DEPARTMENT OF PLANNING AND PERMITTING
KA ʻOIHANA HOʻOLĀLĀ A ME NĀ PALAPALA ʻAE
CITY AND COUNTY OF HONOLULU

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August 30, 2023

2023/ED-10 (LM)

Ms. Mary Alice Evans
State of Hawaiʻi
Office of Planning and Sustainable Development
Environmental Review Program
235 South Beretania Street, Room 702
Honolulu, Hawaiʻi 96813

Dear Ms. Evans:

SUBJECT:	Chapter 343, Hawaiʻi Revised Statutes Draft Environmental Assessment (DEA)
Project:	Waialua Mill Camp Restoration
Applicant:	Hawaii Assisted Housing, Inc.
Agent:	North Shore Community Consultants, LLC (David Robichaux)
Location:	Waialua
Tax Map Key(s):	6-7-001: 030, 058, 076, and 077

With this letter, the Department of Planning and Permitting hereby transmits the DEA and Anticipated Finding of No Significant Impact for the Waialua Mill Camp Restoration at the above-referenced site in the Waialua District on the Island of Oʻahu, for publication in the September 8, 2023, edition of *The Environmental Notice*.

We have uploaded an electronic copy of this letter, the publication form, and the DEA to your online submittal site.

Should you have any questions, please contact Laura Mo, of our Urban Design Branch, at (808) 768-8025 or via email at laura.mo@honolulu.gov.

Very truly yours,

for Dawn Takeuchi Apuna
Director

From:	webmaster@hawaii.gov
To:	DBEDT OPSD Environmental Review Program
Subject:	New online submission for The Environmental Notice
Date:	Thursday, August 31, 2023 12:54:42 PM

Action Name

Waialua Mill Camp Restoration

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds
- (6) Propose any amendments to existing county general plans where the amendment would result in designations other than agriculture, conservation, or preservation
- (9)(A) Propose any wastewater treatment unit, except an individual wastewater system or a wastewater treatment unit serving fewer than fifty single-family dwellings or the equivalent

Judicial district

Waialua, Oʻahu

Tax Map Key(s) (TMK(s))

(1) 6-7-001: 030; 058; 076; and 077

Action type

Applicant

Other required permits and approvals

Building permit, grading permit, Urban Growth Boundary Amendment, 201H, State Land-Use Commission District Boundary Amendment, NPDES Construction Stormwater Permit

Discretionary consent required

201H, State Land-Use Commission District Boundary Amendment

Approving agency

Department of Planning and Permitting

Agency contact name

Laura Mo

Agency contact email (for info about the action)

laura.mo@honolulu.gov

Email address or URL for receiving comments

laura.mo@honolulu.gov

Agency contact phone

(808) 768-8025

Agency address

650 South King Street
7th Floor
Honolulu, Hawaiʻi 96813
United States
Map It

Applicant

Hawaii Assisted Housing, Inc.

Applicant contact name

Carl Cunningham

Applicant contact email

robichaud001@hawaii.rr.com

Applicant contact phone

(808) 735-9099

Applicant address

3165 Waialae Avenue
Suite 200
Honolulu, Hawaiʻi 96816
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

North Shore Community Consultants, LLC

Consultant contact name

David Robichaux

Consultant contact email

robichaud001@hawaii.rr.com

Consultant contact phone

(808) 368-5352

Consultant address

66-031 Mahaulu Lane
Haleʻiwa, Hawaiʻi 96712
United States
Map It

Action summary

Hawaii Assisted Housing, Inc. acquired the Waialua Mill Camp with the objective of restoring the Camp to its original size and function for providing affordable housing to residents of the North Shore while maintaining the promise to provide housing for life for the retirees of Waialua Sugar Company currently living in the Camp. Housing restoration is proposed in four phases. Phase I will include Kupuna/Americans with Disabilities Act compliant housing for retirees and other residents, and multi-family housing to relocate existing tenants during reconstruction of the main Camp. Phase II will be single-family homes in the plantation style. Phase III will be similar to Phase II and may become a Hawaiian Home Lands Community. Phase IV will be restoration or sale of the existing homes along Goodale Avenue. Associated infrastructure improvements will include upgrades to roads, water, wastewater, and power. The area has been used for workforce housing for more than 100 years.

Reasons supporting determination

See section 6.1 of DEA.

Attached documents (signed agency letter & EA/EIS)

- DEA-complete-08282023.pdf

Action location map

- KML.zip

Authorized individual

Laura Mo

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Draft Environmental Assessment
Restoration of Waialua Mill Camp Affordable Housing
Waialua, Oahu, Hawaii

Prepared for
The City and County of Honolulu
Department of Planning and Permitting
650 S. King Street 7th Floor
Honolulu, HI 96712

August 30, 2023

Draft Environmental Assessment
Restoration of Waialua Mill Camp
Affordable Housing
Waialua, Oahu, Hawaii

Approving Agency

Land Use Permits Division
City and County of Honolulu
Department of Planning & Permitting
650 S. King Street
Honolulu, HI 96813

Applicant

HAWAII ASSISTED HOUSING, INC.

August 30, 2023

PROJECT SUMMARY

This Draft Environmental Assessment (EA) has been prepared in accordance with Chapter 343, Hawaii Revised Statutes (HRS), to support restoration of the former plantation camp originally built for employees of the Waialua Sugar Company and their families. The Waialua Sugar Mill Plantation Camp (Mill Camp) originally contained up to 350 single family houses but beginning in the 1970s the number of houses in the Camp was be reduced as employees moved away or were transferred. In the 25 years following the closure of the Waialua Sugar Company, Mill Camp was supported by Dole Foods and further reduced to 67 as former employees disappeared. The Mill Camp Development Group, LLC (MCDG) acquired the property from Dole with the promise to uphold the commitment of housing for life to those employees of Waialua Sugar Company (WSC) who had retired prior to its closing in 1997. Hawaii Assisted Housing Inc. (HAHI) has purchased the area with the objective of restoring Mill Camp to its original size and function while maintaining the promise to the retirees.

Construction of housing and infrastructure will occur primarily on TMK# 6-7-001:077, which is the historical location of the Waialua Mill Camp. Since the closure of WSC in 1997, Mill Camp has suffered deferred maintenance and is now in poor condition. Most of the remaining houses span several of the original lots and in many cases the original house is difficult to identify.

Approximately 20 of the houses are occupied by WSC retirees. Restoration of the camp will begin in an area where camp houses have been removed with the construction of ADA-compliant housing designed for the retirees and other older residents and those with disabilities. At the same time, 68 apartments will be constructed in eight low-rise plantation-style structures. The multi-family buildings will be used to relocate existing residents during the restoration of the existing core areas of Mill Camp. Phase II will include complete replacement of existing housing with 163 single story plantation-style homes reminiscent of the original Mill Camp appearance.

Public funding from the Department of Community Services has been received to develop the property for affordable rentals for households earning less than 60% of the Area Median Income (AMI). The use of this public funding requires that the period of affordability shall not be less than 60 years. In response to demand from the community, some units may be sold through rent-to-own or other mechanisms. Phase III of development will occur in the southern portion of the parcel, which is not sold to HAHI or currently subject to the AHF restrictions. Phase III will consist of approximately 99 single family homes that could either be affordable sales or affordable rentals. MCDG has had discussions with the Hawaii Department of Hawaiian Home Lands for sale of Phase III. If this opportunity is successful, Phase III would be developed by MCDG for sale to persons on the DHHL waitlist. There are 144 families on the wait list who now live in Waialua, Haleiwa, or Kahuku.

The majority of land within the historical footprint of Mill Camp is zoned Ag-2, and is in the State Agriculture District. HAHI and MCDG intend to apply for a permit to allow housing on this property through the HRS 201H statute that is set aside specifically for affordable housing. The 201H permit would allow for affordable rentals or affordable sales, although the sales would come with restrictions on resale.

The Mill Camp parcel includes 12 homes and another five vacant lots near Goodale Avenue. These are located in the State Urban District and are zoned R-5. Following a subdivision or CPR and minor modifications, this area may be offered for sale to the existing residents.

Restoration of Mill Camp will require new water and wastewater infrastructure, road repairs, and power upgrades. One or more package wastewater treatment plants will be constructed to produce R-1 quality wastewater for recycling in landscape or agricultural irrigation.

The proponent's objective in restoring Mill Camp is to provide respectable housing at an affordable price to the current residents of Mill Camp and to others in the immediate area who are currently living in substandard and overcrowded conditions. Priority will be given to existing Mill Camp residents and long-term families in Waialua and Haleiwa.

Three other parcels were included in the acquisition of Mill Camp:

1. TMK # 6-7-001:030 (1.2 ac.) Formerly church grounds fronting Puuiki Street, this parcel may be incorporated into the Phase II housing plan.
2. TMK# 6-7-001:058: (1 ac.) This parcel consists of Puuiki Street between Farrington Highway and the Waialua Hongwanji Mission. It will be reopened and widened at the appropriate time and used for access.
3. TMK# 6-7-001:076 (12.4 ac), This parcel is located on Goodale Avenue across from District Park. Portions of this parcel will be used for the new Waialua Fire Station and Emergency Response Center.

The proposed restoration of Mill Camp triggers the Hawaii Environmental Protection Act (HRS 343) requirements due to the use of public land and funding, construction of wastewater treatment works, and anticipated application for a permit under HRS Chapter 201H for certain exemptions allowed to affordable housing. Other major permits required will include a boundary amendment for the first phase of development that is currently outside of the designated Urban Growth Boundary (UGB). The proposal is consistent with the general plan and North Shore functional plans with the exception of the area of development outside the UGB. A request for boundary amendment was submitted to the City and County of Honolulu in November 2021, and supported by the North Shore Neighborhood Board. Eighteen years ago the Waialua Town Plan called for actions that are almost identical to those proposed herein:

> <u>Long term (20 years or more</u>) *encourage development of rural residential communities – with a housing density ranging from four to eight units per acre – on lands both north and south of the industrial-zoned area, including the current Old Mill Camp.*

The proposed action will result in increased traffic at the Thompson's Corner intersection of Farrington Highway and Kaukonahua Road, and the Waialua traffic circle intersection of Farrington Highway and Goodale Avenue. The actual increase in traffic will be reduced if the developers are successful in placing existing residents of the North Shore in Mill Camp.

Following a review by agencies and interested parties, the proponent and approving agency anticipate reaching a Finding of No Significant Impacts (FONSI).

Name:	**Restoration of Waialua Mill Camp Affordable Housing**
Location:	Waialua, Oahu, Hawaii
Judicial District:	Waialua
Applicant and: **Recorded Fee Owner**	Hawaii Assisted Housing Inc. 3165 Waialae Avenue Suite 200 Honolulu, Hawaii 96816
Approving Agency:	Dept. Of Planning and Permitting City and County of Honolulu Land Use Permitting Division 650 S. King Street 7th Floor Honolulu HI 96823
Agent:	North Shore Community Consultants, LLC 66-031 Mahaulu Lane. Haleiwa, HI 96712 Attn: David Robichaux (808) 368-5352
Tax Map Key:	TMK (1) 6-7-001:077, 6-7-001:076, 6-7-001:030, 6-7-001:058
Land Area:	83 acres
Existing Use:	Residential, vacant, agriculture
Proposed Use:	Residential
Land Use Designations:	State Land Use: Agriculture District County Zoning: Ag-2 Agriculture Special Management Area (SMA): Not within the SMA Sustainable Communities Plan: Rural Residential 80% Agriculture 20%
Major Approvals Required:	Approval of exemptions under HRS 201-H Authorization to construct wastewater treatment works Amendment to the North Shore Urban Growth Boundary State Land Use Commission Boundary Amendment building permits

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1.0 PROJECT LOCATION, PURPOSE AND NEED

1.1 Project Location and Project Scope

The Waialua Mill Camp (Mill Camp) is located near the North Shore of Oahu in the town of Waialua. The setting is the northern coastal plain at the foot of Mount Ka`ala, Oahu's tallest peak (Figure 1-1). Mill Camp is ½ mile from the Pacific Ocean at its closest point. The housing and infrastructure supporting Mill Camp is contained within tax map key number (TMK#) (1) 6-7-001:077 which covers 70.4 acres (Figure 1- 2). Dole Foods Hawaii recently subdivided this parcel from its original configuration to isolate portions that are still subject to environmental remediation. Mill Camp started around 1917 on the western side of the Waialua Sugar Mill to provide workforce housing to the Waialua Sugar Company Mill workers. Waialua Sugar was the major employer in the area from the early 1900s until 1997, and provided very low-cost housing to its employees and their families. Mill Camp gradually grew to cover both the south and west sides of the Mill and its population peaked by the 1950s with more than 300 houses and 1,000 residents.

Mill Camp Development Group, LLC acquired Mill Camp and its associated land and assets in February 2022 with the intention of restoring the housing to its original structure and function for affordable housing. The purchase included five parcels of land and an offsite water source. The scope of this Environmental Assessment includes the proposed future uses for all four of these parcels identified below, and the off-site water system.

- TMK# 6-7-001:077 (70.4 ac) will be used for affordable housing and municipal infrastructure.
- TMK # 6-7-001:030 (1.2 ac.) vacant and will be utilized for affordable housing in Phase II
- TMK# 6-7-001:058: (1 ac.) The roadway parcel of Puuiki Street, which will be used for access.
- TMK# 6-7-001:076 (12.4 ac) is the proposed fire station and other support for affordable housing

Mill Camp surrounds the Waialua Hongwanji Mission, which is located on a separate parcel (TMK #6-7-001:060), which has a dedicated access easement. The Hongwanji Mission obtained a special use permit in 2002 from the City for use of agricultural lands for non-agricultural purposes. The findings of fact reference its historical value and the lack of previous agriculture on the property in justification for granting the permit.

Mill Camp Development Group and Savio Waialua Farmlands, LLC will trade easements. Mill Camp will receive an easement for 3.5 acres that have historically been used for wastewater disposal and the Waialua Farmlands owners will receive access easements to farm plots located to the north and west of Mill Camp.

All four acquired parcels are located within the City and County of Honolulu Agriculture Zone with the exception of approximately 5 acres in Parcel 77 fronting Goodale Avenue which is classified as residential (R-5) and small slivers of land near the boundaries Ag-1 and I-2. Parcels 77, 30, and 58 are in the State Agriculture District with the exception of the same 5 acres zoned R-5 in Parcel 77. Parcel 76 is in the State Urban district.

Figure 1-1: Site location within the town of Waialua, Waialua District, North Shore of Oahu.

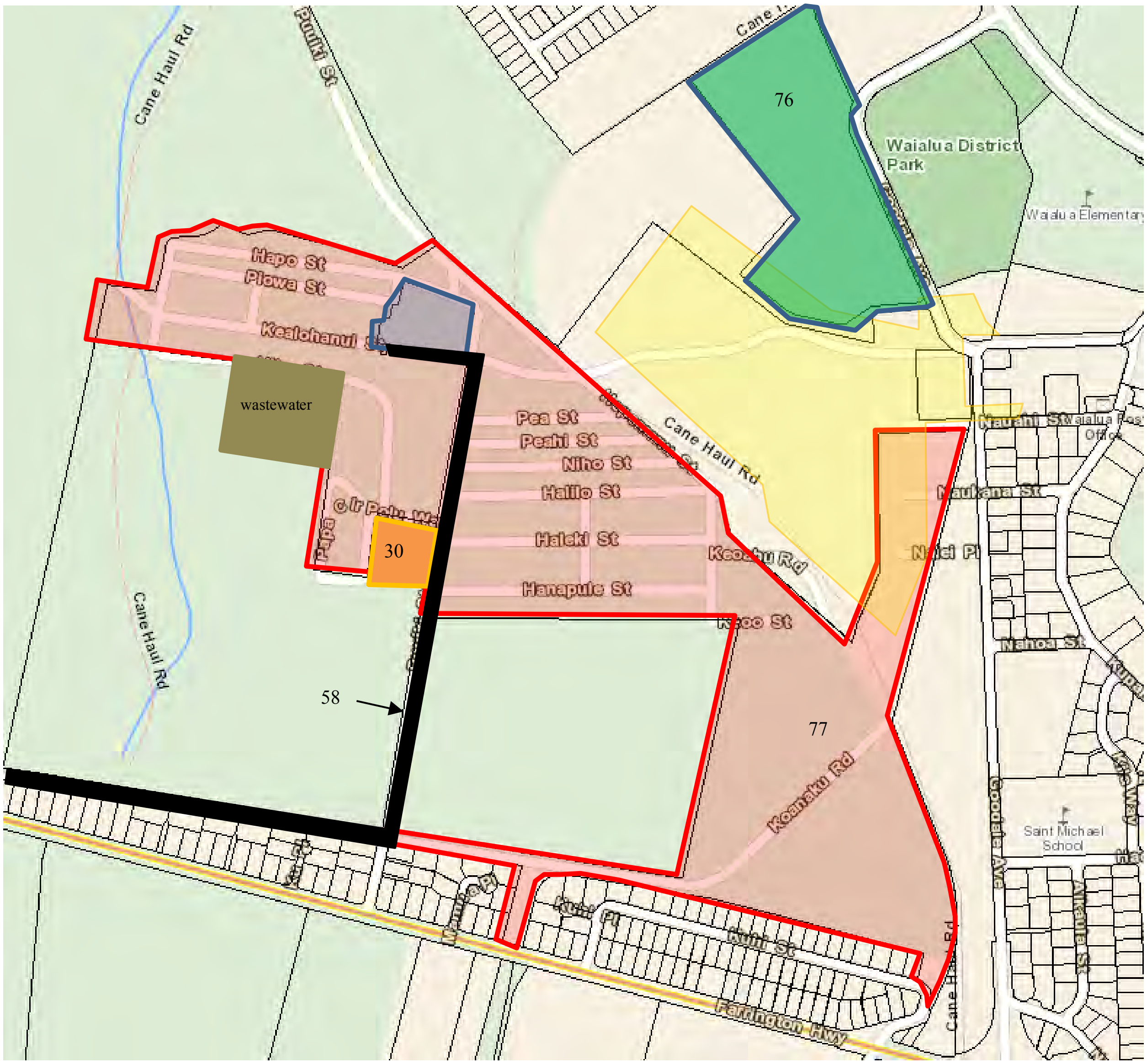

Figure 1-2: Parcels proposed for restoration within the scope of this assessment.

Red:	*6-7-001:077 (housing)*
Green:	*6-7-001:076 (support)*
Orange:	*6-7-001:030 (housing)*
Black:	*6-7-001:058 (access)*
Brown:	*easement for stormwater disposal and wastewater treatment*

The blue area shown above is the existing Waialua Hongwanji Mission, which is surrounded, but not part of the proposed project. The yellow shape is industrial-zoned lands that were the former Waialua Sugar Mill. The Mill site is an active industrial area and not included in the proposed project.

1.2 Need for HRS 343 Environmental Assessment

The Hawaii Environmental Protection Act (HEPA) which is enacted as Hawaii revised Statutes (HRS) Chapter 343 requires public disclosure and environmental assessment for any proposed program or project that proposes one or more land uses or administrative acts that are identified in the Statute. The purpose of this chapter to establish a system of environmental review which will ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations.

The programs and projects that require compliance with HRS 343-5 include:

(1) Propose the use of State or County lands or the use of State or County funds, other than funds to be used for feasibility or planning studies for possible future programs or projects that the agency has not approved, adopted, or funded, or funds to be used for the acquisition of unimproved real property, provided that the agency shall consider environmental factors and available alternatives in its feasibility or planning studies.

(2) Propose any use within any land classified as a conservation district by the State Land Use Commission under Chapter 205.

(3) Propose any use within a shoreline area as defined in Section 205A-41.

(4) Propose any use within any historic site as designated in the National Register or Hawaii Register, as provided for in the Historic Preservation Act of 1966, Public Law 89-665, or Chapter 6E; - 4 – Hawaii Revised Statutes Chapter 343.

(5) Propose any use within the Waikiki area of Oahu, the boundaries of which are delineated in the land use ordinance as amended, establishing the "Waikiki Special District".

(6) Propose any amendments to existing County General Plans where the amendment would result in designations other than agriculture, conservation, or preservation, except actions proposing any new County General Plans or amendments to any existing County General Plan initiated by a county.

(7) Propose any reclassification of any land classified as a conservation district by the State Land Use Commission under Chapter 205.

(8) Propose the construction of new or the expansion or modification of existing helicopter facilities within the State, that by way of their activities, may affect:

- *(A) Any land classified as a conservation district by the State Land Use Commission under Chapter 205.*
- *((B) A shoreline area as defined in Section 205A-41; or*
- *(C) Any historic site as designated in the National Register or Hawaii Register, as provided for in the Historic Preservation Act of 1966, Public Law 89-665, or Chapter 6E; or until the statewide historic places inventory is completed, any historic site that*

is found by a field reconnaissance and is under consideration for placement on the National Register or the Hawaii. Register of Historic Places; and

(9) Propose any:

(A) Wastewater treatment unit, except an individual wastewater system or a wastewater treatment unit serving fewer than fifty single-family dwellings or the equivalent,
(B) Waste-to-energy facility,
(C) Landfill,
(D) Oil refinery, or
(E) Power-generating facility.

1.2.1 Triggers for HEPA

Proposed renovations to the Waialua Mill Camp will be partially funded using public funding including those from the City and County of Honolulu, State of Hawaii and the United States of America (HRS 343-5 (1)). The use of public funding requires public disclosure through HEPA.

The potable water system will be renovated using public funding and a small portion of the water transmission line will pass through State land (HRS 343-5 (1)).

Much of the development will utilize public funding (HRS 343-5 (1)).

Mill Camp will be constructed on land withing the state Agriculture District and County Agricultural Zone (Ag-2). Several mechanisms are available to authorize residential use of agriculture land, but the most appropriate is the permit authorized in HRS 201H for affordable housing. HRS 201H allows exemptions from certain sections of the Land Use Ordinance including certain fees and taxes that are considered public funding. The 201H permit requires public disclosure under HEPA (HRS 343-5 (1)).

Mill Camp is currently operating with wastewater facilities that are adequate for the existing housing units but would not support an expansion. One or more wastewater treatment facilities will be needed for the proposed restoration of housing on the site. Construction of a wastewater treatment plant requires HEPA compliance (HRS 343-5 (9a)).

Each of these three triggers will be discussed separately in the description of the proposed action (Section 2).

A portion of the traditional housing area is now located outside of the urban growth boundary (UGB) described in the North Shore Sustainable Communities Plan. A request for amendment to the UGB has been submitted and is under review for inclusion in the 2020 North Shore Sustainable Communities Plan. Section 343-5(6) requires environmental discloser to support an amendment to the County General Plan; however, urban growth boundaries are topics for the County Functional Plans, not the County General Plan.

1.3 Site History

Waialua Sugar Company was started by the Halstead Brothers who sold the sugarcane plantation to Castle and Cooke in 1898. Castle and Cooke built the Sugar Mill and Mill Camp in its current location and configuration. The exact date is not known but likely to have been within the first few years of the 20th century. Its first crop harvested in 1899. Between 1900 and 1906, four surface water collection systems were constructed, giving the Waialua sugar plantation the largest water storage capacity in the state of Hawaii. As a result of these efforts, sugar production increased from less than 5000 tons in 1900 to 20,000 tons in 1905. Throughout much of the 20th century, Waialua Sugar would be a major contributor to the state's economy through sales of sugar and electricity. By 1991, the Mill was producing eight percent of sugar in Hawaii. The Waialua Sugar Mill closed in October 1996 due to profit concerns. Following its closure, the island of Oahu had no major sugar production for the first time in more than 150 years.

Large agricultural companies throughout the world grappled with the problem of finding and keeping farm laborers for their operations. The plantations in Hawaii and elsewhere found that providing low-cost housing created a cost-effective benefit for attracting and keeping good employees. Rent for the houses was mostly included in wages, but tenants paid a nominal amount for monthly rent. Leaving the job also meant leaving your residence. The low turnover of employees resulted in a stable, highly trained workforce for Waialua Sugar Company, who were safer and more productive than any others. Those same workers were much more likely to start families and need bank accounts, second jobs, and schoolbooks. These employees and their service providers created the towns of Waialua and Haleiwa. The residents of Mill Camp and the other plantation camps created the unique character of the North Shore of Oahu that we enjoy today.

The Mill Camp Development Group purchased Mill Camp from Dole Foods Hawaii in February 2022. The lands include 83 acres across Tax Map Key # (1) 6-7-001:077, (1) 6-7-001:076, (1) 6-7-001:030, and (1) 6-7-001:058. The Mill itself is on a separate adjacent parcel TMK # 6-7-001:062; consisting of 25 acres of industrial zoned land that is not part of this restoration project (Figure 1-4). Two other small parcels are included in the proposed restoration. Parcel TMK# 6-7-001:030 is a 2-acre square lot on the south side of Mill Camp that was formerly used for the Waialua Pilgrim Church and is currently vacant. The third parcel is TMK# 6-7-001:058, a 40-foot easement which is the section of Puuiki Street that connects Mill Camp to Farrington Highway.

The Mill Camp parcels were subdivided in 2021 by Dole as part of its efforts to isolate the housing areas from a portion of land identified for remediation under the State of Hawaii Voluntary Response Program. At its peak, Mill Camp contained 350 single family homes, but through decay and some demolition it is currently down to 67 units. Mill Camp was built prior to City zoning standards. The 67 residential units remaining in Mill Camp date back to the early 1940's and were never intended for such a long service life. The Waialua Mill Camp was established as workforce housing for laborers of the Waialua Sugar Mill. During the 1950s and 1960's, it provided workforce housing for over 1,000 residents. During the peak of sugar production, Mill Camp was at the heart of the Waialua District. The decline of sugar beginning in the 1970's also marked the decline of the economic base for the Waialua District. By 1996, Waialua Sugar Company had shut down its operations and the land reverted to Dole Food

Company. While nearby Haleiwa was able to utilize its beaches to convert its economic engine to tourism, Waialua has remained an agricultural community that is still significantly impacted by the closure of its plantation. Since 1996, Dole honored a commitment to provide lifetime housing for the retirees of Waialua Sugar Company. Dole operated and maintained the homes for over 25 years despite the costs. Of the original 1000+ employees and family members there are 22 who retired prior to the sugar mill closure in 1997. Most of the remaining tenants are former employees of Waialua Sugar or their descendants. HAHI will continue to honor Dole's commitment of lifetime housing to retirees and provide them the option to move out of their current non-conforming structures and into a new and safe affordable rental, built to today's building codes.

Aerial Photographs from 1951 show Mill Camp to have 350 single family homes. At that time the camp was being expanded (Figure 1-5). Following that there is a 30-year gap in aerial coverage from readily available sources. Over that period, automation in the sugar mill reduced the demand for labor, and by the 1980s it was clear that American sugar was more expensive than sugar produced in the Caribbean, South America, and Asia. Beginning in the late 1970s, sugar production began to decline throughout the State of Hawaii. By 1993 the north-eastern portion of the Camp has been abandoned, and there are numerous vacant lots within the main camp area, reflecting the reduction in work force leading up to the closure of Waialua Sugar Company (Figure 1-6). Even before Waialua Sugar closed its doors in 1996, Castle and Cooke began demolition of housing that was not occupied by employees or their immediate family. The Camp has seen more vacant lots and advancing disrepair since that time (Figure 1-7).

Figure 1-3: A 1951 aerial photograph of Mill Camp with more than 350 single family homes. Note housing in the lower left is recently completed as evidenced by the lack of trees.

Figure 1-4: Project site in 1993. Note that the northwestern portion of Mill Camp has been demolished and used for coral mining to improve farm roads.

Figure 1-5: 2018 aerial photograph of the Mill Camp and Mill site (Google Earth). 67 occupied houses remain. Many of the mill buildings have also been removed.

1.4 Surrounding Uses

The City and County of Honolulu' zoning designation is Ag-2 for all of the lots resulting from its subdivision, with the exception of approximately 5 acres in Parcel 77 along Goodale Avenue which are designated R-5.

The State of Hawaii designates the majority of Mill Camp as within the Agriculture District, with the exception of the same 10 acres along Goodale Avenue. The 12.84 acres of Parcel 76 are within the Urban District. Parcel 77 contains 67 houses at this time, down from its peak of more than 300 in the 1960s and 1970s. Parcel 77 contains 70.41 acres and is primarily used for housing, with approximately 5 acres that are occupied by agricultural tenants. Table 1 shows the land use characteristics of properties surrounding parcel 77.

Table 1-1: Surrounding land use characteristics.

Direction	Parcel	Size (ac)	Zoning	District	Current land Use
Northeast	6-7-001:062	25	I-2	U	Light industrial and commercial tenants
Southeast	6-7-001:013	10	Ag-1, R-5	U	Active farm land and housing
West, North	6-7-001:023	211	Ag-2	A	Active farm land
South	6-7-001:037	24	Ag-1	A	Active farm land
South	50+ parcels	0.115	R-5	U	Residential subdivision

The town of Waialua was built around its sugar mill. Beginning in 1913 a significant portion of housing associated with Waialua was within the Mill Camp footprint. Mill Camp contained most of the houses in Waialua between the 1930s and 1950s. Municipal service centers including a bank (closed), post office, shopping center, district park, and schools from K-12 are all located within walking distance to Mill Camp because this was the population center of Waialua in mid-century. The newly constructed bandstand functions as the town square at the entrance to the Mill and Mill Camp. The primary intersection in Waialua is between Kealohanui Street and Goodale Avenue. Almost thirty years following the closure of Waialua Sugar Company, traffic along Goodale Avenue is still required to stop while cars leaving the Sugar Mill and Mill Camp on Kealohanui have no stop sign. Although Mill Camp is relatively well hidden, it is quite close to the center of commercial, industrial, and recreational assets of Waialua.

The former Waialua Sugar Mill is currently owned by Watumull Properties Corporation (WPC). The Mill site is the only property near the North Shore that is zoned for industrial land use. It now hosts a more than 30 small businesses including surfboard makers, boat builders, automobile, boat and jet ski repair shops, welders and dock builders, other craftsmen and agribusinesses. The main access point to Mill Camp is via Kealohanui Street, an easement through the Mill Site. The number of tenants now working at the mill is unknown but following its restoration, Mill Camp will help provide respectable housing suitable for employees in the adjacent Mill Site.

The Waialua Hongwanji Mission is surrounded by Mill Camp but is located on a separate parcel and not part of the proposed restoration. The Hongwanji Mission is active. HAHI and its development partners recognize its significance and will cooperate with the congregation leaders in improvements to access, parking, and services.

Mill Camp Development Group is currently proceeding with negotiations to swap land in Lot 3 with the City and County of Honolulu for an equally valued parcel at the intersection of Waialua Beach Road and Goodale Avenue. Upon successful conclusion of these negotiations, a 2.5 acre portion of Lot 3 will be the site of the new Waialua Fire Station and Community Safety Hub. The new Fire Department location on Lot 3 will provide positive impacts to Mill Camp by reducing emergency response times to Mill Camp and its neighbors, and provide additional space for training and emergency response equipment.

The parcel containing Mill Camp is irregularly shaped and convoluted. It has boundaries with active agriculture land on the north, south and west, residential land uses also on the south, industrial land uses on the east, and preservation/park land on the northeast. Other residential neighborhoods are found along Farrington Highway in the vicinity of Waialua Intermediate and Highschool and on the southern side of Goodale Avenue. The Hawaii Public Housing Authority's Kupuna Hale O Waialua, located along Goodale Avenue, provides low-income rental homes for elderly residents. Additional community landmarks include St. Michael's Catholic Church and School along Goodale Avenue and the Waialua District Park along Waialua Beach Road.

Savio Waialua Farmlands LLC has purchased several hundred acres bordering the project site to provide small agricultural plots for members of the Waialua Farmers' Cooperative. The land is zoned restricted agriculture (Ag-1). Approximately 80 Co-op members have purchased portions of the land. Their plots average 2-4 acres. The new owners executed a purchase agreement that prohibits building residential units on their land. Approximately half of the farm owners will access their lands from Kealohanui Street near the entrance to Mill Camp while others will enter the property through Puuiki Street from Farrington Highway. The additional traffic will be recognized but it is not likely to represent a significant portion of roadway use. Mill Camp is likely to provide housing for some of those farming adjacent lands.

1.5 Purpose and Need

According to a 2016 report by the state Department of Business, Economic Development and Tourism [1], Hawaii would need 64,700 affordable housing units to meet the demand by 2025. This assessment is pre-pandemic, and the estimate is expected to be low due to employment disruptions and the ever-increasing value of real estate. According to experts and public officials, the waiting list for affordable rentals is expected to be between 6 months and 3 years[2]. Mayor Rick Blangiardi expressed his sense of urgency in a press conference on August 2, 2022 and provided funding to build 1,000 new affordable rental housing units within the next 5 years. Mill Camp was one of the projects receiving funding from the Mayor's initiative.

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[1] *RESIDENTIAL HOME SALES IN HAWAII Trends and Characteristics: 2008-2015 (DBEDT, May 2016)*

[2] https://www.civilbeat.org/2022/09/a-tremendous-need-for-affordable-housing-in-Hawaii-leads-to-long-waitlists/

Mill Camp has effectively been affordable housing in Waialua since 1913 and formerly contained 350 single family homes that were rented to employees of the Waialua Sugar Company for between $15 and $40 per month. Approximately 20 of those employees who had retired when the plantation closed in 1996 still reside in Mill Camp and still pay rent between $25 and $45 per month. The remaining 47 homes are rented on a month to month basis for less than $900 per month. The majority of residents are former Waialua Sugar employees or their extended family.

A Hawaii Housing Planning Study[3] was published in 2020 by the Hawaii Finance and Development Corporation. This study is also pre-pandemic and therefore conservative in its estimates. Significant findings include estimates that fair market value for rental of a 2-br apartment in Honolulu is in excess of $2,000/month. More than 138,000 houses on Oahu are rentals (44% of the total number of houses). A worker with a full time job at the mean annual wage is only able to afford to pay $918 per month according to HUD standards, which is less than half of the average rent for a two-bedroom apartment on the North Shore of Oahu. This statistic can be restated as the average rent for a 2-bedroom apartment is more expensive than two full-time workers earning the average wage can afford.

Table 1-2: Average housing costs in comparison to wages and income for Hawaii households

	State of Hawai'i	Counties			
		Hawai'i	Honolulu	Kaua'i	Maui
Housing Wage (for 2-bedroom FMR)	$36.82	$25.88	$39.75	$29.44	$32.21
Housing Costs					
2-bedroom fair market rent	$1,914	$1,346	$2,067	$1,531	$1,675
Annual income needed to afford 2BR FMR	$76,577	$53,840	$82,680	$61,240	$67,000
FT jobs at mini wage needed to afford 2BR	3.6	2.6	3.9	2.9	3.2
Area Median Income (AMI)					
Annual AMI	$92,483	$7,010	$99,000	$90,000	$83,800
Monthly rent affordable at AMI	$1,406	$999	$1,483	$1,345	$1,355
30% of AMI	$27,745	$21,030	$29,700	$27,000	$25,140
Monthly rent affordable at 30% of AMI	$694	$526	$743	$675	$629
Renter Households					
Renter households (2010-2014)	190,880	22,112	138,209	8,350	22,158
% of total households (2010-2014)	42%	33%	44%	37%	41%
Estimated hourly mean renter wage (2016)	$16.68	$13.24	$17.65	$14.79	$14.99
Rent affordable with full-time job at mean renter wage	$868	$689	$918	$769	$780
Hours per week at mean renter wage needed to afford 2BR	88	78	90	80	86

Source. National Low-Income Housing Coalition "Out of Reach Report, 2019" Hawai'i data.

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3 SMS Research https://dbedt.Hawaii.gov/hhfdc/files/2020/02/State_HHPS2019_Report-FINAL-Dec.-2019-Rev.-02102020.pdf

Economic conditions in Waialua, and Mill Camp are worse than the average for urban Honolulu. The need for affordable housing in Waialua is clear. The town was built around its sugar mill and Mill Camp housing contained the majority of Waialua's residential assets into the 1960s. Since the closure of the Waialua Sugar Company, Haleiwa has transitioned to a primarily tourist-based economy, but agricultural and service employment has remained the principal source of income in Waialua. Almost all of the long-term residents of Waialua trace their recent past to direct employment by Waialua Sugar Company or services to the industry and people associated with the sugar plantation. Housing costs have risen dramatically across the United States in recent years and Hawaii is no longer the most expensive state for housing. The influx of new residents and real estate investment from overseas has pushed the cost of living beyond the reach of many long-term residents of Waialua. The 2020 census data reports that nearly 30% of Waialua's working population earns less than $20,000 annually, while the average home price in Waialua has exceeded $1,000,000. Between 2010 and 2019 the number of housing units in Waialua decreased by almost 6%, and its population decreased by 19.6%[4]. This decline in population is among the steepest in the state, and it is due to the disparity between income opportunities and housing costs. The composite cost of living in Waialua is 164% of the national average and the cost of housing is 243% above the national average (Figure 1-6)[4].

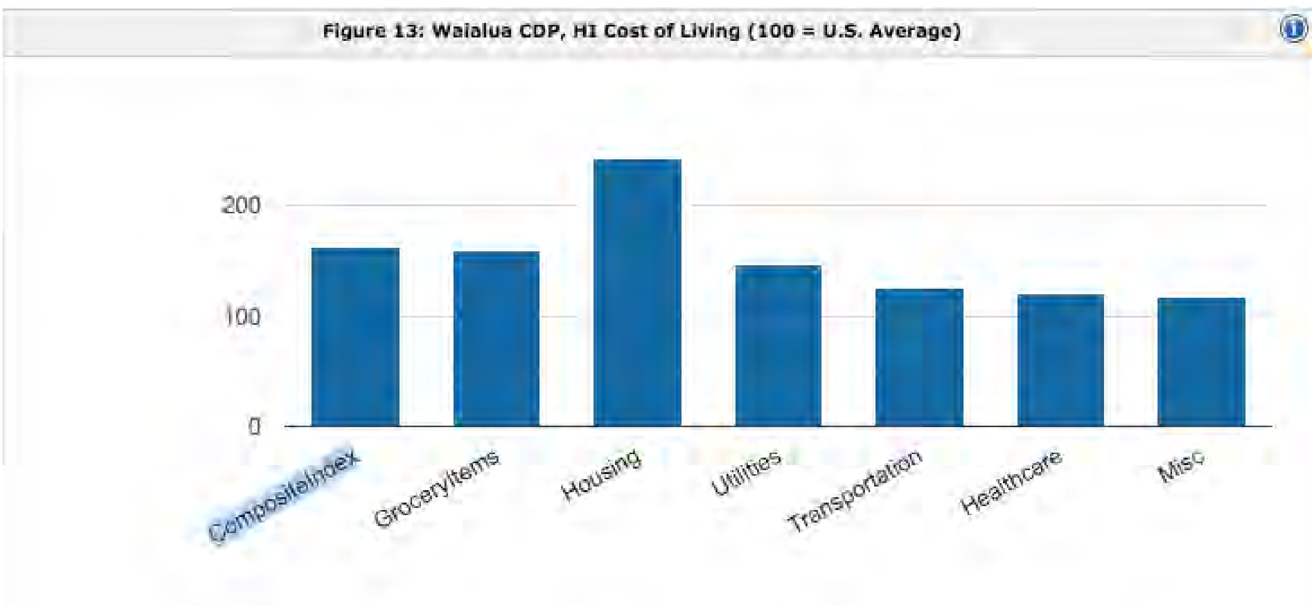


Figure 1-6: Living expenses for Waialua residents indexed as a percentage of the national average.

Census data for Waialua shows that the median income is roughly in pace with the area median income for Honolulu; however, the target population is Mill Camp, where the household income is near 40% AMI and most of the residents are on a fixed income of social security and a small pension. Many households supplement their income through small farm plots. The plantation houses currently in use in Mill Camp were never designed to withstand 75 years of service and many are beyond repair. HAHI's top priority is to secure permits and funds to replace the existing houses with ones that are similar, as well as ADA-compliant kupuna housing for its aging tenants.

4 https://www.towncharts.com/Hawaii/Demographics/Waialua-CDP-HI-Demographics-data.html

The project goal is to restore Mill Camp to its original size, style, and function with a mix of housing for seniors and families. Restoration of Mill Camp will be split into multiple phases of housing and related operations including private utility operation to support residents. Three phases of new housing are being planned to address the critical shortage of housing on the North Shore of Oahu in a manner that is compatible with the unique character of the area. Most of the housing in Waialua is in the plantation camp style; constructed on post and pier with hip roofs and verandas. While design is still incomplete, MCDG intends to conserve the style and character of Mill camp while incorporating current green building and environmental concepts and amenities. The parcel has gone through a Condominium Property Regime (CPR) process to separate the various planned phases of housing into their own CPR unit. By dividing the housing area into CPR units, each phase of housing may be developed using separate financing structures to support affordable housing.

The goals for this proposed action is to:

1. Honor the commitment to the retirees of Waialua Sugar Company and their spouses to provide housing for life.
2. Restore Mill Camp's crumbing houses and infrastructure to sustain its affordable housing assets for current residents of Mill Camp and other working families now living on the North Shore.
3. Expand Waialua's original affordable rental housing development to its former size and function, for affordable rentals for the next 60 years.
4. Build wastewater treatment systems, services, and other municipal infrastructure to support the community.

2.0 PROPOSED ACTIONS AND ALTERNATIVES

Elements of the proposed actions discussed in Section 2 trigger public disclosure under HRS 343 the Hawaii Environmental Protection Act (HEPA).

1. Use of public funding for construction of housing and various infrastructure,
2. Use of State Land for transmitting potable water,
3. Construction of wastewater treatment facilities serving more than 50 households, and
4. Application for exemptions to the Land Use ordinance allowed through HRS 201H.

2.1 Housing

Much of the funding for restoration of Mill Camp and its infrastructure will be from public sources.

The development plan for restoration contains four phases (Figure 2-1). The preference for affordable rentals and limited sales of housing will be to those long-term residents of the North Shore, to the extents allowable by law. The preference for Waialua residents in Phases I and II is to maintain the tight-knit community and families near each other while providing them modern homes at affordable rents and reducing overcrowded, multigenerational homes.

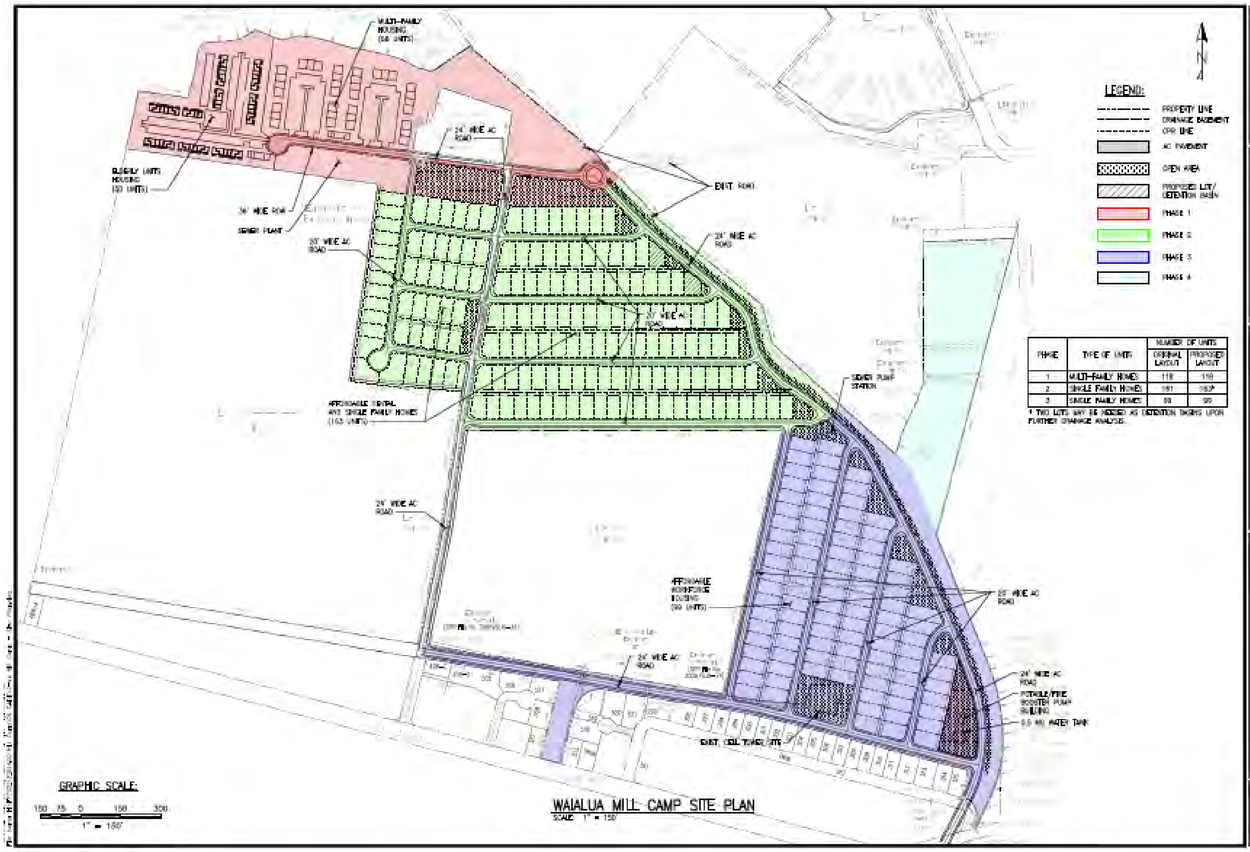


Figure 2-1: Long-Term Development Plan for Waialua Mill Camp. Phase I (red), Phase II (green), and Phase II (purple), Phase IV (turquoise).

Phases IA will accommodate Mill Camp's current retirees and other kupuna with ADA-compliant kupuna units. The proposed action includes construction of 31 one-bedroom units, 18 studio units and one staff unit for a total of 50 units. These are planned as single story quadruplex units that are slab on grade construction, equipped with handrails ramps and ADA-compliant fixtures. A conceptual design for the Phase IA units utilizes metal hip-roofs with yard and garden space between each quad (Figure 2-2). With exception of the site manager, all will be offered to tenants with a household Income less than 60% AMI. The period of affordability will be no less than 60 years, and all will remain as rental units.

Phase IB proposes construction of low-rise, multi-family buildings that will provide 28 one-bedroom units, 14 two-bedroom units, and 26 three-bedroom units for a total of 68 units. Each two-story multifamily structure will contain between 6 and 8 units. Phase IB will be occupied by current residents of Mill Camp during restoration of the main Camp area designated as Phase II. The existing residents will be relocated into the multi-family structure to allow the reconstruction of single-family homes in Phase II. Following completion of Phase II those tenants will be the first to occupy the single family restored housing units. All of the housing units in Phase IB will remain affordable rental units for no less than 60 years.

Figure 2-2 Phase IA: ADA-compliant Kupuna housing profile, consisting of duplex units, slab-on-grade construction in the plantation style.

Figure 2-3: Phase IB: Example of a 4-unit multifamily building plan and profile.

These will match the style of the elderly housing, being slab on grade, metal hip roofs and havening similar color schemes. Both Phase IA and Phase IB will be built around parking areas designed to accommodate residents and guests (Figure 2-3). Phase I B will also be offered to tenants with a household income less than 60% AMI. The period of affordability will be no less than 60 years, and all units will remain as rental units. Construction of Phase I is expected to commence in 2024-5 with completion prior to 2027.

Phase II will replace the existing single-family homes with 163 new 3 and 4 bedroom single - family homes designed and built using current building codes. Lot size will be 7,000 square feet. The plantation-style will be maintained using post and pier construction with small verandas, carports (Figure 2-4). One four-bedroom single-family home will be occupied by the Site Manager. The remainder will be an 81/81 split between three- and four-bedroom homes offered to income qualifying families earning less than 60% of the AMI. The first preference will be given to existing residents and other permanent resident of the area who are now living in overcrowded multi-generational households. HAHI will work with the existing tenants whose current household income does not qualify them for residence under the HUD guidelines. In most cases that will involve splitting up households with multiple wage earners into more than one household. The majority of single-family homes will remain affordable rentals for a period of more than 60 years.

The Hawaii Housing Finance and Development Corporation (HHFDC) is the state agency that manages affordable projects. Under HHFD rules residents may have the option to purchase their unit after a residence period of 15 years for their portion of the remaining project debt plus closing costs. This program can be used so long as the purchase options does not conflict with other restrictions placed on the property. HAHI is currently investigating potential conflicts, but certainty may be unavailable until all of the program funding is in place.

Phase II will continue to be the central portion of Mill Camp in terms of number and density of housing. A major portion of the expense in Phase I and II will be replacement of infrastructure including water supply, wastewater collection, fire protection, power grids, and roads.

Phase III. Phase III is not funded by AHF or other public sources at this time; however, discussions with the Department of Hawaiian Home Lands (DHHL) are underway. At this time a likely scenario for Phase III is for the 20-acre parcel of land designated Phase III will be sold to DHHL. Mill Camp Development Group will retain development rights and maintain the rural style and plantation architecture consistent with the other areas within Mill Camp. The area is sufficient for approximately 99 single family housing units on 7,000 square-foot lots. These houses will be sold at affordable prices to persons who are currently on the DHHL waitlist for housing. A search of the waitlist as of December 2021 yielded 144 eligible families on the North Shore and 260 in Wahiawa, with several currently living in Mill Camp.

DHHL's policy is to announce the availability of a new housing project to every Native Hawaiian residential applicant who currently lives on the Island of Oahu. Preference is given to those who are in good standing and have been on the waitlist the longest. HAHI will request that DHHL also give preference to persons now living in Mill Camp and the North Shore.

Access to Phase III will be from Farrington Highway via Pu`uiki and Koanaku Streets.

Figure 2-4: An example of a Phase II plantation-style 3-bedroom home offered by Honsador.

Phase IV consists of approximately 6 acres with access from Goodale Avenue. Five acres of Phase IV have county zoning designation as residential (R-5) and are within the State urban district. The R-5 area currently contains 13 occupied housing units and another 5 vacant lots. Approximately 1 acre of Phase IV is zoned Ag-2 and in the State Agriculture District. In the near-term redevelopment of Phase IV is likely to be minimal with exception to improvements in water and wastewater treatment. MCDG plans to apply for all land-use permits or exemptions required to sell the houses to the existing Mill Camp residents. Residents that do not wish to purchase will be relocated to one of the new rental units in Phase I, II or III. The vacant lots may be sold to other Mill Camp residents for individual development. Table 2-2 contains the total number of housing units proposed for the restoration of Mill Camp.

Table 2-1: Summary of Unit Mix by Phase

Waialua Mill Camp	Studio	1-bdrm	2-bdrm	3-bdrm	4-bdrm	Total
Phase I, Senior	18	32				50
Phase I, Multi-Family		28	14	26		68
Phase II Single-Family				81	82	163
Phase III Single Family				42	50	92
Phase IV Single Family				10	10	20

Eligibility

HAHI has received funding from the City and County of Honolulu (City) Affordable Housing Fund, for purchase of Phase I and II. Additional funding will be solicited from State and federal sources, Low Income Housing Tax Credits, USDA, Economic Development Agency, and State of Hawaii Revolving Funds. The use of multiple funding sources creates a rather complex matrix of required income eligibility. In addition each program has differing affordability periods. Each group of housing units will comply at minimum, with the eligibility requirements of the program that provides funding for their development. These grant and loan programs are competitive; therefore the minimum requirements are not likely to be the standard, but will be balanced by financial constraints of operation and development costs.

The City passed ordinance 18-10 to regulate the development and use of affordable housing. The goal of this ordinance is to help Oahu address its housing crisis and to build and maintain a more diverse and affordable housing stock. Under ordinance 18-10, for-sale affordable dwelling units must be sold to households earning 120 percent and below of the AMI. At least one half of those units must be sold to households earning 100 percent and below of the AMI. Rental affordable dwelling units must be rented to households earning 80 percent and below of the AMI. Under Ordinance 18-10 the affordability period is between 20 and 30 years.

The Hawaii Housing Finance and Development Corporation (HHFDC), which manages the Low-Income Housing tax credit program has different affordability guidelines for units rented to low-income occupants: At least 20% of its units rented to households with incomes of 50% or less of area median income, or at least 40% of the units must be rented to households with incomes of 60% or less of area median income.

Using the State guidelines established under HRS 201H the requirements are:

Low income households	(< 60%)	No requirement
Lower income households	(<80%)	10%
Moderate income households	(81-120%)	20%
Gap Group Households	(121-140%)	30%
Allowable market rate households		50%

The City's Affordable Housing Fund (AHF) is a special fund that was established by Section 9-204 of the revised charter of the City and County of Honolulu, and Chapter 6-63 of the Revised

Ordinances of Honolulu. The purpose of the AHF is to provide and maintain affordable rental housing for households earning sixty percent (60%) or below of the Area Median Income (AMI) in the City and County of Honolulu. AHF-compliant housing units must remain affordable for a period of at least 60 years.

The household income limit is set for each county in Hawaii by the Department for Housing and Urban Development (HUD). A different scale is published by the City, however, the City's requirement starts only at 80% AMI, so the HUD standards are used for AHF compliance. Mill Camp's AHF units must have a total household income of 60% of the AMI or below. Rents charged for each housing unit will be controlled by the limits set by the Hawaii Housing Finance and Development Corporation (HHFDC), an agency of the State of Hawai`i. The rental cost for combined rent and utility bill are anticipated to be less than or equal to 30% of the household income. 2022 income limits are set by HHFDC and based on the recommendations of HUD. For a family of four, 60% of the area median income is $78,400. The gross household income must be less than this amount to qualify for residence in Mill Camp.

Table 2-2: AMI Statistics for the City and County of Honolulu, 2022

Hawaii Community Development Authority
2022 Reserved Housing Income Limits

		1 person	2 person	3 person	4 person	5 person	6 person	7 person	8 person
Extremely Low Income	**30%**	27,450	31,400	35,300	39,200	42,350	45,500	48,650	53,640
	40%	36,600	41,850	47,050	52,250	56,450	60,650	64,850	69,900
Very Low Income	**50%**	45,750	52,250	58,800	65,300	70,550	75,750	81,000	86,200
	60%	54,900	62,750	70,550	78,400	84,700	90,950	97,250	103,950
	75%	62,550	71,450	80,400	89,300	96,450	103,600	110,750	117,900
Low Income	**80%**	73,150	83,600	94,050	104,500	112,900	121,250	129,600	137,950
Area Median Income	**100%**	79,300	90,650	101,950	113,300	122,350	131,450	140,500	149,550
	110%	87,250	99,700	112,200	124,650	134,600	144,600	154,550	164,550
Gap Income	**120%**	95,150	108,750	122,350	135,950	146,850	157,700	168,600	179,450
	130%	103,100	117,850	132,550	147,300	159,100	170,850	182,650	194,450
	140%	111,000	126,900	142,750	158,600	171,300	184,000	196,650	209,350

A family of four that has two wage earners whose combined income from all sources is $78,400/year qualifies for residence in AHF housing. The family would be placed in a 3-bedroom house, and the combined rent and utility bills would be 30% of the combined income ($1,625/mo.). Of that amount, the family is likely to spend an average of $200/month on electricity and water; therefore, the rent would be set at $1,425/mo. The same family whose household income is $50,000 per year would pay $1,050/mo.

Priorities will be given to lower income tenants and up to 10% of the housing units will be offered to homeless and very low income persons. The community has requested that priority be given to long-term residents of Waialua and farm workers. These segments of the population are currently living in multigenerational housing and/or substandard conditions. These priorities will be used to the extent they are allowed under the federal fair housing regulations. A market study and survey of the Waialua Farmer's Cooperative will be completed to assess the potential for setting aside some portion of Phase II as farm labor housing.

Phase III is not yet funded, or committed to specific affordability requirements, and may be developed as Hawaiian Home Lands pending negotiations with the Department of Hawaiian Home Lands (DHHL).

2.2 TMK# 6-7-001:076 (Lot 3)

Prior to the sale of Mill Camp Dole Foods subdivided (former) parcel 6-7-001:063 into several parts. Parcel 6-7-001:076, also known as Lot 3 is a remnant of that subdivision that was included in the sale to Mill Camp Development Group. Lot 3 has never contained housing and as a sugarcane field until the mid 1990s. It is located on the west side of Goodale Avenue across the street from District Park It is zoned Ag-2, but within the state urban district and within the Urban Growth Boundary. Mill Camp Development Group is in negotiations with the City and County of Honolulu to swap a portion of Lot 3 for adjacent parcel TMK 6-7-001:079 (Figure 2-5). Parcel 79 is also in Ag-2 zoning and the Urban District. If these negotiations are successful, the City and county of Honolulu will construct its new Waialua Fire Station and Emergency Response Center on the portion of Lot 3 nearest the sugar mill and the District Park. The remainder of Lot 3 is not yet planned.

2.3 TMK# 6-7-001:030 (Parcel 30)

Parcel 30 was historically the site of the Waialua Pilgrim Church. During the early 2000s the church relocated to Farrington Highway near the end of Pu`uiki Street. Since that time it has been vacant. Parcel 30 will be incorporated into Phase II housing. Its location is nearest the Waialua Farmer's Association lands, that is currently farmed by over 80 small farmers. HAHI is investigating the feasibility of designating portions of this area as farm-worker housing, which can be funded under the USDA programs designed specifically for disadvantaged farmers whose income is less than or equal to 60% AMI.

Figure 2-5: TMKs 6-7-001:076 (Lot 3) is currently owned by Mill Camp Development Group. Discussions with HFD are pending to swap a portion of Parcel 76 for Parcel 6-7-001:079. Pending successful negotiation the portion highlighted in red will become the new Waialua Fire Station and Emergency Response Center.

2.3 Proposed Infrastructure Improvements

Infrastructure improvements for Phase I, II and III will include roads, wastewater treatment capacity, expansion of the water and wastewater distribution/collection systems, expansion of fire protection, and street lights.

2.3.1 Road improvements

All of the roads within and leading to Mill Camp are substandard. Some have been paved in the past but almost all are now considered un-paved through overuse and lack of maintenance. Approximately 20,000 feet (400,000 square feet) of roadways will be repaved following major construction in Phase I or Phase II. HAHI is currently investigating the cost and feasibility of building the internal roads and or shoulders from pervious materials such as grass blocks or composite webbing material with the objective of minimizing stormwater runoff. The major access/egress roads will be 24 feet wide, internal roads are planned to be 18 feet with 6-foot shoulders.

2.3.2 Wastewater improvements

A trigger for the requirements of HEPA include construction of a wastewater treatment facility. Mill Camp currently disposes of wastewater in either individual wastewater systems (IWS) or a large capacity septic tank system. Sixteen septic tanks are currently in operation. Eight of these serve one single family home each, and the remaining 8 serve two single family homes each. Fifty-three homes are connected by a wastewater collection system that discharges into a 12,750 gallon septic tank. One lift station serves four houses and a food processing building. The remainder of houses operate on gravity flow wastewater collection. The existing wastewater systems hold permits from the Hawaii Department of Health; however, any expansion of the Camp would require an upgraded wastewater collection and treatment system. Wastewater treatment is intended to be scalable to address the increasing population of Mill Camp over the development period. Modular facilities are appropriate so that capacity can be increased as new areas of the Camp are developed.

The basis of design for new wastewater treatment works includes the following requirements:

1. The primary design objective for improvements to the wastewater system shall be to consistently produce R-1 quality effluent.

2. R-1 quality effluent shall be reused for irrigation.

3. The effluent shall be monitored continuously. Any effluent that does not meet the turbidity or other standards for R-1 water shall be automatically diverted to a wastewater storage reservoir for re-treatment.

4. The wastewater treatment capacity shall be adequate to treat all blackwater and greywater generated within Mill Camp.

5. The wastewater treatment system shall be compatible with the rules for recycled water systems described in Hawaii Administrative Rules (HAR) 11-62, and R-1 quality limits that are specifically defined in HAR 11-62-26.

The final decision on technology for wastewater treatment will depend on the cost benefit analysis and a Preliminary Engineering Report summarizing available technologies at the time. A package wastewater system that is currently selected for a similar application is the Epic Cleantech Membrane Bioreactor Wastewater System (MBR), discussed below. Epic's MBR or similar system may be selected for Phase I and II during the detailed design stage for Mill Camp.

Membrane-type treatment units yield processed water characterized by low turbidity and low residual pollutants. The effluent is then subjected to UV disinfection, and the final product is useful as R-1 recycled water[5], particularly for irrigation but also useful in other applications including dust control wash down and ornamental water features. Automatic monitoring of water quality indicators is performed including turbidity (suspended solids, or TSS), chemical oxygen demand (COD), and water flow. Weekly testing of treated water samples is performed at outside labs for biochemical oxygen demand (BOD_5), TSS, and pathogen concentrations. Those results are submitted to the Hawaii Dept. of Health for the purposes of protecting public health. In the event of equipment failure, effluent that does not meet the water quality requirements for recycling is automatically diverted to a recycled water reservoir providing at lease 20-days storage capacity.

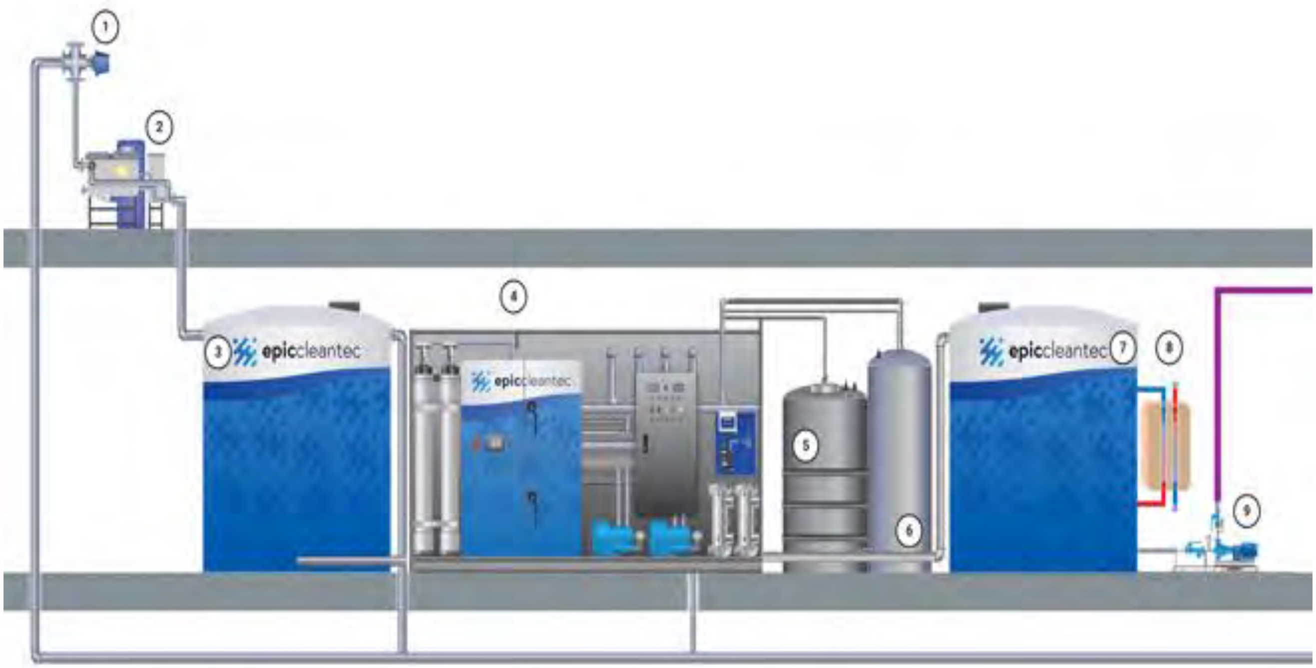
A new wastewater collection system will be installed for each phase of the development. Phases I, and 2 will be directed by gravity to the wastewater treatment facility. Wastewater flow will initially pass through a prescreen to separate out larger solids. Following the prescreen, wastewater will be pumped to a pre-treatment tank. Wastewater from the pre-treatment tank is then fed into the MBR system, comprised of biological treatment, ultrafiltration, and ultraviolet (UV) disinfection. After treatment, the water will be stored in the reclaimed water tank, where it will be pumped to points of use via a dedicated non-potable water distribution system. Recycled water will be used for landscape irrigation within Mill Camp or adjacent farming activities. Potential facility design parameters are listed in Table 2-3.

Table 2-3: Design parameters for wastewater treatment system for Phase I A and IB.

Avg Daily Design Flow	70,000 GPD
Peak Daily Flow	140,000 GPD
Maximum Monthly Flow	84,000 GPD
Non-Potable Uses	Toilet/urinal flushing, irrigation
Use Type	Residential, commercial, mixed-use

Additional capacity will be added before construction of Phase II and Phase III is completed as required. Detailed design will determine whether it is advantageous to combine additional modules at the original site or develop multiple wastewater treatment units at different locations within the Camp.

[5] HRS 11-62-27



1. 3-way valve
2. Micro-screen with solids collection
3. Pre-treatment tank
4. Epic OneWater MBR process skid(s)
5. Aerobic tank
6. Anoxic tank
7. Reclaimed water tank
8. Epic Heat Recovery Module
9. Distribution Pumps

Figure 2-6: Schematic diagram shown as an example of an MBR plant producing R-1 quality wastewater effluent. The model shown is Epic CleanTec with capacity of treating 70,000 gallons per day from a footprint of approximately 40x60 feet.

Wastewater will flow by gravity directly to the treatment facility or lift stations installed within the Camp. Sewer lines will terminate at the inlet screen inside the wastewater treatment plant. After treatment, R-1 recycled water is recycled through 'purple pipes' used exclusively for distributing recycled water.

<u>Wastewater reuse</u>

Mill Camp is located in an area of Oahu that is unrestricted with respect to wastewater reuse (Figure 2-7).

New wastewater treatment and recycling facilities will be operational prior to occupation of Phase I. Lands dedicated to the wastewater treatment and recycling are shown in *Figure 2-8*, and are sized to accommodate Phases I and II. A separate wastewater treatment and disposal system will be constructed for Phase III at such time as it is necessary. The location is in the vicinity of the current wastewater collection tanks for Phase I and II, are near the lowest point in the Camp.

The land on which the wastewater facilities sit has been acquired by a permanent lease from Savio Waialua Farmland, Inc. Approximately 3.5 acres will be used for wastewater treatment , recycling and other community functions.

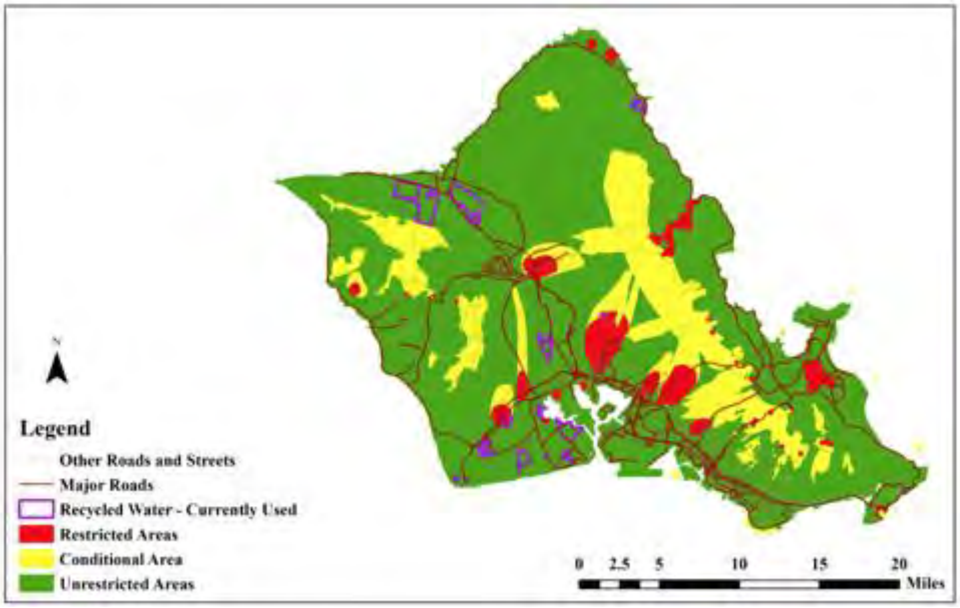


Figure 2-7: Recycled water land use Map from the Hawaii Wastewater Reuse Guidelines[6]

Treatment facilities will utilize equipment and processes that prevent odors and dust from being generated or released. Notably the treatment system does not utilize sewage sludge drying beds. Once pressed and dewatered, the solids are hauled away for disposal at the H-Power facility off-site, where the combustible materials can contribute to energy production for the Oahu power grid. Equipment will be sited no closer than 25’ from the property line, except the EQ Tank, which is set back 10’ from the property line. Prevailing winds blow from east to west during trade wind days, not towards the nearby homes of Mill Camp. However since the facility will utilize enclosed systems, odor problems are not likely. A conceptual layout of the wastewater treatment facilities is presented in Figure 2-8.

In the event that usage of recycled water at any of the normal users is curtailed for any reasons, dedicated lands for a 20-day (2 million gallon) reservoir for emergency storage of wastewater is provided. The emergency reservoir is sited at the lowest point of the sewer line system, ensuring flows into the reservoir in the event that all pumping systems have failed. Wastewater processes are placed with spill containment structures to prevent accidental spills from leaving the site. Agricultural and general irrigation can be applied in excess of the Evapotranspiration rate (ET). Using a design of ½ inch of irrigation per day the recycled water would be sufficient to irrigate 7.4 acres. At ET the area would be approximately 10 acres. More than half of that amount will be utilized for landscape irrigation on the premises. The remaining water will be offered to farm tenants that are adjacent to the wastewater area.

[6] https://health.Hawaii.gov/wastewater/files/2018/06/V2_RWProjects.pdf

Figure 2-8: Conceptual view of the wastewater treatment plant.

__Stormwater Management__

MCDG proposes to manage stormwater on site through three drainage management areas.

Pavements: Internal and perimeter roadways are designed to minimize the use of impervious materials by paving the shoulders of the roadways with permeable materials that absorb runoff. Driveways and parking areas are also paved with grass pavers[7] or Pavedrain[8].

House lots: are designed to slope towards the roads. Lawns in the house lot will absorb water and contaminants prior to reaching the permeable pavements during moderate rain events. During intensive storm events the permeable pavement shoulders will absorb more and the excess will be directed to the perimeter roadways with stormwater conveyance to designated detention areas.

2.3.3 Potable Water System Improvements

OPU has requested funding from the State Drinking Water Revolving Fund (SDWRF) for improvements to the potable water system that provides drinking water to Mill Camp. This

[7] https://www.grasscrete.com/docs/paving/grasscrete.html
[8] https://www.pavedrain.com/

request involves the use of State land and State funding, because the transmission lines cross lands owned by the State of Hawaii.

OPU Waialua Water Association, a non-profit Water Association provides potable water to Mill Camp and others in the area. A map of the Pump 2 service area is shown in Figure 2-10. State well numbers 3-3307-003 and 004 (Public Water System 00309) are a battery of wells connected by a trench. The well names recorded by the Commission on Water Resources Management (CWRM) are Waialua SP2 Battery F and G.

The well supplies water to the Waialua Mill Camp, Otake Camp, Achiu Camp, Dole offices and fields, Dole coffee processing, and Puuiki at the northern end of the service area.

Pump 2 System Elements:

- Two wells with a water allocation of 406,000 gallons per day
- 1– 180 gpm 15 hp Variable Frequency Drive (VFD) submersible pump
- 1 – 500 gpm 40 hp VFD submersible pump
- 1 hypochlorite dosing unit
- Electrical enclosure housing
- Security fencing
- HECO power, 200A 480V 3ph
- Distribution piping and valves of various materials

Transmission distances are as follows:

- Pump 2 to proposed location of storage tanks 3,200 ft.
- Storage to village 2,700 ft.
- Otake Camp line 1,800 ft
- Village to Dole offices and fields 2,500 ft.

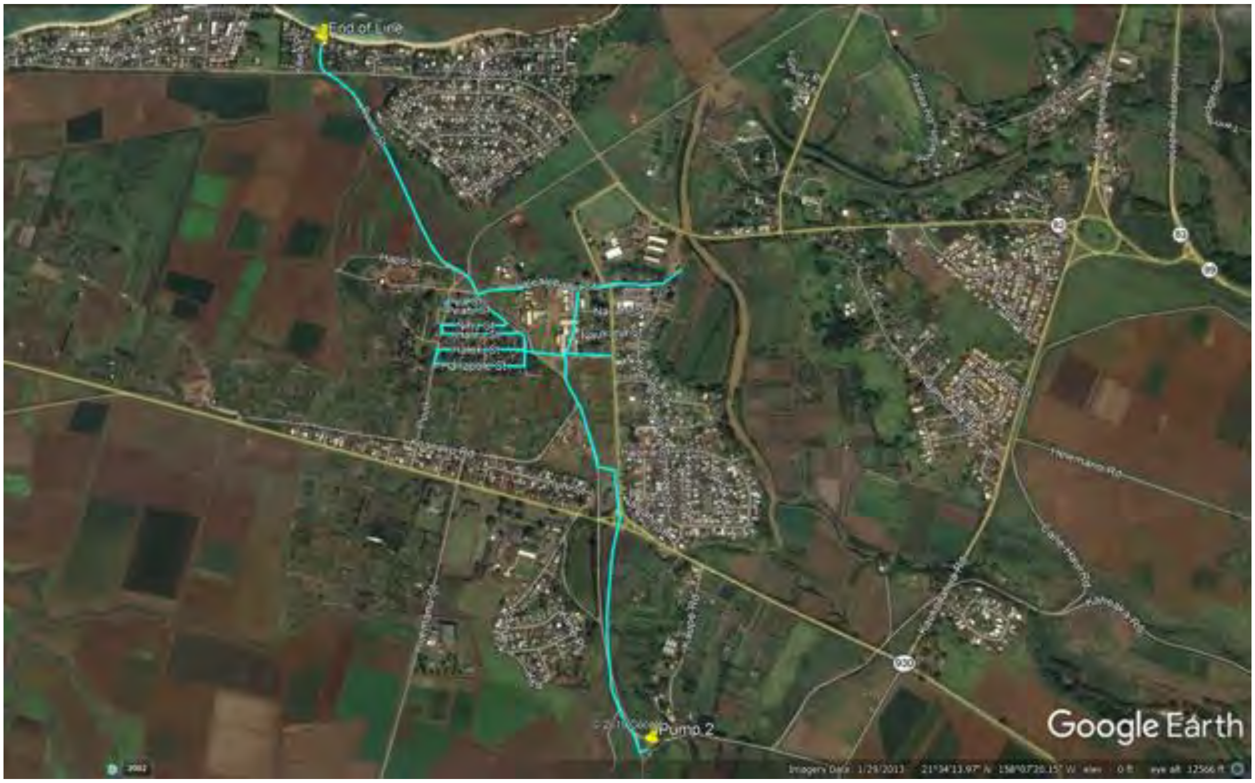


Figure 2-9: Water distribution system for Mill camp and other users of Pump 2 water.

The current deficiencies in the Pump 2 system include:

1. The main transmission lines are a mixture of materials including transite (asbestos-concrete), black iron, and PVC pipe, which are difficult to maintain or repair. Repairs have been made using techniques that result in water loss and compromise the safety and quality of water delivered to the consumers of Pump 2 water. The pumped volume of water is more than 30% greater than the volume of water used. Transmission lines undoubtedly leak in unknow areas, but there are also likely to be unauthorized taps that have occurred over the 80 years that the system has been in place. All water transmission lines will be replaced. Bringing the system into compliance with modern codes is necessary for protecting the health and well-being of our tenants and reducing losses and cost of operation to water customers.
2. Reliability is compromised due to a lack of storage capacity. Any repairs or maintenance at the well results in a shutoff of water service to users. Water pumps run continuously, which substantially reduces the efficiency of operation.
3. A backup power system for the well pumps does not exist. A combination of storage and backup power will provide the highest level of resilience against service disruptions.
4. Dole has historically provided water freely to farms and homes located near the service area, and as a consequence, water usage by individual users is unknown. Water meters are only found at the well site and a few of the main transmission line branches.

At this time OPU has requested funds from the State Drinking Water Revolving Fund to replace the major transmission infrastructure to the Camp and correct deficiencies in the water supply system. These improvements would bring the system into compliance, reduce losses that are currently estimated at 35%, and improve resilience against water outages. Improvements not funded by SDWRF will include the local distribution water lines, household water meters, and fire protection systems.

2.3.4 Electric Power and Energy Storage improvements

The State of Hawaii has established the "Clean Energy Initiative", which set a goal of 100% renewable energy for the state by 2045. This includes electric-grid energy sources as well as transportation energy sources. HAHI and its development partners have the rare opportunity of designing a sustainable rural community from the ground up, and thereby utilizing current technologies to generate, store, and utilize electricity onsite. HAHI intends to build a subdivision-scale private microgrid, which will be based on maximizing roof-mounted Solar PV plus battery or other types of energy storage. The use of rooftop solar at the community scale is demonstrated to be more efficient than remote generation and subsequent transmission over distance. To the extent practical, Mill Camp will be a self-sustaining or net exporting community with respect to energy without the use of methods that emit carbon dioxide or other greenhouse gasses. The State Clean Energy Initiative includes transportation as well as stationary demands. As auto manufacturers move away from gasoline-fueled vehicles over the next 20 years. Mill Camp's energy system will be designed to accommodate electric vehicles (EVs) as well as stationary demand.

Microgrid

The Mill Camp microgrid (MCM) is a scalable private electric grid that is designed to serve homes as they are developed, and support facilities situated within Mill Camp. The MCM is likely to include a connection to the HECO utility grid, but all electric power will be distributed to the MC homes through the MCM wires and meters. Some amount of HECO power will be used during each day to allow the MCM to store solar power for use at night, and as part of HECO efforts to manage excess daytime power on their grid. Each home will have its own electric sub-meter to record energy usage, which will be what energy charges will be based upon for each household.

Preliminary designs feature underground the electric system and communications system in conduits located beneath the streets, with transformers located within the landscaped areas adjacent to the roadways. The interconnection to the HECO grid will be located near the existing cell tower at the southwestern corner of Mill Camp within a fenced facility.

During the daytime each home typically generates far more power from solar PV than is used within the house at any moment, and that excess power will be stored in $LiFePO_4$ batteries, or similar, at each home. During the evening and night hours, energy will be released from storage to power homes. The microgrid will function to share power amongst the Mill Camp homes, and excess power may be used to make hydrogen to be sold or used for other power demands.

Solar PV
Each residence will be equipped with a carport each measuring 20'x20' and fitted with 7.5 kW of solar panels. Additional panels will be placed on a portion of each home's roof. These energy sources will be interconnected to the microgrid, including the connection to HECO. The entire MCM system (Phases 1 and 2) may generate up to 2.9 MW power generating capacity.

Energy Storage

Solar PV energy will be stored using $LiFePO_4$ (lithium ferrous-phosphate) batteries, or similar, for short-term energy storage for instantaneous power demand changes. The $LiFePO_4$ batteries have the lowest potential for fires of all lithium battery types, and feature very high efficiencies, reducing space and cooling requirements. Only power that has been produced renewably on site will be stored.

Hydrogen Energy Storage
Daytime energy production by the solar PV arrays throughout the village may exceed the capacity of lithium batteries, and those times will likely coincide with grid energy excess energy production from solar (plus wind) exceeding power demand. Rather than losing that energy, the Mill Camp microgrid may send it to an energy storage facility, where it will be converted into hydrogen, which will be stored in a secure facility where it can be converted back into electricity via fuel cells when battery power in the village is low, and grid power is unavailable or unaffordable.

Hydrogen is produced by electrolysis of pure water using a direct current to separate hydrogen from oxygen molecules in the water. A manufactured hydrogen plant will be used to split water into pure hydrogen gas plus pure oxygen gas. The hydrogen gas will be compressed and put into storage, while the oxygen may be used in part to aid in the treatment of wastewater or other beneficial reuse. The facility would be enclosed in a security fence, with large setbacks from property lines and buildings. Perimeter landscaping will provide visual screening.

2.3.5 Schedule

HAHI is currently in the planning and design phase; with this Environmental Assessment being a major component. Planning, design, and permitting is optimistically expected to be completed within two years. Low income housing tax credits will be requested in 2024 for Phase I with construction anticipated to begin in 2025. Full buildout of Waialua Mill Camp is optimistically expected by 2036.

2.4 Alternatives to the Proposed Action

2.4.1 No Action Alternative

The no action alternative is operating the existing plantation camp as it has been for the past 25 years. HAHI and its partners can perform emergency repairs on the existing houses and infrastructure as has been the case since Waialua Sugar Company closed. Over the period the more than half of houses in the camp became uninhabitable and were either demolished or left to decompose in-place. Prior to its sale Dole intended to operate the Camp until the last retiree passed away demolish the remaining houses and sell the property as vacant agriculture land. A reasonable estimate for the remaining lifespan of Mill Camp would be 8 to 10 years. The existing housing is in poor condition and to this point residents have made their own repairs, without building permits in most cases.

As the housing and infrastructure ages, its maintenance cost increase. Management does not have the option to increase the rents, particularly for the retirees and therefore would eventually become insolvent. The no action alternative is rejected because in its existing condition Mill Camp is not a sustainable provider of affordable housing and does not meet the needs for the proposed action.

2.4.2 Affordable Housing in Other Locations

The need for affordable housing on the North Shore is discussed in Section 1.4. The State Affordable housing inventory as of August 2022[9] lists 205 affordable properties on Oahu, the vast majority of which are located in urban Honolulu. A single affordable rental operates in Waialua. The Kupuna Home-o-Waialua is owned and operated by the Hawaii Public Housing Authority. It has 40 units and a waitlist for vacancies. Almost all affordable rentals whether public or privately owned have a waitlist of between 6 months and three years.

The majority of Oahu, and particularly the North Shore is either developed or reserved for agriculture. The proponents are not aware of any parcels of more than 40 acres are zoned for residential and not developed. Mill Camp is also zoned agriculture, but it has been used for housing for more than 100 years, and predominately lies within the urban growth boundary. Mill Camp has existing infrastructure including roads, electric power, water, wastewater and fire protection. Although this infrastructure is largely in need of restoration, the cost of starting over on municipal infrastructure is prohibitively high.

At least two parcels of agricultural land has been recently sold to developers who are reselling the land after some type of subdivision or CPR. Both of the parcels referenced are on prime agriculture land and neither has obtained rights to develop housing. With the prevailing public sentiment neither is likely to obtain rights to build housing.

Many affordable housing developments are underway in the Honolulu urban core and south shore urban corridor. It is appropriate to serve the urban core areas, but not appropriate to ignore the needs of the rural areas having a greater per capita need for affordable housing

Alternative locations are rejected because no suitable locations other than Mill Camp which meet the objective to provide affordable housing for Waialua have been identified.

[9] https://dbedt.Hawaii.gov/hhfdc/files/2022/09/Affordable-Housing-Inventory-as-of-AUGUST-2022.pdf

2.4.3 Other types of housing

Almost all affordable housing projects are developed in the form of multifamily housing. Multifamily developments cost less to build and operate. Land costs are generally a significant component of the total development cost and infrastructure for multifamily developments is only a small fraction of what is necessary for single family housing. HAHI has proposed construction of a small number of multifamily units primarily to provide temporary accommodations for families now living in Mill Camp during the period their existing homes are reconstructed. HAHI has assured current residents who are income qualified the first priority for new homes.

The proposed action is to restore a former plantation camp to its original structure and function. Mill Camp will be restored primarily as single-family housing despite the increased cost to do so because the current and future residents are accustomed to single family homes with garden space and yard. To restore in as anything except an upgraded plantation camp would not be as acceptable to the current residents and other families who are now living in single family homes with more than one or two generations of family members or with more than one unrelated family. It is apparent from discussion with the community that most would prefer to stay in a single-family home with too many people than to move to an apartment. Restoration of Mill Camp is expected to be in the same style that it has always been.

2.4.4 Selection of an Alternative

The proposed action to restore the existing plantation camp to its former structure and function at its existing location has been developed from discussion with community leaders and is the most appropriate use of the land. Utilization of the area to provide respectable housing to the current residents and other long-term residents of Waialua currently living in substandard conditions is the highest and best use of the property.

2.5 201H Permit

Application for exemptions to the land use ordinance under Hawaii Revised Statutes Chapter 201-(H) requires public disclosure through HRS 343. The 201-H permit allows affordable housing developments to request exemptions from the land-use ordinance. HRS Chapter 201-H was enacted into law to provide a process whereby an affordable housing project may be granted exemptions from any statutes, ordinances, and rules of any governmental agency relating to planning, zoning, and construction standards that do not negatively affect the health and safety of the general public. The City and County of Honolulu Department of Planning and Permitting (DPP) administers this law, but the permit may also be sponsored by HHFDC.

Affordable housing projects are eligible for the 201-H process if at least half of the units are made affordable to income target groups established by City rules. These rules are based on guidelines established by the US Department of Housing and Urban Development (HUD). The target groups are defined as a percentage of the median income for Honolulu. Normally projects must contain at least 50 dwelling units, but there are exceptions for projects that cater to individuals with special needs.

In order to qualify for the 201-H process, a project developer must submit an application to DPP for review. Subsequent to a wider agency review, the application is delivered to the Honolulu City Council for consideration along with DPP's recommendations. If approved by the City Council, the project may obtain exemptions to certain development standards without rezoning or changing land-use designations contained in the County's planning documents. The purpose of the 201-H process is intended to facilitate qualifying affordable housing projects.

The proposed action is to obtain development exemptions under the 201-H permit to facilitate restoration of Mill Camp as affordable rentals and provide ancillary uses to support the needs of the community.

All of the housing in Phase I (118 units) are required to be offered to families and individuals having a household income less that 60% of the Area Median Income. By contrast the 201H requirement, which will include 183 homes in Phase II and IV contains requirements for household incomes of between 80% and 140% AMI. If the Phase III becomes a Hawaiian home lands community, the homes will be sold at affordable prices as negotiated with DHHL, but Phase III will not be included in the 201H permit and therefore not included in the calculations presented in Table 2-4. Published 201H requirements for affordable housing and early estimates of the income distribution are shown in Table 2-4.

Table 2-4: Income guidelines for qualifying housing units allowable under 201-H. The number of units and percentage is cumulative percent of the total.

Income Category of Resident	201-H Req.	Mill Camp Estimated percentage
Ext. low income (< 30%)	NR	5% (15)
Very Low Income (< 50%)	NR	22% (65)
Low Income households (≤ 60% AMI)	NR	40% (120)
Lower income households (≤80% AMI)	10%	66% (200)
Moderate Income households (81-120%)	20%	75% (225)
Gap group households (121% - 140%)	30%	83% (250)
Allowable Market Rate	50%	100% (301)

NR= no requirement

Figure 2-10 shows the number of housing units which are at or below each income category proposed for construction in Mill Camp in comparison to the requirements for 201H. Note that largest component proposed for Mill Camp is in the categories defined as extremely low, very low, and low income families (≤60%). The affordability requirement for HRS 201H begins at lower income (< 80%) AMI. Mill Camp will serve families who are in the lowest income categories, and provide respectable housing for those who need it most.

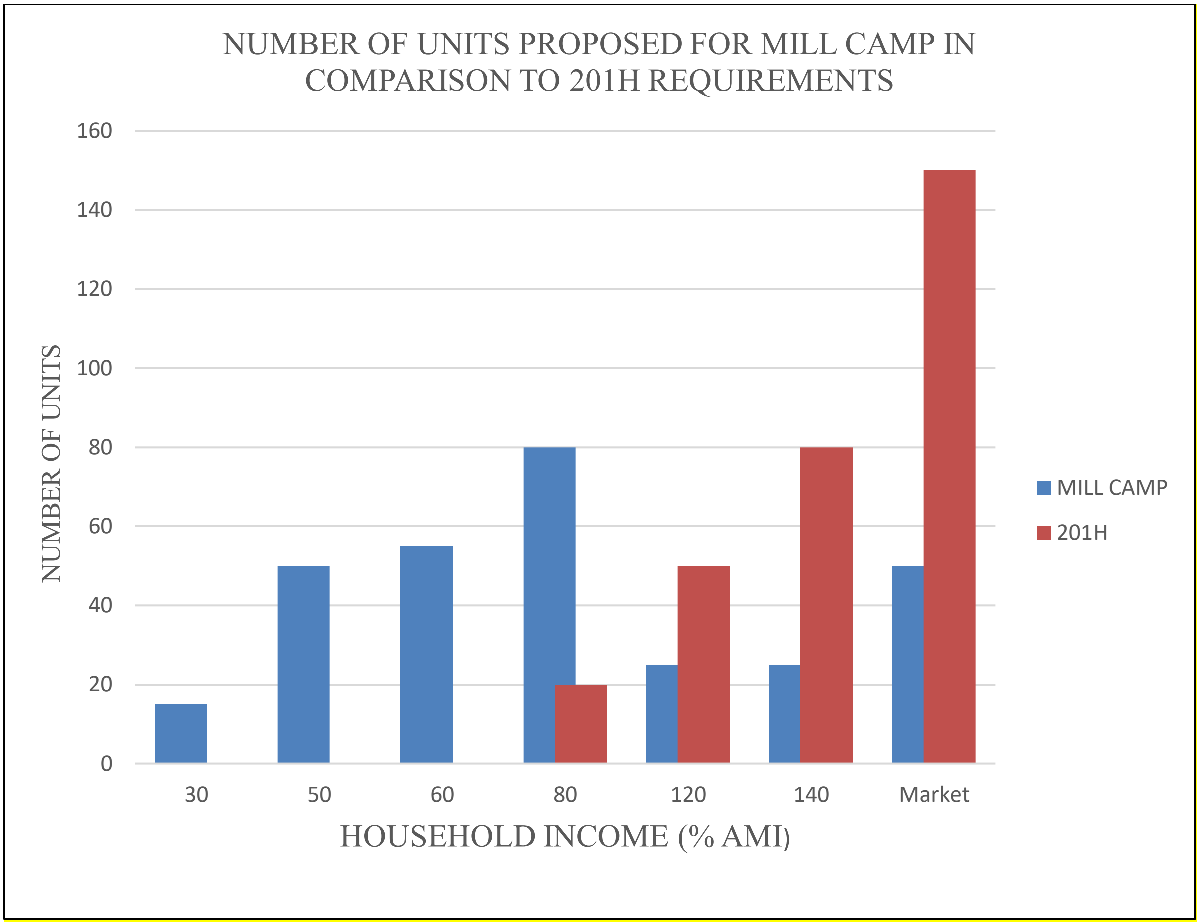


Figure 2-10: Graphical representation of the proposed income allocation of housing units within four phases of Mill Camp compared to the minimum required by 201H.

2.5.1 Exemptions to LUO to be Requested

HAHI will request exemptions to the City Land-Use Ordinance (LUO) through the 201-H permit application process. A preliminary list of exemptions to be requested includes:

(1) The existing dwelling units are not in compliance with LUO Section 21-3.50-2(b),- Site Standards:

(b) The maximum number of farm dwellings in an AG-2 district agricultural cluster shall not exceed one unit per two acres.

Expanding the maximum allowable number of residential units to 400 within the 73 acre site would result in a density of 5.5 units per acre, which exceeds the maximum density allowed by the LUO. HAHI will request an exemption from LUO Section 21-3.50-2(b) through the 201-H permit application.

(2) Existing uses that were established by Dole to provide essential services that are not specifically allowed by the Land-Use Ordinance (Table 21-3) include:

- Housing
- Neighborhood store/food processing building
- Park

Planned land uses which are not now in existence include:

- Housing
- Housing Rental Office
- Housing maintenance shop/equipment base yard
- Energy production and storage facilities
- Water storage and pumping systems
- Wastewater treatment systems

HAHI will request an exemption from LUO Table 21-3 through the 201-H permit application.

(3) The 201-H application will request an exemption from height limits specified in Section 21-3.50-4(1) for the planned community and service infrastructure.

(1) Height. The maximum height may be increased from 15 to 25 feet if height setbacks are provided.

Structures that will exceed the maximum height for Ag-2 land include:
- Phase IB multifamily buildings (30 feet)
- Water storage tanks (45ft.)
- Wastewater treatment equipment (To be determined)

A request for exemption will be made to allow the planned structures to remain taller than 25 feet.

(4) MCDG will request an exemption from the requirement to obtain an existing use permit (ROH 21-2.100) for the housing units in Phase IV; and an exemption to the requirement for a public report prior (HRS §514B-51) to CPR of the existing houses and lots within Phase IV.

(5) HAHI may request an exemption to the Urban Growth Boundary (UGB) to recognize the existing homes and authorize the planned additional homes in the portion of Mill Camp that may extend beyond the current UGB. A UGB request for exemption was submitted November 8, 2021. The request was supported by the North Shore Neighborhood Board. If that request is approved in a timely manner this

exemption will not be required. Some contradictions exist on the actual location of the UGB.

Section 3.3.6.1 contains a more detailed discussion of land use constraints within agricultural zoned land. Zoning of the Parcel 77 is split between Ag-2 and R-5 with the majority in Ag-2. Lands to the north and west are zoned Ag-2. To the south, the property is bounded by Ag-1 and R-5 parcels. The eastern boundary is adjacent to I-2, Ag-1, and R-5 parcels. All of the subject property is within the State agricultural land use district, with exception of 10 acres of Parcel 77, which is urban. Adjacent lands on the north, south, and west are also in the agriculture district, but the eastern boundary is adjacent to the urban land use boundary. (Figures 2-13, 2-14).

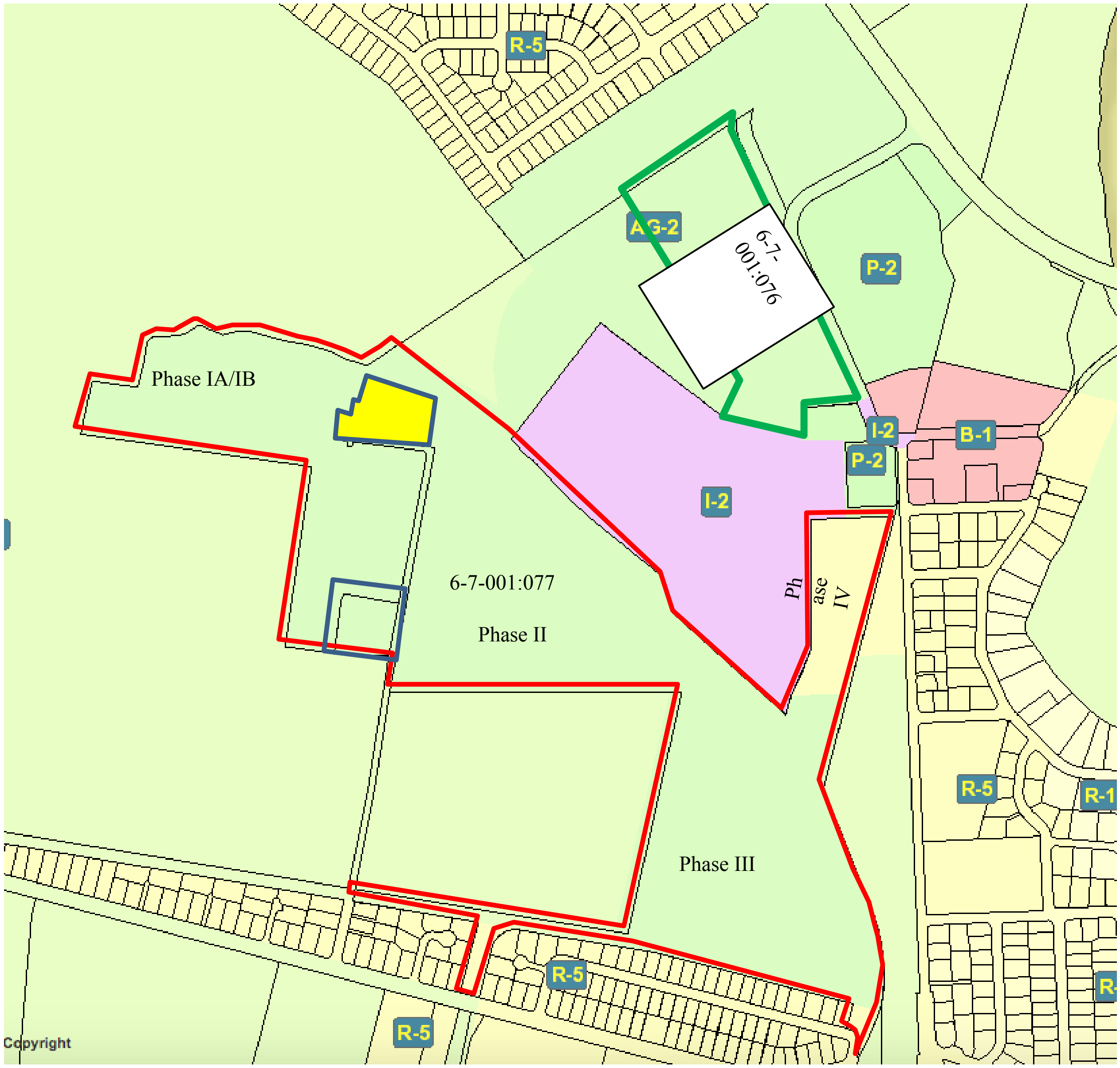


Figure 2-11: County land use zoning designations Parcel 6-7-001:077 (red outline) and Parcel 6-7-001:030 (blue outline) are affected by the urban growth boundary and the land use map. A 6-acre portion of the Parcel 077 is zoned R-5. Parcel 6-7-001:0076 is within the urban growth boundary but zoned Ag-2. Parcel 6-7-001:060 (yellow) is the Waialua Hongwanji Mission, not part of the proposed development. It is also outside of the current Urban Growth Boundary. All parcels affected by this request are zoned Ag-2 except for a 6-acre portion of parcel 077 along Goodale Avenue, which is zoned R-5.

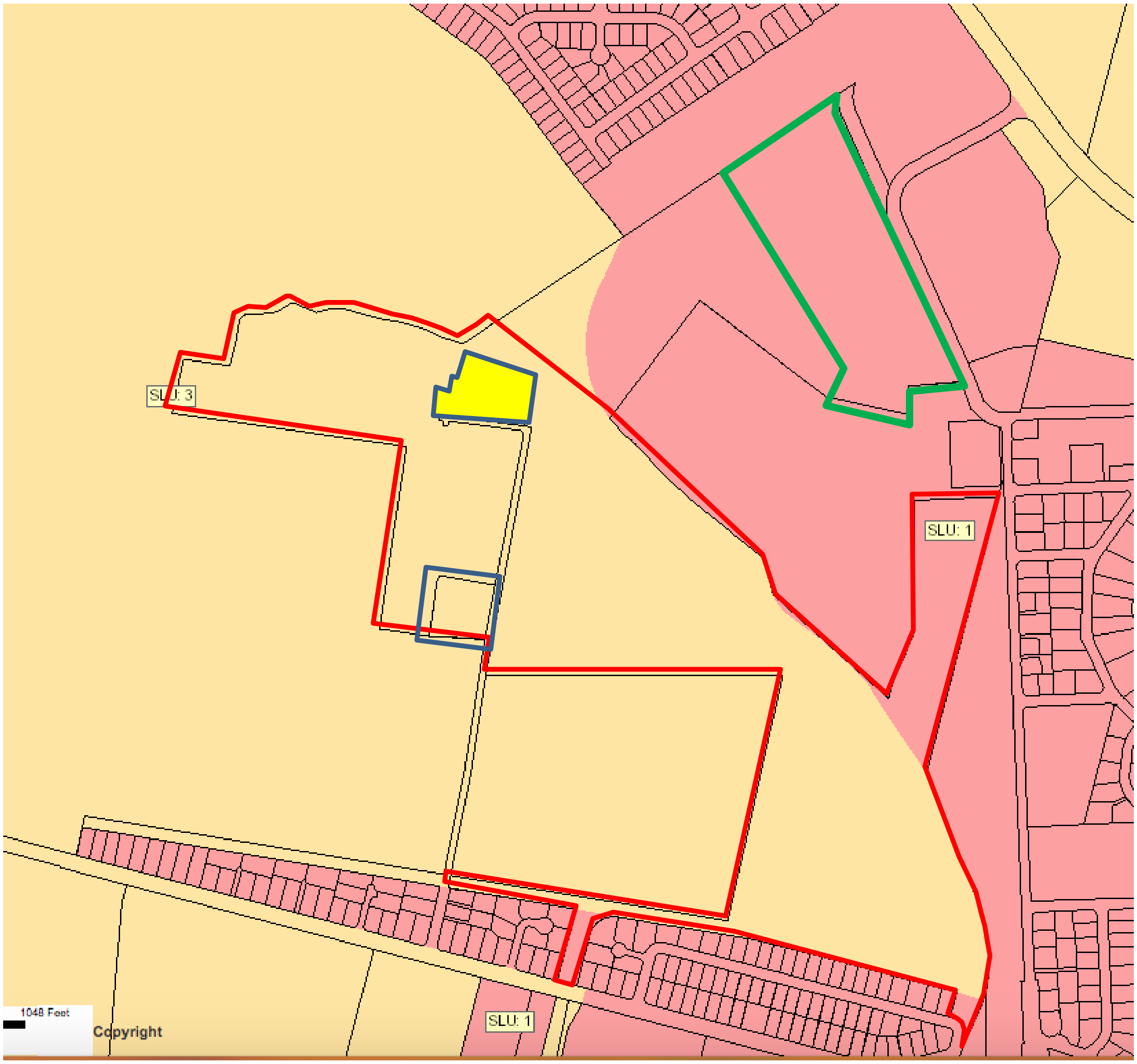


Figure 2-12: State land use boundaries. Parcel 6-7-001:077 is primarily in the agriculture district, with a 6-acre portion on the east in the urban district. Parcel 6-7-001:076 is within the urban district.

2.6 Alternative Land-use Permitting Considered and Rejected

Alternatives for the 201H permit path include agricultural cluster, zone change, and historic site designation. These alternatives and the no action alternative have been considered.

Agricultural Cluster: According to Ord. 99-12 (May 1999), "agricultural clusters are permitted in any agricultural district to promote economy or services and utilities and the most efficient use of the remainder area for agricultural pursuits." For this request, an agricultural cluster alternative for Mill Camp is not feasible because the maximum number of farm dwellings in an Ag-2 district agricultural cluster is not allowed to exceed one unit per two acres, though the spirit of the Agricultural Cluster is present in the proposal. There are 67 existing single family homes structures with planned expansion to 256, not all of which match the definition of farm dwelling. The agricultural cluster alternative is not feasible because it would require more acreage per dwelling than allowed within the Ag-2 zoning. In addition, the agricultural cluster alternative requires each dwelling to be sited on a lot not to exceed 5,000 square feet. The majority of dwellings now and in the future will be located on 7,000 sf lots. These criteria make the Agricultural cluster alternative infeasible.

Zone Change: Most of Mill Camp is located within the City and County of Honolulu's Ag-2 zoning district and the State Agricultural District. A request for a zone change to a residential district for Mill Camp would be feasible for the majority of Mill Camp because all but 12 acres are located within the Urban Growth Boundary (UGB) established in the current 2010 North Shore Sustainable Communities Plan. The portion that lies outside of the UGB contains existing houses and is centrally important to the proposed development plan. The zone change alternative is not as advantageous to the planned development because it restricts land use in the areas of Phase IA and IB.

No Action Alternative: Single family housing is authorized on agricultural lands in current and former plantation communities under HRS 205-4. Maintenance and non-substantial repair of the existing houses is allowed under the statute; however, expansion of Mill Camp would not be allowed. The existing houses are in poor shape and cannot be maintained in a safe and effective manner. The increase in the maximum number of residential units is needed to meet the expanding demand for affordable housing for farm workers and retirees to support Oahu's resurgent agriculture industry. The no action alternative is rejected because it is not sustainable, and it does not meet the objectives of the proposed action.

2.6.1 Selected Land-use Alternative

The proposed action is to obtain a 201H permit. 201H is selected because it supports the increasing demand for affordable housing, and provides opportunities to facilitate restoration of the existing plantation camp. The 201H alternative is allows the developer to maintain the style and character of the existing community and it is consistent with existing planning objectives.

3.0 ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION

3.1 Physical Environment

3.1.1 Geology and Soils

The Island of Oahu covers 597 square miles and is the third-largest island in the Hawaiian chain. The island was formed about 4 million years ago by two volcanoes: Waianae and Koolau. Waianae, the older of the two, created the mountain range on the western side of the island, whereas Koolau shapes the eastern side. Central Oahu is on an elevated plateau bordered by the two mountain ranges, with Pearl Harbor to the south. Oahu's most famous natural landmarks, including Diamond Head and Hanauma Bay, are tuff rings and cinder cones formed during a renewed volcanic stage, roughly 1 million years ago. Waialua sits on an erosional plain formed from the northeastern flank of the Waianae volcano.

Sixty-seven percent of soils in Mill Camp are Mamala cobbly silty-clay loam (MnC), 29% is Waialua silty clay(WkA) and 3% is Waipahu silty clay (WzA).

MnC is described as having slopes from 0 – 12 percent, the surface of which contains stones or boulders over 5%. The depth of soil is between 8 and 20 inches, beneath that is bedrock composed of fossilized calcium carbonate from coral reefs. MnC is well drained with medium runoff potential. Its capacity to transmit water is quite variable between 0.06 and 0.6 inches per hour.

WkA is found at slopes of 0 to 3%, and is generally free of rocks. The soil depth is more than 80 inches below surface. Bedrock may be coral or saprolite clay formed from weathered in place volcanic rock. The soil is moderately well drained with low runoff potential. Its ability to transmit water is high at 0.2 to 0.6 inches per hour. WzA is very similar to WkA with exception of the slopes are 0 – 2 percent. These types of soils are generally not expansive and can be used for housing foundations and spread footings.

3.1.2 Surface Water

Mill Camp is roughly ½ mile upgradient from the Pacific Ocean on Oahu's North Shore. All open coastal waters are classified as Class A or AA Open Coastal Marine waters. Stormwater is likely to drain into Waikele Gulch, and ultimately into the Middle Loch of Pearl Harbor. Pearl Harbor has a special classification for water quality standards. The nearest surface water body is Lake Wilson (Wahiawa Reservoir) approximately 2.5 miles to the northeast and upgradient from the subject property. There are no wetlands, natural streams, or irrigation ditches within Mill Camp. Old agricultural drainage features are present to the south and west of the camp (Figure 3-1). These are dry except for during storm events. Stormwater would sheet flow through the camp toward one of the branches of this drainage feature. The drainage ditch is consistently wet at its mouth where it crosses the Waialua Beach Road and enters the Pacific Ocean near Kaimanu Place. Restoration of Mill Camp will include construction of stormwater retention areas designed to provide infiltration for designed stormwater events.

Figure 3-1: US Fish and Wildlife Wetlands Map[10] (top) and FEMA flood Hazard Map[11] (bottom)

[10] https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html
[11] https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper

Mill Camp is in FEMA Flood Zone D (not studied); however, it is outside the 100-year floodplain. A small portion on the northwest corner is within the 2% annual flood hazard area. There are no recognized wetland on the property (Figure 3-1). Restoration will comply with ROH 21a. It is also outside the Oahu Civil Defense Tsunami inundation zone (Figure 3-2). Mill Camp has existing erosion control measures in those locations that are prone to stormwater runoff. Construction contractors will be required to use best management practices to control stormwater runoff.

Figure 3-2 Tsunami Evacuation Areas shown in blue[12].

3.1.3 Climate Change and Resilience

The elevation of Mill Camp ranges from 20 feet on the northwest corner to 40 feet on the southeast. None of the housing areas are threatened by sea level rise or tsunami inundation. Local flooding has been more frequent in recent years and the trend is expected to continue. Mill camp will be designed to reduce the impacts of local flooding and extreme weather events with the objective of maintaining civil services during events that may interrupt water, power, and communications in older areas of Waialua. Concepts for resilience incorporated in that design include:

- Bioswales at the rear of all single-family homes to facilitate drainage,
- Permeable pavements where practical to reduce stormwater runoff,
- Local power generation and minimal above-ground power transmission,
- Water supply will have storage and backup power, and
- Flood-conscious grading and construction plan. Kupuna and multifamily housing must utilize slab on grade construction. The ground surface beneath these housing units will be elevated two feet above the surrounding grade to prevent flood water damage. Single family homes will be built on post and pier to minimize flood damage.

3.1.4 Groundwater Resources

Waialua Mill Camp sits atop the northern portion of the Waialua Aquifer (Figure 3-3). This aquifer is identified in groundwater permits as being in the north sector aquifer, Waialua System. It is characterized as a basal, unconfined type, originating in sedimentary-type geology. It is

[12] https://geoportal.Hawaii.gov/datasets/HiStateGIS::tsunami-evacuation-zones

currently used, ecologically important (not used for drinking), fresh with less than 250 parts per million salinity. The Waialua aquifer system is considered unique and highly vulnerable to contamination. Ground water is around 10 feet above sea level beneath Mill Camp, which implies between 10 and 30 feet below ground surface. Local groundwater contamination was discovered beneath the adjacent property where the former sugar mill was located. Much of this contamination was remediated through engineering and administrative controls. The sugar mill is northeast of the camp and therefore downgradient. Contamination release within the mill site would be expected to move away from Mill Camp.

The water source for Mill Camp is remote from the camp itself. It is located slightly over ½ mile south of the camp in the foothills of Mount Ka`ala. Public Water Supply 0309 serves Mill Camp, Otake Camp, Kaala Ranch, and various properties owned by Dole Foods. The wells are designated as Well # 3-3307-003 and 004, permitted within the North Oahu Aquifer, Waialua System. The wells' location appear to be within the Mokuleia aquifer system as shown on the Department of Health aquifer maps[13] (Figure 3-4). Characteristics of the source water is quite similar to the those from beneath the camp, except the Mokuleia system is classified as being used for drinking water.

[13] https://geoportal.Hawaii.gov/datasets/doh-aquifers

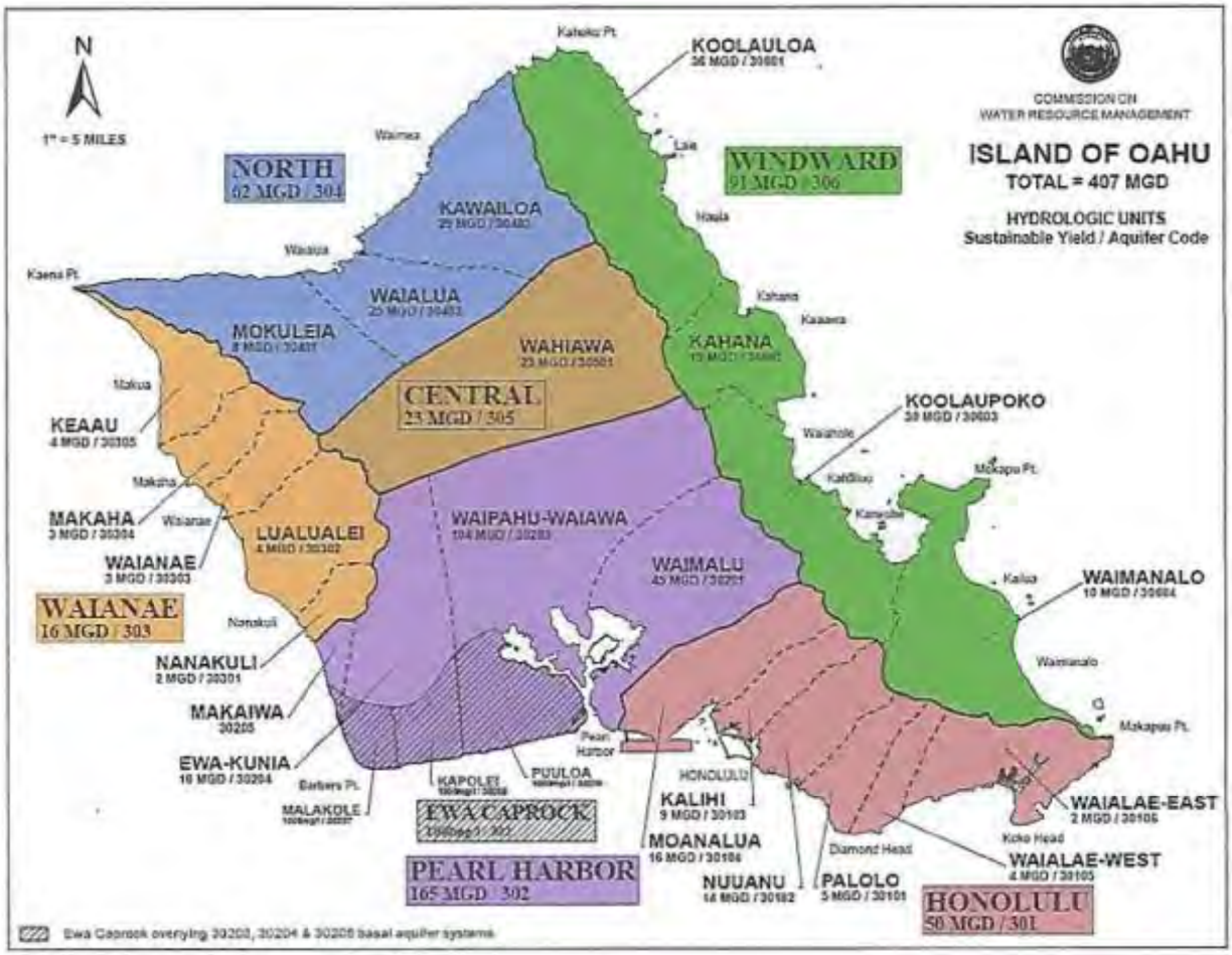


Figure 3-3: Groundwater aquifers of Oahu[14]

[14] Commission on Water Resources Management

Figure 3-4: Detail of the DOH map of groundwater aquifers in the vicinity of Well 3-3307-003 and 004 (shown in red). Locations are estimated.

The Mokuleia System is not currently pumped to its maximum sustainable capacity. Wells serving PW 309 have a water allocation of 406,000 gallons per day and are currently pumping at approximately 80% of their allocated volume, however more than half of the volume pumped appears to be lost to leakage.

3.1.5 Climate and Air Quality

The project site has a mild, semi-tropical climate of characteristic of most regions of Oahu. The average maximum daily temperature ranges from 78°F to 87°F, with an average minimum temperature ranging from 60°F to 68°F, depending on the season. Rainfall for this area is averages 31 inches annually, with much of it occurring between November and April[15]. Winds from the northeast, known as trade winds, are the most predominant over the Hawaiian Islands. Typical wind velocities range from 3 to 14 knots. There is an occasional shift in the wind patterns to the westerly "Kona" winds which are sometimes quite strong.

[15] *http://rainfall.geography.Hawaii.edu*

In Hawaii, both federal and state environmental health standards pertaining to outdoor air quality are generally met due to prevalent trade winds. Since the closure of Waialua Sugar Company in 1997, there have been no significant sources of stationary air emissions in the vicinity. The regulated air pollutants in the area are quite low in comparison with the air quality limits established by the Clean Air Act.

During construction there may be additional traffic with temporary contributions to air pollution from fugitive dust, heavy equipment, and automobile emissions. Automobile and fuel power construction equipment will be limited to that necessary to build the project, and fugitive dust will be managed under best management practices as defined by the State of Hawaii.

3.1.5 Noise and Odor

Mill Camp is relatively quiet. Ambient noise levels are characteristic of rural communities. Noise associated with the proposed action to rebuild Mill Camp will include construction noise during business hours. This construction noise is expected to be intermittent, temporary, and confined to business hours during construction periods. Additional vehicular traffic is also expected to create minimal noise impacts during camp operations.

3.1.6 Scenic Value and View Plane

Mill Camp cannot be seen from any public road, park, or overlook. The topography of the area is gently sloping toward the west southwest. The land begins to slope much more rapidly about two miles to the west where the northern flank of the Waianae range begins. Mill Camp lies on the flank of Mount Ka`ala, which is Oahu's tallest peak. There are no ocean views from the property. View planes toward the west from the Camp are of farmland and the Waianae range including views toward Kaena Point. Views to the north, east, and south are also of farmland, the majority of which is in active production.

The proposed action consists of infill and subtle changes to the camp infrastructure. All new construction will be consistent with the rural character and plantation history. Existing views within the camp will be improved by removal of accumulated trash, abandoned vehicles, and managed vegetation. The proposed restoration of Mill Camp is expected to create noticeable changes in the appearance and view planes within and around the Mill Camp.

3.1.7 Hazardous Substances

Construction equipment using fossil fuels and hydraulic power will be used in grading and building the facility. There is some possibility of leaks, spills, or accidents during construction. The construction contractors will be required to develop and maintain an emergency action plan for management and recovery of any release to the environment. Aging houses may also have asbestos containing materials and lead-based paint. Demolition and/or repair of the structures will be governed by the contractor's best management practices to reduce exposure of both workers and nearby residents to hazardous materials during construction and demolition.

3.2 Biological Environment

3.2.1 Vegetation

The subject property is slightly over 70 acres with elevation differences of less than 20 feet. It has been used for single family housing for almost 100 years. Vegetation consists of trees where planted for fruit or shade, grass for lawns, and invasive plants where the lot has not been maintained. There are no natural lands within the subject property only those that are actively managed and those whose management has lapsed. The dominant vegetation in managed areas on the property are Saint Augustine grass in lawns, with planted fruit or ornamental trees, and vegetable gardens. Land that is not actively managed begins to grow Koa haole (*Leucaena leucocephala*), Guinea grass *(Megathyrsus maximus)* and kiawe (*Prosopis pallida).* All are introduced and considered invasive species.

3.2.2 Wildlife

Wildlife that transits the property would originate primarily within urbanized areas of Waialua, the former Sugar Mill property, as well as active farmlands surrounding the camp. Mill Camp currently has a feral pig that frequents houses and is somewhat supported by residents.

Wild areas of the Waianae Range occur 2 to 5 miles to the south and west of the property. Those areas may be relatively important habitat for endemic Hawaiian birds including the Oahu elepaio (*Chasiempis sandwichensis ibidis*), Apapane (*Himatione sanguinea*), and Amakihi (*Hemignathus virens*). Other species common to the area include northern cardinal (*Cardinalis cardinalis*), spotted dove (*Streptopelia chinensis*), red-vented bulbul (*Pycnonotus cafer*), Indian myna (*Acridotheres tristis*), and gray francolin (*Francolinus pondicerianus*). Feral mammals include pigs (*Sus scrofa*), Indian mongoose (*Herpestes javanicus)*, rats (*Rattus rattus or Rattus norvegicus*), common mice (*mus musculus*), and cats (*Felis domesticus*).

3.2.3 Special-Status Species

The project will occur within areas that experienced large-scale alteration of the natural environment for the sake of housing since 1920. The vast majority of the North Shore alluvial plain has been cultivated for sugarcane for the equivalent period. The U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office (USFWS-PIFWO) has not identified federally designated critical habitat within the immediate vicinity of the proposed project (Figure 3-5). USFWS data contained in their IPAC resources recognizes the area to have six Hawaiian waterbirds, and one mammal as federally protected species that may occur or transit through the project area. These are identified as:

- Hawaiian stilt (Himantopus mexicanus knudseni) or aeʻo
- Hawaiian gallinule (Gallinula galeata sandvicensis) or ʻalae ʻula
- Hawaiian coot (Fulica alai) or ʻalae keʻokeʻo
- Hawaiian petrel (Pterodroma sandwichensis) or ʻuaʻu
- Newell's shearwater (Puffinus auricularis newelli) or ʻaʻo
- Band-rumped storm-petrel (Oceanodroma castro) or ʻakēʻakē

- Hawaiian hoary bat (Lasirus cinereus semotus) or ‘ōpe‘ape‘a

No plants, aquatic fauna, native forest birds, mammals or terrestrial invertebrates that are protected species are expected to be found within the highly disturbed housing areas.

The project is not sited within suitable habitat for native forest birds such as Oahu ‘elepaio (*Chasiempis ibidis*), ‘apapane (*Himatione sanguinea*), and Oahu kihi (*Chlorodrepanis flavus*), and the known breeding range of the indigenous White Tern (*Gygis alba*) or manu o kū. The Black-necked Hawaiian stilt or ae‘o is commonly observed in the area’s wetlands and lo`i, but not within the subject property. Native birds including the Pacific Golden-Plover (*Pluvialis fulva*) and Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*) are likely to be found within the project area. The Hawaiian Short-eared owl (*Asio flammeus sandwichensis* or pueo) is more likely to utilize mountain slopes, grassland, and pastureland beyond the project area. The Hawai`ian hoary bat (*Lasiurus cinereus semotus* or ōpe‘ape‘a) may fly over the project vicinity on a seasonal basis.

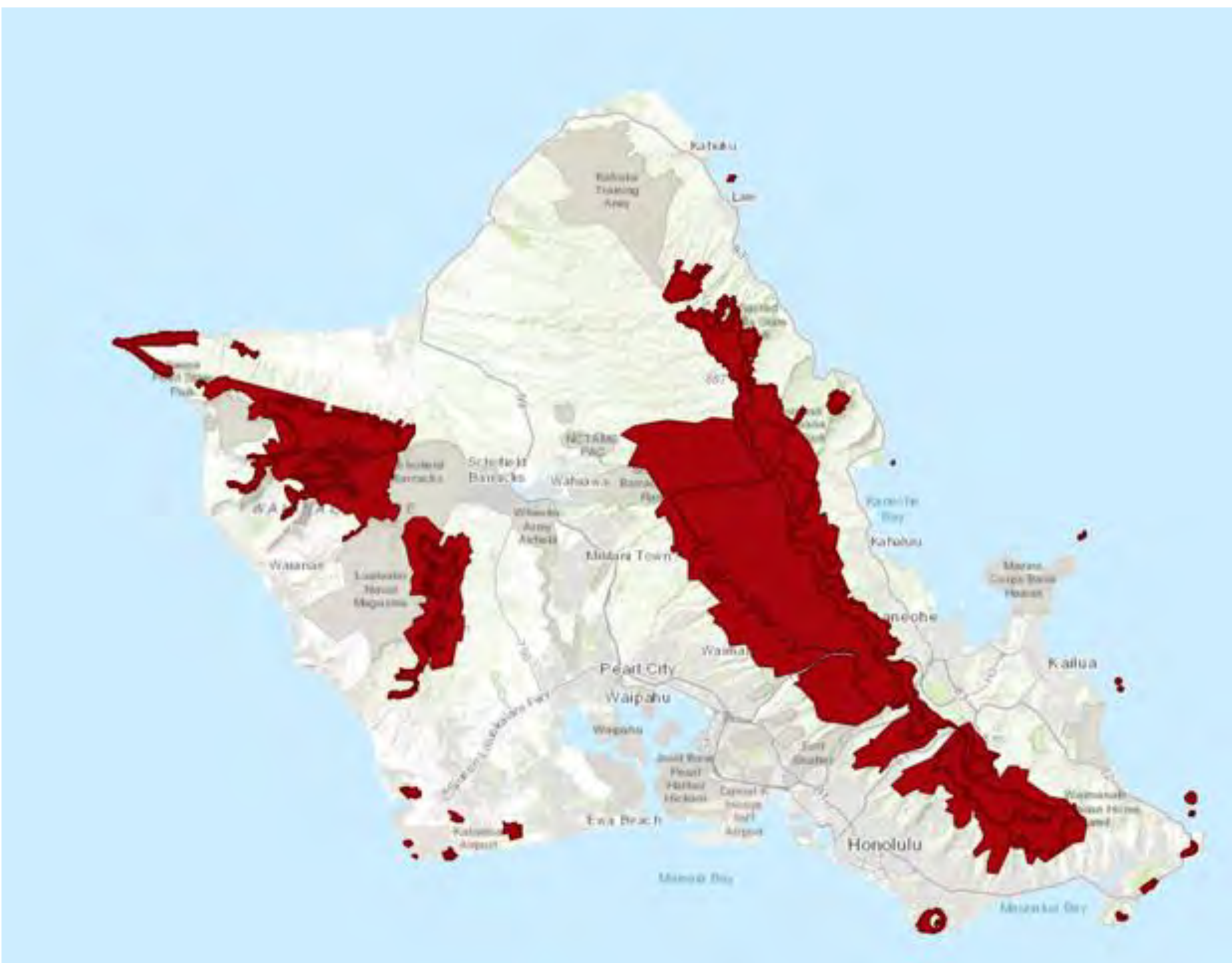


Figure 3-5: US Fish and Wildlife critical habitat for threatened and endangered species on Oahu[16].

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16 *https://geoportal.Hawaii.gov/datasets/Oahu-critical-habitat-ecosystem*

3.3 Socioeconomic Environment

Data from the US Census Bureau shows the statistical description of Waialua as the census designated place (CDP); however, the target population of Mill Camp is distinct from Waialua (Table 3-1). Mill Camp is included in the CDP census data, but it has only a mild impact on that data because of its small number of residents.

Table 3-1: Economic comparison between Waialua and Mill Camp.

Demographics	Waialua CDP[17]	Mill Camp
Population	3112	261
Population change 2010 -2020	-19.4%	-15%
Average Age	40.2	58
Household income	$77,031	$40,000*
Social Security as principle source	10.2	45*
% poverty	11.7	30*
Unemployment	1.5%	43%*

**Estimated*

The socioeconomics of Mill Camp are distinct from Waialua because the residents of Mill Camp are primarily retirees from the Waialua Sugar Mill who live on social security and a small pension. Those residents who were not retired in 1997 when the Mill closed predominately found other agricultural work, but an estimated 43% of people within Mill Camp are either retired or unemployed.

At this time no household income data is collected. Salaries for employees of Waialua Sugar were quite low even for agricultural workers because housing was included as a benefit. While that allowed for reasonable prosperity for sugar workers, their mandatory contributions to social security were less than normal because of the housing offset. Pensions from Waialua Sugar Company are estimated to be between $200 – $400 per month, which implies that almost all of the older residents are highly dependent on a reduced payment from social security. Since Waialua Sugar does not exist these pensions may be fixed since 1996. HAHI estimates that nearly 60% of residents are retired and living primarily on social security, unemployed or are underage dependents. Data from a similar plantation camp operated as an affordable housing community shows the average median household income of 45% of the Area Median Income.

Following the restoration of Mill Camp income data will be collected, and residents must be income qualified. All households in Phases I, II, will be restricted to families earning less than 60% of the Area Median Income as required by the terms of the City Affordable Housing Fund.

[17] https://www.towncharts.com/Hawaii/Housing/Waialua-CDP-HI-Housing-data.html

3.3.1 Social Factors and Community Identity

Community identity is strong within Mill Camp, and most current residents have spent the majority of their lives within its boundaries. A significant fraction of Hawaii's local population either lived in a plantation camp or had relatives who did during their early years. This type of close-knit community recalls a simpler time in our history. During much of this period fathers, sons, and daughters worked the same fields, stayed close together, and faced life's challenges as part of this community. It is a special part of our history that was lost with the loss of the sugar and pineapple plantations. Many social support mechanisms were lost at the same time. Mill Camp has been a community of sugar workers since 1920. Most employees walked or rode a bicycle to assembly point for assignments. The plantation paid the bills, ran the store, and clinic, provided church buildings and recreational facilities. This was a place where neighbors came together when one of their neighbors was sick or injured.

3.3.2 Economic Effects of the Proposed Action

For more than a century, plantation camps were the original live-work-play developments, and they provided affordable workforce housing, an essential resource that is currently in very short supply. Respectable low-cost housing, near the jobsite, provided the foundation on which Hawaii's economy was built in the last century. Our current efforts to stimulate Hawaii's non-tourism related economy have not succeeded primarily due to the disparity between earnings and the cost of living. The term "paradise tax" is a familiar reference to this imbalance. Our labor force cannot be sustained without respectable housing that working families can afford, and Waialua is losing many of its younger families to location where they can afford to settle.

The cost of owning or renting real estate on the North Shore is very high in comparison to the median income. Long-term residents are being squeezed out at a rate that is higher than most other areas. Those who remain are constantly defending the area from the burdens of tourism and high-end developments. Restoration of the Waialua Mill Camp as a source of affordable housing may be one of the few types of "development" that would support the unique character of the North Shore that was built by the very people who can no longer afford to live here.

A Hawaii Housing Planning Study[18] was published in 2020 by HHFDC. This study is based on pre-pandemic data and therefore conservative in its estimates. Significant findings include estimates that fair market value for rental of a 2-bedroom apartment in Honolulu is in excess of $2,000/month. Currently, the cost of that apartment is more than $3,000/month in Waialua. More than 138,000 houses on Oahu are rentals (44% of the total number of houses). A worker with a full-time job at the mean annual wage is only able to afford to pay $918 per month which is less than one third of the average rent for a two-bedroom apartment on the North Shore of O`ahu. This statistic can be restated as the average rent for a 2-bedroom apartment is more expensive than three full-time workers earning the average wage can afford.

Waialua Sugar Company was the economic engine for the North Shore between the 1920s and 1997. The affordable housing provided by the company in Mill Camp and others was the basis for a stable workforce that became the most efficient sugar plantation in Hawaii. Its employees, many of whom

[18] SMS Research https://dbedt.Hawaii.gov/hhfdc/files/2020/02/State_HHPS2019_Report-FINAL-Dec.-2019-Rev.-02102020.pdf

were immigrants, prospered, got married, had families, became more educated, and spent their money in the area. These are the people who built Waialua and Haleiwa. Preservation of that culture is our primary objective. It is hoped that the availability of affordable housing will keep young families who grew up here from moving away. If we are successful in this objective respectable housing at a reasonable price will once again be the foundation for prosperity among the long-term families of the area.

3.4 Archaeological and Historic Resources

The project area and the vicinity of the project area have been subject to a variety of archaeological studies over the years, which is outlined in Table 3-2.

Table 3-1: Previous archaeological studies conducted in the vicinity of the current study area.

Year	*Author(s)*	*Type of Study*	*Findings*
1933	McAllister	Island-wide Survey	Identified Sites 197 through 208. See Table 4.
2002	Collins & Jourdane; Davis	Inadvertent Discovery	A single, likely native Hawaiian burial (SIHP #50-80-04-6403)
2004	Moore et al.	Archaeological Inventory Survey	Identified three sites: a disturbed traditional burial (SIHP #50-80-04-6532); portions of the Waialua Dairy; (SIHP #50-80-04-6533); and two WWII pillboxes (SIHP #50-80-04-6534).
2007	Yorck et al.	Archaeological Monitoring	No historic properties observed.
2010	Filimoehala & Rieth	Archaeological Monitoring	A single human vertebra (SIHP #50-80-04-7143).

Background research indicates that the study area was extensively altered by the sugarcane industry during the 19th and 20th centuries. The study area was used for sugarcane fields, residential developments for employees, and other sugar industry operations. Consequently, there is a high probability that infrastructure related to sugarcane cultivation is extant in the project area including that related to transportation, irrigation, and mill operations. The Waialua Mill Camp remains an active neighborhood today and the current homes are the structures built by the Waialua Agricultural Company. However, it is expected that many of these houses have been altered by renovations and additions since their original construction. Additionally, there is a potential for evidence of structural demolition and landscape repurposing within the project area given the decline of the mill camp housing in later decades. Due to the extensive use and development of the area by the plantation, it is unlikely that evidence of traditional Hawaiian land use remains within the study area. While two previous archaeological investigations (Moore et al. 2004; Filimoehala and Rieth 2010) have identified traditional burials within the general Waialua area and one study (Collins and Jourdane 2002) reported on an inadvertent discovery made in the vicinity of the current study area, the likelihood of encountering such remains within the current study area is minimal.

As a result of the fieldwork for the current study, four sites and a potential historic district were identified (Table 5). The locations of these historical properties relative to the current study area boundaries are presented in Figures 37 All the documented historical properties are associated with the historic Waialua Agricultural Company Sugar Mill or the affiliated community. Extensive modification of the land within the study area was noted during the survey, including prior mass grading and the presence of underground utilities, building footprints, paved and unpaved roads and parking areas, and active agricultural plots. All observed historic properties originate from the 20th century, and include an irrigation ditch, a historic structure associated with the former Waialua Agriculture Company Concrete Products Plant, an isolated retaining wall, a former Church property, and a plantation camp. None are currently listed in either the National Register or the Hawaiʻi Register of Historic Places; and no previously designated local, state, or national historic districts are located within the boundaries of the study area. The four sites and one potential historic district are identified below.

Table 3-2: Significance and treatment recommendations.

SIHP Site #	*Type*	*Function*	*Age*
TS-01	Ditch	Irrigation	20^{th} century
TS-02	Industrial Structure	Concrete plant	20^{th} century
TS-03	Retaining wall	Soil retention, boundary	20^{th} century
TS-04	Former Church Property	Religious/Social	20^{th} century
TS-05	Plantation Camp	Residential	20^{th} century

The recorded historic properties are assessed for their significance based on criteria established and promoted by the Department of Land and Natural Resources-State Historic Preservation Division (SHPD) and contained in the Hawaiʻi Administrative Rules 13§13-284-6. For a resource to be considered significant it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:
a Be associated with events that have made an important contribution to the broad patterns of our history;
b Be associated with the lives of persons important in our past;
c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
d Have yielded, or is likely to yield, information important for research on prehistory or history;
e Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.
As a result of the current study, four historic properties, all dating from the twentieth century and relating to former plantation activities, were identified in the study area (Table 6). A fifth potential historic property, the Waialua Mill Camp Historic District, was also identified but as discussed above, determined not to constitute a significant historic district.

SIHP Site #	*Site Type*	*Temporal Affiliation*	*Significance*	*Recommended Treatment*
TS-01	Irrigation Ditch	20^{th} Century	d	No further work
TS-02	Concrete Plant	20^{th} Century	a	No further work
TS-03	Retaining Wall	20^{th} Century	d	No further work
TS-04	Former Church Property	20^{th} Century	d	No further work
TS-05	Plantation Camp	20^{th} Century	N/A	No further work

SIHP SITE TS-01
Site TS-01 is an irrigation ditch, which appears to still be used periodically. Two abandoned possible irrigation ditches in very poor condition were also recorded. This irrigation ditch retains sufficient

integrity to convey its significance under Criterion d for information it has yielded relative to middle/late twentieth century plantation irrigation practices. As the research potential for this site has been exhausted as a result of the site documentation carried out in this study, no further historic preservation work is the recommended treatment.

SIHP SITE TS-02
Site TS-02 is the remains of the former Waialua Agricultural Company Concrete Products Plant that manufactured, among other things, the segmented Waialua Flumes that gained widespread popularity and use in the mid-twentieth century. Roughly one third of the original structure has collapsed and been removed and what remains of the concrete plant structure is only standing as a result of significant non-compatible structural additions. The innovation and use of what became to be known as “Waialua Flumes” undoubtedly contributed to broad patterns of history at a state-wide level. The poor condition and non-compatible additions to the concrete plant have compromised the integrity of design, materials, and workmanship. Additionally, the concrete plant was just one component of the industrial infrastructure connected to flume construction. The concrete plant is currently surrounded on all sides by vacant land and, thus, no longer retains integrity of setting, feeling, and association that would have once characterized an active sugar mill. The concrete plant does retain integrity of location and is considered significant under Criterion a only. As the history of the invention, use, and distribution of Waialua Flumes has been documented by others (Dorrance and Morgan 2000; Wilcox 1996) and elaborated on in the current study, no further historic preservation work is recommended for this site.

SIHP SITE TS-03
Site TS-03 is a low (two to three course high) retaining wall, that was perhaps once associated with the former Waialua Gakuen School property. This wall retains several aspects (location, design, materials, and workmanship) of integrity, and by virtue of its identification and documentation as a result of the current study, is considered significant under Criterion d for information it has yielded relative to twentieth century land use practices. As this retaining wall was fully documented as a result of the current study, no further historic preservation work is recommended.

SIHP SITE TS-04
Site TS-04 is three features of the former Waialua Pilgrim Church/Waialua Church of Christ property. While the church building was removed in the early 1990s, the three remaining 20th century features, while individually insignificant, collectively are significant under Criterion d by virtue of their identification and documentation as a result of the current study. As these features were fully documented, no further historic preservation work is recommended.

SIHP SITE TS-05
The current study found that the extant Waialua Mill Camp area was not sufficiently intact to constitute a significant historic district.

Determination of Significance
Given the above findings, analysis, and discussion with respect to historic properties identified in the study, the HRS Chapter 6E-42 effects determination for the proposed Waialua Mill Camp restoration project is no historic property affected, therefore no further historic preservation work is recommended. In the unlikely event that archaeological resources are encountered during the implementation of the Waialua Mill Camp Housing Project, work in the immediate area of the discovery should be halted ad SHPD contacted pursuant to HAR §13-280-3.

3.5 Cultural Impacts

The current project area falls within Kamananui Ahupuaʻa in the traditional district or *moku* of Waialua in the northwest portion of Oʻahu. Kamananui extends from the western side of the Koʻolau Mountains and terminates at the coast near Kaiaka Bay. The literal translation of Kamananui is "the large branch" and likely refers to the north fork of Kaukonahoa Stream[19]. According to Sahlins (1992), Waialua comprised six traditional *ahupuaʻa* from west to east as follows: Kaʻena, Kawaihāpai, Mokulēiʻa, Kamananui, Paʻalaʻa, and Kawailoa. However, some historical and modern maps and sources list as many as fourteen *ahupuaʻa* within Waialua District. Sahlins also states that *moku* characteristically comprised of rich and centrally located lands with ecologically marginal lands along their periphery. The fertile lands of neighboring *ahupuaʻa* of Kamananui, Paʻalaʻa, and Kawailoa comprised the ecological center of Waialua Moku, which is described:[20]:

> *Geographically this heartland of Waialua consisted of the area around the neighboring bays, they are about a mile apart, of Kaiaka and Waialua. Into these bays, from their origins in narrow gorges deep in the mountains flowed four major streams. Dense settlements of people and large complexes of irrigated taro fields were situated on the floodplains of these streams. At Kamananui, the lowland fields were watered by means of a ditch some two miles long, the longest such waterway on Oʻahu (McAllister 1933:133; Handy and Handy 1972:466). Irrigation on a smaller scale extended for a considerable distance up the river valleys, while rainfall agriculture was practiced on the adjoining slopes, upland plains (kula), and forest clearings in the higher gulches. Around Waialua Bay were two large and famous brackish water fish ponds ʻUkoʻa and Lokoea. Fish were also raised in the many smaller ponds of the same area as well as in taro pondfields (loʻi). Given such intensive production, the core region must have supported the substantial majority of the Waialua population, which was probably on the order of 6,000 to 8,000 people just before the coming of the Haole. (1992:20).*

Written accounts left by early visitors to the Island of Oʻahu, such as those presented below, offer valuable insight into what life may have been like for the earliest residents of Kamananui and greater Waialua. Many of these historical accounts were penned by seafaring men who dropped anchor at or near what they refer to as Waialua Bay. Kaiaka Bay, which is located within Kamananui Ahupuaʻa, was considered the political center of the *moku* of Waialua. In late February of 1779, after the death of Captain Cook, the remaining crew of his ship Resolution, under the command of Captain Clerke, and Discovery, under the command of Captain James King, sailed from Maui to Oʻahu to water the ship. During the landfall King recorded observations of what he saw in the project area including Kaiaka Bay.

> *Between the north point [Kahuku] and a distant headland, which we saw to the south-west the land bends inward considerably, and appeared likely to afford a good road. . . At a quarter past two, the sight of a fine river, running through a deep valley, induced us to come to an anchor in thirteen fathoms water, with a sandy bottom [Kaiaka Bay]. . . In the afternoon, I attended the two captains on shore, where we found but few of the natives, and those mostly women; the men, they told us, were gone to Morotoi [Molokaʻi] to fight Tahyterree [Kahekili II]; but that their chief Perreeoranee [king of Oʻahu], who had stayed behind, would certainly visit us, as soon as he heard of our arrival.*
>
> *"We were much disappointed to find the water had a brackish taste for two hundred yards up the river, owing to the marshy ground through which it empties itself into the sea, Beyond this, it was*

[19] Pukui et al. 1974:80
[20] Sahlins 1992

> *perfectly fresh, and formed a fine running stream, along the side of which I walked, till I came to the conflux of two small rivulets, that branched off to the right and left of a remarkably steep and romantic mountain. The banks of this river, and indeed the whole we saw of the north-west part of Woahoo are well-cultivated, and full of villages; and the face of the country is uncommonly beautiful and picturesque.* [21]

According to Native Hawaiian Historian Samuel Kamakau[22], Waialua is known as the birthplace of the first Hawaiian ruling chief, Kapawa, and from then on, the group of Hawai`ian Islands were established as chief-ruled kingdoms". Kapawa was born at Kūkaniloko, the sacred birthplace built by his parents Nanakāoko (father) and Kahihiokalani (mother) both of whom were descendants of the famed ʻUlu line of chiefs (Kamakau 1991).

Another significant ruler from Waialua is Māʻilikūkahi, who was chosen as the *mōī hoʻoponopono o ke aupuni* (administrator of the government), and after a rebellion, he replaced the *mōī aliʻi* (head chief) Haka, whose reign is characterized by his mistreatment of the chiefs and people. At the age of twenty-nine, Māʻilikūkahi became *mōī aliʻi*, where he was taken to the *heiau* (place of worship) of Kapukapuākea in Paʻalaʻa-kai in Waialua and consecrated and proclaimed as the *aliʻi o ka moku* (chief of the island). Unlike other chiefs who took their kingdoms by force, the ceremonies conducted at Kapukapuākea for Māʻilikūkahi were reserved for the "chiefs of Pōkano" or those chiefs who had maintained an absolutely pure royal bloodline since ancient times[23]. Māʻilikūkahi then moved Oʻahu's royal center from Waialua and ʻEwa to Waikīkī in Honolulu. Another important hallmark of Māʻilikūkahi's reign was his formalization of the land division system on Oahu, a system that appears to have been later implemented on the other islands[24].

Once the land division system was ordered, Māʻilikūkahi commanded that all classes of people cultivate the land with food and animals and that stealing would not be tolerated and punishable by death. He forbade theft, especially between the chiefs and *makaʻāinana* lest they face death. He suspended the practice of human sacrifices at the *heiau luakini* (sacrificial place of worship) and ordered that the eldest child of each family be cared for by him. Despite efforts from the Maui and Hawaiʻi Island chiefs to conquer Oahu, Māʻilikūkahi managed to eliminate his enemies and maintain peace over his kingdom.

As foreign desire to trade with Canton, China increased in 1785, the Hawaiian Islands became a primary stop on the Pacific trade routes. In the early 19th century, Westerners sought after alternate trade goods due to their limited materials and insufficient quality of desired goods such as ginseng (Hammatt and Wagner-Wright 1999). The trading of fur quickly decreased as land was being cleared in North America and fur-bearing animals became scarce. This resulted in an increase demand in sandalwood which at the time was being traded primarily out of India and the East Indies. Americans became increasingly interested in Hawaiian Sandalwood (*Santalum spp*.). ʻ*Iliahi* (sandalwood) soon became a popular commodity and although it was not of the highest quality, it brought a good price[25]. Kamehameha I kept strict control over the trade of *ʻiliahi* and primarily exchanged the fragrant wood for foreign vessels. He eventually began trading for goods such as nails, olive oil, rice, sugar, pitch, and kettles, expanding trade with Manila and Macao whose captains reassured the great value and demand of sandalwood. Soon the market shifted and Hawaiʻi went from logistical support to direct supplier of goods for the China market (Sahlins 1992). This resulted in the monopolization of sandalwood throughout the islands and the distribution of *aliʻi* to

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[21] *King 1821:81-82*
[22] Kamakau 1964:3
[23] Pukui in Kamakau 1991:54
[24] Kamakau (1991:54-55)
[2524] Hammatt and Wagner-Wright 1999

oversee cultivation. Judging from historical documents, people living in the Waialua area were known for cutting sandalwood in the interior mountain forests. One account by Kamakau confirms the importance of sandalwood to the chief of Waialua at the time, Kahekili Keʻeaumoku, whom despite the island-wide call to erect a fort in Honolulu for the protection against Russian warships enroute for a coup. "His district alone failed to respond to the call"[26]. In a scramble to obtain foreign goods, chiefs in the area had commoners work very hard to cut and transport the sandalwood to the coast. Preoccupation with sandalwood extraction resulted in the abandonment of residential homesteads in the upper Anahulu valley[27].

Prior to the *Māhele ʻĀina* of 1848, Kamananui Ahupuaʻa was held by chiefess Victoria Kamāmalu, daughter of Mataio Kekūanāoʻa and Elizabeth Kīnaʻu. During the *Māhele*, Kamāmalu turned over parts of Kamananui "as commutation of the royal right," which along with the remainder of the *ahupuaʻa* "became government lands when the king divided his holdings between public and Crown property"[28]. No *kuleana* (property) awards were recorded within the current project area. The current project area is part of two Land Grants, which ran *mauka-makai* (inland-seaward). Land Grant 263 was purchased by Ile in 1850 and is approximately 80-acres, spanning from the ocean to the *makai* side of present-day Farrington Highway (Office of Hawaiian Affairs 2018). The eastern half of the current project area encompasses Land Grant 263. The majority of the project area occupies Land Grant 264, which was purchased by Aikaula in May 1850 for $20.00 and was also an 80-acre parcel[29].

By the late 1800s to early 1900s, land use in Waialua was transitioning into commercial agriculture and ranching, with the western portion of the *moku* being utilized for cattle grazing, sugarcane, and rice cultivation. The first sugarcane milled in the Waialua area dates to ca. 1840 and the missionary Rev. John Emerson, who set up a small mill powered by horses that made sugar and molasses for the natives on shares[30]. The sugar industry in the Hawaiian Islands increased significantly during the U.S. Civil War, a result of the U.S. boycott on sugar from Southern states. During the period between 1860 to 1866, sugar exports increased by approximately 175 percent each year.

One of the most important components in agricultural and farming practices was securing water. The Wahiawa Dam and Reservoir, completed in 1906, was fed from The Koolau Mountains by the Oʻahu ditch, later renamed the Mauka Ditch Tunnel. As a result of this irrigation engineering, Waialua joined the Ewa Plantation Company as one of the two largest sugar plantations in the state by 1928[31].

The Waialua Agricultural Company was known for its flume irrigation. Portable flumes were set in a herringbone pattern and the water was released through small tin gates to irrigate the fields. To facilitate the development and maintenance of the flume infrastructure, a cement mixing plant was constructed at the railroad juncture in the southeast part of the project area. It is visible on a USGS survey map dated 1953. This facility likely fell into disuse following the abandonment of the rail transportation system. The Waialua Agricultural Company's rail system was discontinued in 1952 and the track alignments were converted into service roads. The Waialua Agricultural Co. and Hawaiian Pineapple Co. operated in such close proximity to one another that the field boundaries often changed. Castle & Cooke purchased a 21% share of the pineapple company in 1932, and the entire company in 1961. The name of the company was

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[26] Kamakau 1961:206
[27] Kirch 1985:314
[28] Sahlins 1992:190
[29] Office of Hawaiian Affairs 2018
[30] Kuykendall 1938
[31] Taylor et al. 1976

changed to Dole Food Company, Inc. in 1991. However, it only continued to operate until 1996 when the Waialua Sugar Company, the last remaining sugar plantation on O‘ahu, shut down.

3.6 Public Facilities and Services

Much of the infrastructure in the vicinity of the subject property is privately-owned. The infrastructure inherited from Dole Foods, like the housing is in need of repair and maintenance. HAHI and its associated entities own, operates and maintains the roads, water distribution system, wastewater collection, wastewater treatment, fire protection. The existing infrastructure is in place but will be insufficient to meet the demands of roads, water, wastewater, and fire protection following restoration of Mill Camp. Those planned infrastructure upgrades are discussed in Section 2.1. Public services not owned or previously discussed include electrical power, telecommunications, police, fire, solid waste collection, and schools.

3.6.1 Electric Power

Electrical power is currently supplied by Hawaiian Electric (HE). The poles and lines have been consistently maintained and are in good operating condition. Streetlights were installed by Waialua Sugar without authorization from HE. At this time the streetlights are not functional and will be removed. Improvements to Mill Camp beginning in Phase I include a large component of electrical generation using rooftop solar. Bids will be accepted from solar providers to establish a microgrid generating and storage system within the camp. The onsite generation should be more than sufficient to accommodate the average demands from tenants including a provision for charging electric vehicles. Line power from HE is expected to be maintained as a backup to equipment failure. Mill Camp will cooperate with HE to provide energy storage, conditioning and redundancy as is appropriate. The proposed electrical generation and storage is further described in Section 2.1.

3.6.2 Telecommunications

Telephone systems in Mill Camp are currently owned and operated by Hawaiian Telephone or Oceanic Cable Company. No changes of the existing telephone services are planned. Cable and internet services may be obtained from various providers and is left to the discretion of tenants. No changes in the existing arrangement are planned for cable or internet.

3.6.3 Potable Water and Wastewater

Water and wastewater are discussed in detail in Section 2.1.

Mill Camps water is sourced from Waialua Sugar Pump 2. As a public water supply it is either regulated by the public utility commission or a non-profit water association. The Waialua Water Association has been established for the original five members organized as a non-profit 501 C-4 Corporation. Water will be supplied to the members at cost. Those costs will include fees for an equipment reserve that will be maintained to avoid large expenses in the event of a failure of any of the major system components. Operating costs will be split between fixed fees divided evenly between members; and variable fees based on usage. The fixed fees will cover administrative costs and reserve, while variable fees cover repairs, contractors, electricity and chemicals.

Wastewater collection pipes and equipment will be designed and built into each phase of construction. One or more wastewater treatment facilities will be designed and permitted to serve the camp.

3.6.4 Solid Waste

Solid waste generated within the community is collected by the City and County of Honolulu. The internal roads within Mill camp are quite narrow, but still accessible to municipal garbage trucks. Plans for restoration include widening and rerouting the internal roads to allow for adequate access to city waste and fire vehicles. No changes in the solid waste system are envisioned.

3.6.5 Roads and Access

Waialua Mill Camp is accessed from the western end of Kealohanui Street which is currently unpaved. Internal roadways may have been paved and lighted at one point in the history of Mill Camp, however, conditions have deteriorated such that most if not all could be considered unpaved. The final roadway improvements will follow construction, with the objective of minimizing damage to the new roads from heavy construction vehicles; however, some improvements to the entrance must be done in advance of major construction because the road condition is currently unacceptable to most motorists. Redevelopment will improve the safety of the roadways by expanding and repaving to modern standards, improving lighting for visibility and safety, and making considerations for multi-modal transportation. The roadway improvements include re-grading, leveling and paving all arterial and internal circulating roadways servicing Waialua Mill Camp. Roadway widths will be expanded to modern standards. Kealohanui Puuiki Street will be expanded to 24-ft. or more as directed by traffic engineers. Internal roadways will be realigned during the housing redevelopment and road widths will be 20-ft. The paving and expansion of roadways will increase the navigability of the Mill Camp for residents travelling via motor vehicle, pedestrians, and emergency services. The larger community impacts for the traffic improvements will include better access to the Waialua Hongwanji Temple which neighbors the Mill Camp. Roadway materials will include a mix of asphalt concrete, grass pave, and other permeable pavement products. The roads will be asphalt with permeable pavement along the shoulders and parking areas so as to minimize the impervious surfaces. Shoulder lanes will also be utilized to encourage multimodal transportation including walking and bicycle usage. Parking areas in all housing phases will contain grass pave. Traffic volume will gradually increase over current conditions; however, the initial stages of development are focused on restoring housing conditions for existing residents. The flow of traffic into the housing areas will be managed by a planned traffic circle at the end of Kealohanui Street and access from Pu`uiki Street originating at Farrington Highway. A security gate and some form of access control is planned for the entrance of the Camp, primarily to reduce the number of transient motorists who drive through the camp.

3.6.6 Traffic

A Traffic Assessment Report was completed by the Traffic Management Consultant, Inc (TMC) for the purpose of this assessment. TMC provided:

- evaluation of existing roadway and transportation conditions.
- analysis of the future transportation conditions without the proposed project.
- the development of trip generation characteristics of the proposed project.
- identification and analysis of the transportation impacts resulting from the development of the proposed project; and
- recommendation for improvements, which would mitigate the transportation impacts identified in this study.

Mill Camp shares access with the Waialua Sugar Mill industrial area from Kealohanui St at the intersection of Goodale Avenue in the center of Waialua. Access to Mill Camp was formerly available through Puuiki Street at the intersection of Farrington Highway, but this access has been gated for more than 5 years to reduce unwanted use from persons not living in the camp. TMC examined peak morning and evening traffic through the major highway intersections that serve the town of Waialua. Data was collected for multiple days in late November 2022 at the following locations (Figure 3-6):

1. Farrington Highway and Puuiki Street
2. Farrington Highway and Goodale Avenue
3. Farrington Highway and Kaukonahua Road
4. Goodale Avenue and Kealohanui Street.
5. Kealohanui Street and Hopemanu Street

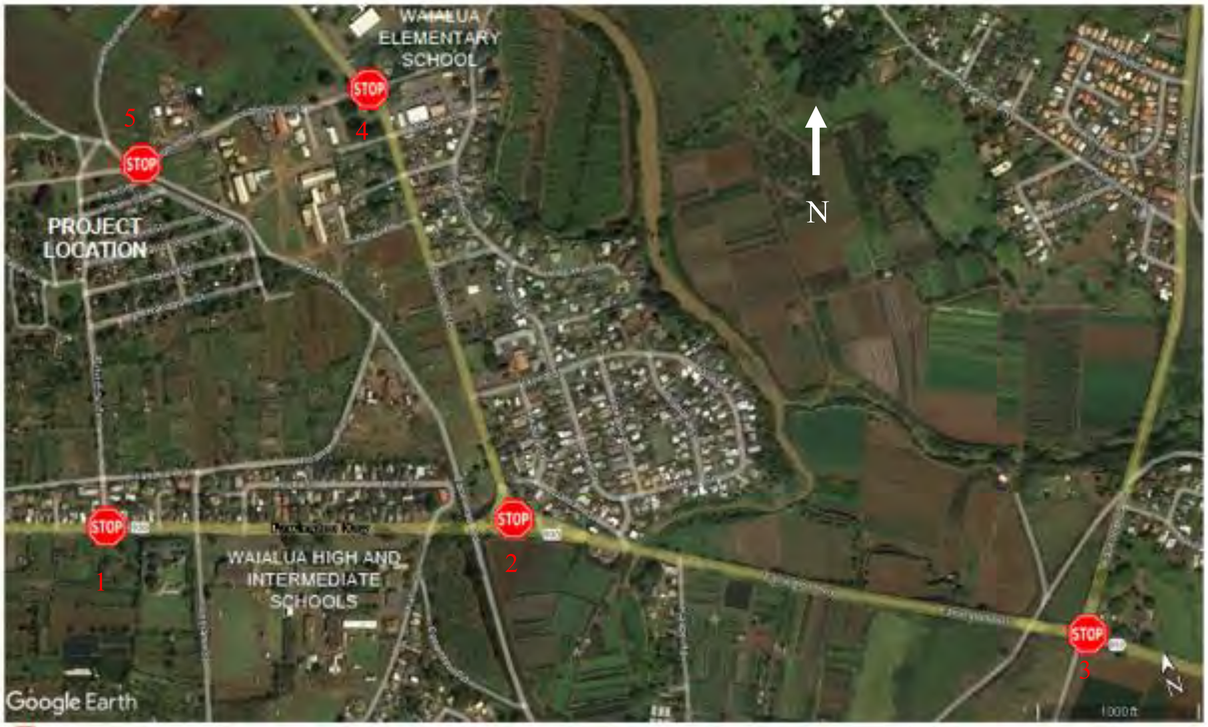

Figure 3-6: Location map with intersections studied for this assessment.

Traffic conditions are categorized according to a national industry standards presented in the Highway Capacity Manual 6th Edition (HCM), published by the Transportation Research Board. HCM defines the Level of Service (LOS) as "*a quantitative stratification of a performance measure or measures representing quality of service.*" HCM defines six (6) Levels of Service from the traveler's perspective, ranging from the best LOS "A" to the worst LOS "F". LOS translates the results of highway capacity analysis into an A through F grading system for the purpose of simplifying the roadway performance.

LOS's "A", "B", and "C" are considered satisfactory Levels of Service. LOS "D" is generally considered a "desirable minimum" operating Level of Service. LOS's "E" and "F" are undesirable conditions. Intersection LOS is primarily based upon average delay (d) in seconds per vehicle (sec/veh) for unsignalized intersections. The criteria only applies to intersections without traffic signals and the descriptions are conservative in comparison to those intersections with traffic lights where the delays normally in the range of 180 seconds for an average traffic light.

Table 3-3. Intersection Level of Service Criteria (HCM)

LOS	Delay (seconds per vehicle)	Description
A	<10	No delay
B	10-15	Insignificant delay
C	15-25	Queuing begins
D	25-35	Decrease in travel speed
E	35-50	Significant delay
F	>50	Extensive queuing

Traffic observations were conducted during the week of November 14, 2022 during the peak periods of traffic from 6:00 AM to 9:00 AM and from 3:00 PM to 6:00 PM. The number of vehicles per hour is reported as the highest of the observational period and translated to the appropriate Level of Service in the tables below. Intersections that operate at acceptable levels of service are left blank for ease of reading.

Table 3-4: Existing Level of Service Peak Hourly Traffic

Intersection	**LOS (AM)**	**LOS (PM)**
All directions Farrington Highway and Puuiki St.		
Westbound Farrington Highway and Goodale Ave	**D**	
East and north Farrington Hwy and Goodale Ave		
Southbound Farrington Hwy and Kaukonahua Rd	**E**	**D**
Westbound Farrington Hwy and Kaukonahua Rd	**D**	**F**
Eastbound Farrington Highway and Kaukonahua Rd	**F**	
All Directions Goodale Ave and Kealohanui St.		
Kealohanui St and Hopemanu St		

In its existing condition the intersection of Farrington Highway and Kaukonahua Road (Thompson's Corner) was found to be overused during morning and evening peak traffic flow. Some backups were also observed at the traffic circle intersection of Farrington and Goodale. The remainder of the intersections studied had excess capacity.

Table 4 is based on an annual population increase of 0.5% per year over the next 13 years with an additional .1% attributed to increased employment, or a total of 0.7% annual increase. This population estimate is the general estimate for Oahu developed by DBEDT in 2019. The estimate predicts a change from the past two decades where Waialua lost 1.4% of its population annually. The estimate for increased traffic amounts to an additional 256 vehicles per hour in the morning peak and 241 in the evening peak. Farrington Highway and Kaukonahua Road afternoon rush hour is the worst intersection. The total traffic afternoon rush hour is predicted to increase 6% over 13 years without the project.

Table 3-5: Estimated Level of Service in 2036 without project

Intersection	**LOS (AM)**	**LOS (PM)**
All directions Farrington Highway and Puuiki St.		
Westbound Farrington Highway and Goodale Ave	E	
East and north Farrington Hwy and Goodale Ave		
Southbound Farrington Hwy and Kaukonahua Rd	F	D
Westbound Farrington Hwy and Kaukonahua Rd	E	F
Eastbound Farrington Highway and Kaukonahua Rd	F	D
Northbound Goodale Ave and Kealohanui St.		D
Kealohanui St and Hopemanu St		

The level of service worsens by one letter in the morning at the traffic circle and leaving Waialua at Thompson's Corner. These trends are mirrored at Thompson's Corner in the evening, but the LOS at the intersection of Kealohanui and Goodale remains unchanged for the PM peak traffic.

At full development the proposed project is expected to generate 223 vehicle trips per hour in the morning peak and 281 vehicle trips per hour in the afternoon peak. These would be split between the Kealohanui/Goodale intersection and Puuiki/Farrington intersection, with the majority going through the now gated Puuiki Street intersection at Farrington Highway. The level of morning service decreases by one letter at eastbound Farrington and Goodale, and Thompson's Corner in the afternoon. The level of service at Goodale and Kealohanui to the east in the afternoon peak (Table 3-5). The Farrington Highway and Kaukonahua Road intersection is predicted to handle an additional 12% of traffic in the afternoon rush hour in 2036.

Table 3-6: Estimated Level of Service in 2036 with project

Intersection	**LOS (AM)**	**LOS (PM)**
All directions Farrington Highway and Puuiki St.		
Westbound Farrington Highway and Goodale Ave	F	D
East Farrington Hwy and Goodale Ave	D	
Southbound Farrington Hwy and Kaukonahua Rd	F	E
Westbound Farrington Hwy and Kaukonahua Rd	E	F
Eastbound Farrington Highway and Kaukonahua Rd	F	E
Northbound Goodale Ave and Kealohanui St.		E
Kealohanui St and Hopemanu St		

The access and egress to Mill Camp on Kealohanui and the now closed Puuiki Street are minimally affected and continue to operate at acceptable levels by the proposed action; however, the State-owned and operated intersections that are now crowded become more crowded by approximately 12% due to both projected population increases and the increased traffic attributable to the restoration of Mill Camp.

The intersection Farrington Highway and Kaukonahua Road (Thompson's Corner) serving Haleiwa and Waialua is currently operating at LOS E or F at peak flow periods. The estimated increase in traffic resulting from population increases and the full occupation of Mill Camp in 2036 results in worsened traffic at Thompson's Corner and additional congestion at the traffic circle intersection of Farrington Highway and Goodale Avenue.

The Traffic Assessment Report concludes:

> *The trips generated by the proposed Waialua Mill Affordable Housing project are expected to increase traffic within the study area by about 11 percent and 13 percent, during the AM and PM peak hours of traffic, respectively. The proposed project is not expected to generate a significant number of transit trips during the peak hours of traffic.*

Traffic counts used in this analysis were the highest numbers observed on the most crowded day in the peak-flow morning and afternoon periods. Considering the local anomalies of the project these may be considered worst case projections. The preceding analysis is based on industry standard models for traffic and State of Hawaii estimated for population trends. The industry standard for intersections without traffic lights, are considered substandard with delay times starting at 35 - 50 seconds. It should be noted for comparison many traffic lights stay red for a period of 120 seconds.

Differences in LOS estimates may arise from assumptions on economic conditions, real estate trends and local anomalies including:

- Waialua has lost approximately 14% of its population during each of the past 2 decades, but is predicted to gain almost 7% in the next decade. Economic trends and access to reasonably-priced housing may be expected to affect this assumption. The North Shore has very little residential land that is not occupied. Mill Camp may provide the only new residential area. As such attributing traffic to population increase and the project-related increase may be double counting.
- The average age of the current residents of Waialua Mill Camp is very high and many do not drive.
- The existing houses are overcrowded with multi-generational families. Upon restoration household densities will be managed, and these families will be spread out within the camp. The actual number of new residents may be significantly less than the number of new occupied houses.
- The project will be an affordable housing community accessible to households earning less than 60% of the area median income, which may reduce the number of vehicles operated by project residents in comparison to the national average.
- Mill Camp will give preference to retirees, existing residents, and long-term residents of Waialua and Haleiwa, whose populations already contribute to the traffic loads that were observed in this study.

Thompson's Corner is the worst intersection within the study area. Following the closure of Waialua Beach Road, the Hawaii Department of Transportation (DOT) installed a four-way stop sign at the intersection as a temporary solution. The DOT website states their intention to study permanent solutions to reduce delays. The Traffic Assessment Report recommends construction of a modern traffic circle at Thompson's Corner, which would reduce the delays to LOS A and B during peak periods. Recent discussions with DOT indicate that this study is not among their first priorities.

3.6.7 Traffic Improvements and Public Transportation

Full development of Mill Camp will optimistically require 13 years. Phase I is estimated to be completed in in 2029. Phase Ia includes 50 Kupuna units primarily for the Mill Camp retirees and other aging residents now living in Mill Camp and surrounding areas. The Kupuna normally do not drive, therefore anticipated traffic increases from Phase Ia will be limited. Phase Ib will be multifamily buildings to accommodate current residents. Phase 1b will also not contribute significantly to traffic. Completion of Phase I is anticipated to be 2029. Phase II will create more traffic upon completion in 2030-3. The development schedule for various phases is highly dependent on competitive grants, which makes precise scheduling impossible. HAHI will coordinate and cooperate with the County Department of Transportation Services (DTS) and

State Department of Transportation (DOT) as appropriate to improve traffic conditions as appropriate in advance of. Phase II construction.

Waialua Mill Camp's primary road access begins at the intersection of Goodale Avenue and Kealohanui Street, which is 0.33 miles from the nearest house in Mill Camp. Kealohanui Street is largely unimproved. Repaving Kelohanui is the most obvious and possibly first mitigation measure to be undertaken. This will be completed following substantial completion of construction on Phase I. Kealohanui will be upgraded to City standards at that time; however, there are no plans to dedicate the easement to the City.

A large number of residents within Mill Camp depend on the Bus as their primary means of transportation. Following improvements to Kealohanui Street, HAHI will request addition of a bus stop within Mill Camp from DTS to add safe alternatives for residents who rely on walking and public transit as their primary means of transportation.

DTS is currently improving the intersection of Goodale Avenue with an extension of the bike path as part of the area wide initiative to bake neighborhoods more bicycle friendly. Ultimately the bike path network will extend down Goodale Avenue connecting Waialua Beach Road with Farrington Highway, Kealohanui Street, Pu`uiki Street through Mill Camp to connect Farrington Highway to Waialua Beach Road, and ultimately to Kamehameha highway in Haleiwa (Figure 3-7). An analysis of these improvements on traffic at the entrance to Mill Camp will be undertaken upon completion of these improvement.

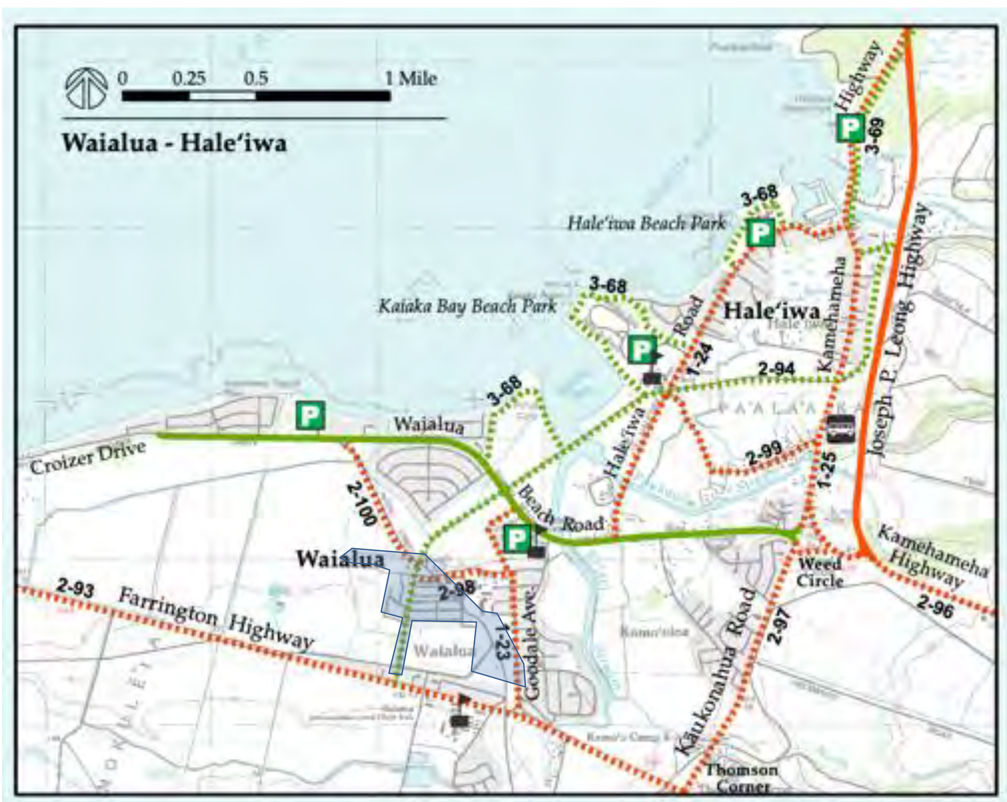

Figure 3-7: showing the City's bike way plan for the vicinity of the project. The project site is outlined in blue.

HAHI will coordinate with the State DOT for all work required along Farrington Highway for the reopening of Pu`uiki Street.

The TAR commissioned for this assessment recommended that the City straighten or improve the intersection of Goodale and Kealohanui. If these recommendations garner sufficient support to be included in DTS' planning, HAHI will cooperate with DTS to assessment impacts on traffic entering Mill Camp.

HAHI will coordinate with all agencies by developing and circulating a Phasing Plan and Construction Management Plan (CMP) to be developed during detailed design of the proposed restoration. The CMP will be submitted to DTS in advance of obtaining building permits. It will contain estimates of the type and timing of heavy trucks and other construction-related traffic, and strategies for minimizing impacts on area transportation.

Other public/private transportation initiates will include:

- Expand services from circulating shuttle services,
- Install car share/ride share parking at Kealohanui Street,
- Extend Bicycle/pedestrian-friendly lanes along Kealohanui Street
- Open Puuiki Street to residents of Mill Camp and the neighboring properties for the Waialua Farmers' Cooperative.

3.6.8 Police and Fire

The Honolulu Police Department (HPD) and Honolulu Fire Department (HFD) in Waialua are very familiar with Mill Camp and its current deficiencies. The proposed improvements to infrastructure, access, and lighting will assist with public safety and fire response.

HFD proposed relocation of the Waialua Fire Station out of its current station to an area near Mill Camp several years ago. The original selection of land for the new fire station was at the intersection of Goodale Avenue and the Waialua Beach Road, which is slightly less than 0.6 miles from the entrance to Mill Camp. During discovery planning it was determined that this site is in the tsunami inundation zone, and therefore less acceptable as a location for emergency services. HFD has had initial discussions with Mill Camp Development Group regarding use of vacant land near the intersection of Kealohanui Street and Goodale Avenue as the site for the new fire station. HFD recently announced that this is their preferred location, ¼ mile from Mill Camp. Mill Camp's management team is encouraging HFD to develop the new site, and further discussion is pending.

3.6.8 Public Schools

Mill Camp is within walking distance to Waialua Elementary School, and Waialua Intermediate and High School. St. Michael's School (private) is also within walking distance.

Waialua Intermediate and High School has 635 students, and 45 teachers making the student/teacher ratio of 14:1, which is considered very good. Waialua Elementary School has

478 students and a student teacher ratio of 17:1, which is still above average for the State. Approximately 18 percent of the Waialua population is of school age. If the residents of Mill Camp immigrated from other places it would imply an additional 180 students of all ages spread between the public schools. HAHI anticipates that at least 70 percent of new residents will originate from within the Waialua/Haleiwa area. This would result in an additional 54 students spread from K – 12 in the two existing public schools.

3.7 Zoning and Land Use

Mill Camp shares joint borders with agricultural, industrial, and urban lands. Other lands zoned Protection and business are within close proximity (Figure 3-7). While the vast majority of Mill Camps proposed restoration will occur within the Ag-2 zone, small portions of each of the adjacent zones are included in the parcel 6-7-001:077. Seven percent of Parcel 6-7-001:077 is Zoned residential (R-5) and 92% is agricultural (Ag-2). An additional 1-2% is zoned industrial (I-2) and/ or Ag-1. I-2 and Ag-1 lands occur on narrow fringes at the margins of the property and are not likely to contain development beyond landscape buffers or access roads; however, all development will be according to development standards on the underlying property or be exempted under the 201H permit. State land use districts are divided between agriculture and urban by roughly equivalent fractions.

HRS §205-4.5 defines the permissible uses within the agricultural districts.
Housing on former sugar or pineapple plantation lands is protected by §205-4.5 (12):

(12) Plantation community subdivisions, which as used in this chapter means an established subdivision or cluster of employee housing, community buildings, and agricultural support buildings on land currently or formerly owned, leased, or operated by a sugar or pineapple plantation; provided that the existing structures may be used or rehabilitated for use, and new employee housing and agricultural support buildings may be allowed on land within the subdivision as follows:
(A) The employee housing is occupied by employees or former employees of the plantation who have a property interest in the land.
(B) The employee housing units not owned by their occupants shall be rented or leased at affordable rates for agricultural workers; or
(C) The agricultural support buildings shall be rented or leased to agricultural business operators or agricultural support services.

Waialua Mill Camp qualified as a plantation Community subdivision for many years, by the fact that all residents were employees or former employees and children of Waialua Sugar Company. Although most current tenants remain the same, several houses are now occupied by persons who were not associated with Waialua Sugar. Its status may be in question at this point, and it would not qualify following its restoration. Other land-use mechanisms will be used to bring Mill Camp into compliance.

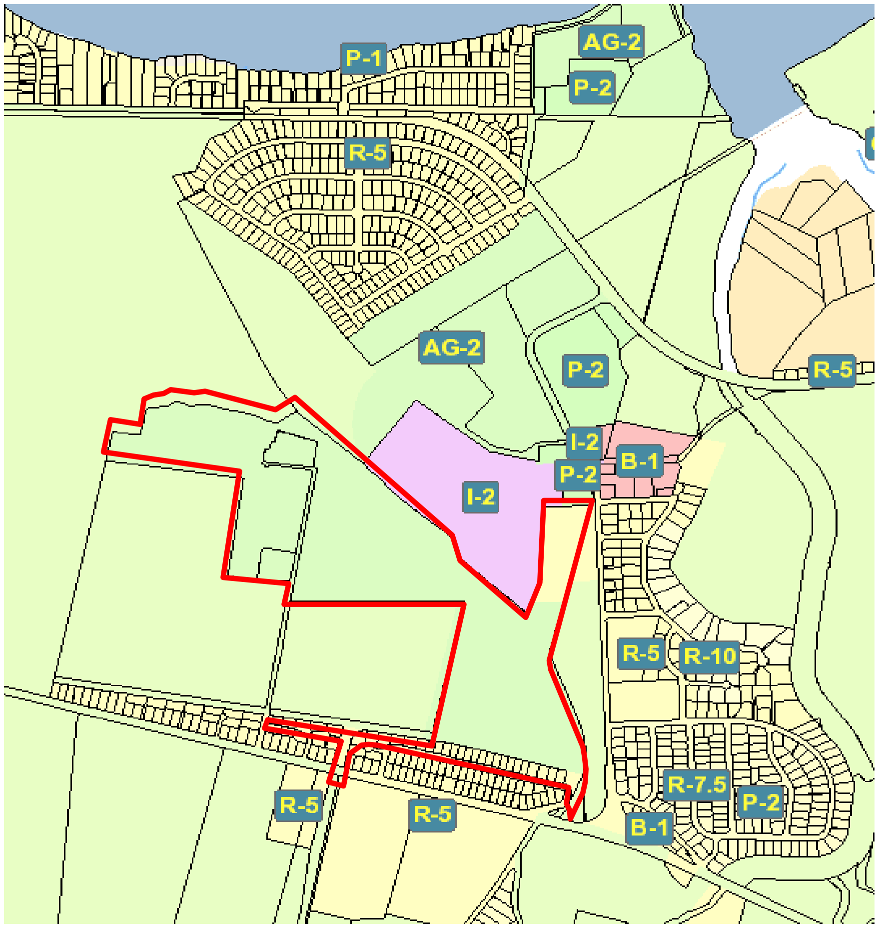

Figure 3-8: County Zoning for lands surrounding Mill Camp. Mill Camp is 93% ag-2, 7% R-5.

HRS §205-8 defines the limits on non-standard use of agriculture land.

§205-8 Nonconforming uses*. The lawful use of land or buildings existing on the date of establishment of any interim agricultural district and rural district in final form may be continued although the use, including lot size, does not conform to this chapter; provided that no nonconforming building shall be replaced, reconstructed, or enlarged or changed to another nonconforming use and no nonconforming use of land shall be expanded or changed to another nonconforming use. In addition, if any nonconforming use of land or building is discontinued or held in abeyance for a period of one year, the further continuation of such use shall be prohibited.*

The development of Mill Camp precedes the State zoning ordinance and has been continually occupied during the period the land use districts have been applied. It was originally restricted to those agricultural workers who were employed by Waialua Sugar Company, and thus entirely compliant with HRS 205-4.5. (12). The paragraph allows for rehabilitation and new structures within the Plantation Community subdivision if all the terms are met. If following restoration of the camp, tenancy was restricted to agricultural workers making less than 60% of the AMI, the land use would be authorized by the State, and the County would defer its zoning to comply with state law. A developer would assume that any deviation from the terms of HRS 205-4.5 (12) would cause the County to decline building permit applications. Currently, many of the residents are not farm workers. The existing former plantation camp is permitted under state law in its current state. Restoration, which includes new structures and expanded use will require land use authorizations.

HAHI will seek funding from the US Department of Agriculture Rural Development Office for funding to construct farm worker housing on a portion of the Mill Camp footprint, but the entire development will proceed according to the development agreement negotiated with the City or State under the 201H process.

The majority of Mill Camp should not be restricted solely to farm families because it would not accommodate some existing residents and may be too restrictive to serve the needs of Waialua families who do not now have access to respectable housing at an affordable price. Section 2.4 discusses the alternatives to permitting Mill Camp to remain as affordable housing without restricting the entire community to farm workers. That discussion concludes that the most appropriate pathway is through the 201H permit process.

3.7.1 Urban Growth Boundary

A portion of Mill Camp may lie outside of the current Urban Growth Boundary (UGB). The UGB was set in the original North Shore Community Plan (2000), and maintained in the North Shore Sustainable Communities Plan (2011).

The existing UGB as shown in the figure does not encompass the historical footprint of the Waialua Mill Camp in the map shown in the plan; it cuts the camp in half (Figure 3-8). More than 100 houses that were in its northwest portion were demolished in the 1970s and 80s because of their condition and reduced labor requirements at the mill.

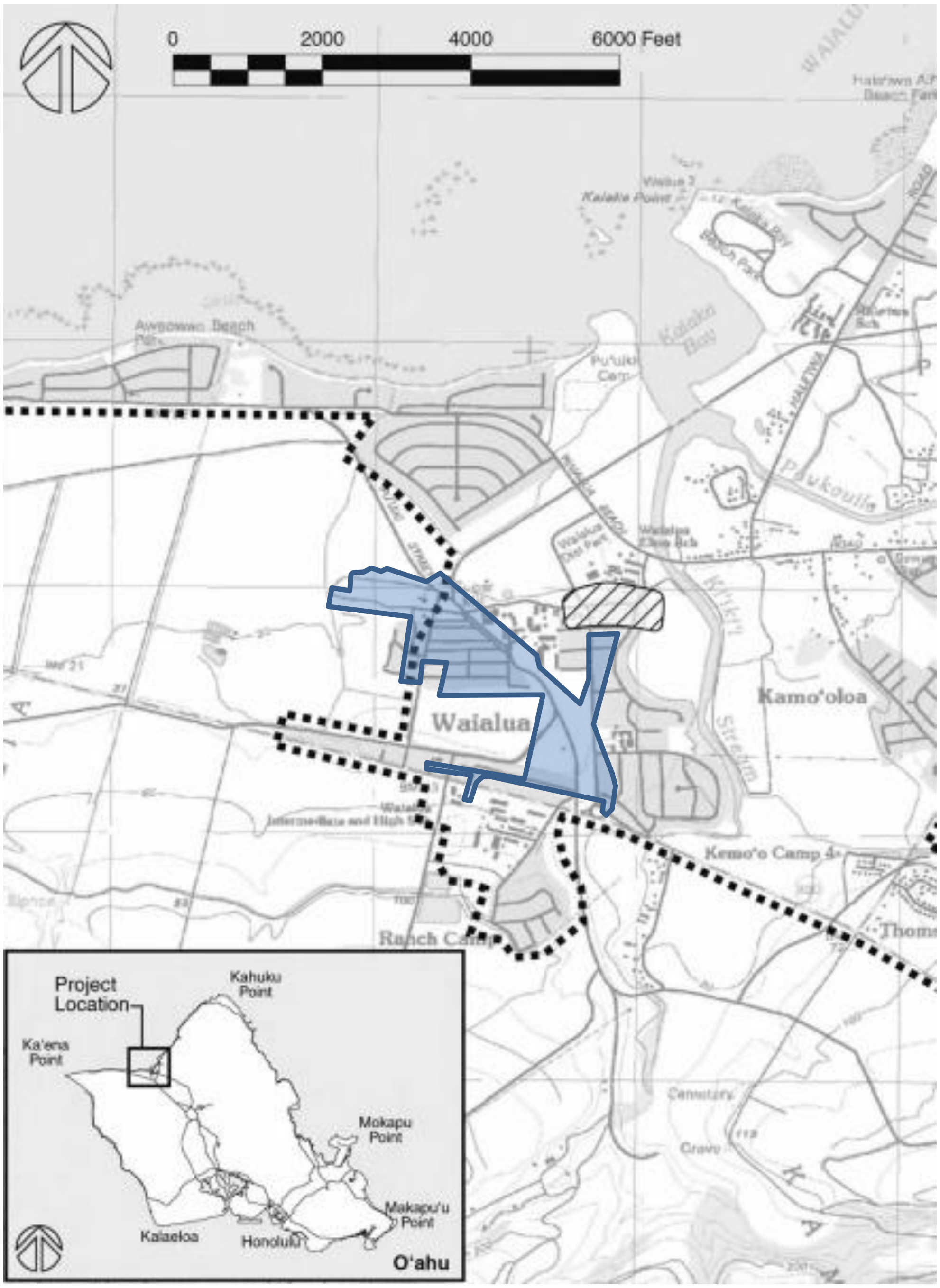

Figure 3-9: The Urban growth boundary map from NSSCP (2000)

A revision to the North Shore Sustainable Communities Plan is currently under review. A boundary amendment request was submitted to the City and County Department of Planning and permitting in November 2021. At the same time the request was presented to the North Shore Neighborhood Board (NSNB). The NSNB prepared a letter supporting the proposed boundary amendment (Appendix A). . Discussions with DPP indicate that the Department will support that request in the pending revision of the NSSCP.

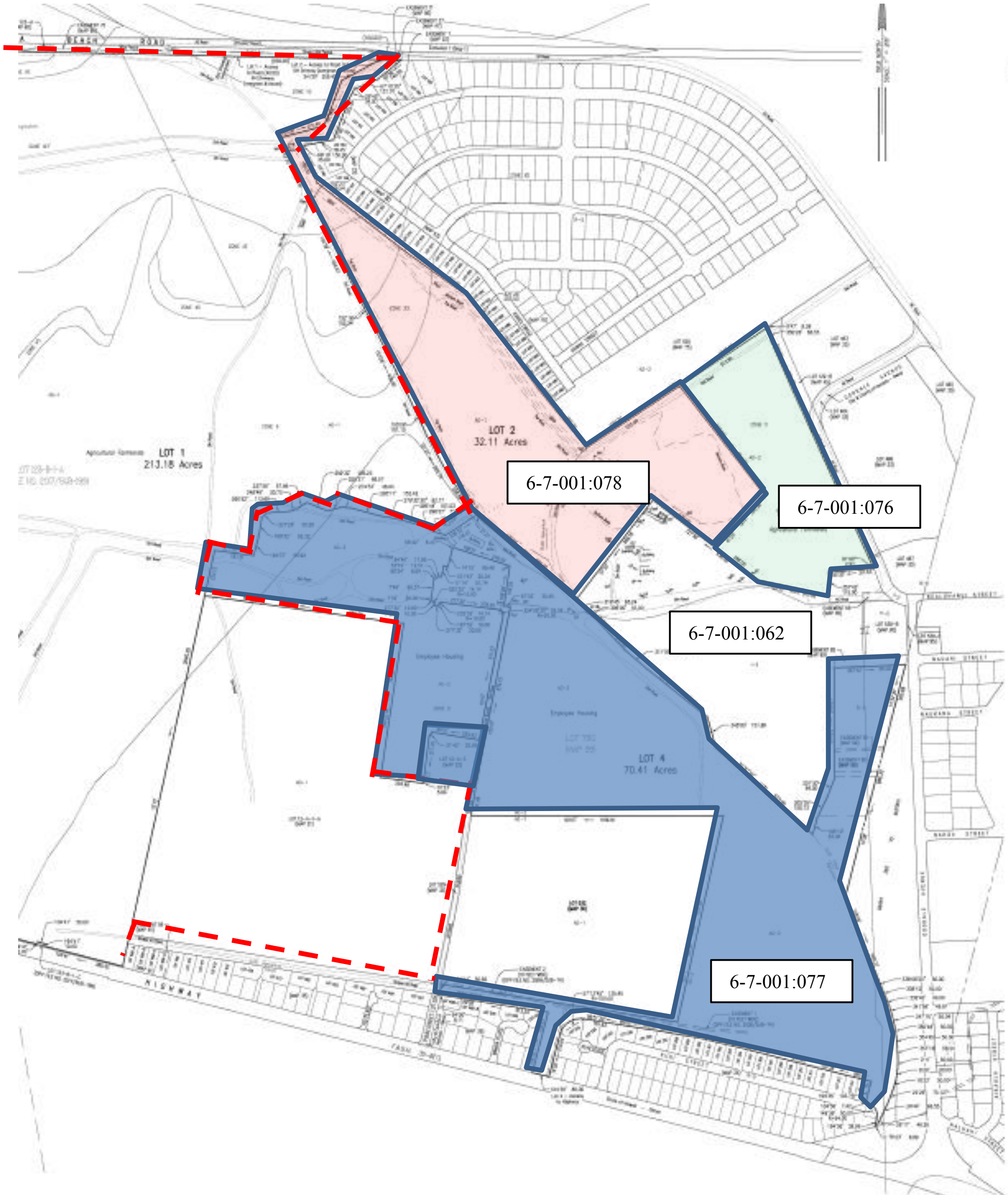

Figure 3-10: The proposed amendment to the UGB which includes the entire historical footprint of Mill Camp (Parcel TMK# 6-7-001:077)

Further discussion of the Boundary amendment request and its relationship with the functional plans established by the city and County of Honolulu are contained in Section 4.3.

4.0 Growth-Inducing, Indirect, Cumulative, and Secondary Impacts

Indirect effects may include other impacts related to changes induced by the proposed action such as growth-induced changes in land-use patterns or air and water quality impacts associated with population growth. Cumulative impacts may be defined as impacts on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes the action. A secondary impact is one that is caused by the proposed action but is removed in time or space from the project.[32]

The proposed restoration of Waialua Mill Camp would return the area surrounding the old Waialua Sugar Mill to the number of houses that were present during the Mill's most profitable period. The population of Mill Camp has steadily decreased over the subsequent 60 years. This was initially due to labor force reductions due to automation in the Mill and fields. Following closure of the Mill, Dole Foods acquired the camp and began to tear down houses when they became vacant. At the same time the number of people living in each house has increased due the lack of affordable housing. Most of the remaining houses in Mill Camp are occupied by more than one generation and/or extended family members.

The proposed action is to expand the capacity within Mill Camp over the next 13 to 20 years. This will increase the demand for goods and services in Waialua, although not so much if many or most of the future residents of Mill Camp now live in the surrounding areas of Waialua and Haleiwa. The projects are anticipated to add traffic to Thompson's Corner and the Waialua traffic circle at Goodale and Farrington Highway and add demand for groceries, gas, and restaurants. The commercial services in the Gilman commercial area are generally underutilized at this time. The Hawaii Department of Transportation Highways Division is aware of the issue at Thompson's corner and is currently studying potential improvements including a traffic light and/or traffic circle.

Public services required to support expansion will increase, but not proportional to the increase in housing number due to the priority given to residents who are already in the area. With expanded availability of housing up to one third of the available housing units may be occupied by existing residents. The majority of the remaining other two thirds are expected to already live within the district and utilize the same services. Solid waste disposal, telephone, cable, and electric power can handle the gradual increase within the footprint of Mill Camp without reaching the limits of service. Public services including police, fire, medical, and schools, will be gradually expanded over a period of 13 years. Growth inducing impacts associated with Mill Camp are partially mitigated if the developers are successful in targeting housing to accommodate the long-term residents of Waialua. Restoration of Mill Camp is expected to require 13 to 20 years. A gradual increase will help to reduce the effects of increasing Waialua's population.

[32]*(40 CFR ~ 1508.7)*
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The North Shore is experiencing a shift in land use from large agriculture to small farm plots. Several large parcels in the area are currently being converted to condominiums through the CPR process. Most do not officially allow for residents, but the developer may have little control over buyers once they own the land. Other parcels now being advertised allow for housing on agriculture land, or are silent on the potential issues for access and infrastructure for housing on agriculture land, leaving potential buyers to do their own due-diligence.

Mill Camp is the first affordable housing development in the area since plantation days, and possibly the last that utilizes land that has been traditionally used for housing instead of agriculture. No other projects offer housing opportunities to income-qualified long-term residents, or include infrastructure of roads, water, and wastewater treatment.

4.1 Required Permits and Approvals

State of Hawaii HRS Chapter 201-H permit for low-income housing.
HRS 201H is administered by the City and County of Honolulu or the Hawaii Housing Finance and Development Corporation (HHFDC) to facilitate development of affordable housing within the State. The permit is only available for construction or conversion of 50 or more housing units that meet affordability and other requirements. Approval of the permit requires a vote of the City Council. This is the major discretionary permit required for the proposed action. Approval allows certain exemptions from City ordinances or statutes; principal among these for the proposed action is the density of housing on land zone for agriculture. Mill Camp is located on Ag-2 land where the maximum density is one house per 2-acres. Under the proposed action the density would be up to 5 per acre for most of the development and higher in the small areas where multifamily units are located. A more detailed discussion is contained in Section 2.4.

State Land-Use Commission District Boundary Amendment. The proposed restoration will occur on more than 15-acres of land zoned for agriculture. The State Land-Use Commission (LUC) has jurisdiction over unusual but reasonable uses of large areas of agricultural land (HRS chapter 205-4). The statute is modified for affordable housing development that are permitted under HRS 201H-38 (4).

§205-4 Amendments to district boundaries involving land areas greater than fifteen acres. *(a) Any department or agency of the State, any department or agency of the county in which the land is situated, or any person with a property interest in the land sought to be reclassified, may petition the land use commission for a change in the boundary of a district. This section applies to all petitions for changes in district boundaries of lands within conservation districts, lands designated or sought to be designated as important agricultural lands, and lands greater than fifteen acres in the agricultural, rural, and urban districts, except as provided in section 201H-38. The land use commission shall adopt rules pursuant to chapter 91 to implement section 201H-38.*

§201H-38 Housing development; exemption from statutes, ordinances, charter provisions, and rules

4) The land use commission shall approve, approve with modification, or disapprove a boundary change within forty-five days after the corporation has submitted a petition to the *commission as provided in section 205-4. If, on the forty-sixth day, the petition is not disapproved, it shall be deemed approved by the commission*

The corporation referenced above is the Hawaii Housing Finance and Development Corporation (HHFDC).

Urban Growth Boundary Amendment. A request to amend the UGB for the Waialua area has been submitted for review in the current revision of the North Shore Sustainable Communities Plan. The UGB was established in 2000 and it currently bisects Mill Camp's current and historical footprint. The UGB was established at a time when Dole Foods' intention was to demolish Mill Camp and return the land to agriculture. The proposal to amend the UGB was supported by the North Shore Neighborhood Board.

City and County of Honolulu, Building and Grading. The proposed project will be required to obtain all building and grading permits from the City and County of Honolulu.

State of Hawaii NPDES Construction Stormwater Permit. The Clean Water Act regulates discharge of all types of water from industrial sources and construction sites as well as discharge of process waters of all types. An NPDES Construction Stormwater Discharge Permit is required of construction projects that are grading areas greater than one acre. If an area larger than 1 acre in total is disturbed, an NPDES Notice of Intent and Form C will be prepared and approved prior to the start of construction. There are no industrial discharges or construction dewatering associated with the project.

The proposed project does not involve stationary sources or air pollution and is not required to obtain Clean Air Act permits. No construction in wetlands or navigable waters is anticipated.

5.0 CONSISITENCY WITH PLANS, POLICIES, AND REGULATIONS

5.1 Federal Policies Supporting Low-income Housing on Agricultural Land

Federal policies on affordable originate mainly from the Department of Housing and Urban Development (HUD). HUD's efforts support a variety of interrelated policy areas, such as affordable housing development and preservation, community and economic development, environment and energy, fair housing, health and housing, ending homelessness, homeownership, rental assistance, and supportive housing and services.

HUD's primary mission is to create strong, sustainable, inclusive communities and quality affordable homes for all. HUD administers over 16 programs designed to support production and preservation of affordable housing including:

- HOME Investment Partnerships Program provides grants to states, units of general local government, and insular areas to implement local housing strategies designed to increase affordable housing opportunities for low- and very low-income families
- HTF: Housing Trust Fund provides grants to states and insular areas for the construction, rehabilitation, and preservation of rental homes and for homeownership for extremely low- and very low-income families, including homeless families

- Section 811 Project Rental Assistance (PRA) Program provides capital advances to private nonprofit sponsors and for-profit limited partnerships to expand the supply of housing integrated with supportive services and promote community integration for low- and extremely low-income persons with disabilities.

Mill Camp may receive grants and loans through USDA Rural Development to support the replacement of some portion of housing units within Mill Camp. USDA supports redevelopment of low-income housing for farm workers through the Section 514 Farm Labor Housing loans and Section 516 FLH grant program, USDA Rural Development awards loans and grants to increase the supply of available rental housing for domestic farm laborers. The housing is intended for any domestic farm laborer who receives a substantial portion of his/her income from the primary production of processed or unprocessed agricultural or aquacultural commodities.

5.2 Hawaii State Policies Supporting Low-income Housing on Agricultural Land

Emergency Proclamation January 23, 2023. Governor Josh Green issued an emergency proclamation to address homelessness under HRS 127-A-14 in order to protect public health, safety and welfare. The emergency proclamation suspended many of the planning and permitting requirements for agencies and individuals working to provide affordable housing. The suspension only lasts for one month, but it is intended to break the impasse for project that have been upheld by bureaucratic backlogs. The proclamation displays the importance of adding to the low-income housing portfolio in the immediate future.

HRS 226 "The Hawaii State Planning Act" was originally prepared in 1978. The purpose of this chapter was to prepare the Hawaii State Plan which serves as a guide for the future long-range development of the State; identify the goals, objectives, policies, and priorities for the State. The Hawai`i State Plan is further divided into 12 functional plans that addressed the priority subjects. At that time the Plantation communities were thriving company towns which did not need preservation or much scrutiny from government at all. The functional plans do not directly address plantation communities or low-income housing, but the broader objectives contained in these plans are still quite relevant.

§226-19 Objectives and policies for socio-cultural advancement--housing.
(a) Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:

> *(1) Greater opportunities for Hawaii's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals, through collaboration and cooperation between government and nonprofit and for-profit developers to ensure that more affordable housing is made available to very low-, low- and moderate-income segments of Hawaii's population.*
>
> *(2) The orderly development of residential areas sensitive to community needs and other land uses.*
>
> *(3) The development and provision of affordable rental housing by the State to meet*

the housing needs of Hawaii's people.
(b) To achieve the housing objectives, it shall be the policy of this State to:
(1) Effectively accommodate the housing needs of Hawaii's people.
(2) Stimulate and promote feasible approaches that increase housing choices for low income, moderate-income, and gap-group households.
(3) Increase homeownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.

(4) Promote appropriate improvement, rehabilitation, and maintenance of existing housing units and residential areas.

(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.

(6) Facilitate the use of available vacant, developable, and underutilized urban lands for housing.

(7) Foster a variety of lifestyles traditional to Hawaii through the design and maintenance of neighborhoods that reflect the culture and values of the community.

The proposed action is consistent with the goals and objectives of HRS 226 agriculture and housing objectives by providing appropriate and affordable rental housing.

HRS Chapter 205 is the Statue which defines the four different land use districts used by State law, and describes the permissible uses within each district. HRS 205-4.5(a) includes as a permissible use of agricultural land, and a provision to allow former plantation camps to remain on agriculture land.

The Coastal Zone Management Act requirements are address in HRS 205A-2, which defines the entire State as being within the Coastal Zone. Of the 11 CZM initiatives the majority apply to coastal resources. The proposed action is consistent with the remaining initiatives:

Cumulative and secondary impacts associated with stormwater and coastal non-point source pollution: The project will involve grading and will obtain NPDES construction stormwater permits. In addition the community employs low maintenance landscaping techniques that do not rely on fertilizers. Best management practices are adopted by camp maintenance staff to reduce runoff from machinery and equipment.

Low impact Development: Plantation camps are among the original low-impact developments. Restoration of the camp will go farther toward these goals with stormwater infiltration trenches, permeable pavements, and infiltration areas. Power will be locally generated without fossil fuels, and wastewater will be recycled.

The Office of State Planning has prepared guidelines for sustainable development that are based on the provisions of HRS 226 and HRS 205. Although the priority guidelines to promote sustainability are too general for detailed applicability, the 10 smart growth and livability principles are directly applicable to the proposed action.

1. ***Provide more transportation choices****. Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce Hawaii's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.*

Mill Camp provides housing that is close to the source of employment, which reduces the need for transportation.

2. ***Promote equitable, affordable housing****. Expand location- and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation.*

Mill Camp is designed and operated to provide affordable housing residents of Waialua who are priced out of the market-rate real estate markets.

3. ***Enhance economic competitiveness****. Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers, as well as expanded business access to markets.*

Stated as above.

4. ***Support existing communities****. Target infrastructure investment toward existing communities (through strategies like transit oriented and mixed-use development) to increase community revitalization and the efficiency of public works investments.*

Mill Camp has been an existing community for workforce housing since 1913, and will be restored to the same function.

5. ***Coordinate and leverage State, County, and Federal policies and investment****. Align state, county, and federal policies and funding to remove barriers to collaboration, leverage funding, and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.*

HAHI will use public and private funding to leveraged to obtain low-income housing tax credits and other source to support affordable farm worker housing.

6. ***Value communities and neighborhoods****. Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods.*

There is no better example of preserving the character of a community than restoring Mill Camp in Waialua it has not occurred to these authors.

7. ***Compact Building Design.*** *Design communities to preserve more open space with compact building designs that make efficient use of land and resources.*

Mill Camp was designed and built by Waialua Sugar Company so that its residents could walk to work and to services in Waialua.

8. ***Preserve open space, farmland, natural beauty, and critical environmental areas****. Preserve natural areas that provide important community space, habitat for plants and animals, recreational opportunities, places of natural beauty, and critical environmental areas. Protect farm and agricultural lands and promote locally grown foods.*

Mill Camp, where possible will provide additional common areas and use design principles to allow green spaces within neighborhoods. It promotes locally grown foods by providing housing that is in some cases within walking distance to the areas farmed by residents.

9. ***Promote community and stakeholder collaboration in development decisions****. Promote an inclusionary process with a common understanding among diverse stakeholders using effective communication techniques.*

As in traditional plantation camps management is easily accessible by residents at all times. Village meetings are held to discuss plans and listen to resident's concerns. A monthly newsletter informs residents of upcoming improvements and proposed changes.

10. Preserve and perpetuate our island cultural values. *Consider the ahupuaa management concept to integrate resource management decisions from the mountains to the sea.*

Mill Camp is restricted to a small portion of land, but perpetuates post-contact plantation lifestyle and values.

5.3 City and County Policies Supporting Affordable Housing

A. Consistency with The Oahu General Plan (revision 2017)[33]

The Oahu General Plan sets forth objectives and broad policies for the long-range development of the Island. Among its primary purposes is to guide land use and development decisions to support the quality of life for Oahu residents. The General Plan is divided into 11 areas of concern. Those most applicable to the proposed change in the urban growth boundary are discussed herein.

Population.
Policy A4: Establish geographic growth boundaries to accommodate future population growth while at the same time protecting valuable agricultural lands, environmental resources, and open space.
Objective B: To establish a pattern of population distribution that will allow the people of Oahu to live, work and play in harmony.

[33] https://www.honolulu.gov/rep/site/dpp/pd/pd_docs/RES21-023_CD1_-_11-18-21_ZP.pdf

The North Shore limit is 2% of the Island population. According to the current Hawaii Databook the population of the North Shore is around 1.7% and has decreased in the period since 2015. One of the important factors in the loss of population is the high cost of housing. We believe that the population loss would be much higher without the influx of high-end real estate speculators non-permanent residents. The link between affordable housing and agriculture is the foundation of the plantation camps.

Economy
Policy C: To ensure the long-term viability and continued productivity of agriculture on Oahu.

C6: Promote small-scale farming activities and other operations,…

Objective F: To maintain a high level of Federal spending on O'ahu consistent with the City's infrastructure and environmental goals.

Farming is not a high-paying business, in general and small farmers in particular work very hard for their earnings. Respectable and affordable housing is essential to support Oahu's agriculture industry. The proposed restoration of Waialua Mill camp will be accomplished largely with federal and tax-credit funding to support construction of affordable homes some of which will be reserved for farm families working in the vicinity.

Housing and Communities
Policy 1: Support programs, policies, and strategies which will provide decent homes for local residents at the least possible cost.
Policy 2: Streamline approval and permit procedures for housing and other development projects.
Policy 3: Encourage innovative residential developments which result in lower costs, the sustainable use of resources, the more efficient use of land and infrastructure, greater convenience and privacy, and a distinct community identity.
Policy 4: Support and encourage programs to maintain and improve the condition of existing housing.
Policy 5: Make full use of government programs that provide assistance for low- and moderate income renters and homebuyers.
Policy 6: Maximize local funding programs available for affordable housing.
Policy 7: Provide financial and other incentives to encourage the private sector to build homes for low- and moderate-income residents.
Policy 8: Encourage and participate in joint public-private development of low- and moderate income housing.
Policy 9: Encourage the replacement of low- and moderate-income housing in areas which are being redeveloped at higher densities.
Policy 10: Promote the design and construction of dwellings which take advantage of O'ahu's year-round moderate climate and use other sustainable design techniques.
Policy 11: Encourage the construction of affordable homes within established low-density and rural communities by such means as 'ohana units, duplex dwellings, and cluster development that embraces the 'ohana concept by maintaining multi-generational proximity for local families.

Policy 13: Encourage the production and maintenance of affordable rental housing, ‘ohana housing, and accessory dwelling units.
Policy 15: Encourage equitable relationships between landowners and leaseholders, between landlords and tenants, and between condominium developers and owners.
Policy 16: Support collaborative partnerships that work toward immediate solutions to house and service homeless populations and toward long-term strategies to prevent and eliminate homelessness.

VII. Physical Development and Urban Design
Policy 1: Provide infrastructure improvements to serve new growth areas, redevelopment areas. and areas with badly deteriorating infrastructure.

Mill camp will redevelop a traditional plantation camp and its infrastructure in the traditional style.

Policy 7: Physical Development and Urban Design
To coordinate changes in the physical environment of O‘ahu to ensure that all new developments are timely, well-designed, and appropriate for the areas in which they will be located.
Policy 9: Locate community facilities on sites that will be convenient to the people they are intended to serve.
Objective E: To maintain those development characteristics in the urban-fringe and rural areas which make them desirable places to live.
Policy 5: Encourage the development of a variety of housing choices including affordable housing in rural communities, to give people the choice to continue to live in the community that they were raised in.

Mill Camp is an appropriate development for Waialua because it constituted most of Waialua until the1980s. Its residents built the economy and culture that is so attractive today. Mill Camp will provide assets to the children of those people, the majority of whom are leaving.

Objective G: To promote and enhance the social and physical character of O‘ahu's older towns and neighborhoods.
Policy 1: Encourage new construction in established areas to be compatible with the character and cultural values of the surrounding community.
Policy 2: Encourage, wherever desirable, the rehabilitation of existing substandard structures.
Policy 3: Provide and maintain roads, public facilities, and utilities without damaging the character of older communities.
Policy 4: Seek the satisfactory relocation of residents before permitting their displacement by new development, redevelopment, or neighborhood rehabilitation.
Policy 5: Acknowledge the cultural and historical significance of kuleana lands and the ancestral ownership of kuleana lands.
Policy 6: Support and encourage cohesive neighborhoods which foster interactions among neighbors, promote vibrant community life, and enhance livability.

The entirety of Objective G supports the concept of restoring a traditional plantation camp.

X. Culture and Recreation
Policy 2: Promote the preservation and enhancement of local cultures, values and traditions.
Policy 5: Preserve the identities of the historical communities of O'ahu.

The proposed amendment to the urban growth boundary is supported by these and other policy objectives. Expanding the urban growth boundary to the extent of parcel 6-7-001:077 will facilitate restoration of the historical Mill Camp residential area that has been the center of history and culture in the area for more than 100 years. It will provide a new supply of affordable housing units for local families who are constrained by the high price of housing whether for rent or purchase.

B. Consistency with the North Shore Sustainable Communities Plan (2000)

The 2000 NSCP recommends redevelopment of Mill Camp, but apparently did not recognize that parts of Mill Camp were not included in the urban growth boundary.

In response to housing needs expressed by Waialua and Haleiwa residents and anticipated demand generated by growth in diversified agriculture and other industries, two residential expansion areas contiguous to Haleiwa and Waialua Towns are proposed. In Waialua, the existing Mill Camp between the Mill site and Puuiki street is designated Residential to reflect its existing use, and new housing will be located mauka of the Mill Camp, between Puuikiale Avenues." Within this designated area, an additional 150 units between Pu`uiki Road and Puuiki Avenue are anticipated. This level of housing development is expected to meet housing needs through 2020 and still maintain the rural character of Waialua town.

C. Consistency with the 2003 Waialua Town Master Plan Economic Base & Market Feasibility Analysis.[34]

The City and County commissioned the above referenced planning study in response to the 1996 closure of Waialua Sugar Company and the relatively serious economic conditions that still prevail in Waialua.

Residents were interested in exploring specific issues related to housing and its impact on economic development. These included: (1) the potential of residential development (and therefore increased population) to support retail/service business expansion in the town core; ***(2)*** *the development of affordable housing for existing Waialua residents;* ***(3)*** *the need for housing to accommodate and/or attract a workforce to sustain Waialua economic growth;* ***(4)*** *the prospects for "revitalizing" Waialua vs. impacts on the town's rural character, open space, and country lifestyle.*

HAHI assumes now that some of those priorities may be changing due to the overcrowding of Haleiwa towns, and its plethora of retail and service businesses. Also the objective is not to attract a workforce, but to preserve what is left of it following the decline stretching over the past 20 years. Restoration of the traditional housing hub of Waialua is consistent with the town's rural

[34] http://www.friendsofhaleiwabeachpark.org/Waialua_Economic_Final_Draft.pdf

character, open space, and country lifestyle. The residents of Mill Camp had a major role in creating it.

D. Consistency with the 2005 Waialua Town Master Plan[35]

One of the guiding principles of the Waialua Town Master Plan is *to foster Waialua's place as the quiet heart of the North Shore's permanent residential and farming communities.* The plan defines the "Waialua area" as the area between Ki`i Ki`i stream, Farrington Highway, and the old Mill Camp.

The Waialua area concept recommends near term, encourage "*infill residential" development of 200 to 225 market priced (moderate range) single-family units on about 45 acres fronting Goodale Avenue and just below the existing residential homes along Farrington Highway.*

The infill areas recommended and shown on the figures cross existing property lines in and around the Mill Camp area. The plan reports: *"many residents acknowledge the need for limited residential development as additional support for retail/service businesses; providing affordable housing for existing residents and workforce housing for an increased population base; and as a way of revitalizing what was lost with the close of the Sugar Mill. The economic analysis for this project concluded that a minimum of 300 new Waialua-area homes would be needed to support significant retail expansion (above and beyond the existing potential to recapture some spending). Smaller numbers would not generate enough local-area expenditures to support new businesses*.

<u>*Long term (20 years or more*</u>*) encourage development of rural residential communities – with a housing density ranging from four to eight units per acre – on lands both north and south of the industrial-zoned area, including the current Old Mill Camp."*

[35] https://www.honolulu.gov/rep/site/dpp/pd/pd_docs/WaialuaTownMasterPlan2005.pdf

Figure 5-1: Conceptual plan for rural residential infill, Waialua Town Master Plan (2005). Note the approximate property boundaries of the Mill Camp parcel (red) are added for reference.

The development objectives proposed for restoration of workforce housing as a rural residential community respond precisely to the concerns addressed in the Waialua Town Plan and the Economic Feasibility Analysis. The proposed restoration of Mill Camp will be 20 years from the date these objectives were published.

E. Consistency with the North Shore Sustainable Communities Plan (2011)[36]

The 2011 NSSCP is the planning guide specifically for the North Shore that is a more current vision of the North Shore.

The 2011 NSCC Plan states: *"Provide sufficient lands adjacent to build areas of Hale'iwa and Waialua for housing that is compatible with the region's rural character and affordable to area residents, without exceeding the General Plan's population guidelines for the region and remaining in line with General Plan policies to maintain the North Shore as a rural area.*

Development character is generally low density, low rise, small scale, and reflective of a "country" setting. Within residential areas, the landscaping and front yards which provide the foregrounds to their respective residences are the principal visual elements.

Areas outside the Community Growth Boundary include agricultural lands as well as preservation lands with important open space, scenic, or natural resource values. Uses such as

[36] http://www.honoluludpp.org/Portals/0/pdfs/planning/NorthShore/NSSCP_May_2011.pdf

commercial and industrial development, public and private schools, and residential subdivisions with no bona fide agricultural activities are not permitted in these areas.

Rural design guidelines and development standards have been adopted to ensure compatibility with the region's rural character and surrounding open space. Rural models such as the plantation community at Poamoho Camp, which is characterized by clusters of single-story dwellings with landscaping, narrow streets, and common parks and open spaces within the neighborhood, were used as examples to follow.

Most of the North Shore's present-day landscape – including the region's physical layout and formation of its towns and neighborhoods, its building forms and landmarks, sense of place, and demographic composition and social fabric of the community – have been influenced by the plantation and its distinctive lifestyle.

Many of the policies and objectives support the restoration of Mill Camp, it simply does not recognize Mill Camp as an area that is among the best infill areas for additional housing. This may be because in 2011 Dole was not planning on selling its assets and this area may have been considered untouchable. That situation has changed, and Dole is selling most of its assets not related to their primary line of business. Something is very likely to be done with the Mill Camp housing area in the near future. We believe that restoring it to its original function for respectable affordable single-family houses is the highest and best use of the property.

It is not coincidental that Mill Camp is in the center of town. Waialua developed around its sugar mill to service a stable and prosperous workforce. Restoration of Mill Camp will once again provide the foundation for the same workforce and prevent the drain of working families that has prevailed since the turn of this century.

Mill Camp was designed by the plantation to allow farm workers a long-term stable and affordable housing within easy commute to the jobsite. This is still needed in Waialua. The proposed action preserves and expands the portfolio of historically appropriate housing for the long-term residents of the North Shore. In doing so it supports area agriculture by providing affordable housing to the community which continues to rely heavily on agriculture for employment. HAHI anticipates many of the farmers who purchased small plots of farm land in the parcels adjacent to Mill Camp will opt to reside here once respectable and affordable housing is available.

The proposed action is supported by Federal, State, and County policy declarations.

6.0 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Affected Environment	Level of Concern	Impact and Mitigation
Water Resources and Drainage	Low	*Impact:* Potential stormwater runoff during and after construction *Mitigation:* NPDES permitting. Permeable pavements, bioswales, onsite infiltration areas, and BMPs
Seismic and Geological	No	*None:* Soils and geology are suitable for development. Outside tsunami and flood zone
Soils and Agriculture	Positive	Provides housing for income qualified farmers and others in the area
Flora and Fauna	No	*None:* Area is residential, previously disturbed and dominated by landscaped areas
Air Quality	Low	*Impact:* Fugitive dust. During construction. *Mitigation:* Fugitive dust minimized by BMPs during construction
Visual Character	Positive	Large-scale cleanup in advance of construction. Landscaping following construction
Noise	Low	*Impact:* construction noise during business hours *Mitigation:* Work time is restricted to business hours.
Odor	No	None
Social	neutral	Expanded housing opportunities, improved community safety, reduced crime; however, some population increase is expected.
Historical and Archaeological	No	No known archaeological resources. Documentation of architecture and other historical All development to be approved by SHPD
Economic	Positive	Provides affordable housing to more families in Waialua.
Cultural	No	No traditional practices or important cultural sites identified
Public Facilities and Services	No	Essential services are designed to accommodate proposed increase in local populations
Roads and Traffic	moderate	*Impact*: increased traffic *Mitigation*: Access and egress through Kealohanui will be widened and improved. Pu'uiki Street reopened and widened as necessary. DOT assistance is expected.
Consistency with Govt. Plans and Policies	Consistent	Rural residential and plantation communities supported by Federal, State and Local Plans
Irretrievable Commitment of Resources	Positive	*Impact:* Use of public funding, labor, materials and energy. Respectable housing at an affordable price reduces crime, supports retention of long-term residents, and increases quality of life for the entire community. Labor, materials and energy are irretrievable, but serve a worthy function.

6.1 Determination of Significance

In determining whether an action may have a significant effect on the environment under HRS 11-200, the proponent must consider every phase of a proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action.

An action shall be determined to have a significant effect on the environment if it:

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.*

   The proposed action would not result in an irrevocable commitment, loss, or destruction of any protected natural resource. No threatened or endangered species were identified within the development area. Archeological studies concluded that there is no evidence of traditional practices or cultural artifacts within the area of the proposed action. Several historical remnants of the sugar plantation activities were documented. The character and architectural elements will be documented and preserved in its restoration.

2. *Curtails the range of beneficial uses of the environment.*

   Mill Camp has been in this location for 100 years, and will continue in its function to provide affordable housing for Waialua's workers and their families. The proposed action will benefit business and agriculture. Both housing and agriculture in areas that are previously developed may be considered beneficial uses of the environment.

3. *Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.*

   Plantation communities are protected by state statutes and city ordinances and supported by planning documents at all levels of the government. The proposed action will obtain permits including a 201H permit and development agreement to become consistent with planning and zoning policies.

4. *Substantially affects the economic welfare, social welfare, and cultural practices of the community or State.*

   The proposed action has beneficial impacts on the social and economic welfare of the County and State. The objective of the proposed action is to maintain a supply of affordable rental housing that has been lost to families living in Waialua.

5. *Substantially affects public health.*

The proposed action benefits public health by expanding the portfolio of safe and respectable housing for Waialua area families. The proposed action will continue to reduce crime in the area through its management and policies.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities.*

   The population of Mill Camp will increase; however, the majority of this increase will come from communities surrounding Mill Camp. These communities suffer from significant overcrowding in available homes because of the disparity between real estate values and family income. District-wide population changes will be reduced by providing priority services to long-term residents.

7. *Involves a substantial degradation of environmental quality.*

   Temporary impacts associated with construction will be mitigated through best management practices. Noise and fugitive dust are not expected to be substantial or lasting. During operations degradation the environment within the community and outside is expected to be improved through stormwater and wastewater management, improved infrastructure, and paved roads.

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

   Restoration of Mill Camp is a single project, albeit developed in stages. It provides respectable housing whose rent is indexed to household income. One potential commitment for larger actions will be to provide housing for families who have purchased small farm plots in the area.

9. *Substantially affects a rare, threatened, or endangered species, or its habitat.*

   No threatened or endangered species were identified within the project site. No critical habitats are recognized or expected within the project area.

10. *Detrimentally affects air or water quality or ambient noise levels.*

    Temporary impacts associated with construction will be small and mitigated through best management practices. Following construction there are no sources of regulated emissions or noise. The proposed action is not expected to result in degradation of the quality of life or the environment within the community.

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

The project site has been used for housing for more than 100 years and is not located in an environmentally sensitive area. The previous use has defined the biological communities that are present. It is not located in a flood zone, tsunami inundation area, estuary, fresh water source, or coastal waters. It is not in an erosion prone or geologically hazardous area.

12. *Substantially affects scenic vistas and view planes identified in county or state plans or studies.*

    Mill Camp cannot be seen from publicly-accessible areas. Height limits will not be significantly changed. The scenic vistas and unique view planes within Mill Camp will be improved, and unique community character will be preserved by the proposed action.

13. *Requires substantial energy consumption.*

    The proposed project will require fossil fuel consumption during construction and increase electrical power consumption during operation. Electric power for use in the Camp will be generated predominately by photovoltaic or other carbon-free methods. The quantity of electrical power derived from Hawaiian Electric may be reduced from the existing condition.

Based on analysis of the 13 significance criteria listed above, the proposed action is not expected to result in significant adverse environmental impacts when conducted within the constraints of the required plans and permits. Additional information and comments will be collected from the public and various agencies in advance and through the public comment period. These will provide additional information for assessment in publication of the Final Environmental Assessment.

Pending receipt of comments received from agencies and interested parties the proponent anticipates reaching a finding of no significant impact.

7.0 COMMENTS AND COORDINATION

7.1 Agencies and Organizations Contacted

The following agencies were contacted for assistance during preparation of the Draft Environmental Assessment.

Director
State Historic Preservation Division, DLNR
Kakuhihewa Building,
601 Kamokila Blvd., Suite 555,
Kapolei, Hawaii, 96707

Department of Planning and Permitting
City and County of Honolulu
650 S. King St. Honolulu, HI 96823

North Shore Neighborhood Board,
Kathleen Pahinui, Chair

Safe Drinking Water Branch
Environmental Management Division
Hawaii State Department of Health
2385 Waimano Home Road, Suite 110
Uluakupu Building 4
Pearl City, Hawai`iHawaii1400

Honolulu Police Department
Community Policing Division
Wahiawa Station

Honolulu Fire Department
Waialua Fire Station

City and County of Honolulu
Department of Community Services
925 Dillingham Blvd,
Honolulu, HI 96817

Hawaii Department of Transportation Highways Division
869 Punchbowl Street
Honolulu, HI 96813

Department of Hawaiian Home Lands
91-5420 Kapolei Pkwy,
Kapolei, HI 96707

Hawaii Department of Health
Clean Water Branch
2827 Waimano Home Rd
Pearl City, HI 96782

Hawaii Department of Health
Safe Drinking Water Branch Branch
2827 Waimano Home Rd
Pearl City, HI 96782

Councilman Matt Weyer
Honolulu Hale, Room 202
Honolulu, HI 96813

Senator Gill Riviere
Hawaii State Capitol
415 S Beretania St.,
Honolulu, HI 96813

7.2 Public Coordination and Individuals Consulted

The following individuals and public interest groups were contacted for assistance during preparation of the Environmental Assessment.

Mill Camp residents
Antya Miller, Hawaii Historical Society
Matthew K. Fujioka, P.E.,
Kathleen Pahinui
Raquel Achiu,
Maka Caisson-Fisher
Mike Lyons
Leif Anderson
Boyd Ready

8.0 LIST OF DOCUMENT PREPARERS

This document was prepared under the direction of The Department of Planning and Permitting, City and County of Honolulu, Laura Mo, Lead Planner

Document preparation and technical research was done by:

Mill Camp Development Group, LLC
David Robichaux
Kanekawaiola "Max" Lindsey
Craig Watase.
Paul Watase
Kyle Watase.
Dean Sakata
Micah Witty-Oakland

Real Green Power
Dennis Furukawa

The preparers also wish to thank the following for their contributions and advice:

Matthew K. Fujioka, P.E., Vice President Bow Engineering & Development, Inc.
Kathleen Pahinui Chair North Shore Neighborhood Board
Raquel Achiu, Vice Chair North Shore Neighborhood Board
Maka Caisson-Fisher, Vice Chair North Shore Neighborhood Board
Mike Lyons, North Shore Neighborhood Board
Leif Anderson, North Shore Neighborhood Board

Appendix A

Comments and Contacts Received During Preparation of the DEA

Agency	Objective/Response
SHPD	Coordination with SHPD Archeology and Architectural personnel. ASM Consultants multiple contacts. SHPD will review/comment on Draft EA
DPP	See correspondence
North Shore Neighborhood Board	Presentations to NSNB June 2022, February 2023. Scheduled presentation September 22, 2022. Boundary amendment support letter attached.
DOH Safe Drinking Water Branch	Multiple contacts regarding water system improvements DOH will review/comment on Draft EA
HPD	Coordination with Community Policing Division on plans and efforts to remove trespassers
HFD	Coordination with Waialua Fire Captain regarding restoration plans and fire prevention methods in design.
Honolulu Dept. of Community Services	Coordination with DCS on multiple occasions regarding funding. DCS will review Draft EA
State DOT	Coordination between The Traffic Management Consultant, Inc. and DOT. DOT will review Draft EA.
DHHL	Multiple contacts regarding DHHL purchase and development of land within Mill Camp. DHHL will review/comment on Draft EA
Councilman Matt Weyer	Advisory/ informational meeting prior to neighborhood Board presentation. Councilman will review Draft EA.
Senator Gill Riviere	Advisory/ informational meeting prior to neighborhood Board presentation in 2022.
US Fish and Wildlife	Advised to use IPAC. FWS will review Draft EA

TRANSMITTAL

TO: Director Dawn Takeuchi Apuna
c/o Laura Mo, Planner
Department of Planning and Permitting
City and County of Honolulu

FROM: Dave Robichaux for Carl Cunningham, President
Hawaii Assisted Housing, Inc.

RE: DEA Restoration of Waialua Mill Camp Affordable Housing Waialua, Oahu, Hawaii. Aug. 10, 2023. File No. 2023 ED-10

Please find attached checks for $200 and $400 addressed to the City and County as payment review and processing pf the above-referenced DEA.

Thank You for your able and prompt reviews. Please contact me if I can provide additional information or clarification.

Dave M. Robichaux

NORTH SHORE CONSULTANTS, LLC

Dawn Takeuchi Apuna, Director
Jiro Sumada, Deputy Director
650 S. King Street, 7th Floor
Honolulu, HI 96813

March 15, 2023

Transmitting Draft Environmental Assessment
201H Pre-consultation package for
Restoration of the Waialua Mill Camp
Waialua, Hawaii 96791

Directors Apuna and Sumada:

By this letter, North Shore Consultants, LLC is requesting DPP as the Approving Agency for the Environmental Assessment to support restoration of the Waialua Mill Camp. We would also loke to begin the 201H process and request a preliminary consultation. PDF copies of the DEA and Pre-consultation memo are attached for your review.

If I can provide additional information of hard copies please do not hesitate to contact me. I look forward to working with you and your staff on what I believe to be an important project.

Sincerely,

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

66-031 Mahaulu Lane
Haleiwa, HI 96712

(808) 368-5352 cell
robichaud001@hawaii.rr.com

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 768-8000 • FAX: (808) 768-6041
DEPT. WEB SITE: www.honolulu.gov/dpp

RICK BLANGIARDI
MAYOR

DAWN TAKEUCHI APUNA
DIRECTOR

JIRO A. SUMADA
DEPUTY DIRECTOR

June 2, 2023

2023/ELOG-613 (LM)

Mr. David M. Robichaux
North Shore Consultants
66-031 Mahaulu Lane
Haleiwa, Hawaii 96712

Dear Mr. Robichaux:

SUBJECT: Request for Pre-Consultation Comments
Environmental Assessment for Restoration of Waialua Mill Camp
67-114 Kealohanui Street – Waialua
Tax Map Keys 6-7-001: 030 and 077

This is in response to your letter, received March 23, 2023, requesting comments on the scope and content to be addressed in a Draft Environmental Assessment (DEA), as required under Chapter 343, Hawaii Revised Statutes (HRS), for the phased restoration of Waialua Mill Camp housing in Waialua. The following items should be addressed in the DEA:

1. Table 2-2 and supporting narrative should utilize and display income limits published by the Department of Planning and Permitting (DPP).

2. Although the Waialua Hongwanji Mission property is not part of the proposed project, the DEA should discuss the Special Use Permit ([SUP] File No. 2002/SUP-9) which covers the entirety of Tax Map Key 6-7-001:060.

3. The DEA should disclose that a District Boundary Amendment (DBA) from the State Agricultural District to the State Urban District is required and cannot be exempted due to the language in 201H-38(a)(4) which sets the process for expedition of DBAs for affordable housing projects.

4. Section 3.7.1 of the DEA should correct the language regarding page A-2 of the 2011 North Shore Sustainable Communities Plan (NSSCP). The underlined sentence is proposed for addition into the NSSCP plan update, currently underway, but is not contained in the 2011 adopted NSSCP. Note that the

proposed language is not required to be inserted into the NSSCP to accomplish the proposed action. DPP supports amending the existing Community Growth Boundary narrative to accommodate the Mill Camp Restoration.

5. Land Use Ordinance ([LUO]; Chapter 21, Revised Ordinances of Honolulu [ROH]):

   The Project site consists of two parcels, with a total of 71.62 acres located in multiple zoning districts: AG-1 Restricted Agricultural District, AG-2 General Agricultural District, and R-5 Residential District. It appears that a small portion of the parcel is within the I-2 Intensive Industrial District. Proposed development activities must comply with all applicable development standards, or noncompliance should be identified and captured in any forthcoming 201H requests. Project compliance with these standards should be presented and evaluated in the DEA. The LUO is available on our website at:

   https://www.honolulu.gov/rep/site/dpp/dpp_docs/land-use-ordinance.pdf

6. Traffic Review:

   a. Transportation Assessment Report (TAR) to be updated and coordinated with the Department of Transportation Services (DTS) for all improvements currently being installed at Goodale Avenue and Kealohanui Street. Provide a follow up analysis of intersection after incorporating any improvements by DTS and provide recommendations to address Level of Service and traffic impacts.

   b. TAR to be revised to include analysis for all-way stop condition at the intersection of Goodale Avenue and Kealohanui Street.

   c. All access points along Farrington Highway to be coordinated with State Department of Transportation.

   d. A time line or phasing plan of the anticipated dates to obtain major building permit(s) for demolition/construction work, including the projected date of occupancy or opening shall be prepared by the applicant in a format acceptable to the DPP. The time line should identify when the construction management plan (CMP) will be submitted for review and approval. Typically, the CMP should be submitted for review and approval prior to the issuance of major building permit(s) for demolition/construction work.

   e. The CMP shall identify the type, frequency, and routing of heavy trucks and construction related vehicles. Every effort shall be made to minimize impacts from these vehicles and related construction activities. The CMP should identify and limit vehicular activity related to construction to periods outside of the peak periods of traffic, utilizing alternate routes for heavy trucks, provisions for either on-site or off-site staging areas for construction related workers and vehicles to limit the use of on-street parking around the project site and other mitigation measures related to traffic and potential neighborhood impacts. Preliminary or conceptual traffic control plans should also be included in the CMP. The Applicant shall document the condition of roadways prior to the start of construction activities and provide remedial measures as necessary, such as restriping, road resurfacing, and/or reconstruction if the condition of the roadways has deteriorated as a result of the related construction activities.

f. Construction plans for all work within or affecting public streets should be submitted for review and approval. Traffic control plans during construction should also be submitted for review and approval as required.

g. If Kealohanui Street were to become a new roadway lot, it must be designed and constructed to City standards. Kealohanui Street is currently considered a driveway, and does not comply with City roadway standards.

6. Flood Zone: The DEA should identify the subject property's Flood Zone, as mapped by the Federal Emergency Management Agency, and evaluate the proposed Project's compliance with the City's Flood Hazard Areas Ordinance (Chapter 21A, ROH), which is available online at:

   https://www.honolulu.gov/rep/site/ocs/roh/ROH_Chapter_21A_.pdf

7. Wetlands and Sensitive Species:

   The DEA should identify the presence or potential presence of any protected wetlands, sensitive habitat, flora species, and fauna species. The DPP recommends reaching out the U.S. Fish and Wildlife Service (USFWS) to obtain a list of species that are known to occur, or may potentially occur, in the project vicinity. Known mapped wetlands can be viewed on the USFWS National Wetlands Inventory *Wetlands Mapper*. The DEA must evaluate potential impacts to each identified sensitive species, and provide standard agency-required mitigation measures as well as any applicable site-specific mitigation measures to avoid or minimize potential impacts to each identified species, critical habitat and habitat applicable to the site. The Wetlands Mapper is available online at:

https://www.fws.gov/wetlands/data/mapper.html.

8. Please be advised that in December of 2020, the State Historic Preservation Division (SHPD) began using a new online system to better track consultation requests, which is available online at:

https://shpd.hawaii.gov/hicris/landing.

Because the new tracking system requires agency-to-agency requests, the DPP has created a generic request letter that property owner(s) and/or consultant(s) may use for projects that will eventually require DPP approval. This letter may be completed by a property owner(s) and/or consultant(s) and submitted to SHPD directly via their online system to initiate requests before permit applications are submitted to the DPP. The letter includes a general DPP contact number and email, as well as blank fields where the property owner(s) or their consultant(s) can enter their contact information. The generic request letter is available online at:

https://www.honolulu.gov/rep/site/dpp/dpp_docs/SHPD-Comment-Request.pdf

9. Visit our Environmental Assessment preparation guide at:

https://www.honolulu.gov/dpp/home/environmental-assessment.html

Finally, please contact the appropriate Neighborhood Board and any relevant neighborhood associations or commissions to request an opportunity to present the Project proposal at the next available Neighborhood Board meeting and/or association meeting(s).

Thank you for the opportunity to comment on this proposal. Should you have any questions, please contact Laura Mo, of our staff, at (808) 768-8025 or via email at laura.mo@honolulu.gov.

Very truly yours,

Alex D. Beatty
for Dawn Takeuchi Apuna
Director

Appendix B

Archaeological Inventory Survey Mill Camp
Cultural Impact Assessment

Archaeological Inventory Survey for the Waialua Mill Camp Housing Project

TMKs: (1) 6-7-001:030, 058, and 077

Kamananui Ahupuaʻa
Waialua District
Island of Oʻahu

DRAFT VERSION

Prepared By:
Nick Belluzzo, M.A.,
Robert B. Rechtman, Ph.D.
Carol Oordt, M.A.,
John Meyer, B.A.,
and
Shannon Davis, M.A.

Prepared For:
Mill Camp Development Group,LLC

July 2023

ASM affiliates
Archaeology • History • Anthropology • Architectural History

Hilo Office: (808) 969-6066 Fax: (808) 443-0065
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820 Mililani Street, Suite 700, Honolulu, HI 96813

ASM Project Number 41900.00

Archaeological Inventory Survey for the Waialua Mill Camp Housing Project

TMKs: (1) 6-7-001:030, 058, and 077

Kamananui Ahupuaʻa
Waialua District
Island of Oʻahu

ASM affiliates

EXECUTIVE SUMMARY

At the request of the Mill Camp Development Group, LLC, ASM Affiliates (ASM) prepared this Archaeological Inventory Survey to both inform a Hawaiʻi Revised Statutes (HRS) Chapter 343 Environmental Assessment (EA) and the HRS Chapter 6E-42 review for the proposed Waialua Mill Camp Housing Project in Waialua, Kamananui Ahupuaʻa, Waialua District, Island of Oʻahu. The study area for this project consists of a roughly 75 acre property (TMKs: [1] 6-7-001: 030, 058, 077) including a roadway (Parcel 058), a former church lot (Parcel 030) and portions of the former Waialua Agricultural Company and Mill Camp (Parcel :077).The Mill Camp Development Group in partnership with Hawaii Assisted Housing, Inc. (HAHI), Mark Development, Inc., and North Shore Community Consultants, LLC, is proposing to construct 368 affordable homes, parking areas, community spaces, new roadways, new wastewater treatment improvements, and an updated water supply for the families residing within the footprint of the extant mill camp. The proposed project aims to address the critical shortage of affordable housing in the north shore area. The current study has been prepared in accordance with Hawaiʻi Administrative Rules (HAR) §13-284 (Rules Governing Procedures for Historic Preservation Review to Comment on Section 6E-42, HRS, Projects) as well as HAR §13-276 (Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports).

Fieldwork for the current study was conducted between December 8-14, 2022 by Nick Belluzzo, M.A., who served as the Principal Investigator, Rancestan DeRego-Cabarloc, B.A., Julie Evo, M.A., John Meyer, B.A., Evan Ryder, B.A., and Carol Oordt, M.A. One day (July 8, 2023) of additional fieldwork was conducted by Nick Belluzzo, M.A. and Robert B Rechtman, Ph.D. During the archaeological field survey, the entire (100%) ground surface of the non-residential study area was visually inspected by field technicians walking transects spaced at no more than 10 meters apart and oriented north-south or east-west as field conditions allowed. Pedestrian survey was conducted along the streets of the residential portion of the study area. Residential parcels were inspected from street vantage as thoroughly as possible given visual obstructions such as fencing and vegetation while respecting the privacy of the tenants. No subsurface testing occurred, and no cultural material was collected from the project area, during the current study. As a result of the fieldwork for the current study, four sites and a potential historic district were identified. All observed historic properties originate from the 20th century, and include an irrigation ditch (Site TS-01), a historic structure associated with the former Waialua Agriculture Company Concrete Products Plant (Site TS-02), an isolated retaining wall (Site TS-03), a former Church property (Site TS-04), and a plantation camp (Site TS-05).

Site TS-01, an irrigation ditch, was determined to be significant under Criterion d; Site TS-02, the remains of the former Waialua Agricultural Company Concrete Products Plant, was determined to be significant under Criterion a; Site TS-03, a retaining wall, was determined to be significant under Criterion d; Site TS-04, the former Waialua Pilgrim Church/Waialua Church of Christ property, was determined to be significant under Criterion d; and Site TS-05, the Waialua Mill Camp area, was determined to be not sufficiently intact to constitute a significant historic district. No further historic preservation work is recommended and the HRS Chapter 6E-42 effects determination for the proposed Waialua Mill Camp Restoration project is *no historic property affected*. However, in the unlikely event that archaeological resources are encountered during the implementation of the Waialua Mill Camp Housing Project, work in the immediate area of the discovery should be halted and SHPD contacted pursuant to HAR §13-280-3.

CHAPTERS

FIGURES

FIGURES

FIGURES

Page

TABLES

Page

1. INTRODUCTION

At the request of the Mill Camp Development Group, LLC, ASM Affiliates (ASM) prepared this Archaeological Inventory Survey to both inform a Hawaiʻi Revised Statutes (HRS) Chapter 343 Environmental Assessment (EA) and the HRS Chapter 6E-42 review for the proposed Waialua Mill Camp Housing Project in Waialua, Kamananui Ahupuaʻa, Waialua District, Island of Oʻahu. The study area for this project consists of a roughly 75 acre property (TMKs: [1] 6-7-001: 030, 058, 077) including a roadway (Parcel 058), a former church lot (Parcel 030) and portions of the former Waialua Agricultural Company and Mill Camp (Parcel :077) (Figures 1, 2, and 3).The Mill Camp Development Group in partnership with Hawaii Assisted Housing, Inc. (HAHI), Mark Development, Inc., and North Shore Community Consultants, LLC, is proposing to construct 368 affordable homes, parking areas, community spaces, new roadways, new wastewater treatment improvements, and an updated water supply for the families residing within the footprint of the extant mill camp. The proposed project aims to address the critical shortage of affordable housing in the north shore area.

ASM prepared this study to identify and determine the potential significance of any historic properties that may exist within the project area prior to the proposed redevelopment of the site. The current study has been prepared in accordance with Hawaiʻi Administrative Rules (HAR) §13-284 (Rules Governing Procedures for Historic Preservation Review to Comment on Section 6E-42, HRS, Projects) as well as HAR §13-276 (Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports).

The current report contains background information outlining the study area's physical and cultural contexts, a summary of relevant previous studies conducted in the vicinity of the current study area, and survey expectations based upon the background information and the previous studies. Also presented is an explanation of the survey field methods, a description of the results of the fieldwork, and significance evaluations and recommendations for the identified historic resources.

PROJECT AREA DESCRIPTION

The current study area is located on the north shore of Oʻahu within the western portion of Waialua Town on the flat coastal plain of Kamananui Ahupuaʻa, Waialua District, Island of Oʻahu. The approximately 75-acre project area is situated to the south and west of the former Waialua Sugar Mill and contains portions of three parcels, TMKs: (1) 6-7-001:030, 058, 077 (see Figure 2). Parcel 077 includes portions of the former Waialua Sugar Mill and Mill Camp and is bounded by Hapo Street and Puuiki Street to the north, Puuiki Street and Papa Circle to the west, Hopemanu Street and Cane Haul Road to the east and Hanapule Street and Koanaku Road to the south. Parcel 058 includes a segment of Puuiki Street. Finally, Parcel 030 is a former church lot within the former Mill Camp.

The geology underlying the project area is formed of alluvium, labeled 'Qa' (Figure 4) and in the southeast portion of the project area is older alluvium originated from the Pleistocene and Pliocene epochs, labeled 'QTao'. The northwest portion of the project area contains older dune deposits from the Holocene and Pleistocene epochs and calcareous reef rock/marine sediment from the Pleistocene epoch, labeled as 'Qdo' and 'Qcrs' (see Figure 4); Sherrod et al. 2007; Wolfe and Morris 1996). The soils that overly the geology in much of the project area include Mamala cobbly silty clay loam on 0 to 12 percent slope and Waialua silty clay on 0 to 3 percent slopes, labeled 'MnC' and 'WkA'. WkA is a deep, moderately well drained alluvial soil often utilized for irrigated sugarcane, while MnC is a very deep, well-drained soil that developed from the underlying substrata and is often used for pasture or the cultivation of macadamia nut, papaya, citrus, and guava. Additionally, there are small pockets of Waipahu silty clay on 0 to 2 percent slope (WzA) and Fill land (Fd) in the northern and southern portions of the project area, respectively (Figure 5 ; Foote et al. 1972; Soil Survey Staff 2022).

The climate within the project area is subtropical and windy year-round. The climate is relatively warm with a mean annual temperature ranging from 67° Fahrenheit during the winter months to 95° during the summer months (Giambelluca et al. 2014). The mean annual rainfall in this area is 783.8-millimeters (30.86 inches) with most rainfall occurring between October and March (Giambelluca et al. 2013). Precipitation within the extent of the project area varies according to elevation with the western end receiving more rainfall than the eastern end. Rainfall averages between approximately 21.3-120.6 millimeters (0.8 – 4.7 inches) throughout the project area (Giambelluca et al. 2014).

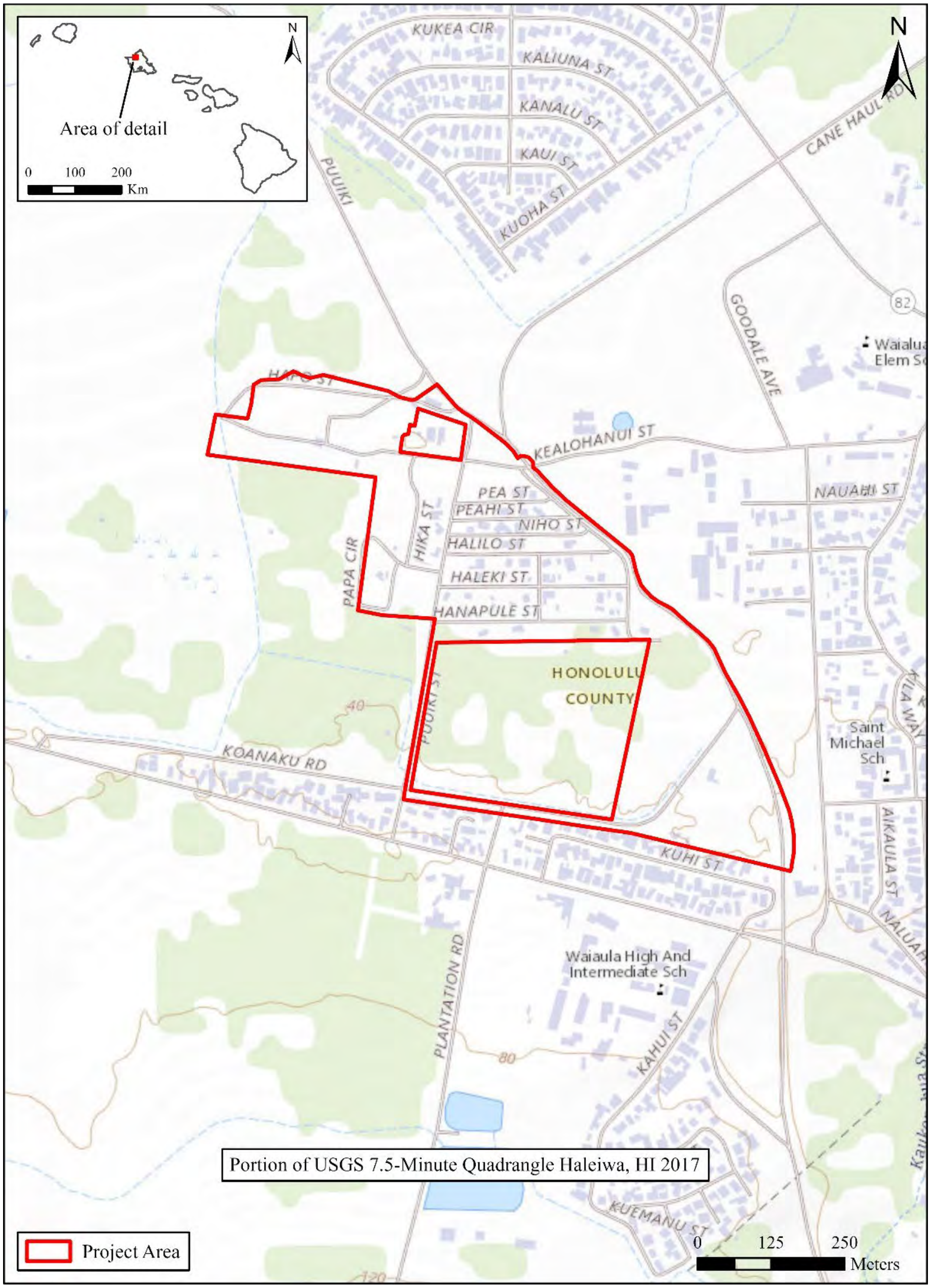

Figure 1. Portion of a USGS map with the study area outlined in red.

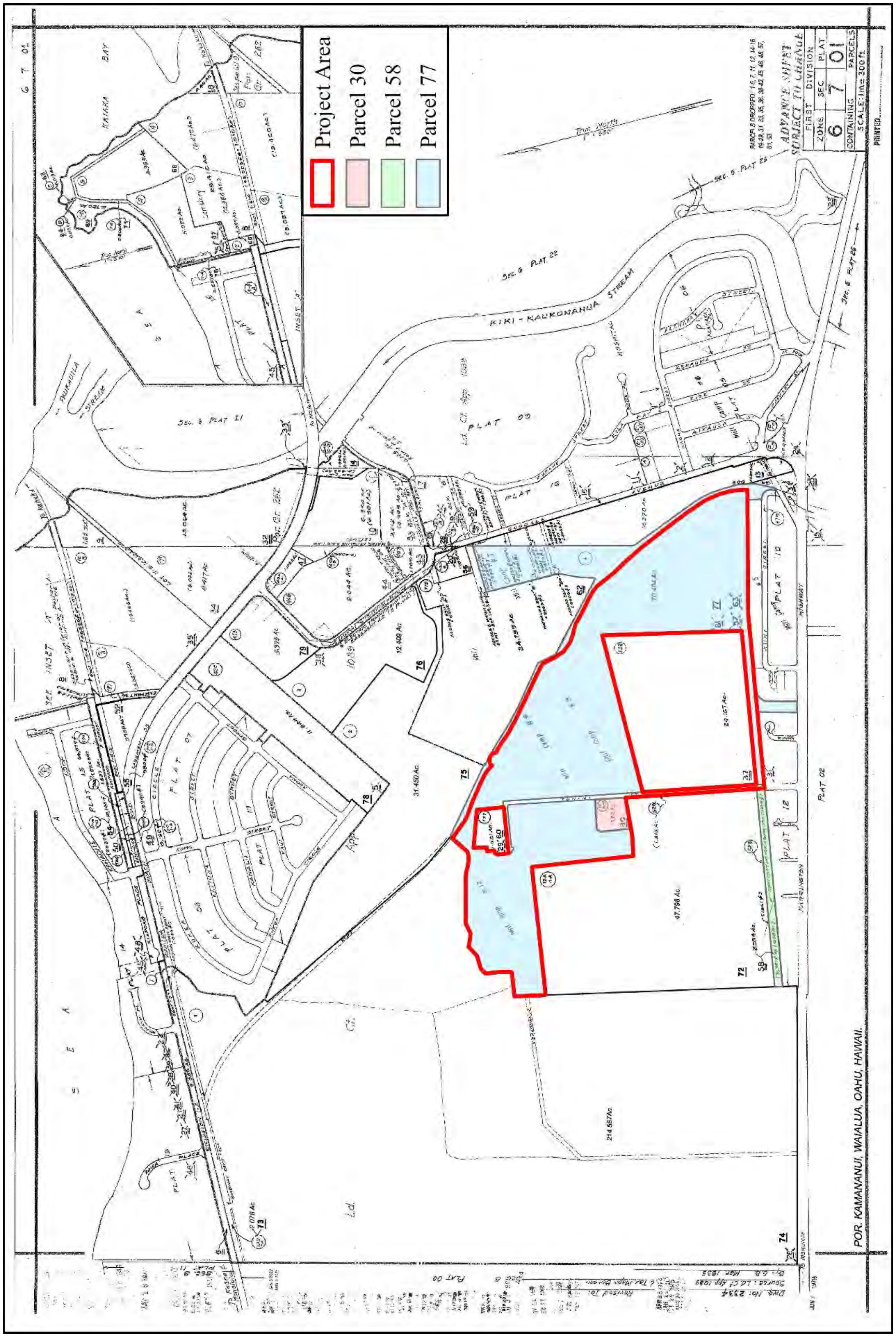

Figure 2. Tax Map Key plat map for TMK: (1) 6-7-001 showing the location of the Waialua Mill Camp study area on parcels 030, 058, and 077.

Figure 3. Satellite imagery showing the study area outlined in red.

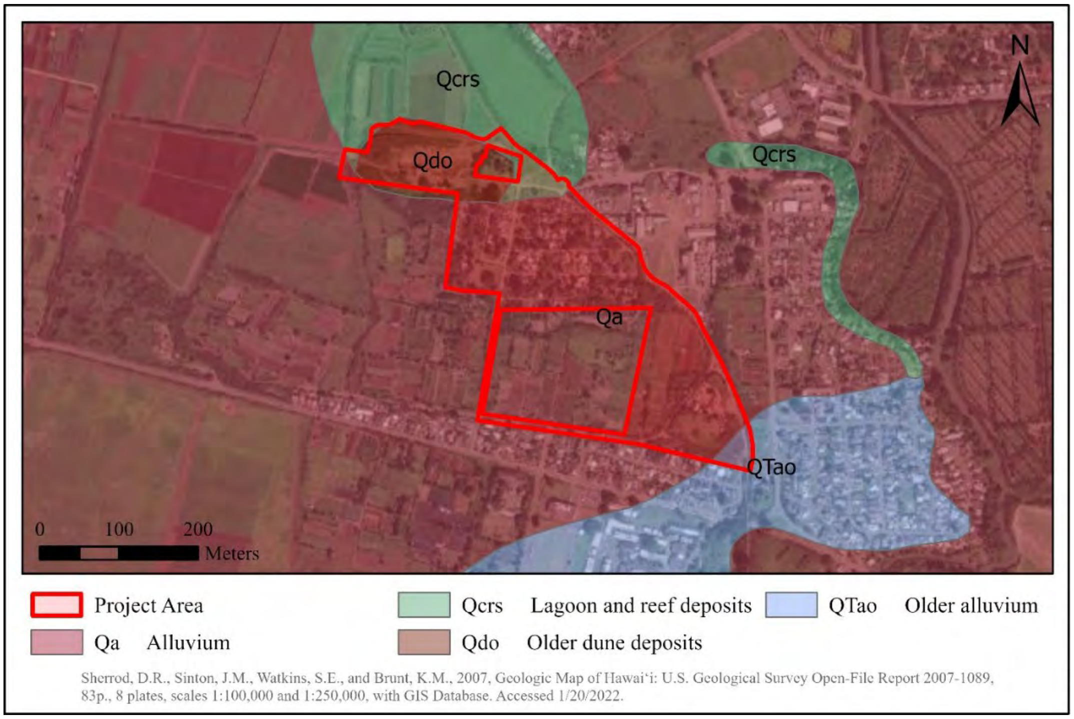

Figure 4. Geological units in the current project area (Sherrod et al. 2007).

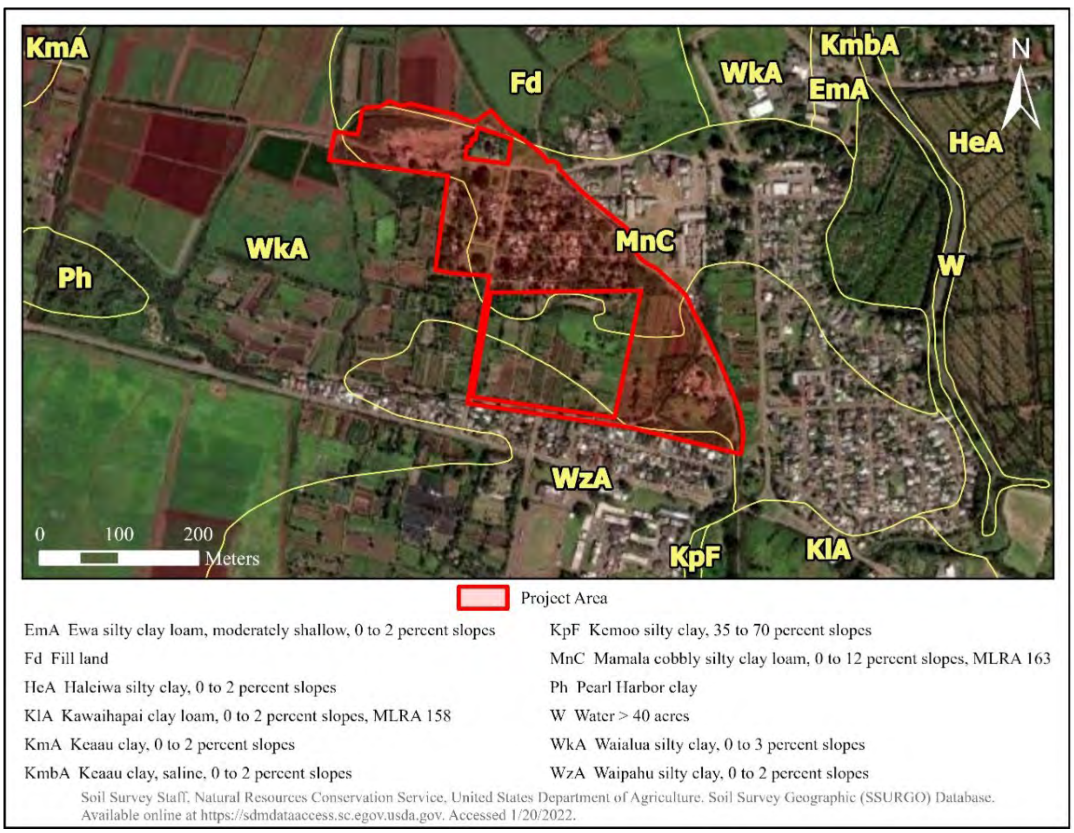

Figure 5. Soils within the project area (Soil Survey Staff 2019).

Vegetation within the project area varies between a wide range of ornamental and cultivated species within maintained portions of the property (Figure 6), and secondary growth consisting largely of grasses, *koa haole* (*Leucaena leucocephala*) and *kiawe* (*Prosopis pallida*) where the land has not been maintained (Figure 7). The southeastern portion of the project area is under active agricultural cultivation and ground surface visibility is excellent (Figure 8). Modern land disturbance, including extensive previous grading and quarrying, is evident throughout most of the project area (Figure 9). Modern rubbish is frequently present, including discarded shade cloth, metal debris, abandoned machinery, and fencing materials (Figure 10). Most of the roads throughout the project area are unpaved and the few paved roads are heavily degraded, resulting in potholes and uneven surfaces (Figure 11). The remnants of a former sand and coral mine occupies the northwest portion of the project area, effectively encompassed by the geological footprint of the older dune deposits (Figure 12). Prior to the mine installation, this area was occupied by mill camp housing. To the east of the mine and outside of the project area is the Waialua Hongwanji Mission, an active Buddhist temple (Figure 13).

Figure 6. Typical vegetation at a house lot, view to the north.

Figure 7. Grasses and koa haole in the northeaster portions of the project area, view to the west.

Figure 8. Overview of cultivated land in the project area, view to the south.

Figure 9. Evidence of previous grading, view to the west.

Figure 10. Examples of previous ground disturbance and discarded debris near cement plant, view to the west.

Figure 11. Southwestern region of the project area along Puuiki Street, view to the south.

Figure 12. Location of the sand quarry, view to the west.

Figure 13. Waialua Hongwanji Mission is situated outside of the project area, view to the north.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological/historical resources that might be encountered within the current project area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the Waialua region that includes specific information regarding the known history of Kamananui Ahupuaʻa and the project area is presented. This is followed by a discussion of relevant prior studies conducted in the vicinity of the project area.

The culture-historical context and summary of previously conducted archaeological, historical, and cultural research presented below are based on research conducted by ASM Affiliates at various physical and digital repositories. Primary English language and Hawaiian language resources were found at multiple state agencies, including the State Historic Preservation Division, Hawaiʻi State Archives, and the Department of Accounting and General Services Land Survey Division. Digital collections provided through the Office of Hawaiian Affairs Papakilo and Kīpuka databases, Waihona ʻĀina, the Ulukau Hawaiian Electronic Library, the Hawaiʻi Genealogical Indexes, and Newspapers.com provided further historical context and information. Lastly, secondary resources stored at ASM Affiliates' Honolulu office offer general information regarding the history of land use, politics, and culture change in Hawaiʻi, enhancing the broad sampling of primary source materials cited throughout this archaeological inventory survey.

CULTURE-HISTORICAL CONTEXT

The chronological summary presented below begins with the settlement of the Hawaiian Islands and includes a presentation of a generalized model of Hawaiian prehistory followed by a discussion of general settlement and historical patterns in Kamananui Ahupuaʻa and the greater Waialua District. The discussion shifts to a summary of historical events beginning with the arrival of foreigners in the islands and continues with the history of land use within the Waialua District. The summary includes a discussion of changing lifeways, a review of land tenure during the *Māhele ʻĀina* of 1848, and the subsequent transition into plantation life, military presence, and commercial agriculture.

A Generalized Model of Hawaiian Prehistory

While the question of the timing of the first settlement of Hawaiʻi by Polynesians remains unanswered, several theories have been offered that derive from various sources of information (i.e., genealogical, oral-historical, mythological, radiometric). However, none of these theories is today universally accepted because there is no archaeological evidence to support the proposed timing for the initial settlement, or colonization stage of island occupation. More recently, with advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have convincingly argued that Polynesians arrived much later in the Hawaiian Islands, sometime between A.D. 1000 and A.D. 1200 and expanded rapidly thereafter (c.f., Kirch 2011).

The initial settlement in Hawai‘i is believed to have originated from the southern Marquesas Islands (Emory in Tatar 1982). During 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* (taboo) system of law and order; cities of refuge; the *‘aumakua* (family or person gods) concept; and the concept of *mana* (divine power).

The earliest inhabitants of the region emphasized the use of natural caves and overhangs, along with the construction of small, simple surface features for habitation purposes, but as populations increased and expanded, so did the occurrence of more permanent habitation structures in both the coastal and upland areas (Jensen 1994). A network of coastal and inland trails, over which the exchange of goods occurred, connected the coastal and upland population centers and resource areas(Hommon 1976). Over a period of a few centuries, the areas with the richest natural resources became populated and perhaps even crowded, and there was increasing separation of the chiefly class from the common people. As populations increased so did societal conflict, which resulted in 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 next period reflect an evolution of the traditional tools and 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. 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* (ivory pendant necklace). The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). As the 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. During this expansion period, additional migrations to Hawai‘i occurred from Tahiti in the Society Islands. Rosendahl (1972) has proposed that settlement at this time was related to the 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* (mountain-sea) settlements expanded to accommodate the exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua‘a* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society. The implications of this model include a shift in residential patterns from seasonal, temporary occupation to the permanent dispersed occupation of both coastal and upland areas.

The *ahupua‘a* became the equivalent of a local community, with its own social, economic, and political significance, which added another component to a then well-stratified society. *Ahupua‘a* were ruled by *ali‘i ‘ai ahupua‘a* or chiefs who controlled the *ahupua‘a* resources, who, for the most part, had complete autonomy over this generally economically self-supporting piece of land. *Ahupua‘a* lands were in turn, managed by an appointed *konohiki* or lesser chief-landlord. The *ali‘i-‘ai-ahupua‘a*, in turn, answered to an *ali‘i ‘ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua‘a* resources supported not only the *maka‘āinana* (commoners) and *‘ohana* (families) who lived on the land but also contributed to the support of the royal community of regional and/or island kingdoms. *Ahupua‘a* are land divisions that typically incorporated 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). Although the *ahupua‘a* land division typically incorporated all of the eco-zones, their size and shape varied greatly. This form of district subdividing was integral to Hawaiian life and was the product of resource management planning that was strictly adhered to. In this system, the land provided fruits and vegetables and some meat for the diet, and the ocean provided a wealth of protein resources (Rechtman and Maly 2003). In communities with long-term royal residents, divisions of labor (with specialists in various occupations on land and in the procurement of marine resources) were also strictly enforced.

Kamananui Ahupuaʻa and the Greater Waialua District

The current project area falls within Kamananui Ahupuaʻa in the traditional district or *moku* of Waialua, located in the northwestern portion of Oʻahu. Kamananui extends from the western side of the Koʻolau Mountains and terminates at the coast near Kaiaka Bay, incorporating the lower slopes of the Waiʻanae range. The literal translation of Kamananui is "the large branch" and likely refers to the north fork of Kaukonahoa Stream (Pukui et al. 1974:80). According to Sahlins (1992), Waialua comprised six traditional *ahupuaʻa* from west to east as follows: Kaʻena, Kawaihāpai, Mokulēʻia, Kamananui, Paʻalaʻa, and Kawailoa. However, some historical and modern maps and sources list as many as fourteen *ahupuaʻa* within Waialua District. Sahlins also states that *moku* characteristically comprised rich and centrally located lands with ecologically marginal lands along their periphery. The fertile lands of neighboring *ahupuaʻa* of Kamananui, Paʻalaʻa, and Kawailoa comprised the ecological center of Waialua Moku, which is eloquently described by Sahlins:

> Geographically this heartland of Waialua consisted of the area around the neighboring bays—they are about a mile apart—of Kaiaka and Waialua. Into these bays, from their origins in narrow gorges deep in the mountains flowed four major streams. Dense settlements of people and large complexes of irrigated taro fields were situated on the floodplains of these streams. At Kamananui, the lowland fields were watered by means of a ditch some two miles long, the longest such waterway on Oʻahu (McAllister 1933:133; Handy and Handy 1972:466). Irrigation on a smaller scale extended for a considerable distance up the river valleys, while rainfall agriculture was practiced on the adjoining slopes, upland plains (*kula*), and forest clearings in the higher gulches. Around Waialua Bay were two large and famous brackish water fish ponds ʻUkoʻa and Lokoea. Fish were also raised in the many smaller ponds of the same area as well as in taro pondfields (*loʻi*). Given such intensive production, the core region must have supported the substantial majority of the Waialua population, which was probably on the order of 6,000 to 8,000 people just before the coming of the Haole. (1992:20)

Regarding the naming of Waialua Moku, Thrum published the following information in the *Hawaiian Almanac and Annual for 1902*:

> Waialua district, Oahu, is said by natives to take its name from a loi (taro patch) situate [sic] near the former Halstead residence, and not from its twin streams as is generally supposed; the natural definition of the name being two waters. It was an ancient saying of the people that if one visited and traveled through the district and did not see this identical loi, he had not seen Waialua. (Thrum 1901:8)

The oral tradition of Hawaiʻi is perhaps best preserved through *ʻōlelo noʻeau* or proverbs, which have been passed down throughout the generations. The following *ʻōlelo noʻeau* illustrate the character of the greater Waialua Moku as they were interpreted and published in *ʻŌlelo Noʻeau, Hawaiian Proverbs & Poetical Sayings* by Mary Kawena Pūkuʻi (1983):

> *I Waialua ka poʻina a ke kai, o ka leo ka ʻEwa e hoʻolono nei.*
>
> The dashing of the waves is at Waialua but the sound is being heard at ʻEwa.
>
> Sounds of fighting in one locality are quickly heard in another. (Pukui (1983:137)

> *Like no Kaʻena me Waialua.*
>
> Kaʻena and Waialua are one.
>
> Kaʻena Point is in Waialua. Similar to the saying, "Six of one and half a dozen of the other." (Pukui 1983:215)

According to Hawaiian historian Samuel Kamakau, Kapawa established his rule at Waialua and became the first ruling chief in Hawaiʻi (Kamakau 1964:3). Kamakau further states that Kapawa was born at Kūkaniloko, the sacred birthplace built by his father, Nanakāoko, and mother, Kahihiokalani, both of whom were descendants of the famed ʻUlu line of chiefs (Kamakau 1991). The distinction and privileges conferred upon the *aliʻi* born at Kūkaniloko were so sought after that, as Fornander (1880) notes, despite the decayed state of the sacred site in the late 18th-century, Kamehameha I had wanted Liholiho to be born at the birthing stones. However, Keōpuolani was unable to travel there for their son's birth due to illness.

Many distinguished *aliʻi* were born at Kūkaniloko, including Māʻilikūkahi, Kalanimanuia (also recorded as Kalaimanuia), and Kākuhihewa, all of whom are celebrated Oʻahu chiefs and noted for their deeds and efforts in establishing traditions that ultimately shaped different aspects of Precontact Hawaiian culture (Kamakau 1991:39). In relating information about the life and accomplishments of Māʻilikūkahi, Kamakau (1991:53) explains that:

> Puaʻa-a-Kahuoi was the father and Nononui the mother of Māʻili-kūkahi. He was born at Kūkaniloko and was named the aliʻi kapu for the land because of his dedication by the chiefs and priest and people; he had been vowed as such before the gods and had been anointed by the kahuna. Chiefs born at Kūkaniloko were the akua of the land and were aliʻi kapu as well.

Kamakau (1991) goes on to add that at about the age of twenty, Māʻilikūkahi was chosen as the *mōʻī hoʻoponopono o ke aupuni* (administrator of the government), and after a rebellion, he replaced the *mōʻī aliʻi* (head chief) Haka, whose reign is characterized by his mistreatment of the chiefs and people. At the age of twenty-nine, Māʻilikūkahi became *mōʻī aliʻi*, where he was taken to the *heiau* (place of worship) of Kapukapuākea in Paʻalaʻa-kai in Waialua and consecrated and proclaimed as the *aliʻi o ka moku* (chief of the island). Unlike other chiefs who took their kingdoms by force, the ceremonies conducted at Kapukapuākea for Māʻilikūkahi were reserved for the “chiefs of Pōkano” or those chiefs who had maintained an absolutely pure royal bloodline since ancient times (Pukui in Kamakau 1991:54). Māʻilikūkahi then moved Oʻahu’s royal center from Waialua and ʻEwa to Waikīkī in Honolulu. Another important hallmark of Māʻilikūkahi’s reign was his formalization of the land division system on Oʻahu—a system that appears to have been later implemented on the other islands. Kamakau (1991:54-55) writes:

> When the kingdom passed to Māʻili-kūkahi, the land divisions were in a state of confusion; the *ahupuaʻa*, the *kū* [*ʻili kūpono*], the *ʻili ʻāina*, the *moʻo ʻāina*, the *paukū ʻāina*, and the *kīhāpai* were not clearly defined. Therefore Māʻili-kūkahi ordered the chiefs, *aliʻi*, the lesser chiefs, *kaukau aliʻi*, the warrior chiefs, *pūʻali aliʻi*, and the overseers, *luna* to divide all of Oʻahu into *moku* and *ahupuaʻa*, *ʻili kūpono*, *ʻili ʻāina*, and *moʻo ʻāina*. There were six districts, *moku*, and six district chiefs, *aliʻi nui ʻai moku*. Chiefs were assigned to the *ahupuaʻa* – if it was a large *ahupuaʻa*, a high chief, an *aliʻi nui*, was assigned to it. Lesser chiefs, *kaukau aliʻi*, were placed over the *kūpono* lands, and warrior chiefs over *ʻili ʻāina*. Lands were given to the *makaʻāinana* all over Oʻahu.

Once the land division system was ordered, Māʻilikūkahi commanded that all classes of people cultivate the land with food and animals and that stealing would not be tolerated and punishable by death. He forbade theft, especially between the chiefs and *makaʻāinana* lest they face death. He suspended the practice of human sacrifices at the *heiau luakini* (sacrificial place of worship) and ordered that the eldest child of each family be cared for by him. Despite efforts from the Maui and Hawaiʻi Island chiefs to conquer Oʻahu, Māʻilikūkahi managed to eliminate his enemies and maintain peace over his kingdom. Because of his great concern for the prosperity of his kingdom, the people willingly obliged to Māʻilikūkahi’s commands, and he ruled peaceably and religiously. Kamakau (1991) stated that because of Māʻilikūkahi’s character as an *aliʻi*, the population of Waialua grew during his reign.

During the late eighteenth century, when western explorers first made contact with Oʻahu, Kamananui “was the ritual and political center of Waialua” (Sahlins 1992:20). However, by the late 1820s the political center of Waialua had shifted over to the Anahulu Valley in Kawailoa Ahupuaʻa. As a result of the relocation of the royal residence, the political boundaries of the *ahupuaʻa* in the region were redrawn (Sahlins 1992:20). Sahlins explains the subsequent re-assignation of lands as follows:

> Until 1824, the two royal fish ponds of Lokoea and ʻUkoʻa, although spatially separated from Kamananui (by the intervening *ahupuaʻa* of Paʻalaʻa and Kawailoa), were nonetheless controlled directly from there, by stewards (*konohiki*) of Kamananui proper. Likewise the remote fishing community of Kapaeloa at the eastern border of Waialua: it was considered part of Kamananui until the late 1840s; the local people held their lands from and “under” a lesser chieftain of Kamananui. The ruling *ahupuaʻa* of Kamananui thus encompassed certain detached lands—which gave it privileged access to important piscine resources. However, in the early nineteenth century, when the Waialua chiefship gravitated to Kawailoa, these outlying sections were taken into the latter land. .
>
> The historic shift in political domination from Kamananui to Kawailoa was paralleled by a transfer of the ceremonial center of the *moku*. In effect the Protestant mission of Waialua, founded in Kawailoa in 1832, usurped the ritual hegemony from the temples of human sacrifice (*poʻokanaka*) that not long before had sanctified the landscape of Kamananui. The *ahupuaʻa* of Kamananui was the site of two temples (*heiau*) of the royal or *luakini* class (cf. Valeri 1985). These *heiau* were probably presided over by an Oʻahu form of the god Kū, the god of conquests and human sacrifice specially associated with kingship (Sterling and Summers 1978:103-4; Thrum 1906a:47, 1906b:52; cf. Valeri 1985). The shift of dominance from Kamananui to Kawailoa corresponded to a change in *tabu* systems. (ibid.:20-21)

The Arrival of Europeans and Agricultural Transformations (1778-1854)

Following the arrival of foreigners to the Hawaiian Islands in 1778, written accounts left by early visitors to the Island of O'ahu, such as those presented below, offer additional valuable insight into what life may have been like for the earliest residents of Kamananui and greater Waialua. Many of these historical accounts were penned by seafaring men who dropped anchor at or near Kaiaka Bay, which they refer to as Waialua Bay. Kaiaka Bay, which is located within Kamananui Ahupua'a, was considered the political center of the *moku* of Waialua at the time.

In late February of 1779, after the death of Captain Cook, the remaining crew of his ship Resolution, under the command of Captain Clerke, and Discovery, under the command of Captain James King, sailed from Maui to O'ahu to water the ship. During this landfall, King recorded the following observations of the landscape in in vicinity of the project area to include the nearby Kaiaka Bay:

> Between the north point [Kahuku] and a distant headland, which we saw to the south-west the land bends inward considerably, and appeared likely to afford a good road. . . At a quarter past two, the sight of a fine river, running through a deep valley, induced us to come to an anchor in thirteen fathoms water, with a sandy bottom [Kaiaka Bay]. . . In the afternoon, I attended the two captains on shore, where we found but few of the natives, and those mostly women; the men, they told us, were gone to Morotoi [Moloka'i] to fight Tahyterree [Kahekili II]; but that their chief Perreeoranee [king of O'ahu], who had stayed behind, would certainly visit us, as soon as he heard of our arrival.
>
> We were much disappointed to find the water had a brackish taste for two hundred yards up the river, owing to the marshy ground through which it empties itself into the sea. Beyond this, it was perfectly fresh, and formed a fine running stream, along the side of which I walked, till I came to the conflux of two small rivulets, that branched off to the right and left of a remarkably steep and romantic mountain. The banks of this river, and indeed the whole we saw of the north-west part of Woahoo are well-cultivated, and full of villages; and the face of the country is uncommonly beautiful and picturesque (King 1821:81–82).

As foreign ambitions to trade with China increased in the late 18th century, the Hawaiian Islands became a primary stop on the Pacific trade routes. By the early 19th century, it was increasingly apparent that a substantial trade imbalance had developed between U.S. and China. While Chinese goods, such as tea, silk, and porcelain, were in high demand in the U.S., America had few desirable goods to offer in exchange besides fur and gold (Hammatt and Wagner-Wright 1999). The trading of fur quickly decreased as land was being cleared in North America and fur-bearing animals became scarce. This resulted in an increase demand in sandalwood which at the time was being traded primarily out of India and the East Indies. Americans became increasingly interested in Hawaiian sandalwood at this time after recent journals written by Captain Cook described the presence of the materials in Hawai'i along with other products such as *bech-de-mer* (sea cucumber) and tortoise shell. Before Europeans arrived in Hawai'i, the several species of sandalwood (*'iliahi*; *Santalum spp.*) were used in a limited way, primarily for medicinal applications, perfume, and firewood (Krauss 1993). Sometimes sandalwood was also used to make bows for the stringed mouth instrument called *'ukēke* (Buck 1957).

'*Iliahi* (sandalwood; *Santalum spp*.) soon became a popular commodity and commanded a decent exchange value. Kamehameha I kept strict control over the trade of *'iliahi* and primarily exchanged the fragrant wood for foreign vessels. He eventually began trading for goods such as nails, olive oil, rice, sugar, pitch, and kettles, expanding trade with Manila and Macao whose captains reassured the great value and demand of sandalwood (Hammatt and Wagner-Wright 1999). Soon the market shifted and Hawai'i went from logistical support to direct supplier of goods for the China market (Sahlins 1992). This resulted in the monopolization of sandalwood throughout the islands and the distribution of *ali'i* to oversee cultivation. Judging from historical documents, people living in the Waialua area were known for cutting sandalwood in the interior mountain forests. One account by Kamakau confirms the importance of sandalwood to the chief of Waialua at the time, Ka-hekili Ke'eaumoku, whom despite the island-wide call to erect a fort in Honolulu for the protection against Russian warships en route for a coup and "his district alone failed to respond to the call" (Kamakau 1961:206). In a scramble to obtain foreign goods, chiefs in the area had commoners work very hard to cut and transport the sandalwood to the coast (Kirch 1985:314). Preoccupation with sandalwood extraction resulted in the abandonment of residential homesteads in the upper Anahulu valley.

The arrival of foreigners in Hawai'i signified the beginning of drastic changes to the culture and economy. By 1810, Kamehameha conquered the Hawaiian Islands through military force, with the exception of Kaua'i, which was brought under his control through peaceful negotiations (Kamakau 1992). By 1811 and until his death in 1819, Kamehameha I was completely vested in the sandalwood industry and controlled all rhythms of the trade. The Hawaiian religious and political systems began a radical transformation; Ka'ahumanu proclaimed herself "*Kuhina* *nui*” (Prime Minister), and within six months the long-standing *kapu* system was overthrown. Within a year, Protestant missionaries arrived from America(Fornander 1969; ‘Ī‘ī 1983; Kamakau 1992). In 1820, American missionary Hiram Bingham and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of O‘ahu seeking out communities in which to establish church centers for the growing Calvinist mission. Bingham recorded observations made during his twenty-one-year residence in the Hawaiian Islands in a journal (Bingham 1847), which offers a rare glimpse at the project area vicinity during the early 1800s. Of Waialua, Bingham (1847:295–296) wrote that “a very large concourse of people assembled on the Lord’s day, for public worship in the open air.” Bingham (1847:296)continues his account as follows:

> After the Sabbath we examined and encouraged, and partially supplied with books, the incipient schools established there under the particular patronage of Lydia Namahana and Gideon Laanui, to whom the district belonged. There were found under Maiao and his assistant teachers, four hundred and ninety-five male and female pupils, and under Kaoo, one hundred and sixty-four, amounting together to six hundred and fifty-nine pupils, chiefly men and women.

In July of 1832, the second missionary station on O‘ahu, located at Waialua was started by Emerson (1847:468). Of the population served by this station at that time, Bingham (1847:468) states, “The districts of Waianae, Waialua, and Koolauloa, extending coastwise about fifty miles, and embracing a population of 7300, were connected with the station, among whom about 1600 could read.” Another visitor to O‘ahu during the 1820s, Mathison (1825:392–395), made the following observations of Waialua at that time:

> July 11.—Having enjoyed a most agreeable sail by moonlight, we this morning entered a small bay called Why-arouah [Waialua, likely referring to Kaiaka Bay], on the N.E. side of the island, formed by two reefs of rocks, which run out parallel a considerable way into the sea, and between which two small rivers discharge themselves, Hence the name Why-arouah; *Whye* in the country language signifying water, and *arouah* the numeral two. Here a chief named Coxe [Kahekili Ke‘eaumoku/George Cox], who is one of the richest and most powerful in the island, resides; and as he was the person from who our Captain was to obtain the sandalwood, our first visit was of course paid to him. He bears the name and office, if it can be so called, of Governor. His hut stands on the seashore, and was sufficiently large to accommodate the whole of our party, consisting of several Americans, besides myself.
>
> . . . he speaks English better than any other native I had yet conversed with. . . His hut might be about twenty feet square, and proportionably high, with an entrance aperture on two sides, and one above. It was fitted up as usual with mats; in the midst of it he himself sat on the ground, having no other covering than the *maro*, and was surrounded by attendants. By his side sat an intelligent-looking American sailor, who had been upwards of twenty years on these islands, and attached himself particularly to Coxe, as his patron and protector. . .
>
> In the cool of the evening I took a walk along the banks of the river, and was delighted with the beauty and fertility of the whole district. Plantations of tarrow, maize, tobacco, sweet potatoes, yams, melons, and water-melons, everywhere met the eye, all neatly arranged, and enclosed, some by stone walls, others by fences. Of trees, the cocoa-nut, bread-fruit, banana, cotton, castor, *cöey*, and *teĕ* species, were most plentiful. The latter is a shrub peculiar, I believe, to these islands, but quite distinct from the Chinese tea-tree. The river, in most places about one hundred feet wide and not very deep, winds its still limpid way through this cheerful scene of cultivation, where the huts rising at intervals from among small groves of bananas and bread-fruit trees, vary in a picturesque and lively manner the soft harmonious touches of nature.

With the passing of Liholiho in 1824, his brother Kauikeaouli (Kamehameha III) took over the Kingdom and became king at the age of nine. Kauikeaouli put his trust and control into the hands of a select group consisting of young chiefs, resident foreigners, and commoners (Kamakau 1992:278-279). The period between Kamehameha I’s death and Kauikeaouli’s reign was critical as *ali‘i* demanded commoners to gather sandalwood in the *mauka* regions of O‘ahu including in Waialua. The wood was sold to foreigners for luxury goods, which lead to the depletion of sandalwood throughout the Hawaiian Islands.

Discussions about the well-cultivated valleys of O‘ahu were included in E.S. Handy (1940) ethnographic study of traditional Hawaiian agricultural activities related to native plants, which were extant on the island prior to European contact. Handy relates the following details about Kamananui Ahupua‘a which specifically paint a picture of how the vicinity of the project area was an area of abundant cultivation nestled between freshwater streams:

> **Kamananui.** Formerly there were large terrace areas along the flatlands between the junction of Helemano and Poamoho Streams and the flatland west of Poamoho. There were also small terrace areas up in the lower flats of Poamoho and Kaukonahua Valleys. There were small flats in the bottom of Kaukonahua Canyon for several miles above its junction with Manawai Stream. Poamoho is probably too narrow for taro terraces. It is likely that in these gulches, as at Waimea, sweet potatoes and bananas were planted around home sites along the ridge and near taro parches at the bottom of the gulch. (1940:85-86)

In *Fragments of Hawaiian History*, Hawaiian Historian John Papa ʻĪʻī (1800-1870) recounts details of the extensive trail networks throughout leeward Oʻahu as he had experienced them in the early 19th century. ʻĪʻī mentions Kamananui in his discussion of trails that connected coastal Waialua with locales in the central plains of Oʻahu:

> From the stream of Anahulu and from Kamani, above the houses and taro patches, a trail stretched along in front of Kuokoa's house lot and the church. This trail went on to meet the creeks of Opaeula and Halemano, the sources of the stream of Paalaa, on down to the stream of Poo a Moho, and on to the junction where the Mokuleia trail branched off to Kamananui and Keawawahie, to Kukaniloko, the birthplace of chiefs. (ʻĪʻī 1959:98)

By the mid-19th century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. Between 1838 and 1842, the United States Exploring Expedition, under the direction of Commander Charles Wilkes, visited Oʻahu. In 1840, Wilkes (1845:74-75) made the following observation of the terrain and flora of Waialua:

> The district of Waialua stretches from the most westerly cape, called Kaena, to Waimea, in the district of Koolaulo [Koʻolauloa], on the northeast, and to Waianae on the southwest, a distance along the coast of above twenty miles. Within this district are a few bays for vessels not exceeding one hundred and fifty tons burden the best of these is Rawailoa [Kawailoa]. Those to the northeast are Waimea, Haula [Hauʻula], Kakua, Moluilui, and Makua. Like all the rest of the places, they are dependent on Honolulu, which is thirty miles distant for a market. A good road might very easily be constructed, and very nearly level, on the plain that lies between the two high mountain ranges which traverse the island from east to west. One of these ranges is called Konahaunui, the other Kaala; the former occupies the eastern end of the island, the latter the western. Both are basaltic. It is remarked of these two ranges, that the soil and growth of the plants are dissimilar; for instance, the kauwila, the wiliwili, the haw [*hao*], and the uhiuhi are found on the Kaala, and are either not found, or only in a dwarfish state, on the Konahaunui; whilst the acacia (koa), and the lehua, do not exist on the former, though growing luxuriantly on the latter.
>
> . . . Part of the Waialua district is cultivated by irrigation, and produces abundantly. Five considerable streams water it from the Konahaunui range, passing down fertile valleys. The largest of these is quite sufficient to supply motive power to the whole year round. . . From sources that are to be depended upon, I was informed that there are upwards of thirty square miles in the Waialua district that can be cultivated without irrigation.

Of the Native Hawaiians of Waialua "having but few wants, and those easily supplied," Wilkes (1845:75) states: "they cannot yet be induced to change their ancient dwellings for better habitations, and still adhere with pertinacity to their thatched grass huts, without floors or windows, and destitute of ventilation." Wilkes (1845:77) also reports on births and deaths in Waialua district: in 1836, there were thirty-four births and ninety deaths recorded; in 1839, there were fifty-six births and one hundred and eighty-five deaths. In addition, over four hundred marriages were entered into between 1832 and 1839; and the population declined from 2,640 in 1832 to 2,415 in 1836, which he attributed to sterility and abortion.

Regarding resources and trade across the Hawaiian Islands, Wilkes (1845:261) mentions the ongoing pursuits of the Hawaiians in supplying visiting whaling fleets and that sugar cultivation had begun to take over for the failed sandalwood trade; and stated the following:

> The islands produce but little, and their consumption of foreign products is necessarily small. The capabilities of the islands have generally been underrated, for their soil and climate are suitable for raising all tropical productions in considerable quantities, and at a moderate cost. But very little investment of capital has yet taken place, and the business that has induced the establishment of several commercial houses has been more that of transit than for the purpose of supplying the consumption of the islands, or obtaining their exports.

In his discussion of the life and death of Kamehameha III (b. August 17, 1813; d. December 16, 1854) in *Ruling Chiefs of Hawaii*, Kamakau (1992:422-423) tells of the young king's proclamation for his government to be one of learning, "in which chiefs should teach commoners and each one teach another." His poetic description goes on to mention Waialua as follows:

> . . . The concert exercises by which they were taught delighted the people. The rhythmical sound of the voices in unison as they rose and fell was like that of the breakers that rise and fall at Waialua or like the beat of the stick hula in the time of Pepe-io-holani and Ka-lani-ʻopuʻu.

A ea mai ke kai o Waialua,	Let the sea of Waialua rise,
Wawa noʻolelo ʻokoʻa i pali,	Let the roar echo over the hills,
Nunu me he ihu o ka puaʻa hae la,	Rumble like the grunt of the wild pig.
ʻAko ka lau o ka nalu piʻi i ka pali,	Let the rising wave break the leaf from the cliff. (Kamakau 1992:423)

Kamakau (1992:424) reports that between fifty and two-hundred pupils attended the newly built schools under Kamehameha III's rule and that "Oahu was then thickly populated." He goes on to lament the drastic population decline thusly, "It is sad to see how in so short a time whole villages have vanished leaving not a man. . . And as the kingdom of letters moved quickly so also moved the kingdom of God. . ." (Kamakau 1992:424-425). This significant decline in the native population was already felt a mere fifty years after Hawaiʻi's first contact with Europeans and Americans. Meanwhile, the Western population kept increasing.

Overall, historic records document the significant effect that western settlement practices had on Hawaiians throughout the islands. Drawing people from isolated native communities into selected village parishes and Hawaiian ports-of-call, had a dramatic, and perhaps unforeseen impact on native residency.

The Māhele ʻĀina of 1848

By the mid-nineteenth century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840, the first Hawaiian constitution had been drafted and the Hawaiian Kingdom shifted from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, King Kamehameha III and his high-ranking chiefs decided to separate and define the ownership of all lands in the Kingdom (King n.d.). This change was further promoted by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be taken from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the King, the chiefs and *konohiki*, and their tenants (the *makaʻāinana* or common people). In 1845 the legislature created the "Board of Commissioners to Quiet Land Titles" (more commonly known as the Land Commission). All land claims, whether by chiefs for entire *ahupuaʻa* or by tenants for their house lots and gardens, had to be filed with the Land Commission within two years of the February 14, 1846, but the deadline was extended several times for chiefs and *konohiki* (Soehren 2005a).

The King and some 245 chiefs (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). Once the King and his chiefs accepted the principles of the Privy Council, the *Māhele ʻĀina* (Land Division) was completed in just forty days (on March 7, 1848). The names of all of the *ahupuaʻa* and *ʻili kūpono*, as well as the nearly independent *ʻili* land division within an *ahupuaʻa*, were recorded in the *Māhele* Book (Soehren 2005). As this process unfolded King Kamehameha III, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. The day after the division with the last chief was recorded in the *Buke Māhele* (*Māhele* Book), King Kamehameha III commuted about two-thirds of the lands awarded to him to the government (King n.d.).

Unlike the King, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their awards (LCAw.). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land," while the lands retained by Kamehameha III became known as "Crown Land," and the lands received by the chiefs became known as "*Konohiki* Land" (Chinen 1958:vii; 1961:13). All lands awarded during the *Māhele* 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.

During the *Māhele*, native tenants on the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to the *kuleana* parcels that they actively lived on or farmed. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848, in order to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more than the two-year term, and the deadline was extended several times for the Land Commission to finish its work (Maly 2002). In the meantime, as the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and the process by which they could apply for fee-simple interest in their *kuleana*. The work of the Land Commission was completed on March 31, 1855. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which only 9,337 were awarded (Maly 2002).

Prior to the *Māhele ʻĀina* of 1848, Kamananui Ahupuaʻa was held by chiefess Victoria Kamāmalu, daughter of Mataio Kekūanāoʻa and Elizabeth Kīnaʻu. Victoria Kamāmalu was the favorite wife of Liholiho (Kamehameha II). During the *Māhele*, Kamāmalu turned over parts of Kamananui "as commutation of the royal right,", which "became government lands when the king divided his holdings between public and Crown property" along with the remainder of the *ahupuaʻa* (Sahlins 1992:190). 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 and ranged in size from roughly ten acres to many hundreds of acres. Despite the stated goal of the grant program to enable native tenants to purchase the lands upon which they lived or land that they felt they could cultivate, many of the government lands were sold to foreigners. No *kuleana* claims were made in the immediate vicinity of the present project area.

In conjunction with the *Māhele*, the King also authorized the issuance of Royal Patent Grants to purchase tracts of Government land larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* of 1848 should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the *Māhele*, to purchase lands of their own. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of the Government Lands. Unlike in the *kuleana* claims, where claimants stated their use of the land, the grant records are silent regarding the grantees' intended use. The Royal Patent deeds and survey notes do contain some limited information about geographical features of the grant lands, and describe boundary markers, such as rock piles and vegetation, but they generally do not say anything about improvements to the land or land use.

In the case of the Kamananui Ahupuaʻa, roughly 245 land grants were parceled out. The parcels were then clustered into tracts and subsequently sold to various natives, foreigners, and businesses (OHA 2018). In an 1881 map by C. J. Lyons, the project area is shown within a section containing many strips of land labeled "Grants Kuleanas" yet no recipients are names (Figure 14). The various Grants were described as "divided into strips…660 ft in width, one or more of which formed a grant.". The project area consists of land divided into six grants awarded in 1850 which ran *mauka-makai* (Table 1 and Figure 15). It is unclear what the recipents of the grants initially intended to use the land for. However, beginning in the 1860s, much of the land in the vicinity of the project area was cultivated for commercial sugarcane.

Table 1. Government land grants in the project area

Land Grant No.	*Awardee*	*Year Awarded*	*Acres*
267	Kupaa	1850	70
335	Kuemanu	1850	122
272	Kapahu	1850	75
264	Aikaula	1850	80
263	Ile	1850	80
262	Kupohu	1850	60

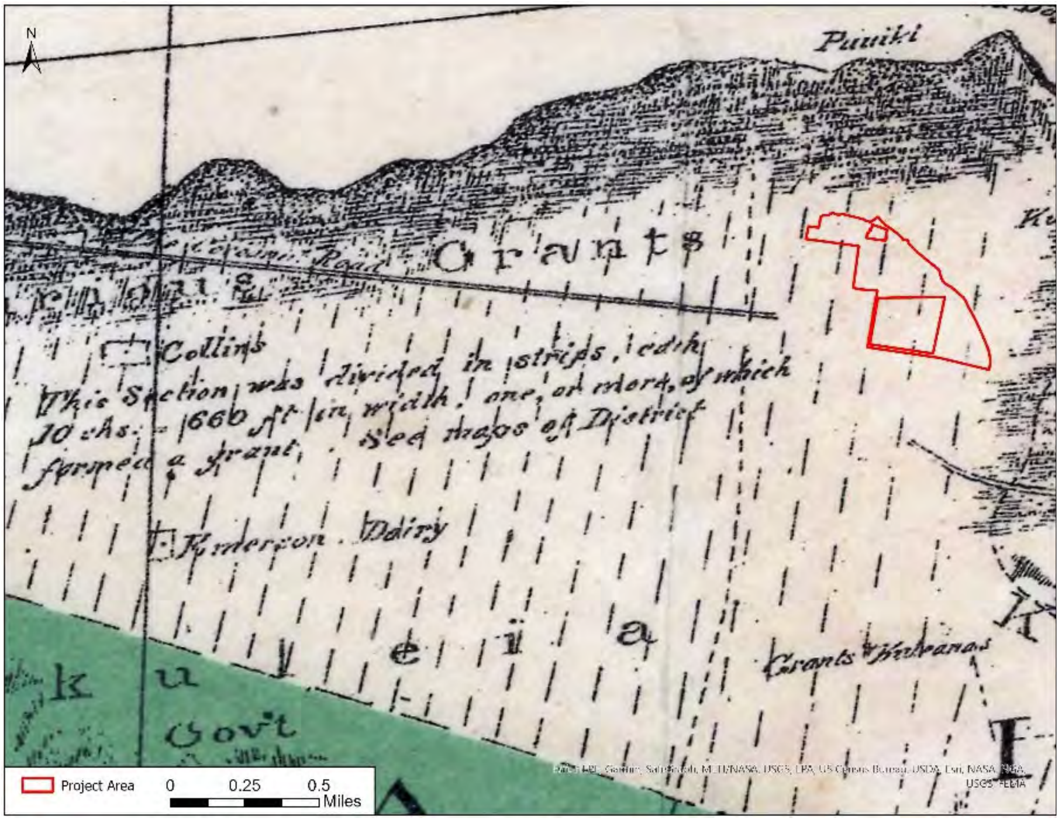

Figure 14. 1901 map showing location of LCAw and Grants in and adjacent to the project area.

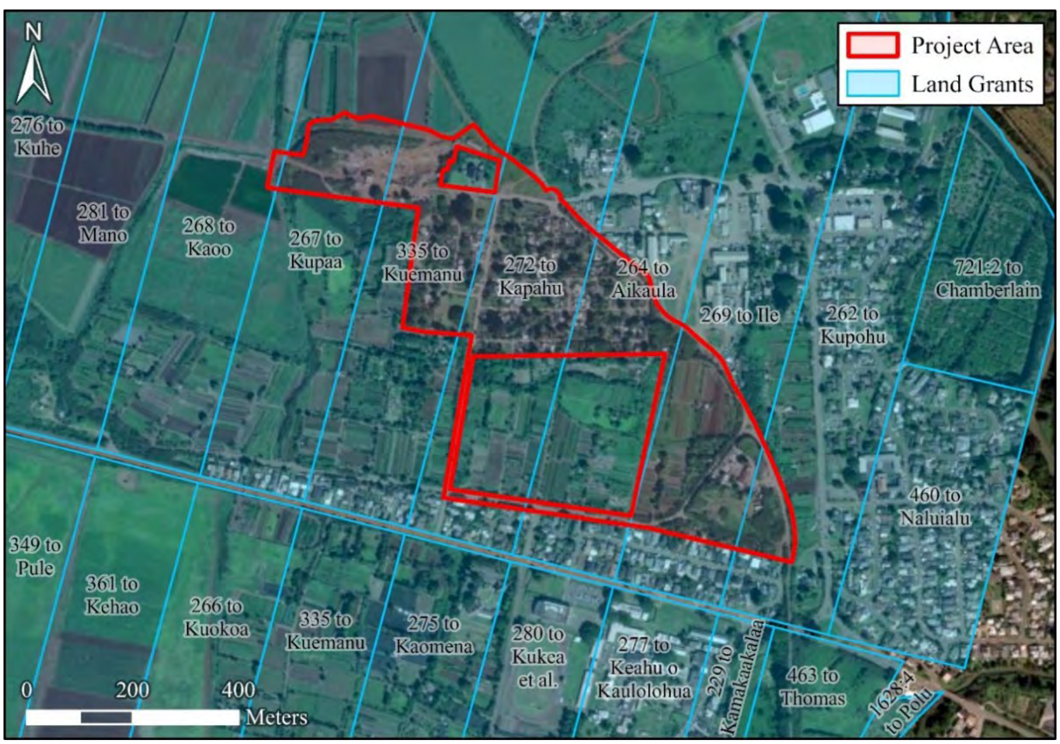

Figure 15. Land grants awarded in and adjacent to the project area.

THE DEVELOPMENT OF THE SUGAR INDUSTRY IN WAIALUA

Beginning in the late 1800s, land-use in Waialua was transformed by the introduction of commercial agriculture to the region, most prominently initiating with the sugar industry. *Kō* (sugarcane) was an important resource for Precontact Hawaiians in their diets and as a raw material for medicines, weapons, dyes, rituals, tattoos, etc. (Kessler 2015:136; Lincoln 2020). Davida Malo (2020) documents the use of *kō* for construction, as well, including for house thatching (p. 201) and to assist with creation of *lo'i* (taro pondfields) (p. 283). Sugarcane was traditionally planted in both wet and dry environments and in lower and upper elevations (Handy and Handy 1991:186) and Lincoln (2020) extensively documents the numerous varietals and uses for each. Judd (1930) documents a number of traditional sayings about *kō*:

> *Ua ulu ke ko-kea:*
>
> The white sugar cane grew. Likened to a person who has grown old (34);
>
> *He paa ko-kea no Kohala, e kole ai ko waha ke ai:*
>
> It is like the hard white sugar cane of Kohala, that will hurt your mouth when it is eaten. Looks easy, but hard to accomplish (35);

Several of these sayings documented by Judd (1930) connect *kō* to seasonal observations.

> *Pua ke ko, ku mai ka hee:*
>
> When the sugar cane is in bloom, the squids are plentiful. Sugarcane bloom is the sign of the time to go squidding (8).
>
> *Pua ke ko, nee i ka hee holua:*
>
> When the sugar cane tassels, move to the sledding course. The season for sledding is when the sugarcane tassles (25).

However, Precontact Hawaiians never produced sugar from sugarcane and the production of sugar only began with the arrival of Europeans. Some of the very earliest voyages saw the potential for sugar production in Hawai‘i. Archibald Menzies, a surgeon on George Vancouver's 1792-94 voyage, expressed that it is "worth the attention of Government to make the experiment and settle these islands [Hawai‘i] by planters from the West Indies, men of humanity, industry and experienced abilities in the exercise of their art would ere in a short time be enabled to manufacture sugar and rum from luxuriant fields of cane equal if not superior to the produce of our West India" (Menzies 1920:79). While the first sugar production in Hawai‘i is attributed to a Chinese merchant on Lana‘i in 1802, the first mills and eventual large-scale industrialization of the sugarcane industry in Hawai‘i can be attributed to American missionaries (Dorrance and Morgan 2000:13).

The first American Board of Commissioners for Foreign Missions (ABCFM) missionaries arrived in Hawai‘i in 1820 and established the Sandwich Island Mission (Kessler 2015:133). While early missionaries expressed some ambivalence towards growing and making sugar, in part due to its association with the production of rum, many missionaries eventually saw small-scale farming and industry as way to teach and foster Christian values to native Hawaiians. In 1838, during a delegate meeting of missionaries such a sentiment was expressed:

> ...the missionary, by directing the labor of natives, and investing some fifty or hundred dollars in a sugar mill, in some other way, might secure a portion and often the whole of his support [of Christian missionaries], and would thus be teaching the people profitable industry (Kuykendall 1938:180).

As a consequence, in the late 1830s, many missionaries set up small-scale sugar operations on O‘ahu and Kaua‘i which they hoped would teach native Hawaiians independence, industry, and other Christian values (Kessler 2015:136; Kuykendall 1938:180).

In Waialua, missionaries were some of the first sugar producers in the area. In the late 1830s, Rev. John Emerson set up a mill in Waialua which according to the *The Sandwich Islands Mirror & Commercial Gazette of 1940* "makes sugar and molasses for the natives on equal shares" (Honolulu Star-Bulletin 1935). Rev S. E. Bishop described Emerson's operation in *The Friend*. Emerson states that he made his own molasses by grinding cane in a "wooden mill turned by oxen and boiling the remaining juice in old whaler trypots" (Honolulu Star-Bulletin 1935) (Figure 16). In 1844, William Perry signed a contact with the mission school to build a mill to manufacture molasses from the sugarcane growing on the mission school's grounds in Waialua (Honolulu Star-Bulletin 1962b). However, this venture did not seem to last long. Small mills, such as Emerson's and Perry's, characterized the early days of the sugar industry. Mill operations tended to be small and production inconsistent. Due to limited capital funding, these mills had high failure rates. Despite these difficulties, sugar production increased significantly from the 1830s-1850s with four tons being produced in (Kessler 2015:134). Eventually missionaries came to embrace large-scale agriculture with the hope that it would lead to social and cultural change among native Hawaiians, and they played a significant role in the development of the plantation system in Hawai‘i. Under this system, the ideas and the industry transformed from an effort to promote the Sandwich Island Mission and foster western cultural notions in Hawai‘i to a system which primarily served the capitalist interests of sugarcane planters (Kessler 2015:136).

Figure 16. 1902 photograph of the Emerson House in Waialua (Hawaiian Mission Children’s Society).

During the U.S. Civil War (1861 to 1865), the sugar industry in the Hawaiian Islands grew significantly because of the boycott on sugar from the southern states and the consequential demand for sugar from other regions. During the period between 1860 and 1866, sugar exports from Hawai‘i increased by approximately 175 percent each year. For instance, in 1861, the Hawaiian Islands produced 572 tons of sugar and in 1864, production had exponentially increased to 8,865 tons (Lal et al. 1993). Consequently, commercial sugarcane agriculture began to dominate vast regions of O‘ahu including the Waialua District.

While the first commercially grown sugar in Waialua can be traced back to the Levi and Chamberlain Sugar Company established in 1865, the Chamberlain Family’s association with sugarcane and other agriculture in Waialua predates the formation of their company by several decades (Wilcox 1996). Levi Chamberlain Sr. arrived in Hawai‘i in 1823 with the Second Company of Missionaries and as a representation for ABCFM. In 1844, when the aforementioned William Perry signed a contract with the Mission to manufacture molasses from the sugarcane growing on the mission school’s grounds, Levi Chamberlain Sr. represented the mission (Honolulu Star-Bulletin 1962a). Following his death in 1849, Levi Chamberlain’s sons, Warren and Levi Chamberlain Jr., inherited land in Waialua on which they attempted to raise farm produce and later rice. Both projects failed. However, in 1865, the brothers built the first sugar mill in Waialua and established the Chamberlain plantation. However, their mill was so small it could not manufacture even one ton per day (Taylor et al. 1976:81; Honolulu Star-Bulletin 1935) The brothers’ venture into the sugar industry was short lived as the company ultimately failed after financial hardships, floods, droughts, and labor shortages (The Honolulu Advertiser 1954).

In 1867, Charles R. Bishop of the Bishop Bank purchased the plantation from the Chamberlain brothers at public auction for $4,750 (The Honolulu Advertiser 1954). At the time of the sale, the plantation consisted of "75 acres of cane land, 16 acres of taro land and 467 acres of pastureland" and an additional "52.2 acres of cane land and 29 acres of pasture under lease" (Honolulu Star-Bulletin 1962b). The Chamberlain brothers and Charles R. Bishop continued to harvest 130 acres of sugarcane during their partnership before their success was cut short and the company foreclosed (The Honolulu Advertiser 1954). In 1870, the bank sold the property to O.R. Woods, who borrowed approximately three thousand dollars from Castle & Cooke. However, Woods was bankrupt within a year and Castle & Cooke foreclosed and took ownership of the property (Taylor et al. 1976:81). Levi Chamberlain ran the plantation until 1875, when Castle & Cooke mortgaged the 775 acres of the plantation to Robert Halstead and Henry Gordon for $30,000 (The Honolulu Advertiser 1954) (Figure 17). George Bowser (1880:489) made the following observations of the Halstead and Gordon plantation and the surrounding lands:

> I passed on to another fertile valley, the Kamananui. At the head of this, closeup to the mountains, is the sugar plantation of Messrs. Halstead & Gordon, one of the most extensive and valuable on the island of Oahu. Mr. Halstead is a thoroughly experienced manager, and everything on the place has thrift and industry written on the face of it. I was made right at his hospitable house, where he resides with Mrs. Halstead and his family. A lovely view of the ocean is to be had from the front of the house, and when I as there the scene was further enlivened by the presence of a fine schooner in full sail on her way to Honolulu. There is plenty of good fishing in this valley; both fresh and saltwater fish being abundant. Excellent shooting, too, is available for the sportsman. At Waialua I found no less than three native churches, a female seminary, three native schools and St. Stephen's Episcopal Mission School.

After the death of Henry Gordon in the same year, Halstead went on to acquire Gordons' portion of the lease for his sons Edgar and Frank and the plantation was renamed as the Halstead Brothers (Taylor et al. 1976:81) (Figure 18). The Halstead Plantation is reported as being capable of producing up to 10 tons of sugar a day, a far greater amount than the previous mills (The Honolulu Advertiser 1892). Consequently, the plantation started generating more revenue for Waialua as well as Castle & Cooke who remained agents for the company (Taylor et al. 1976:81).

Partnership Notice.

NOTICE IS HEREBY GIVEN THAT the Sugar Plantation known as the Waialua Plantation and located at Waialua, Oahu, heretofore carried on by Mr. Robert Halstead, will, in the future, be conducted by the undersigned, under the firm name of Halstead Bros.

E. HALSTEAD,
F. HALSTEAD.

Waialua, Oahu, April 1st, 1894.
3651-1w

Figure 17. Halstead partnership notice (The Honolulu Advertiser 1894).

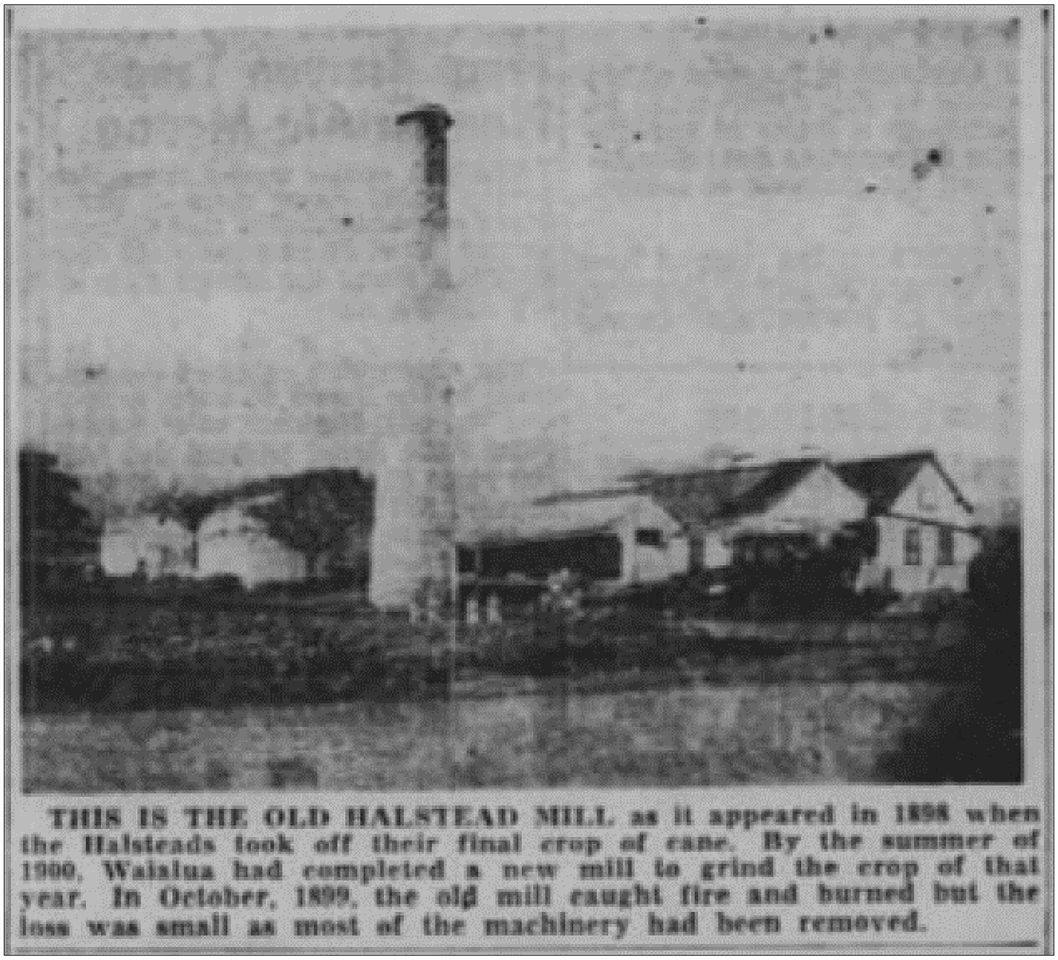

Figure 18. The old Halstead Mill (Honolulu Star-Bulletin 1948).

The success of the Halstead Brothers plantation resulted in the development of infrastructure in the area to support the growth of the plantation. In 1897, Benjamin Dillingham of the Oahu Railway and Land Company (O.R. & L. Co.), proposed a Waialua railroad extension of the O. R & L railroad in an effort to enhance development by providing an alternative mode of transportation for goods produced in the area. Dillingham was eventually granted the lands for the railroad with the help of Senator Henry Waterhouse, who bought more than four thousand acres of ranch property in Waialua from Gaspar Silva of the Gaspar Silva Ranch (Evening Bulletin 1898). The private deal made its way to the *Evening Bulletin* in January 1898 and stated its intentions:

> "The property, or most of it, will find its way into the hands of the Oahu Railway and Land Company's (O. R & L. Co.). There is a private deal to that end between Senator Waterhouse and Mr. Dillingham. In all probability the property will form a part of the proposed new Waialua sugar plantation" (Evening Bulletin 1898).

That same year, the O. R & L. Co. railroad was constructed through Waialua with stations in Kawaihāpai and Mokulēʻia (Figure 19). The railway ran along the coast *makai* of the current project area (Figure 20). However, due to the relatively small size of the plantation, the mill did not produce much freight (Dorrance and Morgan 2000:47). Large tracts of the land surrounding the Halstead Plantation remained uncultivated as it was divided and owned by numerous owners including many native Hawaiians (Dorrance and Morgan 2000:47). Benjamin Dillingham saw potential to increase the amount of freight for his railroads in Waialua if the small Waialua plantation had the same success as the Ewa Plantation (Taylor et al. 1976:128). Subsequently, he encouraged Castle & Cook to buy the Halstead Plantation and the surrounding lands and capitalize on the vast expanse of uncultivated land in Waialua (Dorrance and Morgan 2000:47).

Figure 19. Photograph showing the railroad track leading to the Waialua Sugar Mill.

Figure 20. Map of the completed O. R & L. Co. railway route. Note the red box highlighting the area around the current project area is labeled as Waialua Sugar Plantation.

WAIALUA AGRICULTURAL COMPANY

With Dillingham's encouragement, Castle & Cooke purchased the Halstead plantation on August 1, 1898. That same year, he established the the Waialua Agricultural Company Ltd with the former Halstead Plantation serving as its center. At its inception, the Waialua Agricultural Company Ltd had a capital stock of $3.5 million allowing it quickly expand its land holdings and hire William Goodale from the Onomea Plantation as the first manager. Castle & Cooke worked diligently to acquire as much of the surrounding land as possible from the patchwork of landowners in the area. Following the negotiations with hundreds of landowners and tenants, the Waialua Agricultural Company Ltd consisted of 10,000 acres of land suitable for sugarcane cultivation and an additional 12,000 acres in higher elevation which would later prove promising for pineapple production (Taylor et al. 1976:130). The company leased additonal land from the Bishop Estate and subleased land from Dillingham (Dorrance and Morgan 2000). The company harvested their first sugar cane in 1899, producing 1,741 tons of sugar from 300 acres of planted land.

Recognizing that prior Waialua plantations had failed to properly invest in capital, which likely contributed to small growth and a high rate of failure, Castle & Cook strove to acquire more land and investing in capital improvements including new railroads, irrigation systems which drew from both ground and surface water, and a new mill (Wilcox 1996:109). The first year of operation they invested $758,463 into property and equipment improvements. The following year, company harvested triple the acreage of the previous year resulting in the production of 5,681 tons of sugar from 1,025 acres (Taylor et al. 1976:130). Unfortunately, about one-third of this harvest was lost as the new mill was not yet completed and the smaller Halstead mill was unable to keep up with processing needs of the increased yield (Taylor et al. 1976:130). The new mill was completed the following year and was located where the current Waialua mill stands today.

The yield of each harvest increased exponentially as additional acres were planted and improvements were made to the mill. Only two years after the first harvest, the Waialua Agricultural Company Ltd sugarcane crop yield increased nearly seventeen times the initial amount (Thrum 1906:39). As yields increased, the plantation faced issues concerning irrigation of their vast field systems. The land in Waialua did not receive enough rainwater or runoff water from the mountains in order to efficiently irrigate the sugar cane. While attempts were made to irrigate the fields using wells and pumps, such methods were too expensive to maintain and implement on such a large scale (Taylor et al. 1976:130). However, in 1900, two engineers from the Wahiawa Water Company, Leonard G. Kellog and B.L. Clark, suggested a solution. They proposed to construct a dam across the Kaukonahua Stream to catch rainwater draining from the Ko‘olau Mountains and using gravity, as opposed to pumps, irrigate the fields. They argued this reservoir could alone irrigate approximately 4,800 acres of land and save the company $140,000 to $160,000 a year in pumping expenses (Taylor et al. 1976:130).

Construction on Wahiawa Dam and Reservoir began in 1903 and lasted for two years. The dam was constructed in Kaukonahua Gulch, by the junction of the north and south branches of the stream and formed a seven-mile-long lake referred to today as Lake Wilson or the Wahiawa Reservoir (Figure 21). The dam was located just 8 miles away from the Waialua Sugar Mill and could retain 2.5 billion gallons of water which, upon its completion, could irrigate 12,000 acres of sugarcane land using gravity flow, double the amount it was originally proposed to irrigate (Wilcox 1996:109; The Hawaiian Gazette 1906). The total cost for the dam was $300,000. However, the reservoir provided 90% of the plantation's surface water (Wilcox 1996). Furthermore, while the reservoir and ditch system were primarily engineered to double the area of land available for sugarcane cultivation, they also produced electricity for the area (Hawaiian Gazette 1906).

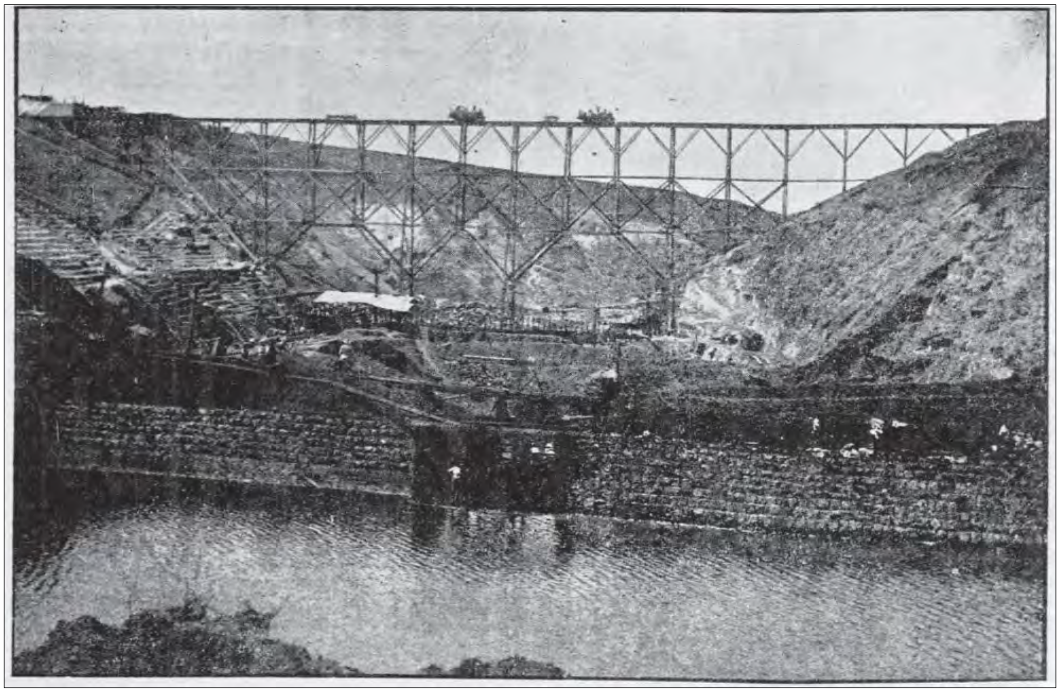

Figure 21. Wahiawa Dam, reservoir (Lake Wilson), and 500-foot-tall railroad trestle upon completion (Hawaiian Gazette 1906).

In addition to the Wahiawa collection system, Waialua Agriculture Co. constructed three other surface water collection systems between 1900 and 1906: Helemano, Opaeula and Kamananui. While smaller than the Wahiawa Reservoir which delivered between 10 and 12 billion gallons of water per year to the Waialua fields, these other collection systems and associates ditches were able to deliver 700 million (Helemano), 350 million (Opaeula), 90 million (Kamananui) gallons of water per year respectively. On February 3, 1911, in the Waialua Agricultural Co. annual report for the year 1910, W. W. Goodale, reported that:

> [Kamananui Ditch], referred to in the Annual reports of the years 1902, 1904 and 1909, was commenced in 1903, but abandoned in 1904. At that time 1,068 feet of tunnels had been excavated. On June 10, 1910 we began work again and have carried it on as rapidly as possible since that time.
>
> The ditch will deliver the water of the Kamananui stream at a point at a point 669 feet above sea level on the upper lands of Kawailoa and on the line of the ditch that crosses the plantation carrying the water from the Wahiawa reservoir.
>
> The ditch is 20, 175.5 feet long, with 17,852.5 feet of tunnels, 325 feet of flume and 1,998 feet of open ditch.
>
> On December 31, 1910, 13,832.5 feet of total length, had been completed leaving 6,343 feet unfinished. The entire cost of the work will be about $69,628.00, of which amount $35,561.00 had been paid on December 31, 1910. Water should be running in the ditch on or about May 1, 1911(Goodale 1911:4).

The Kamananui Ditch was actually completed on December 7, 1911, at a total cost of $76,963.81. From the outset it carried an average of 2,188,471 gallons of water a day to the Kawailoa fields (Goodale 1912). For the year 1910, it was reported that "the Opaeula Ditch system delivered during the year 2,112,401438 gallons of water, used entirely on Kawailoa" (Goodale 1911:4). The Kamananui ditch system was redesigned and realigned in the mid-1920s to increase its water carrying capacity and to allow it to function independent of the Opaeula ditch system (Wilcox 1996). Especially essential to the success of the Waialua Agricultural Company was the interconnectedness of its irrigation ditches which allowed for water to be diverted anywhere (Wilcox 1996:109). Targeted field irrigation was accomplished by way of the Waialua Flume. This flume system consisted of movable and replaceable sections of concrete flume with small metal gates to release water where needed. The network of ditches and flumes on the plantation was complimented by an array of pumping stations. Due to the innovative efforts of Goodale, a self-propelled drag-line excavator was digging new ditches by 1920. The same machine could also lift harvested cane bundles onto railway cars in the field (Dorrance and Morgan 2000).

When William Goodale retired in 1923 after 25 years as the plantation's manager, he summarized the growth of the Waialua Agricultural Company in the annual report for that year, writing "we now have 70 million gallons per day pumping capacity, 30 miles of permanent railway, the Wahiawa reservoir, capacity 2,540,000 gallons, and 33 other reservoirs, ditches to bring the water to Poanoho, Halemano, Opaeula, Kawaiiki, Kamananui and Waimea gulches, a good mill, six locomotives, cane cars, six plow engines and plows, tractors, trucks, buildings, and about 9,000 acres of cane" (Goodall in Clark 2007:57–58). Goodale had also installed a 450-kilowatt hydroelectric plant in the uplands of Kawailoa that supplied not only plantation's needs, but when excess energy was produced, it was sold to the Hawaiian Electric Co. (Dorrance and Morgan 2000). Goodale's management had made the Waialua plantation one of the most productive in the Hawaiian Islands. By 1925, sugar production had grown to 32,585 tons annually (Dorrance and Morgan 2000).

The Great Depression hit the United States from 1931 to 1940. While the Waialua Agricultural Company was not heavily affected by the Great Depression, the world-wide economic downturn heavily effected Dole's pineapple enterprise of which the Waialua Agricultural Company owned one third (Taylor et al 1976:169). Although Castle & Cooke's dividends never plummeted, Dole lost $5.4 million in profits in 1932 (Taylor et al 1976:169). Castle & Cooke took 21% ownership, and the Waialua Agricultural Company took 37% ownership of the Hawaiian Pineapple Company in December of 1932 and by 1936, the $8.5 million debt of Hawaiian Pineapple had been turned into a $2 million credit balance (Taylor et al 1976:169).

In the mid-1930s, the Waialua Sugar Mill reportedly had the capacity to grind 2,540 tons of sugarcane a day transported by the 55-mile railway network on the planation mill (Honolulu Star-Bulletin 1935). They continued to invest in capital improvements and in 1935, the Waialua Agricultural Company invested $3 million in irrigation improvements by building reservoirs, siphons, ditches, and tunnels, as well as improvements to the sugar mill (Honolulu Star-Bulletin 1935). The 1930s was also characterized by a focus on mechanizing harvesting. A new tool called the "Waialua Rake" was created to improve the grab harvest system. It consisted of a "heavy steel pipe contraption in the form of a huge, closed hand" which would be used to grab the sugarcane piles cut from two tractors with steel cables (Jones and Osgood 2015:149). While the tool was inexpensive, it did not help the harvesters to separate the sugarcane stocks from the trash, mud, and rocks uprooted with them (Jones & Osgood 2015:149). In addition, the general decline of animal labor on farms led to new modifications to existing farming equipment like plows being directly mounted on tractors and the tricycle tractor. Despite the continued efforts and investments to attempt mechanization of harvesting, most Hawaiian fields continued to be harvested by the hand grab system (Jones and Osgood).

The commencement World War II with the attack on Pearl Harbor had an instant and profound impact on Hawaiian industry and agriculture, including on sugar production. Following the attacks, martial law was enacted on Hawai‘i, and many plantation workers entered service in the armed forces. The U.S. military immediately began commandeering lands to build defense installations. In Waialua, more than 1,000 acres of sugarcane crops was bulldozed for the installation of military bases, and it's estimated that O‘ahu lost more than $1 million worth of sugarcane within a few days following the attack (Taylor et al. 1976:197). The military additionally ordered that Waialua plantation cane fields near the ocean be converted to potato fields so that the military could have a clear range of fire in case the enemy stormed the coastline. John Midkiff, the plantation manager of Waialua Agricultural Company at the time recalled:

> By nightfall of December 7, troops had moved into my yard, dug a huge hole and filled it with enough explosives to blow up the island. No one seemed to know why, then or after the war. Let's say there was a little 'confusion'. Our bulldozers, crawler cranes and trucks were taken out of the fields to build airfields. I was ordered to supply as many as 500 men a day from my work force to help build defense installations. One truck driver, missing for weeks, finally showed up with the simple explanation that 'the army put me to work'…(Taylor et al. 1976:197).

Midkiff continued to report that one military officer ordered that the Waialua Reservoir to be blown up as he was afraid that enemy planes would see a reflection from the water and therefore be able to target the nearby Wheeler Field. However, before the military destroyed the dam, Midkiff reported that "we got to a higher authority who recognized the utter stupidity of the order" and the order was stopped (Taylor et al. 1976:197-198).The military additionally enclosed the Waialua Sugar Mill with barbed wire fencing throughout the war and painted the mill stack in camouflage (Figure 22).

Figure 22. Waialua Sugar mill enclosed with barbed wire fencing and the sugar stack painted in camouflage following the attack on Pearl Harbor in 1941 (Taylor et al 1976:217).

Although the military acquired many agricultural lands and many of the planation employees left to serve in the military, sugar plantations managed to stay relatively close to normal production rates at the time. The production yields at Waialua plantations dropped only a few thousand tons between 1941 and 1945 (Taylor et al. 1976:197). In 1946, much of the agricultural lands acquired by the military was returned for re-planting (Honolulu Star-Bulletin 1946). Waialua took back 1,513 acres worth of land which they immediately starting replanting using concrete pipe irrigation (Figure 23).

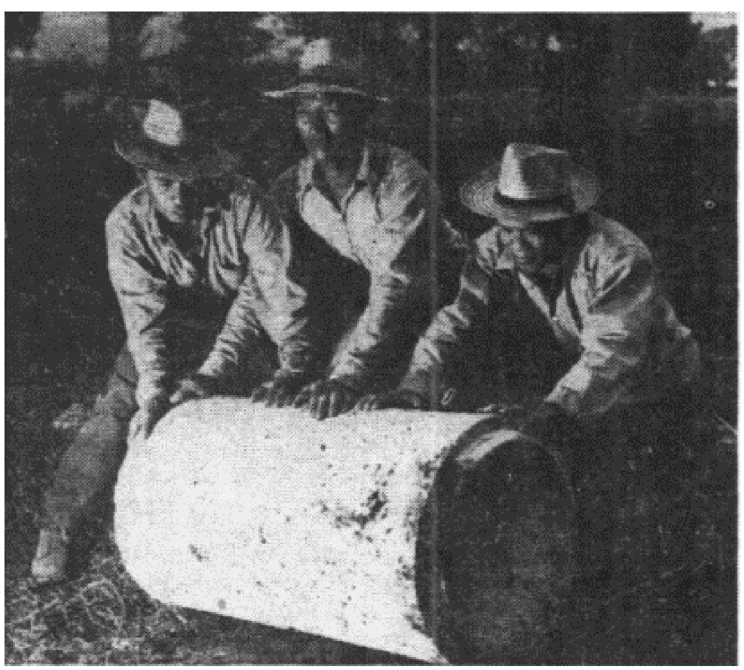

Figure 23. Waialua plantation workers replanting sugarcane using the concrete pipe irrigation method (*Honolulu Star Bulletin* 1946).

WAIALUA SUGAR COMPANY AND THE POST-WORLD WAR II SUGAR INDUSTRY

Upon celebrating the 50th anniversary of the Waialua Agricultural Company in 1948, A.G. Budge, the president of Waialua Agricultural Company and Castle & Cooke at the time, announced his intention to divide the Waialua Agricultural Company into two companies, one to handle the sugar plantation operations and the other to manage the remaining lands (The Honolulu Advertiser 1948). The land and investment company became known as the Helemano Company and the sugar plantation company became known as the Waialua Liquidating Company (The Honolulu Advertiser 1948). Later the sugar company was renamed the Waialua Sugar Company (Dorrance and Morgan 2000). At the time of this division, the Waialua Agricultural Company's lands consisted of a total of 46,773 acres, including 27,197 fee simple and 19,576 leased acres. Of the total acreage, 10,600 were planted in cane. Additionally, a considerable amount of this acreage was being leased to Hawaiian Pineapple Co. and the California Packing Corp (The Honolulu Advertiser 1948).

The split of the Waialua Agricultural Company was devised to curb union bargaining tactics brought on by union negotiators for Waialua's sugar workers (Taylor et al. 1976:225). The labor negotiators had been basing their demands off Waialua's total profits from both sugar and non-sugar enterprises. Therefore, the company decided a division of the company would protect their overall profits and cut down the labor negotiations (Taylor et al. 1976:225). Although Helemano now controlled most of the assets, its primary agent was still Castle & Cooke (Taylor et al. 1976:226). Throughout the mid twentieth century, Castle & Cooke continued to grow. In 1957, Castle & Cooke owned 34% of Waialua and by 1960, they owned 52% (Taylor et al 1976:231 & 242). In 1961, Castle & Cooke bought the remaining shares of Dole's operations.

In 1952, Waialua plantation's railroad system was replaced by a new type of hauling unit known as the "eight rubber-tired Tournatows" (The Honolulu Advertiser 1952) (Figure 24). Previously, the company relied on railroad to transport its product through the plantation to the sugar mill and beyond using a total of 7 locomotives and 742 cane cars (The Honolulu Advertiser 1952). However, in 1951 the plantation manager at the time, John W. Anderson, announced there would be a change in the systems (Honolulu Star-Bulletin 1951). The endeavor costs about $1,500,000 and was financed by the company's reserves (Honolulu Star-Bulletin 1951). To accommodate the new system, the 55 miles of existing railroad tracks were removed, and 44 miles of paved road was built (Honolulu Star-Bulletin 1951).

Figure 24. Tournatows in use in Waialua Sugar Company fields in 1952 (The Honolulu Advertiser 1952).

The end of the railroad system at the Waialua Sugar Plantation coincided with an increased number of challenges such as droughts, labor strikes, and declines in harvest and profits. Despite the challenges, the plantation continued to harvest over ten thousand acres of sugar cane annually. Even with an 8-month long drought in Waialua, the sugar plantation achieved a "world record yield of 15.12 tons of sugar per acre of harvested cane" (The Honolulu Advertiser 1954). The profits from sugar cane remain constant until 1958 when the president of the Waialua Agricultural Company, Malcom McNaughton reported a significant decline in profits. He reported net profits were $482,756 in 1957, $341,217 in 1958, and $133,826 in 1959 (The Honolulu Advertiser 1960a). In 1964, the sugar production for Waialua was 73,103 tons and decreased to 66,078 tons in 1965 (Honolulu Star-Bulletin 1965). The decline in profits and sugar production have been attributed to the decrease in sugar prices as well as labor issues that characterized the mid-20th century (Dorrance and Morgan 2000). In 1975, a severe drought plagued the Waialua Sugar Plantation (Honolulu Star-Bulletin 1975a) (Figures **Error! Reference source not found.** and 26). As William W. Paty Jr., the plantation manager at the time recalled:

> All we can do is stand by and pray for rain. Some fields are dying while others are standing still with no growth. Four thousand acres totally dependent on Lake Wilson behind Kemoo Farm are being rationed to water feeding every 40 days instead of the usually two weeks. Rainfall since April has been as low as we've had in 73 years of keeping records. That's about 20 per cent of normal. So far there has no break. We projected a 91,000 ton yield for 1976. Now the forecast has been trimmed to 79,000 tons and that could go lower if no relief comes (Honolulu Star-Bulletin 1975a).

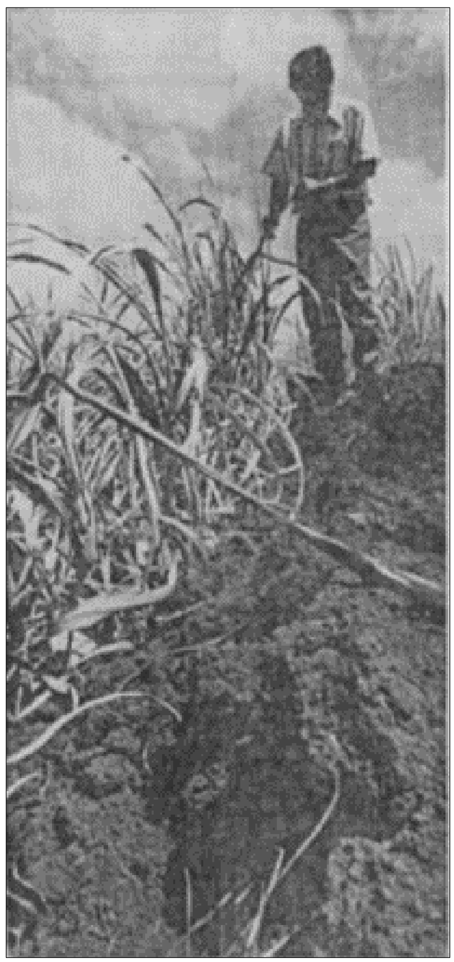

Figure 25. Thomas Hirayama, crop control assistant at Waialua Sugar inspecting drought-stunned sugarcane (Honolulu Star Bulletin 1975a).

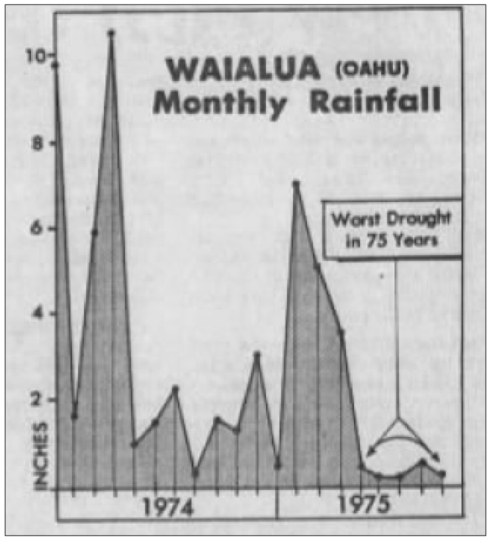

Figure 26. Graph of recorded rainfall levels in inches in Waialua in 1974 and 1975 (Hawaiian Gazette 1906).

In 1980, Waialua Agricultural Company sought new avenues for revenue including using molasses, a byproduct of sugar production, to produce ethanol as an alternative energy source (Honolulu Star-Bulletin 1980). This new endeavor was seen as an opportunity to increase profitability, reduce waste, and as a response to environmental concerns. In 1984, another drought plagued the Waialua Plantation causing low yields (The Honolulu Advertiser 1985b). In 1985, the State Department of Health found a hydrogen sulfide odor problem at the Waialua Sugar Mill and determined the gas was affecting the health of some residents in the area. The problem was linked to mill wastewater sitting stagnate and producing swamp gas (hydrogen sulfide) in a ditch that ran *mauka* of Crozier Drive (The Honolulu Advertiser 1985a; Honolulu Star-Bulletin 1985). The Waialua Sugar Company cut their work force by 15% in response to profit losses and "uncertainty in the troubled sugar industry" (The Honolulu Advertiser 1985b). The previous year, Waialua Sugar Company shut down for 10 weeks in an effort to cut costs and remedy losses as well (The Honolulu Advertiser 1985b). In 1986, Eileen Koontz, a spokeswoman from Castle & Cooke, recalled record yields at Waialua, but it resulted in only a small operating profit which turned into a loss after subtracting interest costs and taxes (The Honolulu Advertiser 1987). These downwards trend f continued through the 1990s.

In 1994, several sugar companies announced a cease in sugar production and business (The Honolulu Advertiser 1995). From 1990 to 1996, nearly 3,000 sugar industry jobs were lost (The Honolulu Advertiser 1995). In 1994, Michael O'Brien, president of Dole Food Hawaii, announced a shutdown of Waialua Sugar Company (The Honolulu Advertiser 1994). He recalled how "none of us want to see Waialua closed but we also have to face the reality that we've lost over $17 million over the last six years" (The Honolulu Advertiser 1994). The 1994 milling season ended on October 29th and yielded an operating loss of more than $3 million, bringing the cumulative loss to more than $20 million for the previous six years (The Honolulu Advertiser 1996; Hawaii Tribune-Herald 1994). The Waialua Sugar Company closed in 1996. The Dole Food Company Hawaii sought to reuse the existing plantation and mill to produce coffee (The Honolulu Advertiser 1998). Dole had previously started to experiment in order to diversify their agriculture and began experiments with coffee in Waialua in the late 1980s (The Honolulu Advertiser 1998). About 20 acres of cacao were also planted in 1996 at Waialua (Honolulu Star-Bulletin 2005). Dole built a visitor center at the old Waialua sugar mill (Figure 27), which opened in December of 1998 (The Honolulu Advertiser 1999a). Despite the Waialua Sugar Company shutting down in 1996, the community continued to see the old sugar mill as the "focal point of the rural town" and continues to use it to this day for community events (The Honolulu Advertiser 2000; Honolulu Star-Bulletin 2010). Recently, many small businesses have repurposed the mill, setting up a soap factory and various surfboard shaper shops (The Honolulu Advertiser 2010)

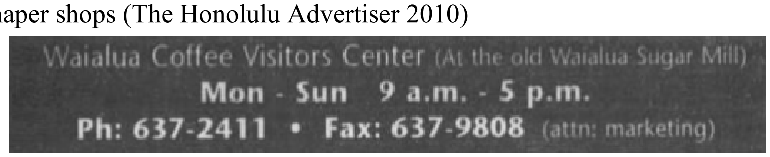

Figure 27. Public advertisement (The Honolulu Advertiser 1999b).

WAIALUA MILL CAMP AND ITS RESIDENTS

Plantation camps were first constructed to house foreign workers, who immigrated to Hawaiʻi to work on plantations. Early housing arrangements divided laborers into skilled workers, who worked more specialized jobs such as irrigation or within the mill, and unskilled workers, who tended to work in the fields. As a consequence of the location of their respective jobs, the skilled workers tended to live near the mill building while camps for unskilled workers were spread more widely across the plantation near the fields where they worked (Marquez 2012:4). Housing was often ethnically segregated as a way to ensure social discordance and prevent labor movements. These early housing arrangements consisted of barracks or double houses. Barracks could house between 50 and 60 laborers who slept on multitiered bunks (Riznik 1999:127). Kitchens, baths, washhouses and toilets were often separate structures. Conditions within these barracks were poor as they were usually cramped, overcrowded, and unsanitary. Early families who immigrated to work on plantations lived in double houses characterized by separate homes that share a wall and with each typically consisting of one or two rooms (Riznik 1999:126). Similar to the barracks, double houses were often overcrowded and unsanitary.

A 1901 map of the Waialua Agricultural Company depicting the extent of the plantation after only three years of operation includes several groups of houses or barracks around the mill (Figure 28). Within the project area and west of the mill, a line of buildings along a road appears to be housing, likely for laborers working in the mill and the surrounding fields. Additional houses, along with an office and store, are located west of the mill. By 1913, several more sections of housing had been constructed including an additional row of houses or barracks located south of the row of houses built prior to 1901 (Figure 29). A group of houses also appears to have been built between the project area and the mill while several rows of houses were constructed south of the project area and north of Farrington Highway near the water reservoir. The rapid development of housing around the mill during the first decade of the 20th century is a visible result of the early successes of the Waialua Agriculture Company and a response to the increased need for immigrant labor and their concomitant need for housing as the company grew. The housing developments were likely a part of the substantial early capital investments Castle & Cooke made in the company to support its growth.

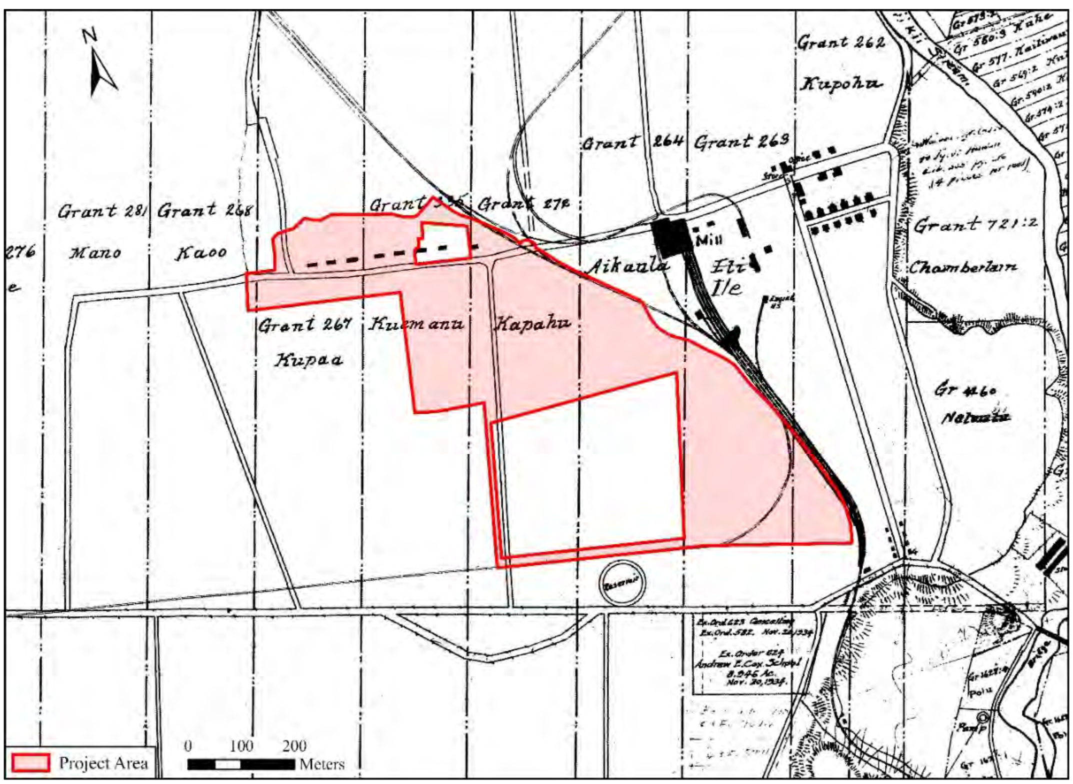

Figure 28. Map of the Waialua Agricultural Company by W.A. Wall in 1901. Note the row of housing in the north of the project area.

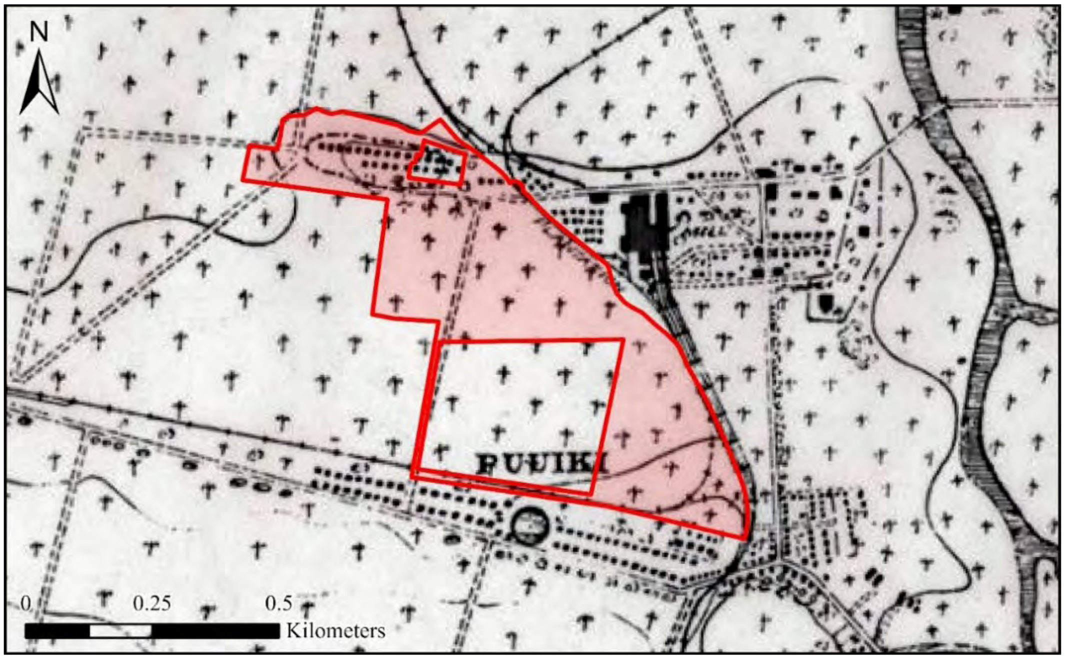

Figure 29. US Army Survey Map from 1913 depicting expanded housing in the northern portion of the current study area.

Around 1910 several housing reform movements developed in part as a result of the sugar industry recognizing the need to increase and control labor. Following the Japanese Labor Strike in 1909, the Labor Committee of the Hawaiian Sugar Planters Association began recommending housing reform to plantations and urging them to provide better welfare for their employees as a way to settle labor issues (Riznik 1999:131). In 1911, following a housing sanitation crisis, the Territorial Board of Health intervened and in a letter to plantation operators provided construction drawings for homes that emphasized sanitary conditions and further recommended good ventilation as a way to reduce diseases. They proposed that such ventilation could be achieved by raising houses that were too low to the ground and removing buildings that were too close together (Riznik 1999: 132). In addition, a general shift in plantation demographics from largely consisting of unmarried men to an increased number of women and families required a change in housing arrangements. Consequently, between 1910 and 1920, the first single family homes were built on plantations. The standard for such homes was set by George Wilcox who built 120 houses for his sugar plantation, Grove Farm, on the west side of Līhuʻe in Kauaʻi. These houses consist of two to three rooms and consisted of several house plans designed for different sizes of families including bachelors, a couple with one to two children and larger families. Except for the houses built for single men, the houses all had kitchens with running water (Riznik 1999: 133-134). These houses provided a drastic change from the congested and unsanitary conditions that characterized the earliest of the plantation housing.

While housing reform improved the lives and welfare of employees and their families, plantation managers were also supportive of such reforms as they served as a way to control labor. Providing housing served as a form of welfare capitalism as it allowed for the development of a community that attracted employees and simultaneously increased the managerial control over the labor (Riznik 1999). In 1919, HSPA established the Social Control Bureau to act as stimulate planning for individual plantations (Riznik 1999:134). The organization conducted surveys detailing the condition of employee housing for plantations and provided blueprints for a standard single-family home which included a kitchen, separate bedrooms, and better ventilation. These early designs were modeled after the plantation homes built for Grove Farm in Kauaʻi (Riznik 1999: 137).

In 1925, the Hawaii Sugar Planters' Association commissioned a survey to evaluate Hawaiʻi industry management standards compared against the mainland U.S industrial housing standards. The mainland policy maintained that barracks were no longer appropriate housing arrangements and new housing was restricted to single-family residences with at least two bedrooms. Importantly, the results of the survey report that by 1925 approximately two-thirds of all plantation housing units were single-family homes and demonstrated that sugar plantation housing had drastically improved since only a few years earlier. The survey report emphasized the importance of the social aspects of worker housing, plantation operators were advised that the use of the word "camp" as a designation for the groups of housing should be abandoned and that housing should be planned and considered more like villages (Marquez 2012:25). The report suggested that professional architects and planners should be commissioned by the HSPA to design the communities according to the recommendation that "the camps should be converted into organized villages, the villages should be named, and every measure taken to stimulate and develop normal community interests" (Riznik 1999:145).

From 1935 through 1950, HSPA ran an architectural service to support the plantations, with Honolulu architect Theodore Vierra serving as the director (*Honolulu Advertiser* 1950). Plans for plantation houses were upgraded and new designs had more open floor plans than those in the 1920s and took into consideration the island environment (Marquez 2012:38). These new houses included toilets, showers, laundries, and additional windows.

At the Waialua Agricultural Company, aerial photographs from 1928 show that between 1913 and 1928 several rows of single-family homes were built within the project area where the current mill camp stands (Figure 30) Additional rows of homes were also built in the northwest portion of the project area where housing had existed since prior to 1901. It is unclear if the original buildings in this area were barracks or houses, and therefore, it is uncertain if the houses seen in this area represent these earlier homes/barracks and additional houses were added or if these older houses/barracks were replaced. However, one reporter visiting the Waialua plantation in 1937 recalled his observations of the Waialua Plantation and Mill Camp and suggests that some original houses remain in use stating that some of the buildings located in the northwest potion of the project area may be original.

> Every person who works on the plantation, from highest to lowest, lives in a company house, rent free. Some of the houses are as old as the plantation, which is 38 years. Some are modern as tomorrow, and the paint is not yet dry on them.
>
> Every house has enough ground around it for a vegetable garden, for chickens, and for trees and myriads of flowers. The workers get electricity at a low rate…get free hospital treatment for anything from a cut fingers to having a baby.
>
> There are three schools on the plantation, including a high school. The workers can trade at the company stores but they don't have to. There is a little settlement of free men at the edge of town with stores, barber shops and lunchrooms and the people can trade there if they wish. (*Honolulu Star Bulletin* August 31, 1946).

Figure 30. 1928 aerial image showing expanded Mill camp housing within the current study area.

Individual home ownership was not as prevalent in Hawai‘i as it was in the U.S. until well after World War II. In 1946, following the “Big Strike of 1946” in which plantation workers in Hawai‘i unionized with the support of International Longshoremen’s and Warehousemen’s Union (ILWU), workers and plantation management agreed to a new union contract which ended the company subsidized housing for plantation workers and implemented a new system which would treat employees as rent-paying tenants (Marquez 2012:43). The union viewed the elimination of the plantation subsidized houses as a way to increase the workers’ control of their living and working conditions while simultaneously reducing the power and control of the plantations. However, home ownership was not a priority for the union at this time as many existing homes on the plantations were old and would have required extensive costly rehabilitations before being able to sell to union members (Riznik 1999:151). Additionally, and as a consequence of the poor condition of the homes, the monthly rent was kept low for the new tenants. The rental fee corresponded to two factors. The first was the type of construction and facilities of the house as determined while the second factor was the house’s physical conditions as described as poor, fair, good, or excellent (Marquez 2012:43).

The settlement between the union and plantations after the strike of 1946 substantially altered the plantation lifestyle in Hawai‘i. In the years to follow, sugar workers continued to see an increase in pay and benefits while the number of camps steadily decreased as workers moved into housing nearby in modern communities. (Dorrance and Morgan 2000:133). Following unionization and the new union contract, several plantations including Waialua Plantation offered the opportunity for individuals to own homes. Subsequently, several new housing divisions were constructed, many of which were designed by Theodore A. Vierra. In the 1940s, Vierra designed the “All Hawaii” house originally a new subdivision for Hawaiian Commercial Sugar Company workers in Maui. However, similar houses to the “All Hawaii” design were built to sell to employees on other plantations, including in Waialua. This new house plan features an 800 and 1,000 sq ft three-bedroom house, built on concrete slab with asphalt tile and hollow tile walls. Each house also contained living and dining rooms, kitchen, toilets, baths, and a laundry (Riznik 1999:151). An aerial photograph from 1944 (Figure 31) compared to topographic map of the study area from 1953 (Figure 32) shows that additional sections of houses were built between these years, likely using designs similar to Vierra’s “All Hawaii” house. In 1951, the Waialua Agricultural Company reported owning 820 houses, “all located on the plantation. Most of them surround the buildings and yard area located near the mill. These houses, together with the business establishments of the community, constitute the village of Waialua. There are 335 houses which are scattered over the plantation, but these too are located in clusters and form small villages.” *Waialua Agr. Co. v. Maneja*, 97 F. Supp. 198, 214 (D. Haw. 1951). A comparison of historic maps (see Figure 32 cf. Figure 33)indicates that only a few more houses were built in the west central portion of the mill camp in the 1960s, while others seem to have been removed.

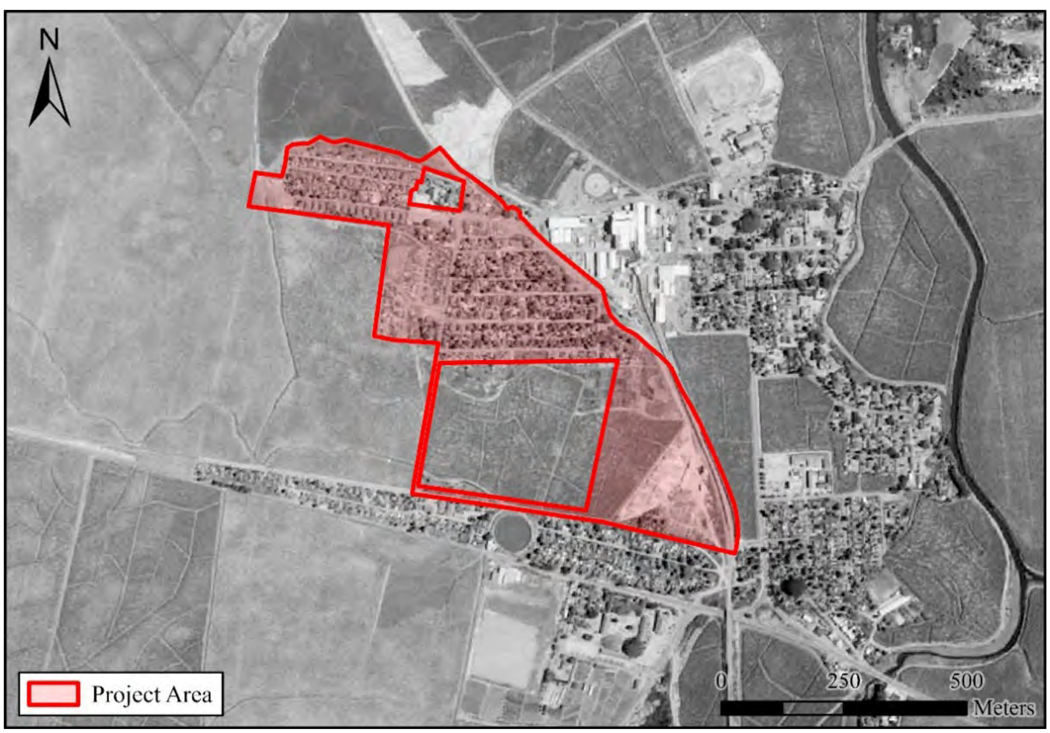

Figure 31. 1944 aerial image showing additionally constructed housing.

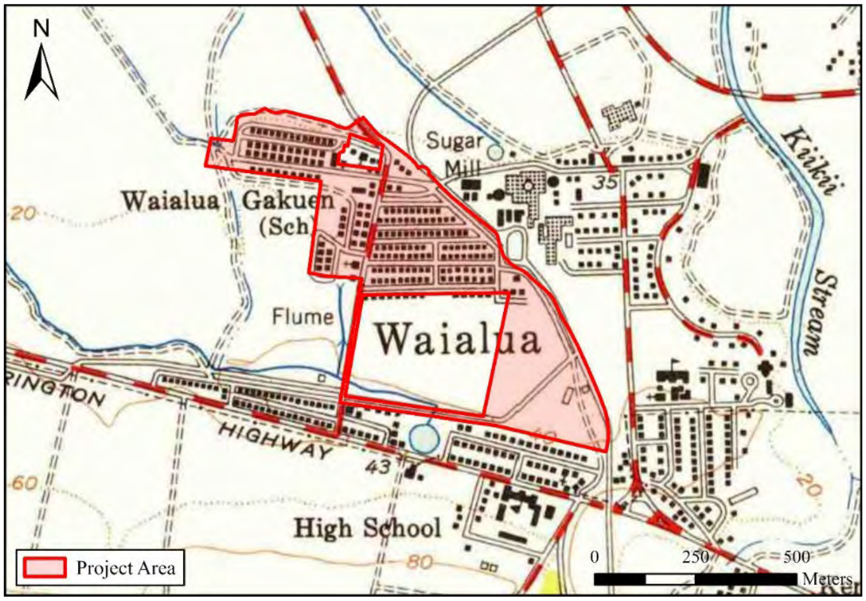

Figure 32. Portion of 1953 USGS Haleiwa 7.5 min. series topographic map.

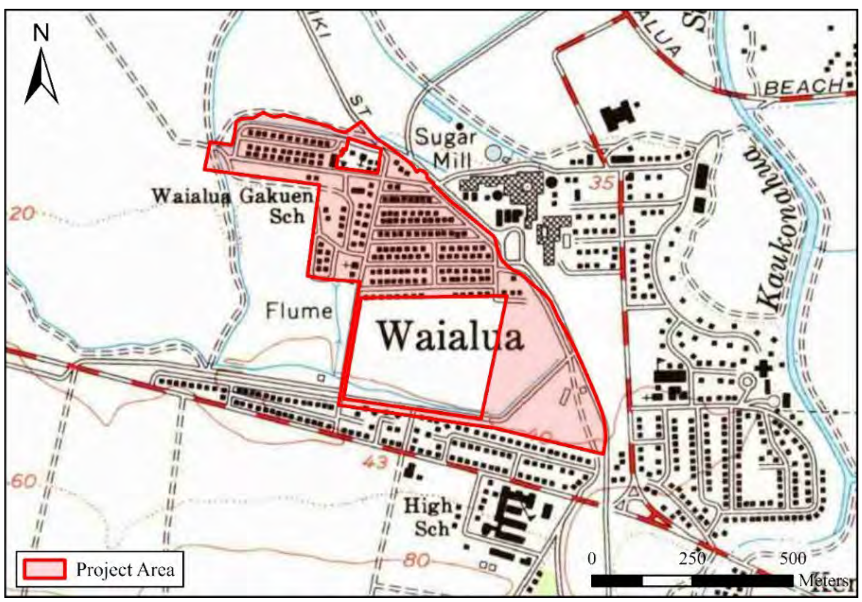

Figure 33. Portion of 1960 USGS Haleiwa 7.5 min. series topographic map showing a few new houses, and some removed.

Although Hawaiian plantation workers' housing built during the twentieth century varies from plantation to plantation, most were designed under the guidance of the architectural services of the HSPA and thus display common features. The distinctive character-defining features of Hawaiian plantation residential architecture, as exhibited in the Waialua workers' housing, include small minimal bungalow-style houses with rectangular plans. Walls are a single board thick (either board-and-batten or tongue-and-groove with horizontal girts), and a variety of roof forms, often hipped or gabled, with wide, overhanging eaves. Commonly seen in the Waialua worker housing are side-gabled roofs with a shed roof extending over a full-width lanai at the primary façade. Jalousie windows, set two-up in a side-by-side configuration are arguably the most common; some double-hung windows remain.

An accounting of plantation workers' housing in Hawai'i lists the following characteristics, encompassing the years of construction of the houses at Waialua (Riznik 1999; Table 2). The remaining houses at Waialua display most of those characteristics listed.

Table 2. Features of plantation workers' housing in Hawai'i, 1920-1960*

Feature	1920-1940	1940-1960
Spatial organization		
House form	Duplex; single-family	Single family
Arrangement of rooms	Three bedrooms in corners	Some L-shaped, three bedrooms
Size of single-family houses	650-100 sq. ft.	850-1,000 sq. ft.
Numbers and types of windows	Two or three per room; double hung; slider	Two or three per room; double hung, slider
Kitchens	Incorporated	Incorporated
Baths	Separate and incorporated	Incorporated
Wash houses	Separate and incorporated	Incorporated
Toilets	Separate and incorporated	Incorporated
Garages/carports	Garages	Garages and carports
Building systems		
Single-wall construction	Yes	Yes
Materials	Board and batten or tongue in groove; first canec; first hollow tile; shingles or metal roofs	Tongue and groove; canec; hollow tile; shingle; metal roof; cement pad
Builder	Plantation	Contractors and plantation
Water supply	Piped to houses	Piped to houses
Sewage	Open sewage; concrete ditches; some tile sewers; some cesspools	Tile sewers; cesspools
Electricity	Yes	Yes
Design characteristics		
Standardized plans	Yes: HSPA	Yes: HSPA
Roofs	Hipped; double hipped; overhanging eaves	Hipped; double hipped; gable; overhanging eaves
Exterior coating	Paint and stain	Paint and statin
Siting	Village grid street plans; parks	First subdivision layout; parks
Surroundings		
Lot size	5,000-7,000 sq. ft.	5,000-7,500 sq. ft.
Yards	Yes	Yes
Roads	Some paved	Paved

* Data is from Riznik (1999), pp. 122-125.

As development around the mill and within Waialua Mill Camp slowed in the latter half of the 20th century, the neighborhood experienced a turbulent period in which the community faced many challenges including a struggling sugar industry, the increased visibility of crime, and health issues cause by the association of the neighborhood with sugar production. Several instances of gun violence resulting in homicides and theft are reported on in newspaper during the 1970s and 1980s (The Honolulu Advertiser 1960b; Honolulu Star-Bulletin 1964; Honolulu Star-Bulletin 1975b). In 1985, it was revealed that a buildup of mill waste water in a ditch *mauka* of Crozier drive was releasing hydrogen sulfide and causing deterioration of the plantation houses as well as health problems for the residents including apnea, headaches, stomach cramping, and, in some cases, insomnia and convulsions (Honolulu Star-Bulletin 1985). After several reported cases, the director of environmental health reported the findings of his health assessment which resulted in a 5-month suspension of sugar processing. With the help of the Department of Health, the Waialua Sugar Mill was able to drain the water out of the ditch. By the 1980s, several of the houses in the mill camp were deconstructed (Figure 34). Additionally, all the houses in the northwest portion of the project area were destroyed and the area converted into a sand quarry.

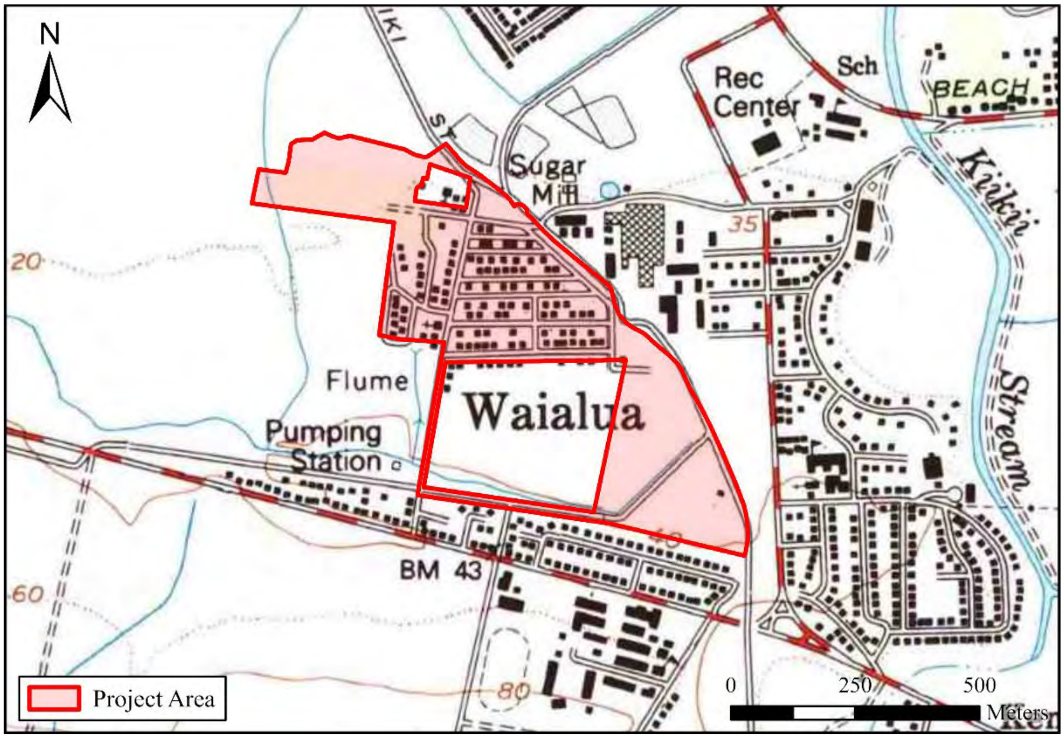

Figure 34. Portion of 1980 USGS Haleiwa 7.5 min. series topographic map showing significant reduction in Mill Camp housing.

During the 1980s and 1990s, life in Waialua Mill Camp was characterized by the uncertainty of the sugar industry and the impending threat of closure of Waialua Sugar Company. In 1985, the company reportedly reduced its work force by 15% due to loses (The Honolulu Advertiser 1985b). The reduction left the company with 69 supervisory employees and 390 union employees. The Company experienced losses in profit and the union agreed to free wages and allowed the company to schedule work on weekends without overtime pay. One worker stated that they voted in favor of the union's contract because otherwise they feared they would not have a job (The Honolulu Advertiser 1985b).

Waialua Sugar Company threatened to shut down in 1987 at the directive of David Murdock, a chairman of Castle & Cooke. However, the decision was reversed after intense criticism (Honolulu Star-Bulletin 1989). Heavy losses continued and the sugar industry remained unstable. Concerning the possible closure of the mill, William Paty, the former manager of the mill, explained that in a rural town like Waialua, the plantation is an entire way of life. He stated that the closing of the plantation would change the lifestyle that was cherished by the plantation workers. However, he offered an optimistic view: "But the essential character of Waialua will not change. The core of the community will be there" (Honolulu Star-Bulletin 1989). Of the paternalistic aspect of the mill camp, William Paty stated the only vestiges that remained is the Waialua Sugar Company's whistle, which previously was used as a reminder of the 8pm curfew for the local youth. Paty joked that the "only thing it's good for now is to tell folks when the 8 o'clock TV show starts" (Honolulu Star-Bulletin 1989). With the impending threat of closure, John Primacio, Jr. and Seiko Shiroma, former employees of Kahuku Sugar Planation which shut down 19 years prior, offered advice to Waialua Sugar Company employees suggesting that one of the more difficult aspects of the closing of a plantation is the fact that former plantations employees are suddenly faced with the reality of having to run a town (Honolulu Star-Bulletin 1989). In many cases, the services that residents relied on had been provided by the plantation including a physician, the water supply, the fire station, the local credit union, and general stores where workers and their families could buy supplies. They emphasized that the Waialua residents must be unified as they rebuild the community (Honolulu Star-Bulletin 1989).

In 1996, the closing of Waialua Sugar Company was felt mostly by families living in plantation homes. There was a general fear that they would lose their homes as well as their jobs. Kawailoa Camp, north of the Waialua Mill Camp, had only 5 years remaining on the lease of the land from Bishop Estates. Kawailoa Camp residents feared that the company would not extend the lease and they would lose their homes. However, many of these residents were willing to move into similar homes at Waialua Mill Camp within the current project area if that was required (The

Honolulu Advertiser 1995). A similar fear permeated communities across the region. Eventually, some mill camps were shut down, including Kawailoa Camp. However, it was announced that housing would continue to be leased to employees in other locations including Waialua Mill Camp, so long as the employees had already retired from the company (The Honolulu Advertiser 1997a). Thus, many employees opted for an early retirement and were allowed to keep their homes within Waialua Mill Camp. However, many were too young to retire and consequently were forced to move (The Honolulu Advertiser 1997a). People who were forced to leave were given 9 months to find another place to live plus another month for every 5 years they worked for the company (The Honolulu Advertiser 1997b). At the time of closing, there were still 115 homes in Waialua Mill Camp. Seventy of these homes were used to house retirees while the other 45 were used to house employees rehired by Dole Plantation (The Honolulu Advertiser 1997b).

The Department of Housing and Development attempted to address the housing crisis by designing a housing project for displaced Waialua Sugar Plantation Employees, but many workers had just lost their job and would be priced out of any newly developed home (The Honolulu Advertiser 1994). The reality facing the 225 plantation workers who had lost their jobs, yet had families to provide for, seemed bleak for many residents. At the time of the shutdown, plantation workers paid $42 in rent per month in addition to water and electricity. Two such workers, Orlando and Irene, had moved from the Philippines and had worked on the plantation for 18 years. As he was not at retirement age yet, he did not qualify as a worker who would be able to keep his plantation home. Orlando says of the changing circumstances, “How can I afford to pay $800 rent?” (The Honolulu Advertiser 1995:2). Another measure to try to help plantation workers was provided by the State Department. Their solution was to attempt to provide $1.4 million worth of loans to affected plantation workers. However, this solution was less than ideal with many plantation workers stating they would not take a loan because of the steep costs of the interest they would be obligated to pay (The Honolulu Advertiser 1995). Even for the workers who were guaranteed housing for life, many were forced to move to another mill camp or plantation home. Although they didn’t need to worry about housing needs in the way that unretired workers did, they still had the heartbreaking task of moving out of homes that they had raised their children in and lived in for decades (The Honolulu Advertiser 1995). Even with a loan, the cost of housing was not attainable for many families causing workers to move in with friends or family or to relocate altogether to locations where there were sufficient job prospects (The Honolulu Advertiser 1996).

In the 20 years since the closing of the Waialua Sugar Mill, community ties have remained strong. While there is no longer a single unifying company as the foundation of the town, the residents remain unified in their shared pride of being part of the sugarcane industry and in shaping the history of Hawaiʻi (The Honolulu Advertiser 1996). This community mindset continues with a rise in co-operative farming practices. The Red Barn Stand in Haleiwa is a business started by two employees who lost their jobs in the closing of the Waialua Sugar Mill. They opened “Twin Bridge Farms” in Waialua which initially grew papaya, potatoes, and asparagus. It became a place for the community to gather and celebrate the agriculture in the area. Other community members began to bring their fresh fruits and vegetables as well as jam, coffee, tea, chocolate, and other specialty products. The company became “The Red Barn Farmstand” and now hosts events, cooking classes, and workshops for members in the community (The Honolulu Advertiser 2017). After the closure, the Dole Company continued to allow former Waialua Plantation employees to meet at the library on the plantation, which functioned as a plantation community center. This continued until the library burnt down in 2003 (The Honolulu Advertiser 2003). The Dole Plantation continues to host community events and benefits, most notably its annual Lūʻau fundraiser for the Waialua High School Robotics Team that it has hosted for over a decade (Honolulu Star-Advertiser 2015).

SUMMARY OF PREVIOUS STUDIES

While there have been no prior archaeological investigations within the project area, several archaeological studies have been previously conducted in the nearby vicinity of the project area. A review of this nature provides a general understanding of the types of resources that can be anticipated within the project area. The studies in the vicinity of the study area and their results are summarized in Table 3 and their locations in relation to the project area is depicted below in Figure 35. The subsequent paragraphs begin with a summary of early archaeological investigations conducted during the early 20th century, followed by a summary of those more recent archaeological studies conducted in the project area vicinity.

Table 3. Previous archaeological studies conducted in the vicinity of the current study area.

Year	*Author(s)*	*Type of Study*	*Findings*
1933	McAllister	Island-wide Survey	Identified Sites 197 through 208. See Table 4.
2002	Collins & Jourdane; Davis	Inadvertent Discovery	A single, likely native Hawaiian burial (SIHP #50-80-04-6403)
2004	Moore et al.	Archaeological Inventory Survey	Identified three sites: a disturbed traditional burial (SIHP #50-80-04-6532); portions of the Waialua Dairy; (SIHP #50-80-04-6533); and two WWII pillboxes (SIHP #50-80-04-6534).
2007	Yorck et al.	Archaeological Monitoring	No historic properties observed.
2010	Filimoehala & Rieth	Archaeological Monitoring	A single human vertebra (SIHP #50-80-04-7143).

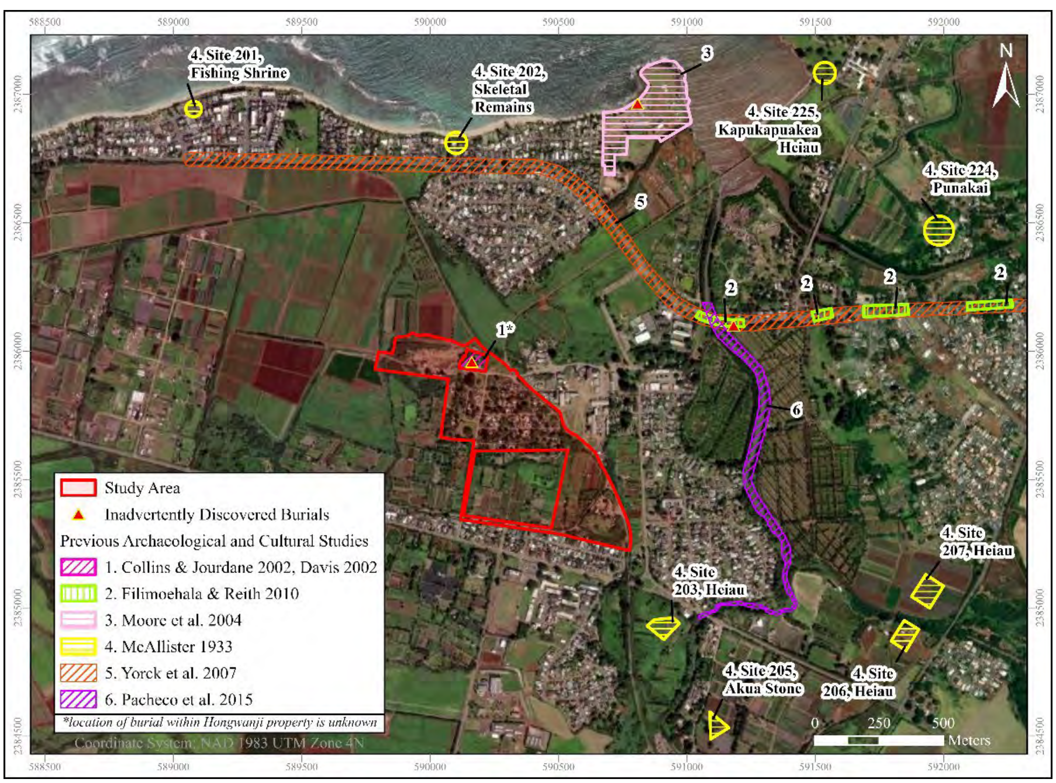

Figure 35. Location of prior archaeological and sites in the study area vicinity.

Summary of Early Archaeological Investigation in Waialua

The earliest archaeological study conducted in the vicinity of the current study area is that of Thomas G. Thrum, who conducted an inventory of the *heiau* of Hawai'i in the early 1900s. Thrum (1906a) published his list of *heiau* in a series of entries in the *Hawaiian Almanac and Annual,* beginning with the 1907 edition. Thrum (1906b:49-50) made the following remarks about his investigations in a preliminary paper titled "Tales from the Temples" published in the 1907 annual:

> 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.

Despite the challenges faced by Thrum, he and his associates compiled information on over seventy *heiau* located throughout O'ahu (Thrum 1906a). One must take into consideration that Thrum listed *heiau* that had already been destroyed prior to his data collection efforts in the early 1900s. Thrum (1906a:47-48) listed the following *heiau*, located in Waialua within five miles of the study area:

> Onehana…………On slope at rear of Waialua Agr. Co.'s mill: a partly walled and platform heiau about 60x100 feet in size; of pookanaka class.
>
> Kalakiki…………On ridge north of Onehana, of pookanaka class; its walls covered in a tangle of hau and lantana.
>
> Hekili……………At Palaa-uka [Pa'ala'a], near the twin bridge, below the road; of luakini class and place of refuge; long since destroyed.
>
> Lonoakeahu………Keehu.—A heiau of small size destroyed years ago; site now planted to cane.
>
> Kapukapuakea……Palaa-kai [Pa'ala'a].—A medium sized heiau of traditional Menehune construction of kauila wood, long since destroyed, said to have worked in connection with Lonoakeahu. Luuau its kahuna.

Onehana and Kalakiki were both located along the slopes of Ka'ala and Thrum (1906b:52, 54) further reports:

> Not only is the beating of drums and sound of the conch shell and gourd rattles heard in the nights of Kane in its precincts, but its influence extends to the shore and sea at its front, for torch-lights at times suddenly appear and dance about within its range, or vanish at one's approach. . . A still further superstition is that a house built within the range from the temple to its deity must not have its doorway face the hills, else trouble, sickness and death to the household is sure to follow.

The earliest formal archaeological survey of O'ahu was conducted by J. Gilbert McAllister under the auspices of the Bishop Museum for nine months in 1930 in an effort to document prominent sites island-wide (McAllister 1933:3).McAllister states that his investigation was a beginning rather than a complete account of all the cultural resources on O'ahu. McAllister (1933:129-132) located twelve traditional sites near the vicinity of the current project area (Figure 36;Table 4). McAllister (1933:3) also made the following statement regarding the state of cultural resources on O'ahu at the time, in the introduction to his resultant publication *Archaeology of Oahu*:

> As the archaeological remains are those of the people found in Hawaii by the early voyagers, contact with Hawaiians was an indispensable part of the work. Not only are the sites being destroyed by the changes wrought by European culture, but with the introduction of exotic vegetation many sites have been completely hidden. Such remains would be as good as lost, were it not for the knowledge of them still treasured by old residents (*kamaaina*) of Oahu. With the passing of these old people most of this information will disappear.

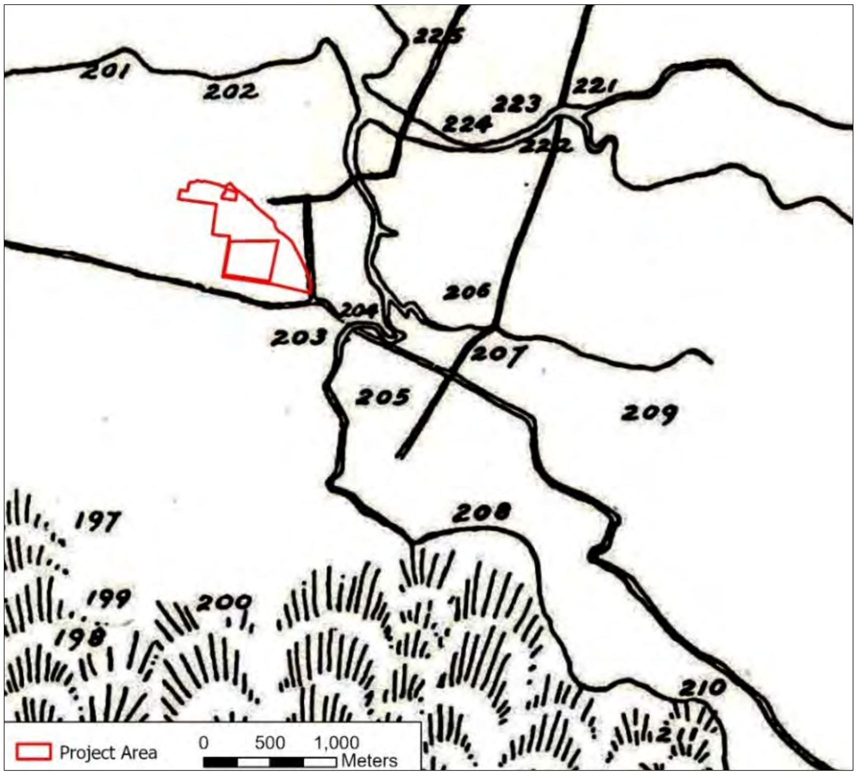

Figure 36. Sites identified by McAllister within the vicinity of the current project area (McAllister 1933).

Table 4. Sites near the project area as identified by McAllister (1933).

Site Number	*Site Name*	*Site Description*	*Approximate Distance from current project area*
197	Kalakiki Heiau	Rock paved front terrace remains overgrown with *Lantana* (perennial flowering plants) likely dedicated to Keanini, the shark-god; original structure was probably 2+ terraces with several small divisions	1.2 miles southwest
198	Burial cave, Kaumoku Gulch	Portions of two skeletons were found in a covered lava tube with no artifacts and evidence of animal scavenging	1.5 miles southwest
199	Piles of stones, near the mouth of Kaumoku Gulch	Six relatively level rock piles, several stone walls, and small enclosures located *mauka* and near the siphon put in 1930 by the Waialua Agricultural Company. Hookala said the rocks were piled to clear the land for agricultural purposes in 1908	1.4 miles southwest
200	Cave in Kaumoku Gulch	The cave was said to have previously contained skeletal material, but none was observed	1.4 miles southwest
201	Keauau fishing shrine (*koʻa*)	Nothing remains of the original site once located on the beach at Puuiki, at the Kaena end of a long row of ironwood trees	1 mile northwest

table continued on next page

Table 4. Cont.

Site Number	*Site Name*	*Site Description*	*Approximate Distance from current project area*
202	Skeletal remains near Puuiki station	Several skeletons were uncovered at approximately 4 feet below ground surface by plantation workers removing sand near the station	0.6 miles north
203	Heiau, near Kaukonahua Stream	A small heiau was said to occupy the site where the Waialua Agricultural Company installed Pump No. 1; name is unknown	0.2 miles south
204	Approx. location of Oahunui	Referred to as the ‘oahu stone’; a stone whose outline is said to resemble that of Oahu located in the gulch near the division between Ewa and Waialua; formerly visited by many Hawaiians in order to say they had been around the entire island of Oahu	0.2 miles south
205	Akua stone, Poloa grove	A once large, sacred grove to Pele, left untouched admist the cane with a small iron fence around a large stone believed to be Oscar Cox, also referred to as Kaneaukai. The grove was a known Hawaiian burial location and is covered in breadfruit, mango, kukui, and Pride of India (sandalwood) trees	0.3 miles south
206	Kahakahuna heiau	The old heiau was located north and *makai* of the mill site but was destroyed and used for agricultural purposes	0.9 miles southeast
207	Kawai Heiau	One of the first heiaus to be destroyed, located below the Waialua Plantation manager’s house and the junction of Poamoho and Kaheeka gulches	1 mile southeast
208	Irrigation ditch	The longest irrigation ditch from the Kaukonahua stream, about 2 miles from the mill. The ditch was used for many years by the plantation	1.3 miles southeast

end of table

Summary of Prior Archaeological Studies Conducted in the Study Area Vicinity

In 2002, an inadvertent burial (SIHP #50-80-04-6403) was found during trenching for an electrical conduit at Waialua Hongwanji Mission property (see Figure 35) (Collins and Jourdane 2002). An assessment was made of these human skeletal remains and it was determined to be one adult individual, likely of Hawaiian ethnicity (Davis 2002). No other cultural deposits and/or features were identified.

In 2003, Archaeological Consultants of the Pacific conducted an archaeological inventory survey of 15-acres along the perimeter of Pu‘uiki Cemetery approximately 500-meters north (see Figure 35) of the current study area (Moore et al. 2004). As a result, three archaeological sites were recorded: an incomplete and previously disturbed traditional burial (SIHP #50-80-04-6532); seven features related to the former Waialua Dairy (SIHP #50-80-04-6533); and portions of two WWII pillboxes (SIHP #50-80-04-6534). The recommended and accepted treatment for Sites 6533 and 6534 was no further work, while the recommended treatment for Site 6532 was relocation. Moore et al. also concluded that, “due to the potential of encountering additional human remains in the event of future land alterations, it is recommended that a qualified archaeologist be on site for the monitoring of all future subsurface activities” (2004:49). An Archaeological Monitoring Plan (Gotay and Rechtman 2019) was prepared by ASM for this project area, and Keala Pono Archaeological Consulting conducted field monitoring, but no monitoring report was prepared. ASM conducted a follow-up site visit and prepared an inspection letter report (Rechtman 2019) documenting no further findings during the monitoring.

In 2004 archaeological monitoring for the Waialua Beach Road Bikeway Project (see Figure 35) was conducted by Cultural Surveys Hawai‘i (CSH) (York et al. 2007). No significant cultural deposits or burials were encountered during the monitoring.

In 2010, archaeological monitoring was conducted by International Archaeological Research Institute, Inc. (IARII) for guardrail improvements (see Figure 35) between Waialua Beach Road and Ki‘iki‘i Stream (Filimoehala and Rieth 2010). No intact cultural deposits or features were identified. However, a single human vertebra was encountered in unsorted calcareous sand fill and was designated as SIHP #50-80-04-7143. The vertebra was reburied at the location of the monitoring under the direction of State Historic Preservation Division.

3. STUDY AREA EXPECTATIONS

Background research indicates that the study area was extensively altered by the sugarcane industry during the 19th and 20th centuries. The study area was used for sugarcane fields, residential developments for employees, and other sugar industry operations. Consequently, there is a high probability that infrastructure related to sugarcane cultivation is extant in the project area including that related to transportation, irrigation, and mill operations. The Waialua Mill Camp remains an active neighborhood today and the current homes are the structures built by the Waialua Agricultural Company. However, it is expected that many of these houses have been altered by renovations and additions since their original construction. Additionally, there is a potential for evidence of structural demolition and landscape repurposing within the project area given the decline of the mill camp housing in later decades.

Due to the extensive use and development of the area by the plantation, it is unlikely that evidence of traditional Hawaiian land use remains within the study area. While two previous archaeological investigations (Moore et al. 2004; Filimoehala and Rieth 2010) have identified traditional burials within the general Waialua area and one study (Collins and Jourdane 2002) reported on an inadvertent discovery made in the vicinity of the current study area, the likelihood of encountering such remains within the current study area is minimal.

4. FIELDWORK

Fieldwork for the current study was conducted between December 8-14, 2022 by Nick Belluzzo, M.A., who served as the Principal Investigator, Rancestan DeRego-Cabarloc, B.A., Julie Evo, M.A., John Meyer, B.A., Evan Ryder, B.A., and Carol Oordt, M.A. One day (July 8, 2023) of additional fieldwork was conducted by Nick Belluzzo, M.A. and Robert B Rechtman, Ph.D.

FIELD METHODS

During the archaeological field survey, the entire (100%) ground surface of the non-residential study area was visually inspected by field technicians walking transects spaced at no more than 10 meters apart and oriented north-south or east-west as field conditions allowed. Pedestrian survey was conducted along the streets of the residential portion of the study area. Residential parcels were inspected from street vantage as thoroughly as possible given visual obstructions such as fencing and vegetation while respecting the privacy of the tenants. No subsurface testing occurred, and no cultural material was collected from the project area, during the current study.

When archaeological features were encountered, their positions were plotted on a map of the current study area using EOS Arrow 100 Global Navigation Satellite System (GNSS) receivers connected to handheld tablet computers running ESRI's Collector Application (Collector App) set to the NAD 83 Zone 4 North. Areas of previous disturbance, conspicuous landforms, and vegetation patterns were also mapped. Identified features located within the current study area were then cleared of vegetation, photographed (both with and without a meter stick for scale), depicted on a scaled drafted plan map, and described using standardized feature record forms.

FINDINGS

As a result of the fieldwork for the current study, four sites and a potential historic district were identified (Table 5). The locations of these historical properties relative to the current study area boundaries are presented in Figures 37 All the documented historical properties are associated with the historic Waialua Agricultural Company Sugar Mill or the affiliated community. Extensive modification of the land within the study area was noted during the survey, including prior mass grading and the presence of underground utilities, building footprints, paved and unpaved roads and parking areas, and active agricultural plots. All observed historic properties originate from the 20th century, and include an irrigation ditch, a historic structure associated with the former Waialua Agriculture Company Concrete Products Plant, an isolated retaining wall, a former Church property, and a plantation camp. None are currently listed in either the National Register or the Hawai‘i Register of Historic Places; and no previously designated local, state, or national historic districts are located within the boundaries of the study area. The four sites and one potential historic district are described below.

Table 5. Historic properties recorded during the current study.

SIHP Site #	*Type*	*Function*	*Age*
TS-01	Ditch	Irrigation	20th century
TS-02	Industrial Structure	Concrete plant	20th century
TS-03	Retaining wall	Soil retention, boundary	20th century
TS-04	Former Church Property	Religious/Social	20th century
TS-05	Plantation Camp	Residential	20th century

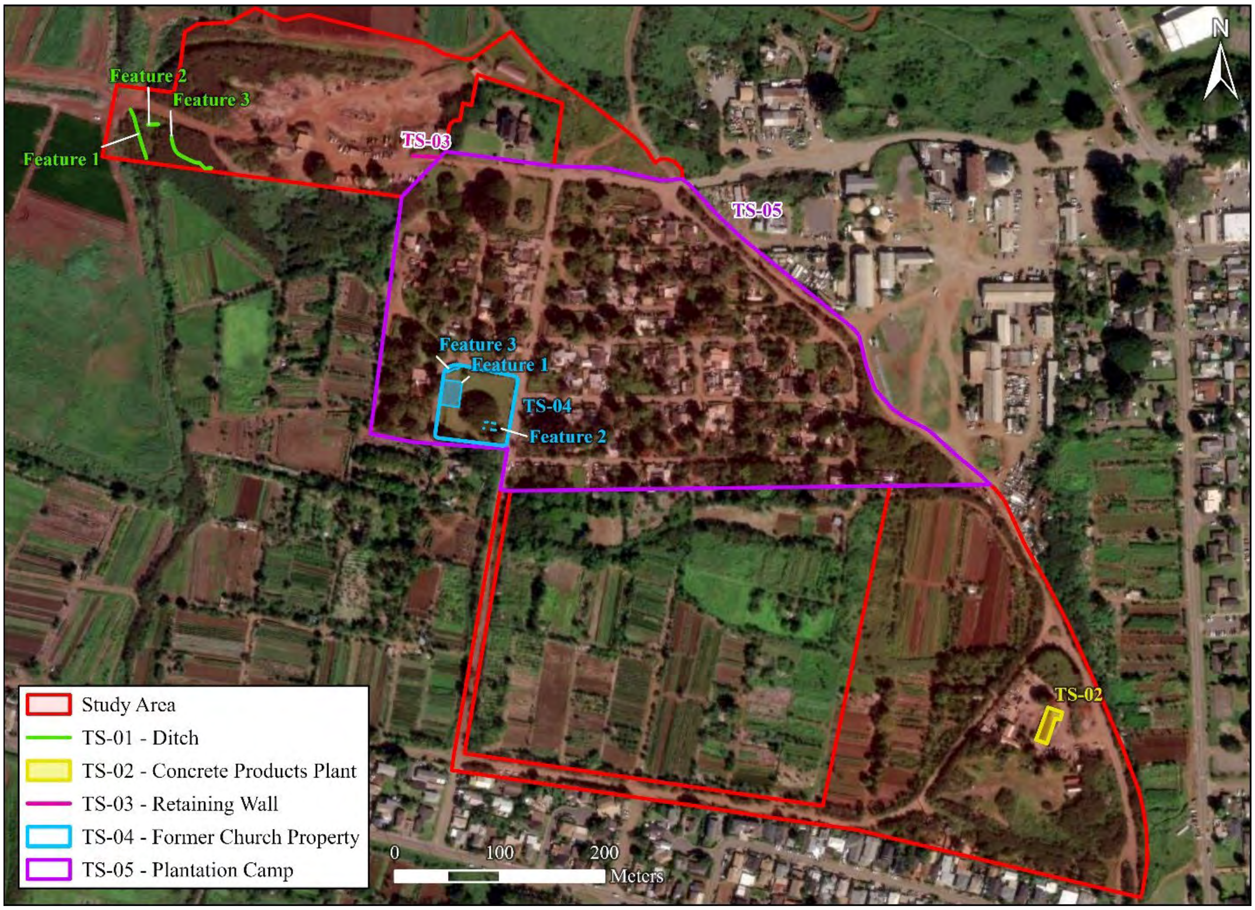

Figure 37. Locations of archaeological sites identified within the current study area.

SIHP Site TS-01

Site TS-01 is a grouping of three ditches (Features 1, 2, and 3) that was identified in the northwest portion of the project area (see Figure 37). Feature 1 (Figure 38) is aligned in a roughly north/south direction and matches closely to an irrigation ditch visible on a 1951 aerial photograph (Figure 39). Feature 1 does not appear on aerial photography dated to 1928; however, a ditch to the north of Feature 1 has a similar alignment but terminates prior to reaching Feature 1 (Figure 40). Therefore, it is assumed Feature 1 was constructed between 1928 and 1951 to extend the older irrigation ditch located to the north. Feature 1 is deeply incised and has certainly been utilized in the modern era. Feature 2 is aligned east/west and appears only as a short segment (Figure 41). It is shallow and contains modern debris. Feature 3 is aligned northwest/southeast and parallels an earthen berm for the eastern-most portion of its extent (Figure 42). Neither Feature 2 nor Feature 3 were observed in aerial photographs, suggesting recent origin and perhaps a modern function unrelated to Feature 1, which is interpreted as a segment of the irrigation system used for watering the adjacent sugarcane fields.

Figure 38. SIHP Site TS-01 Feature 1, view to the north.

Figure 39. 1951 aerial imagery showing irrigation ditches which align with Feature 1 (TS-01).

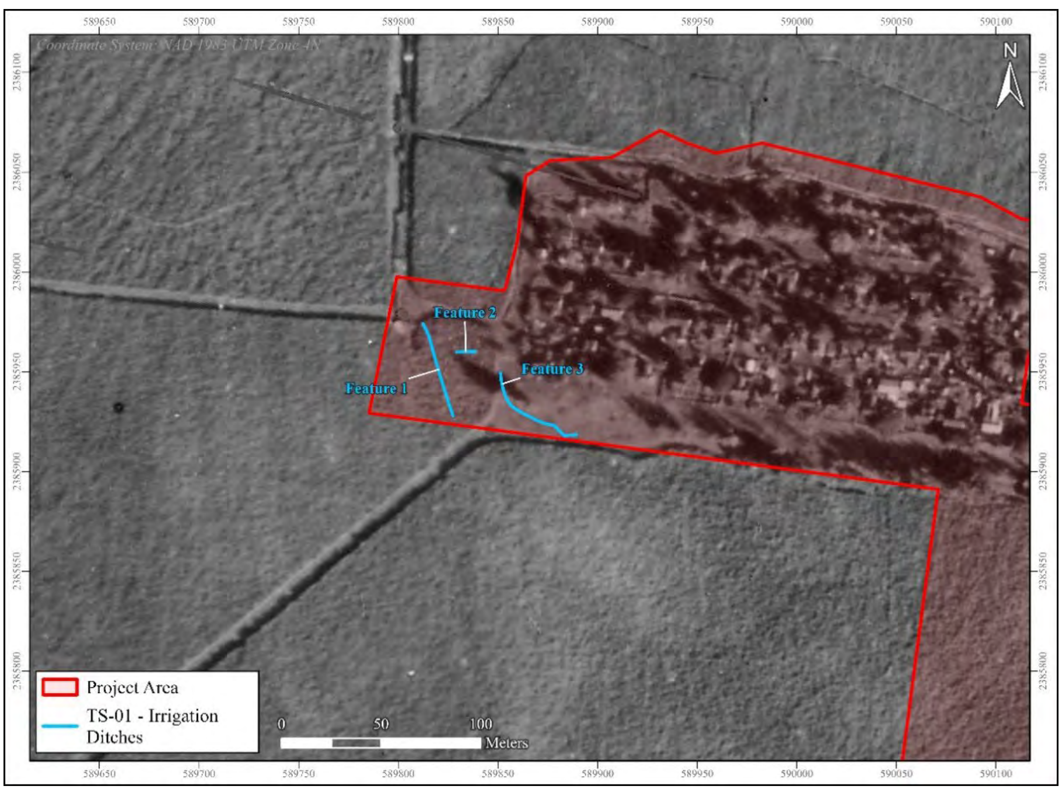

Figure 40. 1928 aerial imagery without Feature 1 (TS-01).

Figure 41. SIHP Site TS-01 Feature 2 (indicated by the red arrows), view to the north.

Figure 42. SIHP Site TS-01 Feature 3, view to the northwest.

SIHP Site TS-02

Site TS-02 is a partial structure, located in the southern portion of the study area (see Figure 37), that was formerly used by the plantation as the Concrete Products Plant. According to a 1951 declaration by the Waialua Agricultural Company, "This plant is engaged primarily in producing concrete irrigation flumes and water supply pipe. It also makes blocks, footings, sidewalk slabs and various other incidental concrete products required by the plantation." [*Waialua Agr. Co. v. Maneja*, 97 F. Supp. 198, 212 (D. Haw. 1951)]. The Waialua Agricultural Company reported that in 1946 "the plant produced approximately 46,000 concrete pieces, including flume sections, pipe and other products." (ibid.).

This structure is not visible on a 1928 aerial image (see Figure 30) but can be seen on a 1944 aerial image (see Figure 31) indicating it was constructed after 1928, but before 1944. The building (Figure 43) consists of a large rectangular footprint formerly under a single simple gable roof of corrugated metal, with an attached smaller rectangular footprint structure (Figure 44) under a similar gable roof. The two roof structures are joined by a projection of the larger rectangular roof intersecting the smaller, but taller, roof forming a ridge and valley connection (Figure 45). The southern third of the main rectangular open-sided structure collapsed in 2017 and only the concrete slab with imbedded metal cart tracks and concrete pier blocks remain in that area (Figure 46). The northern two-thirds of the building has been stabilized with the addition of metal bracing (Figure 47), which is the only thing keeping the structure from total collapse.

Figure 43. SIHP Site TS-02 main structure, view to the northeast.

Figure 44. SIHP Site TS-02 attached structure, view to the southwest.

Figure 45. SIHP Site TS-02 roof junction, view to the north.


Figure 46. SIHP Site TS-02 missing portion (foreground) of main structure, view to the north.


Figure 47. SIHP Site TS-02 metal bracing inside of wooden posts, view to the south.

The attached square structure at the northern end of the rectangular structure measures 25 x 38 feet and houses the concrete handling and mixing equipment (material hopper, conveyor, and mixer; Figures 48 and 49), all of which is in place but non-functional. A set of four overhead I-beam rails (Figures 50 and 51) was used to transport the mixed concrete to the mold pouring stations within the main rectangular structure. Large metal molds (no longer present at the facility) were used, and once the molds were filled, they were transported via the ground-based cart system to drying areas at the southern end of the structure. With respect to the production of the irrigation flume sections, two types were produced, solid sided flumes and flumes with small metal-gated openings to allow water to flow from the flume to the fields. These later flume sections were referred to as "bulldogs" according to Russel Pereira, who worked at the facility in the 1980s.

Figure 48. SIHP Site TS-02 metal material hopper, view to the north.

Figure 49. SIHP Site TS-02 concrete mixer, view to the northwest.

Figure 50. SIHP Site TS-02 switching section of 4 track overhead I-beam rail, view to the south.

Figure 51. SIHP Site TS-02 4 track overhead I-beam rail system, view to the north.

The main structure originally measured 120 x 32 feet but is now only 72 feet long given the 2017 collapse of the southern 48 feet of the structure. Originally there were 18 wooden (6 x 8 inch) posts per side resting on concrete pier blocks (Figure 52) that area integrated into the concrete slab floor of the structure. Several of the original posts have been removed (Figure 53). The posts supported header beams upon which are wooden roof trusses (Figure 54), all bolted together. There is 3-way knee bracing and a 3-foot eave (Figure 55); the roof at its peak is 17 feet tall.

Figure 52. SIHP Site TS-02 original 6 x 8 wooden post on concrete pier block, note metal support post to left of wood post.

Figure 53. SIHP Site TS-02 cut and removed post and bracing.

Figure 54. SIHP Site TS-02 wooden trusses on perimeter beams.

Figure 55. SIHP Site TS-02 3-way knee bracing and eave.

Two separate organized piles of concrete irrigation flume segments were identified in the vicinity of the concrete plant. One of these piles (Figure 56), located to the south of the facility, is comprised of simple u-shaped portable flume sections. The other (Figure 57), located to the west of the facility is a pile of similarly shaped segments featuring small inset sluice gates. An overturned segment exhibits an inscribed date that reads “6-1-60” (Figure 58). These concrete irrigation flume segment are what have come to be known as “Waialua Flumes,” and as the name implies were first invented by the Waialua Agricultural Company to irrigate their fields on the north shore of O‘ahu (Wilcox 1996). According to the 1948 Annual Report of the Waialua Agricultural Company (WAC 1948), one of the accomplishments listed for the period between 1928-1937 was that a “new irrigation system using semi-potable concrete flumes was developed and installed.”

These roughly 3-foot-long sectional flumes are square sided, U-shaped, concrete channels that were placed end to end in a line to carry water in a downslope direction and made watertight at the seams with a black tarlike material. Some of the flume sections have outflow openings (blocked by small tin gates) that could be pulled up to allow for water flow into the fields, where it flowed down slope through furrows between the rows of sugarcane and saturated the ground (Wilcox 1996). Waialua Agricultural Company’s success in irrigating their fields with these types of pre-cast concrete flumes led other plantations statewide to follow suit and adopt their own version of this portable irrigation system.

Figure 56. SIHP Site TS-02 piled flume segments located to the south of the concrete facility, view to the north.

Figure 57. SIHP Site TS-02 concrete flume segments with sluice gates (Bulldogs) located to the west of the concrete facility, view to the east.

Figure 58. SIHP Site TS-02 “bulldog” flume segment with an inscribed date of “6-1-60.”

SIHP Site TS-03

Site TS-03 is an 18-meter-long segment of a retaining wall (Figure 59) extending along the northern side of Kealohanui Street to the west of the Waialua Hongwanji Mission property (see Figure 37). The eastern end of the wall, measuring 3.5 meters long and 110 centimeters tall, is built of large coral boulder rubble (Figure 60). Moving westward, the next 4 meters of this wall is a single course of rounded basalt cobbles cemented together and on top of an exposed face of cut coral bedrock reaching a total height of 80 centimeters (Figure 61). The remainder of the wall to the west is constructed of stacked rounded basalt cobbles with occasional concrete pieces all cemented together to heights ranging from 40 to 60 centimeters (Figure 62). The wall segment is in fair condition and currently only retains a roughly 6 meters level area before a 7-meter cut down to the lower quarry area (Figure 53). Prior to the establishment of the quarry, the Waialua Gauken School formerly stood within the area to the north of this wall (see Figure 33).

Figure 59. SIHP Site TS-06 retaining wall, view to the northeast.

Figure 60. SIHP Site TS-06 eastern end of retaining wall, view to the north.

Figure 61. SIHP Site TS-06 central portion of retaining wall, view to the north.

Figure 62. SIHP Site TS-06 western portion of retaining wall, view to the north.

Figure 63. Current retained area north of wall, view to the east.

SIHP Site TS-04

Site TS-04 (Figure 64) is the former property used by the Waialua Pilgrim Church located within the Mill Camp area (see Figure 37). This property has perimeter chain-link fencing, and we identified three features, a basketball court (Feature 1), a double alignment of cut basalt stones (Feature 2), and a concrete edged planter area (Feature 3), the remainder of the property has been cleared of all evidence of former land use (Figure 65). There is currently a modern sewer line inspection box in the northern lawn area (see Figure 64) as multiple sewer lines extend beneath this property. According to the Waialua United Church of Christ website (https://waialuaucc.org/church-history/) the origins of the Waialua Pilgrim Church date back to 1901 with Japanese plantation workers who formed the Waialua Japanese Christian Church. In 1940, this church merged with both the Waialua Caucasian Church and the Waialua Korean Church to form the Waialua Pilgrim Church. In 1956, the Filipino Evangelical Church joined the Waialua Pilgrim Church congregation, and the name was once again changed to the Waialua Church of Christ. This church (Figure 66) remained extant on the property until 1991, although beginning in 1988, the congregation began moving to its new facilities next to Waialua High and Intermediate School.

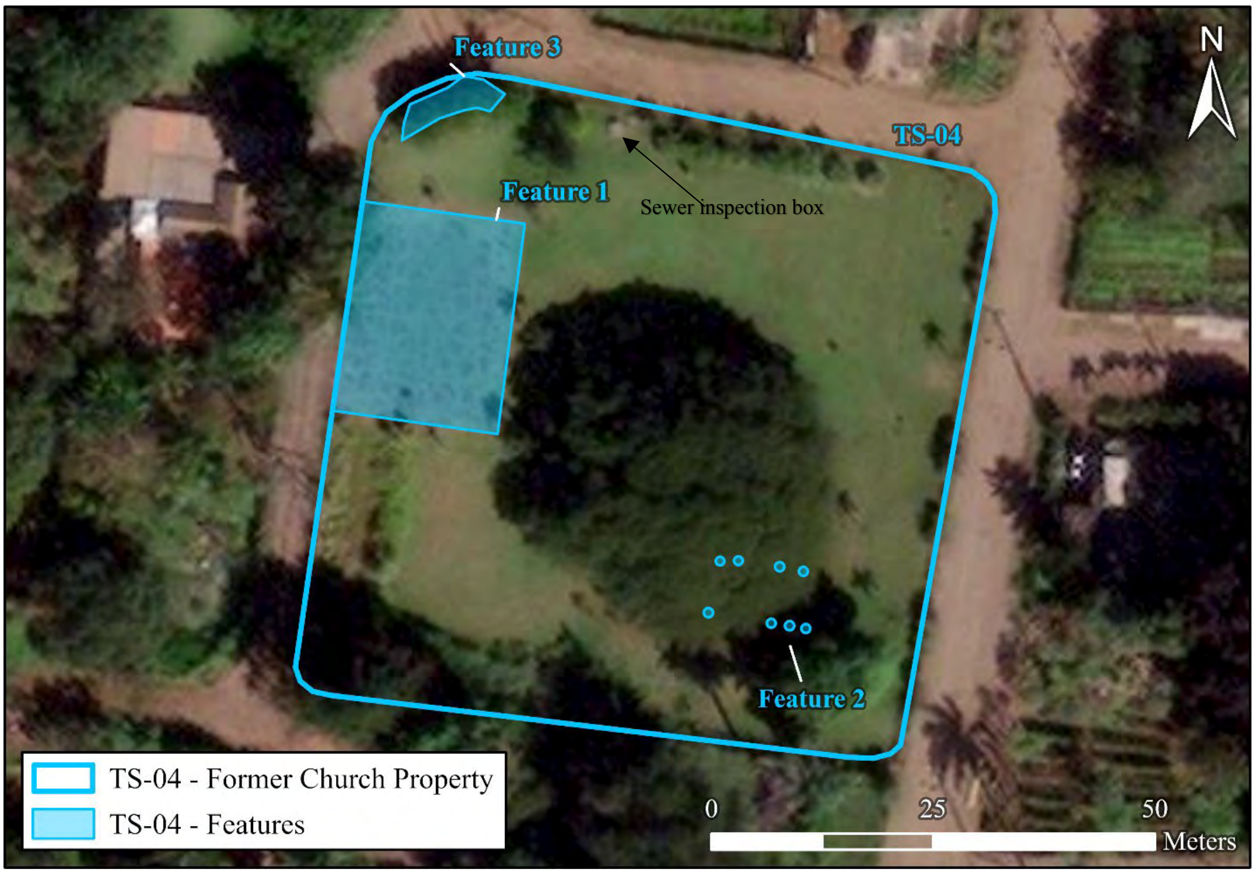

Figure 64. Site TS-04 plan view.

Figure 65. Current cleared condition of the former church property, view to the southeast.

Figure 66. Post 1956 version of the church.

Site TS-04 Feature 1

Along the western side of the property (see Figure 64) is an asphalt-paved basketball court (Figure 67) identified as Feature 1. The fragmented paved area measures 24 meters north/south by 19 meters east/west and is relatively intact. Metal posts and wood backboards are still present and upright at either ends of the court, although the hoops are no longer in position on the backboards. A date of "6-18-72" is inscribed in the concrete base of one of the posts (Figure 68), indicating a potential date of construction for the court.

Figure 67. SIHP Site TS-04 Feature 1, view to the south.

Figure 68. Site TS-04 Feature 1 date (6-18-72) inscribed at base of metal poles.

Site TS-04 Feature 2

Site TS-04 Feature 2 is two parallel alignments of dressed basalt stones (Figure 69) located within the southeastern portion of the fenced property (see Figure 64). Oriented east/west, the alignments are spaced 5 meters apart. There are four stones visible in each alignment and the individual stones are flat and flush with the ground surface (Figures 70 and 71). The stones range in size from 50 x 30 centimeters to 30 x 20 centimeters. Given its location within the property, this feature is interpreted as a foundational element associated with the former outbuilding.

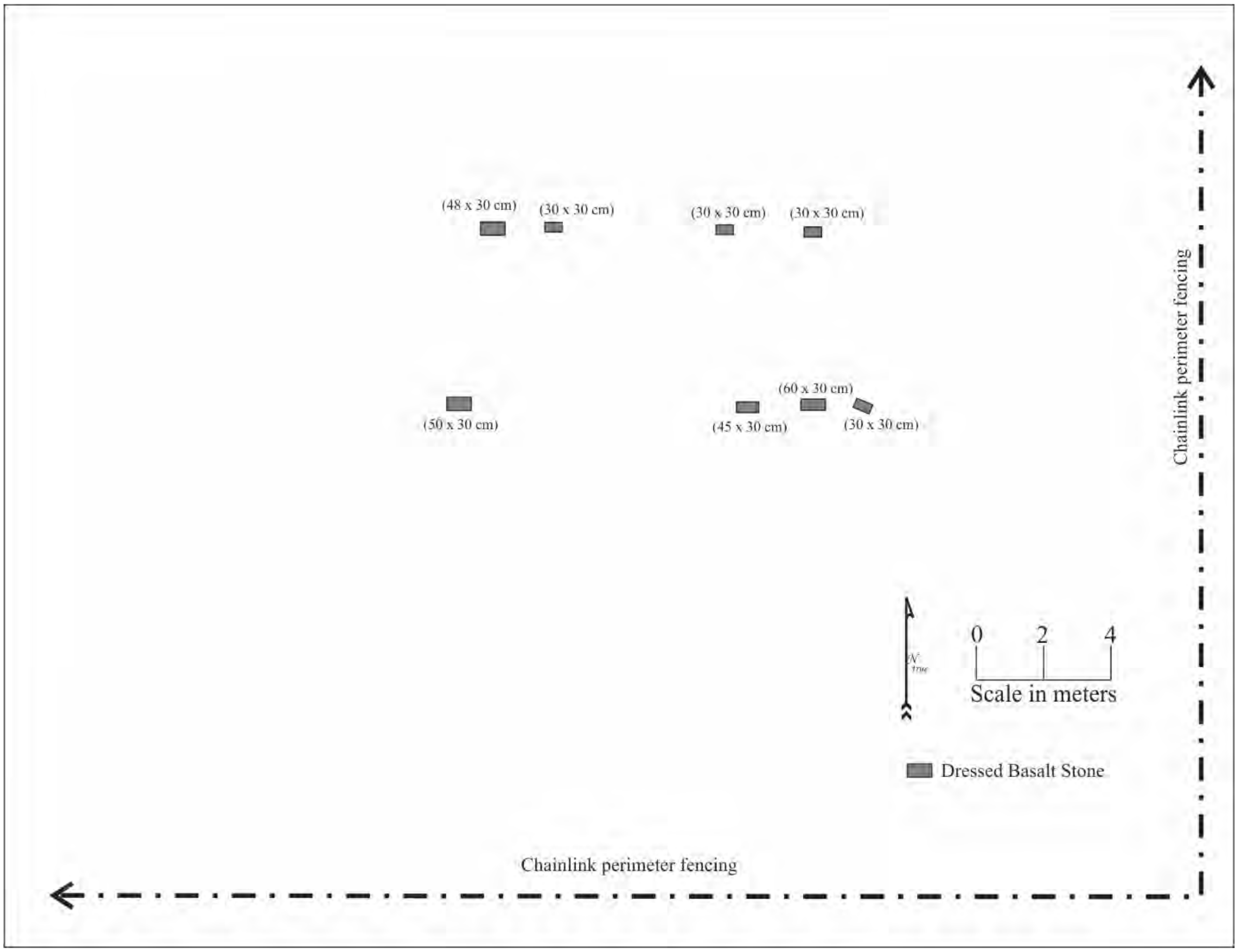

Figure 69. TS-04 Feature 2 plan view.

Figure 70. TS-04 Feature 2 southern alignment, view to the west.

Figure 71. TS-04 Feature 2 northern alignment, view to the east.

Site TS-04 Feature 3

Site TS-04 Feature 3 is an irregularly shaped planter area (Figure 72) located in the northwestern corner of the fenced property (see Figure 64). This area contains areca palms (*Dypsis lutescens*) and is bordered by uniform width concrete fragments set on end (Figure 73) to form the perimeter of the planter. Overall, the area measures roughly 12.8 meters long by a maximum of 3.9 meter wide.

Figure 72. TS-04 Feature 3 planter, view to the northeast.

Figure 73. TS-04 Feature 3 detail, view to the north.

SIHP Site TS-05

Site TS-05 is identified here as a potential historic district situated in the north-central portion of the study area (see Figure 37) and includes the currently extant portions of Waialua Mill Camps 8, 9, and 10. Within the three camps there are currently 59 houses. There is an additional building that was originally the camp store but is now used for agricultural processing purposes. This building (Figures 74 and 75) has been substantially altered and does not resemble its former style, size, or configuration.

Figure 74. Front elevation of former camp store building (now completely renovated), view to the southeast.

Figure 75. Side elevation of new construction attached to former camp store building, view to the northeast.

Originally, within these three camps there were at least 163 houses consisting of single-family residences on formally undivided lots. A variety of tropical plantings, including mature trees, are currently seen throughout the neighborhood. Houses are set on an irregular grid of unpaved roads with no curbs. The majority of the roads run east/west between Puuki Street to the west and Hopemanu Street to the east and northeast. The residential areas were established to the west of the primary mill facilities (Figure 76).

Figure 76. 1946 photograph of the Sugar Mill and a portion of Mill Camp 9 (on file at the Hawai‘i State Archives).

Hawai‘i Administrative Rules (HAR §13-198) defines “District” as “a geographically definable area, urban or rural, possessing a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united by past events or aesthetically by plan or physical development.” Given this definition, there is clearly a geographically definable area within the current study property that potentially qualifies as a historic district, the Waialua Mill Residential Camp area, which is a concentration of houses united in their historical and physical development. A potential period of significance was established based on the history of the development of the Waialua Mill as presented in an earlier section of this report. The period would begin by 1901 when the first camp residences are identified on a map (see Figure 28) and end in 1973 (50 years ago), although the Waialua Mill closed operations in 1996.

A photograph labeled ‘Waialua Mill Camp 1925’ (Figure 77) shows a row of residences that look newly constructed. It appears that there are eleven house in this row, which seems to match a row of eleven houses shown on the 1960 USGS topographic map (see Figure 33). If this correlation is correct, then these houses were removed, along with all of the houses that were built prior to 1913 (see Figures 28 and 29), from the area that was turned into a sand quarry by 1980 (see Figure 34). The houses that remain today are identified as being within Camps 8, 9, and 10 on an ALTA surveyors map (Figure 78) that was prepared in the 1990s for then planned infrastructural improvements to currently occupied houses. This map shows 57 houses present and our field reconnaissance of the property identified an additional 2 houses that were abandoned and in an unlivable state of disrepair (Figures 79 and 80), for a total of 59 houses currently extant out of the original minimally 163 houses. As can be seen in a 2022 aerial image (Figure 81) of the camp area, not only are a majority of the houses no longer extant, those that remain have undergone significant alteration as is observable by the many roof additions now present.

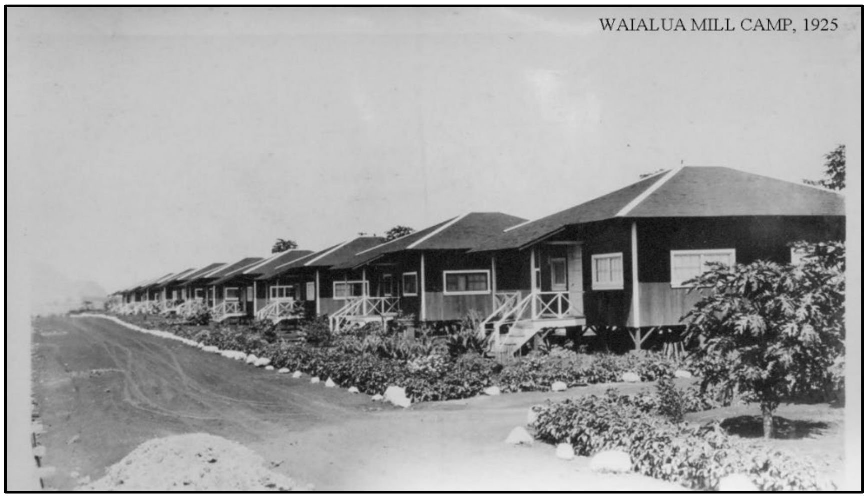

Figure 77. Waialua Mill Camp, 1925 (Mill Camp Development Group 2022).

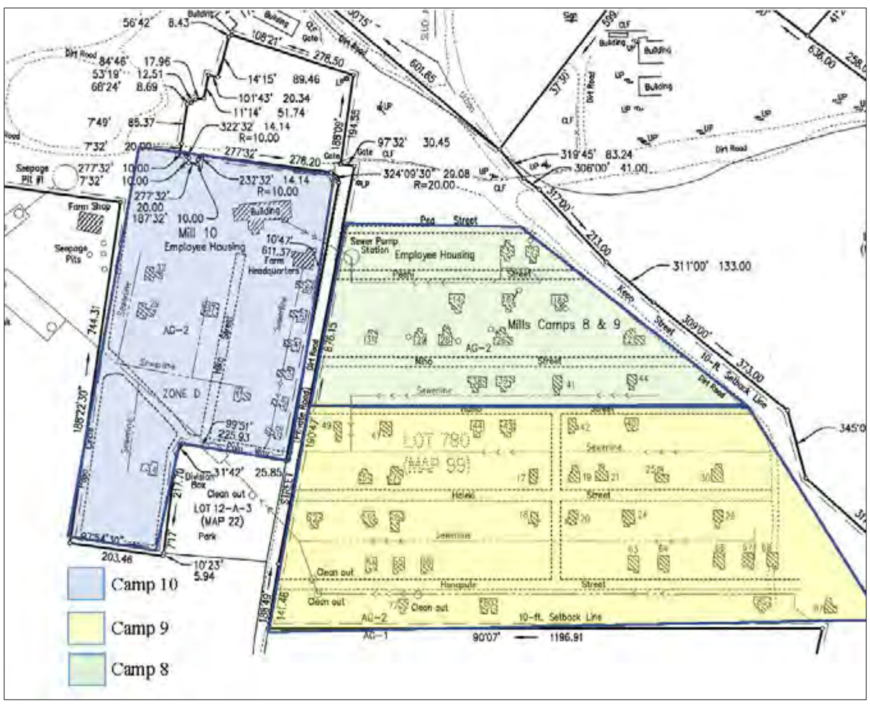

Figure 78. Portion of a 1990s ALTA map showing sewer connections for then inhabited residences. Note the “Farm Headquarters” building in Camp 10 is no longer extant and the other “building” (former camp store) has been greatly altered.

Figure 79. Uninhabitable residence on the north side of Hanapule Street.

Figure 80. Uninhabitable residence on the south side of Hanapule Street.

Figure 81. 2022 aerial image of Camps 8, 9, and 10 showing multiple roof additions indicating multiple alterations to the remaining residential structures.

Given that a sizeable section of the original camp housing was removed by 1980 (compare Figures 33 and 34), and of the remaining camp housing area, identified on Figure 78 as Camps 8, 9, and 10, only an estimated 36% of the houses that were once present in these camps are extant today, and of these, at least 5 have been deemed uninhabitable and most have been significantly altered, it is our conclusion that the Waialua Mill Camp Housing area is not sufficiently intact to constitute a significant historic district. Given this conclusion, and in accordance with Act 224 (signed into law July 10, 2015), the single-family residences within the study area were not subject to individual assessment as part of the current study.

5. SIGNIFICANCE EVALUATIONS AND TREATMENT RECOMMENDATIONS

The recorded historic properties are assessed for their significance based on criteria established and promoted by the Department of Land and Natural Resources-State Historic Preservation Division (SHPD) and contained in the Hawaiʻi Administrative Rules 13§13-284-6. For a resource to be considered significant it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

a Be associated with events that have made an important contribution to the broad patterns of our history;

b Be associated with the lives of persons important in our past;

c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

d Have yielded, or is likely to yield, information important for research on prehistory or history;

e Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

As a result of the current study, four historic properties, all dating from the twentieth century and relating to former plantation activities, were identified in the study area (Table 6). A fifth potential historic property, the Waialua Mill Camp Historic District, was also identified but as discussed above, determined not to constitute a significant historic district.

Table 6. Site significance and treatment recommendations.

SIHP Site #	*Site Type*	*Temporal Affiliation*	*Significance*	*Recommended Treatment*
TS-01	Irrigation Ditch	20th Century	d	No further work
TS-02	Concrete Plant	20th Century	a	No further work
TS-03	Retaining Wall	20th Century	d	No further work
TS-04	Former Church Property	20th Century	d	No further work
TS-05	Plantation Camp	20th Century	N/A	No further work

SIHP SITE TS-01

Site TS-01 is an irrigation ditch, which appears to still be used periodically. Two abandoned possible irrigation ditches in very poor condition were also recorded. This irrigation ditch retains sufficient integrity to convey its significance under Criterion d for information it has yielded relative to middle/late twentieth century plantation irrigation practices. As the research potential for this site has been exhausted as a result of the site documentation carried out in this study, no further historic preservation work is the recommended treatment.

SIHP SITE TS-02

Site TS-02 is the remains of the former Waialua Agricultural Company Concrete Products Plant that manufactured, among other things, the segmented Waialua Flumes that gained widespread popularity and use in the mid-twentieth century. Roughly one third of the original structure has collapsed and been removed and what remains of the concrete plant structure is only standing as a result of significant non-compatible structural additions. The innovation and use of what became to be known as "Waialua Flumes" undoubtedly contributed to broad patterns of history at a state-wide level. The poor condition and non-compatible additions to the concrete plant have compromised the integrity of design, materials, and workmanship. Additionally, the concrete plant was just one component of the industrial infrastructure connected to flume construction. The concrete plant is currently surrounded on all sides by vacant land and, thus, no longer retains integrity of setting, feeling, and association that would have once characterized an active sugar mill. The concrete plant does retain integrity of location and is considered significant under Criterion a only. As the history of the invention, use, and distribution of Waialua Flumes has been documented by others (Dorrance and Morgan 2000; Wilcox 1996) and elaborated on in the current study, no further historic preservation work is recommended for this site.

SIHP SITE TS-03

Site TS-03 is a low (two to three course high) retaining wall, that was perhaps once associated with the former Waialua Gakuen School property. This wall retains several aspects (location, design, materials, and workmanship) of integrity, and by virtue of its identification and documentation as a result of the current study, is considered significant under Criterion d for information it has yielded relative to twentieth century land use practices. As this retaining wall was fully documented as a result of the current study, no further historic preservation work is recommended.

SIHP SITE TS-04

Site TS-04 is three features of the former Waialua Pilgrim Church/Waialua Church of Christ property. While the church building was removed in the early 1990s, the three remaining 20th century features, while individually insignificant, collectively are significant under Criterion d by virtue of their identification and documentation as a result of the current study. As these features were fully documented, no further historic preservation work is recommended.

SIHP SITE TS-05

The current study found that the extant Waialua Mill Camp area was not sufficiently intact to constitute a significant historic district.

6. DETERMINATION OF EFFECT

Given the above findings, analyses, and discussion with respect to historic properties identified in this study, the HRS Chapter 6E-42 effects determination for the proposed Waialua Mill Camp Restoration project is *no historic property affected*. Therefore, no further historic preservation work is recommended. However, in the unlikely event that archaeological resources are encountered during the implementation of the Waialua Mill Camp Housing Project, work in the immediate area of the discovery should be halted and SHPD contacted pursuant to HAR §13-280-3.

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Cultural Impact Assessment for the Waialua Mill Camp Restoration

TMK: (1) 6-7-001: 030, 058, 077

Kamananui Ahupuaʻa
Waialua District
Island of Oʻahu

DRAFT VERSION

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ASM Project Number 41900.01

Cultural Impact Assessment for the Proposed Infrastructure Improvements in the Waialua Mill Camp

TMK: (1) 6-7-001: 030, 058, 077

Kamananui Ahupuaʻa
Waialua District
Island of Oʻahu

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CHAPTERS

FIGURES

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TABLES

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1. INTRODUCTION

At the request of the Mill Camp Development Group, LLC, ASM Affiliates (ASM) prepared this Cultural Impact Assessment (CIA) to inform an Environmental Assessment (EA) being prepared for the proposed Waialua Mill Camp Restoration in Waialua, Kamananui Ahupuaʻa, Waialua District, Island of Oʻahu. The study area for this project consists of a roughly 75 acre property (TMKs: [1] 6-7-001: 030, 058, 077) including a roadway (Parcel 058), a former church lot (Parcel 030) and portions of the former Waialua Sugar Company and Mill Camp (Parcel :077) (Figures 1 through 3).The Mill Camp Development Group in partnership with Hawaii Assisted Housing, Inc. (HAHI), Mark Development, Inc., and North Shore Community Consultants, LLC, is proposing to construct 368 affordable homes, parking areas, community spaces, new roadways, new wastewater treatment improvements, and an updated water supply for the families residing within the footprint of the extant mill camp. The proposed project aims to address the critical shortage of affordable housing in the north shore area.

This CIA, which is intended to inform an EA conducted in compliance with HRS Chapter 343, is being prepared pursuant to Act 50 and in accordance with the Environmental Review Program's (formerly the Office of Environmental Quality Control [OEQC]) *Guidelines for Assessing Cultural Impacts*, adopted by the Environmental Council, State of Hawaiʻi, on November 19, 1997 (OEQC 1997). 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, specifically acknowledges the State's responsibility to protect native Hawaiian cultural practices. Act 50 further states that environmental studies ". . . should identify and address effects on Hawaii's culture, and traditional and customary rights" and that "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."

The current report is divided into four main chapters. Chapter 1, the introduction, includes an overview of the proposed restoration project as well as a physical description of the project area. To provide a cultural context of the project area, Chapter 2 includes cultural-historical background information specific to the project area and the broader geographical region of Kamananui Ahupuaʻa and the greater Waialua District. This chapter also includes a summary of prior archaeological and cultural studies that have been conducted within and near the project area. The methods and results of the consultation process are then presented in Chapter 3. Lastly, Chapter 4 includes a discussion of potential cultural impacts as well as actions and strategies that may help to mitigate any identified impacts.

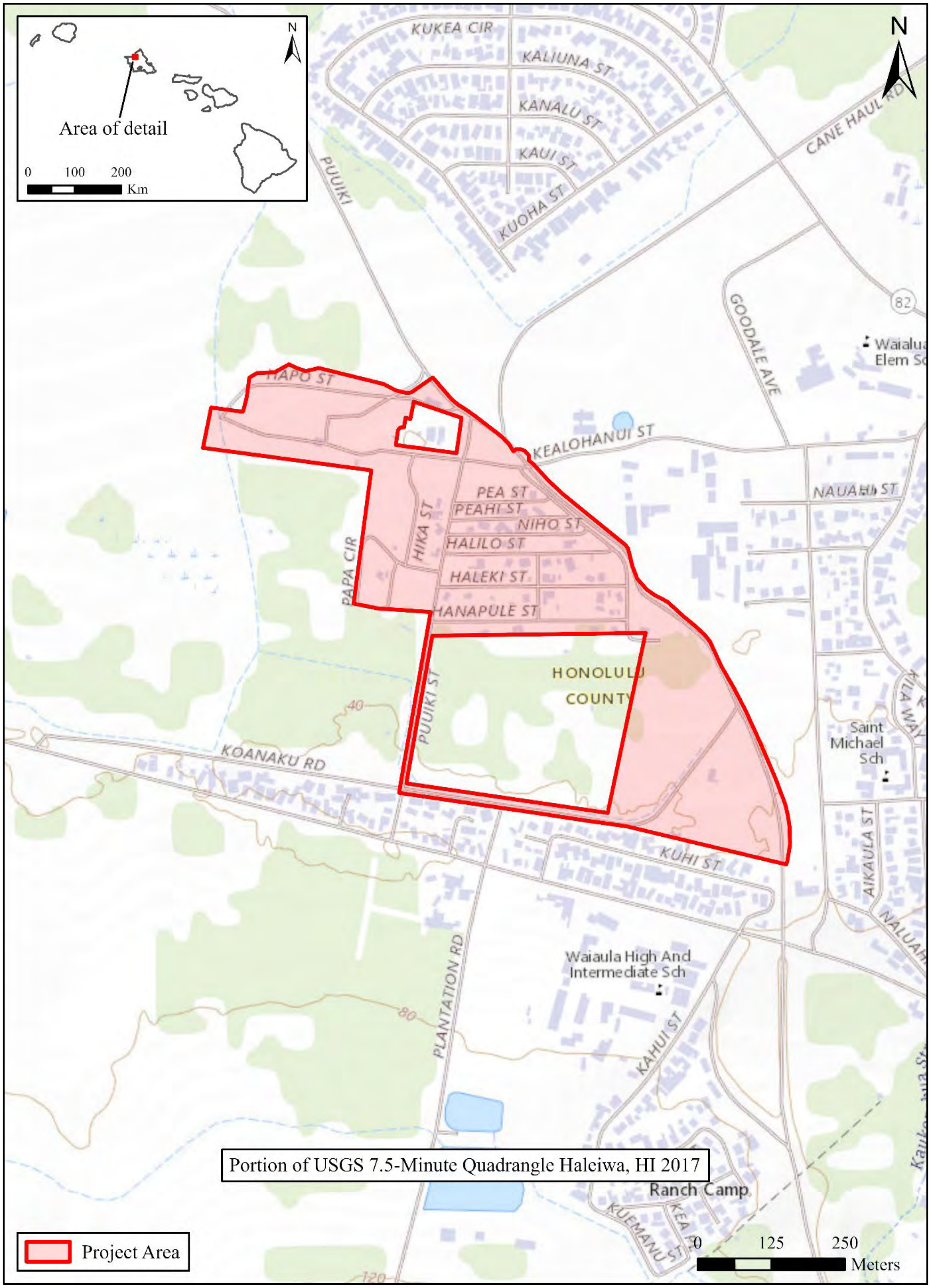


Figure 1. Project area location.

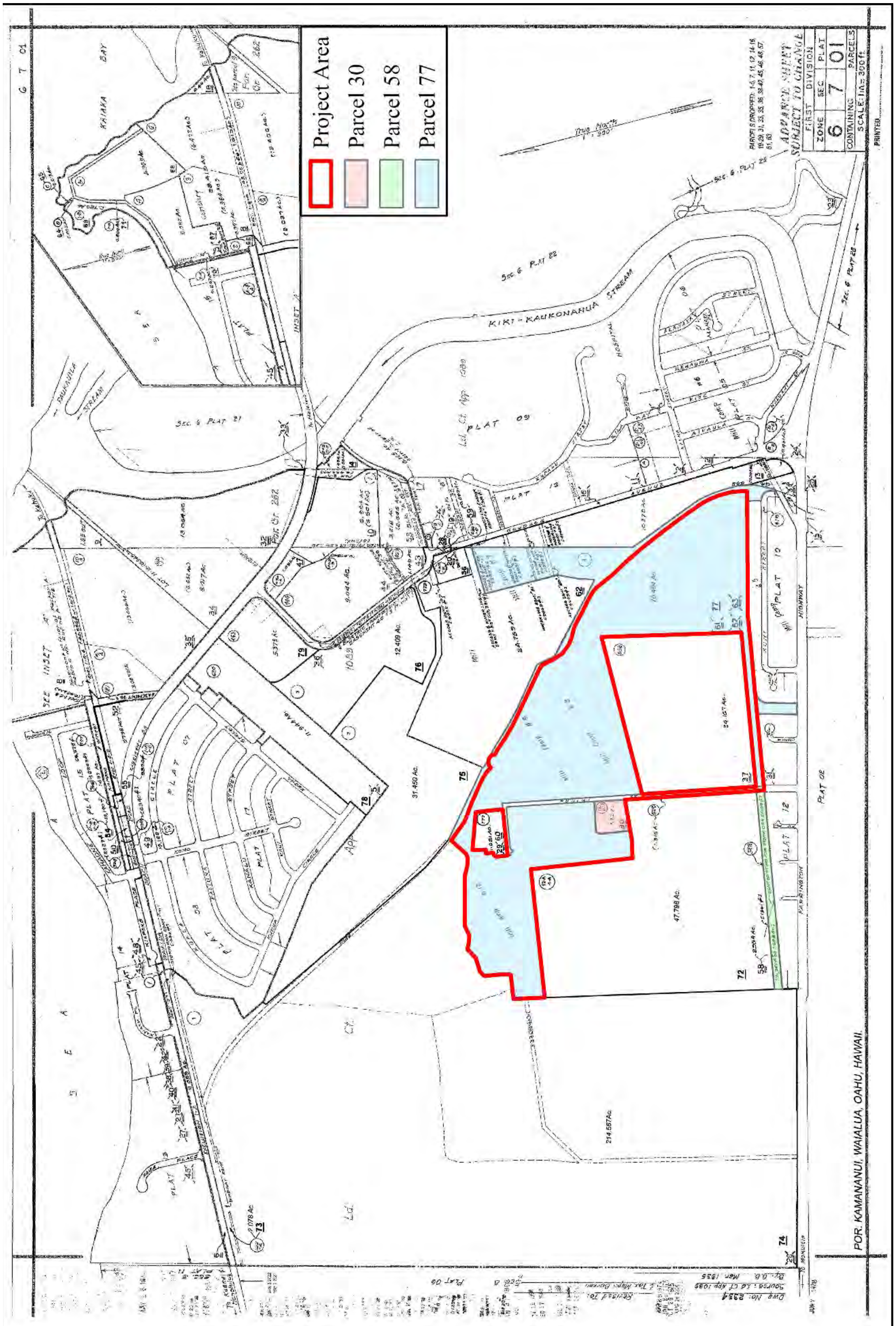


Figure 2. Plat map for Tax Map Key (1) 6-7-001 showing project area located within portion of parcels 030, 058, and 077.

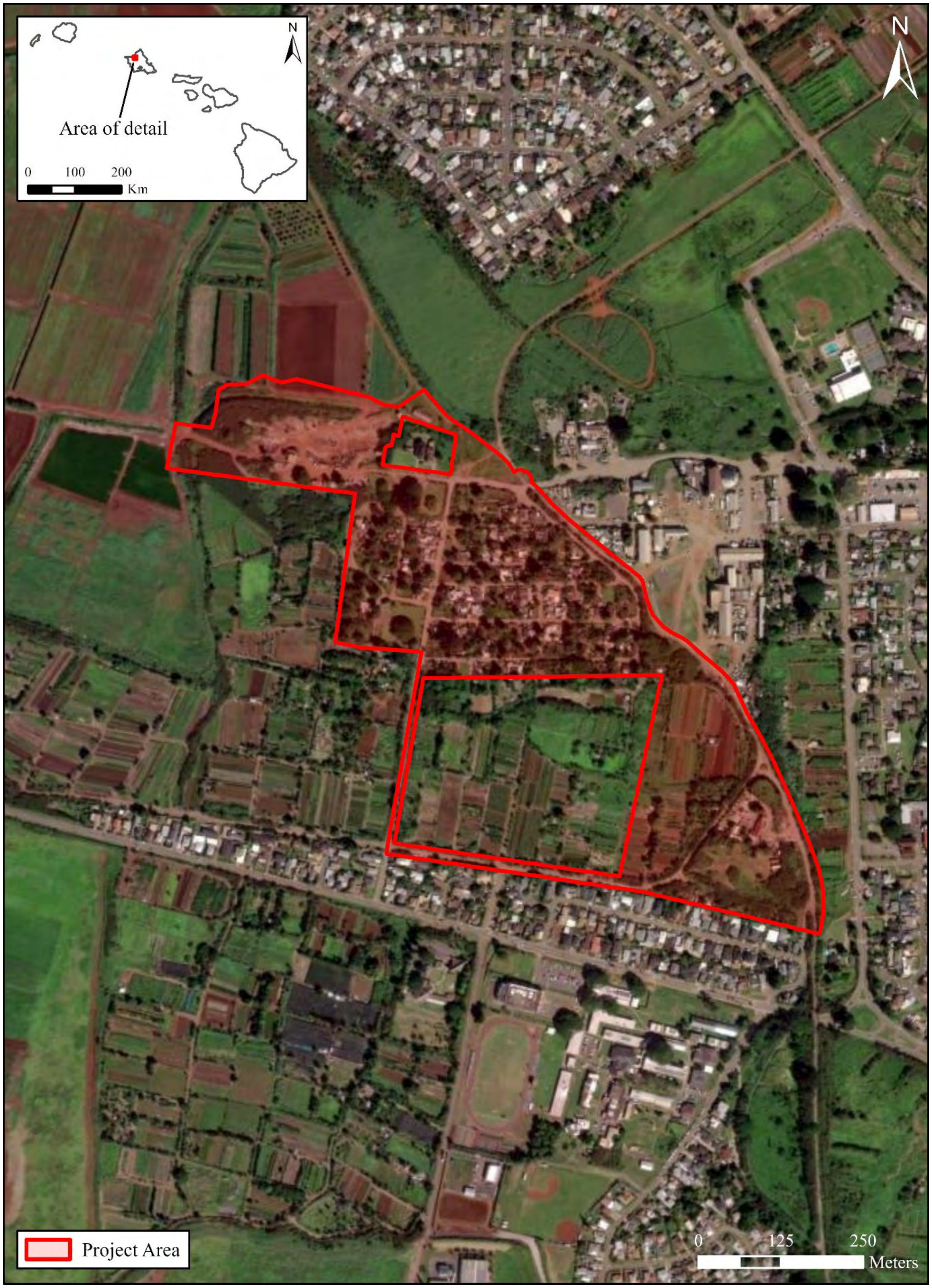


Figure 3. Aerial satellite imagery showing project area location.

PROJECT AREA DESCRIPTION

The current study area is located on the north shore of O‘ahu within the western portion of Waialua Town on the flat coastal plain of Kamananui Ahupua‘a, Waialua District, Island of O‘ahu. The approximately 75-acre project area is situated to the south and west of the former Waialua Sugar Mill and is comprised by portions of three parcels, TMKs: (1) 6-7-001:030, 058, 077 (see Figure 2). Parcel 077 includes portions of the former Waialua Sugar Mill and Mill Camp and is bounded by Hapo Street and Puuiki Street to the north, Puuiki Street and Papa Circle to the west, Hopemanu Street and Cane Haul Road to the east and Hanapule Street and Koanaku Road to the south. Parcel 058 includes a segment of Puuiki Street. Finally, Parcel 030 is a former church lot within the former Mill Camp.

The geology underlying the majority of the project area is formed of alluvium, labeled ‘Qa’ (Figure 4). The southeast portion of the project area is older alluvium originated from the Pleistocene and Pliocene epochs, labeled ‘QTao’. The northwest portion of the project area contains older dune deposits from the Holocene and Pleistocene epochs and calcareous reef rock/marine sediment from the Pleistocene epoch, labeled as ‘Qdo’ and ‘Qcrs’ (Figure 4; Sherrod et al. 2007; Wolfe and Morris 1996). The soils that overly the geology in much of the project area include Mamala cobbly silty clay loam on 0 to 12 percent slope and Waialua silty clay on 0 to 3 percent slopes, labeled ‘MnC’ and ‘WkA’. WkA is a deep, moderately well drained alluvial soil often utilized for irrigated sugarcane, while MnC is a very deep, well-drained soil that developed from the underlying substrata and is often used for pasture or the cultivation of macadamia nut, papaya, citrus, and guava. Additionally, there are small pockets of Waipahu silty clay on 0 to 2 percent slope (WzA) and Fill land (Fd) in the northern and southern portions of the project area, respectively (Figure 5; Foote et al. 1972; Soil Survey Staff 2022).

The climate within the project area is subtropical and windy year-round. The climate is relatively warm with a mean annual temperature ranging from 67° Fahrenheit during the winter months to 95° during the summer months (Giambelluca et al. 2014). The mean annual rainfall in this area is 783.8-millimeters (30.86 inches) with most rainfall occurring between October and March (Giambelluca et al. 2013). Precipitation within the extent of the project area varies according to elevation with the western end receiving more rainfall than the eastern end. Rainfall averages between approximately 21.3-120.6 millimeters (0.8 – 4.7 inches) throughout the project area (Giambelluca et al. 2014).

Vegetation within the project area varies between a wide range of ornamental and cultivated species within maintained portions of the property (Figure 6), and secondary growth consisting largely of grasses, *koa haole* (*Leucaena leucocephala*) and *kiawe* (*Prosopis pallida*) where the land has not been maintained (Figure 7). The southeastern portion of the project area is under active agricultural cultivation and ground surface visibility is excellent (Figure 8). Modern land disturbance, including extensive previous grading and quarrying, is evident throughout most of the project area (Figure 13). Modern rubbish is frequently present, including discarded shade cloth, metal debris, abandoned machinery, and fencing materials (Figure 10). Most of the roads throughout the project area are unpaved and the few paved roads are heavily degraded, resulting in potholes and uneven surfaces (Figure 11). The remnants of a former sand and coral mine occupies the northwest portion of the project area, effectively encompassed by the geological footprint of the older dune deposits (Figure 12). Prior to the mine installation, this area was occupied by mill camp housing. To the east of the mine and outside of the project area is the Waialua Hongwanji Mission, an active Buddhist temple (Figure 13).

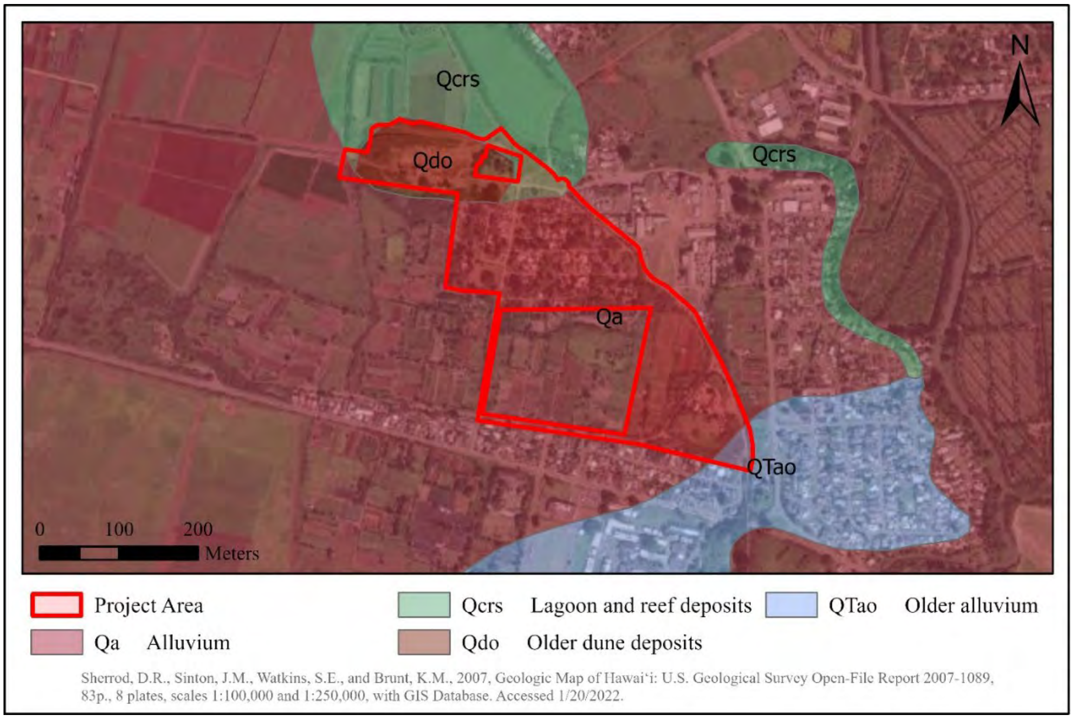


Figure 4. Geological units in the current project area (Sherrod et al. 2007).

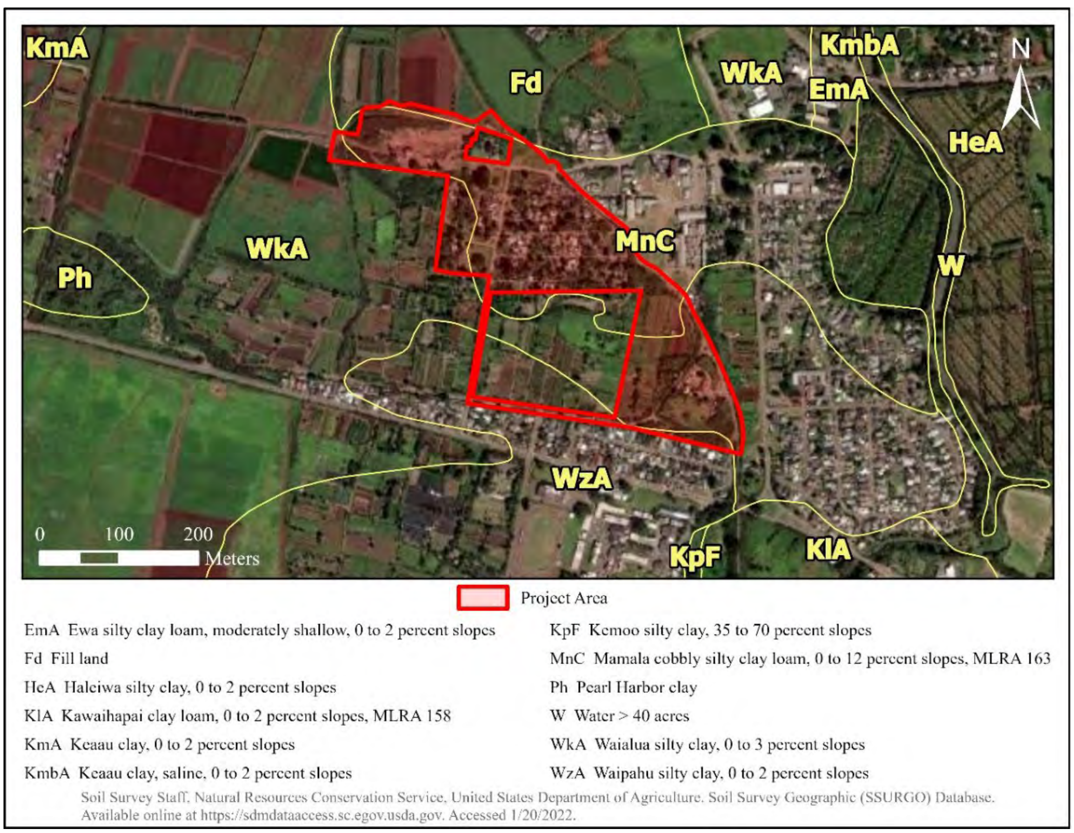


Figure 5. Soils within the project area (Soil Survey Staff 2019).

Figure 6 Typical vegetation at a house lot, view to the north.

Figure 7. Grasses and koa haole in northeastern portions of the project area, view to the west.

Figure 8. Overview of cultivated land in the project area, view to the south.

Figure 9. Evidence of previous grading, view to the west.

Figure 10. Example of previous ground disturbance and discarded debris near cement plant, view to the west.

Figure 11. Southwestern region of the project area along Puuiki Street, view to the south.

Figure 12. Location of the sand quarry, view to the west.

Figure 13. Waialua Hongwanji Mission is situated outside of the project area, view to the north.

2. BACKGROUND

As specified in the OEQC *Guidelines for Assessing Cultural Impacts* (OEQC 1997:1),"…the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment." For this CIA, the *ahupuaʻa* of Kamananui is considered the 'study area', while the location of the proposed development activities is referred to as the 'project area'.

To generate a set of expectations regarding the nature of cultural resources and customary practices that might be encountered within the current project area and to establish a context within which to assess the significance of such resources, the background section begins with a general culture-historical context. This is followed by culture-historical background information concerning the history of Kamananui Ahupuaʻa. Following this background section is a discussion of relevant prior archaeological and cultural studies that have been conducted within and in the immediate vicinity of the project area.

RESEARCH METHODS

The culture-historical context and summary of previously conducted archaeological and cultural research presented below are based on research conducted by ASM Affiliates at various physical and digital repositories. Primary English language and Hawaiian language resources were found at multiple state agencies, including the State Historic Preservation Division, Hawaiʻi State Archives, and the Department of Accounting and General Services Land Survey Division. Digital collections provided through the Office of Hawaiian Affairs Papakilo and Kīpuka databases, Waihona ʻĀina, the Ulukau Hawaiian Electronic Library, and Newspapers.com. Lastly, secondary resources curated at ASM Affiliates' Honolulu office offer general information regarding the history of land use, politics, and culture change in Hawaiʻi, enhancing the broad sampling of source materials cited throughout this CIA.

CULTURE-HISTORICAL CONTEXT

The chronological summary presented below begins with the settlement of the Hawaiian Islands and includes a presentation of a generalized model of Hawaiian prehistory followed by a discussion of general settlement and historical patterns in Kamananui Ahupuaʻa and the greater Waialua District. The discussion shifts to a summary of historical events beginning with the arrival of foreigners in the islands and continues with the history of land use within the Waialua District. The summary includes a discussion of changing lifeways, a review of land tenure during the *Māhele ʻĀina* of 1848, and the subsequent transition into plantation life, military presence, and commercial agriculture.

A Generalized Model of Hawaiian Prehistory

While the question of the timing of the first settlement of Hawaiʻi by Polynesians remains unanswered, several theories have been offered that derive from various sources of information (i.e., genealogical, oral-historical, mythological, radiometric). However, none of these theories is today universally accepted because there is no archaeological evidence to support the proposed timing for the initial settlement, or colonization stage of island occupation. More recently, with advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have convincingly argued that Polynesians arrived much later in the Hawaiian Islands, sometime between A.D. 1000 and A.D. 1200 and expanded rapidly thereafter (c.f., Kirch 2011).

The initial settlement in Hawaiʻi is believed to have originated from the southern Marquesas Islands (Emory in Tatar 1982). During these early times, Hawaiʻi's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy and Handy 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* (taboo) system of law and order; cities of refuge; the *ʻaumakua* (family or person gods) concept; and the concept of *mana* (divine power).

The earliest inhabitants of the region emphasized the use of natural caves and overhangs, along with the construction of small, simple surface features for habitation purposes, but as populations increased and expanded, so did the occurrence of more permanent habitation structures in both the coastal and upland areas (Jensen 1994). A network of coastal and inland trails, over which the exchange of goods occurred, connected the coastal and upland population centers and resource areas (Hommon 1976). Over a period of a few centuries, the areas with the richest natural resources became populated and perhaps even crowded, and there was increasing separation of the chiefly class from the common people. As populations increased so did societal conflict, which resulted in 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 next period reflect an evolution of the traditional tools and 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. 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* (ivory pendant necklace). The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). As the 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. During this expansion period, additional migrations to Hawai‘i occurred from Tahiti in the Society Islands. Rosendahl (1972) has proposed that settlement at this time was related to the 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* (mountain-sea) settlements expanded to accommodate the exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua‘a* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society. The implications of this model include a shift in residential patterns from seasonal, temporary occupation to the permanent dispersed occupation of both coastal and upland areas.

The *ahupua‘a* became the equivalent of a local community, with its own social, economic, and political significance, which added another component to a then well-stratified society. *Ahupua‘a* were ruled by *ali‘i ‘ai ahupua‘a* or chiefs who controlled the *ahupua‘a* resources, who, for the most part, had complete autonomy over this generally economically self-supporting piece of land. *Ahupua‘a* lands were in turn, managed by an appointed *konohiki* or lesser chief-landlord. The *ali‘i-‘ai-ahupua‘a*, in turn, answered to an *ali‘i ‘ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua‘a* resources supported not only the *maka‘āinana* (commoners) and *‘ohana* (families) who lived on the land but also contributed to the support of the royal community of regional and/or island kingdoms. *Ahupua‘a* are land divisions that typically incorporated 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). Although the *ahupua‘a* land division typically incorporated all of the eco-zones, their size and shape varied greatly. This form of district subdividing was integral to Hawaiian life and was the product of resource management planning that was strictly adhered to. In this system, the land provided fruits and vegetables and some meat for the diet, and the ocean provided a wealth of protein resources (Rechtman and Maly 2003). In communities with long-term royal residents, divisions of labor (with specialists in various occupations on land and in the procurement of marine resources) were also strictly enforced.

Kamananui Ahupua‘a and the Greater Waialua District

The current project area falls within Kamananui Ahupua‘a in the traditional district or *moku* of Waialua, located in the northwestern portion of O‘ahu. Kamananui extends from the western side of the Ko‘olau Mountains and terminates at the coast near Kaiaka Bay, incorporating the lower slopes of the Wai‘anae range. The literal translation of Kamananui is “the large branch” and likely refers to the north fork of Kaukonahoa Stream (Pukui et al. 1974:80). According to Sahlins(1992), Waialua comprised six traditional *ahupua‘a* from west to east as follows: Ka‘ena, Kawaihāpai, Mokulēi‘a, Kamananui, Pa‘ala‘a, and Kawailoa. However, some historical and modern maps and sources list as many as fourteen *ahupua‘a* within Waialua District. Sahlins also states that *moku* characteristically comprised rich and centrally located lands with ecologically marginal lands along their periphery. The fertile lands of neighboring *ahupua‘a* of Kamananui, Pa‘ala‘a, and Kawailoa comprised the ecological center of Waialua Moku, which is eloquently described by Sahlins:

> Geographically this heartland of Waialua consisted of the area around the neighboring bays—they are about a mile apart—of Kaiaka and Waialua. Into these bays, from their origins in narrow gorges deep in the mountains flowed four major streams. Dense settlements of people and large complexes of irrigated taro fields were situated on the floodplains of these streams. At Kamananui, the lowland fields were watered by means of a ditch some two miles long, the longest such waterway on O‘ahu

> (McAllister 1933:133; Handy and Handy 1972:466). Irrigation on a smaller scale extended for a considerable distance up the river valleys, while rainfall agriculture was practiced on the adjoining slopes, upland plains (*kula*), and forest clearings in the higher gulches. Around Waialua Bay were two large and famous brackish water fish ponds ‘Uko‘a and Lokoea. Fish were also raised in the many smaller ponds of the same area as well as in taro pondfields (*lo‘i*). Given such intensive production, the core region must have supported the substantial majority of the Waialua population, which was probably on the order of 6,000 to 8,000 people just before the coming of the Haole. (Sahlins 1992:20)

Regarding the naming of Waialua Moku, Thrum published the following information in the *Hawaiian Almanac and Annual for 1902*:

> Waialua district, Oahu, is said by natives to take its name from a loi (taro patch) situate [sic] near the former Halstead residence, and not from its twin streams as is generally supposed; the natural definition of the name being two waters. It was an ancient saying of the people that if one visited and traveled through the district and did not see this identical loi, he had not seen Waialua.(Thrum 1901:8)

The oral tradition of Hawai‘i is perhaps best preserved through *‘ōlelo no‘eau* or proverbs, which have been passed down throughout the generations. The following *‘ōlelo no‘eau* illustrate the character of the greater Waialua Moku as they were interpreted and published in *‘Ōlelo No‘eau, Hawaiian Proverbs & Poetical Sayings* by Mary Kawena Pūku‘i (1983):

> *I Waialua ka po‘ina a ke kai, o ka leo ka ‘Ewa e ho‘olono nei.*
>
> The dashing of the waves is at Waialua but the sound is being heard at ‘Ewa.
>
> Sounds of fighting in one locality are quickly heard in another. (Pukui 1983:137)

> *Like no Ka‘ena me Waialua.*
>
> Ka‘ena and Waialua are one.
>
> Ka‘ena Point is in Waialua. Similar to the saying, “Six of one and half a dozen of the other.” (Pukui 1983:215)

According to Hawaiian historian Samuel Kamakau, Kapawa established his rule at Waialua and became the first ruling chief in Hawai‘i (Kamakau 1964:3). Kamakau further states that Kapawa was born at Kūkaniloko, the sacred birthplace built by his father, Nanakāoko, and mother, Kahihiokalani, both of whom were descendants of the famed ‘Ulu line of chiefs (Kamakau 1991). The distinction and privileges conferred upon the *ali‘i* born at Kūkaniloko were so sought after that, as Fornander (1880) notes, despite the decayed state of the sacred site in the late 18th-century, Kamehameha I had wanted Liholiho to be born at the birthing stones. However, Keōpuolani was unable to travel there for their son’s birth due to illness.

Many distinguished *ali‘i* were born at Kūkaniloko, including Mā‘ilikūkahi, Kalanimanuia (also recorded as Kalaimanuia), and Kākuhihewa, all of whom are celebrated O‘ahu chiefs and noted for their deeds and efforts in establishing traditions that ultimately shaped different aspects of Precontact Hawaiian culture (Kamakau 1991:39). In relating information about the life and accomplishments of Mā‘ilikūkahi, Kamakau (1991:53) explains that:

> Pua‘a-a-Kahuoi was the father and Nononui the mother of Mā‘ili-kūkahi. He was born at Kūkaniloko and was named the ali‘i kapu for the land because of his dedication by the chiefs and priest and people; he had been vowed as such before the gods and had been anointed by the kahuna. Chiefs born at Kūkaniloko were the akua of the land and were ali‘i kapu as well.

Kamakau (1991) goes on to add that at about the age of twenty, Mā‘ilikūkahi was chosen as the *mō‘ī ho‘oponopono o ke aupuni* (administrator of the government), and after a rebellion, he replaced the *mō‘ī ali‘i* (head chief) Haka, whose reign is characterized by his mistreatment of the chiefs and people. At the age of twenty-nine, Mā‘ilikūkahi became *mō‘ī ali‘i*, where he was taken to the *heiau* (place of worship) of Kapukapuākea in Pa‘ala‘a-kai in Waialua and consecrated and proclaimed as the *ali‘i o ka moku* (chief of the island). Unlike other chiefs who took their kingdoms by force, the ceremonies conducted at Kapukapuākea for Mā‘ilikūkahi were reserved for the “chiefs of Pōkano” or those chiefs who had maintained an absolutely pure royal bloodline since ancient times (Pukui in Kamakau 1991:54). Mā‘ilikūkahi then moved O‘ahu’s royal center from Waialua and ‘Ewa to Waikīkī in Honolulu. Another important hallmark of Mā‘ilikūkahi’s reign was his formalization of the land division system on O‘ahu—a system that appears to have been later implemented on the other islands. Kamakau (1991:54-55) writes:

> When the kingdom passed to Māʻili-kūkahi, the land divisions were in a state of confusion; the *ahupuaʻa*, the *kū* [*ʻili kūpono*], the *ʻili ʻāina*, the *moʻo ʻāina*, the *paukū ʻāina*, and the *kīhāpai* were not clearly defined. Therefore Māʻili-kūkahi ordered the chiefs, *aliʻi*, the lesser chiefs, *kaukau aliʻi*, the warrior chiefs, *pūʻali aliʻi*, and the overseers, *luna* to divide all of Oʻahu into *moku* and *ahupuaʻa*, *ʻili kūpono*, *ʻili ʻāina*, and *moʻo ʻāina*. There were six districts, *moku*, and six district chiefs, *aliʻi nui ʻai moku*. Chiefs were assigned to the *ahupuaʻa* – if it was a large *ahupuaʻa*, a high chief, an *aliʻi nui*, was assigned to it. Lesser chiefs, *kaukau aliʻi*, were placed over the *kūpono* lands, and warrior chiefs over *ʻili ʻāina*. Lands were given to the *makaʻāinana* all over Oʻahu.

Once the land division system was ordered, Māʻilikūkahi commanded that all classes of people cultivate the land with food and animals and that stealing would not be tolerated and punishable by death. He forbade theft, especially between the chiefs and *makaʻāinana* lest they face death. He suspended the practice of human sacrifices at the *heiau luakini* (sacrificial place of worship) and ordered that the eldest child of each family be cared for by him. Despite efforts from the Maui and Hawaiʻi Island chiefs to conquer Oʻahu, Māʻilikūkahi managed to eliminate his enemies and maintain peace over his kingdom. Because of his great concern for the prosperity of his kingdom, the people willingly obliged to Māʻilikūkahi's commands, and he ruled peaceably and religiously. Kamakau (1991) stated that because of Māʻilikūkahi's character as an *aliʻi*, the population of Waialua grew during his reign.

During the late eighteenth century, when western explorers first made contact with Oʻahu, Kamananui "was the ritual and political center of Waialua" (Sahlins 1992:20). However, by the late 1820s the political center of Waialua had shifted over to the Anahulu Valley in Kawailoa Ahupuaʻa. As a result of the relocation of the royal residence, the political boundaries of the *ahupuaʻa* in the region were redrawn (Sahlins 1992:20). Sahlins explains the subsequent re-assignation of lands as follows:

> Until 1824, the two royal fish ponds of Lokoea and ʻUkoʻa, although spatially separated from Kamananui (by the intervening *ahupuaʻa* of Paʻalaʻa and Kawailoa), were nonetheless controlled directly from there, by stewards (*konohiki*) of Kamananui proper. Likewise the remote fishing community of Kapaeloa at the eastern border of Waialua: it was considered part of Kamananui until the late 1840s; the local people held their lands from and "under" a lesser chieftain of Kamananui. The ruling *ahupuaʻa* of Kamananui thus encompassed certain detached lands—which gave it privileged access to important piscine resources. However, in the early nineteenth century, when the Waialua chiefship gravitated to Kawailoa, these outlying sections were taken into the latter land. .
>
> The historic shift in political domination from Kamananui to Kawailoa was paralleled by a transfer of the ceremonial center of the *moku*. In effect the Protestant mission of Waialua, founded in Kawailoa in 1832, usurped the ritual hegemony from the temples of human sacrifice (*poʻokanaka*) that not long before had sanctified the landscape of Kamananui. The *ahupuaʻa* of Kamananui was the site of two temples (*heiau*) of the royal or *luakini* class (cf. Valeri 1985). These *heiau* were probably presided over by an Oʻahu form of the god Kū, the god of conquests and human sacrifice specially associated with kingship (Sterling and Summers 1978:103-4; Thrum 1906a:47, 1906b:52; cf. Valeri 1985). The shift of dominance from Kamananui to Kawailoa corresponded to a change in *tabu* systems. (ibid.:20-21)

The Arrival of Europeans and Agricultural Transformations (1778-1854)

Following the arrival of foreigners to the Hawaiian Islands in 1778, written accounts left by early visitors to the Island of Oʻahu, such as those presented below, offer additional valuable insight into what life may have been like for the earliest residents of Kamananui and greater Waialua. Many of these historical accounts were penned by seafaring men who dropped anchor at or near Kaiaka Bay, which they refer to as Waialua Bay. Kaiaka Bay, which is located within Kamananui Ahupuaʻa, was considered the political center of the *moku* of Waialua at the time.

In late February of 1779, after the death of Captain Cook, the remaining crew of his ship Resolution, under the command of Captain Clerke, and Discovery, under the command of Captain James King, sailed from Maui to Oʻahu to water the ship. During this landfall, King recorded the following observations of the landscape in in vicinity of the project area to include the nearby Kaiaka Bay:

> Between the north point [Kahuku] and a distant headland, which we saw to the south-west the land bends inward considerably, and appeared likely to afford a good road. . . At a quarter past two, the sight of a fine river, running through a deep valley, induced us to come to an anchor in thirteen fathoms water, with a sandy bottom [Kaiaka Bay]. . . In the afternoon, I attended the two captains on shore, where we found but few of the natives, and those mostly women; the men, they told us,

> were gone to Morotoi [Molokaʻi] to fight Tahyterree [Kahekili II]; but that their chief Perreeoranee [king of Oʻahu], who had stayed behind, would certainly visit us, as soon as he heard of our arrival.
>
> We were much disappointed to find the water had a brackish taste for two hundred yards up the river, owing to the marshy ground through which it empties itself into the sea. Beyond this, it was perfectly fresh, and formed a fine running stream, along the side of which I walked, till I came to the conflux of two small rivulets, that branched off to the right and left of a remarkably steep and romantic mountain. The banks of this river, and indeed the whole we saw of the north-west part of Woahoo are well-cultivated, and full of villages; and the face of the country is uncommonly beautiful and picturesque (King 1821:81–82).

As foreign ambitions to trade with China increased in the late 18th century, the Hawaiian Islands became a primary stop on the Pacific trade routes. By the early 19th century, it was increasingly apparent that a substantial trade imbalance had developed between U.S. and China. While Chinese goods, such as tea, silk, and porcelain, were in high demand in the U.S., America had few desirable goods to offer in exchange besides fur and gold (Hammatt and Wagner-Wright 1999). The trading of fur quickly decreased as land was being cleared in North America and fur-bearing animals became scarce. This resulted in an increase demand in sandalwood which at the time was being traded primarily out of India and the East Indies. Americans became increasingly interested in Hawaiian sandalwood at this time after recent journals written by Captain Cook described the presence of the materials in Hawaiʻi along with other products such as *bech-de-mer* (sea cucumber) and tortoise shell. Before Europeans arrived in Hawaiʻi, the several species of sandalwood (*ʻiliahi*; *Santalum spp.*) were used in a limited way, primarily for medicinal applications, perfume, and firewood (Krauss 1993). Sometimes sandalwood was also used to make bows for the stringed mouth instrument called *ʻukēke* (Buck 1957).

ʻ*Iliahi* (sandalwood; *Santalum spp*.) soon became a popular commodity and commanded a decent exchange value. Kamehameha I kept strict control over the trade of *ʻiliahi* and primarily exchanged the fragrant wood for foreign vessels. He eventually began trading for goods such as nails, olive oil, rice, sugar, pitch, and kettles, expanding trade with Manila and Macao whose captains reassured the great value and demand of sandalwood (Hammatt and Wagner-Wright 1999). Soon the market shifted and Hawaiʻi went from logistical support to direct supplier of goods for the China market (Sahlins 1992). This resulted in the monopolization of sandalwood throughout the islands and the distribution of *aliʻi* to oversee cultivation. Judging from historical documents, people living in the Waialua area were known for cutting sandalwood in the interior mountain forests. One account by Kamakau confirms the importance of sandalwood to the chief of Waialua at the time, Ka-hekili Keʻeaumoku, whom despite the island-wide call to erect a fort in Honolulu for the protection against Russian warships en route for a coup and "his district alone failed to respond to the call" (Kamakau 1961:206). In a scramble to obtain foreign goods, chiefs in the area had commoners work very hard to cut and transport the sandalwood to the coast (Kirch 1985:314). Preoccupation with sandalwood extraction resulted in the abandonment of residential homesteads in the upper Anahulu valley.

The arrival of foreigners in Hawaiʻi signified the beginning of drastic changes to the culture and economy. By 1810, Kamehameha conquered the Hawaiian Islands through military force, with the exception of Kauaʻi, which was brought under his control through peaceful negotiations (Kamakau 1992). By 1811 and until his death in 1819, Kamehameha I was completely vested in the sandalwood industry and controlled all rhythms of the trade. The Hawaiian religious and political systems began a radical transformation; Kaʻahumanu proclaimed herself "*Kuhina nui*" (Prime Minister), and within six months the long-standing *kapu* system was overthrown. Within a year, Protestant missionaries arrived from America (Fornander 1969; Ii 1993; Kamakau 1992). In 1820, American missionary Hiram Bingham and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Oʻahu seeking out communities in which to establish church centers for the growing Calvinist mission. Bingham recorded observations made during his twenty-one-year residence in the Hawaiian Islands in a journal (Bingham 1847), which offers a rare glimpse at the project area vicinity during the early 1800s. Of Waialua, Bingham (1847:295–296) wrote that "a very large concourse of people assembled on the Lord's day, for public worship in the open air." Bingham (1847:296)continues his account as follows:

> After the Sabbath we examined and encouraged, and partially supplied with books, the incipient schools established there under the particular patronage of Lydia Namahana and Gideon Laanui, to whom the district belonged. There were found under Maiao and his assistant teachers, four hundred and ninety-five male and female pupils, and under Kaoo, one hundred and sixty-four, amounting together to six hundred and fifty-nine pupils, chiefly men and women.

In July of 1832, the second missionary station on Oʻahu, located at Waialua was started by Emerson (1847:468). Of the population served by this station at that time, Bingham (1847:468) states, "The districts of Waianae, Waialua, and Koolauloa, extending coastwise about fifty miles, and embracing a population of 7300, were connected with the station, among whom about 1600 could read." Another visitor to O‘ahu during the 1820s, Mathison (1825:392–395), made the following observations of Waialua at that time:

> July 11.—Having enjoyed a most agreeable sail by moonlight, we this morning entered a small bay called Why-arouah [Waialua, likely referring to Kaiaka Bay], on the N.E. side of the island, formed by two reefs of rocks, which run out parallel a considerable way into the sea, and between which two small rivers discharge themselves, Hence the name Why-arouah; *Whye* in the country language signifying water, and *arouah* the numeral two. Here a chief named Coxe [Kahekili Ke‘eaumoku/George Cox], who is one of the richest and most powerful in the island, resides; and as he was the person from who our Captain was to obtain the sandalwood, our first visit was of course paid to him. He bears the name and office, if it can be so called, of Governor. His hut stands on the seashore, and was sufficiently large to accommodate the whole of our party, consisting of several Americans, besides myself.
>
> . . . he speaks English better than any other native I had yet conversed with. . . His hut might be about twenty feet square, and proportionably high, with an entrance aperture on two sides, and one above. It was fitted up as usual with mats; in the midst of it he himself sat on the ground, having no other covering than the *maro*, and was surrounded by attendants. By his side sat an intelligent-looking American sailor, who had been upwards of twenty years on these islands, and attached himself particularly to Coxe, as his patron and protector. . .
>
> In the cool of the evening I took a walk along the banks of the river, and was delighted with the beauty and fertility of the whole district. Plantations of tarrow, maize, tobacco, sweet potatoes, yams, melons, and water-melons, everywhere met the eye, all neatly arranged, and enclosed, some by stone walls, others by fences. Of trees, the cocoa-nut, bread-fruit, banana, cotton, castor, *cöey*, and *teě* species, were most plentiful. The latter is a shrub peculiar, I believe, to these islands, but quite distinct from the Chinese tea-tree. The river, in most places about one hundred feet wide and not very deep, winds its still limpid way through this cheerful scene of cultivation, where the huts rising at intervals from among small groves of bananas and bread-fruit trees, vary in a picturesque and lively manner the soft harmonious touches of nature.

With the passing of Liholiho in 1824, his brother Kauikeaouli (Kamehameha III) took over the Kingdom and became king at the age of nine. Kauikeaouli put his trust and control into the hands of a select group consisting of young chiefs, resident foreigners, and commoners (Kamakau 1992:278-279). The period between Kamehameha I's death and Kauikeaouli's reign was critical as *ali‘i* demanded commoners to gather sandalwood in the *mauka* regions of O‘ahu including in Waialua. The wood was sold to foreigners for luxury goods, which lead to the depletion of sandalwood throughout the Hawaiian Islands.

Discussions about the well-cultivated valleys of O‘ahu were included in E.S. Handy (1940) ethnographic study of traditional Hawaiian agricultural activities related to native plants, which were extant on the island prior to European contact. Handy relates the following details about Kamananui Ahupua‘a which specifically paint a picture of how the vicinity of the project area was an area of abundant cultivation nestled between freshwater streams:

> **Kamananui.** Formerly there were large terrace areas along the flatlands between the junction of Helemano and Poamoho Streams and the flatland west of Poamoho. There were also small terrace areas up in the lower flats of Poamoho and Kaukonahua Valleys. There were small flats in the bottom of Kaukonahua Canyon for several miles above its junction with Manawai Stream. Poamoho is probably too narrow for taro terraces. It is likely that in these gulches, as at Waimea, sweet potatoes and bananas were planted around home sites along the ridge and near taro parches at the bottom of the gulch. (1940:85-86)

In *Fragments of Hawaiian History*, Hawaiian Historian John Papa ‘Ī‘ī (1800-1870) recounts details of the extensive trail networks throughout leeward O‘ahu as he had experienced them in the early 19th century. ‘Ī‘ī mentions Kamananui in his discussion of trails that connected coastal Waialua with locales in the central plains of O‘ahu:

> From the stream of Anahulu and from Kamani, above the houses and taro patches, a trail stretched along in front of Kuokoa's house lot and the church. This trail went on to meet the creeks of Opaeula and Halemano, the sources of the stream of Paalaa, on down to the stream of Poo a Moho, and on to the junction where the Mokuleia trail branched off to Kamananui and Keawawahie, to Kukaniloko, the birthplace of chiefs. (‘Ī‘ī 1959:98)

By the mid-19th century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. Between 1838 and 1842, the United States Exploring Expedition, under the direction of Commander Charles Wilkes, visited Oʻahu. In 1840, Wilkes (1845:74–75) made the following observation of the terrain and flora of Waialua:

> The district of Waialua stretches from the most westerly cape, called Kaena, to Waimea, in the district of Koolaulo [Koʻolauloa], on the northeast, and to Waianae on the southwest, a distance along the coast of above twenty miles. Within this district are a few bays for vessels not exceeding one hundred and fifty tons burden the best of these is Rawailoa [Kawailoa]. Those to the northeast are Waimea, Haula [Hauʻula], Kakua, Moluilui, and Makua. Like all the rest of the places, they are dependent on Honolulu, which is thirty miles distant for a market. A good road might very easily be constructed, and very nearly level, on the plain that lies between the two high mountain ranges which traverse the island from east to west. One of these ranges is called Konahaunui, the other Kaala; the former occupies the eastern end of the island, the latter the western. Both are basaltic. It is remarked of these two ranges, that the soil and growth of the plants are dissimilar; for instance, the kauwila, the wiliwili, the haw [*hao*], and the uhiuhi are found on the Kaala, and are either not found, or only in a dwarfish state, on the Konahaunui; whilst the acacia (koa), and the lehua, do not exist on the former, though growing luxuriantly on the latter.
>
> . . . Part of the Waialua district is cultivated by irrigation, and produces abundantly. Five considerable streams water it from the Konahaunui range, passing down fertile valleys. The largest of these is quite sufficient to supply motive power to the whole year round. . . From sources that are to be depended upon, I was informed that there are upwards of thirty square miles in the Waialua district that can be cultivated without irrigation.

Of the Native Hawaiians of Waialua "having but few wants, and those easily supplied," Wilkes (1845:75) states: "they cannot yet be induced to change their ancient dwellings for better habitations, and still adhere with pertinacity to their thatched grass huts, without floors or windows, and destitute of ventilation." Wilkes (1845:77) also reports on births and deaths in Waialua district: in 1836, there were thirty-four births and ninety deaths recorded; in 1839, there were fifty-six births and one hundred and eighty-five deaths. In addition, over four hundred marriages were entered into between 1832 and 1839; and the population declined from 2,640 in 1832 to 2,415 in 1836, which he attributed to sterility and abortion.

Regarding resources and trade across the Hawaiian Islands, Wilkes (1845:261) mentions the ongoing pursuits of the Hawaiians in supplying visiting whaling fleets and that sugar cultivation had begun to take over for the failed sandalwood trade; and stated the following:

> The islands produce but little, and their consumption of foreign products is necessarily small. The capabilities of the islands have generally been underrated, for their soil and climate are suitable for raising all tropical productions in considerable quantities, and at a moderate cost. But very little investment of capital has yet taken place, and the business that has induced the establishment of several commercial houses has been more that of transit than for the purpose of supplying the consumption of the islands, or obtaining their exports.

In his discussion of the life and death of Kamehameha III (b. August 17, 1813; d. December 16, 1854) in *Ruling Chiefs of Hawaii*, Kamakau (1992:422-423) tells of the young king's proclamation for his government to be one of learning, "in which chiefs should teach commoners and each one teach another." His poetic description goes on to mention Waialua as follows:

> . . . The concert exercises by which they were taught delighted the people. The rhythmical sound of the voices in unison as they rose and fell was like that of the breakers that rise and fall at Waialua or like the beat of the stick hula in the time of Pepe-io-holani and Ka-lani-ʻopuʻu.

A ea mai ke kai o Waialua,	Let the sea of Waialua rise,
Wawa noʻolelo ʻokoʻa i pali,	Let the roar echo over the hills,
Nunu me he ihu o ka puaʻa hae la,	Rumble like the grunt of the wild pig.
ʻAko ka lau o ka nalu piʻi i ka pali,	Let the rising wave break the leaf from the cliff. (Kamakau 1992:423)

Kamakau (1992:424) reports that between fifty and two-hundred pupils attended the newly built schools under Kamehameha III's rule and that "Oahu was then thickly populated." He goes on to lament the drastic population decline thusly, "It is sad to see how in so short a time whole villages have vanished leaving not a man. . . And as the kingdom of letters moved quickly so also moved the kingdom of God. . ." (Kamakau 1992:424-425). This significant decline in the native population was already felt a mere fifty years after Hawai'i's first contact with Europeans and Americans. Meanwhile, the Western population kept increasing.

Overall, historic records document the significant effect that western settlement practices had on Hawaiians throughout the islands. Drawing people from isolated native communities into selected village parishes and Hawaiian ports-of-call, had a dramatic, and perhaps unforeseen impact on native residency.

The Māhele ʻĀina of 1848

By the mid-nineteenth century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840, the first Hawaiian constitution had been drafted and the Hawaiian Kingdom shifted from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, King Kamehameha III and his high-ranking chiefs decided to separate and define the ownership of all lands in the Kingdom (King n.d.). This change was further promoted by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be taken from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawai'i: the King, the chiefs and *konohiki*, and their tenants (the *maka'āinana* or common people). In 1845 the legislature created the "Board of Commissioners to Quiet Land Titles" (more commonly known as the Land Commission). All land claims, whether by chiefs for entire *ahupua'a* or by tenants for their house lots and gardens, had to be filed with the Land Commission within two years of the February 14, 1846, but the deadline was extended several times for chiefs and *konohiki* (Soehren 2005).

The King and some 245 chiefs (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawai'i amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). Once the King and his chiefs accepted the principles of the Privy Council, the *Māhele 'Āina* (Land Division) was completed in just forty days (on March 7, 1848). The names of all of the *ahupua'a* and *'ili kūpono*, as well as the nearly independent *'ili* land division within an *ahupua'a*, were recorded in the *Māhele* Book (Soehren 2005). As this process unfolded King Kamehameha III, who received roughly one-third of the lands of Hawai'i, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. The day after the division with the last chief was recorded in the *Buke Māhele* (*Māhele* Book), King Kamehameha III commuted about two-thirds of the lands awarded to him to the government (King n.d.).

Unlike the King, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their awards (LCAw.). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land," while the lands retained by Kamehameha III became known as "Crown Land," and the lands received by the chiefs became known as "*Konohiki* Land" (Chinen 1958:vii; 1961:13). All lands awarded during the *Māhele* 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.

During the *Māhele*, native tenants on the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to the *kuleana* parcels that they actively lived on or farmed. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848, in order to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more than the two-year term, and the deadline was extended several times for the Land Commission to finish its work (Maly 2002). In the meantime, as the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and the process by which they could apply for fee-simple interest in their *kuleana*. The work of the Land Commission was completed on March 31, 1855. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which only 9,337 were awarded (Maly 2002).

Prior to the *Māhele ʻĀina* of 1848, the Kamananui Ahupuaʻa was held by chiefess Victoria Kamāmalu, daughter of Mataio Kekūanāoʻa and Elizabeth Kīnaʻu. Victoria Kamāmalu was the favorite wife of Liholiho (Kamehameha II). During the *Māhele*, Kamāmalu turned over parts of Kamananui "as commutation of the royal right,", which "became government lands when the king divided his holdings between public and Crown property" along with the remainder of the *ahupuaʻa* (Sahlins 1992:190). 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 and ranged in size from roughly ten acres to many hundreds of acres. Despite the stated goal of the grant program to enable native tenants to purchase the lands upon which they lived or land that they felt they could cultivate, many of the government lands were sold to foreigners. No *kuleana* claims were made in the immediate vicinity of the present project area.

In conjunction with the *Māhele*, the King also authorized the issuance of Royal Patent Grants to purchase tracts of Government land larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* of 1848 should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the *Māhele*, to purchase lands of their own. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of the Government Lands. Unlike in the *kuleana* claims, where claimants stated their use of the land, the grant records are silent regarding the grantees' intended use. The Royal Patent deeds and survey notes do contain some limited information about geographical features of the grant lands, and describe boundary markers, such as rock piles and vegetation, but they generally do not say anything about improvements to the land or land use.

In the case of the Kamananui Ahupuaʻa, roughly 245 land grants were parceled out. The parcels were then clustered into tracts and subsequently sold to various natives, foreigners, and businesses (OHA 2018). In an 1881 map by C. J. Lyons, the project area is shown within a section containing many strips of land labeled "Grants Kuleanas" yet no recipients are names (Figure 14). The various Grants were described as "divided into strips…660 ft in width, one or more of which formed a grant.". The project area consists of land divided into six grants awarded in 1850 which ran *mauka*-*makai* (Table 1 and Figure 15). It is unclear what the recipents of the grants initially intended to use the land for. However, beginning in the 1860s, much of the land in the vicinity of the project area was cultivated for commercial sugarcane.

Table 1. Government land grants in the project area

Land Grant No.	*Awardee*	*Year Awarded*	*Acres*
267	Kupaa	1850	70
335	Kuemanu	1850	122
272	Kapahu	1850	75
264	Aikaula	1850	80
263	Ile	1850	80
262	Kupohu	1850	60

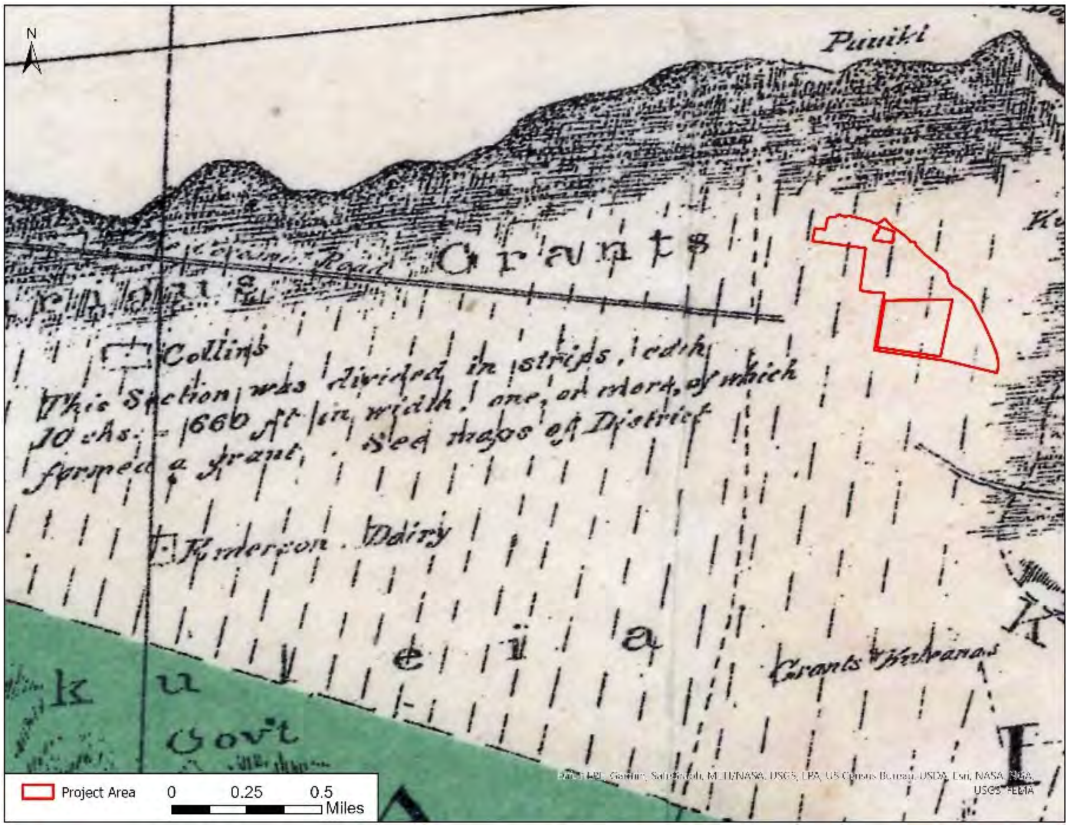


Figure 14. 1901 map showing location of LCAw and Grants in and adjacent to the project area.

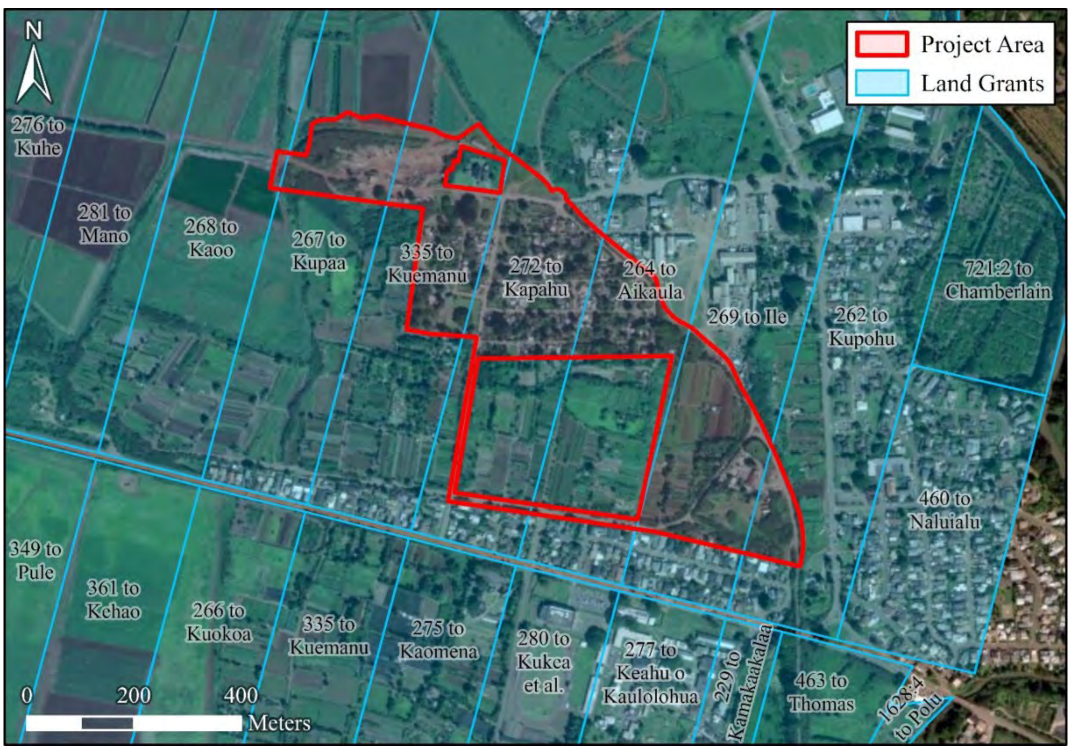


Figure 15. Land grants awarded in and adjacent to the project area.

THE DEVELOPMENT OF THE SUGAR INDUSTRY IN WAIALUA

Beginning in the late 1800s, land-use in Waialua was transformed by the introduction of commercial agriculture to the region, most prominently initiating with the sugar industry. *Kō* (sugarcane) was an important resource for Precontact Hawaiians in their diets and as a raw material for medicines, weapons, dyes, rituals, tattoos, etc. (Kessler 2015:136; Lincoln 2020). Davida Malo (2020) documents the use of *kō* for construction, as well, including for house thatching (201and to assist with creation of *lo'i* (283; kalo pondfields). Sugar cane was traditionally planted in both wet and dry environments and in lower and upper elevations (Handy and Handy 1991:186) and Lincoln (2020) extensively documents the numerous varietals and uses for each. Judd (1930) documents a number of traditional sayings about *kō*:

> *Ua ulu ke ko-kea:*
>
> The white sugar cane grew. Likened to a person who has grown old (34);
>
> *He paa ko-kea no Kohala, e kole ai ko waha ke ai:*
>
> It is like the hard white sugar cane of Kohala, that will hurt your mouth when it is eaten. Looks easy, but hard to accomplish (35);

Several of these sayings documented by Judd (1930) connect *kō* to seasonal observations.

> *Pua ke ko, ku mai ka hee:*
>
> When the sugar cane is in bloom, the squids are plentiful. Sugarcane bloom is the sign of the time to go squidding (8).
>
> *Pua ke ko, nee i ka hee holua:*
>
> When the sugar cane tassels, move to the sledding course. The season for sledding is when the sugarcane tassles (25).

However, Precontact Hawaiians never produced sugar from sugarcane and the production of sugar only began with the arrival of Europeans. Some of the very earliest voyages saw the potential for sugar production in Hawai'i. Archibald Menzies, a surgeon on George Vancouver's 1792-94 voyage, expressed that it is "worth the attention of Government to make the experiment and settle these islands [Hawai'i] by planters from the West Indies, men of humanity, industry and experienced abilities in the exercise of their art would ere in a short time be enabled to manufacture sugar and rum from luxuriant fields of cane equal if not superior to the produce of our West India" (Menzies 1920:79). While the first sugar production in Hawai'i is attributed to a Chinese merchant on Lana'i in 1802, the first mills and eventual large-scale industrialization of the sugarcane industry in Hawai'i can be attributed to American missionaries (Dorrance and Morgan 2000:13).

The first American Board of Commissioners for Foreign Missions (ABCFM) missionaries arrived in Hawai'i in 1820 and established the Sandwich Island Mission (Kessler 2015:133). While early missionaries expressed some ambivalence towards growing and making sugar, in part due to its association with the production of rum, many missionaries eventually saw small-scale farming and industry as way to teach and foster Christian values to native Hawaiians. In 1838, during a delegate meeting of missionaries such a sentiment was expressed:

> ...the missionary, by directing the labor of natives, and investing some fifty or hundred dollars in a sugar mill, in some other way, might secure a portion and often the whole of his support [of Christian missionaries], and would thus be teaching the people profitable industry (Kuykendall 1938:180).

As a consequence, in the late 1830s, many missionaries set up small-scale sugar operations on O'ahu and Kaua'i which they hoped would teach native Hawaiians independence, industry, and other Christian values (Kessler 2015:136; Kuykendall 1938:180).

In Waialua, missionaries were some of the first sugar producers in the area. In the late 1830s, Rev. John Emerson set up a mill in Waialua which according to the *The Sandwich Islands Mirror & Commercial Gazette of 1940* "makes sugar and molasses for the natives on equal shares" (Honolulu Star-Bulletin 1935). Rev S. E. Bishop described Emerson's operation in *The Friend*. Emerson states that he made his own molasses by grinding cane in a "wooden mill turned by oxen and boiling the remaining juice in old whaler trypots" (Honolulu Star-Bulletin 1935) (Figure 16). In 1844, William Perry signed a contact with the mission school to build a mill to manufacture molasses from the sugarcane growing on the mission school's grounds in Waialua (Honolulu Star-Bulletin 1962b). However, this venture did not seem to last long. Small mills, such as Emerson's and Perry's, characterized the early days of the sugar industry. Mill operations tended to be small and production inconsistent. Due to limited capital funding, these mills had high failure rates. Despite these difficulties, sugar production increased significantly from the 1830s-1850s with four tons being produced in (Kessler 2015:134). Eventually missionaries came to embrace large-scale agriculture with the hope that it would lead to social and cultural change among native Hawaiians, and they played a significant role in the development of the plantation system in Hawai‘i. Under this system, the ideas and the industry transformed from an effort to promote the Sandwich Island Mission and foster western cultural notions in Hawai‘i to a system which primarily served the capitalist interests of sugarcane planters (Kessler 2015:136).

Figure 16. 1902 photograph of the Emerson House in Waialua, Hawaiian Mission Children's Society.

During the U.S. Civil War (1861 to 1865), the sugar industry in the Hawaiian Islands grew significantly because of the boycott on sugar from the southern states and the consequential demand for sugar from other regions. During the period between 1860 and 1866, sugar exports from Hawai‘i increased by approximately 175 percent each year. For instance, in 1861, the Hawaiian Islands produced 572 tons of sugar and in 1864, production had exponentially increased to 8,865 tons (Lal et al. 1993). Consequently, commercial sugarcane agriculture began to dominate vast regions of O‘ahu including the Waialua District.

While the first commercially grown sugar in Waialua can be traced back to the Levi and Chamberlain Sugar Company established in 1865, the Chamberlain Family's association with sugarcane and other agriculture in Waialua predates the formation of their company by several decades (Wilcox 1996). Levi Chamberlain Sr. arrived in Hawai‘i in 1823 with the Second Company of Missionaries and as a representation for ABCFM. In 1844, when the aforementioned William Perry signed a contract with the Mission to manufacture molasses from the sugarcane growing on the mission school's grounds, Levi Chamberlain Sr. represented the mission (Honolulu Star-Bulletin 1962a). Following his death in 1849, Levi Chamberlain's sons, Warren and Levi Chamberlain Jr., inherited land in Waialua on which they attempted to raise farm produce and later rice. Both projects failed. However, in 1865, the brothers built the first sugar mill in Waialua and established the Chamberlain plantation. However, their mill was so small it could not manufacture even one ton per day (Taylor et al. 1976:81; Honolulu Star-Bulletin 1935) The brothers' venture into the sugar industry was short lived as the company ultimately failed after financial hardships, floods, droughts, and labor shortages (The Honolulu Advertiser 1954).

In 1867, Charles R. Bishop of the Bishop Bank purchased the plantation from the Chamberlain brothers at public auction for $4,750 (The Honolulu Advertiser 1954). At the time of the sale, the plantation consisted of “75 acres of cane land, 16 acres of taro land and 467 acres of pastureland” and an additional “52.2 acres of cane land and 29 acres of pasture under lease” (Honolulu Star-Bulletin 1962b). The Chamberlain brothers and Charles R. Bishop continued to harvest 130 acres of sugarcane during their partnership before their success was cut short and the company foreclosed (The Honolulu Advertiser 1954). In 1870, the bank sold the property to O.R. Woods, who borrowed approximately three thousand dollars from Castle & Cooke. However, Woods was bankrupt within a year and Castle & Cooke foreclosed and took ownership of the property (Taylor et al. 1976:81). Levi Chamberlain ran the plantation until 1875, when Castle & Cooke mortgaged the 775 acres of the plantation to Robert Halstead and Henry Gordon for $30,000 (The Honolulu Advertiser 1954) (Figure 17). George Bowser (1880:489) made the following observations of the Halstead and Gordon plantation and the surrounding lands:

> I passed on to another fertile valley, the Kamananui. At the head of this, closeup to the mountains, is the sugar plantation of Messrs. Halstead & Gordon, one of the most extensive and valuable on the island of Oahu. Mr. Halstead is a thoroughly experienced manager, and everything on the place has thrift and industry written on the face of it. I was made right at his hospitable house, where he resides with Mrs. Halstead and his family. A lovely view of the ocean is to be had from the front of the house, and when I as there the scene was further enlivened by the presence of a fine schooner in full sail on her way to Honolulu. There is plenty of good fishing in this valley; both fresh and saltwater fish being abundant. Excellent shooting, too, is available for the sportsman. At Waialua I found no less than three native churches, a female seminary, three native schools and St. Stephen’s Episcopal Mission School.

After the death of Henry Gordon in the same year, Halstead went on to acquire Gordons’ portion of the lease for his sons Edgar and Frank and the plantation was renamed as the Halstead Brothers (Taylor et al. 1976:81) (Figure 18). The Halstead Plantation is reported as being capable of producing up to 10 tons of sugar a day, a far greater amount than the previous mills (The Honolulu Advertiser 1892). Consequently, the plantation started generating more revenue for Waialua as well as Castle & Cooke who remained agents for the company (Taylor et al. 1976:81).

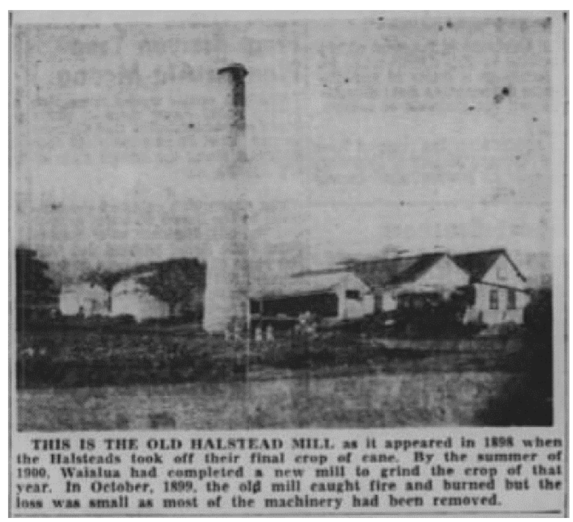
Partnership Notice.

NOTICE IS HEREBY GIVEN THAT the Sugar Plantation known as the Waialua Plantation and located at Waialua, Oahu, heretofore carried on by Mr. Robert Halstead, will, in the future, be conducted by the undersigned, under the firm name of Halstead Bros.

E. HALSTEAD,
F. HALSTEAD.

Waialua, Oahu, April 1st, 1894.
3651-1w

Figure 17. Halstead partnership notice (The Honolulu Advertiser 1894).



THIS IS THE OLD HALSTEAD MILL as it appeared in 1898 when the Halsteads took off their final crop of cane. By the summer of 1900, Waialua had completed a new mill to grind the crop of that year. In October, 1899, the old mill caught fire and burned but the loss was small as most of the machinery had been removed.

Figure 18. The old Halstead Mill (Honolulu Star-Bulletin 1948).

The success of the Halstead Brothers plantation resulted in the development of infrastructure in the area to support the growth of the plantation. In 1897, Benjamin Dillingham of the Oahu Railway and Land Company (O.R. & L. Co.), proposed a Waialua railroad extension of the O. R & L railroad in an effort to enhance development by providing an alternative mode of transportation for goods produced in the area. Dillingham was eventually granted the lands for the railroad with the help of Senator Henry Waterhouse, who bought more than four thousand acres of ranch property in

Waialua from Gaspar Silva of the Gaspar Silva Ranch (Evening Bulletin 1898). The private deal made its way to the *Evening Bulletin* in January 1898 and stated its intentions:

> "The property, or most of it, will find its way into the hands of the Oahu Railway and Land Company's (O. R & L. Co.). There is a private deal to that end between Senator Waterhouse and Mr. Dillingham. In all probability the property will form a part of the proposed new Waialua sugar plantation" (Evening Bulletin 1898).

That same year, the O. R & L. Co. railroad was constructed through Waialua with stations in Kawaihāpai and Mokulēʻia (Figure 19). The railway ran along the coast *makai* of the current project area (Figure 20). However, due to the relatively small size of the plantation, the mill did not produce much freight (Dorrance and Morgan 2000:47). Large tracts of the land surrounding the Halstead Plantation remained uncultivated as it was divided and owned by numerous owners including many native Hawaiians (Dorrance and Morgan 2000:47). Benjamin Dillingham saw potential to increase the amount of freight for his railroads in Waialua if the small Waialua plantation had the same success as the Ewa Plantation (Taylor et al. 1976:128). Subsequently, he encouraged Castle & Cook to buy the Halstead Plantation and the surrounding lands and capitalize on the vast expanse of uncultivated land in Waialua (Dorrance and Morgan 2000:47).

Figure 19. Photograph showing the railroad track leading to the Waialua Sugar Mill.

Figure 20. Map of the completed O. R & L. Co. railway route. Note the red box highlighting the area around the current project area is labeled as Waialua Sugar Plantation.

WAIALUA AGRICULTURAL COMPANY

With Dillingham’s encouragement, Castle & Cooke purchased the Halstead plantation on August 1, 1898. That same year, he established the the Waialua Agricultural Company Ltd with the former Halstead Plantation serving as its center. At its inception, the Waialua Agricultural Company Ltd had a capital stock of $3.5 million allowing it quickly expand its land holdings and hire William Goodale from the Onomea Plantation as the first manager. Castle & Cooke worked diligently to acquire as much of the surrounding land as possible from the patchwork of landowners in the area. Following the negotiations with hundreds of landowners and tenants, the Waialua Agricultural Company Ltd consisted of 10,000 acres of land suitable for sugarcane cultivation and an additional 12,000 acres in higher elevation which would later prove promising for pineapple production (Taylor et al. 1976:130). The company leased additonal land from the Bishop Estate and subleased land from Dillingham (Dorrance and Morgan 2000:47). The company harvested their first sugar cane in 1899, producing 1,741 tons of sugar from 300 acres of planted land.

Recognizing that prior Waialua plantations had failed to properly invest in capital, which likely contributed to small growth and a high rate of failure, Castle & Cook strove to acquire more land and investing in capital improvements including new railroads, irrigation systems which drew from both ground and surface water, and a new mill (Wilcox 1996:109). The first year of operation they invested $758,463 into property and equipment improvements. The following year, company harvested triple the acreage of the previous year resulting in the production of 5,681 tons of sugar from 1,025 acres (Taylor et al. 1976:130). Unfortunately, about one-third of this harvest was lost as the new mill was not yet completed and the smaller Halstead mill was unable to keep up with processing needs of the increased yield (Taylor et al. 1976:130). The new mill was completed the following year and was located where the current Waialua mill stands today.

The yield of each harvest increased exponentially as additional acres were planted and improvements were made to the mill. Only two years after the first harvest, the Waialua Agricultural Company Ltd sugarcane crop yield increased nearly seventeen times the initial amount (Thrum 1906:39). As yields increased, the plantation faced issues concerning irrigation of their vast field systems. The land in Waialua did not receive enough rainwater or runoff water from the mountains in order to efficiently irrigate the sugar cane. While attempts were made to irrigate the fields using wells and pumps, such methods were too expensive to maintain and implement on such a large scale (Taylor et al. 1976:130). However, in 1900, two engineers from the Wahiawa Water Company, Leonard G. Kellog and B.L. Clark, suggested a solution. They proposed to construct a dam across the Kaukonahua Stream to catch rainwater draining from the Ko‘olau Mountains and using gravity, as opposed to pumps, irrigate the fields. They argued this reservoir could alone irrigate approximately 4,800 acres of land and save the company $140,000 to $160,000 a year in pumping expenses (Taylor et al. 1976:130).

Construction on Wahiawa Dam and Reservoir began in 1903 and lasted for two years. The dam was constructed in Kaukonahua Gulch, by the junction of the north and south branches of the stream and formed a seven-mile-long lake referred to today as Lake Wilson or the Wahiawa Reservoir (Figure 21). The dam was located just 8 miles away from the Waialua Sugar Mill and could retain 2.5 billion gallons of water which, upon its completion, could irrigate 12,000 acres of sugarcane land using gravity flow, double the amount it was originally proposed to irrigate (Wilcox 1996:109; The Hawaiian Gazette 1906). The total cost for the dam was $300,000. However, the reservoir provided 90% of the plantation's surface water (Wilcox 1996). Furthermore, while the reservoir and ditch system were primarily engineered to double the area of land available for sugarcane cultivation, they also produced electricity for the area (Hawaiian Gazette 1906).

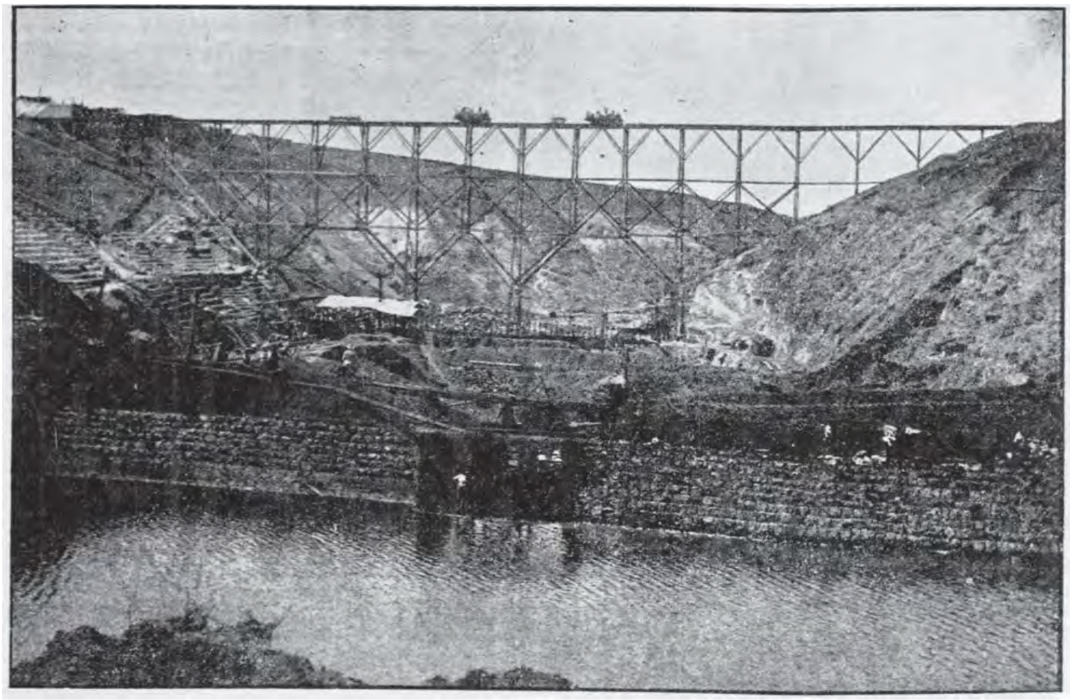


Figure 21. Wahiawa Dam, reservoir (Lake Wilson), and 500-foot-tall railroad trestle upon completion (Hawaiian Gazette 1906).

In addition to the Wahiawa collection system, Waialua Agriculture Co. constructed three other surface water collection systems between 1900 and 1906: Helemano, Opaeula and Kamananui. While smaller than the Wahiawa Reservoir which delivered between 10 and 12 billion gallons of water per year to the Waialua fields, these other collection systems and associates ditches were able to deliver 700 million (Helemano), 350 million (Opaeula), 90 million (Kamananui) gallons of water per year respectively. On February 3, 1911, in the Waialua Agricultural Co. annual report for the year 1910, W. W. Goodale, reported that:

> [Kamananui Ditch], referred to in the Annual reports of the years 1902, 1904 and 1909, was commenced in 1903, but abandoned in 1904. At that time 1,068 feet of tunnels had been excavated. On June 10, 1910 we began work again and have carried it on as rapidly as possible since that time.
>
> The ditch will deliver the water of the Kamananui stream at a point at a point 669 feet above sea level on the upper lands of Kawailoa and on the line of the ditch that crosses the plantation carrying the water from the Wahiawa reservoir.
>
> The ditch is 20, 175.5 feet long, with 17,852.5 feet of tunnels, 325 feet of flume and 1,998 feet of open ditch.
>
> On December 31, 1910, 13,832.5 feet of total length, had been completed leaving 6,343 feet unfinished. The entire cost of the work will be about $69,628.00, of which amount $35,561.00 had been paid on December 31, 1910. Water should be running in the ditch on or about May 1, 1911(Goodale 1911:4).

The Kamananui Ditch was actually completed on December 7, 1911, at a total cost of $76,963.81. From the outset it carried an average of 2,188,471 gallons of water a day to the Kawailoa fields (Goodale 1912). For the year 1910, it was reported that "the Opaeula Ditch system delivered during the year 2,112,401438 gallons of water, used entirely on Kawailoa" (Goodale 1911:4). The Kamananui ditch system was redesigned and realigned in the mid-1920s to increase its water carrying capacity and to allow it to function independent of the Opaeula ditch system (Wilcox 1996). Especially essential to the success of the Waialua Agricultural Company was the interconnectedness of its irrigation ditches which allowed for water to be diverted anywhere (Wilcox 1996:109). Targeted field irrigation was accomplished by way of the Waialua Flume. This flume system consisted of movable and replaceable sections of concrete flume with small metal gates to release water where needed. The network of ditches and flumes on the plantation was complimented by an array of pumping stations. Due to the innovative efforts of Goodale, a self-propelled drag-line excavator was digging new ditches by 1920. The same machine could also lift harvested cane bundles onto railway cars in the field (Dorrance and Morgan 2000).

When William Goodale retired in 1923 after 25 years as the plantation's manager, he summarized the growth of the Waialua Agricultural Company in the annual report for that year, writing "we now have 70 million gallons per day pumping capacity, 30 miles of permanent railway, the Wahiawa reservoir, capacity 2,540,000 gallons, and 33 other reservoirs, ditches to bring the water to Poanoho, Halemano, Opaeula, Kawaiiki, Kamananui and Waimea gulches, a good mill, six locomotives, cane cars, six plow engines and plows, tractors, trucks, buildings, and about 9,000 acres of cane" (Goodall in Clark 2007:57–58). Goodale had also installed a 450-kilowatt hydroelectric plant in the uplands of Kawailoa that supplied not only plantation's needs, but when excess energy was produced, it was sold to the Hawaiian Electric Co. (Dorrance and Morgan 2000). Goodale's management had made the Waialua plantation one of the most productive in the Hawaiian Islands. By 1925, sugar production had grown to 32,585 tons annually (Dorrance and Morgan 2000).

The Great Depression hit the United States from 1931 to 1940. While the Waialua Agricultural Company was not heavily affected by the Great Depression, the world-wide economic downturn heavily effected Dole's pineapple enterprise of which the Waialua Agricultural Company owned one third (Taylor et al 1976:169). Although Castle & Cooke's dividends never plummeted, Dole lost $5.4 million in profits in 1932 (Taylor et al 1976:169). Castle & Cooke took 21% ownership, and the Waialua Agricultural Company took 37% ownership of the Hawaiian Pineapple Company in December of 1932 and by 1936, the $8.5 million debt of Hawaiian Pineapple had been turned into a $2 million credit balance (Taylor et al 1976:169).

In the mid-1930s, the Waialua Sugar Mill reportedly had the capacity to grind 2,540 tons of sugarcane a day transported by the 55-mile railway network on the planation mill (Honolulu Star-Bulletin 1935). They continued to invest in capital improvements and in 1935, the Waialua Agricultural Company invested $3 million in irrigation improvements by building reservoirs, siphons, ditches, and tunnels, as well as improvements to the sugar mill (Honolulu Star-Bulletin 1935). The 1930s was also characterized by a focus on mechanizing harvesting. A new tool called the "Waialua Rake" was created to improve the grab harvest system. It consisted of a "heavy steel pipe contraption in the form of a huge, closed hand" which would be used to grab the sugarcane piles cut from two tractors with steel cables (Jones and Osgood 2015:149). While the tool was inexpensive, it did not help the harvesters to separate the sugarcane stocks from the trash, mud, and rocks uprooted with them (Jones & Osgood 2015:149). In addition, the general decline of animal labor on farms led to new modifications to existing farming equipment like plows being directly mounted on tractors and the tricycle tractor. Despite the continued efforts and investments to attempt mechanization of harvesting, most Hawaiian fields continued to be harvested by the hand grab system (Jones and Osgood).

The commencement World War II with the attack on Pearl Harbor had an instant and profound impact on Hawaiian industry and agriculture, including on sugar production. Following the attacks, martial law was enacted on Hawai‘i, and many plantation workers entered service in the armed forces. The U.S. military immediately began commandeering lands to build defense installations. In Waialua, more than 1,000 acres of sugarcane crops was bulldozed for the installation of military bases, and it's estimated that O‘ahu lost more than $1 million worth of sugarcane within a few days following the attack (Taylor et al. 1976:197). The military additionally ordered that Waialua plantation cane fields near the ocean be converted to potato fields so that the military could have a clear range of fire in case the enemy stormed the coastline. John Midkiff, the plantation manager of Waialua Agricultural Company at the time recalled:

> By nightfall of December 7, troops had moved into my yard, dug a huge hole and filled it with enough explosives to blow up the island. No one seemed to know why, then or after the war. Let's say there

> was a little ‘confusion’. Our bulldozers, crawler cranes and trucks were taken out of the fields to build airfields. I was ordered to supply as many as 500 men a day from my work force to help build defense installations. One truck driver, missing for weeks, finally showed up with the simple explanation that ‘the army put me to work’…(Taylor et al. 1976:197).

Midkiff continued to report that one military officer ordered that the Waialua Reservoir to be blown up as he was afraid that enemy planes would see a reflection from the water and therefore be able to target the nearby Wheeler Field. However, before the military destroyed the dam, Midkiff reported that “we got to a higher authority who recognized the utter stupidity of the order” and the order was stopped (Taylor et al. 1976:197-198).The military additionally enclosed the Waialua Sugar Mill with barbed wire fencing throughout the war and painted the mill stack in camouflage (Figure 22).

Figure 22. Waialua Sugar mill enclosed with barbed wire fencing and the sugar stack painted in camouflage following the attack on Pearl Harbor in 1941 (Taylor et al 1976:217).

Although the military acquired many agricultural lands and many of the planation employees left to serve in the military, sugar plantations managed to stay relatively close to normal production rates at the time. The production yields at Waialua plantations dropped only a few thousand tons between 1941 and 1945 (Taylor et al. 1976:197). In 1946, much of the agricultural lands acquired by the military was returned for re-planting (Honolulu Star-Bulletin 1946). Waialua took back 1,513 acres worth of land which they immediately starting replanting using concrete pipe irrigation (Figure 23).

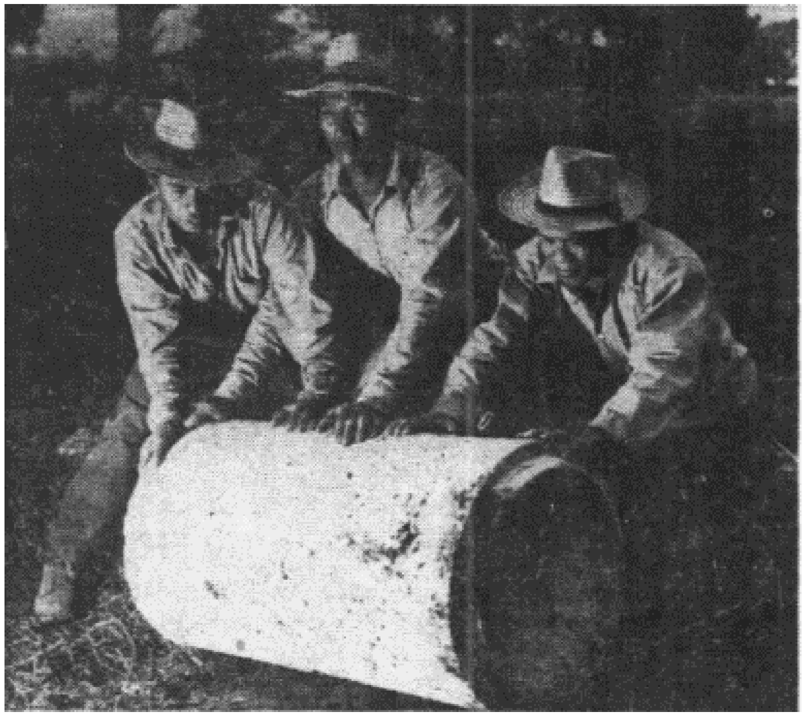


Figure 23. Waialua plantation workers replanting sugarcane using the concrete pipe irrigation method (*Honolulu Star Bulletin* 1946).

WAIALUA SUGAR COMPANY AND THE POST-WORLD WAR II SUGAR INDUSTRY

Upon celebrating the 50th anniversary of the Waialua Agricultural Company in 1948, A.G. Budge, the president of Waialua Agricultural Company and Castle & Cooke at the time, announced his intention to divide the Waialua Agricultural Company into two companies, one to handle the sugar plantation operations and the other to manage the remaining lands (The Honolulu Advertiser 1948). The land and investment company became known as the Helemano Company and the sugar plantation company became known as the Waialua Liquidating Company (The Honolulu Advertiser 1948). Later the sugar company was renamed the Waialua Sugar Company (Dorrance and Morgan 2000). At the time of this division, the Waialua Agricultural Company's lands consisted of a total of 46,773 acres, including 27,197 fee simple and 19,576 leased acres. Of the total acreage, 10,600 were planted in cane. Additionally, a considerable amount of this acreage was being leased to Hawaiian Pineapple Co. and the California Packing Corp (The Honolulu Advertiser 1948).

The split of the Waialua Agricultural Company was devised to curb union bargaining tactics brought on by union negotiators for Waialua's sugar workers (Taylor et al. 1976:225). The labor negotiators had been basing their demands off Waialua's total profits from both sugar and non-sugar enterprises. Therefore, the company decided a division of the company would protect their overall profits and cut down the labor negotiations (Taylor et al. 1976:225). Although Helemano now controlled most of the assets, its primary agent was still Castle & Cooke (Taylor et al. 1976:226). Throughout the mid twentieth century, Castle & Cooke continued to grow. In 1957, Castle & Cooke owned 34% of Waialua and by 1960, they owned 52% (Taylor et al 1976:231 & 242). In 1961, Castle & Cooke bought the remaining shares of Dole's operations.

In 1952, Waialua plantation's railroad system was replaced by a new type of hauling unit known as the "eight rubber-tired Tournatows" (The Honolulu Advertiser 1952) (Figure 24). Previously, the company relied on railroad to transport its product through the plantation to the sugar mill and beyond using a total of 7 locomotives and 742 cane cars (The Honolulu Advertiser 1952). However, in 1951 the plantation manager at the time, John W. Anderson, announced there would be a change in the systems (Honolulu Star-Bulletin 1951). The endeavor costs about $1,500,000 and was financed by the company's reserves (Honolulu Star-Bulletin 1951). To accommodate the new system, the 55 miles of existing railroad tracks were removed, and 44 miles of paved road was built (Honolulu Star-Bulletin 1951).

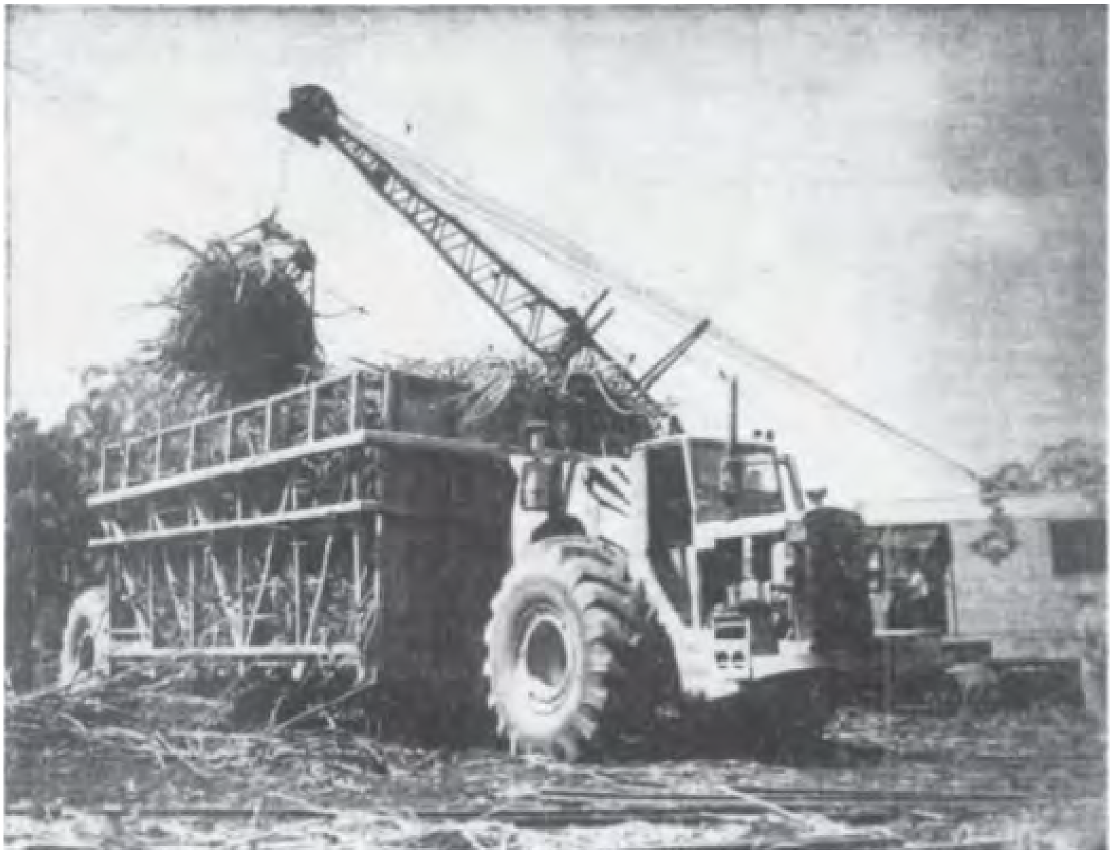


Figure 24. Tournatows in use in Waialua Sugar Company fields in 1952 (The Honolulu Advertiser 1952).

The end of the railroad system at the Waialua Sugar Plantation coincided with an increased number of challenges such as droughts, labor strikes, and declines in harvest and profits. Despite the challenges, the plantation continued to harvest over ten thousand acres of sugar cane annually. Even with an 8-month long drought in Waialua, the sugar plantation achieved a "world record yield of 15.12 tons of sugar per acre of harvested cane" (The Honolulu Advertiser 1954). The profits from sugar cane remain constant until 1958 when the president of the Waialua Agricultural Company, Malcom McNaughton reported a significant decline in profits. He reported net profits were $482,756 in 1957, $341,217 in 1958, and $133,826 in 1959 (The Honolulu Advertiser 1960a). In 1964, the sugar production for Waialua was 73,103 tons and decreased to 66,078 tons in 1965 (Honolulu Star-Bulletin 1965). The decline in profits and sugar production have been attributed to the decrease in sugar prices as well as labor issues that characterized the mid-20th century (Dorrance and Morgan 2000). In 1975, a severe drought plagued the Waialua sugar plantation (Honolulu Star-Bulletin 1975a) (Figures 25 and 26). As William W. Paty Jr., the plantation manager at the time recalled:

> All we can do is stand by and pray for rain. Some fields are dying while others are standing still with no growth. Four thousand acres totally dependent on Lake Wilson behind Kemoo Farm are being rationed to water feeding every 40 days instead of the usually two weeks. Rainfall since April has been as low as we've had in 73 years of keeping records. That's about 20 per cent of normal. So far there has no break. We projected a 91,000 ton yield for 1976. Now the forecast has been trimmed to 79,000 tons and that could go lower if no relief comes (Honolulu Star-Bulletin 1975a).

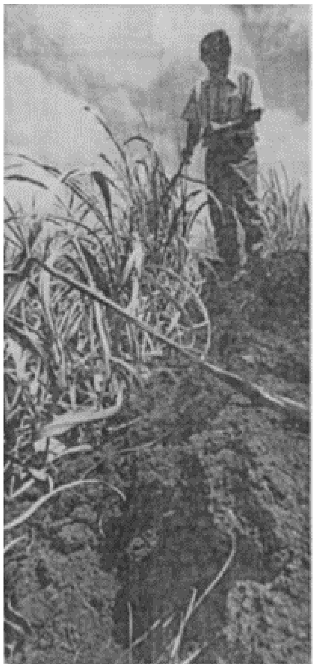


Figure 25. Thomas Hirayama, crop control assistant at Waialua Sugar inspecting drought-stunned sugarcane (Honolulu Star Bulletin 1975a).

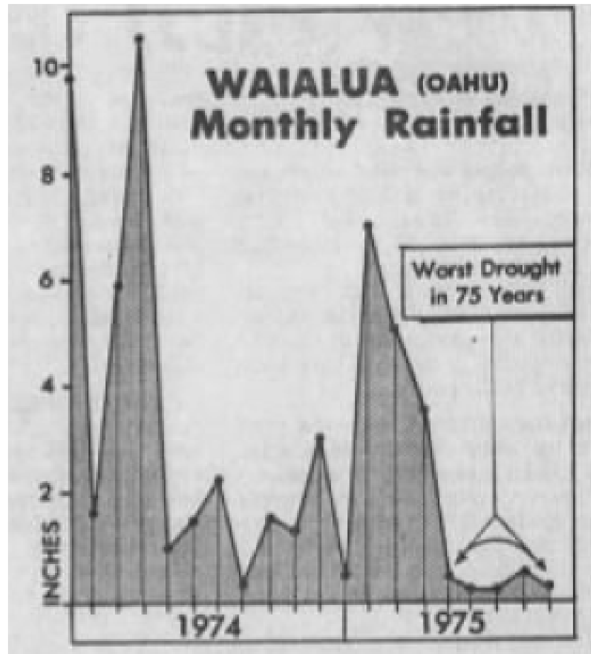


Figure 26. Graph of recorded rainfall levels in inches in Waialua in 1974 and 1975 (Hawaiian Gazette 1906.).

In 1980, Waialua Agricultural Company sought new avenues for revenue including using molasses, a byproduct of sugar production, to produce ethanol as an alternative energy source (Honolulu Star-Bulletin 1980). This new endeavor was seen as an opportunity to increase profitability, reduce waste, and as a response to environmental concerns. In 1984, another drought plagued the Waialua plantation causing low yields (The Honolulu Advertiser 1985b). In 1985, the State Department of Health found a hydrogen sulfide odor problem at the Waialua Sugar Mill and determined the gas was affecting the health of some residents in the area. The problem was linked to mill wastewater sitting stagnate and producing swamp gas (hydrogen sulfide) in a ditch that ran *mauka* of Crozier Drive (The Honolulu Advertiser 1985a; Honolulu Star-Bulletin 1985). The Waialua Sugar Company cut their work force by 15% in response to profit losses and "uncertainty in the troubled sugar industry" (The Honolulu Advertiser 1985b). The previous year, Waialua Sugar Company shut down for 10 weeks in an effort to cut costs and remedy losses as well (The Honolulu Advertiser 1985b). In 1986, Eileen Koontz, a spokeswoman from Castle & Cooke, recalled record yields at Waialua, but it resulted in only a small operating profit which turned into a loss after subtracting interest costs and taxes (The Honolulu Advertiser 1987). The downwards trend for the sugar industry continued through the 1990s.

In 1994, several sugar companies announced a cease in sugar production and business (The Honolulu Advertiser 1995). From 1990 to 1996, nearly 3,000 sugar industry jobs were lost (The Honolulu Advertiser 1995). In 1994, Michael O'Brien, president of Dole Food Hawaii, announced a shutdown of Waialua Sugar Company (The Honolulu Advertiser 1994). He recalled how "none of us want to see Waialua closed but we also have to face the reality that we've lost over $17 million over the last six years" (The Honolulu Advertiser 1994). The 1994 milling season ended on October 29th and yielded an operating loss of more than $3 million, bringing the cumulative loss to more than $20 million for the last six years (The Honolulu Advertiser 1996; Hawaii Tribune-Herald 1994). The Waialua Sugar Company closed in 1996. The Dole Food Company Hawaii sought to reuse the existing plantation and mill to produce coffee (The Honolulu Advertiser 1998). Dole had previously started to experiment in order to diversify their agriculture and began experiments with coffee in Waialua in the late 1980s (The Honolulu Advertiser 1998). About 20 acres of cacao were also planted in 1996 at Waialua (Figure 27) (Honolulu Star-Bulletin 2005). Dole built a visitor center at the old Waialua sugar mill which opened in December of 1998 (The Honolulu Advertiser 1999a). Despite the Waialua Sugar Company shutting down in 1996, the community continued to see the old sugar mill as the "focal point of the rural town" and continues to use it to this day for community events (The Honolulu Advertiser 2000;

Honolulu Star-Bulletin 2010). Recently, many small businesses have repurposed the mill setting up a soap factory and various surfboard shaper shops (The Honolulu Advertiser 2010)

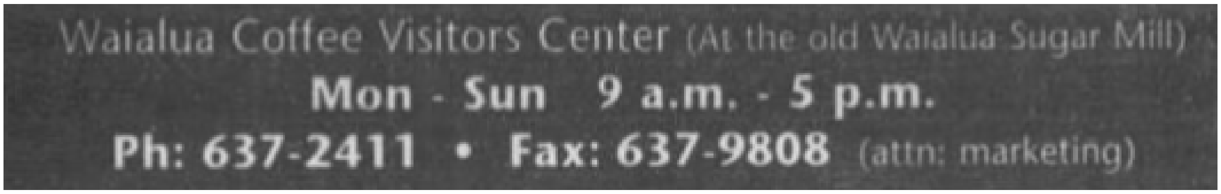


Figure 27. An ad notifying the public of the Waialua coffee visitors center at the old Waialua sugar mill (The Honolulu Advertiser 1999b)

Plantation Labor and Labor Issues

From 1852 to 1946, nearly 400,000 immigrant workers were brought to O‘ahu from Korea, Japan, China, Puerto Rico, the Philippines, and Portugal to service the sugar industry (The Honolulu Advertiser 1996). The utilization of immigrant labor for plantations has contributed to the ethnic diversity seen in Hawai‘i today. Plantations, especially sugar plantations in Hawai‘i, primarily used workers who were racially distinct from both the indigenous Hawaiian population and the plantation power structure in order to control labor (Lal et al. 1993:45). As Lal et al. highlights:

> Most of the plantation economies generated racial ideas, which entered the political structure to create superior and inferior racial classifications. In Hawai‘i, the term race was coupled to expressions of unassailability, depravity, and ineducability. Ironically, the planter group in Hawai‘i often argued that a particular race had those characteristics needed for a docile, servile labor force. The opponents of immigrant labor inverted these arguments to describe an undesirable population. But briefly, the notion of ethnicity and race as applied to plantation systems tended to follow the lines of racist concepts so familiar in American history.
>
> Westerners were struck by two important facts on arriving in early nineteenth century Hawai‘i. The abundance of vacant land and the benign climate suggested the great wealth that this combination could produce. Of the many crops under consideration and experimentation, sugar was one of the forerunners. Whatever the crop, labor was a necessary ingredient, and the indigenous Hawaiian was thought to be in need of a gainful occupation to replace the immorally high level of idleness. Between 1826 and 1850, vigorous attempts were made to convert the Hawaiian commoner into an appropriate, western-oriented labor force to accompany the conversion of Hawaiian communal land system into a fee simple, private property status, suitable for capitalist development.
>
> Reports from all areas of the islands demonstrated the Hawaiians’ refusal to work for low wages. They could be attracted into wage labor for varying periods of time when the offer was attractive enough to persuade them to leave their subsistence activities. It was this refusal to submit to low wages and various legal efforts to compel the Hawaiian to work for wages that played a major role in the enactment of the indentured labor system in 1850, duplicating the experience of other sugar-producing areas around the world. The Masters and Servants Act of 1850 provided for the signed of labor contracts, enforced with penal sanctions. The act, almost incidentally, provided for the importation of indentured workers. (Lal et al. 1993:45–48)

The first major wave of labor immigration into Hawai‘i occurred in January 1852 when 195 laborers from China arrived on O‘ahu with five-year contracts to work on the sugarcane lands (The Hawaiian Star 1904). As the world-wide demand for sugar increased and the sugar plantations demanded more immigrant labor, the Hawaii Bureau of Immigration was formed in 1864 to formalize control of immigration into Hawai‘i (Fleischman & Tyson 1999:9). Between 1876 and 1900, approximately 45,000 Chinese and 86,4000 Japanese laborers were brought to the Hawaiian Islands of which approximately 75% worked on sugar or rice plantations (Cheng and Bonacich 1984) .

As the sugar industry continued to boom and labor demand increased, migrant labor was sought in different countries. The first wave of Portuguese workers arrived in Hawai‘i in 1878 (Rowland 1933). Following the Spanish-American War and Treaty of Paris in 1899, the United States gained control over the Philippines and Puerto Rico, both which subsequently provided large quantities of labor for plantations in Hawai‘i (Fleischman and Tyson 2000; Rowland 1933). Workers also immigrated to Hawai‘i from Germany, Spain, Portugal, and other countries.

Through the early 20th century, the number of Japanese workers in Hawai‘i drastically dropped. In 1908, Japanese workers comprised nearly 70% of plantation workers in Hawai‘i. However, by 1932 they comprised only 18.8% (Fleischman & Tyson 1999). Conversely, the percentage of Filipino workers increased exponentially as they comprised 41% of plantation labor in 1922 and 69.9% in 1932 (Fleischman and Tyson 2000). The shifting ethnicity of plantation laborers during this period is attributed to labor and wage strikes, war propaganda particularly against Japan, and the willingness of Chinese/Japanese workers to relocate into cities (Fleischman and Tyson 2000).

Strikes over labor issues were a defining characteristic on sugar plantations across Hawai‘i during the late 19th to 20th centuries with the earliest records of a strike being recorded at the Kōloa Sugar Plantation on Kaua‘i in 1841. The first cases of strikes at the Waialua plantation were reported in the Hawaiian Star Newspaper in 1904 which consisted of about 1,300 Japanese cane loaders who wanted an increase in pay (The Hawaiian Star 1904). Mr. Goodale, the plantation manager at the time, recalled:

> The strike originated among the loaders-the men who load the cane on the cars in the field. The others that have struck have done so out of sympathy. We have two camps of Japanese on the plantation, about 400 in one and 500 in the other. The 400 struck and as the other camp refused to join them, saying that they had no grievances against the managers, the strikers marched in a body to the other camp with the view of compelling their compatriots to join them. No laborers except the Japanese have struck and none seem inclined to. Most of the recent strikes have been for one fairly good reason and about fifty imaginary ones (The Hawaiian Star 1904).

In 1909, Japanese Merchants’ Association and “agitators of the Higher Wage Association” organized a strike including workers from various sugar plantations across O‘ahu over issues related to wage discrepancy between various ethnic groups. The Zokyu Kisei Kai (Higher Wage Foundation) was formed and established as the first true labor union for plantation workers in Hawai‘i. The foundation submitted a request to the Planter’s Association for a conference to discuss “reason and justice”, which was acknowledged but did not result in the scheduling of a meeting. As a response, the workers of numerous plantations began to vote on strikes one by one. It began with plantation workers of ‘Aiea and quickly spreading throughout the island to other plantations including Waialua. The workers were met with resistance from the major plantation owners and nearly one month after the initiation of the strike, workers were met with evictions from plantation housing with little notice. The strike finally ended after three months following the arrest of Waipahu strikers and a prolonged campaign of targeted arrests and ban on public speeches. While it is estimated that the strike cost the Japanese community $40,000, the strike cost the company owners $2 million – though this figure is estimated by the strike leader. As a result of the walkout plantations pursued strategies to deter future strikes, including increasing laborers from the Philippines but also establishing and constructing programs aimed to address the social needs of plantation communities, such as schools, churches, playgrounds, and housing (Center for Labor Education & Research n.d.).

With World War I, the price of living in Hawai‘i increased by 115% and, as one consequence, resulting in the 1917 formation of the Higher Wage Association by Japanese workers to advocate for a basic living wage given rising cost of living. However, the HSPA responded by importing more laborers from the Philippines. As the war progressed, the plantation workers, rather than press their demands, instead formed a new organization known as Federation of Japanese Labor which organized on every Hawaiian island. At the end of 1919, the Federation of Japanese Labor submitted an appeal request to their low wages as well as a list of demands that include items such as a minimum of ninety-five cents for women laborers, maternity leave with pay, an eight-hour day, and double pay for overtime and work on Sundays and holidays. Portions of their request provide insight on their concerns and demands:

> We are laborers working in the sugar plantations of Hawaii. People know Hawaii as the paradise of the Pacific and as a sugar producing country. But do they know that there are thousands of laborers who are suffering under the heat of the equatorial sun, in field and in factory, and who are weeping with 10 hours of hard labor and with a scanty pay of 77 cents a day?
>
> We love production. Fifty years ago, when we first came to Hawaii, these islands were covered with ohia forests, guava fields and areas of wild grass. Day and night did we work, cutting trees and burning grass, clearing lands and cultivating fields until we made the plantations what they are today.
>
> We are faithful laborers willing to follow the steps of our departed elders and do our part toward Hawaii's production. We hear that there are in Hawaii over a hundred millionaires, men chiefly connected with the sugar plantations. It is not our purpose to complain and envy, but we would like to state that there are on the sugar plantations which produced these large fortunes for their owners a large number of laborers who are suffering under a wage of 77 cents a day.
>
> The effects of the European war have reached Hawaii and there is no need to mention about the spiraling rising living costs. We have so far restrained ourselves because we did not want to cause the slightest disruption in the economy of our nation at war. The war is over, and our plight has

> increased. The sugar industry has prospered. The elimination of wartime taxes, combined with postwar lower freight and fertilizer have resulted in increased profits to the industry. We fully realize that capital is entitled to a fair return. On the other hand, we feel that it would only be fair and just that worker's economic plight be recognized and consideration be given to increasing their wages (Wakukawa 1923:240–242).

All items of the request made by the Federation of Japanese Labor were rejected. The federation sent out representatives to meet with the HSPA who continued to refuse to meet. Meanwhile the laborers brought from the Philippines were organizing their own independent association known as the Filipino Labor Union. They went on strike January 19, 1920, and the Japanese joined in the strike four days later. The January 21st edition of the Honolulu Advertiser reported that Filipino workers had not gone on strike on the same day as plantation workers at Kahuku, Aiea, Waipahu, and Ewa; however, that they walked out two days later (The Honolulu Advertiser 1920). The HSPA countered these strikes by attacking the strike in the press and suggesting the strikers were "alien agitators". They then evicted the laborers on strike from their plantation homes. In addition to these struggles, an influenza epidemic swept across the island, resulting in numerous deaths. However, the disease created solidarity among the different cultural groups on plantations. Consequently, when the leader of the Filipino Labor Union, Pablo Manlapit, announced their return to work in opposition to Japanese unions who continued to strike. Many Filipino laborers stood by their fellow Japanese coworkers and refused to return. Subsequently, Manlapit was forced to withdraw his announcement of the end of the strike. *The Honolulu Advertiser* (1920) reports that a strike parade was planned by striking Waialua employees in April 1920 to impress the Waialua residents with the cause. However, the parade was abruptly canceled. After five months of striking, the Federation of Japanese Labor called to end the strike on July 1, 1920. Many laborers were left without a job and the leaders of the organizations were blacklisted. However, in the months following the end of the strike, wages determined by race differences were eliminated, pay increased, and improvements to housing, sanitation and water systems were underway (Puette 2018:31). At Waialua when the laborers returned to work they learned they would not be given their old positions back resulting in them walking out again (The Honolulu Advertiser 1920). However, all the workers return on July 19th.

In 1924, the Filipino Piecemeal Strike occurred when Filipino workers on sugar plantations across Hawai‘i went on strike under the organization of Pablo Manalapit on the issue of increased pay and a reduced workday. Only three O‘ahu plantations were affected including Waialua, where approximately 500 workers refused to work (Reinecke 1996:199).

As the Second World War came to an end, the International Longshore and Warehouse Union (ILWU) campaigned for representation with use of the new labor laws introduce by Franklin Roosevelt and within two years their membership grew from 900 members to 28,000. Plantation owners suspected a strike on the horizon and responded by bringing 6,000 more laborers from the Philippines. However, members of the ILWU waited by the ships and the laborers joined their union organization. In September, 26,000 sugar workers and their families began to strike against the plantation system shutting down 33 of 34 sugar plantations throughout the islands. The ILWU recruited leaders from all different racial and ethnic groups and gained a total of 76,000 people to strike making this strike the largest in Hawaiian history. The strike was well-organized. Every striker had a job to do whether walking the picket line, printing news bulletins, cooking, or growing and gathering vegetables. Pressures from the plantation owners proved to be unsuccessful due to the solidarity between the workers of different ethnic groups. The strike lasted for 79 days and in the end the union organizers were successful in shifting the power balance between plantations and laborers (Puette 2018:34–35). The laborers had essentially ended the plantation lifestyle in Hawai‘i and continued to see an increase in benefits and wages in the following years. The number of camps began to dwindle, and plantation workers were moving to houses near their work sites. New housing divisions were created, allowing the opportunity for individual ownership for sugar company workers for the very first time (Dorrance and Morgan 2000:133).

The next recorded strike at Waialua occurred in 1952 when 320 Filipino workers walked out in in response to the transfer of an irrigation foreman, Roberto Pagdilao, to a supervisory position (Honolulu Star-Bulletin 1952). The Filipino Community Association of Waialua sought to discuss the matter with the plantation management but received no reply. The plantation management suspended the employees that refused to show up for work and stated that the milling operations would be curtailed due to the dispute. In pamphlets distributed by the Filipino Community Association of Waialua clarified their position in the dispute by stating "Mr. Pagdilao's transfer is considered by the protestors as a demotion, since he has been shifted from irrigation foreman to the foreman of the 'old ladies gang' although at the same pay". The Filipino laborers returned to work after a three day walk off with the dispute unresolved (Honolulu Star-Bulletin 1952).

In 1969, following a failure to neogotiate a new contract with the plantations, ILWU organized a statewide strike consisting of between 9,100 and 10,500 sugar plantation employees from 23 plantations (Honolulu Star-Bulletin 1969;

The Honolulu Advertiser 1969b). The union reported wages, pensions and operating efficiency as the issues on which the strike. On the issue of wages, the plantations had offered wage increases ranging from 33 to 59 cents over a three year period. However, the union wanted wage parity with pineapple plantation workers. On the issue of pensions, the ILWU argued that for a larger retirmentment benefit and proposed to trusteed plan of administering the pension program which would allow the union greater control within the program. However, the plantation's insited such a change would be too complex. Lastly, regarding the issue of operating efficiency, the union wanted to end overtime hours on Saturday eventings (Honolulu Star-Bulletin 1969). As a result of the strike 23 plantations were forced to temporarily close. At the Waialua Sugar Company, striking employees The Honolulu Advertiser (1969b) reported that ILWU workers at Waialua Sugar Co. prepared shelters to prepare for bad weather in anticipation of extended negotiations. The strike lasted 31 days and ended after the unions and plantations agreed on a new 3-year contact with the plantations which included pay raises and larger pension plans (The Honolulu Advertiser 1969a).

WAIALUA MILL CAMP AND ITS RESIDENTS

Plantation camps were first constructed to house foreign workers, who immigrated to Hawaiʻi to work on plantations. Early housing arrangements divided laborers into skilled workers, who worked more specialized jobs such as irrigation or within the mill, and unskilled workers, who tended to work in the fields. As a consequence of the location of their respective jobs, the skilled workers tended to live near the mill building while camps for unskilled workers were spread more widely across the plantation near the fields where they worked (Marquez 2012:4). Housing was often ethnically segregated as a way to ensure social discordance and prevent labor movements. These early housing arrangements consisted of barracks or double houses. Barracks could house between 50 and 60 laborers who slept on multitiered bunks (Riznik 1999:127). Kitchens, baths, washhouse and toilets were often separate structures. Conditions within these barracks were poor as they were usually cramped, overcrowded, and unsanitary. Early families who immigrated to work on plantations lived in double houses characterized by separate homes that share a wall and with each typically consisting of one or two rooms (Riznik 1999:126). Similar to the barracks, double houses were often overcrowded and unsanitary.

A 1901 map of the Waialua Agricultural Company depicting the extent of the plantation after only three years of operation includes several groups of houses or barracks around the mill (Figure 28). Within the project area and west of the mill, a line of buildings along a road appears to be housing, likely for laborers working in the mill and the surrounding fields. Additional houses, along with an office and store, are located west of the mill. By 1913, several more sections of housing had been constructed including an additional row of houses or barracks located south of the row of houses built prior to 1901 (Figure 29). A group of houses also appears to have been built between the project area and the mill while several rows of houses were constructed south of the project area and north of Farrington Highway near the water reservoir. The rapid development of housing around the mill during the first decade of the 20th century is a visible result of the early successes of the Waialua Agriculture Company and a response to the increased need for immigrant labor and their concomitant need for housing as the company grew. The housing developments were likely a part of the substantial early capital investments Castle & Cooke made in the company to support its growth.

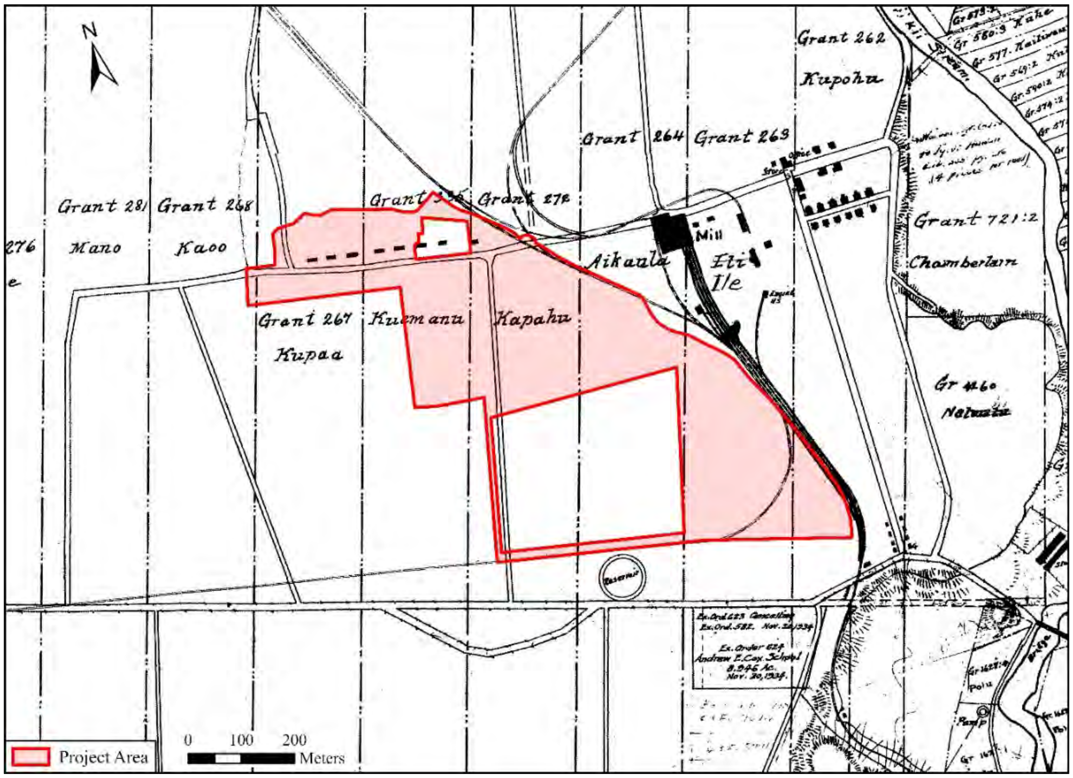


Figure 28. Map of the Waialua Agricultural Company by W.A. Wall in 1901. Note the housing in the north of the project area.

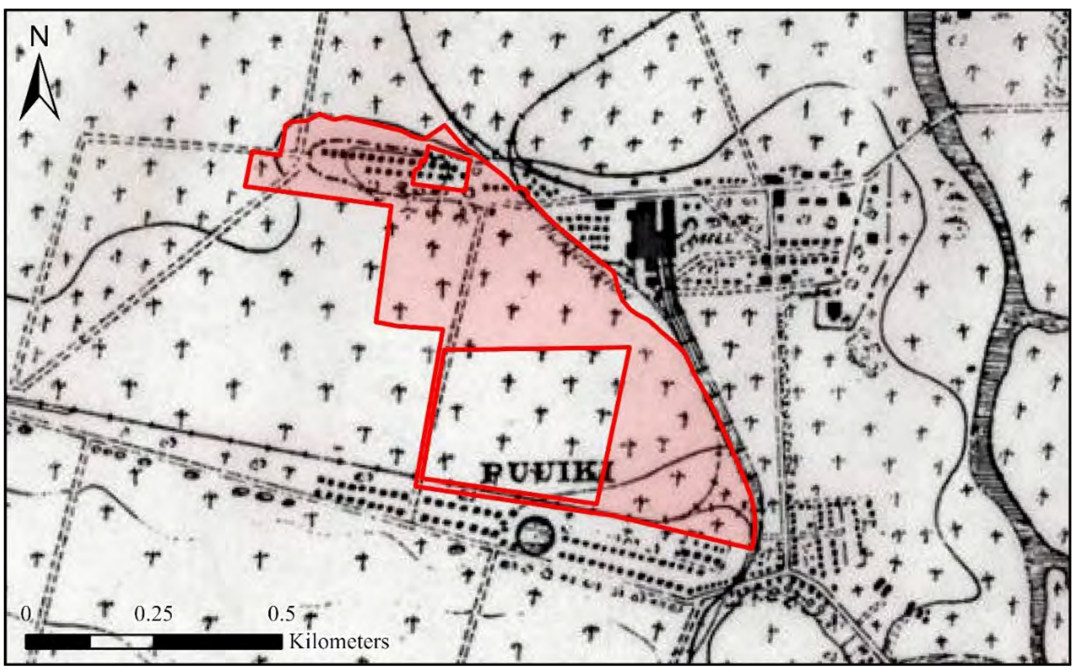


Figure 29. US Army Survey Map from 1913 depicting the plantation in Waialua.

Around 1910 several housing reform movements developed in part as a result of the sugar industry recognizing the need to increase and control labor. Following the Japanese Labor Strike in 1909, the Labor Committee of the Hawaiian Sugar Planters Association began recommending housing reform to plantations and urging them to provide better welfare for their employees as a way to settle labor issues (Riznik 1999:131). In 1911, following a housing sanitation crisis, the Territorial Board of Health intervened and in a letter to plantation operators provided construction drawings for homes that emphasized sanitary conditions and further recommended good ventilation as a way to reduce diseases. They proposed that such ventilation could be achieved by raising houses that were too low to the ground and removing buildings that were too close together (Riznik 1999: 132). In addition, a general shift in plantation demographics from largely consisting of unmarried men to an increased number of women and families required a change in housing arrangements. Consequently, between 1910 and 1920, the first single family homes were built on plantations. The standard for such homes was set by George Wilcox who built 120 houses for his sugar plantation, Grove Farm, on the west side of Līhuʻe in Kauaʻi. These houses consist of two to three rooms and consisted of several house plans designed for different sizes of families including bachelors, a couple with one to two children and larger families. Except for the houses built for single men, the houses all had kitchens with running water (Riznik 1999: 133-134). These houses provided a drastic change from the congested and unsanitary conditions that characterized the earliest of the plantation housing.

While housing reform improved the lives and welfare of employees and their families, plantation managers were also supportive of such reforms as they served as a way to control labor. Providing housing served as a form of welfare capitalism as it allowed for the development of a community that attracted employees and simultaneously increased the managerial control over the labor (Riznik 1999). In 1919, HSPA established the Social Control Bureau to act as stimulate planning for individual plantations (Riznik 1999:134). The organization conducted surveys detailing the condition of employee housing for plantations and provided blueprints for a standard single-family home which included a kitchen, separate bedrooms, and better ventilation. These early designs were modeled after the plantation homes built for Grove Farm in Kauaʻi (Riznik 1999: 137).

In 1925, the Hawaii Sugar Planters' Association commissioned a survey to evaluate Hawaiʻi industry management standards compared against the mainland U.S industrial housing standards. The mainland policy maintained that barracks were no longer appropriate housing arrangements and new housing was restricted to single-family residences with at least two bedrooms. Importantly, the results of the survey report that by 1925 approximately two-thirds of all plantation housing units were single-family homes and demonstrated that sugar plantation housing had drastically improved since only a few years earlier. The survey report emphasized the importance of the social aspects of worker housing, plantation operators were advised that the use of the word "camp" as a designation for the groups of housing should be abandoned and that housing should be planned and considered more like villages (Marquez 2012:25). The report suggested that professional architects and planners should be commissioned by the HSPA to design the communities according to the recommendation that "the camps should be converted into organized villages, the villages should be named, and every measure taken to stimulate and develop normal community interests" (Riznik 1999:145).

From 1935 through 1950, HSPA ran an architectural service to support the plantations, with Honolulu architect Theodore Vierra serving as the director (*Honolulu Advertiser* 1950). Plans for plantation houses were upgraded and new designs had more open floor plans than those in the 1920s and took into consideration the island environment (Marquez 2012:38). These new houses included toilets, showers, laundries, and additional windows.

At the Waialua Agricultural Company, aerial photographs from 1928 show that between 1913 and 1928 several rows of single-family homes were built within the project area where the current mill camp stands (Figure 30) Additional rows of homes were also built in the northwest portion of the project area where housing had existed since prior to 1901. It is unclear if the original buildings in this area were barracks or houses, and therefore, it is uncertain if the houses seen in this area represent these earlier homes/barracks and additional houses were added or if these older houses/barracks were replaced. However, one reporter visiting the Waialua plantation in 1937 recalled his observations of the Waialua Plantation and Mill Camp and suggests that some original houses remain in use stating that some of the buildings located in the northwest potion of the project area may be original.

> Every person who works on the plantation, from highest to lowest, lives in a company house, rent free. Some of the houses are as old as the plantation, which is 38 years. Some are modern as tomorrow, and the paint is not yet dry on them.
>
> Every house has enough ground around it for a vegetable garden, for chickens, and for trees and myriads of flowers. The workers get electricity at a low rate…get free hospital treatment for anything from a cut fingers to having a baby.
>
> There are three schools on the plantation, including a high school. The workers can trade at the company stores but they don't have to. There is a little settlement of free men at the edge of town with stores, barber shops and lunchrooms and the people can trade there if they wish. (*Honolulu Star Bulletin* August 31, 1946).

Figure 30. Aerial imagery of Waialua Agricultural Company from 1928.

Individual home ownership was not as prevalent in Hawai‘i as it was in the U.S. until well after World War II. In 1946, following the “Big Strike of 1946” in which plantation workers in Hawai‘i unionized with the support of International Longshoremen‘s and Warehousemen‘s Union (ILWU), workers and plantation management agreed to a new union contract which ended the company subsidized housing for plantation workers and implemented a new system which would treat employees as rent-paying tenants (Marquez 2012:43). The union viewed the elimination of the plantation subsidized houses as a way to increase the workers’ control of their living and working conditions while simultaneously reducing the power and control of the plantations. However, home ownership was not a priority for the union at this time as many existing homes on the plantations were old and would have required extensive costly rehabilitations before being able to sell to union members (Riznik 1999:151). Additionally, as a consequence of the poor condition of the homes, the monthly rent was kept low for the new tenets. The rental fee corresponded to two factors. The first was the type of construction and facilities of the house as determined while the second factor was the house’s physical conditions as described as poor, fair, good, or excellent (Marquez 2012:43).

The settlement between the union and plantations after the strike of 1946 substantially altered the plantation lifestyle in Hawai‘i. In the years to follow, sugar workers continued to see an increase in pay and benefits while the number of camps steadily decreased as workers moved into housing nearby in modern communities. (Dorrance and Morgan 2000:133). Following unionization and the new union contract, several plantations including Waialua Plantation offered the opportunity for individuals to own homes. Subsequently, several new housing divisions were constructed, many of which were designed by Theodore A. Vierra. In the 1940s, Vierra designed the “All Hawaii” house originally a new subdivision for Hawaiian Commercial Sugar Company workers in Maui. However, similar houses to the “All Hawaii” design were built to sell to employees on other plantations, including in Waialua. This new house plan features an 800 and 1,000 sq ft three-bedroom house, built on concrete slab with asphalt tile and hollow tile walls. Each house also contained living and dining rooms, kitchen, toilets, baths, and a laundry (Riznik 1999:151). An aerial photograph from 1944 (Figure 31) compared to topographic map of the project area from 1953 (Figure 32) shows that additional sections of houses were built between these years, likely using designs similar to Vierra’s “All Hawaii” house. Following, this last major building period in the mill camp, only a few more houses were built in the west central portion of the mill camp in the 1960s (Figure 33).

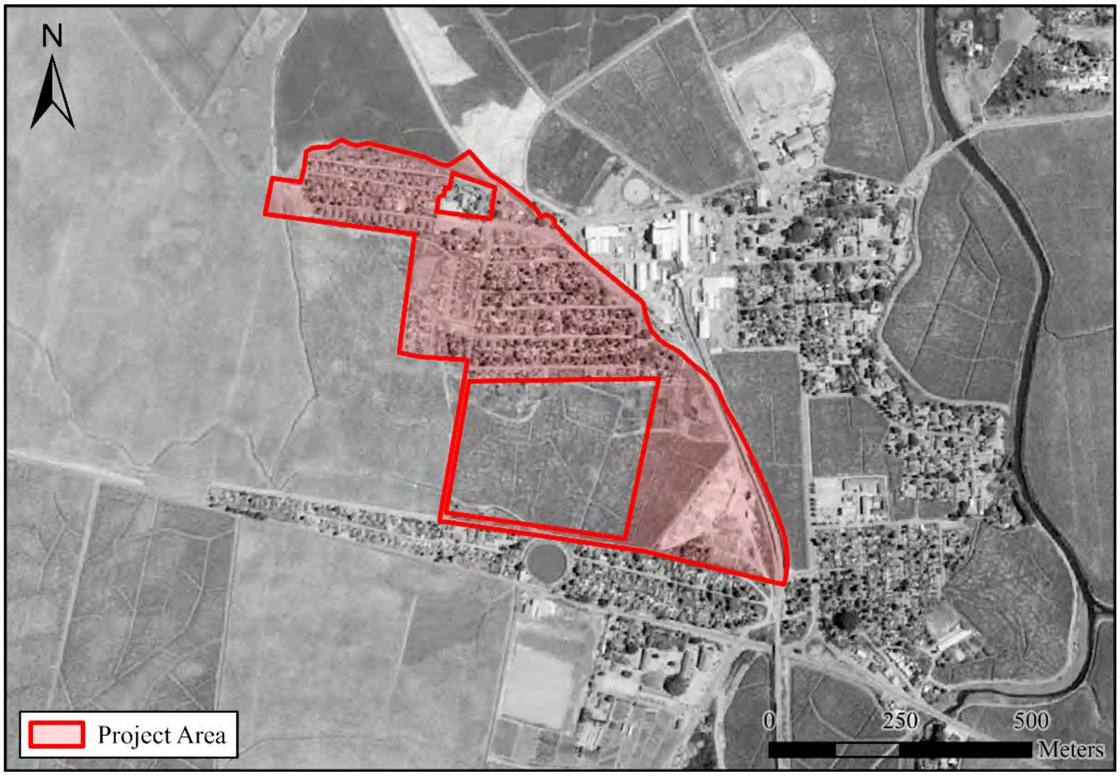


Figure 31. Aerial imagery of Waialua Agricultural Company from 1944.

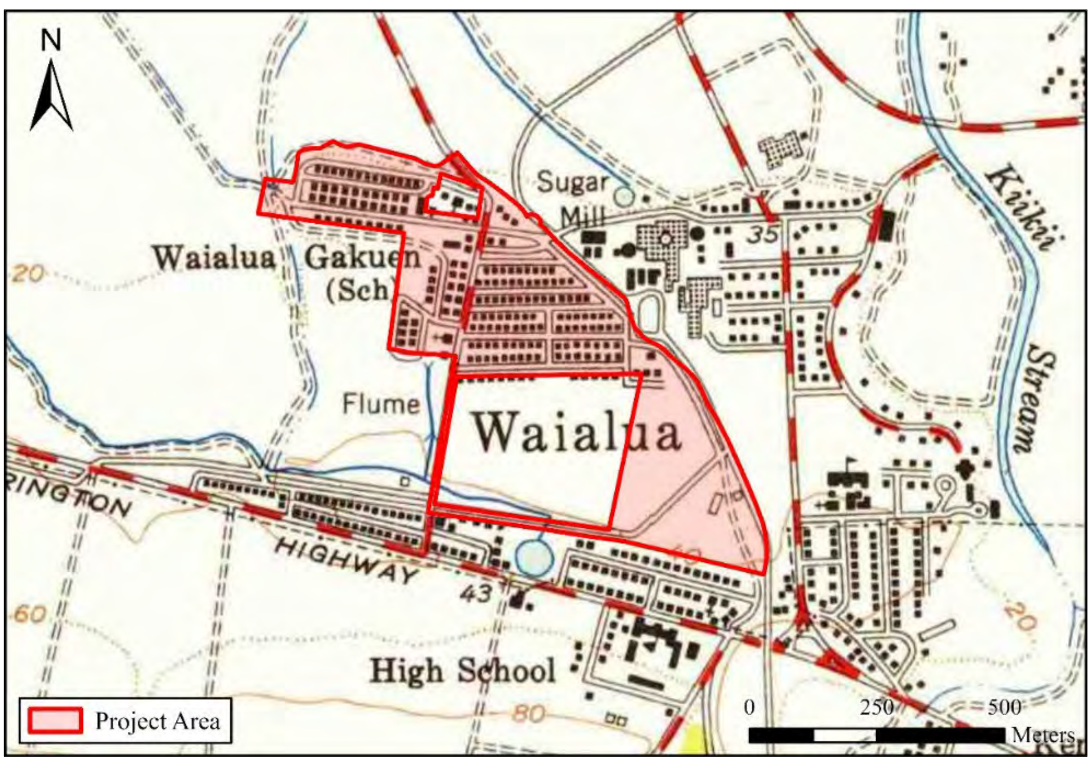


Figure 32. Topographic Map from 1953 depicting Waialua Mill Camp and Mill.

As development around the mill and within Waialua Mill Camp slowed in the latter half of the 20th century, the neighborhood experienced a turbulent period in which the community faced many challenges including a struggling sugar industry, the increased visibility of crime, and health issues cause by the association of the neighborhood with sugar production. Several instances of gun violence resulting in homicides and theft are reported on in newspaper during the 1970s and 1980s (The Honolulu Advertiser 1960b; Honolulu Star-Bulletin 1964; Honolulu Star-Bulletin 1975b). In 1985, it was revealed that a buildup of mill waste water in a ditch *mauka* of Crozier drive was releasing hydrogen sulfide and causing deterioration of the plantation houses as well as health problems for the residents including apnea, headaches, stomach cramping, and, in some cases, insomnia and convulsions (Honolulu Star-Bulletin 1985). After several reported cases, the director of environmental health reported the findings of his health assessment which resulted in a 5-month suspension of sugar processing. With the help of the Department of Health, the Waialua Sugar Mill was able to drain the water out of the ditch. By the 1980s, several of the houses in the mill camp were deconstructed (Figure 34). Additionally, all the houses in the northwest portion of the project area were destroyed and the area converted into a sand quarry.

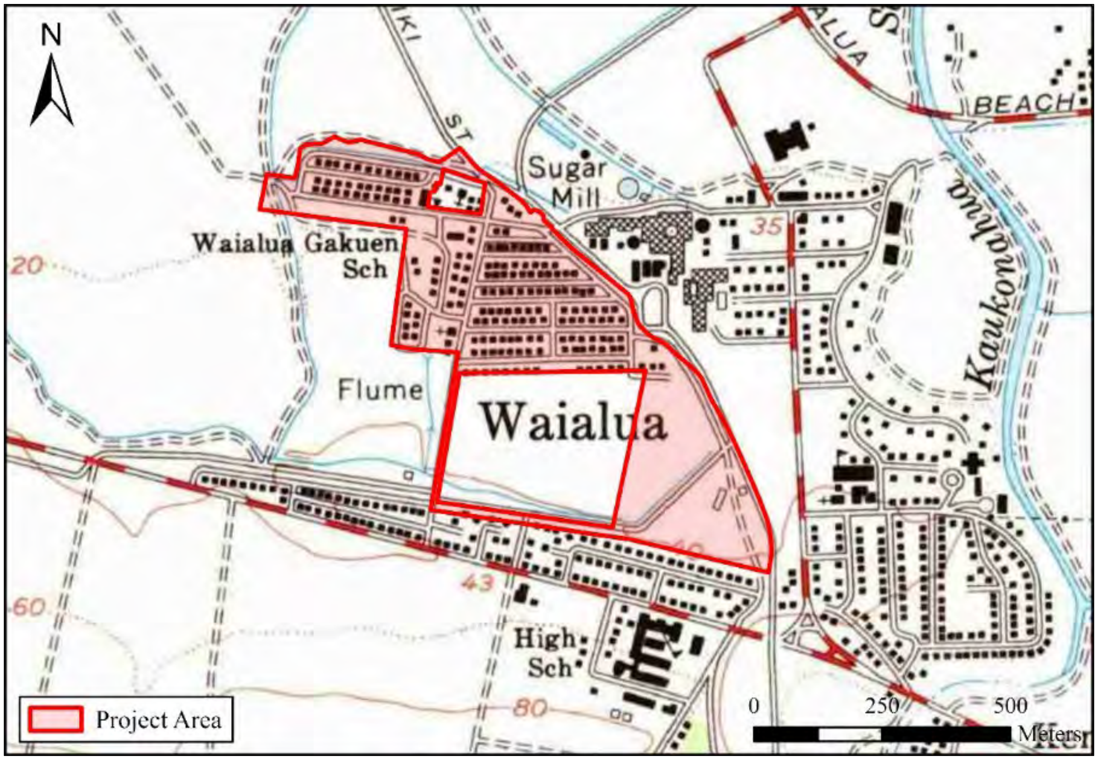


Figure 33. Topographic Map from 1960 depicting Waialua Mill Camp and Mill.

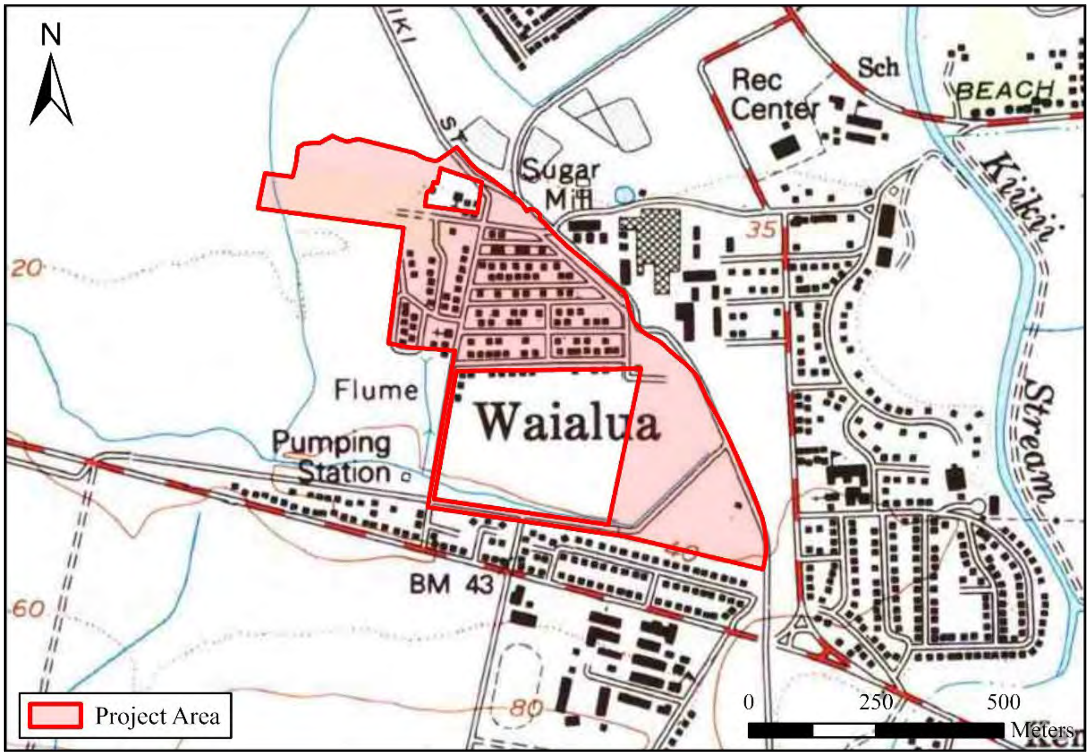


Figure 34. Topographic Map from 1980 depicting Waialua Mill Camp and Mill.

During the 1980s and 1990s, life in Waialua Mill Camp was characterized by the uncertainty of the sugar industry and the impending threat of closure of Waialua Sugar Company. In 1985, the company reportedly reduced its work force by 15% due to recent loses (The Honolulu Advertiser 1985b). The reduction left the company with 69 supervisory employees and 390 union employees. The Company experienced losses in profit and the union agreed to free wages and allowed the company to schedule work on weekend without overtime pay. One worker stated that they voted in favor of the union's contract because otherwise they feared they would not have a job (The Honolulu Advertiser 1985b).

Waialua Sugar Company threatened to shut down in 1987 at the directive of David Murdock, a chairman of Castle & Cooke. However, the decision was reversed after intense criticism (Honolulu Star-Bulletin 1989). Heavy losses continued and the sugar industry remained unstable. Concerning the possible closure of the mill, William Paty, the former manager of the mill, explained that in a rural town like Waialua, the plantation is an entire way of life. He stated that the closing of the plantation would change the lifestyle that was cherished by the plantation workers. However, he offered an optimistic view: "But the essential character of Waialua will not change. The core of the community will be there" (Honolulu Star-Bulletin 1989). Of the paternalistic aspect of the mill camp, William Patsy stated the only vestiges that remained is the Waialua Sugar Company's whistle, which previously was used as a reminder of the 8pm curfew for the local youth. Paty joked that the "only thing it's good for now is to tell folks when the 8 o'clock TV show starts" (Honolulu Star-Bulletin 1989). With the impending threat of closure, John Primacio, Jr. and Seiko Shiroma, former employees of Kahuku Sugar Planation which shut down 19 years prior, offered advice to Waialua Sugar Company employees suggesting that one of the more difficult aspects of the closing of a plantation is the fact that former plantations employees are suddenly faced with the reality of having to run a town (Honolulu Star-Bulletin 1989). In many cases, the services that residents relied on had been provided by the plantation including a physician, the water supply, the fire station, the local credit union, and general stores where workers and their families could buy supplies. They emphasized that the Waialua residents must be unified as they rebuild the community (Honolulu Star-Bulletin 1989).

In 1996, the closing of Waialua Sugar Company was felt mostly by families living in plantation homes. There was a general fear that they would lose their homes as well as their jobs. Kawailoa Camp, north of the Waialua Mill Camp, had only 5 years remaining on the lease of the land from Bishop Estates. Kawailoa Camp residents feared that the company would not extend the lease and they would lose their homes. However, many of these residents were willing to move into similar homes at Waialua Mill Camp within the current project area if that was required (The

Honolulu Advertiser 1995). A similar fear permeated communities across the region. Eventually, some mill camps were shut down, including Kawailoa Camp. However, it was announced that housing would continue to be leased to employees in other locations including Waialua Mill Camp, so long as the employees had already retired from the company (The Honolulu Advertiser 1997a). Thus, many employees opted for an early retirement and were allowed to keep their homes within Waialua Mill Camp. However, many were too young to retire and consequently were forced to move (The Honolulu Advertiser 1997a). People who were forced to leave were given 9 months to find another place to live plus another month for every 5 years they worked for the company (The Honolulu Advertiser 1997b). At the time of closing, there were still 115 homes in Waialua Mill Camp. Seventy of these homes were used to house retirees while the other 45 were used to house employees rehired by Dole Plantation (The Honolulu Advertiser 1997b).

The Department of Housing and Development attempted to address the housing crisis by designing a housing project for displaced Waialua Sugar Plantation Employees, but many workers had just lost their job and would be priced out of any newly developed home (The Honolulu Advertiser 1994). The reality facing the 225 plantation workers who had lost their jobs, yet had families to provide for, seemed bleak for many residents. At the time of the shutdown, plantation workers paid $42 in rent per month in addition to water and electricity. Two such workers, Orlando and Irene, had moved from the Philippines and had worked on the plantation for 18 years. As he was not at retirement age yet, he did not qualify as a worker who would be able to keep his plantation home. Orlando says of the changing circumstances, “How can I afford to pay $800 rent?” (The Honolulu Advertiser 1995:2). Another measure to try to help plantation workers was provided by the State Department. Their solution was to attempt to provide $1.4 million worth of loans to affected plantation workers. However, this solution was less than ideal with many plantation workers stating they would not take a loan because of the steep costs of the interest they would be obligated to pay (The Honolulu Advertiser 1995). Even for the workers who were guaranteed housing for life, many were forced to move to another mill camp or plantation home. Although they didn’t need to worry about housing needs in the way that unretired workers did, they still had the heartbreaking task of moving out of homes that they had raised their children in and lived in for decades (The Honolulu Advertiser 1995). Even with a loan, the cost of housing was not attainable for many families causing workers to move in with friends or family or to relocate altogether to locations where there were sufficient job prospects (The Honolulu Advertiser 1996).

In the 20 years since the closing of the Waialua Sugar Mill, community ties have remained strong. While there is no longer a single unifying company as the foundation of the town, the residents remain unified in their shared pride of being part of the sugarcane industry and in shaping the history of Hawai‘i (The Honolulu Advertiser 1996). This community mindset continues with a rise in co-operative farming practices. The Red Barn Stand in Haleiwa is a business started by two employees who lost their jobs in the closing of the Waialua Sugar Mill. They opened “Twin Bridge Farms” in Waialua which initially grew papaya, potatoes, and asparagus. It became a place for the community to gather and celebrate the agriculture in the area. Other community members began to bring their fresh fruits and vegetables as well as jam, coffee, tea, chocolate, and other specialty products. The company became “The Red Barn Farmstand” and now hosts events, cooking classes, and workshops for members in the community (The Honolulu Advertiser 2017). After the closure, the Dole Company continued to allow former Waialua Plantation employees to meet at the library on the plantation, which functioned as a plantation community center. This continued until the library burnt down in 2003 (The Honolulu Advertiser 2003). The Dole Plantation continues to host community events and benefits, most notably its annual Lū‘au fundraiser for the Waialua High School Robotics Team that it has hosted for over a decade (Honolulu Star-Advertiser 2015).

SUMMARY OF PREVIOUS ARCHAEOLOGICAL STUDIES

Prior archaeological and cultural investigations within the project area are limited to an archaeological inventory survey of the current project area (Belluzzo et al. 2023). However, several archaeological and cultural studies have been conducted in the nearby vicinity of the project area. A review of this nature provides a general understanding of the types of resources and cultural practices that can be anticipated within the project area. The location of these studies in relation to the project area is depicted below in Figure 36. The subsequent paragraphs begin with a summary of early archaeological investigations conducted during the early 20th century, followed by a summary of those more recent archaeological and cultural studies conducted in the project area.

Summary of Early Archaeological Investigation in Waialua

The earliest archaeological study conducted in the vicinity of the current study area is that of Thomas G. Thrum, who conducted an inventory of the *heiau* of Hawaiʻi in the early 1900s. Thrum (1906a) published his list of *heiau* in a series of entries in the *Hawaiian Almanac and Annual,* beginning with the 1907 edition. Thrum (1906b:49-50) made the following remarks about his investigations in a preliminary paper titled "Tales from the Temples" published in the 1907 annual:

> 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.

Despite the challenges faced by Thrum, he and his associates compiled information on over seventy *heiau* located throughout Oʻahu (Thrum 1906a). One must take into consideration that Thrum listed *heiau* that had already been destroyed prior to his data collection efforts in the early 1900s. Thrum (1906a:47-48) listed the following *heiau*, located in Waialua within five miles of the study area:

> Onehana…………On slope at rear of Waialua Agr. Co.'s mill: a partly walled and platform heiau about 60x100 feet in size; of pookanaka class.
>
> Kalakiki………….On ridge north of Onehana, of pookanaka class; its walls covered in a tangle of hau and lantana.
>
> Hekili…………….At Palaa-uka [Paʻalaʻa], near the twin bridge, below the road; of luakini class and place of refuge; long since destroyed.
>
> Lonoakeahu………Keehu.—A heiau of small size destroyed years ago; site now planted to cane.
>
> Kapukapuakea……Palaa-kai [Paʻalaʻa].—A medium sized heiau of traditional Menehune construction of kauila wood, long since destroyed, said to have worked in connection with Lonoakeahu. Luuau its kahuna.

Onehana and Kalakiki were both located along the slopes of Kaʻala and Thrum (1906b:52, 54) further reports:

> Not only is the beating of drums and sound of the conch shell and gourd rattles heard in the nights of Kane in its precincts, but its influence extends to the shore and sea at its front, for torch-lights at times suddenly appear and dance about within its range, or vanish at one's approach. . . A still further superstition is that a house built within the range from the temple to its deity must not have its doorway face the hills, else trouble, sickness and death to the household is sure to follow.

The earliest formal archaeological survey of Oʻahu was conducted by J. Gilbert McAllister on behalf of the Bishop Museum for nine months in 1930 in an effort to document prominent sites island-wide (McAllister 1933:3).McAllister states that his investigation was a beginning rather than a complete account of all the cultural resources on Oʻahu. McAllister (1933:129-132) located twelve traditional sites near the vicinity of the current project area (Figure 35;Table 2). McAllister (1933:3) also made the following statement regarding the state of cultural resources on Oʻahu at the time, in the introduction to his resultant publication *Archaeology of Oahu*:

> As the archaeological remains are those of the people found in Hawaii by the early voyagers, contact with Hawaiians was an indispensable part of the work. Not only are the sites being destroyed by the changes wrought by European culture, but with the introduction of exotic vegetation many sites have been completely hidden. Such remains would be as good as lost, were it not for the knowledge

of them still treasured by old residents (*kamaaina*) of Oahu. With the passing of these old people most of this information will disappear.

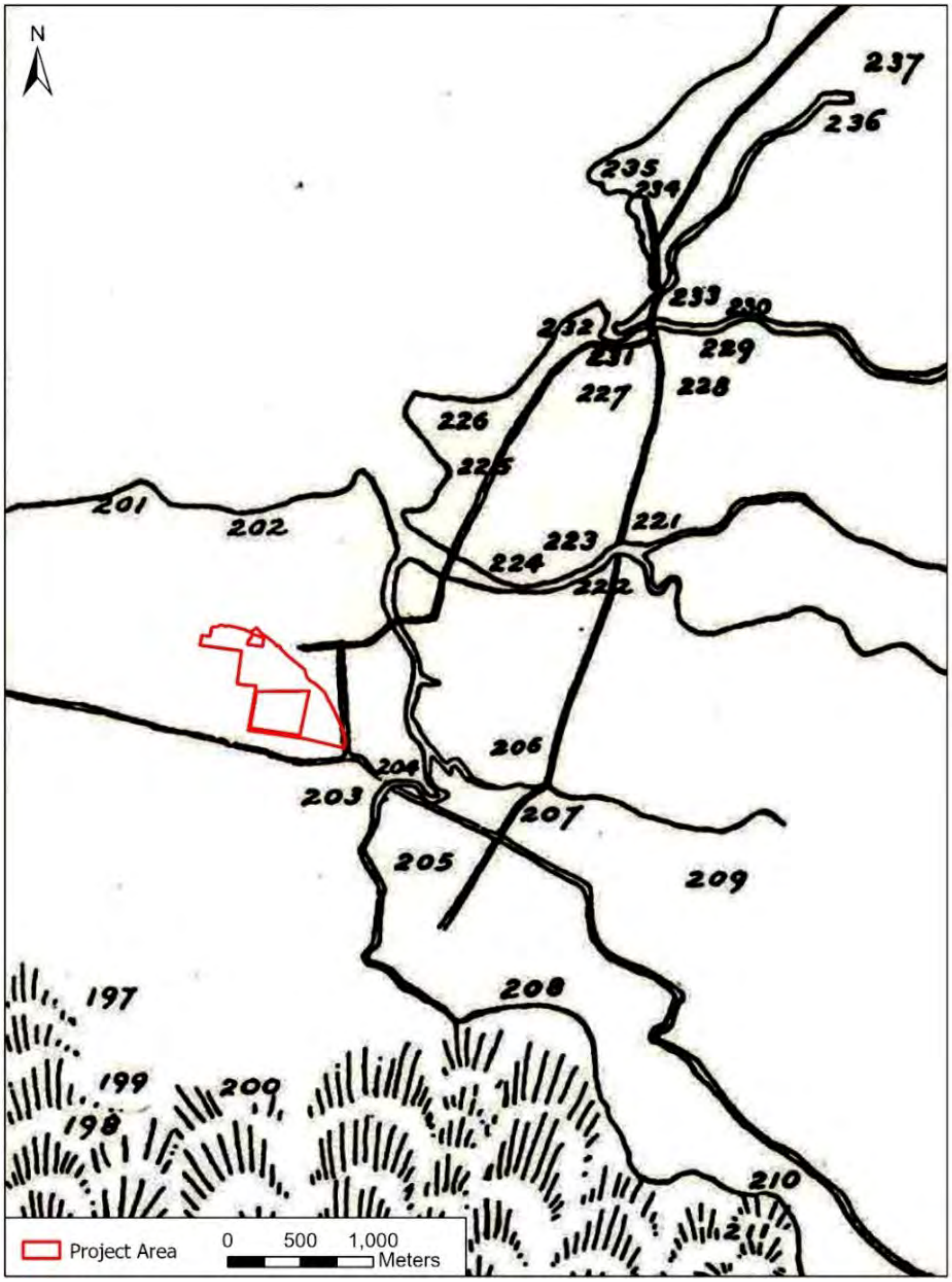


Figure 35. Sites identified by McAllister within the vicinity of the current project area (McAllister 1933).

Table 2. Sites near the project area as identified by McAllister (1933)

Site Number	*Site Name*	*Site Description*	*Approximate Distance from current project area*
197	Kalakiki Heiau	Rock paved front terrace remains overgrown with *Lantana* (perennial flowering plants) likely dedicated to Keanini, the shark-god; original structure was probably 2+ terraces with several small divisions	1.2 miles southwest
198	Burial cave, Kaumoku Gulch	Portions of two skeletons were found in a covered lava tube with no artifacts and evidence of animal scavenging	1.5 miles southwest
199	Piles of stones, near the mouth of Kaumoku Gulch	Six relatively level rock piles, several stone walls, and small enclosures located *mauka* and near the siphon put in 1930 by the Waialua Agricultural Company. Hookala said the rocks were piled to clear the land for agricultural purposes in 1908	1.4 miles southwest
200	Cave in Kaumoku Gulch	The cave was said to have previously contained skeletal material, but none was observed	1.4 miles southwest
201	Keauau fishing shrine (*ko'a*)	Nothing remains of the original site once located on the beach at Puuiki, at the Kaena end of a long row of ironwood trees	1 mile northwest
202	Skeletal remains near Puuiki station	Several skeletons were uncovered at approximately 4 feet below ground surface by plantation workers removing sand near the station	0.6 miles north
203	Heiau, near Kaukonahua Stream	A small heiau was said to occupy the site where the Waialua Agricultural Company installed Pump No. 1; name is unknown	0.2 miles south
204	Approx. location of Oahunui	Referred to as the 'oahu stone'; a stone whose outline is said to resemble that of Oahu located in the gulch near the division between Ewa and Waialua; formerly visited by many Hawaiians in order to say they had been around the entire island of Oahu	0.2 miles south
205	Akua stone, Poloa grove	A once large, sacred grove to Pele, left untouched admist the cane with a small iron fence around a large stone believed to be Oscar Cox, also referred to as Kaneaukai. The grove was a known Hawaiian burial location and is covered in breadfruit, mango, kukui, and Pride of India (sandalwood) trees	0.3 miles south
206	Kahakahuna heiau	The old heiau was located north and *makai* of the mill site but was destroyed and used for agricultural purposes	0.9 miles southeast
207	Kawai Heiau	One of the first heiaus to be destroyed, located below the Waialua Plantation manager's house and the junction of Poamoho and Kaheeka gulches	1 mile southeast
208	Irrigation ditch	The longest irrigation ditch from the Kaukonahua stream, about 2 miles from the mill. The ditch was used for many years by the plantation	1.3 miles southeast

Summary of Prior Archaeological Studies Conducted in the Subject Parcel

In 2002, an inadvertent burial was found during trenching for an electrical conduit at Waialua Hongwanji Mission located southwest of the project area (Collins and Jourdane 2002). Figure 36 provides two possible locations for the inadvertent burial, indicated by a "1*". The eastern location is provided in an archaeological monitoring plan and the western location was derived from GPS data provided by Collins (personal communication 2022). Neither are within the boundaries of the Waialua Hongwanji Mission's property, so it is currently unclear where exactly the inadvertent burial was encountered. The same year, an assessment was made for the inadvertent discovery of human remains previously discovered by Collins and Jourdane (2002), where it was determined to be one adult individual, likely of Hawaiian ethnicity (Davis 2002). No other cultural deposits and/or features were identified.

In 2003, Archaeological Consultants of the Pacific conducted an archaeological inventory survey of 15-acres along the perimeter of Puʻuiki Cemetery approximately 500-meters north of the project area (Moore et al. 2004). As a result, three archaeological sites were recorded: an incomplete and previously disturbed traditional burial (SIHP #50-80-04-6532); seven features related to the former Waialua Dairy (SIHP #50-80-04-6533); and portions of two WWII pillboxes (SIHP #50-80-04-6534). The recommended and accepted treatment for Sites 6533 and 6534 was no further work, while the recommended treatment for Site 6532 was relocation. Moore et al. also concluded that, "due to the potential of encountering additional human remains in the event of future land alterations, it is recommended that a qualified archaeologist be on site for the monitoring of all future subsurface activities" (2004:49).

In 2004 archaeological monitoring for the Waialua Beach Road Bikeway Project was conducted by Cultural Surveys Hawaiʻi (CSH) (York et al. 2007). No significant cultural deposits or burials were encountered during the monitoring.

In 2010, archaeological monitoring was conducted by International Archaeological Research Institute, Inc. (IARII) for guardrail improvements between Waialua Beach Road and Kiʻikiʻi Stream (Filimoehala and Rieth 2010). No intact cultural deposits or features were identified. However, a single human vertebra was encountered in unsorted Calcareous sand fill and was designated as SIHP #50-80-04-7143. The vertebra was reburied at the location of the monitoring under the direction of SHPD.

In 2023, ASM Affiliates (Belluzzo et al. 2023) conducted an archaeological inventory survey of the entirety of the current project area including 100% pedestrian survey and an architectural evaluation on the houses within the mill camp. As a result of the survey, ten archaeological sites were identified including three historic irrgation ditches associated with sugarcane cultivation (labeled TS-01 through TS-03), a basalt stone alignment possibly connected to the former Waialua Pilgrim Church (TS-04), a historic basketball court (TS-05), a segment of a stone wall interpreted as remnants of infrastructure related to the Waialua Gakuen School (TS-06), a historic junction box (TS-07), the Waialua Sugar Mill cement plant (TS-08), and two stacks of flume segments near the cement plant (TS-10). While none of the plantation homes were evaluated as individually eligible for either the National Register of Historic Places (NRHP) or the Hawaiʻi Register of Historic Places (HRHP), most of the buildings are recommended as contributing to the recommended NRHP- and HRHP-Eligible Waialua Mill Camp Historic District.

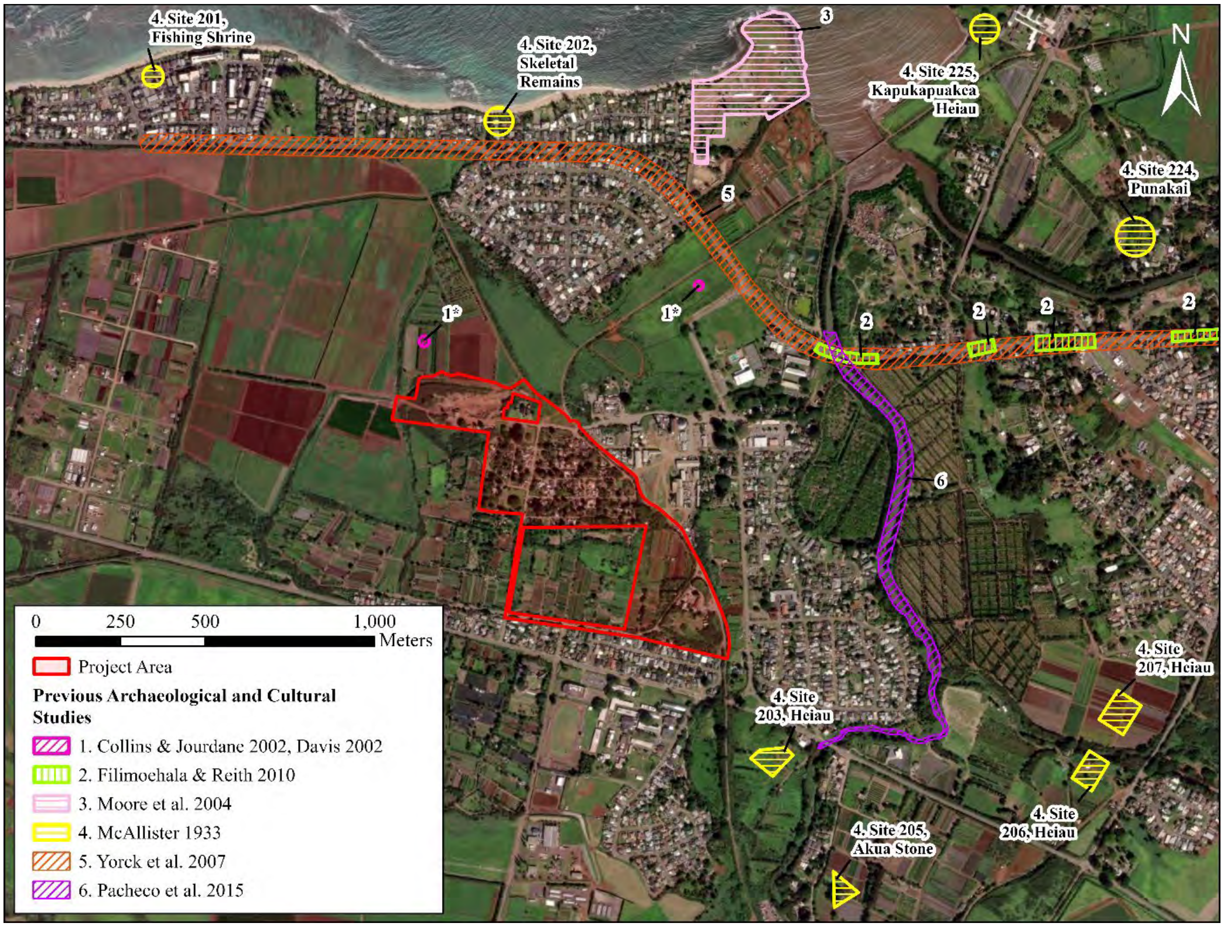


Figure 36. Location of prior archaeological and cultural studies and sites in the project area vicinity. Note the asterisk indicating the uncertainty of the location of Collins & Jourdane 2002 and Davis 2002 discussed above.

Previous Cultural and Ethnographic Studies

In the 1970s, the University of Hawai‘i's Center for Oral History conducted an oral history project with the goal of recording the lived experiences of people who have settled and worked in Waialua and Haleiwa (Ethnic Studies Oral History Project 1977). At the time of the interviews, Waialua Sugar Company was one of the last remaining sugar plantations in operation and therefore, the interviewers chose to focus on the plantation town. Interviewees included John Midkiff and William Patsy, former managers of the Waialua Sugar Company. The interviewers shared what life was like living on the plantation including the diversity of the workers, events held at the plantation, and details about daily life.

In addition to this oral history project, there have been four previous Cultural Impact Assessments (CIA) within the vicinity of the current project area. Three of these projects have been located near Laniākea Beach located northwest of the Waialua Mill Camp (not pictured in Figure 36). In 2004, Cultural Surveys Hawai‘i (CSH) conducted a CIA to assess any potential effects on cultural beliefs, practices, or resources during the Laniākea Beach Support Project (Hammatt et al. 2004). Four people were interviewed including the former resident and head of Department of Land and Natural Resources (DLNR) and the former manager of the Waialua Sugar Company, Mr. Willian Paty, Jr. Mr. Paty began working for the sugar company in 1946, completing a 38-year long career with the company. Mr. Paty had limited information on cultural practices within Laniākea Beach, but he said he knew of a *heiau* down the road from the project. In 2014, CSH conducted another CIA in the same vicinity as the Laniākea Beach Park for the Kamehameha Highway Realignment Project (Ishihara and Hammatt 2014). The main community concerns were the history of burial disturbance in the area and the potential impact on other cultural and archaeological sites, both documented and undocumented. This concern was echoed in a later project by CSH within the same area in 2017 (Liborio et al. 2017). The later project drew additional concerns over the disturbance of cultural sites and practices such as collecting seaweed and shellfish at the beach. A portion of the project area was previously recorded as containing human skeletal remains and the community emphasized their desires to protect these burials.

In 2015, International Archaeology, LLC (IA) conducted a CIA for the Kiʻikiʻi Stream Dredging Project in the *ahupuaʻa* of Kamananui located less than a mile east from the Waialua Sugar Mill (Pacheco et al. 2015). The company reached out to a total of five individuals and organizations for consultation on the impacts to cultural practices within and surrounding the project area. While no responses from the community were received, IA presented potential effects and recommendations for mitigation of effects for the project. They identified crabbing and fishing as cultural activities that continue in the stream today. However, they determined that while the aquaculture will be likely be temporarily impacted in the immediate areas of the dredging, most locations along the stream remained accessible and should not affect the marine ecosystem near the project. They recognized that the surrounding lands have been occupied by both Precontact and Historic populations and thus expressed concern that dredging could potentially impact historic structures that were not yet recorded. Accordingly, they suggested that an archaeological monitor should be present for all dredging activities.

3. CONSULTATION

Gathering input from community members with genealogical ties and long-standing residency or relationships to the project and study area is vital to the process of assessing potential cultural impacts to resources, practices, and beliefs. It is precisely these individuals that ascribe meaning and value to traditional resources and practices. Such individuals often possess traditional knowledge and in-depth understanding that are unavailable elsewhere in the historical or cultural record of a place. As stated in the OEQC (1997) *Guidelines for Assessing Cultural Impacts*, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present authors' further contention that the oral interviews should also be used to augment the process of assessing the significance of any identified traditional cultural properties. Thus, it is the researcher's responsibility to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary. This section of the report begins with a description of level of effort undertaken to identify persons believed to have knowledge of the study area, followed by the interview methodology. This section of the report concludes with a presentation of the interview summaries that have been reviewed and approved by the consulted parties.

In an effort to identify individuals knowledgeable about traditional cultural practices and/or uses associated with the current project and study area, a public notice containing (a) locational information about the project area, (b) a description of the proposed project, and (c) contact information, was printed in a newspaper with state-wide readership. The public notice along with a request for confirmation of the notice was submitted to the Office of Hawaiian Affairs (OHA) on January 13th, 2023, with the intent that the notice would be published in the February edition of *Ka Wai Ola*. The public notice was submitted to the Office of Hawaiian Affairs (OHA) on January 26th, 2023, for publication in their monthly newspaper, *Ka Wai Ola*. This notice was published in the April 2023 edition of *Ka Wai Ola* and a copy of the public notice is included in Appendix A of this report. From the public notice, no responses were received.

In addition to the public notice, ASM staff attempted to contact 23 individuals and 10 organizations as listed in Table 3. As part of the outreach efforts for the individuals listed below, ASM contacted them either via phone or email. If initial contact was made via phone, ASM staff introduced themselves, explained the nature of the proposed project as well as the scope of the CIA study. After this initial conservation, ASM staff emailed a community consultation packet to the community members which included a more comprehensive explanation of the proposed project, contact information including, phone, email, and physical address of ASM staff, as well as maps showing the location of the project area. If initial contact was made via email, the community consultation packet was provided. In some instances, the community members responded with either the names of other community members they felt would be able to contribute to this study or they did not respond altogether. An attempt was made to contact each person/organization at least twice.

Of the 33 people and organizations contacted, three people, Paul Souza, Antya Miller, and Boyd Ready, responded to the interview request and consented to participate in the consultation process. Several additional people responded but declined an interview including Jan Becket, Glen Kila, Kaleo Paik. However, Kaleo Paik and Glen Kila said they would share the community packet with those they knew from the area who may have information related to the Mill Camp. Kathleen Pahinui, chair of the Waialua Neighborhood Board, responded and also declined to interview. However, she also offered several recommendations for people to should reach out to. Pomaikaʻi McGregor, Director of the Center of Oral History at the University of Hawaiʻi at Mānoa responded to say that the organization had no current ties to Waialua. Maka Casson-Fisher spoke with ASM staff at the end of Feburary. Mr. Casson-Fisher expressed concern over the community packet and suggested we add more information about the proposed project to better inform the community about potential impacts. Mr. Casson -Fisher said he would provide additional recommendations after the community packet was updated. Following his suggestions, ASM staff updated the packet and sent it to Mr. Fisher on March 17th. However, as of now, Mr. Casson-Fisher has not responded to the packet or made his recommendations.

Several current residents of the Waialua Mill Camp were contacted. ASM staff talked to Angeline Cruz on Feburary 6th and Febuary 17th. However, due to phone issues, Mrs. Cruz declined to participate. ASM staff talked to Jennette Bushey on Feburary 8th. Ms. Bushey wanted to organize a group interview and told ASM she would call back. As of June, ASM staff has not heard back. Lastly, ASM staff talked to Frank Laurence on Febuary 6. Mr. Lauerence argreed to an interview with ASM and a meeting was scheduled for Feburary 13th. Mr. Laurence had to cancel the interview and an attempt was made to reschedule. However, due to poor weather during mid-Febuary, Mr. Laurence did not want to schedule any meeting for the near future.

Table 3. Individuals and Organizations Contact for Consultation

Individual/Organization	*Association*	*Date of first attempted contact*
Casi Alexander	Waialua Neighborhood Board, Member	2/6/2023
Angeline Cruz	Current resident of the Waialua Mill Camp	2/6/2023
Antya Miller and Boyd Ready	North Shore k*ama'aina* and associated with the Waialua Haleiwa Historical Society	2/17/2023
Jan Becket	Author, photographer, former teacher at Kamehameha Schools, knowledgeable in sites/*mo'olelo*	2/6/2023
Malia Evans	Former resident of Kawailoa Ahupua'a; knowledgeable in archaeological sites of the area; historian; anthropologist	2/6/2023
Filipino Community Center	-	2/6/2023
Francine Kawahakui	Current resident of the Waialua Mill Camp	2/6/2023
Frank Kimitch	Waialua Neighborhood Board, Member	2/6/2023
Frank Laurence	Current resident of Waialua Mill Camp and former planation employee	2/6/2023
Glen Kila		2/6/2023
Jennette Bushey	Current resident of the Waialua Mill Camp	2/6/2023
KAHEA Environmental Alliance	-	2/6/2023
Shad Kāne	Nā Koa 'O Pālehua Association; Hawaiian Civic Club's Historic Preservation Committee	2/6/2023
Kaleo Paik	Lived in Waialua and has associates who lived in the Waialua Mill Camp.	2/6/2023
Kathleen Pahinui	Waialua Neighborhood Board, Chair	2/6/2023
Tom Lenchanko	Hawaiian Civic Club of Wahiawa and Friends of Kukaniloko	2/6/2023
Maka Casson-Fisher	Recommended by Kathleen Pahinui; *kama'aina* to Waialua and Haleiwa	2/22/2023
Blake McElheny	*Kama'āina* of the North Shore; North Shore Neighborhood Board, Member	2/6/2023
Thomas Shirai	Kawaihāpai 'Ohana; cultural practitioner; *kama'aina* to Waialua	2/7/2023
North Shore Ethnographic Field School	-	2/6/2023
Office of Hawaiian Affairs	-	2/6/2023
Paul Souza	Current resident of the Waialua Mill Camp; former plantation employee	2/6/2023
Pomaika'i McGregor	Director of Center of Oral History at the University of Hawai'i at Mānoa	2/6/2023
Jim Quitan	Kawailoa Ranch lease	2/6/2023
St. Michael Parish		2/6/2023
Torrence Pascual	Current resident of Waialua Mill Camp	2/6/2023
Ty Kawika P Tengan	Head of the University of Hawai'i – Mānoa, North Shore Ethnographic Field School	2/3/2023
UH Center for Oral History	-	2/6/2023
Waialua Hawaiian Civic Club	-	2/6/2023

Individual/Organization	*Association*	*Date of first attempted contact*
Waialua Community Association	-	2/6/2023
Waialua Hongwanji Mission	-	2/6/2023
Waialua United Church of Christ	-	2/6/2023

INTERVIEW METHODS

Prior to the interview, ASM staff provided information about the nature and location of the proposed project and informed the potential interviewees about the current study. The potential interviewees were informed that the interviews were completely voluntary and that they would be given an opportunity to review their interview summary prior to inclusion in this report. With their acknowledgement and consent, ASM staff then asked questions about their background, their knowledge of past land use, and the history of the project area, as well as their knowledge of any past or ongoing cultural practices. The informants were also invited to share their thoughts on the proposed development and offer mitigative solutions. All interviews were conducted in person at locations identified by the consulted parties. Below are the interview summaries that have been reviewed and approved by the consulted parties.

PAUL SOUZA

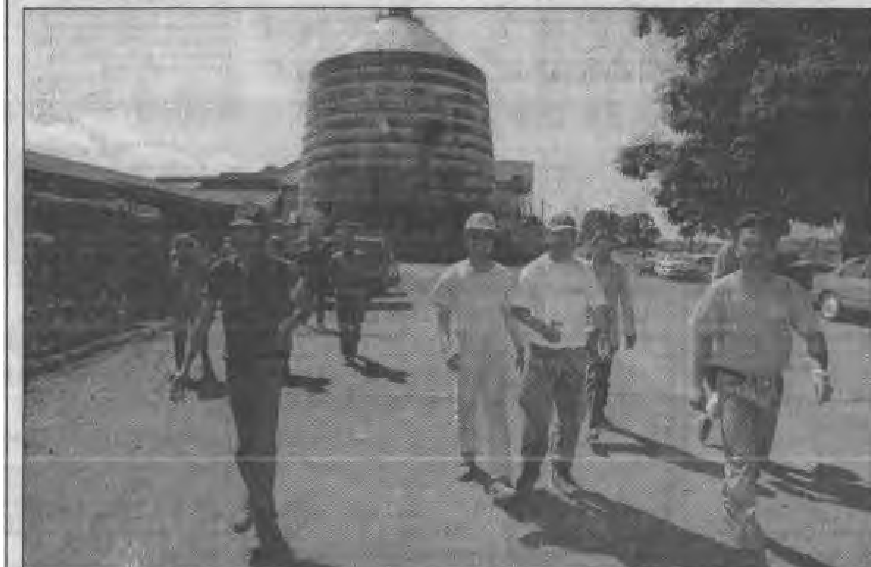
On February 8, 2022, ASM staff, Carol Oordt, met with Paul Souza via phone to discuss the proposed project and the scope of the current study. Much of the information shared by Mr. Souza concerned his employment at Waialua Sugar Company and Dole Plantation and his experiences living in Waialua Mill Camp. Mr. Souza was born in Queens Hospital in Honolulu Ahupuaʻa on the island of Oʻahu. He lived with his family in Mākaha until he moved to Whitmore Village near Wahiawa, at which time he started working as a cane hauler for the Waialua Sugar Company. He continued to work for the plantation until its closing in 1996. That same year, he moved into Waialua Mill Camp and started working for Dole Plantation as an operator and running equipment. In total, Mr. Souza worked for plantations for 35 years. Today, Mr. Souza owns a construction business in Waialua and continues to live in the mill camp.

Although Mr. Souza did not live within the mill camp during the operation of the sugar plantation, he knew many of the people who lived there during this time. He described the neighborhood as a *paniolo* (cowboy) community who all helped each other out. Mr. Souza recalled the instance when he was still living near Wahiawa and working three jobs including one at the Dole Planation. Upon learning about his multiple jobs, his boss arranged for him and his family to move into a house in the mill camp. He explained such helpful behavior exemplified the nature of the mill camp community. He stated that the people within this tight knit, old-school community were his favorite part of living in the area.

Mr. Souza was unaware of any traditional Hawaiian practices within the mill camp area. However, he shared some stories and superstitions that circulated among the plantation workers. He recalled how many of the older workers would wait to walk into the mill until after he had entered as they believed spirits might be present. Additionally, he discussed a rock that was located in the sugarcane fields which people would move. However, the rock would always mysteriously return to the fields, and no one knew why. He does not know where the rock is now. However, he believes that the land where it was located is now owned by other people. Lastly, he mentioned a story about a machine that broke down in the sugarcane fields in 1994. Subsequently, workers reported that the machine would turn on by itself at night and cause damage to the fields. However, in the morning, the machine was always located in the same spot as the night before. The plantation workers theorized that spirits were driving the machine. Mr. Souza explained that he never experienced these events himself, but these were stories he had heard during his employment at the mill.

When discussing his job at Waialua Sugar Company, Mr. Souza explained that he worked as a cane hauler. The plantation was in operation for 24 hours a day which consisted of two 12-hour shifts. Every other week, the employees would switch between working a night shift and a day shift. For a day shift, Mr. Souza said he would arrive at work at 5:30 am and would proceed with readying the equipment, heading to the fields, and hauling the sugar cane back to the mill. In addition to driving a hauler, he helped to load cane, clean the roads and mill, and helped the mechanics repair equipment. He recalled that things would occasionally break at the mill and all the workers would go home. However, when this occurred, he would often stay at work because at least one driver always had to be prepared in case a problem was fixed and the mill began work again. He would often work several shifts in a row if someone on the shift after his did not show up.

Mr. Souza worked for Waialua Sugar Company until its last day of operation. On the final day, Mr. Souza and his fellow haulers took their trucks and paraded through Waialua and Haleiwa. He recalls it as a sad day for the town (Figure 37). He stated that while he was not worried about the closing, he was concerned for the older mill workers who he felt may have a harder time finding work. Shortly after the end of operations of Waialua Sugar Company, Mr. Souza began working as an operator and truck driver for Dole Plantation. Eventually, he shifted to work in irrigation and herbicide for Dole.



Photographs by Gregory Yamamoto/The Honolulu Advertiser

Above: Waialua Sugar Co. employees leave work for the last time, heading for a *pau hana* picnic. The bagasse holding bin is in the background. **Below:** From left, driver Paul Souza Jr., crane operator Tony Medrano and driver Dave Bell attend a program recognizing employees for their service. On Thursday, Medrano's crane grabbed the last of the cane from the field and put it in Bell's truck.

Waialua gets through its saddest day

By Mike Gordon
Advertiser Staff Writer

WAIALUA — The men who made sugar marked the end of an era with beer, laughter and an honest desire to keep reality at bay for one more day.

As they stood on the front lawn of Waialua Sugar Co. yesterday, the silence of their empty, rusted mill seemed as heavy as a funeral dirge.

Waialua Sugar was the last of its kind on Oahu, a holdover from a rural lifestyle marked by mill whistles, burning fields of cane (their ashes drifting on the trades) and back-breaking labor. Its passing leaves 174 people out of work today.

Eric Delgado hid his emotions behind a pair of dark sunglasses. He was a truck driver who hauled cane here for six years, and he helped bring in the last load Thursday morning.

Workers are coping, he said — for now.

"It hasn't set in yet," said Delgado, 40. "It will take a while. When they don't have to show up for work on Monday, then it will start sinking in. For now, their reaction is happy-go-lucky."

Like a lot of workers, Delgado spent the day cleaning up equipment and work areas. There wasn't anything else to do, really, except wait out the day. The last bit of sugar had been processed the day before at 2:25 p.m. Production manager Yoshiaki Tanabe has some of it in a small Mason jar.

"I worked 30 years," he said. "At least I figure I got to keep that on a shelf."

Mill management had invited workers to quit early yesterday and gave each a framed certificate of appreciation. They served up chicken, sashimi and cold drinks, raffled off a TV and tried to put a good face on the whole thing.

They also handed out information about unemployment insurance from the state Department of Labor, which will be in Waialua next Friday to accept applications; this got a lot of cheers.

"I have never been unemployed," said Jerry Vriesenga, president of Dole Foods Hawaii, Waialua's parent company, in a speech to the workers. "I know there is a certain feeling of sadness, though. I can feel it myself."

Paul Souza Jr., who has an automotive mechanic's job lined up, wondered what will become of the old-timers, the men who are too young to retire but too old to hire.

"I just wish the best of luck for everybody," Souza said. "It's sad, you know. After today, it's all over. But life goes on. It just goes to show you that you can't count on a job to last forever."

Just then, as the men stood there, shaking hands and laughing, the mill whistle blew to mark the end of the work day.

It blew long and loud and people looked at each other when it stopped, not knowing exactly what to say.

Figure 37. Newspaper article on the closing day of Waialua Sugar Company (Honolulu Advertiser 1996:9). Mr. Souza is pictured on the far left of the lower image.

When asked about daily life within the mill camp community, he recalled that very few people had cars and rather, everyone would walk or ride bikes. Accordingly, most places were accessible by foot within the mill camp area and many people did not have a reason to leave the area. Most people grew vegetables in their gardens, and they would get meat from a nearby ranch. He recalled the Sugar Bar, located behind Brown Bottle Liquor store and Waialua Public Library, as a location in which the planation workers would often gather after work and as a place where they would often hold company parties. Prior to the establishment of the Sugar Bar, the building was a church. As the interior of the building was small, Mr. Souza explained that they served drinks within the building and then people would gather outside the bar. Additionally, the Bar would often host live music outside. While he said the music was often Hawaiian, they also had bands who played Rock n Roll, reggae, and jazz. The bar closed when the sugar mill closed and eventually became a Bank of Hawaiʻi. The building remains standing today but now is abandoned. Mr. Souza also states that the Hongwanji was a prominent building within the mill camp. Although he had never been in the temple, he noted that they hosted an annual Bon Dance that was very popular with the mill workers. He especially enjoyed the food at the festival.

Mr. Souza explained that while one had to work at the mill to live in the camp, not all plantation workers lived within the Waialua Mill Camp. For example, Mr. Souza lived in Wahiawa during his employment at the plantation. Many of his neighbors in Wahiawa similarly worked at Waialua or Dole Plantations. Mr. Souza mentioned that he remembers additional mill camps being located Kunia (associated with De Monte Plantation), Whitmore (Dole Plantation), and Poamoho (Dole and Waialua Planation). He stated that Peter Savio bought the houses located at Poamoho, renovated them, and offered to sell the houses to the plantation workers. He also mentioned that Waialua had additional housing on Kawailoa Drive by the rubbish dump. When the mill closed, all the workers who lived in this camp moved to the Waialua Mill Camp within the project area. Most of the houses at the former Kawailoa camp were destroyed. However, a few houses were refurbished and, subsequently, moved to the Waialua Mill Camp area. He explains that his home is one of the houses that was originally located in the camp on Kawailoa Drive.

Mr. Souza explained that the employees who lived within the mill camp had significantly smaller wages than those who lived outside the camp. This pay cut was the tradeoff for having their housing provided. Today, he explained that the price of rent within the mill camp is dependent on the length of time that the resident or their family worked for the mill. However, he mentioned that many of the people who currently live in the camp are children of former workers of the Waialua Sugar Company.

When asked about the proposed project, Mr. Souza said the community was originally concerned about losing their houses when the developers bought the area. However, he expressed that he was not worried and had always expected someone would buy the land. He thinks the project will be beneficial because many of the houses are old with some even abandoned and this project would result in new houses for the residents. He recognized that rent prices are going up and stated that he'd rather have increased rental fees for a new house rather than for his old houses. Additionally, he noted that by the time the development is complete, and the families get to move into the new houses, it will benefit his children more than himself. Mr. Souza expressed concern about the price of land in Waialua and stated that he has several friends who have moved to Kahuku to buy land that is more affordable.

ANTYA MILLER AND BOYD READY

On March 2, 2023, ASM staff, Carol Oordt met with Antya Miller and Boyd Ready to discuss the proposed project and the scope of the current study. Much of the information shared during this group interview focused on Ms. Miller's experiences living by the Waialua Mill Camp as a child and the history of the Waialua Sugar Company.

Ms. Miller was born in 1952 in Fort Brag, North Carolina where her father was stationed while serving as a physician in the military. Her family moved to Waialua in 1961 when her father accepted a job as a plantation doctor for the Waialua Sugar Company. Apart from leaving the area to attend college at Louisiana State University where she met her husband, Boyd Ready, Ms. Miller has lived in the North Shore area ever since. She currently serves as president for the Haleiwa Waialua Historical Society and has participated with the Haleiwa Mainstreet organization and Waialua Neighborhood Board in the past. Her husband, Boyd Ready, also serves on the board for the Haleiwa Waialua Historical Society and is a local historian who is interested in the history of the mill and surrounding area.

When discussing her childhood, Ms. Miller said her family lived on the southern dead end of Kupahu Street, immediately next to the Waialua Sugar Company's hospital and east of the current project area. According to Ms. Miller, the hospital was constructed around 1936 and was in operation through the 1970s when it was contracted out to the Medical Arts Clinic in Wahiawa. Her father, Dr. Rodman Miller, served as one of the two physicians at this hospital between 1961 and 1966. As the hospital was built and owned by the sugar company, the majority of his patients were plantation employees, but private paying patients also utilized the hospital. While Dr. Miller was primarily a family physician, he also practiced OB/GYN, and general surgery, performing such operations as C-sections and appendectomies as was customary at the time. All medical care for plantation employees and their families was provided by the Waialua Sugar Company as a part of their employment compensation and thus, patients were not required to pay when they utilized the hospital's services. Mrs. Miller and Mr. Ready expressed that this occasionally presented a problem as people would use the healthcare system unrestrained. Mr. Ready recalled reading that in 1904, an Ewa Plantation physician reportedly saw up to 180 patients a day but refused to pass anyone by even if the reason for their visit was minor.

Dr. Miller left his job at the Waialua Sugar Company in 1966 amongst controversy over plantation physicians accepting Medicare insurance. President Johnson signed the Medicare and Medicaid Act into law in 1965. The issue quickly arose over the plantations receiving the Medicare payments from the government. As the plantations paid for all medical care, the Hawaiʻi Medical Association took the position that it was against medical ethics to accept payment from Medicare. As a result, many plantation doctors, including Dr. Miller, transitioned from their plantation jobs to private practice around this time. Following his departure from Waialua Sugar Company, Dr. Miller opened a private practice in Haleiwa which was in operation until becoming Queen's Haleiwa in 2019

While living on the plantation, Ms. Miller attended the elementary school in Haleiwa, then called Waialua Elementary School. She explained how she experienced tension at school due to her being white as well as being the daughter of a physician and therefore, considered wealthy by the other children. Regardless, she stated that growing up in the Waialua community was enjoyable and described running around with the other neighborhood kids. She explained that the community all knew one another. She remembered a time her little sister was caught stealing candy once from the local store which resulted in the store clerk immediately calling their mother. Another memory Mrs. Miller shared about the mill camp was the whistle that called the workers to work every morning, as well as an earlier whistle which was sounded if work was rained out for the day. Within the community, she recalled there being a local store (Fujioka Store), a barber shop, a photoshop and the Pilgrim Church. She also described how vendors would travel from camp to camp to sell fresh produce and household goods. She notes that while Waialua Sugar Company once operated a company store, a dairy, and other community resources, they eventually chose to focus solely on sugar operations and these businesses transitioned to being privately owned. The stores near the mill were already privately owned when she lived in the mill camp area as a child.

On the topic of the Waialua Sugar Company and Mill Camp, Mr. Ready shared some history which he encountered during personal research and from discussions with George Williams, a former engineer at the mill. According to Mr. Ready, in the mid-20th century, the Waialua Sugar Company prided itself on paying its employees 10 cents more than any other plantation. During the early period of its operation, many of the plantation workers were Japanese and predominantly men. Additionally, as many of these men had immigrated to the area by themselves, the workers lived in barracks rather than single-family homes. Mr. Ready recounted a story told to him by George Williams that some of these barracks remained standing in the 1960s. When the mill went to deconstruct the barracks, an employee named Mr. McGuire refused to leave and had to be forced. Reportedly, a septic tank exists in this area now. As men married, single-family homes were constructed. The women often joined the men in the fields during the early 20th century.

Soon the ethnicity of the plantation workers diversified as immigration increased from other places including workers from Korea, Portugal, Scotland, the Philippines, Puerto Rico, and elsewhere. With these new waves of immigration came conflicts over differing rates of pay. According to the Mr. Ready, the 1920s saw the first general strikes in Hawaiʻi, as well as the reduced number of women working in the fields. Waialua was the last plantation to unionize in the late 1940s. Plantations responded to unionization and strikes through increased mechanization of the production process which reduced the need for labor. Mr. Ready illustrated this with a discussion of irrigation at Waialua. In the 1960s, drip irrigation was developed, aspects of which were patented at Waialua Sugar Company. In addition, new machines were constructed to plant and install irrigation in the field simultaneously, and thus, resulted in the need for less planting and field preparation laborers. Mr. Ready explained that in 1950, the entire 10,000-acre plantation required 80 people in the fields to irrigate even with the improved Waialua Flume channels, but with drip irrigation, it could be irrigated by just 8 people. He concluded that while unions and the strikes in the early and mid-20th century succeeded in gaining workers' rights and increasing compensation, they also led to innovation in agricultural productivity.

On the topic of employee housing, Mr. Ready was familiar with many other mill camps associated with Waialua Sugar Company including Brody Camp, Kawialoa Camp, Ranch Camp, and others. He explained that these camps were spread across the entire district, being located wherever the plantation had sugarcane fields or pump stations. He reasoned that employees without vehicles had to be close to where they were working and thus, the camps had to be spread across the plantation's lands. Accordingly, he stated that the people living in the mill camp within the project area likely worked directly in the mill or in the nearby fields. The illustration below displays a notebook dated to 1927 which details all the camps associated with Waialua Plantation and the number of houses within each camp (Figure 38). Additionally, the meeting attendees described how each house was assigned to an employee by the plantation according to that employee's position and performance. According to Ms. Miller, the plantation cared for the upkeep of all the plantation houses including the one her family lived in.

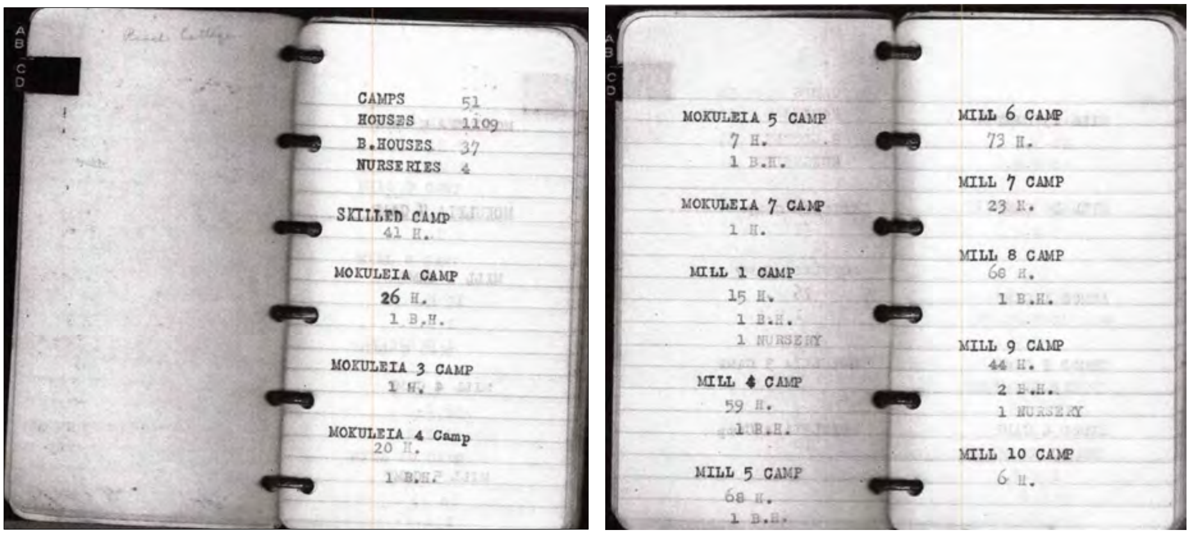


Figure38. Images of notebook dated to 1927 listing mill camps and corresponding houses. Provided courtesy of Mr. Boyd Ready.

On the houses themselves, Mr. Ready reported that he believed Ted Vierra, who was one of the first successful native Hawaiian architects and worked for the Hawaiian Sugar Planters' Association, had aided in designing the houses within the mill camp. Each house contains approximately three bedrooms. Upon being asked if she knew how many people lived in the mill camp, Ms. Miller said she wasn't sure but thought we could approximate a calculation if we multiplied the number of houses by an estimate of four people per household. However, she also stated that she knew of some larger families that also lived within mill camp houses including her babysitter who had six children.

Neither Ms. Miller nor Mr. Ready were aware of any archaeological sites currently within the boundary of the mill camp or in the area surrounding it. However, they explained that before the development of the sugar industry in Waialua, the general area was devoted to individual Hawaiian families' kuleana plots for food production, the boundaries of which are shown on early maps. They noted that prior to the plantation, a two-mile long irrigation ditch, reputedly the longest such feature in the islands, once brought water to the vicinity. It was used by the early plantation before more reliable pumps replaced it. On the topic of more recent cultural practices, Ms. Miller stated that the communities within the mill camp contained many distinct ethnic groups who each practiced their own cultural traditions including foods, religions, dances, etc. She stated that she believes traditional practices have declined in recent years.

When asked about their thoughts on the proposed project, including any impacts it may have on cultural practices, beliefs, or values within the community, both Mrs. Miller and Mr. Ready replied that they thought the project would have a positive impact. They explained that Mill Camp has not been kept up and many houses have become derelict. Consequently, they believe that this has resulted in the loss of community that once was perpetuated through the area during the operation of the plantation. They believe that a new development will aid in bringing back this sense of community and the plantation heritage of Waialua. Similarly, they also expressed that the area has not seen new housing developments in decades. Consequently, much of the local community has been forced to move to other communities such as Wahiawa or to the continent. For this additional reason, they believe the new project will aid in strengthening the community by allowing long-time Waialua families to stay in the area.

4. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines 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" (OEQC 1997:1). The guidelines also identify the types of cultural resources associated with cultural practices and beliefs that are subject to assessment. These include other types of historic properties, both man made and natural, submerged cultural resources, and traditional cultural properties. The origin of the concept and the expanded definition of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service (Parker and King 1998). An abbreviated definition is provided below:

> "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.

"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 in 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.

As the OEQC guidelines do not contain criteria for assessing the significance of traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

a Be associated with events that have made an important contribution to the broad patterns of our history;

b Be associated with the lives of persons important in our past;

c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

d Have yielded, or is likely to yield, information important for research on prehistory or history;

e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion d at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion e. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Pa'akai O Ka 'Āina* 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/or past or ongoing traditional customary practices; 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.

SUMMARY OF CULTURAL-HISTORICAL BACKGROUND INFORMATION

The *moku* of Waialua is known as the birthplace of the first Hawaiian ruling chief, Kapawa, who was born at one of the most sacred places on O‘ahu, Kūkaniloko. From 1795, Hawai‘i and Maui *ali‘i*, Ke‘eaumoku, used the lands of Waialua as his spoils. He later traveled with Kamehameha and possibly died of cholera in 1804. After his passing, the Waialua lands passed to Ka‘ahumanu, the wife of Kamehameha who controlled and taxed the district thereafter. When foreigners first arrived on O‘ahu, Kamananui Ahupua‘a was described as the religious and political epicenter of the district.

The fertile lands of Pa‘ala‘a, Kamananui, and Kawailoa comprised the heartland of Waialua with their sheltered bays and major tributaries. Habitation was dense on the floodplains, which consisted of large complexes of *lo‘i* and large *loko i‘a* (fishponds) including ‘Uko‘a and Lokoea in the vicinity of Waialua Bay. Along with smaller fishponds and *lo‘i* that were also utilized to raise fish, this production was estimated to feed approximately 6,000 to 8,000 people prior to the arrival of foreigners. The uplands of Kamananui had an extensive *lo‘i* system as its *makai* counterpart but was also known for the cultivation of sweet potatoes and yams. Sandalwood was harvested during the late eighteenth to early nineteenth century until the supply dwindled and the trade came to an end. Early historical accounts written by early visitors of O‘ahu describe “the variety of wood and lawn, and rich cultivated valleys” (King 1821).

By the mid-19th century, the lands of Waialua were inherited by a very young Victoria Kamāmalu. She then relinquished a portion of Kamananui to the reigning monarch, Kauikeaouli, who placed Kamananui into the government landholdings. As a result of the Māhele ‘Aina in 1848, Kamananui was parceled out into government grants and sold to natives and foreigners. The current project area is within land sold as a part of six separate grants in 1850.

In the 1860s, commercial sugarcane was introduced into Waialua and the Chamberlain plantation was established. Despite many failures and bankruptcies, the sugarcane industry continued to grow in Waialua. In 1898, Castle & Cook bought the sugar plantation in Waialua, which was at the time the Halstead Brothers plantation, and established the Waialua Agricultural Company. Under the leadership of Castle & Cook along with Benjamin Dillingham of the Oahu Railway and Land Company commercial sugar cultivation expanded across in Waialua and included 10,000 acres of land suitable for sugarcane cultivation and an additional 12,000 acres in higher elevations utilized for other crops including pineapples. Railroads, extensive irrigation systems and other plantation infrastructure were constructed to support the quickly expanding company. The first houses for plantation employees were built and consisted of barracks and double houses organized into camps and spread across the plantation.

As Waialua Agriculture continued to grow, additional houses were built for employees at the mill camp located at the Waialua sugar mill. The company increasingly built more single-family homes and by 1928, the majority of the current mill camp existed. In the mid-20th century, additional houses that encompassed new updated designs were built. These houses featured multiple rooms with kitchens, showers, and laundries. The community that developed within Waialua Mill Camp was close knit and when the plantation shut down operations in 1996, they were forced to learn to run their town. While many former employees were forced to relocate, employees who retired from working were allowed to keep their houses in Waialua Mill Camp and many remain living there today.

Although no prior archaeological or cultural studies have been conducted in the current project area, early archaeological studies conducted prior to the 1930s have identified several *heiau* in the greater Waialua area as well as Kūkaniloko. Subsequent archaeological studies have identified human remains in the area (Collins & Jourdane 2002; McAllister 1933; Filimoehala and Rieth 2010). Thus, there is a small possibility that human remains could be encountered within the project area. However, the area has also been extensively disturbed due to past commercial agricultural activities and residential development, so any unrecorded human burials or subsurface archaeological sites within the project area are likely disturbed. Military and plantation related infrastructure has also been recorded within the vicinity of the project area. Interviewees did not know of any existing archaeological sites within the project area.

IDENTIFICATION OF TRADITIONAL AND CUSTOMARY PRACTICES, VALUED CULTURAL RESOURCES

The information from the culture-historical background information in conjunction with the results of the consultation process revealed the following with respect to traditional and customary practices and valued cultural resources. In addition to the identification portion, if such resources or practices are identified, appropriate mitigative measures are also provided to help protect any of the identified traditional and customary practices and valued cultural resources.

Waialua Plantation Heritage	As noted in the consultation efforts and identified in the cultural historic background, plantation heritage is a significant aspect of Waialua Mill Camp. The interviewees identified a close and supportive community that developed as a result of plantation life. Waialua Mill Camp continued to perpetuate this heritage even after the closing of the mill. Despite this, the interviewees identified the proposed project as a beneficial to the community as it will provide updated homes for the the retired plantation workers and allow families to continue living in an area that they consider home rather than forced to relocate due to the high cost of rent. Daily plantation life was indicated as an integral part of the lived experience at the camp. Interpretive content, such as panels or Historic American Landscapes Survey (HALS) documentation will assist in the preservation and interpretation of plantation life on the North Shore of Oʻahu.
Burials	As noted in prior archaeological investigations, burials are known to exist within the vicinity of the project area. While no burial sites were identified during the archaeological inventory survey of the project area in the unlikely event that significant archaeological resources and or burials are discovered during the proposed development activities, work shall cease in the area of the discovery and the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) should be contacted pursuant to Hawaiʻi Administrative Rules §13-280-3.

Adherence to the recommended actions identified above will help to mitigate any potential impacts on the above-identified traditional customary practices and valued cultural resources. Conversely, failure to implement the recommended mitigative measures has the potential to impact the above-identified traditional customary practices and valued cultural resources.

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APPENDIX A. KA WAI OLA PUBLIC NOTICE

is preparing a Cultural Impact Assessment to inform a HRS, Chapter 343 Environmental Assessment being prepared for the Ocean Well Pilot Project. The project is in the HOST Park at NELHA on a portion of TMK: (3) 7-3-043:042 in coastal ʻOʻoma 1, North Kona, Hawaiʻi.

ASM is seeking kamaʻāina familiar with the area's cultural resources, customs, and practices. We also seek input regarding strategies to prevent or mitigate impacts on culturally valued resources or traditional customary practices. If you know of such information, contact Loke Brandt, lbrandt@asmaffiliates.com, phone (808) 969-6066.

CULTURAL IMPACT ASSESSMENT: WAIALUA SUGAR MILL CAMP, WAIALUA, OʻAHU

Ma o North Shore Consultants, LLC, ke hoʻomākaukau nei ʻo ASM Affiliates i Cultural Impact Assessment i kō pono nā koina o ka HRS, Chapter 343 Environmental Assessment no ka Waialua Mill Camp Improvements. Aia kēia pāhana ma kekahi ʻāpana o TMK (1) 6-7-001: 030, 058, 077, ma Kamananui Ahupuaʻa, ma Waialua, Oʻahu.

Ke ʻimi nei ʻo ASM i poʻe kamaʻāina i loaʻa paha ka ʻike no nā kumu waiwai moʻomeheu, nā loina, a me nā hana kuʻuna i pili me kēia ʻāina. Ke ʻimi pū nei mākou i nā manaʻo e pale ai a hōʻemi ai i nā hopene hiki i ia mau mea. Inā he ʻike kāu, e hoʻokaʻaike me Carol Oordt, coordt@asmaffiliates.com, (808) 439-8089.

On behalf of North Shore Consultants, LLC, ASM Affiliates is preparing a Cultural Impact Assessment to inform a HRS, Chapter 343 Enviornmental Assessment being prepared for the Waialua Mill Camp Improvements. The project includes portions of TMK: (1) 6-7-001: 030, 058, 077 in Kamananui, Waialua, Oʻahu.

ASM is seeking kamaʻāina familiar with the area's cultural resources, customs, and practices. We also seek input regarding strategies to prevent or mitigate impacts on culturally valued resources or traditional customary practices. If you know of such information, contact Carol Oordt, coordt@asmaffiliates.com, (808) 439-8089.

KAWAIAHAʻO CHURCH ARCHIVES

Kawaiahaʻo Church is in its final year of a two-year grant issued by the Institute of Museum and Library Services (Native American/Native Hawaiian Museum Services) with the Na Makamae O Kawaiahaʻo "Treasures of Kawaiahaʻo" project. Beyond digitizing and preserving the contents of the church's archive, the project recently launched a portal within the church's website to make accessible to the public selected digitized images of the records:

https://kawaiahaochurch.com/na-makamae-o-kawaiahao

A point of interest about these archival records is that some of them date back to the 1820s, and most of the records through the 1940s are in ʻōlelo Hawaiʻi.

Submitted by KeikoDenbeau, Grant Coordinator.808-228-2615.

Appendix C

Traffic Assessment Report

TRANSPORTATION ASSESSMENT REPORT

FOR THE PROPOSED

WAIALUA MILL AFFORDABLE HOUSING

WAIALUA, OAHU, HAWAII

TAX MAP KEY: 6-7-001:077

PREPARED FOR

BOW ENGINEERING & DEVELOPMENT, INC.

FEBRUARY 27, 2023

PREPARED BY

TMC THE TRAFFIC MANAGEMENT CONSULTANT

TRANSPORTATION ASSESSMENT REPORT

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FEBRUARY 27, 2023

RANDALL S. OKANEKU
LICENSED PROFESSIONAL ENGINEER
No. 4922-C
HAWAII, U.S.A.

PREPARED BY

TMC
THE TRAFFIC MANAGEMENT CONSULTANT
RANDALL S. OKANEKU, P.E., PRINCIPAL * 1188 BISHOP STREET, SUITE 1907 * HONOLULU, HI 96813

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TRANSPORTATION ASSESSMENT REPORT

FOR THE PROPOSED

WAIALUA MILL AFFORDABLE HOUSING

WAIALUA, OAHU, HAWAII

TAX MAP KEY: 6-7-001:077

I. Introduction

A. Project Description

The proposed Waialua Mill Affordable Housing Project is a planned 370-unit residential development at the former Waialua Mill Camp in Waialua, Oahu, Hawaii. The 70-acre site is identified as Tax Map Key: 6-7-001:077. The proposed project will consist of 50 senior affordable dwelling units, 70 one-, two-, and three-bedroom affordable multi-family units, and 250 three- and four-bedroom single-family dwelling units for a total of 370 dwelling units (DU). Figure 1 depicts the project location and vicinity map.

The existing site access is provided by Goodale Avenue via Kealohanui Street. Additional access is proposed on Farrington Highway via Puuiki Street. The project site plan is depicted in Figure 2. For the purpose of this Transportation Assessment Report, the Year 2036 is selected as the first year of full buildout and occupancy of the Waialua Mill Affordable Housing Project.

B. Purpose and Scope of the Study

The purpose of this study is to assess the transportation impacts resulting from the development of the proposed Waialua Mill Affordable Housing Project. 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 roadway and transportation conditions.
3. Analysis of the future transportation conditions without the proposed project.
4. The development of trip generation characteristics of the proposed project.
5. The identification and analysis of the transportation impacts resulting from the development of the proposed project.
6. The recommendation of improvements, which would mitigate the transportation impacts identified in this study.

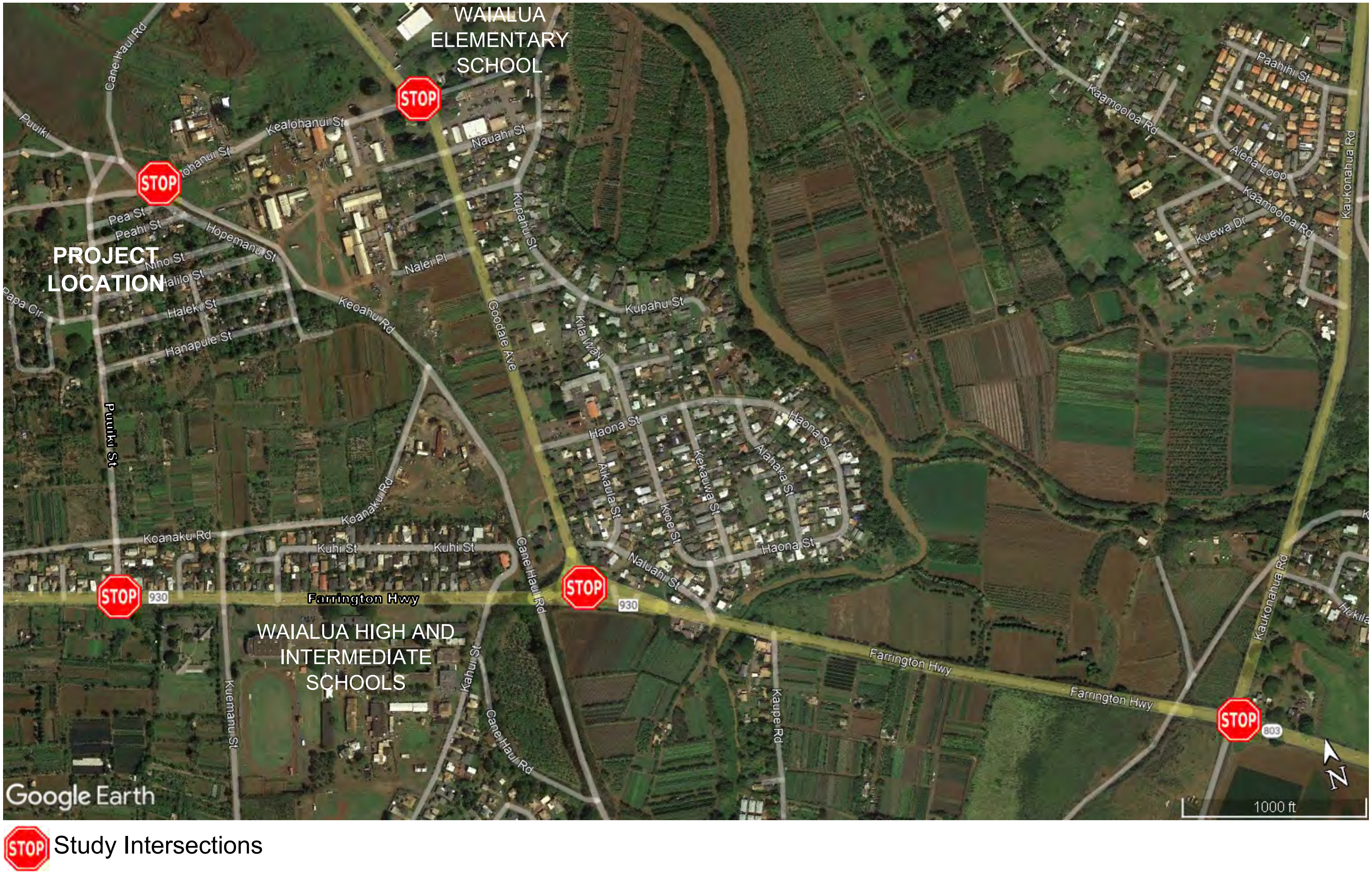


Figure 1. Location and Vicinity Map

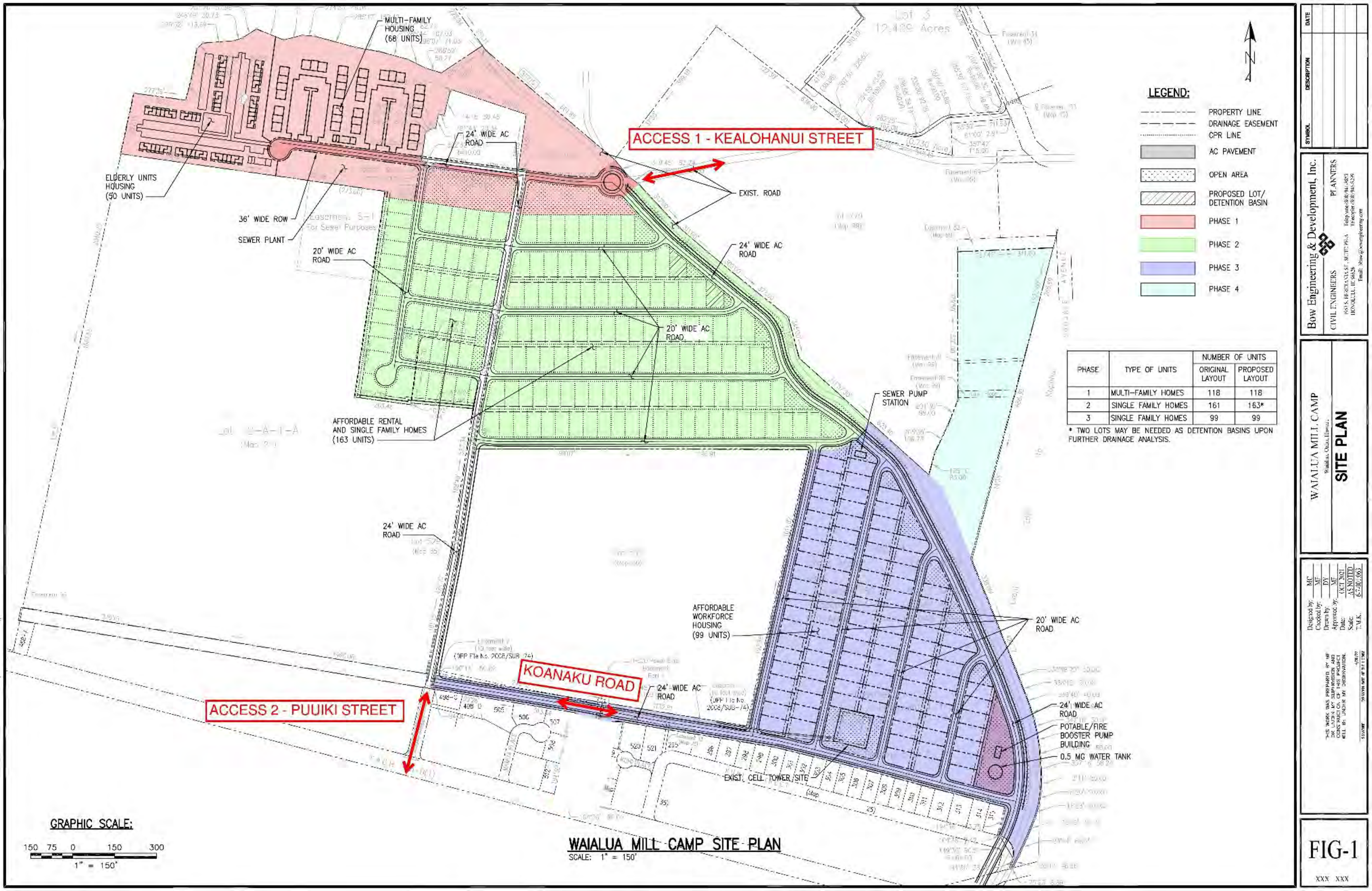


Figure 2. Waialua Mill Affordable Housing Site Plan

C. Methodologies

1. Capacity Analysis

The highway capacity analysis, performed in this study, is based upon procedures presented in the Highway Capacity Manual 6th Edition (HCM), published by the Transportation Research Board. HCM defines the Level of Service (LOS) as "a quantitative stratification of a performance measure or measures representing quality of service." HCM defines six (6) Levels of Service from the traveler's perspective, ranging from the best LOS "A" to the worst LOS "F". LOS translates the complex mathematical results of highway capacity analysis into an A through F grading system for the purpose of simplifying the roadway performance for decision-makers.

LOS's "A", "B", and "C" are considered satisfactory Levels of Service. LOS "D" is generally considered a "desirable minimum" operating Level of Service. LOS's "E" and "F" are undesirable conditions. Intersection LOS is primarily based upon average delay (d) in seconds per vehicle (sec/veh). Table 1 summarizes the HCM LOS criteria.

Table 1. Intersection Level of Service Criteria (HCM)

LOS	Unsignalized Control Delay d (sec/veh)	Description
A	d ≤ 10	Control delay is minimal.
B	10 < d ≤ 15	Control delay is not significant.
C	15 < d ≤ 25	Stable operation. Queuing begins to occur.
D	25 < d ≤ 35	Less stable condition. Increase in delays, decrease in travel speeds.
E	35 < d ≤ 50	Unstable operation, significant delays.
F	d > 50	High delays, extensive queuing.

Synchro is a traffic analysis software program that was developed by Trafficware. Synchro is an intersection analysis program that is based upon the HCM methodology. Synchro was used to calculate the Levels of Service for the intersections in the study area.

2. Trip Generation

The trip generation methodology is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in Trip Generation Manual, 11th Edition. The ITE trip rates were developed by correlating the vehicle, transit, walk, and bicycle trip generation data with various land use activities/characteristics, such as the peak hour trips per dwelling unit (DU). The ITE trip generation rates for senior affordable housing, multi-family affordable housing, and single-family detached dwelling units were used to estimate the trip generation from the proposed Waialua Mill Affordable Housing Project.

II. Existing Conditions

A. Roadways

Puuiki Street is a two-way, two-lane cul-de-sac City and County of Honolulu roadway between Farrington Highway and Koanaku Street, with curbs and gutters on both sides of the roadway. Pedestrian access is provided by grassed/paved shoulders on both sides of the roadway. Puuiki Street intersects Farrington Highway at a stop-controlled Tee-intersection.

Farrington Highway is a two-way, two-lane, State of Hawaii highway between Kaena Point Trail to the west and Kaukonahua Road to the east. Pedestrian access is provided by paved/grassed/gravel shoulders on both sides of Farrington Highway. The posted speed limit on Farrington Highway varies between 25 miles per hour (mph) and 35 mph. Farrington Highway continues to the east as Kaukonahua Road.

Kaukonahua Road is a two-way, two-lane City and County of Honolulu roadway between its all-way stop-controlled intersection with Farrington Highway (also known as Thompson's Corner) and its rotary intersection with Kamehameha Highway and Waialua Beach Road (also known as Weed Junction). Pedestrian access is provided by paved/grassed/gravel shoulders on both sides of Kaukonahua Road. The posted speed on Kaukonahua Road is 35 mph.

Goodale Avenue is a two-way, two-lane City and County of Honolulu roadway between Farrington Highway and Kealohanui Street. Goodale Avenue intersects Farrington Highway at a rotary intersection. A rotary intersection is a circular intersection where the traffic in the circular roadway must yield the right of way to traffic entering the intersection. Whereas a modern roundabout is a circular intersection where traffic entering the intersection must yield the right of way to traffic in the circular roadway. The Goodale Avenue/Farrington Highway rotary intersection is analyzed as three (3) separate Tee-intersections. Goodale Avenue is offset at its stop-controlled four-legged intersection with Kealohanui Street. Goodale Avenue is also a bicycle route between Farrington Highway and Kealohanui Street. Pedestrian access along Goodale Avenue is provided by a paved sidewalk on the east side of the roadway and a grassed shoulder on the west side of the roadway. The posted speed on Goodale Avenue is 25 mph. North of Kealohanui Street, Goodale Avenue continues toward Waialua and Haleiwa.

Kealohanui Street is a two-way, two-lane private roadway between Goodale Avenue and the project site. Kealohanui Street is unpaved, with pedestrian access limited to the unpaved shoulders on both sides of the roadway.

B. Public Transit

TheBus Routes 76 and 83 provide public transit service to Waialua. TheBus stops nearest the project site are located along Goodale Avenue.

C. Waialua Mill Camp

Sixty-seven (67) dwelling units currently exist in the Waialua Mill Camp, which are occupied by a total of 221 residents.

D. Existing Peak Hour Traffic Volumes and Operating Conditions

1. Field Investigation and Data Collection

Turning movement traffic count surveys were conducted in the study area during the week of November 14, 2022, during the peak periods of traffic from 6:00 AM to 9:00 AM and from 3:00 PM to 6:00 PM. The following intersections were included in the study area:

- Farrington Highway and Puuiki Street
- Farrington Highway and Goodale Avenue
- Farrington Highway and Kaukonahua Road
- Goodale Avenue and Kealohanui Street.

Turning movement traffic count surveys also were conducted at the intersection of Kealohanui Street and Hopemanu Street to establish the existing trip generation from the Waialua Mill Camp.

Each intersection was surveyed over a two-day period. The traffic count data for both days were comparable. The higher peak hour traffic volumes on the survey days at the study intersections were selected for the analysis to establish the existing conditions.

2. Existing AM Peak Hour Traffic

The existing AM peak hour of traffic occurred from 7:15 AM to 8:15 AM. Farrington Highway carried approximately 300 vehicles per hour (vph), total for both directions at Puuiki Street. Puuiki Street carried 12 vph. Between Goodale Avenue and Kaukonahua Road, Farrington Highway carried over 800 vph, total for both directions. Goodale Avenue also carried about 800 vph, total for both directions, during the existing AM peak hour of traffic, while Kaukonahua Road carried about 750 vph. Kealohanui Street carried 64 vph, total for both directions. Farrington Highway carried zero (0) bicycles, during the existing AM peak hour of traffic. Kaukonahua Road also did not carry any bicycle traffic. Goodale Avenue carried eight (8) bicycles, total for both directions. The existing Waialua Mill Camp generated about 37 vph, total for both directions, during the existing AM peak hour of traffic.

Westbound Farrington Highway operated at LOS "D" at Goodale Avenue, during the existing AM peak hour of traffic. Queuing on westbound Farrington Highway was observed to extend beyond the intersection. The other traffic movements at the rotary intersection operated at satisfactory Levels of Service, i.e., LOS "C" or better.

During the existing AM peak hour of traffic, the intersection of Farrington Highway and Kaukonahua Road operated at an overall LOS "E". Eastbound Farrington Highway operated at LOS "F" at Kaukonahua Road. Southbound and westbound Kaukonahua Road operated at LOS "E" and LOS "D", respectively.

The other intersections in the study area operated at LOS "B" or better, during the existing AM peak hour of traffic. Figure 3 depicts the existing AM peak hour traffic volumes and Levels of Service.

3. Existing PM Peak Hour Traffic

The existing PM peak hour of traffic occurred from 3:15 PM to 4:15 PM. During the existing PM peak hour of traffic, Farrington Highway carried about 400 vph at Puuiki Street, total for both directions, while Puuiki Street carried 15 vph. Farrington Highway carried over 800 vph, total for both directions, between Goodale Avenue and Kaukonahua Road. Goodale Avenue carried about 600 vph, while Kaukonahua Road carried about 780 vph, total for both directions. Kealohanui Street carried about 120 vph. Farrington Highway and Goodale Avenue carried zero (0) bicycles, during the existing PM peak hour of traffic. Kaukonahua Road carried one (1) bicycle, during the existing PM peak hour of traffic. Waialua Mill Camp generated about 55 vph, total for both directions, during the existing PM peak hour of traffic.

The intersection of Farrington Highway and Kaukonahua Road operated at an overall LOS "F", during the existing PM peak hour of traffic. Westbound Kaukonahua Road operated at LOS "F" at Farrington Highway. Southbound Kaukonahua Road operated at LOS "D".

The other intersections in the study area operated at satisfactory Levels of Service, during the existing PM peak hour of traffic. The existing PM peak hour traffic volumes and Levels of Service are depicted in Figure 4.

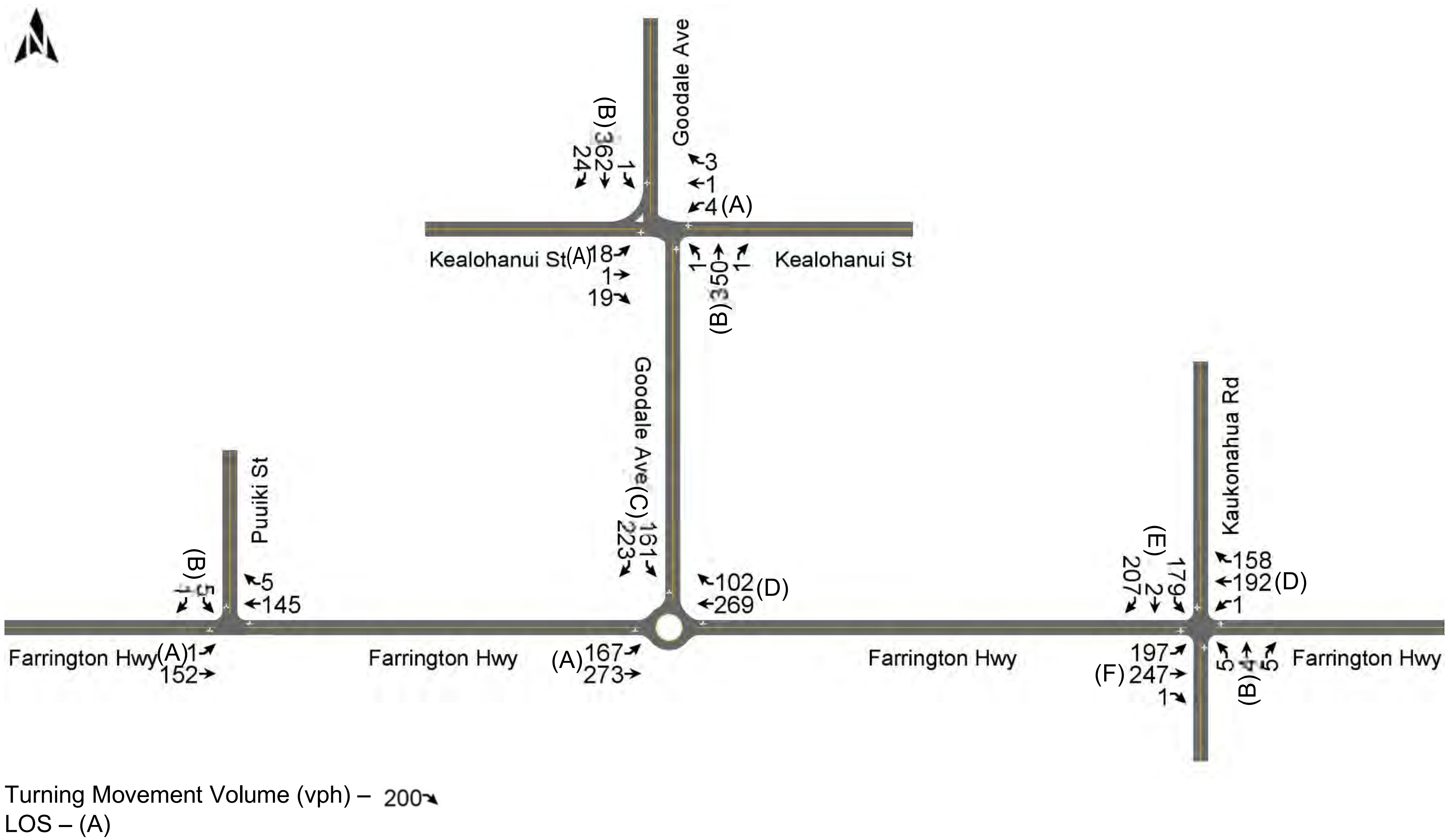
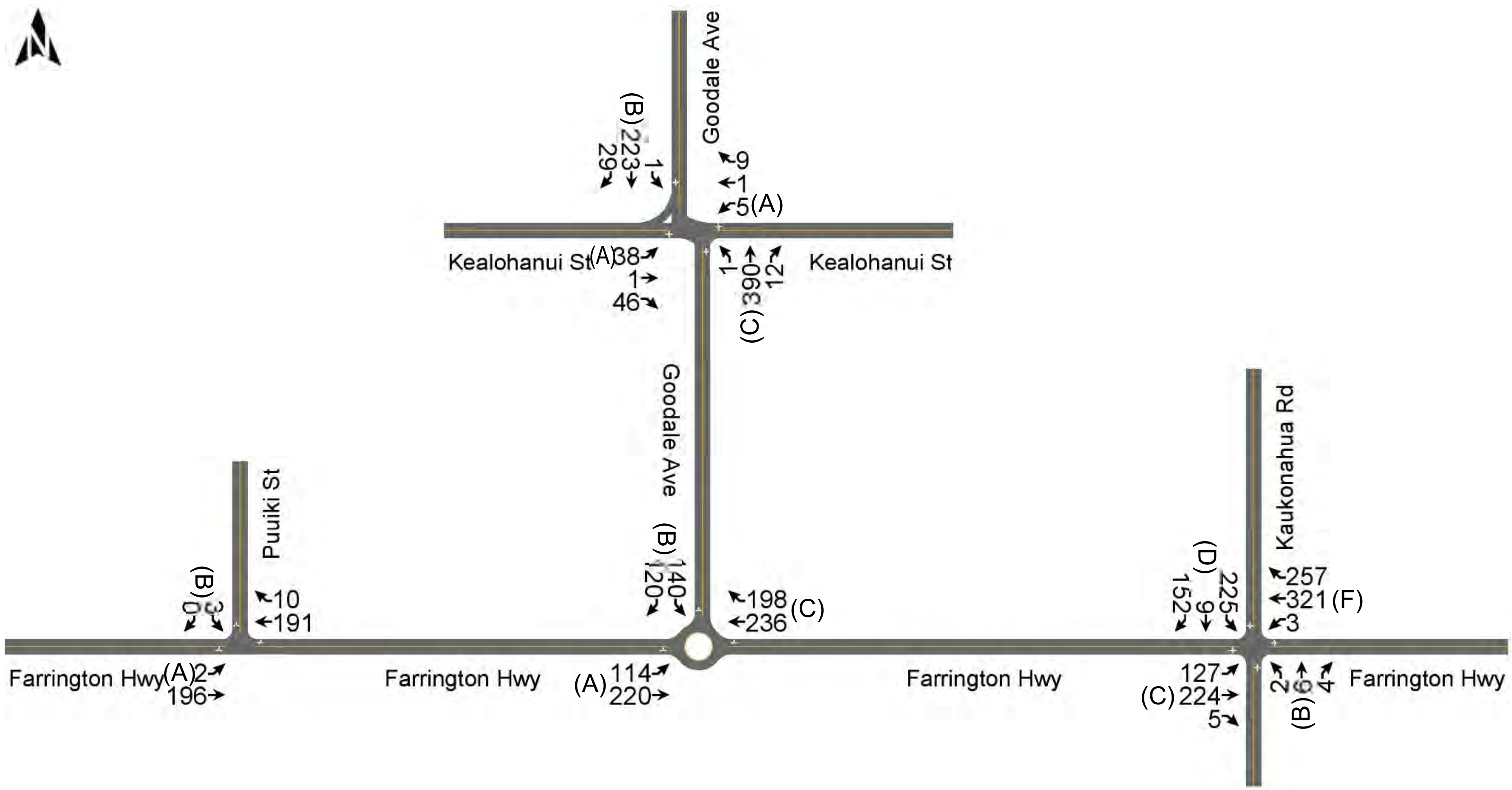


Figure 3. Existing AM Peak Hour Traffic



Turning Movement Volume (vph) – 200
LOS – (A)

Figure 4. Existing PM Peak Hour Traffic

III. Future Traffic Conditions

A. Background Growth in Traffic

The Oahu Regional Transportation Plan (ORTP) is a long-range transportation plan for the island of Oahu, published by the Oahu Metropolitan Planning Organization. The ORTP travel demands were based upon population and economic forecasts for the island of Oahu. The population of the North Shore of Oahu is expected to increase by 0.5 percent per year, while employment is expected to decline by 0.1 percent per year. For the purpose of this analysis, a background growth in traffic of 0.5 percent per year was assumed. A growth factor of 1.07 was uniformly applied to the existing (2022) peak hour traffic to estimate the Year 2036 peak hour traffic demands without the proposed project.

B. Peak Hour Traffic Analysis Without Project

1. AM Peak Hour Traffic Without Project

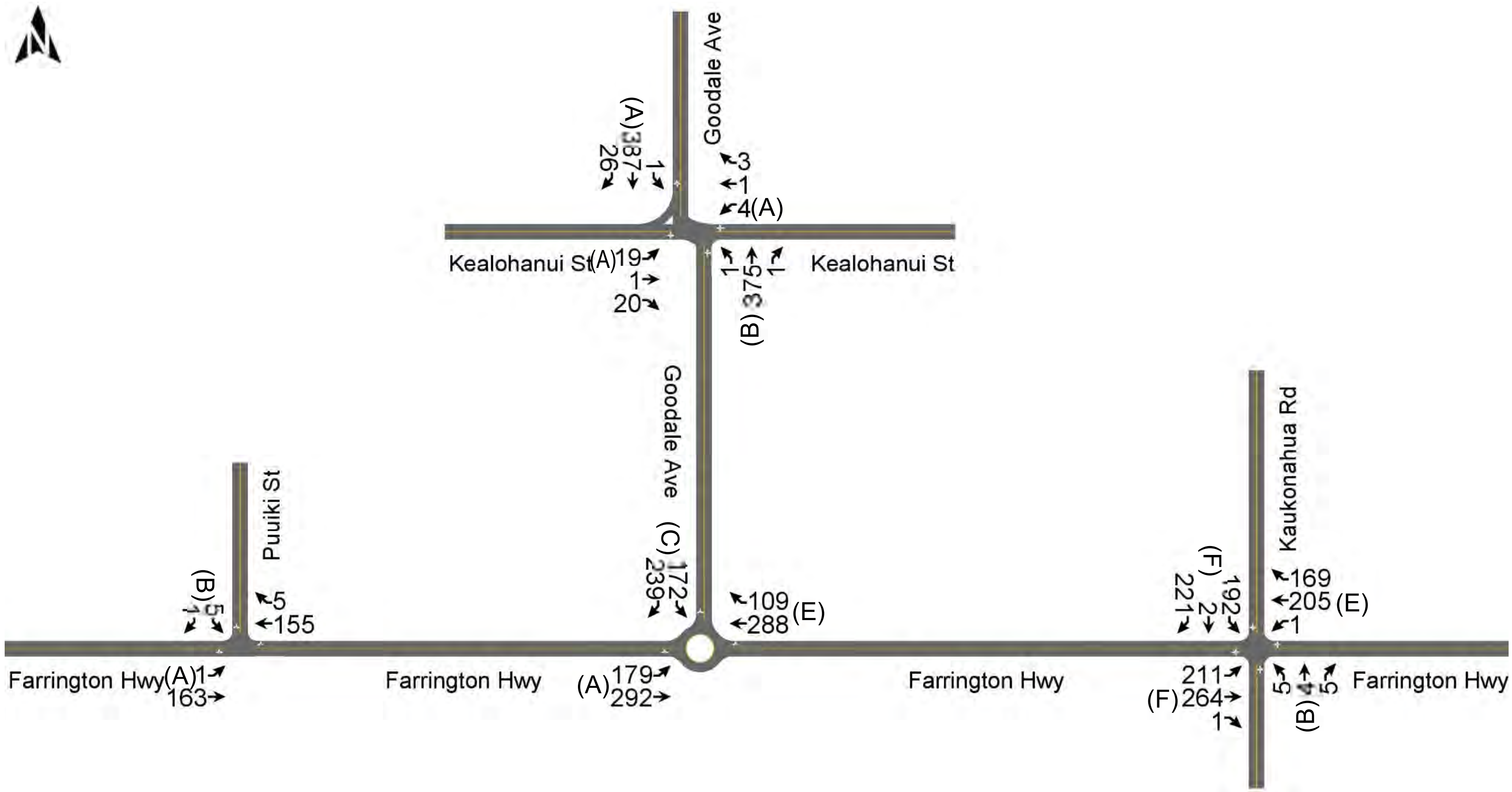
During the AM peak hour of traffic without the proposed project, westbound Farrington Highway is expected to operate at LOS “E” at Goodale Avenue. The other traffic movements at the intersection of Farrington Highway and Goodale Avenue are expected to operate at satisfactory Levels of Service.

The intersection of Farrington Highway and Kaukonahua Road is expected to operate at an overall intersection LOS “F”, during the AM peak hour of traffic without the proposed project. Eastbound Farrington Highway and southbound Kaukonahua Road are expected to operate at LOS “F”. Westbound Kaukonahua Road is expected to operate at LOS “E” at Farrington Highway. The other intersections in the study area are expected to operate at satisfactory Levels of Service, during the AM peak hour of traffic without the proposed project. Figure 5 depicts the AM peak hour traffic volumes and Levels of Service without the proposed project.

2. PM Peak Hour Traffic Without Project

The Farrington Highway and Kaukonahua Road intersection is expected to continue to operate at an overall LOS “F”, during the PM peak hour of traffic without the proposed project. Westbound Kaukonahua Road is expected to operate at LOS “F” at Farrington Highway. Eastbound Farrington Highway and southbound Kaukonahua Road are expected to operate at LOS “D”.

Northbound Goodale Avenue is expected to operate at LOS “D” at Kealohanui Street. The other intersections in the study area are expected to operate at satisfactory Levels of Service, during the PM peak hour of traffic without the proposed project. The PM peak hour traffic volumes and Levels of Service without the proposed project are depicted in Figure 6.



Turning Movement Volume (vph) – 200
LOS – (A)

Figure 5. AM Peak Hour Traffic Without Project

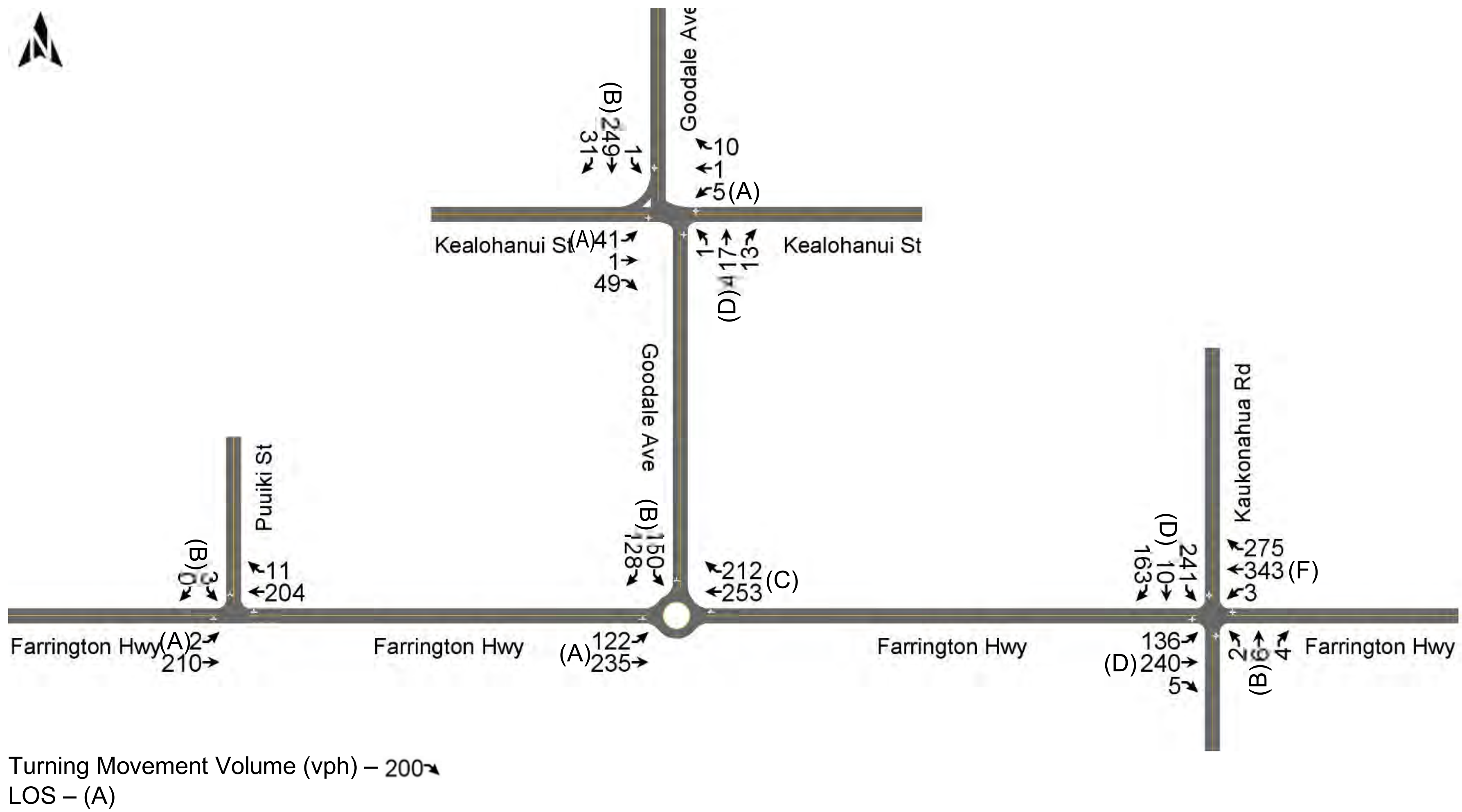


Figure 6. PM Peak Hour Traffic Without Project

IV. Transportation Impact Analysis

A. Trip Generation Characteristics

The trip generation characteristics were based upon the ITE trip generation methodology for senior affordable housing, affordable multi-family housing, and single-family detached housing. The ITE trip generation rates were used to derive the vehicle trips per hour (vph) per dwelling unit (DU), during the weekday AM and PM peak hours of adjacent street traffic.

The trips generated by the proposed project were reduced by the observed traffic generated by the existing Waialua Mill Camp. The proposed project is expected to generate net increases of 186 vph and 226 vph during the AM and PM peak hours of traffic, respectively. The trip generation characteristics in vehicle trips per hour for the proposed project are summarized in Table 2.

Table 2. ITE Vehicle Trip Generation Characteristics

Peak Hour	Direction	Senior Affordable	Multi-Family Affordable	Single-Family	Total	Existing (Observed)
		50 DU	70 DU	250 DU	370 DU	67 DU
AM	Enter	5	11	44	60	10
	Exit	4	28	131	163	27
	Total	9	39	175	223	37
PM	Enter	3	24	148	175	33
	Exit	2	17	87	106	22
	Total	5	41	235	281	55

The ITE trip generation methodology does <u>not</u> provide walk, bicycle, and transit trip generation rates for senior affordable housing, affordable multi-family housing, and single-family detached housing. However, the ITE trip generation methodology does provide walk, bicycle, and transit trip generation rates for low-rise multi-family housing, and single-family attached housing. The senior multi-family housing was combined with the multi-family dwelling units to estimate the walk, bicycle, and transit trip generation. ITE does <u>not</u> publish transit trip rates for multi-family and single-family dwelling units. Therefore, the transit trip generation was derived by subtracting the ITE walk trips and bike trips from the ITE walk+bike+transit trips. Tables 3 and 4 summarize the ITE walk, bike, and transit trips for the multi-family and senior housing and the single-family housing, respectively.

Table 3. ITE Multifamily and Senior Housing Trip Generation Characteristics					
Peak Hour	**Direction**	**Walk Trips/Hour**	**Bike Trips/Hour**	**Walk+Bike+Transit Trips/Hour**	**Transit Trips/Hour**
AM	**Enter**	2	0	2	0
	Exit	2	0	2	0
	Total	4	0	4	0
PM	**Enter**	2	0	2	0
	Exit	2	0	2	0
	Total	4	0	0	0

Table 4. ITE Single-Family Housing Trip Generation Characteristics					
Peak Hour	**Direction**	**Walk Trips/Hour**	**Bike Trips/Hour**	**Walk+Bike+Transit Trips/Hour**	**Transit Trips/Hour**
AM	**Enter**	6	3	7	-2
	Exit	22	1	21	-2
	Total	28	4	28	-4
PM	**Enter**	14	7	15	-5
	Exit	12	8	14	-6
	Total	26	15	30	-12

The walk trips from the multifamily housing account for all the walk+bike+transit trips. The combined walk trips and bike trips from the single-family housing exceed the walk+bike+transit trips, during the AM and PM peak hours. Therefore, the proposed project is <u>not</u> expected to generate any transit trips during the AM and PM peak hours of traffic, based upon the ITE trip generation methodology.

B. Traffic Assignment

The traffic assignments were based upon the existing traffic patterns in the study area. Figures 7 and 8 depict the AM and PM peak hour site traffic assignments, respectively.

C. AM Peak Hour Traffic Analysis With Project

Goodale Avenue is expected to operate at LOS “D” at eastbound Farrington Highway, during the AM peak hour of traffic with the proposed project. Westbound Farrington Highway is expected to operate at LOS “F” at Goodale Avenue. The other traffic movements at the rotary intersection of Farrington Highway and Goodale Avenue are expected to operate at satisfactory Levels of Service, during the AM peak hour of traffic with the proposed project.

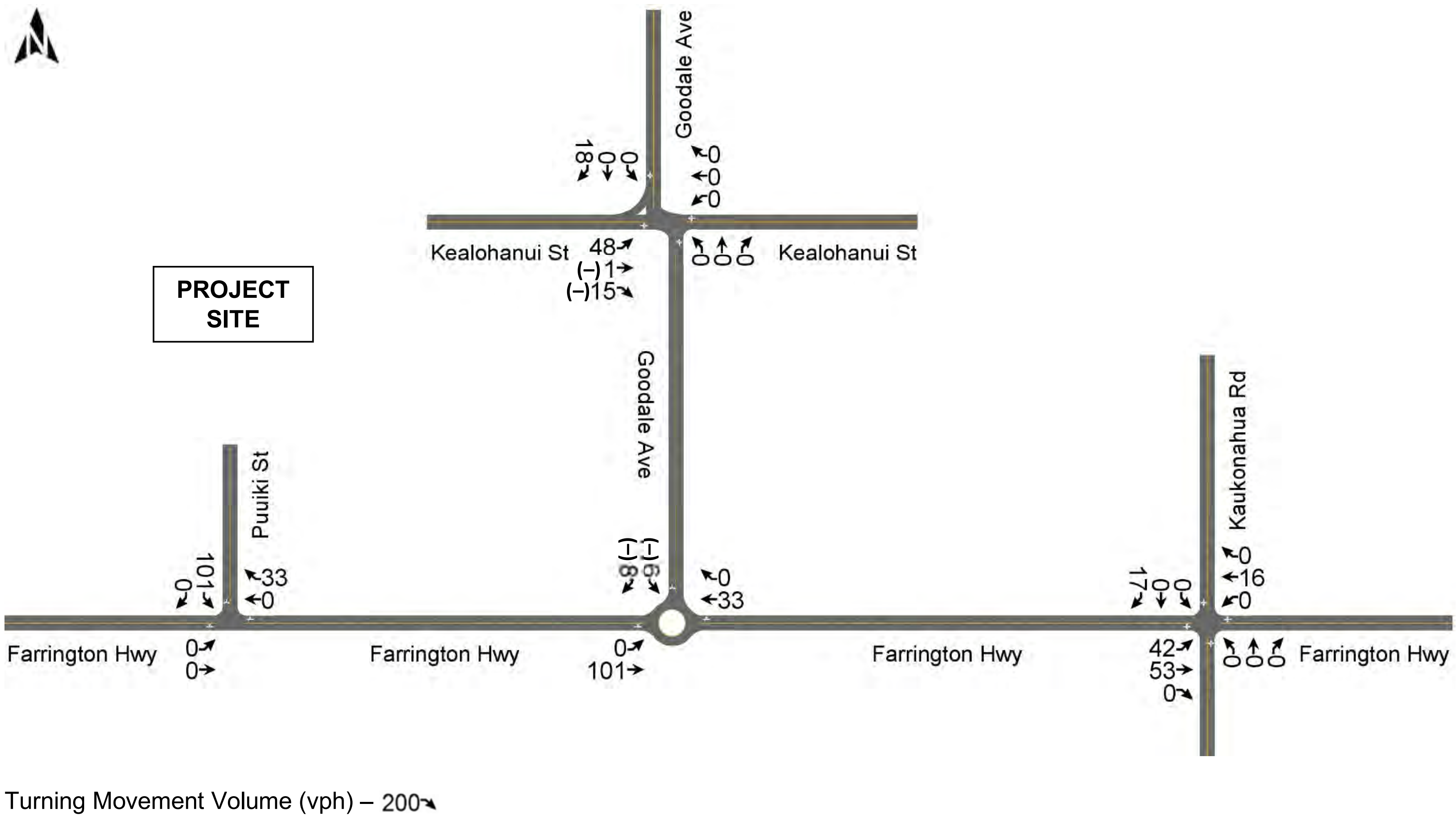


Figure 7. AM Peak Hour Site Traffic Assignment

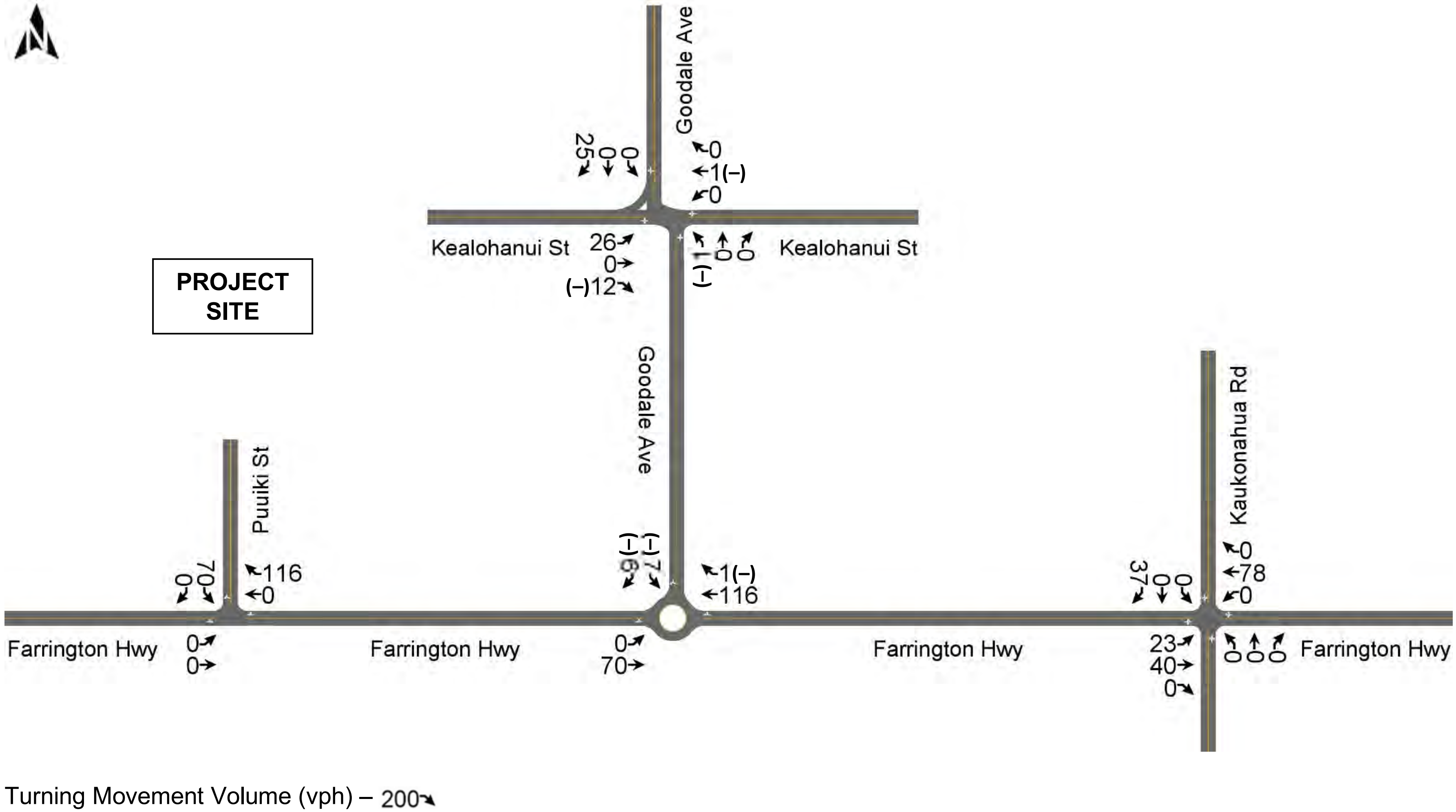


Figure 6. PM Peak Hour Site Traffic Assignment

During the AM peak hour of traffic with the proposed project, the intersection of Farrington Highway and Kaukonahua Road is expected to continue to operate at LOS “F”. The approaches to the intersection are expected to operate at the same Levels of Service as during the AM peak hour of traffic without the proposed project. The other intersections in the study area are expected to operate at satisfactory Levels of Service, during the AM peak hour of traffic with the proposed project. The AM peak hour traffic volumes with the proposed project are depicted in Figure 9.

D. PM Peak Hour Traffic Analysis With Project

During the PM peak hour of traffic with the proposed project, westbound Farrington Highway is expected to operate at LOS ‘D” at Goodale Avenue. The other traffic movements at the rotary intersection are expected to operate at satisfactory Levels of Service, during the PM peak hour of traffic with the proposed project.

The intersection of Farrington Highway and Kaukonahua Road is expected to continue to operate at an overall LOS “F”. Eastbound Farrington Highway and southbound Kaukonahua Road are expected to operate at LOS “E”. Westbound Kaukonahua Road is expected to operate at LOS “F” at Farrington Highway.

Northbound Goodale Avenue is expected to operate at LOS “E” at Kealohanui Street, during the PM peak hour of traffic with the proposed project. The other intersections in the study area are expected to operate at satisfactory Levels of Service, during The PM peak hour traffic with the proposed project. Figure 10 depicts the PM peak hour volumes with the proposed project.

V. Recommendations and Conclusions

A. Recommendations Without Project

The following traffic improvements should be implemented to mitigate the expected Levels of Service “E” and “F” traffic conditions, during the peak hours of traffic <u>without</u> the proposed project. Figures 9 and 10 also depict the AM and PM peak hour Levels of Services with the proposed improvements.

1. Farrington Highway and Goodale Avenue

The existing rotary intersection of Farrington Highway and Goodale Avenue should be improved to a modern roundabout intersection. All traffic entering the proposed modern roundabout must yield the right of way to traffic on the circular roadway. All sight distance obstructions should be removed/relocated from the proposed modern roundabout.

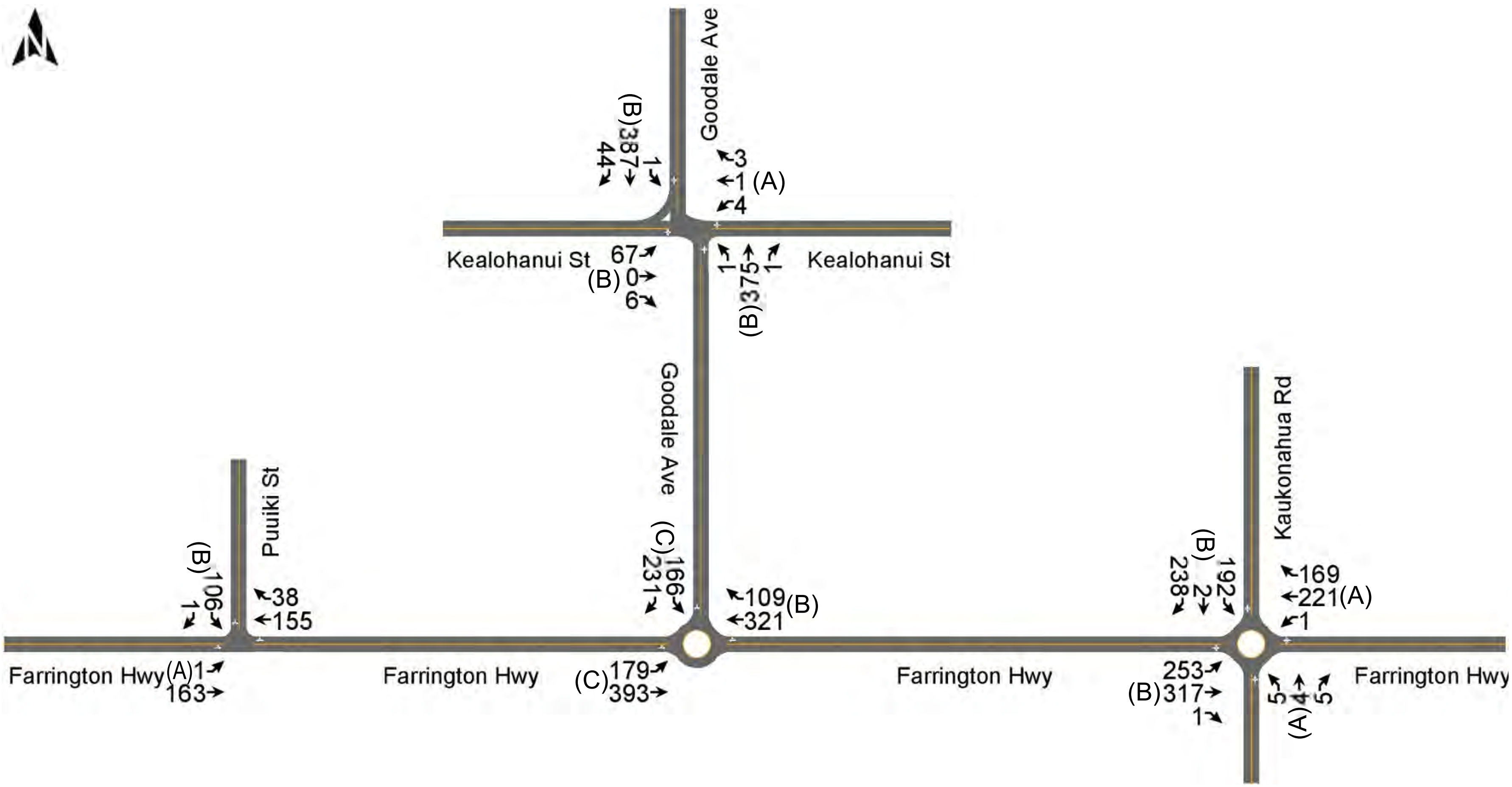
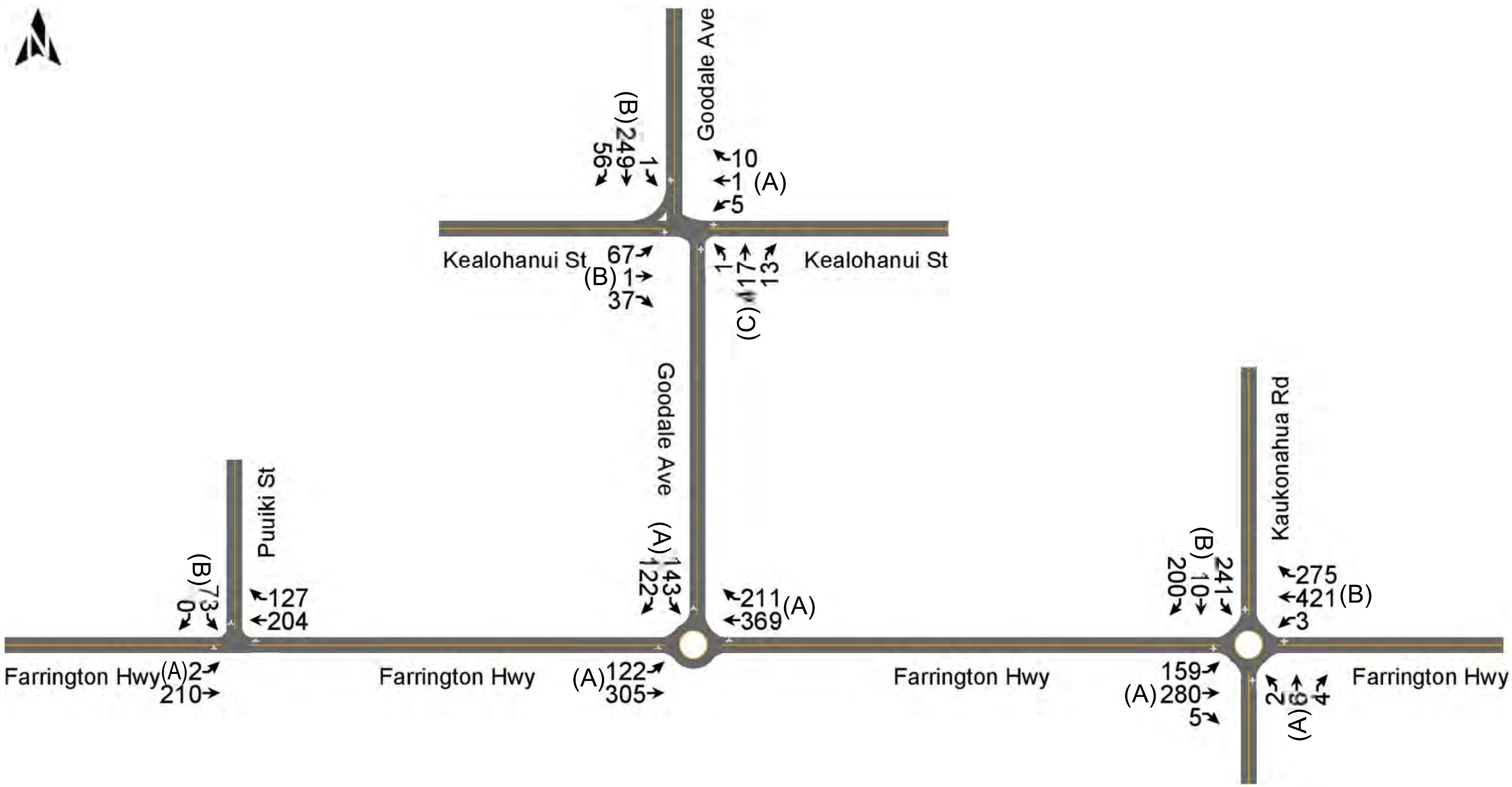


Figure 9. AM Peak Hour Traffic With Project



Turning Movement Volume (vph) – 200
LOS With Improvements – (A)

Figure 10. PM Peak Hour Traffic With Project

2. Farrington Highway and Kaukonahua Road

The all-way stop intersection of Farrington Highway and Kaukonahua Road also should be improved to a modern roundabout intersection. The proposed roundabout may require the acquisition of right-of-way. All sight distance obstructions should be removed/relocated from the proposed modern roundabout.

B. Recommendation With Project

The following traffic improvements should be implemented to improve the roadway deficiencies with the proposed project:

1. Goodale Avenue and Kealohanui Street

The intersection of Goodale Avenue and Kealohanui Street should be converted into an all-way stop intersection to mitigate the expected Level of Service "E" condition, during the PM peak hour of traffic with the proposed project. Marked crosswalks should be installed at the improved intersection. Consideration should be given to realigning the southbound approach to reduce the offset intersection with the northbound approach of Goodale Avenue. Kealohanui Street should be improved to City and County of Honolulu standards from Goodale Avenue through the project site.

2. Puuiki Street and Koanaku Street

Puuiki Street should be extended to Kealohanui Street and improved to City and County of Honolulu standards. Koanaku Street also should be improved to City and County of Honolulu standards, between Puuiki Street and the project site.

C. Conclusions

The trips generated by the proposed Waialua Mill Affordable Housing project are expected to increase traffic within the study area by about 11 percent and 13 percent, during the AM and PM peak hours of traffic, respectively. The proposed project is not expected to generate a significant number of transit trips during the peak hours of traffic.

Puuiki Street is expected to operate at Level of Service "B" at Farrington Highway, during the AM and PM peak hours of traffic with the proposed project. The proposed recommendations are expected to improve traffic operations at the study intersections to satisfactory Levels of Service with the development of the proposed Waialua Mill Affordable Housing Project. Table 5 summarizes the capacity analysis for this Transportation Assessment Report.

Table 5. Capacity Analysis Summary

Peak Hour	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
Existing AM Peak Hour	Farrington Highway & Puuiki Street	LOS	A	A	N/A	N/A	-	-	N/A	N/A	N/A	B	N/A	B	A
		Delay	7.6	0.0	N/A	N/A	-	-	N/A	N/A	N/A	10.4	N/A	10.4	0.2
		v/c	0.00	-	N/A	N/A	-	-	N/A	N/A	N/A	0.01	N/A	0.01	N/A
	EB Farrington Highway & Goodale Avenue	LOS	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C	N/A	C	A
		Delay	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20.3	N/A	20.3	5.4
		v/c	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.49	N/A	0.49	N/A
	EB Farrington Highway & WB Farrington Highway	LOS	A	A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
		Delay	9.5	0.0	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.6
		v/c	0.22	-	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goodale Avenue & WB Farrington Highway	LOS	N/A	N/A	N/A	D	N/A	D	N/A	N/A	N/A	N/A	-	N/A	B
		Delay	N/A	N/A	N/A	27.8	N/A	27.8	N/A	N/A	N/A	N/A	-	N/A	11.5
		v/c	N/A	N/A	N/A	0.72	N/A	0.72	N/A	N/A	N/A	N/A	-	N/A	N/A
	Goodale Avenue & Kealohanui Street	LOS	A	A	-	A	A	-	B			A			B
		Delay	7.3	0.0	-	7.3	0.0	-	13.3			7.3			12.7
		v/c	0.01	-	-	0.00	-	-	0.47			0.01			N/A
	Kaukonahua Road & Farrington Highway	LOS	F			D			B			E			E
		Delay	75.1			30.3			12.3			40.5			50.0
		v/c	1.02			0.80			0.04			0.89			N/A
Existing PM Peak Hour	Farrington Highway & Puuiki Street	LOS	A	A	N/A	N/A	-	-	N/A	N/A	N/A	B	N/A	B	A
		Delay	7.7	0.0	N/A	N/A	-	-	N/A	N/A	N/A	11.5	N/A	11.5	0.1
		v/c	0.00	-	N/A	N/A	-	-	N/A	N/A	N/A	0.01	N/A	0.01	N/A
	EB Farrington Highway & Goodale Avenue	LOS	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B	N/A	B	A
		Delay	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.8	N/A	14.8	3.4
		v/c	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.29	N/A	0.29	N/A
	EB Farrington Highway & WB Farrington Highway	LOS	A	A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
		Delay	8.7	0.0	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.1
		v/c	0.11	-	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goodale Avenue & WB Farrington Highway	LOS	N/A	N/A	N/A	C	N/A	C	N/A	N/A	N/A	N/A	-	N/A	A
		Delay	N/A	N/A	N/A	16.1	N/A	16.1	N/A	N/A	N/A	N/A	-	N/A	7.7
		v/c	N/A	N/A	N/A	0.50	N/A	0.50	N/A	N/A	N/A	N/A	-	N/A	N/A
	Goodale Avenue & Kealohanui Street	LOS	A	A	-	A	A	-	C			A			C
		Delay	7.4	0.0	-	7.3	0.0	-	21.9			7.4			16.5
		v/c	0.03	-	-	0.00	-	-	0.72			0.03			N/A
	Kaukonahua Road & Farrington Highway	LOS	C			F			B			D			F
		Delay	22.3			83.8			11.5			26.1			50.1
		v/c	0.69			1.08			0.03			0.75			N/A

Table 5. Capacity Analysis Summary (Cont'd.)

Peak Hour	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
AM Peak Hour Without Project	Farrington Highway & Puuiki Street	LOS	A	A	N/A	N/A	-	-	N/A	N/A	N/A	B	N/A	B	A
		Delay	7.6	0.0	N/A	N/A	-	-	N/A	N/A	N/A	10.6	N/A	10.6	0.2
		v/c	0.00	-	N/A	N/A	-	-	N/A	N/A	N/A	0.01	N/A	0.01	N/A
	EB Farrington Highway & Goodale Avenue	LOS	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C	N/A	C	A
		Delay	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24.2	N/A	24.2	6.5
		v/c	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.57	N/A	0.57	N/A
	EB Farrington Highway & WB Farrington Highway	LOS	A	A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
		Delay	9.8	0.0	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.7
		v/c	0.25	-	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goodale Avenue & WB Farrington Highway	LOS	N/A	N/A	N/A	E	N/A	E	N/A	N/A	N/A	N/A	-	N/A	C
		Delay	N/A	N/A	N/A	41.7	N/A	41.7	N/A	N/A	N/A	N/A	-	N/A	17.2
		v/c	N/A	N/A	N/A	0.85	N/A	0.85	N/A	N/A	N/A	N/A	-	N/A	N/A
	Goodale Avenue & Kealohanui Street	LOS	A	A	-	A	A	-	B			A			B
		Delay	7.3	0.0	-	7.3	0.0	-	13.9			7.3			13.4
		v/c	0.01	-	-	0.00	-	-	0.51			0.01			N/A
	Kaukonahua Road & Farrington Highway	LOS	F			E			B			F			F
		Delay	114.2			40.2			13.0			54.4			72.0
		v/c	1.14			0.89			0.05			0.99			N/A
PM Peak Hour Without Project	Farrington Highway & Puuiki Street	LOS	A	A	N/A	N/A	-	-	N/A	N/A	N/A	B	N/A	B	A
		Delay	7.7	0.0	N/A	N/A	-	-	N/A	N/A	N/A	11.8	N/A	11.8	0.1
		v/c	0.00	-	N/A	N/A	-	-	N/A	N/A	N/A	0.01	N/A	0.01	N/A
	EB Farrington Highway & Goodale Avenue	LOS	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B	N/A	B	A
		Delay	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.0	N/A	13.0	3.8
		v/c	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.26	N/A	0.26	N/A
	EB Farrington Highway & WB Farrington Highway	LOS	A	A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
		Delay	8.9	0.0	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.1
		v/c	0.12	-	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goodale Avenue & WB Farrington Highway	LOS	N/A	N/A	N/A	C	N/A	C	N/A	N/A	N/A	N/A	-	N/A	B
		Delay	N/A	N/A	N/A	17.8	N/A	17.8	N/A	N/A	N/A	N/A	-	N/A	8.5
		v/c	N/A	N/A	N/A	0.56	N/A	0.56	N/A	N/A	N/A	N/A	-	N/A	N/A
	Goodale Avenue & Kealohanui Street	LOS	A	A	-	A	A	-	D			A			C
		Delay	7.4	0.0	-	7.3	0.0	-	25.9			7.4			18.9
		v/c	0.03	-	-	0.00	-	-	0.78			0.03			N/A
	Kaukonahua Road & Farrington Highway	LOS	D			F			B			D			F
		Delay	26.3			125.2			12.1			31.9			71.0
		v/c	0.75			1.18			0.03			0.83			N/A

Table 5. Capacity Analysis Summary (Cont'd.)

Peak Hour	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
AM Peak Hour With Project	Farrington Highway & Puuiki Street	LOS	A	A	N/A	N/A	-	-	N/A	N/A	N/A	B	N/A	B	A
		Delay	7.7	0.0	N/A	N/A	-	-	N/A	N/A	N/A	12.5	N/A	12.5	2.9
		v/c	0.00	-	N/A	N/A	-	-	N/A	N/A	N/A	0.21	N/A	0.21	N/A
	EB Farrington Highway & Goodale Avenue	LOS	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	D	N/A	D	A
		Delay	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	33.7	N/A	33.7	7.6
		v/c	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.67	N/A	0.67	N/A
	EB Farrington Highway & WB Farrington Highway	LOS	B	A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
		Delay	10.1	0.0	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.5
		v/c	0.26	-	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goodale Avenue & WB Farrington Highway	LOS	N/A	N/A	N/A	F	N/A	F	N/A	N/A	N/A	N/A	-	N/A	C
		Delay	N/A	N/A	N/A	52.0	N/A	52.0	N/A	N/A	N/A	N/A	-	N/A	23.2
		v/c	N/A	N/A	N/A	0.92	N/A	0.92	N/A	N/A	N/A	N/A	-	N/A	N/A
	Goodale Avenue & Kealohanui Street	LOS	A	A	-	A	A	-	C			A			C
		Delay	7.3	0.0	-	7.2	0.0	-	17.4			7.3			16.3
		v/c	0.05	-	-	0.00	-	-	0.59			0.05			N/A
	Kaukonahua Road & Farrington Highway	LOS	F			E			B			F			F
		Delay	221.2			48.8			14.0			67.5			124.1
		v/c	1.39			0.99			0.05			1.09			N/A
PM Peak Hour With Project	Farrington Highway & Puuiki Street	LOS	A	A	N/A	N/A	-	-	N/A	N/A	N/A	B	N/A	B	A
		Delay	8.1	0.0	N/A	N/A	-	-	N/A	N/A	N/A	13.9	N/A	13.9	1.7
		v/c	0.00	-	N/A	N/A	-	-	N/A	N/A	N/A	0.18	N/A	0.18	N/A
	EB Farrington Highway & Goodale Avenue	LOS	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B	N/A	B	A
		Delay	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.0	N/A	14.0	3.5
		v/c	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.28	N/A	0.28	N/A
	EB Farrington Highway & WB Farrington Highway	LOS	A	A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
		Delay	9.4	0.0	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0
		v/c	0.14	-	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goodale Avenue & WB Farrington Highway	LOS	N/A	N/A	N/A	D	N/A	D	N/A	N/A	N/A	N/A	-	N/A	C
		Delay	N/A	N/A	N/A	28.8	N/A	28.8	N/A	N/A	N/A	N/A	-	N/A	16.7
		v/c	N/A	N/A	N/A	0.79	N/A	0.79	N/A	N/A	N/A	N/A	-	N/A	N/A
	Goodale Avenue & Kealohanui Street	LOS	A	A	-	A	A	-	E			A			C
		Delay	7.4	0.0	-	7.3	0.0	-	35.4			7.4			23.7
		v/c	0.05	-	-	0.00	-	-	0.86			0.05			N/A
	Kaukonahua Road & Farrington Highway	LOS	E			F			B			E			F
		Delay	44.7			228.7			13.4			45.0			124.6
		v/c	0.96			1.41			0.03			0.97			N/A

Table 5. Capacity Analysis Summary (Cont'd.)

Peak Hour	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
AM Peak Hour With Project With Improvements	Farrington Highway & Goodale Avenue	LOS	C		N/A	N/A	B		N/A	N/A	N/A	C	N/A	C	B
		Delay	17.2		N/A	N/A	11.0		N/A	N/A	N/A	15.7	N/A	15.7	14.9
		v/c	0.76		N/A	N/A	0.58		N/A	N/A	N/A	0.67	N/A	0.67	N/A
	Goodale Avenue & Kealohanui Street	LOS	B			A			B			B			B
		Delay	10.1			9.1			13.1			14.3			13.4
		v/c	0.14			0.02			0.54			0.60			N/A
	Kaukonahua Road & Farrington Highway	LOS	B			A			A			B			B
		Delay	13.3			9.8			7.3			10.2			11.3
		v/c	0.67			0.50			0.03			0.53			N/A
PM Peak Hour With Project With Improvements	Farrington Highway & Goodale Avenue	LOS	A		N/A	N/A	A		N/A	N/A	N/A	A	N/A	A	A
		Delay	7.4		N/A	N/A	8.8		N/A	N/A	N/A	7.5	N/A	7.5	8.1
		v/c	0.41		N/A	N/A	0.52		N/A	N/A	N/A	0.32	N/A	0.32	N/A
	Goodale Avenue & Kealohanui Street	LOS	B			A			C			B			C
		Delay	11.1			9.5			21.4			13.9			17.2
		v/c	0.23			0.04			0.75			0.54			N/A
	Kaukonahua Road & Farrington Highway	LOS	A			B			A			B			B
		Delay	9.0			11.7			5.7			12.0			11.0
		v/c	0.46			0.64			0.02			0.55			N/A

Legend
MOE – Measure of Effectiveness
LOS – Level of Service
Delay – Average Delay (seconds/vehicle)
v/c – Volume-to-Capacity Ratio
EBL – Eastbound Left-Turn Movement
EBT – Eastbound Through Movement
EBR – Eastbound Right–Turn Movement
WBL – Westbound Left-Turn Movement
WBT – Westbound Through Movement
WBR – Westbound Right-Turn Movement
NBL – Northbound Left-Turn Movement
NBT – Northbound Through Movement
NBR – Northbound Right-Turn Movement
SBL – Southbound Left-Turn Movement
SBT – Southbound Through Movement
SBR – Southbound Right-Turn Movement

TRANSPORTATION ASSESSMENT REPORT

FOR THE PROPOSED

WAIALUA MILL AFFORDABLE HOUSING

WAIALUA, OAHU, HAWAII

TAX MAP KEY: 6-7-001:077

APPENDIX A

EXISTING TRAFFIC COUNT DATA

Farrington Hwy Puuiki St - TMC

Mon Nov 14, 2022
Full Length (3 PM-6 PM, 6 AM-9 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014124, Location: 21.571159, -158.142161, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

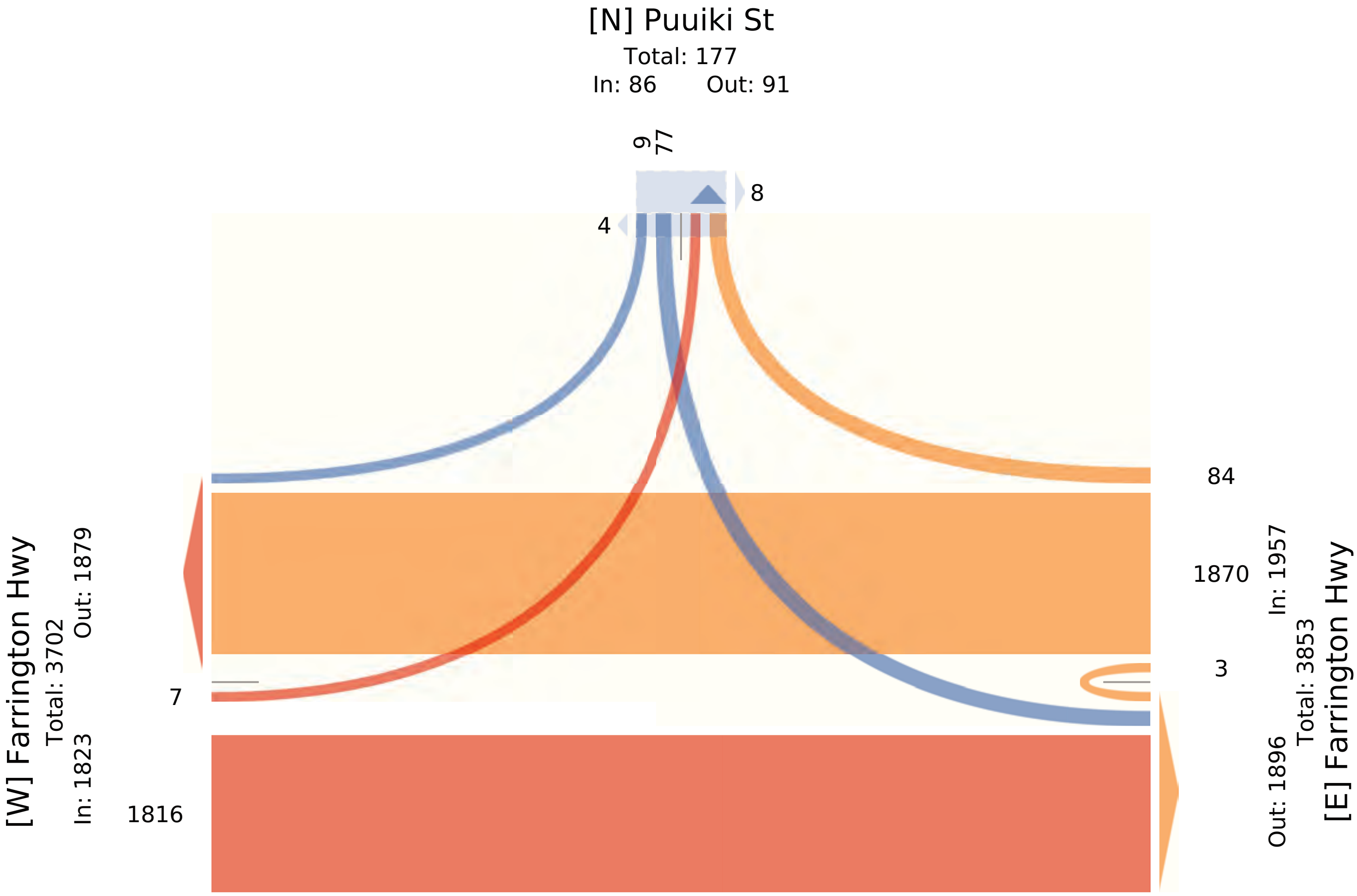
Leg	Farrington Hwy					Farrington Hwy					Puuiki St					
Direction	Eastbound					Westbound					Southbound					
Time	T	L	U	**App**	Ped*	R	T	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
2022-11-14 3:00PM	47	0	0	**47**	0	2	54	0	**56**	0	0	2	0	**2**	0	**105**
3:15PM	41	0	0	**41**	0	2	46	0	**48**	0	0	2	0	**2**	0	**91**
3:30PM	59	0	0	**59**	0	6	51	0	**57**	0	0	1	0	**1**	0	**117**
3:45PM	40	0	0	**40**	0	3	45	0	**48**	0	1	0	0	**1**	0	**89**
Hourly Total	187	0	0	**187**	0	13	196	0	**209**	0	1	5	0	**6**	0	**402**
4:00PM	55	0	0	**55**	0	2	35	0	**37**	0	0	1	0	**1**	0	**93**
4:15PM	53	0	0	**53**	0	3	39	0	**42**	0	0	3	0	**3**	1	**98**
4:30PM	54	0	0	**54**	0	1	56	0	**57**	0	0	1	0	**1**	0	**112**
4:45PM	46	0	0	**46**	0	3	36	0	**39**	0	1	4	0	**5**	0	**90**
Hourly Total	208	0	0	**208**	0	9	166	0	**175**	0	1	9	0	**10**	1	**393**
5:00PM	47	1	0	**48**	0	2	41	0	**43**	0	0	1	0	**1**	0	**92**
5:15PM	44	0	0	**44**	0	2	46	0	**48**	0	0	1	0	**1**	1	**93**
5:30PM	37	0	0	**37**	0	1	53	0	**54**	0	0	5	0	**5**	0	**96**
5:45PM	47	0	0	**47**	0	3	34	0	**37**	0	0	10	0	**10**	0	**94**
Hourly Total	175	1	0	**176**	0	8	174	0	**182**	0	0	17	0	**17**	1	**375**
2022-11-15 6:00AM	12	0	0	**12**	0	0	8	0	**8**	0	0	0	0	**0**	0	**20**
6:15AM	11	0	0	**11**	0	0	16	0	**16**	0	0	1	0	**1**	0	**28**
6:30AM	21	0	0	**21**	0	0	27	0	**27**	0	0	1	0	**1**	1	**49**
6:45AM	19	0	0	**19**	0	4	15	0	**19**	0	0	2	0	**2**	0	**40**
Hourly Total	63	0	0	**63**	0	4	66	0	**70**	0	0	4	0	**4**	1	**137**
7:00AM	29	0	0	**29**	0	0	16	0	**16**	0	0	1	0	**1**	0	**46**
7:15AM	21	0	0	**21**	0	0	25	0	**25**	0	0	0	0	**0**	0	**46**
7:30AM	47	0	0	**47**	0	0	36	0	**36**	0	0	1	0	**1**	0	**84**
7:45AM	36	0	0	**36**	0	1	53	0	**54**	0	0	1	0	**1**	0	**91**
Hourly Total	133	0	0	**133**	0	1	130	0	**131**	0	0	3	0	**3**	0	**267**
8:00AM	32	0	0	**32**	0	2	30	0	**32**	0	1	1	0	**2**	1	**66**
8:15AM	37	1	0	**38**	0	2	26	0	**28**	0	0	2	0	**2**	1	**68**
8:30AM	31	0	0	**31**	0	3	42	0	**45**	0	0	1	0	**1**	0	**77**
8:45AM	29	0	0	**29**	0	0	33	0	**33**	0	0	0	0	**0**	0	**62**
Hourly Total	129	1	0	**130**	0	7	131	0	**138**	0	1	4	0	**5**	2	**273**
3:00PM	45	0	0	**45**	0	0	39	0	**39**	0	0	0	0	**0**	0	**84**
3:15PM	39	0	0	**39**	0	3	49	0	**52**	0	0	0	0	**0**	0	**91**
3:30PM	55	1	0	**56**	0	2	58	0	**60**	0	0	2	0	**2**	0	**118**
3:45PM	63	0	0	**63**	0	3	41	0	**44**	0	0	0	0	**0**	0	**107**
Hourly Total	202	1	0	**203**	0	8	187	0	**195**	0	0	2	0	**2**	0	**400**
4:00PM	39	1	0	**40**	0	2	43	0	**45**	0	0	1	0	**1**	0	**86**
4:15PM	32	0	0	**32**	0	2	32	0	**34**	0	0	0	0	**0**	0	**66**
4:30PM	47	0	0	**47**	0	4	44	1	**49**	0	2	0	0	**2**	0	**98**
4:45PM	42	1	0	**43**	0	2	49	0	**51**	0	2	4	0	**6**	0	**100**
Hourly Total	160	2	0	**162**	0	10	168	1	**179**	0	4	5	0	**9**	0	**350**
5:00PM	54	0	0	**54**	0	2	44	0	**46**	0	0	1	0	**1**	0	**101**
5:15PM	35	1	0	**36**	0	1	43	2	**46**	0	0	1	0	**1**	1	**83**
5:30PM	43	0	0	**43**	0	4	43	0	**47**	0	0	6	0	**6**	0	**96**
5:45PM	47	0	0	**47**	0	0	45	0	**45**	0	0	5	0	**5**	1	**97**
Hourly Total	179	1	0	**180**	0	7	175	2	**184**	0	0	13	0	**13**	2	**377**
2022-11-16 6:00AM	19	0	0	**19**	0	1	45	0	**46**	0	0	1	0	**1**	0	**66**
6:15AM	16	0	0	**16**	0	0	50	0	**50**	0	0	0	0	**0**	0	**66**
6:30AM	24	0	0	**24**	0	3	46	0	**49**	0	0	2	0	**2**	1	**75**
6:45AM	22	0	0	**22**	0	0	46	0	**46**	0	0	0	0	**0**	0	**68**
Hourly Total	81	0	0	**81**	0	4	187	0	**191**	0	0	3	0	**3**	1	**275**
7:00AM	26	0	0	**26**	0	3	32	0	**35**	0	0	3	0	**3**	0	**64**
7:15AM	34	0	0	**34**	0	2	34	0	**36**	0	0	2	0	**2**	1	**72**

Leg	Farrington Hwy					Farrington Hwy					Puuiki St					
Direction	Eastbound					Westbound					Southbound					
Time	T	L	U	**App**	Ped*	R	T	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
7:30AM	52	0	0	**52**	0	0	35	0	**35**	0	0	1	0	**1**	1	**88**
7:45AM	36	0	0	**36**	0	5	48	0	**53**	0	0	1	0	**1**	1	**90**
Hourly Total	148	0	0	**148**	0	10	149	0	**159**	0	0	7	0	**7**	3	**314**
8:00AM	29	0	0	**29**	0	0	37	0	**37**	0	0	2	0	**2**	0	**68**
8:15AM	33	0	0	**33**	0	1	39	0	**40**	0	1	2	0	**3**	0	**76**
8:30AM	41	1	0	**42**	0	1	37	0	**38**	0	1	1	0	**2**	0	**82**
8:45AM	48	0	0	**48**	0	1	28	0	**29**	0	0	0	0	**0**	1	**77**
Hourly Total	151	1	0	**152**	0	3	141	0	**144**	0	2	5	0	**7**	1	**303**
Total	1816	7	0	**1823**	0	84	1870	3	**1957**	0	9	77	0	**86**	12	**3866**
% Approach	99.6%	0.4%	0%	**-**	-	4.3%	95.6%	0.2%	**-**	-	10.5%	89.5%	0%	**-**	-	-
% Total	47.0%	0.2%	0%	**47.2%**	-	2.2%	48.4%	0.1%	**50.6%**	-	0.2%	2.0%	0%	**2.2%**	-	-
Motorcycles	14	0	0	**14**	-	0	14	0	**14**	-	0	0	0	**0**	-	28
% Motorcycles	0.8%	0%	0%	**0.8%**	-	0%	0.7%	0%	**0.7%**	-	0%	0%	0%	**0%**	-	0.7%
Lights	1772	5	0	**1777**	-	84	1809	3	**1896**	-	6	76	0	**82**	-	3755
% Lights	97.6%	71.4%	0%	**97.5%**	-	100%	96.7%	100%	**96.9%**	-	66.7%	98.7%	0%	**95.3%**	-	97.1%
Single-Unit Trucks	20	0	0	**20**	-	0	34	0	**34**	-	0	0	0	**0**	-	54
% Single-Unit Trucks	1.1%	0%	0%	**1.1%**	-	0%	1.8%	0%	**1.7%**	-	0%	0%	0%	**0%**	-	1.4%
Articulated Trucks	0	0	0	**0**	-	0	2	0	**2**	-	0	0	0	**0**	-	2
% Articulated Trucks	0%	0%	0%	**0%**	-	0%	0.1%	0%	**0.1%**	-	0%	0%	0%	**0%**	-	0.1%
Buses	5	0	0	**5**	-	0	7	0	**7**	-	0	0	0	**0**	-	12
% Buses	0.3%	0%	0%	**0.3%**	-	0%	0.4%	0%	**0.4%**	-	0%	0%	0%	**0%**	-	0.3%
Bicycles on Road	5	2	0	**7**	-	0	4	0	**4**	-	3	1	0	**4**	-	15
% Bicycles on Road	0.3%	28.6%	0%	**0.4%**	-	0%	0.2%	0%	**0.2%**	-	33.3%	1.3%	0%	**4.7%**	-	0.4%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	9	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75.0%	-
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	0	-	-	-	-	3	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25.0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Farrington Hwy Puuiki St - TMC
Mon Nov 14, 2022
Full Length (3 PM-6 PM, 6 AM-9 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014124, Location: 21.571159, -158.142161, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US



Farrington Hwy Puuiki St - TMC

Mon Nov 14, 2022
PM Peak (Nov 14 2022 3PM - 4 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014124, Location: 21.571159, -158.142161, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Farrington Hwy					Farrington Hwy					Puuiki St					
Direction	Eastbound					Westbound					Southbound					
Time	T	L	U	**App**	Ped*	R	T	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
2022-11-14 3:00PM	47	0	0	**47**	0	2	54	0	**56**	0	0	2	0	**2**	0	**105**
3:15PM	41	0	0	**41**	0	2	46	0	**48**	0	0	2	0	**2**	0	**91**
3:30PM	59	0	0	**59**	0	6	51	0	**57**	0	0	1	0	**1**	0	**117**
3:45PM	40	0	0	**40**	0	3	45	0	**48**	0	1	0	0	**1**	0	**89**
Total	187	0	0	**187**	0	13	196	0	**209**	0	1	5	0	**6**	0	**402**
% Approach	100%	0%	0%	**-**	-	6.2%	93.8%	0%	**-**	-	16.7%	83.3%	0%	**-**	-	-
% Total	46.5%	0%	0%	**46.5%**	-	3.2%	48.8%	0%	**52.0%**	-	0.2%	1.2%	0%	**1.5%**	-	-
PHF	0.788	-	-	**0.788**	-	0.542	0.907	-	**0.917**	-	-	0.625	-	**0.625**	-	0.855
Motorcycles	1	0	0	**1**	-	0	1	0	**1**	-	0	0	0	**0**	-	2
% Motorcycles	0.5%	0%	0%	**0.5%**	-	0%	0.5%	0%	**0.5%**	-	0%	0%	0%	**0%**	-	0.5%
Lights	184	0	0	**184**	-	13	192	0	**205**	-	0	5	0	**5**	-	394
% Lights	98.4%	0%	0%	**98.4%**	-	100%	98.0%	0%	**98.1%**	-	0%	100%	0%	**83.3%**	-	98.0%
Single-Unit Trucks	1	0	0	**1**	-	0	2	0	**2**	-	0	0	0	**0**	-	3
% Single-Unit Trucks	0.5%	0%	0%	**0.5%**	-	0%	1.0%	0%	**1.0%**	-	0%	0%	0%	**0%**	-	0.7%
Articulated Trucks	0	0	0	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0
% Articulated Trucks	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Buses	0	0	0	**0**	-	0	1	0	**1**	-	0	0	0	**0**	-	1
% Buses	0%	0%	0%	**0%**	-	0%	0.5%	0%	**0.5%**	-	0%	0%	0%	**0%**	-	0.2%
Bicycles on Road	1	0	0	**1**	-	0	0	0	**0**	-	1	0	0	**1**	-	2
% Bicycles on Road	0.5%	0%	0%	**0.5%**	-	0%	0%	0%	**0%**	-	100%	0%	0%	**16.7%**	-	0.5%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Farrington Hwy Puuiki St - TMC
Mon Nov 14, 2022
PM Peak (Nov 14 2022 3PM - 4 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014124, Location: 21.571159, -158.142161, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
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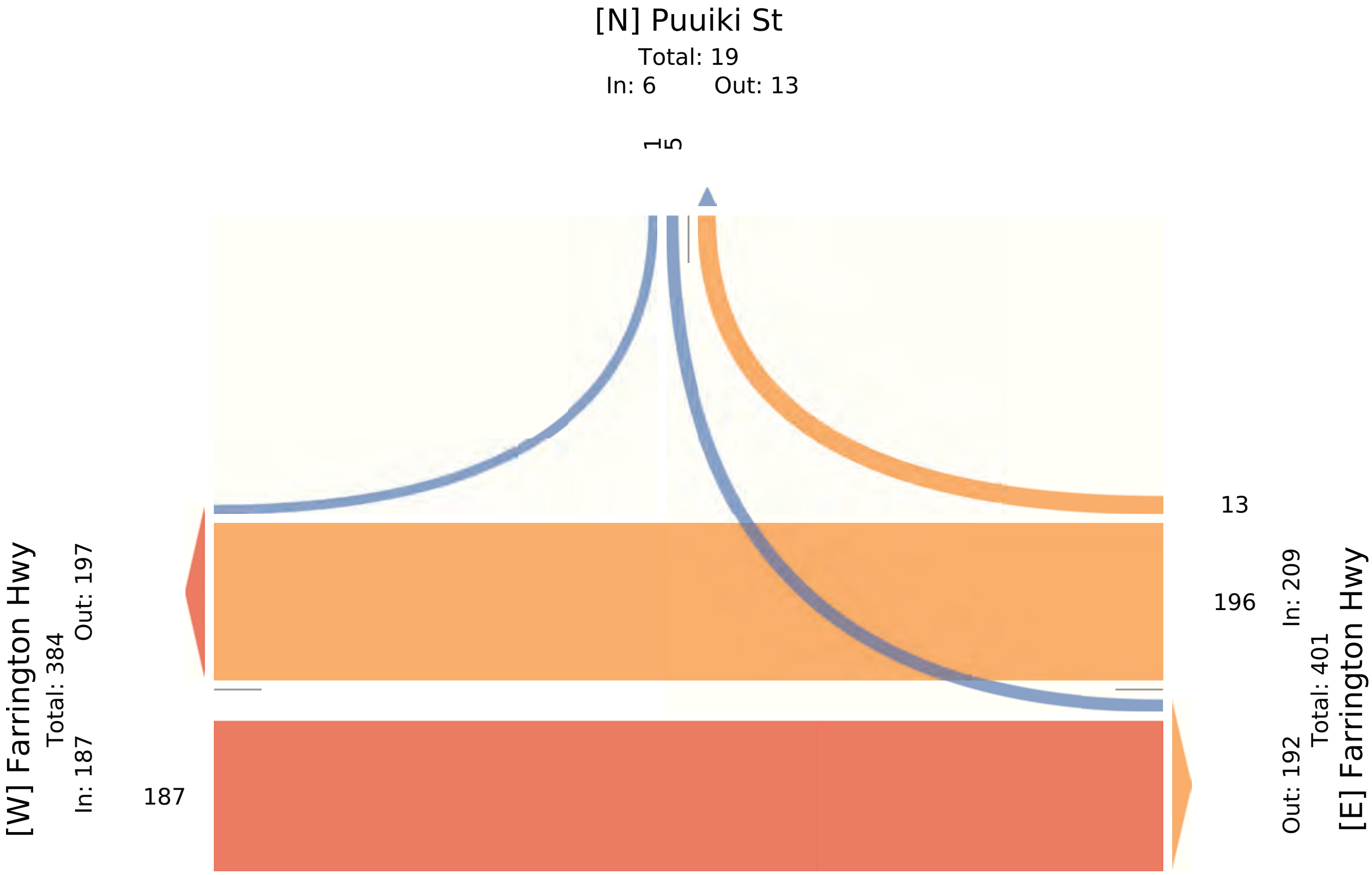

Farrington Hwy Puuiki St - TMC

Wed Nov 16, 2022
AM Peak (Nov 16 2022 7:30AM - 8:30 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014124, Location: 21.571159, -158.142161, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Farrington Hwy					Farrington Hwy					Puuiki St					
Direction	Eastbound					Westbound					Southbound					
Time	T	L	U	App	Ped*	R	T	U	App	Ped*	R	L	U	App	Ped*	Int
2022-11-16 7:30AM	52	0	0	**52**	0	0	35	0	**35**	0	0	1	0	**1**	1	**88**
7:45AM	36	0	0	**36**	0	5	48	0	**53**	0	0	1	0	**1**	1	**90**
8:00AM	29	0	0	**29**	0	0	37	0	**37**	0	0	2	0	**2**	0	**68**
8:15AM	33	0	0	**33**	0	1	39	0	**40**	0	1	2	0	**3**	0	**76**
Total	150	0	0	**150**	0	6	159	0	**165**	0	1	6	0	**7**	2	**322**
% Approach	100%	0%	0%	**-**	-	3.6%	96.4%	0%	**-**	-	14.3%	85.7%	0%	**-**	-	-
% Total	46.6%	0%	0%	**46.6%**	-	1.9%	49.4%	0%	**51.2%**	-	0.3%	1.9%	0%	**2.2%**	-	-
PHF	0.716	-	-	**0.716**	-	0.300	0.828	-	**0.778**	-	0.250	0.750	-	**0.583**	-	0.892
Motorcycles	1	0	0	**1**	-	0	0	0	**0**	-	0	0	0	**0**	-	1
% Motorcycles	0.7%	0%	0%	**0.7%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0.3%
Lights	146	0	0	**146**	-	6	154	0	**160**	-	1	6	0	**7**	-	313
% Lights	97.3%	0%	0%	**97.3%**	-	100%	96.9%	0%	**97.0%**	-	100%	100%	0%	**100%**	-	97.2%
Single-Unit Trucks	2	0	0	**2**	-	0	5	0	**5**	-	0	0	0	**0**	-	7
% Single-Unit Trucks	1.3%	0%	0%	**1.3%**	-	0%	3.1%	0%	**3.0%**	-	0%	0%	0%	**0%**	-	2.2%
Articulated Trucks	0	0	0	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0
% Articulated Trucks	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Buses	0	0	0	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0
% Buses	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Bicycles on Road	1	0	0	**1**	-	0	0	0	**0**	-	0	0	0	**0**	-	1
% Bicycles on Road	0.7%	0%	0%	**0.7%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0.3%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	1	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50.0%	-
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	0	-	-	-	-	1	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50.0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Farrington Hwy Puuiki St - TMC
Wed Nov 16, 2022
AM Peak (Nov 16 2022 7:30AM - 8:30 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014124, Location: 21.571159, -158.142161, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
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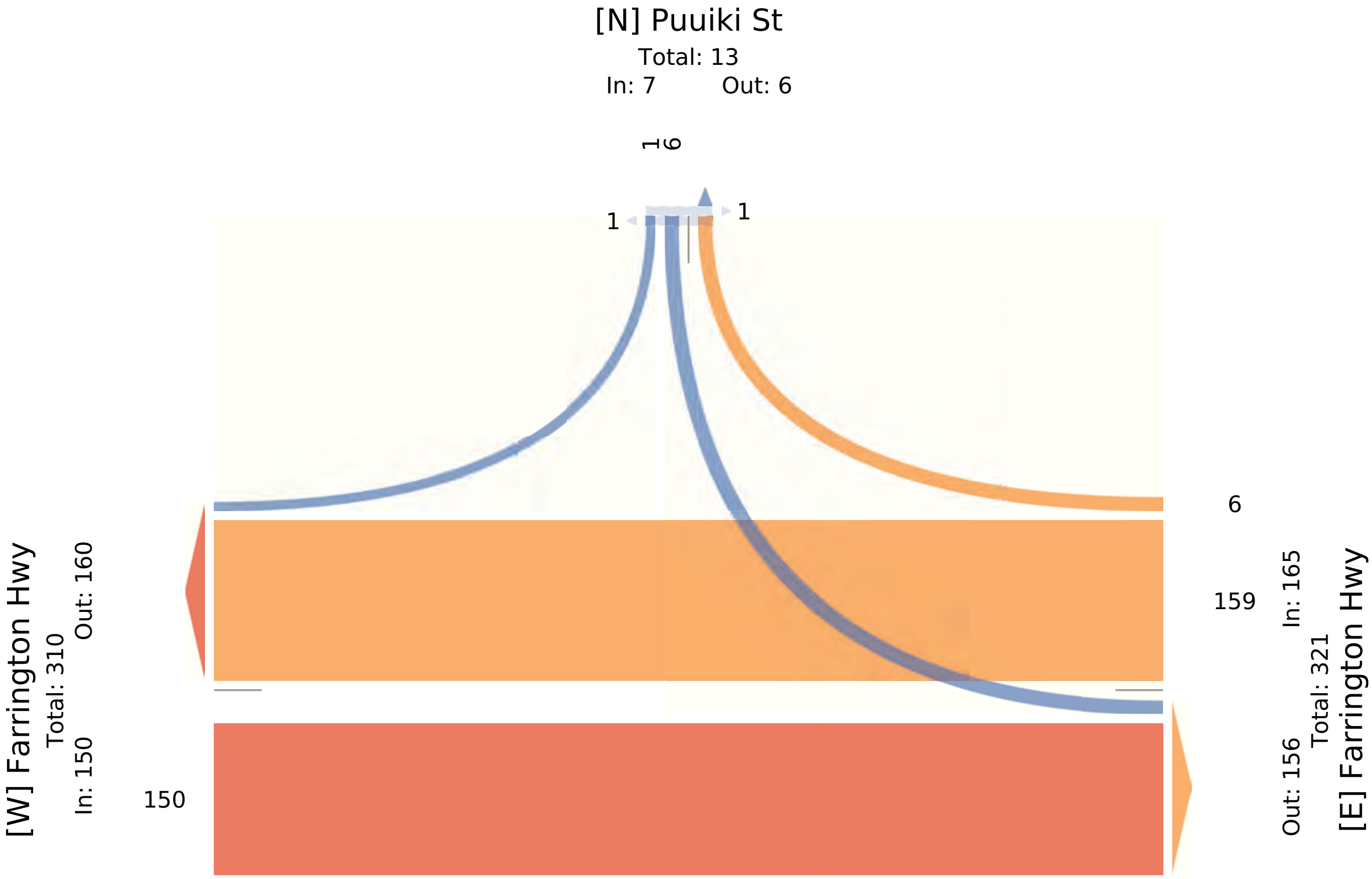

Study Name **Farrington Hwy Goodale Ave**
Start Date **11/14/2022**
Start Time **3:00 PM**
Site Code **Waialua Mill**

	Farrington Hwy Eastbound		Farrington Hwy Westbound		Goodale Ave Southbound		Totals	
Start Time	Left	Thru	Thru	Right-Turn	Left-Turn	Right-Turn	15-Minute	Hourly
Monday, November 14, 2022								
3:00 PM	32	55	64	39	31	31	252	963
3:15 PM	23	51	51	56	30	25	236	955
3:30 PM	25	59	46	52	38	25	245	977
3:45 PM	19	46	52	51	35	27	230	946
4:00 PM	34	65	34	43	35	33	244	924
4:15 PM	32	52	60	54	37	23	258	876
4:30 PM	23	47	58	37	19	30	214	824
4:45 PM	27	48	47	32	26	28	208	798
5:00 PM	23	45	51	30	22	25	196	808
5:15 PM	20	40	52	56	17	21	206	
5:30 PM	23	33	47	30	25	30	188	
5:45 PM	32	58	40	45	21	22	218	977
Tuesday, November 15, 2022								
6:00 AM	6	20	13	6	32	3	80	421
6:15 AM	4	23	19	14	38	7	105	503
6:30 AM	12	28	25	11	42	9	127	607
6:45 AM	13	14	26	18	28	10	109	850
7:00 AM	20	40	21	19	45	17	162	1170
7:15 AM	25	39	47	17	42	39	209	**1195**
7:30 AM	69	68	90	35	31	77	370	1147
7:45 AM	53	112	104	26	44	90	429	936
8:00 AM	20	54	28	24	44	17	187	658
8:15 AM	14	44	29	29	35	10	161	
8:30 AM	15	36	38	17	34	19	159	
8:45 AM	13	31	37	26	27	17	151	1195
Tuesday, November 15, 2022								
3:00 PM	25	53	57	40	40	27	242	996
3:15 PM	20	56	66	49	35	20	246	**1028**
3:30 PM	25	43	54	50	42	35	249	989
3:45 PM	31	68	51	50	29	30	259	973
4:00 PM	38	53	65	49	34	35	274	921
4:15 PM	20	36	39	60	27	25	207	883
4:30 PM	26	45	51	62	25	24	233	902
4:45 PM	26	41	39	55	19	27	207	885
5:00 PM	35	44	56	41	31	29	236	949
5:15 PM	30	35	60	51	26	24	226	
5:30 PM	25	37	49	44	17	44	216	
5:45 PM	29	53	67	40	31	51	271	1028
Wednesday, November 16, 2022								
6:00 AM	4	30	37	8	36	9	124	555
6:15 AM	2	28	57	10	28	7	132	604
6:30 AM	15	26	55	10	32	4	142	728
6:45 AM	11	35	49	15	30	17	157	929
7:00 AM	16	39	37	15	46	20	173	1157
7:15 AM	33	59	64	19	39	42	256	1147
7:30 AM	63	67	76	29	37	71	343	1064
7:45 AM	65	93	108	-3	50	72	385	906
8:00 AM	23	48	31	8	32	21	163	700
8:15 AM	14	43	41	20	36	19	173	
8:30 AM	18	46	49	17	40	15	185	
8:45 AM	16	50	42	26	28	17	179	1157

AM Peak	Tuesday, November 15, 2022						
7:15 AM	167	273	269	102	161	223	1195
PHF	0.79	0.61	0.65	0.98	0.91	0.62	0.70
T	4%	2%	1%	7%	3%	2%	3%
B	0	0	0	0	0	3	3
		3%					
PM Peak	Tuesday, November 15, 2022						
3:15 PM	114	220	236	198	140	120	1028
PHF	0.75	1.04	0.91	1.01	1.03	0.86	0.94
T	3%	4%	0%	2%	5%	1%	2%
B	0	0	0	0	0	0	0

Farrington Hwy Kaukonahua Rd - TMC

Mon Nov 14, 2022
Full Length (3 PM-6 PM, 6 AM-9 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014109, Location: 21.562084, -158.112972, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Farrington Hwy						Farrington Hwy						Kaukonahua Rd						Kaukonahua Rd						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2022-11-14 3:00PM	0	72	33	0	105	0	46	72	3	0	121	0	0	2	1	0	3	0	32	1	79	0	112	0	341
3:15PM	1	50	30	0	81	0	76	75	0	0	151	0	0	1	0	0	1	0	30	1	64	0	95	0	328
3:30PM	1	75	28	0	104	0	52	79	0	0	131	0	2	0	0	0	2	0	37	6	42	0	85	0	322
3:45PM	2	64	20	0	86	0	55	66	2	0	123	0	0	0	2	0	2	0	33	0	82	0	115	0	326
Hourly Total	4	261	111	0	376	0	229	292	5	0	526	0	2	3	3	0	8	0	132	8	267	0	407	0	1317
4:00PM	2	58	42	0	102	0	62	63	1	0	126	0	1	2	1	0	4	0	21	0	79	0	100	0	332
4:15PM	5	42	36	0	83	0	50	87	2	0	139	0	2	0	3	0	5	0	35	1	47	0	83	0	310
4:30PM	0	48	15	0	63	0	48	57	0	0	105	0	0	0	2	0	2	0	38	0	37	0	75	0	245
4:45PM	1	56	25	0	82	0	44	59	0	0	103	0	1	4	2	0	7	0	36	3	49	0	88	0	280
Hourly Total	8	204	118	0	330	0	204	266	3	0	473	0	4	6	8	0	18	0	130	4	212	0	346	0	1167
5:00PM	0	38	35	0	73	0	44	60	0	0	104	0	0	1	1	0	2	0	33	1	69	0	103	0	282
5:15PM	1	35	29	0	65	0	56	78	0	0	134	0	1	2	1	0	4	0	23	1	52	0	76	0	279
5:30PM	1	38	20	0	59	0	31	60	1	1	93	0	0	3	1	0	4	0	28	3	68	0	99	0	255
5:45PM	0	42	37	0	79	0	36	73	1	0	110	0	0	1	0	0	1	0	21	2	37	0	60	0	250
Hourly Total	2	153	121	0	276	0	167	271	2	1	441	0	1	7	3	0	11	0	105	7	226	0	338	0	1066
2022-11-15 6:00AM	0	50	13	0	63	0	10	13	0	0	23	0	0	1	0	0	1	0	7	1	57	0	65	0	152
6:15AM	0	55	8	0	63	0	9	23	1	0	33	0	2	1	0	0	3	0	14	0	39	0	53	0	152
6:30AM	0	67	13	0	80	0	16	26	0	0	42	0	1	2	0	0	3	0	7	0	41	0	48	0	173
6:45AM	0	43	10	0	53	0	24	35	0	0	59	0	0	2	0	0	2	0	18	0	44	0	62	0	176
Hourly Total	0	215	44	0	259	0	59	97	1	0	157	0	3	6	0	0	9	0	46	1	181	0	228	0	653
7:00AM	1	71	16	0	88	0	25	29	1	0	55	0	0	3	0	0	3	0	10	1	42	0	53	0	199
7:15AM	0	61	31	0	92	0	35	44	1	0	80	0	1	1	0	0	2	0	27	0	50	0	77	0	251
7:30AM	0	60	47	0	107	0	26	64	0	0	90	0	1	2	0	0	3	0	72	0	38	0	110	0	310
7:45AM	0	63	75	0	138	0	45	51	0	0	96	0	1	0	3	0	4	0	84	2	44	0	130	0	368
Hourly Total	1	255	169	0	425	0	131	188	2	0	321	0	3	6	3	0	12	0	193	3	174	0	370	0	1128
8:00AM	1	63	44	0	108	0	52	33	0	0	85	1	2	1	2	0	5	0	24	0	47	0	71	0	269
8:15AM	3	55	26	0	84	0	37	34	0	0	71	0	0	3	1	0	4	0	20	0	34	0	54	0	213
8:30AM	1	53	23	0	77	0	29	31	1	0	61	0	1	1	1	0	3	0	27	0	43	1	71	0	212
8:45AM	1	34	23	0	58	0	31	44	2	0	77	0	0	3	3	0	6	0	22	2	38	0	62	0	203
Hourly Total	6	205	116	0	327	0	149	142	3	0	294	1	3	8	7	0	18	0	93	2	162	1	258	0	897
3:00PM	0	62	39	0	101	0	59	64	1	0	124	0	2	1	2	0	5	0	42	0	67	0	109	0	339
3:15PM	1	60	36	0	97	0	61	77	1	0	139	0	1	1	0	0	2	0	38	4	67	0	109	0	347
3:30PM	2	54	25	0	81	0	59	71	2	0	132	0	2	3	1	0	6	0	39	0	85	0	124	0	343
3:45PM	1	62	27	0	90	0	61	71	0	0	132	0	0	1	1	0	2	0	40	3	32	0	75	0	299
Hourly Total	4	238	127	0	369	0	240	283	4	0	527	0	5	6	4	0	15	0	159	7	251	0	417	0	1328
4:00PM	1	48	39	0	88	0	76	102	0	0	178	0	1	1	0	0	2	0	35	2	41	0	78	0	346
4:15PM	2	46	34	0	82	0	61	82	1	0	144	0	1	3	0	0	4	0	33	1	32	0	66	0	296
4:30PM	1	52	26	0	79	0	57	75	0	0	132	0	1	1	3	0	5	0	42	2	42	0	86	0	302
4:45PM	1	41	22	0	64	0	48	76	0	0	124	0	0	1	1	0	2	0	29	3	48	0	80	0	270
Hourly Total	5	187	121	0	313	0	242	335	1	0	578	0	3	6	4	0	13	0	139	8	163	0	310	0	1214
5:00PM	1	41	28	0	70	0	53	60	0	0	113	0	2	2	2	0	6	0	39	1	43	0	83	0	272
5:15PM	2	52	22	0	76	0	49	68	1	0	118	0	1	1	1	0	3	0	40	2	51	0	93	0	290
5:30PM	2	31	27	0	60	0	49	76	1	0	126	0	1	0	0	0	1	0	31	0	50	0	81	0	268
5:45PM	1	46	37	0	84	0	38	78	3	0	119	0	0	0	1	0	1	0	40	2	68	0	110	0	314
Hourly Total	6	170	114	0	290	0	189	282	5	0	476	0	4	3	4	0	11	0	150	5	212	0	367	0	1144
2022-11-16 6:00AM	0	59	9	0	68	0	20	36	0	0	56	0	1	1	0	0	2	0	10	0	57	0	67	0	193
6:15AM	0	56	11	0	67	0	18	53	0	0	71	0	0	0	0	0	0	0	17	1	42	0	60	0	198
6:30AM	0	53	12	0	65	0	21	49	0	0	70	0	0	1	0	0	1	0	11	0	45	0	56	0	192
6:45AM	0	57	21	0	78	0	26	54	1	0	81	0	1	1	0	0	2	0	12	1	45	0	58	0	219
Hourly Total	0	225	53	0	278	0	85	192	1	0	278	0	2	3	0	0	5	0	50	2	189	0	241	0	802
7:00AM	1	55	29	0	85	0	31	46	0	0	77	0	0	1	0	0	1	0	18	0	57	0	75	0	238
7:15AM	0	71	29	0	100	0	24	45	0	0	69	0	1	2	0	0	3	0	44	0	52	0	96	0	268
7:30AM	0	68	49	0	117	0	40	62	1	0	103	0	0	2	3	0	5	0	78	0	43	0	121	0	346
7:45AM	0	66	68	0	134	0	48	64	0	0	112	0	1	1	1	0	3	5	71	0	54	0	125	0	374
Hourly Total	1	260	175	0	436	0	143	217	1	0	361	0	2	6	4	0	12	5	211	0	206	0	417	0	1226
8:00AM	0	60	36	0	96	0	45	27	1	0	73	0	1	2	0	0	3	0	22	2	45	0	69	0	241
8:15AM	2	50	29	0	81	0	33	38	0	0	71	0	0	3	1	0	4	0	28	3	66	0	97	0	253
8:30AM	1	67	29	0	97	0	34	45	0	0	79	0	2	1	2	0	5	0	19	0	36	0	55	0	236

Leg Direction	Farrington Hwy Eastbound						Farrington Hwy Westbound						Kaukonahua Rd Northbound						Kaukonahua Rd Southbound						
Time	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	**Int**
8:45AM	0	53	29	0	**82**	0	31	51	1	0	**83**	0	1	2	0	0	**3**	0	28	0	34	0	**62**	0	**230**
Hourly Total	3	230	123	0	**356**	0	143	161	2	0	**306**	0	4	8	3	0	**15**	0	97	5	181	0	**283**	0	**960**
Total	40	2603	1392	0	**4035**	0	1981	2726	30	1	**4738**	1	36	68	43	0	**147**	5	1505	52	2424	1	**3982**	0	**12902**
% Approach	1.0%	64.5%	34.5%	0%	**-**	-	41.8%	57.5%	0.6%	0%	**-**	-	24.5%	46.3%	29.3%	0%	**-**	-	37.8%	1.3%	60.9%	0%	**-**	-	-
% Total	0.3%	20.2%	10.8%	0%	**31.3%**	-	15.4%	21.1%	0.2%	0%	**36.7%**	-	0.3%	0.5%	0.3%	0%	**1.1%**	-	11.7%	0.4%	18.8%	0%	**30.9%**	-	-
Motorcycles	0	5	5	0	**10**	-	8	9	0	0	**17**	-	0	2	1	0	**3**	-	11	2	18	0	**31**	-	61
% Motorcycles	0%	0.2%	0.4%	0%	**0.2%**	-	0.4%	0.3%	0%	0%	**0.4%**	-	0%	2.9%	2.3%	0%	**2.0%**	-	0.7%	3.8%	0.7%	0%	**0.8%**	-	0.5%
Lights	40	2560	1346	0	**3946**	-	1939	2656	28	1	**4624**	-	35	64	42	0	**141**	-	1453	48	2371	1	**3873**	-	12584
% Lights	100%	98.3%	96.7%	0%	**97.8%**	-	97.9%	97.4%	93.3%	100%	**97.6%**	-	97.2%	94.1%	97.7%	0%	**95.9%**	-	96.5%	92.3%	97.8%	100%	**97.3%**	-	97.5%
Single-Unit Trucks	0	31	19	0	**50**	-	30	47	2	0	**79**	-	1	2	0	0	**3**	-	17	1	25	0	**43**	-	175
% Single-Unit Trucks	0%	1.2%	1.4%	0%	**1.2%**	-	1.5%	1.7%	6.7%	0%	**1.7%**	-	2.8%	2.9%	0%	0%	**2.0%**	-	1.1%	1.9%	1.0%	0%	**1.1%**	-	1.4%
Articulated Trucks	0	1	0	0	**1**	-	3	3	0	0	**6**	-	0	0	0	0	**0**	-	0	0	2	0	**2**	-	9
% Articulated Trucks	0%	0%	0%	0%	**0%**	-	0.2%	0.1%	0%	0%	**0.1%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0.1%	0%	**0.1%**	-	0.1%
Buses	0	6	22	0	**28**	-	1	11	0	0	**12**	-	0	0	0	0	**0**	-	23	0	8	0	**31**	-	71
% Buses	0%	0.2%	1.6%	0%	**0.7%**	-	0.1%	0.4%	0%	0%	**0.3%**	-	0%	0%	0%	0%	**0%**	-	1.5%	0%	0.3%	0%	**0.8%**	-	0.6%
Bicycles on Road	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	1	1	0	0	**2**	-	2
% Bicycles on Road	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0.1%	1.9%	0%	0%	**0.1%**	-	0%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	5	-	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-	100%	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Farrington Hwy Kaukonahua Rd - TMC
Mon Nov 14, 2022
Full Length (3 PM-6 PM, 6 AM-9 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014109, Location: 21.562084, -158.112972, Site Code: Waialua Mill

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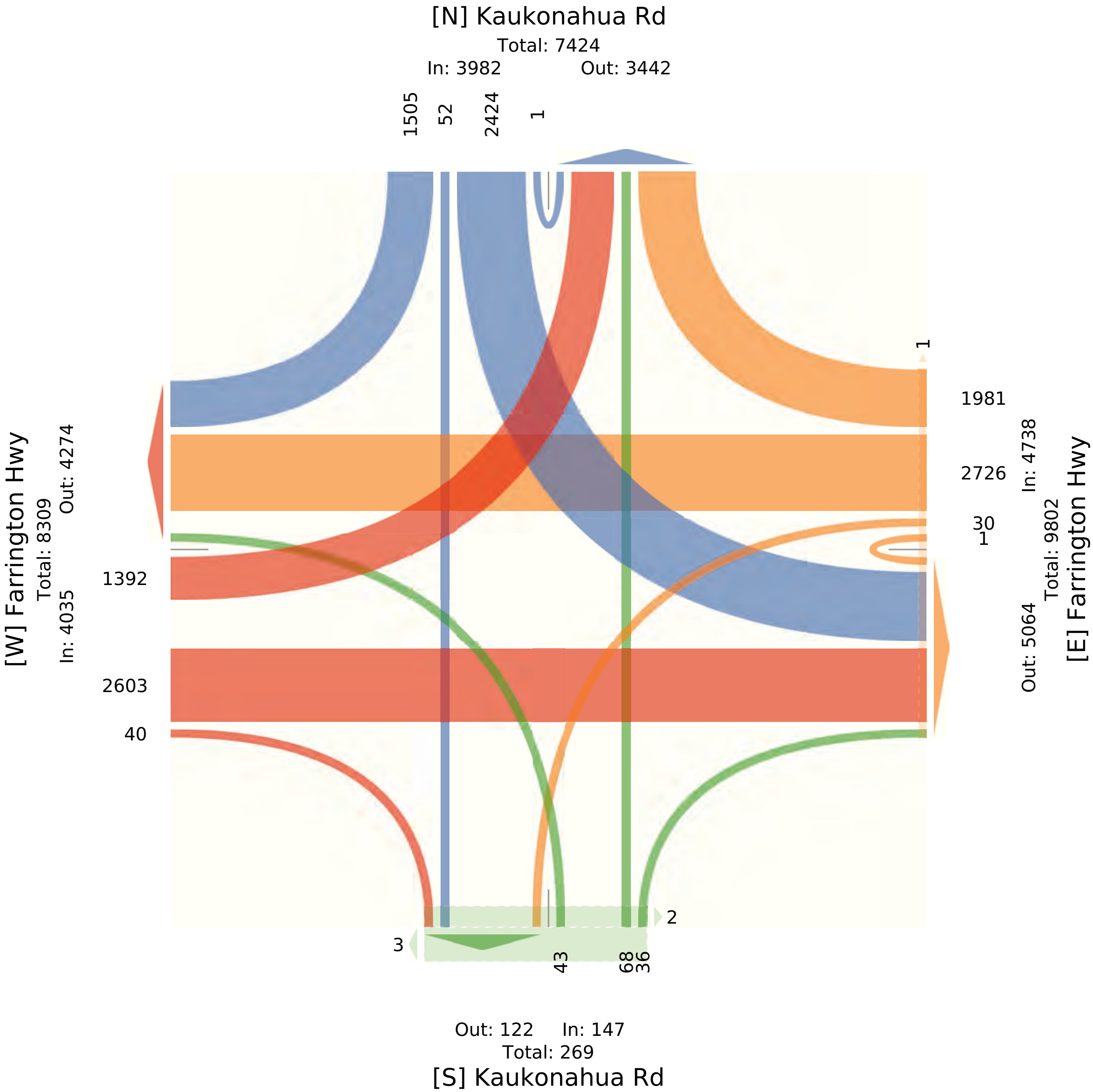

Farrington Hwy Kaukonahua Rd - TMC

Tue Nov 15, 2022
PM Peak (Nov 15 2022 3:15PM - 4:15 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014109, Location: 21.562084, -158.112972, Site Code: Waialua Mill

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Leg Direction	Farrington Hwy Eastbound						Farrington Hwy Westbound						Kaukonahua Rd Northbound						Kaukonahua Rd Southbound						
Time	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	**Int**
2022-11-15 3:15PM	1	60	36	0	**97**	0	61	77	1	0	**139**	0	1	1	0	0	**2**	0	38	4	67	0	**109**	0	**347**
3:30PM	2	54	25	0	**81**	0	59	71	2	0	**132**	0	2	3	1	0	**6**	0	39	0	85	0	**124**	0	**343**
3:45PM	1	62	27	0	**90**	0	61	71	0	0	**132**	0	0	1	1	0	**2**	0	40	3	32	0	**75**	0	**299**
4:00PM	1	48	39	0	**88**	0	76	102	0	0	**178**	0	1	1	0	0	**2**	0	35	2	41	0	**78**	0	**346**
Total	5	224	127	0	**356**	0	257	321	3	0	**581**	0	4	6	2	0	**12**	0	152	9	225	0	**386**	0	**1335**
% Approach	1.4%	62.9%	35.7%	0%	**-**	-	44.2%	55.2%	0.5%	0%	**-**	-	33.3%	50.0%	16.7%	0%	**-**	-	39.4%	2.3%	58.3%	0%	**-**	-	-
% Total	0.4%	16.8%	9.5%	0%	**26.7%**	-	19.3%	24.0%	0.2%	0%	**43.5%**	-	0.3%	0.4%	0.1%	0%	**0.9%**	-	11.4%	0.7%	16.9%	0%	**28.9%**	-	-
PHF	0.625	0.903	0.814	-	**0.918**	-	0.845	0.787	0.375	-	**0.816**	-	0.500	0.500	0.500	-	**0.500**	-	0.950	0.500	0.662	-	**0.776**	-	0.961
Motorcycles	0	0	1	0	**1**	-	1	1	0	0	**2**	-	0	1	0	0	**1**	-	1	0	1	0	**2**	-	6
% Motorcycles	0%	0%	0.8%	0%	**0.3%**	-	0.4%	0.3%	0%	0%	**0.3%**	-	0%	16.7%	0%	0%	**8.3%**	-	0.7%	0%	0.4%	0%	**0.5%**	-	0.4%
Lights	5	211	123	0	**339**	-	250	319	2	0	**571**	-	4	5	2	0	**11**	-	148	8	218	0	**374**	-	1295
% Lights	100%	94.2%	96.9%	0%	**95.2%**	-	97.3%	99.4%	66.7%	0%	**98.3%**	-	100%	83.3%	100%	0%	**91.7%**	-	97.4%	88.9%	96.9%	0%	**96.9%**	-	97.0%
Single-Unit Trucks	0	13	1	0	**14**	-	4	0	1	0	**5**	-	0	0	0	0	**0**	-	2	0	4	0	**6**	-	25
% Single-Unit Trucks	0%	5.8%	0.8%	0%	**3.9%**	-	1.6%	0%	33.3%	0%	**0.9%**	-	0%	0%	0%	0%	**0%**	-	1.3%	0%	1.8%	0%	**1.6%**	-	1.9%
Articulated Trucks	0	0	0	0	**0**	-	2	1	0	0	**3**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	3
% Articulated Trucks	0%	0%	0%	0%	**0%**	-	0.8%	0.3%	0%	0%	**0.5%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0.2%
Buses	0	0	2	0	**2**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	1	0	2	0	**3**	-	5
% Buses	0%	0%	1.6%	0%	**0.6%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0.7%	0%	0.9%	0%	**0.8%**	-	0.4%
Bicycles on Road	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	1	0	0	**1**	-	1
% Bicycles on Road	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	11.1%	0%	0%	**0.3%**	-	0.1%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Farrington Hwy Kaukonahua Rd - TMC
Tue Nov 15, 2022
PM Peak (Nov 15 2022 3:15PM - 4:15 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014109, Location: 21.562084, -158.112972, Site Code: Waialua Mill

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1188 Bishop Street, Suite 1907,
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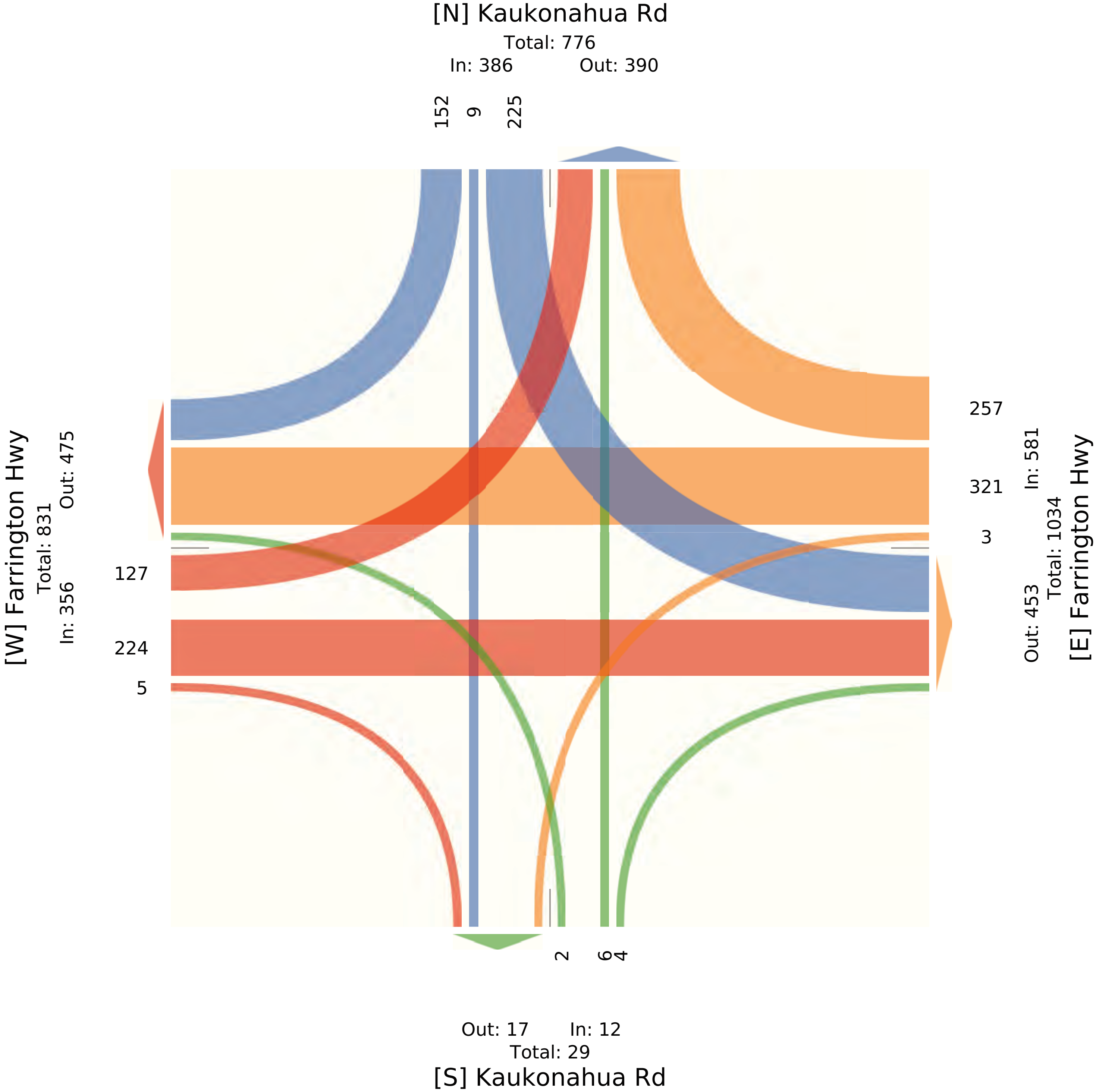

Farrington Hwy Kaukonahua Rd - TMC

Wed Nov 16, 2022
AM Peak (Nov 16 2022 7:15AM - 8:15 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014109, Location: 21.562084, -158.112972, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Farrington Hwy						Farrington Hwy						Kaukonahua Rd						Kaukonahua Rd						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	**Int**
2022-11-16 7:15AM	0	71	29	0	**100**	0	24	45	0	0	**69**	0	1	2	0	0	**3**	0	44	0	52	0	**96**	0	**268**
7:30AM	0	68	49	0	**117**	0	40	62	1	0	**103**	0	0	2	3	0	**5**	0	78	0	43	0	**121**	0	**346**
7:45AM	0	66	68	0	**134**	0	48	64	0	0	**112**	0	1	1	1	0	**3**	5	71	0	54	0	**125**	0	**374**
8:00AM	0	60	36	0	**96**	0	45	27	1	0	**73**	0	1	2	0	0	**3**	0	22	2	45	0	**69**	0	**241**
Total	0	265	182	0	**447**	0	157	198	2	0	**357**	0	3	7	4	0	**14**	5	215	2	194	0	**411**	0	**1229**
% Approach	0%	59.3%	40.7%	0%	**-**	-	44.0%	55.5%	0.6%	0%	**-**	-	21.4%	50.0%	28.6%	0%	**-**	-	52.3%	0.5%	47.2%	0%	**-**	-	-
% Total	0%	21.6%	14.8%	0%	**36.4%**	-	12.8%	16.1%	0.2%	0%	**29.0%**	-	0.2%	0.6%	0.3%	0%	**1.1%**	-	17.5%	0.2%	15.8%	0%	**33.4%**	-	-
PHF	-	0.933	0.669	-	**0.834**	-	0.818	0.773	0.500	-	**0.797**	-	0.750	0.875	0.333	-	**0.700**	-	0.686	0.250	0.898	-	**0.820**	-	0.821
Motorcycles	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	1	0	0	**1**	-	1	0	1	0	**2**	-	3
% Motorcycles	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	14.3%	0%	0%	**7.1%**	-	0.5%	0%	0.5%	0%	**0.5%**	-	0.2%
Lights	0	259	176	0	**435**	-	146	196	2	0	**344**	-	2	6	4	0	**12**	-	208	2	187	0	**397**	-	1188
% Lights	0%	97.7%	96.7%	0%	**97.3%**	-	93.0%	99.0%	100%	0%	**96.4%**	-	66.7%	85.7%	100%	0%	**85.7%**	-	96.7%	100%	96.4%	0%	**96.6%**	-	96.7%
Single-Unit Trucks	0	3	2	0	**5**	-	11	2	0	0	**13**	-	1	0	0	0	**1**	-	3	0	6	0	**9**	-	28
% Single-Unit Trucks	0%	1.1%	1.1%	0%	**1.1%**	-	7.0%	1.0%	0%	0%	**3.6%**	-	33.3%	0%	0%	0%	**7.1%**	-	1.4%	0%	3.1%	0%	**2.2%**	-	2.3%
Articulated Trucks	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0
% Articulated Trucks	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%
Buses	0	3	4	0	**7**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	2	0	0	0	**2**	-	9
% Buses	0%	1.1%	2.2%	0%	**1.6%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0.9%	0%	0%	0%	**0.5%**	-	0.7%
Bicycles on Road	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	1	0	0	0	**1**	-	1
% Bicycles on Road	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0.5%	0%	0%	0%	**0.2%**	-	0.1%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	5	-	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Farrington Hwy Kaukonahua Rd - TMC
Wed Nov 16, 2022
AM Peak (Nov 16 2022 7:15AM - 8:15 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1014109, Location: 21.562084, -158.112972, Site Code: Waialua Mill

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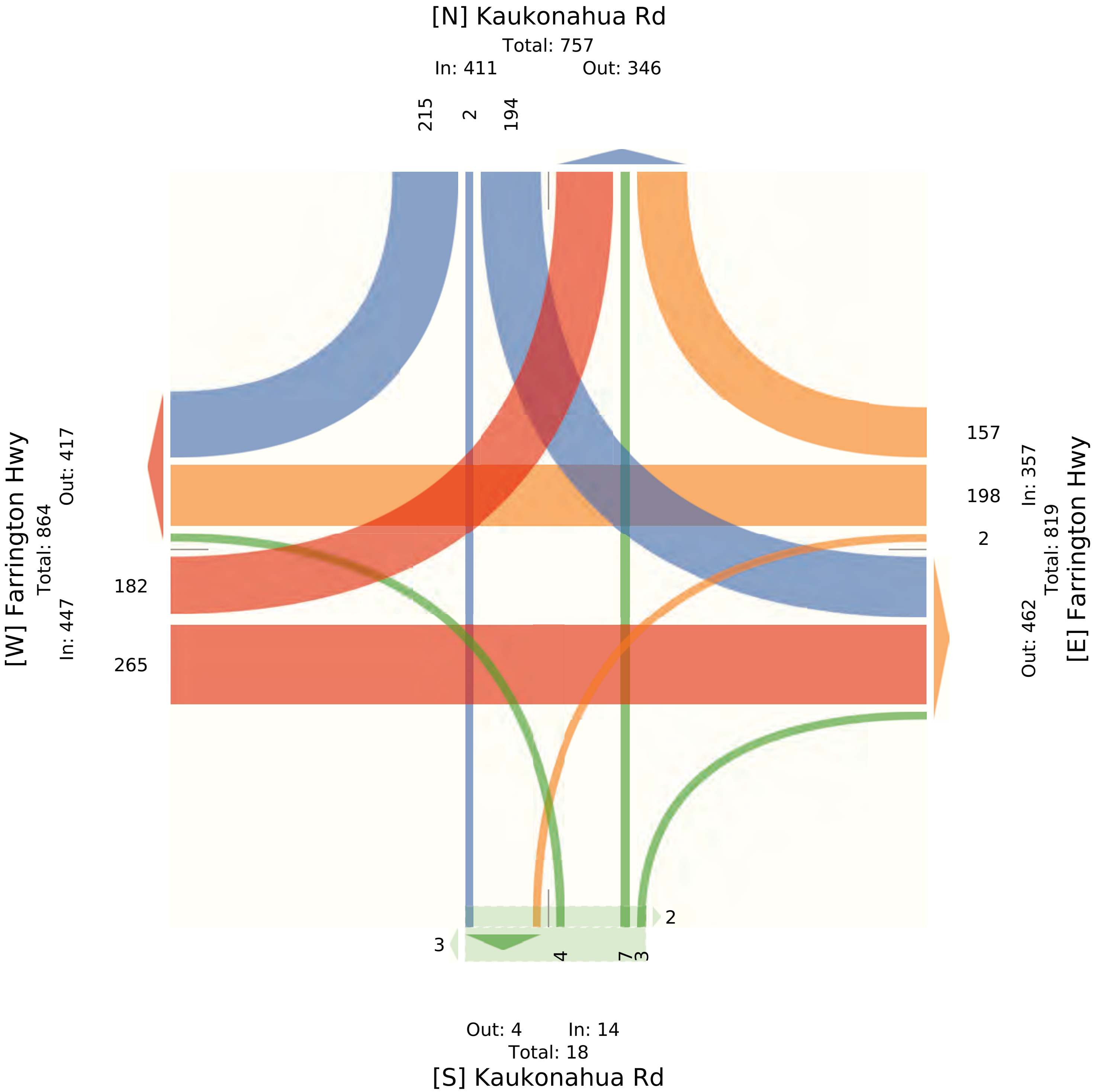

Goodale Ave Kealohanui St East - TMC

Wed Nov 16, 2022
Full Length (3 PM-6 PM, 6 AM-9 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016864, Location: 21.574048, -158.123026, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Kealohanui St					Kealohanui St					Goodale Ave					
Direction	Eastbound					Westbound					Northbound					
Time	R	T	U	App	Ped*	T	L	U	App	Ped*	R	L	U	App	Ped*	Int
2022-11-16 3:00PM	72	0	0	**72**	2	3	1	0	**4**	7	0	66	0	**66**	1	**142**
3:15PM	68	3	0	**71**	0	0	1	0	**1**	11	1	93	0	**94**	1	**166**
3:30PM	57	3	1	**61**	0	3	3	0	**6**	3	4	89	0	**93**	0	**160**
3:45PM	80	3	1	**84**	1	4	0	0	**4**	6	3	106	0	**109**	0	**197**
Hourly Total	277	9	2	**288**	3	10	5	0	**15**	27	8	354	0	**362**	2	**665**
4:00PM	62	0	0	**62**	0	3	1	0	**4**	4	4	103	0	**107**	1	**173**
4:15PM	54	1	0	**55**	0	2	3	0	**5**	0	2	86	0	**88**	1	**148**
4:30PM	56	1	0	**57**	0	1	1	0	**2**	3	2	86	0	**88**	0	**147**
4:45PM	56	1	0	**57**	0	2	0	0	**2**	3	2	81	0	**83**	1	**142**
Hourly Total	228	3	0	**231**	0	8	5	0	**13**	10	10	356	0	**366**	3	**610**
5:00PM	53	1	0	**54**	0	0	1	0	**1**	0	0	85	0	**85**	0	**140**
5:15PM	64	3	0	**67**	0	4	4	0	**8**	7	1	71	0	**72**	1	**147**
5:30PM	49	1	0	**50**	3	3	2	0	**5**	5	1	66	2	**69**	0	**124**
5:45PM	59	1	0	**60**	0	1	1	0	**2**	8	1	69	0	**70**	0	**132**
Hourly Total	225	6	0	**231**	3	8	8	0	**16**	20	3	291	2	**296**	1	**543**
2022-11-17 6:00AM	39	1	0	**40**	0	0	0	0	**0**	0	0	18	0	**18**	0	**58**
6:15AM	26	0	0	**26**	0	0	1	0	**1**	0	0	19	0	**19**	0	**46**
6:30AM	51	1	0	**52**	0	0	0	0	**0**	0	1	22	0	**23**	0	**75**
6:45AM	50	0	0	**50**	0	0	0	0	**0**	1	0	37	0	**37**	2	**87**
Hourly Total	166	2	0	**168**	0	0	1	0	**1**	1	1	96	0	**97**	2	**266**
7:00AM	60	1	0	**61**	0	3	1	0	**4**	2	0	39	0	**39**	0	**104**
7:15AM	70	0	0	**70**	0	0	0	0	**0**	4	1	63	0	**64**	2	**134**
7:30AM	99	0	0	**99**	0	1	0	0	**1**	16	2	99	0	**101**	1	**201**
7:45AM	140	5	0	**145**	0	1	0	0	**1**	8	0	100	0	**100**	0	**246**
Hourly Total	369	6	0	**375**	0	5	1	0	**6**	30	3	301	0	**304**	3	**685**
8:00AM	77	2	0	**79**	0	1	0	0	**1**	1	0	42	0	**42**	0	**122**
8:15AM	59	1	0	**60**	0	1	0	0	**1**	0	1	58	0	**59**	0	**120**
8:30AM	58	1	0	**59**	1	0	0	0	**0**	0	1	43	1	**45**	0	**104**
8:45AM	54	0	0	**54**	0	1	0	0	**1**	1	1	48	0	**49**	0	**104**
Hourly Total	248	4	0	**252**	1	3	0	0	**3**	2	3	191	1	**195**	0	**450**
3:00PM	61	0	0	**61**	0	1	1	0	**2**	2	1	84	0	**85**	0	**148**
3:15PM	69	1	0	**70**	0	3	1	0	**4**	0	1	73	0	**74**	0	**148**
3:30PM	57	2	0	**59**	0	2	0	0	**2**	1	1	98	0	**99**	2	**160**
3:45PM	73	1	0	**74**	0	4	1	0	**5**	0	0	95	0	**95**	0	**174**
Hourly Total	260	4	0	**264**	0	10	3	0	**13**	3	3	350	0	**353**	2	**630**
4:00PM	61	1	0	**62**	0	4	2	0	**6**	2	2	72	0	**74**	0	**142**
4:15PM	60	1	0	**61**	0	3	1	0	**4**	5	3	104	0	**107**	0	**172**
4:30PM	54	6	0	**60**	0	2	1	0	**3**	11	1	76	0	**77**	0	**140**
4:45PM	63	1	0	**64**	0	3	1	0	**4**	3	1	88	0	**89**	0	**157**
Hourly Total	238	9	0	**247**	0	12	5	0	**17**	21	7	340	0	**347**	0	**611**
5:00PM	51	1	0	**52**	0	3	1	0	**4**	2	2	77	0	**79**	1	**135**
5:15PM	57	0	0	**57**	0	2	1	0	**3**	5	1	69	0	**70**	0	**130**
5:30PM	49	1	0	**50**	0	1	0	0	**1**	3	0	78	1	**79**	0	**130**
5:45PM	58	0	0	**58**	0	0	2	0	**2**	3	1	73	0	**74**	0	**134**
Hourly Total	215	2	0	**217**	0	6	4	0	**10**	13	4	297	1	**302**	1	**529**
2022-11-18 6:00AM	36	0	0	**36**	0	0	1	0	**1**	1	1	17	0	**18**	0	**55**
6:15AM	34	1	0	**35**	0	0	0	0	**0**	4	0	21	0	**21**	0	**56**
6:30AM	44	0	0	**44**	0	0	0	0	**0**	5	0	21	0	**21**	2	**65**
6:45AM	49	0	0	**49**	0	0	1	0	**1**	1	0	29	0	**29**	0	**79**
Hourly Total	163	1	0	**164**	0	0	2	0	**2**	11	1	88	0	**89**	2	**255**
7:00AM	66	0	0	**66**	0	1	1	0	**2**	0	0	35	0	**35**	0	**103**
7:15AM	65	1	0	**66**	0	0	1	0	**1**	0	0	71	0	**71**	0	**138**

Leg	Kealohanui St					Kealohanui St					Goodale Ave					
Direction	Eastbound					Westbound					Northbound					
Time	R	T	U	**App**	Ped*	T	L	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
7:30AM	115	1	0	**116**	0	2	1	0	**3**	0	0	95	0	**95**	0	**214**
7:45AM	135	1	0	**136**	1	1	0	0	**1**	0	0	108	0	**108**	0	**245**
Hourly Total	381	3	0	**384**	1	4	3	0	**7**	0	0	309	0	**309**	0	**700**
8:00AM	70	6	0	**76**	1	1	2	0	**3**	5	1	77	0	**78**	0	**157**
8:15AM	46	0	0	**46**	0	0	3	0	**3**	1	1	51	1	**53**	0	**102**
8:30AM	54	0	0	**54**	0	2	2	0	**4**	2	1	43	0	**44**	0	**102**
8:45AM	73	1	0	**74**	0	0	0	0	**0**	2	0	42	0	**42**	0	**116**
Hourly Total	243	7	0	**250**	1	3	7	0	**10**	10	3	213	1	**217**	0	**477**
Total	3013	56	2	**3071**	9	69	44	0	**113**	148	46	3186	5	**3237**	16	**6421**
% Approach	98.1%	1.8%	0.1%	**-**	-	61.1%	38.9%	0%	**-**	-	1.4%	98.4%	0.2%	**-**	-	-
% Total	46.9%	0.9%	0%	**47.8%**	-	1.1%	0.7%	0%	**1.8%**	-	0.7%	49.6%	0.1%	**50.4%**	-	-
Motorcycles	42	6	0	**48**	-	4	1	0	**5**	-	1	66	1	**68**	-	121
% Motorcycles	1.4%	10.7%	0%	**1.6%**	-	5.8%	2.3%	0%	**4.4%**	-	2.2%	2.1%	20.0%	**2.1%**	-	1.9%
Lights	2873	39	2	**2914**	-	42	38	0	**80**	-	42	3016	4	**3062**	-	6056
% Lights	95.4%	69.6%	100%	**94.9%**	-	60.9%	86.4%	0%	**70.8%**	-	91.3%	94.7%	80.0%	**94.6%**	-	94.3%
Single-Unit Trucks	17	1	0	**18**	-	0	0	0	**0**	-	1	21	0	**22**	-	40
% Single-Unit Trucks	0.6%	1.8%	0%	**0.6%**	-	0%	0%	0%	**0%**	-	2.2%	0.7%	0%	**0.7%**	-	0.6%
Articulated Trucks	3	1	0	**4**	-	0	0	0	**0**	-	0	1	0	**1**	-	5
% Articulated Trucks	0.1%	1.8%	0%	**0.1%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0.1%
Buses	38	0	0	**38**	-	1	0	0	**1**	-	0	44	0	**44**	-	83
% Buses	1.3%	0%	0%	**1.2%**	-	1.4%	0%	0%	**0.9%**	-	0%	1.4%	0%	**1.4%**	-	1.3%
Bicycles on Road	40	9	0	**49**	-	22	5	0	**27**	-	2	38	0	**40**	-	116
% Bicycles on Road	1.3%	16.1%	0%	**1.6%**	-	31.9%	11.4%	0%	**23.9%**	-	4.3%	1.2%	0%	**1.2%**	-	1.8%
Pedestrians	-	-	-	-	5	-	-	-	-	113	-	-	-	-	15	
% Pedestrians	-	-	-	-	55.6%	-	-	-	-	76.4%	-	-	-	-	93.8%	-
Bicycles on Crosswalk	-	-	-	-	4	-	-	-	-	35	-	-	-	-	1	
% Bicycles on Crosswalk	-	-	-	-	44.4%	-	-	-	-	23.6%	-	-	-	-	6.3%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Goodale Ave Kealohanui St East - TMC
Wed Nov 16, 2022
Full Length (3 PM-6 PM, 6 AM-9 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016864, Location: 21.574048, -158.123026, Site Code: Waialua Mill

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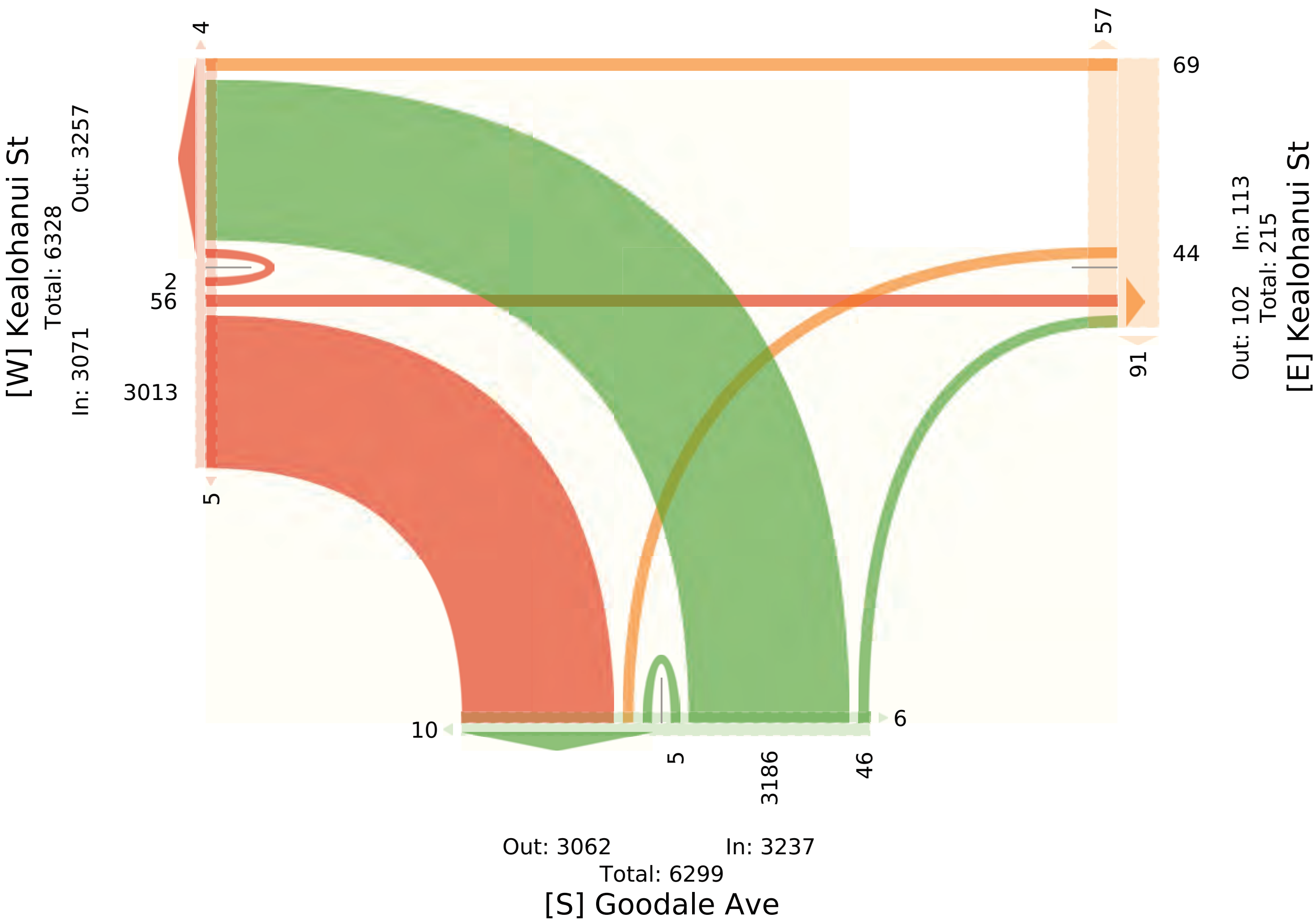

Goodale Ave Kealohanui St East - TMC

Wed Nov 16, 2022
PM Peak (Nov 16 2022 3:15PM - 4:15 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016864, Location: 21.574048, -158.123026, Site Code: Waialua Mill

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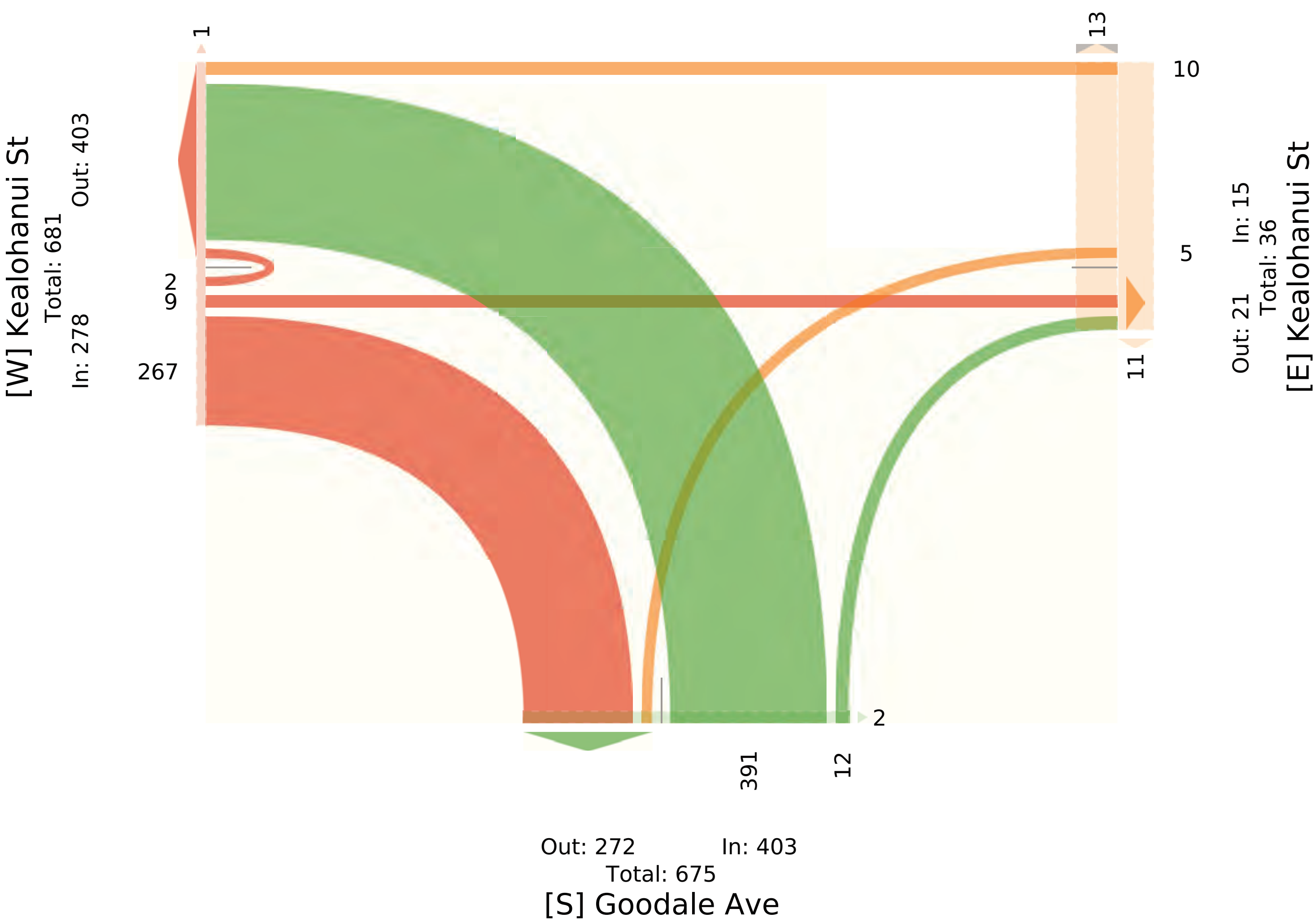
Honolulu, HI, 96813, US

Leg	Kealohanui St					Kealohanui St					Goodale Ave					
Direction	Eastbound					Westbound					Northbound					
Time	R	T	U	**App**	Ped*	T	L	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
2022-11-16 3:15PM	68	3	0	**71**	0	0	1	0	**1**	11	1	93	0	**94**	1	**166**
3:30PM	57	3	1	**61**	0	3	3	0	**6**	3	4	89	0	**93**	0	**160**
3:45PM	80	3	1	**84**	1	4	0	0	**4**	6	3	106	0	**109**	0	**197**
4:00PM	62	0	0	**62**	0	3	1	0	**4**	4	4	103	0	**107**	1	**173**
Total	267	9	2	**278**	1	10	5	0	**15**	24	12	391	0	**403**	2	**696**
% Approach	96.0%	3.2%	0.7%	**-**	-	66.7%	33.3%	0%	**-**	-	3.0%	97.0%	0%	**-**	-	-
% Total	38.4%	1.3%	0.3%	**39.9%**	-	1.4%	0.7%	0%	**2.2%**	-	1.7%	56.2%	0%	**57.9%**	-	-
PHF	0.835	0.667	0.500	**0.825**	-	0.583	0.417	-	**0.600**	-	0.750	0.925	-	**0.928**	-	0.889
Motorcycles	6	0	0	**6**	-	0	0	0	**0**	-	0	14	0	**14**	-	20
% Motorcycles	2.2%	0%	0%	**2.2%**	-	0%	0%	0%	**0%**	-	0%	3.6%	0%	**3.5%**	-	2.9%
Lights	252	7	2	**261**	-	7	5	0	**12**	-	12	366	0	**378**	-	651
% Lights	94.4%	77.8%	100%	**93.9%**	-	70.0%	100%	0%	**80.0%**	-	100%	93.6%	0%	**93.8%**	-	93.5%
Single-Unit Trucks	4	0	0	**4**	-	0	0	0	**0**	-	0	2	0	**2**	-	6
% Single-Unit Trucks	1.5%	0%	0%	**1.4%**	-	0%	0%	0%	**0%**	-	0%	0.5%	0%	**0.5%**	-	0.9%
Articulated Trucks	1	1	0	**2**	-	0	0	0	**0**	-	0	0	0	**0**	-	2
% Articulated Trucks	0.4%	11.1%	0%	**0.7%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0.3%
Buses	1	0	0	**1**	-	0	0	0	**0**	-	0	3	0	**3**	-	4
% Buses	0.4%	0%	0%	**0.4%**	-	0%	0%	0%	**0%**	-	0%	0.8%	0%	**0.7%**	-	0.6%
Bicycles on Road	3	1	0	**4**	-	3	0	0	**3**	-	0	6	0	**6**	-	13
% Bicycles on Road	1.1%	11.1%	0%	**1.4%**	-	30.0%	0%	0%	**20.0%**	-	0%	1.5%	0%	**1.5%**	-	1.9%
Pedestrians	-	-	-	-	0	-	-	-	-	19	-	-	-	-	2	
% Pedestrians	-	-	-	-	0%	-	-	-	-	79.2%	-	-	-	-	100%	-
Bicycles on Crosswalk	-	-	-	-	1	-	-	-	-	5	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	100%	-	-	-	-	20.8%	-	-	-	-	0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Goodale Ave Kealohanui St East - TMC
Wed Nov 16, 2022
PM Peak (Nov 16 2022 3:15PM - 4:15 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016864, Location: 21.574048, -158.123026, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US



Goodale Ave Kealohanui St East - TMC

Fri Nov 18, 2022
AM Peak (Nov 18 2022 7:15AM - 8:15 AM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016864, Location: 21.574048, -158.123026, Site Code: Waialua Mill

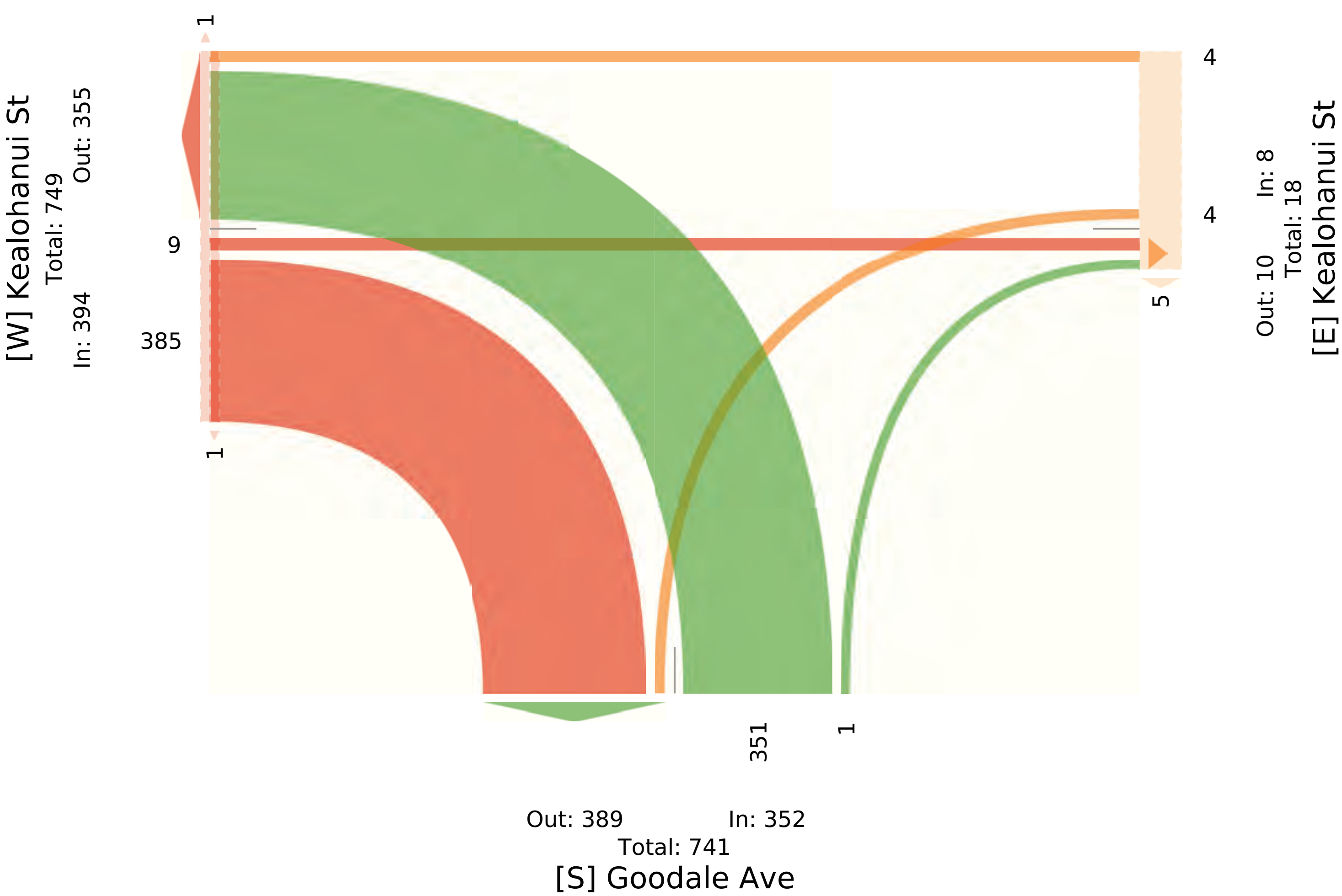
Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Kealohanui St					Kealohanui St					Goodale Ave					
Direction	Eastbound					Westbound					Northbound					
Time	R	T	U	**App**	Ped*	T	L	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
2022-11-18 7:15AM	65	1	0	**66**	0	0	1	0	**1**	0	0	71	0	**71**	0	**138**
7:30AM	115	1	0	**116**	0	2	1	0	**3**	0	0	95	0	**95**	0	**214**
7:45AM	135	1	0	**136**	1	1	0	0	**1**	0	0	108	0	**108**	0	**245**
8:00AM	70	6	0	**76**	1	1	2	0	**3**	5	1	77	0	**78**	0	**157**
Total	385	9	0	**394**	2	4	4	0	**8**	5	1	351	0	**352**	0	**754**
% Approach	97.7%	2.3%	0%	**-**	-	50.0%	50.0%	0%	**-**	-	0.3%	99.7%	0%	**-**	-	-
% Total	51.1%	1.2%	0%	**52.3%**	-	0.5%	0.5%	0%	**1.1%**	-	0.1%	46.6%	0%	**46.7%**	-	-
PHF	0.687	0.375	-	**0.699**	-	0.500	0.500	-	**0.500**	-	0.250	0.813	-	**0.815**	-	0.753
Motorcycles	1	1	0	**2**	-	0	0	0	**0**	-	0	2	0	**2**	-	4
% Motorcycles	0.3%	11.1%	0%	**0.5%**	-	0%	0%	0%	**0%**	-	0%	0.6%	0%	**0.6%**	-	0.5%
Lights	362	8	0	**370**	-	2	4	0	**6**	-	1	341	0	**342**	-	718
% Lights	94.0%	88.9%	0%	**93.9%**	-	50.0%	100%	0%	**75.0%**	-	100%	97.2%	0%	**97.2%**	-	95.2%
Single-Unit Trucks	3	0	0	**3**	-	0	0	0	**0**	-	0	3	0	**3**	-	6
% Single-Unit Trucks	0.8%	0%	0%	**0.8%**	-	0%	0%	0%	**0%**	-	0%	0.9%	0%	**0.9%**	-	0.8%
Articulated Trucks	0	0	0	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0
% Articulated Trucks	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Buses	5	0	0	**5**	-	0	0	0	**0**	-	0	5	0	**5**	-	10
% Buses	1.3%	0%	0%	**1.3%**	-	0%	0%	0%	**0%**	-	0%	1.4%	0%	**1.4%**	-	1.3%
Bicycles on Road	14	0	0	**14**	-	2	0	0	**2**	-	0	0	0	**0**	-	16
% Bicycles on Road	3.6%	0%	0%	**3.6%**	-	50.0%	0%	0%	**25.0%**	-	0%	0%	0%	**0%**	-	2.1%
Pedestrians	-	-	-	-	1	-	-	-	-	5	-	-	-	-	0	
% Pedestrians	-	-	-	-	50.0%	-	-	-	-	100%	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	1	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	50.0%	-	-	-	-	0%	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Goodale Ave Kealohanui St East - TMC
Fri Nov 18, 2022
AM Peak (Nov 18 2022 7:15AM - 8:15 AM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016864, Location: 21.574048, -158.123026, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US



Goodale Ave Kealohanui St West - TMC

Wed Nov 16, 2022
Full Length (6 AM-9 AM, 3 PM-6 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016859, Location: 21.574048, -158.123026, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Kealohanui St					Kealohanui St					Goodale Ave					
Direction	Eastbound					Westbound					Southbound					
Time	T	L	U	**App**	Ped*	R	T	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
2022-11-16 3:00PM	10	9	0	**19**	0	62	7	0	**69**	2	10	60	0	**70**	0	**158**
3:15PM	17	13	0	**30**	0	83	11	0	**94**	0	2	55	0	**57**	0	**181**
3:30PM	5	8	0	**13**	0	81	12	0	**93**	0	10	55	0	**65**	0	**171**
3:45PM	14	8	0	**22**	0	99	13	0	**112**	0	5	72	0	**77**	0	**211**
Hourly Total	46	38	0	**84**	0	325	43	0	**368**	2	27	242	0	**269**	0	**721**
4:00PM	11	9	0	**20**	1	94	11	0	**105**	0	12	52	0	**64**	0	**189**
4:15PM	13	19	0	**32**	0	74	14	0	**88**	0	9	43	0	**52**	0	**172**
4:30PM	9	3	1	**13**	1	77	10	0	**87**	0	5	49	0	**54**	0	**154**
4:45PM	10	12	0	**22**	0	71	12	0	**83**	0	6	47	0	**53**	0	**158**
Hourly Total	43	43	1	**87**	2	316	47	0	**363**	0	32	191	0	**223**	0	**673**
5:00PM	8	15	0	**23**	0	70	14	0	**84**	0	7	45	0	**52**	0	**159**
5:15PM	16	12	0	**28**	0	66	9	0	**75**	0	5	50	1	**56**	0	**159**
5:30PM	7	7	0	**14**	0	64	6	0	**70**	3	3	43	0	**46**	0	**130**
5:45PM	9	9	0	**18**	0	65	6	0	**71**	0	4	52	0	**56**	0	**145**
Hourly Total	40	43	0	**83**	0	265	35	0	**300**	3	19	190	1	**210**	0	**593**
2022-11-17 6:00AM	3	2	0	**5**	0	15	3	0	**18**	0	3	37	0	**40**	0	**63**
6:15AM	6	4	0	**10**	0	13	6	0	**19**	0	1	20	0	**21**	0	**50**
6:30AM	11	0	0	**11**	1	17	5	0	**22**	0	7	41	0	**48**	0	**81**
6:45AM	7	0	0	**7**	1	28	10	0	**38**	0	4	43	0	**47**	0	**92**
Hourly Total	27	6	0	**33**	2	73	24	0	**97**	0	15	141	0	**156**	0	**286**
7:00AM	6	8	0	**14**	0	39	2	0	**41**	0	3	56	0	**59**	0	**114**
7:15AM	5	5	0	**10**	0	55	9	0	**64**	0	5	69	0	**74**	0	**148**
7:30AM	5	4	0	**9**	0	94	6	0	**100**	0	4	100	0	**104**	0	**213**
7:45AM	9	4	0	**13**	1	88	11	0	**99**	0	12	145	0	**157**	0	**269**
Hourly Total	25	21	0	**46**	1	276	28	0	**304**	0	24	370	0	**394**	0	**744**
8:00AM	6	5	0	**11**	0	39	4	0	**43**	0	5	74	0	**79**	0	**133**
8:15AM	6	3	0	**9**	0	49	8	0	**57**	0	3	54	0	**57**	0	**123**
8:30AM	11	5	0	**16**	0	35	9	0	**44**	0	7	48	0	**55**	0	**115**
8:45AM	6	7	0	**13**	0	44	6	0	**50**	0	12	47	0	**59**	0	**122**
Hourly Total	29	20	0	**49**	0	167	27	0	**194**	0	27	223	0	**250**	0	**493**
3:00PM	7	8	0	**15**	0	73	13	0	**86**	0	10	54	0	**64**	0	**165**
3:15PM	12	13	0	**25**	1	64	12	0	**76**	0	11	58	0	**69**	0	**170**
3:30PM	15	11	0	**26**	1	93	8	0	**101**	0	10	45	0	**55**	0	**182**
3:45PM	11	15	0	**26**	1	81	16	0	**97**	0	10	63	0	**73**	0	**196**
Hourly Total	45	47	0	**92**	3	311	49	0	**360**	0	41	220	0	**261**	0	**713**
4:00PM	12	12	0	**24**	0	69	5	0	**74**	0	9	51	0	**60**	0	**158**
4:15PM	9	9	0	**18**	1	96	10	0	**106**	0	7	54	0	**61**	0	**185**
4:30PM	7	7	0	**14**	1	64	13	0	**77**	0	3	52	0	**55**	0	**146**
4:45PM	12	11	0	**23**	1	87	6	0	**93**	0	7	54	0	**61**	0	**177**
Hourly Total	40	39	0	**79**	3	316	34	0	**350**	0	26	211	0	**237**	0	**666**
5:00PM	9	9	0	**18**	0	72	6	0	**78**	0	9	45	0	**54**	0	**150**
5:15PM	8	10	0	**18**	0	62	9	0	**71**	0	3	48	0	**51**	0	**140**
5:30PM	11	7	0	**18**	0	75	6	0	**81**	0	7	39	0	**46**	0	**145**
5:45PM	11	9	0	**20**	1	67	6	0	**73**	0	2	47	0	**49**	1	**142**
Hourly Total	39	35	0	**74**	1	276	27	0	**303**	0	21	179	0	**200**	1	**577**
2022-11-18 6:00AM	6	2	0	**8**	0	15	3	0	**18**	0	2	29	0	**31**	0	**57**
6:15AM	3	3	0	**6**	0	14	6	0	**20**	0	6	32	0	**38**	0	**64**
6:30AM	8	1	0	**9**	0	17	5	0	**22**	0	1	35	0	**36**	0	**67**
6:45AM	3	0	0	**3**	0	24	5	0	**29**	0	4	46	0	**50**	0	**82**
Hourly Total	20	6	0	**26**	0	70	19	0	**89**	0	13	142	0	**155**	0	**270**
7:00AM	7	4	0	**11**	0	33	3	0	**36**	0	4	60	0	**64**	0	**111**
7:15AM	3	5	0	**8**	1	69	2	0	**71**	0	4	61	0	**65**	1	**144**

Leg	Kealohanui St					Kealohanui St					Goodale Ave					
Direction	Eastbound					Westbound					Southbound					
Time	T	L	U	**App**	Ped*	R	T	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
7:30AM	7	6	0	**13**	1	88	8	0	**96**	0	3	106	0	**109**	0	**218**
7:45AM	4	5	0	**9**	1	103	7	0	**110**	0	8	126	0	**134**	0	**253**
Hourly Total	21	20	0	**41**	3	293	20	0	**313**	0	19	353	0	**372**	1	**726**
8:00AM	6	2	0	**8**	0	72	6	0	**78**	1	9	70	0	**79**	0	**165**
8:15AM	7	2	0	**9**	0	41	10	0	**51**	0	9	39	0	**48**	0	**108**
8:30AM	7	4	0	**11**	0	42	3	0	**45**	0	7	48	0	**55**	0	**111**
8:45AM	3	6	0	**9**	0	38	3	0	**41**	0	7	70	0	**77**	0	**127**
Hourly Total	23	14	0	**37**	0	193	22	0	**215**	1	32	227	0	**259**	0	**511**
Total	398	332	1	**731**	15	2881	375	0	**3256**	6	296	2689	1	**2986**	2	**6973**
% Approach	54.4%	45.4%	0.1%	**-**	-	88.5%	11.5%	0%	**-**	-	9.9%	90.1%	0%	**-**	-	-
% Total	5.7%	4.8%	0%	**10.5%**	-	41.3%	5.4%	0%	**46.7%**	-	4.2%	38.6%	0%	**42.8%**	-	-
Motorcycles	7	10	0	**17**	-	58	7	0	**65**	-	6	45	0	**51**	-	133
% Motorcycles	1.8%	3.0%	0%	**2.3%**	-	2.0%	1.9%	0%	**2.0%**	-	2.0%	1.7%	0%	**1.7%**	-	1.9%
Lights	372	317	1	**690**	-	2706	353	0	**3059**	-	282	2552	1	**2835**	-	6584
% Lights	93.5%	95.5%	100%	**94.4%**	-	93.9%	94.1%	0%	**93.9%**	-	95.3%	94.9%	100%	**94.9%**	-	94.4%
Single-Unit Trucks	4	0	0	**4**	-	18	4	0	**22**	-	2	19	0	**21**	-	47
% Single-Unit Trucks	1.0%	0%	0%	**0.5%**	-	0.6%	1.1%	0%	**0.7%**	-	0.7%	0.7%	0%	**0.7%**	-	0.7%
Articulated Trucks	0	0	0	**0**	-	1	0	0	**1**	-	0	1	0	**1**	-	2
% Articulated Trucks	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Buses	1	2	0	**3**	-	41	2	0	**43**	-	0	34	0	**34**	-	80
% Buses	0.3%	0.6%	0%	**0.4%**	-	1.4%	0.5%	0%	**1.3%**	-	0%	1.3%	0%	**1.1%**	-	1.1%
Bicycles on Road	14	3	0	**17**	-	57	9	0	**66**	-	6	38	0	**44**	-	127
% Bicycles on Road	3.5%	0.9%	0%	**2.3%**	-	2.0%	2.4%	0%	**2.0%**	-	2.0%	1.4%	0%	**1.5%**	-	1.8%
Pedestrians	-	-	-	-	10	-	-	-	-	5	-	-	-	-	2	
% Pedestrians	-	-	-	-	66.7%	-	-	-	-	83.3%	-	-	-	-	100%	-
Bicycles on Crosswalk	-	-	-	-	5	-	-	-	-	1	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	33.3%	-	-	-	-	16.7%	-	-	-	-	0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Goodale Ave Kealohanui St West - TMC
Wed Nov 16, 2022
Full Length (6 AM-9 AM, 3 PM-6 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016859, Location: 21.574048, -158.123026, Site Code: Waialua Mill

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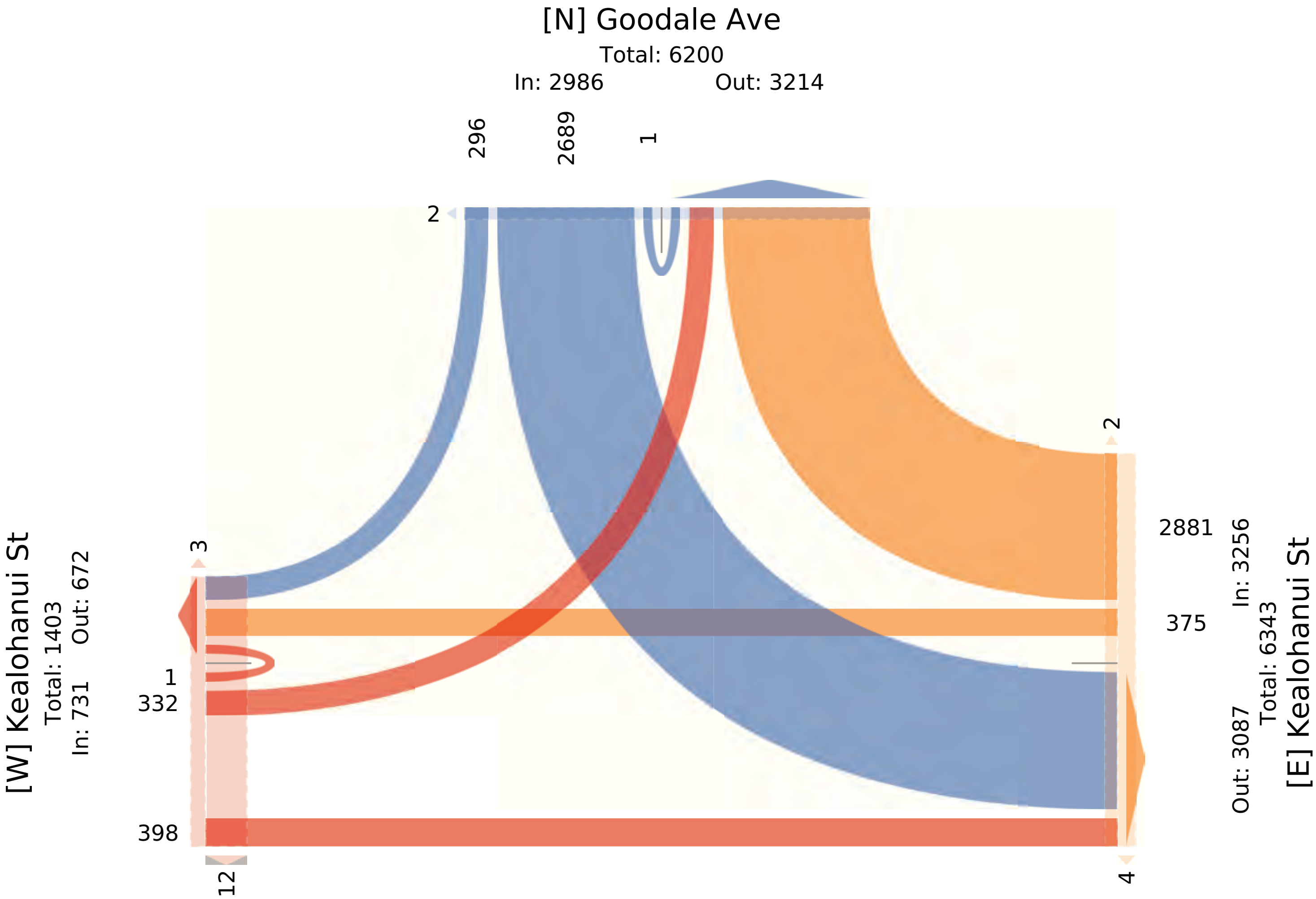


Goodale Ave Kealohanui St West - TMC

Wed Nov 16, 2022
PM Peak (Nov 16 2022 3:15PM - 4:15 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016859, Location: 21.574048, -158.123026, Site Code: Waialua Mill

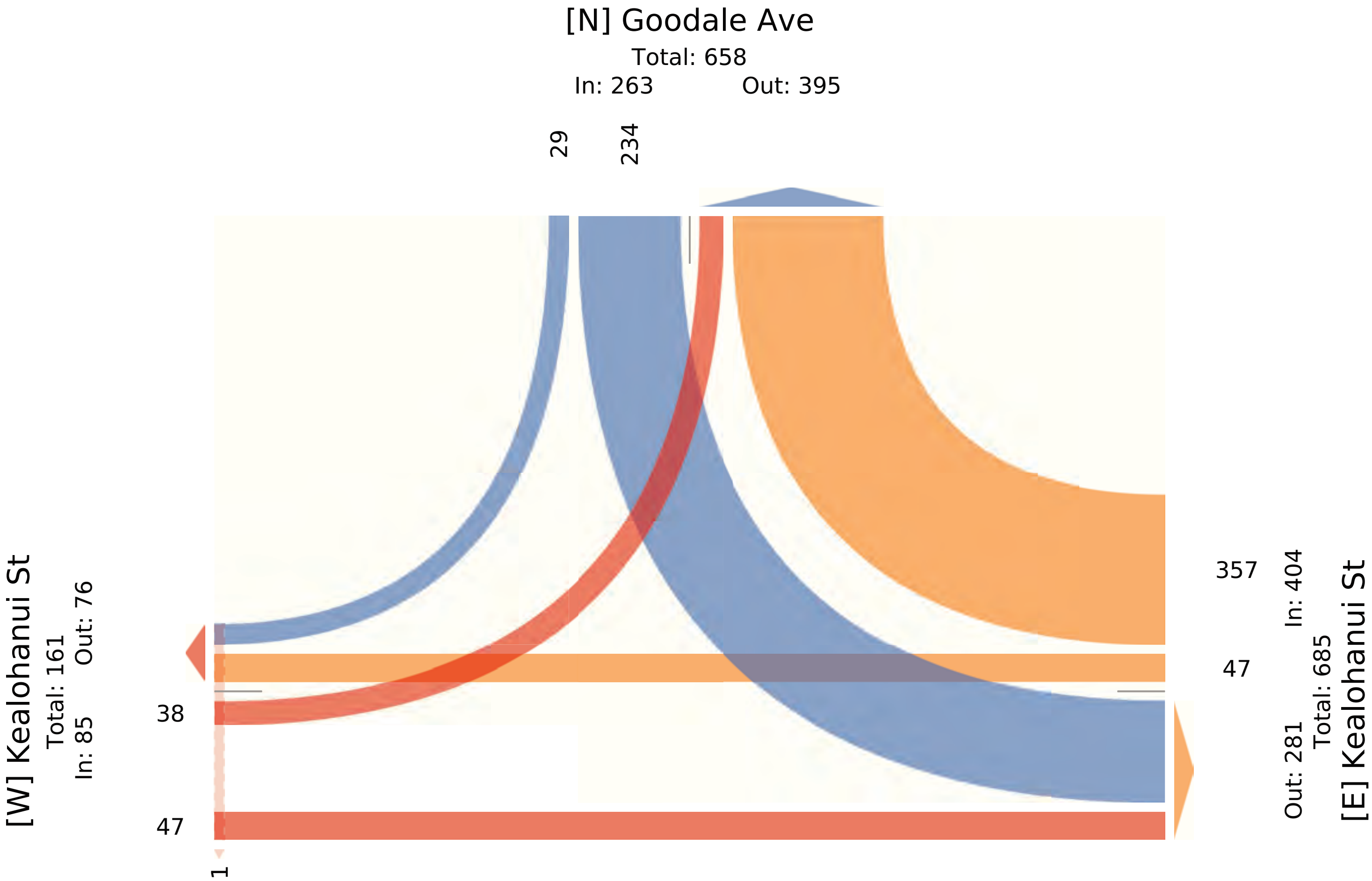
Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Kealohanui St					Kealohanui St					Goodale Ave					
Direction	Eastbound					Westbound					Southbound					
Time	T	L	U	**App**	Ped*	R	T	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
2022-11-16 3:15PM	17	13	0	**30**	0	83	11	0	**94**	0	2	55	0	**57**	0	**181**
3:30PM	5	8	0	**13**	0	81	12	0	**93**	0	10	55	0	**65**	0	**171**
3:45PM	14	8	0	**22**	0	99	13	0	**112**	0	5	72	0	**77**	0	**211**
4:00PM	11	9	0	**20**	1	94	11	0	**105**	0	12	52	0	**64**	0	**189**
Total	47	38	0	**85**	1	357	47	0	**404**	0	29	234	0	**263**	0	**752**
% Approach	55.3%	44.7%	0%	**-**	-	88.4%	11.6%	0%	**-**	-	11.0%	89.0%	0%	**-**	-	-
% Total	6.3%	5.1%	0%	**11.3%**	-	47.5%	6.3%	0%	**53.7%**	-	3.9%	31.1%	0%	**35.0%**	-	-
PHF	0.647	0.731	-	**0.683**	-	0.911	0.904	-	**0.910**	-	0.675	0.810	-	**0.845**	-	0.893
Motorcycles	0	0	0	**0**	-	12	1	0	**13**	-	0	7	0	**7**	-	20
% Motorcycles	0%	0%	0%	**0%**	-	3.4%	2.1%	0%	**3.2%**	-	0%	3.0%	0%	**2.7%**	-	2.7%
Lights	43	38	0	**81**	-	329	46	0	**375**	-	27	219	0	**246**	-	702
% Lights	91.5%	100%	0%	**95.3%**	-	92.2%	97.9%	0%	**92.8%**	-	93.1%	93.6%	0%	**93.5%**	-	93.4%
Single-Unit Trucks	1	0	0	**1**	-	2	0	0	**2**	-	0	3	0	**3**	-	6
% Single-Unit Trucks	2.1%	0%	0%	**1.2%**	-	0.6%	0%	0%	**0.5%**	-	0%	1.3%	0%	**1.1%**	-	0.8%
Articulated Trucks	0	0	0	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0
% Articulated Trucks	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Buses	0	0	0	**0**	-	3	0	0	**3**	-	0	1	0	**1**	-	4
% Buses	0%	0%	0%	**0%**	-	0.8%	0%	0%	**0.7%**	-	0%	0.4%	0%	**0.4%**	-	0.5%
Bicycles on Road	3	0	0	**3**	-	11	0	0	**11**	-	2	4	0	**6**	-	20
% Bicycles on Road	6.4%	0%	0%	**3.5%**	-	3.1%	0%	0%	**2.7%**	-	6.9%	1.7%	0%	**2.3%**	-	2.7%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	1	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	100%	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Goodale Ave Kealohanui St West - TMC
Wed Nov 16, 2022
PM Peak (Nov 16 2022 3:15PM - 4:15 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016859, Location: 21.574048, -158.123026, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US



Goodale Ave Kealohanui St West - TMC

Fri Nov 18, 2022
AM Peak (Nov 18 2022 7:15AM - 8:15 AM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016859, Location: 21.574048, -158.123026, Site Code: Waialua Mill

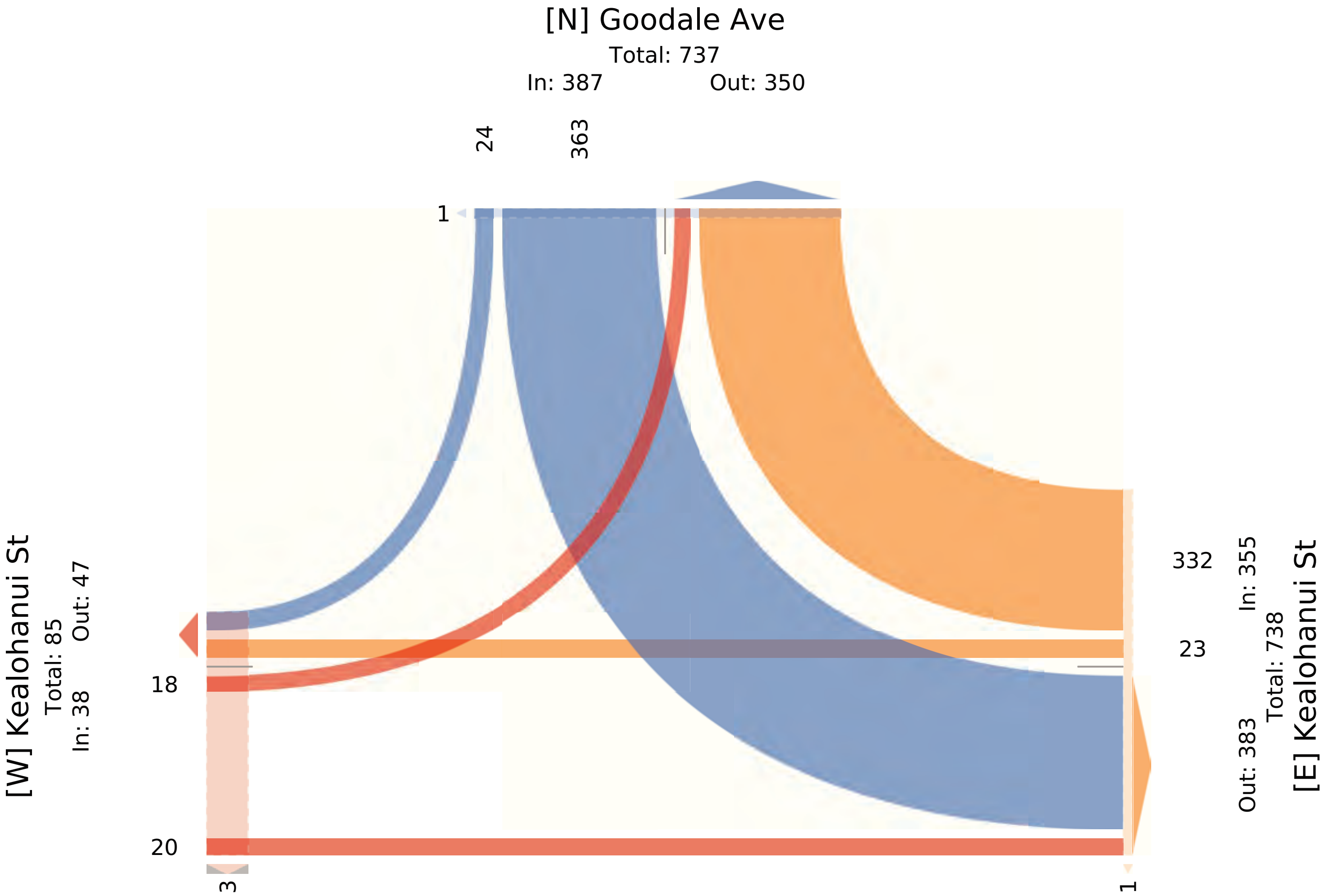
Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Kealohanui St					Kealohanui St					Goodale Ave					
Direction	Eastbound					Westbound					Southbound					
Time	T	L	U	**App**	Ped*	R	T	U	**App**	Ped*	R	L	U	**App**	Ped*	**Int**
2022-11-18 7:15AM	3	5	0	**8**	1	69	2	0	**71**	0	4	61	0	**65**	1	**144**
7:30AM	7	6	0	**13**	1	88	8	0	**96**	0	3	106	0	**109**	0	**218**
7:45AM	4	5	0	**9**	1	103	7	0	**110**	0	8	126	0	**134**	0	**253**
8:00AM	6	2	0	**8**	0	72	6	0	**78**	1	9	70	0	**79**	0	**165**
Total	20	18	0	**38**	3	332	23	0	**355**	1	24	363	0	**387**	1	**780**
% Approach	52.6%	47.4%	0%	**-**	-	93.5%	6.5%	0%	**-**	-	6.2%	93.8%	0%	**-**	-	-
% Total	2.6%	2.3%	0%	**4.9%**	-	42.6%	2.9%	0%	**45.5%**	-	3.1%	46.5%	0%	**49.6%**	-	-
PHF	0.714	0.750	-	**0.731**	-	0.801	0.719	-	**0.802**	-	0.688	0.696	-	**0.701**	-	0.758
Motorcycles	0	1	0	**1**	-	2	0	0	**2**	-	0	3	0	**3**	-	6
% Motorcycles	0%	5.6%	0%	**2.6%**	-	0.6%	0%	0%	**0.6%**	-	0%	0.8%	0%	**0.8%**	-	0.8%
Lights	19	16	0	**35**	-	320	22	0	**342**	-	22	340	0	**362**	-	739
% Lights	95.0%	88.9%	0%	**92.1%**	-	96.4%	95.7%	0%	**96.3%**	-	91.7%	93.7%	0%	**93.5%**	-	94.7%
Single-Unit Trucks	1	0	0	**1**	-	3	1	0	**4**	-	0	4	0	**4**	-	9
% Single-Unit Trucks	5.0%	0%	0%	**2.6%**	-	0.9%	4.3%	0%	**1.1%**	-	0%	1.1%	0%	**1.0%**	-	1.2%
Articulated Trucks	0	0	0	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0
% Articulated Trucks	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Buses	0	1	0	**1**	-	5	0	0	**5**	-	0	4	0	**4**	-	10
% Buses	0%	5.6%	0%	**2.6%**	-	1.5%	0%	0%	**1.4%**	-	0%	1.1%	0%	**1.0%**	-	1.3%
Bicycles on Road	0	0	0	**0**	-	2	0	0	**2**	-	2	12	0	**14**	-	16
% Bicycles on Road	0%	0%	0%	**0%**	-	0.6%	0%	0%	**0.6%**	-	8.3%	3.3%	0%	**3.6%**	-	2.1%
Pedestrians	-	-	-	-	2	-	-	-	-	1	-	-	-	-	1	
% Pedestrians	-	-	-	-	66.7%	-	-	-	-	100%	-	-	-	-	100%	-
Bicycles on Crosswalk	-	-	-	-	1	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	33.3%	-	-	-	-	0%	-	-	-	-	0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Goodale Ave Kealohanui St West - TMC
Fri Nov 18, 2022
AM Peak (Nov 18 2022 7:15AM - 8:15 AM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1016859, Location: 21.574048, -158.123026, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US



Kealohanui St Hopemanu St - TMC

Wed Nov 16, 2022
Full Length (3 PM-6 PM, 6 AM-9 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1015565, Location: 21.573795, -158.127427, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

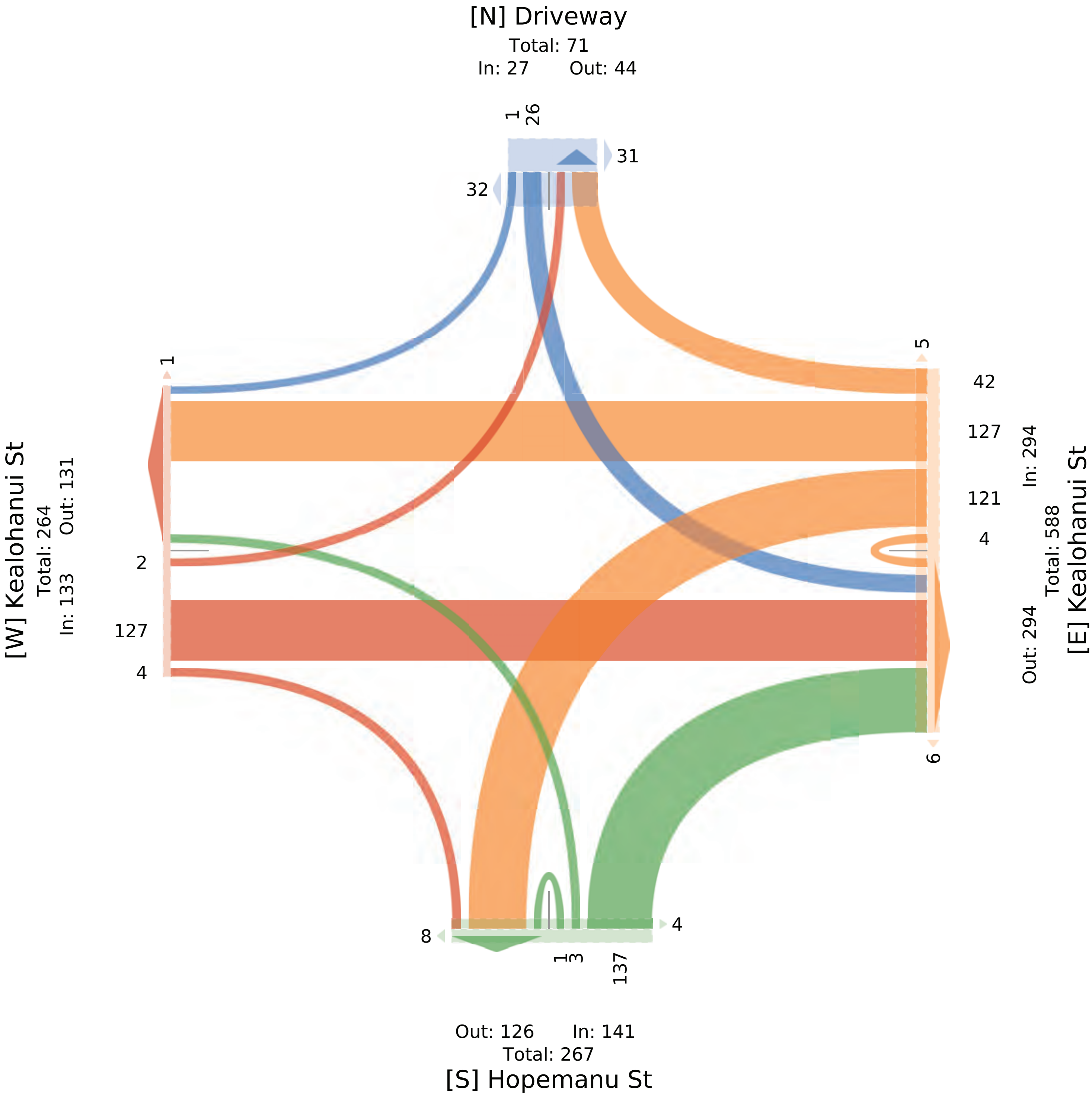
Leg	Kealohanui St						Kealohanui St						Hopemanu St						Driveway						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2022-11-16 3:00PM	0	4	0	0	**4**	0	0	4	4	0	**8**	0	0	0	0	0	**0**	0	0	0	1	0	**1**	0	**13**
3:15PM	0	7	0	0	**7**	0	0	2	6	0	**8**	0	2	0	0	0	**2**	0	0	0	0	0	**0**	0	**17**
3:30PM	0	0	0	0	**0**	0	0	2	4	2	**8**	0	1	0	0	0	**1**	0	0	0	0	0	**0**	0	**9**
3:45PM	0	0	0	0	**0**	0	2	1	9	0	**12**	0	3	0	0	0	**3**	0	0	0	0	0	**0**	4	**15**
Hourly Total	0	11	0	0	**11**	0	2	9	23	2	**36**	0	6	0	0	0	**6**	0	0	0	1	0	**1**	4	**54**
4:00PM	0	0	0	0	**0**	0	2	3	4	0	**9**	0	9	0	1	0	**10**	0	0	0	1	0	**1**	7	**20**
4:15PM	0	3	0	0	**3**	0	3	1	1	0	**5**	0	3	0	0	0	**3**	0	0	0	2	0	**2**	4	**13**
4:30PM	0	0	0	0	**0**	0	0	7	2	0	**9**	0	2	0	0	0	**2**	0	0	0	0	0	**0**	0	**11**
4:45PM	0	0	0	0	**0**	0	0	4	5	0	**9**	0	2	0	0	0	**2**	0	0	0	0	0	**0**	0	**11**
Hourly Total	0	3	0	0	**3**	0	5	15	12	0	**32**	0	16	0	1	0	**17**	0	0	0	3	0	**3**	11	**55**
5:00PM	0	3	0	0	**3**	0	2	6	2	0	**10**	0	3	0	1	0	**4**	2	0	0	0	0	**0**	2	**17**
5:15PM	0	7	0	0	**7**	0	3	5	2	0	**10**	0	5	0	0	0	**5**	0	0	0	1	0	**1**	2	**23**
5:30PM	0	3	0	0	**3**	0	0	3	5	0	**8**	0	1	0	0	0	**1**	0	0	0	0	0	**0**	0	**12**
5:45PM	0	1	0	0	**1**	0	0	2	3	0	**5**	0	4	0	0	0	**4**	1	0	0	5	0	**5**	6	**15**
Hourly Total	0	14	0	0	**14**	0	5	16	12	0	**33**	0	13	0	1	0	**14**	3	0	0	6	0	**6**	10	**67**
2022-11-17 6:00AM	0	0	0	0	**0**	0	0	3	0	0	**3**	0	3	0	0	0	**3**	0	0	0	0	0	**0**	1	**6**
6:15AM	0	4	0	0	**4**	0	0	4	1	0	**5**	0	7	0	0	0	**7**	0	0	0	0	0	**0**	0	**16**
6:30AM	0	3	0	0	**3**	0	1	1	3	0	**5**	0	3	0	0	0	**3**	0	0	0	0	0	**0**	0	**11**
6:45AM	0	3	0	0	**3**	0	3	3	0	0	**6**	0	1	0	0	0	**1**	0	0	0	0	0	**0**	2	**10**
Hourly Total	0	10	0	0	**10**	0	4	11	4	0	**19**	0	14	0	0	0	**14**	0	0	0	0	0	**0**	3	**43**
7:00AM	0	4	0	0	**4**	0	1	1	0	0	**2**	0	7	0	0	0	**7**	1	0	0	0	0	**0**	0	**13**
7:15AM	0	3	0	0	**3**	0	0	2	2	0	**4**	0	3	0	0	0	**3**	0	0	0	0	0	**0**	1	**10**
7:30AM	0	3	0	0	**3**	0	1	1	1	0	**3**	0	3	0	0	0	**3**	0	0	0	1	0	**1**	0	**10**
7:45AM	1	1	0	0	**2**	0	0	4	4	0	**8**	1	2	0	0	0	**2**	3	0	0	0	0	**0**	1	**12**
Hourly Total	1	11	0	0	**12**	0	2	8	7	0	**17**	1	15	0	0	0	**15**	4	0	0	1	0	**1**	2	**45**
8:00AM	1	3	0	0	**4**	0	1	1	0	0	**2**	0	4	0	1	0	**5**	0	0	0	0	0	**0**	4	**11**
8:15AM	0	2	0	0	**2**	0	0	0	1	0	**1**	0	0	0	0	0	**0**	0	0	0	0	0	**0**	0	**3**
8:30AM	0	3	0	0	**3**	0	1	0	1	0	**2**	2	3	0	0	0	**3**	0	0	0	2	0	**2**	2	**10**
8:45AM	0	0	0	0	**0**	0	1	1	2	0	**4**	0	1	0	0	0	**1**	0	0	0	0	0	**0**	2	**5**
Hourly Total	1	8	0	0	**9**	0	3	2	4	0	**9**	2	8	0	1	0	**9**	0	0	0	2	0	**2**	8	**29**
3:00PM	0	2	0	0	**2**	0	2	9	4	1	**16**	0	2	0	0	1	**3**	0	0	0	0	0	**0**	0	**21**
3:15PM	0	4	0	0	**4**	0	0	4	7	0	**11**	0	2	0	0	0	**2**	0	0	0	1	0	**1**	0	**18**
3:30PM	0	2	1	0	**3**	0	0	2	3	0	**5**	0	1	0	0	0	**1**	0	0	0	0	0	**0**	0	**9**
3:45PM	0	3	0	0	**3**	0	1	6	6	0	**13**	0	4	0	0	0	**4**	0	0	0	0	0	**0**	0	**20**
Hourly Total	0	11	1	0	**12**	0	3	21	20	1	**45**	0	9	0	0	1	**10**	0	0	0	1	0	**1**	0	**68**
4:00PM	1	6	0	0	**7**	0	1	8	2	0	**11**	1	3	0	0	0	**3**	3	0	0	0	0	**0**	2	**21**
4:15PM	0	2	0	0	**2**	0	2	3	2	0	**7**	2	3	0	0	0	**3**	1	0	0	1	0	**1**	3	**13**
4:30PM	0	1	0	0	**1**	0	0	2	3	0	**5**	0	1	0	0	0	**1**	0	0	0	1	0	**1**	3	**8**
4:45PM	0	3	0	0	**3**	0	0	5	3	0	**8**	0	2	0	0	0	**2**	0	1	0	1	0	**2**	3	**15**
Hourly Total	1	12	0	0	**13**	0	3	18	10	0	**31**	3	9	0	0	0	**9**	4	1	0	3	0	**4**	11	**57**
5:00PM	0	1	0	0	**1**	0	2	2	5	0	**9**	1	2	0	0	0	**2**	0	0	0	2	0	**2**	0	**14**
5:15PM	0	3	0	0	**3**	0	1	1	3	0	**5**	0	0	0	0	0	**0**	0	0	0	1	0	**1**	0	**9**
5:30PM	0	5	0	0	**5**	0	3	4	4	0	**11**	1	5	0	0	0	**5**	0	0	0	1	0	**1**	0	**22**
5:45PM	0	8	0	0	**8**	0	0	3	1	0	**4**	1	0	0	0	0	**0**	0	0	0	3	0	**3**	0	**15**
Hourly Total	0	17	0	0	**17**	0	6	10	13	0	**29**	3	7	0	0	0	**7**	0	0	0	7	0	**7**	0	**60**
2022-11-18 6:00AM	0	2	0	0	**2**	0	0	2	0	0	**2**	0	6	0	0	0	**6**	0	0	0	0	0	**0**	0	**10**
6:15AM	0	0	0	0	**0**	0	0	5	1	0	**6**	0	3	0	0	0	**3**	0	0	0	0	0	**0**	0	**9**
6:30AM	0	3	0	0	**3**	0	1	0	2	0	**3**	2	5	0	0	0	**5**	0	0	0	0	0	**0**	2	**11**
6:45AM	0	1	0	0	**1**	0	1	1	0	0	**2**	0	1	0	0	0	**1**	0	0	0	0	0	**0**	1	**4**
Hourly Total	0	6	0	0	**6**	0	2	8	3	0	**13**	2	15	0	0	0	**15**	0	0	0	0	0	**0**	3	**34**
7:00AM	0	1	0	0	**1**	0	0	1	1	1	**3**	0	4	0	0	0	**4**	0	0	0	0	0	**0**	0	**8**
7:15AM	0	3	0	0	**3**	1	1	0	1	0	**2**	0	4	0	0	0	**4**	0	0	0	0	0	**0**	1	**9**
7:30AM	0	5	0	0	**5**	0	0	0	0	0	**0**	0	6	0	0	0	**6**	0	0	0	0	0	**0**	0	**11**
7:45AM	0	2	0	0	**2**	0	2	2	2	0	**6**	0	3	0	0	0	**3**	0	0	0	0	0	**0**	4	**11**
Hourly Total	0	11	0	0	**11**	1	3	3	4	1	**11**	0	17	0	0	0	**17**	0	0	0	0	0	**0**	5	**39**
8:00AM	0	4	0	0	**4**	0	2	4	1	0	**7**	0	0	0	0	0	**0**	1	0	0	0	0	**0**	3	**11**

Leg	Kealohanui St						Kealohanui St						Hopemanu St						Driveway						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	R	T	L	U	**App**	Ped*	**Int**
8:15AM	0	3	0	0	**3**	0	1	1	3	0	**5**	0	3	0	0	0	**3**	0	0	0	0	0	**0**	0	**11**
8:30AM	1	1	0	0	**2**	0	1	1	4	0	**6**	0	5	0	0	0	**5**	0	0	0	1	0	**1**	1	**14**
8:45AM	0	5	1	0	**6**	0	0	0	1	0	**1**	0	0	0	0	0	**0**	0	0	0	1	0	**1**	2	**8**
Hourly Total	1	13	1	0	**15**	0	4	6	9	0	**19**	0	8	0	0	0	**8**	1	0	0	2	0	**2**	6	**44**
Total	4	127	2	0	**133**	1	42	127	121	4	**294**	11	137	0	3	1	**141**	12	1	0	26	0	**27**	63	**595**
% Approach	3.0%	95.5%	1.5%	0%	**-**	-	14.3%	43.2%	41.2%	1.4%	**-**	-	97.2%	0%	2.1%	0.7%	**-**	-	3.7%	0%	96.3%	0%	**-**	-	-
% Total	0.7%	21.3%	0.3%	0%	**22.4%**	-	7.1%	21.3%	20.3%	0.7%	**49.4%**	-	23.0%	0%	0.5%	0.2%	**23.7%**	-	0.2%	0%	4.4%	0%	**4.5%**	-	-
Motorcycles	2	7	0	0	**9**	-	0	7	3	0	**10**	-	2	0	1	0	**3**	-	0	0	0	0	**0**	-	22
% Motorcycles	50.0%	5.5%	0%	0%	**6.8%**	-	0%	5.5%	2.5%	0%	**3.4%**	-	1.5%	0%	33.3%	0%	**2.1%**	-	0%	0%	0%	0%	**0%**	-	3.7%
Lights	2	112	2	0	**116**	-	40	111	111	3	**265**	-	121	0	2	1	**124**	-	1	0	26	0	**27**	-	532
% Lights	50.0%	88.2%	100%	0%	**87.2%**	-	95.2%	87.4%	91.7%	75.0%	**90.1%**	-	88.3%	0%	66.7%	100%	**87.9%**	-	100%	0%	100%	0%	**100%**	-	89.4%
Single-Unit Trucks	0	2	0	0	**2**	-	2	1	1	0	**4**	-	1	0	0	0	**1**	-	0	0	0	0	**0**	-	7
% Single-Unit Trucks	0%	1.6%	0%	0%	**1.5%**	-	4.8%	0.8%	0.8%	0%	**1.4%**	-	0.7%	0%	0%	0%	**0.7%**	-	0%	0%	0%	0%	**0%**	-	1.2%
Articulated Trucks	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0
% Articulated Trucks	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%
Buses	0	0	0	0	**0**	-	0	2	0	0	**2**	-	2	0	0	0	**2**	-	0	0	0	0	**0**	-	4
% Buses	0%	0%	0%	0%	**0%**	-	0%	1.6%	0%	0%	**0.7%**	-	1.5%	0%	0%	0%	**1.4%**	-	0%	0%	0%	0%	**0%**	-	0.7%
Bicycles on Road	0	6	0	0	**6**	-	0	6	6	1	**13**	-	11	0	0	0	**11**	-	0	0	0	0	**0**	-	30
% Bicycles on Road	0%	4.7%	0%	0%	**4.5%**	-	0%	4.7%	5.0%	25.0%	**4.4%**	-	8.0%	0%	0%	0%	**7.8%**	-	0%	0%	0%	0%	**0%**	-	5.0%
Pedestrians	-	-	-	-	-	1	-	-	-	-	-	11	-	-	-	-	-	12	-	-	-	-	-	63	
% Pedestrians	-	-	-	-	-	100%	-	-	-	-	-	100%	-	-	-	-	-	100%	-	-	-	-	-	100%	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Kealohanui St Hopemanu St - TMC
Wed Nov 16, 2022
Full Length (3 PM-6 PM, 6 AM-9 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1015565, Location: 21.573795, -158.127427, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US



Kealohanui St Hopemanu St - TMC

Thu Nov 17, 2022
AM Peak (Nov 17 2022 6:15AM - 7:15 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1015565, Location: 21.573795, -158.127427, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Kealohanui St						Kealohanui St						Hopemanu St						Driveway						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2022-11-17 6:15AM	0	4	0	0	**4**	0	0	4	1	0	**5**	0	7	0	0	0	**7**	0	0	0	0	0	**0**	0	**16**
6:30AM	0	3	0	0	**3**	0	1	1	3	0	**5**	0	3	0	0	0	**3**	0	0	0	0	0	**0**	0	**11**
6:45AM	0	3	0	0	**3**	0	3	3	0	0	**6**	0	1	0	0	0	**1**	0	0	0	0	0	**0**	2	**10**
7:00AM	0	4	0	0	**4**	0	1	1	0	0	**2**	0	7	0	0	0	**7**	1	0	0	0	0	**0**	0	**13**
Total	0	14	0	0	**14**	0	5	9	4	0	**18**	0	18	0	0	0	**18**	1	0	0	0	0	**0**	2	**50**
% Approach	0%	100%	0%	0%	**-**	-	27.8%	50.0%	22.2%	0%	**-**	-	100%	0%	0%	0%	**-**	-	0%	0%	0%	0%	**-**	-	-
% Total	0%	28.0%	0%	0%	**28.0%**	-	10.0%	18.0%	8.0%	0%	**36.0%**	-	36.0%	0%	0%	0%	**36.0%**	-	0%	0%	0%	0%	**0%**	-	-
PHF	-	0.875	-	-	**0.875**	-	0.417	0.563	0.333	-	**0.750**	-	0.607	-	-	-	**0.607**	-	-	-	-	-	**-**	-	0.766
Motorcycles	0	2	0	0	**2**	-	0	1	1	0	**2**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	4
% Motorcycles	0%	14.3%	0%	0%	**14.3%**	-	0%	11.1%	25.0%	0%	**11.1%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**-**	-	8.0%
Lights	0	12	0	0	**12**	-	5	7	3	0	**15**	-	16	0	0	0	**16**	-	0	0	0	0	**0**	-	43
% Lights	0%	85.7%	0%	0%	**85.7%**	-	100%	77.8%	75.0%	0%	**83.3%**	-	88.9%	0%	0%	0%	**88.9%**	-	0%	0%	0%	0%	**-**	-	86.0%
Single-Unit Trucks	0	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%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**-**	-	0%
Articulated Trucks	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	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%
Buses	0	0	0	0	**0**	-	0	1	0	0	**1**	-	1	0	0	0	**1**	-	0	0	0	0	**0**	-	2
% Buses	0%	0%	0%	0%	**0%**	-	0%	11.1%	0%	0%	**5.6%**	-	5.6%	0%	0%	0%	**5.6%**	-	0%	0%	0%	0%	**-**	-	4.0%
Bicycles on Road	0	0	0	0	**0**	-	0	0	0	0	**0**	-	1	0	0	0	**1**	-	0	0	0	0	**0**	-	1
% Bicycles on Road	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	5.6%	0%	0%	0%	**5.6%**	-	0%	0%	0%	0%	**-**	-	2.0%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	2	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-	100%	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-	-	-	-	0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Kealohanui St Hopemanu St - TMC
Thu Nov 17, 2022
AM Peak (Nov 17 2022 6:15AM - 7:15 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1015565, Location: 21.573795, -158.127427, Site Code: Waialua Mill

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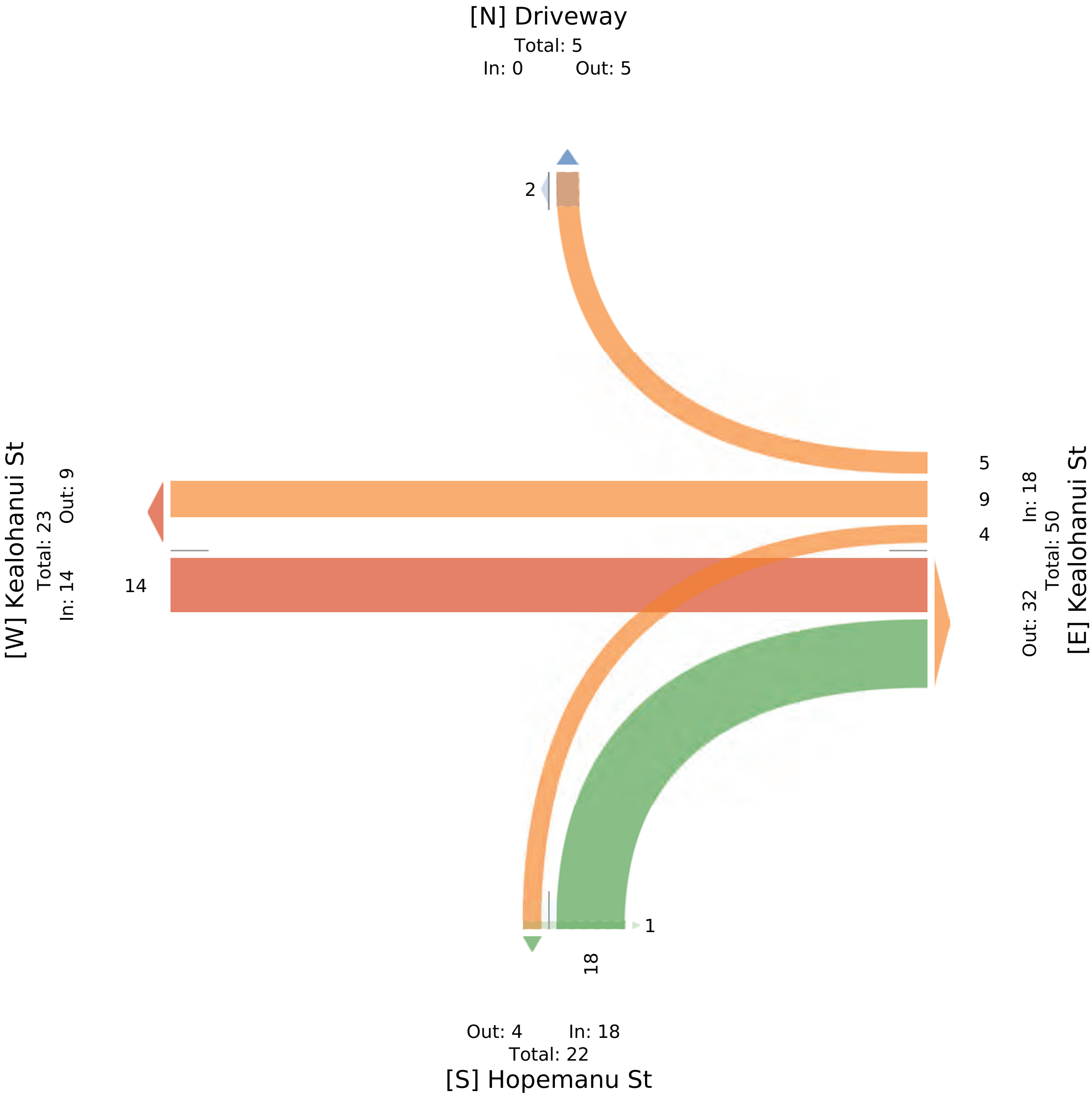

Kealohanui St Hopemanu St - TMC

Thu Nov 17, 2022
PM Peak (Nov 17 2022 3PM - 4 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1015565, Location: 21.573795, -158.127427, Site Code: Waialua Mill

Provided by: The Traffic Management Consultant
1188 Bishop Street, Suite 1907,
Honolulu, HI, 96813, US

Leg	Kealohanui St						Kealohanui St						Hopemanu St						Driveway						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2022-11-17 3:00PM	0	2	0	0	**2**	0	2	9	4	1	**16**	0	2	0	0	1	**3**	0	0	0	0	0	**0**	0	**21**
3:15PM	0	4	0	0	**4**	0	0	4	7	0	**11**	0	2	0	0	0	**2**	0	0	0	1	0	**1**	0	**18**
3:30PM	0	2	1	0	**3**	0	0	2	3	0	**5**	0	1	0	0	0	**1**	0	0	0	0	0	**0**	0	**9**
3:45PM	0	3	0	0	**3**	0	1	6	6	0	**13**	0	4	0	0	0	**4**	0	0	0	0	0	**0**	0	**20**
Total	0	11	1	0	**12**	0	3	21	20	1	**45**	0	9	0	0	1	**10**	0	0	0	1	0	**1**	0	**68**
% Approach	0%	91.7%	8.3%	0%	**-**	-	6.7%	46.7%	44.4%	2.2%	**-**	-	90.0%	0%	0%	10.0%	**-**	-	0%	0%	100%	0%	**-**	-	-
% Total	0%	16.2%	1.5%	0%	**17.6%**	-	4.4%	30.9%	29.4%	1.5%	**66.2%**	-	13.2%	0%	0%	1.5%	**14.7%**	-	0%	0%	1.5%	0%	**1.5%**	-	-
PHF	-	0.688	0.250	-	**0.750**	-	0.375	0.679	0.714	-	**0.808**	-	0.563	-	-	0.250	**0.625**	-	-	-	0.250	-	**0.250**	-	0.813
Motorcycles	0	1	0	0	**1**	-	0	0	0	0	**0**	-	1	0	0	0	**1**	-	0	0	0	0	**0**	-	2
% Motorcycles	0%	9.1%	0%	0%	**8.3%**	-	0%	0%	0%	0%	**0%**	-	11.1%	0%	0%	0%	**10.0%**	-	0%	0%	0%	0%	**0%**	-	2.9%
Lights	0	10	1	0	**11**	-	3	19	20	0	**42**	-	8	0	0	1	**9**	-	0	0	1	0	**1**	-	63
% Lights	0%	90.9%	100%	0%	**91.7%**	-	100%	90.5%	100%	0%	**93.3%**	-	88.9%	0%	0%	100%	**90.0%**	-	0%	0%	100%	0%	**100%**	-	92.6%
Single-Unit Trucks	0	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%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%
Articulated Trucks	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	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%**	-	0%
Buses	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	0
% Buses	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	0%
Bicycles on Road	0	0	0	0	**0**	-	0	2	0	1	**3**	-	0	0	0	0	**0**	-	0	0	0	0	**0**	-	3
% Bicycles on Road	0%	0%	0%	0%	**0%**	-	0%	9.5%	0%	100%	**6.7%**	-	0%	0%	0%	0%	**0%**	-	0%	0%	0%	0%	**0%**	-	4.4%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Kealohanui St Hopemanu St - TMC
Thu Nov 17, 2022
PM Peak (Nov 17 2022 3PM - 4 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)
All Movements
ID: 1015565, Location: 21.573795, -158.127427, Site Code: Waialua Mill

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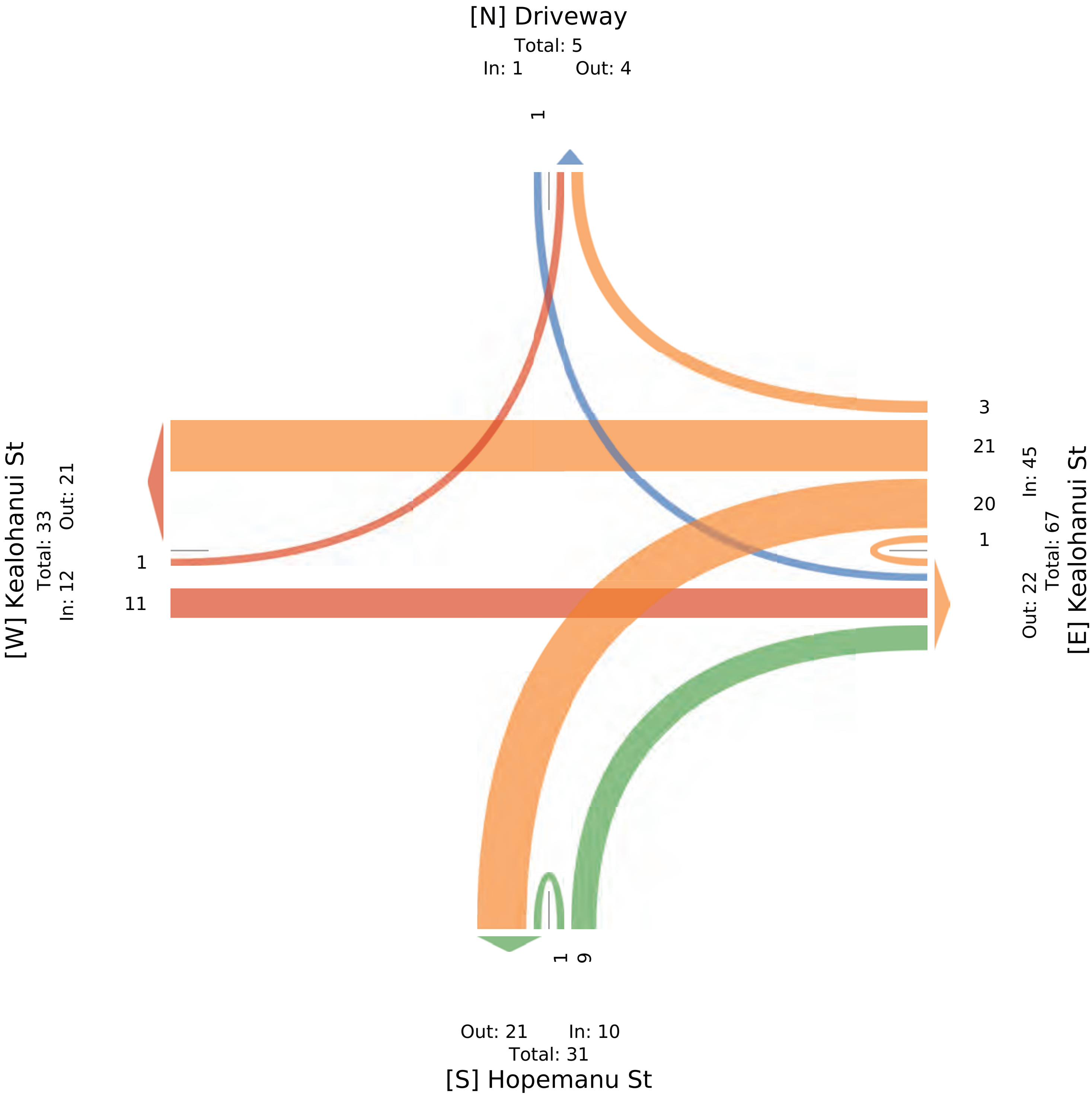

TRANSPORTATION ASSESSMENT REPORT

FOR THE PROPOSED

WAIALUA MILL AFFORDABLE HOUSING

WAIALUA, OAHU, HAWAII

TAX MAP KEY: 6-7-001:077

APPENDIX B

CAPACITY ANALYSIS WORKSHEETS

EXISTING TRAFFIC CONDITIONS

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	152	145	5	5	1
Future Vol, veh/h	1	152	145	5	5	1
Conflicting Peds, #/hr	2	0	0	2	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	0	2	3	0	0	0
Mvmt Flow	1	179	171	6	6	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	179	0	-	0	357	176
Stage 1	-	-	-	-	176	-
Stage 2	-	-	-	-	181	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1409	-	-	-	645	872
Stage 1	-	-	-	-	859	-
Stage 2	-	-	-	-	855	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1406	-	-	-	642	870
Mov Cap-2 Maneuver	-	-	-	-	642	-
Stage 1	-	-	-	-	856	-
Stage 2	-	-	-	-	853	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	10.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1406	-	-	-	671
HCM Lane V/C Ratio	0.001	-	-	-	0.011
HCM Control Delay (s)	7.6	0	-	-	10.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		Y	
Traffic Vol, veh/h	0	440	0	0	161	492
Future Vol, veh/h	0	440	0	0	161	492
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	72	72	72	72	72	72
Heavy Vehicles, %	0	3	2	2	3	2
Mvmt Flow	0	611	0	0	224	683

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	612	-
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	611	-
Critical Hdwy	-	-	-	-	6.43	-
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	-	-	3.527	-
Pot Cap-1 Maneuver	0	-	-	0	455	0
Stage 1	0	-	-	0	1020	0
Stage 2	0	-	-	0	540	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	455	-
Mov Cap-2 Maneuver	-	-	-	-	455	-
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	540	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	20.3
HCM LOS			C

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	455
HCM Lane V/C Ratio	-	-	0.491
HCM Control Delay (s)	-	-	20.3
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	2.7

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	167	434	371	0	0	0
Future Vol, veh/h	167	434	371	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	72	72	72	72	72	72
Heavy Vehicles, %	4	2	2	0	0	0
Mvmt Flow	232	603	515	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	515	0	-	0	1582	-
Stage 1	-	-	-	-	515	-
Stage 2	-	-	-	-	1067	-
Critical Hdwy	4.14	-	-	-	6.4	-
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	-
Pot Cap-1 Maneuver	1040	-	-	0	121	0
Stage 1	-	-	-	0	604	0
Stage 2	-	-	-	0	334	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1040	-	-	-	80	-
Mov Cap-2 Maneuver	-	-	-	-	80	-
Stage 1	-	-	-	-	402	-
Stage 2	-	-	-	-	334	-

Approach	EB	WB	SE
HCM Control Delay, s	2.6	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	SELn1
Capacity (veh/h)	1040	-	-	-
HCM Lane V/C Ratio	0.223	-	-	-
HCM Control Delay (s)	9.5	0	-	0
HCM Lane LOS	A	A	-	A
HCM 95th %tile Q(veh)	0.9	-	-	-

Intersection	
Int Delay, s/veh	11.5

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Vol, veh/h	0	0	0	384	269	269
Future Vol, veh/h	0	0	0	384	269	269
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	73	73	73	73	73	73
Heavy Vehicles, %	0	0	0	2	1	3
Mvmt Flow	0	0	0	526	368	368

Major/Minor	Major2		Minor1	
Conflicting Flow All	-	-	526	-
Stage 1	-	-	0	-
Stage 2	-	-	526	-
Critical Hdwy	-	-	6.41	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.41	-
Follow-up Hdwy	-	-	3.509	-
Pot Cap-1 Maneuver	0	-	514	0
Stage 1	0	-	-	0
Stage 2	0	-	595	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	514	-
Mov Cap-2 Maneuver	-	-	514	-
Stage 1	-	-	-	-
Stage 2	-	-	595	-

Approach	SB	NW
HCM Control Delay, s	0	27.8
HCM LOS		D

Minor Lane/Major Mvmt	NWLn1	SBT
Capacity (veh/h)	514	-
HCM Lane V/C Ratio	0.717	-
HCM Control Delay (s)	27.8	-
HCM Lane LOS	D	-
HCM 95th %tile Q(veh)	5.8	-

Intersection	
Int Delay, s/veh	12.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	1	19	4	1	3	1	350	1	1	362	24
Future Vol, veh/h	18	1	19	4	1	3	1	350	1	1	362	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	20	1	21	4	1	3	1	380	1	1	393	26

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	4	0	0	22	0	0	259	64	12	253	73	3
Stage 1	-	-	-	-	-	-	52	52	-	11	11	-
Stage 2	-	-	-	-	-	-	207	12	-	242	62	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1618	-	-	1593	-	-	694	827	1069	700	817	1081
Stage 1	-	-	-	-	-	-	961	852	-	1010	886	-
Stage 2	-	-	-	-	-	-	795	886	-	762	843	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1618	-	-	1593	-	-	412	814	1069	438	804	1081
Mov Cap-2 Maneuver	-	-	-	-	-	-	412	814	-	438	804	-
Stage 1	-	-	-	-	-	-	949	841	-	997	883	-
Stage 2	-	-	-	-	-	-	429	883	-	411	832	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.4	3.6	13.3	13.2
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	812	1618	-	-	1593	-	-	855
HCM Lane V/C Ratio	0.471	0.012	-	-	0.003	-	-	0.492
HCM Control Delay (s)	13.3	7.3	0	-	7.3	0	-	13.2
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	2.6	0	-	-	0	-	-	2.8

Intersection	
Intersection Delay, s/veh	50
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	197	247	1	1	192	158	5	4	5	179	2	207
Future Vol, veh/h	197	247	1	1	192	158	5	4	5	179	2	207
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles, %	3	1	0	0	2	1	0	0	0	2	0	3
Mvmt Flow	243	305	1	1	237	195	6	5	6	221	2	256
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	75.1	30.3	12.3	40.5
HCM LOS	F	D	B	E

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	36%	44%	0%	46%
Vol Thru, %	29%	56%	55%	1%
Vol Right, %	36%	0%	45%	53%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	14	445	351	388
LT Vol	5	197	1	179
Through Vol	4	247	192	2
RT Vol	5	1	158	207
Lane Flow Rate	17	549	433	479
Geometry Grp	1	1	1	1
Degree of Util (X)	0.041	1.037	0.789	0.874
Departure Headway (Hd)	8.873	6.793	6.705	6.814
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	406	538	542	536
Service Time	6.873	4.81	4.705	4.814
HCM Lane V/C Ratio	0.042	1.02	0.799	0.894
HCM Control Delay	12.3	75.1	30.3	40.5
HCM Lane LOS	B	F	D	E
HCM 95th-tile Q	0.1	15.6	7.4	9.6

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	196	191	10	3	0
Future Vol, veh/h	2	196	191	10	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	0	4	0	1	0	0
Mvmt Flow	2	231	225	12	4	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	237	0	-	0	466	231
Stage 1	-	-	-	-	231	-
Stage 2	-	-	-	-	235	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1342	-	-	-	559	813
Stage 1	-	-	-	-	812	-
Stage 2	-	-	-	-	809	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1342	-	-	-	558	813
Mov Cap-2 Maneuver	-	-	-	-	558	-
Stage 1	-	-	-	-	810	-
Stage 2	-	-	-	-	809	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	11.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1342	-	-	-	558
HCM Lane V/C Ratio	0.002	-	-	-	0.006
HCM Control Delay (s)	7.7	0	-	-	11.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	474	0	0	140	356
Future Vol, veh/h	0	474	0	0	140	356
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	0	1	5	1
Mvmt Flow	0	510	0	0	151	383

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	511	-
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	510	-
Critical Hdwy	-	-	-	-	6.45	-
Critical Hdwy Stg 1	-	-	-	-	5.45	-
Critical Hdwy Stg 2	-	-	-	-	5.45	-
Follow-up Hdwy	-	-	-	-	3.545	-
Pot Cap-1 Maneuver	0	-	-	0	517	0
Stage 1	0	-	-	0	1014	0
Stage 2	0	-	-	0	597	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	517	-
Mov Cap-2 Maneuver	-	-	-	-	517	-
Stage 1	-	-	-	-	1014	-
Stage 2	-	-	-	-	597	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	14.8
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	517
HCM Lane V/C Ratio	-	-	0.291
HCM Control Delay (s)	-	-	14.8
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	1.2

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	114	360	434	0	0	0
Future Vol, veh/h	114	360	434	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	4	0	0	0	0	0
Mvmt Flow	121	383	462	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	462	0	-	0	1087	-
Stage 1	-	-	-	-	462	-
Stage 2	-	-	-	-	625	-
Critical Hdwy	4.14	-	-	-	6.4	-
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	-
Pot Cap-1 Maneuver	1089	-	-	0	241	0
Stage 1	-	-	-	0	638	0
Stage 2	-	-	-	0	537	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1089	-	-	-	207	-
Mov Cap-2 Maneuver	-	-	-	-	207	-
Stage 1	-	-	-	-	548	-
Stage 2	-	-	-	-	537	-

Approach	EB	WB	SE
HCM Control Delay, s	2.1	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	SELn1
Capacity (veh/h)	1089	-	-	-
HCM Lane V/C Ratio	0.111	-	-	-
HCM Control Delay (s)	8.7	0	-	0
HCM Lane LOS	A	A	-	A
HCM 95th %tile Q(veh)	0.4	-	-	-

Intersection	
Int Delay, s/veh	7.7

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Vol, veh/h	0	0	0	260	236	312
Future Vol, veh/h	0	0	0	260	236	312
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	73	73	73	73	73	73
Heavy Vehicles, %	0	0	0	2	1	3
Mvmt Flow	0	0	0	356	323	427

Major/Minor	Major2		Minor1	
Conflicting Flow All	-	-	356	-
Stage 1	-	-	0	-
Stage 2	-	-	356	-
Critical Hdwy	-	-	6.41	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.41	-
Follow-up Hdwy	-	-	3.509	-
Pot Cap-1 Maneuver	0	-	644	0
Stage 1	0	-	-	0
Stage 2	0	-	711	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	644	-
Mov Cap-2 Maneuver	-	-	644	-
Stage 1	-	-	-	-
Stage 2	-	-	711	-

Approach	SB	NW
HCM Control Delay, s	0	16.1
HCM LOS		C

Minor Lane/Major Mvmt	NWLn1	SBT
Capacity (veh/h)	644	-
HCM Lane V/C Ratio	0.502	-
HCM Control Delay (s)	16.1	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	2.8	-

Intersection	
Int Delay, s/veh	16.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	38	1	46	5	1	9	1	390	12	1	233	29
Future Vol, veh/h	38	1	46	5	1	9	1	390	12	1	233	29
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	6	0	5	0	0	0	0	2	0	0	2	2
Mvmt Flow	49	1	59	6	1	12	1	500	15	1	299	37

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	13	0	0	60	0	0	298	154	31	405	177	7
Stage 1	-	-	-	-	-	-	129	129	-	19	19	-
Stage 2	-	-	-	-	-	-	169	25	-	386	158	-
Critical Hdwy	4.16	-	-	4.1	-	-	7.1	6.52	6.2	7.1	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Follow-up Hdwy	2.254	-	-	2.2	-	-	3.5	4.018	3.3	3.5	4.018	3.318
Pot Cap-1 Maneuver	1580	-	-	1556	-	-	658	738	1049	560	717	1075
Stage 1	-	-	-	-	-	-	880	789	-	1005	880	-
Stage 2	-	-	-	-	-	-	838	874	-	641	767	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1580	-	-	1556	-	-	410	711	1049	232	691	1075
Mov Cap-2 Maneuver	-	-	-	-	-	-	410	711	-	232	691	-
Stage 1	-	-	-	-	-	-	852	764	-	973	876	-
Stage 2	-	-	-	-	-	-	531	871	-	211	742	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.3	2.4	21.9	13.3
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	717	1580	-	-	1556	-	-	770
HCM Lane V/C Ratio	0.721	0.031	-	-	0.004	-	-	0.438
HCM Control Delay (s)	21.9	7.4	0	-	7.3	0	-	13.3
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	6.2	0.1	-	-	0	-	-	2.2

Intersection	
Intersection Delay, s/veh	50.1
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	127	224	5	3	321	257	2	6	4	225	9	152
Future Vol, veh/h	127	224	5	3	321	257	2	6	4	225	9	152
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	6	0	33	0	2	0	0	0	3	0	2
Mvmt Flow	132	233	5	3	334	268	2	6	4	234	9	158
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	22.3	83.8	11.5	26.1
HCM LOS	C	F	B	D

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	17%	36%	1%	58%
Vol Thru, %	50%	63%	55%	2%
Vol Right, %	33%	1%	44%	39%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	12	356	581	386
LT Vol	2	127	3	225
Through Vol	6	224	321	9
RT Vol	4	5	257	152
Lane Flow Rate	12	371	605	402
Geometry Grp	1	1	1	1
Degree of Util (X)	0.028	0.669	1.072	0.731
Departure Headway (Hd)	8.31	6.743	6.375	6.811
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	433	538	563	535
Service Time	6.31	4.743	4.469	4.811
HCM Lane V/C Ratio	0.028	0.69	1.075	0.751
HCM Control Delay	11.5	22.3	83.8	26.1
HCM Lane LOS	B	C	F	D
HCM 95th-tile Q	0.1	5	17.7	6.1

TRANSPORTATION ASSESSMENT REPORT

FOR THE PROPOSED

WAIALUA MILL AFFORDABLE HOUSING

WAIALUA, OAHU, HAWAII

TAX MAP KEY: 6-7-001:077

APPENDIX C

CAPACITY ANALYSIS WORKSHEETS

PEAK HOUR TRAFFIC WITHOUT PROJECT

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	163	155	5	5	1
Future Vol, veh/h	1	163	155	5	5	1
Conflicting Peds, #/hr	2	0	0	2	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	0	2	3	0	0	0
Mvmt Flow	1	192	182	6	6	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	190	0	-	0	381	187
Stage 1	-	-	-	-	187	-
Stage 2	-	-	-	-	194	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1396	-	-	-	625	860
Stage 1	-	-	-	-	850	-
Stage 2	-	-	-	-	844	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1393	-	-	-	622	858
Mov Cap-2 Maneuver	-	-	-	-	622	-
Stage 1	-	-	-	-	847	-
Stage 2	-	-	-	-	842	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	10.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1393	-	-	-	652
HCM Lane V/C Ratio	0.001	-	-	-	0.011
HCM Control Delay (s)	7.6	0	-	-	10.6
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	6.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	471	0	0	172	527
Future Vol, veh/h	0	471	0	0	172	527
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	71	71	71	71	71	71
Heavy Vehicles, %	0	3	2	2	3	2
Mvmt Flow	0	663	0	0	242	742

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	664	-
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	663	-
Critical Hdwy	-	-	-	-	6.43	-
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	-	-	3.527	-
Pot Cap-1 Maneuver	0	-	-	0	424	0
Stage 1	0	-	-	0	1020	0
Stage 2	0	-	-	0	511	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	424	-
Mov Cap-2 Maneuver	-	-	-	-	424	-
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	511	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	24.2
HCM LOS			C

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	424
HCM Lane V/C Ratio	-	-	0.571
HCM Control Delay (s)	-	-	24.2
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	3.5

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	179	464	397	0	0	0
Future Vol, veh/h	179	464	397	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	71	71	71	71	71	71
Heavy Vehicles, %	4	2	2	0	0	0
Mvmt Flow	252	654	559	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	559	0	-	0	1717	-
Stage 1	-	-	-	-	559	-
Stage 2	-	-	-	-	1158	-
Critical Hdwy	4.14	-	-	-	6.4	-
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	-
Pot Cap-1 Maneuver	1002	-	-	0	100	0
Stage 1	-	-	-	0	576	0
Stage 2	-	-	-	0	302	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1002	-	-	-	61	-
Mov Cap-2 Maneuver	-	-	-	-	61	-
Stage 1	-	-	-	-	348	-
Stage 2	-	-	-	-	302	-

Approach	EB	WB	SE
HCM Control Delay, s	2.7	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	SELn1
Capacity (veh/h)	1002	-	-	-
HCM Lane V/C Ratio	0.252	-	-	-
HCM Control Delay (s)	9.8	0	-	0
HCM Lane LOS	A	A	-	A
HCM 95th %tile Q(veh)	1	-	-	-

Intersection	
Int Delay, s/veh	17.2

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations				↑	Y	
Traffic Vol, veh/h	0	0	0	411	288	288
Future Vol, veh/h	0	0	0	411	288	288
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	71	71	71	71	71	71
Heavy Vehicles, %	0	0	0	2	1	2
Mvmt Flow	0	0	0	579	406	406

Major/Minor	Major2		Minor1	
Conflicting Flow All	-	-	579	-
Stage 1	-	-	0	-
Stage 2	-	-	579	-
Critical Hdwy	-	-	6.41	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.41	-
Follow-up Hdwy	-	-	3.509	-
Pot Cap-1 Maneuver	0	-	479	0
Stage 1	0	-	-	0
Stage 2	0	-	562	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	479	-
Mov Cap-2 Maneuver	-	-	479	-
Stage 1	-	-	-	-
Stage 2	-	-	562	-

Approach	SB	NW
HCM Control Delay, s	0	41.7
HCM LOS		E

Minor Lane/Major Mvmt	NWLn1	SBT
Capacity (veh/h)	479	-
HCM Lane V/C Ratio	0.847	-
HCM Control Delay (s)	41.7	-
HCM Lane LOS	E	-
HCM 95th %tile Q(veh)	8.6	-

Intersection	
Int Delay, s/veh	13.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	1	20	4	1	3	1	375	1	1	387	26
Future Vol, veh/h	19	1	20	4	1	3	1	375	1	1	387	26
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	1	22	4	1	3	1	408	1	1	421	28

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	4	0	0	23	0	0	275	66	12	270	76	3
Stage 1	-	-	-	-	-	-	54	54	-	11	11	-
Stage 2	-	-	-	-	-	-	221	12	-	259	65	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1618	-	-	1592	-	-	677	825	1069	683	814	1081
Stage 1	-	-	-	-	-	-	958	850	-	1010	886	-
Stage 2	-	-	-	-	-	-	781	886	-	746	841	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1618	-	-	1592	-	-	382	812	1069	408	801	1081
Mov Cap-2 Maneuver	-	-	-	-	-	-	382	812	-	408	801	-
Stage 1	-	-	-	-	-	-	946	839	-	997	883	-
Stage 2	-	-	-	-	-	-	397	883	-	378	830	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.4	3.6	13.9	14.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	810	1618	-	-	1592	-	-	839
HCM Lane V/C Ratio	0.506	0.013	-	-	0.003	-	-	0.536
HCM Control Delay (s)	13.9	7.3	0	-	7.3	0	-	14.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	2.9	0	-	-	0	-	-	3.3

Intersection	
Intersection Delay, s/veh	72
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	211	264	1	1	205	169	5	4	5	192	2	221
Future Vol, veh/h	211	264	1	1	205	169	5	4	5	192	2	221
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles, %	3	1	0	0	2	1	0	0	0	2	0	3
Mvmt Flow	260	326	1	1	253	209	6	5	6	237	2	273
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	114.2	40.2	13	54.4
HCM LOS	F	E	B	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	36%	44%	0%	46%
Vol Thru, %	29%	55%	55%	0%
Vol Right, %	36%	0%	45%	53%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	14	476	375	415
LT Vol	5	211	1	192
Through Vol	4	264	205	2
RT Vol	5	1	169	221
Lane Flow Rate	17	588	463	512
Geometry Grp	1	1	1	1
Degree of Util (X)	0.043	1.153	0.865	0.947
Departure Headway (Hd)	9.543	7.063	7.037	7.082
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	377	517	519	517
Service Time	7.543	5.083	5.037	5.082
HCM Lane V/C Ratio	0.045	1.137	0.892	0.99
HCM Control Delay	13	114.2	40.2	54.4
HCM Lane LOS	B	F	E	F
HCM 95th-tile Q	0.1	20.5	9.3	11.9

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	210	204	11	3	0
Future Vol, veh/h	2	210	204	11	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	0	4	0	1	0	0
Mvmt Flow	2	247	240	13	4	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	253	0	-	0	498	247
Stage 1	-	-	-	-	247	-
Stage 2	-	-	-	-	251	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1324	-	-	-	535	797
Stage 1	-	-	-	-	799	-
Stage 2	-	-	-	-	795	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1324	-	-	-	534	797
Mov Cap-2 Maneuver	-	-	-	-	534	-
Stage 1	-	-	-	-	797	-
Stage 2	-	-	-	-	795	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	11.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1324	-	-	-	534
HCM Lane V/C Ratio	0.002	-	-	-	0.007
HCM Control Delay (s)	7.7	0	-	-	11.8
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		Y	
Traffic Vol, veh/h	0	357	0	0	150	381
Future Vol, veh/h	0	357	0	0	150	381
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	0	1	5	1
Mvmt Flow	0	384	0	0	161	410

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	385	-
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	384	-
Critical Hdwy	-	-	-	-	6.45	-
Critical Hdwy Stg 1	-	-	-	-	5.45	-
Critical Hdwy Stg 2	-	-	-	-	5.45	-
Follow-up Hdwy	-	-	-	-	3.545	-
Pot Cap-1 Maneuver	0	-	-	0	612	0
Stage 1	0	-	-	0	1014	0
Stage 2	0	-	-	0	682	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	612	-
Mov Cap-2 Maneuver	-	-	-	-	612	-
Stage 1	-	-	-	-	1014	-
Stage 2	-	-	-	-	682	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	13
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	612
HCM Lane V/C Ratio	-	-	0.264
HCM Control Delay (s)	-	-	13
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	1.1

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	122	385	465	0	0	0
Future Vol, veh/h	122	385	465	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	4	0	0	0	0	0
Mvmt Flow	130	410	495	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	495	0	-	0	1165	-
Stage 1	-	-	-	-	495	-
Stage 2	-	-	-	-	670	-
Critical Hdwy	4.14	-	-	-	6.4	-
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	-
Pot Cap-1 Maneuver	1058	-	-	0	217	0
Stage 1	-	-	-	0	617	0
Stage 2	-	-	-	0	512	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1058	-	-	-	182	-
Mov Cap-2 Maneuver	-	-	-	-	182	-
Stage 1	-	-	-	-	519	-
Stage 2	-	-	-	-	512	-

Approach	EB	WB	SE
HCM Control Delay, s	2.1	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	SELn1
Capacity (veh/h)	1058	-	-	-
HCM Lane V/C Ratio	0.123	-	-	-
HCM Control Delay (s)	8.9	0	-	0
HCM Lane LOS	A	A	-	A
HCM 95th %tile Q(veh)	0.4	-	-	-

Intersection	
Int Delay, s/veh	8.5

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Vol, veh/h	0	0	0	278	253	334
Future Vol, veh/h	0	0	0	278	253	334
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	73	73	73	73	73	73
Heavy Vehicles, %	0	0	0	2	1	3
Mvmt Flow	0	0	0	381	347	458

Major/Minor	Major2		Minor1	
Conflicting Flow All	-	-	381	-
Stage 1	-	-	0	-
Stage 2	-	-	381	-
Critical Hdwy	-	-	6.41	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.41	-
Follow-up Hdwy	-	-	3.509	-
Pot Cap-1 Maneuver	0	-	623	0
Stage 1	0	-	-	0
Stage 2	0	-	693	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	623	-
Mov Cap-2 Maneuver	-	-	623	-
Stage 1	-	-	-	-
Stage 2	-	-	693	-

Approach	SB	NW
HCM Control Delay, s	0	17.8
HCM LOS		C

Minor Lane/Major Mvmt	NWLn1	SBT
Capacity (veh/h)	623	-
HCM Lane V/C Ratio	0.556	-
HCM Control Delay (s)	17.8	-
HCM Lane LOS	C	-
HCM 95th %tile Q(veh)	3.4	-

Intersection	
Int Delay, s/veh	18.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	41	1	49	5	1	10	1	417	13	1	249	31
Future Vol, veh/h	41	1	49	5	1	10	1	417	13	1	249	31
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	6	0	5	0	0	0	0	2	0	0	2	2
Mvmt Flow	53	1	63	6	1	13	1	535	17	1	319	40

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	14	0	0	64	0	0	318	165	33	435	190	8
Stage 1	-	-	-	-	-	-	139	139	-	20	20	-
Stage 2	-	-	-	-	-	-	179	26	-	415	170	-
Critical Hdwy	4.16	-	-	4.1	-	-	7.1	6.52	6.2	7.1	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Follow-up Hdwy	2.254	-	-	2.2	-	-	3.5	4.018	3.3	3.5	4.018	3.318
Pot Cap-1 Maneuver	1578	-	-	1551	-	-	639	728	1046	535	705	1074
Stage 1	-	-	-	-	-	-	869	782	-	1004	879	-
Stage 2	-	-	-	-	-	-	827	874	-	619	758	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1578	-	-	1551	-	-	378	700	1046	191	678	1074
Mov Cap-2 Maneuver	-	-	-	-	-	-	378	700	-	191	678	-
Stage 1	-	-	-	-	-	-	839	755	-	969	875	-
Stage 2	-	-	-	-	-	-	504	871	-	172	731	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.3	2.3	25.9	14.1
HCM LOS			D	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	706	1578	-	-	1551	-	-	754
HCM Lane V/C Ratio	0.783	0.033	-	-	0.004	-	-	0.478
HCM Control Delay (s)	25.9	7.4	0	-	7.3	0	-	14.1
HCM Lane LOS	D	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	7.7	0.1	-	-	0	-	-	2.6

Intersection	
Intersection Delay, s/veh	71
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	134	236	5	3	343	275	2	6	4	241	10	163
Future Vol, veh/h	134	236	5	3	343	275	2	6	4	241	10	163
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	6	0	33	0	2	0	0	0	3	0	2
Mvmt Flow	140	246	5	3	357	286	2	6	4	251	10	170
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	26.3	125.2	12.1	31.9
HCM LOS	D	F	B	D

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	17%	36%	0%	58%
Vol Thru, %	50%	63%	55%	2%
Vol Right, %	33%	1%	44%	39%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	12	375	621	414
LT Vol	2	134	3	241
Through Vol	6	236	343	10
RT Vol	4	5	275	163
Lane Flow Rate	12	391	647	431
Geometry Grp	1	1	1	1
Degree of Util (X)	0.028	0.723	1.188	0.793
Departure Headway (Hd)	8.852	7.035	6.609	7.052
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	407	520	550	518
Service Time	6.852	5.035	4.674	5.052
HCM Lane V/C Ratio	0.029	0.752	1.176	0.832
HCM Control Delay	12.1	26.3	125.2	31.9
HCM Lane LOS	B	D	F	D
HCM 95th-tile Q	0.1	5.9	23.1	7.4

TRANSPORTATION ASSESSMENT REPORT

FOR THE PROPOSED

WAIALUA MILL AFFORDABLE HOUSING

WAIALUA, OAHU, HAWAII

TAX MAP KEY: 6-7-001:077

APPENDIX D

CAPACITY ANALYSIS WORKSHEETS

PEAK HOUR TRAFFIC WITH PROJECT

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	163	155	38	106	1
Future Vol, veh/h	1	163	155	38	106	1
Conflicting Peds, #/hr	2	0	0	2	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	0	2	3	0	0	0
Mvmt Flow	1	192	182	45	125	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	229	0	-	0	401	207
Stage 1	-	-	-	-	207	-
Stage 2	-	-	-	-	194	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1351	-	-	-	609	839
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	844	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1348	-	-	-	606	837
Mov Cap-2 Maneuver	-	-	-	-	606	-
Stage 1	-	-	-	-	830	-
Stage 2	-	-	-	-	842	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1348	-	-	-	608
HCM Lane V/C Ratio	0.001	-	-	-	0.207
HCM Control Delay (s)	7.7	0	-	-	12.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.8

Intersection	
Int Delay, s/veh	7.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	571	0	0	166	552
Future Vol, veh/h	0	571	0	0	166	552
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	71	71	71	71	71	71
Heavy Vehicles, %	0	3	2	2	3	2
Mvmt Flow	0	804	0	0	234	777

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	805	-
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	804	-
Critical Hdwy	-	-	-	-	6.43	-
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	-	-	3.527	-
Pot Cap-1 Maneuver	0	-	-	0	350	0
Stage 1	0	-	-	0	1020	0
Stage 2	0	-	-	0	439	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	350	-
Mov Cap-2 Maneuver	-	-	-	-	350	-
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	439	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	33.7
HCM LOS			D

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	350
HCM Lane V/C Ratio	-	-	0.668
HCM Control Delay (s)	-	-	33.7
HCM Lane LOS	-	-	D
HCM 95th %tile Q(veh)	-	-	4.6

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	179	558	430	0	0	0
Future Vol, veh/h	179	558	430	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	71	71	71	71	71	71
Heavy Vehicles, %	4	2	2	0	0	0
Mvmt Flow	252	786	606	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	606	0	-	0	1896	-
Stage 1	-	-	-	-	606	-
Stage 2	-	-	-	-	1290	-
Critical Hdwy	4.14	-	-	-	6.4	-
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	-
Pot Cap-1 Maneuver	962	-	-	0	77	0
Stage 1	-	-	-	0	548	0
Stage 2	-	-	-	0	261	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	962	-	-	-	41	-
Mov Cap-2 Maneuver	-	-	-	-	41	-
Stage 1	-	-	-	-	293	-
Stage 2	-	-	-	-	261	-

Approach	EB	WB	SE
HCM Control Delay, s	2.4	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	SELn1
Capacity (veh/h)	962	-	-	-
HCM Lane V/C Ratio	0.262	-	-	-
HCM Control Delay (s)	10.1	0	-	0
HCM Lane LOS	B	A	-	A
HCM 95th %tile Q(veh)	1.1	-	-	-

Intersection	
Int Delay, s/veh	23.2

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations				↑	Y	
Traffic Vol, veh/h	0	0	0	397	321	288
Future Vol, veh/h	0	0	0	397	321	288
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	71	71	71	71	71	71
Heavy Vehicles, %	0	0	0	2	1	2
Mvmt Flow	0	0	0	559	452	406

Major/Minor	Major2		Minor1	
Conflicting Flow All	-	-	559	-
Stage 1	-	-	0	-
Stage 2	-	-	559	-
Critical Hdwy	-	-	6.41	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.41	-
Follow-up Hdwy	-	-	3.509	-
Pot Cap-1 Maneuver	0	-	492	0
Stage 1	0	-	-	0
Stage 2	0	-	574	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	492	-
Mov Cap-2 Maneuver	-	-	492	-
Stage 1	-	-	-	-
Stage 2	-	-	574	-

Approach	SB	NW
HCM Control Delay, s	0	52
HCM LOS		F

Minor Lane/Major Mvmt	NWLn1	SBT
Capacity (veh/h)	492	-
HCM Lane V/C Ratio	0.919	-
HCM Control Delay (s)	52	-
HCM Lane LOS	F	-
HCM 95th %tile Q(veh)	10.8	-

Intersection	
Int Delay, s/veh	16.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	67	0	6	4	1	3	1	375	1	1	387	44
Future Vol, veh/h	67	0	6	4	1	3	1	375	1	1	387	44
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	73	0	7	4	1	3	1	408	1	1	421	48

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	4	0	0	7	0	0	371	162	4	365	164	3
Stage 1	-	-	-	-	-	-	150	150	-	11	11	-
Stage 2	-	-	-	-	-	-	221	12	-	354	153	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1618	-	-	1614	-	-	586	730	1080	591	729	1081
Stage 1	-	-	-	-	-	-	853	773	-	1010	886	-
Stage 2	-	-	-	-	-	-	781	886	-	663	771	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1618	-	-	1614	-	-	281	696	1080	306	695	1081
Mov Cap-2 Maneuver	-	-	-	-	-	-	281	696	-	306	695	-
Stage 1	-	-	-	-	-	-	815	738	-	965	884	-
Stage 2	-	-	-	-	-	-	390	884	-	283	736	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	6.7	3.6	17.4	17.3
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	694	1618	-	-	1614	-	-	754
HCM Lane V/C Ratio	0.59	0.045	-	-	0.003	-	-	0.623
HCM Control Delay (s)	17.4	7.3	0	-	7.2	0	-	17.3
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	3.9	0.1	-	-	0	-	-	4.4

Intersection	
Intersection Delay, s/veh	124.1
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	253	317	1	1	221	169	5	4	5	192	2	238
Future Vol, veh/h	253	317	1	1	221	169	5	4	5	192	2	238
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles, %	3	1	0	0	2	1	0	0	0	2	0	3
Mvmt Flow	312	391	1	1	273	209	6	5	6	237	2	294
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	221.2	48.8	14	67.5
HCM LOS	F	E	B	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	36%	44%	0%	44%
Vol Thru, %	29%	56%	57%	0%
Vol Right, %	36%	0%	43%	55%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	14	571	391	432
LT Vol	5	253	1	192
Through Vol	4	317	221	2
RT Vol	5	1	169	238
Lane Flow Rate	17	705	483	533
Geometry Grp	1	1	1	1
Degree of Util (X)	0.044	1.42	0.907	0.996
Departure Headway (Hd)	10.489	7.254	7.527	7.492
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	343	508	488	491
Service Time	8.489	5.257	5.527	5.492
HCM Lane V/C Ratio	0.05	1.388	0.99	1.086
HCM Control Delay	14	221.2	48.8	67.5
HCM Lane LOS	B	F	E	F
HCM 95th-tile Q	0.1	33.8	10.3	13.3

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	210	204	127	73	0
Future Vol, veh/h	2	210	204	127	73	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	0	4	0	1	0	0
Mvmt Flow	2	247	240	149	86	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	389	0	-	0	566	315
Stage 1	-	-	-	-	315	-
Stage 2	-	-	-	-	251	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1181	-	-	-	489	730
Stage 1	-	-	-	-	744	-
Stage 2	-	-	-	-	795	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1181	-	-	-	488	730
Mov Cap-2 Maneuver	-	-	-	-	488	-
Stage 1	-	-	-	-	743	-
Stage 2	-	-	-	-	795	-

Approach	EB		WB		SB
HCM Control Delay, s	0.1		0		13.9
HCM LOS					B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1181	-	-	-	488
HCM Lane V/C Ratio	0.002	-	-	-	0.176
HCM Control Delay (s)	8.1	0	-	-	13.9
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.6

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		Y	
Traffic Vol, veh/h	0	426	0	0	143	491
Future Vol, veh/h	0	426	0	0	143	491
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	0	1	5	1
Mvmt Flow	0	458	0	0	154	528

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	459	-
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	458	-
Critical Hdwy	-	-	-	-	6.45	-
Critical Hdwy Stg 1	-	-	-	-	5.45	-
Critical Hdwy Stg 2	-	-	-	-	5.45	-
Follow-up Hdwy	-	-	-	-	3.545	-
Pot Cap-1 Maneuver	0	-	-	0	555	0
Stage 1	0	-	-	0	1014	0
Stage 2	0	-	-	0	631	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	555	-
Mov Cap-2 Maneuver	-	-	-	-	555	-
Stage 1	-	-	-	-	1014	-
Stage 2	-	-	-	-	631	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	14
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	555
HCM Lane V/C Ratio	-	-	0.277
HCM Control Delay (s)	-	-	14
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	1.1

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	122	448	580	0	0	0
Future Vol, veh/h	122	448	580	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	4	0	0	0	0	0
Mvmt Flow	130	477	617	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	617	0	-	0	1354	-
Stage 1	-	-	-	-	617	-
Stage 2	-	-	-	-	737	-
Critical Hdwy	4.14	-	-	-	6.4	-
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.236	-	-	-	3.5	-
Pot Cap-1 Maneuver	953	-	-	0	167	0
Stage 1	-	-	-	0	542	0
Stage 2	-	-	-	0	477	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	953	-	-	-	136	-
Mov Cap-2 Maneuver	-	-	-	-	136	-
Stage 1	-	-	-	-	441	-
Stage 2	-	-	-	-	477	-

Approach	EB	WB	SE
HCM Control Delay, s	2	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	SELn1
Capacity (veh/h)	953	-	-	-
HCM Lane V/C Ratio	0.136	-	-	-
HCM Control Delay (s)	9.4	0	-	0
HCM Lane LOS	A	A	-	A
HCM 95th %tile Q(veh)	0.5	-	-	-

Intersection	
Int Delay, s/veh	16.7

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Vol, veh/h	0	0	0	266	369	333
Future Vol, veh/h	0	0	0	266	369	333
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	73	73	73	73	73	73
Heavy Vehicles, %	0	0	0	2	1	3
Mvmt Flow	0	0	0	364	505	456

Major/Minor	Major2		Minor1	
Conflicting Flow All	-	-	364	-
Stage 1	-	-	0	-
Stage 2	-	-	364	-
Critical Hdwy	-	-	6.41	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.41	-
Follow-up Hdwy	-	-	3.509	-
Pot Cap-1 Maneuver	0	-	637	0
Stage 1	0	-	-	0
Stage 2	0	-	705	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	637	-
Mov Cap-2 Maneuver	-	-	637	-
Stage 1	-	-	-	-
Stage 2	-	-	705	-

Approach	SB	NW
HCM Control Delay, s	0	28.8
HCM LOS		D

Minor Lane/Major Mvmt	NWLn1	SBT
Capacity (veh/h)	637	-
HCM Lane V/C Ratio	0.794	-
HCM Control Delay (s)	28.8	-
HCM Lane LOS	D	-
HCM 95th %tile Q(veh)	7.8	-

Intersection	
Int Delay, s/veh	23.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	67	1	37	5	0	10	1	417	13	1	249	56
Future Vol, veh/h	67	1	37	5	0	10	1	417	13	1	249	56
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	6	0	5	0	0	0	0	2	0	0	2	2
Mvmt Flow	86	1	47	6	0	13	1	535	17	1	319	72

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	13	0	0	48	0	0	375	222	25	492	239	7
Stage 1	-	-	-	-	-	-	197	197	-	19	19	-
Stage 2	-	-	-	-	-	-	178	25	-	473	220	-
Critical Hdwy	4.16	-	-	4.1	-	-	7.1	6.52	6.2	7.1	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Follow-up Hdwy	2.254	-	-	2.2	-	-	3.5	4.018	3.3	3.5	4.018	3.318
Pot Cap-1 Maneuver	1580	-	-	1572	-	-	586	677	1057	490	662	1075
Stage 1	-	-	-	-	-	-	809	738	-	1005	880	-
Stage 2	-	-	-	-	-	-	828	874	-	576	721	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1580	-	-	1572	-	-	312	636	1057	136	622	1075
Mov Cap-2 Maneuver	-	-	-	-	-	-	312	636	-	136	622	-
Stage 1	-	-	-	-	-	-	764	697	-	949	876	-
Stage 2	-	-	-	-	-	-	489	871	-	125	681	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4.7	2.4	35.4	14.9
HCM LOS			E	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	642	1580	-	-	1572	-	-	751
HCM Lane V/C Ratio	0.861	0.054	-	-	0.004	-	-	0.522
HCM Control Delay (s)	35.4	7.4	0	-	7.3	0	-	14.9
HCM Lane LOS	E	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	9.9	0.2	-	-	0	-	-	3.1

Intersection	
Intersection Delay, s/veh	124.6
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	159	280	5	3	421	275	2	6	4	241	10	200
Future Vol, veh/h	159	280	5	3	421	275	2	6	4	241	10	200
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	6	0	33	0	2	0	0	0	3	0	2
Mvmt Flow	166	292	5	3	439	286	2	6	4	251	10	208
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	44.7	228.7	13.4	45
HCM LOS	E	F	B	E

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	17%	36%	0%	53%
Vol Thru, %	50%	63%	60%	2%
Vol Right, %	33%	1%	39%	44%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	12	444	699	451
LT Vol	2	159	3	241
Through Vol	6	280	421	10
RT Vol	4	5	275	200
Lane Flow Rate	12	462	728	470
Geometry Grp	1	1	1	1
Degree of Util (X)	0.031	0.88	1.439	0.883
Departure Headway (Hd)	10.094	7.586	7.113	7.554
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	357	481	517	484
Service Time	8.094	5.586	5.115	5.554
HCM Lane V/C Ratio	0.034	0.96	1.408	0.971
HCM Control Delay	13.4	44.7	228.7	45
HCM Lane LOS	B	E	F	E
HCM 95th-tile Q	0.1	9.5	35.5	9.6

TRANSPORTATION ASSESSMENT REPORT

FOR THE PROPOSED

WAIALUA MILL AFFORDABLE HOUSING

WAIALUA, OAHU, HAWAII

TAX MAP KEY: 6-7-001:077

APPENDIX E

CAPACITY ANALYSIS WORKSHEETS

PEAK HOUR TRAFFIC WITH PROJECT

WITH IMPROVEMENTS

Intersection	
Intersection Delay, s/veh	14.9
Intersection LOS	B

Approach	EB	WB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	806	606	559
Demand Flow Rate, veh/h	823	618	573
Vehicles Circulating, veh/h	241	252	461
Vehicles Exiting, veh/h	792	812	409
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	17.2	11.0	15.7
Approach LOS	C	B	C

Lane	Left	Left	Left
Designated Moves	LT	TR	LR
Assumed Moves	LT	TR	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	823	618	573
Cap Entry Lane, veh/h	1079	1067	862
Entry HV Adj Factor	0.980	0.981	0.976
Flow Entry, veh/h	806	606	559
Cap Entry, veh/h	1057	1046	841
V/C Ratio	0.763	0.579	0.665
Control Delay, s/veh	17.2	11.0	15.7
LOS	C	B	C
95th %tile Queue, veh	8	4	5

Intersection	
Intersection Delay, s/veh	11.3
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	704	483	17	533
Demand Flow Rate, veh/h	717	490	17	547
Vehicles Circulating, veh/h	245	332	958	285
Vehicles Exiting, veh/h	587	643	4	537
Ped Vol Crossing Leg, #/h	0	1	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.3	9.8	7.3	10.2
Approach LOS	B	A	A	B

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	717	490	17	547
Cap Entry Lane, veh/h	1075	984	519	1032
Entry HV Adj Factor	0.982	0.985	1.000	0.974
Flow Entry, veh/h	704	483	17	533
Cap Entry, veh/h	1055	968	519	1005
V/C Ratio	0.667	0.498	0.033	0.530
Control Delay, s/veh	13.3	9.8	7.3	10.2
LOS	B	A	A	B
95th %tile Queue, veh	5	3	0	3

Intersection	
Intersection Delay, s/veh	13.4
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	67	1	6	4	1	3	1	375	1	1	387	44
Future Vol, veh/h	67	1	6	4	1	3	1	375	1	1	387	44
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	73	1	7	4	1	3	1	408	1	1	421	48
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.1	9.1	13.1	14.3
HCM LOS	B	A	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	91%	50%	0%
Vol Thru, %	99%	1%	12%	90%
Vol Right, %	0%	8%	38%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	377	74	8	432
LT Vol	1	67	4	1
Through Vol	375	1	1	387
RT Vol	1	6	3	44
Lane Flow Rate	410	80	9	470
Geometry Grp	1	1	1	1
Degree of Util (X)	0.535	0.136	0.015	0.599
Departure Headway (Hd)	4.704	6.094	6.028	4.591
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	762	592	597	779
Service Time	2.767	4.096	4.031	2.649
HCM Lane V/C Ratio	0.538	0.135	0.015	0.603
HCM Control Delay	13.1	10.1	9.1	14.3
HCM Lane LOS	B	B	A	B
HCM 95th-tile Q	3.2	0.5	0	4.1

Intersection	
Intersection Delay, s/veh	8.1
Intersection LOS	A

Approach	EB	WB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	459	624	285
Demand Flow Rate, veh/h	475	626	294
Vehicles Circulating, veh/h	162	134	397
Vehicles Exiting, veh/h	529	503	363
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	7.4	8.8	7.5
Approach LOS	A	A	A

Lane	Left	Left	Left
Designated Moves	LT	TR	LR
Assumed Moves	LT	TR	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	475	626	294
Cap Entry Lane, veh/h	1170	1204	920
Entry HV Adj Factor	0.966	0.997	0.969
Flow Entry, veh/h	459	624	285
Cap Entry, veh/h	1130	1200	892
V/C Ratio	0.406	0.520	0.319
Control Delay, s/veh	7.4	8.8	7.5
LOS	A	A	A
95th %tile Queue, veh	2	3	1

Intersection	
Intersection Delay, s/veh	11.0
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	463	728	12	469
Demand Flow Rate, veh/h	484	735	12	481
Vehicles Circulating, veh/h	273	177	738	445
Vehicles Exiting, veh/h	653	573	19	467
Ped Vol Crossing Leg, #/h	0	1	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.0	11.7	5.7	12.0
Approach LOS	A	B	A	B

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	484	735	12	481
Cap Entry Lane, veh/h	1045	1152	650	876
Entry HV Adj Factor	0.958	0.990	1.000	0.975
Flow Entry, veh/h	463	728	12	469
Cap Entry, veh/h	1000	1141	650	855
V/C Ratio	0.463	0.638	0.018	0.549
Control Delay, s/veh	9.0	11.7	5.7	12.0
LOS	A	B	A	B
95th %tile Queue, veh	2	5	0	3

Intersection	
Intersection Delay, s/veh	17.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	67	1	37	5	1	10	1	417	13	1	249	56
Future Vol, veh/h	67	1	37	5	1	10	1	417	13	1	249	56
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Heavy Vehicles, %	6	0	5	0	0	0	0	2	0	0	2	2
Mvmt Flow	86	1	47	6	1	13	1	535	17	1	319	72
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	11.1	9.5	21.4	13.9
HCM LOS	B	A	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	64%	31%	0%
Vol Thru, %	97%	1%	6%	81%
Vol Right, %	3%	35%	62%	18%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	431	105	16	306
LT Vol	1	67	5	1
Through Vol	417	1	1	249
RT Vol	13	37	10	56
Lane Flow Rate	553	135	21	392
Geometry Grp	1	1	1	1
Degree of Util (X)	0.755	0.232	0.035	0.545
Departure Headway (Hd)	4.921	6.197	6.196	4.997
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	740	579	575	722
Service Time	2.921	4.245	4.26	3.03
HCM Lane V/C Ratio	0.747	0.233	0.037	0.543
HCM Control Delay	21.4	11.1	9.5	13.9
HCM Lane LOS	C	B	A	B
HCM 95th-tile Q	7	0.9	0.1	3.3