight distance by minimizing curvatures along the length of the road. The proposed road alignment was determined to be the most feasible, as it minimizes crossings of Ōmaʻo Stream, while providing the most direct alignment between the established termini.

4.2.2 Kōloa-Poʻipū-Kalāheo Development Plan

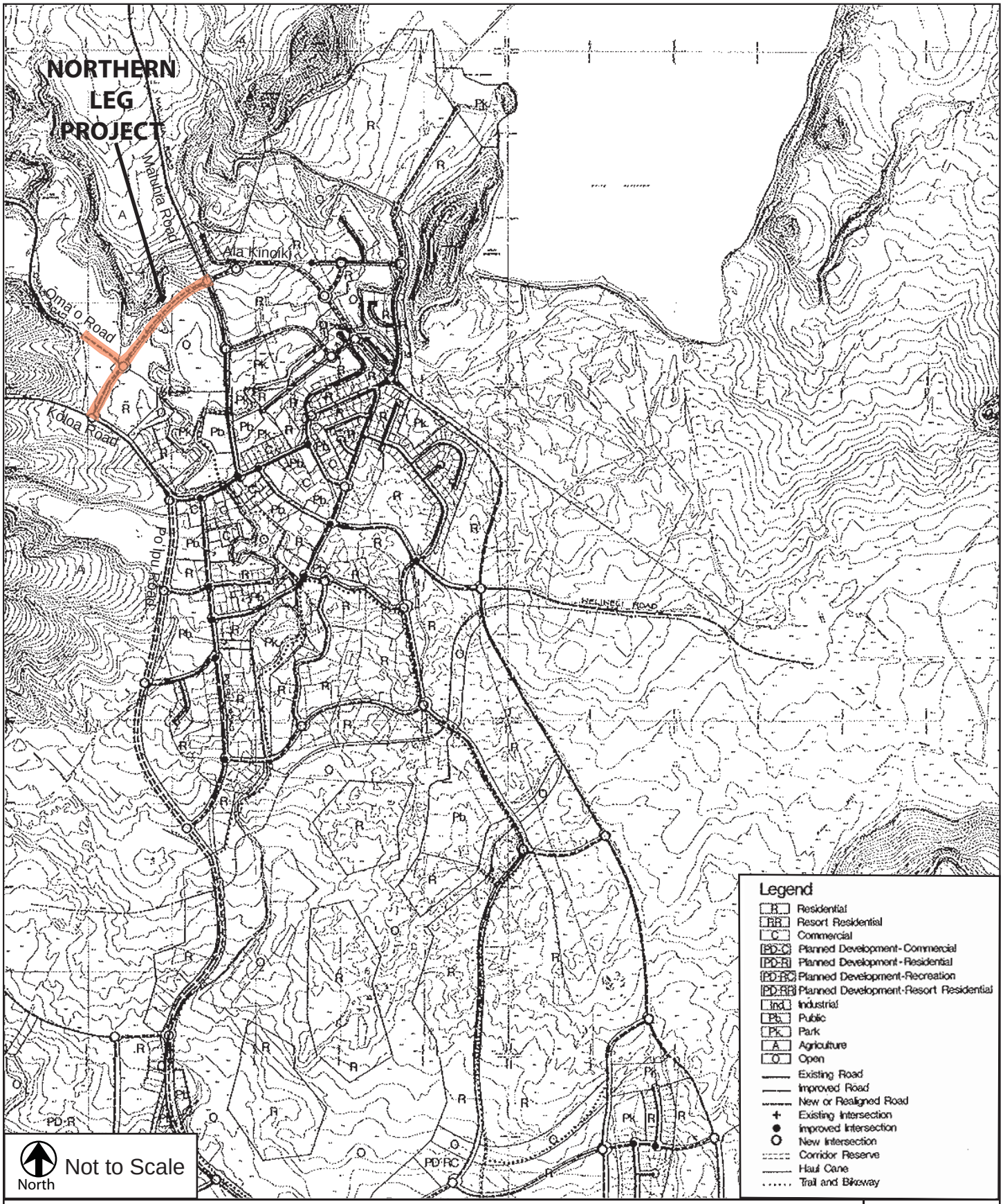
The County's Kōloa-Poʻipū-Kalāheo Development Plan, adopted by County ordinance in 1983, provides physical, social and economic measures which relate specifically to these communities. The goals and objectives that provide overall guidance to the implementation of the Kōloa-Poʻipū-Kalāheo Development Plan, and with which the proposed Project is consistent with, include the following:

> *(11) Transportation and Circulation.*
> *(A) Improve roadway patterns and linkages at points of congestion and areas of future growth.*
>
> *(14) Public Facilities.*
> *(A) Encourage development of roads, sewerage, water facilities, drainage improvements and other public facilities necessitated by existing uses and proposed growth.*

The proposed Project is depicted as one of several vehicular circulation systems recommended in the Kōloa-Poʻipū-Kalāheo Development Plan. Under Physical Implementation – Infrastructure, the Plan states:

> *Proposed improvements to infrastructure will insure a functional, coordinated circulation system. While there is obvious flexibility in the precise location and detailed design of recommended improvements, there is little or no flexibility in the system itself. …*
>
> *The circulation system as proposed should be adopted by ordinance and no variation to the implementation of that system permitted without a complete analysis of impact on the system and a feasible alternative solution which accomplishes the same functional objectives.*

The Kōloa-Poʻipū-Kalāheo Development Plan map depicts the proposed Northern Leg alignment connecting Kōloa Road with Maluhia Road, and the realignment of the southern end of Ōmaʻo Road intersecting with the Northern Leg (see Figure 4-3).



Northern Leg of the Western Bypass Road

KŌLOA-POIʻPŪ-KALĀHEO DEVELOPMENT PLAN MAP

FIGURE

4-3

The proposed Northern Leg implements the goals and objectives of the Kōloa-Poʻipū-Kalāheo Development Plan by providing the remaining road link between the existing Western Bypass Road and existing Ala Kinoiki in the Kōloa-Poʻipū region, thereby facilitating access and mobility in this area by providing an alternative route for motorists.

The Kōloa-Poʻipū-Kalāheo Development Plan land use designations for the Project area are Agriculture, Open and Residential (see Figure 4-3).

4.2.3 Kōloa-Poʻipū Area Circulation Plan

The Kōloa-Poʻipū Area Circulation Plan (KPACP) (April 2007) was developed through a broad-based community planning effort to address existing traffic flow concerns, mitigate the traffic impacts of significant new development during the next 15 years (through 2020), and create a more balanced transportation system that includes all travel modes within the Kōloa-Poʻipū-Kukuiʻula area. The KPACP was created through a partnership involving local residents, businesses, associations, developers, elected officials, and government agencies. The multi-modal transportation planning consulting firm of Charlier Associates, Inc. was retained to conduct the planning process, develop the plan, and prepare the report. The KPACP was donated to the County, and approved by the County Council on August 8, 2007.

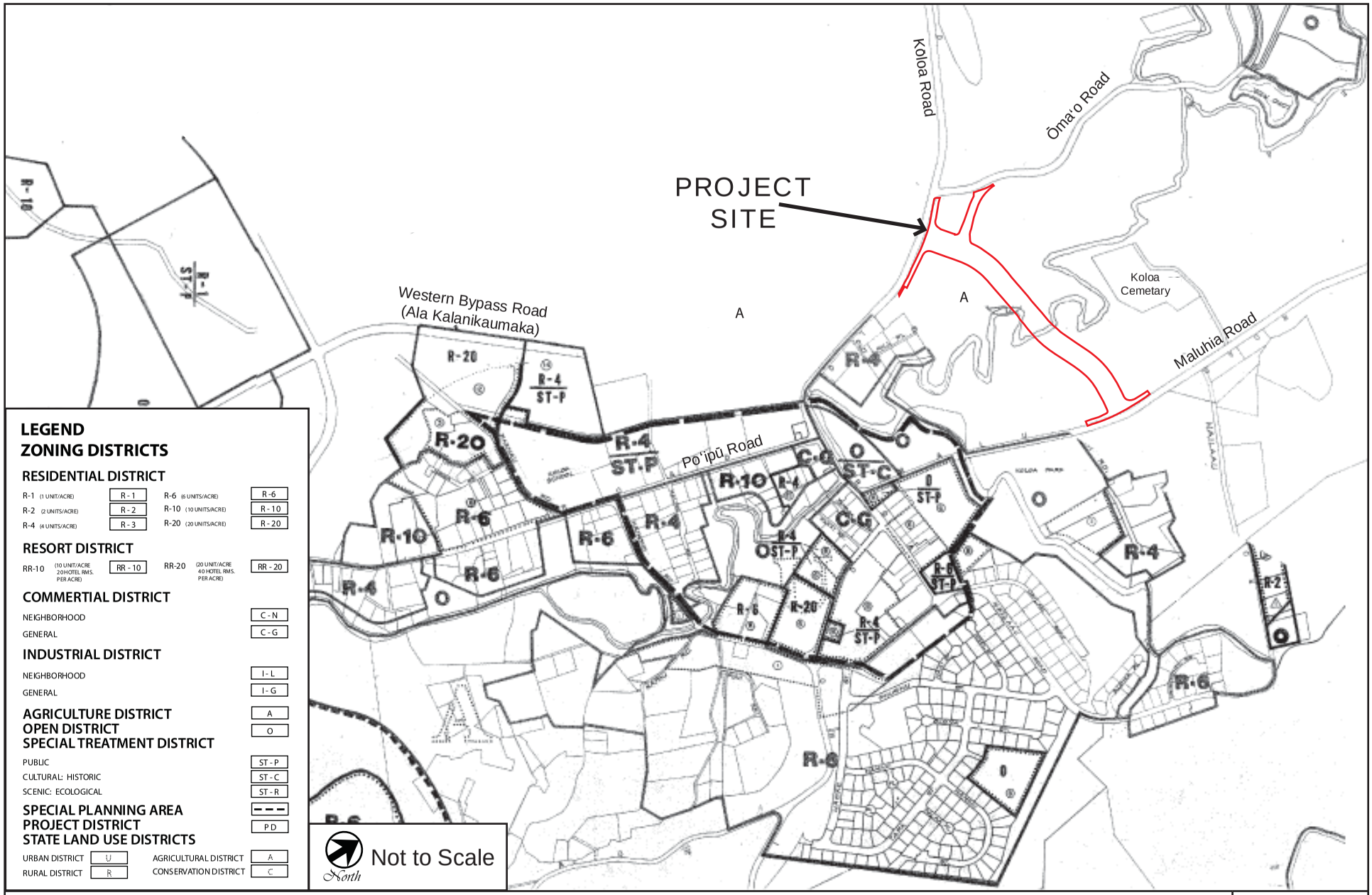
The Northern Leg is included as a recommended street connection in the KPACP, one of several projects intended to enhance the network connectivity and improve traffic flow at major intersections throughout Kōloa and Poʻipū. The 2020 traffic forecasts in the KPACP indicates that the Northern Road could provide regional benefit, and function as an important component of the area's major roadway network. The KPACP's long-term recommendation for the Northern Road involves replacing its intersection at Maluhia Road with a roundabout. The KPACP also designates the Northern Leg as a primary proposed street for an emergency evacuation route.

The KPACP's implementation timeframe for the Northern Leg indicates that it would be developed in ten to 15 years since significant pre-design work is anticipated to occur, and the required environmental review process would need to be undertaken. The Northern Leg project is indicated to be eligible for federal funding, with a 20 percent local match.

4.2.4 County Comprehensive Zoning Ordinance

The County's Comprehensive Zoning Ordinance (CZO) establishes procedures for the division of the County into land use districts, and creates regulations for the types, size, placement, and control of structures within various zoning district classifications. The CZO also delineates the respective types of permitted uses and the development that can take place in those zoning districts.

The zoning designation for the Project Site is Agriculture District (A) as shown on Figure 4-4.



Northern Leg of the Western Bypass Road

FIGURE

4-4

COUNTY OF KAUA'I ZONING MAP

4.2.5 County Special Management Area

The Hawai‘i Coastal Zone Management (CZM) Act (Chapter 205, HRS) is the basis of the Hawai‘i CZM Program as discussed previously in Section 4.1.3. In addition to providing for Federal Consistency Review, the Act establishes objectives, policies and guidelines upon which all counties within the State have structured specific legislation which designated Special Management Areas (SMA). Any development located within the SMA requires a County-issued SMA permit, which on Kaua‘i is administered by the County Planning Department. The proposed Project is located outside of the County’s SMA.

4.3 Permits and Approvals

The following is a list of permits and approvals which may be required prior to construction of the proposed Project:

<u>Federal</u>
Federal Emergency Management Agency (FEMA)

- Compliance with Executive Order 11988, Floodplain Management

<u>State of Hawai‘i</u>
Department of Health

- National Pollutant Discharge Elimination System (NPDES) Permit
- Community Noise Permit

Department of Land and Natural Resources, Historic Preservation Division

- Section 106, National Historic Preservation Act of 1966
- Chapter 6E, HRS Historic Preservation

DLNR, Commission on Water Resource Management

- Stream Channel Alteration Permit

Department of Business, Economic Development & Tourism, Office of State Planning

- Hawai‘i Coastal Zone Management Program Federal Consistency Certification

<u>County of Kaua‘i</u>
Department of Public Works

- Grubbing and Grading Permit
- Road Permit

5. ANTICIPATED DETERMINATION

Based on the significance criteria set forth in Chapter 200, Title 11, State of Hawai‘i Department of Health Administrative Rules, it is anticipated that the proposed Project will not have a significant effect on the environment, and that a Finding of No Significant Impact (FONSI) will be filed with the State Office of Environmental Quality Control (OEQC) following the public consultation period. The reasons supporting this determination are described below according to these significance criteria.

1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;

Development of the proposed Project will require an irrevocable commitment of land, energy, labor, capital, and materials for construction. The principal irrevocable commitment of a natural resource that would result from the proposed Project is the development of land encompassing the Northern Leg and realigned Ōma‘o Road corridors that are currently within agricultural and pasture uses. The land would be committed to the proposed Project for an indefinite period of time.

No listed, candidate, or proposed threatened or endangered botanical, fauna, and aquatic species under either the Federal or State endangered species statutes will be disturbed as a result of the proposed Project.

No archaeological sites have been identified within the Project Site. Should any previously unidentified burial, archaeological or historic sites be found during the course of construction, the Applicant will stop work in the immediate vicinity and the SHPD will be notified immediately. The significance of these finds will then be determined and appropriate mitigation measures will be approved by the SHPD and the Kaua‘i/Ni‘ihau Islands Burial Council, as appropriate. As there is no reported ongoing traditional gathering or hunting practices occurring within the Project area, the proposed Project will have no adverse impact on traditional cultural properties or practices, gathering rights, or access.

2) Curtails the range of beneficial uses of the environment;

The intention of the proposed Project is to commit the Project Site to the proposed use over the long-term. Beneficial uses of the Project Site and environment would not be curtailed since the Northern Leg is an appropriate use for the site as recommended in the various State and County transportation and land use planning documents that have identified the need for this road link.

3) Conflicts with the State’s long-term environmental policies or goals and guidelines as expressed in Chapter 344 HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;

The Project’s relationship to the environmental policies, goals, and guidance set forth in Chapter 344, HRS, is assessed through this EA process.

4) Substantially affects the economic, social welfare, or cultural practices of the community or State;

In the short term, the Project will confer positive benefits in the local area. Direct economic benefits will result from construction expenditures both through the purchase of material from local suppliers and through the employment of local labor, thereby stimulating that sector of the economy. Indirect economic benefits may include benefits to local retailing businesses resulting from construction activities.

There are no significant adverse long-term socio-economic impacts anticipated with the proposed Project. The proposed Northern Leg is not expected to induce growth beyond that which is anticipated for the region. Rather, the proposal has long been considered part of the future of Kōloa-Poʻipū. The Kōloa-Poʻipū-Kalāheo Development Plan, which was prepared in 1978 and adopted by County ordinance in 1983, envisioned the Northern Leg as part of the circulation system for the area. The proposed Northern Leg is not anticipated to have a major influence in future land use patterns in the Kōloa area. In particular, the agriculture-designated lands abutting the proposed Northern Leg are anticipated to remain in its current state for the foreseeable future, unless State Land Use designations are revised, the Kauaʻi General Plan is amended, and the lands are rezoned.

The Northern Leg is intended to benefit the entire Kōloa-Poʻipū region without impacting a specific ethnicity or income group. Further, the Project is not located in a residential area that may otherwise directly impact residents. The proposed Project will not result in a disproportionately high adverse impact on minority and low-income populations.

As there is no reported ongoing traditional gathering or hunting practices occurring within the Project area, the proposed Project will have no adverse impact on traditional cultural properties or practices, gathering rights, or access.

5) Substantially affects public health;

An efficient transportation system is essential to protect the public health of residents and visitors of Kauaʻi. The proposed Project is anticipated to improve emergency vehicle access and travel times. Thus, the Project will not have an adverse affect on public health.

6) Involves substantial secondary impacts, such as population changes or effects on public facilities;

The proposed Northern Leg is not expected to induce growth beyond that which is anticipated for the region. Rather, the proposal has long been considered part of the future of Kōloa-Poʻipū. The Kōloa-Poʻipū-Kalāheo Development Plan, which was prepared in 1978 and adopted by County ordinance in 1983, envisioned the Northern Leg as part of the circulation system for the area. The proposed Northern Leg is not anticipated to have a major influence in future land use patterns in the Kōloa area. In particular, the agriculture-designated lands abutting the proposed Northern Leg are anticipated to remain in its current state for the foreseeable future, unless State Land Use designations are revised, the Kauaʻi General Plan is amended, and the lands are rezoned.

7) Involves a substantial degradation of environmental quality;

The proposed Project is not anticipated to involve a substantial degradation of environmental quality.

Construction activities associated with the proposed Project will create some adverse short-term impacts such as temporary disruption of traffic, unavoidable noise impacts, and air quality impacts from soil excavation and grading activities in the vicinity of the Project Site. The construction contractor(s) will be required to mitigate potential vehicular traffic impacts through appropriate traffic control measures (see Section 3.15 Traffic). Unavoidable construction noise impacts on nearby land uses in the immediate vicinity of the proposed Project will be mitigated to some degree by complying with the provisions of the State DOH Administrative Rules, Title 11, Chapter 46, Community Noise Control (see Section 3.10 Noise). Potential air quality impacts during construction of the proposed Project will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60, Air Pollution Control (see Section 3.9 Air Quality).

Potential water quality impacts to Ōmaʻo Stream and near shore coastal waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation. No construction activities in conjunction with the Project will occur within Ōmaʻo Stream and the two abutting wetlands.

In the long-term, no significant air quality, noise, or water quality impacts are anticipated from the operation of the proposed Project.

Construction and operation of the proposed Project are not anticipated to result in flooding of the Project area or to increase flood risks to properties lying uphill or downhill of the Project Site. The proposed Project improvements will be designed and constructed in full compliance with the flood plain management requirements of the County.

Following construction, the Project improvements will produce no adverse effects from storm runoff to adjacent and downstream areas. New drainage improvements, including drain headwalls, drain lines, grass swales, and culverts, will be provided in conjunction with the proposed Project improvements.

8) Is individually limited but cumulatively has a considerable effect upon the environment or involves a commitment for larger actions;

The Project itself is not anticipated to have a significant adverse cumulative effect on the environment, nor will it involve a commitment for larger actions. The proposed Northern Leg is not expected to induce growth beyond that which is anticipated for the region. Rather, the proposal has long been considered part of the future of Kōloa-Poʻipū as recommended in the various State and County transportation and land use planning documents that have identified

the need for this road link. The Kōloa-Poʻipū-Kalāheo Development Plan, which was prepared in 1978 and adopted by County ordinance in 1983, envisioned the Northern Leg as part of the circulation system for the area. The Northern Leg represents an important component of the County's objective to improve regional traffic flow and circulation within the South Shore region of Kauaʻi. The proposed Northern Leg is not anticipated to have a major influence in future land use patterns in the Kōloa area. In particular, the agriculture-designated lands abutting the proposed Northern Leg are anticipated to remain in its current state for the foreseeable future, unless State Land Use designations are revised, the Kauaʻi General Plan is amended, and the lands are rezoned.

9) Substantially affects a rare, threatened or endangered species, or its habitat;

No listed, candidate, or proposed threatened or endangered botanical species under either the Federal or State endangered species statutes will be disturbed as a result of the proposed Project.

No listed, candidate, or proposed threatened or endangered avian and mammalian species under either the Federal or State endangered species statutes will be disturbed or adversely impacted as a result of the proposed Project. To reduce the potential for interactions between nocturnally flying Hawaiian Petrels, Newell's Shearwaters, and Band-rumped Storm Petrels with external lights, street lighting proposed for the Project will be shielded or of the cut-off luminaire or indirect lighting types. In addition, night time construction activities will not be undertaken in conjunction with the proposed Project improvements.

It is unknown whether the endangered Hawaiian hoary bat utilizes the Project Site as a roosting site. The potential impact that construction of the proposed Project would have on the Hawaiian hoary bat is during grubbing and clearing of the dense vegetation along Ōmaʻo Stream. Since females carry their pups during the pupping season, which occurs between April and early August, they may be less able to quickly vacate roosting sites during clearing of such habitat. To avoid potential impacts to the Hawaiian hoary bat, it is recommended that clearing of the dense *hau* vegetation along Ōmaʻo Stream be conducted outside of the pupping season.

Since the Project Site is not located within any of the Critical Habitat Units designated for the endemic, endangered Kauaʻi cave wolf spider and the Kauaʻi cave amphipod by the USFWS' Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Kauaʻi Cave Wolf Spider and Kauaʻi Cave Amphipod; Final Rule (50 CFR 17) published on April 9, 2003, it is not anticipated that the development of the Project will have an adverse impact on both species or their habitat.

No Federal or State listed endangered or threatened aquatic species will be disturbed or adversely impacted as a result of the proposed Project.

10) Detrimentally affects air or water quality or ambient noise levels;

Construction activities associated with the proposed Project will create adverse short-term impacts such as unavoidable noise impacts and air quality impacts from soil excavation and grading activities in the vicinity of the Project Site. Unavoidable construction noise impacts on nearby land uses in the immediate vicinity of the proposed Project will be mitigated to some

degree by complying with the provisions of the State DOH Administrative Rules, Title 11, Chapter 46, Community Noise Control. The hours of permitted construction noise operations specified in the Rules will be adhered to and enforced. Potential air quality impacts during construction of the proposed Project will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60, Air Pollution Control.

In the long-term, no significant air quality or noise impacts are anticipated from the operation of the proposed Project. Due to the small impact the Project is expected to have on air quality, implementing mitigation measures for long-term traffic-related air quality impacts is probably unnecessary and unwarranted. Future traffic noise levels with the proposed Project are not expected to exceed the DOT's noise abatement criteria. The Northern Leg is located relatively far from existing noise sensitive developments in the Project vicinity. Furthermore, the nearby areas surrounding the Northern Leg are presently mostly vacant and undeveloped. Therefore, traffic noise mitigation measures should not be required for this Project.

Potential water quality impacts to Ōmaʻo Stream and near shore coastal waters during construction of the Project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the State DOH will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and minimizing time of exposure between construction and re-vegetation. No construction activities in conjunction with the Project will occur within Ōmaʻo Stream.

Following construction, the Project improvements will produce no adverse effects from storm runoff to adjacent and downstream areas. New drainage improvements, including drain headwalls, drain lines, grass swales, and culverts, will be provided in conjunction with the proposed Project improvements.

11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;

According to the FIRM FEMA, the central portion of the Project Site in the vicinity of Ōmaʻo Stream is designated "Floodway Areas in Zone AE" (see Figure 3-4). The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. The areas bordering both sides of this Floodway Area are designated Zone "AE", "Special flood hazard areas subject to inundation by the 1% annual chance flood, with base flood elevations determined." The base flood elevation for Zone "AE" within the Project Site is 220 feet above msl. The areas bordering both sides of Zone "AE" are designated Zone "X", "Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood." The remainder of the Project Site within the northern and southern ends is designated Zone "X", "Areas determined to be outside the 0.2% annual chance floodplain".

Construction and operation of the proposed Project are not anticipated to result in flooding of the Project area or to increase flood risks to properties lying uphill or downhill of the Project Site.

The Northern Leg bridge will be designed to span the Ōma‘o Stream crossing and associated designated floodway area. Concrete piers supporting the bridge will extend vertically into the ground. The bridge will be designed and constructed to meet the current standards for flood elevation. The current standard is for a two-foot minimum freeboard from finished deck elevation to the 100-year water surface elevation. The proposed Project improvements will be designed and constructed in full compliance with the flood plain management requirements of the County. This will include certification by a registered professional civil engineer that the Project improvements will not result in any increase in base flood elevations during the occurrence of base flood discharges.

Two wetlands associated with Ōma‘o Stream are located within the central portion of the Project Site. No construction activities in conjunction with the Project will occur within Ōma‘o Stream and the two abutting wetlands.

The Project is located approximately 1.8 miles inland (mauka) from the coastline and, therefore, will not adversely affect or suffer damage from coastal waters.

12) Substantially affects scenic vistas and viewplanes identified in county or state plans or studies;

The Kōloa-Po‘ipū-Kalāheo Planning District Heritage Resources Map of the County General Plan designates Maluhia Road and the segment of Kōloa Road along the Project Site as Scenic Roadway Corridors. The proposed Northern Leg will not have a substantial visual impact, and will not obstruct existing view planes.

13) Requires substantial energy consumption;

Operation of the proposed Project will not result in a significant increase in energy consumption demand.

6. REFERENCES

1. Austin, Tsutsumi & Associates, Inc. *Kaua'i Long-Range Land Transportation Plan*. Prepared for the State of Hawai'i Department of Transportation, In Cooperation With the County of Kaua'i Department of Public Works and the County of Kaua'i Planning Department. May 1997.

2. Charlier Associates, Inc. *Kōloa-Po'ipū Area Circulation Plan*. April 2007.

3. County of Kaua'i. Resolution No. 2008-10, Requesting the Administration to Pursue Implementation of the Kōloa-Po'ipū Area Circulation Plan (KPACP). Adopted by the County Council on March 12, 2008.

4. County of Kaua'i, Planning Department. *Kaua'i General Plan*. November 2000

5. County of Kaua'i. *Kōloa-Po'ipū-Kalāheo Development Plan*. 1983.

6. Hawai'i Cooperative Park Service Unit, National Park Service for the State of Hawai'i Commission on Water Resource Management. *Hawai'i Stream Assessment, A Preliminary Appraisal of Hawai'i's Stream Resources, Report R84.* December 1990

7. Hawai'i State Department of Business, Economic Development and Tourism. *Hawai'i Census 2000*.

8. Macdonald, Gordon A., A.T. Abbott and Frank L. Peterson. *Volcanoes in the Sea, The Geology of Hawai'i*. Second Edition 1986.

9. Sterns, Harold T. *Geology of the State of Hawai'i.* Second Edition 1985.

10. United States Department of Agriculture Soil Conservation Service. *Soil Survey of Islands of Kaua'i, Oahu, Maui, Molokai, and Lanai, State of Hawai'i*, August 1972.

11. U.S. Census Bureau. *Census 2000 Summary 100 Percent Data.*

12. Wilson Okamoto Corporation. *Kōloa to Po'ipū Bypass Road From Weliweli Road to Maluhia Road Draft Environmental Assessment*. Prepared for County of Kaua'i Department of Public Works. May 1997.

13. Wilson Okamoto Corporation. *Hawai'i Water Plan, Water Resource Protection Plan.* Prepared for the State of Hawai'i Department of Land and Natural Resources, Commission on Water Resource Management. June 2008.

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7. CONSULTATION

7.1 Pre-Assessment Consultation

The following agencies and organizations were consulted during the preparation of the Draft EA. Those who formally replied are indicated by an asterisk (*). All written comments and responses are reproduced herein.

Federal

* U.S. Army Corps of Engineers
* U.S. Geological Survey
* U.S. Fish and Wildlife Service
* U.S. Natural Resources Conservation Service
U.S. Department of Transportation, Federal Highway Administration

State of Hawai‘i

* Department of Accounting and General Services
* Department of Education
Department of Business, Economic Development & Tourism
Department of Business, Economic Development & Tourism, Land Use Commission
Department of Business, Economic Development & Tourism, Office of Planning
Department of Health
* Department of Health, Office of Environmental Quality Control
Department of Health, Environmental Planning Office
Department of Health, Environmental Management Division
Department of Land and Natural Resources
* Department of Land and Natural Resources, Land Division
* Department of Land and Natural Resources, Historic Preservation Division
* Department of Transportation
Office of Hawaiian Affairs

County of Kaua‘i

Planning Department
* Department of Public Works, Building Division
Department of Public Works, Solid Waste Division
* Department of Public Works, Division of Wastewater Management
* Department of Water
* Housing Agency
Department of Parks and Recreation
Transportation Agency
Civil Defense Agency
Office of Economic Development
Police Department
Fire Department

Others

Kōloa Community Association
* Po‘ipū Beach Resort Association
* Kaua‘i Path, Inc.

7.2 Draft Environmental Assessment Consultation

The following agencies and organizations will be consulted during the public review period of the Draft EA.

Federal
U.S. Army Corps of Engineers
U.S. Geological Survey
U.S. Fish and Wildlife Service
U.S. Natural Resources Conservation Service
U.S. Department of Transportation, Federal Highway Administration

State of Hawai‘i
Department of Agriculture
Department of Accounting and General Services
Department of Education
Department of Business, Economic Development & Tourism
Department of Business, Economic Development & Tourism, Land Use Commission
Department of Business, Economic Development & Tourism, Office of Planning
Department of Business, Economic Development & Tourism, Energy Division
Department of Defense
Department of Health
Department of Health, Office of Environmental Quality Control
Department of Health, Environmental Planning Office
Department of Health, Environmental Management Division
Department of Land and Natural Resources
Department of Land and Natural Resources, Land Division
Department of Land and Natural Resources, Division of Forestry and Wildlife
Department of Land and Natural Resources, Division of Forestry and Wildlife, Kaua‘i District
Department of Land and Natural Resources, Division of Aquatic Resources
Department of Land and Natural Resources, Kaua‘i District Office
Department of Land and Natural Resources, Historic Preservation Division
Department of Hawaiian Home Lands
Department of Human Services
Department of Labor and Industrial Relations
Department of Transportation
Office of Hawaiian Affairs
University of Hawai‘i Environmental Center

County of Kaua‘i
Planning Department
Department of Public Works, Building Division
Department of Public Works, Solid Waste Division
Department of Public Works, Division of Wastewater Management
Department of Water
Housing Agency
Department of Parks and Recreation
Transportation Agency
Civil Defense Agency

County of Kaua‘i (cont.)
Office of Economic Development
Police Department
Fire Department

Elected Officials
Honorable Mayor Bernard P. Carvalho, Jr.
Senator Gary Hooser
Representative James Tokioka
Representative Roland Sagum, III
Council Chair Bill “Kaipo” Asing
Council Vice Chair Jay Furfaro
Councilmember Tim Bynum
Councilmember Dickie Chang
Councilmember Daryl Kaneshiro
Councilmember Lani Kawahara
Councilmember Derek Kawakami

Utilities
Kaua‘i Island Utility Cooperative
Hawaiian Telcom
Oceanic Time Warner Cable

Others
Kōloa Community Association
Po‘ipū Beach Resort Association
Kaua‘i Path, Inc.
Kaua‘i Community College Library
Līhu‘e Public Library
Kōloa Public/School Library
Hawai‘i State Library

7.3 Public Informational Meeting

A public informational meeting was held on November 12, 2009 at the Kōloa Neighborhood Center to present the proposed Project and obtain comments. The meeting format included an “open house” session in which attendees were provided the opportunity to review map exhibits of the Project, and ask questions and talk with County DPW representatives, as well as the Project consultants. The formal portion of the meeting included a power point presentation of the proposed Project, followed by questions and comments from the meeting attendees. A summary of the meeting, as well as written comments received and written responses provided, are included herein following the Pre-Assessment Consultation Correspondence.

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Pre-Assessment Consultation Correspondence

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:

October 31, 2008

Regulatory Branch

File Number POH-2006-516

RECEIVED
NOV 03 2008
WILSON OKAMOTO CORPORATION

Mr. Ronald Sato
Wilson Okamoto Corporation
1907 S. Beretania Street
Artesian Plaza, Suite 400
Honolulu, HI 96826

Dear Mr. Sato:

This letter responds to your September 24, 2008 request for comments for the proposed construction of the roadway referred to as the "Northern Leg of the Western Bypass Road" located in Koloa, Kauai Island, Hawaii (TMKs: (4) 2-7-03: por. 2 and 2-8-06: por. 1). We have reviewed the information you provided with respect to the Corps' authority to issue DA permits pursuant to the Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) and Section 404 of the Clean Water Act (33 USC 1344).

On June 18, 2008, an approved jurisdictional determination was issued to you for the proposed project which identified the Omao Stream and the Area B and Area C adjacent wetlands as waters of the U.S. (WOUS) subject to our jurisdiction. The project summary you provided does not contain an adequate level of detail for the purpose of determining whether the proposed road construction would involve activities that result in the placement and/or discharge of dredged and/or fill material into these waters.

Additional information is required in order to make a permit determination; therefore, please submit for review a copy of the draft EA, including detailing project alignment drawings and cross-sections design plans, and report any construction methods and/or activities that would involve aquatic resources, including the types and quantities of material to be placed in the previously identified WOUS.

Should you have questions regarding this request for additional information, please contact Ms. Joy Anamizu at (808) 438-7023, fax (808) 438-4060, or by e-mail at *joy.n.anamizu@usace.army.mil*.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS · CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

6607-34
July 26, 2010

Mr. George P. Young, P.E., Chief
Department of the Army
U.S. Army Corps of Engineers, Honolulu District
Regulatory Branch
Fort Shafter, Hawai'i 96858-5440

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Young:

Thank you for your letter dated October 31, 2008 (Ref: POH-2006-516) regarding the subject Project.

The forthcoming Draft EA, a copy which will be submitted for your review, will discuss the proposed construction methods for the Project, and will include conceptual plans, sections and elevations of the proposed road improvements. The Draft EA will also indicate that the Project improvements will be designed and constructed to avoid Ōma'o Stream and the two abutting wetlands, which have been determined to be waters of the U.S., subject to the jurisdiction of the U.S. Department of the Army, Corps of Engineers.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Pacific Islands Water Science Center
677 Ala Moana Blvd., Suite 415
Honolulu, HI 96813
Phone: (808) 587-2400/Fax: (808) 587-2401

October 10, 2008

Mr. Ronald A. Sato, AICP
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii 96826

RECEIVED
OCT 14 2008
WILSON OKAMOTO CORPORATION

Dear Mr. Sato:

Subject: Northern Leg of the Western Bypass Road Project
Pre-Assessment Consultation for Draft Environmental Assessment
Kōloa, Kaua'i, Hawai'i
Tax Map Key: 2-07-003: portion of 002, and 2-08-006: portion of 001

Thank you for forwarding the subject Pre-Assessment Consultation for Draft Environmental Assessment for review and comment by the staff of the U.S. Geological Survey, Pacific Islands Water Science Center. We regret however, that due to prior commitments and lack of available staff, we are unable to review this document.

We appreciate the opportunity to participate in the review process.

Sincerely,

Gordon Tribble
Director

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS • CONSULTANTS

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6607-34
July 26, 2010

Mr. Stephen Anthony, Center Director
United States Department of the Interior
U.S. Geological Survey
Pacific Islands Water Science Center
677 Ala Moana Blvd., Suite 415
Honolulu, Hawai'i 96813

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Anthony:

Thank you for your letter dated October 10, 2008 regarding the subject project. We acknowledge that your department was unable to review this document due to prior commitments and lack of available staff.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2008-TA-0339

OCT 0 8 2008

Mr. Ronald A. Sato, AICP
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96825

Subject: Pre-Assessment for the Draft Environmental Assessment for the Northern Leg of the Western Bypass Road Project, Koloa, Kauai

Dear Mr. Sato:

Thank you for your letter, received September 26, 2008, requesting our input on the development of a draft Environmental Assessment (DEA) for the proposed Northern Leg of the Western Bypass Road in Koloa, Kauai. The proposed project is to create a County-owned roadway that connects the Western Bypass Road at Koloa Road to Ala Kinoiki (Eastern Bypass Road). A bridge over the Omao Stream is part of the planned roadway.

Based on the project information you provided and pertinent information in our files, the threatened Newell's shearwater (*Puffinus auricularis newelli*), endangered Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), and a species of concern, the Band-rumped storm petrel (*Oceanodroma castro*) (collectively referred to as seabirds) are known to traverse the project area. In addition, the construction of the bridge has potential impacts to water quality that should be addressed in the DEA.

To assist you in developing your project to minimize impacts to species listed under the Endangered Species Act (ESA) of 1973 [16 U.S.C. 1531-1544], as amended, we provide the following guidance. Seabirds may traverse the project area at night during the breeding season (February 1 through December 15), and they are attracted to artificial lighting. Any outdoor lighting, particularly when used during the peak fledging period (September 15 through December 15), could result in seabird disorientation, fallout, injury, or mortality. Potential impacts to seabirds can be minimized by shielding outdoor lights associated with the project, avoiding night-time construction, installing motion detectors and timers on all light fixtures, and providing all project staff with information regarding seabird fallout. All project lights should be shielded so the bulb can be seen only from below.

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If night time construction can not be avoided during the seabird fledging period, we also recommend the development and implementation of a Seabird Response Plan, which includes:

- Response plan for circling/downed birds: lights may be turned off temporarily *if it is safe* for workers and if birds are circling the lights.
- Staff should receive seabird awareness training (this should be verified on their personnel file).
- Active searching for downed birds during fledging season (September 15 through December 15).
- If a downed seabird is detected, immediately take the bird to a Save Our Shearwaters (SOS) dropoff station and then contact our office.
- Maintain a pet carrier on-site at all times with instructions on how and where to keep recovered birds.
- Maintenance of a log of seabird incidences that will be submitted to the Pacific Islands Fish and Wildlife Office and Hawaii Division of Forestry and Wildlife at regular intervals.

For your reference we have attached additional recommended practices to minimize construction impacts to water quality and fish and wildlife resources. If you have questions regarding these comments would like additional information, please contact Megan Laut, Fish and Wildlife Biologist, Consultation and Technical Assistance Program (phone: 808-792-9400, fax: 808-792-9581).

Sincerely,

Christe Russell
for Patrick Leonard
Field Supervisor

Enclosure

U.S. Fish and Wildlife Service
Recommended Standard Best Management Practices

The U.S. Fish and Wildlife Service recommends that the measures below be incorporated into projects to minimize the degradation of water quality and minimize the impacts to fish and wildlife resources.

1. Turbidity and siltation from project-related work shall be minimized and contained within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

2. Dredging/filling in the marine environment shall be scheduled to avoid coral spawning and recruitment periods and sea turtle nesting and hatching periods.

3. Dredging and filling in the marine/aquatic environment shall be designed to avoid or minimize the loss special aquatic site habitat (beaches, coral reefs, wetlands, etc.) and the function of such habitat shall be replaced.

4. All project-related materials and equipment (dredges, barges, backhoes, etc.) to be placed in the water shall be cleaned of pollutants prior to use.

5. No project-related materials (fill, revetment rock, pipe, etc.) should be stockpiled in the water (intertidal zones, reef flats, stream channels, wetlands, etc.) or on beach habitats.

6. All debris removed from the marine/aquatic environment shall be disposed of at an approved upland or ocean dumping site.

7. No contamination (trash or debris disposal, non-native species introductions, attraction of non-native pests, etc.) of adjacent habitats (reef flats, channels, open ocean, stream channels, wetlands, beaches, forests, etc.) shall result from project-related activities. This shall be accomplished by implementing a litter-control plan and developing a Hazard Analysis and Critical Control Point Plan (HACCP – see http://www.haccp-nrm.org/Wizard/default.asp) to prevent attraction and introduction of non-native species.

8. Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project shall be developed. Absorbent pads and containment booms shall be stored on-site, if appropriate, to facilitate the clean-up of accidental petroleum releases.

9. Any under-layer fills used in the project shall be protected from erosion with stones (or core-loc units) as soon after placement as practicable.

10. Any soil exposed near water as part of the project shall be protected from erosion (with plastic sheeting, filter fabric etc.) after exposure and stabilized as soon as practicable (with native or non-invasive vegetation matting, hydroseeding, etc.).

WILSON OKAMOTO CORPORATION
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6607-34
July 26, 2010

Mr. Patrick Leonard, Field Supervisor
United States Department of the Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Blvd., Room 3-122, Box 50088
Honolulu, Hawai'i 96850

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Leonard:

Thank you for your letter dated October 8, 2008 (Ref: 2008-TA-0339) regarding the subject Project.

The forthcoming Draft EA will discuss the potential impacts of the proposed Project on seabirds, aquatic fauna, and water quality, and appropriate mitigation measures, as may be required.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
P.O. Box 50004 Rm. 4-118
Honolulu, HI 96850
808-541-2600

October 8, 2008

RECEIVED
OCT 09 2008
WILSON OKAMOTO CORPORATION

Mr. Ronald A. Sato. ACIP
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Ronald A. Sato,

Thank you for providing the NRCS the opportunity to review the Northern leg of the Western Bypass Road project Pre-Assessment Consultation for Draft Environmental Assessment, Koloa, Kauai, Hawaii. Please find enclosed the NRCS Soil Survey Map, soil reports, and a map indicating areas of Important Farmlands. The important Farmlands map has been enclosed for your aid in determining if a Farmland Impact Conversion Rating Form (AD-1006) is needed for this project. Typically, this form is required on projects that convert farmlands into non-farmland uses, and have federal dollars attached to the project. See the website link below for more information on the Farmland Protection Policy Act, and a copy of the AD-1006 form, with instructions. In addition, hydric soils are located in the project area. The Hydric Soils report indicates that soil map unit HnA contains 15 percent hydric soils. The location and extent of soil map unit HnA can be found on the enclosed soil map. Hydric soils identify potential areas of wetlands. If wetlands do exist, any proposed impacts to these wetlands would need to demonstrate compliance with the "Clean Water Act", and may need an Army Corp of Engineers 404 permit. Also, as identified on your Exhibit 2 "Preliminary Northern Leg Site Plan", the proposed Northern Leg Project crosses the Omao Stream. Any work in the stream or near the stream banks may require additional Federal, State or Local permitting.

The enclosed Soil Survey Map identifies all soil map units in the project area. The soil reports provide selected soil properties and interpretations, e.g., Local Roads and Streets, soil layers with USDA textures, and engineering classifications. The limitation ratings for the selected use, local roads and streets, are very limited for all map units in the project area . These ratings do not preclude the intended land use, however they do identify potential limitations for the use, which may require corrective measures, increase costs, and/or require continued maintenance.

The NRCS Soil Survey is a general planning tool and does not eliminate the need for an onsite investigation. If you have any questions concerning the soils or interpretations for this project please call, Tony Rolfes, Assistant State Soil Scientist, (808) 541-2600 x129, or email, Tony.Rolfes@hi.usda.gov.

NRCS - Farmland Protection Policy Act Website:
http://www.nrcs.usda.gov/programs/fppa/

LAWRENCE T. YAMAMOTO
Director
Pacific Islands Area

cc: Michael Robotham, Assistant Director for Soil Science and Natural Resource Assessments, USDA-NRCS, Honolulu, HI

Enclosures:

NRCS Soil Mapunits
Northern Leg of The Western Bypass Road Project
County of Kauai

0 255 510 1,020 1,530 2,040 Feet

N

NRCS
7/2008

Legend
Approx. Project Area
Soil Mapunits

Important Farmlands
Northern Leg of The Western Bypass Road Project
County of Kauai

0 255 510 1,020 1,530 2,040 Feet

N

NRCS
7/2008

Legend
Approx. Project Area
Important Farmlands
<all other values>
AGTYPE
Prime Farmland
Unique Farmland
Statewide Important

Hydric Soils

Island of Kauai, Hawaii

Map symbol and map unit name	Component	Percent of map unit	Landform	Hydric rating	Hydric criteria
HnA:					
Hanalei silty clay, 0 to 2 percent slopes	Inclusion	15	Alluvial flats	Yes	2B3, 3

Explanation of hydric criteria codes:

1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      1.) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      2.) a water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      3.) a water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for long or very long duration during the growing season.
4. Soils that are frequently flooded for long or very long duration during the growing season.

Selected Soil Interpretations

Island of Kauai, Hawaii

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

*This soil interpretation was designed as a "limitation" as opposed to a "suitability". The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation.

Map symbol and soil name	Pct. of map unit	ENG - Local Roads and Streets *	
		Rating class and limiting features	Value
HnA:			
Hanalei	85	Very limited	
		Ponding	1.00
		Flooding	1.00
		Low strength	1.00
		Shrink-swell	0.50
IoC:			
Ioleau	100	Very limited	
		Low strength	1.00
		Slope	0.04
IoD2:			
Ioleau	100	Very limited	
		Low strength	1.00
		Slope	1.00
LhB:			
Lihue	100	Very limited	
		Low strength	1.00
LlB:			
Lihue, gravelly	100	Very limited	
		Low strength	1.00
LlC:			
Lihue, gravelly	100	Very limited	
		Low strength	1.00
		Slope	0.63
PkB:			
Pohakupu	100	Very limited	
		Low strength	1.00

Water Features

Island of Kauai, Hawaii

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
PkB:										
Pohakupu	B	Low	Jan-Dec			---	---	None	---	None

Water Features

Island of Kauai, Hawaii

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
HnA:										
Hanalei	C	Negligible	January	2.0-5.0	>6.0	0.0-0.5	Very brief	Occasional	Very brief	Frequent
			February	2.0-5.0	>6.0	0.0-0.5	Very brief	Occasional	Very brief	Frequent
			March	2.0-5.0	>6.0	0.0-0.5	Very brief	Occasional	Very brief	Frequent
			April	2.0-5.0	>6.0	0.0-0.5	Very brief	Occasional	Very brief	Frequent
			May	2.0-5.0	>6.0	0.0-0.5	Very brief	Rare	Very brief	Occasional
			May	2.0-5.0	>6.0	0.0-0.5	Very brief	Rare	Very brief	Occasional
			June	2.0-5.0	>6.0	0.0-0.5	Very brief	Rare	Very brief	Occasional
			July	2.0-5.0	>6.0	0.0-0.5	Very brief	Rare	Very brief	Occasional
			August	2.0-5.0	>6.0	0.0-0.5	Very brief	Rare	Very brief	Occasional
			September	2.0-5.0	>6.0	0.0-0.5	Very brief	Rare	Very brief	Occasional
			October	2.0-5.0	>6.0	0.0-0.5	Very brief	Rare	Very brief	Occasional
			November	2.0-5.0	>6.0	0.0-0.5	Very brief	Occasional	Very brief	Frequent
			December	2.0-5.0	>6.0	0.0-0.5	Very brief	Occasional	Very brief	Frequent
IoC:										
Ioleau	C	Medium	Jan-Dec			---	---	None	---	None
IoD2:										
Ioleau	C	Medium	Jan-Dec			---	---	None	---	None
LhB:										
Lihue	B	Low	Jan-Dec			---	---	None	---	None
LlB:										
Lihue, gravelly	B	Low	Jan-Dec			---	---	None	---	None
LlC:										
Lihue, gravelly	B	Medium	Jan-Dec			---	---	None	---	None

Engineering Properties

Island of Kauai, Hawaii

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
LhB:												
Lihue	0-12	Silty clay	MH-K (proposed)	A-7	0	0	95-100	95-100	95-100	90-100	50-60	15-25
	12-60	Silty clay	MH-K (proposed)	A-7	0	0-5	95-100	95-100	95-100	90-100	50-60	15-25
LlB:												
Lihue, gravelly	0-12	Gravelly silty clay	MH-K (proposed)	A-7	0	0-5	65-75	65-75	65-75	60-70	50-60	15-25
	12-60	Silty clay	MH-K (proposed)	A-7	0	0-5	95-100	95-100	95-100	90-100	50-60	15-25
LlC:												
Lihue, gravelly	0-12	Gravelly silty clay	MH-K (proposed)	A-7	0	0-5	65-75	65-75	65-75	60-70	50-60	15-25
	12-60	Silty clay	MH-K (proposed)	A-7	0	0-5	95-100	95-100	95-100	90-100	50-60	15-25
PkB:												
Pohakupu	0-13	Silty clay loam	MH-O (proposed), OH	A-7	0	0	100	100	95-100	90-100	60-75	15-25
	13-76	Silty clay loam	MH-O (proposed)	A-7	0	0	95-100	95-100	90-100	85-100	60-75	15-25

Engineering Properties

Island of Kauai, Hawaii

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
HnA:												
Hanalei	0-13	Silty clay	MH-O (proposed), OH	A-7	0	0	95-100	95-100	90-100	85-100	65-75	20-30
	13-26	Silty clay loam	MH-O (proposed), OH	A-7	0	0	95-100	95-100	90-100	85-100	65-75	20-30
	26-36	Silty clay	MH-O (proposed), OH	A-7	0	0	95-100	95-100	90-100	75-100	65-75	20-30
IoC:												
Ioleau	0-15	Silty clay loam	MH-O (proposed)	A-7	0	0	100	100	95-100	85-100	55-75	15-30
	15-61	Silty clay, Silty clay loam	MH-O (proposed)	A-7	0	0	100	100	95-100	85-100	55-75	15-30
IoD2:												
Ioleau	0-3	Silty clay loam	MH-O (proposed)	A-7	0	0	100	100	95-100	85-100	55-75	15-30
	3-60	Silty clay, Silty clay loam	MH-O (proposed)	A-7	0	0	100	100	95-100	85-100	55-75	15-30

WILSON OKAMOTO CORPORATION
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6607-34
July 26, 2010

Mr. Lawrence T. Yamamoto, Director
United States Department of Agriculture
Natural Resources Conservation Service
P.O. Box 50004, Room 4-118
Honolulu, Hawai'i 96850

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Yamamoto:

Thank you for your letter dated October 8, 2008 regarding the subject Project.

Coordination will be undertaken with the U.S. Department of Agriculture, Natural Resources Conservation Service to determine if a Farmland Conversion Rating Form (AD-1006) will be required for the proposed Project. This will be included in the forthcoming Draft EA.

The U.S. Department of the Army, Corps of Engineers, by letter dated June 18, 2008, issued a determination that Ōma'o Stream and two abutting wetlands associated with Ōma'o Stream located within the central portion of the Project Site are waters of the U.S. subject to their jurisdiction. The Draft EA will include this information, and will indicate that the Project improvements will be designed and constructed to avoid Ōma'o Stream and the two abutting wetlands. The Draft EA will also discuss the applicable permits that would be required for work conducted near the Ōma'o Stream banks associated with the proposed Project.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

BARBARA A. ANNIS
DEPUTY COMPTROLLER

(P)1326.8

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

OCT - 8 2008

Mr. Ronald A. Sato
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza Suite 400
Honolulu, Hawaii 96826

Dear Mr. Sato:

Subject: Northern Leg of the Western Bypass Road Project
Pre-Consultation for Draft Environmental Assessment
Koloa, Kauai, Hawaii
TMK 2-07-003: portion 002, and 2-08-006: portion 001

Thank you for the opportunity to comment on your September 24, 2008 letter. This proposed project does not directly impact any of the Department of Accounting and General Services' facilities or projects, and we have no comments to offer at this time

If you have any questions, please call me at 586-0400 or have your staff call Mr. Bruce Bennett of the Public Works Division at 586-0491.

Sincerely,

RUSS K. SAITO
State Comptroller

c: Ms. Katherine Kealoha, DOH-OEQC

WILSON OKAMOTO CORPORATION
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Honolulu, Hawaii, 96826 USA
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6607-34
July 26, 2010

Mr. Russ K. Saito, Comptroller
State of Hawai'i
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawai'i 96810

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Saito:

Thank you for your letter dated October 8, 2008 (Ref. (P)1326.8) indicating that you have no comments to offer on the subject Project at this time.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

LINDA LINGLE
GOVERNOR

PATRICIA HAMAMOTO
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

October 8, 2008

Mr. Ronald A. Sato
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawai'i 96826

Dear Mr. Sato:

Subject: North Leg of Western Koloa Bypass Road Pre-Assessment Consultation

The Department of Education has reviewed your letter and has no comment or concern that should be addressed in the Draft Environmental Assessment. Should you have any questions, please call Heidi Meeker of the Facilities Development Branch at 377-8301.

Very truly yours,

Patricia Hamamoto
Superintendent

PH:jmb

c: Randolph Moore, Assistant Superintendent, OSFSS
William Arakaki, CAS, Kapaa/Kauai/Waimea Complex Areas

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

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6607-34
July 26, 2010

Ms. Kathryn Matayoshi, Interim Superintendent
State of Hawai'i
Department of Education
P.O. Box 2360
Honolulu, Hawai'i 96804

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Ms. Matayoshi:

Thank you for your letter dated October 8, 2008 indicating that you have no comments or concerns that should be addressed in the Draft EA for the proposed Project.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

LINDA LINGLE
Governor of Hawai'i

KATHERINE PUANA KEALOHA
Director

Telephone (808) 586-4185
Facsimile (808) 586-4186
Electronic Mail: oeqc@doh.hawaii.gov

STATE OF HAWAI'I
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
Department of Health
235 South Beretania Street
Leiopapa A Kamehameha, Suite 702
Honolulu, Hawai'i 96813

November 26, 2008

RECEIVED
NOV 28 2008
WILSON OKAMOTO CORPORATION

Mr. Ronald A. Sato
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawai'i 96826

Subject: Northern Leg of the Western Bypass Road Project, Pre-Assessment Consultation for Draft Environmental Assessment, Koloa, Kaua'i, Hawai'i, Tax Map Key: 2-07-003:portion of 002, and 2-08-006:portion of 001

Dear Mr. Sato:

Thank you for the opportunity to comment on your pre-assessment consultation for the subject draft environmental assessment. The Office of Environmental Quality Control offers these comments:

1. Besides following the format and contents described in the Hawai'i Administrative Rules, Chapter 11-200-10 (http://gen.doh.hawaii.gov/sites/har/AdmRules1/11-200.htm#sec_10), please address the question of why this "Northern Leg of the Western Bypass Road Project" was not included in the assessment for the Ala Kinoiki Road (Eastern Bypass Road) or the Western Bypass Road (Under Construction). At first glance, the proposal appear to part of a project which has been developed in segments. HAR Chapter 11-100-7 (http://gen.doh.hawaii.gov/sites/har/AdmRules1/11-200.htm#sec_7) states that "A group of actions proposed by an agency or an applicant shall be treated as a single action when: C. An individual project represents a commitment to a larger project;..."

2. Please make sure to list the alternatives evaluated and fully discuss the impacts to landowners, the environment, archaeological/historical/sensitive sites in the project area, secondary impacts, and mitigation measures to address impacts to the land, water quality, air quality (including fugitive dust), noise pollution, sensitive sites, etc.

Please contact Herman Tuiolosega at (808) 586-4185 if you have further questions or need any clarification.

Sincerely,

Katherine Puana Kealoha
Director

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS • CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
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www.wilsonokamoto.com

6607-34
July 26, 2010

Ms. Katherine Puana Kealoha, Director
State of Hawai'i
Department of Health
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Ms. Kealoha:

Thank you for your letter dated November 26, 2008 regarding the subject Project. We offer the following responses in the order of your comments:

1. The proposed Northern Leg is an important component of the County of Kaua'i's objective to improve traffic flow and circulation within the Kōloa-Po'ipū region of the Island, which extends from Kōloa town makai to the Po'ipū and Kukui'ula areas. The need for the Northern Leg, in part, is to implement the recommendations of State and County transportation and land use planning documents, including the Kaua'i Long-Range Land Transportation Plan (May 1997), and the County of Kaua'i's General Plan (November 2000) and Kōloa-Po'ipū-Kalāheo Development Plan (1983). While these planning documents are comprehensive and regional in scope with regard to transportation, they regard the Northern Leg of the Western Bypass Road, the Western Bypass Road, and Ala Kinoiki (Eastern Bypass Road) as separate road project recommendations. It could not be assumed that all of the recommendations would be implemented, nor could their timing be determined. Fragmented land ownership prevented clear determination of alignments and rights-of-way acquisition. Therefore, these three roadways are considered separate projects that are not part of a larger project.

2. The Draft EA will include an assessment of the alternatives considered for the Project. We note that the assessment of alternatives is based on the termini of the Northern Leg corridor being fixed, as recommended by the various State and County transportation and land use planning documents.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

LINDA LINGLE
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
SEP 30 2008
WILSON OKAMOTO CORPORATION

September 26, 2008

Wilson Okamoto Corporation
1907 South Beretania Street Suite 400
Honolulu, Hawaii 96826

Attention: Mr. Ronald A. Sato

Gentlemen:

Subject: Pre-Assessment Consultation for Draft Environmental Assessment for Northern Leg of the Western Bypass Road Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Morris M. Atta
Administrator

WILSON OKAMOTO CORPORATION

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
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6607-34
July 26, 2010

Mr. Morris M. Atta, Administrator
State of Hawai'i
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Atta:

Thank you for your letter dated September 26, 2008 indicating that you have no comments to offer on the subject Project.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

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

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

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

November 19, 2008

Mr. Ronald A. Sato, AICP
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawai'i 96826

RECEIVED
NOV 24 2008
WILSON OKAMOTO CORPORATION

LOG NO: 2008.4450
DOC NO: 0810WT49
Archaeology

Dear Mr. Sato:

**SUBJECT: National Historic Preservation Act Section 106 Review—
Request for Archaeological Inventory Survey of the Northern Leg of the Western Bypass Road Project, Pre-Assessment Consultation for Draft Environmental Assessment, Koloa, Kaua'i, Hawai'i
TMK: (4) 2-07 003: portion of 002, and 2-08-006: portion of 001**

We are in receipt of your letter regarding the pre-assessment for a Draft Environmental Assessment for the northern leg of the Western Bypass Road project. We received this communication on September 29, 2008.

Section 106 of the National Historic Preservation Act (NHPA) establishes this project as an undertaking and definition the Area of Potential Effect (APE) [36 CFR 800.2 (4)]. The Area of Potential Effect (APE) is the road right-of-way of the leg. There is a possibility that historic properties in the form of pre-contact agricultural sites or historic sugar plantation features could be adversely impacted within the APE.

Therefore we are requesting an Archaeological Inventory Survey be conducted:

1. An archaeological inventory survey work shall be conducted by a qualified archaeologist to ensure significant historic sites have been properly identified and treated in the project area. The archeological inventory survey must meet out standards to be approved by the SHPD. If historic properties are found, appropriate mitigation plans must be developed in consultation with our office.

2. The scope of work for the Archaeological Inventory Survey will include a research design that addresses site and feature functionality as well settlement patterns applied to Ahupua'a, District, and Region. Depending on the project, SHPD may require an ethnographic survey as well.

We have enclosed some information to assist you in building the documentation to continue consultation under Section 106.

Please call Wendy Tolleson at (808) 692-8024 if there are any questions or concerns regarding this letter.

Aloha,

Nancy A. McMahon

Nancy A. McMahon (Deputy SHPO)
State Historic Preservation Officer

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS · CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

6607-34
July 26, 2010

Ms. Nancy A. McMahon, State Historic Preservation Officer
State of Hawai'i
Department of Land and Natural Resources
State Historic Preservation Division
601 Kamokila Blvd., Room 555
Kapolei, Hawai'i 96707

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Ms. McMahon

Thank you for your letter dated November 19, 2008 (Ref: LOG NO: 2008.4450, DOC NO: 0810WT49 Archaeology) regarding the subject Project.

An archaeological inventory survey of the proposed Northern Leg corridor was conducted by Cultural Surveys Hawai'i, Inc. in October 2003. During the inventory survey, no historic or indigenous sites or artifacts were encountered, and none are believed to exist in the area of likely impact. The archaeological inventory survey was accepted by the State Department of Land and Natural Resources (DLNR) Historic Preservation Division (SHPD) by letter dated January 28, 2004.

Subsequently, a supplemental archaeological assessment and cultural background study was conducted by Cultural Surveys Hawai'i, Inc. in March 2010. This supplemental study covered five small areas within the Project Site that are proposed for intersection improvements at both ends of the Northern Leg corridor, and the proposed realigned Ōma'o Road corridor, that were not included in the archaeological inventory survey. During the supplemental field inspection, no historic properties were observed in the five small areas within the Project Site. Furthermore, none are believed to be present in subsurface deposits, given the long history of ground disturbance in this area. The supplemental archaeological assessment and cultural background study was accepted by the SHPD by letter dated March 19, 2010. In this letter, SHPD indicated that the report meets the minimum requirements for compliance with the Hawai'i Administrative Rules, §13-13-276, *Rules Governing Standards for Archaeological Inventory Studies and Reports.*

The above information will be included in the forthcoming Draft EA.

Further consultation under Section 106 of the National Historic Preservation Act will be conducted with the SHPD through the EA process.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

BRENNON T. MORIOKA
DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI
JIRO A. SUMADA

IN REPLY REFER TO:

STP 8.3016

October 7, 2008

Mr. Ronald A. Sato, AICP
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii 96826

RECEIVED
OCT 14 2008
WILSON OKAMOTO CORPORATION

Dear Mr. Sato:

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (Draft EA)
County of Kauai, Department of Public Works
Northern Leg of the Western Bypass Road Project, Koloa

Thank you for the notification of the subject project.

The Department of Transportation (DOT) supports the County in its development of alternate and connective roadway routes that address regional traffic needs.

The DOT Highways Division is interested in the regional traffic flow and circulation from Koloa Road and Maluhia Road to their intersections with Kuhio Highway.

A traffic study was mentioned as being included in the Draft EA. Request that the Draft EA's traffic study address any anticipated related effects on regional traffic patterns.

Please provide three (3) copies of the completed Draft EA to the Highways Division Planning Branch in Honolulu for distribution, review and solicitation of additional comments.

The DOT appreciates the courtesy of your early consultation.

Very truly yours,

BRENNON T. MORIOKA, PH.D., P.E.
Director of Transportation

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6607-34
July 26, 2010

Mr. Brennon Morioka, Director
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai'i 96813-5097

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Morioka:

Thank you for your letter dated October 7, 2008 (Ref. STP 8.3016) regarding the subject Project.

The proposed Northern Leg is an important component of the County of Kaua'i's objective to improve traffic flow and circulation within the Kōloa -Po'ipū region of the Island, which extends from Koloa town makai to the Po'ipū and Kukui'ula areas. The need for the Northern Leg, in part, is to implement the recommendations of State and County transportation and land use planning documents, including the Kaua'i Long-Range Land Transportation Plan (May 1997), and the County of Kaua'i's General Plan (November 2000) and Koloa-Po'ipū-Kalaheo Development Plan (1983). Further, the Northern Leg is included as a recommended street connection in the Koloa-Po'ipū Area Circulation Plan (KPACP) (April 2007). The KPACP, developed through a broad-based community planning effort, recommended various road improvement projects to enhance the network connectivity and improve traffic flow at major intersections throughout Koloa and Po'ipū.

On this basis, a Traffic Assessment Report (TAR) has been prepared for the proposed Project, focusing on the existing and future traffic operations of the roadways and intersections in the immediate vicinity of the Project. The TAR will be included in the Draft EA.

As requested, we will provide three (3) copies of the Draft EA to the DOT for review upon its availability.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

BILL "KAIPO" ASING
MAYOR

GARY K. HEU
ADMINISTRATIVE ASSISTANT

DONALD M. FUJIMOTO
COUNTY ENGINEER
TELEPHONE 241-4992

EDMOND P.K. RENAUD
DEPUTY COUNTY ENGINEER
TELEPHONE 241-4992

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766-1340

October 10, 2008

Mr. Ronald A. Sato, Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, HI 96826

RECEIVED
OCT 20 2008
WILSON OKAMOTO CORPORATION

SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment
Northern Leg of Western Bypass Road Project, Kōloa District, County of Kaua'i

Dear Mr. Sato:

We offer the following comments on the flood requirements for the subject Environmental Assessment. The project lies within the Flood Insurance Rate Map (FIRM) panels 311E, 312E, and 313E.

The road is not a structure as defined by the National Flood Insurance Program (NFIP) so there would be no flood concerns except in areas where the path crosses the floodway of the Omao Stream. Where development is proposed in a floodway, a registered professional engineer will need to certify that the work will not cause any increase in the base flood elevation during the occurrence of the base flood discharge.

The work shall not alter the drainage pattern to the detriment of abutting properties. In the event that the work results in physical changes that affect flood conditions of the area under development or abutting properties, the developer's engineer shall submit the technical or scientific data through the Letter of Map Revision process.

Should you have any questions, please contact Mario T. Antonio of my staff at (808)241-4873.

Very truly yours,

DONALD M. FUJIMOTO, P.E.
County Engineer

MTA

Copies to: DOUGLAS HAIGH, P.E. — Chief of Building Division
WALLACE KUDO, P.E. — Chief of Engineering Division

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6607-34
July 26, 2010

Mr. Donald Fujimoto, County Engineer
County of Kaua'i
Department of Public Works
4444 Rice Street
Moikeha Building, Suite 275
Lihue, Hawai'i 96766-1340

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Fujimoto:

Thank you for your letter dated October 15, 2008 regarding the subject Project. The proposed Project will not require sewer service.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

BILL "KAIPO" ASING
MAYOR

GARY K. HEU
ADMINISTRATIVE ASSISTANT

DONALD M. FUJIMOTO
COUNTY ENGINEER
TELEPHONE 241-4992

EDMOND P.K. RENAUD
DEPUTY COUNTY ENGINEER
TELEPHONE 241-4992

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
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LIHU'E, KAUA'I, HAWAI'I 96766-1340

October 15, 2008

RECEIVED
OCT 20 2008
WILSON OKAMOTO CORPORATION

WILSON OKAMOTO CORPORATION
1907 South Beretania Street
Honolulu, Hawai'i 96826
Attention: Mr. Ronald A. Sato, AICP

SUBJECT: NORTHERN LEG OF THE WESTERN BYPASS ROAD PROJECT, PRE-ASSESSMENT CONSULTATION FOR DRAFT ENVIRONMENTAL ASSESSMENT, TMKs 2-07-003:002 (por.), and 2-08-006:001 (por.).

Dear Mr. Sato:

We acknowledge receipt of your letter dated September 24, 2008 for the proposed Draft Environmental Assessment (DEA) for the proposed project.

The proposed project is not located within a County Wastewater service area. Sewer service, if needed, would be subject to the requirements of the State of Hawai'i Department of Health (DOH) for individual wastewater systems, and/or a private wastewater utility.

Should you have questions, please contact Edward Tschupp at (808) 241-6610.

Very truly yours,

EDWARD TSCHUPP
Chief, Wastewater Management Division

CONCUR:

DONALD M. FUJIMOTO
County Engineer

c: Engineering Division
Planning Department

OCT 16 2008

WILSON OKAMOTO CORPORATION
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6607-34
July 26, 2010

Mr. Donald Fujimoto, County Engineer
County of Kaua'i
Department of Public Works
4444 Rice Street
Moikeha Building, Suite 275
Lihue, Hawai'i 96766-1340

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Fujimoto:

Thank you for your letter dated October 10, 2008 regarding the subject Project.

The forthcoming Draft EA will discuss the proposed design of the Northern Leg in regard to the designated floodway associated with Ōma'o Stream. The Draft EA will further discuss that the proposed Project improvements will be designed and constructed in full compliance with the flood plain management requirements of the County of Kaua'i. This will include certification by a registered professional civil engineer that the Project improvements will not result in any increase in base flood elevations during the occurrence of base flood discharges.

The Draft EA will also discuss that construction and operation of the proposed Project are not anticipated to result in flooding of the Project area or to increase flood risks to properties lying uphill or downhill of the Project Site.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

Department of Water
County of Kaua'i

Water has no substitute.....Conserve it

October 10, 2008

RECEIVED
OCT 15 2008
WILSON OKAMOTO CORPORATION

Mr. Ronald Sato
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, HI 96826

Dear Mr. Sato:

Subject: Northern Leg of the Western Bypass Road Project – Pre-Assessment Consultation for Draft Environmental Assessment, TMK: 2-7-03: por 002 and 2-8-06: por 001, Koloa, Kauai, Hawaii

This letter is in response to your September 24, 2008 request for pre-assessment comment letter.

Any request for water service to the area being subdivided will be dependent on the adequacy of the source, storage, and transmission facilities existing at that time. Water requirements for the subdivision will be addressed at the time of subdivision application.

The Department of Water (DOW) has existing water mains and associated water system facilities along the section of Omao Road proposed to be closed. The DOW may require the existing water system facilities, located along the section of Omao Road proposed to be closed, to be relocated along the proposed roadways and reconnected with the appropriate existing water mains.

If you have any questions, please contact Mr. Keith Aoki at (808) 245-5418.

Sincerely,

Gregg Fujikawa
Chief of Water Resources and Planning

KA:mll
W2-7-03-002 etc sato T-10385

c: DOW Special Projects

4398 Pua Loke St., P.O. Box 1706, Lihue, HI 96766 Phone: 808-245-5400
Engineering and Fiscal Fax: 808-245-5813, Operations Fax: 808-245-5402, Administration Fax: 808-246-8628

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6607-34
July 26, 2010

Mr. Gregg Fujikawa, Chief of Water Resources and Planning
County of Kaua'i
Department of Water
4398 Pua Loke Street
Lihue, Hawai'i 96766

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Fujikawa:

Thank you for your letter dated October 10, 2008 regarding the subject Project.

Any water service requirements for the proposed Project will be coordinated with the Department of Water (DOW).

The forthcoming Draft EA will indicate that the DOW has existing water mains and associated water system facilities along the section of Ōma'o Road proposed to be eliminated as part of the subject road realignment improvements. The Draft EA will further indicate that during the design phase of the Project, coordination will be undertaken with the DOW on the location and, as may be required, the relocation and/or removal of existing County water system facilities, to ensure that functions of the facilities are not impacted or impeded.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

Bill "Kaipo" Asing
Mayor

Gary K. Heu
Administrative Assistant

KAUA'I COUNTY HOUSING AGENCY
Pi'ikoi Building 4444 Rice Street Suite 330
Lihu'e Hawai'i 96766

Kenneth N. Rainforth
Housing Director

Gary A. Mackler
Development Coordinator

October 17, 2008

RECEIVED
OCT 21 2008
WILSON OKAMOTO CORPORATION

Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, HI 96826

Attn: Mr. Ronald A. Sato, AICP

SUBJECT: Northern Leg of the Western Bypass Road Project
Pre-Assessment Consultation for Draft Environmental Assessment
Kōloa, Kaua'i, Hawai'i
TMK 2-7-3:2 por. and 2-8-6:1 por.

Dear Mr. Sato,

This letter is in response to your letter dated September 24, 2008, regarding pre-assessment consultation for the Draft Environmental Assessment for the Northern Leg of the Western Bypass Road Project, Kōloa, Kaua'i. We provide the following comments.

(1) The Housing Agency supports the construction of the proposed project, as it will facilitate transportation to and circulation within the Kōloa-Po'ipū regional area, and reduce traffic impacts on the Kōloa Town community.

(2) Approximately 135 workforce housing units are proposed for construction in the Kōloa area within the near term (approximately 5 years). These include 60 units at Pa'anau Village Phase 2 and 75 units at the Kukui'ula Employee Housing project. The proposed project would assist in reduced commute times for the residents.

(3) The proposed project is not anticipated to adversely impact any housing projects.

Thank you for the opportunity to provide pre-assessment consultation on the proposed road project. Please contact housing planner Barbara Pendragon at 241-4432 with any questions.

Very truly yours,

KENNETH N. RAINFORTH
Housing Director

bp:BP

Development Section (808) 241 4444 FAX (808) 241 5118
TDD (808) 241 4411

Section 8 (HUD) (808) 241 4440 FAX (808) 241 5119

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6607-34
July 26, 2010

Mr. Eugene K. Jimenez, Director
County of Kaua'i
Housing Agency
4444 Rice Street
Pi'ikoi Building, Suite 330
Lihue, Hawai'i 96766

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Jimenez:

Thank you for your letter dated October 17, 2008 regarding the subject Project. We appreciate your Agency's support of the proposed Project. We acknowledge that the proposed Project would assist in reduced commute times for residents of the workforce housing units to be constructed in the Kōloa area, and that the Project is not anticipated to adversely impact any housing projects.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

KAUAI PATH

P. O. Box 81 :: Lihue, HI 96766
phone 808.639.1018 :: fax 808.822.5075
www.KauaiPath.org
ThomasNoyes@hawaiiantel.net

A Project of Garden Island Resource Conservation & Development, Inc.

October 6, 2008

FAX MEMO

TO: **MR. RONALD A. SATO, ACIP**
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, HI 96826 ph. 808.946.2277, fax 808.946.2253

Copy to: Mr. Donald Fujimoto, County Engineer
Public Works, County of Kauai ph. 241-4993, fax 241-6604

From: Thomas A. Noyes, secretary
Kauai Path, Inc. Board of Directors

Via: Fax

Subject: Northern Leg of the Western Bypass Road Project
Pre-Assessment Consultation for Draft Environmental Assessment
Kōloa, Kaua'i, Hawai'i
Tax Map Key: 2-07-003: portion of 002, and 2-08-006: portion of 001

Dear Mr. Sato,

Please include Kauai Path, Inc. in any notifications regarding the above referenced project. Materials may be sent via e-mail to me at ThomasNoyes@hawaiiantel.net or mailed to:

Thomas Noyes, Secretary
Kauai Path, Inc. Board of Directors
P. O. Box 81
Lihue, HI 96766

Thank you for your attention to this request,

Thomas A. Noyes

Kauai residents working together to preserve, protect, and extend access island-wide through the design, implementation, and stewardship of non-vehicular paths.

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS · CONSULTANTS

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6607-34
July 26, 2010

Mr. Thomas Noyes, Secretary
Kaua'i Path, Inc.
Board of Directors
P.O. Box 81
Lihue, Kaua'i 96766

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Noyes:

Thank you for your letter dated October 6, 2008 regarding the subject Project. As requested, a copy of the Draft EA will be provided to your organization for review upon its availability.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

P.O. Box 730
Koloa, Kauai, HI 96756
V: (808) 742-7444
F: (808) 742-7887
info@poipubeach.org
www.poipubeach.org

October 07, 2008

RECEIVED
OCT 10 2008
WILSON OKAMOTO CORPORATION

Ronald A. Sato, AICP
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii 96826

Re: Northern Leg of Western Bypass Road Project
Pre-Assessment Consultation for Draft Environmental Assessment
Koloa, Kauai, Hawaii
Tax Map Key: 2-07-003: portion of 002 and 2-08-006: portion 001

Dear Mr. Sato:

On behalf of the Poipu Beach Resort Association (PBRA), I would like to offer our support of the proposed planning and construction of the roadway segment referred to as the "Northern Leg of the Western Bypass Road" Project, located in the Koloa District on the island of Kauai.

In 2005, the Poipu Beach Resort Association created a Vision Statement for the South Shore of Kauai. The primary goal of the Vision Statement is to provide a clear understanding of PBRA's vision for the future of the Poipu-Koloa region as a place to live, work and visit in the context of how social, natural and public infrastructure affect the quality of the region.

An excerpt from that Vision Statement reads "Roadway Objectives ... (to) establish a full beltway road around the core of Koloa and Poipu, including a northerly connecting road between Koloa Road and Maluhia Road and a new Westerly By-Pass connecting to Poipu Road and Ala Kinoiki." The Northern Leg Project of the Western Bypass Road Project as described in your Project Summary dated Sept. 24, 2008 will help to achieve this objective. Therefore, PBRA supports this project and would like to continue to participate in the Environmental Assessment process as it evolves.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

Jody Kono Kjeldsen
Executive Director

cc: PBRA Board of Directors

WILSON OKAMOTO CORPORATION
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Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
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FAX: 808-946-2253
www.wilsonokamoto.com

6607-34
July 26, 2010

Ms. Jody Kono Kjeldsen, Executive Director
Po'ipū Beach Resort Association
P.O. Box 730
Kōloa, Kaua'i 96756

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Ms. Kjeldsen:

Thank you for your letter dated October 7, 2008 regarding the subject Project. We appreciate the Po'ipū Beach Resort Association's support of the proposed Project. A copy of the Draft EA will be provided to your Association for review upon its availability.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

Public Informational Meeting Summary and Comments

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS · CONSULTANTS

1907 South Beretania Street
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www.wilsonokamoto.com

6607-34
December 11, 2009

SUMMARY MEETING NOTES

SUBJECT: Northern Leg of the Western Bypass Road Project
Public Informational Meeting No. 1

MEETING DATE/
TIME/LOCATION: November 12, 2009, 6:00 p.m.
Kōloa Neighborhood Center

PERSONS
PRESENT: Approximately 24 Persons from the Public
County of Kaua'i Department of Public Works (DPW) Representatives
Wilson Okamoto Corporation Representatives

MEETING SUMMARY:

The purpose of the meeting was to inform the public of the proposed Northern Leg of the Western Bypass Road Project and to solicit comments and feedback.

The meeting format included an "open house" session from 6:00 to 6:30 p.m. in which attendees were provided the opportunity to review map exhibits of the Project and to ask questions and talk with DPW representatives and the Project consultant. The formal portion of the meeting commenced at 6:30 p.m. with a power point presentation of the proposed Project, followed by questions and comments from the meeting attendees.

Questions/responses and comments provided at the meeting are summarized below.

1. Why is the Northern Leg being built as four lanes? The other two bypass roads (Ala Kalanikaumaka (Western Bypass Road) and Ala Kinoiki (Eastern Bypass Road)) are two-lane roadways so there will still be a bottleneck at the points of intersection with the Northern Leg.

   Response: The Northern Leg has a right-of-way width of 150 feet which can accommodate four lanes. Initially, two lanes of the road will be built and, in the future, may be built to four lanes.

   The road will still go from four lanes to two lanes at the intersections with the other two bypass roads. This will still not solve the problem. The Project funding should instead go toward providing more access out of the area. Since the tsunami inundation line is by the Chevron Service Station, everyone makai of the Chevron Station will need to evacuate in tsunami conditions.

   Response: That line by the Chevron Service Station is the 100-year flood limit line and not the tsunami inundation line. The tsunami inundation line is located along the shoreline. Also, the Western Bypass Road provides another route out of the area.

2. How will the Northern Leg be built over the Ōma'o Stream and wetland area?

   Response: The Northern Leg road will include a 520-foot long bridge which will span over the stream and wetland area. Options are currently being looked into

as to whether or not the bridge span would require piers to be constructed within the stream.

3. At the Northern Leg intersection with Kōloa Road, will it be a two-way or four-way stop? Why is there not a roundabout alternative at that intersection?

   Response: The possible provision of a roundabout would be a County decision, but the current proposal is to signalize the intersection of the Northern Leg at Kōloa Road when warranted. Traffic counts have been conducted at that intersection, but it is unknown at this time whether signalization will be warranted.

   Could a roundabout be considered at that intersection? A roundabout should function better than a standard intersection. Is the existing grade at that intersection too steep for a roundabout?

   Response: The County could look into a possible roundabout at that intersection. A larger right-of-way area is needed to accommodate a roundabout.

   A roundabout at the Northern Leg intersection with Kōloa Road, along with the proposed roundabout at the Maluhia Road intersection, is a good idea. A roundabout would be safer than a four-way stop intersection.

4. What is being done to address pedestrian and bicycle traffic along the Northern Leg segment?

   Response: There are currently no plans for pedestrian and bicycle traffic improvements along the Northern Leg. This could be coordinated as part of the County's overall Bike Plan.

5. What is the estimated design and construction cost of this Project?

   Response: The estimated cost has not yet been determined. This information will be included in the Project's Environmental Assessment (EA) document.

6. What amount is the County paying the landowners for the Northern Leg's right-of-way?

   Response: The right-of-way is being acquired by Kukui'ula who is negotiating with the landowner to acquire the land. We currently do not have that cost amount.

7. A gentleman currently leases 20 acres of farmland from A&B within the location of the proposed Northern Leg alignment. The farm provides much fruits and vegetables to the community. Can the road be located elsewhere? The Federal funding to be used for the Northern Leg is meant to stimulate the economy.

   Response: This Northern Leg Project is currently not listed on the State's Statewide Transportation Improvement Program (STIP) for Federal funding. Further, Federal stimulus funds are applicable only to shovel-ready projects which are projects that are ready for construction. The County is only currently in the planning stages for this Project.

8. The Western Bypass Road currently routes traffic past Kōloa Town and to the Kukui'ula shopping center. I own a spa business and 50 percent of my business comes from my business sign. I almost went out of business with the roundabout at Po'ipū Road/Lāwa'i Road. The Northern Leg's drive-by traffic will affect Kōloa Town and the local economy, and I may need to close my business. The Federal funds will bring motorists right past the Kukui'ula shopping center. The use of such Federal funds would be better spent on improvements to allow people to more effectively exit the area and not bypass Kōloa Town.

   Response: The assessment on impacts will be undertaken as part of the Project and the County will work with landowners through the Project's process.

9. The names of the streams are not correctly shown on the Project maps.

10. As a note of clarification, the *Kōloa-Po'ipū Area Circulation Plan* was accepted by the Kaua'i County Council as a gift and not adopted as indicated in the presentation.

11. The Project's summary handout indicates that the EA will be prepared in accordance with Federal standards, yet the County DPW is the Approving Agency. Will Federal and State agencies also be reviewing the EA?

    Response: Yes, the State Department of Transportation and the U.S. Federal Highways Administration will review the EA.

12. Did the State's defacto government ask Dane Aipolani about this Project? He will be crowned king next month. Is anyone responsible for letting His Majesty know about this Project?

    Response: The EA process will allow for comments from the Department of the Interior.

COMMENT SHEET

Department of Public Works
County of Kauai
4444 Rice Street, Suite 275
Lihue, HI 96766
Attention: Mr. Ken Teshima, Engineering Program Administrator

SUBJECT: NORTHERN LEG OF THE WESTERN BYPASS ROAD PROJECT

I am a member of NPAC (Nutrition Physical Activity Coalition) which also oversees Get Fit Kauai

We want to urge the inclusion of "complete streets" to the construction of ANY ROADS

Complete streets include both pedestrian & bicycle space. Ala Kinoiki does have adequate width for both. The newer "kukui 'ula" by pass does not. It has a pedestrian path, but no bicycle lane

Please include Both pedestrian AND Bicycle lanes/paths in this Northern Leg

(Include additional sheets as necessary)

PLEASE PRINT: Name: Cheryl Ann Farrell Phone: 652-1284
Organization: NPAC / Get Fit Kauai
Address: 2598 Waho St
Koloa HI 96756
Email: cherylannfarrell@gmail.com

Please submit comments by November 27, 2009, or send via fax by the same date to (808) 241-6604.

WILSON OKAMOTO CORPORATION

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

6607-34
July 26, 2010

Ms. Cheryl Ann Farrell
NPAC/Get Fit Kaua'i
2598 Waho Street
Kōloa, Hawai'i 96756

Subject: Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Ms. Farrell:

Thank you for your written comments on the proposed Northern Leg of the Western Bypass Road Project which was submitted pursuant to the public informational meeting held on November 12, 2009 for the subject Project.

The provision of bikeway and pedestrian facilities along the Northern Leg corridor will be considered in the future. There is adequate right-of-way width along the Northern Leg corridor to accommodate future bikeway and pedestrian facilities.

We note that the Northern Leg is initially planned to be a two-lane, two-way roadway based on current and projected traffic conditions to Year 2035. Ultimately, the Northern Leg is planned to be a four-lane, two-way roadway in the future.

We appreciate your participation in the public informational meeting. We will notify you upon the availability of the Draft Environmental Assessment for the subject Project for public review.

Sincerely,

for Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

COMMENT SHEET

Department of Public Works
County of Kauai
4444 Rice Street, Suite 275
Lihue, HI 96766
Attention: Mr. Ken Teshima, Engineering Program Administrator

SUBJECT: NORTHERN LEG OF THE WESTERN BYPASS ROAD PROJECT

THE ATTACHED COMMENTS MY RECOMMENDATIONS FOR THE SUBJECT PROJECT.

IT IS DEFINITELY MORE IMPORTANT TO PUT YOUR ENERGY TO MOVE COMMUTERS IN POIPU, KOLOA AND WESTERN KAUAI TO AND FROM LIHUE VIA AN ALTERNATE HIGHWAY TO EASE TRAFFIC ON KAUMUALII HIGHWAY.

(Include additional sheets as necessary)

PLEASE PRINT: Name: KATSUO KIKUCHI Phone: 808-742-8846
Organization: RETIRED
Address: 4349 OMAO RD.
Email:

Please submit comments by **November 27, 2009**, or send via fax by the same date to (808) 241-6604.

November 23, 2009

As I read your plan to provide "connectivity" between Ala Kinoiki (Eastern Road) with Ala Kalanikaumaka (Western Bypass Road), this plan only service the people of Poipu and Kukuiula but not the people of Koloa, Omao, Lawai, Kalaheo and points west. The Western Bypass Road, as it is now, works very well for the commuters who reside on the Westside of the Kauai for they now can bypass Koloa town to get to work at the hotels and shops in Poipu and Kukuiula. The Eastern Road serves the same purpose for the commuters coming to Poipu and Kukuiula from the east side of Kauai.

It would make for better commuting if the County would put maximum energy into plans to use these two roads to extend a second highway to funnel the residents of the west and south to commute to Lihue and parts east and north of Kauai. As a daily commuter who walks daily from Omao Raod to Koloa and Lawai on Kaumualee Highway to catch the bus for Lihue, I am aware of the frustration commuters go through when there is an accident on Kaumualee during morning and evening commuter hours. There is no alternative roadway to keep the traffic moving. What we get is miles of parking lot.

Now, if it is your plan to extend a second highway connecting Koloa Road to Eastern Road and through or over Haupu Range into Lihue, then your plans to connect Eastern Road with Western Bypass Road would make sense for it will allow commuters to skirt around Koloa Town. You need to seriously consider this second highway into Lihue and parts east and north to accommodate anticipated residents that will result from the developments in Poipu and Kukuiula.

On the matter of the proposed Northern Leg Roadway Project, people who travel Omao Road object to the cutoff segment which ushers all traffic into the Northern Leg. This only complicates matters. It would be simpler to drive all the way to Koloa Road and make the turn to Koloa Town or right unto Western Bypass Road.

Since your plan is to improve traffic flow into this district, I would like to recommend working closer with the Transportation Agency to the bus service to the Poipu district. The present bus schedule should be expanded to service this district throughout the day. The route presently starts in Kalaheo, going down Koloa Road to Poipu Road and through Koloa Town before going to Lihue via the Kaumualee. This route operates only during the morning and evening hours. This route should be expanded to serve commuters throughout the day.

Sincerely,

Katsuo Kikuchi

6607-34
July 26, 2010

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS • CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

Mr. Katsuo Kikuchi
4349 Ōma'o Road
Kōloa, Hawai'i 96756

Subject: Northern Leg of the Western Bypass Road Project
Kōloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Kikuchi:

Thank you for your written comments on the proposed Northern Leg of the Western Bypass Road Project which was submitted pursuant to the public informational meeting held on November 12, 2009 for the subject Project.

The purpose of the proposed Northern Leg Project is to provide a road link between the present terminus of the Western Bypass Road at Kōloa Road, and Maluhia Road at its intersection with Ala Kinoiki. The Northern Leg will complete the northern segment of the Western Bypass Road, which will allow motorists traveling between Po'ipū and Kaumuali'i Highway to bypass Kōloa Town. The Northern Leg will complete the beltway circulation system with Ala Kinoiki, thereby resulting in improved traffic circulation within Kōloa Town. We note that any proposal for a second highway that would transport motorists from the Kōloa-Po'ipū region to areas east and north within Kaua'i would be separate from the proposed Northern Leg Project.

The proposed realignment of the southern end of the existing Ōma'o Road to intersect with the Northern Leg, near its southern end, is necessary because of the close proximity of its current intersection at Kōloa Road to the proposed Northern Leg intersection at Kōloa Road. Elimination of the current Ōma'o Road intersection at Kōloa Road will allow for a more efficient flow of traffic along Kōloa Road in the Project vicinity.

Your recommendation for expanded bus service within this district would be more appropriately addressed with the County of Kaua'i's Transportation Agency.

We appreciate your participation in the public informational meeting process. We will notify you upon the availability of the Draft Environmental Assessment for the subject Project for public review.

Sincerely,

for Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

COMMENT SHEET

Department of Public Works
County of Kauai
4444 Rice Street, Suite 275
Lihue, HI 96766
Attention: Mr. Ken Teshima, Engineering Program Administrator

SUBJECT: NORTHERN LEG OF THE WESTERN BYPASS ROAD PROJECT

I THINK BOTH THE KOLOA ROAD AND THE MALUHIA ROAD FOUR WAY INTERSECTIONS SHOULD HAVE FOUR WAY SIGNAL LIGHTS.

(Include additional sheets as necessary)

PLEASE PRINT: Name: STAN WEEKS Phone: 742 6390
Organization:
Address: 5115 HOONA ROAD
KOLOA, HI 96756
Email: STAN@STANWEEKS.COM

Please submit comments by **November 27, 2009**, or send via fax by the same date to (808) 241-6604.

WILSON OKAMOTO CORPORATION
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FAX: 808-946-2253
www.wilsonokamoto.com

6607-34
July 26, 2010

Mr. Stan Weeks
5115 Hoona Road
Koloa, Hawai'i 96756

Subject: Northern Leg of the Western Bypass Road Project
Koloa, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 2-7-003: 002 (por.) and 014; and 2-8-006: 001 (por.)

Dear Mr. Weeks:

Thank you for your written comments on the proposed Northern Leg of the Western Bypass Road Project which was submitted pursuant to the public informational meeting held on November 12, 2009 for the subject Project.

A traffic assessment report (TAR) has been prepared for the proposed Project. The purpose of the TAR is to assess traffic operating conditions resulting from the construction of the proposed Project, and to identify recommendations, if appropriate, that would alleviate anticipated traffic conditions. The TAR will be included in the forthcoming Draft Environmental Assessment (EA) for the Project.

We appreciate your participation in the public informational meeting. We will notify you upon the availability of the Draft EA for the subject Project for public review.

Sincerely,

Earl Matsukawa, AICP
Project Manager

EM/fy

cc: Mr. Donald Fujimoto, County of Kaua'i Department of Public Works

Appendix A

Project Site Photos

Photo 1: Northern portion of Northern Leg corridor looking northeast toward Maluhia Road.

Photo 2: Ōma'o Stream (looking upstream) within central portion of Northern Leg corridor.

Photo 3: Ōma'o Stream (looking upstream) within central portion of Northern Leg corridor.

Photo 4: Maluhia Road (foreground) intersection looking northeast toward Ala Kinoiki.

Northern Leg of the Western Bypass Road

Photos

PROJECT SITE PHOTOS

1-4

Photo 5: Agricultural cultivation within southern portion of Northern Leg corridor.

Photo 6: Central portion of Northern Leg corridor, makai of Ōma'o Stream.

Photo 7: From Ōma'o Stream (foreground), view of northern portion of Northern Leg corridor.

Photo 8: Western Bypass Road looking north toward intersection at Kōloa Road.

Photo 9: Intersection of Western Bypass Road (foreground) and Kōloa Road looking west.

Photo 10: Ōma'o Road (foreground) looking south toward Kōloa Road intersection.

Photo 11: Ōma'o Road (foreground) intersection at Kōloa Road looking east.

Photo 12: Vicinity of proposed realigned segment of Ōma'o Road, to the left and center of road.

Appendix B

Biological and Water Quality Survey
of Omao Stream
Prepared by AECOS, Inc.
June 2010

Biological and water quality survey of Ōma'o Stream for the Northern Leg of the Western Bypass Road, Kōloa, Kaua'i[1]

June 1, 2010 *AECOS* No. 1183

Susan Burr
AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāne'ohe, Hawai'i 96744
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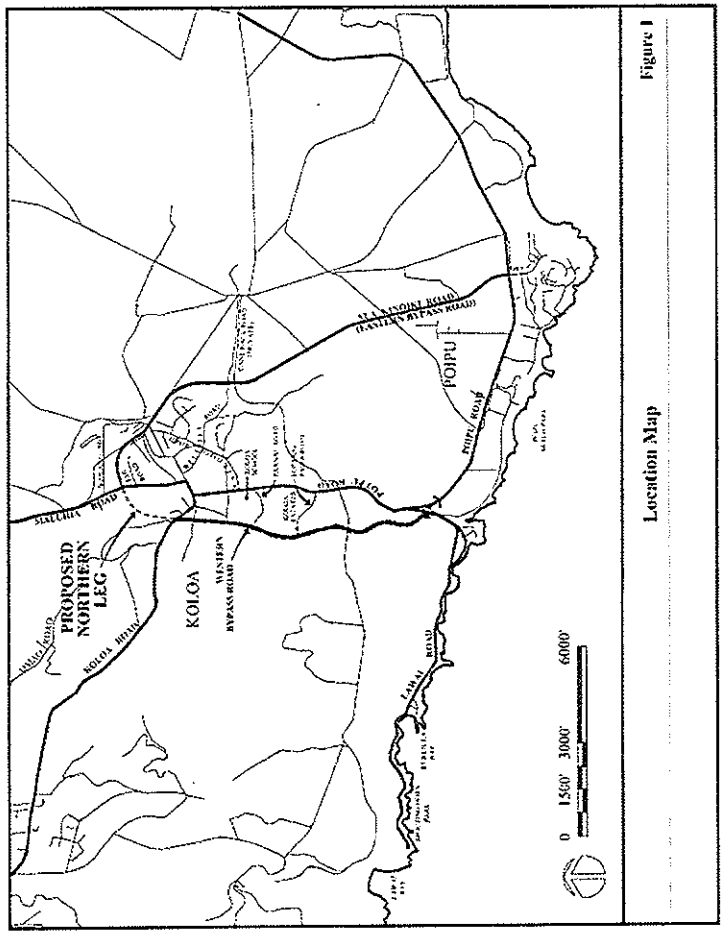
Introduction

On January 13, 2009, *AECOS* biologists conducted a reconnaissance survey of Ōma'o Stream, a tributary to Waikomo Stream, in the vicinity of the north end (or Northern Leg) of the Western Bypass Road (Fig. 1). The existing Western Bypass Road extends from the Po'ipū Road/Lawai Road intersection *mauka* to Kōloa Road. The approximately 0.4 mi Northern Leg is a planned extension of the Western Bypass Road that crosses Ōma'o Stream as it traverses from Kōloa Road to Maluhia Road at the intersection of Maluhia with Ala Kino'iki Road. Botanical resource surveys of the Northern Leg roadway route were undertaken in 2003 and 2009 (Char, 2003; Rana Productions, 2009) and the wetland associated with the stream at the proposed Northern Leg crossing was delineated in 2007 (Guinther, 2007). Much of the site description for this report is taken from the wetland delineation report.

Waikomo Stream is classified by the Department of Land and Natural Resources - Division of Aquatic Resources (DLNR-DAR) as a perennial stream with a total stream length of 34.7 km or 21.6 mi (DLNR-DAR, 2009). Pō'ele'ele Stream, Ōma'o Stream, and Waihohonu Stream originate in the lower slopes of the Lihue-Kōloa Forest Reserve, flow through numerous reservoirs and diversion ditches, and join together to form Waikomo Stream, which flows through the coastal flats of Po'ipū and enters

[1] This report was prepared for Wilson Okamoto corp. for use associated with environmental permitting for the Northern Leg of the Western Bypass Road in Kōloa, Kaua'i.



Location Map

Figure 1

the Pacific Ocean at Koloa Landing (Fig. 2). Waikomo watershed is comprised of Waikomo Stream, its tributaries and reservoirs, and the lands that these waterbodies drain, and is assigned watershed code 23002 (DLNR-DAR, 2009).

Figure 2. Waikomo watershed (Code No. 23002) includes Waikomo Stream and its tributaries Pō'ele'ele, Ōma'o, Waihohonu streams, and associated reservoirs.

Waikomo watershed used to be predominantly cultivated in sugar cane. However, much of that land has since been converted to grow diversified agricultural crops and to serve as pasture. Currently, land use in 66% of the watershed is agriculture (DLNR-DAR, 2009). Several residential housing projects are in various stages of development, particularly in the lower elevations of the watershed.

A National Wetland Inventory (NWI; USFWS, 1984) map of the area shows an extensive palustrine, forested, broad-leaved, evergreen, seasonally flooded wetland

along Ōma'o Stream upstream of the proposed new road crossing (Fig. 3). As noted in the wetland delineation report (Guinther, 2007), conditions in Ōma'o Stream appear generally similar downstream, so the wetland should be considered as extending southeast through the project area, although not at the point where the road actually crosses Ōma'o Stream. This area (1 in Fig. 3) includes jurisdictional waters but no wetlands.

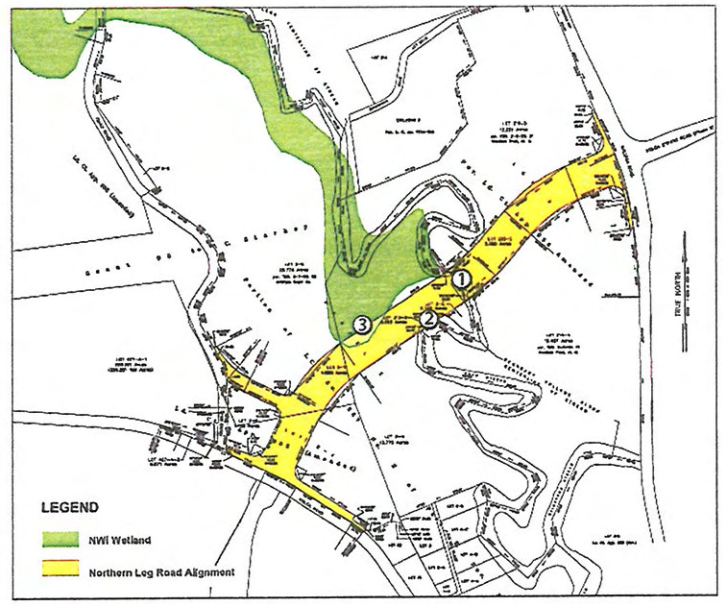


Figure 3. Property map showing Ōma'o Stream as it crosses the Northern Leg of the Western Bypass Road parcel (in yellow) and a presumed wetland (from USFWS, in green). Locations shown of the three wetland areas delineated (Guinther, 2007).

Site Description

The land use in the project area is agricultural: mostly banana plantation and pasture. Ōma'o Stream meanders across this landscape, incised from 1 to 2 m (3 to

6 ft) into the floodplain, with cut-off meanders[2] present. The banks are moderately steep. In February 2007, the active flow channel occupied only a fraction of the bed between the banks (Guinther, 2007), but in January 2009, the stream channel was full.

Ōma'o Stream and the cut-off meanders surveyed are overgrown with hau (*Hibiscus tiliaceus*) in the general area, but the stream course is open where the proposed roadway would cross (Fig. 4). The hau was probably removed from this specific area some time ago and presumably predates the planning of a crossing road here. The hau was probably cleared for reasons related to the properties north of the stream used as horse pasture.

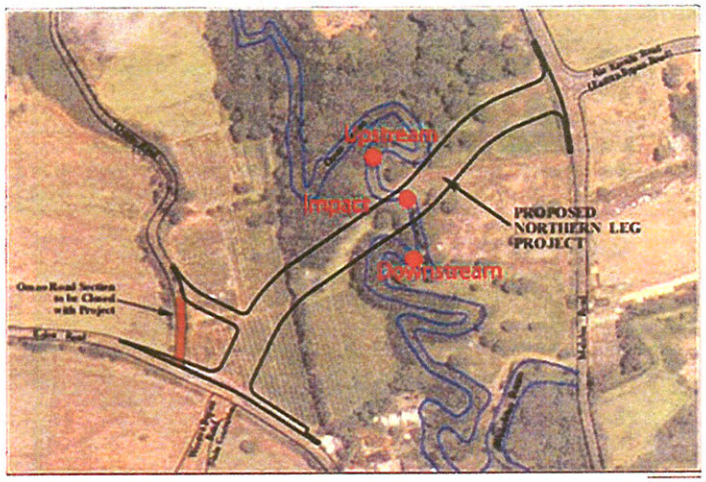


Figure 4. Preliminary site plan showing Ōma'o Stream meandering across the plain and water quality sampling locations (base map provided by Wilson Okamoto Corp).

Immediately downstream of the south edge of the proposed roadway crossing, a low dam has been constructed by pushing soil into the stream bed from the left

[2] A "cut-off meander," sometimes called an oxbow, is a looped section of a meandering stream channel that is abandoned by the main stream flow shorting across the top of the loop.

bank[3] (Fig. 5). The dense hau forest starts here and continues downstream. The presence of this low head dam has backed water upstream of the road crossing (Figs. 6). This ponding of the stream has contributed to accumulation of sediment as bars. The banks and sediment bars in this area support para grass (*Urochloa mutica*). Where the proposed road will cross the stream, the stream is flowing mostly east, then turns southward; this bend to the right directs the active flow against the left bank, which is actively eroding. Upstream of the ponded flow is an extensive hau wetland with several cut-off meanders and a drainage ditch.

Figure 5. An eroding low-head dam in foreground backing up Ōma'o Stream behind it (looking upstream). The stream crosses the dam by two channels, one of which can be seen here; the other exits through the hau to the left.

Pastured horses have access to the stream in the vicinity and downstream of the proposed road crossing. Some of the stream bank erosion may be attributable to the horses accessing the stream and water quality may be affected by feces of these animals.

[3] The left and right banks of a stream are established by looking in the direction of flow (i.e., downstream).

Figure 6. Ōma'o Stream looking upstream from approximately the centerline of the proposed Northern Leg crossing. The stream is wide and slow-flowing at this point and shifting vegetated sediment bars are present.

Water Quality

Water quality samples were collected from Ōma'o Stream at stations designated 'downstream, 'impact,' and 'upstream' (see Fig. 4). The downstream station was located just downstream from the location shown in Fig. 5 in a short riffle zone. The impact station was located off the left bank shown in Fig. 6, in the vicinity of the proposed Northern Leg Road crossing. The upstream station was located in the hau forest. Dissolved oxygen (DO), pH, and temperature were measured *in situ*. Prior to collecting a sample, one 1-L, one 250-mL, and two 125-mL plastic bottles were pre-rinsed with the water to be sampled. The samples were collected just below the surface by facing the bottles upstream to fill. The samples were placed in a cooler and delivered to the *AECOS* laboratory (*AECOS* Laboratory Log No. 24909) the same day. Table 1 lists the analytical methods and instrumentation used for each water quality parameter measured. The results of this sampling event are given in Table 2.

Table 1. Analytical methods and instruments used for January 13, 2009 water quality sampling of Ōma'o Stream.

Analysis	Method	Reference	Instrument
Conductivity	Method 2510B (EPA 120.1)	Standard Methods, 20th Edition (1998); EPA (1979)	Hydach pH/conductivity meter
Dissolved Oxygen	EPA 360.1	EPA (1979)	YSI Model 550A DO meter
Nitrate + Nitrite	EPA 353.2	EPA (1993)	Technicon AutoAnalyzer II
pH	EPA 150.1	EPA (1979)	Hannah pocket pH meter
Temperature	thermister calibrated to NBS cert. thermometer (EPA 170.1)	EPA (1979)	YSI Model 550A DO meter
Total Nitrogen	persulfate digestion/EPA 353.2	D'Elia et al. (1977) / EPA (1993)	Technicon AutoAnalyzer II
Total Phosphorus	persulfate digestion/EPA 365.1	Koroleff in Grasshoff et al. (1986)/EPA 1993)	Technicon AutoAnalyzer II
Total Suspended Solids	Method 2540D (EPA 160.2)	Standard Methods 20th Edition (1998); EPA(1979)	Mettler H31 balance
Turbidity	Method 2130B (EPA 180.1)	Standard Methods 20th Edition (1998); EPA (1993)	Hach 2100N Turbidimeter

D'Elia, C.F., P.A. Stendler, & N. Corwin. 1977. *Limnol. Oceanogr.* 22(4): 760-764.
EPA. 1979. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, EPA 600/4-79-020.
EPA. 1993. Methods for the Determination of Inorganic Substances in Environmental Samples. EPA 600/R-93/100.
EPA. 1994. Methods for Determination of Metals in Environmental Samples, Supplement 1. EPA/600/R-94/111. May 1994.
Grasshoff, K., M. Ehrhardt, & K. Kremling (eds). 1986. Methods of Seawater Analysis (2nd ed). Verlag Chemie, GmbH, Weinheim.
Standard Methods. 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. 1998. (Greenberg, Clesceri, and Eaton, eds.). APHA, AWWA, & WEF. 1220 p.

Table 2. Water quality measured on January 13, 2009 at three stations in Ōma'o Streams near proposed Northern Leg road.

	Time	Temp. (°C)	DO (mg/l)	DO sat. (%)	pH	Conduct. (µmhos/cm)
Upstream	1250	22.3	5.56	64	6.58	157
Impact	1305	21.7	5.44	62	6.78	226
Downstream	1310	22.0	6.30	72	6.81	156
arithmetic mean		**22.0**	**5.77**	**66**	**6.72**	**178**

	Turbidity (ntu)	TSS (mg/l)	NH_3 (µg N/l)	$NO_3 + NO_2$ (µg N/l)	Total N (µg N/l)	Total P (µg P/l)
Upstream	14.1	8.3	10	396	678	59
Impact	10.8	5.3	12	388	662	55
Downstream	15.0	8.7	6	387	648	59
geometric mean	**13.2**	**7.3**	**9**	**390**	**663**	**58**

Table 3. Selected State of Hawaii water quality criteria for streams (HAR §11-54-05.2; HDOH, 2004)

Parameter	Geometric Mean value not to exceed this value	Value not to be exceeded more than 10% of the time	Value not to be exceeded more than 2% of the time
Total Nitrogen (µg N/l)	250.0 *180.0*	520.0 *380.0*	800.0 *600.0*
Nitrate + Nitrite (µg N/l)	70.0 *30.0*	180.0 *90.0*	300.0 *170.0*
Total Phosphorus (µg P/l)	50.0 *30.0*	100.0 *60.0*	150.0 *80.0*
Total Suspended Solids (mg/l)	20.0 *10.0*	50.0 *30.0*	80.0 *55.0*
Turbidity (NTU)	5.0 *2.0*	15.0 *5.5*	25.0 *10.0*

Upper, "wet" criteria apply during the rainy season (November 1 through April 30); lower, "dry" (italicized) criteria apply during the dry season (May 1 through October 31).

Other "standards":
- pH units shall not deviate more than 0.5 units from ambient conditions and shall not be lower than 5.5 nor higher than 8.0.
- Dissolved oxygen shall not decrease below 80% of saturation.
- Temperature shall not vary more than 1 C° from ambient conditions.
- Specific conductance shall not exceed 300 µmhos/cm.

Temperatures and pH measured at the three stations are typical of streams in the coastal plain. Dissolved oxygen (DO) was low at all three stations, although slightly higher at the Downstream station, located in a riffle zone. Conductivity levels show some groundwater input, particularly at the Impact station. Turbidity levels were high at all three stations, although TSS was not. All nitrogen moiety concentrations (NH_3, NO_3 + NO_2, and Total N) were elevated and total phosphorus was slightly elevated at all three stations.

Water quality criteria for streams have been promulgated by the State of Hawai'i Department of Health or HDOH (Table 3, above). The criteria for streams are divided into "wet" season (November 1 through April 30) and "dry" season (May 1 through October 31) to correspond with historic rainy and non-rainy seasons in Hawai'i. The samples in the present survey were collected during the "wet" season. Note that state water quality criteria for particulates (turbidity and total suspended solids) and nutrients (NO_3 + NO_2, Total N, and Total P) are based upon geometric mean values as opposed to arithmetic means, and are reported as such herein. Geometric means are to be based upon samples collected over time, not distance as

is the case here. Therefore, these results cannot be compared with the criteria in Table 3 to establish stream compliance with the water quality standards.

Water quality criteria for ammonia have not been promulgated for streams. The DO saturation levels are all below the 80% minimum specified by the state criterion; however, the stations were located in areas with relatively sluggish flow so this low saturation values are not surprising. The pH levels were all within the criterion of >5.5 and <8.5 pH units. Stream conductivities were below the maximum allowed state criterion of 300 µmhos/cm.

Aquatic Biota

During the January 13, 2009 survey, the only aquatic animals (including insects, crustaceans, amphibians, and fishes) biologists observed in the project area were introduced species (Table 4). No state or federally listed endangered or threatened (DLNR, 1998; Federal Register, 2005; USFWS, 2005, 2009) or native migratory (amphidromous[4]) species were observed.

Table 4. Checklist of aquatic biota observed in Ōma'o Stream on January 13, 2009.

Species	Common name	Status	Location	Abundance
	INVERTEBRATES			
MOLLUSCA, GASTROPODA	(mollusks)			
PHYSIDAE				
Physa virgata	pond snail	Nat	N. Leg	U
THIARIDAE				
Melanoides tuberculata	melanid snail	Nat	Koloa Road	C
MOLLUSCA, BIVALVIA	(clams)			
Corbicula fluminea†	Asiatic clam	Nat	Koloa Road	U
ARTHROPODA, CRUSTACEA	(crustaceans)			
CAMBARIDAE				
Procambarus clarki	American crayfish	Nat	N. Leg	U
ARTHROPODA, INSECTA	(insects)			
ODONATA, LIBELLULIDAE				
Orthemis ferruginea	roseate skimmer	Nat	N. Leg	R
ODONATA, COENAGRIONIDAE				
Ischnura posita	fragile forktail	Nat	N. Leg	U
Ischnura ramburi	Rambur's damselfly	Nat	N. Leg	R

[4] Amphidromous means that the adult animals live and breed in fresh water, the larvae develop in the ocean for several months, and the post-larvae migrate back from the ocean into a stream.

Table 4 (continued).

Species	Common name	Status	Location	Abundance
	VERTEBRATES			
VERTEBRATA, AMPHIBIA	(amphibians)			
RANIDAE				
Rana catesbeiana†	American bullfrog	Nat	N. Leg	U
VERTEBRATA, PISCES	(fishes)			
CICHLIDAE				
Sarotherodon melanotheron	black chin tilapia	Nat	N.Leg & Koloa Road	O
POECILIIDAE				
undet. poeciilid		Nat	N.Leg & Koloa Road	C
Poecilia reticulata	rainbow fish or guppy	Nat	Koloa Road	U
Xiphophorus helleri	swordtail	Nat	N. Leg	C

KEY TO SYMBOLS USED:
Status:
nat - naturalized. An introduced or exotic species.
ind - indigenous. A native species also found elsewhere in the Pacific.
end - endemic - A native species found only in the Hawaiian Islands.
Location:
N. Leg – In the vicinity of the proposed Northern Leg Road crossing.
Koloa Road – In the vicinity of the Koloa Road crossing.
Abundance at survey location:
P - present; not common, but abundance not determined.
R - rare; only one or two individuals seen.
U - uncommon; several individuals seen, in some habitat places visited.
C - common; numerous individuals seen, or seen in most habitat places visited.
A - abundant; numerous in most habitat places visited
†: Identified by call, carapace, or shell only

DLNR-DAR has conducted surveys in unspecified reservoirs in the Waikomo watershed and the results are listed in the watershed atlas (DLNR-DAR, 2009). In addition to the species found in our survey of Ōma'o Stream, DLNR-DAR also reports *Awaous guamensis* (*'o'opu nakea*), *Bufo marinus*, *Macrobrachium lar*, *Lepomis* sp., *Micropterus* sp., *Tilapia* sp., and unidentified cyprinidae as being present in the watershed. *A. guamensis* is a native goby and *M. lar* is an introduced prawn, both of which are amphidromous and may migrate through the project area.

Conclusions

Waikomo Stream is listed on the Hawai'i Department of Health (HDOH) 2006 list of impaired waters in Hawai'i, prepared under Clean Water Act §303(d). This listing

indicates that the stream may not meet the Hawai'i Water Quality Standards for certain parameters. Waikomo Stream is listed as exceeding the wet season water quality standards for nitrates, Total N, and turbidity (HDOH, 2006). These parameters may need to be included in a water quality monitoring program designed to monitor impacts on water quality of the stream during construction. The project will reduce the area of pasture and pastured animal access to the stream, but only on the parcel set aside for the new road. A Best Management Practices (BMP) plan should be developed and implemented to minimize environmental impacts to water quality and aquatic biota in the vicinity of and downstream of the project site.

No federally- or state-listed endangered or threatened species (Federal Register, 2005; USFWS, 2005) were encountered during the survey, and none is anticipated to utilize stream habitats in the project area. Although none was observed in our survey, one native amphidromous species, *'o'opu nakea* (*Awaous guamensis*), is reported in the Waikomo watershed. Hawaii Administrative Rules (HAR) 13-100 and 188-43.5 regulate the taking of all *'o'opu* in Hawai'i waters (DLNR, 2007). No structures should be built within the stream bed that would impede the migration of native aquatic fauna.

A Best Management Practices (BMP) plan should be developed and implemented to minimize environmental impacts to water quality and aquatic biota in the vicinity of and downstream of the project site.

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Appendix C

Biological Surveys
Conducted for the Northern Leg
Prepared by
Rana Productions, Ltd.
and
AECOS Consultants
February 2009,
Revised June 2010

Biological Surveys Conducted for the Northern Leg of the Western Bypass Road, Kōloa District, Island of Kaua'i.

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Revised June 28, 2010

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Introduction

The County of Kaua'i, Department of Public Works is proposing to construct a roadway segment currently being referred to as the "Northern Leg of the Western Bypass Road". This new road will extend, and connect the existing Western Bypass Road's terminus at Kōloa Road, in a northerly direction to the intersection of the Ala Kinoiki (Eastern Bypass Road) and Maluhia Road, just above the Anne Knudsen County Park. This Northern Leg will establish a fourth leg at this intersection creating a four-way intersection. In addition, a segment of 'Ōma'o Road will be realigned to connect to this Northern Leg which will eliminate its intersection with Kōloa Road.

This report presents the results of the botanical, avian and mammalian surveys, which were conducted on the project site, as part of the environmental disclosure process. The primary purpose of the surveys was to determine if there are any botanical, avian or mammalian species currently listed, or proposed for listing under either federal or State of Hawai'i endangered species statutes within or adjacent to the study area. We were also asked to evaluate the potential impacts that the development of the project might pose to any sensitive or protected native botanical, avian or mammalian species, and to propose appropriate minimization and or mitigative measures that could be implemented to reduce or eliminate any such impacts. The federal and State of Hawai'i listed species status follows species identified in the following referenced documents, (Division of Land and Natural Resources (DLNR) 1998, Federal Register 2005, U. S. Fish & Wildlife Service (USFWS) 2005, 2008). Fieldwork was conducted on January 6, 2009.

The avian phylogenetic order and nomenclature used in this report follows *The American Ornithologists' Union Checklist of North American Birds 7th Edition* (American Ornithologists' Union 1998), and the 42nd through the 49th supplements to *Check-list of North American Birds* (American Ornithologists' Union 2000; Banks et al. 2002, 2003, 2004, 2005, 2006, 2007, 2008). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Hawai'i's Ferns and Fern Allies* (Palmer, 2003) for ferns, *Manual of the Flowering Plants of Hawai'i* (Wagner et al., 1990, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for crop and ornamental plants. Place names follow *Place Names of Hawaii* (Pukui et al. 1974).

Hawaiian and Latin species names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text on Page 16.

General Site Description

The proposed Northern Leg roadway will extend a distance of approximately 2100 feet (640 meters), from Kōloa Road inland (north) up to Maluhia Road. A 150-foot (46 meter) right-of-way is planned for this roadway, and it will be routed through privately owned parcels identified as Tax Map Keys (4) 2-07-003: portion of 002 and 2-08-006: portion of 001. This roadway will include a bridge planned to span the 'Ōma'o Stream area and floodway associated with this stream. The vegetation in the project area largely reflects current uses: pasture shrubs and grasses, food and ornamental agriculture. Trees are present growing along 'Ōma'o Stream and as windbreaks in the agricultural area. A portion of the property is essentially overgrown with grasses.

Figure 1- Diversified agricultural field on the south end of right-of-way

Figures 2 - Central portion of right-of-way, overgrown with Guinea grass. Note windbreak of ironwood trees in background.

Figure 3 – East side of right-of-way looking west across the horse pasture. Tall albizia trees provide shade for the horses, although some clearing of these has been on going.

The following description of the watershed and Oma'o Stream is taken from AECOS (2010):

> *"Waikomo Stream is classified by the Department of Land and Natural Resources – Division of Aquatic Resources (DLNR-DAR) as a perennial stream with a total stream length of 34.7 km or 21.6 mi (DLNR-DAR, 2009). Pō'ele'ele Stream, 'Ōma'o Stream, and Waihohonu Stream originate in the lower slopes of the Lihue-Kōloa Forest Reserve, flow through numerous reservoirs and diversion ditches, and join together to form Waikomo Stream, which flows through the coastal flats of Po'ipū and enters the Pacific Ocean at Kōloa Landing ..... Waikomo watershed is comprised of Waikomo Stream, its tributaries and reservoirs, and the lands that these waterbodies drain, and is assigned watershed code 23002 (DLNR-DAR, 2009).*
>
> *Waikomo watershed used to be predominantly cultivated in sugar cane. However, much of that land has since been converted to grow diversified agricultural crops and to serve as pasture. Currently, land use in 66% of the watershed is agriculture (DLNR-DAR, 2009). Several residential housing projects are in various stages of development, particularly in the lower elevations of the watershed.*

> *A National Wetland Inventory (NWI; USFWS, 1984) map of the area shows an extensive palustrine, forested, broad-leaved, evergreen, seasonally flooded wetland along 'Ōma'o Stream upstream of the proposed new road crossing .... As noted in the wetland delineation report (Guinther, 2007), conditions in 'Ōma'o Stream appear generally similar downstream, so the wetland should be considered as extending southeast through the project area, although not at the point where the road actually crosses 'Ōma'o Stream. This area .....includes jurisdictional waters but no wetlands."*

Botanical Survey Methods

The botanical survey was undertaken utilizing wandering transects that traversed most of the subject parcels on January 6, 2009. This survey was conducted in the wet season and therefore plants typical of this site, including annuals, were readily observed and identified. For a few specimens not recognized in the field, photographs were taken and material collected for identification in the laboratory.

Botanical Survey Results

A plant checklist (Table 1) was compiled from field observations, with entries arranged alphabetically under plant family names (standard practice). Included in the list are scientific name, common name, and status (whether native or non-native) for each species. In addition to identifying the plants present within the study site, qualitative estimates of plant abundance were made. These are coded in the table as explained in the Legend to Table 1 and apply to observations made during the present survey. For some species, a two-level system of abundance is used: the letter-number codes indicating species that have a limited distribution (e.g., found in only one small area of the property), but where present occur in numbers exceeding just a few individuals. For example, an abundance rating of "R" indicates a plant encountered only once or twice during the entire survey. A "R2" indicates a plant encountered in just one or two places, but with several to many individuals present where encountered. A "R3" would be a plant seldom encountered (i.e., rare), but locally abundant in one or more of the locations where encountered.

Abundance information is given roughly for the entire survey area, although several distinct plant communities are present: diversified agriculture, riparian, pasture, and high verge. These separate environments shared many of the same weedy species. Planted species in the diversified agriculture portion are identified as "Orn" (maintained ornamental and agriculture species).

Table 1 – Flora for the Northern Leg of the Western Bypass Road, Kaua'i

Species	Common name	Status	Abundance	Notes
	FERNS			
NEPHROLEPIDACEAE				
Nephrolepis multiflora (Roxb.) F. M. Jarrett ex C.V. Morton	---	Nat.	U	(1, 2)
POLYPODIACEAE				
Phymatosorus grossum (Langsd. & Fisch.) Brownlie	*laua'e*	Nat.	U	
	FLOWERING PLANTS			
	DICOTYLEDONES			
ACANTHACEAE				
Thunbergia fragrans Roxb.	sweet clockvine	Nat.	R	(3)
AMARANTHACEAE				
Amaranthus viridis L.	slender amaranth	Nat.	R	
ANACARDIACEAE				
Mangifera indica L.	mango	Nat.	R	(2)
Schinus terebinthifolius Raddi	Christmas berry	Nat.	R	(3)
ARALIACEAE				
Schefflera actinophylla (Endl.) Harms.	octopus tree	Nat.	R	(3)
ASTERACEAE (COMPOSITAE)				
Ageretum conyzoides L.	*maile hohono*	Nat.	C	(3)
Ageretum houstonianum Mill.	*maile hohono*	Nat.	--	(2)
Bidens pilosa L.	*ki*	Nat.	--	(2)
Calyptocarpus vialis Less.		Nat.	U	(2)
Conyza sp.	horseweed	Nat.	U2	(3)
Cyanthillium cinereum (L.) H. Rob.	little ironweed	Nat.	R	(3)
Emilia fosbergii Nicolson	Flora's paintbrush	Nat.	U	(2)
Parthenium hysterophorus L.	false ragweed	Nat.	R	
Pluchea carolinensis	sourbush	Nat.	U2	(2, 3)
Pseudelephantopus spicatus (Juss. ex Aubl.) Vahl.		Nat.	--	(2)
Sphagneticola trilobata (L.) Pruski	wedelia	Nat.	O3	
Synedrella nodiflora (L.) Gaertn.	nodeweed	Nat.	C	(2)
BORAGINACEAE				
Cordia subcordata Lam.	*kou*	Orn.	R	(2)
CARICACEAE				
Carica papaya L.	papaya	Orn.	U	
CASUARINACEAE				
Casuarina equisetifolia L.	ironwood	Nat.	U2	(2,3)

Table 1 continued

Species	Common name	Status	Abundance	Notes
CONVOLVULACEAE				
Ipomoea triloba L.	little bell	Nat.	O	
CUCURBITACEAE				
Cucurbita sp.	indet. squash	Orn.	U	(4)
EUPHORBIACEAE				
Chamaesyce hirta (L.) Millsp.	garden spurge	Nat.	U	(2)
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	Nat.	U	
Macaranga tanarius (L.) Müll. Arg.		Nat.	--	(2)
Phyllanthus debilis Klein ex Willd.	niuri	Nat.	U3	
Phyllanthus tenellus Roxb.	---	Nat.	R	
Ricinus communis L.	castor bean	Nat.	R2	
FABACEAE				
Alysicarpus vaginalis (L.) DC	alyce clover	Nat.	U	
Canavalia cathartica Thours	*maunaloa*	Nat.	O	(3)
Cassia cf. *javanica* L.	shower tree	Orn.	R	(4)
Chamaecrista nictitans (L.) Moench	partridge pea	Nat.	C	(3)
Crotalaria pallida Aiton	smooth rattlepod	Nat.	U	
Desmodium incanum DC	Spanish clover	Nat.	--	(3)
Desmodium triflorum (L.) DC		Nat.	U3	
Falcataria moluccana (Miq.) Barneby & Grimes	albizia	Nat.	O	(2,3)
Indigofera hendecaphyla Jacq.	creeping indigo	Nat.	--	(2)
Indigofera suffruticosa Mill.	indigo	Nat.	C2	(2,3)
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat.	U	(2)
Mimosa pudica L.	sensitive plant	Nat.	C	
MALVACEAE				
Hibiscus tiliaceus L.	*hau*	Pol.	AA	(1,2,3)
Malvastrum coromandelianum (L.) Garck	false mallow	Nat.	U	
Sida acuta N.L. Burm.	---	Nat.	O3	(2)
Sida rhombifolia L.	Cuba jute	Nat.	C	(3)
MYRTACEAE				
Psidium guajava L.	common guava	Nat.	O	
Syzygium cumini (L.) Skeels.	Java plum	Nat.	O	(3)
ONAGRACEAE				
Ludwigia octovalvis (Jacq.) Raven	primrose willow	Nat.	R	(3)
PLANTAGINACEAE				
Plantago lanceolata L.	narrow-leaved plantain	Nat.	U	
Plantago major		Nat.	R	

Table 1 continued

Species	*Common name*	*Status*	*Abundance*	*Notes*
PORTULACACEAE				
Portulaca oleracea L.	pig weed	Nat.	U	
RUBIACEAE				
Paederia foetida L.	*maile pilau*	Nat.	U2	(3)
SOLANACEAE				
Solanum americanum Mill.	*pōpolo*		U	
Solanum melongena L.	eggplant	Orn.	R2	(4)
STERCULIACEAE				
Waltheria indica L.	*'uhaloa*		U	
VERBENACEAE				
Stachytarpheta cayennensis (Rich.) Vahl.	---	Nat.	R	
Verbena littoralis Kunth	*owi*	Nat.	O	(3)
MONOCOTYLEDONES				
AGAVACEAE				
Cordyline fruticosa (L.) A. Chev.	ti	Orn.	O3	
ARACEAE				
Colocasia esculenta (L.) Schott	*kalo*	Pol.	U2	
ARECACEAE				
Cocos nucifera L.	*niu*; coconut	Orn.	O2	
Dipsys lutescens (H. Wendl.) Beentje & Dransfield	golden-fruited palm	Orn.	U	
Roystonia regia (Kunth) O.F. Cook	royal palm	Orn.	R	
COMMELINACEAE				
Commelina diffusa N. L. Burm.	*honohono*	Nat.	U	(3)
CYPERACEAE				
Cyperus polystachyos Rottb.			--	(2,3)
Cyperus rotundus L.	nut grass	Nat.	U2	
Kylinga brevifolia Rottb.	*kili'o'opu*	Nat.	R	
HELICONIACEAE				
Heliconia spp.		Orn.	U3	(2)
MUSACEAE				
Musa cf. *acuminata* Colla	banana	Orn.	U3	(2)
POACEAE (GRAMINEAE)				
Axonopus fisifolius (Raddi) Kuhlm.	nrw-lvd carpet grass	Nat.	R	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat.	O	(2)
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat.	U2	(2)
Coix lachryma-jobi L.	Job's tears	Nat.	--	(3)
Digitaria insularis (L.) Mez ex Ekman	sourgrass	Nat.	R	
Eleusine indica (L.) Gaertn.	beach wiregrass	Nat.	C	(2)
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	Nat.	U	

Table 1 continued

Species	*Common name*	*Status*	*Abundance*	*Notes*
Paspalum conjugatum Bergius	Hilo grass	Nat.	A	(2,3)
Paspalum fimbriatum Kunth	Panama paspalum	Nat.	--	(2)
Paspalum scrobiculatum L.	ricegrass		U	(2)
Saccharum spontaneum L.	wild cane	Nat.	--	(2)
Sporobolus cf. *indicus* (L.) R.Br.	West Indian dropseed	Nat.	U	(2)
Urochloa maxima (Jacq.) Webster	Guinea grass	Nat.	AA	(2, 3)
Urochloa mutica (Forssk.) T.Q. Nguyen	California grass	Nat.	A	(1,2,3)
Urochloa subquadripara (Trin.) Webster		Nat.	C	(2)
TYPHACEAE				
Typha latifolia L.	cattail	Nat.	R1	(1,3)

Legend to Table 1

Status = distributional status

- **End.** = endemic; native to Hawai'i and found naturally nowhere else.
- **Ind.** = indigenous; native to Hawai'i, but not unique to the Hawaiian Islands.
- **Nat.** = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.
- **Orn.** = exotic, ornamental or cultivated crop; plant not naturalized (not well-established outside of cultivation, at least at this location).
- **Pol.** = Polynesian introduction; brought to the Hawaiian Islands before 1778.

Abundance = occurrence ratings for plants on property in March 2008

- R – Rare - only one or two plants seen.
- U - Uncommon - several to a dozen plants observed.
- O - Occasional - found regularly, but not abundant anywhere.
- C - Common - considered an important part of the vegetation and observed numerous times.
- A - Abundant - found in large numbers; may be locally dominant.
- AA - Abundant - very abundant and dominant; defining vegetation type.

Numbers (as in R3) offset occurrence ratings (1 – several plants; 2 – many plants; 3 – abundant in a limited area) in cases where distribution across the survey area may be limited, but individuals seen are more than indicated by the occurrence rating alone.

Notes:

(1) Riparian; seen mostly or entirely along 'Ōma'o Stream
(2) Reported previously by Char (2003) for this site.
(3) Reported previously by Guinther (2007) for this site.
(4) Vegetative tissues only; no flowers or fruit observed in January 2009.

A total of 83 species of flowering plants and 2 species of ferns were identified as occurring in the project area during the course of the January 2009 survey, or were previously reported from the site by Char (2003) or Guinther (2007). The 83 species included only 4 (4.8 %) indigenous species, no endemic species, and several early Polynesian introductions (some listed here as ornamentals planted in the agriculture area). The native species are all fairly commonly occurring species.

Avian Survey Methods

Five avian count stations were evenly spaced along the proposed right-of-way. An eight-minute point count was conducted at each station. Stations were each counted once. Field observations were made with the aid of Leitz 10 X 42 binoculars and by listening for vocalizations. Counts were conducted during the early morning hours, the peak of daily bird activity. Time not spent

counting was used to search the general project area for species and habitats not detected during count sessions.

Avian Survey Results

A total of 140 individual birds of 17 species, representing 14 separate families, were recorded during station counts (Table 2). One species recorded, Pacific Golden-Plover (*Pluvialis fulva*) is an indigenous migratory shorebird, that nests in the high Arctic during the late spring and summer months, returning to their wintering grounds in Hawaii, Japan, Okinawa, Polynesia, Micronesia, Melanesia, New Zealand, Australia, Indonesia, Philippines, southern China, southeast Asia, Bangladesh, Nepal, India, Sri Lanka, Pakistan, Iran, Bahrain, and northeast and southern Africa (Johnson and Conners 1996). Wintering birds usually leave Hawai'i for their trip back to the Arctic in late April or the very early part of May, and return to their wintering grounds in late July and early August. Some individuals overwinter in Hawai'i, and thus are present all year. The remaining 13 species detected are regularly encountered alien species, common in the low to mid-elevation areas the Island of Kaua'i. (Table 2).

Avian diversity and densities were in keeping with the locations and the habitat present along the right-of-way. Three species, Japanese White-eye (*Zosterops japonicus*), Common Myna (*Acridotheris tristis*), and Red Junglefowl (*Gallus gallus*), accounted for slightly less than 53% of the total number of all birds recorded during station counts. The most commonly recorded species was Japanese White-eye, which accounted for slightly more than 19% of the total number of individual birds recorded. An average of 28 birds were detected per station count.

No avian species currently protected, or proposed for protection under either the Federal or State of Hawai'i endangered species programs were detected during the course of this survey (DLNR 1998, Federal Register 2005, USFWS 2005, 2008).

Table 2 – Avian Species Detected Northern Bypass Road, Kaua'i

Common Name	*Scientific Name*	*ST*	*RA*
	GALLIFORMES		
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Red Junglefowl	*Gallus gallus*	A	4.40
Ring-necked Pheasant	*Phasianus colchicus*	A	0.20
	CICONIIFORMES		
	ARDEIDAE - Herons, Bitterns & Allies		
Cattle Egret	*Bubulcus ibis*	A	1.69
	CHARADRIIFORMES		
	CHARADRIIDAE - Lapwings & Plovers		
Pacific Golden-Plover	*Pluvialis fulva*	IM	0.20

Table 2 Continued

Common Name	*Scientific Name*	*ST*	*RA*
	COLUMBIFORMES		
	COLUMBIDAE – Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	A	2.00
Zebra Dove	*Geopelia striata*	A	1.40
	PASSERIFORMES		
	SYLVIIDAE – Old World Warblers & Gnatcatchers		
	Sylviinae – Old World Warblers		
Japanese Bush-Warbler	*Cettia diphone*	A	1.00
	TURDIDAE – Thushes		
White-rumped Shama	*Copsychus malabaricus*	A	1.60
	TIMALIIDAE – Babblers		
Hwamei	*Garrulax canorus*	A	1.00
	ZOSTEROPIDAE – White-Eyes		
Japanese White-eye	*Zosterops japonicus*	A	5.40
	STURNIDAE – Starlings		
Common Myna	*Acridotheres tristis*	A	5.00
	EMBERIZIDAE – Emberizids		
Red-crested Cardinal	*Paroaria coronata*	A	0.40
	CARDINALIDAE – Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	2.20
	FRINGILLIDAE – Fringilline And Carduelline Finches & Allies		
	Carduelinae – Carduline Finches		
House Finch	*Carpodacus mexicanus*	A	0.80
	PASSERIDAE - Old World Sparrows		
House Sparrow	*Passer domesticus*	A	0.60
	ESTRILDIDAE – Estrildid Finches		
	Estrildinae – Estrildine Finches		
Chestnut Munia	*Lonchura atricapilla*	A	0.20
Java Sparrow	*Padda oryzivora*	A	1.40

Key to Table 2.

	Status
A	Alien species – introduced to Hawai'i by humans, and have become established in the wild
IM	Indigenous Migratory species – native to the Hawaiian Islands, but also found elsewhere naturally
	Relative Abundance: Number of birds detected divided by the number of count stations (5)

Mammalian Survey Methods

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *'ōpe'ape'a* as it is known locally, all terrestrial mammals currently found on the Island of Kaua'i are alien species, and most are ubiquitous. The survey of mammals was limited to visual

and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all vertebrate species observed and heard within the project area.

Mammalian Survey Results

Five mammalian species were detected during the course of this survey. A pit bull (*Canis f. familiaris*) belonging to the caretakers of the property on the west side of the stream was present on the site at the time that we conducted the surveys. Six horses (*Equus c. caballus*) and one mule (*Equus asinus x Equus caballus*), were present within the paddocks on the eastern side of Ōmao Stream. Additionally, scat; tracks and sign of dog, cat (*Felis catus*), and pig (*Sus s. scrofa*) were encountered at several locations within the study area. The endangered Hawaiian hoary bat was not seen during the course of this survey.

No mammalian species protected or proposed for protection under either the Federal or State of Hawai'i endangered species programs were detected during the course of this survey (DLNR 1998, Federal Register 2005, USFWS 2005, 2008).

Discussion

Botanical Resources

As noted in the results section, the majority of the plant species encountered are introduced plants, many considered to be ruderal species. Considering that the majority of the survey area consists of pasture, abandoned pasture, and diversified agriculture, the majority of species encountered are associated with highly disturbed environments. Detail is provided in Guinther (2007, pp 3, 7-8) with respect to the riparian environment to be crossed by the proposed roadway:

> *" 'Ōma'o Stream and the cut-off meanders surveyed are overgrown with hau (Hibiscus tiliaceus) in the general area, but the stream course is open where the proposed roadway would cross it. The absence of hau from this specific area is presumed to reflect a removal [of vegetation] accomplished some time ago and one that may well predate the decision to build a road here. Clearing of hau was probably related to use of the properties north of the stream as horse pasture.*
>
> *The vegetation on the sediment deposit [in the stream here] varies from nearly barren at the downstream end where the sediment bar is heavily shaded by hau (and includes some hau), to dominated overwhelmingly by California grass where the forest canopy is restricted to ironwood (Casuarina equisetifolia) and Java plum (Syzygium cumini) growing on the right bank and albizia (Falcataria moluccana) growing somewhat back from the left bank. These trees do not overhang the channel.*
>
> *It is evident..... that with respect to wetland vegetation, only the channel supports wetland indicator species in an abundance sufficient to pass the vegetation test for wetland status: more than 50% of the dominant species are hydrophytic (i.e., status of OBL, FACW, or FAC[1]). The area surveyed is dominated by California grass (Urochloa mutica), a FACW species covering more than 80% of the area.... "*

The report also includes a delineation of wetlands i the vicinity of the proposed road crossing. The outcome of the wetlands delineation and inspection by the Army Corps of Engineers (USACE) was that the stream itself is jurisdictional within the banks as defined by the ordinary high water mark (OHWM), and wetlands are present in the *hau* groves on the north side of the right-of-way, but not at the point where the roadway would cross over 'Ōma'o Stream (AECOS, 2010).

Avian Resources

The findings of the avian survey are consistent with at least one other avian survey conducted on a portion of the project site in the recent past (David 2003a), and with the findings of at least two other faunal surveys conducted on lands immediately adjacent to the subject property in the recent past (David 2002, 2005, Guinther and David 2009).

Of the 17 separate avian species detected during the course of this survey only one, Pacific Golden-Plover is an indigenous species. As previously mentioned this species nests in the high Arctic, and spends its winter and spring months in the central and Tropical Pacific, before once again flying north to breed in late April. During the 2003 survey of the same general right-of-way, I detected another common native species on the site, namely Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*) along 'Ōmao Stream. With the large number of frogs associated with the stream and wetter areas along the stream, it is likely that this species utilizes resources on the site for foraging on a regular basis.

Although not detected during this survey, both the endangered Hawaiian Petrel (*Pterodroma sandwichensis*) and the threatened endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*) have been recorded over-flying the general project area between April and the end of November each year (David et al., 2002, David 2009). Additionally, the Save Our Shearwaters Program has recovered both species from the general project area on an annual basis over the past three decades (Morgan et al., 2003, 2004, David and Planning Solutions 2008, Save Our Shearwater Program 2009).

There are no nesting colonies nor appropriate nesting habitat for either of these listed seabird species within or close to the bypass right-of-way. The two closest historically known Newell's shearwater colonies to the project are, or were located at Kāluahonu and above Kalāheo, the former colony is located approximately three miles (5000-meters) northeast of the northeastern most portion of the proposed project, and the latter is located more than four and a half miles (7500-meters) northwest of the most northeastern point of the project. It is currently thought that the Kāluahonu is no longer extant as no birds have been recorded there in over six years (David et al., 2002; David, 2003b, DOFAW 2009), and it is unclear as to whether the Kalāheo is still extant

[1] Excluding FAC plants, a category no longer used in revised plant status listing

(David et al., 2002). The only presently known Hawaiian Petrel colonies are located in remote valleys, inland from the north and northeast shores of the island.

The primary cause of mortality in both Hawaiian Petrels and Newell's Shearwaters is thought to be predation by alien mammalian species at the nesting colonies (USFWS 1983, Simons and Hodges 1998, Ainley et al. 2001). Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds often collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Hadley 1961, Telfer 1979, Sincock 1981, Reed et al. 1985, Telfer et al. 1987, Cooper and Day 1994, Podolsky et al. 1998, Ainley et al. 2001).

Mammalian Resources

The findings of the mammalian survey are consistent with at least one other avian survey conducted on a portion of the project site in the recent past (David 2003a), and with the findings of at least two other faunal surveys conducted on lands immediately adjacent to the subject property in the recent past (David 2004, Guinther and David 2009).

Although no Hawaiian hoary bats were detected during the course of this survey, bats have been recorded foraging for insects in the general vicinity of the project site in the recent past (David 2009). Hawaiian hoary bats are widely distributed in the lowland areas on the Island of Kaua'i, and have been documented in and around almost all areas that still have some dense vegetation (Tomich 1986, David 1999, 2000, 2008, USFWS 1998).

Although no rodents were detected during the course of this survey, it is likely that several if not all of the four established alien *muridae* found on Kaua'i, roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*) and Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within the project area. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependant on them.

Potential Impacts to Protected Species

Botanical Resources

No plant species currently listed as endangered, threatened, or proposed for listing under either the federal or the State of Hawai'i's endangered species programs were recorded within or close to the proposed project site.

Hawaiian Petrel and Newell's Shearwater

The principal potential impact that the development of this project poses to Hawaiian Petrels and Newell's Shearwaters is the increased threat that birds will be downed after becoming disoriented by outdoor lighting which may be necessary if night-time construction activity is planned, and following build-out with street lights that may be installed along the roadway.

Hawaiian Hoary Bat

It is not known if any bats use the site as a roosting site. The principal potential impact that the construction of this project poses to Hawaiian hoary bats is during the grubbing and clearing phase of construction, especially the removal of the dense vegetation along 'Ōmao Stream. During the pupping season females carry their pups and thus may be less able to vacate roosting sites when such habitat is being cleared, quickly enough to avoid harm.

Conclusions

If the following recommendations are implemented, it is not expected that the modification of the habitat currently found within or adjacent to the project site will have a negative impact on any botanical, avian or mammalian species currently listed as endangered, threatened, or that are currently proposed for listing under either federal or State of Hawai'i endangered species statutes (DLNR 1998, Federal Register 2005, USFWS 2005, 2008).

Recommendations

- If nighttime work will be required in conjunction with the construction of the project, it is recommended that lights be shielded to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed et al. 1985, Telfer et al. 1987).

- It is also recommended that all exterior lighting associated with the new roadway be shielded so as to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed et al. 1985, Telfer et al. 1987).

- It is recommended that clearing of the dense *hau* forest along 'Ōmao Stream be conducted outside of the Hawaiian hoary bat pupping season to avoid potential impacts to this species in the event that they roost in the tree line along the stream. Hawaiian hoary bat pupping season runs between April and early August (Tomich 1986, USFWS 1998).

Glossary:

Alien - Introduced to Hawai'i by humans.
Crepuscular – Twilight hours either in the evening or the morning.
Endemic – Native and unique to the Hawaiian Islands.
Endangered – Listed and protected under the ESA as an endangered species.
Indigenous - Native to Hawai'i, but also found elsewhere naturally.
Muridae – Rodents, including rats, mice and voles, one of the most diverse families of mammals.
Nocturnal – Night-time, after dark.
Pelagic – An animal that spends it's life at sea – in the case of seabirds only returning to land to nest.
Ruderal – Disturbed, rocky, rubbishy areas, such as old agricultural fields and rock piles.
Sign – Biological term referring tracks, scat, rubbing, odor, marks, nests, and other signs created by animals by which their presence may be detected.
Volant – Flying, capable of flight - as in flying insect.
Threatened - Listed and protected under the ESA as a threatened species.

DLNR – Hawaii State Department of Land & Natural resources.
DLNR-DAR - Department of Land and Natural Resources – Division of Aquatic Resources
ESA – Federal Endangered Species Act of 1973, as amended
FAC – Facultative Species
FACW – Facultative Wetland Species
OBL – Obligate Wetland Species
OHWM – Ordinary High Water Mark
USACE – U. S. Army Corps of Engineers
USFWS – U.S. Fish & Wildlife Service.

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Appendix D

Air Quality Study
Prepared by
B.D. Neal & Associates
May 2010

AIR QUALITY STUDY

FOR THE PROPOSED

NORTHERN LEG OF WESTERN BYPASS ROAD

KOLOA, KAUAI, HAWAII

Prepared for:

Wilson Okamoto Corporation

May 2010

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6 Estimated Worst-Case 8-Hour Carbon Monoxide Concentrations Along Roadways Within Northern Leg Western Bypass Project

1.0 SUMMARY

The County of Kauai, Department of Public Works, is proposing to develop the Northern Leg Western Bypass Project in the Koloa area on the island of Kauai. The proposed project will consist of the construction of a new two-lane, two-way roadway between Koloa Road and Maluhia Road. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

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

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the Koloa area is very much affected by the topography of the island and its coastal situation. Winds are predominantly trade winds from the east northeast except for occasional periods when kona storms may generate strong winds from the south or when the trade winds are weak and landbreeze-seabreeze circulations may develop. Wind speeds average about 13 miles per hour providing relatively good ventilation much of the time. Temperatures in the area are generally very moderate with average daily temperatures ranging from about 68°F to 81°F.

Average annual rainfall in the Koloa area amounts to about 40 to 45 inches with summer months being the driest.

Although there is very little air quality data available from the Department of Health for the island of Kauai, the present air quality of the project area appears to be reasonably good. Based on the information available, it appears likely that all national air quality standards are currently being met, although occasional exceedances of the more stringent state standards for carbon monoxide may occur near congested roadway intersections.

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

boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

To assess the potential long-term impact of emissions from motor vehicles operating on the new roadway after construction is completed, a computerized air quality modeling study was undertaken. The air quality modeling study estimated current worst-case concentrations of carbon monoxide at intersections in the project vicinity and predicted future levels both with and without the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour worst-case carbon monoxide concentrations are well within both the state and the national ambient air quality standards. In the year 2015 without the project, worst-case carbon monoxide concentrations were predicted to increase due to added traffic, but concentrations would still remain well within standards. With the project in the year 2015, worst-case carbon monoxide concentrations were projected to increase compared to the without project case at the intersections of the new roadway with Koloa Road and with Maluhia Road, but concentrations would still remain relatively low and well within standards. Other locations studied along Koloa Road would benefit from reduced traffic volumes and experience reduced carbon monoxide concentrations. Due to the small impact the project is expected to have, implementing mitigation measures for long-term traffic-related air quality impacts is probably unnecessary and unwarranted.

2.0 INTRODUCTION

The County of Kauai, Department of Public Works, is proposing to construct the northern leg segment of the existing Western Bypass Road (Ala Kalanikaumaka Road) near Koloa on the island of Kauai (see Figure 1 for project location). The project would extend the Western Bypass Road approximately 0.4 mile northward from where it presently terminates at its intersection with Koloa Road to connect with the Eastern Bypass Road (Ala Kinioki Road), which presently terminates at its intersection with Maluhia Road. Also, in conjunction with this project, the southern end of Omao Road will be realigned to intersect with the proposed new roadway instead of at Koloa Road. The proposed new roadway is initially planned to be a two-lane, two-way roadway with left-turn pockets at its intersections.

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

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

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

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

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards were challenged in federal court. A Supreme Court ruling was issued during February 2001, and as a result, the new standards for particulate were finally implemented during 2005. To date, the Hawaii Department of Health has not updated the state particulate standards. In September 2001, the state vacated the state 1-hour standard for ozone and an 8-hour standard was adopted.

During the latter part of 2008, EPA revised the standard for lead making the standard more stringent. So far, the Hawaii Department of Health has not revised the corresponding state standard for lead. Most recently (January 2010), a national 1-hour standard for nitrogen dioxide was implemented.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affects the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout

most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east of the islands. These tradewinds are one of the outstanding features of Kauai's climate along with equable temperatures from day to day and season to season and the marked variation in rainfall from the wet to the dry season and from place to place.

The nearest long-term wind data available for the project area are collected at the Lihue Airport located about 10 miles to the northeast of Koloa. These data are probably at least semi-representative of the project area. As indicated in Table 2, they indicate a mean annual wind speed of 12.8 mph and a northeast annual prevailing wind direction for this area of Kauai [1]. Monthly wind speeds and directions are similar to the annual averages. Winds from the south are infrequent occurring only a few days during the year and mostly in winter in association with kona storms.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from stack sources. In Hawaii, the annual

and daily variations of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. At nearby Lihue Airport, average annual daily minimum and maximum temperatures are 68°F and 81°F, respectively. The extreme minimum temperature on record is 50°F, and the extreme maximum is 90°F [1]. Temperatures at the project site are very similar.

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

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentra-

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

Rainfall can have a beneficial affect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The Lihue area has a moderately wet climate. Normal annual rainfall for Lihue Airport is about 43 inches. Three-fourths of this total, on the average, falls during the wet season of October through April. Widespread rainstorms, which account for much of the precipitation, occur most frequently during this period. January is the wettest month, averaging over six inches [1]. Rainfall in the Koloa area is similar.

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles, industrial sources, agricultural operations and to a lesser extent by natural sources. Table 3 presents an air pollutant emission summary for the island of Kauai

for calendar year 1993. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Kauai originate from area sources, such as the mineral/aggregate products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and industrial boilers. Nitrogen oxides emissions emanate predominantly from area sources (mostly motor vehicle traffic), although industrial point sources also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources.

Arterial roadways in the project area, such as Koloa Road, Maluhia Road, Poipu Road and Ala Kinoiki Road, presently carry moderate to heavy levels of vehicle traffic during peak traffic hours. Sources of industrial air pollution are located at Port Allen, which is located about 8 miles to the west. These industrial sources emit sulfur dioxide, nitrogen oxides, particulate matter, carbon monoxide and other air pollutants. Prevailing winds from the east or northeast will carry these emissions away from the project area most of the time.

Until recently, air pollution in the project area originating from agricultural sources could mainly be attributed to sugar cane operations. Emissions from both the mill and much of the canefield operations in the area have now been eliminated with the closure of the Koloa Sugar Mill. Minor emissions of dust may occur from farming and ranching activities.

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

The State Department of Health operates a network of air quality monitoring stations at various locations around the state, but very little data is available for the island of Kauai. Table 4 shows annual summaries of air quality measurements for particulate (as PM-10) that were made at Lihue for the period 2002 through 2006. These are the only published and most recent air quality monitoring data that are currently available for the project area. Annual second-highest 24-hour PM-10 concentrations (which are regulated by state and federal standards) ranged from 24 to 30 $\mu g/m^3$ between 2002 and 2006. Average annual concentrations ranged from 13 to 16 $\mu g/m^3$. All values reported were within the state and national AAQS.

Although very little ambient air quality data is available to characterize existing conditions, due to the relatively small number of emission sources in the project area, it is likely that all ambient air quality standards are currently being met except perhaps for small areas around industrial sources or near traffic congested locations. Present worst-case concentrations of carbon monoxide due to traffic-related emissions occurring in the project area are estimated later in this study using computerized emissions and atmospheric dispersion models.

6.0 SHORT-TERM IMPACTS OF PROJECT

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

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the project site would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from

construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

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

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

exceed the standard. Carbon monoxide emissions from diesel engines are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

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

7.0 LONG-TERM IMPACTS OF PROJECT

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

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This legislation required further emission reductions, which have been phased in since 1994. More recently, additional restrictions were signed into law during the Clinton administration, and these began

to take effect during the next decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways. It is estimated that carbon monoxide emissions, for example, will go down by an average of about 25 to 30 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

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

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2010 with present conditions, (2) year 2015 without the project, and (3) year 2015 with the project. To begin the modeling study of the three scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. For this study, the five key intersections identified in the traffic study were also selected

for air quality analysis. These included the following intersections:

- Koloa Road at Omao Road
- Koloa Road at Western Bypass Road
- Koloa Road at Poipu Road
- Koloa Road at Maluhia Road
- Maluhia Road at Ala Kinoiki Road.

The traffic impact report for the project [4] describes the existing and projected future traffic conditions and laneage configurations of the study intersections in detail. In performing the air quality impact analysis, it was assumed that all recommended traffic mitigation measures would be implemented.

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

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

The EPA computer model MOBILE6.2 [5] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE6.2 is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 43.6% light-duty gasoline-powered automobiles, 43.6% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.4% heavy-duty diesel-powered trucks and buses, and 0.6% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change slightly with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and carbon monoxide emission estimates given by MOBILE6.2 generally have an inverse relationship to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE6.2, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [6] currently recommend that the computer model CAL3QHC [7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [8] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the

California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model had become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

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

Although CAL3QHC is intended primarily for use in assessing atmospheric dispersion near signalized roadway intersections, it can also be used to evaluate unsignalized intersections. This is accomplished by manually estimating queue lengths and then applying the same techniques used by the model for signalized intersections. Currently, all of the study intersections are unsignalized. In the future with the project, in accordance with the traffic report, two of the study intersections (Koloa Road at Western Bypass Road and Maluhia Road at Ala Kinoiki/Western Bypass Road) were assumed to become signalized.

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

MOBILE6.2 based on assumed free-flow vehicle speeds corresponding to the posted or design speed limits.

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

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

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at low levels. Thus, background contributions of carbon monoxide from sources or roadways not directly considered in the analysis were accounted for by adding a background concentration of 0.5 ppm to all predicted concentrations for 2010. Although increased traffic is expected to occur within the project area within the next several years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 0.5 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 5 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for three scenarios: year 2010 with existing traffic, year 2015 without the project and year 2015 with the project. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration within the project vicinity for the present (2010) case was 2.2 mg/m^3. This was projected to occur during the morning peak traffic hour both near the intersection of Koloa Road at Poipu Road and also at the intersection of Koloa Road at the Western

Bypass Road. Concentrations at other locations and times studied were 2.1 mg/m^3 or lower. Predicted worst-case 1-hour concentrations at all locations studied for the 2010 scenario were within both the national AAQS of 40 mg/m^3 and the state standard of 10 mg/m^3.

In the year 2015 without the proposed project, the highest worst-case 1-hour concentration was predicted to occur during the afternoon at the intersection of Koloa Road and Maluhia Road. A value of 4.0 mg/m^3 was predicted to occur at this location and time. Peak-hour worst-case values at the other locations and times studied for the 2015 without project scenario ranged between 1.5 and 3.3 mg/m^3. Compared to the existing case, concentrations generally increased at all locations, but the worst-case concentrations remained within the state and national standards.

Predicted 1-hour worst-case concentrations for the 2015 with project scenario increased somewhat at the intersections of Koloa Road at the Western Bypass and Maluhia Road at Ala Kinoiki Road/Northern Leg Western Bypass. Concentrations decreased at the other locations studied. A maximum concentration of 3.0 mg/m^3 was predicted to occur during the morning peak hour at the intersections of Koloa Road at the Western Bypass Road and Maluhia Road at Ala Kinoiki Road/Northern Leg Western Bypass Road. Other concentrations ranged between 1.2 and 2.8 mg/m^3, well within the state and federal standards.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One study based on modeling [9] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [10] recommend using a value of 0.7 unless a locally derived persistence factor is available. Recent monitoring data for locations on Oahu reported by the Department of Health [11] suggest that this factor may range between about 0.2 and 0.6 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 6. For the 2010 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the five locations studied ranged from 1.0 to 1.1 mg/m^3. The estimated worst-case concentrations for the existing case were well within both the state standard of 5 mg/m^3 and the national limit of 10 mg/m^3.

For the year 2015 without project scenario, worst-case concentrations ranged between 1.1 and 2.0 mg/m^3, with the highest

concentration occurring at the intersection of Koloa Road and Maluhia Road. All predicted concentrations were within the standards.

For the 2015 with project scenario, worst-case concentrations remained substantially unchanged compared to the without project case, indicating minimal project impact. Concentrations would increase somewhat at the intersections of Koloa Road at the Western Bypass Road and Maluhia Road at Ala Kinoiki Road/Western Bypass but still remain relatively low. All predicted 8-hour concentrations for this scenario were well within both the national and the state AAQS.

Conservativeness of Estimates

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

8.0 CONCLUSIONS AND RECOMMENDATIONS

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

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

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

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Figure 1 - Project Location

Table 2

MEAN WIND SPEED AND PREVAILING DIRECTION FOR LIHUE AIRPORT, KAUAI

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Speed (mph)	11.3	12.0	12.8	13.7	13.4	13.6	14.1	13.4	12.1	11.9	12.7	12.2	12.8
Direction	NE	ENE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Notes: Mean wind speeds are based on 32 years of data. Mean wind direction based on 20 years of data.

Source: "Local Climatological Data, Annual Summary With Comparative Data, Lihue, Hawaii, 1999", U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, National Climatic Center, Asheville, NC.

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual	-	-	50
		24 Hours	150[a]	150[a]	150[b]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual	15[c]	15[c]	-
		24 Hours	35[d]	35[d]	-
Sulfur Dioxide	$\mu g/m^3$	Annual	80	-	80
		24 Hours	365[b]	-	365[b]
		3 Hours	-	1300[b]	1300[b]
Nitrogen Dioxide	$\mu g/m^3$	Annual	100	100	70
		1 Hour	189[d]	-	-
Carbon Monoxide	mg/m^3	8 Hours	10[b]	-	5[b]
		1 Hour	40[b]	-	10[b]
Ozone	$\mu g/m^3$	8 Hours	157[e]	157[e]	157[e]
		1 Hour	235[f]	235[f]	-
Lead	$\mu g/m^3$	3 Months	0.15[g]	0.15[g]	-
		Quarter	1.5[h]	1.5[h]	1.5[h]
Hydrogen Sulfide	$\mu g/m^3$	1 Hour	-	-	35[b]

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

Table 3

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF KAUAI, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	614	4,817	5,431
Sulfur Oxides	703	nil	703
Nitrogen Oxides	4,072	7,054	11,126
Carbon Monoxide	2,315	11,974	14,289
Hydrocarbons	859	224	1,083

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

Table 4

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST NORTHERN LEG WESTERN BYPASS PROJECT

Parameter / Location	2002	2003	2004	2005	2006
Particulate (PM-10) / Lihue					
24-Hour Averaging Period:					
No. of Samples	56	61	52	195	335
Highest Concentration ($\mu g/m^3$)	27	31	28	30	34
2nd Highest Concentration ($\mu g/m^3$)	24	27	24	28	30
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	14	16	13	14	11

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2002 - 2006"

Table 5

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS WITHIN NORTHERN LEG WESTERN BYPASS PROJECT (milligrams per cubic meter)

Roadway Intersection	Year/Scenario					
	2010/Present		2015/Without Project		2015/With Project	
	AM	PM	AM	PM	AM	PM
Koloa Road at Omao Road	2.1	1.5	2.2	1.5	-	-
Omao Road at Western Bypass Road	-	-	-	-	1.4	1.2
Koloa Road at Western Bypass Road	2.2	1.3	2.5	2.1	3.0	2.2
Koloa Road at Poipu Road	2.2	2.0	3.1	3.2	2.4	2.4
Koloa Road at Maluhia Road	2.1	2.0	3.3	4.0	2.2	2.8
Maluhia Road at Ala Kinoiki Road	1.6	2.1	2.2	2.2	3.0	2.5

Hawaii State AAQS: 10
National AAQS: 40

Table 6

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS WITHIN NORTHERN LEG WESTERN BYPASS PROJECT (milligrams per cubic meter)

Roadway Intersection	Year/Scenario		
	2010/Present	2015/Without Project	2015/With Project
Koloa Road at Omao Road	1.0	1.1	-
Omao Road at Western Bypass Road	-	-	0.7
Koloa Road at Western Bypass Road	1.1	1.2	1.5
Koloa Road at Poipu Road	1.1	1.6	1.2
Koloa Road at Maluhia Road	1.0	2.0	1.4
Maluhia Road at Ala Kinoiki Road	1.0	1.1	1.5

Hawaii State AAQS: 5
National AAQS: 10

Appendix E

Noise Study
Prepared by
Y. Ebisu & Associates
May 2010

ACOUSTIC STUDY FOR THE NORTHERN LEG OF THE WESTERN BYPASS ROAD KOLOA, KAUAI, HAWAII

Prepared for:

WILSON OKAMOTO CORPORATION

Prepared by:

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MAY 2010

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CHAPTER I. SUMMARY

The existing and future traffic noise levels in the environs of the proposed Northern Leg of the Western Bypass Road Project on the island of Kauai were studied to evaluate potential noise impacts associated with the Build Alternative. The proposed alignment of the new bypass road was evaluated, and its location is shown in Figure 1. Noise measurements were obtained, traffic noise predictions developed, and noise abatement alternatives evaluated.

At locations along the proposed bypass road alignment, existing traffic and background ambient noise levels in the project area currently do not exceed the U.S. Federal Highway Administration (FHWA) and Hawaii State Department of Transportation, Highways Division (HDOT) noise abatement criteria. Future (CY 2035) traffic noise levels should not exceed the "66 Leq" HDOT noise abatement criteria along the proposed bypass road's alignment. The HDOT's "15 dB increase" criteria will probably not be exceeded at future developments along the proposed highway alignment since no residences, public use facilities, or park lands are expected to be located along the proposed bypass road prior to its construction.

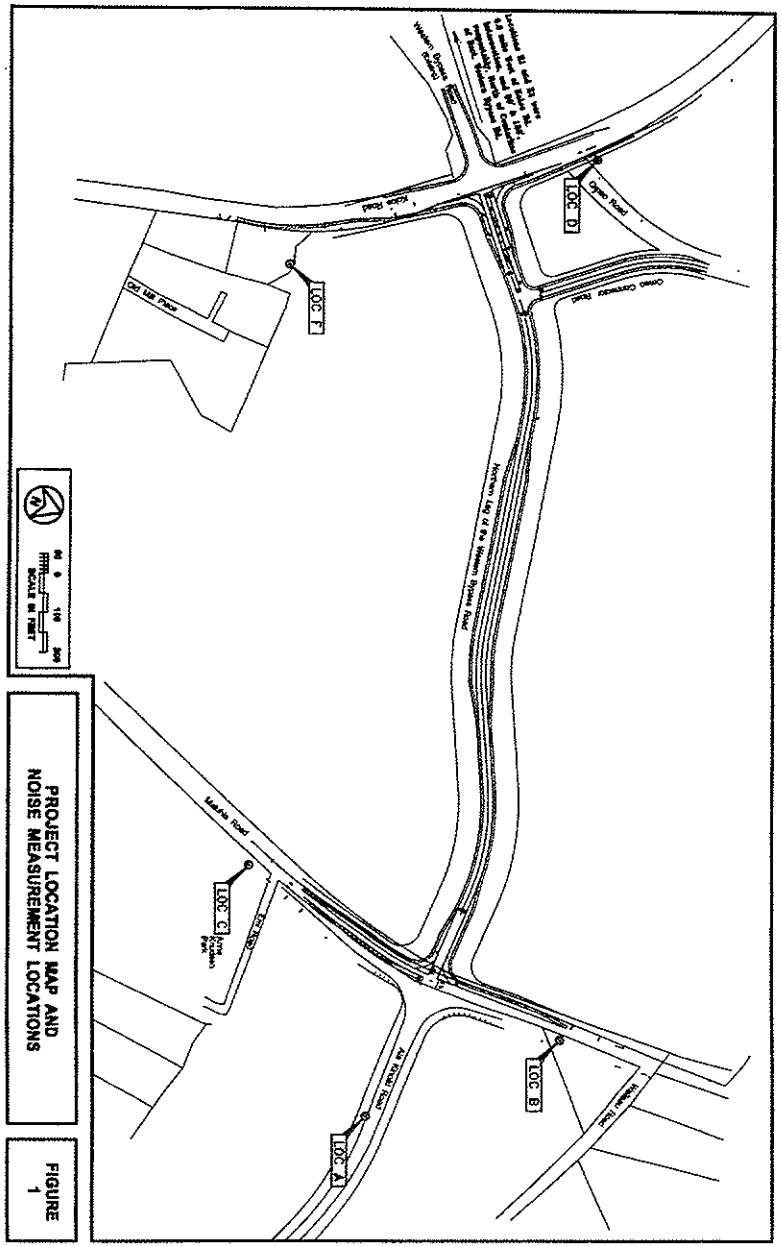
The following general conclusions can be made in respect to the potential traffic noise impacts which are possible by CY 2035 under the Build Alternative. These conclusions are valid for the future traffic volumes, mix, and average speed assumptions used for this traffic noise study.

- The HDOT's 66 Leq(h) noise abatement criteria for noise sensitive properties will not be exceeded at any noise sensitive developments located along the bypass road's Rights-of-Way with a posted speed limit of 25 miles per hour. Currently, most of the lands along the bypass road's alignment are vacant and undeveloped, with other areas in agricultural use.

- The HDOT's 71 Leq(h) noise abatement criteria for commercial and industrial properties will not be exceeded at any developments located along the bypass road's Rights-of-Way with a posted speed limit of 25 miles per hour. Currently, most of the lands along the bypass road's alignment are vacant and undeveloped, other other areas in agricultural use.

- The HDOT's "15 dB increase" noise abatement criteria will probably not be exceeded at future developments located along the bypass road corridor as long as no future developments along the Rights-of-Way precede the construction of the bypass road. As long as the bypass road construction precedes any future development along the bypass road's Rights-of-Way, the "15 dB increase" criteria will not be exceeded at these future developments.

- Future traffic noise levels from the proposed bypass road are not expected to exceed the HDOT noise abatement criteria at existing residences closest to the planned bypass road. Because the project should not cause future traffic noise



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

levels to exceed the "66 Leq" or "15 dB increase" criteria at these existing residences, special noise mitigation measures at these residences need not be included with the project improvements.

- No parks or public structures (such as churches) are located within the limits of project construction; therefore, none should be affected by the proposed project or require noise mitigation measures.

- Potential short term construction noise impacts are possible during the project construction period in the project environs wherever noise sensitive receptors are located. However, minimizing these types of noise impacts is possible using standard curfew periods, properly muffled equipment, administrative controls, and construction barriers as required.

CHAPTER II. GENERAL STUDY METHODOLOGY

Noise Measurements. Existing traffic and background ambient noise levels at 7 locations in the project area were measured in May 2010. The traffic noise measurements were used to calibrate the traffic noise model which was used to calculate the Base Year (CY 2010) and future (CY 2035) traffic noise levels under the Build Alternative. The background ambient noise measurements were used to define existing noise levels at the closest noise sensitive receptors to the planned bypass road which may be affected by the project. Also, the measurements were used in conjunction with forecast traffic noise levels to determine if future traffic noise levels are predicted to "substantially exceed" existing background ambient noise levels at these noise sensitive receptors, and therefore exceed FHWA and HDOT noise abatement criteria.

The noise measurement locations are shown in Figure 1. Traffic noise measurements were obtained at Locations "A," "B," "C," "D," "E1," and "E2." Background ambient noise measurements were obtained at Location "F" which was shielded from Koloa Road by the Hadama Service shop building. The results of the traffic and background ambient noise measurements are summarized in Table 1. In Table 1 and in subsequent tables, Leq represents the average (or equivalent), A-Weighted, Sound Level. A list and description of the acoustical terminology used are contained in Appendix B.

Traffic Noise Predictions. The Federal Highway Administration (FHWA) Traffic Noise Model, Version 2.5 (or TNM, see Reference 1) was used as the primary method for calculating Base Year and future traffic noise levels, with model parameters adjusted to reflect terrain, ground cover, and local shielding conditions. The traffic noise measurement Locations "A," "B," "C," "D," "E1," and "E2" were used to validate the traffic noise model along the various existing roadways in the project area. At these traffic noise measurement locations, the measured traffic noise levels were compared with TNM model predictions to determine if the measured and calculated noise levels for the existing conditions were consistent and in general agreement. As indicated in Table 1, spot counts of traffic volumes were also obtained during the measurement periods and were used to generate the Equivalent Sound Level (Leq) predictions shown in the table. Traffic mix by vehicle types and average vehicle speeds for the various sections of the existing and future roadways were derived from observations during the traffic noise monitoring periods.

Measured and predicted traffic noise levels at Locations "A," "B," "C," "D," "E1," and "E2" were generally in good agreement at distances ranging from 33 to 100 feet from the centerlines of the roadways. So for this study, TNM 2.5 model predictions of existing and future traffic noise levels along the new bypass road were considered to be acceptable for use on this project.

The Equivalent (or Average) Hourly Sound Level [Leq(h)] noise descriptor was

TABLE 1
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

	LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A	33 FT from the centerline of Ala Kinoiki Road (5/3/10)	0639 TO 0739	35	210	2	4	62.7	62.9
B	42 FT from the centerline of Malulihia Road (5/3/10)	0745 TO 0845	45	470	19	2	67.4	67.3
C	50 FT from the centerline of Malulihia Road (5/3/10)	1252 TO 1352	35	493	9	2	61.6	61.6
D	54 FT from the centerline of Kolea Road (5/3/10)	0914 TO 1014	45	395	11	4	66.1	65.9
E1	50 FT from the centerline of Bypass Road (5/3/10)	1125 TO 1225	35	217	2	0	59.5	59.6
E2	100 FT from the centerline of Bypass Road (5/3/10)	1125 TO 1225	35	217	2	0	53.2	54.3
F	Behind Hadama Service Off Kolea Road (5/2/10)	1130 TO 1139	N/A	N/A	N/A	N/A	47.8	N/A

used to describe the Base Year and CY 2035 traffic noise levels as required by References 2 and 3. The bypass road plans and profiles, topographic maps (where available) of the area, and visual survey of the area were used to determine terrain, ground cover, and local shielding effects and distances from building structures, which were entered into the noise prediction model. Receptor elevations were estimated using these maps.

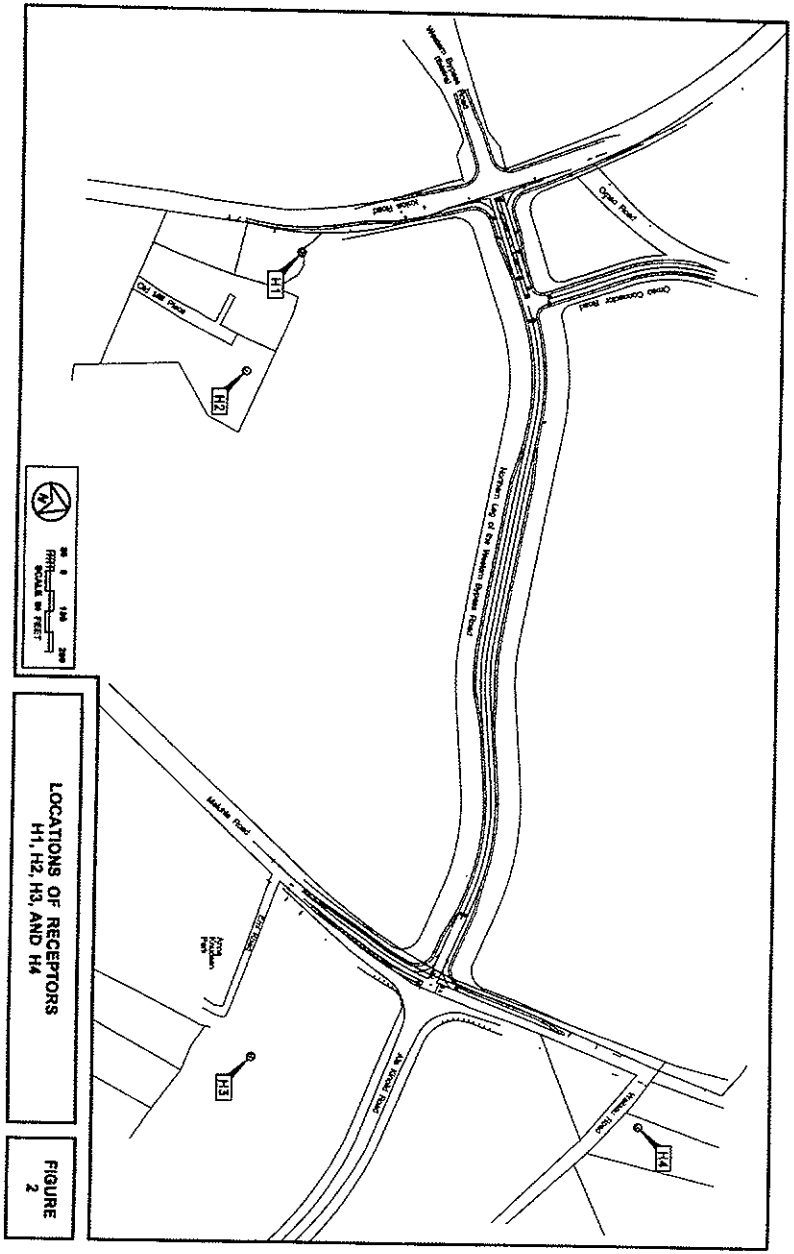
Future year (2035) traffic noise levels were then developed for the Build (New Bypass Road) Alternative along the bypass road alignment using the future pm peak hour traffic volumes from Reference 4. Existing average vehicle speeds and mixes were assumed to remain the same between the Base Year and future year (2035).

Noise sensitive residential structures are located in the vicinity of the proposed bypass road alignment, and are the only existing structures currently near the proposed bypass road alignment. These noise sensitive receptor locations are identified as Locations H1 through H4, are shown in Figure 2, and represent the closest noise sensitive buildings to the proposed bypass road alignment. Future traffic noise levels at these existing receptor locations closest to the proposed bypass road alignment were evaluated using the 2035 pm peak hour volumes from Reference 4.

Impact Assessments and Mitigation. Following the calculation of the future traffic noise levels, evaluations were made of the future traffic noise levels and impacts at receptor locations which were closest to the proposed bypass road alignment. Comparisons of predicted future traffic noise levels with FHWA and HDOT noise abatement criteria (see Table 2) were made at these receptor locations to determine specific locations where the noise abatement criteria are expected to be exceeded.

The HDOT 66 Leq(h) noise abatement criteria and the HDOT "15 dB increase" criteria were applied to all noise sensitive buildings in Activity Category B (see Table 2) closest to the proposed bypass road alignment. By Reference 3, the HDOT has replaced the FHWA 67 Leq(h) criteria with their 66 Leq(h) criteria for Activity Category B. Along the proposed bypass road alignment, the locations of the 66 Leq(h) traffic noise contour, without the benefit of shielding from natural terrain or man-made sound barriers, were also used to identify noise sensitive receptor locations where the HDOT's 66 Leq(h) noise abatement criteria would not be exceeded due to their locations outside the 66 Leq(h) contours. In addition, the HDOT's criteria of "15 dB increase or more above existing background noise levels" was also used as a noise abatement criteria for this project (from Reference 3).

If the proposed bypass road is constructed prior to the development of new noise sensitive residences along the bypass road Right-of-Way, background noise levels will be much higher than existing values when the noise sensitive buildings are completed. For this situation, future noise sensitive residences should not experience a



LOCATIONS OF RECEPTORS H1, H2, H3, AND H4

FIGURE 2

TABLE 2

FHWA & HDOT NOISE ABATEMENT CRITERIA
[Hourly A–Weighted Sound Level––Decibels (dBA)]

ACTIVITY CATEGORY	LEQ (h)*	DESCRIPTION OF ACTIVITY CATEGORY
A	57 (Exterior)	Lands on which serenity and quiet are of extra–ordinary significance and serve an important public need and where the preservation of those qualities is essential if the areas are to continue to serve their intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, activity sports areas, parks, residences, motels, hotels, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	------	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

---

* The Hawaii State Department of Transportation, Highways Division, utilizes Leq criteria levels which are 1 Leq unit less than the FHWA values shown.

noise level increase of 15 dB resulting from the construction of the bypass road, so the only noise abatement criteria applicable to these residences will be the 66 Leq(h) criteria for Activity Category B. In addition, unless building permits for planned noise sensitive structures have been received prior to this noise study, the HDOT will not be responsible for providing noise abatement at these future noise sensitive structures along the bypass road Rights-of-Way.

If the proposed bypass road is constructed after the construction of noise sensitive residences along the bypass road Rights-of-Way, background noise levels prior to construction of the bypass road may be similar to existing values of 40 to 45 Leq(h). Under these conditions, future traffic noise levels at developed properties along the bypass road Rights-of-Way could exceed the HDOT's "15 dB increase" noise abatement criteria following completion of the bypass road construction. The HDOT could then consider the application of reasonable and feasible traffic noise mitigation measures at these developed properties in accordance with Reference 3. However, since there are no noise sensitive receptors located near the Rights-of-Way along the proposed bypass road alignment, the likelihood of exceeding the HDOT's "15 dB increase" noise abatement criteria was considered to be very small.

For the potential office/commercial/industrial receptors in Activity Category C (see Table 2), the HDOT 71 Leq(h) and "15 dB increase" noise abatement criteria were also applied. However, because future (2035) traffic noise levels were not expected to exceed the 71 Leq(h) beyond the bypass road Rights-of-Way and because there were no office/commercial/industrial receptors along the the bypass road Rights-of-Way, potential noise impacts at receptors in Activity Category C were considered to be very unlikely.

CHAPTER III. EXISTING ACOUSTICAL ENVIRONMENT

For the purposes of this study, 2010 was used as the Base Year for calculating changes in traffic and background ambient noise levels between the Base Year and 2035 under the Build Alternative. The Base Year noise environment in the environs of the Northern Leg of the Western Bypass Road was described by noting the measured noise levels at Locations "A" through "F". The measured average sound levels during the quietest periods, expressed in decibels, represent the average levels of background ambient during the study's Base Year along the now undeveloped lands along the proposed bypass road's alignment. Table 1 contains the traffic and background noise measurement results at Locations "A" through "F", which were used to calibrate the traffic noise model and to refine estimates of existing traffic and background noise levels along the existing roadways in the project environs.

Table 3 presents the Base Year traffic noise levels during the pm peak traffic hour at receptor locations of 50, 100, and 150 feet from the centerlines of existing roadways in the project environs. Base Year traffic noise levels currently exceed the "66 Leq" noise abatement criteria at 50 feet from the centerlines of Maluhia Road north of Ala Kinoiki Road, and at 50 feet from the centerline of Koloa Road north and south of the Western Bypass Road. The "66 Leq" criteria is not exceeded at 50 feet from the centerlines of Ala Kinoiki Road, Maluhia Road south of Ala Kinoiki Road, and the Western Bypass Road.

Table 4 presents the setback distances from the centerlines of the existing roadways in the project environs to the 66 and 71 Leq contours during the pm peak hour. The 66 Leq criteria for noise sensitive uses was exceeded during the Base Year along the Rights-of-Way of Maluhia Road north of Ala Kinoiki Road, and along Koloa Road north and south of the Western Bypass Road. The 71 Leq criteria for commercial/industrial uses was also exceeded during the Base Year along the Rights-of-Way of Maluhia Road north of Ala Kinoiki Road, and along Koloa Road north and south of the Western Bypass Road.

It should be noted that existing background ambient noise levels at existing noise sensitive receptors closest to the proposed Northern Leg of the Western Bypass Road are currently less than the FHWA and HDOT noise abatement criteria level of 66 Leq(h). The locations of these existing noise sensitive receptors "H1" through "H4" are shown in Figure 2. Estimates of the existing noise levels at these receptor Locations "H1" through "H4" are shown in Table 5. The existing background ambient noise levels for receptor locations shown in Figure 2 which are removed from existing roads were estimated from the measurements shown in Table 1 and from the residual noise levels measured at Locations "A" through "F". The residual background noise level measured at Locations "A" through "F" was approximately 40 dB (Leq), but increased to the range of 45 to 55 dB (Leq) due to the sounds of distant traffic or construction activities, birds, and foliage moving with the wind.

TABLE 3

EXISTING (CY 2010) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS IN PROJECT ENVIRONS (PM PEAK HOUR)

ROADWAY SECTION	SPEED (MPH)	TOTAL VPH	VOLUMES (VPH) AUTOS	M.TRUCKS	H.TRUCKS	50'.Leq	100'.Leq	150'.Leq
Ala Kinoiki Rd. East of Maluhia Rd.	35	533	520	5	8	64.4	59.2	56.5
Maluhia Rd. North of Ala Kinoiki Rd.	45	915	869	37	9	69.1	63.9	61.3
Maluhia Rd. South of Ala Kinoiki Rd.	35	430	417	9	4	61.4	56.2	53.4
Koloa Rd. North of Western Bypass Rd.	45	922	885	28	9	70.0	64.5	61.7
Koloa Rd. South of Western Bypass Rd.	45	773	742	23	8	69.2	63.8	61.0
Western Bypass Rd. West of Koloa Rd.	35	273	269	3	1	60.9	55.6	52.8

Notes:
1. All distances shown are from the center of roadways.
2. Calculated Leq's are for unobstructed line-of-sight conditions.

TABLE 4

YEAR 2010 AND 2035 DISTANCES TO 66 AND 71 LEQ CONTOURS (PM PEAK HOUR)

ROADWAY SECTION	66 Leq SETBACK (FT) EXISTING	CY 2035	71 Leq SETBACK (FT) EXISTING	CY 2035
Ala Kinoiki Rd. East of Maluhia Rd.	40	47	21	24
Maluhia Rd. North of Ala Kinoiki Rd.	76	157	39	75
Maluhia Rd. South of Ala Kinoiki Rd.	27	49	14	25
Koloa Rd. North of Western Bypass Rd.	83	99	44	53
Koloa Rd. South of Western Bypass Rd.	75	82	40	44
Western Bypass Rd. West of Koloa Rd.	26	72	13	37
Proposed Bypass Rd. West of Maluhia Rd.	N/A	62	N/A	32
Proposed Bypass Rd. East of Omao Rd.	N/A	62	N/A	32
Proposed Bypass Rd. West of Omao Rd.	N/A	66	N/A	34
Omao Rd. Connector At Proposed Bypass Rd.	N/A	19	N/A	< 12
Proposed Bypass Rd. East of Koloa Rd.	N/A	66	N/A	34

Notes:
1. All distances shown are from the center of roadway.
2. See TABLES 3 and 6 for traffic volume, speed, and mix assumptions.
3. Setback distances are for unobstructed line-of-sight conditions.

TABLE 5

EXISTING AND FUTURE TRAFFIC NOISE LEVELS AT VARIOUS RECEPTOR LOCATIONS (4.92 FT RECEPTOR, PM PEAK HOUR)

RECEPTOR LOCATION	EXISTING (CY 2010) Leq	FUTURE (2035) / CHANGE Leq
IN THE VICINITY OF OLD MILL PLACE:		
Receptor Location H1	65.0	65.7 / 0.7
Receptor Location H2	45.0	47.6 / 2.6
SOUTH OF ALA KINOIKI ROAD):		
Receptor Location H3	48.0	50.4 / 2.4
NORTH OF ALA KINOIKI ROAD):		
Receptor Location H4	65.2	70.2 / 5.0

Notes:

1. All receptors were assumed to be at 4.92 feet above ground level.
2. Existing and future traffic noise levels dominated by noise contributions from existing roadways.
3. Future noise contributions from new bypass road are less than 48 dB (Leq).

Existing background ambient noise levels at receptor locations in the undeveloped areas of the proposed bypass road alignment are controlled by distant traffic or construction activities, and the natural sounds of birds and foliage moving with the wind. Estimated minimum background noise levels in these undeveloped areas during the pm peak traffic hour range from 40 to 45 dB (Leq). These estimates were based on the residual noise levels at Locations "A" through "F" during the quiet periods.

CHAPTER IV. DESCRIPTION OF FUTURE TRAFFIC NOISE LEVELS

The traffic noise levels along the proposed Northern Leg of the Western Bypass Road alignment during CY 2035 were evaluated for the Build Alternative. The same methodology that was used to validate the measured Base Year traffic noise levels in Table 1 was also used to calculate the Year 2035 noise levels under the Build Alternative. Predictions of future traffic noise levels along the bypass road alignment assumed the following:

- West of Maluhia Road, 1,103 vehicles per hour during the pm peak hour (see Appendix C).
- East of Omao Connector Road, 1,103 vehicles per hour during the pm peak hour (see Appendix C).
- West of Omao Connector Road, 1,239 vehicles per hour during the pm peak hour (see Appendix C).
- East of Koloa Road, 1,249 vehicles per hour during the pm peak hour (see Appendix C).
- Average speed of 35 miles per hour, with future traffic mix of 97.5 percent automobiles, 1.0 percent medium trucks, and 1.5 percent heavy trucks and buses.

Table 6 presents the future traffic noise modeling assumptions used for the four sections of the Northen Leg of the Western Bypass Road from Koloa Road to Maluhia Road. The 2035 traffic volumes shown were obtained from Reference 4. Table 6 also includes the calculated traffic noise levels at 50, 100, and 150 feet from the bypass road centerline during the pm peak traffic hour for unobstructed line of sight conditions between the receptor and the bypass road lanes.

Table 4 presents the calculated setback distances of the 66 and 71 Leq(h) traffic noise contours from the bypass road centerline for 2035 based on the results and assumptions shown in Tables 4 and 6. From the results shown in Table 4, it was concluded that Right-of-Way widths of 124 to 132 feet would be required to insure that noise sensitive properties would not be exposed to future traffic noise levels greater than 66 Leq(h). Because the Right-of-Way width is expected to be 150 feet, the 66 Leq(h) traffic noise contour should not extend beyond the bypass road Rights-of-Way. The same conclusion applies to the 71 Leq(h) contour, which is expected to extend from 32 to 34 feet from the bypass road's centerline.

The predicted future traffic noise levels for ground level receptors at the four existing noise sensitive receptor locations closest to the bypass road are shown in Table 5. Figure 2 depicts the locations of the noise sensitive receptors closest to the

TABLE 6

FUTURE (CY 2035) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS IN PROJECT ENVIRONS (WITH PROJECT; PM PEAK HOUR)

ROADWAY SECTION	SPEED (MPH)	TOTAL VPH	******** VOLUMES (VPH) ********** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	150' Leq
Ala Kinoiki Rd. East of Maluhia Rd.	35	682	665	7	10	65.5	60.3	57.6
Maluhia Rd. North of Ala Kinoiki Rd.	45	2,863	2,719	115	29	74.0	68.9	66.3
Maluhia Rd. South of Ala Kinoiki Rd.	35	1,206	1,170	24	12	65.9	60.7	58.0
Koloa Rd. North of Western Bypass Rd.	45	1,270	1,219	38	13	71.4	65.9	63.1
Koloa Rd. South of Western Bypass Rd.	45	901	865	27	9	69.9	64.4	61.6
Western Bypass Rd. West of Koloa Rd.	35	1,674	1,649	17	8	68.8	63.5	60.7
Proposed Bypass Rd. West of Maluhia Rd.	35	1,103	1,075	11	17	67.6	62.4	59.7
Proposed Bypass Rd. East of Omao Rd.	35	1,103	1,075	11	17	67.6	62.4	59.7
Proposed Bypass Rd. West of Omao Rd.	35	1,239	1,208	12	19	68.1	62.9	60.2
Omao Rd. Connector At Proposed Bypass Rd.	35	158	155	2	1	58.7	53.4	50.7
Proposed Bypass Rd. East of Koloa Rd.	35	1,249	1,218	12	19	68.1	62.9	60.2

Notes:
1. All distances shown are from the center of roadways.
2. Calculated Leq's are for unobstructed line-of-sight conditions.

bypass road where the future traffic noise levels were calculated. Notes 2 and 3 shown in Table 5 indicate that future traffic noise levels from the proposed bypass road are very low, less than 48 Leq(h), and well below the 66 Leq(h) noise abatement criteria for Activity Category B. In addition, because minimum existing background noise levels at the closest receptor locations in the project environs exceed 44 Leq(h), the "15 dB Increase" noise abatement criteria will also not be exceeded as a result of the proposed bypass road. The predicted increases in traffic noise levels at the four receptor locations are shown in Table 5, and range from 0.7 to 5.0 dB.

The following general conclusions can be made in respect to the potential noise impacts which can be expected by CY 2035 under the Build Alternative without noise mitigation measures. These conclusions are valid as long as the future vehicle mixes and average speeds do not differ from the assumed values shown in Table 6.

- By CY 2035, traffic noise levels along the Northern Leg of the Western Bypass Road are not expected to exceed 66 Leq(h) along the Rights-of-Way. Noise sensitive developments are not located along the Rights-of-Way of the bypass road, so traffic noise mitigation measures associated with exceedance of the 66 Leq criteria should not be required.

- By CY 2035, traffic noise levels along the Northern Leg of the Western Bypass Road should not cause existing background noise levels to increase by 15 dB or more at any existing receptor location, so traffic noise mitigation measures associated with exceedance of the "15 dB Increase" criteria should not be required.

- In the now undeveloped lands where the Northern Leg of the Western Bypass Road is planned, existing background noise levels are expected to increase by 22 to 28 dB. However, there are no noise sensitive or commercial receptors presently located along the planned Northern Leg of the Western Bypass Road.

- Within the limits of project construction, exceedances of the "66 Leq" or "71 Leq" noise abatement criteria are not expected to occur.

- Developments which precede the construction of the Northern Leg of the Western Bypass Road could be candidates for traffic noise mitigation measures if they are located within distances of approximately 0 to 225 feet from the bypass road Rights-of-Way. If the existing background noise levels at these noise sensitive developments which precede the construction of the bypass road are approximately 40 Leq(h), traffic noise mitigation measures may be applied if the forecasted traffic noise from the Northern Leg of the Western Bypass Road exceeds the background noise levels by 15 dB. Therefore, at these developments which precede the construction of the Northern Leg of the Western Bypass Road, the application of traffic noise mitigation measures could occur at forecasted noise levels below 66 or 71 Leq(h) and at buffer distances within approximately 225 feet from the bypass road Rights-of-Way. However, as

of the time of this noise study, there were no developments located within 225 feet of the bypass road's Rights-of-Way where the "15 dB increase" noise abatement criteria could be exceeded.

- No office, commercial, or industrial structures should experience future traffic noise levels which exceed the HDOT noise abatement criteria of 71 Leq(h) for Activity Category C.

- No existing park lands or public use structures should experience traffic noise levels from the proposed Northern Leg of the Western Bypass Road which exceed 66 Leq(h) or which exceed existing background ambient noise levels by 15 dB.

CHAPTER V. FUTURE TRAFFIC NOISE IMPACTS AND POSSIBLE NOISE MITIGATION MEASURES

Future traffic noise levels are not expected to exceed the HDOT 66 or 71 Leq(h) noise abatement criteria by CY 2035 under the Build Alternative at existing noise sensitive or commercial structures within the limits of project construction. By 2035, traffic noise contributions from the proposed Northern Leg of the Western Bypass Road should not exceed 48 dB (Leq) at the existing noise sensitive receptors which are closest to the proposed bypass road. In addition, the "15 dB Increase" criteria should not be exceeded at any existing receptor located within the limits of project construction. Therefore, traffic noise mitigation measures should not be required for this project. The location of the Northern Leg of the Western Bypass Road is relatively far from existing noise sensitive developments in the project environs, and are located in currently vacant and undeveloped areas.

It is anticipated that potential noise impacts at any new noise sensitive or commercial establishments located in the project area may be mitigated through the inclusion of sound walls or other noise mitigation measures within the individual lot development plans. In addition, any new commercial establishments, public use facilities, or housing units which may be planned alongside the new bypass road represent areas of potential adverse noise impacts if adequate noise mitigation measures are not incorporated into the planning of these future projects. It is anticipated that the project's roadway improvements will be completed prior to any redevelopment of the presently open areas adjacent to the bypass road, and that noise abatement measures such as adequate setbacks, sound attenuating walls or berms, or closure and air conditioning will be incorporated into these new developments along the bypass road as required. In any event, new structures whose building permits were obtained after the date of this noise study will not qualify for noise abatement measures under existing HDOT procedures.

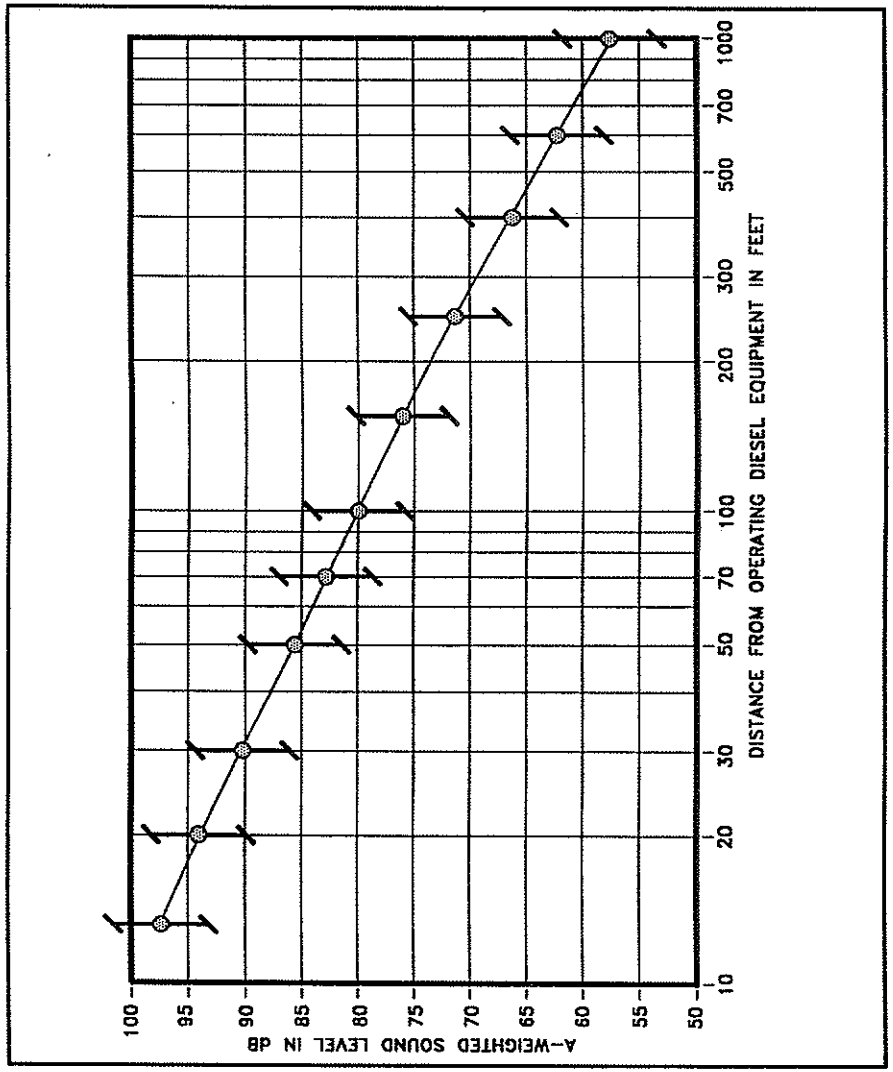
CHAPTER VI. CONSTRUCTION NOISE IMPACTS

Short-term noise impacts associated with construction activities along portions of the proposed Northern Leg of the Western Bypass Road may occur. These impacts can occur as a result of the low background ambient noise levels along the project corridor and the relatively high noise levels of heavy construction equipment. The total duration of the construction period for the proposed project is not known, but noise exposure from construction activities at any one receptor location is not expected to be continuous during the total construction period.

Noise levels of diesel powered construction equipment typically range from 80 to 90 dB at 50 FT distance. Typical levels of noise from construction activity (excluding pile driving activity) are shown in Figure 3. Because the closest noise sensitive receptors are approximately 500 to 700 feet from the proposed bypass road, anticipated construction noise levels are expected to range from 57 to 68 dBA. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

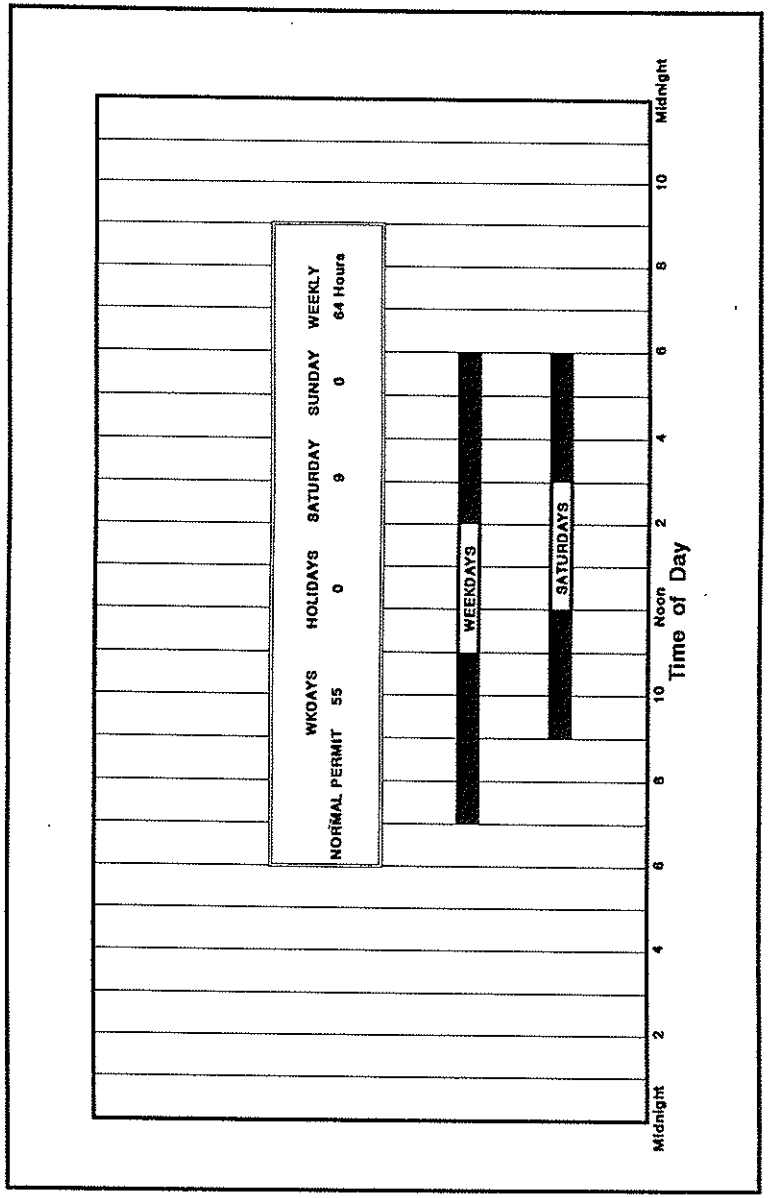
Where land developments along the bypass road Right-of-Way precede the bypass road project, distances between the construction sites and receptors can be as close as 60 feet, and construction noise levels may intermittently exceed 90 dB. The State Department of Health currently regulates noise from construction activities under a permit system (Reference 5). Under current permit procedures (see Figure 4), noisy construction activities are restricted to hours between 7:00 AM and 6:00 PM, from Monday through Friday, and exclude certain holidays. Noisy construction activities are normally restricted to the hours of 9:00 AM to 6:00 PM on Saturdays, with construction not permitted on Sundays. These restrictions would minimize construction noise impacts on noise sensitive residences along the roadway project corridor, and have generally been successfully applied. In this way, construction noise impacts on noise sensitive residences can be minimized. Construction activities during the evening and nighttime hours are possible but require the issuance of a noise variance by the State Department of Health.

In addition, the use of quieted portable engine generators and diesel equipment should be specified for use on this project. Heavy truck and equipment staging areas should also be located at areas which are as far from noise sensitive properties as feasible. Truck routes which avoid residential communities should be identified wherever possible. The use of 8 to 12 FT high construction noise barriers may also be used where close-in construction work to noise sensitive structures is unavoidable.



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 3



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE 4

APPENDIX A. REFERENCES

(1) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(2) Federal Highway Administration; "Procedures for Abatement of Highway Traffic Noise and Construction Noise;" 23 CFR Chapter I, Subchapter H, Part 772;" April 1, 1995.

(3) "Noise Analysis and Abatement Policy;" Hawaii State Department of Transportation, Highways Division, Materials Testing and Research Branch; June 1997.

(4) Existing and future traffic turning movements for the Northern Leg of the Western Bypass Road project; Wilson Okamoto Corporation; April 2010.

(5) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE(1) A-WEIGHTING	OTHER(2) WEIGHTING	UNWEIGHTED
1. Sound (Pressure)(3) Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level (4) Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND FUTURE YEAR (2035) TRAFFIC VOLUMES ALONG PROJECT ROADWAYS

ROADWAY LANES	**** CY 2010 *****		CY 2035 (NO BUILD)		CY 2035 (BUILD)	
	AM VPH	PM VPH	AM VPH	PM VPH	AM VPH	PM VPH
Ala Kinoiki Rd., East of Maluhiai Rd. (WB)	171	284	N/A	N/A	234	352
Ala Kinoiki Rd., East of Maluhiai Rd. (EB)	146	249	N/A	N/A	190	330
Two-Way	317	533	N/A	N/A	424	682
Maluhia Rd., North of Ala Kinoiki Rd. (NB)	313	486	N/A	N/A	954	1,394
Maluhia Rd., North of Ala Kinoiki Rd. (SB)	316	429	N/A	N/A	741	1,469
Two-Way	629	915	N/A	N/A	1,695	2,863
Maluhia Rd., South of Ala Kinoiki Rd. (NB)	147	226	N/A	N/A	405	560
Maluhia Rd., South of Ala Kinoiki Rd. (SB)	175	204	N/A	N/A	256	646
Two-Way	322	430	N/A	N/A	661	1,206
Koloa Rd., North of Western Bypass Rd. (NB)	218	496	N/A	N/A	362	645
Koloa Rd., North of Western Bypass Rd. (SB)	602	426	N/A	N/A	620	625
Two-Way	820	922	N/A	N/A	982	1,270
Koloa Rd., South of Western Bypass Rd. (NB)	189	419	N/A	N/A	222	477
Koloa Rd., South of Western Bypass Rd. (SB)	474	354	N/A	N/A	498	424
Two-Way	663	773	N/A	N/A	720	901
Western Bypass Rd., West of Koloa Rd. (EB)	69	139	N/A	N/A	524	819
Western Bypass Rd., West of Koloa Rd. (WB)	168	134	N/A	N/A	555	855
Two-Way	237	273	N/A	N/A	1,079	1,674
N. Leg, Western Bypass Rd., W. of Maluhia Rd. (WB)	N/A	N/A	N/A	N/A	329	557
N. Leg, Western Bypass Rd., W. of Maluhia Rd. (EB)	N/A	N/A	N/A	N/A	349	546
Two-Way	N/A	N/A	N/A	N/A	678	1,103
N. Leg, Western Bypass Rd., E. of Omao Rd. (WB)	N/A	N/A	N/A	N/A	329	557
N. Leg, Western Bypass Rd., E. of Omao Rd. (EB)	N/A	N/A	N/A	N/A	349	546
Two-Way	N/A	N/A	N/A	N/A	678	1,103
N. Leg, Western Bypass Rd., W. of Omao Rd. (WB)	N/A	N/A	N/A	N/A	415	617
N. Leg, Western Bypass Rd., W. of Omao Rd. (EB)	N/A	N/A	N/A	N/A	368	622
Two-Way	N/A	N/A	N/A	N/A	783	1,239
Omao Rd. Connector, At N. Leg, Western Bypass (NB)	N/A	N/A	N/A	N/A	27	87
Omao Rd. Connector, At N. Leg, Western Bypass (SB)	N/A	N/A	N/A	N/A	94	71
Two-Way	N/A	N/A	N/A	N/A	121	158
N. Leg, Western Bypass Rd., E. of Koloa Rd. (WB)	N/A	N/A	N/A	N/A	418	626
N. Leg, Western Bypass Rd., E. of Koloa Rd. (EB)	N/A	N/A	N/A	N/A	369	623
Two-Way	N/A	N/A	N/A	N/A	787	1,249

Appendix F

Archaeological Inventory Survey
Prepared by
Cultural Surveys Hawaii, Inc.
October 2003
And
Letter from the
State Department of Land and Natural Resources
Historic Preservation Division
Dated January 28, 2004

ARCHAEOLOGICAL INVENTORY SURVEY IN SUPPORT OF THE PROPOSED NORTHERN LEG OF THE WESTERN BYPASS ROAD, KŌLOA *AHUPUA'A*, KONA DISTRICT, ISLAND OF KAUA'I

TMK 2-7-3:2

by

Todd Tulchin, B.S.
and
Hallett H. Hammatt, Ph.D.

Prepared

for

Kukui 'Ula Development Company (Hawaii) LLC.

by

Cultural Surveys Hawai'i, Inc.

October 2003

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I. INTRODUCTION

A. Project Background

At the request of Kukui 'Ula Development Company (Hawaii) LLC., Cultural Surveys Hawai'i performed an archaeological inventory survey in support of the proposed Northern Leg of the Western Bypass Road project. The project area consists of a 2,150 ft. (664 m) long by 200 ft. (60 m) wide corridor running northeast to southwest from Maluhia Road, near the intersection of Ala Kinoiki Street, to Kōloa Road, near the intersection of 'Ōma'o Road (Figures 1-2). The proposed Northern Leg of the Western Bypass Road consists of grubbing and grading for the construction of an approximately 100 ft. (30 m) wide road corridor, including a bridge crossing 'Ōma'o Stream.

B. Scope of Work

The agreed upon scope of work for the archaeological inventory survey was as follows:

1. A complete ground survey of the project area for the purpose of site inventory. All sites will be located, described, and mapped with evaluation of function, interrelationships, and significance. Documentation will include photographs and scale drawings of selected sites and complexes. All sites will be assigned State site numbers.
2. Limited subsurface testing by hand if appropriate, to determine if subsurface deposits are located in the project area, and, if so, evaluate their significance.
3. Research on historic and archaeological background, including search of historic maps, written records, and Land Commission Award documents. This research will focus on the specific area with general background on the *ahupua'a* and district and will emphasize settlement patterns.
4. Preparation of a survey report that will include the following:
   a. A topographic map, if available, of the survey area showing all archaeological sites and site areas;
   b. Description of all archaeological sites with selected photographs, scale drawings, and discussions of function;
   c. Historical and archaeological background sections summarizing pre-contact and historic land use as they relate to the archaeological features;
   d. A summary of site categories and their significance in an archaeological and historic context;
   e. Recommendations based on all information generated that specifies what steps should be taken to mitigate impact of development on archaeological resources - such as data recovery (excavation) and preservation of specific areas. These recommendations will be developed in consultation with the client and the State agencies.

This scope of work also includes full coordination with the State Historic Preservation Division, and County relating to archaeological matters.

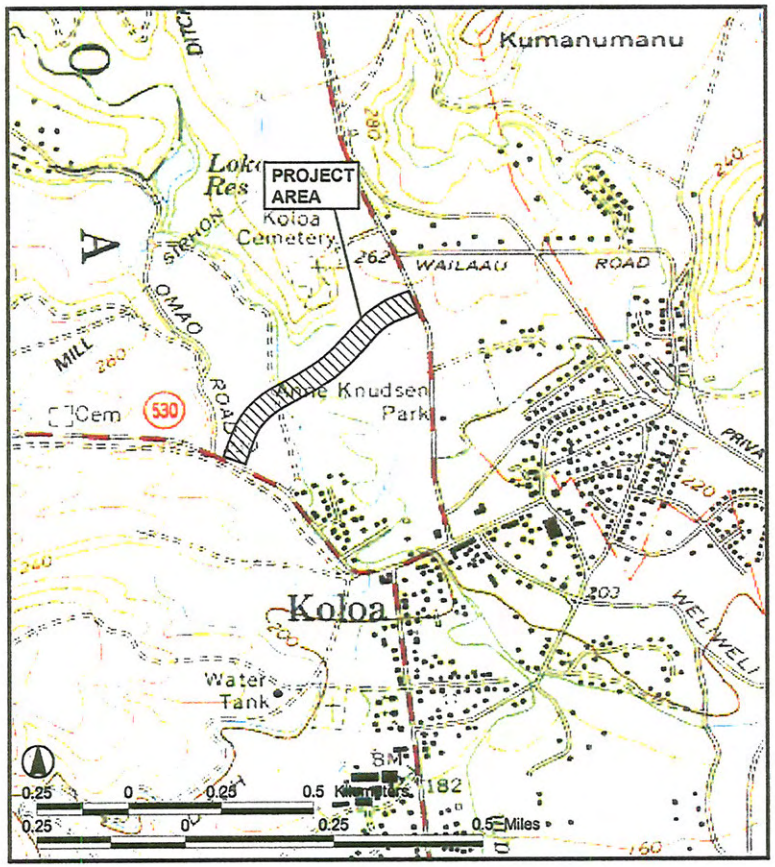

Figure 1 **Portion of USGS Topographic Map, Kōloa Quadrangle, Showing the Location of the Project Area.**

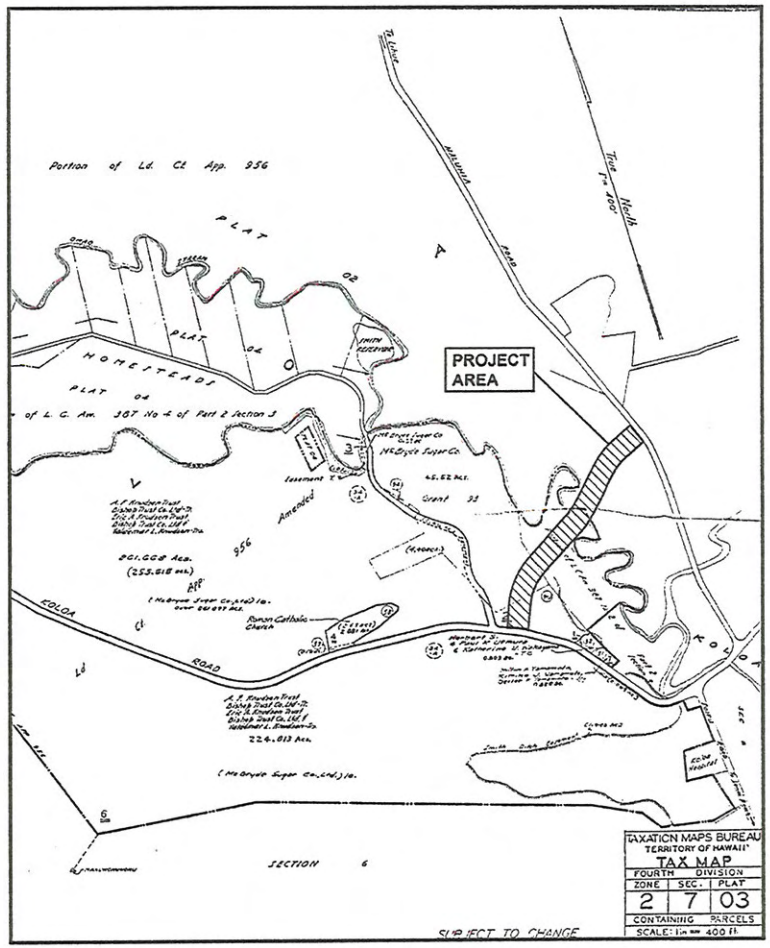

Figure 2 **Portion of TMK 2-7-03, Showing the Location of the Project Area.**

C. Project Area Description

The project area is located in the *ahupua'a* of Kōloa, in the Kona District of the island of Kaua'i. Kōloa is a fairly large *ahupua'a* (9,500 ac.), bounded on the east by Weliweli *Ahupua'a*, and on the west by Lāwa'i *Ahupua'a*. The perennial Waikomo Stream traverses most of Kōloa *Ahupua'a*. The project area lies downstream of the confluence of Pō'ele'ele Stream and 'Ōma'o Stream, which joins with Waikomo Stream further downstream to the south. The stretch of stream crossed by the project corridor is commonly referred to as 'Ōma'o Stream.

The elevation within the project area ranges from approximately 200-230 ft (60-70 m) A.M.S.L. The soils in the project area are mostly Pohakapu Silty Clay Loam (PkB), with small areas of Lihue Gravelly Silty Clay (LIB, LIC) and Hanalei Silty Clay (HnA) (Foote *et al.* 1972). Soils of the Pohakapu Series are described as "well-drained soils on terraces and alluvial fans... formed in old alluvium derived from basic igneous material" (*Ibid.*:113). The project area receives approximately 2,500 mm (100 inches) of annual rainfall (Giambelluca *et al.* 1986).

The project area consists mainly of former sugar cane fields, with an active banana plantation and ornamental plant nursery in the southwest portion of the project area near Kōloa Road. Vegetation within the project area is dominated by guinea grass (*Panicum maximum*) in the former sugar cane fields, and *hau* (*Hibiscus tiliaceus*) near 'Ōma'o Stream. Also scattered throughout the project area were white monkeypod trees (*Albizia lebbeck*), windbreak plantings of ironwood (*Casuarina equisetifolia*), papaya (*Carica papaya*) near 'Ōma'o Stream, false sensitive plant (*Mimosa microphylla*), octopus tree (*Brassaia actinophylla*), and *koa haole* (*Leucaena leucocephala*) along the edges of Kōloa and Maluhia Roads.

D. Methods

Background research included a review of previous archaeological studies on file at the State Historic Preservation Division of the Department of Land and Natural Resources, a review of geology and cultural history documents at Hamilton Library at the University of Hawai'i, the Hawai'i State Archives, the Mission House Museum Library, the Hawai'i Public Library, and the Archives of the Bishop Museum. Further research included a study of historic photographs at the Hawai'i State Archives and the Archives of the Bishop Museum, a study of historic maps at the Hawai'i State Archives and the Archives of the Bishop Museum, and a study of historic maps at the Survey Office of the Department of Accounting and General Services.

Information on Land Commission Awards was accessed through Waihona Aina Corporation's Māhele Data Base (Waihona 'Aina Corporation <www.waihona.com>).

A complete pedestrian inspection of the project area was accomplished on September 10, 2003 by two Cultural Surveys Hawai'i archaeologists, David Shideler, M.A. and Todd Tulchin, B.S., under the overall supervision of Hallett H. Hammatt, Ph.D. The survey was conducted by making lateral sweeps extending 100 ft. (30 m) on either side of the previously surveyed and staked road centerline. During the background research for the project area, it was ascertained that much of the property had previously been used as sugar cane fields, and thus remnants of any archaeological value were likely to have been bulldozed. Pedestrian sweeps of the project area were completed with 4 to 6 m spacing.

II. HISTORICAL BACKGROUND

E. Historical Setting: Pre-Contact Kōloa

The project area is in the *ahupua'a* of Kōloa in the Kona District on the island of Kaua'i. Few records exist that document traditional Hawaiian life in the *ahupua'a* of Kōloa. While settlement by westerners with religious and commercial interests make the area a focus of documentation after the first quarter of the nineteenth century, the accounts generated generally focus on the lives and concerns of the westerners themselves with only anecdotal references to the Hawaiian population. Two nineteenth century documents (Boundary Commission Testimony of 1874 and a Lahainaluna manuscript of 1885), however, did provide two Hawaiians an opportunity to speak for themselves and thus offer a possible insight into the life of Kōloa before the arrival of westerners.

A dispute over the northern boundary of Kōloa *Ahupua'a* in 1874 led to a hearing before Duncan McBryde, the Commissioner of Boundaries for Kaua'i. One native witness, Nao (who describes himself as born in Kōloa but presently living in Ha'ikū), in order to show that Hoaea (the area in dispute) was indeed at the northern boundary of Kōloa, testifies: "At Hoaea tea [sic] leaves were hung up to show that there were battles going on" (Boundary Commission, Kaua'i, vol. 1, 1874:124). That there was a traditional "warning system" --well-known to all natives--suggests that Kōloa, throughout its history, may well have been the scene of some serious conflicts--serious enough and perhaps often enough to warrant devising such a system.

Additional evidence of a rich history within Kōloa is offered in a Lahainaluna document produced eleven years later. This document appears to be based on an oral historical project. On September 7, 1885 a student from Lahainaluna Schools (HMS 43 #17) interviewed Makea – "a native who is well acquainted with Kōloa" -- and recorded "what she said about the well-known places in the olden times." More than sixty-four years after the abolition of the *kapu* system and almost as many years of contact with westerners, Makea was able to describe in detail fourteen *heiau* within the Kōloa area; for example:

> Maulili was the first *heiau* of south Kōloa. Kapulauki was the first chief of Kōloa, Kiha came next. That is the chief I know of. He was a ruling chief of Kaua'i in the olden days, when the *heiau* was standing there. It had already been built and men had been sacrificed on its altars. This Kiha was called Kiha-of-the-luxuriant-hair. Another name for him was Kakae and another was Ka-pueo-maka-walu (Right-eyed-owl).
>
> This *heiau* was also famous for this reason -- it was the first *heiau* to which Kawelo was carried after he had swooned in Wahiawa, in the battle where stones were used as missiles.
>
> The location of this *heiau* was not known, but a deaf mute knew and it was he who pointed it out to the chiefs, and that is how it was rediscovered in the olden days.
>
> Kiha lived on the eastern side of the *heiau* and Aikanaka lived on the northeastern side. This chief, Aikanaka, was the one with whom Kawelo fought and he was the owner of this *heiau* at that time.

F. Mythological and Traditional Accounts

Clearly Kōloa was a particularly important *ahupua'a* in traditional Hawaiian times. That at least fourteen *heiau* – of varying sizes and functions--have been documented in the Kōloa area (Thrum 1907, Bennett 1931) and the association of legendary-historic figures such as Kawelo and Aikanaka with the *heiau*, suggests a heightened cultural richness of the *ahupua'a*.

Further confirmation of a rich traditional life within Kōloa is furnished by the presence of a *hōlua* slide on the slopes of Pu'u o Hewa in the *mauka* reaches of the *ahupua'a* and by the myriad legends attached to Maulili Pool, a sacred place once located in the present Kōloa Town. J. K. Farley (1907) describes the pool and its legendary associations:

> The pool of Maulili, on Waikomo stream...is a few hundred feet south of the Maulili road bridge. The gods Kāne, and his brother, Kanaloa, are said to have once slept above it, on its eastern bank and left the impress of their forms as can be seen in the *apapa*...The *apapa* in this vicinity is called an *'Unu*,' and a *'Heiau*,' but was never walled in, it is said. [This *heiau* may be the Maulili Heiau described by Makea above.] On the nights of Kāne the drums are heard to beat there, also at the sacred rocks, or *unu's*, of Opuokahaku and Kānemilohae, near the beach of Po'ipū...
>
> In the Maulili pool lived a large *Mo'o*, named 'Kihawahine'...The eastern wall of the pool, just below the resting places of Kāne and Kanaloa, for a short distance, only, is called the 'Pali of Kōloa.' The District of Kōloa is named for this *Pali*, we are told by old Hawaiians. To the south of the Pali o Kōloa, in the wall is a rock named 'Waihanau'...as one of their *meles* has it:
>
> *"Aloha wale ka Pali o Kōloa,*
> *Ke Ala huli i Waihānau e, hānau."*
>
> To the south of Waihānau is a projecting rock named 'Ke elelo o ka Hawai'i' -- the tongue of Hawai'i, said to have been wrested and brought from Hawai'i by the Kaua'i warrior Kawelo, of Wailua.
>
> At the southern end of the Maulili pool started two large *'auwai's*, that watered the land east and west of Kōloa (Farley 1907:93).

Thus, this sacred legend-imbued locus was the source that gave life to the lowland taro patches of Kōloa. These special associations would not have been lost on the Hawaiians dependent upon those waters. While taro would have been essential to the life of the *ahupua'a*, other resources were available. Bernice Judd, writing in 1935, summarizes most of what was known -- into the first decades of this century -- of the traditional Hawaiian life of Kōloa:

> In the old days two large *'auwai* or ditches left the southern end of the Maulili pool to supply the taro patches to the east and west. On the *kuaunas* or embankments the natives grew bananas and sugar cane for convenience in irrigating. Along the coast they had fish ponds and salt pans, ruins of which are still to be seen. Their dry land farming was done on the *kula*, where they raised sweet potatoes, of which both the tubers and the leaves were good to eat. The Hawaiians planted *pia* (arrowroot) as well as *wauke* (mulberry) in patches in the hills wherever they would grow naturally with but little cultivation. In the uplands they also gathered the leaves of the *hala* for mats and the nuts of the *kukui* for light (Judd 1935:53).

It appears that the relatively good situation for the development of irrigated agriculture (the Kōloa Field System) focused agriculture and habitation at elevations below the present project area.

G. Early Historic Period

Accounts by visitors and settlers at Kōloa Ahupua'a focus on these westerners' own concerns--religious and commercial--as these concerns appropriate the historical record of Kōloa in the 1800's. However, scattered throughout the accounts are occasional references to the Hawaiians of the *ahupua'a*, which may give some insights into their lives.

The American Board of Commissioners for Foreign Missions (ABCFM) missionary Samuel Whitney described, in an article in the *Missionary Herald* (June 1827:12), a visit to Kōloa with Kaikio'ewa, the governor of Kaua'i, in 1826:

> The people of this place were collected in front of the house where the old chief lodged in order to hear his instructions. After a ceremony of shaking hands with men, women, and children they retired...
>
> Our company consisted of more than a hundred persons of all ranks. The wife of the chief, with her train of female attendants, went before. The governor, seated on a large white mule with a Spaniard to lead him, and myself by his side, followed next. A large company of aipupu, [*'ā'īpu'upu'u*] cooks, attendants came on in the rear (p. 284).

Whitney's account suggests something of the deference paid to the *ali'i* by the local populations and the scale at which the *ali'i* carried out their functions. An even grander view of that deference is provided in an account of a later visit by an *ali'i* to Kōloa. John Townsend, a naturalist staying in Kōloa in 1834, described a visit by Kamehameha III (In Palama and Stauder 1973:18):

> In the afternoon, the natives from all parts of the island began to flock to the king's temporary residence. The petty chiefs, and head men of the villages, were mounted upon all sorts of horses from the high-headed and high-mettled California steed, to the shaggy and diminutive poney [sic] raised on their natives hills; men, women, and children were running on foot, laden with pigs, calabashes of Poe [sic], and every production of the soil; and though last certainly not least, in the evening there came the troops of the island, with fife and drum, and 'tinkling cymbal' to form a body guard for his majesty, the king. Little houses were put up all around the vicinity, and thatched in an incredibly short space of time, and when Mr. Nuttall, and myself visited the royal mansion, after nightfall, we found the whole neighborhood metamorphosed; a beautiful little village had sprung up as by magic, and the retired studio of the naturalists had been transformed into a royal banquet hall... (In Palama and Stauder 1973:18)

On December 31, 1834, Peter Gulick and his family arrived in Kōloa. Apparently the first foreigners to settle in the *ahupua'a*, they initiated the process of rapid change that would re-shape the life of Kōloa in the nineteenth century. In 1835, a 30 by 60 ft. grass house was erected as a meeting house and school (probably located at Kōloa Town). Mr. Gulick initiated sugar cane cultivation and collected a cattle herd for the Protestant Mission. In 1837, a 45 by 90 ft. adobe

church was built (probably at the same ABCFM site) and the first mission doctor, Thomas Lafon, arrived to assist Mr. Gulick (Damon 1931:179, 187). The Kōloa mission station apparently flourished immediately; Charles Wilkes, a member of the U.S. Exploring Expedition visiting Kōloa in 1840, recorded:

> The population in 1840, was one thousand three hundred and forty-eight. There is a church with one hundred and twenty-six members, but no schools. The teachers set apart for this service were employed by the chiefs, who frequently make use of them to keep their accounts, gather in their taxes &c [and for similar tasks]. The population is here again increasing partly by immigration, whence it was difficult to ascertain its ratio (Wilkes 1845:64).

Other sources, however, give different population figures for Kōloa during the first half of the nineteenth century. In 1834, according to a report by missionaries on Kaua'i, the inhabitants of the *ahupua'a* numbered 2,166. An article in the *Pacific Commercial Advertiser* of December 21, 1867 estimated that the population in 1838 was about 3,000 (though, by 1867, it had been reduced to a third of that number). James Jackson Jarves, who visited Kōloa and Kaua'i for nine months during the early 1840's, recorded:

> Kōloa is now a flourishing village. A number of neat cottages, prettily situated amid shrubbery have sprung up, within two years past. The population of the place, also, has been constantly increasing, by emigration from other parts of the island. It numbers, now, about two thousand people, including many foreigners, among whom are stationed a missionary preacher, and physician, with their families (Jarves, 1844:100).

The arrival of "many foreigners" was the cause of, and the native immigration to Kōloa was the result of, the many commercial activities that burgeoned beginning in the 1830's. In 1835, Ladd and Company gained from the king and local chiefs the lease of about one thousand acres at Kōloa for 50 years at $300 a year and "allowed the use of the waterfall and an adjoining mill site at Maulili pool, not far from the thousand acres, together with the right to build roads, the privilege of unrestricted buying and selling and freedom from local harbor dues" (Judd, 1935:57). Ladd and Company was not the first to mill sugar cane in the area: there was a Chinese-operated granite roller mill in operation at Māhā'ulepū, Kōloa, in 1830; it was, however, the first plantation-organized industry in Hawai'i (Damon, 1931:176, 198). Judd notes the following:

> The company was permitted to hire natives to work on the plantation provided they paid Kauikeaouli, the king, and Kaikio'ewa, the governor of Kaua'i, a tax for each man employed and paid the men satisfactory wages. The workers were to be exempt from all taxation except the tax paid by their employers (Op. cit.:57).

Judd further described the revolutionary implication of this arrangement: "The significance of Ladd & Co.'s lease lay in the fact that it was the first public admission by the Hawaiian chiefs that their subjects had rights of personal property backed with a guaranty of protection to that property" (Op cit.:58). Local chiefs, fearful of an usurpation of their power, resisted the company's first efforts to recruit workers, forcing the king's intervention.

Another missionary, Dr. James W. Smith, who was stationed at Kōloa for forty-five years, beginning in 1842, mentioned in his journal a visit to "the school at Kukui'ula." If there was a second school in Kōloa outside the population center of Kōloa Town, Kukui'ula may have warranted the placing of a school there because of a sufficiently large population in the area.

A long-known history of severe flooding in the central flood plain of Kōloa provided an impetus for the native Hawaiians to develop an irrigated field network well off that plain. In a typical Hawaiian valley such as Pō'ele'ele it is difficult to get off the flood plain and in Kōloa a large percentage of homes and agricultural fields are located in the large volcanic terrace *makai* of the project area that is not susceptible to flooding. Thus the extensive *lo'i* network within the *makai* portion of Kōloa may have been, in part, a clearly thought-out use of a fortuitous land configuration to avoid the force of occasional floods that might, elsewhere on the island, have had disastrous effects.

H. Mid-1800's (Land Commission Awards)

The Māhele records of Kōloa give a picture of what had evolved by the middle of the nineteenth century when Kōloa *Ahupua'a*--8,620 acres–was awarded (LCA 7714-B) to Moses Kekūāiwa, the brother of Alexander Liholiho (Kamehameha IV), Lot Kapuāiwa (Kamehameha V), and Victoria Kamāmalu. (The awarding of the *ahupua'a* to Kekūāiwa was an outcome of an event twenty-five years in the past: the crushing - by forces loyal to Kamehameha II - of the 1824 revolt on Kaua'i when Kaua'i lands were divided up among the chiefs of the other islands.) Eighty-eight other *kuleana* awards were given to individuals within Kōloa *Ahupua'a*. The majority of these Land Commission Awards (LCAs) were located in or around Kōloa Town itself. This concentration of awards around the town area may reflect both the traditional land settlement pattern, a focus on the resources of Maulili Pool and Waikomo Stream (a permanent stream), and a more recent movement of the populace to the plantation and missionary centers. An 1891 map by M.D. Monsarrat shows the location of these awards (Figure 3).

The only LCA known in the immediate vicinity of the present project area is the parcel along the southwestern portion of 'Ōma'o Stream that was awarded to the American Board of Commissioners for Foreign Missions (ABCFM); this was LCA. 387, No. 2, Part 2, Section 3. This portion of LCA 387 is only a small share of the Commission Award holdings given to the ABCFM on the island of Kaua'i.

I. Late 1800's To Present

Kōloa became the scene of the confrontation of the traditional social structure with commercially-impelled forces of change. The cane growing activity of Ladd and Company would inevitably affect the lives of the inhabitants of the rest of the *ahupua'a*. Traditional settlement patterns (e.g. permanent and temporary habitation interspersed throughout the irrigated agricultural fields near the coastal zone and traditional farming along streams) would have been distorted by a shift to Kōloa Town where sugar cane milling activities were located, and a shift to cash crops other than taro.

Although Ladd and Company would go bankrupt in 1845, its earlier success was an impetus for other entrepreneurial attempts within Kōloa. Silkworm farming, oil extraction from *kukui* nuts, cigar manufacturing, sago raising, and tapioca manufacturing were all attempted with varied success during the middle third of the nineteenth century.

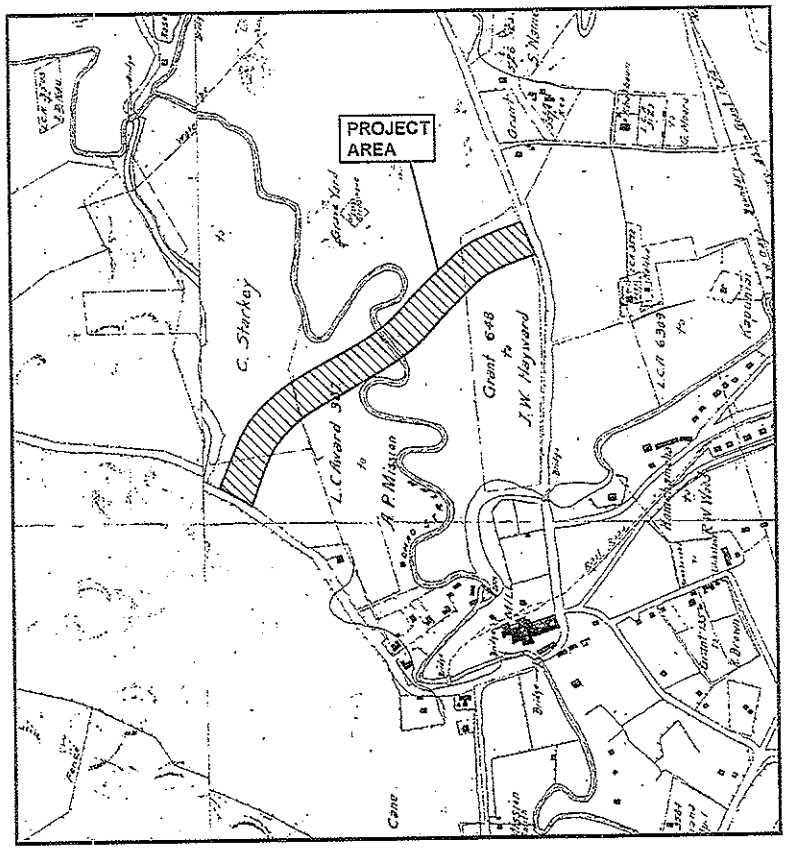

Figure 3 **Portion of 1891 Map of Kōloa by M.D. Monsarrat (R.M.1694), Showing the Location of the Project Area.**

Another major area of commercial enterprise was associated with the whaling industry at Kōloa Landing. Accounts of visitors suggest that the inhabitants of Kōloa, took advantage of their nearness to the landing to participate in the booming trade of the port. An article in the *Pacific Commercial Advertiser* of Feb. 19, 1857 described the salient characteristics of the port at mid-century and mentions:

> From the landing there is a good carriage road to the town, distant about two miles. Large quantities of firewood, bullocks and sweet potatoes are furnished to whalers in this port, and these chattels can nowhere be procured cheaper or better. It is estimated that 10,000 barrels of sweet potatoes are cultivated annually here, which are thought to be the best on the islands. Nearly all the potatoes furnished for the California market are produced here...Sweet potatoes, sugar and molasses constitute the chief trade of the port.

Kōloa became the official port of entry for Kaua'i in the 1850's and participated in the profitable trade with the whaling industry whose peak years ran from the 1830's to the 1860's. It seems likely the demand for firewood, bullocks, sweet potatoes, sugar and molasses at Kōloa Landing was met to at least some small degree by activities in the *mauka* regions of Kōloa in the vicinity of the present project area. A map of Kōloa by M.D. Monsarrat in 1891 (R.M.1694; Figure 3) shows cane cultivation in the vicinity of the present project area but the extent of cane in this area is uncertain.

Koloa Plantation began a program of developing water storage c. 1904. Clearly the development of the larger reservoirs such as the Waita Reservoir (also known as the Koloa Reservoir and combining the former Hauiki Reservoir and the Marsh Reservoirs) and Alexander Reservoir were not only major engineering feats but were matters of significant social impact involving repeated armed confrontations (Wilcox 1996:77-84). There are several seemingly similar small reservoirs developed within a radius of a couple of kilometers, including: Aepo, Aepoalua, Aepoakolu, Huinawai, Loko, Mauka, 'Ōma'o, Pia Mill, Pinau, and Pu'u o Hewa reservoirs. The development of these modest reservoirs is not well documented in the readily available literature. The 1910 USGS Lihue Quad Map (Figure 4) and the 1912 USGS Topographic Map of the Island of Kaua'i (Figure 5) show most of the reservoirs in the immediate vicinity (including the Huinawai, Loko, Mauka, 'Ōma'o , Pinau, and Pia Mill, reservoirs) already developed. The lands around these reservoirs are understood to have been under sugar cane cultivation in the 1800s.

Kōloa Landing was phased out around 1925 when McBryde Sugar Company and Kōloa Sugar Company began using Port Allen. Soon after, McBryde ceased to use several of the Kōloa fields. It is our understanding, however, that sugar cane was last harvested within the present project area by McBryde in the mid 1990s. The lands on the west side of 'Ōma'o Stream had been under cultivation by McBryde continuously for many decades while the lands of the east side of the stream, owned by descendants of the Knudsen family, were leased by various sugar cane interests including Koloa Sugar, then Grove Farm, and then McBryde. A 1950 aerial photograph of the Kōloa area (Figure 6) shows the majority of the current project area under sugar cane cultivation. The Foote *et al.* soil map ortho-photograph (Figure 7) indicates the majority of the project area was still in sugar cane c. 1970. Subsequently, these cane lands were abandoned. The southwestern portion of the project area was later converted to a macadamia nut tree farm. Following damage from Hurricane 'Iniki in 1992, the macadamia nut tree farm was converted to

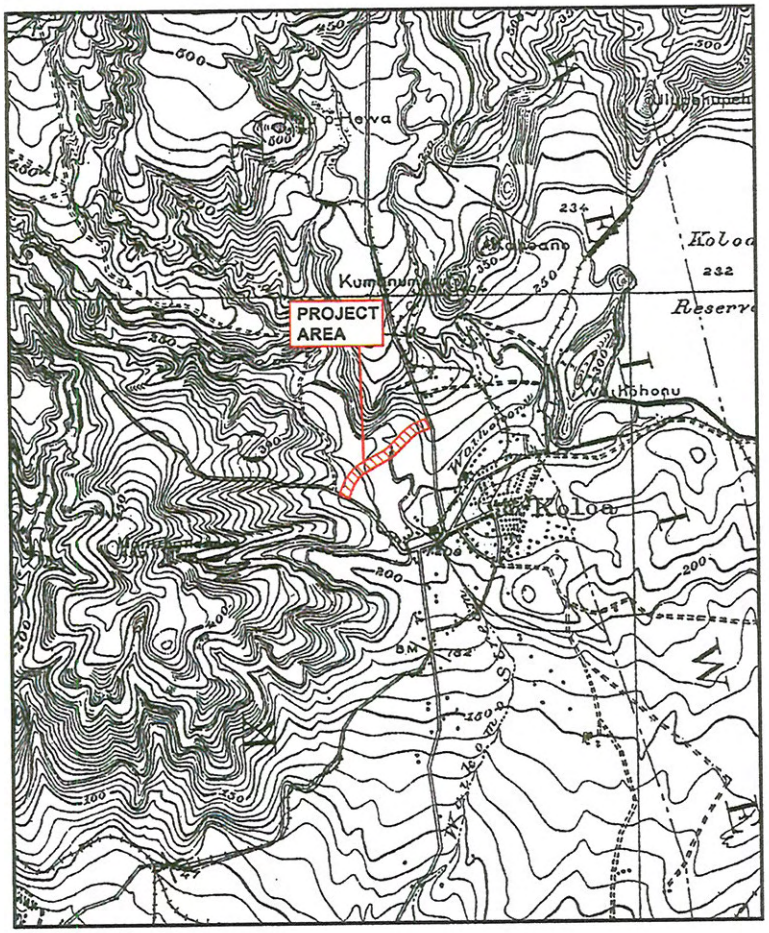

Figure 4 **Portion of 1910 USGS Topographic Map, Lihue Quadrangle, Showing the Location of the Project Area.**

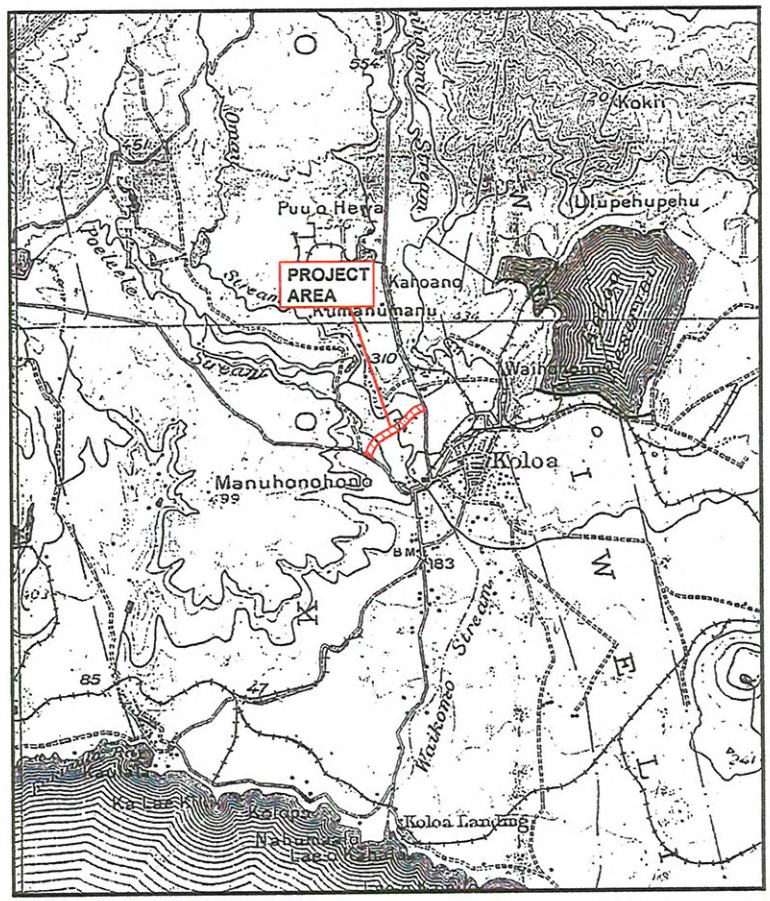

Figure 5 **Portion of 1912 USGS Map of the Island of Kaua'i, Showing the Location of the Project Area.**

Figure 6 **1950 Aerial Photograph Showing Extent of Sugar Cane Cultivation in the Project Area.**

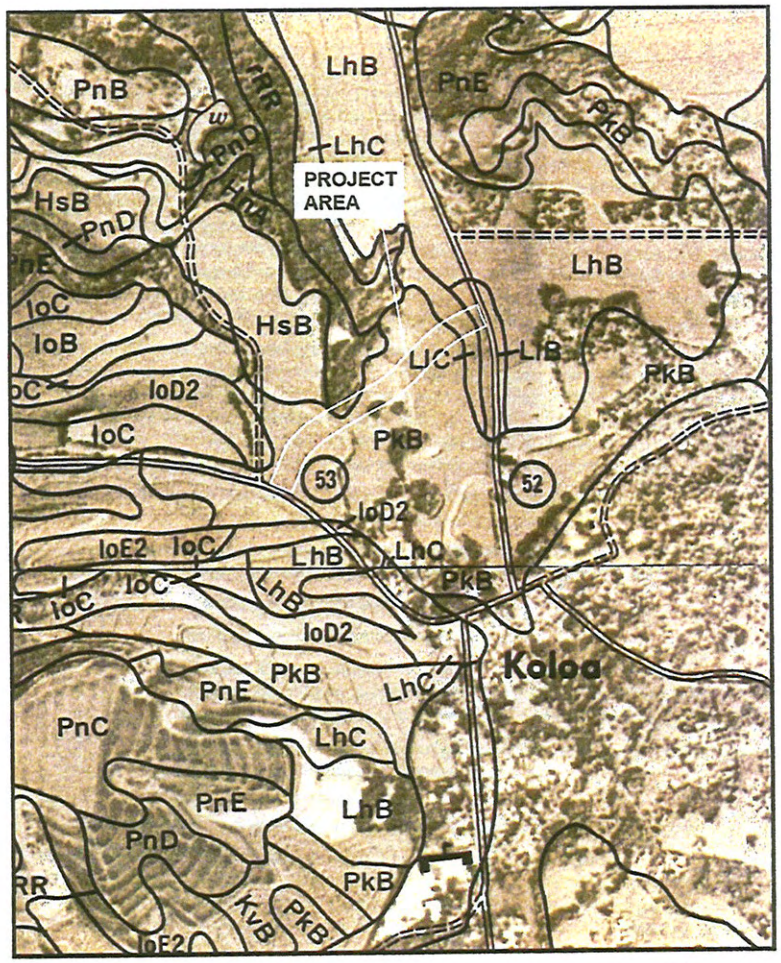

Figure 7 **Portion of Soil Survey (Foote *et al.* 1972) Map Showing Extent of Sugar Cane Cultivation within the Project Area, Circa 1970.**

its present usage as a banana plantation and ornamental plant nursery. The northeastern portion of the project area is currently used as pasture for horses.

J. Summary of Historical Background

Although much of the seaward portion of Kōloa is a relatively dry area with approximately 30 in. (760 mm) of rain per year, the perennially flowing streams provided a resource for the development of a rather expansive agricultural system. Accounts of the early history of Kōloa (Farley 1907; Jarves 1844; Townsend 1839; and Judd 1935) describe in the lands *mauka* of Kōloa Town a seemingly continuous, well-maintained, agricultural complex of taro, yams, sweet potato, and sugar cane that was irrigated by an extensive *'auwai* system siphoned off of Waikomo and Pō'el'ele streams. This system had a significant influence on later commercial endeavors in Kōloa.

Kōloa is the site of the first organized sugar plantation in Hawaii. Ladd and Company leased about a thousand acres for the sole purpose of growing sugar cane (Palama and Stauder 1973:18, from Judd 1935). The commercialization of sugar cane in Kōloa had widespread social effects. The traditional view of the *'āina* being a responsibility of the *ali'i* was being transformed.

Kōloa Town, and Kōloa Landing, at the mouth of Waikomo Stream, became prominent commercial centers during the mid to late 1800's, exporting a variety of products such as sweet potatoes, sugar, and molasses. Whalers also stopped for provisions of squash, salt, salt beef, pigs, and cattle (Palama and Stauder 1973:20). This heightened activity dramatically altered the social structure and landscape of Kōloa.

Kōloa soon reflected the effects of a traditional social structure in conflict with commercially -impelled forces of change. Traditional settlement patterns (e.g. permanent and temporary habitation interspersed throughout the irrigated agricultural fields near the coastal zone and along streams in the steeper valleys inland) would have been significantly changed by a flux to Kōloa Town where sugar cane milling activities were located. Later land use in the study area (i.e. sugar cane, pasture, macadamia nut farm development, and banana cultivation) also had detrimental impacts on any surviving traditional structures.

III. PREVIOUS ARCHAEOLOGICAL RESEARCH

K. Previous Studies

Table 1 arrays the previous archaeology conducted in Kōloa and vicinity (Figure 8). The earliest systematic archaeological survey on the Island of Kaua'i was conducted by Wendell Bennett in the late 1920's. Bennett examined and recorded 202 sites on the island. The following are sites recorded within Kōloa Ahupua'a (see Bennett 1931:116-117, 120):

Site 72	Niu Kapukapu Heiau - on the top of Niu Kapukapu Hill on the east bluff of Lāwa'i Valley.
Site 73	Stone work on the hill just in-land from Site 72
Site 74	Fishing shelter on the shore near the mouth of Kukui'ula valley.
Site 75	Kūhiō Park, west of Waikomo Stream with taro patches, a small *heiau*, an oven, paved house platform, fish pond, game ground with seats and a fishing shrine.
Site 76	Salt pans east of Waikomo Stream
[Sites 77-84]	Located east of Kōloa Ahupua'a
Site 85	Walls, enclosures and house sites in the cactus covered country around the Kōloa reservoir and extending to the sea.
Site 86	House site in the area described in Site 85

All of these seven sites are well *makai* (seaward) of the current project area.

William Kikuchi (1963) conducted a general survey of the Kona District of Kaua'i including all *ahupua'a* from Hanapēpē, eastward to Kīpū Kai. Information from Thrum (1907), Bennett (1931), a Lahainaluna School manuscript (1885), and other sources was instrumental in helping to locate major archaeological sites during the field survey. Kikuchi's survey was selective since it was not designed to be a complete inventory, and generally focused on larger or more coastal sites. No sites were noted by Kikuchi in the present study area.

Palama and Stauder (1973) conducted a reconnaissance survey along the route of the then-proposed main cane haul road to the Kōloa mill site. The proposed new section of road extended from Weliweli Road, southwestward across Po'ipū Road, connecting to an existing cane haul road. The section west of Po'ipū Road is approximately 3,000 ft. long with a north/south oriented branch approximately 1,500 ft. long. A total of 18 sites were recorded along the road corridor. All of these sites are south of the present study. Although the Palama and Stauder study was limited in scope to the proposed road right of way, it included a short but thorough historical summary of the place of archaeological sites within the context of the Kōloa and Weliweli Ahupua'a. An extensive *'auwai* system was observed east of Po'ipū Road. The following comments on this system and the sites in general are relevant to understanding the archaeological significance of the area as a whole, and the historic processes at work:

Table 1 Previous Archaeological Research in Kōloa and Vicinity

AUTHOR(S)	YEAR	LOCATION	STUDY TYPE
Bennett	1931	Kukui'ula Valley, Prince Kūhiō Park	General Survey
Kikuchi	1963	Kona District	General Survey
Kikuchi	1973	Hawaiian Fishponds	General Survey
Palama and Stauder	1973	Cane Haul Road-Kōloa Mill	Reconnaissance Survey
Sinoto	1975	Knudsen Trust Lands	Reconnaissance Survey
Bordner	1977	Kukui'ula *'auwai*, Site 50-39-10-1934	Reconnaissance Survey
Hammatt, Bordner and Tomonari-Tuggle	1978	Kīahuna Complex	General Survey
Kikuchi	1979	Sheraton Kauai Hotel	Survey and Subsurface Testing
Connolly	1982	Kōloa-Po'ipū Bypass Road	Reconnaissance Survey
Ching	1983	Kukui'ula-Kualu, Alexander and Baldwin Lands	Reconnaissance Survey
Landrum	1984	Kukui'ula-Kualu, Alexander and Baldwin Lands	Reconnaissance Survey
Hammatt, Borthwick and Shideler	1985	Kōloa-Po'ipū Bypass Road	Survey and Subsurface Testing
Kikuchi	1985	Shoreline Improvements, Waiohai Hotel, Kiha Houna Heiau	Reconstruction
Kikuchi	1988	Pa'anau Sugar Camp	Reconnaissance Survey
Hammatt et al.	1988	Kukui'ula Bay Planned Community	Inventory Survey
McMahon	1989	Kaua'i Fishponds	General Survey
Hammatt	1990	Pa'anau Housing Project	Inventory Survey
Hammatt	1991	Pō'ele'ele Stream – Waterline crossing	Archaeological Reconnaissance
Hammatt, Folk, and Stride	1991	Po'ipulani Golf Course	Inventory Survey
Hammatt	1992a	Kīahuna	Inventory Survey
Hammatt	1992b	Po'ipū Road and Lāwa'i Road Junction	Archaeological Reconnaissance
Hammatt, Ida and Folk	1993a	Po'ipū Road 7.6-acre Parcel	Inventory Survey
Hammatt et al.	1993b	Po'ipū Beach Park	Subsurface Testing and Monitoring

AUTHOR(S)	YEAR	LOCATION	STUDY TYPE
Creed, Ida and Hammatt	1995	Po'ipū Road	Inventory Survey
Bushnell and Hammatt	1996	'Ōma'o Bridge, 'Ōma'o Homestead	Archaeological Investigation
Hammatt, Creed, and Ida	1996	Waiohai Resort	Assessment Survey
McMahon	1996	Sheraton Kauai Hotel	Reconnaissance Survey
Ida, Creed, and Hammatt	1997	Po'ipū Bypass Road	Inventory Survey
Hammatt et al.	1998	Kukui'ula Planned Community Phase I	Data Recovery
Hammatt et al.	1999	Kukui'ula Planned Community Phase II	Data Recovery
Jones et al.	2002	260-acre parcel along Pō'ele'ele Stream at 'Ōma'o	Inventory Survey
Yorck, Shideler, and Hammatt 2002	2002	Well Sites and Appurtenances near Piwai Reservoir, Alexander and Baldwin Properties	Inventory Survey
O'Hare, Shideler, and Hammatt	2003	Sheraton Kauai Resort	Archaeological Assessment
Tulchin and Hammatt	2003	Knudsen Trust Lands *mauka* of Po'ipū Road	Archaeological Assessment

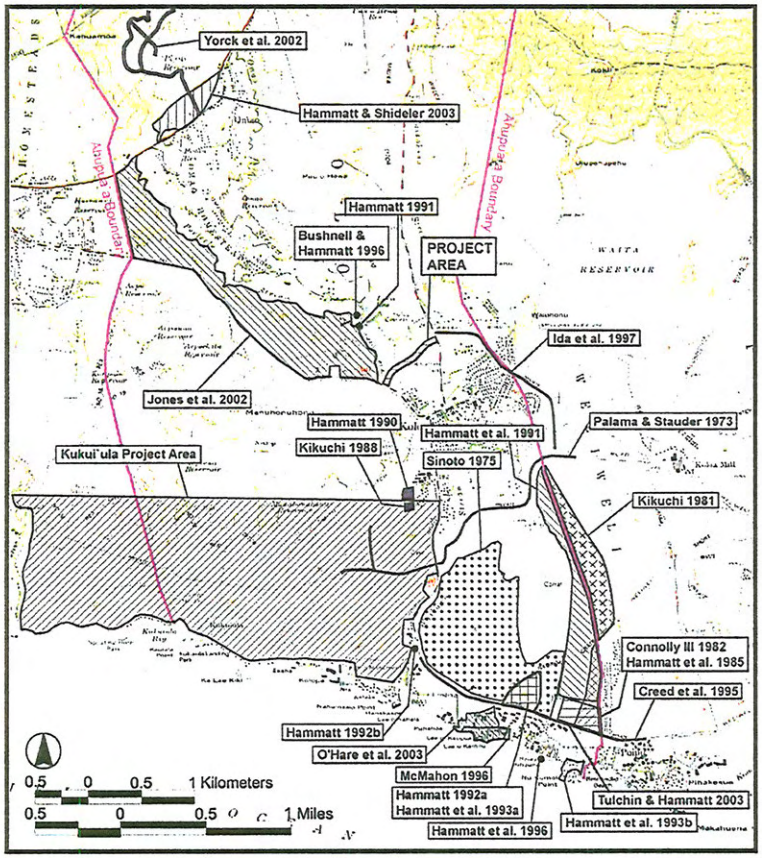

Figure 8 **Previous Archaeological Studies in the Vicinity of the Project Area.**

> Our reconnaissance revealed that the most significant archaeological feature located within the study area is the extensive *'auwai* system. Remnants of this irrigation system were observed on both sides of the Waikomo Stream. ...[This] network of watering canals proved to be the key to the success of the prehistoric Hawaiian Culture in turning these marginal lands into flourishing wet and dry agricultural fields. From information gathered from local informants and preliminary historical investigation of this area it is evident that the early commercial growers of sugar cane utilized the existing *'auwai* system. Gradually as more and more fields came under sugar cane production these replaced the wet and dry fields of an earlier day. Today the archaeological sites remaining stand as islands as these marginal cane lands were taken out of production and turned into pasture (Palama and Stauder 1973:4).

Bordner and Ching (1977) conducted a one-day reconnaissance survey of a specific *'auwai* located in Kukui'ula and corresponding to the major *'auwai* system assigned State Site # 50-30-10-1934. The *'auwai* traverses Kukui'ula from northeast to southwest and includes a number of associated remnant fields. A portion of this *'auwai*, the raised "aqueduct" type section, is slated for preservation (Bordner and Ching 1977:26).

Hammatt *et al.* 1978, as part of Archaeological Research Center of Hawaii (ARCH), reported on a general survey of 460 ac. for the then proposed Kīahuna Golf Village (Hammatt, Bordner, and Tomonari-Tuggle 1978) located on the east side of Waikomo Stream and Po'ipū Road. The Kīahuna survey recorded 583 archaeological sites including 175 stone enclosures and 108 stone house platforms, some of which are clustered as family compounds. The water channels (*'auwai*), ponded fields, terrace plots, and mound fields all indicate extensive wet and dry land agriculture (Hammatt, Bordner & Tomonari-Tuggle 1978:5). The water source for this highly integrated agricultural system was Waikomo Stream which was tapped upstream. Additional sites included 10 occupation caves and a *heiau*.

William Kikuchi (1981) conducted a reconnaissance survey of Weliweli Tract (TMK 2-8-22-06) in the *ahupua'a* of Weliweli, abutting the *ahupua'a* of Kōloa. The survey included the railroad causeway, which "historically connected the Kōloa Sugar Mill to Kōloa Landing" (Kikuchi 1981:2), *'auwai*, walls, terraces, alignments, and habitation sites. Kikuchi states that "the sites...were probably an extension of the vast, prehistoric habitation and agricultural sites of the adjacent Kīahuna (see Hammatt, Bordner & Tomonari-Tuggle, 1978) property" (1981:17)

Connolly (1982) conducted a reconnaissance survey of sections (310 acres) in the *ahupua'a* of Kōloa and Weliweli in 1982 for the Kōloa-Po'ipū Bypass Road. The sites that Connolly encountered were predominantly wall remnants, a few rock mounds, a hole, two complexes, a railway causeway, and an enclosure.

Francis Ching (1983) conducted a reconnaissance survey, and an historical investigation of sections of the *ahupua'a* of Kōloa and Lāwa'i. According to Ching, three-fourths of the study area was bulldozed and rocks re-located, however, remnants of walls, *lo'i*, *'auwai*, flumes, terraces, *kula* and an historic railroad berm were still discernable. These remnants are evidence of the expansiveness of the Kōloa Field System.

James Landrum (1984), of the Bishop Museum, conducted a reconnaissance survey of a 200+ acre portion of Kukui'ula. Landrum recognized that his survey area was once part of an

extensive irrigated agricultural complex developed in the prehistoric period with superimposed historic-era occupation (Landrum 1984:24).

Hallett Hammatt, Douglas Borthwick, and David Shideler (1985) conducted a survey with subsurface testing for the proposed Kōloa-Po'ipū Bypass Road which extends 9,000 ft. along the boundary of Kōloa and Weliweli Ahupua'a. The road corridor was proposed to connect Po'ipū Road (the beach road) to Weliweli Road, southeast of Kōloa Town. A total of 47 archaeological features were located along the corridor. These were concentrated at the *makai* or southern end of the corridor and included the southeastern portion of the "Kīahuna Complex" documented by Hammatt *et al.* in 1978 (see above).

William Kikuchi (1988) conducted a reconnaissance level survey of the former Pa'anau Sugar Camp. The camp was located just *makai* (south) of the present day Kōloa Elementary School. The survey recorded a number of cement foundations, ditches, and portable historic artifacts. Kikuchi states that archaeologically the site is interesting because it contains remnants of an early (1910-1950) plantation camp, even though the vast majority of its structures have been destroyed or removed.

Hallett Hammatt (1990) conducted an inventory survey of a 4.6 ac. parcel at the west end of Pa'anau Road, Kōloa. The historical segment of this report indicates the previous existence of the Pa'anau Camp, and a railroad and *'auwai* irrigation ditch which traversed the study area. However, the survey revealed the absence of any traces of pertinent features.

Hallett Hammatt (1991) carried out an archaeological reconnaissance for a proposed waterline stream crossing of Pō'ele'ele Stream noting extensive modern land modification and no significant findings.

Hallett Hammatt, William Folk, and Mark Stride (1991) conducted an archaeological inventory survey of 160 ac. within Kōloa along the Kōloa-Weliweli *ahupua'a* boundary. They located, mapped, described, and evaluated a total of 75 sites and observed a wide range of site types. Their survey indicates that the (never built) Po'ipūlani project area was associated with what is referred to as the Kōloa Field System.

Hallett Hammatt (1992a) carried out an Archaeological Inventory Survey of a 3.8 Acre Property at Kīahuna, but the entire parcel had been previously graded and there were no significant findings.

Hallett Hammatt (1992b) carried out an Archaeological Reconnaissance of the Po'ipū Road and Lāwa'i Road Junction, but again there were no significant findings owing to prior land disturbance.

Hallett H. Hammatt, Gerald Ida, and William Folk (1993) conducted an inventory survey, with limited subsurface testing, of 7.6 ac. (TMK 2-8-14:30) in the Kīahuna area, *mauka* of Po'ipū Road. Site 3758 was re-mapped, and three new sites were recorded. According to Hammatt *et al.*, these sites are remnants of traditional *'auwai*, walls, fields, enclosures and habitation platforms, and appear to be a part of the larger Kōloa Field System which encompassed over 1000 acres (Hammatt 1993:21).

Hallett Hammatt, Gerald Ida, William Folk, David Shideler and Brian Collin (1993) conducted an assessment survey, subsurface testing and monitoring at Po'ipū Beach Park in the *ahupua'a* of Kōloa. Wave action during Hurricane 'Iniki in 1992 had exposed a cultural layer (Site 50-30-10-745) which needed to be preserved and monitored during the reconstruction and

restoration of the park. Auger testing (1993:11) revealed charcoal, and both traditional and historic midden and artifacts (i.e. basalt flakes and fragments, nails, glass, *kukui* shells, and mollusk shells). A cemetery (State Site 50-30-10-1871), located in the middle of Po'ipū Beach Park, and other sections of the buried cultural layer beneath the park, were also monitored during the removal of several cement slabs, remnants of a pavilion, picnic tables, and barbecues. The rich cultural layer, supported by radiocarbon dating, indicates that this shoreline occupation is contemporaneous with the development of the Kōloa Field System. This cultural layer is the "single largest coastal beach deposit in the *ahupua'a* of Kōloa" (Hammatt *et al.* 1993:65, 66) and greatly contributes to the information bank regarding the cultural development of the Kōloa district.

Victoria Creed, Gerald Ida and Hallett H. Hammatt (1995) report on an inventory survey within a 1.4-mile corridor along Po'ipū Road (TMK 2-8-15, 16, 17 & 18) in the *ahupua'a* of Kōloa and Weliweli. Three sites, including enclosures, a terrace, and the Kōloa-Weliweli boundary wall, survived previous bulldozing of the area and were understood as components of the Kōloa Field System.

Tina Bushnell and Hallett H. Hammatt (1996) carried out an archaeological investigation of 'Ōma'o Bridge in 'Ōma'o Homestead but the only objects of historical interest noted were the existing bridge and features associated with an old railroad.

Hallett Hammatt, Victoria Creed, and Gerald Ida (1996) conducted an assessment survey of an exposed cultural layer in undisturbed sand deposits at Waiohai Hotel. This layer was disturbed by high wave action during Hurricane 'Iniki which completely destroyed the associated reconstructed Kiha Houna Heiau (Site 50-30-10-80). The exposed cultural layer supports the potential existence of widespread intact cultural areas along the general shoreline (Hammatt *et al.*, 1996:39)

Nancy McMahon (1996), at the time an independent archaeological consultant, completed a reconnaissance survey of TMK 2-08-16:3 (8.444 acres), property known as Sheraton Kaua'i in the *ahupua'a* of Kōloa. No surface sites or cultural deposits were reported.

Gerald Ida, Victoria Creed and Hallett H. Hammatt (1997) conducted a reconnaissance survey on a 1.2 mile corridor of a proposed bypass road within the *ahupua'a* of Kōloa and Weliweli (TMK 2-8-02:3, 2-8-03:1, 2-8-04:1, 2-8-05:2) that had previously been bulldozed. This survey did not reveal any archaeological sites, and further study was not recommended.

Cultural Surveys Hawai'i, Inc. (Hammatt, Chiogioji, Shideler, Borthwick, McDermott and Masterson, 1998) reported on data recovery of the Kukui'ula Planned Community Project Phase 1 area encompassing approximately 219 acres. The project included excavations at 20 different sites which encompassed 64 individual features. There was a total of 212 excavation units (212 m^2) and 19 backhoe trenches (only 14 backhoe trenches were chosen for study). Large quantities of midden (approx. 23.7 kg.) and artifacts (10,635 items) were recovered and are reported on. The artifacts include a wide range of types with both indigenous (2,592 items) and historic (8,043 items) represented. Radiocarbon (C14) dates range from ca. A.D. 1050 onward. The earliest date comes from the habitation/burial cave Site 50-30-10-1927A. In addition to the habitation sites and features dated, seven (7) dating samples from agricultural features were also analyzed.

Cultural Surveys Hawai'i, Inc. (Hammatt, Bushnell, Ida, Chiogioji, Creed and Shideler 1999) reported on data recovery work just *makai* and southwest of Kōloa Town on the west side of Waikomo Stream in the northeastern portion of the Kukui'ula Planned Community Phase II Area. The study area is comprised of approximately 33 ac. and has been used as a buffer zone between cane lands/pastures and the residential lots bordering Po'ipū Road. While some ten land commission awards lie partially or entirely within the project area, most of these properties were bulldozed in the course of sugar cane cultivation. There were however, areas that appeared undisturbed by sugar cane cultivation or heavy machinery. Excavations were conducted within five archaeological sites (thirteen features).

These excavations yielded 264.8 g. of midden; 53 indigenous artifacts (including 43 volcanic glass flakes, 9 basalt flakes, and one coral manuport); and 877 late-historic artifacts (e.g. glass, metal, ceramics, plastic, leather, and slate). Twelve charcoal samples were dated.

Cultural Surveys Hawai'i Inc. (Jones, Bush, Folk, Chiogioji, Shideler, and Hammatt, 2002) conducted an archaeological inventory survey with subsurface testing on an approximately 260 acre parcel (TMK 2-7-03:5) along Pō'ele'ele Stream at 'Ōma'o just seaward of Kaumuali'i Highway. Two sites were identified, terrace remnants of LCA 3229 awarded to Eke 'Opunui for the cultivation of taro and sugar cane and a sugar plantation irrigation ditch feature. Two carbon dates are reported of ca. A.D. 1010 - 1180 understood to shortly predate wall construction.

Cultural Surveys Hawai'i Inc. (Yorck, Shideler, and Hammatt 2002) conducted an archaeological inventory survey in support of a well sites and appurtenances project including an access corridor in the vicinity of Piwai Reservoir). No significant sites were observed.

Cultural Surveys Hawai'i Inc. (O'Hare, Shideler, and Hammatt 2003) conducted an archaeological assessment of the Sheraton Kaua'i Resort parcel. Although heavily impacted by modern development some traditional surface sites were documented. Historic research indicated traditional agriculture (*lo'i*) quite close to the coast.

Cultural Surveys Hawai'i Inc. (Tulchin and Hammatt 2003) conducted an archaeological assessment of certain Knudsen Trust lands *mauka* of Po'ipū Road. Most of the extensive previously recorded sites were reported to be still intact.

Cultural Surveys Hawai'i. Inc. (Hammatt and Shideler 2003) conducted an archaeological inventory of an approximately 35 acre parcel for the Kaua'i Bible Chuch, just *makai* (south) of the Pīwai Reservoir. No archaeological sites were identified in the project area or vicinity.

L. Previous Archaeology Summary

Previous archaeological work concerning the Kōloa district has, until recently, been mostly surface surveys. The Kōloa area began to be documented by subsurface testing of sub-surface cultural deposits within the proposed Kīahuna Golf Course area in 1979. Information gleaned from intensive excavations in the *ahupua'a* of Kōloa, Weliweli, and Pa'a, combined with the inventory surveys in these *ahupua'a*, clearly indicate an expansive irrigated agricultural complex and associated temporary and permanent habitation features. The focus of this integrated Kōloa Field System was Waikomo Stream which was utilized as the main source of irrigation. However, the full extent of the Kōloa Field System is hard to estimate because of the widespread historic land modifications (mainly for sugar cane).

Chronological analysis from the neighboring three *ahupua'a* suggests an early initial occupation within the Pa'a Ahupua'a ca. A.D. 535 (Walker and Rosendahl, 1990b:131). No coinciding early dates have been found within Kōloa Ahupua'a, since most of the shoreline area of Kōloa has been heavily impacted by commercial, residential, and resort development. Initial occupation probably was characterized by temporary and/or recurrent occupation developed into permanent settlement within an integrated (both irrigated and *kula* or dryland) agricultural system by ca. A.D. 1200 (*Ibid.*). Portions of this Kōloa Field System functioned well into historic times (ca. 1880's) and co-existed with commercial sugar cane cultivation.

Relatively little archaeological study has been conducted in the *mauka* portions of Kōloa Ahupua'a (*mauka* of Kōloa Town). Recent archaeological investigations in areas *mauka* of Kōloa Town (Hammatt 1991; Bushnell and Hammatt 1996; Yorck *et al.* 2002; Hammatt and Shideler 2003) noted substantial historic land modification, with no significant archaeological findings. However, the recent Cultural Surveys Hawai'i Inc. (Jones *et al.* 2002) archaeological inventory survey on an approximately 260-acre parcel at 'Ōma'o, immediately *mauka* of the current project area, does indicate the potential of locating pre-contact sites in these heavily modified *mauka* lands of Kōloa Ahupua'a.

M. Predictive Model

From previous archaeological studies and historic accounts, it appears that habitation and intensive irrigated agriculture were widespread in central and coastal Kōloa utilizing the opportunity to develop an extensive irrigated complex (the Kōloa Field System) off of Waikomo Stream. Evidence of intensive traditional Hawaiian use of lands *mauka* of Kōloa Town is generally lacking. Previous archaeological studies in the vicinity and *mauka* of the current project area have indicated a lack of traditional Hawaiian sites. As the Judd account given above asserts, it is likely environs like the present project area were used for less intensive cultivation of patches of sweet potato, *pia*, and *wauke* and the gathering of *hala*, *kukui* and other upland resources. Remnants of irrigated agriculture including terraces or *'auwai* off of 'Ōma'o Stream, or temporary field shelters associated with upland gardening or gathering and processing of forest resources are certainly possible.

A major constraint on the development of an archaeological record in the vicinity of the present project area is the general absence of rock. The silty clay and silty clay loam soils of the vicinity are almost stone-free, and any traditional Hawaiian constructions likely to endure in this environment would have to have been constructed of rock imported from some distance away.

While clearly most of the infrastructure supporting historic agriculture lies well seaward of the present project area, during the later historic period the upper elevations of Kōloa became important collection areas of irrigation water. It is possible that historic ditches, flumes, pipelines, and other features related to collection of irrigation water exist in the vicinity of the current project area. Ranching may have also left physical remains within the current project area. Barbed wire fences, wooden or stacked stone enclosures, water troughs, and historic habitation deposits, including structure foundations and refuse dumps, could potentially be found within the project area vicinity.

IV. SURVEY RESULTS

Pedestrian inspection of the project area was accomplished by Cultural Surveys Hawai'i archaeologists David Shideler, M.A. and Todd Tulchin, B.S., under the overall supervision of Hallett H. Hammatt, Ph.D. The fieldwork for this project was conducted in one working day, September 10, 2003. Fieldwork consisted of a pedestrian ground survey and photography of the proposed Northern Leg of the Western Bypass Road. The pedestrian inventory of the project area was completed at 100% coverage.

Dense vegetation (i.e. guinea grass) in former sugar cane lands made for relatively poor visibility (Figure 9). Areas of former sugar cane cultivation, now densely covered in grass, included all lands in the project area north of 'Ōma'o Stream, and the northern portion of the area south of 'Ōma'o Stream. In all, approximately 2/3 of the project corridor was determined to be formerly under sugar cane cultivation. Pedestrian sweeps through the dense grass exemplified the extensive land modification associated with sugar cane cultivation. The area was thoroughly graded and no surface stones were located within the former sugar cane lands. Cleared dirt roads and barbed wire fences were found throughout the project area, associated with the current usage of the land as pasture. No historic properties were observed in the former cane lands.

The southwestern portion of the project area was being utilized as a banana plantation and nursery for the cultivation of ornamental plants (Figure 10). Primarily banana (*Musa sp.*) and *heleconia* were observed to be cultivated in irrigated rows. A covered shed, trailer, and farm equipment associated with the agricultural endeavor were observed in the banana plantation area. A small concrete and iron dam, associated with sugar cane cultivation, was located in a ditch running through the plantation area but was not regarded as a historic property more than fifty years old.

The central portion of the project area was characterized by the presence of 'Ōma'o Stream. The main stream channel was bordered along its northeastern edge by a wide marsh / wetlands area (Figure 11). Dense *hau* covered a broad, low-lying, and muddy area up to the stream bank along the southwestern edge of 'Ōma'o Stream. The stream bank was relatively steep and generally elevated approximately 5-15 ft (1.5-4.5 m) above the stream water level. The main 'Ōma'o Stream was also observed to have a small natural branch which circumvented the oxbow in the area of the stream which is crossed by the project corridor. No historic properties were observed in the 'Ōma'o Stream area of the project corridor.

No historic or indigenous sites or artifacts were encountered during the survey and none are believed to exist in the area of likely impact. Any indigenous activity that could have been observed probably would have been destroyed during the years when much of this portion of Kōloa was used for sugar cane cultivation.

Figure 9 **Former Sugar Cane Lands in the Northern Portion of the Project Area. View to Northeast.**

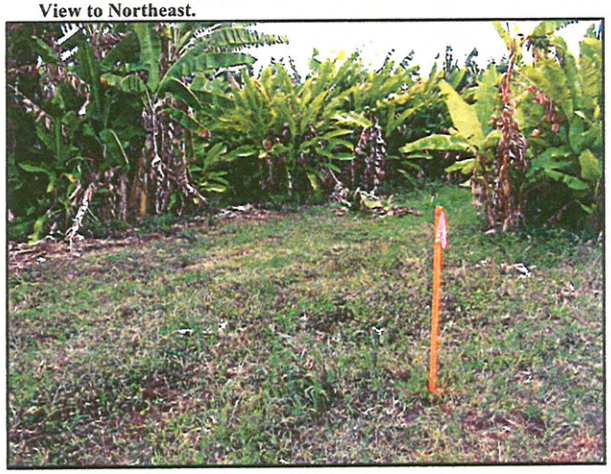

Figure 10 **Southern Portion of the Project Area, Showing Cleared Agricultural Lands Currently Under Banana and Ornamental Plant Cultivation. View to Southeast.**

Figure 11 **Marsh / Wetlands Area Along Northeastern Edge of ʻŌmaʻo Stream. View to Northeast.**

V. RECOMMENDATIONS

No archaeological sites were identified in the project area or vicinity. No further work is recommended for the proposed Northern Leg of the Western Bypass Road project corridor. Extensive land modification associated with both sugar cane cultivation and the establishment of a macadamia nut / banana farm appears to have greatly impacted the area.

Construction of the road right-of-way and related infrastructure is anticipated to have "no effect" on historical properties. As always, if in the unlikely event that any human remains or other significant subsurface deposits are encountered during the course of development activities all work in the immediate area should stop and the State Historic Preservation Division should be promptly notified.

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January 28, 2004

Mr. David Shideler
Cultural Surveys Hawaii
733 N. Kalaheo Avenue
Kailua, Hawaii 96734

LOG NO: 2004.0038
DOC NO: 0401NM04

Dear Mr. Shideler:

SUBJECT: Chapter 6E-42 Historic Preservation Review – Archaeological Inventory Survey in Support of the Northern Leg of the Western Bypass Road, (Tulchin and Hammatt, CSH, 2003)
TMK: 2-7-3: 2
Koloa, Kauai

Thank you for submitting the above report (Tulchin and Hammatt, 2003. *Archaeological Inventory Survey In Support of the Northern Leg of the Western Bypass Road, Koloa Ahupua'a, Kaua'i Island* (TMK: 2-7-3: 2) CSH ms.). We received the report on December 18, 2003 and provide the following comments.

The historical and archaeological background sections are well done, and the predictability model is well written. Two archaeologists surveyed 100% of 430,000 sq foot corridor running northeast to southwest from Maluhia Road near the intersection of Ala Kinoiki St to Koloa Road. No historic sites were found, and no further archaeological work is needed for this project.

The report is acceptable, and we shall place it in our library for the public's benefit. If you have any questions, please call Nancy McMahon 742-7033.

Aloha,

P. Holly McEldowney

P. Holly McEldowney, Administrator
State Historic Preservation Division

c. Ian Costa, Planning Department
Chair, Kaua'i Historic Preservation Review Commission

NM:ak

Koloa 14

Appendix G

Supplemental Archaeological Assessment
and
Cultural Background Study
Prepared by
Cultural Surveys Hawaii, Inc.
March 2010
And
Letter from the
State Department of Land and Natural Resources
Historic Preservation Division
Dated March 19, 2010

Supplemental Archaeological Assessment and Cultural Background Study for the Kukui'ula Western Bypass Road Northern Leg Project, Kōloa Ahupua'a, Kōloa District, Kaua'i Island

TMKs: [4] 2-7-003:002 (portion) & 2-8-006:001 (portion)

Prepared for

Wilson Okamoto Corporation

Prepared by

Hallett H. Hammatt, Ph.D.

and

David W. Shideler

Cultural Surveys Hawai'i, Inc.

Kailua, Hawai'i

(Job Code: KOLOA 27)

March 2010

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Management Summary

Reference	Supplemental Archaeological Assessment and Cultural Background Study for the Kukui'ula Western Bypass Road Northern Leg Project, Kōloa Ahupua'a, Kōloa District, Kaua'i Island, TMK: [4] 2-7-003:002 (portion) & 2-8-006:001 (portion) (Hammatt and Shideler 2010)
Date	March 2010
Project Number (s)	Cultural Surveys Hawai'i, Inc. (CSH) Job Code KOLOA 27
Investigation Permit Number	Fieldwork for this project was conducted under Hawai'i State Department of Land and Natural Resources (DLNR) / State Historic Preservation Division (SHPD) permit no. 08-14
Project Location	The project area is located in the *ahupua'a* and district of Kōloa, Kaua'i Island, approximately one-third of a mile northwest of Kōloa Town; approximately one-quarter mile downstream from the confluence of Pō'ele'ele Stream and 'Ōma'o Stream. The stretch of stream crossed by the project corridor is commonly referred to as 'Ōma'o Stream. The project area is depicted on the 1996 Kōloa USGS 7.5-minute series topographic quadrangle (see Figure 1)
Land Jurisdiction	Kukui'ula Development Company (Hawai'i), LLC
Agencies	SHPD / DLNR
Project Description	The proposed project consists of the construction of a bypass road around Kōloa Town, connecting Maluhia Road, 'Ōma'o Road and Kōloa Road, as well as a bridge crossing 'Ōma'o Stream. A prior archaeological inventory survey (AIS) and cultural impact assessment (CIA) were conducted by CSH (see Tulchin and Hammatt 2003a; Chiogioji and Hammatt 2003, respectively) in conjunction with the environmental review process for the main roadway corridor linking these roads. This supplemental literature review, field check and cultural background study is needed to address five small areas located at either end of the main corridor that were not included in the original study; these five small areas will be impacted for intersection improvements along Maluhia and Kōloa Roads as well as a short section connecting the new bypass road with the existing 'Ōma'o Road. Proposed ground disturbance includes vegetation clearing, grubbing and grading, and deeper excavations for associated infrastructure and appurtenances.
Project Acreage	The prior AIS and CIA were conducted within an approximately one-acre project area, based on a main corridor of approximately 2,150 ft. (664 m) long by 200 ft. (60 m) wide. The five (5) additional areas combined comprise a supplemental project area of less than one-tenth of one acre.
Area of Potential Effect (APE) and Survey Acreage	For the purposes of this document, the Area of Potential Effect (APE) for the archaeological issues is represented by the five supplemental areas highlighted in Figure 1.

Historic Preservation Regulatory Context	The prior AIS (Tulchin and Hammatt 2003a) was accepted by the SHPD in a letter (Log No 204.0038, Doc No 0401NM04) dated January 28, 2004, in accordance with Hawai'i Revised Statutes (HRS) 6E-42 and Hawai'i Administrative Rules (HAR) 13-13-284 & -276.
Fieldwork Effort	Fieldwork was conducted by Missy Kamai, B.A. and Gerald Ida, B.A., which required 2 person-days to complete. Fieldwork took place on August 8th 2008 under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).
Number of Historic Properties Identified	None
Historic Properties Recommended Eligible to the Hawai'i Register of Historic Places (Hawai'i Register)	None
Historic Properties Recommended Ineligible to the Hawai'i Register	None
Effect Recommendation	Based on the subject supplemental study, construction of the road right-of-way and related infrastructure is anticipated to have "no effect" on historic properties and/or cultural practices, gathering rights or access issues.
Mitigation Recommendation	Given the long history of human occupation and settlement in this general area, and despite the documented presence of commercial sugar cane operations and impacts in the subject project area, it is still possible that (as yet) undiscovered cultural or historic resources may be located during proposed ground disturbance; the project proponents shall report any such finds to the SHPD, in compliance with applicable laws and administrative rules.

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Section 1 Introduction

1.1 Project Background

At the request of Wilson Okamoto Corporation, on behalf of Kukui'ula Development Company (Hawai'i), LLC, Cultural Surveys Hawai'i, Inc. (CSH) performed a supplemental archaeological assessment and cultural background study of five small areas of the proposed Northern Leg of the Western Bypass Road project. The project area is located in the *ahupua'a* and district of Kōloa, Kaua'i Island, approximately one-third of a mile northwest of Kōloa Town; approximately one-quarter mile downstream from the confluence of Pō'ele'ele Stream and 'Ōma'o Stream. The stretch of stream crossed by the project corridor is commonly referred to as 'Ōma'o Stream. The project area is depicted on the 1996 Kōloa USGS 7.5-minute series topographic quadrangle (Figures 1-3).

The proposed project is to construct a bypass road around Kōloa Town, connecting Maluhia Road, 'Ōma'o Road and Kōloa Road, as well as a bridge crossing 'Ōma'o Stream. A prior archaeological inventory survey (AIS) and cultural impact assessment (CIA) were conducted by CSH (see Tulchin and Hammatt 2003a; Chiogioji and Hammatt 2003, respectively) in conjunction with the environmental review process for the main roadway corridor linking these roads. This supplemental literature review, field check and cultural background study is needed to address five small areas located at either end of the main corridor that were not included in the original study; these five small areas will be used for intersection improvements along Maluhia and Kōloa Roads as well as a short road section connecting the new bypass road with the existing 'Ōma'o Road. Proposed ground disturbance includes vegetation clearing, grubbing and grading, and deeper excavations for associated infrastructure and appurtenances.

The prior AIS and CIA were conducted within an approximately one-acre project area, based on a main corridor of approximately 2,150 ft. long by 200 ft. wide. The five additional areas combined comprise a supplemental project area of less than one-tenth of one acre.

For the purposes of this document, the Area of Potential Effect (APE) for the archaeological issues is represented by the five supplemental areas highlighted in Figure 1.

1.2 Previous Survey and Assessment of the Project Area

The prior AIS (Tulchin and Hammatt 2003), which documented no historic properties within the project area, was accepted by the SHPD in a letter (Log No 204.0038, Doc No 0401NM04) dated January 28, 2004, in accordance with Hawai'i Revised Statutes (HRS) 6E-42 and Hawai'i Administrative Rules (HAR) 13-13-284 & -276. There is no formal review mechanism for CIA documents. The prior AIS and CIA concluded that construction of the road right-of-way and related infrastructure would have "no effect" on historic properties and/or cultural practices, gathering rights or access issues.

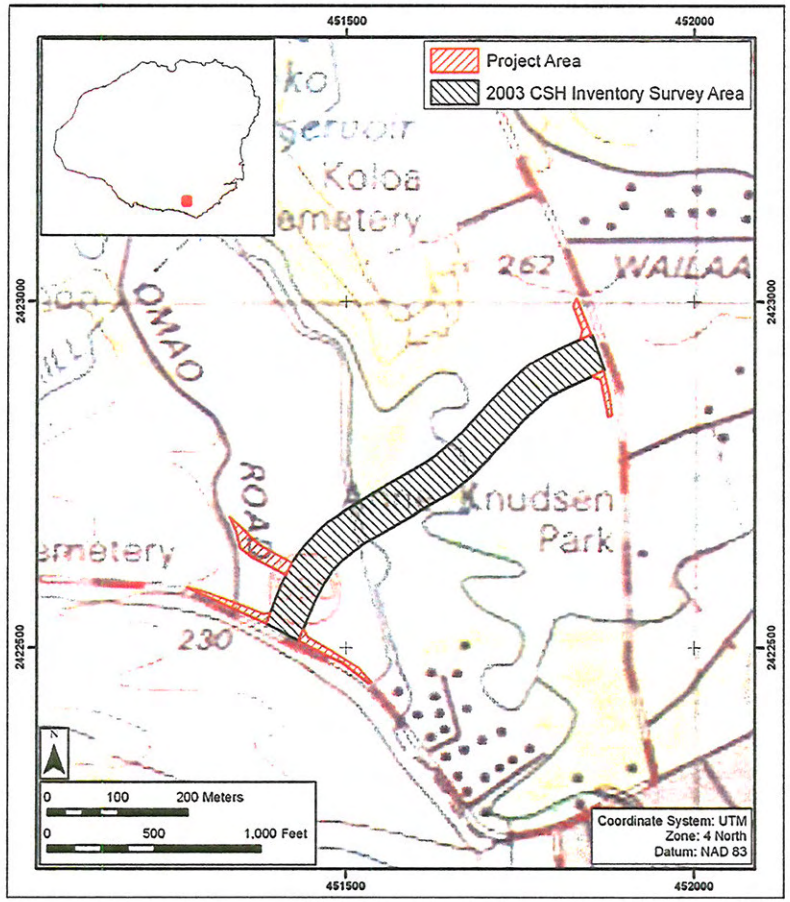

Figure 1. Project area located on a portion of the 1996 Kōloa U. S. Geological Survey 7.5-minute series topographic quadrangle

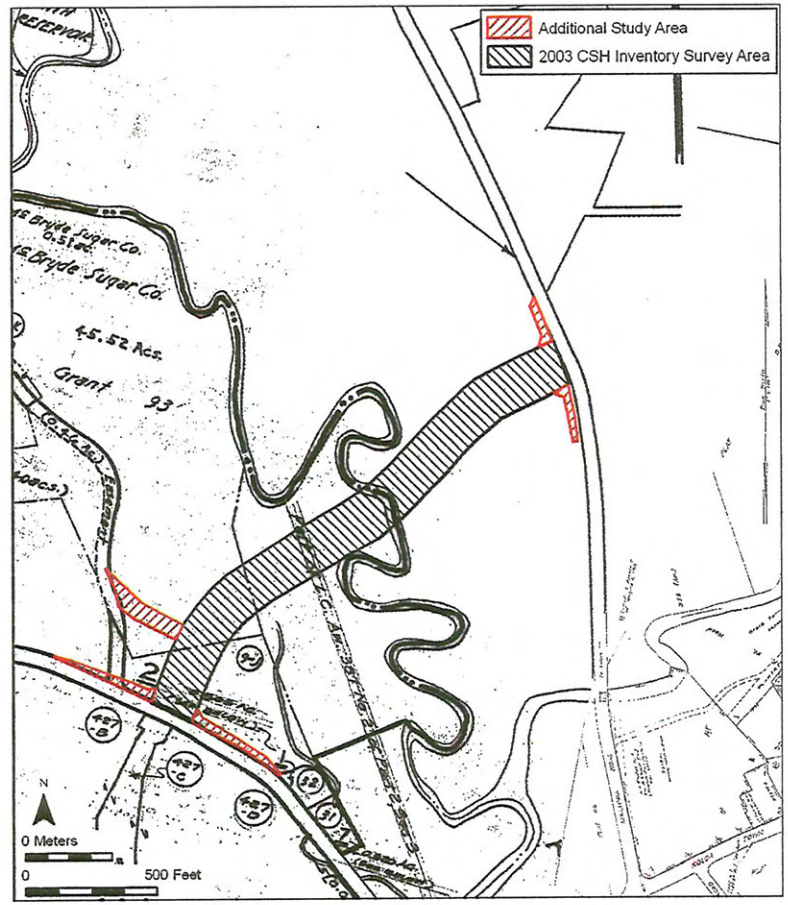

Figure 2. Portion of Tax Map Key (TMK) plats 2-7-003 & 2-8-006 (the later plat includes Maluhia Road at the east end) showing the location of the project area

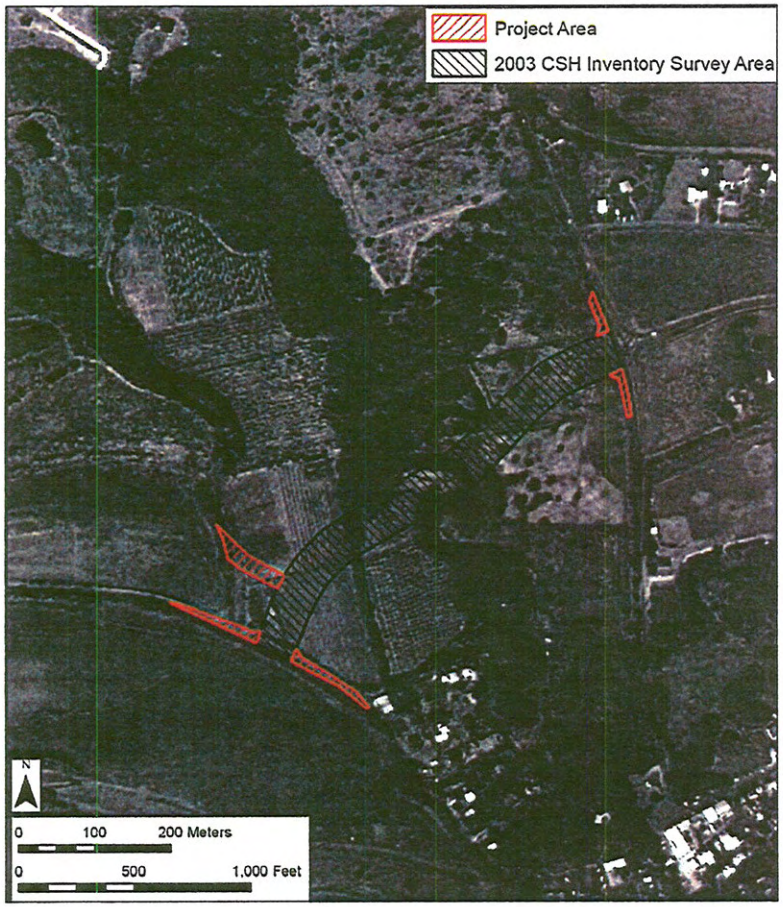

Figure 3. Orthophotograph showing the project area (source: USDA Aerial Photograph Field Office 2000)

1.3 Scope of Work

The agreed upon scope of work for this document includes the following:

1. Historical and previous archaeological background research to include study of archival sources, historic maps, Land Commission Awards and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near this property (drawing heavily on the Tulchin and Hammatt 2003a. and Chiogioji and Hammatt 2003 studies).
2. Field inspection of the new portions of the project area to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. This assessment will identify any sensitive areas that may require further investigation or mitigation before the project proceeds.
3. Preparation of a report to include the results of historical research and the fieldwork with an assessment of archaeological potential based on that research, with recommendations for further archaeological work, if appropriate. It will also provide mitigation recommendations if there are archaeologically sensitive areas that need to be taken into consideration.

1.4 Environmental Setting

The project area is located in the *ahupua'a* of Kōloa, in the Kona District of the Island of Kaua'i. Kōloa is a fairly large *ahupua'a* (9,500 ac.), bounded on the east by Weliweli Ahupua'a, and on the west by Lāwa'i Ahupua'a. The perennial Waikomo Stream traverses most of Kōloa Ahupua'a. The project area lies downstream of the confluence of Pō'ele'ele Stream and 'Ōma'o Stream, which joins with Waikomo Stream further downstream to the south. The stretch of stream crossed by the project corridor is commonly referred to as 'Ōma'o Stream. None of the five specific project areas studied here is immediately adjacent to 'Ōma'o Stream with the nearest project area approximately 200 m from the stream.

Elevation within the project area(s) ranges from approximately 200-230 ft (60-70 m) above mean annual sea level. Soils in the project area are mostly Pohakapu Silty Clay Loam (PkB), with small areas of Lihue Gravelly Silty Clay (LlB, LlC) and Hanalei Silty Clay (HnA) (Foote et al. 1972; Figure 4). Soils of the Pohakapu Series are described as "well-drained soils on terraces and alluvial fans... formed in old alluvium derived from basic igneous material" (Foote et al. 1972:113). The project area receives approximately 2,500 mm (100 inches) of annual rainfall (Giambelluca et al. 1986).

The project area(s) consists mainly of former sugar cane fields, with an active banana plantation and ornamental plant nursery in the southwest portion of the project area near Kōloa Road. Vegetation within the project area is dominated by guinea grass (*Panicum maximum*) in the former sugar cane fields, and *hau* (*Hibiscus tiliaceus*) near 'Ōma'o Stream. Also scattered throughout the project area were white monkeypod trees (*Albizia lebbeck*), windbreak plantings of ironwood (*Casuarina equisetifolia*), papaya (*Carica papaya*) near 'Ōma'o Stream, false sensitive plant (*Mimosa microphylla*), octopus tree (*Brassaia actinophylla*), and *koa haole* (*Leucaena leucocephala*) along the edges of Kōloa and Maluhia Roads.

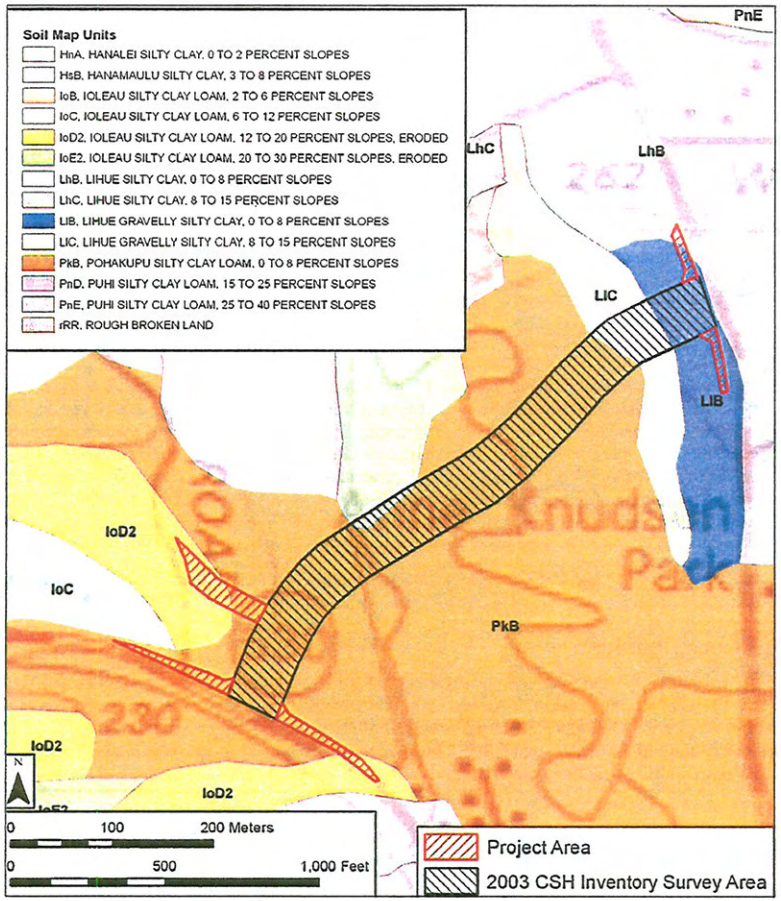

Figure 4. Overlay of Soil Survey of the State of Hawai'i (Foote et al. 1972), indicating sediment types within the project area (indicated in red)

Section 2 Methods

2.1 Field Methods

A complete pedestrian inspection of the main roadway corridor was conducted on September 10, 2003, by CSH archaeologists David Shideler, M.A. and Todd Tulchin, B.S., under the overall supervision of Hallett H. Hammatt, Ph.D. The survey of the main roadway corridor was conducted by making lateral sweeps extending 100 ft. (30 m) on either side of the previously surveyed and staked road centerline. Pedestrian sweeps of the project area were completed with 4 to 6 m spacing.

The supplemental field inspection was conducted by Missy Kamai, B.A. and Gerald Ida, B.A., which required 2 person-days to complete. Fieldwork took place on August 8th 2008 under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).

2.2 Document Review

Background research included a review of previous archaeological studies on file at the State Historic Preservation Division of the Department of Land and Natural Resources, a review of geology and cultural history documents at Hamilton Library at the University of Hawai'i, the Hawai'i State Archives, the Mission House Museum Library, the Hawai'i Public Library, and the Archives of the Bishop Museum. Further research included a study of historic photographs at the Hawai'i State Archives and the Archives of the Bishop Museum, a study of historic maps at the Hawai'i State Archives and the Archives of the Bishop Museum, and a study of historic maps at the Survey Office of the Department of Accounting and General Services.

Information on Land Commission Awards was accessed through Waihona Aina Corporation's Māhele Data Base (Waihona 'Aina Corporation <www.waihona.com>).

2.3 Consultation

According to the terms of the current scope of work, and in light of prior results and the limited size of the supplemental survey areas, no formal consultation was conducted for the subject document. Consultation for the prior CIA (Chiogioji and Hammatt 2003), from which relevant information is abstracted in the subject document, included formal interviews with three *kama'āina* familiar with the project area.

Section 3 Background Research

3.1 Traditional and Historical Background

The project area is in the *ahupua'a* of Kōloa in the Kona District on the island of Kaua'i. Few records exist that document traditional Hawaiian life in the *ahupua'a* of Kōloa. While settlement by westerners with religious and commercial interests makes the area a focus of documentation after the first quarter of the nineteenth century, the accounts typically focus on the lives and concerns of the westerners themselves with only anecdotal references to the Hawaiian population. Two nineteenth century documents (Boundary Commission Testimony of 1874 and a Lahainaluna manuscript of 1885), however, do provide two Hawaiians an opportunity to speak for themselves and thus offer a possible insight into the life of Kōloa before the arrival of westerners.

A dispute over the northern boundary of Kōloa Ahupua'a in 1874 led to a hearing before Duncan McBryde, the Commissioner of Boundaries for Kaua'i. One native witness, Nao (who describes himself as born in Kōloa but presently living in Ha'ikū), in order to show that Hoaea (the area in dispute) was indeed at the northern boundary of Kōloa, testifies: "At Hoaea tea [sic] leaves were hung up to show that there were battles going on" (Boundary Commission, Kaua'i, vol. 1, 1874:124). That there was a traditional "warning system" --well-known to all natives-- suggests that Kōloa, throughout its history, may well have been the scene of some serious conflicts--serious enough and perhaps often enough to warrant devising such a system.

Additional evidence of Kōloa's rich history is offered in a Lahainaluna document produced eleven years later. This document appears to be based on an oral historical project. On September 7, 1885, a student from Lahainaluna Schools (HMS 43 #17) interviewed Makea -- "a native who is well acquainted with Kōloa" -- and recorded "what she said about the well-known places in the olden times." More than sixty-four years after the abolition of the *kapu* (taboo) system and after a century of contact with westerners, Makea was able to describe in detail fourteen *heiau* within the Kōloa area; for example:

> Maulili was the first heiau of south Kōloa. Kapulauki was the first chief of Kōloa, Kiha came next. That is the chief I know of. He was a ruling chief of Kaua'i in the olden days, when the heiau was standing there. It had already been built and men had been sacrificed on its altars. This Kiha was called Kiha-of-the-luxuriant-hair. Another name for him was Kakae and another was Ka-pueo-maka-walu (Right-eyed-owl).
>
> This heiau was also famous for this reason - it was the first heiau to which Kawelo was carried after he had swooned in Wahiawa, in the battle where stones were used as missiles.
>
> The location of this heiau was not known, but a deaf mute knew and it was he who pointed it out to the chiefs, and that is how it was rediscovered in the olden days.

> Kiha lived on the eastern side of the heiau and Aikanaka lived on the northeastern side. This chief, Aikanaka, was the one with whom Kawelo fought and he was the owner of this heiau at that time.

3.1.1 Mythological and Traditional Accounts

Clearly Kōloa was a particularly important *ahupua'a* in traditional Hawaiian times. The fact that at least fourteen *heiau* of varying sizes and functions have been documented in the Kōloa area (Thrum 1907, Bennett 1931), and that these *heiau* are associated with many legendary-historic figures such as Kawelo and 'Aikanaka, suggests a heightened cultural richness of the *ahupua'a*.

Further confirmation of a rich traditional life within Kōloa is furnished by the presence of a *hōlua* (sliding run) on the slopes of Pu'u o Hewa in the *mauka* reaches of the *ahupua'a*, and by the myriad legends attached to Maulili Pool, a sacred place once located in the present Kōloa Town. J. K. Farley (1907) describes the pool and its legendary associations:

> The pool of Maulili, on Waikomo stream...is a few hundred feet south of the Maulili road bridge. The gods Kāne, and his brother, Kanaloa, are said to have once slept above it, on its eastern bank and left the impress of their forms as can be seen in the apapa...The apapa in this vicinity is called an 'Unu.' and a 'Heiau,' but was never walled in, it is said. [This *heiau* may be the Maulili Heiau described by Makea above.] On the nights of Kāne the drums are heard to beat there, also at the sacred rocks, or *unu's*, of Opuokahaku and Kānemilohae, near the beach of Po'ipū...
>
> In the Maulili pool lived a large Mo'o, named 'Kihawahine'...The eastern wall of the pool, just below the resting places of Kāne and Kanaloa, for a short distance, only, is called the 'Pali of Kōloa.' The District of Kōloa is named for this Pali, we are told by old Hawaiians. To the south of the Pali o Kōloa, in the wall is a rock named 'Waihanau'...as one of their meles has it:
>
> > "*Aloha wale ka Pali o Kōloa,*
> >
> > *Ke Ala huli i Waihānau e, hānau.*
>
> To the south of Waihānau is a projecting rock named 'Ke elelo o ka Hawai'i' -- the tongue of Hawai'i, said to have been wrested and brought from Hawai'i by the Kaua'i warrior Kawelo, of Wailua.
>
> At the southern end of the Maulili pool started two large 'auwais, that watered the land east and west of Kōloa. (Farley 1907:93)

Thus, this sacred legend-imbued locus was the source that gave life to the lowland taro patches of Kōloa. These special associations would not have been lost on the Hawaiians dependent upon those waters. While taro would have been essential to the life of the *ahupua'a*, other resources were available. Bernice Judd, writing in 1935, talks about traditional Hawaiian life in Kōloa:

> In the old days two large *'auwai* or ditches left the southern end of the Maulili pool to supply the taro patches to the east and west. On the *kuaunas* or

> embankments the natives grew bananas and sugar cane for convenience in irrigating. Along the coast they had fish ponds and salt pans, ruins of which are still to be seen. Their dry land farming was done on the *kula*, where they raised sweet potatoes, of which both the tubers and the leaves were good to eat. The Hawaiians planted *pia* (arrowroot) as well as *wauke* (mulberry) in patches in the hills wherever they would grow naturally with but little cultivation. In the uplands they also gathered the leaves of the *hala* for mats and the nuts of the *kukui* for light. (Judd 1935:53)

It appears the relatively good situation for the development of irrigated agriculture (the Kōloa Field System) focused agriculture and habitation at elevations below the present project area.

3.1.2 Early Historic Period

Accounts by visitors and settlers at Kōloa Ahupua'a focus on these westerners' own concerns--religious and commercial--as these concerns appropriate the historical record of Kōloa in the 1800s. However, scattered throughout the accounts are occasional references to the Hawaiians of the *ahupua'a*, which may give some insights into their lives.

The American Board of Commissioners for Foreign Missions (ABCFM) missionary Samuel Whitney described, in an article in the *Missionary Herald* (June 1827:12), a visit to Kōloa with Kaikio'ewa, the governor of Kaua'i, in 1826:

> The people of this place were collected in front of the house where the old chief lodged in order to hear his instructions. After a ceremony of shaking hands with men, women, and children they retired...
>
> Our company consisted of more than a hundred persons of all ranks. The wife of the chief, with her train of female attendants, went before. The governor, seated on a large white mule with a Spaniard to lead him, and myself by his side, followed next. A large company of aipupu, cooks, attendants came on in the rear.

Whitney's account suggests something of the deference paid to the *ali'i* by the local populations and the scale at which the *ali'i* carried out their functions. An even grander view of that deference is provided in an account of a later visit by an *ali'i* to Kōloa. John Townsend, a naturalist staying in Kōloa in 1834, described a visit by Kamehameha III:

> In the afternoon, the natives from all parts of the island began to flock to the king's temporary residence. The petty chiefs, and head men of the villages, were mounted upon all sorts of horses from the high-headed and high-mettled California steed, to the shaggy and diminutive poney [sic] raised on their natives hills; men, women, and children were running on foot, laden with pigs, calabashes of Poe [sic], and every production of the soil; and though last certainly not least, in the evening there came the troops of the island, with fife and drum, and 'tinkling cymbal' to form a body guard for his majesty, the king. Little houses were put up all around the vicinity, and thatched in an incredibly short space of time, and when Mr. Nuttall, and myself visited the royal mansion, after nightfall, we found the whole neighborhood metamorphosed; a beautiful little village had

> sprung up as by magic, and the retired studio of the naturalists had been transformed into a royal banquet hall... (Palama and Stauder 1973:18)

In 1834, Peter Gulick and his family arrived in Kōloa. Apparently the first foreigners to settle in the *ahupua'a*, they initiated the process of rapid change that would re-shape the life of Kōloa in the nineteenth century. In 1835, a 30 by 60 ft. grass house was erected as a meeting house and school (probably located at Kōloa Town). Mr. Gulick initiated sugar cane cultivation and collected a cattle herd for the Protestant Mission. In 1837, a 45 by 90 ft. adobe church was built (probably at the same ABCFM site) and the first mission doctor, Thomas Lafon, arrived to assist Mr. Gulick (Damon 1931). The Kōloa mission station apparently flourished immediately. Charles Wilkes, a member of the U.S. Exploring Expedition visiting Kōloa in 1840, recorded:

> The population in 1840 was one thousand three hundred and forty-eight. There is a church with one hundred and twenty-six members, but no schools. The teachers set apart for this service were employed by the chiefs, who frequently make use of them to keep their accounts, gather in their taxes &c [and for similar tasks]. The population is here again increasing partly by immigration, whence it was difficult to ascertain its ratio. (Wilkes 1845:64)

Other sources, however, give different population figures for Kōloa during the first half of the nineteenth century. In 1834, according to a report by missionaries on Kaua'i, the inhabitants of the *ahupua'a* numbered 2,166. An article in the *Pacific Commercial Advertiser* of December 21, 1867 estimated that the population in 1838 was about 3,000 (though, by 1867, it had been reduced to a third of that number). James Jackson Jarves, who visited Kōloa and Kaua'i for nine months during the early 1840s, recorded:

> Kōloa is now a flourishing village. A number of neat cottages, prettily situated amid shrubbery have sprung up, within two years past. The population of the place, also, has been constantly increasing, by emigration from other parts of the island. It numbers, now, about two thousand people, including many foreigners, among whom are stationed a missionary preacher, and physician, with their families. (Jarves 1844:100)

The arrival of "many foreigners" was the cause of, and the native immigration to Kōloa was the result of, the many commercial activities that burgeoned beginning in the 1830s. In 1835, Ladd and Company gained from the king and local chiefs the lease of about one thousand acres at Kōloa for 50 years at $300 a year and "allowed the use of the waterfall and an adjoining mill site at Maulili pool, not far from the thousand acres, together with the right to build roads, the privilege of unrestricted buying and selling and freedom from local harbor dues" (Judd 1935:57). Ladd and Company was not the first to mill sugar cane in the area (there was a Chinese-operated granite roller mill in operation at Māhā'ulepū, Kōloa, in 1830); however, Ladd and Company was the first plantation-organized industry in Hawai'i (Damon 1931). Judd notes the following:

> The company was permitted to hire natives to work on the plantation provided they paid Kauikeaouli, the king, and Kaikio'ewa, the governor of Kaua'i, a tax for each man employed and paid the men satisfactory wages. The workers were to be exempt from all taxation except the tax paid by their employers. (Judd 1935:57)

Judd further described the revolutionary implication of this arrangement: "The significance of Ladd & Co.'s lease lay in the fact that it was the first public admission by the Hawaiian chiefs that their subjects had rights of personal property backed with a guaranty of protection to that property" (Judd 1935:58). Local chiefs, fearful of a usurpation of their power, resisted the company's first efforts to recruit workers, forcing the king's intervention.

Another missionary, Dr. James W. Smith, who was stationed at Kōloa for forty-five years, beginning in 1842, mentioned in his journal a visit to "the school at Kukuiula." (Smith n.d.). If there was a second school in Kōloa outside the population center of Kōloa Town, Kukui'ula may have warranted the placing of a school there because of a sufficiently large population in the area.

A well-known history of severe flooding in the central flood plain of Kōloa forced native Hawaiians to develop an irrigated field network well off that plain. In Kōloa, a large percentage of homes and agricultural fields are located in the large volcanic terrace *makai* of the project area that is not susceptible to flooding. This extensive *lo'i* network within the *makai* portion of Kōloa may have been, in part, a clearly thought-out use of a fortuitous land configuration to avoid the force of occasional floods that might, elsewhere on the island, have had disastrous effects.

Coulter (1931) provided population estimates for the island of Kaua'i at 1853 that shows a considerable settlement of about one thousand people in and around Kōloa (Figure 5).

3.1.3 Mid-1800s (Land Commission Awards)

The Māhele records of Kōloa give a picture of how land ownership and access to the *'āina* (land) had changed by the middle of the nineteenth century when the 8,620-acre Kōloa Ahupua'a was awarded (Land Commission Award 7714-B) to Moses Kekūāiwa, the brother of Alexander Liholiho (Kamehameha IV), Lot Kapuāiwa (Kamehameha V), and Victoria Kamāmalu. (The awarding of the *ahupua'a* to Kekūāiwa was an outcome of an event twenty-five years in the past: the crushing - by forces loyal to Kamehameha II - of the 1824 revolt on Kaua'i when Kaua'i lands were divided up among the chiefs of the other islands.)

Eighty-eight other *kuleana* (small parcel) were awarded to individuals within Kōloa Ahupua'a. The majority of these Land Commission Awards (LCAs) were located in or around Kōloa Town itself. This concentration of awards around the town area may reflect both the traditional land settlement pattern, that is, a focus on the resources of Maulili Pool and Waikomo Stream (a permanent stream), as well as a more recent movement of the populace to the plantation and missionary centers. An 1891 map by M.D. Monsarrat shows the location of these awards (Figure 6).

The only LCA known in the immediate vicinity of the present project area is the parcel along the southwestern portion of 'Ōma'o Stream that was awarded to the ABCFM; this was LCA. 387, No. 2, Part 2, Section 3. This portion of LCA 387 is only a small share of the land holdings awarded to the ABCFM on the island of Kaua'i.

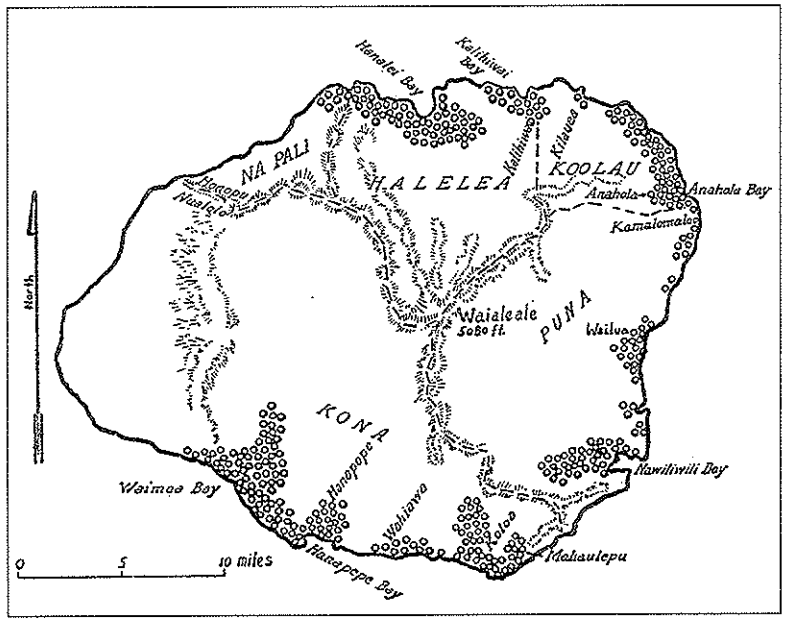

Figure 5. Coulter's (1931) population estimates for Kaua'i, indicating approximately one thousand people in and around Kōloa (each symbol represents 50 people)

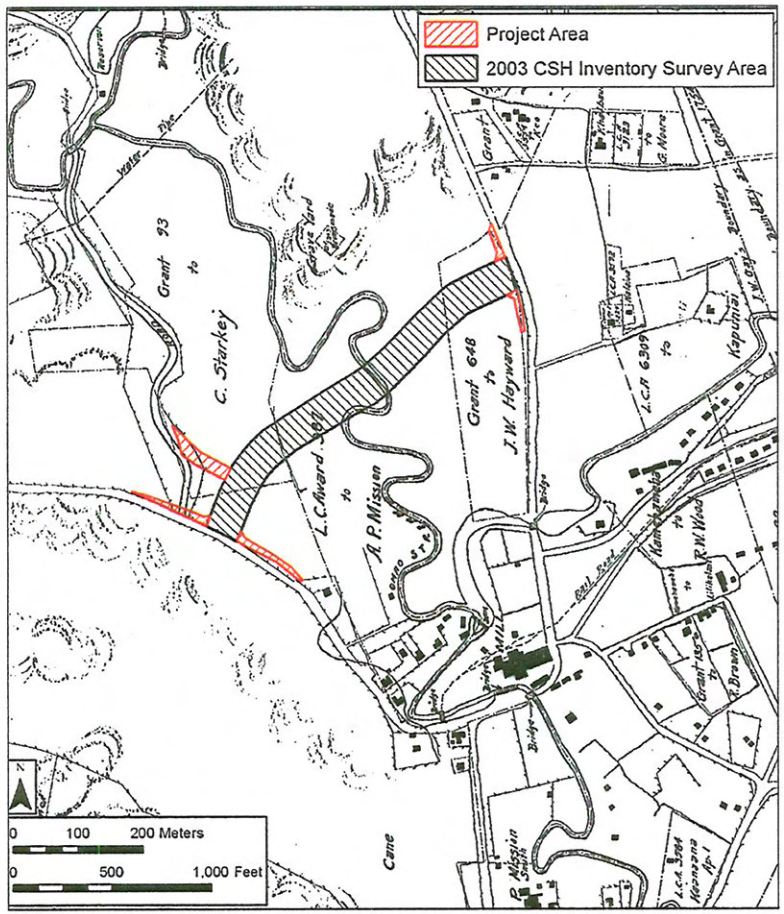

Figure 6. Portion of 1891 map of Kōloa by M.D. Monsarrat (R.M.1694) showing the location of the project area

3.1.4 Late 1800s to Present

Kōloa became the scene of a confrontation of the traditional social structure with commercially-impelled forces of change. The sugar cane growing activity of Ladd and Company would inevitably affect the lives of the inhabitants of the rest of the *ahupua'a*. Traditional settlement patterns (e.g. permanent and temporary habitation interspersed throughout the irrigated agricultural fields near the coastal zone and traditional farming along streams) were disrupted by a shift to Kōloa Town where sugar cane milling activities were located, and a shift to cash crops other than taro.

Although Ladd and Company would go bankrupt in 1845, its earlier success was an impetus for other entrepreneurial attempts within Kōloa. Silkworm farming, oil extraction from *kukui* (candlenuts), cigar manufacturing, sago raising, and tapioca manufacturing were all attempted with varied success during the middle third of the nineteenth century.

Another major area of commercial enterprise was associated with the whaling industry at Kōloa Landing. Accounts of visitors suggest that the inhabitants of Kōloa took advantage of their proximity to the landing to participate in the booming trade of the port. An article in the *Pacific Commercial Advertiser* of Feb. 19, 1857, described the salient characteristics of the port at mid-century and mentions:

> From the landing there is a good carriage road to the town, distant about two miles. Large quantities of firewood, bullocks and sweet potatoes are furnished to whalers in this port, and these chattels can nowhere be procured cheaper or better. It is estimated that 10,000 barrels of sweet potatoes are cultivated annually here, which are thought to be the best on the islands. Nearly all the potatoes furnished for the California market are produced here...Sweet potatoes, sugar and molasses constitute the chief trade of the port.

Kōloa became the official port of entry for Kaua'i in the 1850s and participated in the profitable trade with the whaling industry whose peak years ran from the 1830s to the 1860s. It seems likely the demand for firewood, bullocks, sweet potatoes, sugar and molasses at Kōloa Landing was met to at least some small degree by activities in the *mauka* regions of Kōloa in the vicinity of the present project area. Monsarrat's 1891 map (R.M.1694; see Figure 6) shows sugar cane cultivation in the vicinity of the present project area.

Koloa Plantation began a program of developing water storage circa 1904. Clearly the development of the larger reservoirs such as the Waita Reservoir (also known as the Koloa Reservoir and combining the former Hauiki Reservoir and the Marsh Reservoirs) and Alexander Reservoir were not only major engineering feats but were matters of significant social impact involving repeated armed confrontations (Wilcox 1996:77-84). Several other smaller reservoirs were developed within a radius of a couple of kilometers, including: Aepo, Aepoalua, Aepoakolu, Huinawai, Loko, Mauka, 'Ōma'o, Pia Mill, Pinau, and Pu'u o Hewa reservoirs. The development of these modest reservoirs is not well documented in the readily available literature. The 1910 U. S. Geological Survey Lihue Quad Map (Figure 7) and the 1963 USGS Topographic Map of the Kōloa (Figure 8) show most of the reservoirs in the immediate vicinity (including the Huinawai, Loko, Mauka, 'Ōma'o , Pinau, and Pia Mill, reservoirs) already developed. The lands

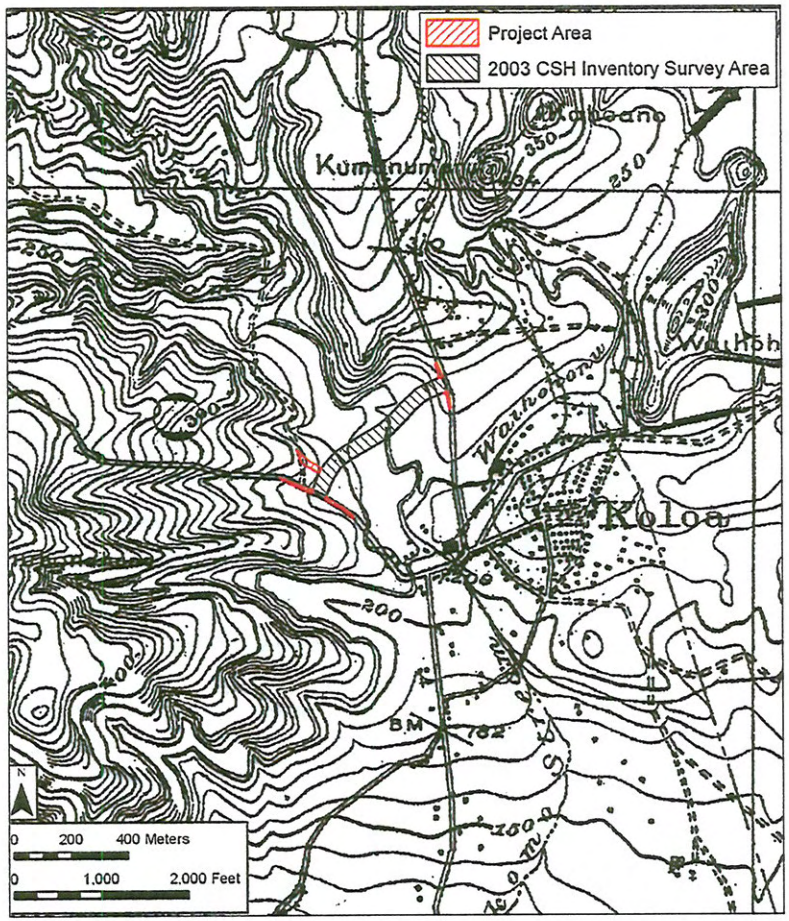

Figure 7. Portion of 1910 U. S. Geological Survey topographic map, Lihue quadrangle, showing the location of the project area

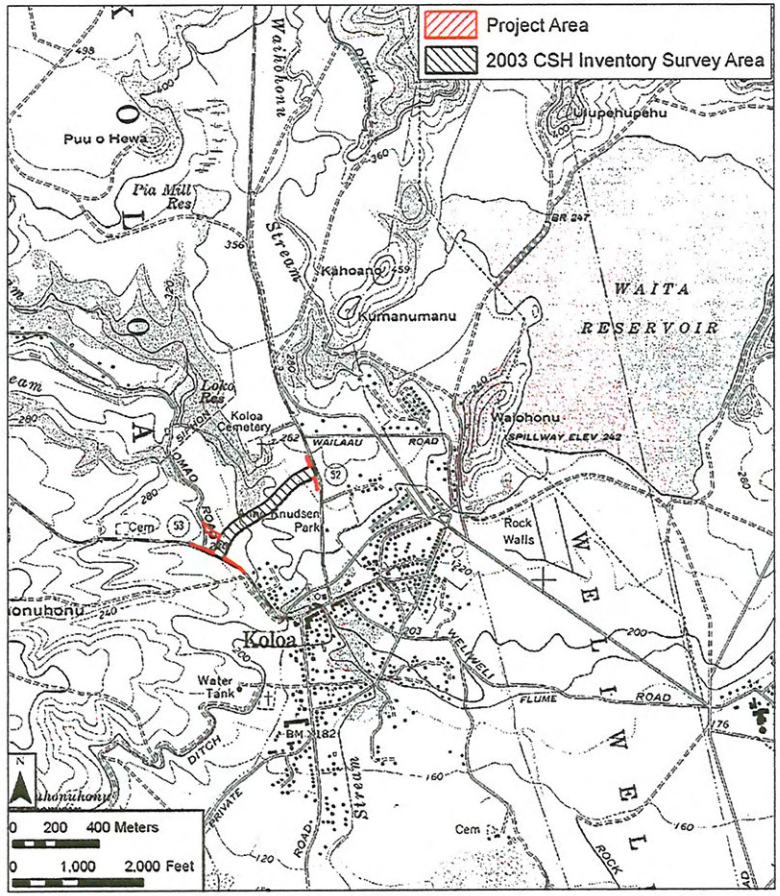

Figure 8. Portion of 1963 U. S. Geological Survey map of Kōloa, showing the location of the project area

around these reservoirs are understood to have been under sugar cane cultivation since the mid 1800s.

Kōloa Landing was phased out around 1925 when McBryde Sugar Company and Kōloa Sugar Company began using Port Allen ('Ele'ele). Soon after this time, McBryde ceased to use several of the Kōloa fields. It is our understanding, however, that sugar cane was last harvested within the present project area by McBryde in the mid 1990s. A map reproduced by Donohugh (2001) appears to show the western half of the project area was not in sugar cane by 1935 (Figure 9). The lands on the east side of 'Ōma'o Stream, owned by descendants of the Knudsen family, were leased by various sugar cane interests including Koloa Sugar, then Grove Farm, and then McBryde. A 1950 aerial photograph of the Kōloa area (Figure 10) appears to show the majority of the current project area under sugar cane cultivation. Soil survey data (see Figure 4) appears to indicate the majority of the project area was still in sugar cane circa 1970. Subsequently, these cane lands were abandoned. The southwestern portion of the project area was later converted to a macadamia nut tree farm. Following damage from Hurricane 'Iniki in 1992, the macadamia nut tree farm was converted to its present usage as a banana plantation and ornamental plant nursery. The northeastern portion of the project area is currently used as pasture for horses.

3.1.5 Summary of Historical Background

Although much of the seaward portion of Kōloa is a relatively dry area with approximately 30 in. (760 mm) of rain per year, the perennially flowing streams have provided a resource for the development of a rather expansive agricultural system. Historical accounts of Kōloa (Farley 1907; Jarves 1844; Townsend 1839; Judd 1935) describe in the lands *mauka* of Kōloa Town as a seemingly continuous, well-maintained, agricultural complex of taro, yams, sweet potato, and sugar cane that was irrigated by an extensive *'auwai* system fed from Waikomo and Pō'ele'ele streams. This system had a significant influence on later commercial endeavors in Kōloa.

Kōloa is the site of the first organized sugar plantation in Hawai'i. Ladd and Company leased about a thousand acres for the sole purpose of growing sugar cane (Judd 1935; Palama and Stauder 1973). The commercialization of sugar cane in Kōloa had widespread social effects. The traditional view of the *'āina* being a responsibility of the *ali'i* was being transformed.

Kōloa Town and Kōloa Landing became prominent commercial centers during the mid to late 1800s, exporting a variety of products such as sweet potatoes, sugar, and molasses. Whalers stopped for provisions of squash, salt, salt beef, pigs, and cattle (Palama and Stauder 1973:20). This heightened activity dramatically altered the social structure and landscape of Kōloa.

Kōloa soon reflected the effects of a traditional social structure in conflict with commercially -impelled forces of change. Traditional settlement patterns (e.g. permanent and temporary habitation interspersed throughout the irrigated agricultural fields near the coastal zone and along streams in the steeper valleys inland) would have been significantly changed by a flux to Kōloa Town where sugar cane milling activities were located. Later land use in the study area (i.e. sugar cane, pasture, macadamia nut farm development, and banana cultivation) also had detrimental impacts on any surviving traditional structures.

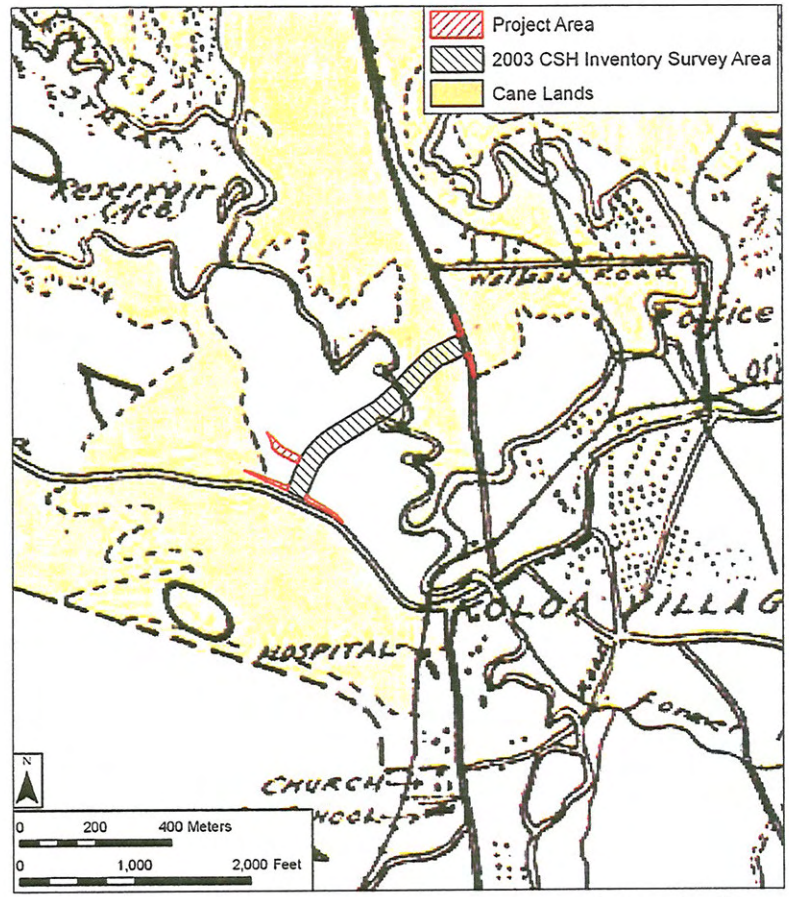

Figure 9. Sugar cane fields of the Koloa Plantation circa 1935 (green shading) reproduced in Donohugh (2001); most of the project area was not in cane at this time, according to this map

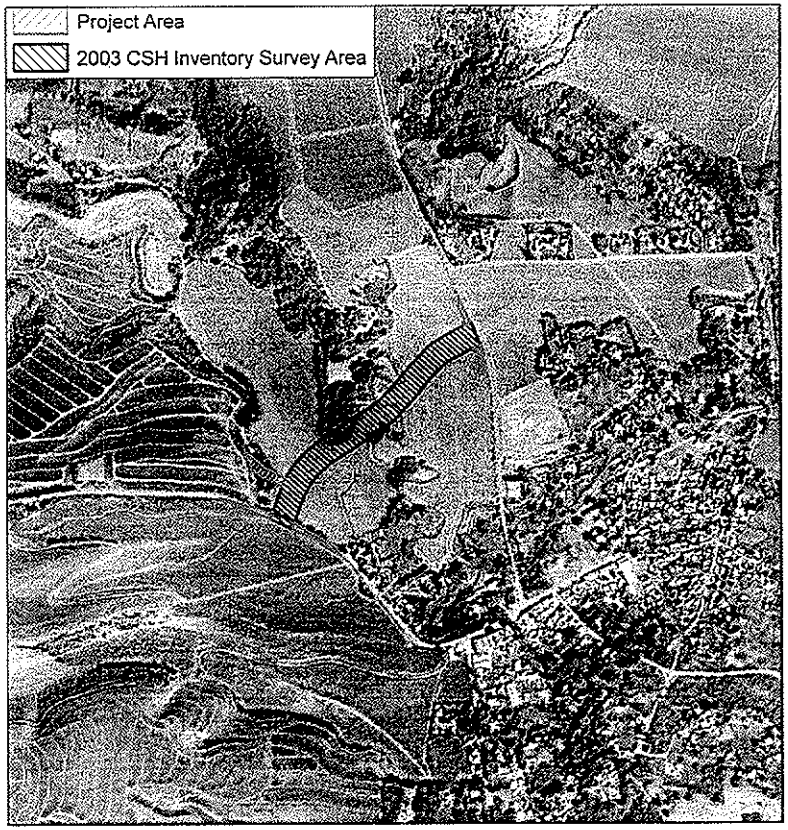

Figure 10. 1950 aerial photograph showing extent of sugar cane cultivation in the project area

3.2 Previous Archaeological Research

3.2.1 Overview

Most of the early archaeological work in the Kōloa District was limited to surface surveys, and studies of *heiau* and other conspicuous sites (e.g., Thrum 1907; Bennett 1931; Kikuchi 1963). Starting in the late 1970s, work in the area of the (then) proposed Kīahuna Golf Course and the Sheraton Kauai Hotel was some of the first subsurface testing (excavation) for buried cultural resources (e.g., Hammatt et al. 1978; Kikuchi 1979). Results of these intensive excavations in the *ahupua'a* of Kōloa, Weliweli, and Pa'a documented an extensive irrigated agricultural complex known as the Kōloa Field System (KFS), along with associated temporary and permanent habitation features. The heart of the KFS was centered on, and built around, Waikomo Stream (located *makai* of the subject project area), which was utilized as the main source of irrigation. However, the full extent of the KFS is hard to estimate because of the widespread historic land modifications (mainly for sugar cane).

Chronological analysis of neighboring *ahupua'a* suggests an early initial occupation of Pa'a Ahupua'a (site of the Hyatt Regency resort) circa A.D. 535 (Walker and Rosendahl 1990b:131). Similarly early dates have not been found at Kōloa Ahupua'a, in part because most of its shoreline area has been heavily impacted by commercial, residential, and resort development; however, Hammatt et al. (1998) reported radiocarbon dates of approximately A.D. 1050 from the Kukui'ula Planned Community Project Phase 1. Initial occupation in Kōloa Ahupua'a was probably characterized by temporary and/or recurrent occupation developed into permanent settlement within an integrated (both irrigated and *kula* or dryland) agricultural system by circa A.D. 1200 (Walker and Rosendahl 1990b). Portions of the KFS were still in use well into historic times (circa 1880s) and co-existed with commercial sugar cane cultivation.

Fewer archaeological studies have been conducted in *mauka* portions of Kōloa Ahupua'a (*mauka* of Kōloa Town), compared with the coast; in general, these *mauka* studies have documented substantial historic land modification, with no significant archaeological findings (e.g., Hammatt 1991b; Bushnell and Hammatt 1996; Yorck et al. 2002; Hammatt and Shideler 2003). A recent CSH archaeological inventory survey (Jones et al. 2002) on an approximately 260-acre parcel at 'Ōma'o, immediately *mauka* of the current project area, does indicate the potential of locating pre-Contact sites in subsurface contexts.

3.2.2 Previous Archaeology in the Vicinity of the Project Area

Other than Thrum's cursory description of Kaua'i's *heiau*, the earliest systematic archaeological survey on the Island of Kaua'i was conducted by Wendell Bennett in the late 1920s. Bennett recorded and documented 202 sites on the island. As illustrated in Figure 11, Bennett recorded a total of seven (7) sites within Kōloa Ahupua'a (Bennett 1931:116-117, 120), mostly located in coastal or near-coastal settings:

Site 72	Niu Kapukapu Heiau - on the top of Niu Kapukapu Hill, on the east bluff of Lāwa'i Valley
Site 73	Stone work on the hill just in-land from Site 72

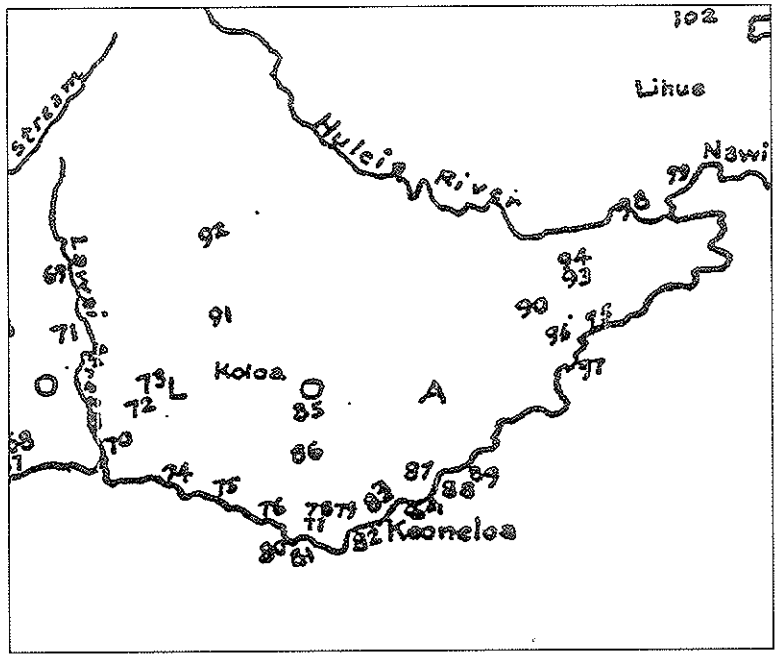

Figure 11. Archaeological sites documented by Bennett (1931) in the vicinity of Kōloa

Site 74	Fishing shelter on the shore near the mouth of Kukui'ula valley
Site 75	Kūhiō Park, west of Waikomo Stream with taro patches, a small heiau, an oven, paved house platform, fish pond, game ground with seats and a fishing shrine
Site 76	Salt pans east of Waikomo Stream
Site 85	Walls, enclosures and house sites in the cactus covered country around the Kōloa reservoir and extending to the sea
Site 86	House site in the area described in Site 85

Table 1 and Figure 12 summarize a representative sample of previous archaeological work conducted in and around Kōloa Ahupua'a. Kikuchi (1963) conducted a general survey of the Kona District of Kaua'i including all *ahupua'a* between Hanapēpē and Kīpū Kai. No sites were noted by Kikuchi in the present study area.

Palama and Stauder (1973) conducted a reconnaissance survey along the route of the then-proposed main cane haul road to the Kōloa mill site. The proposed new section of road extended from Weliweli Road, southwestward across Po'ipū Road, connecting to an existing cane haul road. The section west of Po'ipū Road is approximately 3,000 ft. long with a north/south oriented branch approximately 1,500 ft. long. A total of 18 sites were recorded along the road corridor. All of these sites are south of the present study. Although the Palama and Stauder study was limited in scope to the proposed road right of way, it included a short but thorough historical summary of the place of archaeological sites within the context of the Kōloa and Weliweli Ahupua'a. An extensive *'auwai* system was observed east of Po'ipū Road. The following comments on this system and the sites in general are relevant to understanding the archaeological significance of the area as a whole, and the historic processes at work:

> Our reconnaissance revealed that the most significant archaeological feature located within the study area is the extensive 'auwai system. Remnants of this irrigation system were observed on both sides of the Waikomo Stream. ...[This] network of watering canals proved to be the key to the success of the prehistoric Hawaiian Culture in turning these marginal lands into flourishing wet and dry agricultural fields. From information gathered from local informants and preliminary historical investigation of this area it is evident that the early commercial growers of sugar cane utilized the existing 'auwai system. Gradually as more and more fields came under sugar cane production these replaced the wet and dry fields of an earlier day. Today the archaeological sites remaining stand as islands as these marginal cane lands were taken out of production and turned into pasture. (Palama and Stauder 1973:4)

Bordner and Ching (1977) conducted a one-day reconnaissance survey of a specific *'auwai* located in Kukui'ula and corresponding to the major *'auwai* system assigned SIHP No. 50-30-10-1934. The *'auwai* traverses Kukui'ula from northeast to southwest and includes a number of associated remnant fields. A portion of this *'auwai*, the raised "aqueduct" type section, was recommended for preservation (Bordner and Ching 1977:26).

Table 1. Previous Archaeological Research in Kōloa and Vicinity

Author(s)	Year	Location	Study Type
Thrum	1907	Heiau study, Kaua'i Island	General Survey
Bennett	1931	Kaua'i Island, in general; Kukui'ula Valley and Prince Kūhiō Park, specifically	General Survey
Kikuchi	1963	Kona District	General Survey
Kikuchi	1973	Hawaiian Fishponds	General Survey
Palama and Stauder	1973	Cane Haul Road-Kōloa Mill	Reconnaissance Survey
Sinoto	1975	Knudsen Trust Lands	Reconnaissance Survey
Bordner and Ching	1977	Kukui'ula *'auwai*, SIHP No. 50-39-10-1934	Reconnaissance Survey
Hammatt et al.	1978	Kīahuna Complex	General Survey
Kikuchi	1979	Sheraton Kauai Hotel	Survey and Subsurface Testing
Hammatt	1979	Keoneloa Bay, Weliweli, Pa'a	Archaeological and Historical Investigations
Kikuchi	1981	Weliweli Tract, TMK 2-8-22:por 6,	Reconnaissance Survey
Connolly	1982	Kōloa-Po'ipū Bypass Road	Reconnaissance Survey
Ching	1983	Kukui'ula-Kualu, Alexander and Baldwin Lands	Reconnaissance Survey
Landrum	1984	Kukui'ula-Kualu, Alexander and Baldwin Lands	Reconnaissance Survey
Hammatt et al.	1985	Kōloa-Po'ipū Bypass Road	Survey and Subsurface Testing
Kikuchi	1985	Shoreline Improvements, Waiohai Hotel, Kiha Houna Heiau	Reconstruction
Kikuchi	1988	Pa'anau Sugar Camp	Reconnaissance Survey
Hammatt et al.	1988	Kukui'ula Bay Planned Community	Inventory Survey
McMahon	1989	Kaua'i Fishponds	General Survey
Hammatt	1990a	a Proposed Swimming Pool, Kīahuna Plantation, TMK 4-2-8-17:26	Archaeological Reconnaissance Survey
Hammatt	1990b	Pa'anau Housing Project	Inventory Survey
Walker and Rosendahl	1990a	Hyatt Regency Kaua'i Proposed Golf Course Project Area, Land of Pa'a	Archaeological Inventory Survey,

Author(s)	Year	Location	Study Type
Walker and Rosendahl	1990b	Hyatt Regency Kaua'i	Archaeological Data Recovery, Phase II
Hammatt	1991	Pō'ele'ele Stream – Waterline crossing	Archaeological Reconnaissance
Hammatt et al.	1991	Po'ipulani Golf Course	Inventory Survey
Hammatt and Toenjes	1991	Proposed Keoneloa Bay Villas, Weliweli and Pa'a, (TMK 4-2-8-20:1 & 4-2-8-21:1),	Archaeological Data Recovery and Construction Monitoring
Hammatt	1992a	Kīahuna	Inventory Survey
Hammatt	1992b	Po'ipū Road and Lāwa'i Road Junction	Archaeological Reconnaissance
Hammatt and Craddock	1992	Keoneloa Bay Villas, Weliweli and Pa'a, TMK 4-2-8-20:1, 4-2-8-21:1	Archaeological Inventory Surveys and Subsurface Testing
Hammatt, Ida and Folk	1993	Po'ipū Road 7.6-acre Parcel	Inventory Survey
Hammatt, Ida, Folk, Shideler and Colin	1993	Po'ipū Beach Park	Subsurface Testing and Monitoring
Creed et al.	1995	Po'ipū Road	Inventory Survey
Bushnell and Hammatt	1996	'Ōma'o Bridge, 'Ōma'o Homestead	Archaeological Investigation
Hammatt, Creed and Ida	1996	Waiohai Resort	Assessment Survey
McMahon	1996	Sheraton Kauai Hotel	Reconnaissance Survey
Ida, Creed and Hammatt	1997	Po'ipū Bypass Road	Inventory Survey
Hammatt et al.	1998	Kukui'ula Planned Community Phase I	Data Recovery
Hammatt et al.	1999	Kukui'ula Planned Community Phase II	Data Recovery
Ida, Bushnell and Hammatt	2000	a Portuguese Oven Site (A Portion of SIHP 50-30-10-1911), Kukui'ula, Kōloa	Mitigation Report
Jones et al.	2002	260-acre parcel along Pō'ele'ele Stream at 'Ōma'o	Inventory Survey

Author(s)	Year	Location	Study Type
Yorck et al.	2002	Well Sites and Appurtenances near Piwai Reservoir, Alexander and Baldwin Properties	Inventory Survey
O'Hare et al.	2003	Sheraton Kauai Resort	Archaeological Assessment
Rohrer, Tulchin, and. Hammatt	2003	An Approximately 10.6 Acre Parcel At Kōloa Ahupua'a, (TMK: 2-8-15:43,44,82)	Archaeological Assessment
Tulchin and Hammatt	2003	Knudsen Trust Lands *mauka* of Po'ipū Road	Archaeological Assessment
Hammatt et al.	2004	Parcel 30 of the Eric A. Knudsen Trust Lands, Kōloa Ahupua'a, , TMK: (4) 2-8-014: 30	Archaeological Survey
Hammatt	2005	An 8.15-acre Knudsen Trust Parcel, Kōloa Ahupua'a, TMK: (4) 2-8-004: por. 003 & 055.	Archaeological Inventory Survey
Hammatt et al.	2005	Kiahuna Golf Village and KMP Development Project Parcels in Approximately 400 Acres at Kōloa Ahupua'a	Archaeological Inventory Survey & Data Recovery
Hill, Dockall and Hammatt	2005	10.6-Acre Parcel at Kōloa Ahupua'a, TMK: (4) 2-8-15: 43, 44, 82	Archaeological Inventory Survey
Hill, Tulchin, Tulchin and Hammatt	2005a	8.633 Acre Parcel at Kōloa Ahupua'a, TMK: (4) 2-8-014: 001 *Mauka* Portion	Archaeological Inventory Survey
Hill, Tulchin, Tulchin and Hammatt	2005b	9.348-Acre Parcel Kōloa Ahupua'a, TMK: (4) 2-8-009: 001	Archaeological Inventory Survey
Tulchin and Hammatt	2007	SIHP No. 50-30-10-0362, at the proposed Starwood Vacation Ownership Development Project, Kōloa Ahupua'a, TMK: (4) 2-8-015: 43, 44, & 82	Data Recovery
Tulchin Hammermeister and Hammatt	2007	10-Acre Knudsen Trust Parcel, Kōloa Ahupua'a, TMK: [4] 2-8-011:001	Archaeological Inventory Survey
Simonson et al.	2009	a portion of the Eric A. Knudsen Trust Lands, Kōloa Ahupua'a, (TMK: (4) 2-8-014:019 por.)	Data Recovery Report

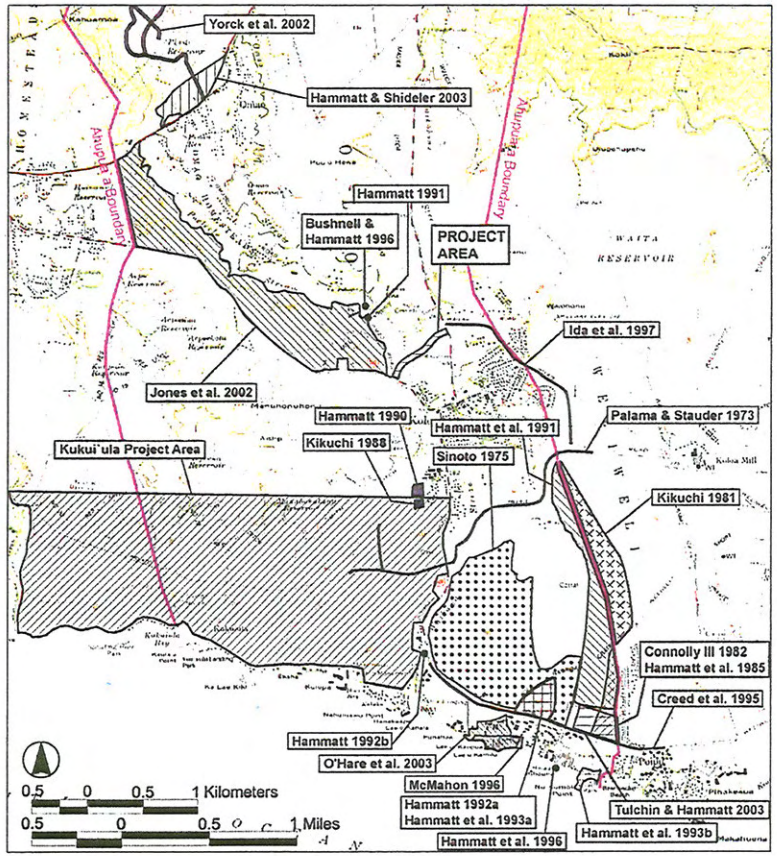

Figure 12. Previous archaeological studies in the vicinity of the project area

Hammatt et al. (1978) reported on a general survey of 460 acres for the (then) proposed Kīahuna Golf Village located on the east side of Waikomo Stream and Po'ipū Road. The Kīahuna survey recorded 583 archaeological sites, including 175 stone enclosures and 108 stone house platforms, some of which are clustered as family compounds. The water channels (*'auwai*), ponded fields, terrace plots, and mound fields all indicate extensive wet- and dry-land agriculture. The water source for this highly integrated agricultural system was Waikomo Stream, which was tapped upstream. Additional sites included 10 occupation caves and a *heiau*.

Kikuchi (1981) conducted a reconnaissance survey of Weliweli Tract in the *ahupua'a* of Weliweli, abutting the *ahupua'a* of Kōloa. The survey documented the railroad causeway, which "historically connected the Kōloa Sugar Mill to Kōloa Landing" (Kikuchi 1981:2), *'auwai*, walls, terraces, alignments, and habitation sites. Kikuchi concluded that these traditional sites were likely part of the KFS in the adjacent Kīahuna.

Connolly (1982) conducted a reconnaissance survey of 310 acres in the *ahupua'a* of Kōloa and Weliweli in 1982 for the Kōloa-Po'ipū Bypass Road. Connolly documented numerous wall remnants, a few rock mounds, a hole, two site complexes, a railway causeway, and an enclosure.

Ching (1983) conducted a reconnaissance survey and historical investigation of parts of Kōloa and Lāwa'i Ahupua'a. Ching showed that three-fourths of the study area was bulldozed and rocks re-located; however, remnants of walls, *lo'i*, *'auwai*, flumes, terraces, *kula* and an historic railroad berm were still discernable. These remnants are evidence of the expansiveness of the KFS.

Landrum (1984) conducted a reconnaissance survey of more than 200 acres in Kukui'ula, and concluded the area was once part of an extensive irrigated agricultural complex developed in the prehistoric period with superimposed historic-era occupation (Landrum 1984:24).

Hammatt et al. (1985) conducted a survey with subsurface testing for the proposed Kōloa-Po'ipū Bypass Road, which extends 9,000 ft. along the boundary of Kōloa and Weliweli Ahupua'a. A total of 47 archaeological features were located along the corridor, concentrated at the *makai* / southern end of the corridor.

Kikuchi (1988) conducted a reconnaissance of the former Pa'anau Sugar Camp, located just *makai* / south of the present day Kōloa Elementary School, and recorded a number of cement foundations, ditches, and portable historic artifacts.

Hammatt (1991) carried out an archaeological reconnaissance for a proposed waterline stream crossing of Pō'ele'ele Stream noting extensive modern land modification and no significant findings.

Hammatt et al. (1991) conducted an archaeological inventory survey of 160 acres within Kōloa, along the Kōloa-Weliweli *ahupua'a* boundary, documenting a total of 75 sites associated with the KFS.

Hammatt et al. (1993) conducted an archaeological inventory survey with limited subsurface testing of 7.6 acres (TMK 2-8-14:30) in the Kīahuna area, *mauka* of Po'ipū Road. Results included remnants of traditional *'auwai*, walls, fields, enclosures and habitation platforms, parts of the vast KFS.

Hammatt et al. (1993) conducted an archaeological assessment with subsurface testing and monitoring at Po'ipū Beach Park in the *ahupua'a* of Kōloa. Wave action during Hurricane 'Iniki in 1992 had exposed a cultural layer (SIHP No. 50-30-10-745) that needed to be preserved and monitored during the reconstruction and restoration of the park. Auger testing revealed charcoal, and both traditional and historic midden and artifacts (i.e., basalt flakes and fragments, nails, glass, *kukui* shells, and mollusk shells). A cemetery (SIHP No. 50-30-10-1871), located in the middle of Po'ipū Beach Park, and other sections of the buried cultural layer beneath the park, were also monitored during the removal of several cement slabs, remnants of a pavilion, picnic tables, and barbecues. The rich cultural layer, supported by radiocarbon dating, indicates that this shoreline occupation is contemporaneous with the development of the KFS. According to Hammatt et al. (1993:65-66), this cultural layer is the "single largest coastal beach deposit in the *ahupua'a* of Kōloa."

Creed et al. (1995) conducted an archaeological inventory survey within a 1.4-mile corridor along Po'ipū Road (TMK 2-8-015, 016, 017 & 018) in the *ahupua'a* of Kōloa and Weliweli. Three sites, including enclosures, a terrace, and the Kōloa-Weliweli boundary wall, survived previous bulldozing of the area and were understood as components of the KFS.

Hammatt et al. (1996) conducted an assessment survey of an exposed cultural layer in undisturbed sand deposits at Waiohai Hotel. This layer was disturbed by high wave action during Hurricane 'Iniki that completely destroyed the associated reconstructed Kiha Houna Heiau (SIHP No. 50-30-10-80). According to the authors, the exposed cultural layer supports the potential existence of widespread intact cultural areas along the general shoreline.

Hammatt et al. (1998) reported on data recovery of the Kukui'ula Planned Community Project Phase 1 area encompassing approximately 219 acres. This extensive project included a total of 212 excavation units (212 m^2) and 14 backhoe trenches at 20 different sites. Recovered material included large quantities of midden (approximately 23.7 kg) and a wide variety of historic items (n = 8,043) and traditional artifacts (n = 2,592). Radiocarbon dates range from circa A.D. 1050 to the present. The earliest date comes from the habitation/burial cave SIHP No. 50-30-10-1927A.

Hammatt et al. (1999) reported on data recovery work just *makai* and southwest of Kōloa Town on the west side of Waikomo Stream in the northeastern portion of the Kukui'ula Planned Community Phase II Area. The study area is comprised of approximately 33 acres. Excavations yielded 264.8 g. of midden; 53 indigenous artifacts (including 43 volcanic glass flakes, 9 basalt flakes, and one coral manuport); and 877 late-historic artifacts (e.g. glass, metal, ceramics, plastic, leather, and slate).

Jones et al. (2002) conducted an archaeological inventory survey with subsurface testing on an approximately 260-acre parcel (TMK 2-7-003:005) along Pō'ele'ele Stream at 'Ōma'o just seaward of Kaumuali'i Highway. Two sites were identified: terrace remnants of LCA 3229 awarded to Eke 'Opunui, and a sugar-plantation irrigation ditch. Two carbon dates are reported of circa A.D. 1010 - 1180 understood to shortly predate wall construction.

Section 4 Results of Fieldwork

4.1 Previous Survey (Tulchin and Hammatt 2003)

The previous archaeological inventory survey of the main proposed road corridor at the subject project area (Tulchin and Hammatt 2003) noted the presence of dense vegetation (including guinea grass) that made for relatively poor visibility (Figure 13). No historic properties were documented during the previous survey work, and none are believed to exist in the area of likely impact. Any indigenous activity that could have been observed probably would have been destroyed during the years when much of this portion of Kōloa was used for sugar cane cultivation.

Areas of former sugar cane cultivation, now densely covered in grass, included all lands in the project area north of 'Ōma'o Stream, and the northern portion of the area south of 'Ōma'o Stream. In all, approximately two-thirds of the project corridor was determined to be formerly under sugar cane cultivation. Pedestrian sweeps through the dense grass exemplified the extensive land modification associated with sugar cane cultivation. The area was thoroughly graded and no surface stones were located within the former sugar cane lands. Cleared dirt roads and barbed wire fences were found throughout the project area, associated with the current usage of the land as pasture.

At the time of the prior survey, the southwestern portion of the project area was being utilized as a banana plantation and nursery for the cultivation of ornamental plants (Figure 14). A covered shed, trailer, and farm equipment associated with the agricultural endeavor were observed in the banana plantation area. A small concrete and iron dam, associated with sugar cane cultivation, was located in a ditch running through the plantation area but was not regarded as a historic property more than fifty years old.

The central portion of the project area was characterized by the presence of 'Ōma'o Stream. The main stream channel was bordered along its northeastern edge by a wide marsh / wetlands area (Figure 15). The stream bank was relatively steep and generally elevated approximately 5-15 ft (1.5-4.5 m) above the stream water level.

4.2 Supplemental Field Check

The recent supplemental field check confirmed the results of the previous archaeological inventory survey. No historic properties were observed in the five additional small areas, and none are believed to be present in subsurface deposits given the long history of ground disturbance in this area. Four of the five additional small areas are narrow slivers along established roadways (Maluhia and Kōloa Roads), and it is likely that subsurface disturbance associated with road-bed preparation has completely obliterated any intact subsurface deposits. The fifth small area linking 'Ōma'o Road with the main proposed road corridor of the Northern Leg of the Western Bypass Road project is devoid of any significant surface structures or sites. Of note was the presence of an earthen ditch running parallel to 'Ōma'o Road (Figure 16). A review of historic documents as well as its proximity to and orientation with 'Ōma'o Road

Figure 13. Former sugar cane lands, northern portion of the project area; view to northeast

Figure 14. Southern portion of the project area showing cleared agricultural lands currently under banana and ornamental plant cultivation; view to southeast

Figure 15. Marsh / wetlands area along northeastern edge of 'Ōma'o Stream; view to northeast

Figure 16. Earthen ditch along eastern edge of 'Ōma'o Road, view to northwest

indicate that the ditch is not associated with historic sugar agriculture but rather functions as a drainage for the existing road.

Section 5 Cultural Background Study

5.1 Prior Assessment (Chiogioji and Hammatt 2003)

Hawaiian legends and traditions celebrate Kōloa Ahupua'a's taro lands. Archaeological investigations have documented, *makai* (seaward) of the project area, widespread habitation and intensive irrigated agriculture in central and coastal Kōloa utilizing the opportunity to develop an extensive irrigated complex (the Kōloa Field System) off of Waikomo Stream. In the portion of Kōloa Ahupua'a that includes the main proposed road corridor of the Northern Leg of the Western Bypass Road project, it is likely that pre-contact and early post-contact indigenous Hawaiian activities included cultivation of patches of sweet potato, *pia*, and *wauke* and the gathering of *hala*, *kukui* and other upland resources. Taro cultivation may have also occurred along the section of Ōma'o Stream which bisects the main proposed road corridor.

Beginning in the 19th century and continuing throughout most of the 20th century, the main proposed road corridor of the Northern Leg of the Western Bypass Road project was under continuous cultivation of sugar cane by a succession of commercial interests that included Kōloa Sugar Company, Grove Farm, and McBryde Sugar Company.

Three *kama'āina* former sugar company employees interviewed during the 2003 Chiogioji and Hammatt cultural impact assessment reported that, during the decades of their work within the main proposed road corridor, no traditional trails, no historic sites, no sacred sites, and no burials were observed. None knew of any traditional place names associated with the proposed road corridor. All three interviewees reported no ongoing traditional gathering or hunting practices occurred within the proposed road corridor – the establishment of private plantation property precluding access to the area by non-plantation personnel.

Based on the above findings, it is recommended that no further formal cultural impact mitigation measures are warranted.

It should be noted, however, that subsurface properties associated with former traditional Hawaiian activities in the main proposed road corridor of the Northern Leg of the Western Bypass Road project, such as artifacts and cultural layers, may be present despite the decades of sugar cultivation activities. As a precautionary measure, personnel involved in future development activities in the area should be informed of the possibility of inadvertent cultural finds, and should be made aware of the appropriate notification measures to follow.

5.2 Supplemental Assessment

The present study addresses five very small later additions to the proposed Western Bypass Road Northern Leg project. (the five additional areas combined comprise a supplemental project area of less than one-tenth of one acre).

Previous archaeological studies in the vicinity and *mauka* of the current project area have indicated a lack of traditional Hawaiian sites. Remnants of traditional cultural activities in the vicinity of the present project area have generally eluded archaeological investigation. A major constraint on the development of an archaeological record in the vicinity of the present project

area(s) is the general absence of rock. The silty clay and silty clay loam soils of the vicinity are almost stone-free, and any traditional Hawaiian constructions likely to endure in this environment would have to have been constructed of rock imported from some distance away. In terms of geographical implications for traditional cultural practices it should also be noted that all five of the small study areas are at some distance (200 m or further) from 'Ōma'o Stream (see Figures 1 to 3). Traditional cultural properties and practices would be more probable in closer proximity to the stream.

No evidence of cultural resources or any cultural practices were observed in the five small additional areas during the field work.

The three parties interviewed in the (Chiogioji and Hammatt 2003) Cultural Impact Assessment (Louis Jacintho, Abel Mederios, and Patrick Pavao) for the main project corridor knew of no trails, historic sites, sacred sites, burials, traditional place names or gathering or hunting practices in the area. The interview transcripts make it clear the consulted parties were asked about the general area (and not just the initial corridor per se). They did offer the opinion that the project area may have been one of the earliest areas of Kōloa to have been planted in commercial sugarcane cultivation – possibly as early as the 1830s.

The additional research conducted in this supplemental study confirms that the proposed project will have no adverse impact on any archaeological sites, historic properties, traditional cultural properties, or practices.

Section 6 Summary and Recommendations

No archaeological sites were identified in the project area or vicinity. No further work is recommended for the proposed Northern Leg of the Western Bypass Road project corridor. Extensive land modification associated with both sugar cane cultivation and the establishment of a macadamia nut / banana farm appears to have greatly impacted the area.

Construction of the road right-of-way and related infrastructure is anticipated to have "no effect" on historical properties. As always, if in the unlikely event that any human remains or other significant subsurface deposits are encountered during the course of development activities all work in the immediate area should stop and the State Historic Preservation Division should be promptly notified.

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KAHOOLAWE ISLAND RESERVE COMMISSION
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STATE PARKS

March 19, 2010

Mr. David Shideler
Cultural Surveys Hawai'i
P. O. Box 1114
Kailua, Hawai'i 96736

LOG NO: 2010.0656
DOC NO: 1003NM44
Archaeology

Dear Mr. Shideler:

SUBJECT: 6E-42 Historic Preservation Review–
SupplementalArchaeological Assessment and Cultural Background Study
For Kukuiula's Western ByPass Road Northern Leg Project
Koloa Ahupua'a, Koloa district, Kaua'i Island, Hawai'i
TMK: (4) 2-7-003: 002 portion 2-8-006: 001

Thank you for providing us the opportunity to review this Archaeological Assesment Report (AA), (*Archaeological Assessment and Cultural Background Study For Kukuiula's Western ByPass Road Northern Leg Project, Koloa Ahupua'a, Koloa District, Kauai Island, Hawai'i, TMK: (4) 2-7-003; 002 por and 2-8-006: 001 [Shideler and Hammatt PhD, October 2010]*) which we received March 11, 2010. The assessment covered 1/10 of an acre. No historic properties were found.

This project is the for Bypass road. The land was extensively modified during the sugar plantation and therefore no subsurface testing was warranted. No further archaeological is needed for this project. We concur with this assessment.

This report is accepted and it meets the minimum requirements for compliance with the Hawaii Administrative Rules (HAR) §13-13-276 *Rules Governing Standards for Archaeological Inventory Studies and Reports.*

Please send a copy of this review letter and a text-searchable PDF version on CD to the attention of the "SHPD Library" at the Kapolei SHPD office.

Please contact me at (808) 692-8015 if you have any questions or concerns regarding this letter.

Aloha,

Nancy A. McMahon

Nancy A. McMahon (Deputy SHPO),
Archaeology and Historic Preservation Manager

Appendix H

Cultural Impact Assessment
Prepared by
Cultural Surveys Hawaii, Inc.
November 2003

CULTURAL IMPACT ASSESSMENT OF THE PROPOSED NORTHERN LEG OF THE WESTERN BYPASS ROAD, KŌLOA *AHUPUA'A*, KONA DISTRICT, ISLAND OF KAUA'I

(TMK 2-7-3:2)

by

Rodney Chiogioji, B.A.

and

Hallett H. Hammatt, Ph.D.

Prepared for

Kukui 'Ula Development Company (Hawaii) LLC.

by

Cultural Surveys Hawai'i, Inc.

November 2003

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I. INTRODUCTION

A. Project Background

At the request of Kukui 'Ula Development Company (Hawaii) LLC., Cultural Surveys Hawai'i, Inc. has conducted a cultural impact assessment for the proposed Northern Leg of the Western Bypass Road project. The project area consists of a 2,150 ft. (840 m) long by 200 ft. (60 m) wide corridor running northeast to southwest from Maluhia Road, near the intersection of Ala Kinoiki Street., to Kōloa Road, near the intersection of 'Ōma'o Road (Figures 1&2). The Northern Leg of the Western Bypass Road project consists of grubbing and grading for the construction of an approximately 100 ft. (30 m) wide road corridor, including a bridge crossing 'Ōma'o Stream.

The purpose of this cultural impact assessment is to consider the effects the proposed Northern Leg of the Western Bypass Road project may have on native Hawaiians, their culture and their right to practice traditional customs. The Hawai'i State Constitution, Article XII, Section 7 protects "all rights" of native Hawaiians that are "customarily and traditionally exercised for subsistence, cultural and religious purposes."

The suggested "Guidelines for Assessing Cultural Impacts" issued by the Office of Environmental and Quality Control (OEQC) discuss the types of cultural resources, practices and beliefs that might be assessed. The Guidelines read:

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man-made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

The primary focus of this assessment is the specific Northern Leg of the Western Bypass Road project area. However, the assessment also considers cultural resources, practices and beliefs within the broader context of Kōloa that are relevant to assessing the role of the project area within the Kōloa landscape.

B. Scope of Work

The following Scope of Work (SOW) was followed to satisfy requirements related to Hawaiian customary and traditional rights and their applicability to the Kōloa bypass road project area:

1) Examination of historical documents, Land Commission Awards, historic maps, and oral histories with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal and other resources or agricultural pursuits as may be indicated in the historic record.

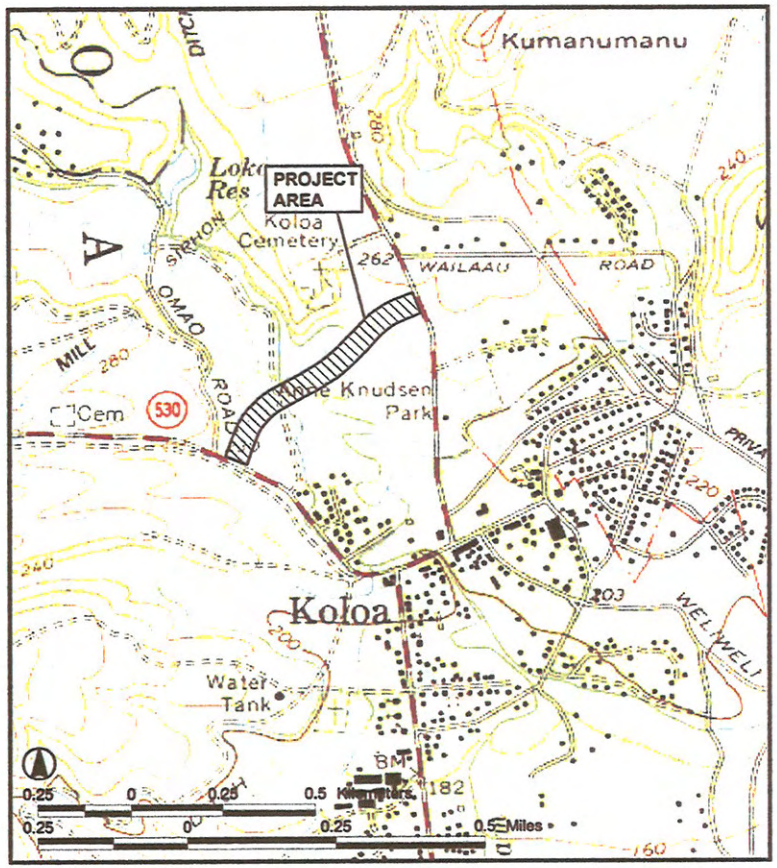

Figure 1 Portion of USGS Topographic Map, Kōloa Quadrangle, Showing the Location of the Project Area.

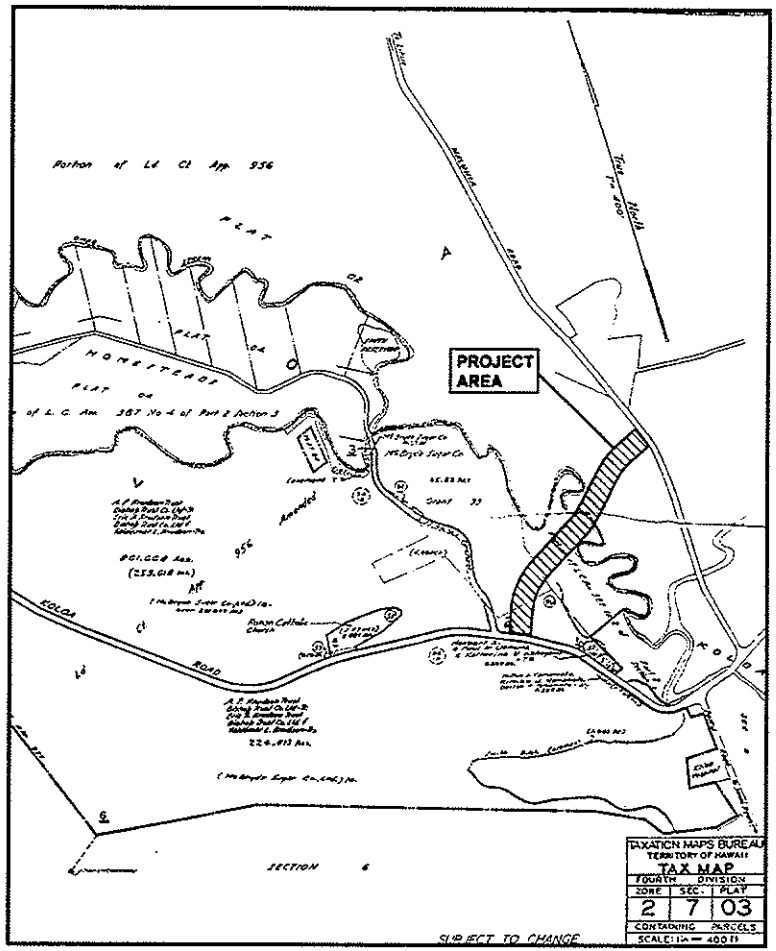

Figure 2 Portion of TMK 2-7-03, Showing the Location of the Project Area.

2) A review of the existing archaeological information pertaining to the sites in the vicinity as they may allow us to reconstruct traditional land use activities and identify and describe the cultural resources, practices and beliefs associated with the project area and identify present uses, if appropriate.

3) Conduct oral interviews with persons knowledgeable about the historic and traditional practices in the project area.

4) Preparation of a report on items 1-3 summarizing the information gathered related to traditional practices and land use. The report will assess the impact of the proposed action on the cultural practices and features identified

C. Methods

Historical documents, maps, and photographs were researched at: the Kaua'i Historical Society, the Hawai'i State Archives; the Survey Office of the Department of Accounting and General Services; the Hawai'i State Library; the Bernice Pauahi Bishop Museum archives and library; Hamilton Library at the University of Hawai'i at Mānoa; the Mission Houses Museum Library; the State Historic Preservation Division (SHPD) library; and the library of Cultural Surveys Hawai'i.

Hawaiian organizations, government agencies, community members and cultural and lineal descendants with ties to Kōloa were contacted to: (1) identify potentially knowledgeable individuals with cultural expertise and knowledge of the project area and the surrounding vicinity, and (2) identify cultural concerns and potential impacts within the project area. A discussion of the community contact process is presented in Section VI.

D. Identification of Knowledgeable Interview Informants

Based on recommendations from organizations and the community, three *kama'āina* were identified with whom interviews were conducted. The three interviewees were: Louis Jacintho, Abel Medeiros, and Patrick Pavao. All of the interviewees have knowledge of the bypass road project area as former Kōloa sugar plantation employees. Two of the interviewees – Louis Jacintho and Abel Medeiros – also recall the project area during their childhood years in the 1920s. Interview summaries and transcripts are presented below in Section VII.

E. The Interview Process

Once potential participants were identified, they were contacted by telephone or in person. If the individual expressed a willingness to participate, an appointment was scheduled at a location of the individual's choosing. Following the interview's completion, it was transcribed. The interviewees were given the opportunity to review the typed transcript for corrections, editing and additions.

II. TRADITIONAL AND LEGENDARY ASSOCIATIONS OF KŌLOA *AHUPUA'A*

Kōloa was a particularly important *ahupua'a* in traditional Hawaiian times. That at least fourteen *heiau* of varying sizes and functions have been documented in the Kōloa area (Thrum 1907, Bennett 1931) and the association of legendary-historic figures such as Kawelo and Aikanaka with the *heiau*, suggests a heightened cultural richness of the *ahupua'a*.

Further confirmation of a rich traditional life within Kōloa is the presence of a *hōlua* slide on the slopes of Pu'u o Hewa in the *mauka* reaches of the *ahupua'a* and by the myriad legends attached to Maulili Pool, a sacred place once located in the present Kōloa Town. J. K. Farley (1907) describes the pool and its legendary associations:

> The pool of Maulili, on Waikomo stream...is a few hundred feet south of the Maulili road bridge. The gods Kāne, and his brother, Kanaloa, are said to have once slept above it, on its eastern bank and left the impress of their forms as can be seen in the *apapa*...The *apapa* in this vicinity is called an *'Umu'* and a *'Heiau,'* but was never walled in, it is said. [This *heiau* may be the Maulili Heiau described by Makea above.] On the nights of Kāne the drums are heard to beat there, also at the sacred rocks, or *umu's*, of Opuokahaku and Kānemilohae, near the beach of Po'ipū...
>
> In the Maulili pool lived a large *Mo'o*, named 'Kihawahine'...The eastern wall of the pool, just below the resting places of Kāne and Kanaloa, for a short distance, only, is called the 'Pali of Kōloa.' The District of Kōloa is named for this *Pali*, we are told by old Hawaiians. To the south of the Pali o Kōloa, in the wall is a rock named 'Waihanau'...as one of their *meles* has it:
>
> *"Aloha wale ka Pali o Kōloa,*
>
> *Ke Ala huli i Waihānau e, hānau."*
>
> To the south of Waihānau is a projecting rock named 'Ke elelo o ka Hawai'i' -- the tongue of Hawai'i, said to have been wrested and brought from Hawai'i by the Kaua'i warrior Kawelo, of Wailua.
>
> At the southern end of the Maulili pool started two large *'auwai's*, that watered the land east and west of Kōloa (Farley 1907:93).

Thus, this sacred legend-imbued locus was the source that gave life to the lowland taro patches of Kōloa. These special associations would not have been lost on the Hawaiians of Kōloa who were dependent upon those waters.

III. CULTURAL AND HISTORICAL DOCUMENTATION OF KŌLOA *AHUPUA'A*

A. Historical Setting: Pre-Contact Kōloa

The project area is in the *ahupua'a* of Kōloa in the Kona District on the island of Kaua'i. Few records exist that document traditional Hawaiian life in the *ahupua'a* of Kōloa. While settlement by westerners with religious and commercial interests make the area a focus of documentation after the first quarter of the nineteenth century, the accounts generated generally focus on the lives and concerns of the westerners themselves with only anecdotal references to the Hawaiian population. Two nineteenth century documents (Boundary Commission Testimony of 1874 and a Lahainaluna manuscript of 1885), however, did provide two Hawaiians an opportunity to speak for themselves and thus offer a possible insight into the life of Kōloa before the arrival of westerners.

A dispute over the northern boundary of Kōloa *Ahupua'a* in 1874 led to a hearing before Duncan McBryde, the Commissioner of Boundaries for Kaua'i. One native witness, Nao (who describes himself as born in Kōloa but presently living in Ha'ikū), in order to show that Hoaea (the area in dispute) was indeed at the northern boundary of Kōloa, testifies: "At Hoaea tea [sic] leaves were hung up to show that there were battles going on" (Boundary Commission, Kaua'i, vol. I, 1874:124). That there was a traditional "warning system" --well-known to all natives--suggests that Kōloa, throughout its history, may well have been the scene of some serious conflicts--serious enough and perhaps often enough to warrant devising such a system.

Additional evidence of a rich history within Kōloa is offered in a Lahainaluna document produced eleven years later. This document appears to be based on an oral historical project. On September 7, 1885 a student from Lahainaluna Schools (HMS 43 #17) interviewed Makea – "a native who is well acquainted with Kōloa" -- and recorded "what she said about the well-known places in the olden times." More than sixty-four years after the abolition of the *kapu* system and almost as many years of contact with westerners, Makea was able to describe in detail fourteen *heiau* within the Kōloa area; for example:

> Maulili was the first *heiau* of south Kōloa. Kapulauki was the first chief of Kōloa, Kiha came next. That is the chief I know of. He was a ruling chief of Kaua'i in the olden days, when the *heiau* was standing there. It had already been built and men had been sacrificed on its altars. This Kiha was called Kiha-of-the-luxuriant-hair. Another name for him was Kakae and another was Ka-pueo-maka-walu (Right-eyed-owl).
>
> This *heiau* was also famous for this reason -- it was the first *heiau* to which Kawelo was carried after he had swooned in Wahiawa, in the battle where stones were used as missiles.
>
> The location of this *heiau* was not known, but a deaf mute knew and it was he who pointed it out to the chiefs, and that is how it was rediscovered in the olden days.

> Kiha lived on the eastern side of the *heiau* and Aikanaka lived on the northeastern side. This chief, Aikanaka, was the one with whom Kawelo fought and he was the owner of this *heiau* at that time.

B. Early Historic Period

Accounts by visitors and settlers at Kōloa Ahupua'a focus on these westerners' own concerns--religious and commercial--as these concerns appropriate the historical record of Kōloa in the 1800's. However, scattered throughout the accounts are occasional references to the Hawaiians of the *ahupua'a*, which may give some insights into their lives.

The American Board of Commissioners for Foreign Missions (ABCFM) missionary Samuel Whitney described, in an article in the *Missionary Herald* (June 1827:12), a visit to Kōloa with Kaikio'ewa, the governor of Kaua'i, in 1826:

> The people of this place were collected in front of the house where the old chief lodged in order to hear his instructions. After a ceremony of shaking hands with men, women, and children they retired...
>
> Our company consisted of more than a hundred persons of all ranks. The wife of the chief, with her train of female attendants, went before. The governor, seated on a large white mule with a Spaniard to lead him, and myself by his side, followed next. A large company of aipupu, [*'ā'īpu'upu'u*] cooks, attendants came on in the rear (p. 284).

Whitney's account suggests something of the deference paid to the *ali'i* by the local populations and the scale at which the *ali'i* carried out their functions. An even grander view of that deference is provided in an account of a later visit by an *ali'i* to Kōloa. John Townsend, a naturalist staying in Kōloa in 1834, described a visit by Kamehameha III (In Palama and Stauder 1973:18):

> In the afternoon, the natives from all parts of the island began to flock to the king's temporary residence. The petty chiefs, and head men of the villages, were mounted upon all sorts of horses from the high-headed and high-mettled California steed, to the shaggy and diminutive poney [sic] raised on their natives hills; men, women, and children were running on foot, laden with pigs, calabashes of Poe [sic], and every production of the soil; and though last certainly not least, in the evening there came the troops of the island, with fife and drum, and 'tinkling cymbal' to form a body guard for his majesty, the king. Little houses were put up all around the vicinity, and thatched in an incredibly short space of time, and when Mr. Nuttall, and myself visited the royal mansion, after nightfall, we found the whole neighborhood metamorphosed; a beautiful little village had sprung up as by magic, and the retired studio of the naturalists had been transformed into a royal banquet hall... (In Palama and Stauder 1973:18)

On December 31, 1834, Peter Gulick and his family arrived in Kōloa. Apparently the first foreigners to settle in the *ahupua'a*, they initiated the process of rapid change that would re-shape the life of Kōloa in the nineteenth century. In 1835, a 30 by 60 ft. grass house was erected

as a meeting house and school (probably located at Kōloa Town). Mr. Gulick initiated sugar cane cultivation and collected a cattle herd for the Protestant Mission. In 1837, a 45 by 90 ft. adobe church was built (probably at the same ABCFM site) and the first mission doctor, Thomas Lafon, arrived to assist Mr. Gulick (Damon 1931:179, 187). The Kōloa mission station apparently flourished immediately; Charles Wilkes, a member of the U.S. Exploring Expedition visiting Kōloa in 1840, recorded:

> The population in 1840, was one thousand three hundred and forty-eight. There is a church with one hundred and twenty-six members, but no schools. The teachers set apart for this service were employed by the chiefs, who frequently make use of them to keep their accounts, gather in their taxes &c [and for similar tasks]. The population is here again increasing partly by immigration, whence it was difficult to ascertain its ratio (Wilkes 1845:64).

Other sources, however, give different population figures for Kōloa during the first half of the nineteenth century. In 1834, according to a report by missionaries on Kaua'i, the inhabitants of the *ahupua'a* numbered 2,166. An article in the *Pacific Commercial Advertiser* of December 21, 1867 estimated that the population in 1838 was about 3,000 (though, by 1867, it had been reduced to a third of that number). James Jackson Jarves, who visited Kōloa and Kaua'i for nine months during the early 1840's, recorded:

> Kōloa is now a flourishing village. A number of neat cottages, prettily situated amid shrubbery have sprung up, within two years past. The population of the place, also, has been constantly increasing, by emigration from other parts of the island. It numbers, now, about two thousand people, including many foreigners, among whom are stationed a missionary preacher, and physician, with their families (Jarves, 1844:100).

The arrival of "many foreigners" was the cause of, and the native immigration to Kōloa was the result of, the many commercial activities that burgeoned beginning in the 1830's. In 1835, Ladd and Company gained from the king and local chiefs the lease of about one thousand acres at Kōloa for 50 years at $300 a year and "allowed the use of the waterfall and an adjoining mill site at Maulili pool, not far from the thousand acres, together with the right to build roads, the privilege of unrestricted buying and selling and freedom from local harbor dues" (Judd, 1935:57). Ladd and Company was not the first to mill sugar cane in the area: there was a Chinese-operated granite roller mill in operation at Māhā'ulepū, Kōloa, in 1830; it was, however, the first plantation-organized industry in Hawai'i (Damon, 1931:176, 198). Judd notes the following:

> The company was permitted to hire natives to work on the plantation provided they paid Kauikeaouli, the king, and Kaikio'ewa, the governor of Kaua'i, a tax for each man employed and paid the men satisfactory wages. The workers were to be exempt from all taxation except the tax paid by their employers (Op. cit.:57).

Judd further described the revolutionary implication of this arrangement: "The significance of Ladd & Co.'s lease lay in the fact that it was the first public admission by the Hawaiian chiefs that their subjects had rights of personal property backed with a guaranty of protection to that property" (Op cit.:58). Local chiefs, fearful of an usurpation of their power, resisted the company's first efforts to recruit workers, forcing the king's intervention.

Another missionary, Dr. James W. Smith, who was stationed at Kōloa for forty-five years, beginning in 1842, mentioned in his journal a visit to "the school at Kukui'ula." If there was a second school in Kōloa outside the population center of Kōloa Town, Kukui'ula may have warranted the placing of a school there because of a sufficiently large population in the area.

A long-known history of severe flooding in the central flood plain of Kōloa provided an impetus for the native Hawaiians to develop an irrigated field network well off that plain. In a typical Hawaiian valley such as Pō'ele'ele it is difficult to get off the flood plain and in Kōloa a large percentage of homes and agricultural fields are located in the large volcanic terrace *makai* of the project area that is not susceptible to flooding. Thus the extensive *lo'i* network within the *makai* portion of Kōloa may have been, in part, a clearly thought-out use of a fortuitous land configuration to avoid the force of occasional floods that might, elsewhere on the island, have had disastrous effects.

C. Mid-1800's (Land Commission Awards)

The Māhele records of Kōloa give a picture of what had evolved by the middle of the nineteenth century when Kōloa *Ahupua'a*--8,620 acres--was awarded (LCA 7714-B) to Moses Keküāiwa, the brother of Alexander Liholiho (Kamehameha IV), Lot Kapuāiwa (Kamehameha V), and Victoria Kamāmalu. (The awarding of the *ahupua'a* to Keküāiwa was an outcome of an event twenty-five years in the past: the crushing - by forces loyal to Kamehameha II - of the 1824 revolt on Kaua'i when Kaua'i lands were divided up among the chiefs of the other islands.)

Eighty-eight other *kuleana* awards were given to individuals within Kōloa *Ahupua'a*. The majority of these Land Commission Awards (LCAs) were located in or around Kōloa Town itself. This concentration of awards around the town area may reflect both the traditional land settlement pattern, a focus on the resources of Maulili Pool and Waikomo Stream (a permanent stream), and a more recent movement of the populace to the plantation and missionary centers. An 1891 map by M.D. Monsarrat shows the location of these awards (Figure 3).

The only LCA known in the immediate vicinity of the present project area is the parcel along the southwestern portion of 'Ōma'o Stream that was awarded to the American Board of Commissioners for Foreign Missions (ABCFM); this was LCA. 387, No. 2, Part 2, Section 3. This portion of LCA 387 is only a small share of the Commission Award holdings given to the ABCFM on the island of Kaua'i.

D. Late 1800's To Present

Kōloa became the scene of the confrontation of the traditional social structure with commercially-impelled forces of change. The cane growing activity of Ladd and Company would inevitably affect the lives of the inhabitants of the rest of the *ahupua'a*. Traditional settlement patterns (e.g. permanent and temporary habitation interspersed throughout the irrigated agricultural fields near the coastal zone and traditional farming along streams) would have been distorted by a shift to Kōloa Town where sugar cane milling activities were located, and a shift to cash crops other than taro.

Although Ladd and Company would go bankrupt in 1845, its earlier success was an impetus for other entrepreneurial attempts within Kōloa. Silkworm farming, oil extraction from *kukui* nuts,

cigar manufacturing, sago raising, and tapioca manufacturing were all attempted with varied success during the middle third of the nineteenth century.

Another major area of commercial enterprise was associated with the whaling industry at Kōloa Landing. Accounts of visitors suggest that the inhabitants of Kōloa, took advantage of their nearness to the landing to participate in the booming trade of the port. An article in the *Pacific Commercial Advertiser* of Feb. 19, 1857 described the salient characteristics of the port at mid-century and mentions:

> From the landing there is a good carriage road to the town, distant about two miles. Large quantities of firewood, bullocks and sweet potatoes are furnished to whalers in this port, and these chattels can nowhere be procured cheaper or better. It is estimated that 10,000 barrels of sweet potatoes are cultivated annually here, which are thought to be the best on the islands. Nearly all the potatoes furnished for the California market are produced here...Sweet potatoes, sugar and molasses constitute the chief trade of the port.

Kōloa became the official port of entry for Kaua'i in the 1850's and participated in the profitable trade with the whaling industry whose peak years ran from the 1830's to the 1860's. It seems likely the demand for firewood, bullocks, sweet potatoes, sugar and molasses at Kōloa Landing was met to at least some small degree by activities in the *mauka* regions of Kōloa in the vicinity of the present project area. A map of Kōloa by M.D. Monsarrat in 1891 (R.M.1694; Figure 3) shows cane cultivation in the vicinity of the present project area but the extent of cane in this area is uncertain.

Koloa Plantation began a program of developing water storage c. 1904. Clearly the development of the larger reservoirs such as the Waita Reservoir (also known as the Koloa Reservoir and combining the former Hauiki Reservoir and the Marsh Reservoirs) and Alexander Reservoir were not only major engineering feats but were matters of significant social impact involving repeated armed confrontations (Wilcox 1996:77-84). There are several seemingly similar small reservoirs developed within a radius of a couple of kilometers, including: Aepo, Aepoalua, Aepoakolu, Huinawai, Loko, Mauka, 'Ōma'o, Pia Mill, Pinau, and Pu'u o Hewa reservoirs. The development of these modest reservoirs is not well documented in the readily available literature. The 1910 USGS Lihue Quad Map (Figure 4) and the 1912 USGS Topographic Map of the Island of Kaua'i (Figure 5) show most of the reservoirs in the immediate vicinity (including the Huinawai, Loko, Mauka, 'Ōma'o , Pinau, and Pia Mill, reservoirs) already developed. The lands around these reservoirs are understood to have been under sugar cane cultivation in the 1800s.

Kōloa Landing was phased out around 1925 when McBryde Sugar Company and Kōloa Sugar Company began using Port Allen. Soon after, McBryde ceased to use several of the Kōloa fields. It is our understanding, however, that sugar cane was last harvested within the present project area by McBryde in the mid 1990s. The lands on the west side of 'Ōma'o Stream had been under cultivation by McBryde continuously for many decades while the lands of the east side of the stream, owned by descendants of the Knudsen family, were leased by various sugar cane interests including Koloa Sugar, then Grove Farm, and then McBryde. A 1950 aerial photograph of the Kōloa area (Figure 6) shows the majority of the current project area under sugar cane cultivation. The Foote *et al.* soil map ortho-photograph (Figure 7) indicates the

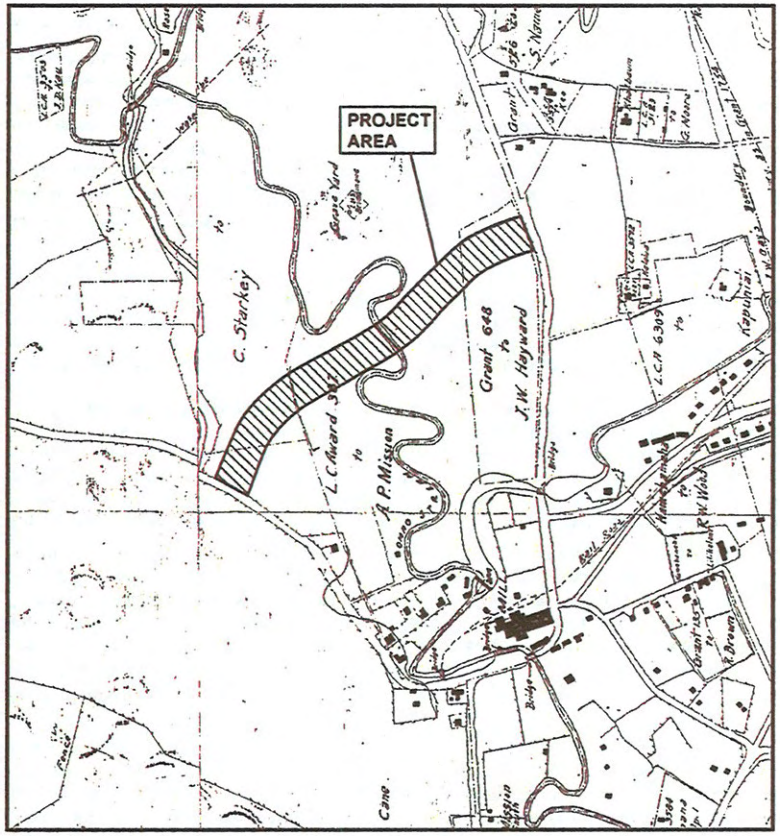

Figure 3 Portion of 1891 Map of Kōloa by M.D. Monsarrat (R.M.1694), Showing the Location of the Project Area.

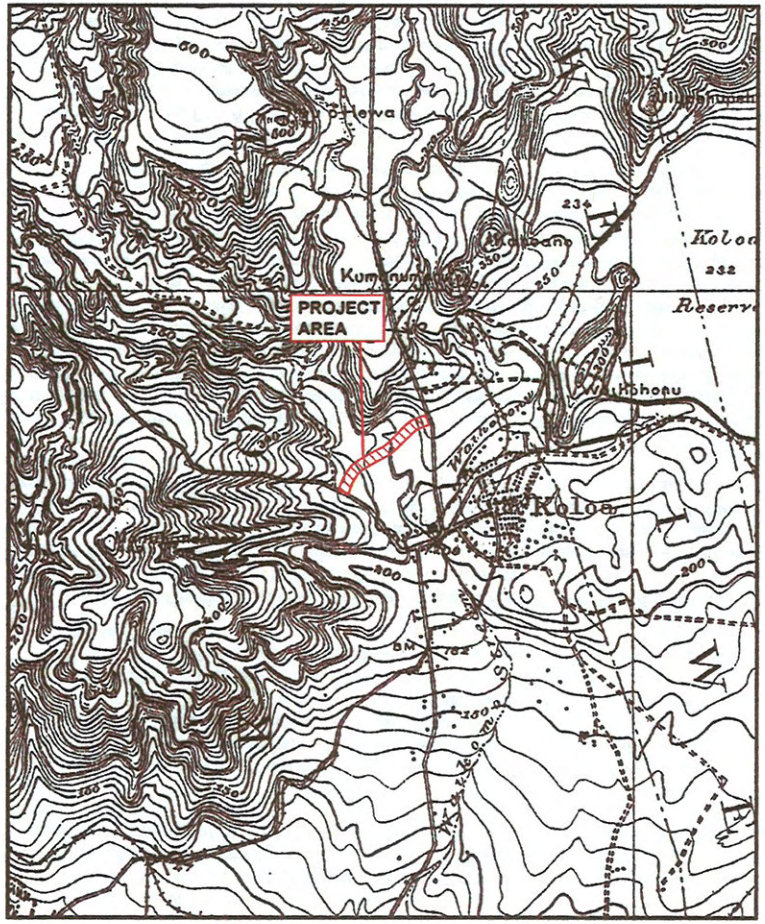

Figure 4 Portion of 1910 USGS Topographic Map, Lihue Quadrangle, Showing the Location of the Project Area.

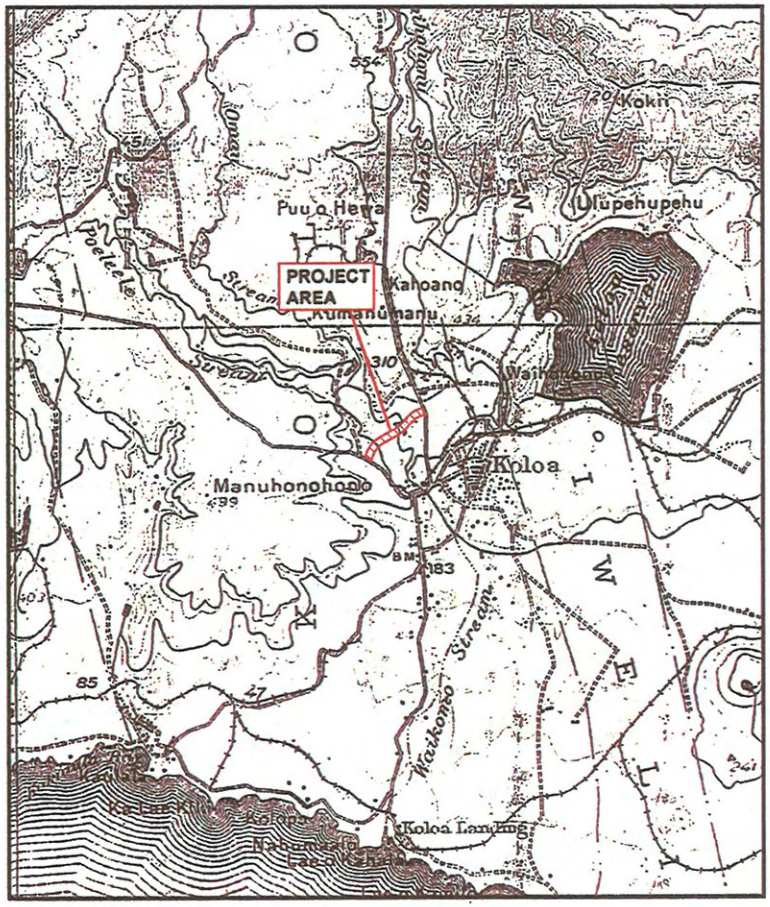

Figure 5 Portion of 1912 USGS Map of the Island of Kaua'i, Showing the Location of the Project Area.

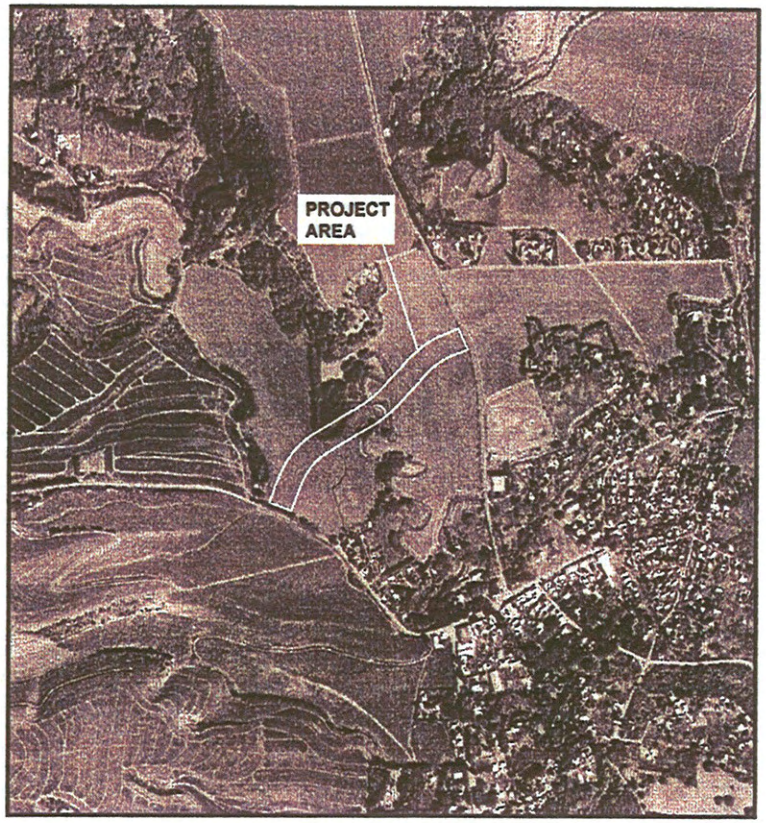

Figure 6 1950 Aerial Photograph Showing Extent of Sugar Cane Cultivation in the Project Area.

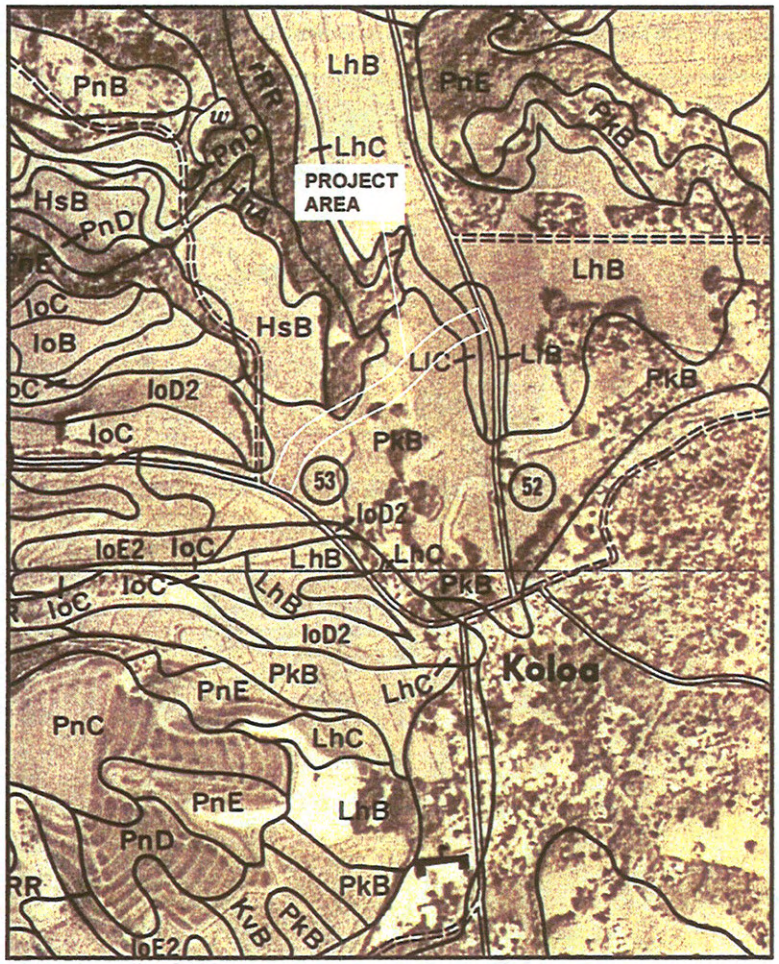

Figure 7 Portion of Soil Survey (Foote et al. 1972) Map Showing Extent of Sugar Cane Cultivation within the Project Area, Circa 1970.

majority of the project area was still in sugar cane c. 1970. Subsequently, these cane lands were abandoned. The southwestern portion of the project area was later converted to a macadamia nut tree farm. Following damage from Hurricane 'Iniki in 1992, the macadamia nut tree farm was converted to its present usage as a banana plantation and ornamental plant nursery. The northeastern portion of the project area is currently used as pasture for horses.

E. Summary of Historical Background

Although much of the seaward portion of Kōloa is a relatively dry area with approximately 30 in. (760 mm) of rain per year, the perennially flowing streams provided a resource for the development of a rather expansive agricultural system. Accounts of the early history of Kōloa (Farley 1907; Jarves 1844; Townsend 1839; and Judd 1935) describe in the lands *mauka* of Kōloa Town a seemingly continuous, well-maintained, agricultural complex of taro, yams, sweet potato, and sugar cane that was irrigated by an extensive *'auwai* system siphoned off of Waikomo and Pō'el'ele streams. This system had a significant influence on later commercial endeavors in Kōloa.

Kōloa is the site of the first organized sugar plantation in Hawaii. Ladd and Company leased about a thousand acres for the sole purpose of growing sugar cane (Palama and Stauder 1973:18, from Judd 1935). The commercialization of sugar cane in Kōloa had widespread social effects. The traditional view of the *'āina* being a responsibility of the *ali'i* was being transformed.

Kōloa Town, and Kōloa Landing, at the mouth of Waikomo Stream, became prominent commercial centers during the mid to late 1800's, exporting a variety of products such as sweet potatoes, sugar, and molasses. Whalers also stopped for provisions of squash, salt, salt beef, pigs, and cattle (Palama and Stauder 1973:20). This heightened activity dramatically altered the social structure and landscape of Kōloa.

Kōloa soon reflected the effects of a traditional social structure in conflict with commercially - impelled forces of change. Traditional settlement patterns (e.g. permanent and temporary habitation interspersed throughout the irrigated agricultural fields near the coastal zone and along streams in the steeper valleys inland) would have been significantly changed by a flux to Kōloa Town where sugar cane milling activities were located. Later land use in the study area (i.e. sugar cane, pasture, macadamia nut farm development, and banana cultivation) also had detrimental impacts on any surviving traditional structures.

IV. ARCHAEOLOGICAL RESEARCH IN KŌLOA *AHUPUA'A*

A. Archaeological Studies

Table 1 presents the archaeological research that has been conducted in Kōloa and vicinity (Figure 8).

The earliest systematic archaeological survey on the Island of Kaua'i was conducted by Wendell Bennett in the late 1920's. Bennett examined and recorded 202 sites on the island. The following are sites recorded within Kōloa Ahupua'a (see Bennett 1931:116-117, 120):

Site 72	Niu Kapukapu Heiau - on the top of Niu Kapukapu Hill on the east bluff of Lāwa'i Valley.
Site 73	Stone work on the hill just in-land from Site 72
Site 74	Fishing shelter on the shore near the mouth of Kukui'ula valley.
Site 75	Kūhiō Park, west of Waikomo Stream with taro patches, a small *heiau*, an oven, paved house platform, fish pond, game ground with seats and a fishing shrine.
Site 76	Salt pans east of Waikomo Stream
[Sites 77-84]	Located east of Kōloa Ahupua'a
Site 85	Walls, enclosures and house sites in the cactus covered country around the Kōloa reservoir and extending to the sea.
Site 86	House site in the area described in Site 85

All of these seven sites are well seaward of the current study area.

William Kikuchi (1963) conducted a general survey of the Kona District of Kaua'i including all *ahupua'a* from Hanapēpē, eastward to Kīpū Kai. Information from Thrum (1907), Bennett (1931), a Lahainaluna School manuscript (1885), and other sources was instrumental in helping to locate major archaeological sites during the field survey. Kikuchi's survey was selective since it was not designed to be a complete inventory, and generally focused on larger or more coastal sites. No sites were noted by Kikuchi in the present study area.

Palama and Stauder (1973) conducted a reconnaissance survey along the route of the then-proposed main cane haul road to the Kōloa mill site. The proposed new section of road extended from Weliweli Road, southwestward across Po'ipū Road, connecting to an existing cane haul road. The section west of Po'ipū Road is approximately 3,000 ft. long with a north/south oriented branch approximately 1,500 ft. long. A total of 18 sites were recorded along the road corridor. All of these sites are south of the present study. Although the Palama and Stauder study was limited in scope to the proposed road right of way, it included a short but thorough historical summary of the place of archaeological sites within the context of the Kōloa and Weliweli *Ahupua'a*. An extensive *'auwai* system was observed east of Po'ipū Road. The following comments on this system and the sites in general are relevant to understanding the archaeological significance of the area as a whole, and the historic processes at work:

Table 1 Archaeological Research in Kōloa and Vicinity

Author(s)	Year	Location	Study Type
Bennett	1931	Kukui'ula Valley, Prince Kūhiō Park	General Survey
Kikuchi	1963	Kona District	General Survey
Kikuchi	1973	Hawaiian Fishponds	General Survey
Palama and Stauder	1973	Cane Haul Road-Kōloa Mill	Reconnaissance Survey
Sinoto	1975	Knudsen Trust Lands	Reconnaissance Survey
Bordner	1977	Kukui'ula 'auwai, Site 50-39-10-1934	Reconnaissance Survey
Hammatt, Bordner and Tomonari-Tuggle	1978	Kīahuna Complex	General Survey
Kikuchi	1979	Sheraton Kauai Hotel	Survey and Subsurface Testing
Connolly	1982	Kōloa-Po'ipū Bypass Road	Reconnaissance Survey
Ching	1983	Kukui'ula-Kualu, Alexander and Baldwin Lands	Reconnaissance Survey
Landrum	1984	Kukui'ula-Kualu, Alexander and Baldwin Lands	Reconnaissance Survey
Hammatt, Borthwick and Shideler	1985	Kōloa-Po'ipū Bypass Road	Survey and Subsurface Testing
Kikuchi	1985	Shoreline Improvements, Waiohai Hotel, Kiha Houna Heiau	Reconstruction
Kikuchi	1988	Pa'anau Sugar Camp	Reconnaissance Survey
Hammatt et al. (Hammatt, Borthwick, Shideler, and Stride)	1988	Kukui'ula Bay Planned Community	Inventory Survey
McMahon	1989	Kaua'i Fishponds	General Survey
Hammatt	1990	Pa'anau Housing Project	Inventory Survey
Hammatt	1991	Pō'ele'ele Stream – Waterline crossing	Archaeological Reconnaissance
Hammatt, Folk, and Stride	1991	Po'ipulani Golf Course	Inventory Survey
Hammatt	1992a	Kīahuna	Inventory Survey
Hammatt	1992b	Po'ipū Road and Lāwa'i Road	Archaeological

Author(s)	Year	Location	Study Type
		Junction	Reconnaissance
Hammatt, Ida and Folk	1993a	Po'ipū Road 7.6-acre Parcel	Inventory Survey
Hammatt et al. (Hammatt, Ida, Folk, Shideler, and Colin)	1993b	Po'ipū Beach Park	Subsurface Testing and Monitoring
Creed, Ida and Hammatt	1995	Po'ipū Road	Inventory Survey
Bushnell and Hammatt	1996	'Ōma'o Bridge, 'Ōma'o Homestead	Archaeological Investigation
Hammatt, Creed, and Ida	1996	Waiohai Resort	Assessment Survey
McMahon	1996	Sheraton Kauai Hotel	Reconnaissance Survey
Ida, Creed, and Hammatt	1997	Po'ipū Bypass Road	Inventory Survey
Hammatt et al.	1998	Kukui'ula Planned Community Phase I	Data Recovery
Hammatt et al.	1999	Kukui'ula Planned Community Phase II	Data Recovery
Jones et al.	2002	260-acre parcel along Pō'ele'ele Stream at 'Ōma'o	Inventory Survey
Yorck, Shideler, and Hammatt 2002	2002	Well Sites and Appurtenances near Piwai Reservoir, Alexander and Baldwin Properties	Inventory Survey
O'Hare, Shideler, and Hammatt	2003	Sheraton Kauai Resort	Archaeological Assessment
Tulchin and Hammatt	2003	Knudsen Trust Lands mauka of Po'ipū Road	Archaeological Assessment

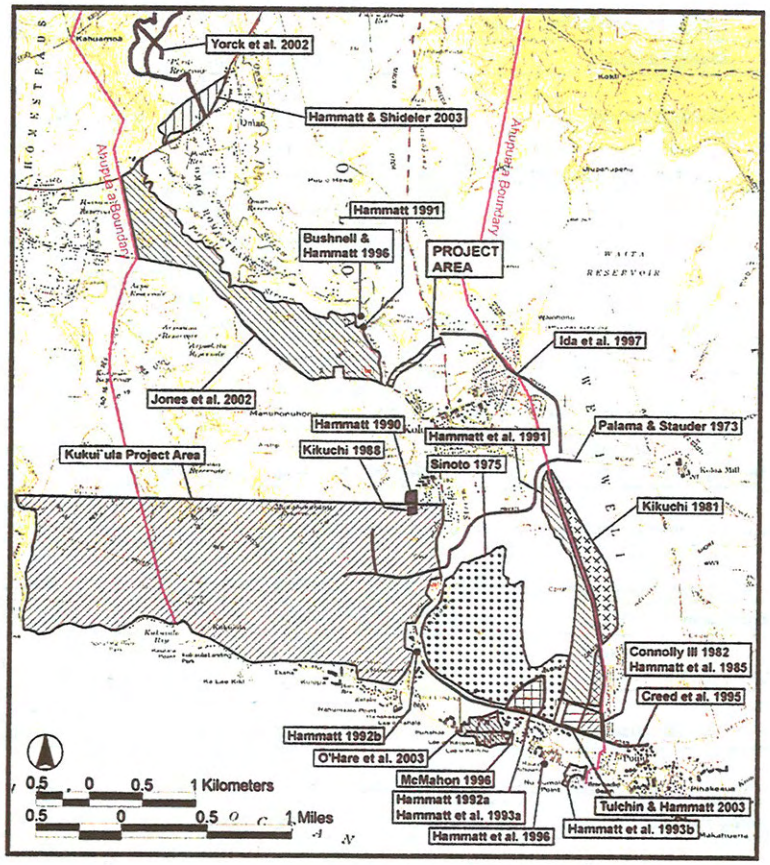

Figure 8 Archaeological Studies in the Vicinity of the Project Area.

> Our reconnaissance revealed that the most significant archaeological feature located within the study area is the extensive *'auwai* system. Remnants of this irrigation system were observed on both sides of the Waikomo Stream. ...[This] network of watering canals proved to be the key to the success of the prehistoric Hawaiian Culture in turning these marginal lands into flourishing wet and dry agricultural fields. From information gathered from local informants and preliminary historical investigation of this area it is evident that the early commercial growers of sugar cane utilized the existing *'auwai* system. Gradually as more and more fields came under sugar cane production these replaced the wet and dry fields of an earlier day. Today the archaeological sites remaining stand as islands as these marginal cane lands were taken out of production and turned into pasture (Palama and Stauder 1973:4).

Bordner and Ching (1977) conducted a one-day reconnaissance survey of a specific *'auwai* located in Kukui'ula and corresponding to the major *'auwai* system assigned State Site # 50-30-10-1934. The *'auwai* traverses Kukui'ula from northeast to southwest and includes a number of associated remnant fields. A portion of this *'auwai*, the raised "aqueduct" type section, is slated for preservation (Bordner and Ching 1977:26).

Hammatt *et al.* 1978, as part of Archaeological Research Center of Hawaii (ARCH), reported on a general survey of 460 acres for the then proposed Kīahuna Golf Village (Hammatt, Bordner, and Tomonari-Tuggle 1978) located on the east side of Waikomo Stream and Po'ipū Road. The Kīahuna survey recorded 583 archaeological sites including 175 stone enclosures and 108 stone house platforms, some of which are clustered as family compounds. The water channels (*'auwai*), ponded fields, terrace plots, and mound fields all indicate extensive wet and dry land agriculture (Hammatt, Bordner & Tomonari-Tuggle 1978:5). The water source for this highly integrated agricultural system was Waikomo Stream which was tapped upstream. Additional sites included 10 occupation caves and a *heiau*.

William Kikuchi (1981) conducted a reconnaissance survey of Weliweli Tract (TMK 2-8-22-06) in the *ahupua'a* of Weliweli, abutting the *ahupua'a* of Kōloa. The survey included the railroad causeway, which "historically connected the Kōloa Sugar Mill to Kōloa Landing" (Kikuchi 1981:2), *'auwai*, walls, terraces, alignments, and habitation sites. Kikuchi states that "the sites...were probably an extension of the vast, prehistoric habitation and agricultural sites of the adjacent Kīahuna (see Hammatt, Bordner & Tomonari-Tuggle, 1978) property" (1981:17)

Connolly (1982) conducted a reconnaissance survey of sections (310 acres) in the *ahupua'a* of Kōloa and Weliweli in 1982 for the Kōloa-Po'ipū Bypass Road. The sites that Connolly encountered were predominantly wall remnants, a few rock mounds, a hole, two complexes, a railway causeway, and an enclosure.

Francis Ching (1983) conducted a reconnaissance survey, and an historical investigation of sections of the *ahupua'a* of Kōloa and Lāwa'i. According to Ching, three-fourths of the study area was bulldozed and rocks re-located, however, remnants of walls, *lo'i*, *'auwai*, flumes, terraces, *kula* and an historic railroad berm were still discernable. These remnants are evidence of the expansiveness of the Kōloa Field System.

James Landrum (1984), of the Bishop Museum, conducted a reconnaissance survey of a 200+ acre portion of Kukui'ula. Landrum recognized that his survey area was once part of an

extensive irrigated agricultural complex developed in the prehistoric period with superimposed historic-era occupation (Landrum 1984:24).

Hallett Hammatt, Douglas Borthwick, and David Shideler (1985) conducted a survey with subsurface testing for the proposed Kōloa-Po'ipū Bypass Road which extends 9,000 ft. along the boundary of Kōloa and Weliweli Ahupua'a. The road corridor was proposed to connect Po'ipū Road (the beach road) to Weliweli Road, southeast of Kōloa Town. A total of 47 archaeological features were located along the corridor. These were concentrated at the *makai* or southern end of the corridor and included the southeastern portion of the "Kīahuna Complex" documented by Hammatt *et al.* in 1978 (see above).

William Kikuchi (1988) conducted a reconnaissance level survey of the former Pa'anau Sugar Camp. The camp was located just *makai* (south) of the present day Kōloa Elementary School. The survey recorded a number of cement foundations, ditches, and portable historic artifacts. Kikuchi states that archaeologically the site is interesting because it contains remnants of an early (1910-1950) plantation camp, even though the vast majority of its structures have been destroyed or removed.

Hallett Hammatt (1990) conducted an inventory survey of a 4.6-acre parcel at the west end of Pa'anau Road, Kōloa. The historical segment of this report indicates the previous existence of the Pa'anau Camp, and a railroad and *'auwai* irrigation ditch which traversed the study area. However, the survey revealed the absence of any traces of pertinent features.

Hallett Hammatt (1991) carried out an archaeological reconnaissance for a proposed waterline stream crossing of Pō'ele'ele Stream noting extensive modern land modification and no significant findings.

Hallett Hammatt, William Folk, and Mark Stride (1991) conducted an archaeological inventory survey of 160 acres within Kōloa along the Kōloa-Weliweli *ahupua'a* boundary. They located, mapped, described, and evaluated a total of 75 sites and observed a wide range of site types. Their survey indicates that the (never built) Po'ipūlani project area was associated with what is referred to as the Kōloa Field System.

Hallett Hammatt (1992a) carried out an Archaeological Inventory Survey of a 3.8 Acre Property at Kīahuna, but the entire parcel had been previously graded and there were no significant findings.

Hallett Hammatt (1992b) carried out an Archaeological Reconnaissance of the Po'ipū Road and Lāwa'i Road Junction, but again there were no significant findings owing to prior land disturbance.

Hallett H. Hammatt, Gerald Ida, and William Folk (1993) conducted an inventory survey, with limited subsurface testing, of 7.6 acres (TMK 2-8-14:30) in the Kīahuna area, *mauka* of Po'ipū Road. Site 3758 was re-mapped, and three new sites were recorded. According to Hammatt *et al.*, these sites are remnants of traditional *'auwai*, walls, fields, enclosures and habitation platforms, and appear to be a part of the larger Kōloa Field System which encompassed over 1000 acres (Hammatt 1993:21).

Hallett Hammatt, Gerald Ida, William Folk, David Shideler and Brian Colin (1993) conducted an assessment survey, subsurface testing and monitoring at Po'ipū Beach Park in the *ahupua'a* of Kōloa. Wave action during Hurricane 'Iniki in 1992 had exposed a cultural layer (Site 50-30-10-745) which needed to be preserved and monitored during the reconstruction and restoration of

the park. Auger testing (1993:11) revealed charcoal, and both traditional and historic midden and artifacts (i.e. basalt flakes and fragments, nails, glass, *kukui* shells, and mollusk shells). A cemetery (State Site 50-30-10-1871), located in the middle of Po'ipū Beach Park, and other sections of the buried cultural layer beneath the park, were also monitored during the removal of several cement slabs, remnants of a pavilion, picnic tables, and barbecues. The rich cultural layer, supported by radiocarbon dating, indicates that this shoreline occupation is contemporaneous with the development of the Kōloa Field System. This cultural layer is the "single largest coastal beach deposit in the *ahupua'a* of Kōloa" (Hammatt *et al.* 1993:65, 66) and greatly contributes to the information bank regarding the cultural development of the Kōloa district.

Victoria Creed, Gerald Ida and Hallett H. Hammatt (1995) report on an inventory survey within a 1.4-mile corridor along Po'ipū Road (TMK 2-8-15, 16, 17 & 18) in the *ahupua'a* of Kōloa and Weliweli. Three sites, including enclosures, a terrace, and the Kōloa-Weliweli boundary wall, survived previous bulldozing of the area and were understood as components of the Kōloa Field System.

Tina Bushnell and Hallett H. Hammatt (1996) carried out an archaeological investigation of 'Ōma'o Bridge in 'Ōma'o Homestead but the only objects of historical interest noted were the existing bridge and features associated with an old railroad.

Hallett Hammatt, Victoria Creed, and Gerald Ida (1996) conducted an assessment survey of an exposed cultural layer in undisturbed sand deposits at Waiohai Hotel. This layer was disturbed by high wave action during Hurricane 'Iniki which completely destroyed the associated reconstructed Kiha Houna Heiau (Site 50-30-10-80). The exposed cultural layer supports the potential existence of widespread intact cultural areas along the general shoreline (Hammatt *et al.*, 1996:39)

Nancy McMahon (1996), at the time an independent archaeological consultant, completed a reconnaissance survey of TMK 2-08-16:3 (8.444 acres), property known as Sheraton Kaua'i in the *ahupua'a* of Kōloa. No surface sites or cultural deposits were reported.

Gerald Ida, Victoria Creed and Hallett H. Hammatt (1997) conducted a reconnaissance survey on a 1.2 mile corridor of a proposed bypass road within the *ahupua'a* of Kōloa and Weliweli (TMK 2-8-02:3, 2-8-03:1, 2-8-04:1, 2-8-05:2) that had previously been bulldozed. This survey did not reveal any archaeological sites, and further study was not recommended.

Cultural Surveys Hawai'i, Inc. (Hammatt, Chiogioji, Shideler, Borthwick, McDermott and Masterson, 1998) reported on data recovery of the Kukui'ula Planned Community Project Phase 1 area encompassing approximately 219 acres. The project included excavations at 20 different sites which encompassed 64 individual features. There was a total of 212 excavation units (212 m^2) and 19 backhoe trenches (only 14 backhoe trenches were chosen for study). Large quantities of midden (approx. 23.7 kg.) and artifacts (10,635 items) were recovered and are reported on. The artifacts include a wide range of types with both indigenous (2,592 items) and historic (8,043 items) represented. Radiocarbon (C14) dates range from ca. A.D. 1050 onward. The earliest date comes from the habitation/burial cave Site 50-30-10-1927A. In addition to the habitation sites and features dated, seven (7) dating samples from agricultural features were also analyzed.

Cultural Surveys Hawai'i, Inc. (Hammatt, Bushnell, Ida, Chiogioji, Creed and Shideler 1999) reported on data recovery work just *makai* and southwest of Kōloa Town on the west side of Waikomo Stream in the northeastern portion of the Kukui'ula Planned Community Phase II Area. The study area is comprised of approximately 33 acres and has been used as a buffer zone between cane lands/pastures and the residential lots bordering Po'ipū Road. While some ten land commission awards lie partially or entirely within the project area, most of these properties were bulldozed in the course of sugar cane cultivation. There were however, areas which appeared undisturbed by sugar cane cultivation or heavy machinery. Excavations were conducted within five archaeological sites (thirteen features).

These excavations yielded 264.8 g. of midden; 53 indigenous artifacts (including 43 volcanic glass flakes, 9 basalt flakes, and one coral manuport); and 877 late-historic artifacts (e.g. glass, metal, ceramics, plastic, leather, and slate). Twelve charcoal samples were dated.

Cultural Surveys Hawai'i Inc. (Jones, Bush, Folk, Chiogioji, Shideler, and Hammatt, 2002) conducted an archaeological inventory survey with subsurface testing on an approximately 260 acre parcel (TMK 2-7-03:5) along Pō'ele'ele Stream at 'Ōma'o just seaward of Kaumuali'i Highway. Two sites were identified, terrace remnants of LCA 3229 awarded to Eke 'Opunui for the cultivation of taro and sugar cane and a sugar plantation irrigation ditch feature. Two carbon dates are reported of ca. A.D. 1010 - 1180 understood to shortly predate wall construction.

Cultural Surveys Hawai'i Inc. (Yorck, Shideler, and Hammatt 2002) conducted an archaeological inventory survey in support of a well sites and appurtenances project including an access corridor in the vicinity of Piwai Reservoir). No significant sites were observed.

Cultural Surveys Hawai'i Inc. (O'Hare, Shideler, and Hammatt 2003) conducted an archaeological assessment of the Sheraton Kaua'i Resort parcel. Although heavily impacted by modern development some traditional surface sites were documented. Historic research indicated traditional agriculture (*lo'i*) quite close to the coast.

Cultural Surveys Hawai'i Inc. (Tulchin and Hammatt 2003) conducted an archaeological assessment of certain Knudsen Trust lands *mauka* of Po'ipū Road. Most of the extensive previously recorded sites were reported to be still intact.

Cultural Surveys Hawai'i. Inc. (Hammatt and Shideler 2003) conducted an archaeological inventory of an approximately 35 acre parcel for the Kaua'i Bible Chuch, just *makai* (south) of the Pīwai Reservoir. No archaeological sites were identified in the project area or vicinity.

B. Archaeology Summary

Archaeological work conducted within the Kōloa district has, until recently, been mostly surface surveys. The Kōloa area began to be documented by subsurface testing of sub-surface cultural deposits within the proposed Kīahuna Golf Course area in 1979. Information gleaned from intensive excavations in the *ahupua'a* of Kōloa, Weliweli, and Pa'a, combined with the inventory surveys in these *ahupua'a*, clearly indicate an expansive irrigated agricultural complex and associated temporary and permanent habitation features. The focus of this integrated Kōloa Field System was Waikomo Stream which was utilized as the main source of irrigation. However, the full extent of the Kōloa Field System is hard to estimate because of the widespread historic land modifications (mainly for sugar cane).

Chronological analysis from the neighboring three *ahupua'a* suggests an early initial occupation within the Pa'a *Ahupua'a* ca. A.D. 535 (Walker and Rosendahl, 1990b:131). No coinciding early dates have been found within Kōloa *Ahupua'a*, since most of the shoreline area of Kōloa has been heavily impacted by commercial, residential, and resort development. Initial occupation probably was characterized by temporary and/or recurrent occupation developed into permanent settlement within an integrated (both irrigated and *kula* or dryland) agricultural system by ca. A.D. 1200 (*Ibid.*). Portions of this Kōloa Field System functioned well into historic times (ca. 1880's) and co-existed with commercial sugar cane cultivation.

Relatively little archaeological study has been conducted in the *mauka* portions of Kōloa *Ahupua'a* (*mauka* of Kōloa Town). Recent archaeological investigations in areas *mauka* of Kōloa Town (Hammatt 1991; Bushnell and Hammatt 1996; Yorck *et al.* 2002; Hammatt and Shideler 2003) noted substantial historic land modification, with no significant archaeological findings. However, the recent Cultural Surveys Hawai'i Inc. (Jones *et al.* 2002) archaeological inventory survey on an approximately 260-acre parcel at 'Ōma'o, immediately *mauka* of the current project area, does indicate the potential of locating pre-contact sites in these heavily modified *mauka* lands o of Kōloa *Ahupua'a*.

V. TRADITIONAL CULTURAL PRACTICES IN KŌLOA *AHUPUA'A* AND THE PROJECT AREA

Reviewing the information provided by the elements of this cultural impact assessment – historical documentation, archaeological research, and kama'āina interviews – there emerges a more detailed picture of the traditional landscape of Kōloa *ahupua'a* and the current project area.

Late 18th-century accounts by European navigators record well-maintained agricultural systems above the southern coast of Kaua'i. The evidence suggests that, by the beginnings of western contact, the Hawaiian inhabitants of Kōloa were well-versed in the agricultural arts, maintaining fields that included taro, sugarcane, and sweet potatoes. The extensive agricultural systems of the region would have supported a substantial population. Even in 1833, following the depredations of diseases and social disruption introduced by decades of western contact, the population of the Kōloa district (from Wahiawa to Kalapaki) was 2,166.

Fourteen heiau in Kōloa were documented in an early oral history project of the 1880s. The range of class and function – including luakini and po'okanaka class heiau, and heiau related to fishing, medicine, and agriculture – illustrate the range of the traditional Hawaiian belief system established in Kōloa.

From previous archaeological studies and historic accounts, it appears that habitation and intensive irrigated agriculture were widespread in central and coastal Kōloa utilizing the opportunity to develop an extensive irrigated complex (the Kōloa Field System) off of Waikomo Stream. Evidence of intensive traditional Hawaiian use of lands *mauka* of Kōloa Town is generally lacking. Previous archaeological studies in the vicinity and *mauka* of the current project area have indicated a lack of traditional Hawaiian sites. As the Judd account given above asserts, it is likely environs like the present project area were used for less intensive cultivation of patches of sweet potato, *pia*, and *wauke* and the gathering of *hala*, *kukui* and other upland resources. Additionally, the section of Ōma'o Stream valley that will be crossed by the proposed bypass road may have included taro *lo'i*.

Remnants of traditional cultural activities in the vicinity of the present project area have generally eluded archaeological investigation. A major constraint on the development of an archaeological record in the vicinity of the present project area is the general absence of rock. The silty clay and silty clay loam soils of the vicinity are almost stone-free, and any traditional Hawaiian constructions likely to endure in this environment would have to have been constructed of rock imported from some distance away.

VI. COMMUNITY CONTACT PROCESS

Throughout the course of this assessment, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge and/or concerns about traditional cultural resources, practices and beliefs specifically related to the Northern Leg of the Western Bypass Road project area. This effort was made by letter, e-mail, telephone or in-person contact. In the majority of cases, letters – along with a map and aerial photograph of the project area – were mailed with the following text:

> At the request of DMB Associates, Inc., Cultural Surveys Hawai'i is conducting a cultural impact assessment of the proposed Northern Leg of the Western Bypass Road project. The project area consists of a 2,750 ft. (840 m) long by 200 ft. (60 m) wide corridor running northeast to southwest from Maluhia Road, near the intersection of Ala Kinoiki Street., to Kōloa Road, near the intersection of 'Ōma'o Road. The Northern Leg of the Western Bypass Road project consists of grubbing and grading for the construction of an approximately 100 ft. (30 m) wide road corridor, including a bridge crossing 'Ōma'o Stream.
>
> We are seeking your kōkua and guidance regarding the following aspects of our study:
>
> 1. General history and present and past land use of the study area.
> 2. Knowledge of cultural sites which may be impacted by the project, for example historic sites, archaeological sites, and burials.
> 3. Knowledge of traditional gathering practices in the study area, both past and on-going.
> 4. Cultural associations with the study area through legends, traditional use or otherwise.
> 5. Referrals of kūpuna or anyone else who might be willing to share their general cultural knowledge of the study area.

Attempts were made to contact eighteen individuals (who are either residents or former residents of the area), cultural organizations and government agencies (see Table 2 below). The organizations and agencies include: the Office of Hawaiian Affairs, the Kaua'i Historic Preservation Review Commission, the Burials Program of the State Historic Preservation Division, and the Culture and History Branch of the State Historic Preservation Division.

Table 2 Community Consultation

Name	Organization	Comments
Ahahui Ka`ahumanu	Hawaiian civic organization	
	Bishop Museum Archives	Provided historic photographs
	Hawai'i State Survey Office	Provided historic maps and documents
Iida, Ron	Royal Order of Kamehameha, Kaumuali`i Chapter No. 3	
Jacintho, Louis		Consented to be interviewed
Kaohi, Aletha	Director, West Kaua`i Visitor Center	
Kapaka-Arboleda, La France	Office of Hawaiian Affairs/Kaua`i Island Burial Council	
	Kaua`i Historical Society	Assisted with maps and historical documentation
	Kaua`i Museum	
Kruse, John	Kaua'i Island Burial Council	
Markell, Ka`iana	Burials Program, State Historic Preservation Division	
McEldowney, Holly	State Historic Preservation Division	
McMahon, Nancy	State Historic Preservation Division, Kaua`i Archaeologist	
Medeiros, Abel		Consented to be interviewed
Pavao, Louis		Consented to be interviewed
Perry, Warren	Royal Order of Kamehameha, Kaumuali`i Chapter 3	
Shigemoto, Tom	A&B Properties	Gave referrals
Tsuchiya, Rick	Kaua`i Historic Preservation Review Commission	

Referrals given by the individuals and organizations contacted resulted in interviews with three *kama'āina* Kaua'i residents – Louis Jacintho, Abel Medeiros, and Louis Pavao – who have personal, long-term knowledge of the project area. Apart from the interviewees, the others contacted made no claim to specific knowledge of traditional cultural resources, practices, beliefs or related concerns within the project area.

VII. *KAMA'ĀINA* INFORMANT INTERVIEWS

Three *kama'āina* informant interviews were conducted for this cultural impact assessment. All three interviewees are former sugar plantation employees with decades-long knowledge of the Northern Leg of the Western Bypass Road project area. Two of the interviewees have recollections of the project area dating back to the 1920s to their childhood years in Kōloa. Presented below are summaries and full transcripts of the interviews. The summaries focus on the information in the interviews most pertinent to land uses and traditional cultural resources, practices and beliefs related to the Kōloa project area.

A. Louis Jacintho

Interview Summary

Louis Jacintho was born in Kōloa's Portuguese Camp in 1924. In 1939 he began working for Kōloa Sugar Company. He continued to work in Kōloa sugar after Grove Farm took over Kōloa Plantation in 1948 and McBryde Sugar took over Grove Farm's lands in 1974. He retired in 1986.

Mr. Jacintho states that the project area was always under cultivation of sugar cane throughout his lifetime. He knows of no traditional trails, no historic sites, no sacred sites, no burials, and no traditional place names related to the project area. He does not recall any ongoing gathering or hunting practices ever attempted in the project area.

Mr. Jacintho speculates that the project area may have been one of the earliest areas of Kōloa to be planted in sugar cane following the establishment of the Kōloa plantation in the 1830s.

Interview Transcript

Louis Jacintho (identified as LJ in the transcript below) was interviewed by Cultural Surveys Hawai'i (CSH) at Kukui'ula, Kaua'i on October 1, 2003.

CSH: Would you tell me something about your background on Kaua'i? When were you born?

LJ: I was born in Portuguese Camp [in Kōloa], where they have Waikomo Subdivision now. 'I was born there December 19, 1924. That was Portuguese Camp. In those days all [the plantation camps] were ethnic. Then I went to Kōloa School. A couple times I went freshman [year] to Kaua'i School. But in those days no more transportation. So eventually I had to give up. So I started working September 1st, 1939 for Kōloa Sugar Company. We did all kinds [of] work, all kinds [of] jobs. All got to do with sugar. Then in 1946 I was a fireman on one of those cane trains. And coming from *mauka*, from Highway 50, in the back of these houses by Wailaau Road, the thing ran away and I smashed my head. Anyway, then I started working [at] the plantation store, Kōloa Plantation store. It's Big Save now. Of course, it was smaller. Anyway, then in 1948, Grove Farm took over Kōloa Plantation. And I worked there as crew chief on the spray gangs. Spray the fields. Then later I went to work as a ditch man, taking the rain gauges.

Grove Farm is 23,000 acres. Half of that, I took the gauges – Kōloa *mauka.* And then get Ka`ala where the water tunnel comes out in back of Waita. Then you get M&M, and then Kaluahonu, and Kōloa mill. So I used to take the rain gauges. Four o'clock in the morning, I start. And open the water for certain different fields. The water takes so long. We know which ones to open, at what time. Takes so long to get to the irrigators. I stayed there until 1974 when McBryde took over Grove Farm's property. Which is Knudsen land and Grove Farm land. So I became irrigation supervisor in 1974. I was pensioned in 1986.

CSH: *So a total of how many years working in sugar?*

LJ: Forty-seven and a half. I'm 78 years old.

CSH: *You've known this area all your life, even before you worked for the plantations.*

LJ: Yes. But not as familiar with 535. [Mr. Jacintho points to the portion of the project area on the west side of 'Ōma'o Stream.] This here is McBryde. Funny way that it is. [Pointing to the east side of the stream:] Across the stream is Knudsen [land]. Funny.

CSH: 'Ōma'o *Stream: did anybody ever use it for fishing or anything like that?*

LJ: No, that ditch never really was open. It always was closed up. The other one that comes from Waihohonu, that comes from Waita, that one the plantation every year used to clean that ditch. They don't anymore. They used to clean that ditch because there's hardly any water in there.

CSH: *So this stream through the project area was never used for recreational fishing?*

LJ: No. But real swampy over here.

CSH: *All your lifetime you've known both sides of the stream as all in sugar?*

LJ: All sugar. When I was with Grove Farm I used to be crew chief--

CSH: *So you've actually worked inside the project area?*

LJ: Yeah, inside there. As far as I know there's nothing.

CSH: *Mr. Jacintho, I'd like to go over a list of the kinds of concerns that are raised about traditional cultural resources, beliefs and practices that may be related to a project area. Did you ever hear of any old trails in this area?*

LJ: No.

CSH: *Have you heard of any old sites in this area?*

LJ: No.

CSH: *How about any burials?*

LJ: No.

CSH: *Have you heard of people going into this area for any traditional gathering practices – for example, for flowers, plants, or medicinal herbs?*

LJ: No. Not in my time anyway. The factory [*i.e.*, the sugar mill] was over here [*makai* of the project area and *mauka* of Kōloa Town] someplace. So I know they had sugarcane

growing all the way up here. Since the factory was there, had Hawaiians in all those places. But I don't remember – I've been in there how many times, I don't see anything.

CSH: *Have you heard of any kind of hunting in the area?*

LJ: Now they've got pasture over there so I guess guys go in for pigs.

CSH: *But before when there was active sugarcane growing --*

LJ: No. Only sugar.

CSH: *Did anybody ever tell you of any Hawaiian place names for this area that maybe are not mentioned on modern maps?*

LJ: No. If Val Knudsen was living, he would know.

CSH: *And you don't know of any other activities that might have gone on in this area?*

LJ: Nothing. Not there.

CSH: *Did you ever hear any stories, any legends about this area?*

LJ: Zero. I don't think they have anything in there because there's a stream all the time. Kind of wide, some places. All *hau* bush.

CSH: *So, especially for the stream, nothing going on?*

LJ: Nothing.

CSH: *And that stream was more associated with the reservoir?*

LJ: Two [streams connect] and then go down. That one comes from the reservoir. And the other stream comes from the overflow from 'Ōma'o Reservoir.

CSH: *So nobody ever used the stream for any kind of --*

LJ: No, never did.

CSH: *Can you give me a sense of what this area was like when the plantations were in business? When this area was in active sugarcane growing, was it pretty much kapu and people didn't go in? Except the plantation people?*

LJ: Yes. [Other people] had nothing to do in there.

CSH: *Did anyone ever tell you what this area was like before the sugar came in?*

LJ: Well, I tell you, it must have been sugarcane from the first beginning [of the sugar plantation], when they started planting, making sugar in the 1840s or '50s. The sugarcane was all around there. I don't know if the McBryde part [of the project area] had sugar. We call that field 535. Fertile soil, you know. Flat land. Unirrigated. And the yields used to be better than the irrigated fields.

CSH: *It's good soil over there?*

LJ: Rich soil. No more irrigation, that field. Rest of the fields are all irrigated.

CSH: *So that area, even before the plantation, would have been good for growing?*

LJ: They probably grew taro and stuff like that.

CSH: *The soil was so good --*

LJ: That was some nice field.

CSH: *I've heard up mauka there was also pineapple. But not in this area.*

LJ: No, never had pineapple there. Only sugar. The pineapple was Kaua'i Pine Company, before. Even that land, when you come in through the tree tunnel, had pineapple. All over was pineapple up there. Kaua'i Pine had pineapple all the way up there.

CSH: *You've known this area over your entire lifetime. You've seen all the changes from the sugar plantation era to now. As a resident of this area do you have any concerns about the future road development in the project area?*

LJ: The only concern I have is that it will probably affect the stores [in Kōloa]. The other bypass road didn't have much effect. Most people go to Līhu'e. So business must have dropped here. But if you go up that town, I remember when there were one or two cars. Now, no more parking up that small little town. So everything must be okay, even with the other bypass. This one I don't know because it will only be the people that build going that way [*i.e.*, from Kukui'ula]. So shouldn't make any difference.

CSH: *Then no concerns related to cultural resources, beliefs and practices because it is your understanding that whatever may have been in the project area is long gone?*

LJ: Yes. I've never seen anything.

CSH: *Thank you for this interview.*

B. Abel Medeiros

Interview Summary

Abel Medeiros was born in 'Ōma'o in 1920, the son of John Medeiros, Jr. and Mary Costa Medeiros. Mr. Medeiros worked for McBryde Sugar Company both in his youth and adult life. He and his family have also raised cattle within the pasture lands of Kōloa.

Mr. Medeiros states that the project area was always under cultivation of sugar cane throughout his lifetime. He knows of no traditional trails, no historic sites, no sacred sites, no burials, and no traditional place names related to the project area. He does not recall any ongoing gathering or hunting practices ever attempted in the project area.

Interview Transcript

Abel Medeiros (identified as AM in the transcript below) was interviewed by Cultural Surveys Hawai'i (CSH) at Kukui'ula, Kaua'i on September 30, 2003.

CSH: *You've known the land in the project area --*

AM: Every since I was a kid. I was born in 'Ōma'o. I used to come down to Kukui'ula to change horses for my father every Sunday. That way I could ride around.

CSH: *As you look at the aerial photo and the map, what comes to mind when you think about this area as you knew it from your childhood on? Was it always in sugarcane?*

AM: Sugarcane, and on the *makai* side was cattle. McBryde had a pretty good ranch at that time. Of course, we [the Medeiros family] used to put cattle in there with them. Other than that the area was just cane and a lot of rock piles. We used to just pile rocks and plant cane around it.

CSH: *Did you ever ride around that area on horseback?*

AM: Yes. Of course we used to be *kolohe* kids. If there was a railroad car up in 'Ōma'o we can all get inside and – When I think about it I think how stupid we were. We could get killed.

CSH: *What did you do?*

AM: We used to take the cane cars. They used to leave it locked with the brake on, at 'Ōma'o, with blocks. So we used to [go] from 'Ōma'o all the way down to Kukui'ula.

CSH: *What year were you born?*

AM: 1920.

CSH: *I'd like to go over a list of the kinds of concerns that are raised about traditional cultural resources, beliefs and practices. Again, you've been acquainted with this area all your life, both through your employment with McBryde and through your family?*

AM: Through McBryde and since my father worked for the plantation for so long. We worked over here [*i.e.*, in Kukui'ula where the interview was taking place]. *Huki lepo.*

CSH: *Are you aware of any traditional trails in this project area?*

AM: Not really any trails. We used to have horse trails but we'd go through any place.

CSH: *Any historic sites related to Hawaiian culture? Like ahu or platforms?*

AM: No. Never. Except there were a few volcanic caves in the pasture. Lava tubes. We used to go inside.

CSH: *Were there any caves up here in the vicinity of the project area?*

AM: No, not in this section. Not that I know of.

CSH: *Did you hear of any burials in this area?*

AM: No. The only burials that I knew of were back here [*i.e.*, *mauka* of Kukui'ula Bay where the interview took place] if you go through the back road and cut up. There used to be a Japanese cemetery. As you go back of Lāwa'i Kai, up on the side. I think they disinterred all of them from there.

CSH: *Was that related to the plantation camp?*

AM: No, that was by itself on the other side. And over here they had some before, identified that they were Hawaiians, by Kūhio Park.

CSH: *Did you ever hear of anybody using the project area for traditional gathering practices?*

AM: No, never. Not to my knowledge.

CSH: *Anybody hunting in that area?*

AM: No. We used to restrict hunting. Except pheasant hunting. People just drive through and if they see something they shoot. But it was not a game area.

CSH: *How about Hawaiian sacred sites in that area?*

AM: None that I know of.

CSH: *Did you ever hear of any traditional place names in this area that might not be on the map?*

AM: No. The only thing that comes to mind would be that cemetery over there: Erasmus. Just opened up.

CSH: *Did you ever hear any stories, any stories, legends about this area?*

AM: No.

CSH: *Did anyone ever tell you what this area was like before sugarcane came in?*

AM: Yes. Basically, wherever there [wasn't any] cane, it was pasture. Just plots of pasture. Whether McBryde or Medeiros or us. Raised cattle. But other than that, that area was just open. I never heard of any sacred areas.

CSH: *How about the stream?*

AM: The reservoirs used to let water out.

CSH: *So nobody ever used the stream for anything --*

AM: No, it was only to let water out of the reservoirs.

CSH: *No recreational use like for swimming --*

AM: No.

CSH: *It was basically a waterway for the plantation?*

AM: Yes, that's all. It was basically for cane growing. Someplace up [*mauka*] they used to grow pineapple also. Up on the hill – Manuhonuhonu.

CSH: *Right now there are banana patches in the western half of the project area.*

AM: Banana probably just started recently. Nothing else in that general area.

CSH: *Did you go up much mauka above the town or were you mostly down in the Kukui'ula side?*

AM: No. We used to cover the whole area. As kids we used to ride along with my father.

CSH: *Just to review, this project area is proposed for a bypass road and bridge over the stream --*

AM: Instead of going through Kōloa [Town]. That will be good. That's not too big a bridge. Because there's not that much water coming down. Look at the 'Ōma'o Road bridge. It's a regular bridge and the county says: oh, it's going to cost five hundred thousand or almost a million dollars. All they have to do is put some four-foot culverts. That's all it needs. Because if it backs up, it will back up but it will flow down, come through.

CSH: *So the stream water was basically for the plantation? It wasn't used by the community?*

AM: No, no. Not for recreation or anything else. In fact, they [*i.e.*, the plantation] wouldn't let them.

CSH: *During the plantation era were the sugarcane lands basically kapu? People stayed out if they weren't plantation people?*

AM: Basically, yes. People couldn't just come in and try to sell you something. They come in and as long as the people didn't complain there was no problem. Never had that kind of problems.

CSH: *So the stream water was basically for the plantation? It wasn't used by the community?*

AM: No, no. Not for recreation or anything else. In fact, they [*i.e.*, the plantation] wouldn't let them.

CSH: *In an earlier interview about Kukui'ula, you talked about letting people use the cane road for short cut --*

AM: Short cut right across to come down.

CSH: *But when pakalolo became a problem --*

AM: They stopped any stranger coming in. They'd kick 'em out. That used to be the main theme. If you're a trespasser – That's my job. Every Saturday and Sunday I drove [around] the plantation. If you catch anybody you just stop them. I don't care who – I've stopped doctors and everybody else. And today they're my friends.

CSH: *So plantation lands – People wouldn't have gone in? They respected --*

AM: Yes. They respected...

CSH: *To review, it was always basically cane and pasture around this project area?*

AM: Cane, pasture. Some was pineapple. Pineapple wasn't very long. When cane was three or four crops then pineapple would come in. Because it will enhance the cane. It's a nice area. I'd like to own one of 'em. A nice house up there.

CSH: *Do you have any concerns about the development of this project area?*

AM: I think it will be good. If you're going to have a road there – avoid people coming all the way to Kōloa. It would be ideal.

CSH: *So, based on what you recollect, it's not going to affect traditional Hawaiian practices?*

AM: None that I know of. I think it might be a good project.

CSH: *Thank you for this interview.*

C. Patrick Pavao

Interview Summary

Patrick Pavao was born in 1941. He began working for McBryde Sugar Company in 1968 and continued with the company until operations shut down in the mid-1990s. His work with McBryde included running heavy equipment in the project area.

Mr. Pavao states that the project area was always under cultivation of sugar cane throughout his lifetime. He knows of no traditional trails, no historic sites, no sacred sites, no burials, and no traditional place names related to the project area. He does not recall any ongoing gathering or hunting practices ever attempted in the project area.

Interview Transcript

Patrick Pavao (identified as PP in the transcript below) was interviewed by Cultural Surveys Hawai'i (CSH) at Kukui'ula, Kaua'i on September 30, 2003.

CSH: *May we start with your background on Kaua'i?*

PP: I was born in 1941. Raised here. Started working for McBryde in '68 after the service. But born and raised here all my life. McBryde closed down before I could retire. I'm still [working] with Kaua'i Coffee. With McBryde I was a truck driver [then] went to supervisor in the transportation department.

CSH: [Mr. Pavao is shown the USGS map and 1950 aerial photograph showing the location of the project area]. *This is the project area. Are you familiar with this area.*

PP: Yes. It's up above Koloa Town, Knudsen Park. As far as my knowledge, that was all into cane. The housing tract that was there is still there, I guess. But as far as I know it was cane

CSH: *During all your time with McBryde it was cane?*

PP: And before McBryde. Going up the tree tunnel road that was cane.

CSH: *Are you from Koloa?*

PP: No, Kalaheo.

CSH: *So you knew the area anyway, before you worked for McBryde, when you were growing up.*

PP: Before, when I was growing up.

CSH: *I'd like to go over a list of the kinds of concerns that are raised about traditional cultural resources, beliefs and practices. Did you ever see any traditional trails in this project area?*

PP: No, not in that area.

CSH: *Any historic sites inside this project area?*

PP: In that project area, no.

CSH: *Any burials?*

PP: No.

CSH: *As far as you know, did anybody go into that area for any traditional gathering practices? For example, for flowers, plants, or medicinal herbs?*

PP: No.

CSH: *Did anybody go in there for hunting?*

PP: No, not really.

CSH: *Any sacred sites, like heiau, in the project area?*

PP: No. Working in there, plowing the fields, we didn't come across any *heiaus*. We [just] had cane in there from McBryde.

CSH: *Did you hear of any place names in this general area that local folks had and that aren't on any maps?*

PP: No.

CSH: *Any other traditional activities that might have occurred in that area?*

PP: No, I've never seen any.

CSH: *As a lifelong resident of Kaua'i, do you have any concerns about the development of this project area and how it might affect traditional cultural resources, beliefs and practices?*

PP: No. I don't think it will affect anybody. Probably help ease the traffic that we have now. No traditional place there that I know of.

CSH: *To review, you actually worked in the fields in this area?*

PP: Yes. Mostly I delivered equipment. Like I said I was transportation. Later on, the last two years, I was [running] heavy equipment, plowing up the places. Like I said we didn't come upon anything in that area.

CSH: *And the cane was on both sides of the stream?*

PP: Yes.

CSH: *As for the stream itself, did you hear of people using the stream for any purpose?*

PP: No. I think that stream was just for the overflow from [the reservoir], more than anything else. One time when we had really high water we had trouble there. We had to clean [out] all the *hau* trees. We had trouble there with the water going into the homes. So we had to try and clean out the area.

CSH: *Again, you never heard of anyone doing anything with the stream, as far as recreation --*

PP: No. None whatsoever.

CSH: *Now there are some banana patches on the west side of the stream in the project area.*

PP: As far as now, I really don't know. [After the mid-1990s when McBryde closed down] I've hardly had [any opportunity] to come in that area.

CSH: *Thank you for this interview.*

VIII. SUMMARY AND RECOMMENDATIONS

A. Summary

Hawaiian legends and traditions celebrate Kōloa *ahupua'a*'s taro lands. Archaeological investigations have documented, *makai* (seaward) of the present Northern Leg of the Western Bypass Road project area, widespread habitation and intensive irrigated agriculture in central and coastal Kōloa utilizing the opportunity to develop an extensive irrigated complex (the Kōloa Field System) off of Waikomo Stream. In the portion of Kōloa *ahupua'à* that includes the present project area, it is likely that upper Kōloa plains activities included cultivation of patches of sweet potato, *pia*, and *wauke* and the gathering of *hala*, *kukui* and other upland resources during traditional Hawaiian times. The section of Ōma'o Stream valley that will be crossed by the bypass road may also have included taro *lo'i*.

Beginning in the 19th century and continuing throughout most of the 20th century, the project area was under continuous cultivation of sugar cane by a succession of commercial interests that included Kōloa Sugar Company, Grove Farm, and McBryde Sugar Company.

Three *kama'āina* former sugar company employees interviewed for this assessment reported that, during the decades of their work within the project area, no traditional trails, no historic sites, no sacred sites, and no burials were observed. None knew of any traditional place names associated with the project area. All three interviewees reported no ongoing traditional gathering or hunting practices occurred within the project area – the establishment of private plantation property precluding access to the area by non-plantation personnel.

B. Recommendations

Based on the above findings, it is recommended that no further formal cultural impact mitigations measures are warranted.

It should be noted, however, that subsurface properties associated with former traditional Hawaiian activities in the project area, such as artifacts and cultural layers, may be present despite the decades of sugar cultivation activities. As a precautionary measure, personnel involved in future development activities in the area should be informed of the possibility of inadvertent cultural finds, and should be made aware of the appropriate notification measures to follow.

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Appendix I

Traffic Assessment Report
Prepared by
Wilson Okamoto Corporation
May 2010

TRAFFIC ASSESSMENT REPORT

FOR THE PROPOSED

WESTERN BYPASS ROAD NORTHERN LEG

Prepared for:

Kukui'ula Development Company (Hawaii), LLC
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I. INTRODUCTION

A. Purpose of Study

The purpose of this study is to assess traffic operating conditions resulting from the construction of the proposed Northern Leg of the Western Bypass Road in Koloa on the island of Kauai. The proposed roadway will to extend the existing Western Bypass Road from its northern terminus at Koloa Road to Maluhia Road.

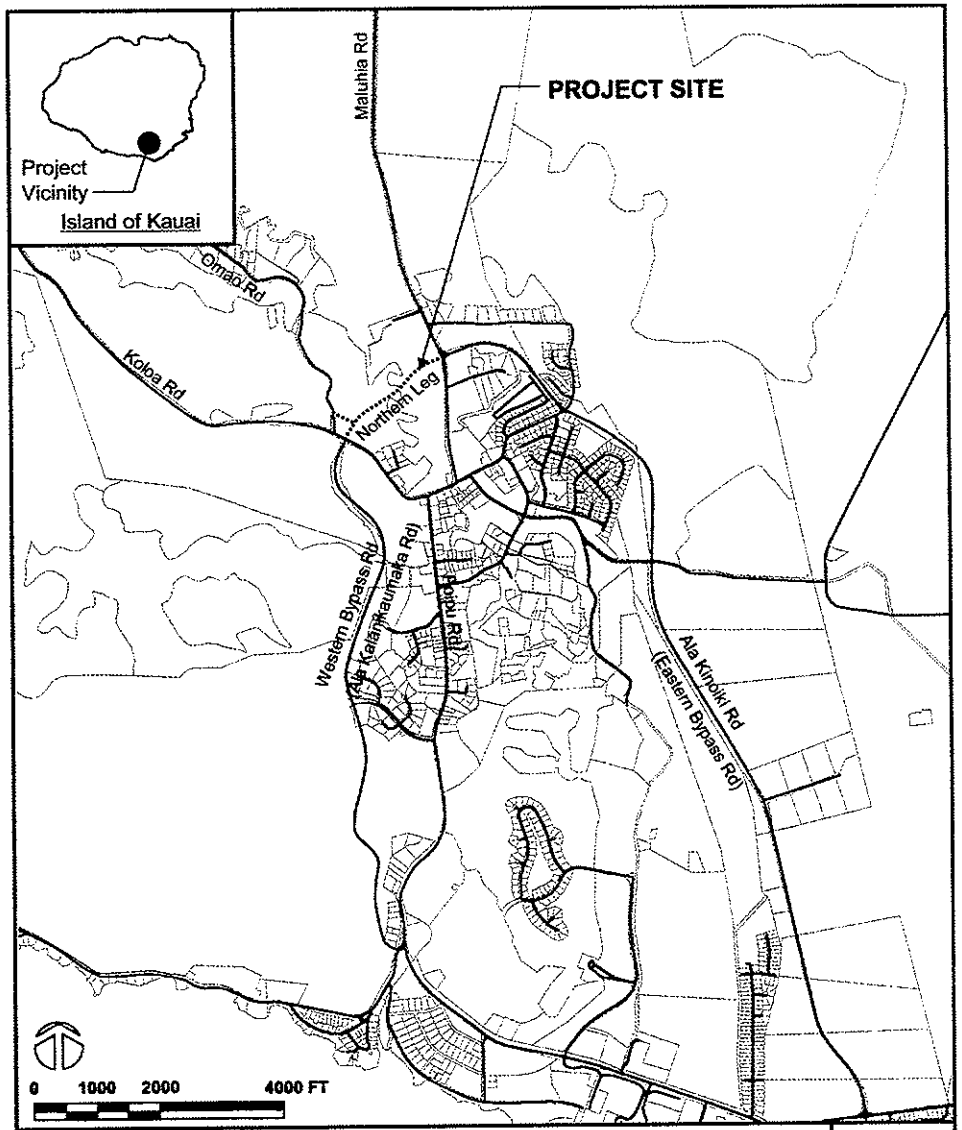
B. Scope of Study

This report presents the findings and conclusions of the traffic study, the scope of which includes:

1. Description of the proposed project.
2. Evaluation of existing roadway and traffic operations in the vicinity.
3. Analysis of future traffic conditions without the proposed project.
4. Development of trip reassignment characteristics for the proposed project.
5. Analysis of future traffic conditions with the proposed project.
6. Identification of recommendations, if appropriate, that would alleviate anticipated traffic conditions.

II. PROJECT DESCRIPTION

The existing Western Bypass Road originates in Poipu near the coastline at Poipu Road and extends through the Kukui'ula development to its northern terminus at Koloa Road in Koloa. The proposed project entails the extension of this roadway further northeast to Maluhia Road to provide an alternate route through Koloa. The proposed roadway is initially expected to be a predominantly two-lane, two-way roadway with auxiliary lanes at the intersections along its alignment encompassing Tax Map Keys: (4) 2-7-03: por 2 and 2-8-06: por 1 (see Figures 1 to 3 for the location map and project site plans). In conjunction with the proposed project, Omao Road will be realigned to intersect with the new roadway and the existing intersection of Omao Road with Koloa Road will be eliminated. The proposed project is expected to be completed by the Year 2015.



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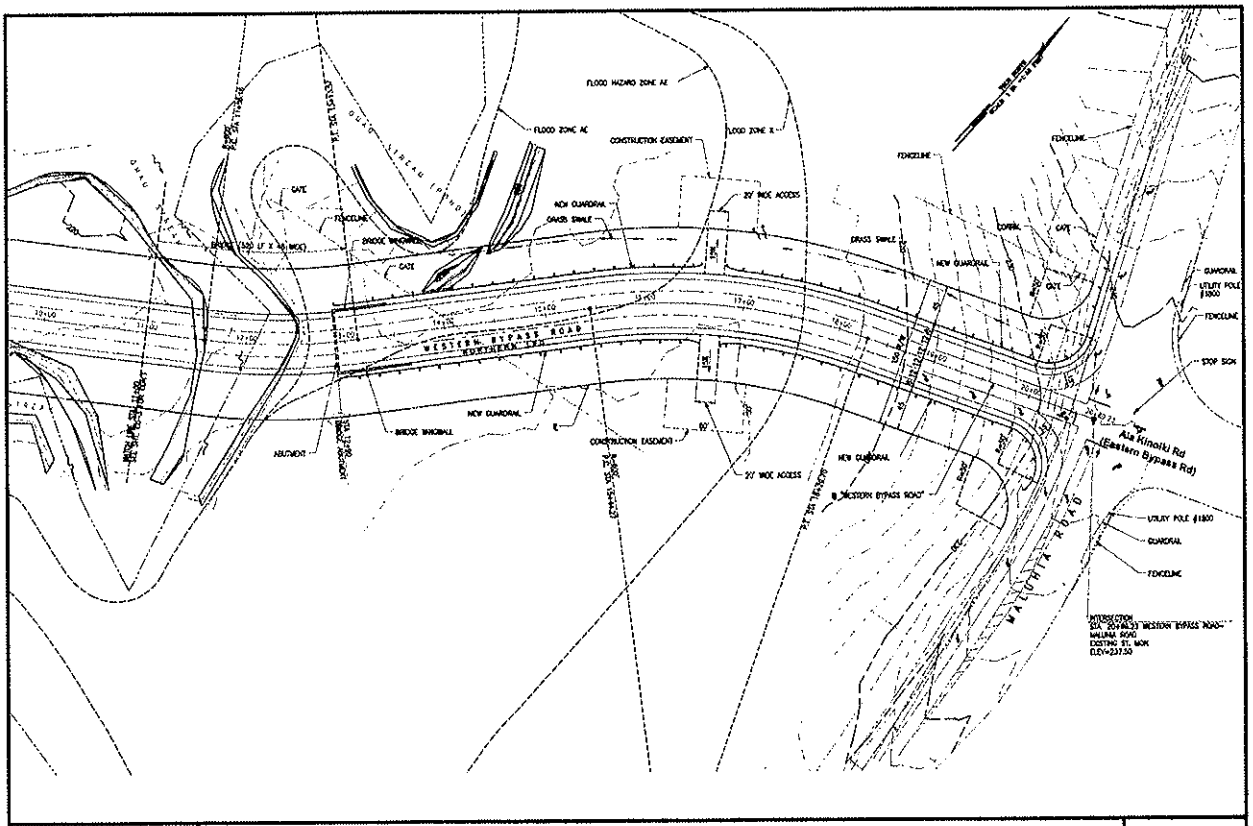
ENGINEERS - PLANNERS

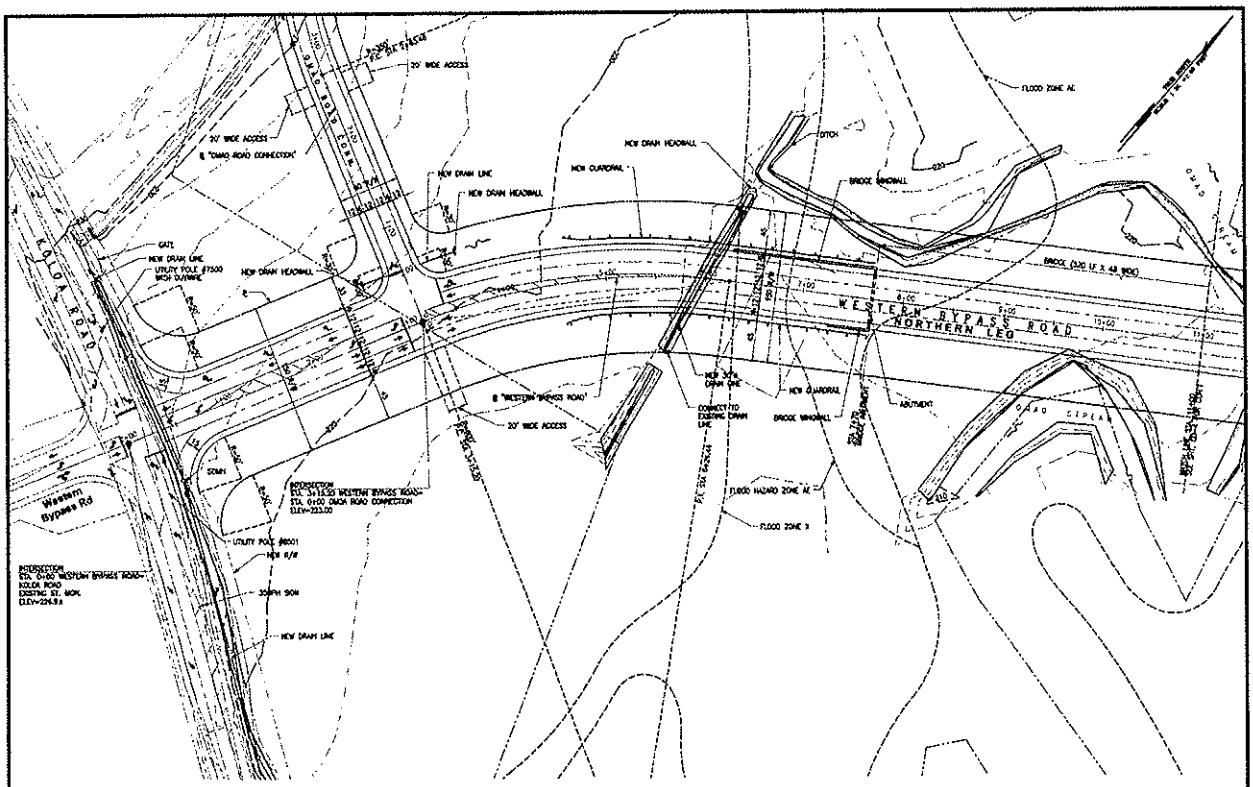
WESTERN BYPASS ROAD NORTHERN LEG

Location Map and Vicinity Map

FIGURE 1



WILSON OKAMOTO CORPORATION ENGINEERS - PLANNERS	WESTERN BYPASS ROAD NORTHERN LEG Project Site Plan	FIGURE 3



WILSON OKAMOTO CORPORATION ENGINEERS - PLANNERS	WESTERN BYPASS ROAD NORTHERN LEG Project Site Plan	FIGURE 2

III. EXISTING TRAFFIC CONDITIONS

A. Area Roadway System

Maluhia Road is a predominantly two-lane, two-way County of Kauai roadway generally oriented in the north-south direction that serves as the main access roadway to Koloa and Poipu, providing connection between those areas and Kaumualii Highway. At the northern end of the project site, Maluhia Road intersects Ala Kinoiki Road. At this unsignalized T-intersection, the northbound approach of Maluhia Road has one through lane and an exclusive right-turn lane while the southbound approach has an exclusive left-turn lane and one through lane. Ala Kinoiki Road (also referred to as the "Eastern Bypass Road") is a predominantly two-lane, two-way roadway with auxiliary lanes at the intersections along its alignment that provides an alternate route between Maluhia Road and the Poipu area. At the intersection with Maluhia Road, the stop-controlled approach of Ala Kinoiki Road has exclusive left-turn and right-turn lanes. In addition, acceleration lanes are provided along Maluhia Road and Ala Kinoiki Road to allow right-turning vehicles to proceed freely through the intersection.

South of the intersection with Ala Kinoiki Road, Maluhia Road intersects Koloa Road. At this unsignalized T-intersection, the southbound approach of Maluhia Road is stop-controlled with exclusive left-turn and right-turn lanes. Koloa Road is a predominantly two-lane, two-way County of Kauai roadway generally oriented in the east-west direction that serves as the main access roadway through Koloa. At the intersection with Maluhia Road, the eastbound approach of Koloa Road has an exclusive left-turn lane and one through lane while the westbound approach has a shared through and right-turn lane.

West of the intersection with Maluhia Road, Koloa Road intersects Poipu Road. At this unsignalized T-intersection, the eastbound approach of Koloa Road has a shared through and right-turn lane while the westbound approach has an exclusive left-turn lane and one through lane. Poipu Road is a predominantly two-lane, two-way County of Kauai roadway that primarily serves as the main access roadway to and through Poipu. At the intersection with Koloa Road, the Poipu Road approach is

stop-controlled with exclusive left-turn and right-turn lanes.

Further west, Koloa Road intersects the existing Western Bypass Road. At this unsignalized T-intersection, the eastbound approach of Koloa Road has one through lane and an exclusive right-turn lane while the westbound approach has an exclusive left-turn lane and one through lane. The existing Western Bypass Road is a predominantly two-lane, two-way roadway generally oriented in the north-south direction that serves as the primary access roadway through the on-going Kukui'ula development. At the intersection with Koloa Road, the northbound approach of the Western Bypass Road is stop-controlled with exclusive left-turn and right-turn lanes. In addition, an acceleration lane is provided along Koloa Road allowing right-turning vehicles from the Western Bypass Road to proceed freely through the intersection.

At the western edge of the project area, Koloa Road intersects Omao Road. At this unsignalized T-intersection, the eastbound approach of Koloa Road has one lane that serves left-turn and through traffic movements while the westbound approach has one lane that serves through and right-turn traffic movements. Omao Road is a predominantly two-lane, two-way County of Kauai roadway generally oriented in the north-south direction that extends between Kaumualii Highway and Koloa Road. At the intersection with Koloa Road, the southbound approach of Omao Road has one stop-controlled lane that serves left-turn and right-turn traffic movements.

B. Traffic Volumes and Conditions

1. General

a. Field Investigation

Field investigations were conducted on January 22-24, 2008 and consisted of manual turning movement count surveys during the morning peak hours between 6:00 AM and 9:00 AM, and the afternoon peak hours between 3:00 PM and 6:00 PM at the following intersections:

- Maluhia Road and Ala Kinoiki Road
- Maluhia Road and Koloa Road

- Koloa Road and Poipu Road
- Koloa Road and Omao Road

It should be noted that the field investigations were conducted prior to the opening of the existing Western Bypass Road. As such, supplemental turning movement count surveys were conducted on November 12-13, 2009 at the intersections of Koloa Road with Poipu Road and the existing Western Bypass Road to determine the affect of this new roadway on the distribution of traffic in the vicinity. In addition, 24-hour mechanical count surveys were conducted along Maluhia Road, Ala Kinoiki Road, and Koloa Road. Appendix A includes the existing traffic count data.

b. Capacity Analysis Methodology

The highway capacity analysis performed in this study is based upon procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2000, and the "Highway Capacity Software", developed by the Federal Highway Administration. The analysis is based on the concept of Level of Service (LOS) to identify the traffic impacts associated with traffic demands during the peak hours of traffic.

LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F"; LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" unacceptable or potentially congested traffic operating conditions.

"Volume-to-Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at or near capacity. A v/c ratio of greater than 1.00 indicates that the traffic demand exceeds the road's carrying capacity. The LOS definitions are included in Appendix B.

2. Existing Peak Hour Traffic

a. General

Figures 4 and 5 show the existing AM and PM peak hour traffic volumes and operating traffic conditions in the vicinity of the proposed project. The morning peak hour of traffic generally occurs between 7:00 AM and 8:00 AM in the vicinity of the project. In the afternoon, the peak hour of traffic generally occurs between the hours of 3:15 PM and 4:15 PM. The analysis is based on these peak hour time periods to identify the traffic impacts resulting from the proposed project. LOS calculations are included in Appendix C.

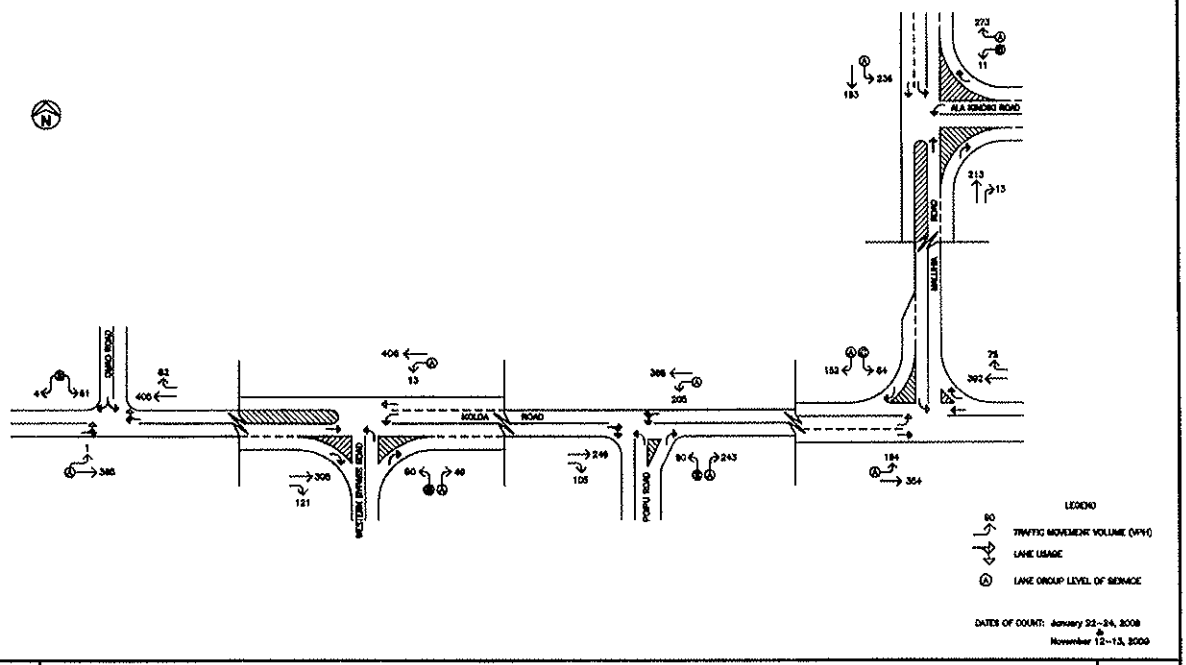
b. Maluhia Road and Ala Kinoiki Road

At the intersection with Ala Kinoiki Road, Maluhia Road carries 147 vehicles northbound and 316 vehicles southbound during the AM peak period. During the PM peak period, traffic volumes are higher with 226 vehicles traveling northbound and 429 vehicles traveling southbound. The critical movement on the Maluhia Road approaches of the intersection is the southbound left-turn traffic movement that operates at LOS "A" during both peak periods.

The Ala Kinoiki Road approach of the intersection carries 171 vehicles and 284 vehicles westbound during the AM and PM peak periods, respectively. The left-turn traffic movement on this approach operates at LOS "A" and LOS "B" during the AM and PM peak periods, respectively, while the right-turn traffic movement operates at LOS "A" during both peak periods.

c. Maluhia Road and Koloa Road

At the intersection with Koloa Road, Maluhia Road carries 183 vehicles during the AM peak period. During the PM peak period, the traffic volume is higher with 218 vehicles traveling southbound. The left-turn traffic movement on this approach operates at LOS "A" and LOS "C" during the AM and PM peak periods, respectively, while the



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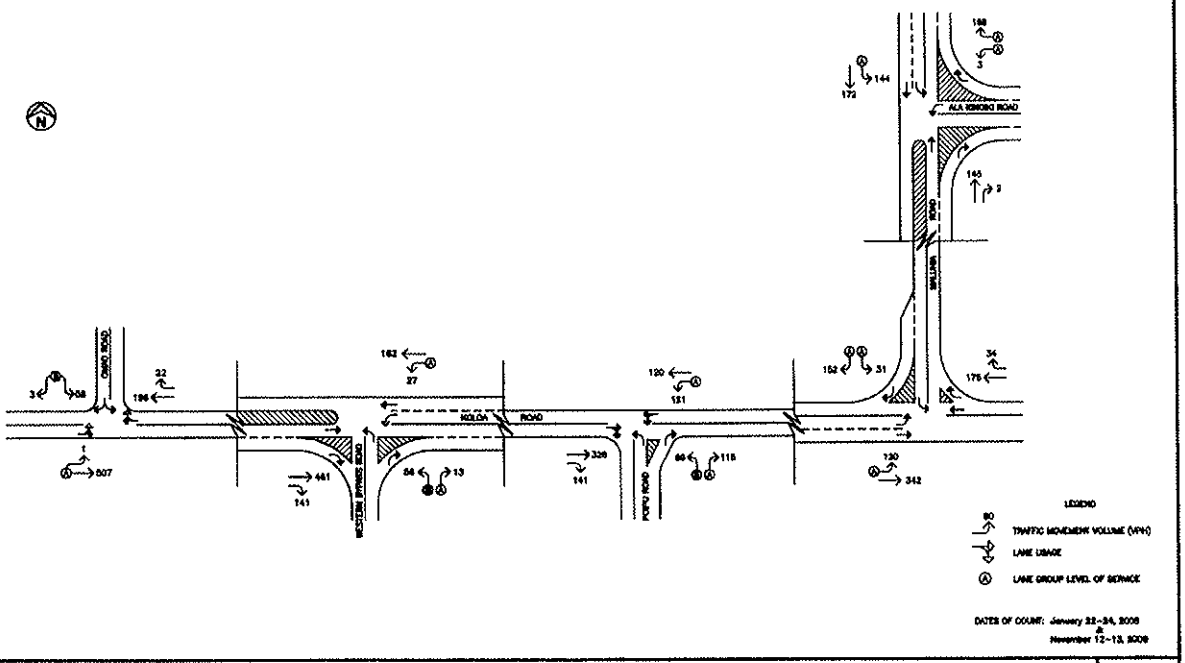
WESTERN BYPASS PROJECTION

EXISTING PM PEAK HOUR OF TRAFFIC

FIGURE 5



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WESTERN BYPASS PROJECTION

EXISTING AM PEAK HOUR OF TRAFFIC

FIGURE 4

right-turn traffic movement operates at LOS "A" during both peak periods. Traffic queues periodically formed on the Maluhia Road approach of the intersection with average queue lengths of 2-4 vehicles observed during both peak periods.

The Koloa Road approaches of this intersection carry 462 vehicles eastbound and 209 vehicles westbound during the AM peak period. During the PM peak period, traffic volumes are higher with 538 vehicles traveling eastbound and 467 vehicles traveling westbound. The critical movement on the Koloa Road approaches of the intersection was the eastbound left-turn traffic movement which operates at LOS "A" during both peak periods.

d. Koloa Road and Poipu Road

At the intersection with Poipu Road, Koloa Road carries 469 vehicles eastbound and 301 vehicles westbound during the AM peak periods. During the PM peak period, the overall traffic volume is higher with 354 vehicles traveling eastbound and 543 vehicles traveling westbound. The critical movement on the Koloa Road approaches of the intersection is the westbound left-turn traffic movement which operates at LOS "A" during both peak periods.

The Poipu Road approach carries 184 vehicles northbound during the AM peak hour. During the PM peak hour, the traffic volume is higher with 333 vehicles traveling northbound. The critical movement on the Poipu Street approach is the northbound left-turn traffic movement which operates at LOS "B" during both peak periods. Traffic queues periodically formed on the Poipu Road approach of the intersection with average queue lengths of 1-3 vehicles observed during both peak periods.

e. Koloa Road and the Western Bypass Road

At the intersection with the Western Bypass Road, Koloa Road carries 602 vehicles eastbound and 189 vehicles westbound during the

AM peak hour. During the PM peak hour, the overall traffic volume is higher with 426 vehicles traveling eastbound and 419 vehicles traveling westbound. The critical movement on the Koloa Road approaches is the westbound left-turn traffic movement which operates at LOS "A" during both peak periods.

The Western Bypass Road approach of the intersection carries 69 vehicles northbound during the AM peak period. During the PM peak period, the traffic volume is higher with 139 vehicles traveling northbound. The critical movement on the Western Bypass Road approach is the northbound left-turn traffic movement which operates at LOS "B" during both peak periods. Traffic queues occasionally formed on this approach with average queue lengths of 1-2 vehicles observed during both peak periods.

f. Koloa Road and Omao Road

At the intersection with the Omao Road, Koloa Road carries 508 vehicles eastbound and 218 vehicles westbound during the AM peak hour. During the PM peak hour, the overall traffic volume is higher with 366 vehicles traveling eastbound and 487 vehicles traveling westbound. The critical movement on the Koloa Road approaches is the eastbound left-turn and through traffic movement which operates at LOS "A" during both peak periods.

The Omao Road approach of the intersection carries 91 vehicles southbound during the AM peak period. During the PM peak period, the traffic volume is less with 65 vehicles traveling southbound. The Omao Road approach operates at LOS "B" during both peak periods. Traffic queues occasionally formed on this approach with average queue lengths of 1-2 vehicles observed during both peak periods.

IV. PROJECTED TRAFFIC CONDITIONS

A. Development of Other Projects in the Vicinity

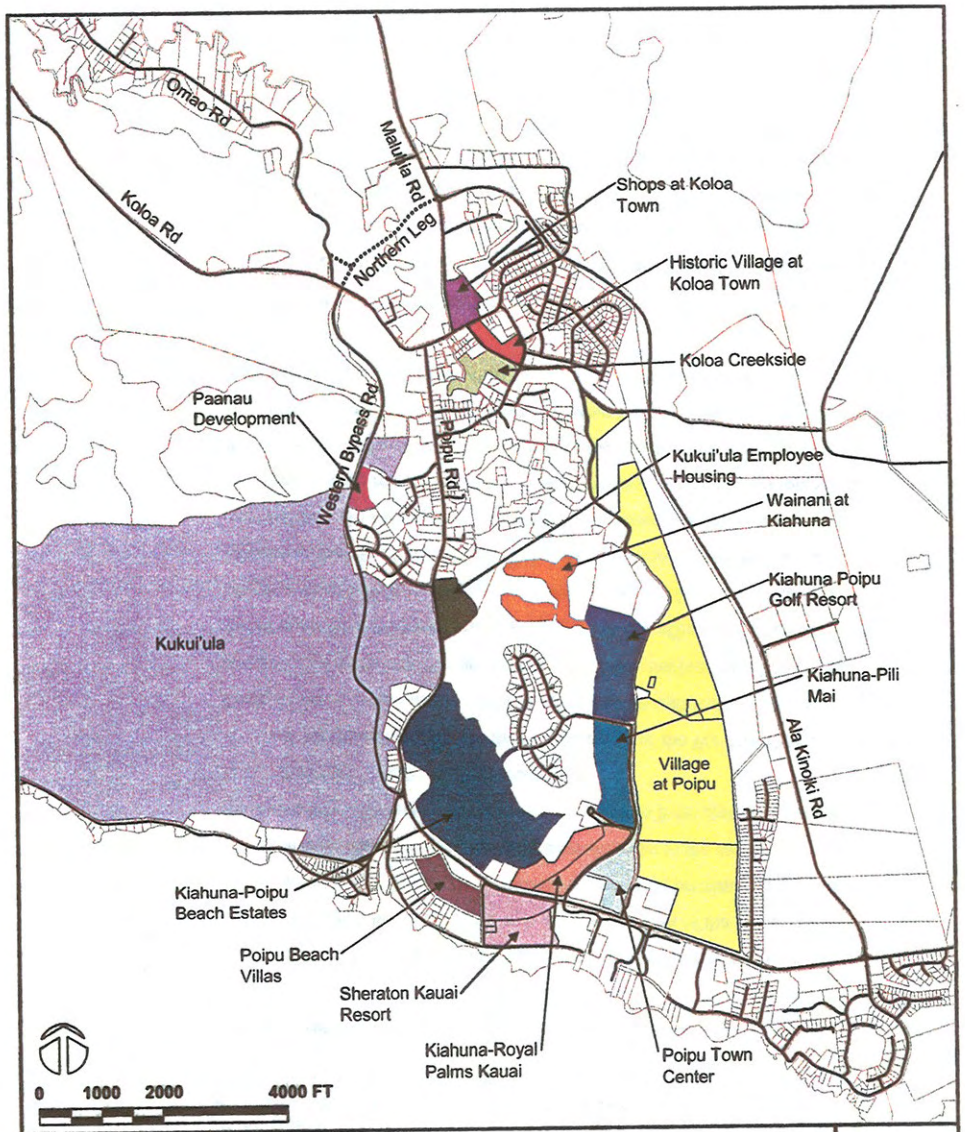
1. General

There are a number of projects expected to be developed within the Koloa and Poipu area in the next 5 to 25 years (see Figure 6). These projects are discussed briefly in the following sections. The trip generation methodology used in this study is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 8th Edition," 2008. The ITE trip generation rates are developed empirically by correlating the vehicle trip generation data with various land use characteristics such as the number of vehicle trips generated per dwelling unit or 1,000 square feet of development. The trip generation characteristics for these projects are included in Appendix D.

The directional distribution of the trips associated with these projects was based on the distribution of population and activity centers on the island of Kauai. As such, approximately 80% were assumed to be traveling to/from areas to the east while approximately 20% were assumed to be traveling to/from areas to the west. These trips were distributed throughout the surrounding roadway network based upon their assumed origin and destination.

2. Kukui'ula

Kukui'ula is located south of Koloa Road and west of Poipu Road with access provided via the existing Western Bypass Road. For the purpose of this report, the remaining commercial areas and approximately 1/3 of the dwelling units are expected to be completed by the Year 2015 with the remainder expected to be completed by the end year of this study (Year 2035). The development is expected to include 1,200 secondary or vacation homes, 300 multi-family homes, and 43,800 square feet of commercial space.



WILSON OKAMOTO CORPORATION
ENGINEERS - PLANNERS

WESTERN BYPASS ROAD NORTHERN LEG

Other Projects in the Vicinity

FIGURE 6

3. Development in Poipu

There are a number of projects expected to be developed in Poipu over the next 5 to 25 years. The majority of these projects are expected to be developed in the western portion of Poipu with only the Village at Poipu project expected in the eastern portion of Poipu. The following is a summary of the planned projects in Poipu that are expected to be completed in the next 5 to 25 years:

By Year 2015

- Sheraton Kauai Resort (~365 secondary or vacation homes)
- Kiahuna-Poipu Beach Estates (~108 multi-family units)
- Kiahuna-Royal Palms Kauai (~164 multi-family units)
- Wainani at Kiahuna (~70 single-family units)
- Poipu Beach Villas (~323 secondary or vacation homes)
- Poipu Town Center (~107,000 square feet of commercial)

By Year 2035

- Kiahuna-Pili Mai (~191 multi-family units)
- Kiahuna Poipu Golf Resort (~ 2 single-family and ~280 multi-family units)
- Village at Poipu (~298 secondary or vacation homes and ~130 multi-family units)

4. Development in Koloa

The following is a summary of the planned projects in Poipu that are expected to be completed in the next 5 to 25 years:

By Year 2015

- Shops at Koloa Town (~75,000 square feet of commercial)
- Historic Village at Koloa Town (~34 single-family units and ~45,000 square feet of commerical)

By Year 2035

- Koloa Creekside (~8 multi-family units)

5. Development along Poipu Road between Koloa and Poipu

The following is a summary of the planned projects that are expected to be completed along Poipu Road between Koloa and Poipu in the next 5 years:

By Year 2015

- Kukui'ula Workforce Housing (~135 multi-family units)
- Paanau Development (~60 multi-family units)

B. Trip Reassignment

1. General

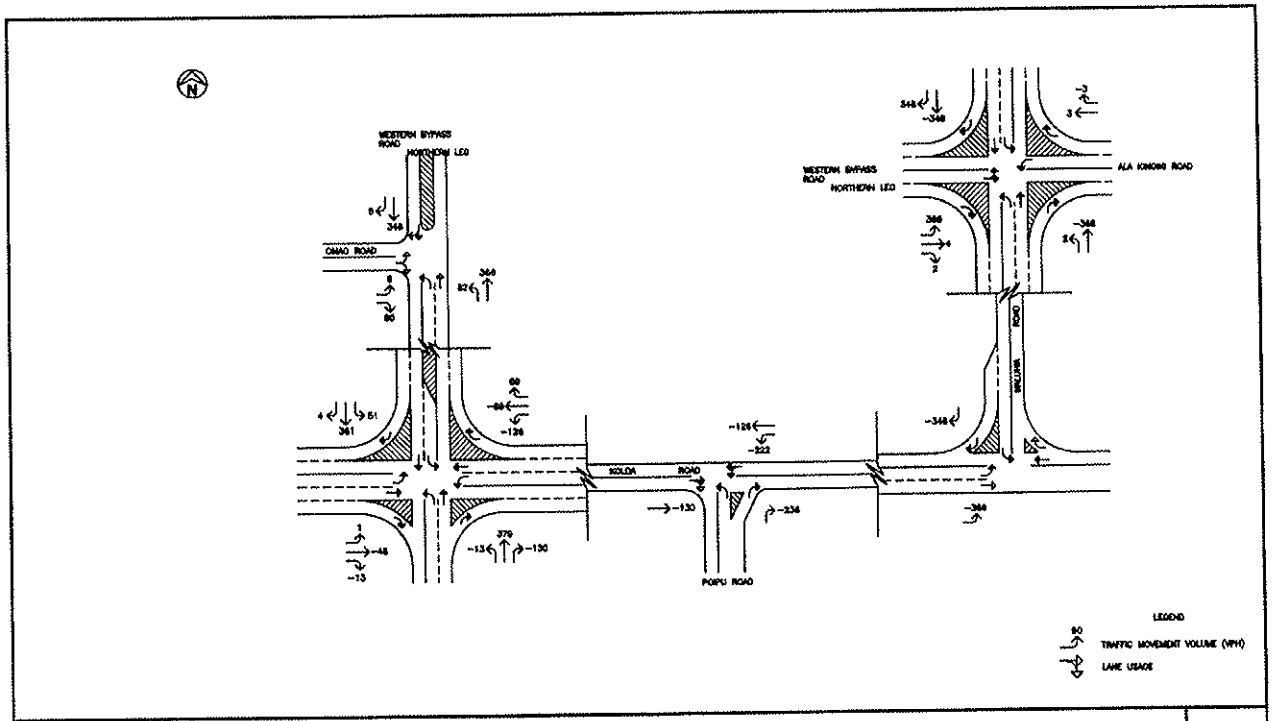
Figures 7 and 8 show the reassignment of trips during the Year 2015 AM and PM peak hours of traffic with the construction of the Northern Leg of the Western Bypass Road. As previously indicated, approximately 80% of the new trips were assumed to be traveling to/from areas to the east while approximately 20% were assumed to be traveling to/from areas to the west.

2. Existing Traffic Reassignment

With the construction of the Northern Leg of the Western Bypass Road, a portion of the traffic currently traveling through Koloa Town to enter or exit Poipu and Kukui'ula are expected to utilize the Northern Leg instead. Based upon the existing directional distribution of traffic at the intersection of Maluhia Road with Koloa Road, a portion of the southbound right-turning vehicles at the Maluhia Road and Koloa Road intersection, as well as, the northbound right-turning vehicles at the Koloa Road and Poipu Road intersection were reassigned to the Western Bypass Road. In addition, Omao Road will be realigned in conjunction with the construction of the proposed roadway. As such, vehicles currently utilizing Koloa Road to access Omao Road will utilize the Northern Leg of the Western Bypass Road instead.

3. Kukui'ula

Primary access to the Kukui'ula development is provided via the existing Western Bypass Road. Site-generated trips headed to/from areas to the west are assumed to utilize Koloa Road to reach their destination while those headed to/from areas to the east are assumed to travel through Koloa Town via Koloa Road to access Maluhia Road. With the construction of the

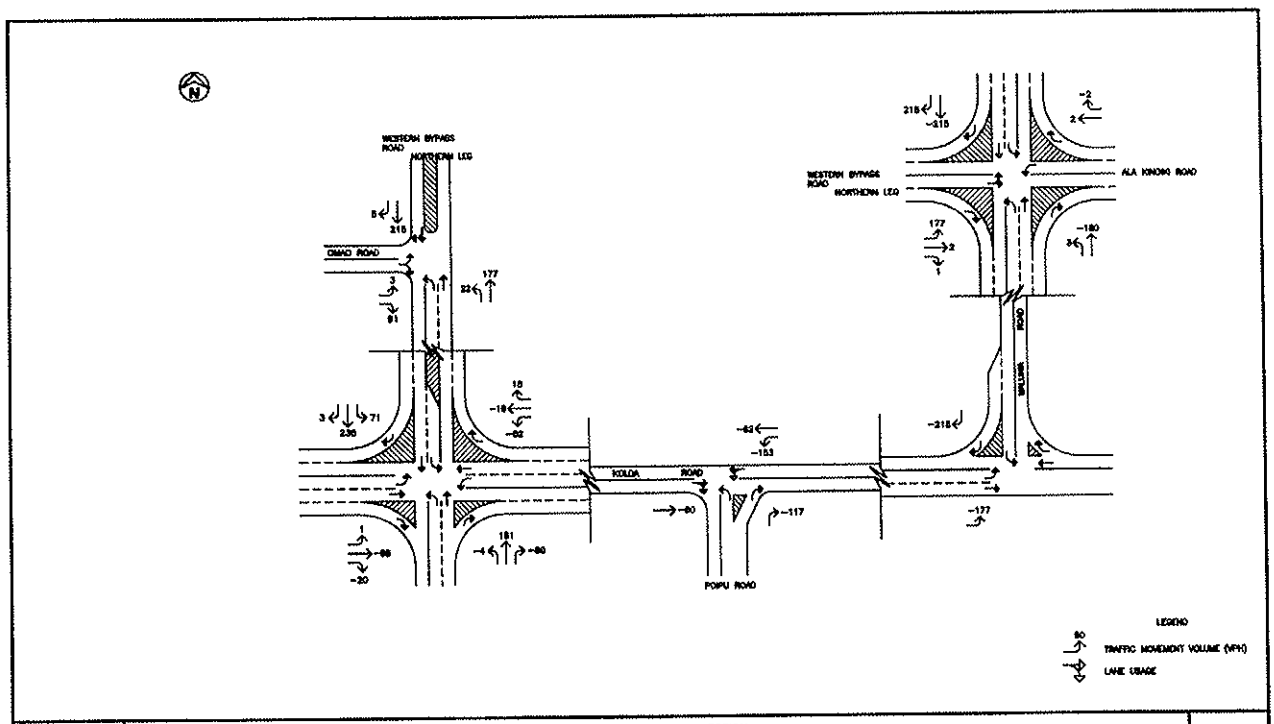


WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS

WESTERN BYPASS PROJECTION

YEAR 2015 TRIP REASSIGNMENT - PM PEAK HOUR OF TRAFFIC

FIGURE 8



WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS

WESTERN BYPASS PROJECTION

YEAR 2015 TRIP REASSIGNMENT - AM PEAK HOUR OF TRAFFIC

FIGURE 7

Northern Leg, site-generated trips headed to/from areas to the east are assumed to utilize the Northern Leg instead of Koloa Road to avoid traveling through Koloa Town.

4. Development in Poipu

Access to the new developments in the western portion of Poipu is provided via the existing Western Bypass Road and Poipu Road. Site-generated trips headed to/from areas to the west are assumed to utilize the existing Western Bypass Road to access Koloa Road while those headed to/from areas to the east are assumed to utilize Poipu Road to access Koloa Road and travel through Koloa Town. With the construction of the Northern Leg, a portion of the site-generated trips headed to/from areas to the east are assumed to utilize the Northern Leg instead of Koloa Road to avoid traveling through Koloa Town.

Access to the new developments in the eastern portion of Poipu is provided via Ala Kinoiki Road. Site-generated trips headed to/from areas to the east are assumed to utilize Maluhia Road to reach their destinations. Since the proposed Northern Leg of the Western Bypass Road is expected to be completed prior to the completion of the new developments in the eastern portion of Poipu, site-generated trips headed to/from areas to the west are assumed to utilize the Northern Leg to access Koloa Road west of Koloa Town.

5. Development in Koloa

The new developments in Koloa are expected to be located east of the Maluhia Road and Koloa Road intersection. All site-generated trips headed to/from areas to the west are assumed to utilize Koloa Road while those headed to/from areas to the east are assumed to utilize Maluhia Road. The construction of the Northern Leg of the Western Bypass Road is not expected to alter the travel patterns of trips generated by developments in Koloa.

6. Development along Poipu Road between Koloa and Poipu

Access to the new developments along Poipu Road between Koloa and Poipu is provided via Poipu Road. Site-generated vehicles headed to/from the west are assumed to utilize Koloa Road while those headed to/from the east area assumed to travel through Koloa Town via Koloa Road to access Maluhia Road. The construction of the Northern Leg of the Western Bypass Road is not expected to alter the travel patterns of trips generated by developments along Poipu Road between Koloa and Poipu.

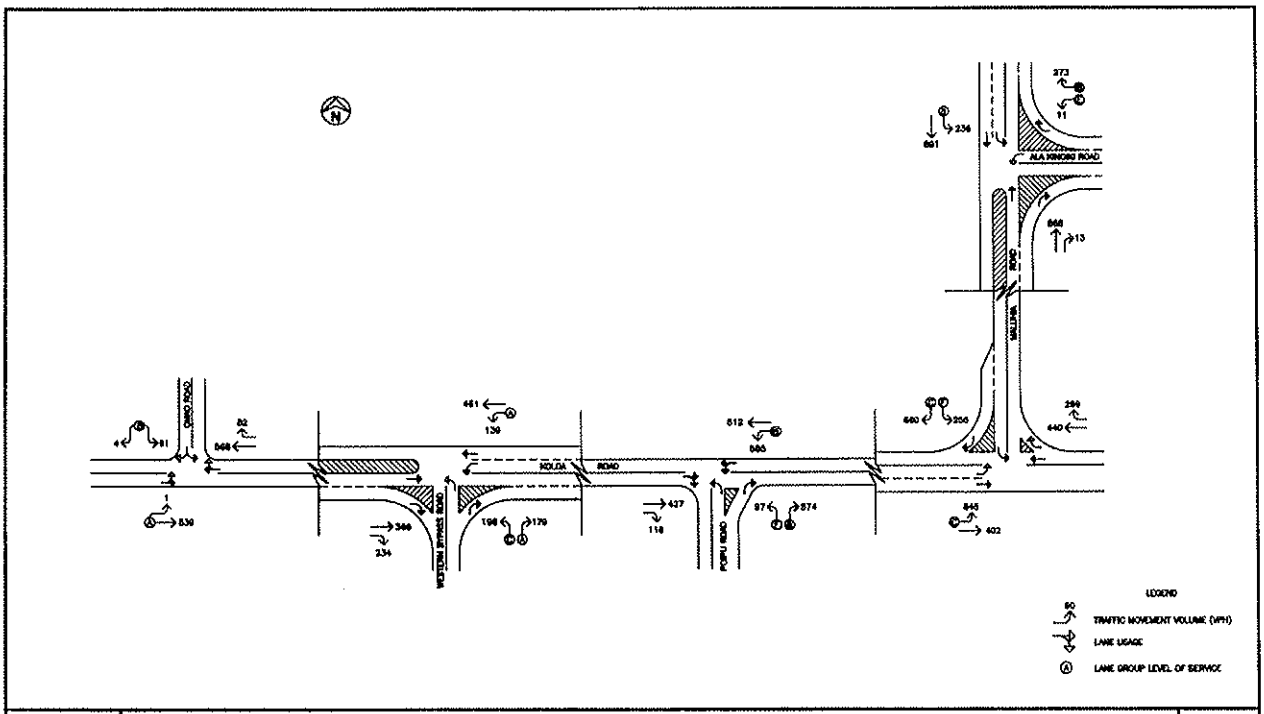
C. Year 2015 Total Traffic Volumes

1. Without Project

The projected Year 2015 AM and PM peak hour traffic volumes and operating conditions in the project vicinity without the proposed Northern Leg of the Western Bypass Road are shown on Figures 9 and 10, and summarized in Table 1. The existing levels of service are provided for comparison purposes. LOS calculations are included in Appendix E.

Table 1: Existing and Projected Year 2015 (Without Project) Traffic Operating Conditions

Intersection	Critical Movement		AM		PM	
			Exist	Year 2015 w/out Proj	Exist	Year 2015 w/out Proj
Maluhia Rd/ Ala Kinoiki Rd	WB	LT	A	B	B	E
		RT	A	A	A	B
	SB	LT	A	A	A	B
Maluhia Rd/ Koloa Rd	EB	LT	A	A	A	C
	SB	LT	A	D	C	F
		RT	A	A	A	C
Koloa Rd/ Poipu Rd	WB	LT	A	B	A	B
	NB	LT	B	C	B	F
Koloa Rd/ Western Bypass Rd	WB	LT	A	A	A	A
	NB	LT	B	B	B	C
Koloa Rd/ Omao Rd	EB	LT-TH	A	A	A	A
	SB	LT-RT	B	B	B	B

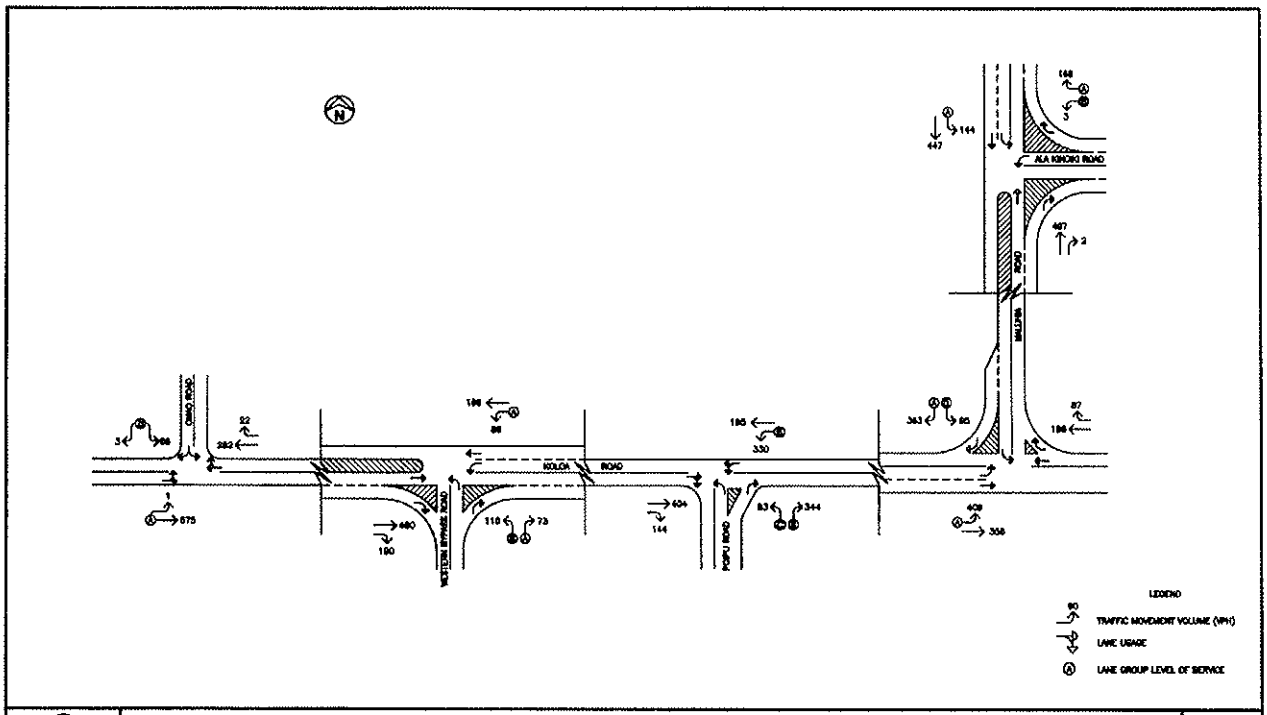


WILSON OKAMOTO CORPORATION

WESTERN BYPASS PROJECTION

YEAR 2015 PM PEAK HOUR OF TRAFFIC WITHOUT PROJECT

FIGURE 10



WILSON OKAMOTO CORPORATION

WESTERN BYPASS PROJECTION

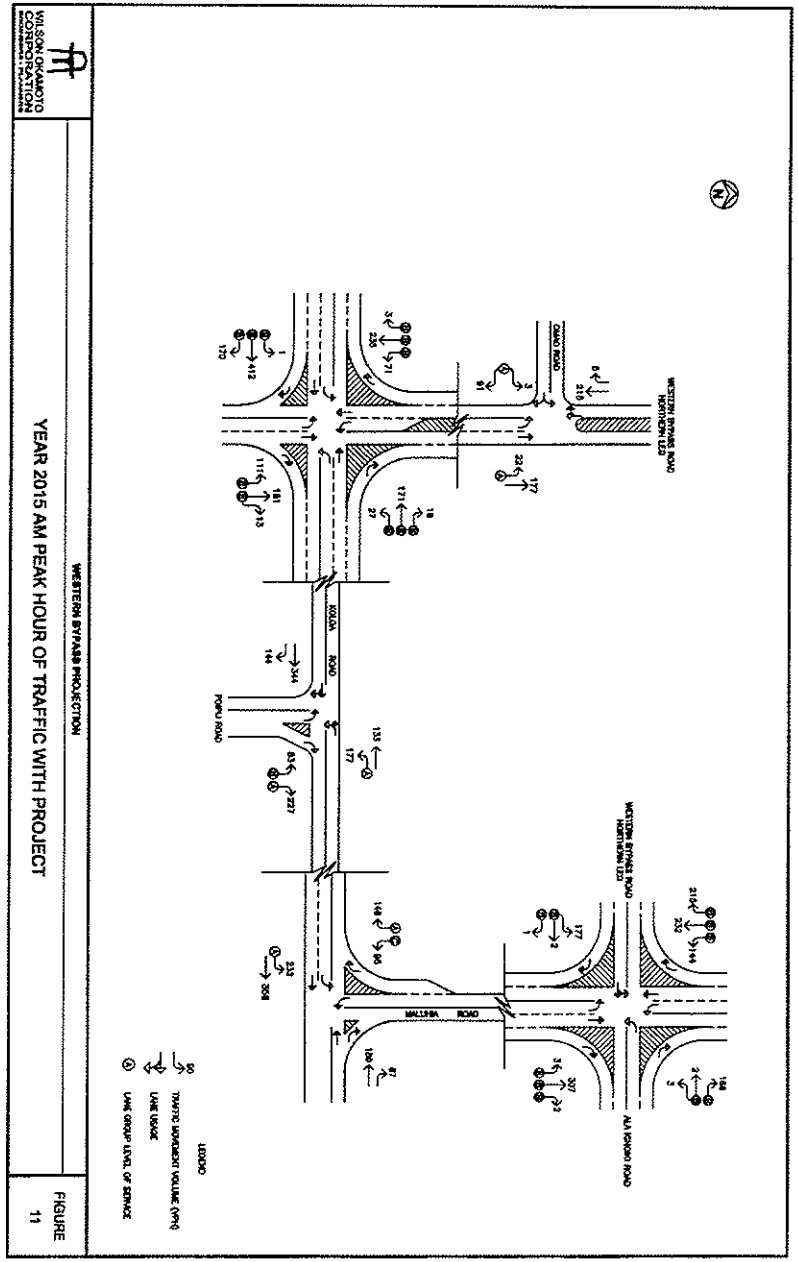
YEAR 2015 AM PEAK HOUR OF TRAFFIC WITHOUT PROJECT

FIGURE 9

Without the construction of the Northern Leg of the Western Bypass Road, traffic operations in Koloa are expected to deteriorate from existing conditions. Along Maluhia Road, the westbound left-turn traffic movement at the intersection with Ala Kinoiki Road is expected to deteriorate to LOS "B" and LOS "E" during the AM and PM peak periods, respectively, while other critical traffic movements are expected to deteriorate to LOS "B" during the PM peak period. Similarly, at the intersection with Koloa Road, the southbound left-turn traffic movement is expected to deteriorate to LOS "D" and LOS "F" during the AM and PM peak periods, respectively, while the other critical traffic movements are expected to deteriorate to LOS "C" during the PM peak period. Along Koloa Road, the westbound left-turn traffic movement is expected to deteriorate to LOS "B" during both peak periods while the northbound left-turn traffic movement is expected to deteriorate to LOS "C" and LOS "F" during the AM and PM peak periods, respectively. At the intersection with the existing Western Bypass Road, the northbound left-turn traffic movement is expected to deteriorate to LOS "C" during the PM peak period.

2. With Project

The projected Year 2015 AM and PM peak hour traffic volumes and operating conditions in the project vicinity with the construction of the Northern Leg of the Western Bypass Road are shown on Figures 11 and 12, and summarized in Table 2. Due to the anticipated high volume of traffic along the Northern Leg of the Western Bypass Road and shifts in traffic patterns in Koloa, traffic signal systems are assumed to be installed at the intersections of the Northern Leg with Maluhia Road and Koloa Road to alleviate anticipated poor levels-of-service at those intersections. The Year 2015 levels of service without the project are provided for comparison purposes. LOS calculations are included in Appendix F.



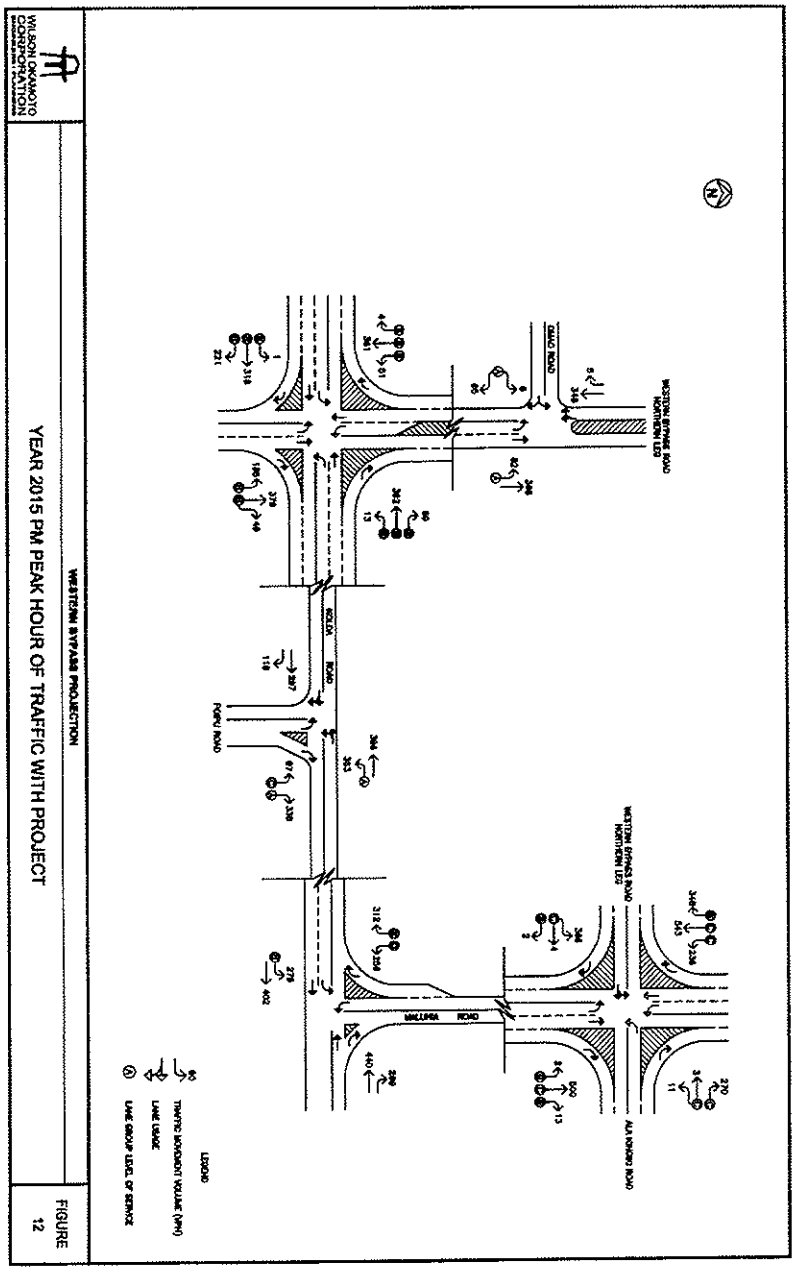


Table 2: Projected Year 2015 (Without and With Project) Traffic Operating Conditions

Intersection	Critical Movement		AM		PM	
			Year 2015 w/out Proj	Year 2015 w/ Proj	Year 2015 w/out Proj	Year 2015 w/ Proj
Maluhia Rd/ Ala Kinoiki Rd/Western Bypass Rd Northern Leg*	EB	LT-TH	-	B	-	C
		RT	-	B	-	B
	WB	LT-TH	B	B	E	C
		RT	A	B	B	C
	NB	LT	-	B	-	B
		TH	-	B	-	C
		RT	-	B	-	B
	SB	LT	A	B	B	C
		TH	-	B	-	C
		RT	-	B	-	B
Maluhia Rd/ Koloa Rd	EB	LT	A	A	C	B
	SB	LT	D	C	F	D
		RT	A	A	C	B
Koloa Rd/ Poipu Rd	WB	LT	B	A	B	A
	NB	LT	C	B	F	C
Koloa Rd/ Western Bypass Rd*	EB	LT	-	B	-	B
		TH	-	B	-	B
		RT	-	B	-	B
	WB	LT	A	B	A	B
		TH	-	B	-	B
		RT	-	B	-	B
	NB	LT	B	B	C	B
		TH-RT	-	B	-	B
	SB	LT	-	B	-	B
		TH	-	B	-	B
		RT	-	B	-	B
Western Bypass Road Northern Leg/Omao Rd	EB	LT-RT	-	A	-	A
	NB	LT	-	A	-	A

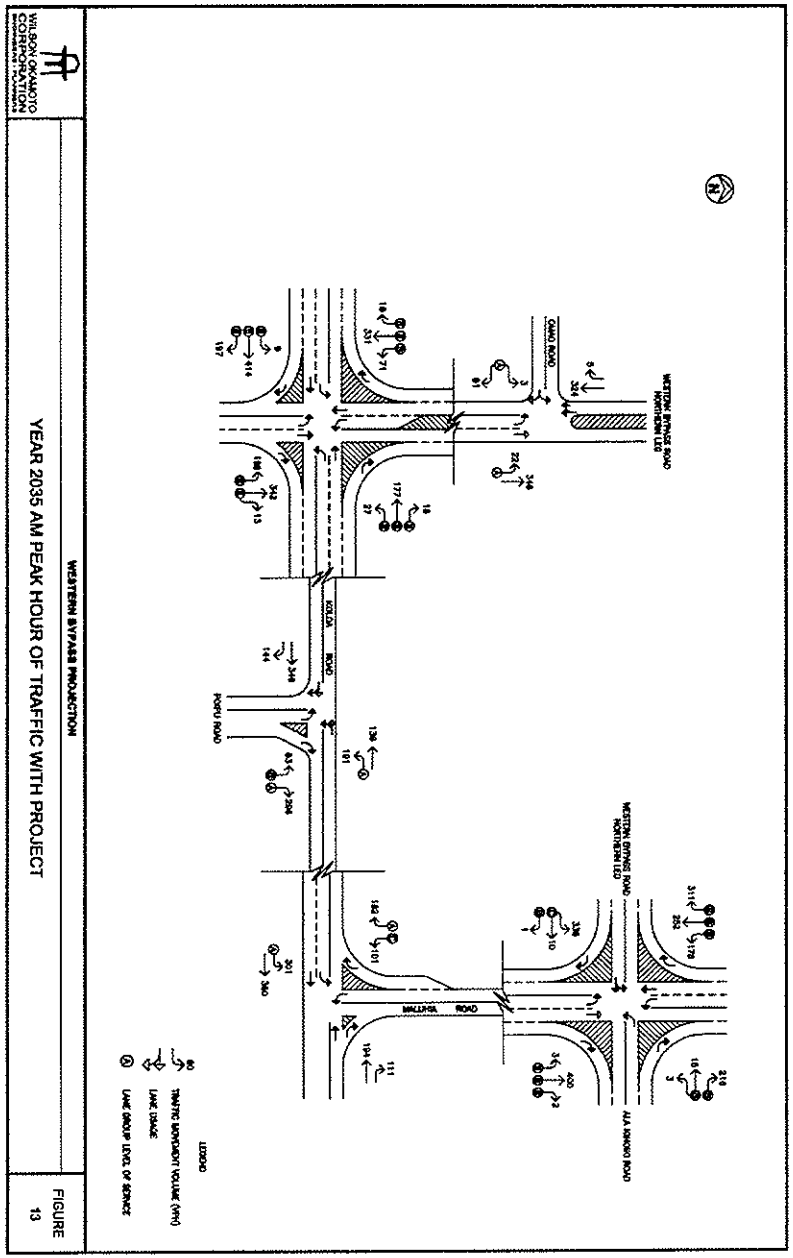
*Traffic signal system installed.

Traffic operations through Koloa town are expected to improve with construction of the Northern Leg of the Western Bypass Road. At the intersection of Koloa Road with Maluhia Road, southbound left-turn traffic movement is expected to improve from LOS "D" to LOS "C" during the AM peak period and LOS "F" to LOS "D" during the PM peak period. On the eastbound approach of the intersection, the left-turn traffic movement is expected to improve from LOS "C" to LOS "B" during the PM peak period. At the intersection of Koloa Road with Poipu Road, the westbound left-turn traffic movement is expected to improve from LOS "B" to LOS "A" during both peak periods while the northbound left-turn traffic movement is expected to improve from LOS "C" to LOS "B" during the AM peak period and LOS "F" to LOS "C" during the PM peak period.

Along the Northern Leg of the Western Bypass Road, traffic operations are expected to operate at acceptable levels of service primarily due to the installation of traffic signal systems at the intersections of that roadway with Maluhia Road and Koloa Road. At the intersections with Maluhia Road and Ala Kinoiki Road, the critical movements are expected to operate at LOS "B" during the AM peak period and LOS "C" or better during the PM peak period while those at the intersections with Omao Road and Koloa Road are expected to operate at LOS "A" and LOS "B," respectively, during both peak periods.

D. Year 2035 Total Traffic Volumes

An additional scenario was analyzed for the purpose of this report to assess traffic operating conditions with the full build-out of the currently planned projects in the Koloa and Poipu areas. As such, an assessment is provided of traffic operations 20 years after the completion of construction of the Western Bypass Road Northern Leg. The projected Year 2035 AM and PM peak hour traffic volumes and operating conditions in the project vicinity are shown on Figures 13 and 14, and summarized in Table 3. The Year 2015 levels of service with the project are provided for comparison purposes. LOS calculations are included in Appendix G.



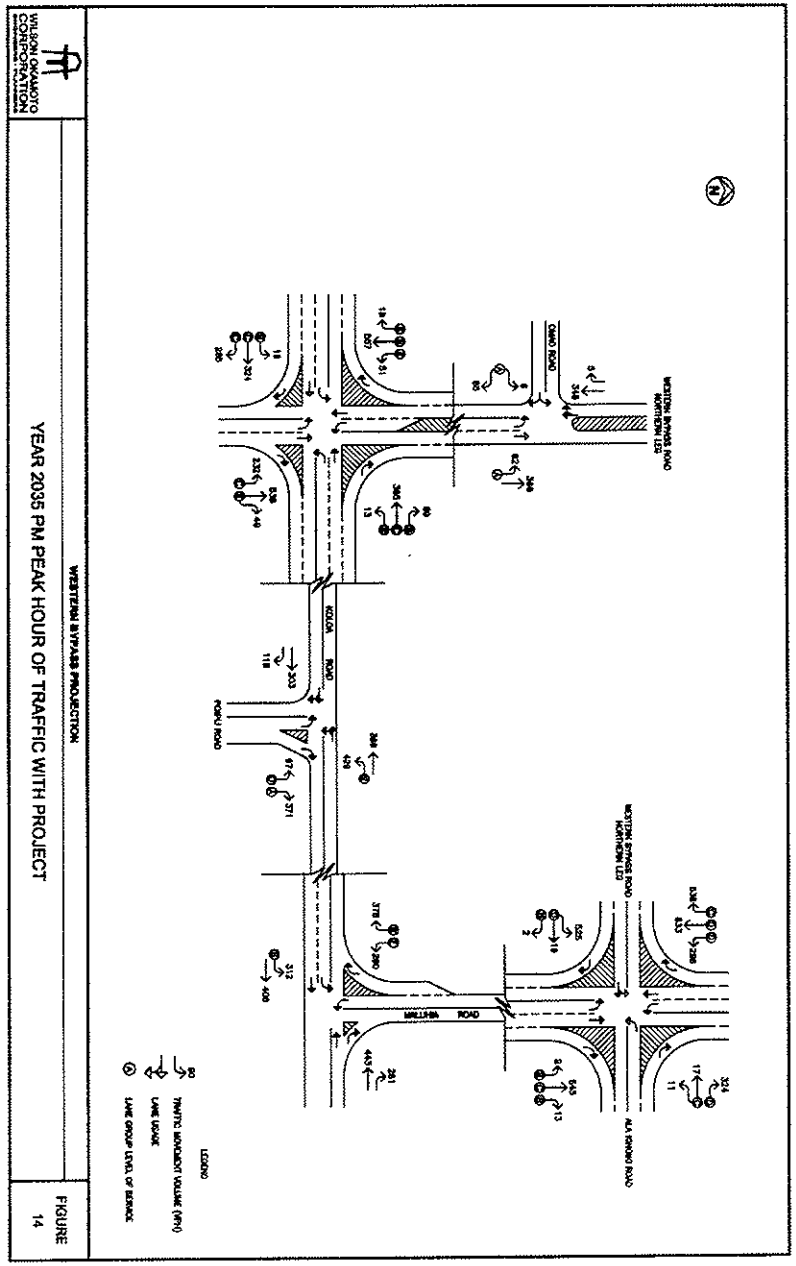


Table 3: Projected Year 2015 and Year 2035 With Project Traffic Operating Conditions

Intersection	Critical Movement		AM		PM	
			Year 2015 w/ Proj	Year 2035 w/ Proj	Year 2015 w/ Proj	Year 2035 w/ Proj
Maluhia Rd/ Ala Kinoiki Rd/ Western Bypass Rd Northern Leg	EB	LT-TH	B	C	C	D
		RT	B	B	B	B
	WB	LT-TH	B	B	C	C
		RT	B	B	C	D
	NB	LT	B	B	B	B
		TH	B	B	C	C
		RT	B	B	B	B
	SB	LT	B	B	C	D
		TH	B	B	C	D
		RT	B	B	B	C
Maluhia Rd/Koloa Rd	EB	LT	A	A	B	B
	SB	LT	C	C	D	E
		RT	A	A	B	B
Koloa Rd/Poipu Rd	WB	LT	A	A	A	B
	NB	LT	B	B	C	D
Koloa Rd/Western Bypass Rd	EB	LT	B	B	B	B
		TH	B	B	B	C
		RT	B	B	B	C
	WB	LT	B	B	B	B
		TH	B	B	B	C
		RT	B	B	B	B
	NB	LT	B	B	B	C
		TH-RT	B	B	B	B
	SB	LT	B	B	B	B
		TH	B	B	B	B
		RT	B	B	B	B
Western Bypass Road Northern Leg/ Omao Rd	EB	LT-RT	A	A	A	A
	NB	LT	A	A	A	A

Traffic operations in Koloa are expected to deteriorate under Year 2035 conditions due to the continued development of other projects in Koloa and Poipu. The critical movements at the study intersections are expected, in general, to operate at levels of service similar to Year 2015 with project conditions during the AM peak

period and slightly lower levels of service during the PM peak period. The critical movements at the intersection of the Northern Leg of the Western Bypass with Maluhia Road and Ala Kinoiki Road, as well as, the intersection of Koloa Road with Poipu Road are expected to operate at LOS "D" or better during the PM peak period while those at the intersection of Koloa Road with both sections of the Western Bypass Road are expected to operate at LOS "C" or better during that time period. At the intersection of Maluhia Road with Koloa Road, the southbound left-turn traffic movement is expected to operate at LOS "E" during the PM peak period due to the high volume of conflicting traffic.

V. RECOMMENDATIONS

Based on the analysis of the traffic data, the following are the recommendations of this study for implementation with the proposed project:

1. Monitor traffic conditions at the intersection of the Northern Leg of the Western Bypass Road with Maluhia Road and Ala Kinoiki Road and install a traffic signal system when warranted. The placement, phasing, and timing of the system should be determined during the design of the traffic signal system. Alternate intersection control strategies, such as roundabouts, could also be considered to alleviate anticipated conditions.

2. Monitor traffic conditions at the intersection of the Northern Leg of the Western Bypass Road with Koloa Road and the existing segment of the Western Bypass Road and install a traffic signal system when warranted. The placement, phasing, and timing of the system should be determined during the design of the traffic signal system.

3. Monitor traffic conditions along Koloa Road through Koloa Town to verify projected traffic conditions. Additional mitigative measures may be required for this segment of Koloa Road as development in the vicinity continues to progress.

VI. CONCLUSION

Significant increases in traffic volumes along the roadways throughout Koloa and Poipu are expected due to the development of other projects in the vicinity. The construction of the Northern Leg of the Western Bypass Road, as well as, the installation of traffic signal systems at both ends of that roadway are expected to alleviate projected traffic operating conditions. However, as development continues to progress in Koloa and Poipu over the next 25 years, additional mitigative measures such as intersection signalization or roadway

widening may be required, especially through Koloa Town. As such, traffic conditions should be monitored and periodically assessed to determine if additional measures are required.

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:T-1839
Counted:TO
Weather:Clear

File Name : KolOma AM
Site Code : 00000006
Start Date : 1/24/2008
Page No : 1

Groups Printed- Unshifted

	Koloa Road Southbound				Omao Road Westbound				Koloa Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
06:00 AM	1	30	0	31	4	0	0	4	0	22	3	25	0	60
06:15 AM	0	70	0	70	12	0	0	12	0	38	1	39	0	121
06:30 AM	0	135	0	135	17	0	0	17	0	28	0	28	0	180
06:45 AM	0	117	0	117	13	0	1	14	0	34	4	38	0	169
Total	1	352	0	353	46	0	1	47	0	122	8	130	0	530
07:00 AM	0	100	0	100	18	0	0	18	0	38	5	43	0	161
07:15 AM	0	119	0	119	23	0	1	24	0	50	2	52	0	195
07:30 AM	1	145	0	146	22	0	0	22	0	53	4	57	0	225
07:45 AM	0	143	0	143	25	0	2	27	0	55	11	66	0	236
Total	1	507	0	508	88	0	3	91	0	196	22	218	0	817
08:00 AM	0	102	0	102	19	0	2	21	0	41	7	48	0	171
08:15 AM	1	87	0	88	16	0	1	17	0	31	8	39	0	144
08:30 AM	0	90	0	90	16	0	1	17	0	50	5	55	0	162
08:45 AM	0	76	0	76	12	0	1	13	0	44	8	52	0	141
Total	1	355	0	356	63	0	5	68	0	166	28	194	0	618
Grand Total	3	1214	0	1217	197	0	9	206	0	484	58	542	0	1965
Apprch %	0.2	99.8	0		95.6	0	4.4		0	89.3	10.7			
Total %	0.2	61.8	0	61.9	10	0	0.5	10.5	0	24.6	3	27.6	0	

	Koloa Road Southbound				Omao Road Westbound				Koloa Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:15 AM														
07:15 AM	0	119	0	119	23	0	1	24	0	50	2	52	0	195
07:30 AM	**1**	**145**	0	**146**	22	0	0	22	0	53	4	57	0	225
07:45 AM	0	143	0	143	**25**	0	**2**	**27**	0	**55**	**11**	**66**	0	**236**
08:00 AM	0	102	0	102	19	0	2	21	0	41	7	48	0	171
Total Volume	1	509	0	510	89	0	5	94	0	199	24	223	0	827
% App. Total	0.2	99.8	0		94.7	0	5.3		0	89.2	10.8			
PHF	.250	.878	.000	.873	.890	.000	.625	.870	.000	.905	.545	.845	.000	.876

APPENDIX A

EXISTING TRAFFIC COUNT DATA

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5673
Counted By:TF
Weather:Clear

File Name : KoloaBy-Pass AM
Site Code : 00000001
Start Date : 11/13/2009
Page No : 1

Groups Printed- Unshifted

	Southbound	Koloa Road Westbound					By-Pass Road Northbound					Koloa Road Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	11	33	0	0	44	10	0	3	0	13	0	55	32	0	87	144
07:15 AM	0	5	37	0	0	42	17	0	4	0	21	0	60	25	0	85	148
07:30 AM	0	6	26	0	0	32	14	0	2	0	16	0	87	41	0	128	176
07:45 AM	0	5	31	0	0	36	13	0	4	0	17	0	107	42	0	149	202
Total	0	27	127	0	0	154	54	0	13	0	67	0	309	140	0	449	670
Grand Total	0	27	127	0	0	154	54	0	13	0	67	0	309	140	0	449	670
Apprch %		17.5	82.5	0	0		80.6	0	19.4	0		0	68.8	31.2	0		
Total %	0	4	19	0	0	23	8.1	0	1.9	0	10	0	46.1	20.9	0	67	

	Southbound	Koloa Road Westbound					By-Pass Road Northbound					Koloa Road Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	**11**	33	0	0	**44**	10	0	3	0	13	0	55	32	0	87	144
07:15 AM	0	5	**37**	0	0	42	**17**	0	**4**	0	**21**	0	60	25	0	85	148
07:30 AM	0	6	26	0	0	32	14	0	2	0	16	0	87	41	0	128	176
07:45 AM	0	5	31	0	0	36	13	0	4	0	17	0	**107**	**42**	0	**149**	**202**
Total Volume	0	27	127	0	0	154	54	0	13	0	67	0	309	140	0	449	670
% App. Total		17.5	82.5	0	0		80.6	0	19.4	0		0	68.8	31.2	0		
PHF	.000	.614	.858	.000	.000	.875	.794	.000	.813	.000	.798	.000	.722	.833	.000	.753	.829

WILSON OKAMOTO CORPORATION

1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:T-1839
Counted:TO
Weather:Clear

File Name : KolOma PM
Site Code : 00000006
Start Date : 1/24/2008
Page No : 1

Groups Printed- Unshifted

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Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
03:00 PM	2	86	0	88	21	0	2	23	0	116	14	130	0	241
03:15 PM	0	94	0	94	15	0	1	16	0	86	21	107	0	217
03:30 PM	0	82	0	82	14	0	0	14	0	95	19	114	0	210
03:45 PM	1	86	0	87	14	0	2	16	0	98	18	116	0	219
Total	3	348	0	351	64	0	5	69	0	395	72	467	0	887
04:00 PM	0	103	1	104	18	0	1	19	0	126	24	150	0	273
04:15 PM	2	94	0	96	20	0	0	20	0	137	22	159	0	275
04:30 PM	0	115	0	115	12	0	2	14	0	110	20	130	0	259
04:45 PM	0	94	0	94	15	0	3	18	0	100	18	118	0	230
Total	2	406	1	409	65	0	6	71	0	473	84	557	0	1037
05:00 PM	1	77	0	78	6	0	2	8	0	107	21	128	0	214
05:15 PM	0	74	0	74	7	0	0	7	0	110	18	128	0	209
05:30 PM	0	59	0	59	13	0	0	13	0	97	14	111	0	183
05:45 PM	0	51	0	51	11	0	1	12	0	96	22	118	0	181
Total	1	261	0	262	37	0	3	40	0	410	75	485	0	787
Grand Total	6	1015	1	1022	166	0	14	180	0	1278	231	1509	0	2711
Apprch %	0.6	99.3	0.1		92.2	0	7.8		0	84.7	15.3			
Total %	0.2	37.4	0	37.7	6.1	0	0.5	6.6	0	47.1	8.5	55.7	0	

	Koloa Road Southbound				Omao Road Westbound				Koloa Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 04:00 PM														
04:00 PM	0	103	**1**	104	18	0	1	19	0	126	**24**	150	0	273
04:15 PM	**2**	94	0	96	**20**	0	0	**20**	0	**137**	22	**159**	0	**275**
04:30 PM	0	**115**	0	**115**	12	0	2	14	0	110	20	130	0	259
04:45 PM	0	94	0	94	15	0	**3**	18	0	100	18	118	0	230
Total Volume	2	406	1	409	65	0	6	71	0	473	84	557	0	1037
% App. Total	0.5	99.3	0.2		91.5	0	8.5		0	84.9	15.1			
PHF	.250	.883	.250	.889	.813	.000	.500	.888	.000	.863	.875	.876	.000	.943

Wilson Okamoto Corporation
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676
Counted By:CL
Weather:Clear

File Name : KoloaPoipu AM
Site Code : 00000001
Start Date : 11/13/2009
Page No : 1

Groups Printed- Unshifted

	Southbound	Koloa Road Westbound					Poipu Road Northbound					Koloa Road Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	31	36	0	0	67	19	0	28	0	47	0	40	19	0	59	173
07:15 AM	0	28	20	0	0	48	14	0	23	0	37	0	44	33	0	77	162
07:30 AM	0	55	19	0	0	74	16	0	34	0	50	0	60	49	0	109	233
07:45 AM	0	30	23	0	0	53	16	0	43	0	59	0	60	34	0	94	206
Total	0	144	98	0	0	242	65	0	128	0	193	0	204	135	0	339	774
Grand Total	0	144	98	0	0	242	65	0	128	0	193	0	204	135	0	339	774
Apprch %		59.5	40.5	0	0		33.7	0	66.3	0		0	60.2	39.8	0		
Total %	0	18.6	12.7	0	0	31.3	8.4	0	16.5	0	24.9	0	26.4	17.4	0	43.8	

	Southbound	Koloa Road Westbound					Poipu Road Northbound					Koloa Road Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	31	**36**	0	0	67	**19**	0	28	0	47	0	40	19	0	59	173
07:15 AM	0	28	20	0	0	48	14	0	23	0	37	0	44	33	0	77	162
07:30 AM	0	**55**	19	0	0	**74**	16	0	34	0	50	0	**60**	**49**	0	**109**	**233**
07:45 AM	0	30	23	0	0	53	16	0	**43**	0	**59**	0	60	34	0	94	206
Total Volume	0	144	98	0	0	242	65	0	128	0	193	0	204	135	0	339	774
% App. Total		59.5	40.5	0	0		33.7	0	66.3	0		0	60.2	39.8	0		
PHF	.000	.655	.681	.000	.000	.818	.855	.000	.744	.000	.818	.000	.850	.689	.000	.778	.830

Wilson Okamoto Corporation
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5673
Counted By:TF
Weather:Clear

File Name : KoloaBy-Pass PM
Site Code : 00000001
Start Date : 11/12/2009
Page No : 1

Groups Printed- Unshifted

	Southbound	Koloa Road Westbound					Koloa Road Northbound					Koloa Road Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
03:30 PM	0	2	67	0	0	69	56	0	27	0	83	0	77	24	0	101	253
03:45 PM	0	5	82	0	0	87	38	0	9	0	47	0	68	36	0	104	238
Total	0	7	149	0	0	156	94	0	36	0	130	0	145	60	0	205	491
04:00 PM	0	4	102	0	0	106	52	0	7	0	59	0	80	39	0	119	284
04:15 PM	0	2	88	0	0	90	28	0	6	0	34	0	91	31	0	122	246
Grand Total	0	13	339	0	0	352	174	0	49	0	223	0	316	130	0	446	1021
Apprch %		3.7	96.3	0	0		78	0	22	0		0	70.9	29.1	0		
Total %	0	1.3	33.2	0	0	34.5	17	0	4.8	0	21.8	0	31	12.7	0	43.7	

	Southbound	Koloa Road Westbound					Koloa Road Northbound					Koloa Road Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
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	2	67	0	0	69	**56**	0	**27**	0	**83**	0	77	24	0	101	253
03:45 PM	0	5	82	0	0	87	38	0	9	0	47	0	68	36	0	104	238
04:00 PM	0	4	**102**	0	0	**106**	52	0	7	0	59	0	80	**39**	0	119	**284**
04:15 PM	0	2	88	0	0	90	28	0	6	0	34	0	**91**	31	0	**122**	246
Total Volume	0	13	339	0	0	352	174	0	49	0	223	0	316	130	0	446	1021
% App. Total		3.7	96.3	0	0		78	0	22	0		0	70.9	29.1	0		
PHF	.000	.650	.831	.000	.000	.830	.777	.000	.454	.000	.672	.000	.868	.833	.000	.914	.899

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:D4-3891, T-1841
Counted:EK, ER
Weather:Clear

File Name : KolPoi AM
Site Code : 00000002
Start Date : 1/23/2008
Page No : 1

Groups Printed- Unshifted

	Southbound	Koloa Road Westbound				Poipu Road Northbound				Koloa Road Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	0	19	21	0	40	15	0	9	24	0	31	24	55	119
06:15 AM	0	31	30	0	61	9	0	14	23	0	36	37	73	157
06:30 AM	0	47	28	0	75	11	0	18	29	0	78	48	126	230
06:45 AM	0	53	19	0	72	12	0	26	38	0	64	57	121	231
Total	0	150	98	0	248	47	0	67	114	0	209	166	375	737
07:00 AM	0	41	23	0	64	11	0	21	32	0	78	54	132	228
07:15 AM	0	54	21	0	75	17	0	28	45	0	84	58	142	262
07:30 AM	0	68	21	0	89	28	0	33	61	0	89	83	172	322
07:45 AM	0	45	28	0	73	10	0	33	43	0	77	87	164	280
Total	0	208	93	0	301	66	0	115	181	0	328	282	610	1092
08:00 AM	0	43	24	0	67	16	0	25	41	0	41	38	79	187
08:15 AM	0	41	33	0	74	12	0	29	41	0	54	32	86	201
08:30 AM	0	30	25	0	55	19	0	36	55	0	49	32	81	191
08:45 AM	0	37	35	0	72	20	0	41	61	0	52	31	83	216
Total	0	151	117	0	268	67	0	131	198	0	196	133	329	795
Grand Total	0	509	308	0	817	180	0	313	493	0	733	581	1314	2624
Apprch %		62.3	37.7	0		36.5	0	63.5		0	55.8	44.2		
Total %	0	19.4	11.7	0	31.1	6.9	0	11.9	18.8	0	27.9	22.1	50.1	

	Southbound	Koloa Road Westbound				Poipu Road Northbound				Koloa Road Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:00 AM														
07:00 AM	0	41	23	0	64	11	0	21	32	0	78	54	132	228
07:15 AM	0	54	21	0	75	17	0	28	45	0	84	58	142	262
07:30 AM	0	**68**	21	0	**89**	**28**	0	**33**	**61**	0	**89**	83	**172**	**322**
07:45 AM	0	45	**28**	0	73	10	0	33	43	0	77	**87**	164	280
Total Volume	0	208	93	0	301	66	0	115	181	0	328	282	610	1092
% App. Total		69.1	30.9	0		36.5	0	63.5		0	53.8	46.2		
PHF	.000	.765	.830	.000	.846	.589	.000	.871	.742	.000	.921	.810	.887	.848

Wilson Okamoto Corporation
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676
Counted By:CL
Weather:Clear

File Name : KoloaPoipu PM
Site Code : 00000001
Start Date : 11/12/2009
Page No : 1

Groups Printed- Unshifted

	Southbound	Koloa Road Westbound					Poipu Road Northbound					Koloa Road Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
03:30 PM	0	53	47	0	0	100	22	0	74	0	96	0	79	26	0	105	301
03:45 PM	0	56	62	0	0	118	25	0	63	0	88	0	48	22	0	70	276
Total	0	109	109	0	0	218	47	0	137	0	184	0	127	48	0	175	577
04:00 PM	0	64	76	0	0	140	28	0	72	0	100	0	65	23	0	88	328
04:15 PM	0	58	68	0	0	126	29	0	62	0	91	0	62	35	0	97	314
Grand Total	0	231	253	0	0	484	104	0	271	0	375	0	254	106	0	360	1219
Apprch %		47.7	52.3	0	0		27.7	0	72.3	0		0	70.6	29.4	0		
Total %	0	18.9	20.8	0	0	39.7	8.5	0	22.2	0	30.8	0	20.8	8.7	0	29.5	

	Southbound	Koloa Road Westbound					Poipu Road Northbound					Koloa Road Eastbound					
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
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	53	47	0	0	100	22	0	**74**	0	96	0	**79**	26	0	**105**	301
03:45 PM	0	56	62	0	0	118	25	0	63	0	88	0	48	22	0	70	276
04:00 PM	0	**64**	**76**	0	0	**140**	28	0	72	0	**100**	0	65	23	0	88	**328**
04:15 PM	0	58	68	0	0	126	**29**	0	62	0	91	0	62	**35**	0	97	314
Total Volume	0	231	253	0	0	484	104	0	271	0	375	0	254	106	0	360	1219
% App. Total		47.7	52.3	0	0		27.7	0	72.3	0		0	70.6	29.4	0		
PHF	.000	.902	.832	.000	.000	.864	.897	.000	.916	.000	.938	.000	.804	.757	.000	.857	.929

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:D4-3891, T-1841
Counted:EK, ER
Weather:Clear

File Name : KolPoi PM
Site Code : 00000002
Start Date : 1/23/2008
Page No : 1

Groups Printed- Unshifted

	Southbound	Koloa Road Westbound				Poipu Road Northbound				Koloa Road Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	0	58	67	0	125	37	0	46	83	0	51	53	104	312
03:15 PM	0	61	82	0	143	36	0	56	92	0	64	52	116	351
03:30 PM	0	60	81	0	141	47	0	70	117	0	60	43	103	361
03:45 PM	0	43	68	0	111	48	0	70	118	0	67	52	119	348
Total	0	222	298	0	520	168	0	242	410	0	242	200	442	1372
04:00 PM	0	41	107	0	148	49	0	47	96	0	58	44	102	346
04:15 PM	0	45	96	0	141	46	0	68	114	0	48	41	89	344
04:30 PM	0	53	68	0	121	49	0	74	123	0	39	65	104	348
04:45 PM	0	49	59	0	108	36	0	61	97	0	55	42	97	302
Total	0	188	330	0	518	180	0	250	430	0	200	192	392	1340
05:00 PM	0	42	76	0	118	50	0	55	105	0	45	36	81	304
05:15 PM	0	51	68	0	119	38	0	68	106	0	43	33	76	301
05:30 PM	0	58	68	0	126	66	0	54	120	0	44	29	73	319
05:45 PM	0	44	69	0	113	48	0	48	96	0	39	31	70	279
Total	0	195	281	0	476	202	0	225	427	0	171	129	300	1203
Grand Total	0	605	909	0	1514	550	0	717	1267	0	613	521	1134	3915
Apprch %		40	60	0		43.4	0	56.6		0	54.1	45.9		
Total %	0	15.5	23.2	0	38.7	14	0	18.3	32.4	0	15.7	13.3	29	

	Southbound	Koloa Road Westbound				Poipu Road Northbound				Koloa Road Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 03:15 PM														
03:15 PM	0	**61**	82	0	143	36	0	56	92	0	64	**52**	116	351
03:30 PM	0	60	81	0	141	47	0	**70**	117	0	60	43	103	**361**
03:45 PM	0	43	68	0	111	48	0	70	**118**	0	**67**	52	**119**	348
04:00 PM	0	41	**107**	0	**148**	**49**	0	47	96	0	58	44	102	346
Total Volume	0	205	338	0	543	180	0	243	423	0	249	191	440	1406
% App. Total		37.8	62.2	0		42.6	0	57.4		0	56.6	43.4		
PHF	.000	.840	.790	.000	.917	.918	.000	.868	.896	.000	.929	.918	.924	.974

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:D4-3889, T-1839
Counted:RY, TO
Weather:Clear

File Name : MalKol AM
Site Code : 00000004
Start Date : 1/23/2008
Page No : 1

Groups Printed- Unshifted

	Maluhia Road Southbound				Koloa Road Westbound				Northbound	Koloa Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	2	0	16	18	0	28	6	34	0	10	32	0	42	94
06:15 AM	12	0	45	57	0	19	4	23	0	12	41	0	53	133
06:30 AM	14	0	45	59	0	44	12	56	0	17	73	0	90	205
06:45 AM	8	0	50	58	0	21	18	39	0	28	58	0	86	183
Total	36	0	156	192	0	112	40	152	0	67	204	0	271	615
07:00 AM	13	0	35	48	0	36	10	46	0	21	78	0	99	193
07:15 AM	9	0	38	47	0	40	14	54	0	31	82	0	113	214
07:30 AM	4	0	42	46	0	58	2	60	0	37	87	3	127	233
07:45 AM	5	0	37	42	0	41	8	49	0	31	95	0	126	217
Total	31	0	152	183	0	175	34	209	0	120	342	3	465	857
08:00 AM	9	0	40	49	0	31	5	36	0	19	57	0	76	161
08:15 AM	3	0	40	43	0	31	9	40	0	27	53	0	80	163
08:30 AM	4	0	23	27	0	44	8	52	0	30	68	0	98	177
08:45 AM	4	0	34	38	0	49	14	63	0	34	69	0	103	204
Total	20	0	137	157	0	155	36	191	0	110	247	0	357	705
Grand Total	87	0	445	532	0	442	110	552	0	297	793	3	1093	2177
Apprch %	16.4	0	83.6		0	80.1	19.9			27.2	72.6	0.3		
Total %	4	0	20.4	24.4	0	20.3	5.1	25.4	0	13.6	36.4	0.1	50.2	

	Maluhia Road Southbound				Koloa Road Westbound				Northbound	Koloa Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:00 AM														
07:00 AM	**13**	0	35	**48**	0	36	10	46	0	21	78	0	99	193
07:15 AM	9	0	38	47	0	40	**14**	54	0	31	82	0	113	214
07:30 AM	4	0	**42**	46	0	**58**	2	**60**	0	**37**	87	**3**	**127**	**233**
07:45 AM	5	0	37	42	0	41	8	49	0	31	**95**	0	126	217
Total Volume	31	0	152	183	0	175	34	209	0	120	342	3	465	857
% App. Total	16.9	0	83.1		0	83.7	16.3			25.8	73.5	0.6		
PHF	.596	.000	.905	.953	.000	.754	.607	.871	.000	.811	.900	.250	.915	.920

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:D4-3890, D4-3888
Counted:BG, ZW
Weather:Clear

File Name : MalKin AM
Site Code : 00000001
Start Date : 1/23/2008
Page No : 1

Groups Printed- Unshifted

	Maluhia Road Southbound				Kinoiki Road Westbound				Maluhia Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
06:00 AM	13	17	0	30	1	0	15	16	0	13	1	14	0	60
06:15 AM	23	58	0	81	0	0	21	21	0	15	0	15	0	117
06:30 AM	33	56	0	89	1	0	29	30	0	26	0	26	0	145
06:45 AM	36	57	0	93	1	0	25	26	0	39	1	40	0	159
Total	105	188	0	293	3	0	90	93	0	93	2	95	0	481
07:00 AM	29	45	0	74	1	0	35	36	0	28	0	28	0	138
07:15 AM	32	47	0	79	1	0	41	42	0	44	2	46	0	167
07:30 AM	26	43	0	69	0	1	38	39	0	35	0	35	0	143
07:45 AM	57	37	0	94	1	0	54	55	0	38	0	38	0	187
Total	144	172	0	316	3	1	168	172	0	145	2	147	0	635
08:00 AM	33	41	0	74	1	0	29	30	0	20	0	20	0	124
08:15 AM	36	45	0	81	0	0	38	38	0	31	0	31	0	150
08:30 AM	29	25	0	54	4	0	40	44	0	21	0	21	0	119
08:45 AM	25	29	0	54	2	0	44	46	0	40	1	41	0	141
Total	123	140	0	263	7	0	151	158	0	112	1	113	0	534
Grand Total	372	500	0	872	13	1	409	423	0	350	5	355	0	1650
Apprch %	42.7	57.3	0		3.1	0.2	96.7		0	98.6	1.4			
Total %	22.5	30.3	0	52.8	0.8	0.1	24.8	25.6	0	21.2	0.3	21.5	0	

	Maluhia Road Southbound				Kinoiki Road Westbound				Maluhia Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:30 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:00 AM														
07:00 AM	29	45	0	74	1	0	35	36	0	28	0	28	0	138
07:15 AM	32	**47**	0	79	1	0	41	42	0	**44**	**2**	**46**	0	167
07:30 AM	26	43	0	69	0	**1**	38	39	0	35	0	35	0	143
07:45 AM	**57**	37	0	**94**	1	0	**54**	**55**	0	38	0	38	0	**187**
Total Volume	144	172	0	316	3	1	168	172	0	145	2	147	0	635
% App. Total	45.6	54.4	0		1.7	0.6	97.7		0	98.6	1.4			
PHF	.632	.915	.000	.840	.750	.250	.778	.782	.000	.824	.250	.799	.000	.849

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:D4-3889, T-1839
Counted:RY, TO
Weather:Clear

File Name : MalKol PM
Site Code : 00000004
Start Date : 1/23/2008
Page No : 1

Groups Printed- Unshifted

	Maluhia Road Southbound				Koloa Road Westbound				Northbound	Koloa Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	15	0	46	61	0	91	15	106	0	34	70	0	104	271
03:15 PM	16	0	49	65	0	104	20	124	0	30	102	0	132	321
03:30 PM	18	0	41	59	0	91	21	112	0	55	88	0	143	314
03:45 PM	17	0	32	49	0	82	14	96	0	48	88	0	136	281
Total	66	0	168	234	0	368	70	438	0	167	348	0	515	1187
04:00 PM	13	0	32	45	0	115	20	135	0	51	76	0	127	307
04:15 PM	17	0	28	45	0	107	23	130	0	48	87	0	135	310
04:30 PM	26	0	38	64	0	84	15	99	0	53	79	0	132	295
04:45 PM	22	0	35	57	0	84	17	101	0	43	86	0	129	287
Total	78	0	133	211	0	390	75	465	0	195	328	0	523	1199
05:00 PM	15	0	35	50	0	87	14	101	0	45	71	0	116	267
05:15 PM	22	0	35	57	0	78	11	89	0	44	65	0	109	255
05:30 PM	17	0	43	60	0	75	19	94	0	40	67	0	107	261
05:45 PM	21	0	32	53	0	67	11	78	0	22	63	0	85	216
Total	75	0	145	220	0	307	55	362	0	151	266	0	417	999
Grand Total	219	0	446	665	0	1065	200	1265	0	513	942	0	1455	3385
Apprch %	32.9	0	67.1		0	84.2	15.8			35.3	64.7	0		
Total %	6.5	0	13.2	19.6	0	31.5	5.9	37.4	0	15.2	27.8	0	43	

	Maluhia Road Southbound				Koloa Road Westbound				Northbound	Koloa Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 03:15 PM														
03:15 PM	16	0	**49**	**65**	0	104	20	124	0	30	**102**	0	132	**321**
03:30 PM	**18**	0	41	59	0	91	**21**	112	0	**55**	88	0	**143**	314
03:45 PM	17	0	32	49	0	82	14	96	0	48	88	0	136	281
04:00 PM	13	0	32	45	0	**115**	20	**135**	0	51	76	0	127	307
Total Volume	64	0	154	218	0	392	75	467	0	184	354	0	538	1223
% App. Total	29.4	0	70.6		0	83.9	16.1			34.2	65.8	0		
PHF	.889	.000	.786	.838	.000	.852	.893	.865	.000	.836	.868	.000	.941	.952

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Malehia Road
Title3 :

Site:
Date: 01/24/08
Day: Thursday

Interval Begin	NB AM	NB PM	SB AM	SB PM	Combined AM	Combined PM
12:00	8	20	2	10	10	30
12:15	5		3		8	
12:30	5		3		7	
12:45	2		2		5	
01:00	2	5	1	3	3	8
01:15	1		1		2	
01:30	1		1		2	
01:45	1		0		1	
02:00	0	5	1	3	1	8
02:15	2		1		3	
02:30	2		1		3	
02:45	1		0		1	
03:00	1	11	4	12	5	23
03:15	4		3		7	
03:30	1		2		3	
03:45	5		3		8	
04:00	3	13	3	30	6	43
04:15	4		7		11	
04:30	3		10		13	
04:45	3		10		13	
05:00	9	60	3	52	12	112
05:15	16		18		34	
05:30	17		15		32	
05:45	18		16		34	
06:00	31	148	24	260	55	408
06:15	32		52		84	
06:30	33		86		119	
06:45	53		98		151	
07:00	71	319	75	338	146	657
07:15	86		66		152	
07:30	74		91		165	
07:45	88		106		194	
08:00	84	316	92	320	176	636
08:15	60		92		152	
08:30	104		62		166	
08:45	68	421	74	301	142	722
09:00	96		70		166	
09:15	110		57		167	
09:30	104		56		207	
09:45	114	472	68	307	182	779
10:00	116		68		184	
10:15	130		95		225	
10:30	112		76		188	
10:45	126		102		228	
11:00	0		0		0	
11:15	*		*		*	
11:30	*		*		*	
11:45	*		*		*	
Totals	1,916	0	1,738	0	3,654	0
Split%	52.4		47.6			
Day Totals		1,916		1,738		3,654
Day Splits		52.4		47.6		
Peak Hour	10:15	*	07:30	*	10:15	*
Volume	484	*	381	*	825	*
Factor	0.93	*	0.90	*	0.90	*

Data File: STMJ50013

Printed : 1/25/2008 Page: 3

WILSON OKAMOTO CORPORATION

1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:D4-3890, D4-3888
Counted:BG, ZW
Weather:Clear

File Name : MalKin PM
Site Code : 00000001
Start Date : 1/23/2008
Page No : 1

Groups Printed- Unshifted

	Malulia Road Southbound				Kinoiki Road Westbound				Malulia Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
03:00 PM	37	46	0	83	0	0	63	63	1	35	5	41	0	189
03:15 PM	62	60	0	122	3	0	60	63	0	41	1	42	0	227
03:30 PM	62	50	0	112	4	0	73	77	0	64	7	71	0	260
03:45 PM	49	45	0	94	1	0	56	57	0	55	5	60	0	211
Total	210	203	0	413	8	0	252	260	1	195	18	214	0	887
04:00 PM	63	38	0	101	3	0	84	87	0	53	0	53	0	241
04:15 PM	63	35	0	98	2	0	68	70	0	54	1	55	0	223
04:30 PM	64	52	0	116	7	0	75	82	0	56	1	57	0	255
04:45 PM	44	55	0	99	3	0	59	62	0	40	1	41	0	202
Total	234	180	0	414	15	0	286	301	0	203	3	206	0	921
05:00 PM	57	46	0	103	2	0	55	57	0	46	2	48	0	208
05:15 PM	59	52	0	111	5	0	53	58	0	29	1	30	0	199
05:30 PM	59	53	0	112	4	0	59	63	0	44	4	48	0	223
05:45 PM	62	45	0	107	3	0	40	43	0	27	4	31	0	181
Total	237	196	0	433	14	0	207	221	0	146	11	157	0	811
Grand Total	681	579	0	1260	37	0	745	782	1	544	32	577	0	2619
Apprch %	54	46	0		4.7	0	95.3		0.2	94.3	5.5			
Total %	26	22.1	0	48.1	1.4	0	28.4	29.9	0	20.8	1.2	22	0	

	Malulia Road Southbound				Kinoiki Road Westbound				Malulia Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 03:15 PM														
03:15 PM	62	60	0	122	3	0	60	63	0	41	1	42	0	227
03:30 PM	62	50	0	112	4	0	73	77	0	64	7	71	0	260
03:45 PM	49	45	0	94	1	0	56	57	0	55	5	60	0	211
04:00 PM	63	38	0	101	3	0	84	87	0	53	0	53	0	241
Total Volume	236	193	0	429	11	0	273	284	0	213	13	226	0	939
% App. Total	55	45	0		3.9	0	96.1		0	94.2	5.8			
PHF	.637	.804	.000	.879	.688	.000	.813	.816	.000	.832	.464	.796	.000	.903

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Maluhia Road
Title3 :

Site:
Date: 01/23/08

Interval Begin	NB AM		NB PM		SB AM		SB PM		Combined AM		Combined PM		Day: Wednesday
12:00	4	13	76	370	4	9	100	391	8	22	176	761	
12:15	5		88		0		104		5		192		
12:30	3		118		3		92		6		210		
12:45	1		88		2		95		3		183		
01:00	1	11	104	400	1	4	86	401	2	15	190	801	
01:15	3		104		2		105		5		209		
01:30	2		100		0		88		2		188		
01:45	5		92		1		122		6		214		
02:00	1	9	104	444	2	10	104	406	3	19	208	850	
02:15	3		119		3		108		6		227		
02:30	2		110		3		90		5		200		
02:45	3		111		2		104		5		215		
03:00	1	11	100	477	3	10	115	417	4	21	215	894	
03:15	3		109		2		100		5		209		
03:30	2		136		2		121		4		257		
03:45	5		132		3		81		8		213		
04:00	1	25	107	485	5	28	110	422	6	53	217	907	
04:15	9		154		5		91		14		245		
04:30	7		108		12		118		19		226		
04:45	8		116		6		103		14		219		
05:00	7	56	124	420	5	56	106	431	12	112	230	851	
05:15	11		97		16		108		27		205		
05:30	23		100		20		111		43		211		
05:45	15		99		15		106		30		205		
06:00	28	159	81	295	20	255	95	306	48	414	176	601	
06:15	30		70		66		76		96		146		
06:30	49		78		74		82		123		160		
06:45	52		66		95		53		147		119		
07:00	74	334	52	164	69	317	56	192	143	651	108	356	
07:15	80		39		83		46		163		85		
07:30	92		40		86		47		178		87		
07:45	88		33		79		43		167		76		
08:00	66	320	38	125	100	312	41	162	166	632	79	287	
08:15	66		25		76		42		142		67		
08:30	98		32		64		33		162		65		
08:45	90		30		72		46		162		76		
09:00	96	394	23	106	60	297	25	177	156	691	48	283	
09:15	100		33		67		41		167		74		
09:30	103		22		82		67		185		89		
09:45	95		28		88		44		183		72		
10:00	114	424	22	95	55	291	50	103	169	715	72	198	
10:15	100		31		70		17		170		48		
10:30	108		23		75		24		183		47		
10:45	102		19		91		12		193		31		
11:00	109	403	9	42	94	360	6	20	203	763	15	62	
11:15	110		13		88		5		198		18		
11:30	100		15		88		3		188		18		
11:45	84		5		90		6		174		11		
Totals	2,159		3,423		1,949		3,428		4,108		6,851		
Split%	52.6		50.0		47.4		50.0						
Day Totals		5,582				5,377				10,959			
Day Splits		50.9				49.1							
Peak Hour	10:30		03:30		10:45		02:45		10:45		03:30		
Volume	429		529		361		440		782		932		
Factor	0.98		0.86		0.96		0.91		0.96		0.91		

Data File : STMS0013 Printed : 1/25/2008 Page : 2

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Kolea Road
Title3 :

Site: 100000000000
Date: 01/22/08

Interval Begin	WB AM		WB PM		EB AM		EB PM		Combined AM		Combined PM		Day: Tuesday
12:00	*		42	247	*		64	277	*		106	524	
12:15	*		56		*		75		*		131		
12:30	*		71		*		74		*		145		
12:45	*		78		*		64		*		142		
01:00	*		64	291	*		58	280	*		122	571	
01:15	*		78		*		83		*		161		
01:30	*		75		*		67		*		142		
01:45	*		74		*		72		*		146		
02:00	*		74	319	*		82	334	*		156	653	
02:15	*		76		*		87		*		163		
02:30	*		85		*		83		*		168		
02:45	*		84		*		82		*		166		
03:00	*		86	368	*		94	390	*		180	758	
03:15	*		92		*		94		*		186		
03:30	*		92		*		108		*		200		
03:45	*		98		*		94		*		192		
04:00	*		88	348	*		142	502	*		230	850	
04:15	*		79		*		144		*		223		
04:30	*		90		*		104		*		194		
04:45	*		91		*		112		*		203		
05:00	*		86	312	*		100	390	*		186	702	
05:15	*		78		*		92		*		170		
05:30	*		78		*		96		*		174		
05:45	*		70		*		102		*		172		
06:00	*		63	194	*		92	280	*		155	474	
06:15	*		49		*		74		*		123		
06:30	*		36		*		71		*		107		
06:45	*		46		*		43		*		89		
07:00	*		46	146	*		73	170	*		119	316	
07:15	*		38		*		46		*		84		
07:30	*		33		*		23		*		56		
07:45	*		29		*		28		*		57		
08:00	*		28	99	*		37	124	*		65	223	
08:15	*		27		*		24		*		51		
08:30	*		25		*		40		*		65		
08:45	*		19		*		23		*		42		
09:00	*		24	76	*		35	125	*		59	201	
09:15	*		21		*		35		*		56		
09:30	*		11		*		22		*		33		
09:45	*		20		*		33		*		53		
10:00	*		12	40	*		39	147	*		51	187	
10:15	*		8		*		50		*		58		
10:30	34		13		28		25		62		38		
10:45	60		7		62		33		122		40		
11:00	57	197	6	22	61	274	30	77	118	471	36	99	
11:15	39		5		79		25		118		30		
11:30	46		6		77		12		123		18		
11:45	55		5		57		10		112		15		
Totals	291		2,462		364		3,096		655		5,558		
Split%	44.4		44.3		55.6		55.7						
Day Totals		2,753				3,460				6,213			
Day Splits		44.3				55.7							
Peak Hour	10:45		03:15		10:45		04:00		10:45		04:00		
Volume	202		370		279		502		481		850		
Factor	0.84		0.94		0.88		0.87		0.98		0.92		

Data File : STMS0017 Printed : 1/25/2008 Page : 1

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Site: 100000000000
Date: 01/22/08

Title1 : Western Bypass
Title2 : Kolea Road
Title3 : :

Interval Begin	WB AM	WB PM	EB AM	EB PM	Combined AM	Combined PM
12:00	*	42	*	64	*	106
12:15	*	56	*	75	*	131
12:30	*	71	*	74	*	145
12:45	*	78	*	64	*	142
01:00	*	64	*	58	*	122
01:15	*	78	*	83	*	161
01:30	*	75	*	67	*	142
01:45	*	74	*	72	*	146
02:00	*	74	*	82	*	156
02:15	*	76	*	87	*	163
02:30	*	85	*	83	*	168
02:45	*	84	*	82	*	166
03:00	*	86	*	94	*	180
03:15	*	92	*	94	*	186
03:30	*	92	*	108	*	200
03:45	*	98	*	94	*	192
04:00	*	88	*	142	*	230
04:15	*	79	*	144	*	223
04:30	*	90	*	104	*	194
04:45	*	91	*	112	*	203
05:00	*	86	*	100	*	186
05:15	*	78	*	92	*	170
05:30	*	78	*	96	*	174
05:45	*	70	*	102	*	172
06:00	*	63	*	92	*	155
06:15	*	49	*	74	*	123
06:30	*	36	*	71	*	107
06:45	*	46	*	43	*	89
07:00	*	46	*	73	*	119
07:15	*	38	*	46	*	84
07:30	*	33	*	23	*	56
07:45	*	29	*	28	*	57
08:00	*	28	*	37	*	65
08:15	*	27	*	24	*	51
08:30	*	25	*	40	*	65
08:45	*	19	*	23	*	42
09:00	*	24	*	35	*	59
09:15	*	21	*	35	*	56
09:30	*	11	*	22	*	33
09:45	*	20	*	33	*	53
10:00	*	12	*	39	*	51
10:15	*	8	*	50	*	58
10:30	34	13	28	25	62	38
10:45	60	7	62	33	122	40
11:00	57	6	61	30	118	36
11:15	39	5	79	25	118	30
11:30	46	6	77	12	123	18
11:45	55	5	57	10	112	15
Totals	291	2,462	364	3,096	655	5,558
Split%	44.4	44.3	55.6	55.7		
Day Totals	2,753		3,460		6,213	
Day Splits	44.3		55.7			
Peak Hour	10:45	03:15	10:45	04:00	10:45	04:00
Volume	202	370	279	502	481	850
Factor	0.84	0.94	0.88	0.87	0.98	0.92

Data File: STMS0017 Printed : 1/25/2008 Page : 1

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Counter:D4-3890, D4-3888
Counted:BG, ZW
Weather:Clear

File Name : MalKin PM
Site Code : 00000001
Start Date : 1/23/2008
Page No : 1

Groups Printed- Unshifted

	Maluhia Road Southbound				Kinoiki Road Westbound				Maluhia Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
03:00 PM	37	48	0	85	0	0	63	63	1	35	5	41	0	189
03:15 PM	62	60	0	122	3	0	60	63	0	41	1	42	0	227
03:30 PM	62	50	0	112	4	0	73	77	0	64	7	71	0	260
03:45 PM	49	45	0	94	1	0	56	57	0	55	5	60	0	211
Total	210	203	0	413	8	0	252	260	1	195	18	214	0	887
04:00 PM	63	38	0	101	3	0	84	87	0	53	0	53	0	241
04:15 PM	63	35	0	98	2	0	68	70	0	54	1	55	0	223
04:30 PM	64	52	0	116	7	0	75	82	0	56	1	57	0	255
04:45 PM	44	55	0	99	3	0	59	62	0	40	1	41	0	202
Total	234	180	0	414	15	0	286	301	0	203	3	206	0	921
05:00 PM	57	46	0	103	2	0	55	57	0	46	2	48	0	208
05:15 PM	59	52	0	111	5	0	53	58	0	29	1	30	0	199
05:30 PM	59	53	0	112	4	0	59	63	0	44	4	48	0	223
05:45 PM	62	45	0	107	3	0	40	43	0	27	4	31	0	181
Total	237	196	0	433	14	0	207	221	0	146	11	157	0	811
Grand Total	681	579	0	1260	37	0	745	782	1	544	32	577	0	2619
Apprch %	54	46	0		4.7	0	95.3		0.2	94.3	5.5			
Total %	26	22.1	0	48.1	1.4	0	28.4	29.9	0	20.8	1.2	22	0	

	Maluhia Road Southbound				Kinoiki Road Westbound				Maluhia Road Northbound				Eastbound	
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 03:15 PM														
03:15 PM	62	60	0	122	3	0	60	63	0	41	1	42	0	227
03:30 PM	62	50	0	112	4	0	73	77	0	64	7	71	0	260
03:45 PM	49	45	0	94	1	0	56	57	0	55	5	60	0	211
04:00 PM	63	38	0	101	3	0	84	87	0	53	0	53	0	241
Total Volume	236	193	0	429	11	0	273	284	0	213	13	226	0	939
% App. Total	55	45	0		3.9	0	96.1		0	94.2	5.8			
PHF	.937	.804	.000	.879	.688	.000	.813	.816	.000	.832	.464	.796	.000	.903

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Koloa Road
Title3 :

Site: 100000000000
Date: 01/23/08

Day: Wednesday

Interval	WB				EB				Combined			
Begin	AM		PM		AM		PM		AM		PM	
12:00	5	9	48	286	18	42	80	308	23	51	128	594
12:15	3		70		14		82		17		152	
12:30	0		91		9		80		9		171	
12:45	1		77		1		66		2		143	
01:00	0	4	70	305	4	9	60	261	4	13	130	566
01:15	0		78		2		86		2		164	
01:30	3		77		1		72		4		149	
01:45	1		80		2		43		3		123	
02:00	1	4	54	290	4	13	78	313	5	17	132	603
02:15	1		75		1		78		2		153	
02:30	1		81		4		87		5		168	
02:45	1		80		4		70		5		150	
03:00	2	12	92	369	1	5	90	392	3	17	182	761
03:15	1		91		2		100		3		191	
03:30	5		92		0		116		5		208	
03:45	4		94		2		86		6		180	
04:00	6	45	81	364	4	15	128	454	10	60	209	818
04:15	11		96		5		140		16		236	
04:30	18		95		2		94		20		189	
04:45	10		92		4		92		14		184	
05:00	16	114	67	252	6	38	102	417	22	152	169	669
05:15	25		68		4		97		29		165	
05:30	47		56		11		110		58		166	
05:45	26		61		17		108		43		169	
06:00	44	364	60	190	26	124	94	298	70	488	154	488
06:15	78		38		37		78		115		116	
06:30	120		47		28		70		148		117	
06:45	122		45		33		56		155		101	
07:00	114	514	42	142	35	165	62	171	149	679	104	313
07:15	107		32		42		50		149		82	
07:30	156		34		44		29		200		63	
07:45	137		34		44		30		181		64	
08:00	70	290	19	98	34	170	40	145	104	460	59	243
08:15	78		17		37		39		115		56	
08:30	66		34		49		36		115		70	
08:45	76		28		50		30		126		58	
09:00	63	235	29	93	58	227	31	125	121	462	60	218
09:15	53		23		52		41		105		64	
09:30	51		21		54		32		105		53	
09:45	68		20		63		21		131		41	
10:00	54	226	10	38	62	222	54	169	116	448	64	207
10:15	59		10		62		50		121		60	
10:30	57		11		52		43		109		54	
10:45	56		7		46		22		102		29	
11:00	46	222	5	21	44	214	28	67	90	436	33	88
11:15	64		10		58		23		122		33	
11:30	62		2		62		5		124		7	
11:45	50		4		50		11		100		15	
Totals	2,039		2,448		1,244		3,120		3,283		5,568	
Split%	62.1		44.0		37.9		56.0					
Day Totals		4,487				4,364				8,851		
Day Splits		50.7				49.3						
Peak Hour	07:00		03:00		09:30		03:30		07:00		03:30	
Volume	514		369		241		470		679		833	
Factor	0.82		0.98		0.96		0.84		0.85		0.88	

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Koloa Road
Title3 :

Site: 100000000000
Date: 01/24/08

Day: Thursday

Interval	WB				EB				Combined			
Begin	AM		PM		AM		PM		AM		PM	
12:00	5	12	*		18	36	*		23	48	*	
12:15	3		*		7		*		10		*	
12:30	1		*		7		*		8		*	
12:45	3		*		4		*		7		*	
01:00	5	15	*		5	19	*		10	34	*	
01:15	4		*		4		*		8		*	
01:30	3		*		6		*		9		*	
01:45	3		*		4		*		7		*	
02:00	1	4	*		5	14	*		6	18	*	
02:15	1		*		6		*		7		*	
02:30	2		*		1		*		3		*	
02:45	0		*		2		*		2		*	
03:00	4	15	*		1	6	*		5	21	*	
03:15	0		*		1		*		1		*	
03:30	2		*		2		*		4		*	
03:45	9		*		2		*		11		*	
04:00	7	44	*		2	15	*		9	59	*	
04:15	12		*		7		*		19		*	
04:30	16		*		2		*		18		*	
04:45	9		*		4		*		13		*	
05:00	18	125	*		9	52	*		27	177	*	
05:15	28		*		10		*		38		*	
05:30	39		*		18		*		57		*	
05:45	40		*		15		*		55		*	
06:00	30	349	*		23	121	*		53	470	*	
06:15	65		*		36		*		101		*	
06:30	138		*		26		*		164		*	
06:45	116		*		36		*		152		*	
07:00	102	518	*		38	189	*		140	707	*	
07:15	121		*		48		*		169		*	
07:30	143		*		48		*		191		*	
07:45	152		*		55		*		207		*	
08:00	100	358	*		45	171	*		145	529	*	
08:15	89		*		32		*		121		*	
08:30	92		*		45		*		137		*	
08:45	77		*		49		*		126		*	
09:00	42	206	*		48	212	*		90	418	*	
09:15	54		*		48		*		102		*	
09:30	60		*		65		*		125		*	
09:45	50		*		51		*		101		*	
10:00	64	234	*		44	225	*		108	459	*	
10:15	63		*		56		*		119		*	
10:30	49		*		67		*		116		*	
10:45	58		*		58		*		116		*	
11:00	58		*		64		*		122		*	
11:15	0		*		0		*		0		*	
11:30	*		*		*		*		*		*	
11:45	*		*		*		*		*		*	
Totals	1,938		0		1,124		0		3,062		0	
Split%	63.3		*		36.7		*					
Day Totals		1,938				1,124				3,062		
Day Splits		63.3				36.7						
Peak Hour	07:00		*		10:15		*		07:15		*	
Volume	518		*		245		*		712		*	
Factor	0.85		*		0.91		*		0.86		*	

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Ala Kinoiki
Title3 :

Site:
Date: 01/22/08
Day: Tuesday

Interval Begin	WB AM		WB PM		EB AM		EB PM		Combined AM		Combined PM	
12:00	*		56	222	*		46	208	*		102	430
12:15	*		54		*		46		*		100	
12:30	*		58		*		64		*		122	
12:45	*		54		*		52		*		106	
01:00	*		64	240	*		54	207	*		118	447
01:15	*		52		*		49		*		101	
01:30	*		62		*		44		*		106	
01:45	*		62		*		60		*		122	
02:00	*		67	256	*		56	176	*		123	432
02:15	*		70		*		40		*		110	
02:30	*		66		*		36		*		102	
02:45	*		53		*		44		*		97	
03:00	*		62	250	*		60	229	*		122	479
03:15	*		52		*		65		*		117	
03:30	*		62		*		58		*		120	
03:45	*		74		*		46		*		120	
04:00	*		78	314	*		66	217	*		144	531
04:15	*		76		*		49		*		125	
04:30	*		98		*		54		*		152	
04:45	*		62		*		48		*		110	
05:00	*		62	234	*		52	229	*		114	463
05:15	*		51		*		54		*		105	
05:30	*		77		*		72		*		149	
05:45	*		44		*		51		*		95	
06:00	*		52	172	*		60	218	*		112	390
06:15	*		38		*		72		*		110	
06:30	*		38		*		49		*		87	
06:45	*		44		*		37		*		81	
07:00	*		28	120	*		32	138	*		60	258
07:15	*		29		*		47		*		76	
07:30	*		39		*		39		*		78	
07:45	*		24		*		20		*		44	
08:00	*		24	89	*		39	147	*		63	236
08:15	*		13		*		33		*		46	
08:30	*		25		*		32		*		57	
08:45	*		27		*		43		*		70	
09:00	*		18	69	*		24	88	*		42	157
09:15	*		15		*		26		*		41	
09:30	*		24		*		18		*		42	
09:45	*		12		*		20		*		32	
10:00	*		20	76	*		18	59	*		38	135
10:15	*		15		*		16		*		31	
10:30	*		29		*		16		*		45	
10:45	*		12		*		9		*		21	
11:00	*		7	32	*		7	15	*		14	47
11:15	78		10		50		2		128		12	
11:30	68		9		48		1		116		10	
11:45	56		6		42		5		98		11	
Totals	202		2,074		140		1,931		342		4,005	
Split%	59.1		51.8		40.9		48.2					
Day Totals			2,276				2,071				4,347	
Day Splits			52.4				47.6					
Peak Hour	*		03:45		*		05:30		*		03:45	
Volume	*		326		*		255		*		541	
Factor	*		0.83		*		0.89		*		0.89	

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Ala Kinoiki
Title3 :

Site:
Date: 01/23/08
Day: Wednesday

Interval Begin	WB AM		WB PM		EB AM		EB PM		Combined AM		Combined PM	
12:00	4	9	48	225	2	7	40	192	6	16	88	417
12:15	1		46		3		48		4		94	
12:30	3		59		0		46		3		105	
12:45	1		72		2		58		3		130	
01:00	1	4	56	248	1	2	40	197	2	6	96	445
01:15	0		69		0		44		0		113	
01:30	1		70		1		60		2		130	
01:45	2		53		0		53		2		106	
02:00	4	9	66	302	1	3	55	217	5	12	121	519
02:15	1		80		1		67		2		147	
02:30	2		74		0		52		2		126	
02:45	2		82		1		43		3		125	
03:00	0	5	66	275	2	5	60	236	2	10	126	511
03:15	1		68		2		58		3		126	
03:30	3		70		0		46		3		116	
03:45	1		71		1		72		2		143	
04:00	2	11	72	290	1	18	44	238	3	29	116	528
04:15	0		62		1		60		1		122	
04:30	4		92		5		66		9		158	
04:45	5		64		11		68		16		132	
05:00	8	30	67	252	5	33	51	233	13	63	118	485
05:15	4		67		4		58		8		125	
05:30	6		64		11		66		17		130	
05:45	12		54		13		58		25		112	
06:00	7	70	59	193	10	70	64	209	17	140	123	402
06:15	14		41		14		62		28		103	
06:30	18		44		14		39		32		83	
06:45	31		49		32		44		63		93	
07:00	24	146	44	122	36	133	28	121	60	279	72	243
07:15	31		27		26		31		57		58	
07:30	52		25		40		30		92		55	
07:45	39		26		31		32		70		58	
08:00	52	194	21	76	50	166	22	94	102	360	43	170
08:15	32		24		52		22		84		46	
08:30	40		15		28		28		68		43	
08:45	70		16		36		22		106		38	
09:00	50	248	18	62	38	155	24	106	88	403	42	168
09:15	60		11		28		20		88		31	
09:30	62		24		38		23		100		47	
09:45	76		9		51		39		127		48	
10:00	62	264	14	63	34	139	29	69	96	403	43	132
10:15	74		17		37		26		111		43	
10:30	56		17		34		5		90		22	
10:45	72		15		34		9		106		24	
11:00	56	280	6	27	46	200	8	14	102	480	14	41
11:15	71		5		54		3		125		8	
11:30	79		9		51		3		130		12	
11:45	74		7		49		0		123		7	
Totals	1,270		2,135		931		1,926		2,201		4,061	
Split%	57.7		52.6		42.3		47.4					
Day Totals			3,405				2,857				6,262	
Day Splits			54.4				45.6					
Peak Hour	11:00		02:00		11:00		05:30		11:00		03:45	
Volume	280		302		200		250		480		539	
Factor	0.89		0.92		0.93		0.95		0.92		0.85	

Wilson Okamoto Corporation

1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Ala Kinoiki
Title3 :

Site:
Date: 01/24/08
Day: Thursday

Interval	WB			EB			Combined		
Begin	AM		PM	AM		PM	AM		PM
12:00	3	17	*	3	6	*	6	23	*
12:15	5		*	1		*	6		*
12:30	4		*	2		*	6		*
12:45	5		*	0		*	5		*
01:00	1	2	*	2	3	*	3	5	*
01:15	1		*	0		*	1		*
01:30	0		*	0		*	0		*
01:45	0		*	1		*	1		*
02:00	1	3	*	0	4	*	1	7	*
02:15	0		*	2		*	2		*
02:30	1		*	1		*	2		*
02:45	1		*	1		*	2		*
03:00	0	4	*	0	6	*	0	10	*
03:15	1		*	3		*	4		*
03:30	2		*	2		*	4		*
03:45	1		*	1		*	2		*
04:00	2	7	*	3	15	*	5	22	*
04:15	1		*	2		*	3		*
04:30	3		*	2		*	5		*
04:45	1		*	8		*	9		*
05:00	4	31	*	10	34	*	14	65	*
05:15	7		*	3		*	10		*
05:30	10		*	12		*	22		*
05:45	10		*	9		*	19		*
06:00	9	61	*	13	77	*	22	138	*
06:15	14		*	10		*	24		*
06:30	23		*	20		*	43		*
06:45	15		*	34		*	49		*
07:00	26	157	*	37	134	*	63	291	*
07:15	42		*	34		*	76		*
07:30	46		*	27		*	73		*
07:45	43		*	36		*	79		*
08:00	40	198	*	50	188	*	90	386	*
08:15	46		*	53		*	99		*
08:30	40		*	56		*	96		*
08:45	72		*	29		*	101		*
09:00	46	254	*	30	151	*	76	405	*
09:15	62		*	36		*	98		*
09:30	68		*	31		*	99		*
09:45	78		*	54		*	132		*
10:00	66	282	*	48	159	*	114	441	*
10:15	70		*	35		*	105		*
10:30	68		*	32		*	100		*
10:45	78		*	44		*	122		*
11:00	72		*	60		*	132		*
11:15	81		*	61		*	142		*
11:30	0		*	0		*	0		*
11:45	*		*	*		*	*		*
Totals	1,169		0	898		0	2,067		0
Split%	56.6		*	43.4		*			
Day Totals		1,169			898			2,067	
Day Splits		56.6			43.4				
Peak Hour	10:30		*	10:30		*	10:30		*
Volume	299		*	197		*	496		*
Factor	0.92		*	0.81		*	0.87		*

Data File : $TM50014 Printed : 1/25/2008 Page : 3

Wilson Okamoto Corporation

1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Maluhia Road
Title3 :

Site:
Date: 01/22/08
Day: Tuesday

Interval	NB				SB				Combined			
Begin	AM		PM		AM		PM		AM		PM	
12:00	*		96	380	*		86	387	*		182	767
12:15	*		112		*		108		*		220	
12:30	*		92		*		91		*		183	
12:45	*		80		*		102		*		182	
01:00	*		104	394	*		100	389	*		204	783
01:15	*		104		*		84		*		188	
01:30	*		94		*		110		*		204	
01:45	*		92		*		95		*		187	
02:00	*		102	418	*		100	374	*		202	792
02:15	*		121		*		75		*		196	
02:30	*		95		*		101		*		196	
02:45	*		100		*		98		*		198	
03:00	*		93	447	*		110	451	*		203	898
03:15	*		92		*		110		*		202	
03:30	*		128		*		103		*		231	
03:45	*		134		*		128		*		262	
04:00	*		130	493	*		94	390	*		224	883
04:15	*		144		*		98		*		242	
04:30	*		109		*		98		*		207	
04:45	*		110		*		100		*		210	
05:00	*		93	382	*		106	433	*		199	815
05:15	*		116		*		120		*		236	
05:30	*		92		*		101		*		193	
05:45	*		81		*		106		*		187	
06:00	*		68	286	*		95	306	*		163	592
06:15	*		71		*		77		*		148	
06:30	*		74		*		70		*		144	
06:45	*		73		*		64		*		137	
07:00	*		50	176	*		76	260	*		126	436
07:15	*		57		*		73		*		130	
07:30	*		37		*		43		*		80	
07:45	*		32		*		68		*		100	
08:00	*		24	129	*		60	202	*		84	331
08:15	*		35		*		54		*		89	
08:30	*		34		*		53		*		87	
08:45	*		36		*		35		*		71	
09:00	*		22	106	*		46	149	*		68	255
09:15	*		34		*		40		*		74	
09:30	*		19		*		32		*		51	
09:45	*		31		*		31		*		62	
10:00	*		24	110	*		31	86	*		55	196
10:15	*		46		*		28		*		74	
10:30	*		26		*		16		*		42	
10:45	*		14		*		11		*		25	
11:00	4	318	13	45	0	260	11	29	4	578	24	74
11:15	116		13		92		8		208		21	
11:30	98		14		80		8		178		22	
11:45	100		5		88		2		188		7	
Totals	318		3,366		260		3,456		578		6,822	
Split%	55.0		49.3		45.0		50.7					
Day Totals		3,684				3,716				7,400		
Day Splits		49.8				50.2						
Peak Hour	11:00		03:30		11:00		03:00		11:00		03:30	
Volume	318		536		260		451		578		959	
Factor	0.69		0.93		0.71		0.88		0.69		0.92	

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Wilson Okamoto Corporation

1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Maluhia Road
Title3 :

Site:
Date: 01/23/08

Day: Wednesday

Interval	NB				SB				Combined			
Begin	AM		PM		AM		PM		AM		PM	
12:00	4	13	76	370	4	9	100	391	8	22	176	761
12:15	5		88		0		104		5		192	
12:30	3		118		3		92		6		210	
12:45	1		88		2		95		3		183	
01:00	1	11	104	400	1	4	86	403	2	15	190	801
01:15	3		104		2		105		5		209	
01:30	2		100		0		88		2		188	
01:45	5		92		1		122		6		214	
02:00	1	9	104	444	2	10	104	406	3	19	208	850
02:15	3		119		3		108		6		227	
02:30	2		110		3		90		5		200	
02:45	3		111		2		104		5		215	
03:00	1	11	100	477	3	10	115	417	4	21	215	894
03:15	3		109		2		100		5		209	
03:30	2		136		2		121		4		257	
03:45	5		132		3		81		8		213	
04:00	1	25	107	485	5	28	110	422	6	53	217	907
04:15	9		154		5		91		14		245	
04:30	7		108		12		118		19		226	
04:45	8		116		6		103		14		219	
05:00	7	56	124	420	5	56	106	431	12	112	230	851
05:15	11		97		16		108		27		205	
05:30	23		100		20		111		43		211	
05:45	15		99		15		106		30		205	
06:00	28	159	81	295	20	255	95	306	48	414	176	601
06:15	30		70		66		76		96		146	
06:30	49		78		74		82		123		160	
06:45	52		66		95		53		147		119	
07:00	74	334	52	164	69	317	56	192	143	651	108	356
07:15	80		39		83		46		163		85	
07:30	92		40		86		47		178		87	
07:45	88		33		79		43		167		76	
08:00	66	320	38	125	100	312	41	162	166	632	79	287
08:15	66		25		76		42		142		67	
08:30	98		32		64		33		162		65	
08:45	90		30		72		46		162		76	
09:00	96	394	23	106	60	297	25	177	156	691	48	283
09:15	100		33		67		41		167		74	
09:30	103		22		82		67		185		89	
09:45	95		28		88		44		183		72	
10:00	114	424	22	95	55	291	50	103	169	715	72	198
10:15	100		31		70		37		170		48	
10:30	108		23		75		24		183		47	
10:45	102		19		91		12		193		31	
11:00	109	403	9	42	94	360	6	20	203	763	15	62
11:15	110		13		88		5		198		18	
11:30	100		15		88		3		188		18	
11:45	84		5		90		6		174		11	
Totals	2,159		3,423		1,949		3,428		4,108		6,851	
Split%	52.6		50.0		47.4		50.0					

Day Totals	5,582		5,377		10,959	
Day Splits	50.9		49.1			
Peak Hour	10:30	03:30	10:45	02:45	10:45	03:30
Volume	429	529	361	440	782	932
Factor	0.98	0.86	0.96	0.91	0.96	0.91

Wilson Okamoto Corporation

1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Western Bypass
Title2 : Maluhia Road
Title3 :

Site:
Date: 01/24/08

Day: Thursday

Interval	NB				SB				Combined			
Begin	AM		PM		AM		PM		AM		PM	
12:00	8	20	*		2	10	*		10	30	*	
12:15	5		*		3		*		8		*	
12:30	5		*		2		*		7		*	
12:45	2		*		3		*		5		*	
01:00	2	5	*		1	3	*		3	8	*	
01:15	1		*		1		*		2		*	
01:30	1		*		1		*		2		*	
01:45	1		*		0		*		1		*	
02:00	0	5	*		1	3	*		1	8	*	
02:15	2		*		1		*		3		*	
02:30	2		*		1		*		3		*	
02:45	1		*		0		*		1		*	
03:00	1	11	*		4	12	*		5	23	*	
03:15	4		*		3		*		7		*	
03:30	1		*		2		*		3		*	
03:45	5		*		3		*		8		*	
04:00	3	13	*		3	30	*		6	43	*	
04:15	4		*		7		*		11		*	
04:30	3		*		10		*		13		*	
04:45	3		*		10		*		13		*	
05:00	9	60	*		3	52	*		12	112	*	
05:15	16		*		18		*		34		*	
05:30	17		*		15		*		32		*	
05:45	18		*		16		*		34		*	
06:00	31	148	*		24	260	*		55	408	*	
06:15	32		*		52		*		84		*	
06:30	32		*		86		*		118		*	
06:45	53		*		98		*		151		*	
07:00	71	319	*		75	338	*		146	657	*	
07:15	86		*		66		*		152		*	
07:30	74		*		91		*		165		*	
07:45	88		*		106		*		194		*	
08:00	84	316	*		92	320	*		176	636	*	
08:15	60		*		92		*		152		*	
08:30	104		*		62		*		166		*	
08:45	68		*		74		*		142		*	
09:00	96	421	*		70	301	*		166	722	*	
09:15	110		*		57		*		167		*	
09:30	111		*		96		*		207		*	
09:45	104		*		78		*		182		*	
10:00	114	472	*		68	307	*		182	779	*	
10:15	116		*		68		*		184		*	
10:30	130		*		95		*		225		*	
10:45	112		*		76		*		188		*	
11:00	126		*		102		*		228		*	
11:15	0		*		0		*		0		*	
11:30	*		*		*		*		*		*	
11:45	*		*		*		*		*		*	
Totals	1,916		0		1,738		0		3,654		0	
Split%	52.4		*		47.6		*					

Day Totals	1,916		1,738		3,654	
Day Splits	52.4		47.6			
Peak Hour	10:15	*	07:30	*	10:15	*
Volume	484	*	381	*	825	*
Factor	0.93	*	0.90	*	0.90	*

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average control delay per vehicle, typically a 15-min analysis period. The criteria are given in the following table.

Table 1: Level-of-Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec/veh)
A	≤10.0
B	>10.0 and ≤20.0
C	>20.0 and ≤35.0
D	>35.0 and ≤55.0
E	>55.0 and ≤80.0
F	>80.0

Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group.

Level of Service A describes operations with low control delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

Level of Service B describes operations with control delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

Level of Service C describes operations with control delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

Level of Service D describes operations with control delay greater than 35 and up to 55 sec per vehicle. At level of service D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

"Highway Capacity Manual," Transportation Research Board, 2000.

Level of Service E describes operation with control delay greater than 55 and up to 80 sec per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

Level of Service F describes operations with control delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service (LOS) criteria are given in Table 1. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in the queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. If the degree of saturation is greater than about 0.9, average control delay is significantly affected by the length of the analysis period.

Table 1: Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (Sec/Veh)
A	≤10.0
B	>10.0 and ≤15.0
C	>15.0 and ≤25.0
D	>25.0 and ≤35.0
E	>35.0 and ≤50.0
F	>50.0

APPENDIX C

CAPACITY ANALYSIS CALCULATIONS
EXISTING PEAK HOUR TRAFFIC ANALYSIS

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Koloa Rd
North/South Street: Omao Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	507			196	22
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	1	507			196	22
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				88		3
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				88		3
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	1						91	
C(m) (vph)	1352						765	
v/c	0.00						0.12	
95% queue length	0.00						0.40	
Control Delay	7.7						10.3	
LOS	A						B	
Approach Delay							10.3	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Koloa Rd
North/South Street: Omao Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	365			405	82
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	1	365			405	82
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				61		4
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				61		4
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	1						65	
C(m) (vph)	1076						705	
v/c	0.00						0.09	
95% queue length	0.00						0.30	
Control Delay	8.3						10.6	
LOS	A						B	
Approach Delay							10.6	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Koloa Rd
North/South Street: Western Bypass
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		461	141	27	162	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		461	141	27	162	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided		/			
RT Channelized?			No			
Lanes		1	1	1	1	
Configuration		T	R	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	56		13			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	56		13			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		27	56		13			
C(m) (vph)		975	760		1046			
v/c		0.03	0.07		0.01			
95% queue length		0.09	0.24		0.04			
Control Delay		8.8	10.1		8.5			
LOS		A	B		A			
Approach Delay				9.8				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Koloa Rd
North/South Street: Western Bypass
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		305	121	13	406	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		305	121	13	406	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1	1	1	
Configuration		T	R	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	90		49			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	90		49			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes		1	1			
Configuration		L	R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		13	90		49			
C(m) (vph)		1133	732		1196			
v/c		0.01	0.12		0.04			
95% queue length		0.03	0.42		0.13			
Control Delay		8.2	10.6		8.1			
LOS		A	B		A			
Approach Delay				9.7				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Koloa Rd
North/South Street: Poipu Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		328	141	181	120	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		328	141	181	120	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	69		115			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	69		115			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes		1	1			
Configuration		L	R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		181	69		115			
C(m) (vph)		1093	596		1104			
v/c		0.17	0.12		0.10			
95% queue length		0.59	0.39		0.35			
Control Delay		8.9	11.8		8.6			
LOS		A	B		A			
Approach Delay				9.8				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Koloa Rd
North/South Street: Poipu Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		249	105	205	338	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		249	105	205	338	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	90		243			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	90		243			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		205	90		243			
C(m) (vph)		1205	504		1199			
v/c		0.17	0.18		0.20			
95% queue length		0.61	0.65		0.76			
Control Delay		8.6	13.7		8.8			
LOS		A	B		A			
Approach Delay				10.1				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Koloa Rd
North/South Street: Maluhia Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	120	342			175	34
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	120	342			175	34
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				31		152
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				31		152
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	120					31		152
C(m) (vph)	1362					892		1318
v/c	0.09					0.03		0.12
95% queue length	0.29					0.11		0.39
Control Delay	7.9					9.2		8.1
LOS	A					A		A
Approach Delay							8.3	
Approach LOS							A	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Koloa Rd
North/South Street: Maluhia Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	184	354			392	75
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	184	354			392	75
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				64		154
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				64		154
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	184					64		154
C(m) (vph)	1094					381		1074
v/c	0.17					0.17		0.14
95% queue length	0.61					0.60		0.50
Control Delay	9.0					16.4		8.9
LOS	A					C		A
Approach Delay							11.1	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Ala Kinoiki
North/South Street: Maluhia Rd
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		145	2	144	172	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		145	2	144	172	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided		/			
RT Channelized?			No			
Lanes		1	1	1	1	
Configuration		T	R	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	3		168			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	3		168			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		144	3		168			
C(m) (vph)		1435	750		1372			
v/c		0.10	0.00		0.12			
95% queue length		0.33	0.01		0.42			
Control Delay		7.8	9.8		8.0			
LOS		A	A		A			
Approach Delay				8.0				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Ala Kinoiki
North/South Street: Maluhia Rd
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		213	13	236	193	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		213	13	236	193	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1	1	1	
Configuration		T	R	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	11		273			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	11		273			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes		1	1			
Configuration		L	R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		236	11		273			
C(m) (vph)		1342	537		1295			
v/c		0.18	0.02		0.21			
95% queue length		0.64	0.06		0.80			
Control Delay		8.3	11.8		8.5			
LOS		A	B		A			
Approach Delay				8.7				
Approach LOS				A				

APPENDIX D

TRIP GENERATION

Year 2035 Peak Hour Trip Generation

Development Name/Entity	Land Use	Units	TSF	AM Peak			PM Peak		
				Total	Enter	Exit	Total	Enter	Exit
Kukui'ula									
Kukui'ula	Rec (SF)	1,200		128	86	42	208	85	123
	MF	300		88	15	73	104	69	35
Kukui'ula Totals				**216**	**101**	**115**	**312**	**155**	**157**
Poipu (West)									
Kiahuna - Pili Mai	MF	191		84	14	70	99	66	33
Kiahuna Poipu Golf Resort	SF	2		2	1	1	2	1	1
	MF	280		123	21	102	146	98	48
Poipu (West) Totals				**209**	**36**	**173**	**247**	**165**	**82**
Poipu (East)									
Village at Poipu	Rec (SF)	298		48	32	16	77	32	45
	MF	130		57	10	47	68	45	23
Poipu (East) Totals				**105**	**42**	**63**	**145**	**77**	**68**
Koloa									
Koloa Creekside	SF	8		6	2	4	8	5	3
	MF	72		32	6	26	37	25	12
Koloa Totals				**38**	**8**	**30**	**46**	**30**	**15**

Year 2015 Peak Hour Trip Generation

Development Name/Entity	Land Use	Units	TSF	AM Peak			PM Peak		
				Total	Enter	Exit	Total	Enter	Exit
Kukui'ula									
Kukui'ula	Rec Home	1,200		64	43	21	104	43	61
	MF	300		44	7	37	52	35	17
	Commercial		43.8	44	27	17	163	80	83
Kukui'ula Totals				**152**	**77**	**75**	**319**	**157**	**162**
Poipu									
Sheraton Kauai Resort	Rec Home	365		58	39	19	95	39.0	56.0
Kiahuna - Poipu Beach Estates	MF	108		48	8	40	56	38	18
Kiahuna - Royal Palms Kauai	MF	164		72	12	60	85	57	28
Wainani at Kiahuna	SF	70		53	13	40	71	45	26
Poipu Beach Villas	Rec Home	323		52	35	17	84	34	50
Poipu Town Center	Commercial		107	107	65	42	399	196	203
Poipu Totals				**389**	**172**	**218**	**790**	**409**	**381**
Koloa									
Shops at Koloa Town	Commercial		75	75	46	29	280	137	143
Historic Village at Koloa Town	SF	34		26	7	19	34	21	13
	Commercial		45	45	27	18	168	82	86
Koloa Totals				**146**	**80**	**66**	**482**	**240**	**242**
Poipu Road									
Kukuiula Workforce Housing	MF	135		59	10	47	70	45	23
Paanau (on street of same name)	MF	60		26	4	22	31	21	10
Poipu Road Totals				**86**	**14**	**69**	**101**	**66**	**33**

APPENDIX E

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2015 PEAK HOUR TRAFFIC
ANALYSIS WITHOUT PROJECT
WITH IMPROVEMENTS

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Koloa Rd
North/South Street: Omao Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	575			282	22
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	1	575			282	22
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				88		3
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				88		3
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		No	/
Lanes				0	0	
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	1						91	
C(m) (vph)	1257						665	
v/c	0.00						0.14	
95% queue length	0.00						0.47	
Control Delay	7.9						11.3	
LOS	A						B	
Approach Delay							11.3	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Koloa Rd
North/South Street: Omao Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	539			568	82
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	1	539			568	82
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				61		4
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				61		4
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		No	/
Lanes				0	0	
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	1						65	
C(m) (vph)	936						520	
v/c	0.00						0.13	
95% queue length	0.00						0.43	
Control Delay	8.9						12.9	
LOS	A						B	
Approach Delay							12.9	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Koloa Rd
North/South Street: Western Bypass
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		480	190	89	189	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		480	190	89	189	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided		/			
RT Channelized?			No			
Lanes		1	1	1	1	
Configuration		T	R	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	115		73			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	115		73			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		89	115		73			
C(m) (vph)		920	605		1029			
v/c		0.10	0.19		0.07			
95% queue length		0.32	0.70		0.23			
Control Delay		9.3	12.3		8.8			
LOS		A	B		A			
Approach Delay				11.0				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Koloa Rd
North/South Street: Western Bypass
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		366	234	139	461	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		366	234	139	461	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1	1	1	
Configuration		T	R	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	198		179			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	198		179			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		139	198		179			
C(m) (vph)		977	454		1135			
v/c		0.14	0.44		0.16			
95% queue length		0.50	2.28		0.56			
Control Delay		9.3	19.0		8.8			
LOS		A	C		A			
Approach Delay				14.2				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Koloa Rd
North/South Street: Poipu Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		404	144	330	195	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		404	144	330	195	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	83		344			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	83		344			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		330	83		344			
C(m) (vph)		1021	314		1032			
v/c		0.32	0.26		0.33			
95% queue length		1.43	1.07		1.49			
Control Delay		10.2	20.6		10.2			
LOS		B	C		B			
Approach Delay				12.2				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Koloa Rd
North/South Street: Poipu Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		427	118	585	512	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		427	118	585	512	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	97		574			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	97		574			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		585	97		574			
C(m) (vph)		1024	88		1023			
v/c		0.57	1.10		0.56			
95% queue length		3.93	14.52		3.77			
Control Delay		13.2	437.4		13.0			
LOS		B	F		B			
Approach Delay				74.3				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Koloa Rd
North/South Street: Maluhia Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	409	358			188	87
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	409	358			188	87
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				95		363
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				95		363
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	409					95		363
C(m) (vph)	1288					234		1274
v/c	0.32					0.41		0.28
95% queue length	1.39					1.99		1.19
Control Delay	9.1					30.8		9.0
LOS	A					D		A
Approach Delay							13.5	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Koloa Rd
North/South Street: Maluhia Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	645	402			440	269
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	645	402			440	269
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				256		660
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				256		660
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1	1	
Configuration				L	R	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	645					256		660
C(m) (vph)	890					36		948
v/c	0.72					7.11		0.70
95% queue length	7.45					113.39		6.57
Control Delay	19.5					11220		17.4
LOS	C					F		C
Approach Delay							3148	
Approach LOS							F	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Ala Kinoiki
North/South Street: Maluhia Rd
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		487	2	144	447	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		487	2	144	447	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided		/			
RT Channelized?			No			
Lanes		1	1	1	1	
Configuration		T	R	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	3		168			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	3		168			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		144	3		168			
C(m) (vph)		1074	410		1022			
v/c		0.13	0.01		0.16			
95% queue length		0.46	0.02		0.59			
Control Delay		8.9	13.8		9.2			
LOS		A	B		A			
Approach Delay				9.3				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/out project
Project ID:
East/West Street: Ala Kinoiki
North/South Street: Maluhia Rd
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		868	13	236	891	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		868	13	236	891	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	11		273			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	11		273			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		236	11		273			
C(m) (vph)		767	127		733			
v/c		0.31	0.09		0.37			
95% queue length		1.33	0.28		1.77			
Control Delay		11.8	36.0		12.8			
LOS		B	E		B			
Approach Delay				13.7				
Approach LOS				B				

APPENDIX F

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2015 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT

HCS+: Signalized Intersections Release 5.4

Analyst:
Agency:
Date: 4/26/10
Period: AM Peak
Project ID:
E/W St: Koloa Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2015 w/ project

N/S St: Western Bypass

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	1	1	1	1	0	1	1	1
LGConfig	L	T	R	L	T	R	L	TR		L	T	R
Volume	1	412	170	27	171	18	111	181	13	71	235	3
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0
RTOR Vol			43			9			13			1

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	40.0	0.0				40.0	0.0		
Yellow	4.0					4.0			
All Red	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	534	1202	0.00	0.44	13.9	B		
T	828	1863	0.50	0.44	18.3	B	17.6	B
R	704	1583	0.18	0.44	15.2	B		
Westbound								
L	325	731	0.08	0.44	14.5	B		
T	828	1863	0.21	0.44	15.4	B	15.2	B
R	704	1583	0.01	0.44	14.0	B		
Northbound								
L	475	1069	0.23	0.44	15.8	B		
TR	828	1863	0.22	0.44	15.5	B	15.6	B
Southbound								
L	524	1180	0.14	0.44	14.9	B		
T	828	1863	0.28	0.44	16.1	B	15.8	B
R	704	1583	0.00	0.44	13.9	B		

Intersection Delay = 16.4 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.4

Analyst:
Agency:
Date: 4/26/10
Period: PM Peak
Project ID:
E/W St: Koloa Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2015 w/ project

N/S St: Western Bypass

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	1	1	1	1	0	1	1	1
LGConfig	L	T	R	L	T	R	L	TR		L	T	R
Volume	1	318	221	13	392	69	185	379	49	51	361	4
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0
RTOR Vol			55			35			49			1

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	40.0	0.0				40.0	0.0		
Yellow	4.0					4.0			
All Red	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	341	768	0.00	0.44	13.9	B		
T	828	1863	0.38	0.44	17.0	B	16.6	B
R	704	1583	0.24	0.44	15.7	B		
Westbound								
L	403	906	0.03	0.44	14.1	B		
T	828	1863	0.47	0.44	18.0	B	17.6	B
R	704	1583	0.05	0.44	14.2	B		
Northbound								
L	367	825	0.50	0.44	19.0	B		
TR	828	1863	0.46	0.44	17.8	B	18.2	B
Southbound								
L	352	791	0.14	0.44	15.0	B		
T	828	1863	0.44	0.44	17.6	B	17.3	B
R	704	1583	0.00	0.44	13.9	B		

Intersection Delay = 17.5 (sec/veh) Intersection LOS = B

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/ project
Project ID:
East/West Street: Omao
North/South Street: Western Bypass
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	22	177			215	5
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	22	177			215	5
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				3		91
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				3		91
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		No	/
Lanes				0	0	
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	22						94	
C(m) (vph)	1349						1275	
v/c	0.02						0.07	
95% queue length	0.05						0.24	
Control Delay	7.7						8.0	
LOS	A						A	
Approach Delay							8.0	
Approach LOS							A	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/ project
Project ID:
East/West Street: Omao
North/South Street: Western Bypass
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	82	366			348	5
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	82	366			348	5
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				6		65
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				6		65
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		No	/
Lanes				0	0	
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	82						71	
C(m) (vph)	1206						1070	
v/c	0.07						0.07	
95% queue length	0.22						0.21	
Control Delay	8.2						8.6	
LOS	A						A	
Approach Delay							8.6	
Approach LOS							A	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/ project
Project ID:
East/West Street: Koloa Rd
North/South Street: Poipu Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		344	144	177	133	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		344	144	177	133	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	83		227			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	83		227			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		177	83		227			
C(m) (vph)		1075	583		1087			
v/c		0.16	0.14		0.21			
95% queue length		0.59	0.50		0.79			
Control Delay		9.0	12.2		9.2			
LOS		A	B		A			
Approach Delay				10.0-				
Approach LOS				A				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/ project
Project ID:
East/West Street: Koloa Rd
North/South Street: Poipu Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		297	118	363	386	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		297	118	363	386	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	97		338			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	97		338			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		363	97		338			
C(m) (vph)		1144	278		1145			
v/c		0.32	0.35		0.30			
95% queue length		1.39	1.58		1.25			
Control Delay		9.6	24.8		9.5			
LOS		A	C		A			
Approach Delay				12.9				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/ project
Project ID:
East/West Street: Koloa Rd
North/South Street: Maluhia Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	232	358			188	87
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	232	358			188	87
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				95		148
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				95		148
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	232					95		148
C(m) (vph)	1288					418		1274
v/c	0.18					0.23		0.12
95% queue length	0.66					0.88		0.39
Control Delay	8.4					16.1		8.2
LOS	A					C		A
Approach Delay							11.3	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2015 w/ project
Project ID:
East/West Street: Koloa Rd
North/South Street: Maluhia Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	279	402			440	269
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	279	402			440	269
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				256		312
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				256		312
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	279					256		312
C(m) (vph)	890					401		948
v/c	0.31					0.64		0.33
95% queue length	1.36					4.96		1.46
Control Delay	10.9					29.5		10.7
LOS	B					D		B
Approach Delay							19.1	
Approach LOS							C	

HCS+: Signalized Intersections Release 5.4

Analyst:
Agency:
Date: 4/26/10
Period: AM Peak
Project ID:
E/W St: Western Bypass/Ala Kinoiki

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2015 w/ project
N/S St: Maluhia

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	0	1	1	1	1	1	1	1	1
LGConfig		LT	R		LT	R	L	T	R	L	T	R
Volume	177	2	1	3	2	166	3	307	2	144	232	215
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
RTOR Vol			0			83			0			108

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	40.0	0.0					40.0	0.0		
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	601	1352	0.30	0.44	16.3	B	16.3	B
R	704	1583	0.00	0.44	13.9	B		
Westbound								
LT	768	1728	0.01	0.44	13.9	B	14.7	B
R	704	1583	0.12	0.44	14.7	B		
Northbound								
L	478	1075	0.01	0.44	13.9	B		
T	828	1863	0.37	0.44	16.9	B	16.9	B
R	704	1583	0.00	0.44	13.9	B		
Southbound								
L	412	927	0.35	0.44	17.0	B		
T	828	1863	0.28	0.44	16.1	B	16.1	B
R	704	1583	0.15	0.44	15.0	B		

Intersection Delay = 16.2 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.4

Analyst:
Agency:
Date: 4/26/10
Period: PM Peak
Project ID:
E/W St: Western Bypass/Ala Kinoiki

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2015 w/ project
N/S St: Maluhia

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	0	1	1	1	1	1	1	1	1
LGConfig		LT	R		LT	R	L	T	R	L	T	R
Volume	366	4	2	11	3	270	2	500	13	236	543	348
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
RTOR Vol			0			135			3			174

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A	A			NB	Left	A	A		
Thru	A	A				Thru		A		
Right	A	A				Right		A		
Peds						Peds				
WB Left		A			SB	Left	A	A		
Thru		A				Thru		A		
Right		A				Right		A		
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	10.0	27.0	0.0				6.0	37.0	0.0	
Yellow	0.0	4.0					0.0	4.0		
All Red	0.0	1.0					0.0	1.0		

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	568	1775	0.65	0.41	24.0	C	24.0	C
R	651	1583	0.00	0.41	15.6	B		
Westbound								
LT	440	1465	0.03	0.30	22.3	C	24.2	C
R	475	1583	0.28	0.30	24.4	C		
Northbound								
L	300	1770	0.01	0.53	12.7	B		
T	766	1863	0.65	0.41	23.3	C	23.2	C
R	651	1583	0.02	0.41	15.7	B		
Southbound								
L	333	1770	0.71	0.53	28.0	C		
T	766	1863	0.71	0.41	25.1	C	24.5	C
R	651	1583	0.27	0.41	17.8	B		

Intersection Delay = 24.0 (sec/veh) Intersection LOS = C

APPENDIX G

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2035 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT

HCS+: Signalized Intersections Release 5.4

Analyst:
Agency:
Date: 4/26/10
Period: AM Peak
Project ID:
E/W St: Koloa Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2035 w/ project

N/S St: Western Bypass

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	1	1	1	1	0	1	1	1
LGConfig	L	T	R	L	T	R	L	TR		L	T	R
Volume	9	414	197	27	177	18	169	342	13	71	331	16
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0
RTOR Vol			49			9			13			4

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	40.0	0.0				40.0	0.0		
Yellow	4.0					4.0			
All Red	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	528	1189	0.02	0.44	14.0	B		
T	828	1863	0.50	0.44	18.3	B	17.5	B
R	704	1583	0.21	0.44	15.5	B		
Westbound								
L	324	728	0.08	0.44	14.5	B		
T	828	1863	0.21	0.44	15.5	B	15.3	B
R	704	1583	0.01	0.44	14.0	B		
Northbound								
L	392	881	0.43	0.44	17.9	B		
TR	828	1863	0.41	0.44	17.3	B	17.5	B
Southbound								
L	382	860	0.19	0.44	15.4	B		
T	828	1863	0.40	0.44	17.2	B	16.8	B
R	704	1583	0.02	0.44	14.0	B		

Intersection Delay = 17.1 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.4

Analyst:
Agency:
Date: 4/26/10
Period: PM Peak
Project ID:
E/W St: Koloa Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2035 w/ project
N/S St: Western Bypass

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	1	1	1	1	0	1	1	1
LGConfig	L	T	R	L	T	R	L	TR		L	T	R
Volume	16	324	285	13	395	69	232	538	49	51	551	18
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0
RTOR Vol			71			35			49			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	33.0	0.0				47.0	0.0		
Yellow	4.0					4.0			
All Red	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	241	656	0.07	0.37	18.6	B		
T	683	1863	0.47	0.37	22.4	C	21.8	C
R	580	1583	0.37	0.37	21.3	C		
Westbound								
L	298	812	0.04	0.37	18.4	B		
T	683	1863	0.58	0.37	24.1	C	23.5	C
R	580	1583	0.06	0.37	18.5	B		
Northbound								
L	313	600	0.74	0.52	26.4	C		
TR	973	1863	0.55	0.52	15.1	B	18.5	B
Southbound								
L	323	619	0.16	0.52	11.4	B		
T	973	1863	0.57	0.52	15.4	B	14.9	B
R	827	1583	0.02	0.52	10.4	B		

Intersection Delay = 19.3 (sec/veh) Intersection LOS = B

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2035 w/ project
Project ID:
East/West Street: Omao
North/South Street: Western Bypass
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	22	346			324	5
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	22	346			324	5
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				3		91
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				3		91
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	22						94	
C(m) (vph)	1231						1154	
v/c	0.02						0.08	
95% queue length	0.05						0.27	
Control Delay	8.0						8.4	
LOS	A						A	
Approach Delay							8.4	
Approach LOS							A	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/27/2010
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2035 w/ project
Project ID:
East/West Street: Omao
North/South Street: Western Bypass
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	82	540			552	5
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	82	540			552	5
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				6		65
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				6		65
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		No	/
Lanes				0	0	
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	82						71	
C(m) (vph)	1014						870	
v/c	0.08						0.08	
95% queue length	0.26						0.27	
Control Delay	8.9						9.5	
LOS	A						A	
Approach Delay							9.5	
Approach LOS							A	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2035 w/ project
Project ID:
East/West Street: Koloa Rd
North/South Street: Poipu Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		346	144	191	139	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		346	144	191	139	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	83		296			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	83		296			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		191	83		296			
C(m) (vph)		1073	555		1085			
v/c		0.18	0.15		0.27			
95% queue length		0.65	0.53		1.12			
Control Delay		9.1	12.6		9.6			
LOS		A	B		A			
Approach Delay				10.2				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2035 w/ project
Project ID:
East/West Street: Koloa Rd
North/South Street: Poipu Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		303	118	429	389	
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR		303	118	429	389	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	97		371			
Peak Hour Factor, PHF	1.00		1.00			
Hourly Flow Rate, HFR	97		371			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		429	97		371			
C(m) (vph)		1138	221		1139			
v/c		0.38	0.44		0.33			
95% queue length		1.81	2.26		1.44			
Control Delay		10.1	33.9		9.7			
LOS		B	D		A			
Approach Delay				14.7				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2035 w/ project
Project ID:
East/West Street: Koloa Rd
North/South Street: Maluhia Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	301	360			194	111
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	301	360			194	111
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				101		162
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				101		162
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	301					101		162
C(m) (vph)	1256					325		1254
v/c	0.24					0.31		0.13
95% queue length	0.94					1.34		0.44
Control Delay	8.8					21.1		8.3
LOS	A					C		A
Approach Delay							13.2	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.:
Date Performed: 4/26/10
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2035 w/ project
Project ID:
East/West Street: Koloa Rd
North/South Street: Maluhia Rd
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	312	408			443	281
Peak-Hour Factor, PHF	1.00	1.00			1.00	1.00
Hourly Flow Rate, HFR	312	408			443	281
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				280		378
Peak Hour Factor, PHF				1.00		1.00
Hourly Flow Rate, HFR				280		378
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1	1	
Configuration				L	R	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	312					280		378
C(m) (vph)	879					356		940
v/c	0.35					0.79		0.40
95% queue length	1.64					8.95		2.00
Control Delay	11.3					49.3		11.4
LOS	B					E		B
Approach Delay							27.5	
Approach LOS							D	

HCS+: Signalized Intersections Release 5.4

Analyst:
Agency:
Date: 4/26/10
Period: AM Peak
Project ID:
E/W St: Western Bypass/Ala Kinoiki

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2035 w/ project
N/S St: Maluhia

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	0	1	1		1	1		1	1
LGConfig		LT	R		LT	R	L	T	R	L	T	R
Volume	338	10	1	3	15	216	3	400	2	178	252	311
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
RTOR Vol			0			108			0			156

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru	A			
Right	A				Right	A			
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	40.0	0.0				40.0	0.0		
Yellow	4.0					4.0			
All Red	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	596	1340	0.58	0.44	20.2	C	20.2	C
R	704	1583	0.00	0.44	13.9	B		
Westbound								
LT	799	1797	0.02	0.44	14.0	B	14.9	B
R	704	1583	0.15	0.44	15.0	B		
Northbound								
L	460	1035	0.01	0.44	13.9	B		
T	828	1863	0.48	0.44	18.1	B	18.1	B
R	704	1583	0.00	0.44	13.9	B		
Southbound								
L	335	753	0.53	0.44	19.8	B		
T	828	1863	0.30	0.44	16.3	B	17.2	B
R	704	1583	0.22	0.44	15.6	B		

Intersection Delay = 17.9 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.4

Analyst:
Agency:
Date: 4/26/10
Period: PM Peak
Project ID:
E/W St: Western Bypass/Ala Kinoiki

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2035 w/ project
N/S St: Maluhia

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	0	1	1	1	1	1	1	1	1
LGConfig		LT	R		LT	R	L	T	R	L	T	R
Volume	525	19	2	11	17	324	2	545	13	298	633	538
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
RTOR Vol			0			162			3			269

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A	A			NB Left	A	A		
Thru	A	A			Thru		A		
Right	A	A			Right		A		
Peds					Peds				
WB Left		A			SB Left	A	A		
Thru		A			Thru		A		
Right		A			Right		A		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	22.0	14.0	0.0			10.0	34.0		
Yellow	0.0	4.0				0.0	4.0		
All Red	0.0	1.0				0.0	1.0		

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	599	1777	0.91	0.40	43.2	D	43.1	D
R	633	1583	0.00	0.40	16.2	B		
Westbound								
LT	223	1431	0.13	0.16	33.0	C	40.7	D
R	246	1583	0.66	0.16	42.1	D		
Northbound								
L	280	1770	0.01	0.54	14.5	B		
T	704	1863	0.77	0.38	30.0	C	29.7	C
R	598	1583	0.02	0.38	17.5	B		
Southbound								
L	337	1770	0.88	0.54	39.4	D		
T	704	1863	0.90	0.38	40.9	D	36.2	D
R	598	1583	0.45	0.38	21.5	C		

Intersection Delay = 36.6 (sec/veh) Intersection LOS = D