Bernard P. Carvalho, Jr.
Mayor

Nadine K. Nakamura
Managing Director

Lyle Tabata
Acting County Engineer

Deputy County Engineer

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MAR 08 2016

DEPARTMENT OF PUBLIC WORKS
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite 275, Līhu'e, Hawai'i 96766
TEL (808) 241-4992 FAX (808) 241-6604

February 20, 2016

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OFC. OF ENVIRONMENTAL QUALITY CONTROL

Scott Glenn, Interim Director
Office of Environmental Quality Control
Department of Health, State of Hawai'i
235 S Beretania Street, Room 702
Honolulu, Hawai'i 96813

Subject: Transmittal of Draft Environmental Assessment

Dear Mr. Glenn,

With this letter, the County of Kauai, Public Works Department, hereby transmits the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) for the **Environmental Assessment of Materials Recycling Facility for County of Kauai** situated at TMK 4-03-07-02:14, in the Lihue district on the island of Kauai for publication in the next available edition of the Environmental Notice.

Enclosed is a completed OEQC Publication Form, two copies of the DEA-AFONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to your office.

If there are any questions, please contact County of Kauai, Public Works Department, at (808-241-4837).

Sincerely,

TROY TANIGAWA, P.E.
ESME

Concur:

LYLE TABATA
Acting County Engineer

Enclosures
Cc: CalRecovery, Inc.

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MAR 08 2016

AGENCY PUBLICATION FORM

Project Name:	Environmental Assessment of Materials Recycling Facility for County of Kauai
Project Short Name:	Kauai County Materials Recovery Facility
HRS §343-5 Trigger(s):	Use of state or county lands or funds
Island(s):	Kauai
Judicial District(s):	Lihue
TMK(s):	4-03-07-02:14
Permit(s)/Approval(s):	
Proposing/Determining Agency:	County of Kauai, Public Works Department
Contact Name, Email, Telephone, Address	Lyle Tabata, ltabata@kauai.gov 808-241-4996, 4444 Rice Street, Suite 275, Līhu'e, HI 96766
Accepting Authority:	(for EIS submittals only)
Contact Name, Email, Telephone, Address	
Consultant:	CalRecovery, Inc.
Contact Name, Email, Telephone, Address	George M. Savage, GSavage@calrecovery.com 925-356-3700 x106, 2454 Stanwell Drive, Concord CA 94520

Status (select one)	**Submittal Requirements**
__X__ DEA-AFNSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
____ FEA-FONSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the proposing agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.
____ FEIS Acceptance Determination	The accepting authority simultaneously transmits to both the OEQC and the proposing agency a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
FEIS Statutory Acceptance	Timely statutory acceptance of the FEIS under Section 343-5(c), HRS, is not applicable to agency actions.
____ Supplemental EIS Determination	The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.

____ Withdrawal — Identify the specific document(s) to withdraw and explain in the project summary section.

____ Other — Contact the OEQC if your action is not one of the above items.

Project Summary
Provide a description of the proposed action and purpose and need in 200 words or less.

The proposed action is to implement a Materials Recovery Facility (MRF) at the site of the County's Kauai Resource Center located at 3460 Ahukini Road, Lihue. The facility would accept, process, and recycle clean, source-separated recyclable materials.

The County of Kauai desires to modify its current Kauai Resource Center facility for the important purpose of substantially increasing the amount of recycling of materials on the Island and decreasing the Island's dependence on landfill disposal. Such an action, when implemented, would expand the County's capacity to receive large quantities of clean, source-separated recyclables delivered by recycling program collection vehicles as well as by the public and to process and recycle the materials. The quantities of recoverable recyclables are scheduled to increase substantially, in response to the County's Solid Waste Management Plan goals of improving solid waste management on the Island, substantially increasing the rate of recycling, and lessening the environmental footprint of the Island. The proposed MRF is needed to supply the capacity to accept, process, and market the future quantities of recyclable materials.

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Draft Environmental Assessment of Materials Recycling Facility for County of Kauai

Prepared for
County of Kauai

Solid Waste Division
4444 Rice Street, Suite 295
Lihue, Hawaii 96766

Prepared by
CalRecovery, Inc.

2454 Stanwell Drive
Concord, California 94520

Prepared in accordance with Title 11,
Department of Health Chapter 200, Section 11-200-10/200-13

February 2016

CalRecovery INCORPORATED

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Preliminary Draft: Environmental Assessment for Materials Recycling Facility for County of Kauai

1. INTRODUCTION

1.1 Identification of Applicant or Proposing Agency

Kauai County - Public Works Department

1.2 Identification of Approving Agency, if applicable

Kauai County - Public Works Department

1.3 Identification of Agencies, Citizen Groups, and Individuals Consulted in Making the Assessment

- Kauai County – Fire Department
- Kauai County - Public Works Department
- Kauai County – Planning Department
- State of Hawaii Department of Health Solid and Hazardous Waste Branch
- State of Hawaii Department of Transportation/Airports
- State of Hawaii Office of Environmental Quality Control
- Agencies, Organizations, and other Stakeholders provided with an advance copy of the Assessment

2. PROJECT

2.1 General Description of the Action's Technical, Economic, Social, and Environmental Characteristics

The proposed action is to implement a Materials Recovery Facility at the site of the County's Kauai Resource Center located at 3460 Ahukini Road, Lihue. The facility would accept, process, and recycle clean, source-separated recyclable materials. The characteristics of the proposed facility are described in detail in the following sections of the Assessment.

2.2 General Description of the Proposed County of Kauai Clean Materials Recovery Facility

The County of Kauai desires to modify its current Kauai Resource Center facility for the important purpose of substantially increasing the amount of recycling of materials on the Island. Such a modification will expand the County's capacity at this location to both receive large quantities of source-separated recyclables and to process and package them for acceptance by the marketplace for recycling. The quantities of recoverable recyclables are scheduled to increase substantially, in response to the County's Solid Waste Management Plan goals of improving solid waste management on the Island, substantially increasing the rate of recycling, and lessening the environmental footprint of the Island.

The proposed Materials Recovery Facility processing clean, source-separated recyclables (Clean MRF) is needed to supply the capacity to accept, process, and market the future quantities of recyclable materials.

The proposed Clean MRF would be located adjacent to the Lihue Transfer Station (LTS) on land that now includes the existing structures of the Kauai Resource Center (KRC), as shown in Figures 1 and 2 (Sheets No. 2 and 3). The Kauai Resource Center currently serves and operates as a permitted site and facility (including land use and solid waste facility permits) for receiving and processing source-separated drop-off and HI-5 redemption recyclable materials. Two structures of the KRC would be modified, improved, and enlarged to contain and enclose the receiving and processing areas of the new recycling facility. The proposed MRF is essentially a light industrial facility; it would receive and process source-separated recyclables generated by residential and commercial sources that would be delivered by various types of collection vehicles and by the public. The processing system would include equipment and personnel to process and segregate recyclable materials into marketable commodities. The targeted materials generally would be metal, glass, plastic, and paper commodities. These types of materials are currently received and processed at the KRC, although the rate of receipt and processing and the degree of processing will be much greater in the case of the proposed Clean MRF. The average design rate for receiving and processing of materials for the MRF would be approximately 58 tons/day (TPD), or equivalently approximately 15,000 tons/year (TPY), including both quantities of recyclable materials and assumed low levels of attendant contamination. The maximum processing capacity of the proposed facility would be approximately 26,700 TPY. The estimated recovery and recycling rate is 14,200 TPY of recyclable materials while generating approximately 800 TPY of solid waste residuals from processing that would be disposed in a permitted solid waste disposal facility (i.e., Kekaha Landfill or its successor). The current rate of recovery of recyclables at the Kauai Resource Center is about 1,000 tons TPY.

The vehicles that would deliver residential and commercial commingled recyclables and commercial source-separated glass would be typical collection route vehicles. The vehicles that would deliver commercial source-separated cardboard would be front-end packers, compactor roll-offs, or covered roll-offs. Redemption center and drop-off program recyclables would be delivered to the MRF in small trucks, covered roll-offs, or bins. The majority of materials currently received at the KRC as drop-off materials are expected to eventually migrate to the residential commingled collection system once that system is fully rolled out and matured. Since recyclables currently being collected and/or delivered to the facility as part of the mixed solid wastes would be collected and/or delivered to the facility as source-separated materials, the quantities and number of deliveries of mixed solid waste would decrease accordingly. For the environmental assessment, however, no decrease in deliveries, and therefore decrease in traffic associated with deliveries of mixed solid waste, is assumed.

2.2.1 Site Size and Configuration

The proposed Clean MRF will occupy approximately 1.5 acres of the KRC site, which is located north by northeast of the Lihue Airport on a parcel of land described by Tax Map Key (TMK) 4-03-07-02:14 (see Figures 1 and 2 (Sheets 1 and 2)). The anticipated area of the proposed MRF enclosed building, as shown in Figure 3 (Sheet 3), is approximately 31,000 square feet.

The locations of the areas of the proposed MRF building for receiving and tipping vehicle loads of source-separated materials and for processing the materials and the general circulation pattern for recyclables collection vehicles are also shown in Figure 3 (Sheet 3).

2.2.2 Need and Urgency

The County of Kauai desires to modify its Kauai Resource Center facility for the important purpose of substantially increasing the amount of recycling of materials on the Island. Such a modification will expand the County's capacity to both receive large quantities of source-separated recyclables and to process and package them for acceptance by the marketplace. The quantities of recoverable recyclables are scheduled to increase substantially when organized, separate collection of source-separated recyclables from residential generators is scheduled to commence on or about July 2019. Additionally, while collection of source-separated materials from commercial generators exists currently to a limited degree, the MRF will also provide the processing capacity required for the substantial increase in captured quantities of materials anticipated from businesses as a consequence of the proposed Business Recycling Ordinance. To meet the scheduled date for commercial operation, the County has to perform an environmental assessment, finalize the design, procure equipment, perform substantial modifications to the existing facility, and test the installed equipment. The County is planning that the process of final design, permitting, procurement, and installation of equipment and structural improvements will require a period of two years; thus, the need and urgency of performing the environmental assessment now.

2.2.3 Land Use Designations

The State designated land use of the subject property is agricultural, with surrounding land use designated urban and conservation, as shown in Figure 4.

The land use of the subject property is located within an area designated transportation in the Kauai General Plan, with surrounding land uses designated urban center, as shown in Figure 5.

The County of Kauai granted a land use permit in June of 1997 to allow the establishment of a solid waste reuse/recycling facility in its present location adjacent to the Lihue Solid Waste Transfer Station.

The vicinity around the proposed MRF primarily includes the County of Kauai Lihue Solid Waste Transfer Station, vacant land, a parcel that contains the University of Hawaii's Topical Fruit Disinfection Facility, which is not operating at this time, an area used to store rental vehicles, and the Lihue Airport facility. Some of these land areas surrounding the KRC have been the subject of proposed improvements and environmental analysis by the State of Hawaii Department of Transportation/Airports Division [Wilson Okamoto Corp., November 2007].

2.2.4 Special Management Area

The location of the proposed MRF is at least 500 feet south of Hanamaulu Bay; thus, the project site is outside the boundary of the State's Special Management Area, as shown in Figure 6.

2.2.5 Population Growth and Generation Rate of Source-Separated Recyclables

The estimated total resident population of the County of Kauai to year 2040 is shown in Table 1. The average annual growth rate in population for this time period is approximately 1.1%.

The annual rate of generation of container and paper recyclables by residents and businesses on Kauai is estimated to be a maximum availability of approximately 26,700 tons/year [AECOM, 2013] and a likely rate of capture and processing of approximately 14,200 tons/year of recyclables [CalRecovery, 2016] after accounting for rates of participation by residents and businesses in the collection programs for source-separated recyclable materials, population growth, and other factors (see Appendix A).

Table 1. Kauai County Estimated Total Resident Population 2015-2040

2015	2020	2025	2030	2035	2040
71,379	75,636	79,997	84,384	88,730	93,023

Source: U.S. Census Bureau

2.2.6 Pertinent Related Infrastructure

The County is planning to add organized, separate curbside collection of recyclables in FY 2019 to increase the Island's rate of recycling. The proposed new Ma'alo Landfill behind Kalepa ridge is planned to be operational by 2023 and will serve as the disposal facility for process residues (mixed solid waste) generated by the new MRF as a consequence of removing incidental contamination arriving with source-separated materials.

Two existing structures of the KRC would be improved to expand the amount of area under roof and to increase unobstructed area under roof (by eliminating some non-bearing vertical support members) in order to contain the processing equipment and systems. Additionally, certain portions of the roofing/ceiling and eaves will be raised to provide adequate height clearance for processing equipment and for collection vehicles to discharge their loads unhindered.

The existing main roadway (Ahukini Road) serving the facility and existing facility driveways are adequate to support the additional vehicular traffic projected for the new MRF. The results of the effects of the estimated additional traffic and its potential impacts are included in subsection 4.3.8 below.

3. LOCAL CONDITIONS

3.1 Climate

The climate in Lihue is semi-tropical. The average annual temperature at the nearby Lihue Airport ranges from approximately 70 to 80 degrees Fahrenheit during the year, and the average annual rainfall is approximately 45 inches. Winds near the Lihue Airport are predominantly from the northeast at speeds of 10 to15 miles per hour.

3.2 Geology and Topography

The project site is located on a slightly graded plateau and on the Koloa Volcanic Series, which includes lava flows of nepheline basalt, melilite-nepheline basalt, olivine basalt, picrite-basalt, and basanite.

3.3 Seismic Conditions

The entire Island of Kauai is rated Zone 1 Seismic Hazard, with a low probablity of experiencing severe shaking in any given 50-year period. The Island of Kauai is rated within the lowest seismic hazard zone by the Uniform Building Code.

4. IDENTIFICATION AND SUMMARY OF POTENTIAL IMPACTS

CalRecovery identified that an increase in traffic flow to the proposed MRF would potentially be the most likely adverse environmental impact of the project. However, the increase in MRF traffic would exist at any alternative location because the new collection system vehicles have to travel to a MRF to deliver loads for processing no matter where the MRF would be located. The detailed traffic analysis and results are discussed in Section 4.3.8.

4.1 Alternatives Considered

The County of Kauai considered four other potential locations for the proposed MRF:

- Within a proposed resource recovery park that would be located at the proposed Ma'alo Landfill location. The County eliminated this alternative location from further consideration because the Ma'alo site will take years to develop, and time is of the essence in developing the MRF.
- At the location of the University of Hawaii's Tropical Fruit Disinfection Facility, which is on property just to the northeast of the location of the LTS and KRC. The large building on the Disinfection Facility site was seen as potentially viable for conversion to a structure that could contain a materials processing facility. However, the County eliminated this alternative location from further consideration because the Dept. of Transportation, Airports had prior plans for the facility.
- The old Hansador Lumber site, now known as the Carriage House, is a property owned by the County. This facility has a pre-existing structure and ample space that would have supported a MRF operation. It was seen as potentially viable to complete small improvements to use the site. However, the County eliminated this alternative location from further consideration because many agencies at the County had already claimed the space for storage and other uses. There were too many competing factors to overcome.
- The Bulk Sugar Storage Facility in Nawiilwili Harbor was considered as well. This is a privately owned facility with a building of adequate size and height. At time of consideration, the property owners were asking to sell at a price that was not feasible for the County, so the site was removed from further consideration.

4.2 Potential Favorable Impacts

The following are anticipated favorable benefits of the proposed MRF:

1. Increasing the recycling rate and diverting of recyclables from landfill disposal conserves land resources of the Island in comparison to disposing of the same materials on the land.
2. Conservation of materials and resources inasmuch as it is well known that manufacturing of commodities from recyclables conserves raw materials and natural resources.
3. Conservation of energy inasmuch as it is well known that manufacturing of commodities from recyclables requires less energy than producing the same goods from raw materials.
4. Reduction of the environmental footprint (e.g., greenhouse gas generation) of the Island resulting from benefits #1 through #3.
5. Convenience of organized vehicular collection of recyclables to the public, institutions, and businesses as opposed to having to drive to recyclables' drop-off and redemption centers. This type of collection and processing system has been proven to increase recycling rates and quantities substantially above those achieved by voluntary drop-off and redemption programs. The proposed system will serve to substantially maximize benefits #1 through #4.

4.3 Potential Environmental Impacts

Potential environmental impacts are described in this section under separate subheadings as well as methods of control and mitigation.

4.3.1 Noise Impacts

Sources of noise generation at the MRF will include some or all of the following: recyclables collection vehicles, roll-off chassis trucks, front-end loaders and forklifts, mechanical conveyors, grinder for size reducing glass, baling machine for baling commodities for markets, and tractor/trailer vehicles that will transport materials to markets. Almost all of the operations involving vehicles will be performed within the confines of an enclosed building, which will serve to lessen noise emissions generated by collection and other vehicles unloading materials on the tipping floor and generated by mechanical processing equipment. The exception would be the noise of vehicle traffic circulating outside of the MRF building; however, circulating traffic areas are not located near concentrations of population and businesses. Emissions of noise emissions from these sources will not exceed the allowable noise levels, i.e., 70 dBA, and the allowable impulsive noise levels, 80 dBA, for agricultural and industrial zones at the property boundary of the existing KRC (proposed MRF) site.

Noise emission levels measured inside six clean MRFs in the United States in a study by the United States Environmental Protection Agency (USEPA) when averaged were in the range of 58 to 106 dBA for rolling and fixed equipment, but noise levels at the property lines were in the range of 50 to 74 dBA [USEPA, 1995]. As a basis of comparison, noise levels from aircraft using Lihue Airport have been measured previously in the range of 64 to 88 dBA at a location about 500 feet to the north of the KRC property [Y. Ebisu & Assoc., 2007].

4.3.2 Dust Litter, and Wind-Blown Debris Impacts

The areas for receiving and unloading vehicular loads of materials and for processing operations possess the potential to generate litter, dust, and wind-blown debris if such nuisances are not contained and

controlled. The receiving and processing areas will be enclosed in a building. Proper methods and procedures will be used for operating the facility such that impacts of litter, dust, and wind-blown debris to the ambient environment will be controlled to less than significant levels. Proper methods of control include frequent broom sweeping of flooring and collection of debris and materials that might spill from processing equipment onto the floor of the facility, using manual labor, mechanical equipment, or both.

Outgoing truckloads of recovered recyclables will primarily be baled material in enclosed ocean shipping containers. Other materials awaiting transport off site will be covered to minimize spillage of materials, nuisance litter, and vector attraction. The roadways within and nearby the facility and property boundaries of the facility will be regularly monitored by staff of the facility operator for the purpose of collecting litter and keeping the area clean.

4.3.3 Stormwater Impacts

The existing KRC facility, in conjunction with the Lihue Solid Waste Transfer Station, has a stormwater management and control system and possesses a valid National Pollution Discharge Elimination System (NPDES) permit. Stormwater surface flows occurring off-site are diverted from the subject property via perimeter swales. On-site stormwater flows are subjected to best management practices (BMPs), which are described in the NPDES permit and application, and the flows are collected in storm drains that empty into a grass-lined swale located along the northeast boundary of the facility where the water is treated before it eventually enters the Pacific Ocean.

The existing stormwater management system for the KRC facility will be modified as necessary during final design of the proposed MRF to take into account the larger roofed area of the MRF and the need to slightly reconfigure the drainage and collection system for stormwater. The total incident drainage area for rainfall will remain almost the same as that of the existing KRC since the proposed MRF will occupy the same area now occupied by the KRC. As part of the BMPs, solid residues segregated during processing and recyclables packaged for markets/recycling would be protected from incident rainfall; thus, minimizing the potential of contaminating stormwater runoff from the facility. The receiving area/tipping floor of the proposed MRF, which is under roof, would be subjected regularly to manual and/or mechanical sweeping to control generation of dust and tracking of nuisance materials outside of the building envelope.

4.3.4 Odor Impacts

The primary source of nuisance odors would be incidental putrescible matter, in very low concentrations, arriving with some of the source-separated containers and paper, most frequently beverage liquids and solid food materials. However, no significant nuisance odor intensities are expected to drift beyond the property boundaries of the proposed Clean MRF. The recyclables materials delivered and processed at the facility will have been source separated by the generators and be free of significant quantities of putrescible materials (e.g., post-consumer food waste). Any incidental putrescible materials are expected to be much less than 1% and would be separated from recyclable materials during processing, subsequently stored as processing residue at the facility, and finally transported promptly and disposed at a permitted solid waste disposal facility (e.g., the adjacent Lihue Solid Waste Transfer Station or landfill facility). All of these methods of odor control are expected to

reduce any nuisance odor intensities that might be generated at the MRF to less than significant levels at the facility's property line.

4.3.5 Flora Impacts

Based on an earlier study, no rare or endangered plant species were found near the KRC site [Wilson Okamoto Corp., 2007].

No candidate, proposed, or listed threatened or endangered species of flora as set forth in the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) are known in the vicinity of the proposed MRF site nor were any found during field studies performed about eight years ago [Wilson Okamoto Corp., 2007].

The proposed project is not anticipated to have adverse impacts upon plant species inasmuch as the proposed MRF will occupy essentially the same land area as the current KRC facility.

4.3.6 Fauna Impacts

Based on the analysis and results of the *Lihue Airport Improvements Final Environmental Impact Statement* (LAI/FEIS) [Wilson Okamoto Corp., 2007], no significant impact to mammalian species is anticipated from the proposed project and based on the fact that the proposed MRF will occupy essentially the same land area as the current KRC facility. Also, based on the LAI/FEIS, there would appear to be no habitat within the KRC facility site that is essential for the survival of any species of mammalian fauna identified in the area currently listed as endangered, threatened, or proposed for listing under either the Federal or State of Hawaii endangered species programs.

4.3.7 Avifauna Impacts

A wide variety of species of birds are present in the vicinity around the proposed MRF. Five endangered waterbird species have been observed in the vicinity of the project area [Wilson Okamoto Corp., 2007]. These are: the Hawaiian Duck *(Anas wyvilliana),* the Hawaiian Coot *(Fulica americana alai),* the Common Moorhen *(Gallinula chloropus sandvicensis),* the Black-necked Stilt *(Himantopus mexicanus knudseni),* and the Hawaiian Goose *(Branta sandvicensis)* [Wilson Okamoto Corp., 2007]. For example, they were seen within the manmade water features on the adjacent Mokihana and Kiele Golf Courses to the south.

Also, based on the LAI/FEIS, there is no habitat within the site of the proposed MRF that is essential for the survival of any avian species currently listed as endangered, threatened, or proposed for listing under either the Federal or State of Hawaii endangered species programs. None of the proposed improvements to the KRC site should have a direct impact to endangered avifauna in the area.

4.3.8 Traffic Impacts

Vehicular traffic has been described previously as a potential adverse impact of the proposed MRF. The number of vehicles will increase due to population growth, which generally governs the rate of generation of solid waste materials, and to the increase in traffic flow to and from the MRF primarily in the form of future numbers of collection vehicles dedicated to the organized collection of source-separated recyclables from residential and commercial generators. To evaluate the potential impacts of vehicular traffic frequencies projected for the proposed project, The Traffic Management Consultant

(TMC) was retained by CalRecovery to perform a traffic analysis at the two driveways of the facility and of the relative effect of the traffic along Ahukini Road [Traffic Management Consultant, 2016] (see Appendix B).

The TMC study found that the existing peak hours of traffic on Ahukini Road at the project site occurred during the mid-morning – after the AM commuter peak hour of traffic, and during the mid-afternoon – before the PM commuter peak hour of traffic. Therefore, the peak hour traffic, generated by the proposed Kauai MRF, is not expected to significantly impact the AM and PM commuter peak hour traffic.

The TMC study also estimated that the trip generation from the proposed Kauai Materials Recovery Facility would increase the existing site traffic by 52% and 19%, during the AM and PM peak hours of traffic, respectively. However, the existing RTS and KRC Driveways are expected to continue to operate at Level of Service (LOS) "A," during the AM and PM peak hours of traffic. The Kauai MRF trip generation is expected to increase the AM and PM peak hour traffic on Ahukini Road, south of the project site, by 25% and 11%, respectively. The proposed Kauai MRF trip generation is expected to increase the projected Year 2019 mid-morning and mid-afternoon peak hour traffic on Ahukini Road at the entrance to the Lihue Airport by 7.1% and 3.8%, respectively. At the intersection of Kapule Highway and Ahukini Road, the proposed Kauai MRF trip generation is expected to increase the projected Year 2019 mid-morning and mid-afternoon peak hour traffic by 2.3% and 1.0%, respectively.

The study also indicates that exclusive left-turn lanes on Ahukini Road are not expected to be warranted at the KRC Driveway and the RTS Driveway, because the opposing (southbound) volumes on Ahukini Road are less than the minimum 100 vehicles per hour, cited in the American Association of State Highway & Transportation Officials (AASHTO) guidelines. Furthermore, the posted speed of 25 mph is well below the minimum operating speed of 40 mph, cited in the AASHTO guidelines. Therefore, exclusive left-turn lanes are not considered necessary on Ahukini Road at the KRC Driveway and the RTS Driveway.

The TMC study further states that traffic improvements at the project's access driveways are not necessary at this time. The proposed Kauai Materials Recovery Facility is not expected to significantly impact traffic operations at its driveways on Ahukini Road during the peak hours of traffic flow.

4.3.9 Climate Change Impacts

The ground height of the existing KRC and proposed MRF is in the range of approximately 80 to 90 feet above mean sea level, so projected sea level rises of up to 3 feet are not expected to adversely impact the proposed facility.

Storm conditions may worsen in the future due to the effects of climate change, but the structures for the proposed MRF will be designed and constructed to the latest building code requirements for wind loads, etc.

As another measure of climate change factors, namely potential greenhouse gas emissions from the proposed project, CalRecovery estimated the carbon footprints of the existing situation in which the

recyclable materials projected for recovery are landfilled and the case in which the recyclables would be recovered at the proposed MRF and recycled. The estimation was performed using the Waste Reduction Model (WARM) developed by the United States Environmental Protection Agency (EPA). The EPA created the Waste Reduction Model (WARM) to help solid waste planners and organizations estimate and track potential greenhouse gas (GHG) emissions reductions from several different types of waste management programs and practices. WARM calculates and totals GHG emissions of baseline and alternative waste management practices — source reduction, recycling, combustion, composting, and landfilling. The model calculates emissions in metric tons of carbon equivalent (MTCE), metric tons of carbon dioxide equivalent (MTCO2E), and energy units (million BTU) across a wide range of material types commonly found in municipal solid waste (MSW). CalRecovery modeled the case of the impact of recyclables projected for recovery from organized collection of source-separated recyclables, excluding drop-off and redemption quantities.

The results of the WARM analysis indicate that the greenhouse gas emissions will change from an environmentally detrimental position of being carbon positive for the existing case of disposal of recyclable materials that are projected for recovery in the future to being in the environmentally superior position of carbon negative for recycling the same quantities of recyclables. The estimates are shown in Table 2, including some common benefits for comparative purposes. The estimated reductions in GHG emissions are approximately 27,500 MTCO2E and 7,500 MTCE.

Table 2. Estimated Annual Enviornmental Benefits as a Result of Implementing the Proposed Kauai Clean MRF [a)]

Tons Recycled	9,560	
Total Change in GHG Emissions (MTCO2E):	(27,453)	[b)]
Total Change in GHG Emissions (MTCE):	(7,487)	[b)]
This is equivalent to…		
Removing annual emissions from	5,780	Passenger Vehicles
Conserving	3,089,118	Gallons of Gasoline
Total Change in Energy Use (million BTU):	(173,037)	
This is equivalent to…		
Conserving	1,573	Households' Annual Energy Consumption
Conserving	29,783	Barrels of Oil
Conserving	1,392,781	Gallons of Gasoline

[a)] MTCO2 and MTCE = metric tons of carbon dioxide and of carbon equivalents, respectively.

[b)] Results in parentheses mean projected future GHG emissions associated with recycling of materials a result of the proposed project are less than those estimated for the current situation (disposed).

4.3.10 Archeological and Cultural Impact Assessment

According to State guidelines for an environmental assessment, it must assess any potentially adverse effects on cultural resources or traditional cultural practices. Consequently, an Archeological and Cultural Impact Assessment was performed in support of a HRS Chapter 343 Environmental Assessment.

The archaeological portion of the study was prepared in accordance with Hawaii Administrative Rules 13§13–275, and performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawaii Administrative Rules 13§13–276. According to 13§13-275- 5(b)(5)(A), when no archaeological resources are discovered during an archaeological survey the production of an Archaeological Assessment report is appropriate. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Kauai Planning Department. The cultural portion of this study was prepared to comply with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawaii, on November 19, 1997. As stated in Act 50, which was proposed and passed as Hawaii State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, "environmental assessments . . . should identify and address effects on Hawaii's culture, and traditional and customary rights . . . native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the 'aloha spirit' in Hawai'i. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups."

ASM Affiliates (ASM) was retained by CalRecovery to conduct an Archaeological and Cultural Impact Assessment of roughly 3.1 acres of land comprising all of TMK: (4) 3-7-002:015 (0.86 acres) and a 2.24 acre portion of TMK: (4) 3-7-002:014 located adjacent to Ahukini Road in Hanamā'ulu Ahupua'a, Līhu'e District, Island of Kauai [ASM Affiliates, 2016] (see Appendix C).

Archaeological fieldwork for the current study was conducted on November 20, 2015 by Teresa Gotay, M.A. and Robert Rechtman, Ph.D. The surface of the entire study area was inspected by fieldworkers walking meandering transects spaced at five meter intervals parallel to the parcels' boundaries. Ground surface visibility was excellent, and it was quite apparent that the entire study area had been subject to prior significant ground-disturbing activity associated with the development of the existing refuse transfer station and recycling facilities. (As a historical note, the local area had been cultivated in sugar cane since the 1800s and thus had been highly disturbed prior to the construction of the LTS and KRC.) As a result of the field survey, there were no archaeological features observed on the surface and given the highly disturbed nature of the study area, there is virtually no likelihood of encountering subsurface remains.

As a result of the archaeological study of the current project area, there were no historic properties identified; likewise, there were no traditional cultural places and associated practices identified within the current project area. However, in the highly unlikely event that any unanticipated archaeological resources are unearthed during development activities, in compliance with HAR 13§13-280, work in the immediate vicinity of the finds should be halted and State of Hawaii Department of Land and Natural Resources, State Historic Preservation Division (DLNR-SHPD) contacted. As documented in prior consultations for the general study area, the cultural concerns for the Hanamā'ulu/Ahukini area revolved around maintaining access to the shoreline where a variety of traditional cultural practices have taken place and are still ongoing. As there are no traditional cultural places and associated

practices identified within the current project area and there is nothing in the current proposed project that will impact access to the shoreline, it is the conclusion of ASM that the development of the proposed County of Kauai Materials Recovery Facility will have no impact on any traditional cultural resources or related practices.

5. ALTERNATIVES TO THE PROPOSED ACTION

Principal alternatives to construction of the proposed MRF are the following:

1. No action
2. Siting at a location different than that of the existing KRC facility

With respect to Alternative No. 1, the no-action alternative would preclude achieving the five beneficial results described previously in Section 4.2, Potential Favorable Impacts.

With respect to Alternative No. 2, the four alternative sites that were considered by the County were deemed unsatisfactory for the reasons given in Section 4, Identification and Summary of Potential Impacts and Alternatives Considered. Additionally, the proposed use for and the existing use of the KRC are one and the same, namely receiving and processing recyclable materials and marketing them.

5.1 Proposed Mitigation Measures

Design, construction, and operating measures will be taken to minimize those adverse impacts which cannot be avoided. Structural modifications to two existing KRC buildings and facility construction will conform to the requirements of County Ordinances.

Locating the proposed MRF at the site of the existing recycling facility is considered the principal mitigating measure of this assessment. In addition, however, another related mitigation for the proposed project is that the County is planning implementation of curbside green waste collection concurrent with curbside recyclables collection, which will eliminate the majority of the residential green waste traffic using the site in the future. Thirty to forty percent of the existing traffic entering the site is delivering loads of green waste; the estimated reduction in traffic due to implementation of curbside green waste collection is approximately 25 percent.

5.2 Anticipated Determination for DEAs or Agency Determination for FEAs

The anticipated determination of the Draft Environmental Assessment is that all identified environmental impacts are less than significant, and consequently a negative declaration is appropriate.

5.3 Findings and Reasons Supporting the Agency Determination or Anticipated Determination

The County of Kauai has reviewed the "significance criteria" in paragraph 11-200-12 of the State Environmental Impact Statement Rules, Chapter 200 of the State Administrative Rules (Department of Health Regulations) and has determined that a Negative Declaration is appropriate.

The proposed MRF would be located on land that is now permitted for recycling, processing, and marketing of source-separate recyclable materials, i.e., the KRC facility, in a neighborhood of compatible

land uses. Minor adverse impacts, if any are subsequently identified, can and will be mitigated through appropriate design, construction, and operating conditions.

5.4 List of all Permits and Approvals (State, Federal, County) Required

The following permits and approvals are anticipated for the proposed MRF:

- Kauai County Use Permit and Special Permit
- State of Hawaii Department of Health Solid Waste Management Facility Permit, Recycling and Materials Recovery Facilities
- State of Hawaii Department of Health Solid Waste Management Permit, Drop-off and Redemption
- State of Hawaii Department of Health Solid Waste Management Permit, Household Battery Collection Facility
- State of Hawaii Department of Health Solid Waste Management Permit, Electronic Waste Collection Facility
- National Pollution Discharge Elimination System Permit
- Kauai County Building Department Building Permit

6. WRITTEN COMMENTS AND RESPONSES TO THE COMMENTS UNDER THE EARLY CONSULTATION PROVISIONS AND STATUTORY PUBLIC REVIEW PERIODS

The following agencies, organizations, and stakeholders are being provided with an advance copy of the Assessment prior to its submittal to the State of Hawaii Office of Environmental Quality Control:

1. Kauai County – Fire Department
2. Kauai County – Planning Department
3. Kauai County – Wastewater Division
4. Kauai County – Water Department
5. State of Hawaii Department of Health Solid and Hazardous Waste Branch/Office of Solid Waste Management
6. State of Hawaii Department of Land and Natural Resources, State Historic Preservation Division
7. State of Hawaii Department of Transportation/Airports
8. State of Hawaii Department of Transportation/Highways
9. Grove Farm Inc.

Prior to submitting advanced copies of the Assessment to the above stakeholders, CalRecovery preliminarily contacted the Kauai County Planning Department by telephone regarding the environmental assessment in order to assess the current zoning and designated land uses and the zoning situation for the proposed MRF. Planning indicated that the proposed action might require another planning process and use permit and also a building permit due to the proposed modifications to the existing buildings on the KRC site. CalRecovery also contacted the Fire Prevention Bureau of the

Kauai County Fire Department to assess potential requirements of fire safety and control. The Department indicated that the project would require a sprinkler system, hydrant water supply, and potentially a fire alarm system. The Hawaii Department of Health Solid and Hazardous Waste Branch was contacted concerning the current Lihue Transfer Station and Kauai Resource Center facility operations and any problems or concerns the Branch had in terms of actual or potential environmental impacts associated with those two facilities, inasmuch as the proposed MRF project would have some generally similar operating characteristics as both of those existing facilities. According to Branch records over the past five to ten years, there have been no significant environmental problems for either of the existing facilities. The environmental control and monitoring functions for the proposed MRF would be as or more thorough than those of the current facilities and operations.

REFERENCES

AECOM, *Kaua'i Resource Recovery Park Feasibility Study*, April 2013.

ASM Affiliates, *An Archaeological and Cultural Impact Assessment for the County of Kaua'I Materials Recovery Facility*, January 2016.

CalRecovery, Inc., *Conceptual Design of Kauai Clean Materials Processing Facility (Clean MRF) Proposed for the Existing Site of the Kauai Resource Center*, Combined Technical Memorandums Nos. 1 and 2, January 2016.

Y. Ebisu & Associates, *Acoustic Study for the Lihue Airport Improvements, Lihue, Kauai, Hawaii*, prepared for Wilson Okamoto Corp., January 2007.

Traffic Management Consultant, *Draft Traffic Assessment Report for the Proposed Kauai Materials Recycling Facility*, January 2016.

Wilson Okamoto Corporation, *Lihue Airport Improvements, Final Environmental Impact Statement*, November 2007.

USEPA, Environmental, Economic and Energy Impacts of Material Recovery Facilities, A MITE Program Evaluation, EPA/600/R-95-125, August 1995.

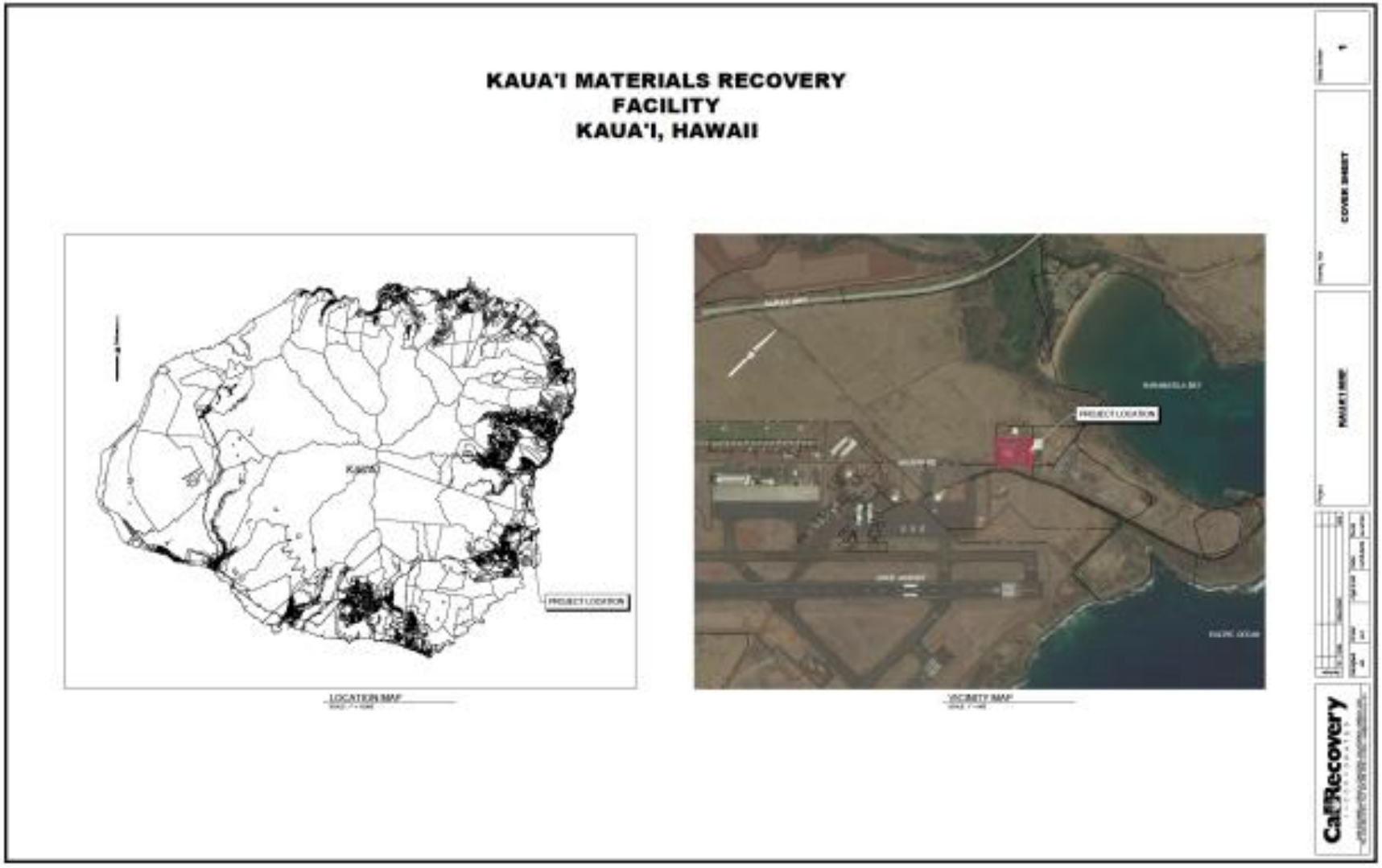


Figure 1. Location of Proposed MRF Project

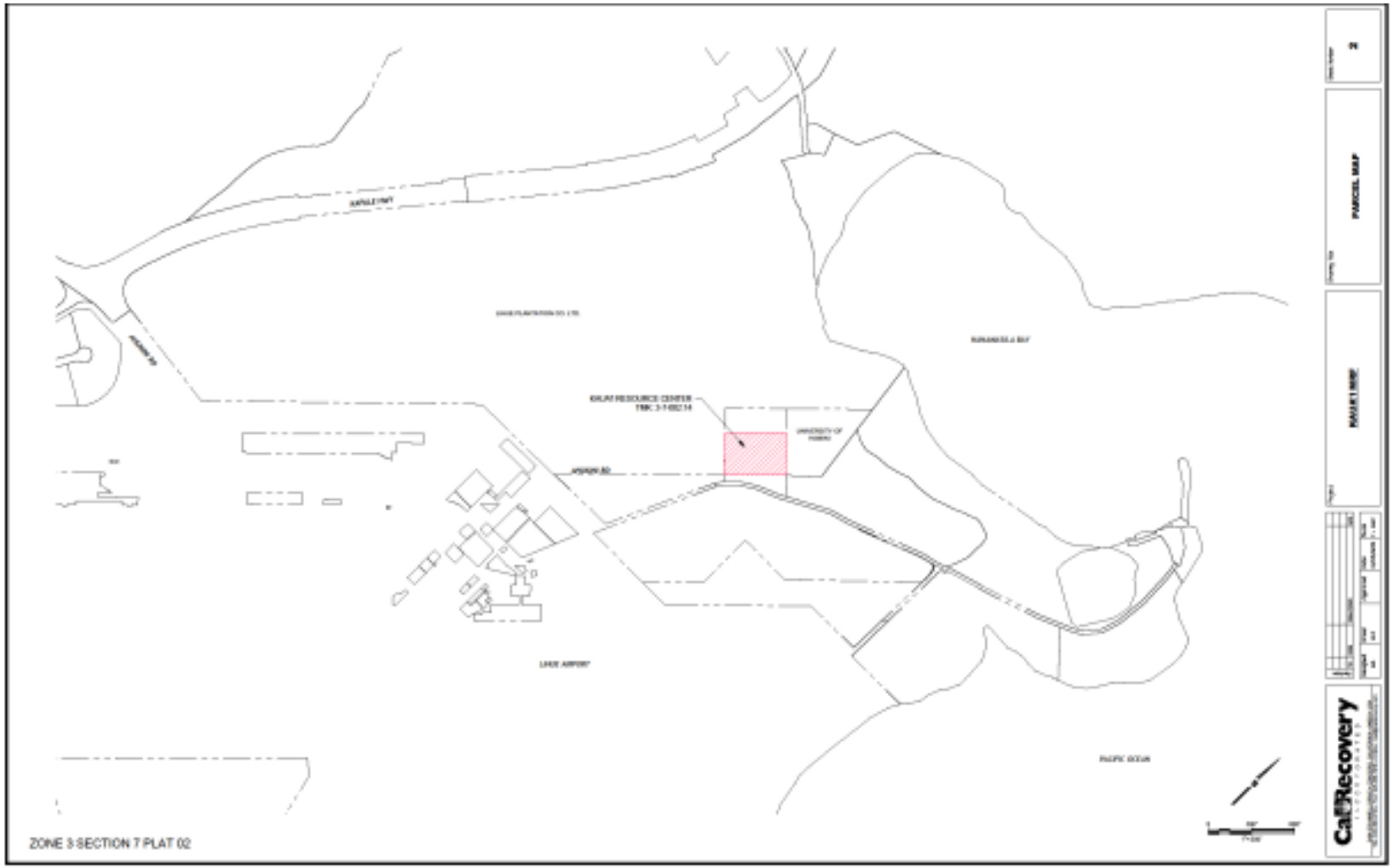
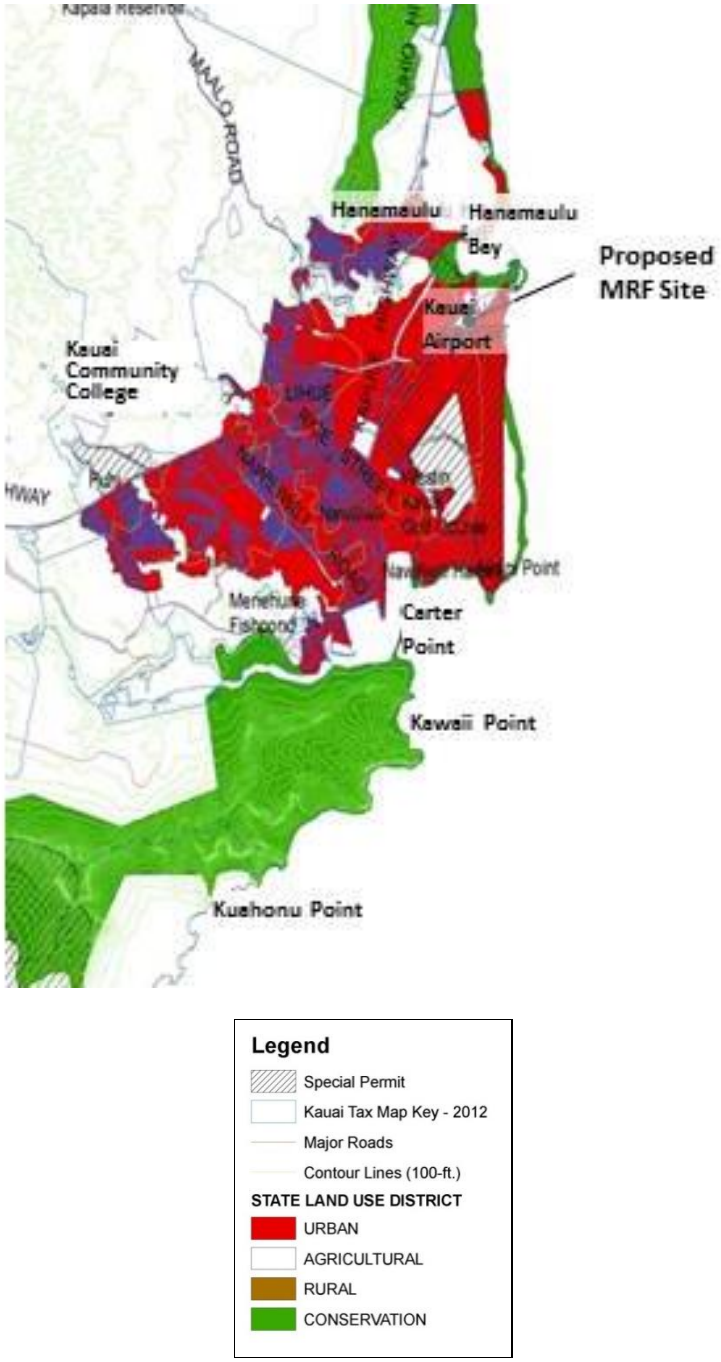


Figure 2. Location of Land Parcel for Proposed MRF

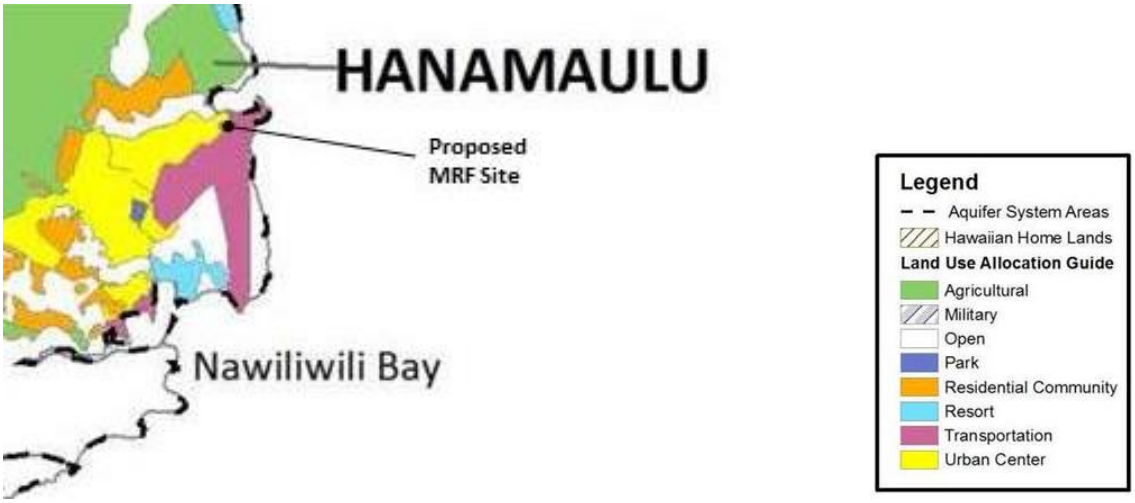
Satellite Image, courtesy of Google Earth.

Figure 3. Site Plan



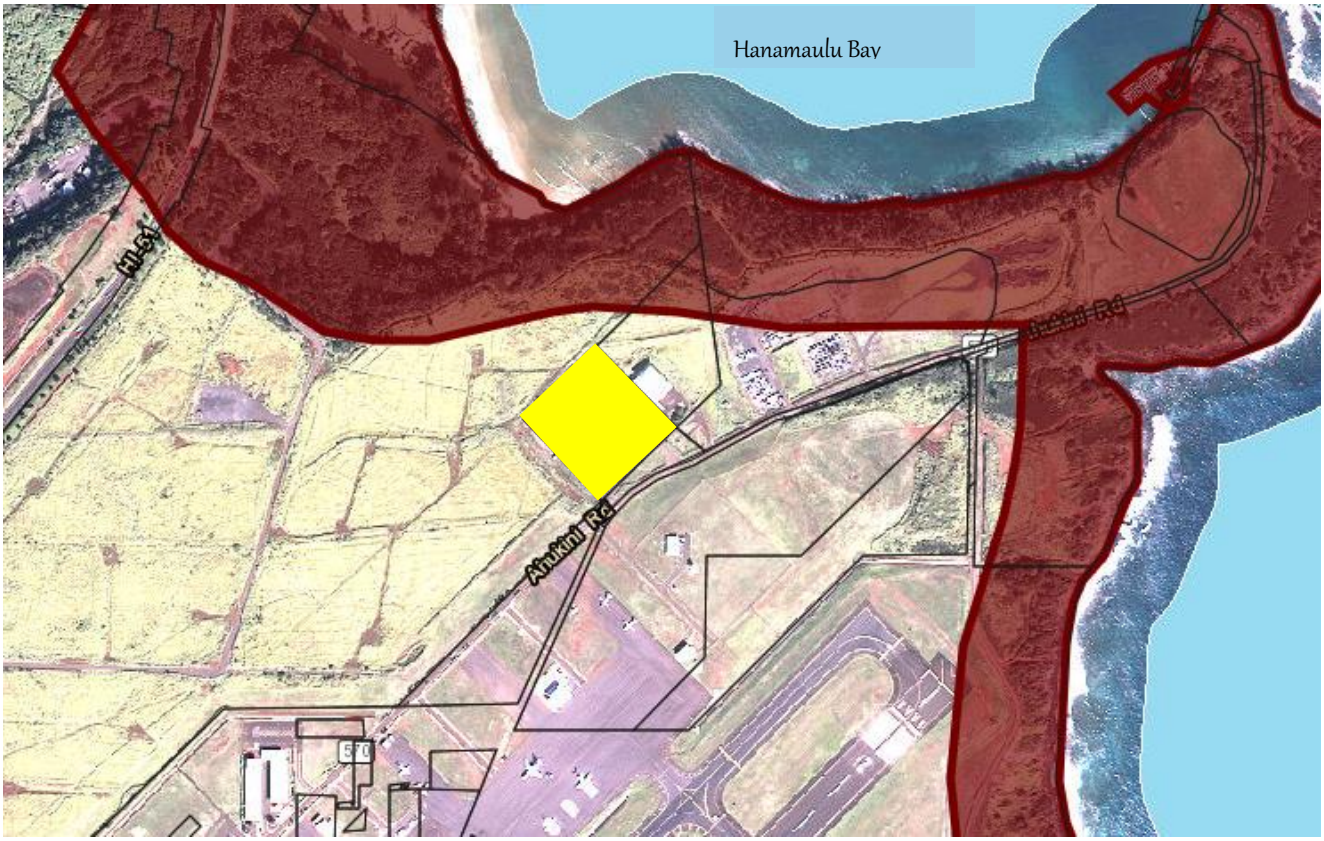
Source: *Kauai General Plan*, County of Kauai Planning Department, 2000.

Figure 4. State of Hawaii Conservation District Subzone (Lihue, Kauai)



Source: *Kauai General Plan*, County of Kauai Planning Department, 2000.

Figure 5. Kauai General Plan Land Use Map (Lihue)



Source: http://histategis.maps.arcgis.com/apps/Viewer/index.html?appid=f30604a60fe64945af7442c7c08174f9

Figure 6. Location of Special Management Area (SMA, reddish brown shading) in the Vicinity of the Lihue Transfer Station/Proposed MRF (yellow rectangle)

APPENDICES

APPENDIX A

CalRecovery, Inc., Conceptual Design of Kauai Clean Materials Processing Facility (Clean MRF) Proposed for the Existing Site of the Kauai Resource Center, Combined Technical Memorandums Nos. 1 and 2, February 2016

Combined Technical Memorandums Nos. 1 and 2

Conceptual Design of Kauai Clean Materials Processing Facility (Clean MRF) Proposed for the Existing Site of the Kauai Resource Center

February 2016

CalRecovery INCORPORATED

Introduction and Background

The original site of the proposed Clean MRF was intended to be the site of the Kauai Tropical Fruit Disinfection Facility, which is located near the KRC property. After CalRecovery's original conceptual MRF design was completed in April 2014, the intended site was changed to the KRC property with the objective of using as much of the existing site and building envelopes as would be technically practical and financially feasible. This combined memorandum of Technical Memorandums Nos. 1 and 2 contains the conceptual design basis and other details of the proposed Clean MRF that is planned for the KRC property.

Technical Memorandum No. 1 contains estimated inbound and outbound mass flows, processing equipment and system configuration, and operating conditions and served as the primary basis for the preparation of Technical Memorandum No. 2.

CalRecovery used the processing concepts and configuration presented in Memorandum No. 1 as the basis of the conceptual design of the processing system and configuration for implementation at the KRC site. While the reader will note when reading Memorandum No. 2 that the layout of the main sorting line planned for the facility at the KRC site is shown with a 90 degree change in direction on the site plan while that plan in Memorandum No. 1 shows a straight-line configuration, the layout depicted in Memorandum No. 1 is sufficient as a starting point for the final design of the proposed MRF, which will have to be based on the latest information regarding estimated number, frequency of deliveries, and composition of loads as a function of type of delivering vehicles as well as on the latest information on recycling markets and their specifications for recovered recyclable materials. The total processing floor area and the necessary clearance heights for the Clean MRF located at the KRC site will be very similar to those reflected in the example processing layout shown in Memorandum No. 1. In other words, whether the processing line is essentially a "straight line" (or "in-line") configuration or is arranged with one or more 90 degree turns at some point in the processing train, the total areas and necessary heights will be similar regardless of whether a straight-line or 90 degree configuration is used. Note that the necessary floor-to-ceiling heights are described in Memorandum No. 2 as a result of the additional conceptual design work Calrecovery performed at the request of the County when the County changed the location of the proposed MRF to the KRC site.

Memorandum No. 2 provides the conceptual design of the proposed MRF when located at the KRC site. As indicated above, the estimated mass flows and operating conditions presented in Memorandum No. 1 apply to the MRF design for the KRC site. Memorandum No. 2 also describes the conceptual design for modifying two of the KRC structures for the purpose of accommodating the processing system and ancillary operations. The design of the proposed enclosed structure is sufficient to accommodate the proposed main sort line processing configuration either as a straight-line train or one arranged with a 90 degree turn. The exact configuration will be left for completion of the final design work and any suggestions offered by the selected MRF equipment supplier(s), i.e., flexibility of processing configuration is built into the conceptual design and proposed building envelope.

Task 1: Technical Memorandum

Conceptual Design for County of Kaua'i Clean MRF

DEA3
CalRecovery, Inc.

Conceptual Design for County of Kaua'i Clean MRF

Introduction

CalRecovery has revised the initial draft of the design criteria to reflect the comments of the County of Kaua'i and further refinements to the design and layout of the materials recovery facility (MRF). The primary revisions accommodate the following:

- Revision of quantities and compositions of the source material streams based on refinement of the available data by County staff and CalRecovery
- Addition of the delivery of commercial source-separated (SS) glass (mixed color) to the MRF, since the County anticipates such a collection program will become a parallel program to its commercial source-separated old corrugated cardboard (OCC) recycling program
- Addition of a system to separate a container-rich mixture (glass, metal, and plastic) from the residential and commercial source-separated commingled mixture, using screening equipment; the container-rich mixture would then be re-introduced in a separate processing shift onto the main processing line downstream of the screening operation

Details of the sources and types of recyclables, methods of processing, material flows, and proposed processing configuration are presented below.

Primary Sources of Recyclables Scheduled for Delivery to and Processing at the MRF

The proposed MRF would process six generic sources of recyclables, namely:

1. Residential Source-Separated Commingled Recyclables (paper and containers)
2. Commercial Source-Separated Commingled Recyclables (paper and containers)
3. Commercial Source-Separated Corrugated Fiber (OCC)
4. Commercial Source-Separated Glass (mixed color)
5. Redemption Center Source-Separated, Individual Material Types (e.g., separate loads of aluminum beverage cans, of mixed PET/HDPE beverage containers (or of PET and of HDPE containers individually), and of mixed-color glass beverage containers)
6. Drop-off Program Source-Separated, Individual Material Types

The vehicles delivering residential and commercial commingled recyclables and commercial source-separated glass are assumed to be typical collection route vehicles. The vehicles delivering commercial source-separated OCC are assumed to be front-end packers, compactor roll-offs, or covered roll-offs. Redemption center and drop-off program recyclables are assumed to be delivered to the MRF in small trucks, covered roll-offs, or bins. Drop-off program materials likely will migrate to the residential commingled collection system once it is fully rolled out.

Sources and Characteristics of Recyclables Targeted by the County's Recycling Program

The County staff and CalRecovery worked jointly to describe the quantities and characteristics of sources of recyclables listed in the previous section. The compositions of each source have been estimated in terms of material types and two forms of anticipated contamination, namely: 1) large, bulky objects and items that would have to be removed very early in the processing line since the later processing equipment could not handle such material sizes, and 2) smaller particles of non-recyclable materials remaining after sorting ("process residue"). The estimated compositions of the material streams corresponding to each source of generation are presented in Tables 1 through 6.

Table 1. Estimated Composition of Residential Commingled Recyclables

Residential Commingled Material Type	Composition		Excluding Contamination
OCC	27.5%		30.5%
News	15.9%	71.9%	17.7%
Mixed paper	28.5%		31.6%
PET #1	1.2%		1.4%
HDPE #2	4.2%		4.7%
Molded plastics	0.2%		0.2%
Tin cans	1.5%		1.7%
Aluminum (HI 5)	0.1%		0.1%
Glass (HI 5 & non-HI 5)	10.4%		11.6%
Bimetal	0.5%		0.6%
Misc. contamination	8.0%	10.0%	xxxxxx
Nonprocessible/bulky percentage	2.0%		xxxxxx
Calculated Sum of Streams	100.0%		100.0%

Note: Values may not sum exactly due to rounding.

Table 2. Estimated Composition of Commercial Commingled Recyclables

Commercial Commingled Material Type	Composition		Excluding Contamination
OCC	14.4%		16.0%
News	14.4%	69.3%	16.0%
Mixed paper	40.5%		45.0%
PET #1	2.7%		3.0%
HDPE #2	6.3%		7.0%
Molded plastics	1.8%		2.0%
Tin cans	5.4%		6.0%
Aluminum (HI 5)	1.8%		2.0%
Glass (HI 5 & non-HI 5)	2.7%		3.0%
Bimetal	0.0%		0.0%
Misc. contamination	8.0%	10.00%	xxxxxx
Nonprocessible/bulky percentage	2.0%		xxxxxx
Calculated Sum of Streams	100.0%		100.0%

Note: Values may not sum exactly due to rounding.

Table 3. Estimated Composition of Commercial Source-Separated OCC

Commercial SS OCC Material Type	Composition		Excluding Contamination
OCC	98.0%		100.0%
News	0.0%	98.0%	0.0%
Mixed paper	0.0%		0.0%
PET #1	0.0%		0.0%
HDPE #2	0.0%		0.0%
Molded plastics	0.0%		0.0%
Tin cans	0.0%		0.0%
Aluminum (HI 5)	0.0%		0.0%
Glass (HI 5 & non-HI 5)	0.0%		0.0%
Bimetal	0.0%		0.0%
Misc. contamination	1.0%	2.0%	xxxxxx
Nonprocessible/bulky percentage	1.0%		xxxxxx
Calculated Sum of Streams	100.0%		100.0%

Note: Values may not sum exactly due to rounding.

Table 4. Estimated Composition of Commercial Source-Separated Glass Containers

Commercial SS Glass Material Type	Composition		Excluding Contamination
Glass	99.0%		99.0%
Misc. contamination	0.5%	1.0%	xxxxxx
Nonprocessible/bulky percentage	0.5%		xxxxxx
Calculated Sum of Streams	100.0%		99.0%

Note: Values may not sum exactly due to rounding.

Table 5. Estimated Composition of Redemption Center Containers

Redemption Centers Material Type	Composition		Excluding Contamination
OCC	0.0%		0.0%
News	0.0%	0.0%	0.0%
Mixed paper	0.0%		0.0%
PET #1	14.4%		14.7%
HDPE #2	0.1%		
Molded plastics	0.0%		0.0%
Tin cans	0.0%		0.0%
Aluminum (HI 5)	12.0%		12.1%
Glass (HI 5 & non-HI 5)	72.1%		72.8%
Bimetal	0.4%		0.4%
Misc. contamination	0.5%	1.0%	xxxxxx
Nonprocessible/bulky percentage	0.5%		xxxxxx
Calculated Sum of Streams	100.0%		100.0%

Note: Values may not sum exactly due to rounding.

Table 6. Estimated Composition of Materials Received from Dropbox Program

Dropbox Program Material Type	Composition		Excluding Contamination
OCC	41.2%		41.6%
News	6.5%	75.9%	6.6%
Mixed paper	28.1%		28.4%
PET #1	4.7%		4.7%
HDPE #2	0.0%		0.0%
Molded plastics	0.0%		0.0%
Tin cans	2.3%		2.4%
Aluminum (HI 5)	0.0%		0.0%
Glass (HI 5 & non-HI 5)	16.1%		16.2%
Bimetal	0.0%		0.0%
Misc. contamination	0.5%	1.0%	xxxxxx
Nonprocessible/bulky percentage	0.5%		xxxxxx
Calculated Sum of Streams	100.0%		100.0%

Note: Values may not sum exactly due to rounding.

Facility Feedstock Receiving and Storage

Several areas of the proposed MRF would serve as tipping floors and storage areas for deliveries of recyclable materials. These areas are listed below in terms of source/sector, form, and composition of recyclables:

1. Tipping floor dedicated to receiving and storing commingled recyclables:
   a. Residential source-separated commingled recyclables (paper and containers)
   b. Commercial source-separated commingled recyclables (paper and containers)
2. Tipping floor dedicated to receiving commercial source-separated OCC
3. Tipping floor dedicated to receiving commercial source-separated glass (mixed color)
4. Tipping floor dedicated to receiving and storing individual, non-fiber material types:
   a. Redemption center and drop-off program source-separated, individual material types (e.g., separate loads of aluminum beverage containers, PET beverage containers, and mixed-color glass beverage containers)

Proposed locations of various dedicated tipping floor areas are shown in Figure 1.

The general processing conditions for the proposed MRF and description of general characteristics of the targeted material feedstocks are summarized in Table 7 by source of recyclables -- residential, commercial, etc. The estimated average delivery rate, assuming 5-day, 8-hour operation, is approximately 58 tons/day (TPD), which is equivalent to approximately 15,000 tons/year (TPY). The average hourly rate of delivery of materials to the facility would be about 7 tons/hour (TPH). The estimated maximum availability of targeted materials is approximately 26,700 tons/year [AECOM 2013].

Table 7. General Delivery Conditions and Targeted Material Types by Source

Average Delivery Rate					
Source	**Tons/Day (TPD)**	**Days/ Year**	**Calculated Tons/Year (TPY)**	**Targeted/Allowable Material Types**	**Anticipated Contamination (not inclusive)**
Residential SS commingled recyclables	20.0	260	5,200	tin and bimetal cans, aluminum beverage cans, glass beverage and food containers, PET, HDPE, and molded plastic containers, paper (all grades)	textiles, film plastic, food, polystyrene forms and pellets, wrapping tape, shrink wrap, strapping, non-corrugated fiber grades, small and large non-container metal and plastic objects (fasteners, toys, etc.)
Commercial SS commingled recyclables	10.7	260	2,782	tin and bimetal cans, aluminum beverage cans, glass beverage and food containers, PET, HDPE, and molded plastic containers, paper (all grades)	textiles, film plastic, food, polystyrene forms and pellets, wrapping tape, shrink wrap, strapping, non-corrugated fiber grades, small and large non-container metal and plastic objects (fasteners, toys, etc.)
Redemption centers	11.5	260	3,000	tin and bimetal cans, aluminum beverage cans, glass beverage and food containers, PET and HDPE plastic containers	paper, textiles, film plastic, plastic #3 through 7 containers, paper
Dropbox program	6.5	260	1,700	tin and bimetal cans, aluminum beverage cans, glass beverage and food containers, PET and HDPE plastic containers, OCC, news, mixed paper	paper, textiles, film plastic, plastic #3 through 7 containers, paper
Commercial SS OCC	6.9	260	1,794	corrugated fiber	polystyrene forms and pellets, wrapping tape, shrink wrap, strapping, non-corrugated fiber grades
Commercial SS glass	2.4	260	624	HI 5 and non-HI 5 glass containers	food, non-container glass
Calculated Total Feedstock	58.1		15,100		

Note: Values may not sum exactly due to rounding.

The estimated area required for receiving and storing materials on the tipping floor of the proposed MRF is summarized in Table 8. Two days of storage are assumed. An estimated 6,600 sq. ft. is required for receiving and storing residential and commercial commingled materials over a 2-day period.

Table 8. Estimated Tipping Floor Areas Required for Receiving and Storing Recyclables at the MRF

Inbound deliveries	Days	Sq. Ft.
Res./Comm. commingled mix	2	6,600
Redemption center beverage container mix	2	2,100
Dropbox program	2	1,200
Comm. SS glass-mixed color	2	300
Comm. SS OCC	2	1,500

The nine key recyclable material types identified for recovery, the general method of recovering them, and the assumed markets and uses are described in Table 9. Plastic, metal, and paper grades would be baled for market using a baler to export specifications. Glass would be size reduced in a glass grinder to market or use specifications, and shipped to users in gaylords, bins, or roll-off containers depending on volumes, shipping costs, and user preferences.

Table 9. Key Recyclable Commodities that will be Recovered at the MRF and General Method of Recovery

Recovered Products	Method of Recovery	Assumed Market/Use	Reference
Tin and bimetal cans	Magnet	Steel manuf.	AECOM, 2013
Aluminum cans	Manual	Aluminum manuf.	AECOM, 2013
PET #1	Manual	Plastic manuf.	AECOM, 2013
HDPE #2	Manual	Plastic manuf.	AECOM, 2013
Plastic molded #3-7	Manual	Plastic manuf.	AECOM, 2013
Glass color-mixed, broken, low quality	Disk screen	Local aggregate and/or Strategic Materials Inc.	AECOM, 2013
Glass color-mixed, broken, high quality	Received clean from commercial source-separated glass collection, direct to grinder	Local aggregate and/or Strategic Materials Inc.	
OCC	Fiber line, positive sort	Paper manuf.	AECOM, 2013
Mixed paper	Fiber line, positive sort	Paper manuf.	AECOM, 2013

The estimated quantities of recovered products and of contamination and process residue are summarized in Table 10. The overall rate of recovery of recyclables and of contamination and residue is estimated to be 94% and 6%, by mass, respectively. The average processing rate is about 7 TPH, assuming an 8-hour processing schedule.

Table 10. Estimated Quantities of Recovered Products and Process Residue

Output Streams by Source (average TPD)					
Source	**Recovered Products**	**Contam./ Residue**	**Total**	**Contam. %**	**Avg. TPH_8**
Res./Comm. material type	18.0	2.0	20.0	10.0%	2.5
Comm. commingled material type	9.6	1.1	10.7	10.0%	1.3
Redemption centers material type	11.4	0.1	11.5	1.0%	1.4
Dropbox program	6.5	0.1	6.5	1.0%	0.8
Comm. SS OCC	6.8	0.1	6.9	2.0%	0.9
Comm. SS Glass	2.4	0.0	2.4	1.0%	0.3
Total	54.7	3.4	58.1		7.3
Percent of Input Stream	94.1%	5.9%	100.0%		

Note: Values may not sum exactly due to rounding.

Approximately 36 TPD of materials are scheduled for baling. The breakdown of daily production for OCC and non-OCC material types is shown in Table 11, along with the estimated storage areas for storing two and four weeks of production.

Table 11. Estimated Production of Baled Products and Required Storage Areas

			5 days/week	
Commodity	**Material Type/Grade**	**Avg. TPD**	**Bale Area (sq. ft.)/ 2 wks**	**Bale Area (sq. ft.)/ 4 wks**
Non-OCC	ONP	5.2	392	785
	Mixed paper	11.9	959	1,918
	PET	2.5	238	477
	HDPE	1.5	158	315
	Molded plastics	0.2	23	46
	Aluminum	1.6	121	242
	Tin cans + bimetal	1.2	63	126
	Subtotal Baled	24.1	1,955	3,910
OCC	Resid. OCC from commingled			
	Comm. OCC from commingled			
	Redemption center			
	SS OCC			
	Subtotal Baled OCC	16.5	1,466	2,932
	Grand Total Baled			6,842

Note: Values may not sum exactly due to rounding.

Processing Rates and Operating Schedule

As indicated previously, the average estimated delivery rate of materials for the proposed MRF is 7 TPH, which is a very low rate compared to processing rates of equipment and systems typically installed in municipal MRFs. Typical clean MRF processing line capacities are 12 to 15 TPH. For purposes of achieving cost-effective processing, CalRecovery analyzed estimated processing rates for the various sources/input stream compositions based on a typical commercial processing rate of about 15 TPH of a commingled mixture of glass, metal, and plastic containers and paper grades (i.e., a typical source-separated, single stream commingled recyclables mixture). The basis of the analysis was to assume processing of the commingled mixture over the main sort line; diversion of the glass, metal, and plastic containers for later processing over the main sort line; and processing and recovery of paper grades over the second (back) half of the main sort line. The layout of this proposed processing scheme is shown in Figure 1.

The diversion of the glass, metal, and plastic containers from the main sort line and the reintroduction of them onto the second half of the main sort line after the paper grades are recovered eliminates the need for a separate line to process the containers, thus eliminating the need for such a separate container line and optimizing capital equipment expenditure. The results of the analysis indicate that this processing scheme will work and is feasible, inasmuch as the estimated main sort line processing time is approximately 4 hours, as shown in Table 12 for a main sorting line configuration with average system design capacities of 15 tons per 8-hour shift for processing the residential and commercial commingled material streams, and 20 tons per 8-hour shift for reprocessing the recovered container-rich fraction at a later time. The estimated average time of operation of the baling line is approximately 5 hours, also shown in Table 12. The analysis indicates this processing scheme has capacity for growth to accommodate increases in residential and commercial recycling in the future (e.g., July 2024, when the County estimates that total deliveries could be about 17,000 TPY).

For substantial growth in processing capacity wherein the additional capital expense has a more beneficial cost-benefit ratio (i.e., when approaching 12 to 15 TPH of commingled mixtures of paper and glass, metal, and plastic containers), a separate processing line for processing the containers could be designed and incorporated in the future into the original, simpler process design.

Table 12. Processing Rates and Operating Schedule assuming Re-run Scenario for Recovered Container Mix

Source/Input Stream	Process Line	TPD	Avg. Design Processing Rate (TPH_8)	Main Line Hrs/day	Baler Line Hrs/day
Res./ Comm. commingled mix	Full main line	30.7	15	2.0	
Re-run of recovered container mix (metal, glass, plastic)	Back half main line	18.2	15	1.2	
Redemption centers material type	Back half main line	11.5	20	0.6	
Dropbox program	Back half main line	6.5	20	0.3	
Comm. SS glass	Back half main line	2.4	20	0.1	
Comm. SS OCC	Baler line	6.9	8		0.9
OCC recovered from Res./Comm. commingled lines	Baler line	9.7	8		1.2
Non-OCC materials recovered from Res./Comm. commingled lines	Baler line	24.1	8		3.0
			Total	4.3	5.1

Note: Values may not sum exactly due to rounding.

Area of Processing Facility

Based on the analysis to date, CalRecovery estimates that the processing equipment and system will require approximately 22,000 sq. ft., including tipping floor, processing system, and some indoor product storage, but excluding area for administrative offices.

REFERENCE

AECOM, *Kaua'i Resource Recovery Park Feasibility Study*, April 2013.

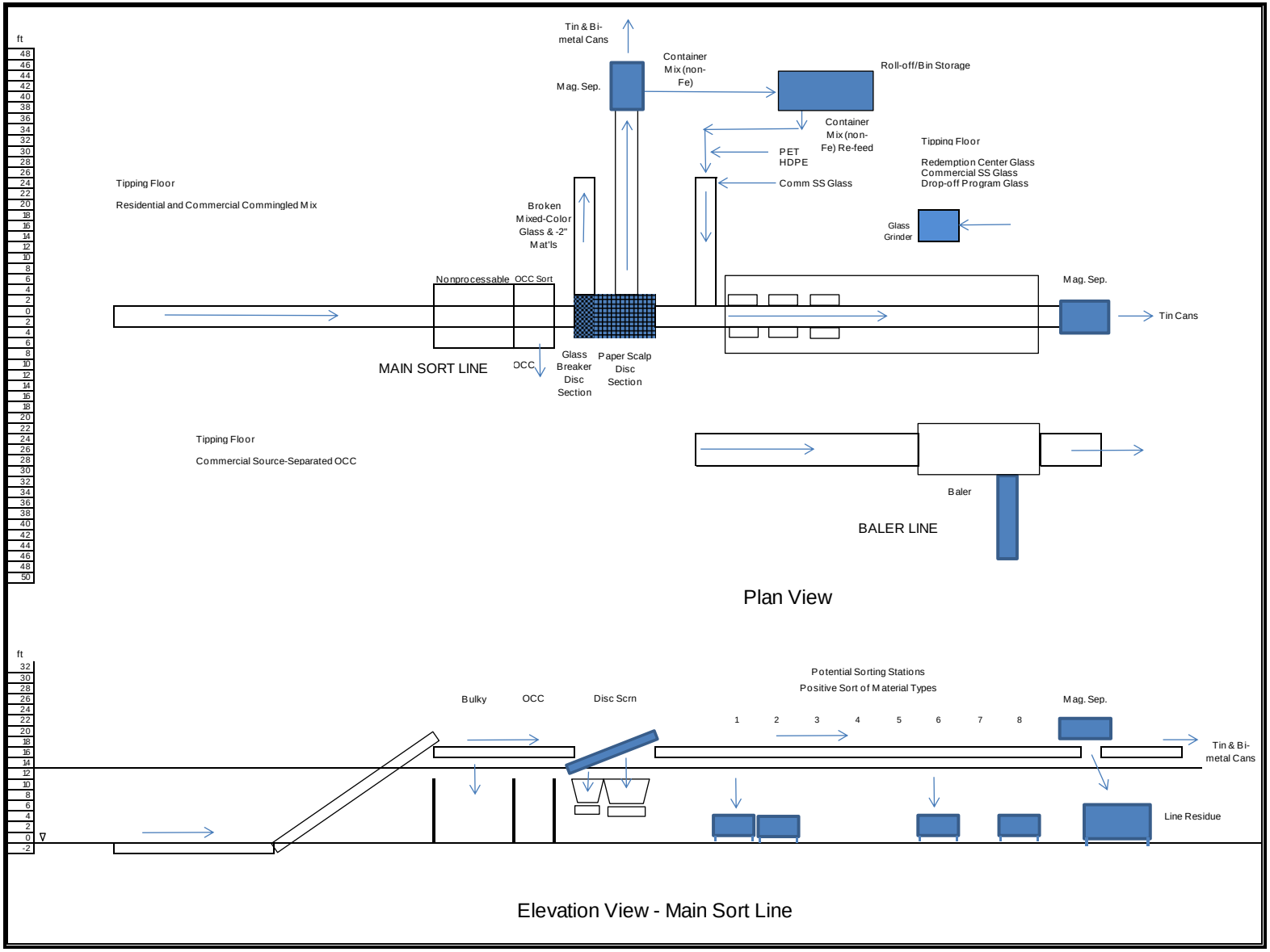


Figure 1. General Arrangement Views of Processing System

Technical Memorandum 2

Conceptual Design of Kaua`i County Materials Recovery Facility Proposed for Kaua`i Resource Center Site

2016 DEA
CalRecovery, Inc.

Conceptual Design of Kaua`i County Materials Recovery Facility Proposed for Kaua`i Resource Center Site

Introduction

The County of Kaua`i requested CalRecovery, as part of the work for Amendment 1 Task 1, to analyze the existing Lihue Transfer Station/Kaua`i Resource Center (LTS/KRC) site for locating the proposed Clean MRF processing system that CalRecovery had conceptually designed for installation and operation within the Tropical Fruit Disinfestation Building located just to the northeast. Key issues of concern are the technical and financial feasibility of adapting some or all of the two main KRC structures to accommodate receiving and processing recyclable materials and of accommodating the physical size and weight of large collection vehicles and to a lesser degree of other rolling equipment that would be required for successful operation of the new MRF. As the initial work task, CalRecovery performed a reconnaissance of the LTS/KRC site and its existing facilities on June 16, 2015, along with our structural engineering subcontractor, Jim Walfish, and John Harder of the County. Also, during and after the visit to the site, CalRecovery and Mr. Walfish reviewed and discussed with the County its goals and general design and operating requirements with regard to this particular site. Subsequently, CalRecovery and Mr. Walfish analyzed the situation and determined that by raising the vertical clearance in strategic areas in the existing structures to accommodate vehicle flow and operation and with creating an integrated building enclosure (e.g., roof and sidewalls) between the two existing buildings, modifying the existing structures would be significantly less costly than razing all or part of the two structures and erecting essentially a completely new structure for receiving and processing materials.

Analysis

The materials processing configuration for the proposed Clean MRF would remain essentially the same as described in CalRecovery's Task 1 Technical Memorandum. The major difference in terms of the physical layout of the processing lines is that at the KRC site, the main sorting line would be broken into two lines with at least one 90-degree transition occurring after the presorting portion of the processing line as opposed to an in-line configuration assumed earlier for the case in which the proposed processing would occur in the Disinfection Facility Building. The general arrangement of the proposed main sorting line and of the baler line is shown schematically in Figure 1. The proposed arrangement of the processing lines and increase in ceiling height are to enable preservation of the existing conference room, office, and mezzanine of Building A. Also shown and described in Figure 1 are the proposed major improvements and modifications of the existing structures (Buildings A and B) and of other areas near them. The areas of the tipping floor/inbound materials storage and of the main processing lines and outbound materials storage are approximately 7,000 and 13,000 sq. ft., respectively. A top view of the proposed general arrangement of the two major materials processing lines and of the proposed major improvements of the site and structures is shown in Figure 2, superimposed on a satellite image of the existing LTS/KRC facility. The receiving/tip floor and materials processing areas are shown in Figure 3.

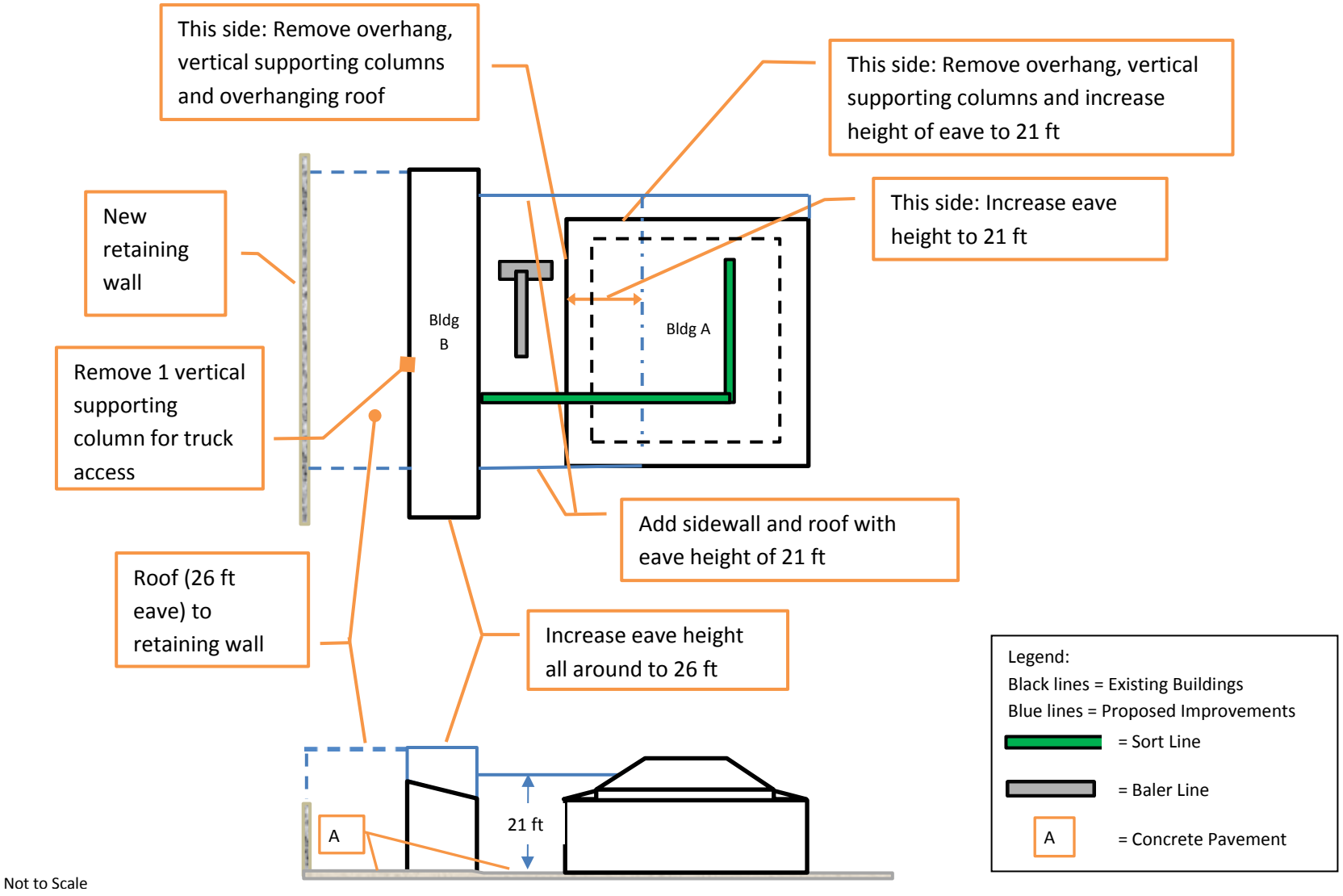


Figure 1. Plan and Elevation Views of Proposed Clean MRF Building, including Processing Line Configuration and Proposed Improvements

Figure 2. Aerial View of Key Processing Lines and Structural Improvements Overlain on a Satellite Image of the Existing LTS/KRC Facility Site

Satellite Image, courtesy of Google Earth.

Figure 3. Aerial View of the Proposed MRF Showing Receiving/Tip Floor and Material Processing Areas

Satellite Image, courtesy of Google Earth.

APPENDIX B

Traffic Management Consultant, Draft Traffic Assessment Report for the Proposed Kauai Materials Recycling Facility, January 2016

TRAFFIC ASSESSMENT REPORT

FOR THE PROPOSED

KAUAI MATERIALS RECOVERY FACILITY

LIHUE, KAUAI, HAWAII

TAX MAP KEY: 03-07-02:14

PREPARED FOR

CALRECOVERY, INC.

FEBRUARY 16, 2016

PREPARED BY

TMC

THE TRAFFIC MANAGEMENT CONSULTANT

KAUAI MATERIALS RECOVERY FACILITY

LIHUE, KAUAI, HAWAII

TAX MAP KEY: 03-07-02:14

PREPARED FOR

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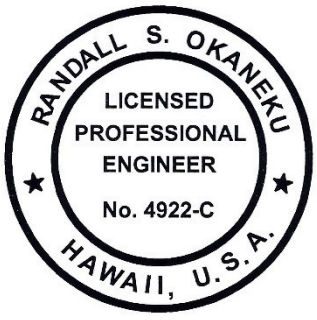

PREPARED BY

THE TRAFFIC MANAGEMENT CONSULTANT

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TRAFFIC ASSESSMENT REPORT

FOR THE PROPOSED

KAUAI MATERIALS RECOVERY FACILITY

LIHUE, KAUAI, HAWAII

TAX MAP KEY: 03-07-02:14

I. Introduction

A. Project Description

The Kauai Materials Recovery Facility (MRF) is proposed to be constructed at the existing Lihue Refuse Transfer Station and Kauai Resource Center, which are located on Ahukini Road, north of the Lihue Airport. The site is identified as Tax Map Key: 03-07-02:14. Figure 1 depicts the location of the proposed Kauai Materials Recovery Facility.

The Kauai Materials Recovery Facility will include the modification and expansion of two existing structures, currently used by the Kauai Resource Center. The Kauai MRF will receive and process recyclables, which will be generated from residential and commercial sources. The materials are expected to be collected throughout the island of Kauai and delivered to the Kauai MRF by the County of Kauai and commercial collection vehicles. The existing site contains structures, which total approximately 24,600 square feet of gross floor area (SFGFA). The Lihue Refuse Transfer Station and Kauai Resource Center structures will be modified and expanded by about 15,700 SFGFA to accommodate the Kauai MRF. Table 1 summarizes the building floor areas.

Table 1. Kauai Materials Recovery Facility

Scenario	Building	SFGFA
Existing	Transfer Station	4,100
	Resource Center	16,000
	Storage	4,500
	Total	24,600
Proposed	MRF Expansion	15,700
	Total	40,300

Figure 1. Location and Vicinity Map

The Kauai Materials Recovery Facility is expected to be built out by the Year 2019. The establishment of a future landfill on Kauai can be expected to reduce or eliminate the existing refuse collection and transfer trailer traffic to/from the project site. For the purpose of this traffic assessment, it is assumed that the new landfill is beyond the time frame of this study, and that the refuse collection and transfer trailer traffic will continue to use the Lihue Refuse Transfer Station.

B. Site Access

The existing site access on Ahukini Road is provided by two driveways: the Kauai Resource Center (KRC) Driveway, which is located at the southeast corner of the site, provides access to the Lihue Refuse Transfer Station and Kauai Resource Center employees and visitors; and the Refuse Transfer Station (RTS) Driveway, which is located at the northeast corner of the site, provides access for all other traffic.

In order to balance the traffic demands between the RTS and KRC Driveways, and reduce the traffic conflicts within the site, the Kauai MRF will include a new traffic circulation plan. Employees and visitors will continue to enter and exit the KRC Driveway. All transfer station single-unit trucks and articulated trucks will continue to enter and exit the RTS Driveway. All other transfer station traffic (passenger vehicles and light goods vehicles) will enter the RTS Driveway and exit the KRC Driveway. The MRF single-unit (collection) truck traffic will enter the RTS Driveway and exit the KRC Driveway. The MRF articulated trucks will enter and exit the RTS Driveway. The proposed site plan is depicted on Figure 2.

C. Purpose and Scope of the Study

The purpose of this study is to assess the traffic access impacts resulting from the Kauai Materials Recovery Facility. This report presents the findings and recommendations of the study, the scope of which includes:

1. A description of the proposed project.
2. An evaluation of existing roadways and traffic conditions.
3. The analysis of the future traffic conditions without the proposed project.
4. The development of trip generation characteristics of the proposed project.
5. The identification and analysis of the traffic access impacts resulting from the development of the proposed project.
6. The relative increases in peak hour traffic beyond the study area.
7. The recommendations of roadway improvements, which would mitigate the traffic access impacts, as necessary.

Figure 2. Site Plan

D. Methodologies

1. Capacity Analysis Methodology

The highway capacity analysis, performed for this study, is based upon procedures presented in the Highway Capacity Manual (HCM2010), published by the Transportation Research Board. HCM2010 defines the Level of Service (LOS) as "a quality measure describing operational conditions within a traffic stream". Several factors may be included in determining LOS, such as: speed, travel time, freedom to maneuver, traffic interruptions, driver comfort, and convenience.

LOS's "A", "B", and "C" are considered to be satisfactory Levels of Service. LOS "D" is generally considered to be a "desirable minimum" operating Level of Service. LOS "E" and LOS "F" are considered to be undesirable conditions. Intersection LOS is primarily based upon delay, which is measured in seconds per vehicle (sec/veh). Table 2 summarizes the LOS criteria.

Table 2. Level of Service Criteria (HCM2010)

LOS	Unsignalized Intersections	
	Control Delay (sec/veh)	Description
A	≤ 10	Little or no delays
B	> 10 – 15	Short delays
C	> 15 – 25	Average delays
D	> 25 – 35	Long delays
E	> 35 – 50	Very long delays
F	> 50	Extreme delays

Worksheets for the capacity analysis, performed throughout this study, are compiled in the Appendix.

2. Trip Generation Methodology

The trip generation methodology is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in Trip Generation, 9th Edition. ITE has not developed trip generation rates for a refuse transfer or materials recovery facility. Therefore, the trip generation characteristics were based upon the MRF processing capacity and the carrying capacities of the trucks that are expected to deliver the collected materials to, and haul the processed materials from the Kauai MRF.

3. Left-Turn Lane Warrant

The left-turn lane analysis on a two-lane highway is based upon A Policy on Geometric Design of Highways and Streets, 2011, published by the American Association of State Highway and Transportation Officials (AASHTO). The AASHTO guide is based upon the combination of the left-turn volumes between 5 percent and 30 percent of the advancing volume; the advancing volumes, ranging from 160 vehicles per hour (vph) to 720 vph; and the opposing volumes, ranging from 100 vph to 800 vph for an operating speed of 40 miles per hour (mph). The AASHTO guide is based upon the "Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections", Highway Research Record 211, Highway Research Board, 1967, by M. D. Harmelink. Harmelink analyzed the probability of the arrival of an advancing through vehicle having to slow down and/or stop behind a vehicle, waiting to turn left from the through lane. Harmelink proposed that this probability should not exceed 2.0 percent.

4. Vehicle-Type Classification Scheme

The traffic count surveys included vehicle-type classification. Table 3 describes the vehicle-type classification scheme:

Table 3. Vehicle-Type Classification

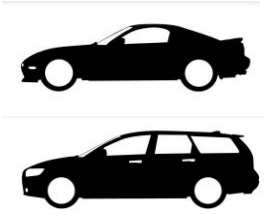
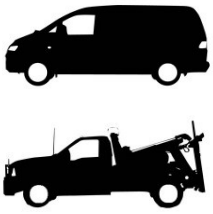
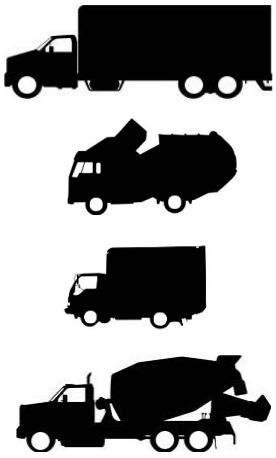
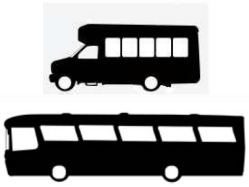
Vehicle-Type	Description
Motorbike 	All motorcycles, motor scooters, mopeds, motor-powered bicycles, and three-wheel motorcycles. Relevant FHWA Class – 1: Motorcycles Typical Vehicle Length: 3.15 - 7.61 feet (0.96 - 2.32 m)
Car 	All passenger-carrying vehicles, including those that pull light trailers; sedans, coupes, station wagons, SUVs, vans, limousines, campers, motor homes, small ambulances, etc. Relevant FHWA Class – 2: Passenger Cars and Other Two-Axle, Four-Tire Single Unit Passenger Vehicles Typical Vehicle Length: 13.06 - 22.45 feet (3.98 - 6.84 m)

Table 3. Vehicle-Type Classification (Cont'd.)	
Vehicle-Type	**Description**
Light Goods Vehicle 	All light goods-carrying vehicles, including those that pull light trailers: pickups, panel vans, tow trucks, etc. Relevant FHWA Class 3: 2 Axles, 4-Tire Single Units, Pickup trucks or Vans (With 1- or 2-Axle Trailers) Typical Vehicle Length: 13.06 - 22.45 feet (3.98 - 6.84 m)
Single-Unit Truck 	All rigid vehicles over 3.5-ton gross vehicle weight. All large vehicles on a single-frame: trucks, tow trucks, campers, motor homes, large ambulances, etc., including passenger-carrying vehicles from this category pulling trailers. Relevant FHWA Classes – 4: Buses; 5-7: Two-Axle, Six-Tire, Single Unit Trucks and Three or More Axle Single Unit Trucks Typical Vehicle Length: 20.23 - 34.44 feet (6.17 - 10.50 m)
Bus 	All passenger-carrying buses, including school buses and articulated buses. Relevant FHWA Class – 4: Buses Typical Vehicle Length: 31.19 - 44.93 feet (9.51 - 13.69 m)
Articulated Truck 	All articulated vehicles. All multi-unit goods-carrying vehicles with a tractor or straight truck power unit, including goods-carrying rigid trucks pulling trailers. Relevant FHWA Classes – 8-13: Three or More Axle Trailer or Multi Trailer Trucks Typical Vehicle Length: 31.19 - 77.59 feet (9.51 - 23.65 m)

II. Existing Conditions

A. Roadways

Ahukini Road is a two-way, two-lane collector roadway between the Lihue Airport and Kuhio Highway. Ahukini Road continues pass the Lihue Airport toward the air freight carriers and commuter airlines, and terminates at the Ahukini Landing, which is located to the northeast of the project site. The posted speed on Ahukini Road is 25 mph.

B. Existing Peak Hour Traffic Volumes and Operating Conditions

1. Field Investigation and Data Collection

State of Hawaii Department of Transportation (DOT) collected 24-hour traffic count data on Ahukini Road, between Kapule Highway and the Lihue Airport, on May 7-8, 2014; and at the intersection of Kapule Highway and Ahukini Road on February 28-29, 2012. The County of Kauai Department of Public Works (DPW) collected one week of traffic data at the Lihue Refuse Transfer Station (LRTS) from October 19 through 26, 2012.

Turning movement count traffic surveys were conducted for this traffic assessment at the Lihue Refuse Transfer Station and the Kauai Resource Center Driveways on Ahukini Road on October 20, 2015, during the hours of operation, from 7:00 AM to 4:30 PM. The turning movement count traffic surveys included vehicle-type classification. Table 4 summarizes the vehicle-type classification totals, collected at the RTS and KRC Driveways.

Table 4. Vehicle-Type Classification Data

Vehicle-Type	RTS Driveway			KRC Driveway		
	Enter	Exit	Total	Enter	Exit	Total
Motorbikes	0	1	1	0	0	0
Cars	82	60	142	17	32	49
Light Good Vehicles	256	238	494	11	35	46
Buses	0	0	0	0	0	0
Single-Unit Trucks	17	15	32	3	3	6
Articulated Trucks	4	4	8	0	0	0
Totals	359	318	677	31	70	101

The DPW-LRTS traffic count study utilized mechanical counters, which were located within the project site, at the entry/exit to the existing Lihue Refuse Transfer Station. The DPW-LRTS study reported that the average daily traffic entering the facility at 323 vehicles per day, which is comparable to the RTS Driveway volume of 359 vehicles entering from Ahukini Road, during the operating hours of the KRC and LRTS.

2. Existing AM Peak Hour Traffic

The existing AM peak hour of traffic on Ahukini Road occurred in the mid-morning, from 10:15 AM to 11:15 AM. South of the KRC Driveway, Ahukini Road carried 185 vehicles per hour (vph), total for both directions, during the existing AM peak hour of traffic. By comparison, Ahukini Road carried about 640 vph, total for both directions, between Kapule Highway and the Lihue Airport, during the same time period. Kapule Highway and Ahukini Road carried about 1,900 vph entering the intersection.

The RTS Driveway carried 88 vph, total for both directions. Three-fourths of the vehicles entering the RTS Driveway were light goods vehicles. The KRC Driveway carried 5 vph, exiting the site, and zero traffic entering the site. The RTS and KRC Driveways both operated at LOS "A", during the existing AM peak hour of traffic. Figure 3 depicts the existing AM peak hour traffic volumes.

3. Existing PM Peak Hour Traffic

The existing PM peak hour of traffic on Ahukini Road occurred in the mid-afternoon, between 2:15 PM and 3:15 PM. Ahukini Road carried over 225 vph, south of the KRC Driveway, total for both directions. West of the Lihue Airport, Ahukini Road carried about 630 vph, total for both directions. Kapule Highway and Ahukini Road carried about 2,300 vph entering the intersection, during that mid-afternoon time period.

The RTS Driveway carried 123 vph, total for both directions. Eighty percent (80%) of the vehicles entering the RTS Driveway were light goods vehicles. The KRC Driveway carried 14 vph, total for both directions. During the existing PM peak hour of traffic, both the RTS and KRC Driveways operated at LOS "A". The existing PM peak hour traffic volumes are depicted on Figure 4.

III. Future Traffic Conditions Without the Proposed Project

A. Background Growth in Traffic

The population forecasts for Kauai were developed by the State of Hawaii Department of Business, Economic Development, and Tourism (DBEDT). The DBEDT population forecasts were one of the socio-economic factors that were used as the basis for the Federal-Aid Highways 2035 Transportation Plan for the District of Kauai, dated July, 2014, which was prepared for the State of Hawaii Department of Transportation by CH2M Hill. Between the Years 2015 and 2020, the population of Kauai is expected to increase by about 1.2 percent per year. For the purpose of this analysis, a background growth in traffic of 1.2 percent per year was assumed. A growth factor of 1.048 was uniformly applied to the existing (Year 2015) peak hour traffic demands to estimate the Year 2019 peak hour traffic demands, without the proposed project.

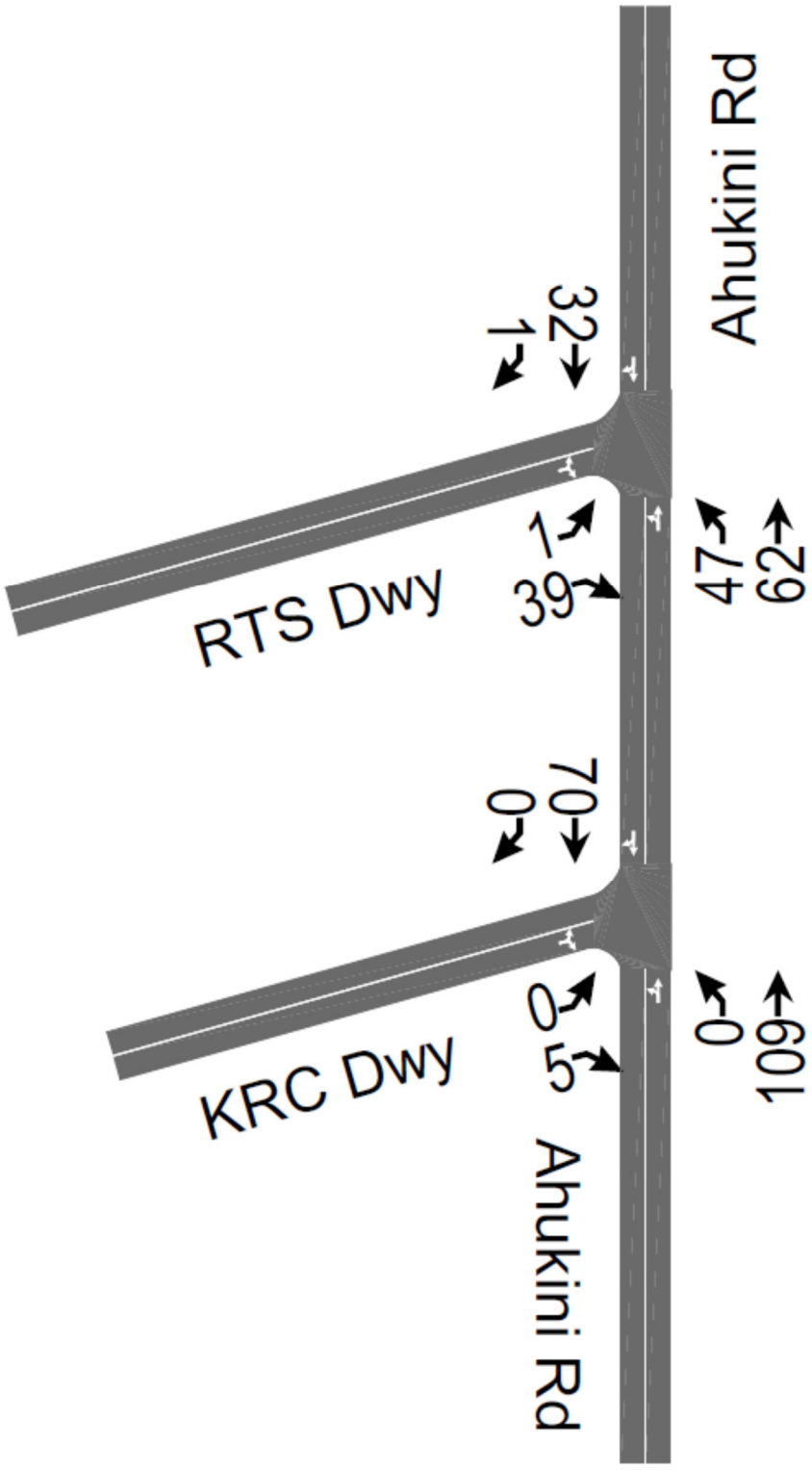


Figure 3. Existing AM Peak Hour Traffic

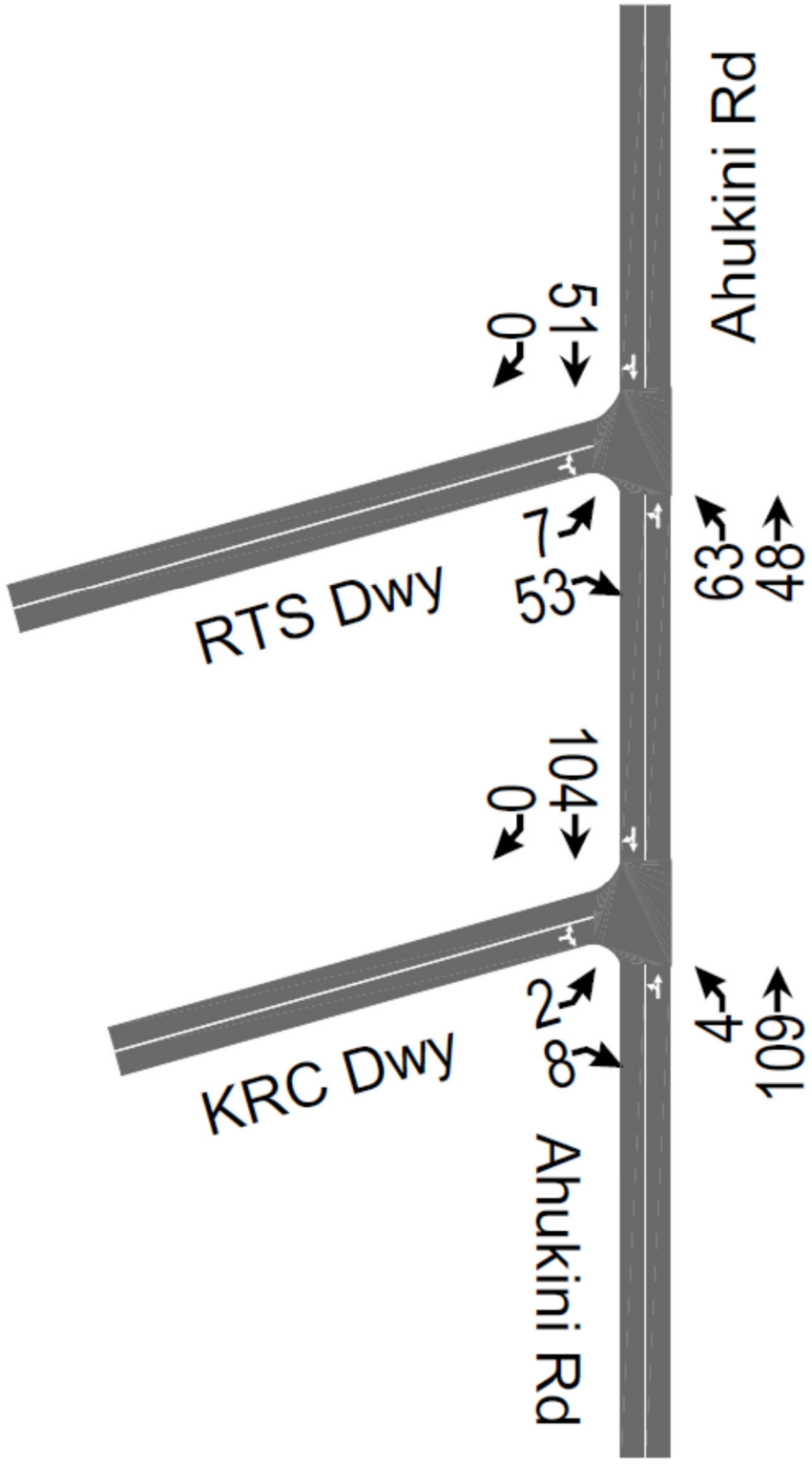


Figure 4. Existing PM Peak Hour Traffic

B. Peak Hour Traffic Without the Proposed Project

The RTS and KRC Driveways are expected to continue to operate at LOS "A", during both the AM and PM peak hours of traffic without the proposed project. Figures 5 and 6 depict the AM and PM peak hour traffic volumes without the proposed project, respectively.

IV. Traffic Assessment

A. Trip Generation Characteristics

The proposed Kauai MRF, which is expected to serve the entire island of Kauai, will have a design capacity to process 70 tons of recyclable materials per day. The design capacity is based upon an alternative site for a materials recovery facility, which was evaluated in the Kauai Resource Recovery Park Feasibility Study (KRRPFS), prepared for the County of Kauai Department of Public Works, by AECOM Technical Services, Inc., dated April, 2013. The KRRPFS estimated its MRF would process up 70 tons per day for a 7-hour work shift. The KRRPFS estimated that a total of 36 trips would enter its MRF per day.

The recyclable materials will be delivered to the Kauai MRF by collection trucks, with carrying capacities ranging from 2 to 8 tons per load. Using the conservative (lower) capacity of 2 tons per load, 35 truck-loads can be expected to deliver recyclable materials per day. It is estimated that 46.5 percent and 53.5 percent of the truck-loads are expected to be collected from residential and commercial sources, respectively (KRRPFS, 2013). The 16 residential collection truck trips are expected to arrive in the morning, averaging about 5 vph over a three-hour period (9:00 AM to 12 noon). The 19 commercial collection trucks are expected to arrive throughout the day, averaging about 3 vph over a six-hour period (9:00 AM to 3:00 PM).

The processed materials will be hauled from the Kauai MRF by 20-ton payload articulated trucks. At an estimated average payload of 14 tons (70 percent payload), the Kauai MRF is expected to generate 5 articulated trucks per day, averaging about 1 vph over a six-hour period (9:00 AM to 3:00 PM). Finally, up to 5 visitor trips can be expected during the AM and PM peak hours of traffic. The total of number of vehicle trips that are expected to arrive at the Kauai MRF during the non-commuter peak hours of traffic is about 50 vehicle trips.

The peak hour truck trips were estimated by doubling the average hourly truck trips in the morning and afternoon. Employee trips were excluded from the analysis, because they are expected to arrive before the AM peak hour of traffic and depart after the PM peak hour of traffic. The trip generation characteristics for the proposed project are summarized in Table 5.

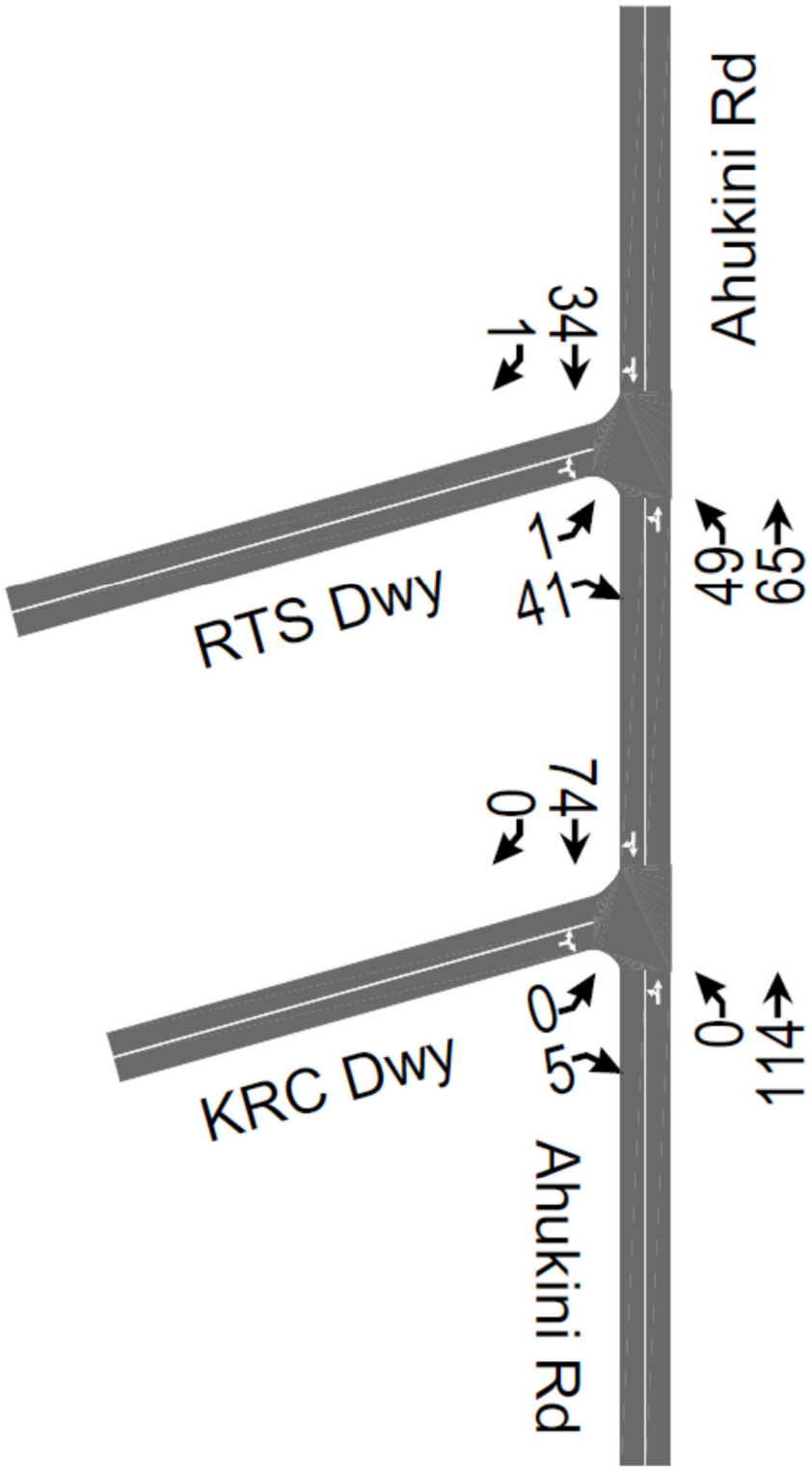


Figure 5. AM Peak Hour Traffic Without Project

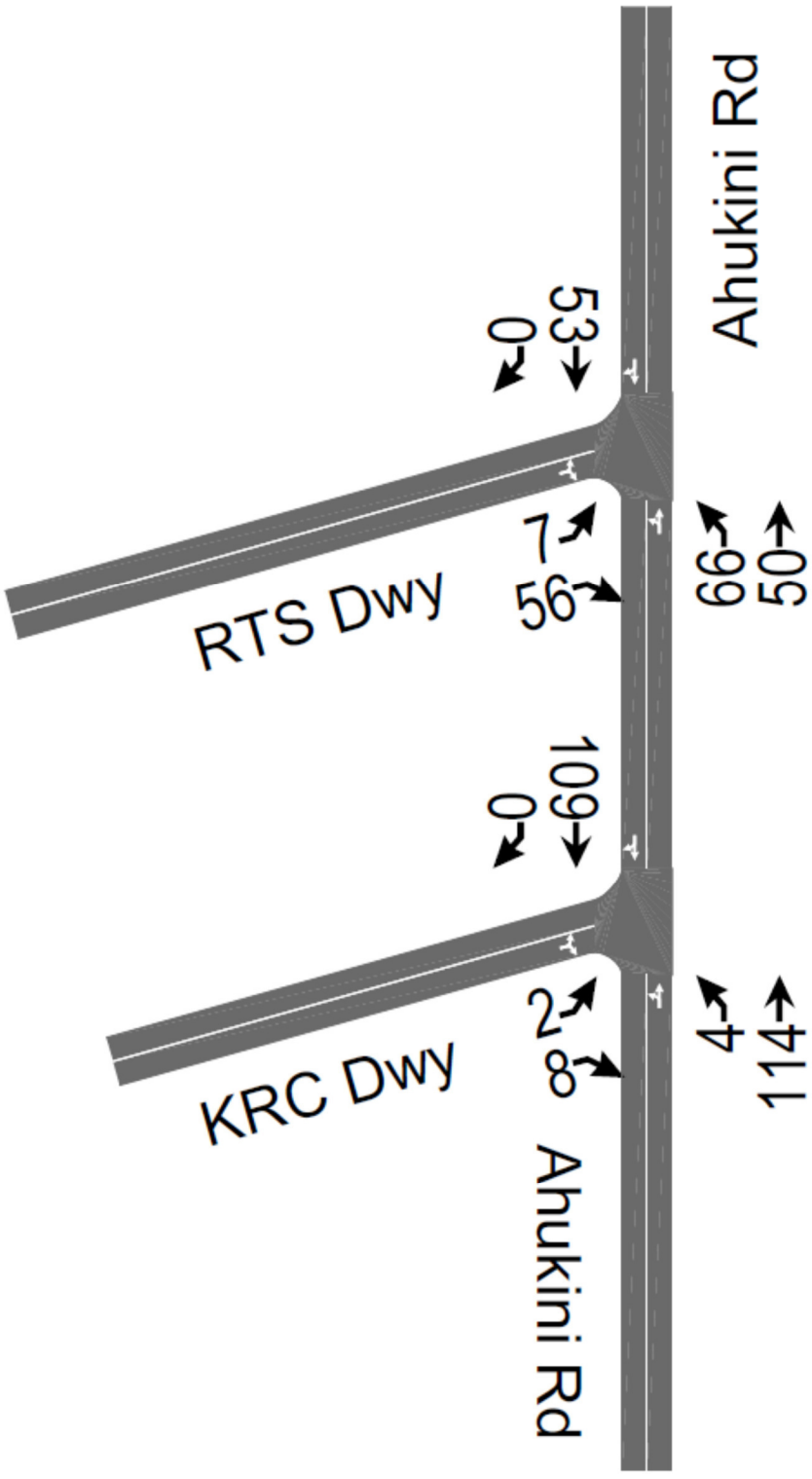


Figure 6. PM Peak Hour Traffic Without Project

Table 5. MRF Trip Generation Characteristics							
Vehicle-Type		AM Peak Hour (vph)			PM Peak Hour (vph)		
		Enter	Exit	Total	Enter	Exit	Total
Collection Trucks	Residential	11	11	22	0	0	0
	Commercial	6	6	12	6	6	12
Articulated Trucks		2	2	4	2	2	4
Visitors		5	5	10	5	5	10
Totals		**24**	**24**	**48**	**13**	**13**	**26**

B. Peak Hour Traffic With Proposed Project

During the AM and PM peak hours of traffic with the proposed project, the RTS and KRC Driveways are expected to continue to operate at LOS "A". The AM and PM peak hour traffic with the proposed project are depicted on Figures 7 and 8, respectively.

V. Conclusions

The estimated trip generation from the Kauai Materials Recovery Facility is considered to be conservative (higher), when compared to the trip generation for the Kauai Resource Recovery Park MRF, which was evaluated in the AECOM study. The existing peak hours of traffic on Ahukini Road at the project site occurred during the mid-morning – after the AM commuter peak hour of traffic, and during the mid-afternoon – before the PM commuter peak hour of traffic. Therefore, the peak hour traffic, generated by the proposed Kauai MRF, is not expected to impact the AM and PM commuter peak hour traffic.

The trip generation from the proposed Kauai Materials Recovery Facility is estimated to increase the existing site traffic by 52 percent and 19 percent, during the AM and PM peak hours of traffic, respectively. However, the existing RTS and KRC Driveways are expected to continue to operate at LOS "A", during the AM and PM peak hours of traffic. The Kauai MRF trip generation is expected to increase the AM and PM peak hour traffic on Ahukini Road, south of the project site, by 25 percent and 11 percent, respectively. The proposed Kauai MRF trip generation is expected to increase the projected Year 2019 mid-morning and mid-afternoon peak hour traffic on Ahukini Road at the entrance to the Lihue Airport by 7.1 percent and 3.8 percent, respectively. At the intersection of Kapule Highway and Ahukini Road, the proposed Kauai MRF trip generation is expected to increase the projected Year 2019 mid-morning and mid-afternoon peak hour traffic by 2.3 percent and 1.0 percent, respectively.

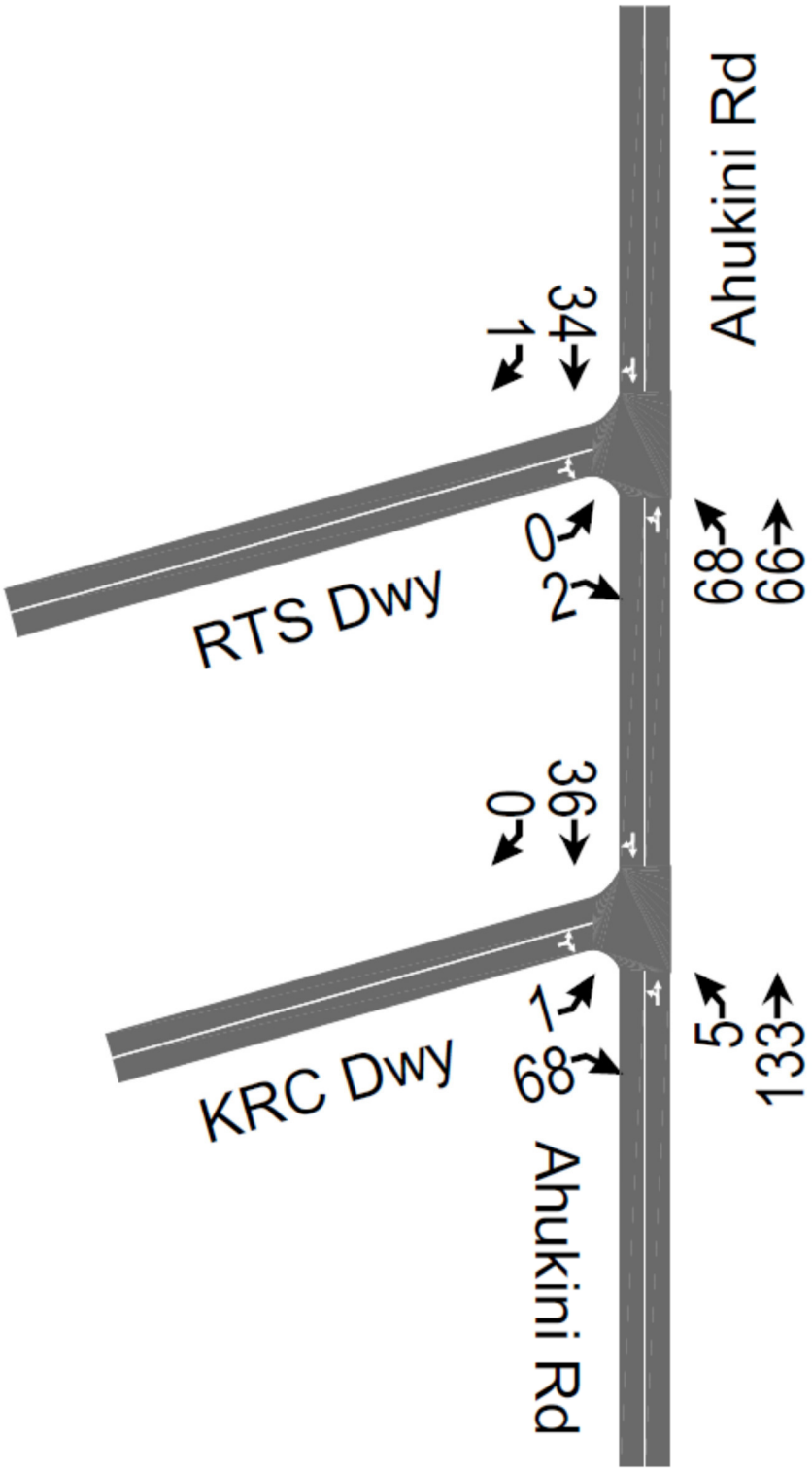


Figure 7. AM Peak Hour Traffic With Project

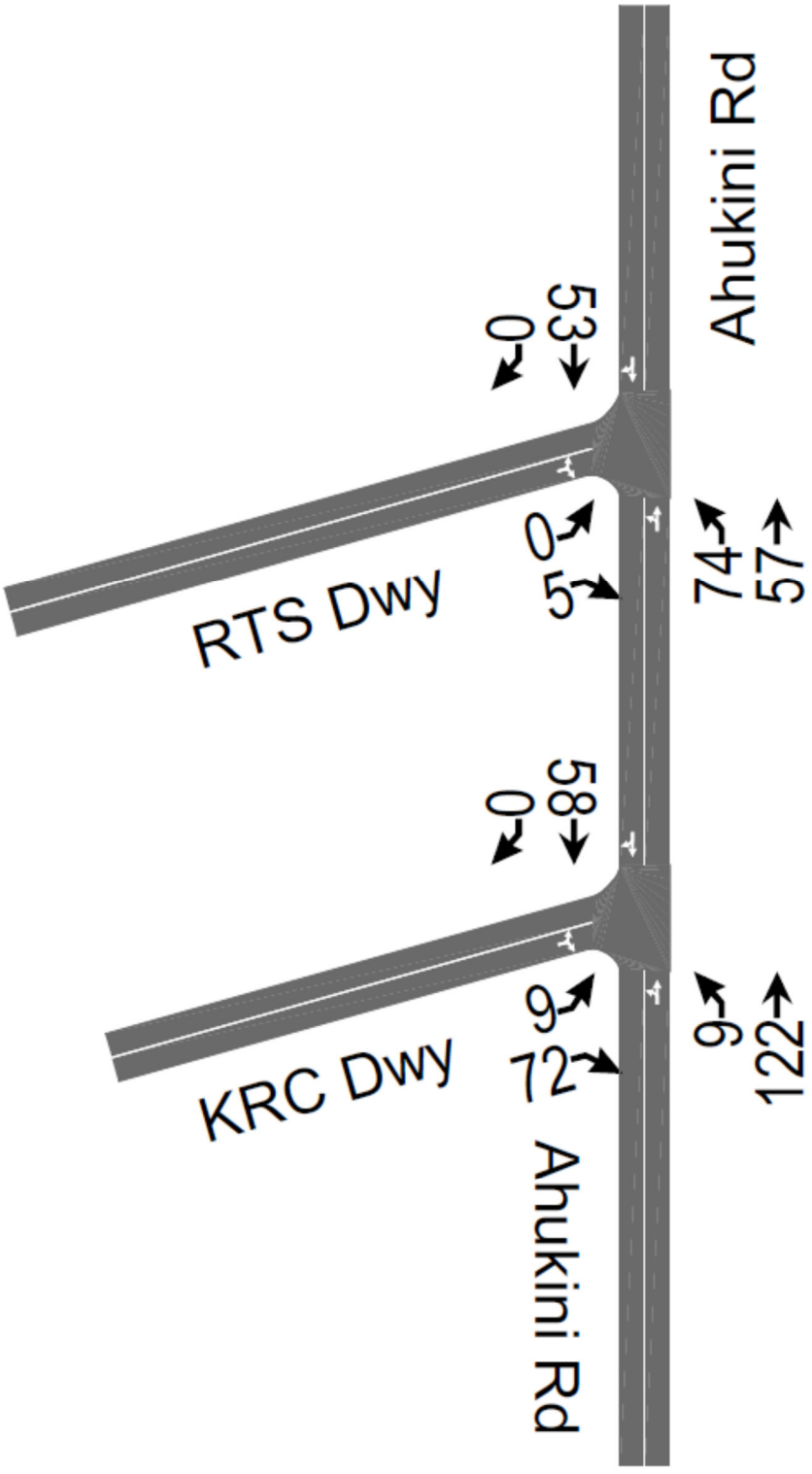


Figure 8. PM Peak Hour Traffic With Project

Exclusive left-turn lanes on Ahukini Road are not expected to be warranted at the KRC Driveway and the RTS Driveway, because the opposing (southbound) volumes on Ahukini Road are less than the minimum 100 vph, cited in the AASHTO guidelines. Furthermore, the posted speed of 25 mph is below the minimum operating speed of 40 mph, also cited in the AASHTO guidelines. Therefore, exclusive left-turn lanes are not recommended on Ahukini Road at the KRC Driveway and the RTS Driveway.

Traffic improvements at the project's access driveways are not recommended at this time. The proposed Kauai Materials Recovery Facility is not expected to significantly impact traffic operations at its driveways on Ahukini Road, during the peak hours of traffic.

TRAFFIC ASSESSMENT REPORT

FOR THE PROPOSED

KAUAI MATERIALS RECOVERY FACILITY

LIHUE, KAUAI, HAWAII

TAX MAP KEY: 03-07-02:14

APPENDIX A

TRAFFIC COUNT DATA

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Data

Start Time	RTS Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
7:00 AM	0	0	0	5	4	9	0	1	1	2	11
7:15 AM	1	6	7	4	5	9	0	6	0	6	22
7:30 AM	0	7	7	9	2	11	0	5	0	5	23
7:45 AM	0	2	2	3	11	14	0	10	0	10	26
Hourly Total	1	15	16	21	22	43	0	22	1	23	82
8:00 AM	0	5	5	5	3	8	0	2	0	2	15
8:15 AM	0	5	5	9	8	17	0	4	0	4	26
8:30 AM	0	10	10	9	10	19	0	4	1	5	34
8:45 AM	0	9	9	10	5	15	0	4	0	4	28
Hourly Total	0	29	29	33	26	59	0	14	1	15	103
9:00 AM	1	4	5	6	7	13	0	6	0	6	24
9:15 AM	0	7	7	9	20	29	0	8	0	8	44
9:30 AM	0	7	7	10	4	14	0	10	0	10	31
9:45 AM	0	5	5	5	20	25	0	4	1	5	35
Hourly Total	1	23	24	30	51	81	0	28	1	29	134
10:00 AM	0	8	8	10	8	18	0	7	0	7	33
10:15 AM	0	11	11	16	18	34	0	5	0	5	50
10:30 AM	1	14	15	13	16	29	0	8	0	8	52
10:45 AM	0	6	6	8	15	23	0	12	1	13	42
Hourly Total	1	39	40	47	57	104	0	32	1	33	177
11:00 AM	0	8	8	10	13	23	0	7	0	7	38
11:15 AM	2	9	11	8	16	24	1	6	0	7	42
11:30 AM	1	8	9	10	12	22	0	13	0	13	44
11:45 AM	1	5	6	10	14	24	0	21	0	21	51
Hourly Total	4	30	34	38	55	93	1	47	0	48	175
12:00 PM	1	12	13	11	10	21	0	9	0	9	43
12:15 PM	0	12	12	13	12	25	0	17	1	18	55
12:30 PM	0	11	11	14	13	27	0	10	0	10	48
12:45 PM	0	11	11	11	12	23	0	15	0	15	49
Hourly Total	1	46	47	49	47	96	0	51	1	52	195
1:00 PM	3	6	9	11	11	22	0	9	0	9	40
1:15 PM	0	5	5	5	8	13	0	12	0	12	30
1:30 PM	0	14	14	19	4	23	0	8	1	9	46
1:45 PM	1	17	18	16	9	25	0	6	0	6	49
Hourly Total	4	42	46	51	32	83	0	35	1	36	165
2:00 PM	0	10	10	13	9	22	0	7	0	7	39
2:15 PM	2	11	13	16	18	34	0	12	0	12	59
2:30 PM	3	12	15	17	5	22	0	11	0	11	48
2:45 PM	1	15	16	14	17	31	0	11	0	11	58
Hourly Total	6	48	54	60	49	109	0	41	0	41	204
3:00 PM	1	15	16	16	8	24	0	17	0	17	57
3:15 PM	1	8	9	2	9	11	0	4	0	4	24
3:30 PM	0	2	2	2	19	21	0	13	0	13	36
3:45 PM	0	3	3	5	10	15	0	5	0	5	23
Hourly Total	2	28	30	25	46	71	0	39	0	39	140
4:00 PM	0	3	3	2	7	9	0	5	0	5	17
4:15 PM	0	2	2	2	6	8	0	6	0	6	16
Grand Total	20	305	325	358	398	756	1	320	6	327	1408
Approach %	6.2	93.8	-	47.4	52.6	-	0.3	97.9	1.8	-	-
Total %	1.4	21.7	23.1	25.4	28.3	53.7	0.1	22.7	0.4	23.2	-
Motorcycles	0	1	1	0	0	0	0	0	0	0	1
% Motorcycles	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Cars	5	58	63	86	316	402	0	233	1	234	699
% Cars	25.0	19.0	19.4	24.0	79.4	53.2	0.0	72.8	16.7	71.6	49.6
Light Goods Vehicles	13	228	241	255	71	326	1	75	3	79	646
% Light Goods Vehicles	65.0	74.8	74.2	71.2	17.8	43.1	100.0	23.4	50.0	24.2	45.9
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Single-Unit Trucks	2	14	16	12	11	23	0	12	2	14	53
% Single-Unit Trucks	10.0	4.6	4.9	3.4	2.8	3.0	0.0	3.8	33.3	4.3	3.8
Articulated Trucks	0	4	4	5	0	5	0	0	0	0	9
% Articulated Trucks	0.0	1.3	1.2	1.4	0.0	0.7	0.0	0.0	0.0	0.0	0.6

The Traffic Management Consultant
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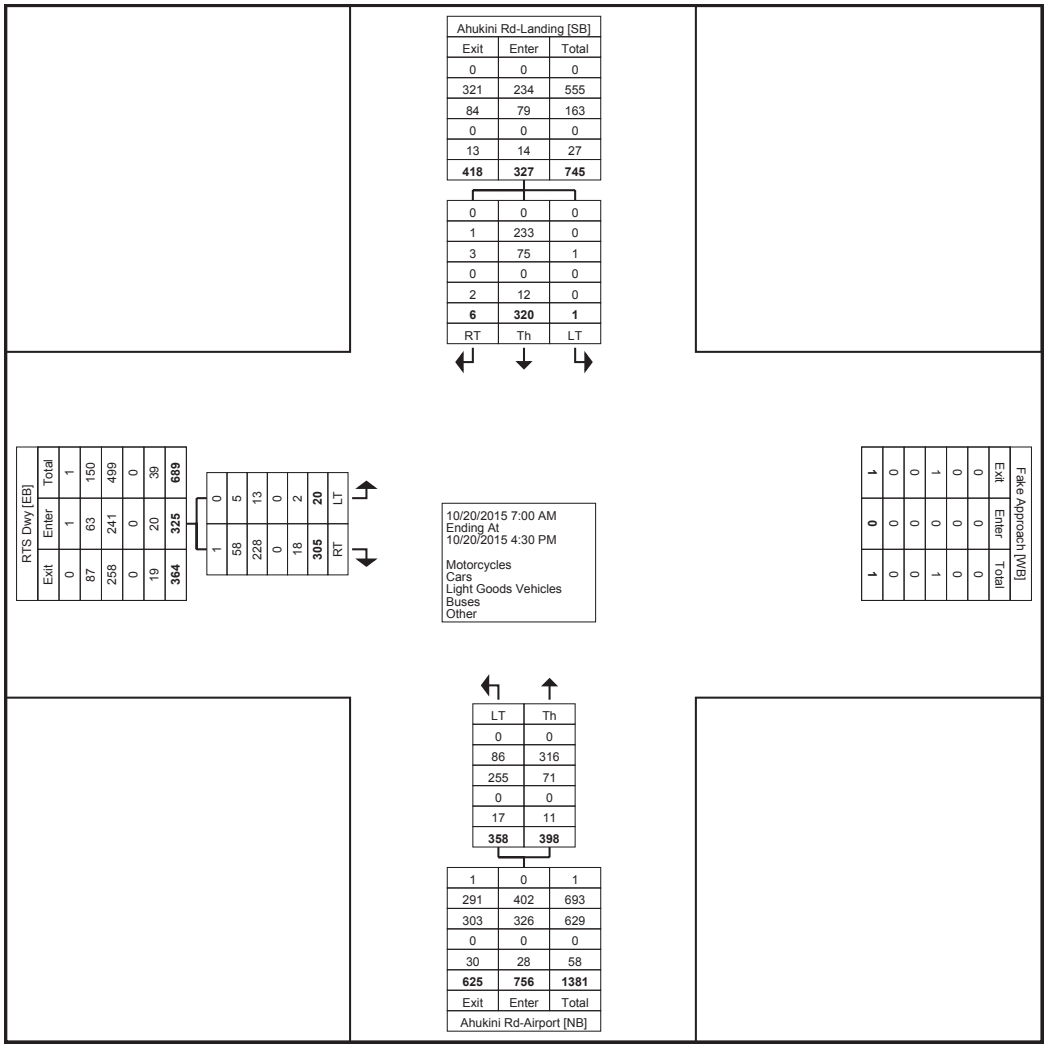
Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015
Page No: 2



Turning Movement Data Plot

The Traffic Management Consultant
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Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Peak Hour Data (10:15 AM)

Start Time	RTS Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
10:15 AM	0	11	11	16	18	34	0	5	0	5	50
10:30 AM	1	14	15	13	16	29	0	8	0	8	52
10:45 AM	0	6	6	8	15	23	0	12	1	13	42
11:00 AM	0	8	8	10	13	23	0	7	0	7	38
Total	1	39	40	47	62	109	0	32	1	33	182
Approach %	2.5	97.5	-	43.1	56.9	-	0.0	97.0	3.0	-	-
Total %	0.5	21.4	22.0	25.8	34.1	59.9	0.0	17.6	0.5	18.1	-
PHF	0.250	0.696	0.667	0.734	0.861	0.801	0.000	0.667	0.250	0.635	0.875
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
Cars	0	10	10	13	52	65	0	28	0	28	103
% Cars	0.0	25.6	25.0	27.7	83.9	59.6	-	87.5	0.0	84.8	56.6
Light Goods Vehicles	1	29	30	31	10	41	0	4	1	5	76
% Light Goods Vehicles	100.0	74.4	75.0	66.0	16.1	37.6	-	12.5	100.0	15.2	41.8
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
Single-Unit Trucks	0	0	0	1	0	1	0	0	0	0	1
% Single-Unit Trucks	0.0	0.0	0.0	2.1	0.0	0.9	-	0.0	0.0	0.0	0.5
Articulated Trucks	0	0	0	2	0	2	0	0	0	0	2
% Articulated Trucks	0.0	0.0	0.0	4.3	0.0	1.8	-	0.0	0.0	0.0	1.1

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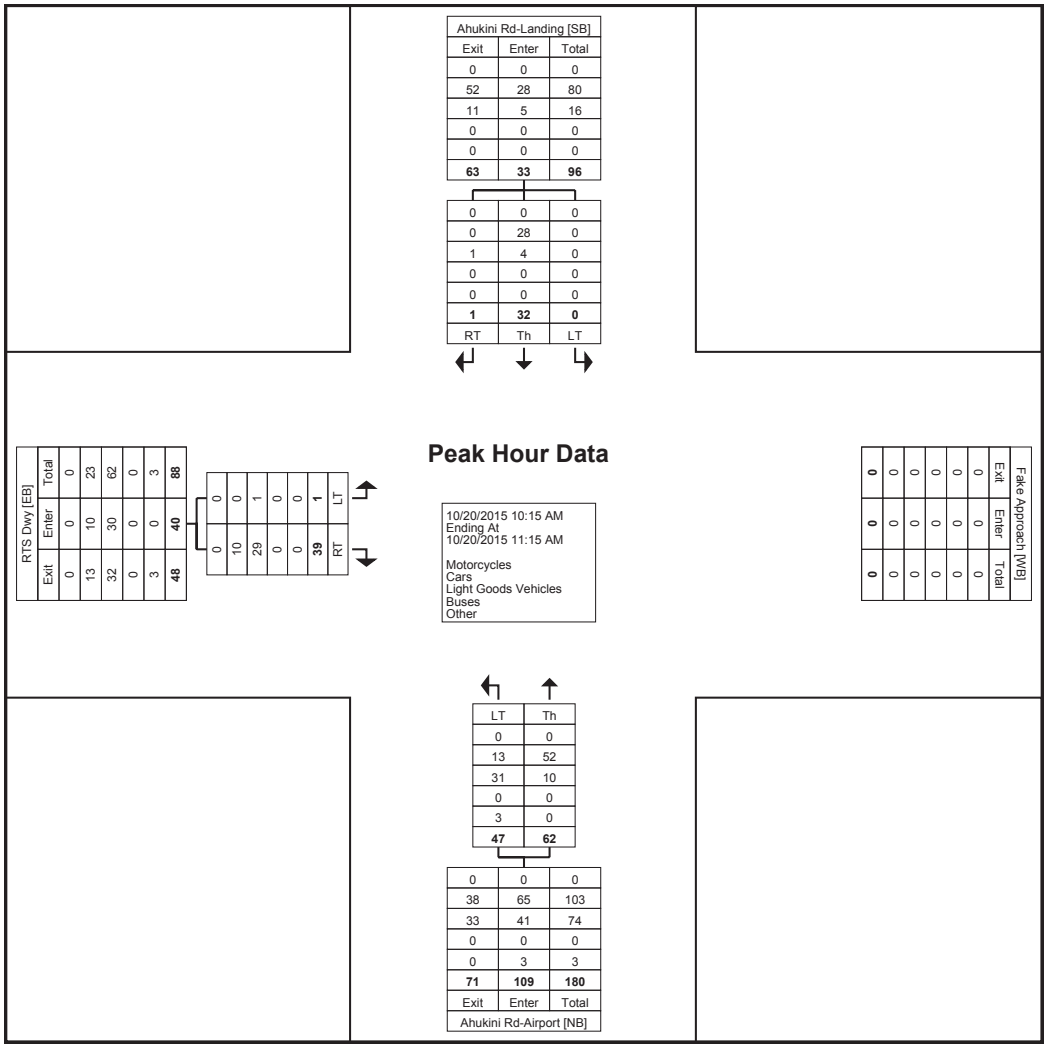
Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015



Turning Movement Peak Hour Data Plot (10:15 AM)

The Traffic Management Consultant
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Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Peak Hour Data (7:15 AM)

Start Time	RTS Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
7:15 AM	1	6	7	4	5	9	0	6	0	6	22
7:30 AM	0	7	7	9	2	11	0	5	0	5	23
7:45 AM	0	2	2	3	11	14	0	10	0	10	26
8:00 AM	0	5	5	5	3	8	0	2	0	2	15
Total	1	20	21	21	21	42	0	23	0	23	86
Approach %	4.8	95.2	-	50.0	50.0	-	0.0	100.0	0.0	-	-
Total %	1.2	23.3	24.4	24.4	24.4	48.8	0.0	26.7	0.0	26.7	-
PHF	0.250	0.714	0.750	0.583	0.477	0.750	0.000	0.575	0.000	0.575	0.827
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Cars	1	1	2	5	16	21	0	9	0	9	32
% Cars	100.0	5.0	9.5	23.8	76.2	50.0	-	39.1	-	39.1	37.2
Light Goods Vehicles	0	16	16	15	3	18	0	10	0	10	44
% Light Goods Vehicles	0.0	80.0	76.2	71.4	14.3	42.9	-	43.5	-	43.5	51.2
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Single-Unit Trucks	0	2	2	1	2	3	0	4	0	4	9
% Single-Unit Trucks	0.0	10.0	9.5	4.8	9.5	7.1	-	17.4	-	17.4	10.5
Articulated Trucks	0	1	1	0	0	0	0	0	0	0	1
% Articulated Trucks	0.0	5.0	4.8	0.0	0.0	0.0	-	0.0	-	0.0	1.2

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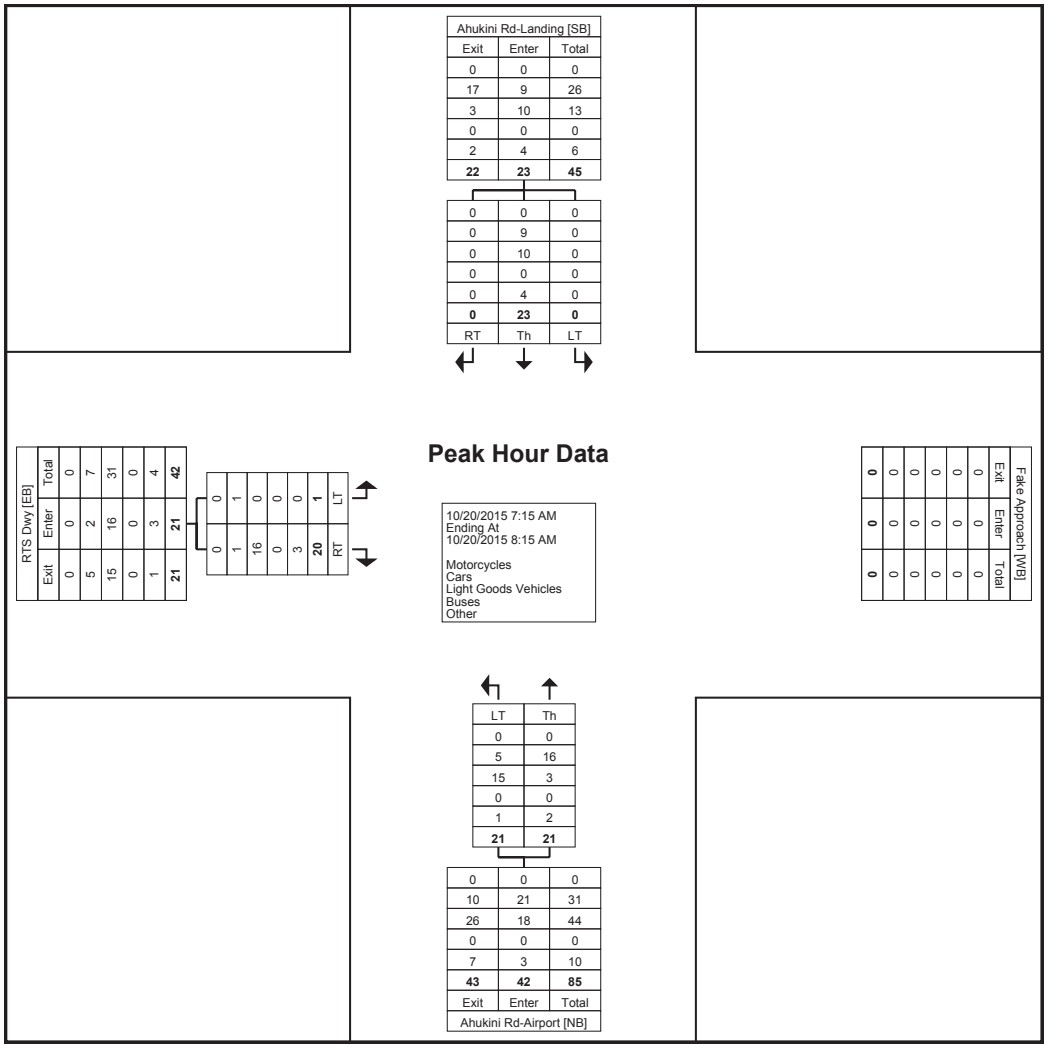
Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015



Turning Movement Peak Hour Data Plot (7:15 AM)

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Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Peak Hour Data (2:15 PM)

Start Time	RTS Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
2:15 PM	2	11	13	16	18	34	0	12	0	12	59
2:30 PM	3	12	15	17	5	22	0	11	0	11	48
2:45 PM	1	15	16	14	17	31	0	11	0	11	58
3:00 PM	1	15	16	16	8	24	0	17	0	17	57
Total	7	53	60	63	48	111	0	51	0	51	222
Approach %	11.7	88.3	-	56.8	43.2	-	0.0	100.0	0.0	-	-
Total %	3.2	23.9	27.0	28.4	21.6	50.0	0.0	23.0	0.0	23.0	-
PHF	0.583	0.883	0.938	0.926	0.667	0.816	0.000	0.750	0.000	0.750	0.941
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Cars	3	6	9	13	42	55	0	38	0	38	102
% Cars	42.9	11.3	15.0	20.6	87.5	49.5	-	74.5	-	74.5	45.9
Light Goods Vehicles	4	44	48	48	5	53	0	12	0	12	113
% Light Goods Vehicles	57.1	83.0	80.0	76.2	10.4	47.7	-	23.5	-	23.5	50.9
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Single-Unit Trucks	0	3	3	1	1	2	0	1	0	1	6
% Single-Unit Trucks	0.0	5.7	5.0	1.6	2.1	1.8	-	2.0	-	2.0	2.7
Articulated Trucks	0	0	0	1	0	1	0	0	0	0	1
% Articulated Trucks	0.0	0.0	0.0	1.6	0.0	0.9	-	0.0	-	0.0	0.5

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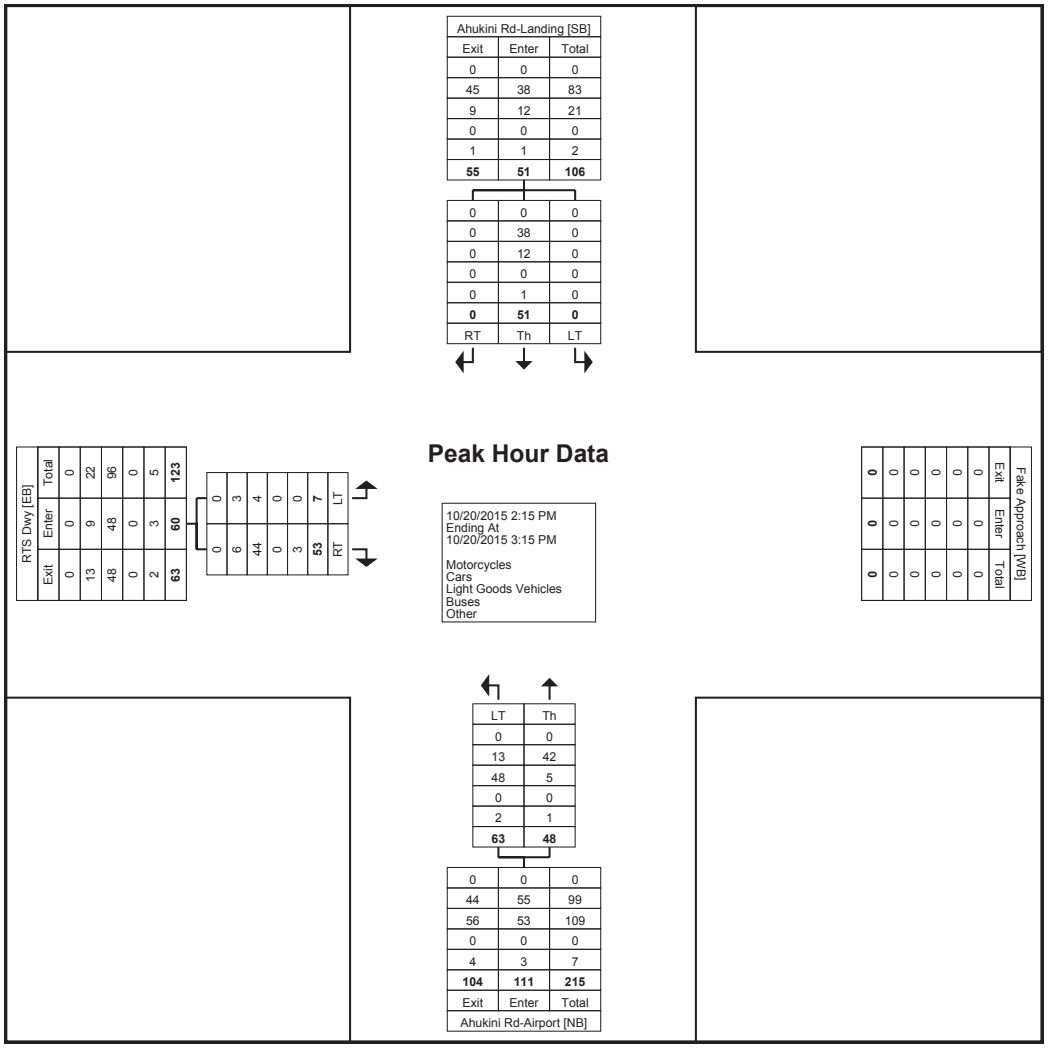
Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015



Turning Movement Peak Hour Data Plot (2:15 PM)

The Traffic Management Consultant
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Honolulu, Hawaii, United States 96813
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Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Peak Hour Data (3:30 PM)

Start Time	RTS Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
3:30 PM	0	2	2	2	19	21	0	13	0	13	36
3:45 PM	0	3	3	5	10	15	0	5	0	5	23
4:00 PM	0	3	3	2	7	9	0	5	0	5	17
4:15 PM	0	2	2	2	6	8	0	6	0	6	16
Total	0	10	10	11	42	53	0	29	0	29	92
Approach %	0.0	100.0	-	20.8	79.2	-	0.0	100.0	0.0	-	-
Total %	0.0	10.9	10.9	12.0	45.7	57.6	0.0	31.5	0.0	31.5	-
PHF	0.000	0.833	0.833	0.550	0.553	0.631	0.000	0.558	0.000	0.558	0.639
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	-	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Cars	0	6	6	4	30	34	0	27	0	27	67
% Cars	-	60.0	60.0	36.4	71.4	64.2	-	93.1	-	93.1	72.8
Light Goods Vehicles	0	2	2	7	12	19	0	2	0	2	23
% Light Goods Vehicles	-	20.0	20.0	63.6	28.6	35.8	-	6.9	-	6.9	25.0
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	-	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Single-Unit Trucks	0	2	2	0	0	0	0	0	0	0	2
% Single-Unit Trucks	-	20.0	20.0	0.0	0.0	0.0	-	0.0	-	0.0	2.2
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	-	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0

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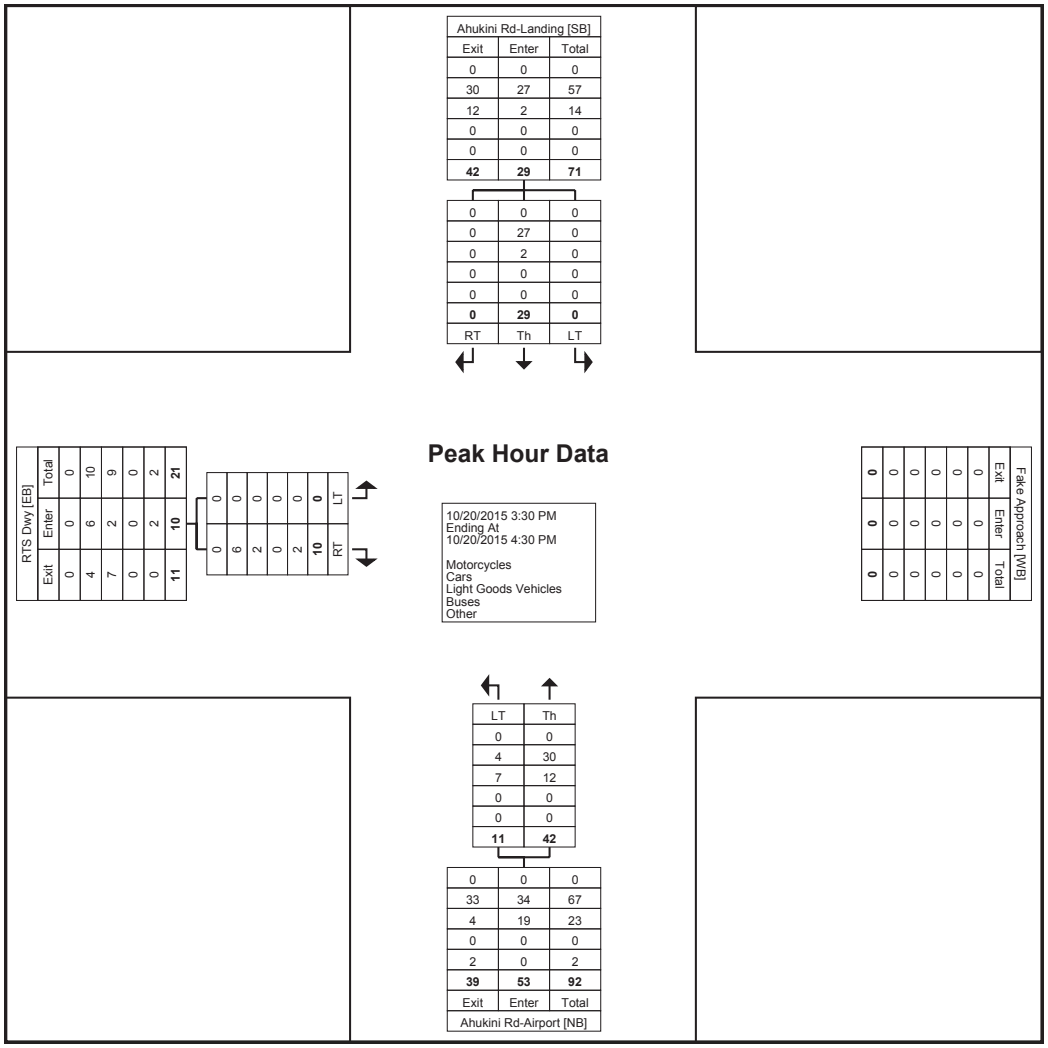
Count Name: RTS Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015
Page No: 10



Turning Movement Peak Hour Data Plot (3:30 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Data

Start Time	KRC Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
7:00 AM	0	2	2	3	9	12	0	1	0	1	15
7:15 AM	1	0	1	2	8	10	0	12	0	12	23
7:30 AM	0	3	3	3	11	14	0	12	0	12	29
7:45 AM	0	2	2	1	14	15	0	13	0	13	30
Hourly Total	1	7	8	9	42	51	0	38	0	38	97
8:00 AM	1	2	3	1	7	8	0	7	0	7	18
8:15 AM	0	0	0	0	17	17	0	9	0	9	26
8:30 AM	0	0	0	0	19	19	0	15	0	15	34
8:45 AM	0	3	3	1	16	17	0	14	0	14	34
Hourly Total	1	5	6	2	59	61	0	45	0	45	112
9:00 AM	1	0	1	0	12	12	0	10	0	10	23
9:15 AM	0	1	1	0	29	29	0	15	0	15	45
9:30 AM	0	3	3	0	16	16	0	17	0	17	36
9:45 AM	0	1	1	0	23	23	0	9	0	9	33
Hourly Total	1	5	6	0	80	80	0	51	0	51	137
10:00 AM	0	0	0	1	18	19	0	14	0	14	33
10:15 AM	0	2	2	0	34	34	0	16	0	16	52
10:30 AM	0	1	1	0	29	29	0	23	0	23	53
10:45 AM	0	2	2	0	22	22	1	16	0	17	41
Hourly Total	0	5	5	1	103	104	1	69	0	70	179
11:00 AM	0	0	0	0	23	23	0	15	0	15	38
11:15 AM	1	1	2	2	23	25	0	13	0	13	40
11:30 AM	0	1	1	1	22	23	0	19	1	20	44
11:45 AM	0	4	4	0	24	24	0	24	0	24	52
Hourly Total	1	6	7	3	92	95	0	71	1	72	174
12:00 PM	1	0	1	1	19	20	0	21	0	21	42
12:15 PM	0	2	2	0	26	26	0	29	0	29	57
12:30 PM	1	2	3	1	25	26	0	21	0	21	50
12:45 PM	0	1	1	1	23	24	0	27	0	27	52
Hourly Total	2	5	7	3	93	96	0	98	0	98	201
1:00 PM	0	4	4	1	22	23	0	15	0	15	42
1:15 PM	0	2	2	2	14	16	0	17	1	18	36
1:30 PM	0	3	3	1	23	24	0	20	0	20	47
1:45 PM	0	2	2	0	25	25	0	24	0	24	51
Hourly Total	0	11	11	4	84	88	0	76	1	77	176
2:00 PM	0	0	0	0	23	23	0	20	0	20	43
2:15 PM	0	1	1	2	34	36	0	23	0	23	60
2:30 PM	1	5	6	1	21	22	0	23	0	23	51
2:45 PM	1	1	2	1	31	32	0	26	0	26	60
Hourly Total	2	7	9	4	109	113	0	92	0	92	214
3:00 PM	0	1	1	0	23	23	0	31	0	31	55
3:15 PM	0	2	2	0	11	11	0	13	0	13	26
3:30 PM	0	2	2	1	22	23	0	16	0	16	41
3:45 PM	0	1	1	0	16	16	0	8	0	8	25
Hourly Total	0	6	6	1	72	73	0	68	0	68	147
4:00 PM	1	1	2	1	7	8	0	8	0	8	18
4:15 PM	0	4	4	0	9	9	0	9	1	10	23
Grand Total	9	62	71	28	750	778	1	625	3	629	1478
Approach %	12.7	87.3	-	3.6	96.4	-	0.2	99.4	0.5	-	-
Total %	0.6	4.2	4.8	1.9	50.7	52.6	0.1	42.3	0.2	42.6	-
Motorcycles	0	0	0	0	0	0	0	1	0	1	1
% Motorcycles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.1
Cars	4	30	34	18	404	422	0	293	1	294	750
% Cars	44.4	48.4	47.9	64.3	53.9	54.2	0.0	46.9	33.3	46.7	50.7
Light Goods Vehicles	4	31	35	7	319	326	1	304	1	306	667
% Light Goods Vehicles	44.4	50.0	49.3	25.0	42.5	41.9	100.0	48.6	33.3	48.6	45.1
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Single-Unit Trucks	1	1	2	3	22	25	0	24	1	25	52
% Single-Unit Trucks	11.1	1.6	2.8	10.7	2.9	3.2	0.0	3.8	33.3	4.0	3.5
Articulated Trucks	0	0	0	0	5	5	0	3	0	3	8
% Articulated Trucks	0.0	0.0	0.0	0.0	0.7	0.6	0.0	0.5	0.0	0.5	0.5

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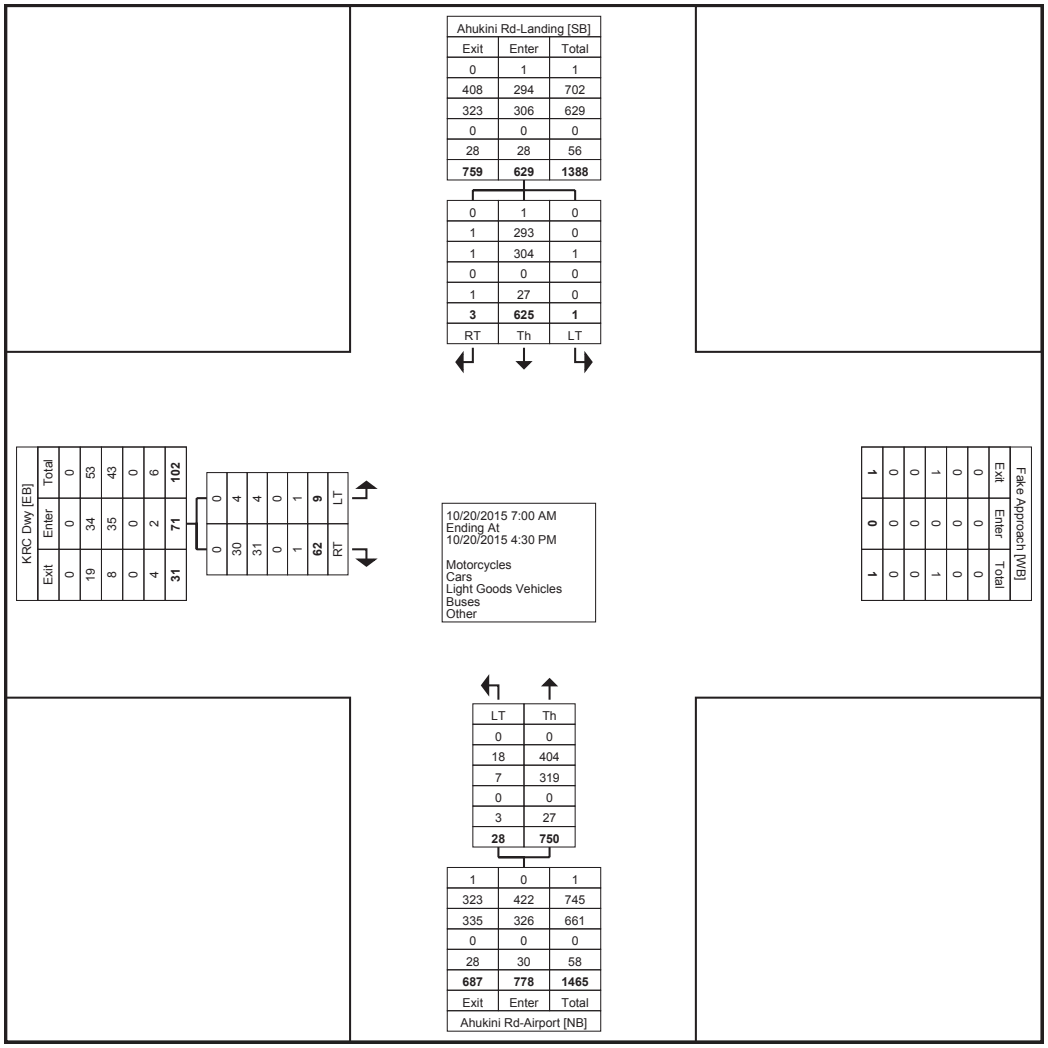
Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015
Page No: 2



Turning Movement Data Plot

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Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Peak Hour Data (10:15 AM)

Start Time	KRC Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
10:15 AM	0	2	2	0	34	34	0	16	0	16	52
10:30 AM	0	1	1	0	29	29	0	23	0	23	53
10:45 AM	0	2	2	0	22	22	1	16	0	17	41
11:00 AM	0	0	0	0	23	23	0	15	0	15	38
Total	0	5	5	0	108	108	1	70	0	71	184
Approach %	0.0	100.0	-	0.0	100.0	-	1.4	98.6	0.0	-	-
Total %	0.0	2.7	2.7	0.0	58.7	58.7	0.5	38.0	0.0	38.6	-
PHF	0.000	0.625	0.625	0.000	0.794	0.794	0.250	0.761	0.000	0.772	0.868
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	-	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Cars	0	1	1	0	64	64	0	38	0	38	103
% Cars	-	20.0	20.0	-	59.3	59.3	0.0	54.3	-	53.5	56.0
Light Goods Vehicles	0	4	4	0	41	41	1	32	0	33	78
% Light Goods Vehicles	-	80.0	80.0	-	38.0	38.0	100.0	45.7	-	46.5	42.4
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	-	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Single-Unit Trucks	0	0	0	0	1	1	0	0	0	0	1
% Single-Unit Trucks	-	0.0	0.0	-	0.9	0.9	0.0	0.0	-	0.0	0.5
Articulated Trucks	0	0	0	0	2	2	0	0	0	0	2
% Articulated Trucks	-	0.0	0.0	-	1.9	1.9	0.0	0.0	-	0.0	1.1

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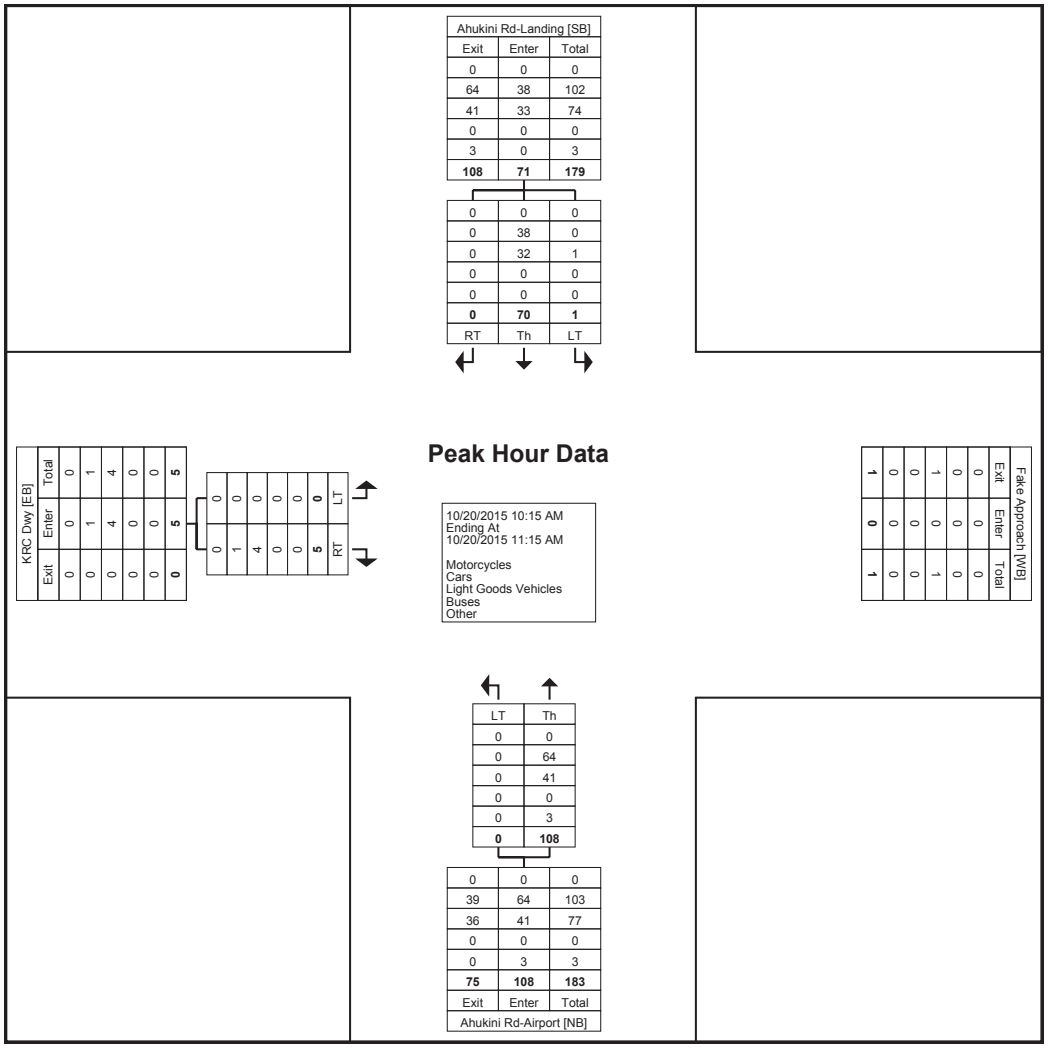
Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015
Page No: 4



Turning Movement Peak Hour Data Plot (10:15 AM)

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Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Peak Hour Data (7:15 AM)

Start Time	KRC Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
7:15 AM	1	0	1	2	8	10	0	12	0	12	23
7:30 AM	0	3	3	3	11	14	0	12	0	12	29
7:45 AM	0	2	2	1	14	15	0	13	0	13	30
8:00 AM	1	2	3	1	7	8	0	7	0	7	18
Total	2	7	9	7	40	47	0	44	0	44	100
Approach %	22.2	77.8	-	14.9	85.1	-	0.0	100.0	0.0	-	-
Total %	2.0	7.0	9.0	7.0	40.0	47.0	0.0	44.0	0.0	44.0	-
PHF	0.500	0.583	0.750	0.583	0.714	0.783	0.000	0.846	0.000	0.846	0.833
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Cars	1	6	7	6	19	25	0	10	0	10	42
% Cars	50.0	85.7	77.8	85.7	47.5	53.2	-	22.7	-	22.7	42.0
Light Goods Vehicles	1	1	2	1	19	20	0	29	0	29	51
% Light Goods Vehicles	50.0	14.3	22.2	14.3	47.5	42.6	-	65.9	-	65.9	51.0
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Single-Unit Trucks	0	0	0	0	2	2	0	4	0	4	6
% Single-Unit Trucks	0.0	0.0	0.0	0.0	5.0	4.3	-	9.1	-	9.1	6.0
Articulated Trucks	0	0	0	0	0	0	0	1	0	1	1
% Articulated Trucks	0.0	0.0	0.0	0.0	0.0	0.0	-	2.3	-	2.3	1.0

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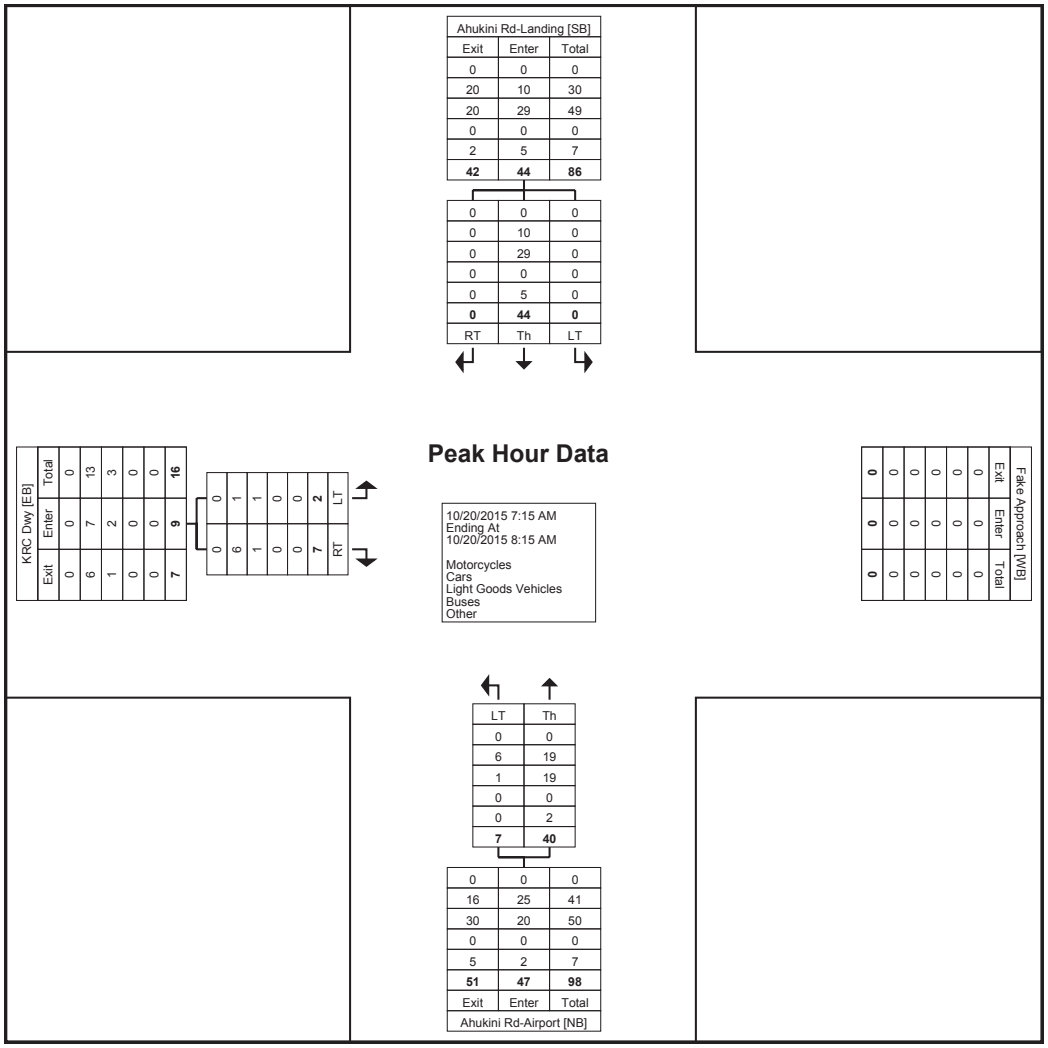
Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015
Page No: 6



Turning Movement Peak Hour Data Plot (7:15 AM)

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Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Peak Hour Data (2:15 PM)

Start Time	KRC Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
2:15 PM	0	1	1	2	34	36	0	23	0	23	60
2:30 PM	1	5	6	1	21	22	0	23	0	23	51
2:45 PM	1	1	2	1	31	32	0	26	0	26	60
3:00 PM	0	1	1	0	23	23	0	31	0	31	55
Total	2	8	10	4	109	113	0	103	0	103	226
Approach %	20.0	80.0	-	3.5	96.5	-	0.0	100.0	0.0	-	-
Total %	0.9	3.5	4.4	1.8	48.2	50.0	0.0	45.6	0.0	45.6	-
PHF	0.500	0.400	0.417	0.500	0.801	0.785	0.000	0.831	0.000	0.831	0.942
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Cars	1	6	7	1	52	53	0	38	0	38	98
% Cars	50.0	75.0	70.0	25.0	47.7	46.9	-	36.9	-	36.9	43.4
Light Goods Vehicles	1	2	3	2	54	56	0	61	0	61	120
% Light Goods Vehicles	50.0	25.0	30.0	50.0	49.5	49.6	-	59.2	-	59.2	53.1
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
Single-Unit Trucks	0	0	0	1	2	3	0	4	0	4	7
% Single-Unit Trucks	0.0	0.0	0.0	25.0	1.8	2.7	-	3.9	-	3.9	3.1
Articulated Trucks	0	0	0	0	1	1	0	0	0	0	1
% Articulated Trucks	0.0	0.0	0.0	0.0	0.9	0.9	-	0.0	-	0.0	0.4

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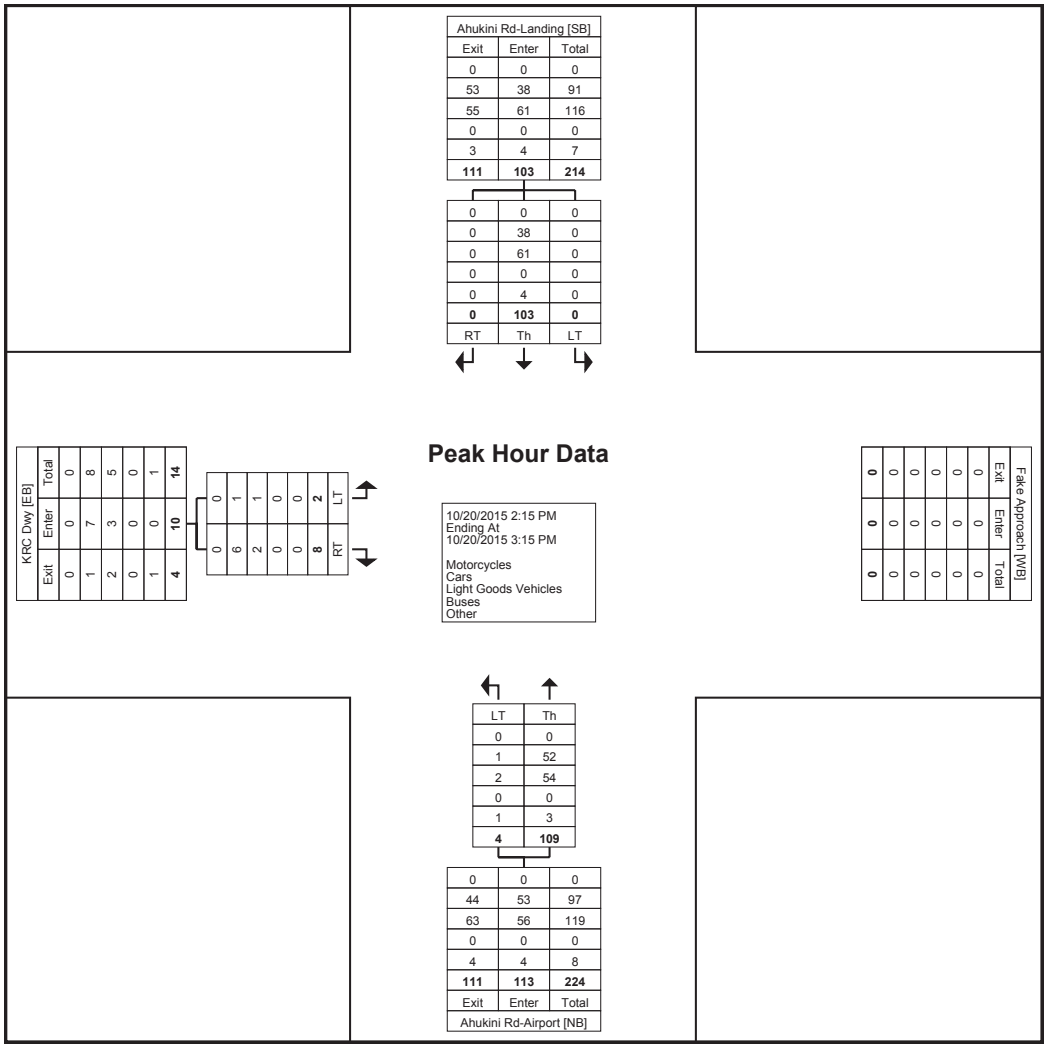
Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015



Turning Movement Peak Hour Data Plot (2:15 PM)

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Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015

Turning Movement Peak Hour Data (3:30 PM)

Start Time	KRC Dwy Eastbound			Ahukini Rd-Airport Northbound			Ahukini Rd-Landing Southbound				
	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
3:30 PM	0	2	2	1	22	23	0	16	0	16	41
3:45 PM	0	1	1	0	16	16	0	8	0	8	25
4:00 PM	1	1	2	1	7	8	0	8	0	8	18
4:15 PM	0	4	4	0	9	9	0	9	1	10	23
Total	1	8	9	2	54	56	0	41	1	42	107
Approach %	11.1	88.9	-	3.6	96.4	-	0.0	97.6	2.4	-	-
Total %	0.9	7.5	8.4	1.9	50.5	52.3	0.0	38.3	0.9	39.3	-
PHF	0.250	0.500	0.563	0.500	0.614	0.609	0.000	0.641	0.250	0.656	0.652
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
Cars	0	3	3	1	35	36	0	29	0	29	68
% Cars	0.0	37.5	33.3	50.0	64.8	64.3	-	70.7	0.0	69.0	63.6
Light Goods Vehicles	1	5	6	0	19	19	0	11	0	11	36
% Light Goods Vehicles	100.0	62.5	66.7	0.0	35.2	33.9	-	26.8	0.0	26.2	33.6
Buses	0	0	0	0	0	0	0	0	0	0	0
% Buses	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
Single-Unit Trucks	0	0	0	1	0	1	0	1	1	2	3
% Single-Unit Trucks	0.0	0.0	0.0	50.0	0.0	1.8	-	2.4	100.0	4.8	2.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0

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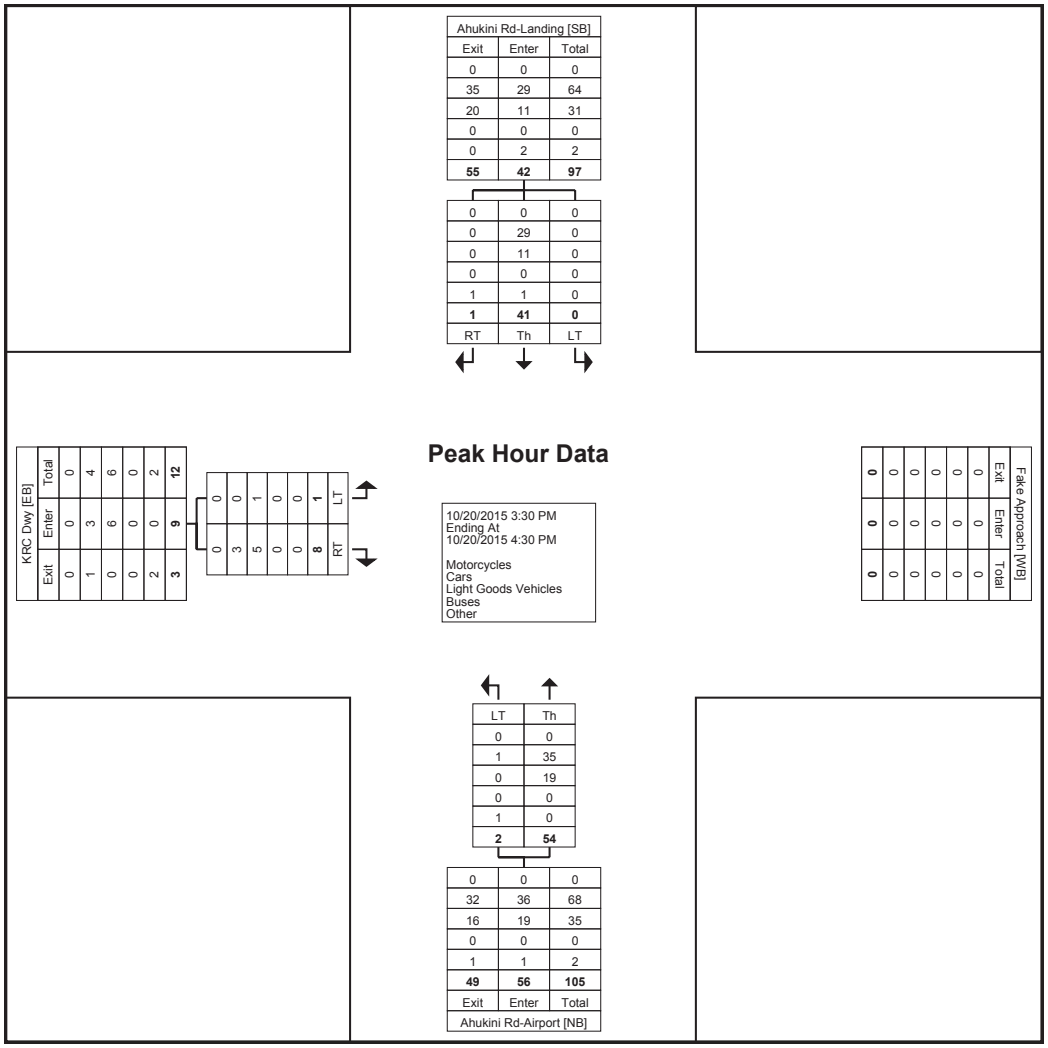
Count Name: KRC Dwy Ahukini Rd 0700-1630
Site Code: Kauai MRF
Start Date: 10/20/2015
Page No: 10



Turning Movement Peak Hour Data Plot (3:30 PM)

TRAFFIC ASSESSMENT REPORT

FOR THE PROPOSED

KAUAI MATERIALS RECOVERY FACILITY

LIHUE, KAUAI, HAWAII

TAX MAP KEY: 03-07-02:14

APPENDIX B

CAPACITY ANALYSIS WORKSHEETS

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	1	39	47	62	32	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	25	70	73	86	67	25
Heavy Vehicles, %	0	0	6	0	0	0
Mvmt Flow	4	56	64	72	48	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	251	50	52	0	-	0
Stage 1	50	-	-	-	-	-
Stage 2	201	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.16	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.254	-	-	-
Pot Cap-1 Maneuver	742	1024	1529	-	-	-
Stage 1	978	-	-	-	-	-
Stage 2	838	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	709	1024	1529	-	-	-
Mov Cap-2 Maneuver	709	-	-	-	-	-
Stage 1	978	-	-	-	-	-
Stage 2	801	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	3.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1529	-	994	-	-
HCM Lane V/C Ratio	0.042	-	0.06	-	-
HCM Control Delay (s)	7.5	0	8.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	5	0	109	70	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	63	92	79	78	92
Heavy Vehicles, %	0	0	0	3	0	2
Mvmt Flow	0	8	0	138	90	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	228	90	90	0	-	0
Stage 1	90	-	-	-	-	-
Stage 2	138	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	765	973	1518	-	-	-
Stage 1	939	-	-	-	-	-
Stage 2	894	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	765	973	1518	-	-	-
Mov Cap-2 Maneuver	765	-	-	-	-	-
Stage 1	939	-	-	-	-	-
Stage 2	894	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1518	-	973	-	-
HCM Lane V/C Ratio	-	-	0.008	-	-
HCM Control Delay (s)	0	-	8.7	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	7	53	63	48	51	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	58	88	93	67	75	92
Heavy Vehicles, %	0	6	3	2	2	0
Mvmt Flow	12	60	68	72	68	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	275	68	68	0	-	0
Stage 1	68	-	-	-	-	-
Stage 2	207	-	-	-	-	-
Critical Hdwy	6.4	6.26	4.13	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.354	2.227	-	-	-
Pot Cap-1 Maneuver	719	984	1527	-	-	-
Stage 1	960	-	-	-	-	-
Stage 2	832	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	686	984	1527	-	-	-
Mov Cap-2 Maneuver	686	-	-	-	-	-
Stage 1	960	-	-	-	-	-
Stage 2	794	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	3.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1527	-	917	-	-
HCM Lane V/C Ratio	0.044	-	0.079	-	-
HCM Control Delay (s)	7.5	0	9.3	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.3	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	2	8	4	109	104	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	50	40	50	80	83	92
Heavy Vehicles, %	0	0	25	3	4	0
Mvmt Flow	4	20	8	136	125	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	277	125	125	0	-	0
Stage 1	125	-	-	-	-	-
Stage 2	152	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.35	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.425	-	-	-
Pot Cap-1 Maneuver	717	931	1331	-	-	-
Stage 1	906	-	-	-	-	-
Stage 2	881	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	712	931	1331	-	-	-
Mov Cap-2 Maneuver	712	-	-	-	-	-
Stage 1	906	-	-	-	-	-
Stage 2	875	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.4	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1331	-	886	-	-
HCM Lane V/C Ratio	0.006	-	0.027	-	-
HCM Control Delay (s)	7.7	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	1	41	49	65	34	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	25	70	73	86	67	25
Heavy Vehicles, %	0	0	6	0	0	0
Mvmt Flow	4	59	67	76	51	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	263	53	55	0	-	0
Stage 1	53	-	-	-	-	-
Stage 2	210	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.16	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.254	-	-	-
Pot Cap-1 Maneuver	730	1020	1525	-	-	-
Stage 1	975	-	-	-	-	-
Stage 2	830	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	696	1020	1525	-	-	-
Mov Cap-2 Maneuver	696	-	-	-	-	-
Stage 1	975	-	-	-	-	-
Stage 2	792	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	3.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1525	-	991	-	-
HCM Lane V/C Ratio	0.044	-	0.063	-	-
HCM Control Delay (s)	7.5	0	8.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	5	0	114	74	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	63	92	79	78	92
Heavy Vehicles, %	0	0	0	3	0	2
Mvmt Flow	0	8	0	144	95	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	239	95	95	0	-	0
Stage 1	95	-	-	-	-	-
Stage 2	144	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	754	967	1512	-	-	-
Stage 1	934	-	-	-	-	-
Stage 2	888	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	754	967	1512	-	-	-
Mov Cap-2 Maneuver	754	-	-	-	-	-
Stage 1	934	-	-	-	-	-
Stage 2	888	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.8	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1512	-	967	-	-
HCM Lane V/C Ratio	-	-	0.008	-	-
HCM Control Delay (s)	0	-	8.8	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	7	56	66	50	53	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	58	88	93	67	75	92
Heavy Vehicles, %	0	6	3	2	2	0
Mvmt Flow	12	64	71	75	71	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	288	71	71	0	-	0
Stage 1	71	-	-	-	-	-
Stage 2	217	-	-	-	-	-
Critical Hdwy	6.4	6.26	4.13	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.354	2.227	-	-	-
Pot Cap-1 Maneuver	707	980	1523	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	824	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	672	980	1523	-	-	-
Mov Cap-2 Maneuver	672	-	-	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	784	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	3.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1523	-	913	-	-
HCM Lane V/C Ratio	0.047	-	0.083	-	-
HCM Control Delay (s)	7.5	0	9.3	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.3	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	2	8	4	114	109	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	50	40	50	80	83	92
Heavy Vehicles, %	0	0	25	3	4	0
Mvmt Flow	4	20	8	142	131	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	290	131	131	0	-	0
Stage 1	131	-	-	-	-	-
Stage 2	159	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.35	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.425	-	-	-
Pot Cap-1 Maneuver	705	924	1324	-	-	-
Stage 1	900	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	700	924	1324	-	-	-
Mov Cap-2 Maneuver	700	-	-	-	-	-
Stage 1	900	-	-	-	-	-
Stage 2	869	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.4	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1324	-	877	-	-
HCM Lane V/C Ratio	0.006	-	0.027	-	-
HCM Control Delay (s)	7.7	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	2	68	66	34	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	25	70	73	86	67	25
Heavy Vehicles, %	0	100	32	0	0	0
Mvmt Flow	0	3	93	77	51	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	316	53	55	0	-	0
Stage 1	53	-	-	-	-	-
Stage 2	263	-	-	-	-	-
Critical Hdwy	6.4	7.2	4.42	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	4.2	2.488	-	-	-
Pot Cap-1 Maneuver	681	795	1378	-	-	-
Stage 1	975	-	-	-	-	-
Stage 2	786	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	633	795	1378	-	-	-
Mov Cap-2 Maneuver	633	-	-	-	-	-
Stage 1	975	-	-	-	-	-
Stage 2	731	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	4.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1378	-	795	-	-
HCM Lane V/C Ratio	0.068	-	0.004	-	-
HCM Control Delay (s)	7.8	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.2	-	0	-	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	1	68	5	133	36	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	63	92	79	78	92
Heavy Vehicles, %	0	25	0	17	6	2
Mvmt Flow	1	108	5	168	46	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	225	46	46	0	-	0
Stage 1	46	-	-	-	-	-
Stage 2	179	-	-	-	-	-
Critical Hdwy	6.4	6.45	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.525	2.2	-	-	-
Pot Cap-1 Maneuver	768	962	1575	-	-	-
Stage 1	982	-	-	-	-	-
Stage 2	857	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	765	962	1575	-	-	-
Mov Cap-2 Maneuver	765	-	-	-	-	-
Stage 1	982	-	-	-	-	-
Stage 2	854	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1575	-	960	-	-
HCM Lane V/C Ratio	0.003	-	0.114	-	-
HCM Control Delay (s)	7.3	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.4	-	-

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	5	74	57	53	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	58	88	93	67	75	92
Heavy Vehicles, %	0	100	14	2	2	0
Mvmt Flow	0	6	80	85	71	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	315	71	71	0	-	0
Stage 1	71	-	-	-	-	-
Stage 2	244	-	-	-	-	-
Critical Hdwy	6.4	7.2	4.24	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	4.2	2.326	-	-	-
Pot Cap-1 Maneuver	682	775	1456	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	801	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	642	775	1456	-	-	-
Mov Cap-2 Maneuver	642	-	-	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	755	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.7	3.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1456	-	775	-	-
HCM Lane V/C Ratio	0.055	-	0.007	-	-
HCM Control Delay (s)	7.6	0	9.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.2	-	0	-	-

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	9	72	9	122	58	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	50	40	50	80	83	92
Heavy Vehicles, %	0	12	11	9	10	0
Mvmt Flow	18	180	18	152	70	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	259	70	70	0	-	0
Stage 1	70	-	-	-	-	-
Stage 2	189	-	-	-	-	-
Critical Hdwy	6.4	6.32	4.21	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.408	2.299	-	-	-
Pot Cap-1 Maneuver	734	965	1475	-	-	-
Stage 1	958	-	-	-	-	-
Stage 2	848	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	724	965	1475	-	-	-
Mov Cap-2 Maneuver	724	-	-	-	-	-
Stage 1	958	-	-	-	-	-
Stage 2	837	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.9	0.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1475	-	937	-	-
HCM Lane V/C Ratio	0.012	-	0.211	-	-
HCM Control Delay (s)	7.5	0	9.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

APPENDIX C

ASM Affiliates, An Archaeological and Cultural Impact Assessment for the County of Kaua'i Materials Recovery Facility, January 2016

An Archaeological and Cultural Impact Assessment for the County of Kauaʻi Materials Recovery Facility

TMKs: (4) 3-7-002: 015 and 014 Por.

Hanamāʻulu Ahupuaʻa
Līhuʻe District
Island of Kauaʻi

DRAFT VERSION

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February 2016

ASM Project Number 24970.00

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An Archaeological and Cultural Impact Assessment for the County of Kauaʻi Materials Recovery Facility

TMKs: (4) 3-7-002: 015 and 014 Por.

Hanamāʻulu Ahupuaʻa
Līhuʻe District
Island of Kauaʻi

ASM affiliates

EXECUTIVE SUMMARY

At the request of CalRecovery, Inc., on behalf of the County of Kauaʻi (land owner), ASM Affiliates conducted an Archaeological and Cultural Impact Assessment of roughly 3.1 acres of land comprising all of TMK: (4) 3-7-002:015 (0.86 acres) and a 2.24 acre portion of TMK: (4) 3-7-002:014 located adjacent to Ahukini Road in Hanamāʻulu Ahupuaʻa, Līhuʻe District, Island of Kauaʻi. The County of Kauaʻi intends to modify and improve two existing structures that comprise the Kauaʻi Resource Center by enclosing the receiving and processing areas and creating the proposed Materials Recovery Facility (MRF). The proposed modifications will be undertaken within the existing footprint of the Kauaʻi Resource Center. The existing paved parking areas and access roads and adjacent Ahukini Road will not be modified. The present study is intended to support a HRS Chapter 343 Environmental Assessment (EA). The archaeological portion of the study was prepared in accordance with Hawaiʻi Administrative Rules13§13–275, and performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawaiʻi Administrative Rules 13§13–276. According to 13§13-275-5(b)(5)(A) when no archaeological resources are discovered during an archaeological survey the production of an Archaeological Assessment report is appropriate. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Kauaʻi Planning Department. The cultural portion of this study was prepared to comply with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawaiʻi, on November 19, 1997. As stated in Act 50, which was proposed and passed as Hawaiʻi State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, "environmental assessments . . . should identify and address effects on Hawaii's culture, and traditional and customary rights . . . native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the 'aloha spirit' in Hawaiʻi. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups."

Based on an analysis of historical background information coupled with a review of historic maps, previous archaeological and cultural studies conducted in the vicinity of the current study area, the archaeological expectations for the current study area are meager at best. The extensive Historic Period agriculture activities associated with sugarcane cultivation likely destroyed any Precontact cultural remains that may have been present in the immediate project area, and the modern development of the existing refuse transfer station and recycling facility likely destroyed any evidence of Historic Period land use. Although highly unlikely, the remote possibility does remain that scant remnants of either Precontact or Historic Period sites might remain along the margins of the project area, which is a totally developed landscape.

Archaeological fieldwork for the current study was conducted on November 20, 2015 by Teresa Gotay, M. A. and Robert Rechtman, Ph. D. The surface of the entire study area was inspected by fieldworkers walking meandering transects spaced at five meter intervals parallel to the parcels' boundaries. Ground surface visibility was excellent, and it was quite apparent that the entire study area had been subject to prior significant ground-disturbing activity associated with the development of the existing refuse transfer station and recycling facilities. As a result of the field survey, there were no archaeological features observed on the surface and given the highly disturbed nature of the study area, there is virtually no likelihood of encountering subsurface remains. As a result of three prior cultural impacts assessments (Kanahele et al. 2005; PHRI 2001; Spearing et al. 2008) conducted for projects in the general vicinity of the current study area, twenty-six interviews were conducted and a wealth of traditional knowledge was shared about the Hanamāʻulu (and Ahukini) and Kalapikī areas. All of the previous interviews were reviewed The primary cultural concerns raised in all of the interviews revolved around maintaining free and clear access to the shoreline, where a variety of traditional cultural practices have occurred and continue to take place.

As the current study area is an already completely altered landscape and there are no historic properties present, it is the conclusion of the current study that no further historic preservation work need be conducted with respect to the development of the County of Kauaʻi MRF; however, in the highly unlikely event that any unanticipated archaeological resources are unearthed during development activities, in compliance with HAR 13§13-280, work in the immediate vicinity of the finds should be halted and DLNR-SHPD contacted. As there are no traditional cultural places and associated practices identified within the current project area and there is nothing in the current proposed project that will impact access to the shoreline, it is our conclusion that the development of the proposed County of Kauaʻi Materials Recovery Facility will have no impact on any traditional cultural resources or related practices.

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1. INTRODUCTION

At the request of CalRecovery, Inc., on behalf of the County of Kauaʻi (land owner), ASM Affiliates conducted an Archaeological and Cultural Impact Assessment of roughly 3.1 acres of land comprising all of TMK: (4) 3-7-002:015 (0.86 acres) and a 2.24 acre portion of TMK: (4) 3-7-002:014 located adjacent to Ahukini Road in Hanamāʻulu Ahupuaʻa, Līhuʻe District, Island of Kauaʻi (Figures 1 and 2). The County of Kauaʻi intends to modify and improve two existing structures that comprise the Kauaʻi Resource Center by enclosing the receiving and processing areas and creating the proposed Materials Recovery Facility (MRF). The proposed MRF will receive and process residentially and commercially generated, source-separated recyclable materials delivered by various collection vehicles and private citizens. The proposed modifications will be undertaken within the existing footprint of the Kauaʻi Resource Center (Figure 3). The existing paved parking areas and access roads and adjacent Ahukini Road will not be modified. The present study is intended to support a HRS Chapter 343 Environmental Assessment (EA). The archaeological portion of the study was prepared in accordance with Hawaiʻi Administrative Rules13§13–275, and performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawaiʻi Administrative Rules 13§13–276. According to 13§13-275-5(b)(5)(A) when no archaeological resources are discovered during an archaeological survey the production of an Archaeological Assessment report is appropriate. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Kauaʻi Planning Department.

The cultural portion of this study was prepared to comply with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawaiʻi, on November 19, 1997. As stated in Act 50, which was proposed and passed as Hawaiʻi State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, "environmental assessments . . . should identify and address effects on Hawaii's culture, and traditional and customary rights . . . native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the 'aloha spirit' in Hawaiʻi. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups."

This report contains a description of the study area, a culture-historical background, a discussion of prior archaeological and cultural studies that have been conducted within the vicinity of the current study area, a summary of consultation, and the results of both the archaeological field investigation of the current study area along with a discussion of potential cultural impacts.

STUDY AREA DESCRIPTION

The current study area is located in the southeast coastal region of Hanamāʻulu Ahupuaʻa in the Līhuʻe District of the island of Kauaʻi. As one of the geologically oldest of the Hawaiian Islands, the topography of Kauaʻi exhibits an advanced degree of erosion, in the form of true riverbeds and less jagged mountain peaks. Kauaʻi's Mount Waiʻaleʻale, which raises to an elevation of 5,148 feet, is said to be one of the wettest places on earth; "the rain gage at Mt. Waiʻaleʻale receives more rainfall than any other gage in the world, with an annual median rainfall of 449 inches" (Giambelluca et al. 1986:17).

Figure 1. Study area location.

Figure 2. 2003 satellite image with the current study area shaded red.

The current study area consists of roughly half (2.24 acres) of TMK: (3) 7-8-002:014 and TMK: (3) 7-8-002: 015, in its entirety. Parcel 015 has an area of roughly 0.86 acres and is located along Ahukini Road adjacent to northwest portion of Līhuʻe Airport (see Figure 2). The southern half of Parcel 014 borders Parcel 15 and is the current site of the Garden Isle Disposal Inc. Redemption Center. There are two paved access roads servicing the study area that extend westward from Ahukini Road. The current study area is located south of Hanamāʻulu Bay (see Figure 1), within a land area that was previously under intensive sugarcane cultivation; and presently the entire study area is a modified landscape with portions that have been graded, paved, and built up (Figures 4-9). A modern drainage ditch (see Figures 5 and 7) extends along the southeastern edge of the study area, roughly parallel to Ahukini Road, with culverts (see Figure 9) beneath both access roads. The study area has an annual average rainfall of 50 inches (997 mm) with higher rainfall averages between October and January (Giambelluca et al. 2013). Study area temperatures range between 78 and 85 degrees Fahrenheit (US Climate Data 2015). Elevation within the study area ranges from 75 to 94 feet (22.86 to 28.65 meters) above sea level. Vegetation in the study area is limited to a variety of non-native grasses, some ornamental bushes, and a few palms (Figures 5 and 6). Soil within the current study area consist of well-drained reddish-brown silty clay soil (Figure 7) with a slope of 0 to 8 percent and basic igneous dust as parent material, classified as Lihue Silty Clay (LhB). The typical profile consists of silty clay at 0-60 inches with the water table at more than 80 inches below the surface (USGS Soil Survey 2014).

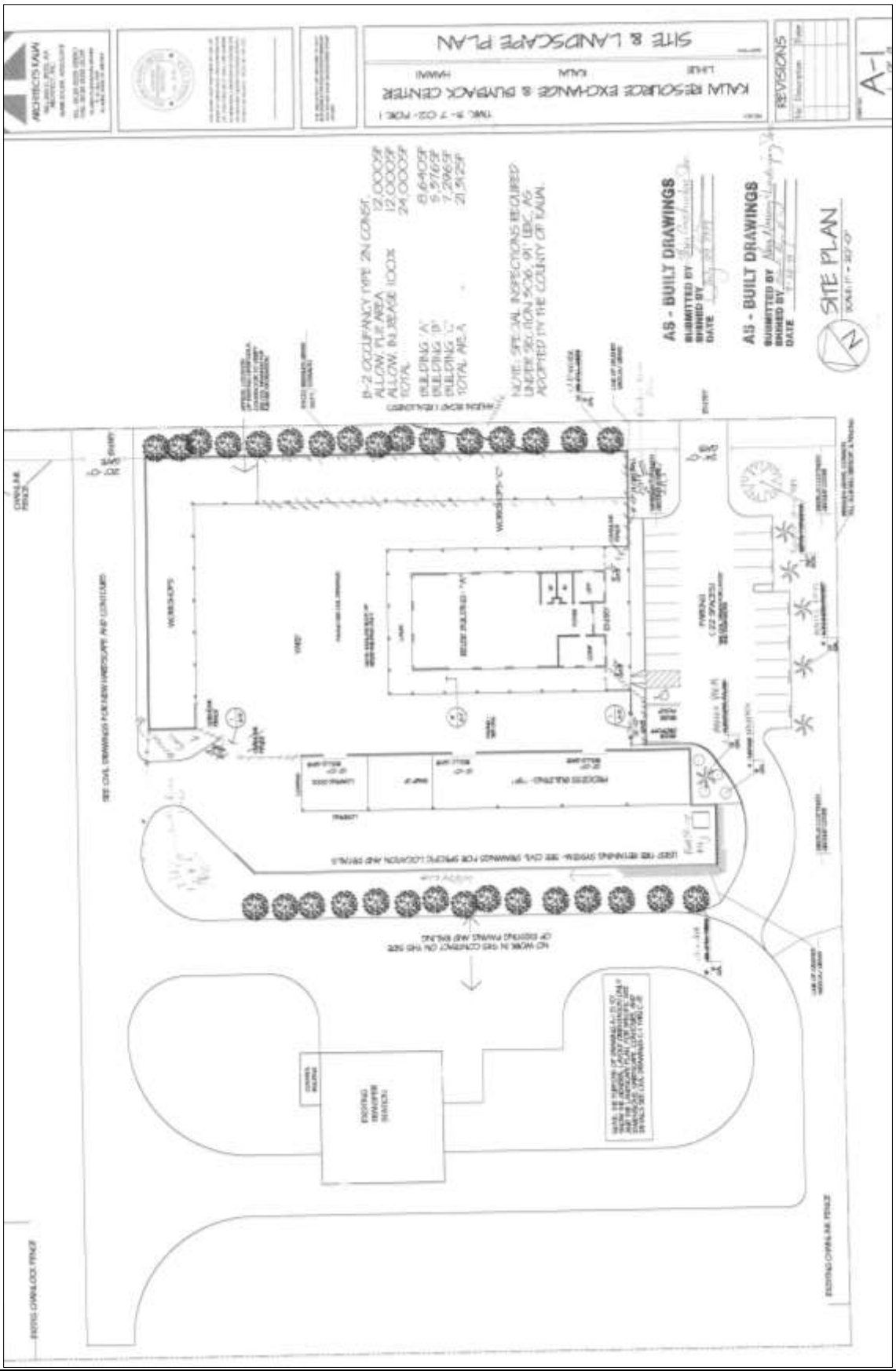

Figure 3. Site plan showing the existing Kauai Resource Center.

Figure 4. Redemption center entrance showing developed nature of the current study area, view to the south.

Figure 5. Southeastern end of the current study area near Ahukini Road showing modern ditch and existing development.

Figure 6. Southwest boundary of the current study area showing typical ornamental vegetation and parking area, view to the southwest.

Figure 7 Portion of modern drainage at the southwest corner of study area showing typical silty-clay soil, view to the southwest.

Figure 8. Northwest boundary of study area, showing built environment, view to the northeast.

Figure 9. Modern drainage ditch and culvert near northeast access road, view to the southwest.

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2. BACKGROUND

This section of the report includes a discussion of the cultural-historical background for the region as well as a synthesis of prior archaeological, cultural, and historical research relevant to the current study area. This information is presented in order to provide a comprehensive understanding of the significance of the area, and to generate a set of expectations regarding the nature of the cultural resources that might be encountered within the study area, and to establish an analytical basis for the assessment of the significance of any such resources.

CULTURE-HISTORICAL CONTEXT

Early Hawaiian Settlement Patterns

The question of the timing of the first settlement of Hawai'i by Polynesians remains unanswered. Several theories have been offered that are derived from various sources of information (i.e., genealogical, oral-historical, mythological, radiometric), but none of these theories is today universally accepted (c.f., Kirch 2011). For many years, researchers have proposed that early Polynesian settlement voyages between Kahiki (the ancestral homelands of the Hawaiian gods and people) and Hawai'i were underway by A.D. 300, with long distance voyages occurring fairly regularly through at least the thirteenth century. More recent re-evaluation of the data, however, seems to indicate that there is no concrete archaeological evidence for pre-A.D. 1000 claims, rather Kirch (2011) and others (Athens et al 2014; Wilmshurst et al. 2011) have argued that Polynesians may not have arrived to the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. What is more widely accepted is the answer to the question of where Hawaiian populations came from and the transformations they went through on their way to establishing a uniquely Hawaiian culture.

The initial settlement in Hawai'i is believed to have occurred from the southern Marquesas Islands. In these early times, Hawai'i's inhabitants were primarily engaged in subsistence level agriculture and fishing (Handy et al. 1991). This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order; which was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs and belief: the major gods Kāne, Kū, and Lono; the *kapu* system of law and order; cities of refuge; the *'aumakua* concept; and the concept of *mana*.

In 1893, Dr. Nathaniel Emerson made the following observations about the link between Kaua'i and southern Polynesia:

> It is a matter of observation that only on the island of Kauai both the special features of its spoken language and the character of its myths and legends indicate a closer relationship to the groups of the southern Pacific, to which the Hawaiian people owe their origin, than do those of the other islands of the Hawaiian group. (quoted from Joesting 1984)

Initial permanent settlements in the islands were established at sheltered bays with access to fresh water and marine resources. Communities shared extended familial relations and there was an occupational focus on the collection of marine resources. Over a period of several centuries the areas with the richest natural resources became populated and perhaps even crowded, and there was an increasing separation of the chiefly class from the common people. As the environment reached its maximum carrying capacity, the result was social stress, hostility, and war between neighboring groups (Kirch 1985). Soon, large areas of Hawai'i were controlled by a few powerful chiefs.

As time passed, a uniquely Hawaiian culture developed. The portable artifacts found in archaeological sites of this period reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*ko'i*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. A few areas in Hawai'i produced quality basalt for adze production. Mauna Kea, on the island of Hawai'i, possessed a well-known adze quarry. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are '*ulu maika* stones and *lei niho palaoa*. The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). As population continued to expand so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. Additional migrations to Hawai'i occurred from Tahiti in the Society Islands. Rosendahl (1972) has

proposed that settlement at this time was related to seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites were occupied during the winter months, with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well; as Hommon (1976) argues, kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupuaʻa* system sometime during the A.D. 1400s (Kirch 1985), adding another component to an already well-stratified society. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to permanent dispersed occupation of both coastal and upland areas.

By this time (A.D. 1400s) the island of Kauaʻi appears to have been divided into six traditional districts or *moku*, and the *moku* were further divided into distinct land units known as *ahupuaʻa*. The *ahupuaʻa* became the equivalent of a local community, with its own social, economic, and political significance. *Ahupuaʻa* were ruled by *aliʻi ʻai ahupuaʻa*; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. The *aliʻi ʻai ahupuaʻa* in turn answered to an *aliʻi ʻai moku,* a higher chief who ruled over the *moku* and claimed the abundance of the entire district. Thus, *ahupuaʻa* resources supported not only the *makaʻāinana* (commoners) and *ʻohana* (extended families) who lived on the land, but also provided support to the ruling class of higher chiefs and ultimately the crown. *Ahupuaʻa* were ideally wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). The *aliʻi* and the *makaʻāinana* (commoners) were not confined to the boundaries of an *ahupuaʻa*; when there was a perceived need, they also shared with their neighbor *ahupuaʻa ʻohana* (Hono-ko-hau 1974). The *ahupuaʻa* were further divided into smaller sections such as *ʻili, moʻoʻaina, paukuʻaina, kihapai, koele, hakuone,* and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *moʻi* (king). *Heiau* building flourished as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206).

The current study area is located within the traditional *moku* or district of Puna (Figure 10), along the windward southeast coast of Kauaʻi. As previously mentioned, the current study area is located in the modern district of Līhuʻe within the *ahupuaʻa* of Hanamāʻulu, which is bounded on the north by Wailua Ahupuaʻa and on the south by Kalapakī Ahupuaʻa.

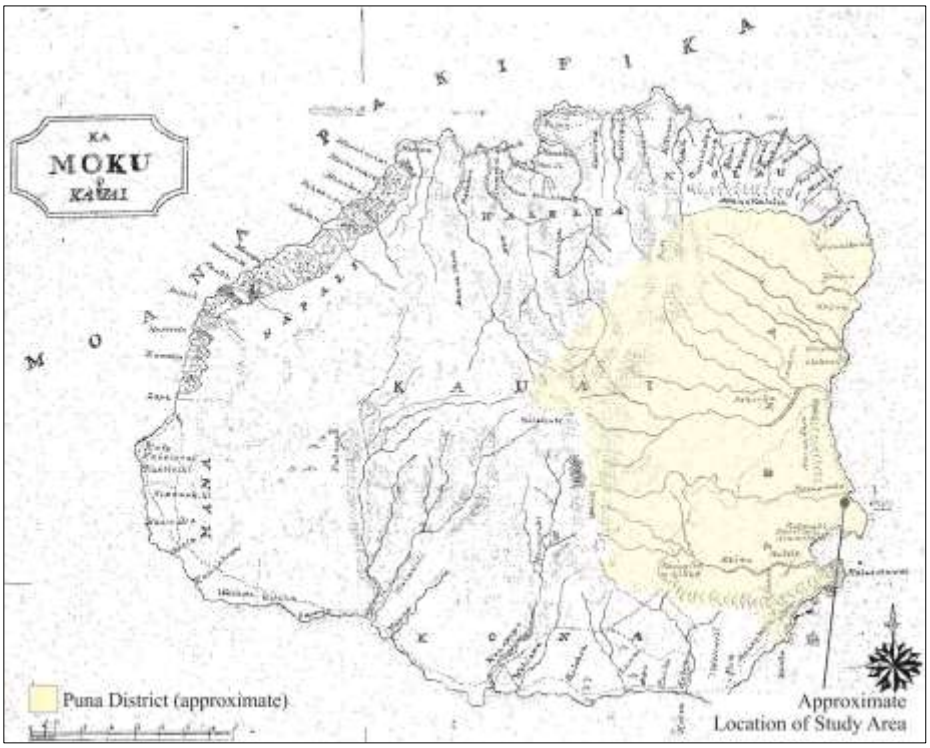

Figure 10. Map of traditional *moku* of Kauaʻi (ca. 1830s) showing approximate study area within the traditional Puna District.

Legendary Accounts of the Study Area Vicinity

According to Fornander, the earliest legends of ancient Kauaʻi are few, but paint a picture of independence and separation from the islands of Oʻahu, Molokaʻi, Maui and Hawaiʻi. Until the time when Kauaʻi was under the rule of Kukona, the seventh *mōʻī,* or ruling chief, "Kauai, its government and chiefs, had been living apart, or not mingled much with the chiefs or events on the other islands"(1996:92). Fornander specifically mentions Hanamāʻulu as the birthplace of Kaweloleimakua the namesake of the Legend of Kawelo, a famous ruler of Kauaʻi whose maternal grandparents foresaw his future at the time of his birth.

> After the examination the old people called the parents of Kawelo and said to them: "Where are ou two? This child of yours is going to be a soldier; he is going to be a very powerful man and shall some day rule as king." (Fornander 1918-1919:2)

Kawelo was taken from Hanamāʻulu to Wailua and raised by his grandparents until they all relocated to Oʻahu where Kawelo took up farming and married Kanewahineikiaoha. Kawelo went on to master both fishing and the art of war and had become renowned for his feats of strength. He returned to Kauaʻi to defend his family against Aikanaka who had stolen Kawelo's parents land and resources and led his small army to victory, dividing the island among his followers. Fornander mentions the subject *ahupuaʻa* again in the following sentence, "After the conquest of Kauai, Kawelo and his wife Kanewahineikiaoha took up their residence in Hanamaulu (1918-1919:62)." In a footnote, Fornander defines Hanamāʻulu as "adjacent to Wailua, the principal township of old-time Kauai (ibid:62)." According to Fornander, after narrowly surviving a brush with death at the hands of Aikanaka and his followers, Kawelo lived out his life in Hanamāʻulu with his wife and parents.

In addition to the stories surrounding venerated rulers, Kauaʻi legends tells of the *Menehune*, a mythical race of little people who inhabited the mountains and valleys in ancient times. Such stories of magical little people pervade the folklore of the Pacific Islands and the term *menehune* is often used as a general reference to the ancient inhabitants of the islands and their handiwork before the advent of written history. Many feats of construction on Kauaʻi, such as the Na Kiki-a-ʻOla (known as the *Menehune* Ditch) in Waimea, are attributed to supernatural handiwork, performed under the cover of darkness, often over the course of just one night. Interestingly, a census of Kauaʻi conducted in the early 1800s recorded no less than 65 individuals, residing in the upper section of Wainiha Valley on the north coast, who identified their nationality as *Menehune* (Joesting 1984).

Several locations and topographic features within the vicinity of Hanamāʻulu Ahupuaʻa have legendary associations. For instance, in the legend "The Goddess Pele", recorded by William Hyde Rice (1923), Ahukini and Hanamāʻulu are both mentioned by name. In this legend, the handsome king of Kauai, Lohiau became the object of affection of the goddess Pele and her sister Hiiaka. In a jealous rage, Pele ordered her sisters to kill him and cover him in lava on the slopes of Kilauea on the island of Hawaii. Upon seeing his body turned to stone within a lava flow, two of Pele's brothers reacted thusly:

> Pity welled up in their hearts and they brought Lophiau to life again. One of these brothers made his own body into a canoe and carried the unfortunate Lohiau to Kauai, where he was put ashore at Ahukini.
>
> Coming to Hanamaulu, Lohiau found all the houses but one closed. In that one were two old men, one of whom recognized him and asked him to enter. The men were making tapa which they expected to carry soon to Kapaa, where fames were being held in honor of Kaleiapaoa and his bride Hiiaka. (Rice 1923:16-17)

According to Rice, as a result of his visit to Kauaʻi, Lohiau was reunited with his love Hiiaka and they lived out their lives together in Hāʻena.

In the legend above, the reference to Ahukini likely refers to Ahukini *heiau*, which once stood near Ahukini Point, to the southeast of the current study area in neighboring Kalapakī Ahupuaʻa. Another reference to the subject *ahupuaʻa* comes from the following Hawaiian proverb *No Hanamāʻulu ka ipu puehu*, which translates as "the quickly emptied container belongs to Hanamāʻulu" (Pukui 1983:252 in Bell et al. 2006:13), and may imply that food was often scarce in Hanamāʻulu.

The wind that travels across the Hanamāʻulu landscape is also noted in legendary accounts, being just one of 269 winds traditional identified on Kauaʻi (Kanahele et al. 2005) and as described in an ancient wind chant: *He Hoʻoluakanehe ka makani o Hanamāʻulu* — Moving in two directions from the land or from the ocean, is the free blowing wind of Hanamāʻulu.

Kauaʻi Prior to European Contact

Prior to European contact, the Hawaiian economy was subsistence based with an emphasis on *kalo* (taro) production. *Kalo* is most productive when it is planted in cool, fresh, shallow water (Wilcox 1996). In order to create these conditions, early Hawaiians developed terraces or *loʻi* that contained dikes or *pani wai,* which were used to divert water from nearby streams. This water was then channeled through a network of irrigation ditches or *ʻauwai*. Within Hanamāʻulu conditions for such agricultural systems existed along the river that traverses through Hanamāʻulu Valley and empties into Hanamāʻulu Bay to the north of the current study area. It was within this river valley and along the bay where Precontact settlement within the *ahupuaʻa* was centered. As described by Handy et al.:

> South of Wailua there is a very large stream named Hanamaulu flowing from the side of Kilohana crater through a broad gulch in which there were many terraced flats, beginning about two and a half miles upstream. The large delta area where the stream flows into the bay undoubtedly was covered with *loʻi* for wet-taro cultivation before this land was taken over for sugar cane. Much of the higher land now planted with cane must formerly have been used for growing sweet potatoes. (Handy et al. 1991:425-426)

The *kula* lands of Hanamāʻulu Ahupuaʻa, as with elsewhere on Kauaʻi would have been used for the dry-land cultivation of *ʻuala* (sweet potato), *pia* (arrowroot), dryland taro, as well as *wauke* (paper mulberry). The upland and forest zones were areas of resource collection, where birds, *hala*, *kukui* nuts, and firewood were obtained. An indication of a significant albeit modest Precontact population in Hanamāʻulu is the presence of only one ethnohistorically recorded *heiau* (Kalauokamanu Heiau) and the fact the Hanamāʻulu was the birth and death place of Kawelo, the late seventh century paramount chief.

Kauaʻi After European Contact

The Island of Kauaʻi was the first of the Hawaiian Islands to be reached by Europeans, which occurred in 1778 when Captain James Cook's ships the *Discovery* and the *Resolution* anchored at Waimea. As previously mentioned, in the years leading up to the first contact with Europeans, the Hawaiian Islands were under the control of various *mōʻī*. These high ranking chiefs acted as kings or sovereigns of the different *moku* (districts) and in some cases of entire islands. Interisland and intraisland warfare resulted in tremendous loss of life and power shifts across the island chain. A decade after Hawaiʻi's first contact with the Western world, Hawaiians began to acquire firearms and cannons, which resulted in even greater casualties.

In 1790, Kamehameha I was still battling for complete control of Hawaiʻi Island. During this time he invaded Maui, Lānaʻi, and Molokaʻi, wresting control from Kahekili, then king of Maui and Oʻahu. In 1791, Kahekili's half-brother Kaeo (Kaeokulani) was king of Kauaʻi, and joined Kahekili in successfully reclaiming the islands of Maui, Lānaʻi, and Molokaʻi. Later that same year, Kaeo and Kahekili tried to invade the island of Hawaiʻi and were defeated by Kamehameha in a sea battle known as "the battle of the red-mouthed guns" (Joesting 1984: 55). Shortly thereafter, Kamehameha was able to unite the island of Hawaiʻi under his rule, upon the sacrificial death of his greatest rival Keoua, the high chief of Kaʻū. Kahekili died on Maui in 1794. Soon after, Kaeo stopped in at Oʻahu on his way back to Kauaʻi and was killed at the hands of his own forces and foreign reinforcements as he attempted to suppress a rebellion. With Kaeo and Kahekili gone, Kamehameha was able to conquer Maui, Molokaʻi, Lānaʻi and Oʻahu by October of 1795, and set his sights set on the last holdouts: Kauaʻi and Niʻihau.

At this time, the island of Kauaʻi was host to its own civil war, which had erupted upon the death of Kaeo because his son Keawe "decided to ignore his father's wishes that Kaumualii become king" (Joesting 1984:58). As a result of this feud, the brothers fought bitterly and by July of 1796, Keawe successfully defeated Kaumualiʻi. Rather than kill Kaumualiʻi, Keawe kept him under house arrest, but Keawe died soon after taking him prisoner. As a result, Kauaʻi and Niʻihau came under the rule of Kaumualiʻi, a mere teenager at the time.

In April 1796, while Kaumualiʻi was still his brother's prisoner, Kamehameha I had mounted a failed invasion of Kauaʻi. Kamehameha I and his troops fell prey to the strong currents and dangerous winds of the Kaieie Waho channel (between Oʻahu and Kauaʻi) and were forced to turn back to Oʻahu before they even reached their target. About eight years later, Kamehameha I prepared for a second invasion of Kauaʻi. However, an epidemic swept through Oʻahu, which depleted his ranks and claimed the lives of his most trusted advisors before they had a chance to set sail across the channel, thereby foiling another invasion attempt (Joesting 1984). Kamehameha I and the young king endured five years of fruitless negotiations and Kaumualiʻi finally agreed to meet Kamehameha face to face in Honolulu in 1810. As a result of this meeting, Kaumualiʻi retained control of the Kauaʻi by pledging his allegiance to Kamehameha I; although Kauaʻi had officially become part of Kamehameha's kingdom.

This arrangement lasted until a few years after the death of Kamehameha I (c. 1819). In 1821, Kamehameha's son Liholiho (Kamehameha II) kidnapped Kaumualiʻi from Kauaʻi and took him to Oʻahu. Within days, Kaumualiʻi was forced to marry Kamehameha I's widow Kaʻahumanu. A few days after that, Kaʻahumanu also took Kaumualiʻi's son Kealiiahonui as her husband, thereby sealing the alliance between the leeward and windward islands (Joesting 1984). Kaumualiʻi, the last independent king of Kauaʻi, died in 1824 in Honolulu, having never returned to Kauaʻi after Liholiho lured him away (Donohugh 2001). According to most accounts, Kaumualiʻi was remembered favorably by *kamaʻāina* and foreigners alike. Upon Kaumualiʻi's death, Kauaʻi became divided over whether to be loyal to Kamehameha II and the windward chiefs who had taken it upon themselves to fill in for the late king of Kauaʻi; or pursue the independence they had enjoyed in the early days under Kaumualiʻi's rule (Donohugh 2001). After Kaumualiʻi's death, Keeaumoku, the first appointed governor, died shortly after his appointment. Keeaumoku was replaced by Kahalaia (Joesting 1984). However, as a result of the mounting tensions throughout Kauaʻi, Kaʻahumanu's cousin Kalanimoku, the prime minister and treasurer of the kingdom, ventured to Waimea, Kauaʻi on August 1, 1824, to diffuse the situation (Del Piano 2009).

In an attempt to reclaim sovereignty for Kauaʻi and Niʻihau, on August 8, 1824, a small group of rebels that included Kaumualiʻi's son George (Ḥumehume) mounted a failed uprising against the Hawaiian presence at the Russian Fort at Waimea (Del Piano 2009; Joesting 1984). Prince George and the other insurgents were forced to retreat and sought refuge in Hanapēpē Valley. In response, some Kauaʻi natives armed themselves to fight the rebels and Kalanimoku called in reinforcements from Oʻahu and Maui. On August 20, 1824, experienced troops armed with muskets arrived in Kauaʻi and defeated Humehume and his small group of rebel supporters in the battle of Hanapēpē-Wahiawa. The rebels who survived the battle, fled; however, many of them were later caught and held captive. Humehume was among these men and was brought before Kalanimoku, who spared the prince's life (Del Piano 2009). The repercussions of this decisive battle resulted in the realization of Kamehameha I's aspirations for the unification of all the Hawaiian Islands under one rule, albeit five years after his death.

Various historic accounts of the battle of Hanapēpē-Wahiawa and its aftermath describe the extreme brutality meted out by the invaders, which included violent acts against unarmed women and children (Joesting 1984). The invaders looted the island, stripped the chiefs of their lands, and deported them to Hawaiʻi, Oʻahu, and Maui. Kaʻahumanu continued to influence Hawaiian history during this time. She had assumed control over the Hawaiian kingdom since 1823 when her son Liholiho had set sail for England, and upon notification of Liholiho's death in 1825, she became the self-appointed regent of Hawaiʻi. After Kaumualiʻi's death, Kaʻahumanu redistributed many of the Kauaʻi chiefs' lands to members of the royal family (descendants of Kamehameha), or gave them out as rewards to favored court advisors and proven warriors, all of whom acted as absentee landlords because they resided on other islands (Joesting 1984). In his history of Kauai, Joesting (1984) opines that the motives for these vengeful attacks upon Kauaʻi after Kaumualiʻi's death had been building for generations. Some of the windward island rulers resented the power inherent in the birthright of the kings of Kauaʻi and likely held grudges from earlier invasions of the windward islands; while others may have felt that they had unfinished business after Kamehameha I's two failed invasion attempts. In addition, some of the windward fighters may have gone to Kauaʻi in an effort to root out the missionary presence that Kaumualiʻi had so warmly welcomed there.

Missionary Influences and the Shift Away from a Traditional Economy

The first missionaries to arrive in Kauaʻi were sent on the *Thaddeus* by the American Board of Commissioners for Foreign Missions (ABCFM) in 1820 from Boston Massachusetts. Also on board the *Thaddeus* were four young Hawaiian men who had been educated at the Foreign Mission School in Cornwall Connecticut. Among these young Hawaiians was Kaumualiʻiʻs son George, who wished to be reunited with his father on Kauaʻi (Joesting 1984). By the time they arrived to the island of Hawaiʻi in April of 1820, Kamehameha I had died and the traditional *kapu* system had been discarded. Some of the contingent stayed at Kailua-Kona on Hawaiʻi while the rest set up mission headquarters in Honolulu. George Kaumualiʻi and his missionary escorts Ruggles and Whitney anchored at Waimea, Kauaʻi on May 3, 1820. As a result of his joyous reunion with his son and Prince George's accounts of the missionaries' kindness, Kaumualiʻi extended an open invitation with full support for his guests and their families to settle in Kauaʻi. Furthermore, Kaumualiʻi pledged to build school houses, meeting houses and observe the Sabbath (Joesting 1984). The first mission in Kauaʻi was located at Waimea and in 1835 a second mission station was opened in Kōloa. Missionaries and their families traveling from these stations to other part of the island passed through the general Līhuʻe and specific Hanamāʻulu area and recorded their observations. In 1824 Reverend Hiram Bingham traveled from the mission station in Waimea to Hanalei passing through in the inland portion of the district, as Damon recounted:

> In 1824, when walking around the island from Waimea to consul the people after the wreck of *The Cleopatra's Barge*, Rev. Hiram Bingham crossed from Hamapepe, as been seen, over the old upland trail back of Kilohana [through Hanamāʻulu], and wrote of it as "a country of good land, mostly open, unoccupied and covered with grass, sprinkled with trees, and watered with lively streams that descend from the forest-covered mountains and wind their way along ravines to the sea, - a much finer country than the western part of the island" (Damon 1931:401)

Twenty-five years later, in 1849, William DeWitt Alexander, son of Waiʻoli missionary William P. Alexander traveling between the Koloa mission station and the Waiʻoli mission station recorded the following with respect to Hamamāʻulu Valley:

> . . . A few miles further on we crossed the picturesque valley of Hanamaulu. This valley is prettily bordered by groves of Kukui, koa, & hala trees, and is well cultivated with taro. A fine stream flows through the midst of it, which makes a remarkable bend at this place like a horse shoe. We then traveled along the seashore at the foot of a range of hills through groves of hau, & among hills of sand. It was now after dark, but the moon shone brightly, and there was no difficulty in finding our way. At about eight o-clock we arrived at the banks of the Wailua river (Alexander 1933 reprinted in Kauaʻi Historical Society 1991:121)

In addition to observations recorded by the missionaries and foreigners who made Kauaʻi their home, their western influences prevailed upon the native Hawaiian a new market system economy. Beginning in the early 1800s, Hawaiʻi shifted from a traditional self-sustaining, subsistence economy based on *kalo* production to an economy based on the sale of goods and services. This progression affected the society as a whole and caused the population to move away from villages and valleys and settle in towns and seaports (Wilcox 1996). The sandalwood trade with the Orient (ca. 1811-1835), visits from whaling ships (ca. 1819-1861), the California Gold Rush (ca. 1849-1859), and commercial sugar cultivation (ca. 1849-1990) had profound influences on the landscape and people within the vicinity of the current study area.

The Māhele Āina of 1848

The profound religious, socioeconomic, and demographic changes that took place in the early 1800s resulted in the establishment of a Euro-American style of land tenure, and the *Māhele ʻĀina* of 1848 or Great *Māhele* was the vehicle used to divide the land between the crown, government, *konohiki*, and native tenants. Prior to this land reformation, all the land and natural resources of Hawaiʻi were held in trust by the *aliʻi* who, in concert with *konohiki* land agents, meted out use rights to the native tenants at will. During the *Māhele* all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands; all three types of land were subject to the rights of the native tenants therein.

The *aliʻi* and *konohiki* were required to present their claims to the Land Commission to receive a Land Commission Award (LCAw.) for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission and subsequent land transfers (Chinen 1961). Native commoners could also register claims for land with the Land Commission, and if substantiated, they would receive awards referred to as *kuleana*. Upon confirmation of a claim, a survey was required before the Land Commission could issue a *kuleana* award.

Although no records exist of the names of individuals who had their land stripped from them after the conquest of Kauaʻi in 1824, the *Māhele* records provide data on those who claimed possession of the lands in ca. 1847 (Joesting 1984). As previously mentioned, many lands in Kauaʻi were given to individuals related in some way to the Kamehameha dynasty. In addition, the names of two governors of Kauaʻi, Kaikioewa and Paul Kanoa appear often in the *Māhele* records; as does the name Kalanimoku, sometimes spelled Kalaimoku, which translates as "Counselor, prime minister, high official" (Pukui and Elbert :121).

As a result of the *Māhele*, Hanamāʻulu Ahupuaʻa was awarded as *konohiki* land to Victoria Kamāmalu (LCAw. 7713:2), despite a competing claim made by Paul Kanoa, which was rejected. Victoria Kamāmalu was the sister of Alexander Liholiho (King Kamehameha IV), Lot Kapuāiwa (King Kamehameha V), and half-sister of Ruth Keʻelikōlani; who upon Victoria's death in 1866 inherited the Hanamāʻulu land.

There were an additional fifteen *kuleana* awarded to *makaʻāinana*, principally within the Hanamāʻulu River Valley from the seashore inland for roughly a mile. Land use recorded in *Māhele* testimony indicates that residences were located along the coast and taro *loʻi* and *kula* lands were in the flood plain areas of the river valley. Both coastal and *mauka/makai* trails are mentioned in the *kuleana* testimony, the latter being identified at *ʻili* and *ahupuaʻa* boundaries. There were no *kuleana* awarded in the vicinity of the current study area.

Following the *Māhele,* the Hawaiian kingdom initiated a grant program in an effort to encourage more native tenants to engage in fee-simple ownership of parcels of land. These parcels consisted primarily of Government lands-those lands given outright by the King, or commuted to the Government by the *ali'i* in lieu of paying the commutation fees on the parcels awarded them during the *Māhele*. These land grants were quite large, ranging in size from approximately ten acres to many hundreds of acres. When the sales were agreed upon, Royal Patents were issued and recorded following a numerical system that remains in use today. In 1862, the Commission of Boundaries (Boundary Commission) was established to legally set the boundaries of all the *ahupua'a* that had been awarded as a part of the *Māhele*. However, boundary descriptions were not collected for all *ahupua'a*. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between 1873 and 1885, and was usually given in Hawaiian and transcribed in English as it occurred. The boundary certification for Hanamā'ulu, possibly prepared in 1891, was located in the Land File of the State Archives with the papers of 'Oahu Governor John Dominis, and reads as follows:

> Document 336 of State Survey Office, Describing Boundaries of Hanamaulu
>
> Commencing upon the sea, at the mouth of the small stream called Kawailoa, and upon the southerly bank of the said stream running from thence South 74° West 90 chains to the top of the hill called Kailiiliahinale bounded by the land called Wailua, belonging to His Majesty the King, from thence North 82° West 494 chains, passing over the plains to the top of the mountain range called Waialeale, thence South 76° East 204 chains following along the top of the said mountain range called Waialeale to a certain peak, standing upon the northwesterly corner of land called Haiku from thence North 86° [?] East 166 chains to the top of the hill called Momakuhana bounded by the land Haiku, thence South 84° East 114 chains crossing the mountain road leading to Kilauhana, and passing down the range of hills on the makai side of Kilauhana, and through a small ravine to a certain koa tree, a short distance south of the Hanamaulu River, thence South 82° East 126 chains crossing the plantation of H.A. Peirce & Co. to a certain kukui tree, standing alone on the plains makai of the above plantation of H.A. Peirce & Co, marked K, bounded by the land called Kalapaki, thence North 75° 45' East 102 chains passing over the plains to the point of rock, upon the sea called Opoi, which forms the northeasterly corner of land called Kalapaki, from thence following the sea to the point of commencement. Comprising an area of 9,177 Acres. (Waihona 'Āina Database).

This boundary certification makes mention of the 'plantation of H.A. Peirce & Co.,' which references the sugarcane plantation started by Henry A. Pierce in 1849, which later became the Lihue Sugar Plantation. In 1870, the *konohiki* lands of Hanamā'ulu were sold to Paul Isenberg and incorporated into the Lihue Sugar Plantation.

The Sugar Industry in Hanamā'ulu

A condensed history of formation and early operation of the Lihue Sugar Plantation was published in the *Pacific Commercial Advertiser*'s 50th Anniversary Edition dated July 2, 1906, and read:

> Lihue sugar plantation is interesting because of its phenomenal success and the many obstacles which have been encountered and overcome all through its progreee, and especially during the early years when the sugar industry in Hawai'i was in its experimental stages.
>
> The early records of the plantation show that in 1854 Messrs. Henry Peirce, Wm. L. Lee, Wm. C. Parke, Edwin O. Hall, C.R. Bishop, C.W. Austin, W. H. Bates formed a copartnership under the name of Henry A, Peirce & Co. whose bussiness should be to plant sugar cane, manuafcturing sugar, and all other branches of bussiness thertofore carried on by the proprietors of the said plantation, which indicates that the plantation which indicates that the plantation had been in operation prior to that date. Mr Rice was the maanger. The mill which stood on the present site, was run by water power, the crop amounted to 120 tons of sugar. The plantation store stood near the site of the prsent manager's residence on the road to Koloa, and was conducted by Mr. Samuel T. Alexander. In fromnt of the store was a large open space surrounded by a grove of koa and kukui trees where natives from all parts of the island congregated on Saturday afternoons, bringing products of all kinds for sale. Wailua produced hau rope; Kapaa was noted for its rush hats and mats, while bullock cart loads of melons were brought from Anahola and Kealia. The taro and sugar cane from Waihiawa was regarded by the natives as especially fine in quality and was in demand for the use of the chiefs not only in Kauai, but in Honolulu as well. The salt produced in the ponds of Makaweli took the color of the soil blown from the land and was regarded as a luxury because of its red tinge. Opihi's

> from the mountains were then, as today, regarded by Hawaiian epicures as particularly toothsome, and all these staple supplies, food and delicacies found their way to Lihue market.
>
> It was Mr. Rice who first introduced irrigation on the fields in Hawai‘i. the aveage yield of sugar per acre was, at that time, ona nad one-half tons and was insufficient to make the industry a profitable one, and he concieved the idea of bringing the waters of the Kilohana stream on to the plantation for irrigation, and he built a ditch for that purpose. Even with irrigation the outlook for the place was evidently dark, for in 1861 a proposition was considered to abandon the planting of sugar cane. Mr. paul Isenberg was an employee of the plantation at the time and it was due to his advice and efforts that the proposition to abandon was given up, and planting was continued.
>
> In the year 1862 Mr. Rice died and Mr. isenberg succeded to the management of the estate. Mr. Isenberg was a man of strong character, clear foresight and indomitable will and energy, who, by his perserverance and example, not only pulled Lihue plantation through difficulties of extraordinary success, but he inspired his neighbors with pluck to plod along to a successful issue against conditions, at times, most discouraging. So great was his faith in the sugar industry in Hawaii that, when later he had acquired an interest in the plantation, and his proposal to purchase the *Hanamaulu* lands was opposed by his partners, he entered into an agreement with them whereby any loss which might be incurred in the planting of these lands was to be borne by him individually, whereas any profit arising from the same was to go in as a general realization to the several partners. The tract in question contains 17,000 acres and was bought for $8,500, which price was regarded by some members of the firm as too high.
>
> Men of Mr. Isenberg’s discernment rarely err in such matters. It was this purchase which gave to Lihue plantation its present water supply, and added thousands of acres of fine cane land . . .
>
> In 1877 Mr. A. S. Wilcox was given a contract to plant the tract on shares; the mill was erected by Lihue plantation . . . and in 1899 Mr. A. S. Wilcox, giving up Hanamaulu, the cultivation of that place was taken up by Lihue plantation, since which time the two places have been run in conjunction, although the cane of the respective places has been ground at its own mill. . . . Mr. Wolters (manager) succeeded in increasing the crop of the combined places, Lihue and Hanamaulu, to 18,000 tons. (*Pacific Commercial Advertiser* 1906:60-1)

Prior to the twentieth century, the current project area was not part of the cultivated sugarcane land as can be seen on Figure 11. The twentieth century history of the plantation continued to exhibit many innovations with respect to growing sugarcane, as well as producing and manufacturing sugar. In the Hanamā‘ulu portion of the plantation, Hanamā‘ulu Bay was developed as a commercial vessel landing site when the plantation built the Ahukini Landing. In a 2008 posting in the GardenIsland.com, Soboleski summarized the history of the Ahukini Landing area:

> The first pier on Hanama‘ulu Bay was a concrete block built at Kou on the north side of the bay in 1890. Rowboats would carry freight and passengers between this pier and inter-island steamers anchored offshore. Not long afterward, a small concrete pier and a short breakwater were also built at Ahukini on the south side of the bay. Ahukini then became the first port on Kaua‘i where inter-island vessels could tie up directly to shore. The original eight houses of Ahukini Camp were also constructed by Lihu‘e Plantation at that time. When a new pier and breakwater were built at Ahukini in 1920, transpacific Matson freighters of that era could likewise tie up directly. That same year, Ahukini Terminal & Railway Co. was organized to operate a freight railroad linking Ahukini with sugar plantations in the Lihu‘e, Kawaihau and Kilauea districts and the Kapa‘a pineapple cannery. Railroad trackage included the line from Ahukini to Lihu‘e mill and north to Kealia via Kapa‘a. Between 1922 and 1925, 34 more houses were built at Ahukini on the makai side of the county road and along the coast toward the Nawiliwili Lighthouse. In 1930, when construction of Nawiliwili Harbor was completed, the bulk of Kaua‘i’s cargo began moving through Nawiliwili and inter-island service to Ahukini stopped. The dismantling of the Makee mill at Kealia in 1934 further reduced shipping at Ahukini. Matson freighters continued to call regularly at Ahukini until Matson modernized its fleet after World War II with bigger ships. Thereafter, only tank barges called at Ahukini to supply its tank farm. Port operations at Ahukini closed in 1950, yet excess sugar from the sugar storage plant built at Niumalu that same year was stored temporarily at two warehouses at Ahukini until 1965, the same year Ahukini Camp was razed. (Soboleski 2008)

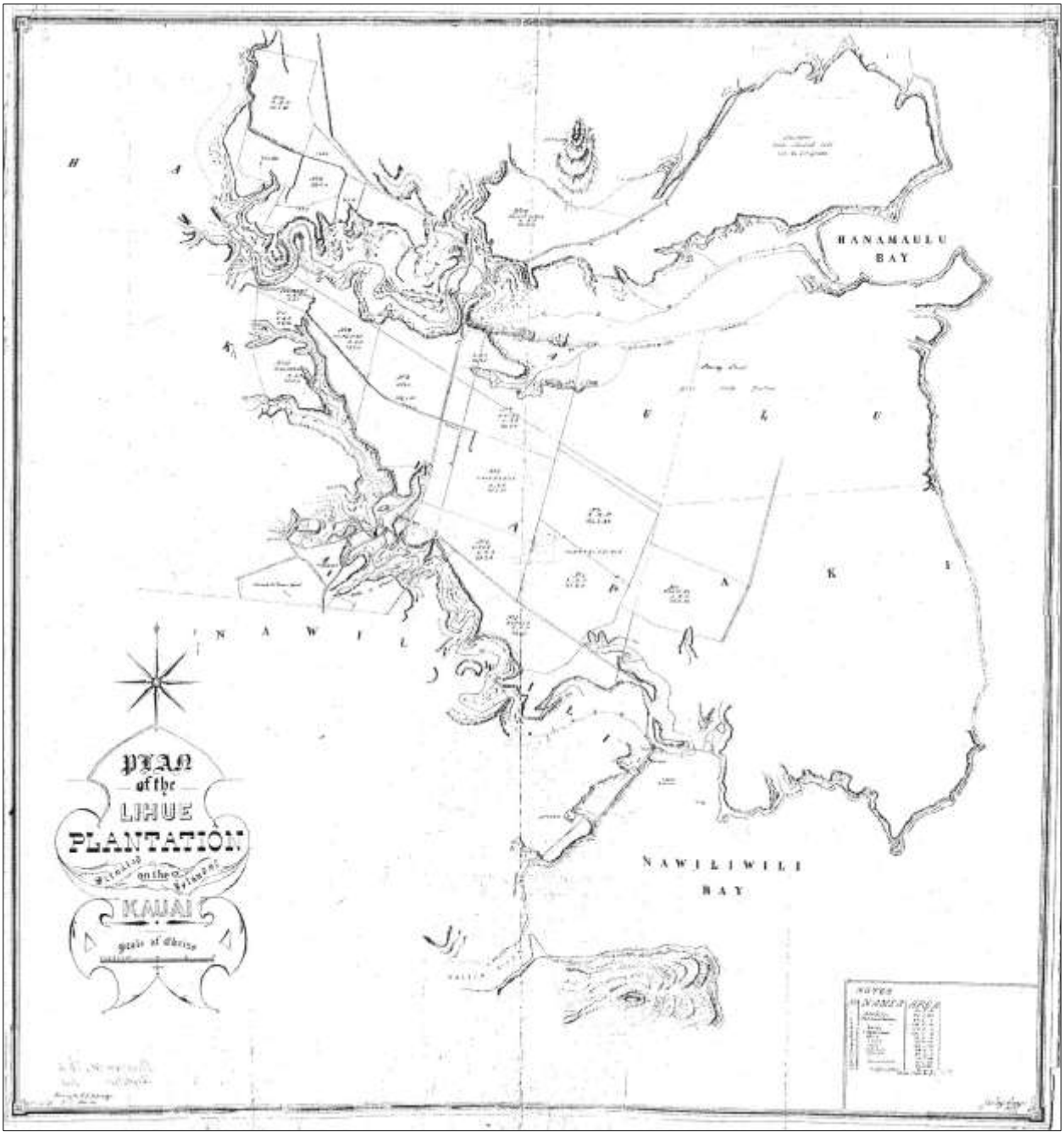

Figure 11. 1876 map of the Lihue Plantation.

In 1922, American Factors, Ltd. (AMFAC) acquired control of the Lihue Plantation Company through a stock purchase and by 1930 the sugar yield increased to 36,506 tons. The WWII years slowed the plantations efforts, but by September of 1944 the plantation was back in full swing with roughly 5,000 employees. And by 1947, a record 59,417 tons of sugar were produced. The current study area is shown to have been under cultivation on a 1941 map of the plantation (Figure 12). A series of aerial photographs taken in 1950 (Figure 13), 1959 (Figure 14), and 1978 (Figure 15) show the continued cultivation of the current study area. While it was not until November 2000 that AMFAC closed the Lihue Plantation Company, cultivation in the Hanamā‘ulu field section where the current project area is, seems to have stopped in the late 1980s.

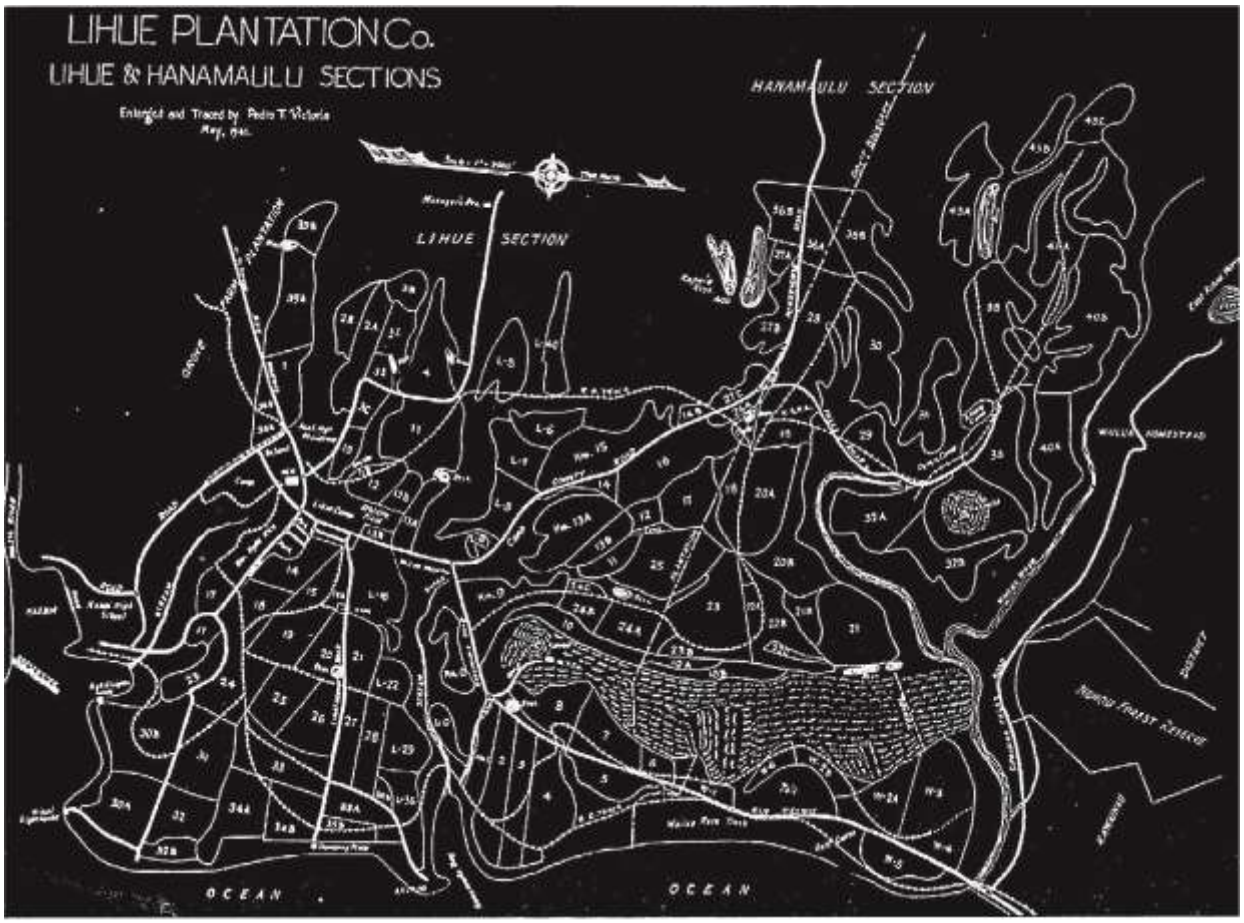

Figure 12. 1941 map of the Lihue Plantation.

Figure 13. 1950 aerial showing current study area vicinity with study area outlined in red.

Figure 14. 1959 aerial showing current study area vicinity with study area outlined in red.

Figure 15. 1978 aerial showing current study area vicinity with study area outlined in red.

The Current Project Area During Recent Years

Following the abandonment of sugarcane cultivation in Hanamāʻulu including the current project area, the County of Kauaʻi prepared an Environmental Assessment (GMP Associates, Inc. 1990) for the development of a Refuse Transfer Station, which was subsequently built adjacent to the current project area. A few years later, the existing recycling facility was constructed (Figure 16).

Figure 16. 2000 aerial photograph showing development within the current project area outlined in red.

PREVIOUS STUDIES

The earliest archaeological study in Kauaʻi appears to be that of Thomas G. Thrum, who created a list of the *heiau* of ancient Hawaiʻi. Thrum published his list of *heiau* in a series of entries in the *Hawaiian Almanac and Annual*, beginning with the 1907 edition. Of his investigations, Thrum noted the following:

> This much is being realized, and expressions of regret have been freely made, that we are at least fifty years too late in entering upon these investigations for a complete knowledge of the matter, for there are no natives now living that have more than hear-say information on the subject, not a little of which proves conflicting if not contradictory . . . While these difficulties may delay the result of our study of the subject, there is nevertheless much material of deep interest attending the search and listing of the temples of these islands that warrants a record thereof for reference and preservation. (1906a:49-50)

Thrum and his associates compiled information on over 120 *heiau* on Kauaʻi. One must take into consideration that Thrum included data on *heiau* that had already been destroyed prior to his data collection efforts in the early 1900s. The results of his investigations relative to the current study area *ahupuaʻa* are reproduced in Table 1 below.

Table 1. *Heiau* and *heiau* sites recorded by Thrum (1906) closest to the current study area.

Name	*Location*	*Thrum's Remarks*
Kalauokamanu	Hanamāʻulu	A large walled *heiau* that stood above the present mill; destroyed about 1855. Of *poʻokanaka* class.
Ahukini	Kalapakī	A *heiau* of medium size; foundations only now remain
Pohakoelele	Kalapakī	A medium sized *heiau*; all destroyed.

Thrum reported the following about the classification of *heiau* in his entry called "Tales from the Temples" from the 1907 *Hawaiian Almanac and Annual*:

> Authorities seem to agree on at least four classes or grades of heiaus, viz.: Heiau me luakini, Heiau pookanaka, Heiau waihau, and Heiau unu, as mentioned by Kamakau, though as to their supremacy or severity there is a difference of opinion. (1906b: 50).

Regarding the *heiau* known as Kalauokamanu, Thrum assigned it to the *pookanaka* class; however, Thrum did not provide any further discussion of the class nor did he elaborate on the descriptions of the three *heiau* mentioned above.

The earliest formal archaeological survey of Kauaʻi was conducted by Wendell C. Bennett on behalf of the Bishop Museum between June of 1928 and June of 1929. Bennett's purpose was "to locate and describe the remains of all Hawaiian structures, to describe the artefacts of Kauai and to review the literature relating to Kauai" (Bennett 1930: 53). In his paper, *Kauai Archeology* presented to the Hawaiian Historical Society in 1930, Bennett (1930) noted that the population of Kauaʻi was distributed primarily along the coasts, river valleys, and inland as far as irrigable land would reach, while the mountains were only sparsely inhabited. Bennett remarked on the impressive engineering skill involved in the construction of complex irrigation and terrace networks, particularly the *Menehune* ditch, which "represent probably the most remarkable piece of work of its kind, not only in the Hawaiian Islands but in all Polynesia" (1930: 57).

Bennett refers to Thrum's 1906 list of 124 *heiau* on Kauaʻi as "a very complete list" and goes on to emphasize that Thrum included sacred places and small *heiau* in his list (1930:57). Bennett noted a lack of the "great massive forms [of *heiau*] so characteristic of the later Hawaiian epoch" and an abundance of smaller (less than fifty feet in size) *heiau* on Kauaʻi (1930:59). He also mentioned the difficulty in distinguishing these small ceremonial structures from house sites, due to their similarities in form, which consisted mainly of simple platforms or enclosures. Bennett recorded twenty "principal large heiau" on his survey of the island, three of which were listed as "destroyed" (1930:58-59). None of these *heiau* included those previously recorded by Thrum, discussed above. Bennett also included a discussion of distinctively Kauaʻi artifacts, namely block grinders and ring-form food rubbing stones/pounders. Other interesting and potentially relevant observations made from his literature review include the presence of polished stone knives, carved stone bowls, the utilization of dressed stone in ditch construction, and that women as well as men made *poi* on Kauaʻi.

During the decades that followed Bennett's initial survey of Kauaʻi, no archaeological studies of the Līhuʻe District were produced. However, beginning in the 1990s, lands within Hanamāʻulu Ahupuaʻa became the subject of some archaeological investigations related to the ongoing development of the area, particularly related to expansion of Līhuʻe Airport, the coastal area along Hanamāʻulu Bay, and in neighboring Kalapakī Ahupuaʻa. Previous studies (archaeological and cultural) conducted in the vicinity of the current study area are listed in Table 2 and shown on Figure 17, and are discussed in further detail below.

Table 2. Previous studies conducted in the vicinity of the current study area.

Year	*Author*	*Type of Study*	*Ahupuaʻa*
1988	Hammatt	Reconnaissance	Kalapakī
1990	Hammatt	AIS	Kalapakī
1990	McMahon	Field Inspection	Hanamāʻulu, Kalapakī, and Nāwiliwili
1990	Walker and Rosendahl	AIS	Hanamāʻulu
1991	Walker et al.	AIS	Hanamāʻulu, Kalapakī, Nāwiliwili Niumalu, and Wailua
1999	Creed et al.	AIS	Hanamāʻulu and Kalapakī
2001	PHRI	CIA	Hanamāʻulu
2002	Corbin	AIS	Hanamāʻulu
2005	Kanahele et al.	CIA	Hanamāʻulu and Kalapakī
2006	Bell et al.	AIS	Hanamāʻulu and Kalapakī
2008	Spearing et al.	CIA	Hanamāʻulu, Kalapakī, and Nāwiliwili
2008	Monahan and Hammatt	Field Inspection	Hanamāʻulu, Kalapakī, and Nāwiliwili

In 1988, Cultural Surveys Hawaiʻi, Inc. (CSH) conducted an archaeological reconnaissance (Hammatt 1988) of roughly 150 acres of coastal land between Līhuʻe Airport and Ninini Point for the proposed Kauaʻi Lagoons Resort, located to the southwest of the current study area (see Figure 17). As a result, five archaeological sites were recorded, including three Historic wall remnants, a midden scatter, and an oval terrace. Hammatt also reported that the area was heavily disturbed. In 1991, CSH conducted additional archaeological survey (Hammatt 1990) of a portion of the Kauaʻi Lagoon Resort lands (TMK: (4) 3-5-001:102). No cultural resources were encountered as a result of this subsequent study.

In 1989, PHRI conducted an archaeological inventory survey (AIS) of the roughly 66-acre Hanamāʻulu Affordable Housing project area (Walker and Rosendahl 1990), located to the northwest of the current study area between Hanamāʻulu Stream and Kūhiʻo Highway (see Figure 17). As a result of their variable coverage surface survey and limited subsurface testing, the only cultural material encountered were isolated coral fragments on the surface.

In 1990, SHPD conducted an archaeological field inspection of three land parcels (McMahon 1990) located to the west of the current study area (see Figure 17). As a result, three previously recorded historic residences were recorded (SIHP Sites 9390, 9401, and 9402). No additional cultural resources were identified.

In 1990, PHRI conducted an AIS of the roughly 1,500 acre Lihue/Puhi/Hanamaulu Master Plan project area (Walker et al. 1991). The western half of the current study area falls within the northeastern edge of one of their project area's discontinuous study units (see Figure 17). However, the current subject parcel was the subject of field inspection rather than inventory-level survey. As a result of their study, ten previously unrecorded archaeological sites, comprised of fourteen features, were identified. The majority of which were recorded to well outside of the current study area, to the north and west of Hanamāʻulu Bay. Functional feature types included the following: habitation, transportation, and burial. Seven of the ten identified sites were assessed as significant for information content; four of which were recommended for further data collection. Of these, three of the sites are of historic age and likely associated with Lihue Plantation and the remaining site is a Historic Japanese and Filipino cemetery.

In 1990, PHRI conducted an AIS of the roughly 460-acre Ocean Bay Plantation at Hanamāʻulu. The study area is located to the north of the current study area along Hanamāʻulu Bay (see Figure 17). The findings were compiled in a report, however the report was never submitted to SHPD for formal review. As a result, in 2001, PHRI returned to the original project area to relocate the previously recorded sites and generate and updated report (Corbin 2002). As a result of the original survey and revisit, ten sites (SIHP Sites 50-30-08-1838 thru 1841, 1843, 1845, 1846, and 2066-2068) comprised of four complexes and six single-feature sites, containing fourteen features were identified.

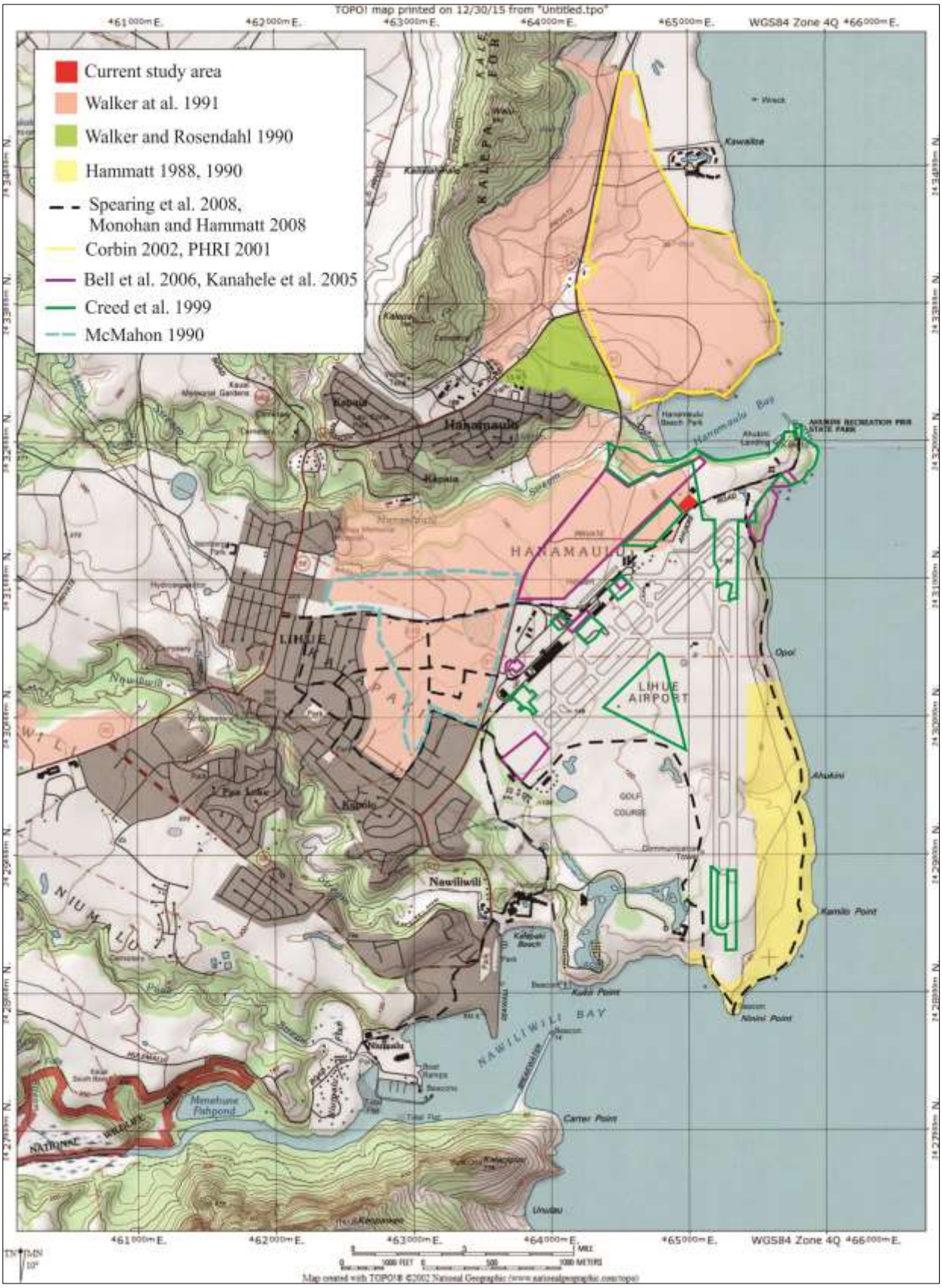

Figure 17. Map showing previous studies in the vicinity of the current study area.

Functional feature types included the following: habitation (cultural deposit, wall, and terrace), transportation (retaining wall, bridges, roads, concrete foundation), burial (a historic cemetery and one possible isolated burial), and a dump. A radiocarbon sample from SIHP Site 1838, a coastal habitation complex, yielded a date range A.D. 1170-1400 for the occupation of Feature A. The majority of the artifacts recovered were non-indigenous in origin and of recent age. Midden analysis revealed a prevalence of shallow water marine taxa at SIHP Site 1838. All ten sites were identified in areas that were either unaltered or only minimally impacted by Historic sugarcane cultivation. The Historic Period sites were likely associated with the sugarcane cultivation and transport or nearby Ahukini Landing.

In 2001, PHRI generated a cultural impact assessment (CIA) for a proposed golf course and residential development of the Ocean Bay Plantation at Hanamāʻulu (PHRI 2001). PHRI consulted with forty-one cultural informants. As a result, PHRI determined that ongoing local cultural practices were closely tied to marine exploitation of the shoreline and coastal waters and no traditional cultural properties were identified within their study area. Additionally, all proposed development would be concentrated in previously altered areas of former sugar cultivation.

In 1999, CSH conducted an AIS of several discontinuous parcels associated with development at Līhuʻe Airport (Creed et al. 1999; see Figure 17). As a result of their study, no prehistoric or historic cultural remains were identified within their study area. However, Creed et al. did document fifteen concrete slab foundations as part of previously recorded Ahukini Landing (SIHP Site 50-30-08-9000). The foundations were interpreted as the remains of residential structures and infrastructure related to Ahukini Camp.

In 2005, as part of an Environmental Impact Statement for improvements to Līhuʻe Airport Kanahele et al. (2005) prepared a CIA. As a result of consultation with twelve cultural informants, Kanahele et al. reported their informants' concerns regarding continued access to Ahukini landing for fishing and the increase in visitors to the island that would accompany improvements to the airport. They determined that the proposed improvements would not impact any cultural sites. Kanahele et al. recommended that access to Ahukini Landing and the nearby coastline be maintained and that measures be taken to ensure the coastal resources be kept clean and healthy.

In 2006, CSH conducted an AIS of roughly 175 acres of discontinuous lands associated with additional improvements to Līhuʻe Airport (Bell et al. 2006; see Figure 17). As a result of their study, a historic complex of concrete enclosures and foundation remnants (SIHP Site 50-30-08-3958) was identified along the sea coast to the east of the current study area. Site 3958 was interpreted as a plantation-era pig farm and no further work was the recommended treatment.

In 2008, CSH conducted a field inspection and subsequent CIA for roughly 8 miles of bicycle and pedestrian trail routes between Nāwilwili, Ahukini Landing, and Līhuʻe Civic Center (see Figure 17), and reported their findings along with an archaeological literature review (Monahan and Hammatt 2008). A portion of the proposed alignment passes the current study area along Ahukini Road. The majority of the proposed alignments follow extant paved or unimproved roads. As a result of their field inspection seven previously recorded properties, located along the coast were identified. Of these seven only two are located somewhat close to the current study area, the aforementioned historic pig farm (SIHP Site 3958) and Ahukini Landing (SIHP Site 50-30-08-9000). The CIA (Spearing et al. 2008) consisted of brief informal interviews with seventeen cultural informants. As a result of their consultations, CSH reported the following concerns of their informants: the potential discovery of human remains within the proposed project area, potential restriction of access to shoreline areas for fishing, the need to protect historic and cultural properties, and the eventual displacement of Native Hawaiians from Hawaiian Homelands if the proposed project expands in the future. CSH recommended that ongoing cultural practices be recognized and accommodated and that community members be consulted throughout the development process.

3. STUDY AREA EXPECTATIONS

Based on an analysis of historical background information coupled with a review of historic maps, previous archaeological and cultural studies conducted in the vicinity of the current study area, the archaeological expectations for the current study area are meager at best. The extensive Historic Period agriculture activities associated with sugarcane cultivation likely destroyed any Precontact cultural remains that may have been present in the immediate project area, and the modern development of the existing refuse transfer station and recycling facility likely destroyed any evidence of Historic Period land use. Although highly unlikely, the remote possibility does remain that scant remnants of either Precontact or Historic Period sites might remain along the margins of the project area, which as can be seen in Figure 18 is a totally developed landscape.

Figure 18. 2003 satelite imagery showing current developed state of the study area (outlined in red).

4. ARCHAEOLOGICAL FIELDWORK AND CONSULTATION

Archaeological fieldwork for the current study was conducted on November 20, 2015 by Teresa Gotay, M. A. and Robert Rechtman, Ph. D. The surface of the entire study area was inspected by fieldworkers walking meandering transects spaced at five meter intervals parallel to the parcels' boundaries. Ground surface visibility was excellent, and it was quite apparent that the entire study area had been subject to prior significant ground-disturbing activity associated with the development of the existing refuse transfer station and recycling facilities. As a result of the field survey, there were no archaeological features observed on the surface and given the highly disturbed nature of the study area, there is virtually no likelihood of encountering subsurface remains.

As a result of three prior cultural impacts assessments (Kanahele et al. 2005; PHRI 2001; Spearing et al. 2008) conducted for projects in the general vicinity of the current study area, twenty-six interviews were conducted and a wealth of traditional knowledge was shared about the Hanamāʻulu (and Ahukini) and Kalapikī areas. All of the previous interviews were reviewed The primary cultural concerns raised in all of the interviews revolved around maintaining free and clear access to the shoreline, where a variety of traditional cultural practices have occurred and continue to take place. This issue was aptly summarized by two native Hawaiian practitioners interviewed in the Kanahele et al. (2005) study:

> John Pia
>
> Mr. Pia was born and raised in the ahupuaʻa of Hanamaʻulu. His maternal side of the family descends from the project area location. His family always utilized the natural and cultural resources of the Hanamaʻulu arae as well as that of the ʻAhukini coastal shoreline for subsistence purposes. Mr Pia commented that the various fresh water springs located near Hanamaʻulu stream where they continue to plan taro for family use only. Heʻe, ʻopihi, limu, reef and deep sea fish provide food for their table . . . He was discontented with the issue about the lack of access to the area where he and his family have fished and gathered many, many generations. Mostly as a result to the closure of roads and right-of-ways imposed by land owners . . . ʻaccess is the most important concern to me. We must be able to continue our customary practices.' (Kanahele et al. 2005:26)
>
> Mr. Alexander Kelekoma
>
> Mr Kelekoma was born and raised in the ahupuaʻa of Hanamaʻulu, located north of the project area. He is the son of the late Franklin manu Kelekoma, the last person who was given the konohiki fishing rights to Hanamāʻulu. Fishing practices have always been part of their family lifestyle since they were children . . . he shared that the most devastating impact would be caused by restricting or limiting access to the resources along the coastline and in the ocean . . . He felt that continued convenient access was extremely important. ʻAhukini Landing is a fishing area for diving and pole fishing. Pole fishing is enjoyed mostly by kupuna, although others of younger generations frequent the area too. (Kanahele et al. 2005:25-26)

As part of the current study, Randy Wichman, a Kauaʻi cultural historian and cultural practitioner was informally consulted in person by the primary author on December 10, 2015. The proposed County of Kauaʻi MRF project was described to him and its location specified. Mr. Wichman explained that he was familiar with the specific project area and that he was unaware of any cultural properties or practices associated with it. He did suggest that as Ahukini Road is used to access the shorelines of Hanamāʻulu and Kalapakī and that the project should take care to not impact access along that road.

Additionally, the Office of Hawaiian Affairs has been provided with a copy of this document for their review and comment.

5. CONCLUSION AND DISCUSSION OF POTENTIAL CULTURAL IMPACTS

As the current study area is an already completely altered landscape and there are no historic properties present, it is the conclusion of the current study that no further historic preservation work need be conducted with respect to the development of the County of Kauaʻi MRF; however, in the highly unlikely event that any unanticipated archaeological resources are unearthed during development activities, in compliance with HAR 13§13-280, work in the immediate vicinity of the finds should be halted and DLNR-SHPD contacted.

With respect to assessing cultural impacts, as stated in the OEQC guidelines, oral interviews should be conducted to identify potential cultural resources, practices, and beliefs associated with an affected project area. To that end, and given the nature of the current proposed County of Kauaʻi MRF development project (redevelopment of an existing spatially and functionally similar facility and property), several previously conducted oral interviews were reviewed and one new interview was conducted.

The OEQC guidelines also identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are natural features of the landscape and historic sites, including traditional cultural properties. A working definition of traditional cultural property is:

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them. It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties.

A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Paʻakai O Kaʻāina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

As a result of the archaeological study of the current project area there were no historic properties identified; likewise, there were no traditional cultural places and associated practices identified within the current project area. As documented in prior consultations for the general study area, the cultural concerns for the Hanamāʻulu/Ahukini area revolved around maintaining access to the shoreline where a variety traditional cultural practice have taken place and are still ongoing. As there are no traditional cultural places and associated practices identified within the current project area and there is nothing in the current proposed project that will impact access to the shoreline, it is our conclusion that the development of the proposed County of Kauaʻi Materials Recovery Facility will have no impact on any traditional cultural resources or related practices.

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