Water has no substitute……. Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

Ms. Mary Alice Evans, Director
State of Hawai'i,
Office of Planning and Sutainable Development
Environmental Review Program
235 South Beretania Street, Room 702
Honolulu, Hawai'i 96813

SUBJECT: Final Environmental Assessment (FEA) and
Finding of No Significant Impact (FONSI)
Kapa'a Homesteads 325' Tanks and Exploratory Well
Kawaihau District, Kapa'a, Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011: 003 and (4) 4-6-011: 125

Dear Ms. Evans:

With this letter, the County of Kaua'i, Department of Water hereby transmits the Final Environmental Assessment (FEA) for the Kapa'a Homesteads 325' Tanks and Exploratory Well for publication in the upcoming September 8, 2024 edition of *The Environmental Notice*. The proposed action includes the construction of two 0.5-million-gallon (MG) reservoirs, drainage site improvements, and pump testing of an exploratory well. Based on the comments received during the 30-day public comment period for the Draft Environmental Assessment, and pursuant to the significance criteria specified in the Hawai'i Administrative Rules, Section 11-200.1-13, we hereby issue a Finding of No Significant Impact (FONSI). The FEA has been prepared pursuant to Chapter 343, Hawai'i Revised Statutes and Chapter 11-200.1, Hawai'i Administrative Rules.

An electronic copy of the FEA and FONSI has been uploaded to the Environmental Review Program's online submission portal.

Should you have any questions, please contact Jason Kagimoto at (808) 245-5417 or by email at jkagimoto@kauaiwater.org.

Sincerely,

Scott Suga

Scott I. Suga, Project Management Officer
Department of Water
County of Kaua'i

c: Jared Chang, Bowers + Kubota Consulting, Inc.

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Friday, August 30, 2024 2:28:28 PM

Action Name

Kapaa Homesteads 325' Tanks and Exploratory Well

Type of Document/Determination

Final environmental assessment and finding of no significant impact (FEA-FONSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds

Judicial district

Kawaihau, Kauaʻi

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

(4) 4-6-011:003; (4) 4-6-011:125

Action type

Agency

Other required permits and approvals

Various, see Final EA

Proposing/determining agency

County of Kauai, Department of Water

Agency contact name

Scott Suga

Agency contact email (for info about the action)

sisuga@kauaiwater.org

Agency contact phone

(808) 245-5411

Agency address

4398 Pua Loke Street
Lihue, Hawaii 96766
United States
Map It

Is there a consultant for this action?

Yes

Consultant

Bowers + Kubota Consulting, Inc

Consultant contact name

Jared Chang

Consultant contact email

jchang@bowersandkubota.com

Consultant contact phone

(808) 836-7787

Consultant address

2153 N. King Street
Suite 200
Honolulu, Hawaii 96819
United States
Map It

Action summary

The County of Kauai, Department of Water is proposing to construct two 0.5-million-gallon (MG) reservoirs, named Kapa‘a Homesteads 325’ Tanks, at the Ornellas Tank Site in Kawaihau, Kaua‘i, Hawai‘i. The new tanks will supplement the site’s existing 0.2-MG storage facility. An exploratory well (Kapa‘a Homesteads Well No. 4) has been drilled at this site adjacent to the existing Ornellas Tank. This well needs to be tested to determine its source capacity to allow the DOW to move forward with the permitting and design of its well pump and operational controls. The overall objective of the Proposed Action is to provide additional water storage and water source for the Wailua-Kapa‘a community. A new drainage line for the tanks and well site has been installed along Ka‘apuni Road but is not currently in service. The proposed outlet for the drain line is on a non-contiguous, privately-owned parcel adjacent to Ka‘apuni Road. The permitting and construction of the outlet needs to be completed.

Reasons supporting determination

See Section 9 of the Final EA

Attached documents (signed agency letter & EA/EIS)

- 240830-Final-EA-Kapaa-Homestead-Tank-with-Appendices.pdf
- 240830-Final-EA-Kapaa-Homestead-Tank-Transmittal-Letter-signed.pdf

Shapefile

- The location map for this Final EA is the same as the location map for the associated Draft EA.

Action location map

- Kapaa-Homestead-Tanks-and-Exploratory-Well-Proj-Location.zip

Authorized individual

Carah Kadota

Authorization

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

KAPA‘A HOMESTEADS 325' TANKS AND EXPLORATORY WELL

FINAL ENVIRONMENTAL ASSESSMENT

Prepared for:
Department of Water, County of Kaua‘i

Prepared by:
Bowers + Kubota Consulting, Inc.

September 2024

FINAL ENVIRONMENTAL ASSESSMENT

KAPA‘A HOMESTEADS 325’ TANKS AND EXPLORATORY WELL

KAPA‘A, KAUA‘I, HAWAI‘I

PREPARED FOR:

DEPARTMENT OF WATER

COUNTY OF KAUA‘I

PREPARED BY:

BOWERS + KUBOTA CONSULTING, INC.

SEPTEMBER 2024

TABLE OF CONTENTS

1 DESCRIPTION OF THE PROPOSED ACTION 1-1
1.1 Background 1-1
1.2 Purpose of Environmental Assessment 1-1
1.3 Description of the Proposed Action 1-2
1.4 Estimated Cost 1-11
1.5 Construction Schedule 1-11
2 DESCRIPTION OF THE EXISTING ENVIRONMENT 2-1
2.1 Regional Setting 2-1
2.2 Land Use and Existing Water System 2-1
2.3 Land Tenure 2-4
2.4 Physiography 2-4
2.5 Geology 2-4
2.6 Hydrology 2-6
2.7 Soils 2-12
2.8 Flora 2-12
2.9 Fauna 2-14
2.10 Climate 2-15
2.11 Natural Hazards 2-15
2.12 Air Quality 2-15
2.13 Acoustical Environment 2-16
2.14 Scenic Resources 2-16
2.15 Archaeological Resources 2-16
2.16 Cultural Resources 2-17
3 SOCIO-ECONOMIC SETTING 3-1
3.1 Socio-Economic Background of the Region 3-1
3.2 Economic Impacts Assessment 3-1
3.3 Social Considerations 3-2
4 PUBLIC FACILITIES AND SERVICES 4-1
4.1 Circulation and Traffic 4-1
4.2 Water, Sewer, Electricity, and Telephone 4-1
4.3 Solid Waste 4-2
4.4 Public Facilities and Services 4-2

5 RELATIONSHIP TO PUBLIC LAND USE POLICIES 5-1
5.1 Hawai‘i State Plan 5-1
5.2 State Land Use Law 5-2
5.3 State Environmental Policy 5-2
5.4 Hawai‘i Coastal Zone Management Program 5-4
5.5 Kaua‘i County General Plan 5-9
5.6 Kapa‘a-Wailua Development Plan 5-10
5.7 Water Plan 2020 5-10
5.8 Kaua‘i County Zoning Ordinance 5-10
5.9 Special Management Area 5-11
5.10 Required Permits and Approvals 5-11
6 DESCRIPTION OF AFFECTED ENVIRONMENT AND MITIGATION MEASURES 6-1
6.1 Construction Methodology and Impacts 6-1
6.2 Surface Water and Soil 6-1
6.3 Groundwater 6-2
6.4 Air Quality 6-2
6.5 Noise 6-2
6.6 Archaeological Resources 6-2
6.7 Solid Waste 6-2
6.8 View Plane 6-3
6.9 Traffic 6-3
6.10 Biological Resources 6-3
7 ALTERNATIVES CONSIDERED 7-1
7.1 No Action 7-1
7.2 Increasing Existing Tank Size 7-1
7.3 Alternative Tank Configurations 7-2
7.4 Alternative Location 7-2
7.5 Alternative Drainage Improvements 7-3
8 DETERMINATION 8-1
9 FINDINGS AND REASONS SUPPORTING DETERMINATION 9-1
10 AGENCIES AND ORGANIZATIONS CONSULTED 10-1
11 REFERENCES 11-1

LIST OF FIGURES

Figure 1-1 Project Location Map 1-6
Figure 1-2 Proposed Improvements 1-7
Figure 1-3 Storage Tank Section 1-8
Figure 1-4 Ornellas Tank Site Layout 1-9
Figure 1-5 Section Thru Exploratory Well 1-10
Figure 2-1 Wailua-Kapa‘a Water System Pressure Zones 2-3
Figure 2-2 Site Photos 2-5
Figure 2-3 Ground Water Hydrologic Units and 2019 Sustainable Yields 2-7
Figure 2-4 Plat Map – Easement F Location 2-11
Figure 2-5 Soil Map 2-13
Figure 2-6 Survey Map from 1905 2-19
Figure 2-7 Survey Map from 1956 2-20
Figure 4-1 Public Facilities 4-4
Figure 4-2 County Bus Routes 4-5
Figure 5-1 State Land Use Districts 5-3
Figure 5-2 County of Kaua‘i General Plan Land Use Designations 5-12
Figure 5-3 County of Kaua‘i Zoning 5-13

LIST OF TABLES

Table 2-1 Wailua-Kapa‘a System Sources 2-2
Table 2-2 Storage Facilities in the Wailua-Kapa‘a Water System 2-2
Table 2-3 Nearby Wells 2-8
Table 2-4 Potential Well Sites 2-9
Table 2-5 Observed Avifauna Species 2-14
Table 10-1 Agencies and Organizations Consulted 10-1
Table 10-2 Pre-Assessment Consultation Comments and Responses 10-5

APPENDICES

APPENDIX A DRAFT EA COMMENT AND RESPONSE LETTERS

APPENDIX B PHASE 1 SITE SELECTION REPORT FOR KAPA‘A HOMESTEADS WELL NO. 4

APPENDIX C FLORA AND FAUNA SURVEY REPORT

APPENDIX D ARCHAEOLOGICAL ASSESSMENT

APPENDIX E CULTURAL IMPACT ASSESSMENT

APPENDIX F FINAL DRAINAGE REPORT

ACRONYMS AND ABBREVIATIONS

BMP	Best Management Practices
CIA	Cultural Impact Assessment
cmu	concrete masonry unit
CO	carbon monoxide
CSH	Cultural Surveys Hawai‘i, Inc.
CZM	Coastal Zone Management
CZO	Comprehensive Zoning Ordinance
DAGS	Department of Accounting and General Services, State of Hawai‘i
DEA	Draft Environmental Assessment
DLNR	Department of Land and Natural Resources, State of Hawai‘i
DOH	Department of Health, State of Hawai‘i
DOW	Department of Water, County of Kaua‘i
EA	Environmental Assessment
EIS	Environmental Impact Statement
EKWUC	East Kaua‘i Water Users’ Cooperative
EPA	U.S. Environmental Protection Agency
ERP	Environmental Review Program
FEA	Final Environmental Assessment
FEA-FONSI	Final Environmental Assessment, Finding of No Significant Impact
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FWS	U.S. Fish and Wildlife Service
HAR	Hawai‘i Administrative Rules
HDOT	Department of Transportation, State of Hawai‘i
HRS	Hawai‘i Revised Statutes
KIUC	Kaua‘i Island Utility Cooperative
MDD	Maximum Day Demand
MG	million gallons
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NFIP	National Flood Insurance Program
NO2	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
O3	ozone
Pb	lead
SHPD	State Historic Preservation Division
SO2	Sulfur dioxide
TMK	Tax Map Key
USGS	U.S. Geological Survey

PROJECT SUMMARY

PROJECT NAME:	Kapa‘a Homesteads 325’ Tanks and Exploratory Well
PROPOSING/DETERMINING AGENCY:	Department of Water (DOW), County of Kaua‘i 4398 Pua Loke Street Līhu‘e, Kaua‘i 96766 Contact: Scott Suga, Project Management Officer Email: sisuga@kauaiwater.org Phone: 808-245-5411
CONSULTANT:	Bowers + Kubota Consulting, Inc. 2153 N. King St., Suite 200 Honolulu, Hawai‘i 96819 Contact: Jared Chang, AICP Email: jchang@bowersandkubota.com Phone: 808-836-7787
LOCATION:	Kawaihau District, Kapa‘a, Kaua‘i, Hawai‘i
TAX MAP KEYS:	Ornellas Tank Site: (4) 4-6-011: 003 Drainage Site: (4) 4-6-011: 125
GENERAL PROJECT DESCRIPTION:	The DOW is proposing to construct two 0.5-million-gallon (MG) reservoirs, named Kapa‘a Homesteads 325’ Tanks, at the Ornellas Tank Site in Kawaihau, Kaua‘i, Hawai‘i. The new tanks will supplement the site’s existing 0.2-MG storage facility. An exploratory well (Kapa‘a Homesteads Well No. 4) has been drilled at this site adjacent to the existing Ornellas Tank. This well needs to be tested to determine its source capacity to allow the DOW to move forward with the permitting and design of its well pump and operational controls. The overall objective of the Proposed Action is to provide additional water storage and water source for the Wailua-Kapa‘a community. A new drainage line for the tanks and well site has been installed along Ka‘apuni Road but is not currently in service. The proposed outlet for the drain line is on a non-contiguous, privately-owned parcel adjacent to Ka‘apuni Road. The permitting and construction of the outlet needs to be completed.
PROJECT SITE:	The Ornellas Tank Site is located at the intersection of Kawaihau Road and Ka‘apuni Road of the Kapa‘a

	Homesteads in Kawaihau, Kaua‘i (see Figure 1-1). The 0.836-acre property, which is identified by Tax Map Key (TMK) as (4) 4-6-011:003 (see Figure 1-2), is owned by the State of Hawai‘i and utilized by the County of Kaua‘i via the Governor’s Executive Order No. 1091. The drainage improvements for the project will be located on approximately 0.55 miles of Ka‘apuni Road and a privately owned property identified by TMK: (4) 4-6-011:125,
HAWAI‘I REVISED STATUTES §343-5(a) TRIGGER:	(1) Propose the use of State or County Lands or the use of State or County funds
STATE LAND USE DISTRICT:	Agricultural
COUNTY OF KAUA‘I ZONING:	Agricultural
COUNTY OF KAUA‘I GENERAL PLAN LAND USE DESIGNATION:	Residential Community and Agricultural
PERMITS ANTICIPATED:	Zoning Permit Use Permit Variance Permit Noise Permit
DETERMINATION:	Finding of No Significant Impact (FONSI)

1 DESCRIPTION OF THE PROPOSED ACTION

1.1 BACKGROUND

The Wailua-Kapa‘a Water System serves an area that has continued to grow over the past 30 years with a population increase of approximately 46 percent from 1990 (13,449 people) to 2021 (19,583 people).[1] The service area includes the Wailua-Waipouli Resort area, Wailua Houselots, Wailua Homesteads, Kapa‘a town, and Kapa‘a Homesteads. New developments have and will continue to include residential and agricultural subdivisions, individual homes, and new business enterprises, which will increase the demand for potable water in the project service area.

The water system that presently serves the Wailua-Kapa‘a community in the Kawaihau District of Kaua‘i lacks adequate storage capacity to meet Maximum Day Demand (MDD) and County fire flow requirements. In the event of prolonged periods of peak day demand or during events of extreme emergencies, inadequate storage capacity may cause a negative effect on DOW’s capability to sufficiently serve its customers and more concerning its critical facilities, which include the Samuel Mahelona Memorial Hospital, Kapa‘a Elementary, and Kapa‘a High School. These facilities are also designated and serve as emergency shelters. DOW’s plan for the Wailua-Kapa‘a Water System is to add additional potable water storage capacity in an appropriate pressure zone where the tanks can effectively integrate with its existing water system, and to locate it on a site that is readily available for use.

As the resident population in the region continues to grow, additional sources of water will be required to meet the requirements of the service area. The Kapa‘a Homesteads Exploratory Well No. 4 has been drilled to supplement the water sources of the Wailua-Kapa‘a Water System. Preliminary hydro-geological studies suggest that a potential groundwater resource with a sustainable yield may be available at this location. The stormwater drainage system for the Kapa‘a Homesteads 325’ Tanks site has been designed to collect the stormwater runoff from the tank site and accommodate the runoff from the Kawaihau Road section that currently flows to the tank site. The runoff from the Ornellas Tank site currently discharges into an existing gulch. The stormwater will be collected and conveyed via a drain line on Ka‘apuni Road and discharged into an existing stream which currently receives the flow from the existing Ornellas Tank discharge. The drain line on Ka‘apuni Road conveys the flow from the Kapa‘a Homesteads 325’ Tanks site and does not collect additional runoff from Ka‘apuni Road or parcels along the road.

1.2 PURPOSE OF ENVIRONMENTAL ASSESSMENT

To meet the needs of the Wailua-Kapa‘a area and the surrounding community, this project will construct two (2) new 0.5 MG water storage tanks adjacent to the existing Kapa‘a Homesteads Exploratory Well No. 4 within the Kapa‘a Homesteads community located in the Kawaihau

[1] U.S. Census American Community Survey 2021 5-yr Estimates – Census Tracts 402.04, 402.05, 403.01 and 403.02.

District of Kaua‘i (see Figure 1-1). The selected location for the project is located on two sites. The new storage tanks will be built on the existing 0.2-MG Ornellas Storage Tank site (Ornellas Tank Site) (see Figure 1-2) which is strategically situated within a high growth area of Kapa‘a and services a pressure zone that can effectively serve the area’s customers.

The proposed drainage improvements include connecting to an existing drainage line along Ka‘apuni Road and providing a new drainage outlet in a non-contiguous privately owned property downhill of the Ornellas Tank Site, identified as TMK: (4) 4-6-011:125 (Drainage Site) (see Figure 1-2). The drainage line will convey runoff collected from the Ornellas Tank Site and adjacent Kawaihau Road and discharge to an existing gulch.

In 2011, the DOW published a Final Environmental Assessment, Finding of No Significant Impact (FEA-FONSI) for the Kapahi Homesteads Storage Tanks and Exploratory Well, which included the Proposed Action of constructing the two 0.5 MG water storage tanks and drilling of the exploratory well at the Ornellas Tank Site. The 2011 FEA-FONSI identified a perimeter drain line from the new tanks to connect with a new 18-inch diameter drain line that would extend into Kawaihau Road on the northwest side of the site, and run down Kapahi Road to discharge into an existing 18-inch drain line within the Kapahi Road right-of-way.

Following publication of the 2011 FEA-FONSI, the exploratory well was drilled. In addition, the drainage design was revised to the current design being proposed in this Environmental Assessment. As such, a new Environmental Assessment was prepared to assess the impacts of the installation of the additional new drainage line section and new outlet proposed at the Drainage Site. Additional details for site improvements have also been identified, including grass cell pavement driveway and access road, concrete walkways, a retaining wall on the southeast perimeter of the site, a detention basin, and a chain link fence enclosing the tank site.

This FEA has been prepared in accordance with the requirements of Hawai‘i Revised Statutes (HRS), Chapter 343 and Hawai‘i Administrative Rules (HAR), Title 11, Department of Health, Chapter 200.1, Environmental Impact Statement Rules. The proposed project will require the use of State lands (the Ornellas Tank Site), and the use of County funds, thus triggering the preparation of an EA as prescribed by HAR 11-200.1-8(1) and HRS, Chapter 343-5(a)(1).

1.3 DESCRIPTION OF THE PROPOSED ACTION

1.3.1 NEW RESERVOIR DESCRIPTION

Two (2) new 0.5-MG tanks and ancillary improvements will be constructed at the existing Ornellas Tank Site, which is a State-owned property identified as TMK (4) 4-6-011:003. The 0.836-acre parcel is relatively level with an overall gradient of approximately 2.5 percent. The area where the new tanks will be constructed is presently vacant and covered by a variety of overgrown shrubs and groundcover. The remainder of the parcel is occupied by the 0.2-MG Ornellas Tank, a square, concrete masonry unit (cmu) water storage facility with partial sheet-metal siding and sheet-metal roofing.

The new storage tanks will be cylindrical in configuration, each measuring approximately 72 feet in diameter and approximately 22 feet in height (see Figure 1-3). They will have a finish floor elevation of approximately 307 feet above mean sea level (msl) (existing site elevation is 305 feet msl).

The tanks are designed to efficiently fit within the narrow parcel and, visually, to be at scale with the surrounding land uses. The proposed tanks will be constructed of reinforced concrete. A driveway will be constructed from Ka‘apuni Road to provide access into the site and around the new storage tanks. The chain link fence presently surrounding the existing Ornellas Tank will be expanded to encompass the new storage facilities. The entire parcel will be enclosed within a secured six-foot tall chain link fence with a one-foot tall, barbed wire top. Landscaping, consisting of hedges and groundcover, will be provided for visual enhancement and erosion control.

The new tanks will connect with the DOW distribution system via a 12-inch line to one of two existing 12-inch lines fronting the property in Kawaihau Road. The connecting line from the Ornellas Tank will be refitted and connected to the other 12-inch line in Kawaihau Road. These existing 12-inch mains presently serve as the primary distribution and service lines to the lower Wailua-Kapa‘a Water System.

In the northeastern corner of the Ornellas Tank Site, there will be a two-foot-deep detention basin with an overflow structure. The detention basin is designed to accommodate the runoff generated from a storm with a recurrence interval of two years with a duration of 24 hours. The detention basin is designed to prevent an increase in the discharge flow from the project site. The drainage report approved by the Department of Public Works is attached in Appendix F. The layout of the Ornellas Tank Site is shown in Figure 1-4.

1.3.2 RESERVOIR CONSTRUCTION METHODOLOGY

Heavy equipment and construction vehicles will be used during the site preparation stage of the project construction. The site presently contains an overgrown groundcover which will require grubbing, clearing, and removal. Excavation and grading equipment will be used to prepare the site foundation for the proposed facilities. Geotechnical reports indicate that the foundation for the proposed tanks will require three (3)-foot diameter, grout-filled shafts to depths of approximately 60 feet for structural support. Coring for the shafts will be performed by mobile drilling rigs. Rebar cages will then be installed in each shaft and grout will be pumped into the hole to form the solid base. The finished floor elevation of the tanks will be at an elevation of 307 feet msl, sitting atop the grout-filled deep-set shafts.

Alternatively, micropiles may be used in lieu of grout-filled shafts if their construction costs are more favorable. Micropiles are approximately seven (7) inches in diameter and would be installed to approximately the same depths as the grout-filled shafts. A drilling rig would be similarly set up on the property to drill the deep shafts for the micropile placements.

It is anticipated that construction of the new tanks will involve the use of such heavy equipment and construction vehicles as a flatbed truck, concrete truck, asphalt concrete truck, backhoe, loader, dump truck, boom-mounted truck, and dozer. Dust and noise are expected to be generated

during the site preparation and tank construction stages. Groundwater is not expected to be encountered while drilling the deep-set shafts. Construction equipment will be stored on-site to minimize off-site mobilization which would include the transferring of equipment on the local roadways between the construction yard and project site. Once the tanks are completed, the new facility will be cleaned, tested, and disinfected before they are placed into operation.

Landscaping will occur as the last stage of construction, and then all construction debris and waste materials will be removed from the construction area.

1.3.3 EXPLORATORY WELL

An exploratory well has been drilled next to the existing Ornellas Tank. The exploratory well has been drilled and cased. The well casing does not meet the plumbness required by DOW for the entire length of the well casing. Fortunately, the section of the well that does not meet the plumbness requirement is located below the anticipated pump location and will not impact the function of the pump and well.

Pump Test

The exploratory well still needs to be pump tested to ascertain its potential yield. The water will be sampled and tested for all regulated water constituents and the results will be provided in an engineering report to the State Department of Health (DOH).

The piezometric head of the aquifer is anticipated to be at 10 feet to 15 feet above sea level, but the aquifer itself is substantially below sea level. Drilling at depth will enable the solid casing to be extended below sea level and function as a shroud if a submersible pump and motor is used for the permanent pump.

The first set of pump tests, known as the step-drawdown test, will consist of pumping the water from the well at various pumping rates to estimate the well’s hydraulic capacity (quantity withdrawn per foot of drawdown).

After the step-drawdown test is concluded, a constant rate pump test will be performed over a period of 4 – 7 days to determine the quality of the water that the well will produce on a continuous basis. The well water will be discharged into an existing underground 18-inch drain line along Ka‘apuni Road and outlet through the Drainage Site, as detailed in the following Section 1.3.4.

After completing the pump tests, the contractor’s temporary pump will be removed and the well will be capped. Data compiled from the pump tests will provide a decision point. If the tests show that the site will not provide sufficient yield or has organic contamination that may require treatment, the DOW may seek an alternative site. If the DOW determines not to move forward with the permanent well at this site, the capped well will be backfilled with cement, the drill rig and support equipment will be removed from the site, and the area surrounding the well will be restored to its previous condition. Alternatively, the abandoned well may not be backfilled with cement but used periodically for groundwater monitoring purposes.

If the pump tests produce favorable results, an engineering report will be generated to recommend use of the exploratory well as a long-term production well. A new Environmental Assessment (EA) may also be required to assess the potential impacts that might result from the overall operations of the new well.

The normal discharge into the storm drain system will consist of well and storm water, which are not chlorinated. The well water flowing into the water storage tanks is chlorinated before entering the tanks. On the rare occasion that the tanks need to be drained, a de-chlorination apparatus will be used to remove the residual chlorine from the water. De-chlorination is also currently utilized for disposal of chlorinated hydrotesting water and must be approved by the State of Hawai‘i, Department of Health, Clean Water Branch.

1.3.4 DRAINAGE SITE IMPROVEMENTS

The washout and overflow line from the existing tank will connect with the washout and overflow line from the new tanks to the existing 18-inch drain line along Ka‘apuni Road and outlet through a 20-ft wide easement on the Drainage Site, a privately-owned parcel identified as TMK (4) 4-6-011:125. At the Drainage Site, a new 18-inch diameter drainage pipe will be installed and will discharge through an outlet headwall into a natural gulch, Moikeha Stream, in the northern corner of the property. The new drain line will be designed to avoid and prevent any potential discharge into any State irrigation ditches. Following the installation of the line, the soil dug out for the trench will be replaced.

FIGURE 1-1 PROJECT LOCATION MAP

FIGURE 1-2 PROPOSED IMPROVEMENTS

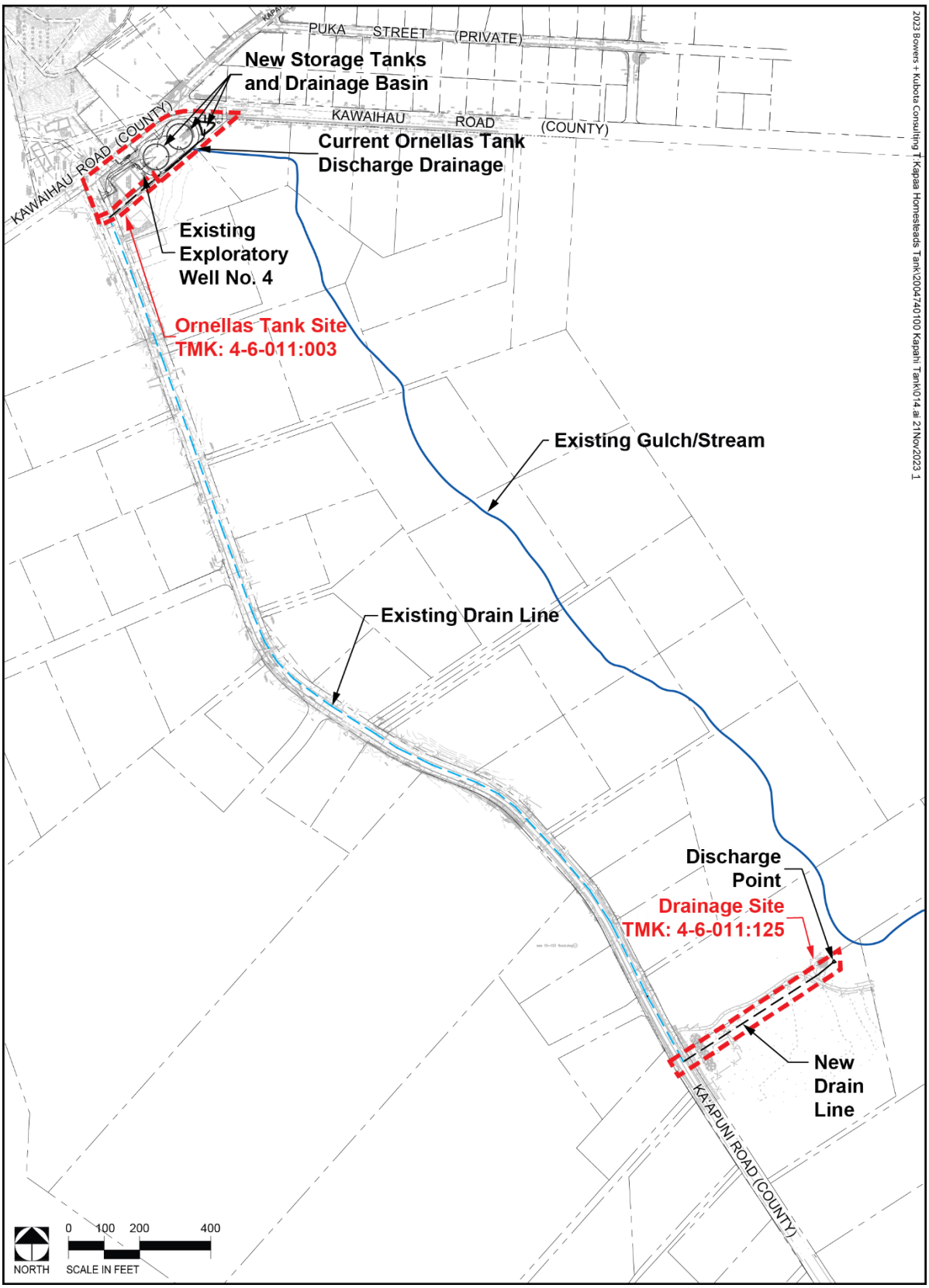


FIGURE 1-3 STORAGE TANK SECTION

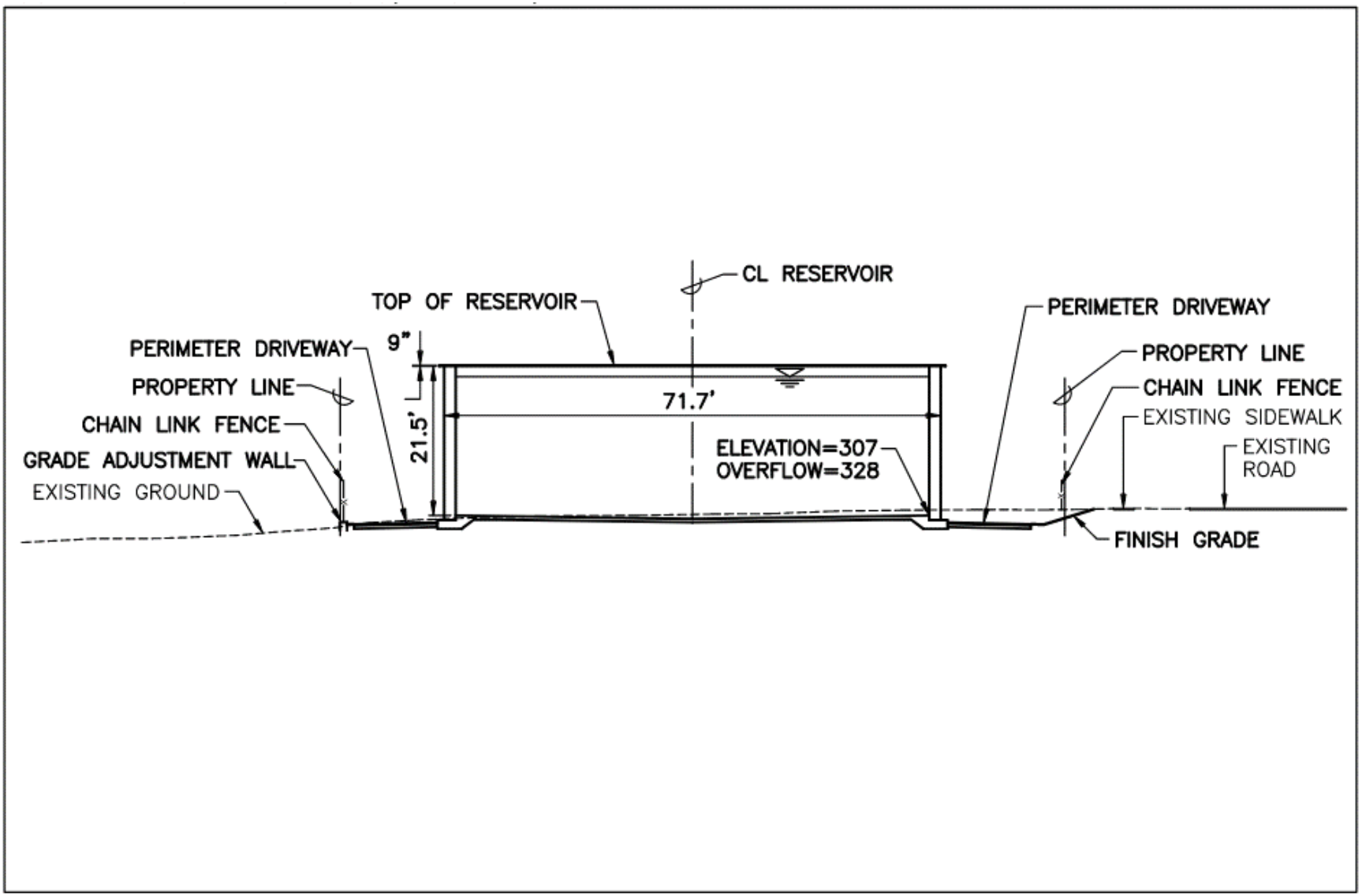


FIGURE 1-4 ORNELLAS TANK SITE LAYOUT

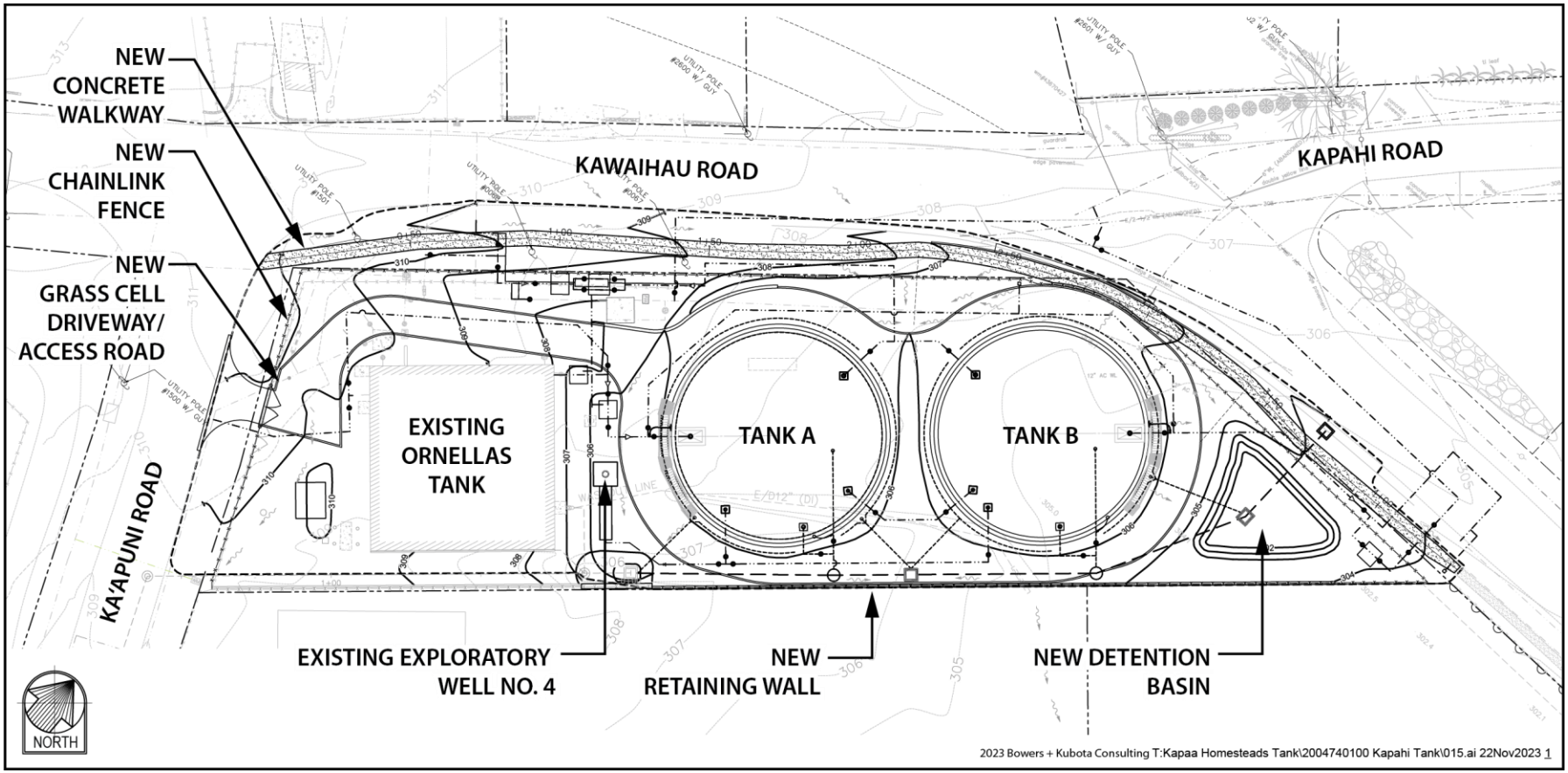
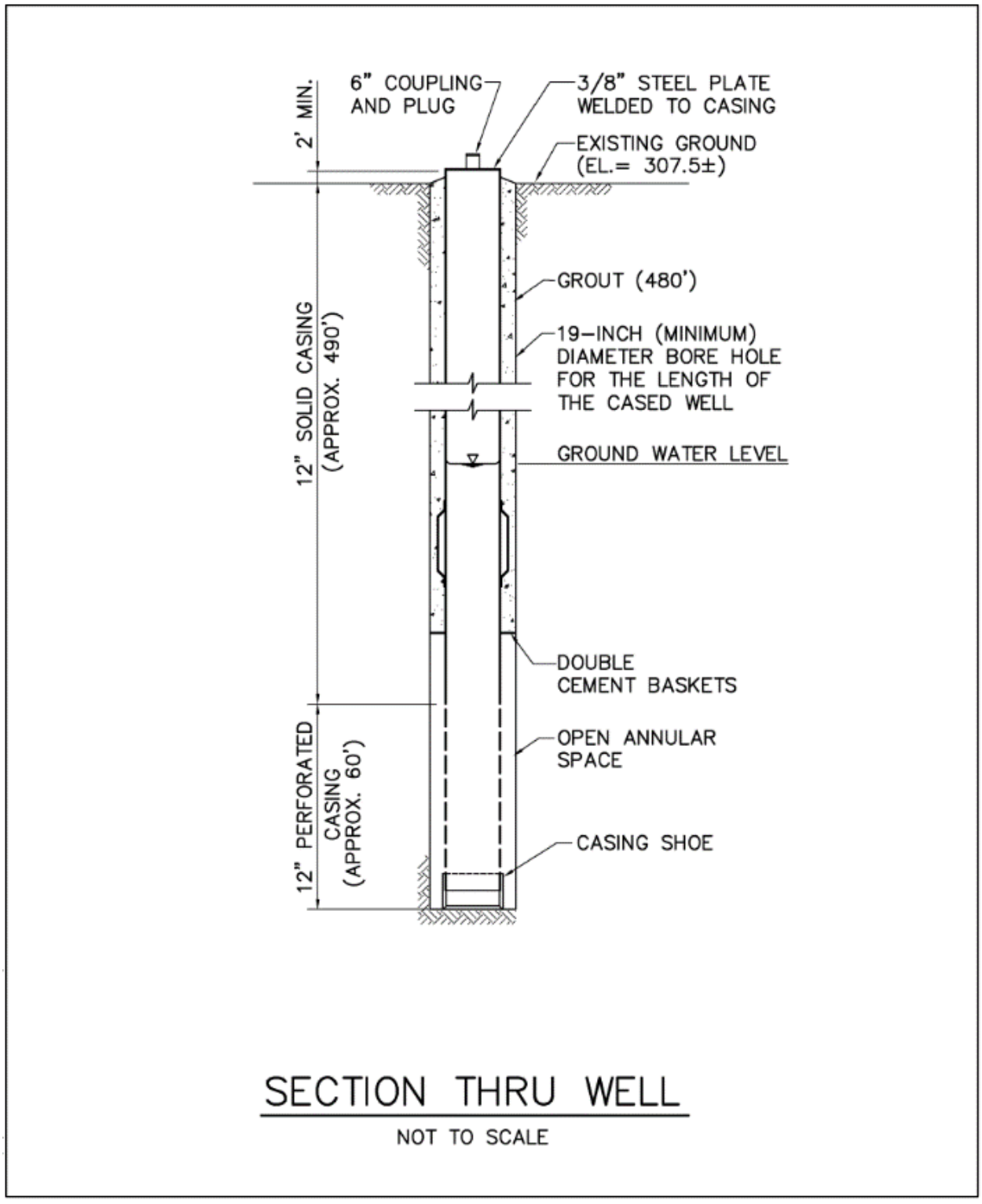


FIGURE 1-5 SECTION THRU EXPLORATORY WELL



1.4 ESTIMATED COST

Construction of the Proposed Action is estimated to cost approximately $31 million in total. This estimate includes the cost of the two new tanks and ancillary equipment ($25 million), exploratory well and pump ($4.5 million), and the drainage line ($1.5 million). Funding for the project will come from the County DOW funds and grants in State Aid.

1.5 CONSTRUCTION SCHEDULE

Construction is projected to begin in 2024. Construction duration for the Proposed Action will be approximately three years.

2 DESCRIPTION OF THE EXISTING ENVIRONMENT

2.1 REGIONAL SETTING

The project site is located in the Kawaihau District of Kaua‘i, in a region extending from the ocean to the Makaleha Mountains. This region includes the small coastal town of Kapa‘a, beach resorts of Wailua, upland rural residences, small agricultural farms, grazing lands, large open spaces of Wailua Homesteads and Kapa‘a Homesteads, public and private schools, and the Samuel Mahelona Memorial Hospital with emergency care facilities.

The people of the region are a mix of long-time residents, newcomers, and visitors. Kūhiō Highway is the main access through Kapa‘a, extending approximately 30 miles from Līhu‘e to Hanalei. The two-lane coastal State highway has numerous local side streets that provide access to the shoreline and upland areas. The Ornellas Tank Site is located more than two and one-half miles from the shoreline in the rural/agricultural section of Kawaihau.

2.2 LAND USE AND EXISTING WATER SYSTEM

Plans call for the proposed storage tanks and exploratory well to connect with the Wailua-Kapa‘a Water System, the County’s largest water system on Kaua‘i. Operated by DOW, the Wailua-Kapa‘a System services Wailua-Waipouli Resort, Wailua Houselots, Wailua Homesteads, Kapa‘a town, and Kapa‘a Homesteads. Feeding the system are three tunnels and eight operational wells (see Table 2-1). The two sources that feed the Kapa‘a Sector of the Wailua-Kapa‘a System are the Makaleha Tunnel in the Keālia Forest Reserve (approximately 1,400 feet above the existing Makaleha Tank, elevation 510 feet msl) and the Kapa‘a Homesteads Well No. 1 located at the Makaleha Tank site.

All storage facilities in the Wailua-Kapa‘a System are listed in Table 2-2.

For operational purposes, the Wailua-Kapa‘a Water System contains three service areas including: (1) the coastal area of Wailua-Waipouli Resort and Kapa‘a town, (2) Wailua Homesteads, and (3) Kapa‘a Homesteads. The proposed storage tanks and exploratory well will be located in the Kapa‘a Homesteads service area or the Kapa‘a Sector of the Wailua-Kapa‘a System. This service area is connected to two storage tanks: the 1.0-MG Makaleha Tank at an elevation of 510 feet msl and the 0.2-MG Ornellas Tank at an elevation of 305 feet msl.

TABLE 2-1 WAILUA-KAPA‘A SYSTEM SOURCES

Source	Elevation (in feet)	Capacity (in gallons per minute)
Tunnels		
Makaleha Tunnel	574	575
Moalepe Tunnel	568	300
Akulikuli Tunnel	360	not in service
Wells		
Nonou 9-1A	155	not in service
Nonou 9-1B	157	425-450
Nonou 9-1C	72	850
Kapa‘a Homesteads Well No. 1	525	750
Kapa‘a Homesteads Well No. 2	500	500
Kapaa Homesteads Well No. 3	10	400
Wailua Homesteads Well “A”	462	470
Wailua Homesteads Well “B”	458	500

Source: Water Plan 2020, March 2001.

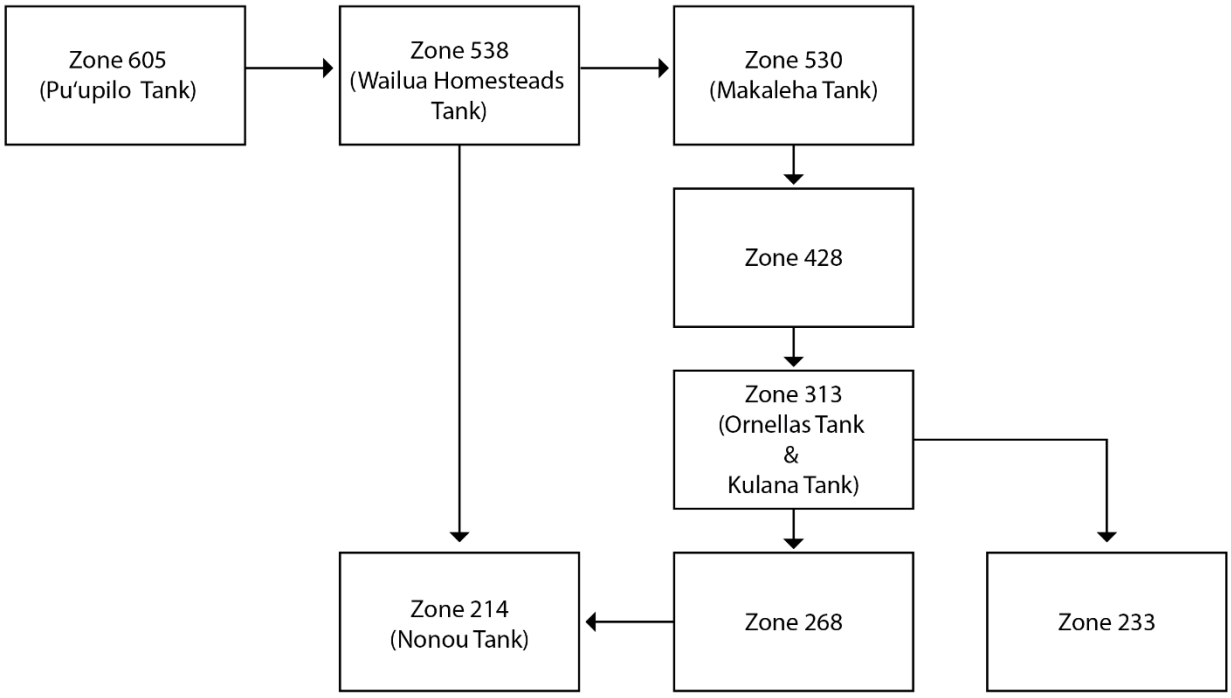
TABLE 2-2 STORAGE FACILITIES IN THE WAILUA-KAPA‘A WATER SYSTEM

Storage Facility	Overflow Elevation (in feet msl)	Capacity (in million gallons)
Makaleha Tank	530	1.0
Ornellas Tank	312.84	0.20
Nonou Tank	214	2.0
Wailua Homesteads Tank	538	0.5
Pu‘upilo Tank	605	0.125
Kulana Tank	300	0.25

Source: Water Plan 2020, March 2001

There are eight primary pressure zones within the Wailua-Kapa‘a service area to control the flow of water through DOW’s water system (see Figure 2-1). These pressure zones are determined by the system’s various elevational sections. Existing storage tanks and pressure reducing valves are used to control the flow of water through the different zones.

FIGURE 2-1 WAILUA-KAPA‘A WATER SYSTEM PRESSURE ZONES



Source: DOW

According to DOW’s Water Plan 2020, a long-range planning guide for the County agency, Wailua-Kapa‘a’s storage facilities are operating at capacity for several pressure zones. Notably, all storage deficiencies within the system are based on MDD criteria. Future deficiencies are based on projected population growth and projected MDD.

Zone 313 pressure zone, serviced by the Ornellas Tank, required more than 770,000 gallons by 2020. The two pressure zones (Zone 268 and Zone 233) immediately makai of Zone 313 required approximately 74,000 gallons by 2020. Thus, the current need for the Ornellas Tank pressure zone and its two adjoining makai zones is 844,000 gallons. The proposed two 0.5-MG supplemental storage facilities at the Ornellas Tank site will provide the needed additional capacity to adequately accommodate the deficiency and long-term needs of the area.

In addition to storage demand, Water Plan 2020 projected the overall Wailua-Kapa‘a water system’s supply and demand. The plan projected that Zones 530 and 538 would have water supply deficiencies by 2020. Zone 530 requires approximately 1,285 gallons per minute (gpm) as it also encompasses the demand from Zones 313 and 428. Zone 538 requires 883 gpm, which also includes the demand from Zone 605.

The prospect of a new source of water in Zone 313 is ideal for the Wailua-Kapa‘a Water System. A hydrological and well site selection study was conducted by Tom Nance Water Resource Engineering, and the findings of the study demonstrated that there are favorable conditions at the Ornellas Tank site for potable groundwater development. As a result of that study, DOW drilled an exploratory well to ascertain the potential yield of this groundwater source. If the test results are positive, the DOW will propose to convert the well into a production well. This would help

to address the supply deficiencies outlined in Water Plan 2020. A separate EA will be prepared should the DOW decide that the exploratory well be converted into a long-term production well.

The water system includes a network of 2- to 12-inch diameter distribution lines in the upper elevations and 6-, 8-, and 12-inch pipelines in the lower sections. There are also various types of valves including backpressure valves, pressure reducing valves, solenoid valves, and altitude valves.

2.3 LAND TENURE

The Ornellas Tank Site is a 0.836-acre property owned by the State of Hawai‘i and is identified as TMK: (4) 4-6-011:003. Executive Order 1091, November 28, 1944, set aside the Ornellas Tank Site for public purpose and to be under the control and management of the County of Kaua‘i.

The proposed drainage improvements will be located at the Drainage Site, a privately owned property identified as TMK: (4) 4-6-011:125.

2.4 PHYSIOGRAPHY

The Ornellas Tank Site is located in Kawaihau at the approximately 305-foot msl elevation of the Kapa‘a Homesteads. The terrain is relatively even and its gradient is approximately 2.5 percent descending generally from west to east. The terrain at the Drainage Site is relatively flat except for the northeastern portion of the site, where it drops off into a gulch. There are no prominent or distinguishable geographic features on the tank site, the privately owned property, or in the immediate vicinity. Photos of the site are included in Figure 2-2.

2.5 GEOLOGY

Kaua‘i is the oldest of the major Hawaiian Islands and, geologically, the most weathered or eroded. It consists of at least one extinct volcano and was formed by lava flows from the shield, post shield, and rejuvenated stages. The island has a lack of rift zones, but has an enormous caldera complex with a graben, or down-dropped block on the caldera’s south side. Rejuvenated-stage lava flows have covered much of the eastern half of the island. Through time, numerous landslides have modified Kaua‘i’s northern, northeastern, eastern, and southern sides.

Rocks of the Kōloa Volcanic Series cover most of the eastern half of the island including the project area. The Project Site is situated on a gently sloping plateau along the foot of the Makaleha Mountains. This region, which is underlain by weathered soils and basaltic rock belonging to the Kōloa Volcanic Series, is known as the Kapa‘a dissected upland. Geologically, it is composed of alluvium deposits.

FIGURE 2-2 SITE PHOTOS

Ornellas Tank Site - Existing tank.

Ornellas Tank Site - Looking south.

Ornellas Tank Site - Looking northeast.

Ornellas Tank Site - Looking southwest.

Drainage Site looking northeast.

2.6 HYDROLOGY

2.6.1 GROUNDWATER

The Kōloa Volcanic Series, which blankets the project region, is the island’s later stage volcanics laid down long after the original Waimea Volcanic Series. The original island-building Waimea volcanics is generally very permeable and yields water readily to wells. In comparison, the Kōloa Volcanic Series is generally moderate to poor in permeability. With a few notable exceptions, wells drawing water from the Kōloa volcanics have had relatively modest yields. The depth of the Kōloa series is not known, but it is undoubtedly substantial.

The prospect of developing a well that extends through the Kōloa volcanics and associated unconformities to the Waimea series below would require drilling to an impractically expensive depth. As such, DOW is focused on exploring whatever potential source that might be found in the Kōloa volcanics.

A number of wells have been developed in the Kapa‘a Homesteads area: some are being used as production wells; some are being used for groundwater monitoring purposes; and others have been tested and abandoned. Those that have proven to be productive are drawing from the Anahola Aquifer in which the project site is located (see Figure 2-3). The State Commission on Water Resource Management (CWRM) lists the total sustainable yield for the Anahola Aquifer as 21 MGD. The current usage by active wells, tunnels, and shafts in the aquifer, is a small fraction of this amount.

Groundwater levels in the project vicinity appear to be in the range of 12 feet msl. Table 2-3 lists the wells in the general area and includes information on the year drilled, ground elevation, well depth, and static head.

In 2008, Tom Nance Water Resource Engineering conducted a well site selection study for the DOW (see Appendix B). The purpose of the study was to investigate potential well locations in the 313- and 214-foot service zones of the Wailua-Kapa‘a Water System. Data from all existing wells within or near those zones were reviewed. Any selected drilling site should be viewed as having an inherent risk of not producing the desired yield, regardless of the depth drilled.

Under that premise, the study identified six potential sites for possible test drilling: three sites at an upland location and three sites in the lower elevations (see Table 2-4).

The three upland locations are at existing County tank sites. These sites provide immediate advantages over the lower-elevation (non-County owned) sites. There would be no land acquisition cost for the well, start and stop operations of the well pump could be controlled by water levels in the adjacent tank, and contact time for chlorine in the system could be provided by storage in the same tank.

The disadvantage of the lower elevation sites is that, as a practical matter, they would have to pump directly into the distribution system rather than into a nearby storage facility.

FIGURE 2-3 GROUND WATER HYDROLOGIC UNITS AND 2019 SUSTAINABLE YIELDS

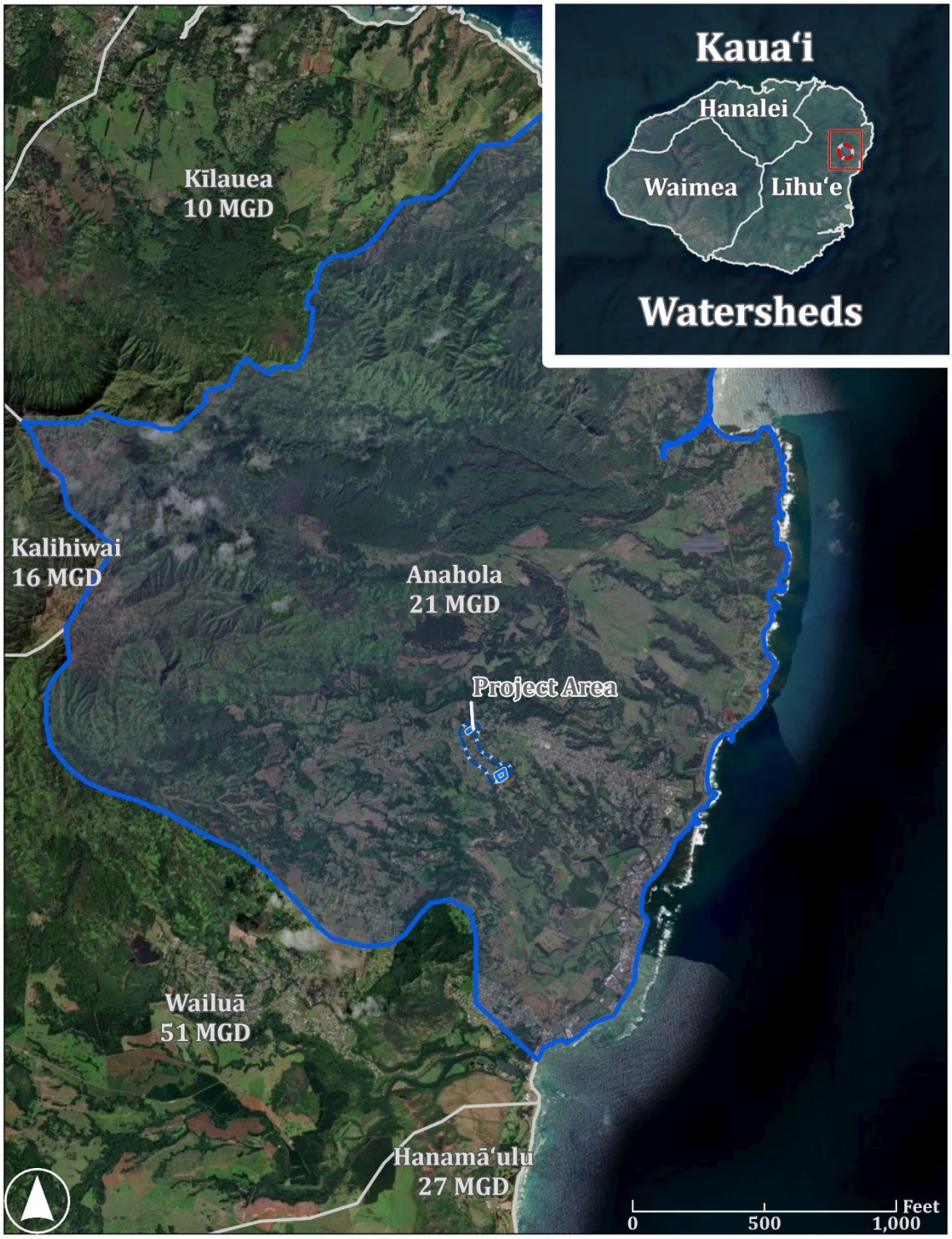


TABLE 2-3 NEARBY WELLS

Well No.	Well Name	Owner/User	Year Drilled	Ground Elevation	Well Depth (Total)	Initial Water Level (in Elev.)	Initial Head (in Elev.)
0419-05	Kapa‘a Highlands 1	No record	2006	25	260		13
0519-01	Kapa‘a	State HHA	1986	8	221	12	12
0519-05	Lydgate 1	Ogden L B	2005	48	234		12
0521-03	Kulana 17	Kapa‘a 382 LLC	2001	282	495		
0618-01 to 07	Kealia 1-7	Līhu‘e Plantation	1898-1928	8-15	213-402	8-10	8-10
0618-09	Kealia 1A	Kealia Water Company Holdings, LLC	2001	10	195		7
0618-10	Kealia 2A	Kealia Water Company Holdings, LLC	2001	10	195		7
0620-01	Kapa‘a Cannery	T. Baker Assoc.	1960	249	466	12	12

Source: Commission of Water Resource Management, DLNR, State of Hawai‘i

TABLE 2-4 POTENTIAL WELL SITES

Well Site	Landowner
Inland Sites	
Kulana Tank Site (Zone 313; 0.25 MG tank)	County of Kaua‘i
Stable Tank Site (Zone 214; 1.0 MG tank)	County of Kaua‘i
Ornellas Tank Site (Zone 313; 0.2 MG tank)	County of Kaua‘i
Lower Elevation Sites	
TMK: 4-3-003:001 (80-foot elevation; 163.1 acres)	Private Owner
TMK: 4-3-003:020 (120-foot elevation; 16.6 acres)	State of Hawai‘i
TMK: 4-5-015:030 (40-foot elevation; 35.9 acres)	State of Hawai‘i

In the final analysis, the study recommended the Ornellas Tank site for DOW’s initial exploration well. This site would provide DOW with the greatest flexibility for distributing the water within the two service zones of Kapa‘a.

2.6.2 SURFACE WATER

No surface water features traverse the property. The nearest stream is Kapa‘a Stream located approximately 1,800 feet to the north of the property. There is an un-named stream located near the Drainage Site. The existing stream conveys flow to Moikeha Canal.

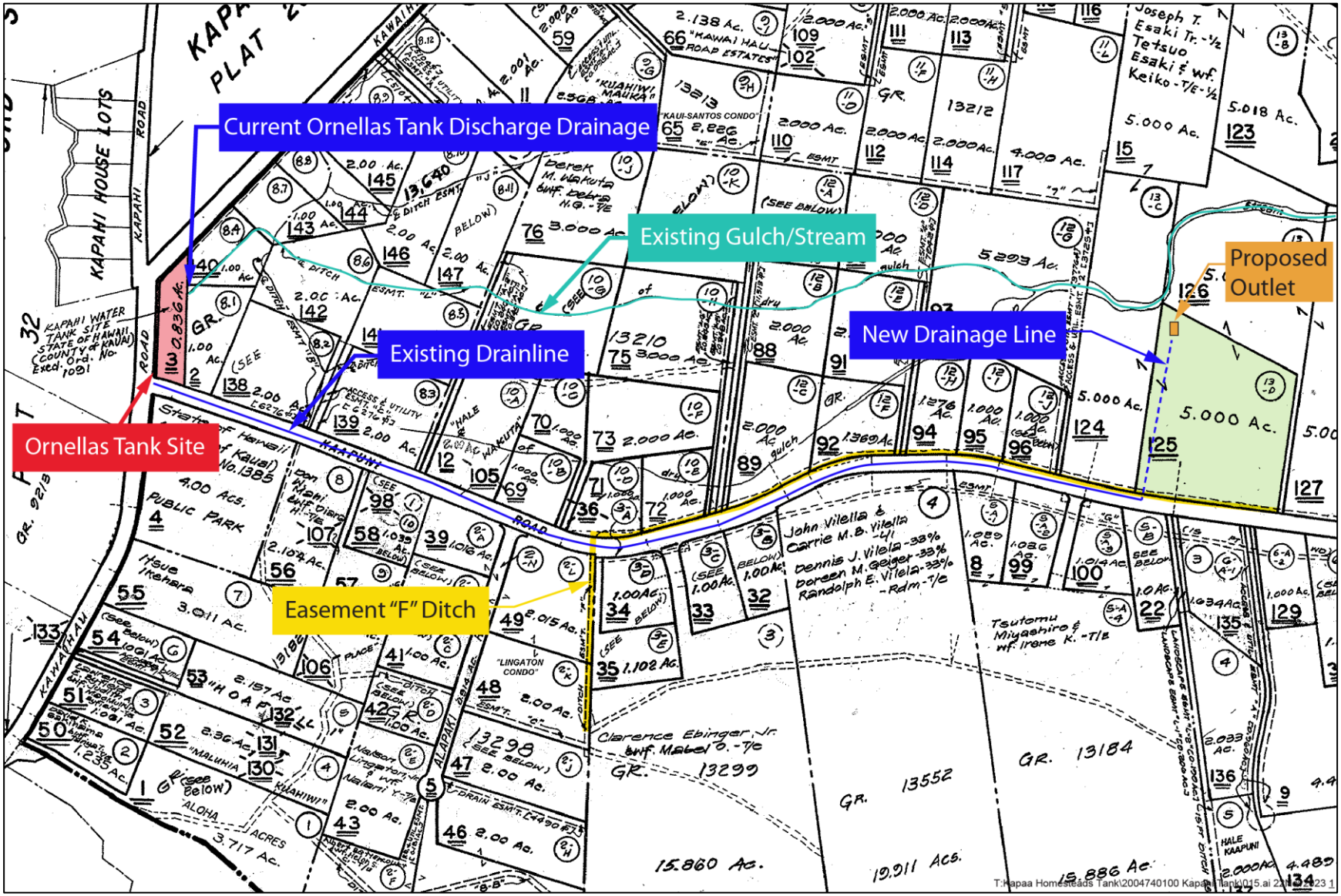
In 2000, Amfac Company ceased farm operations on Kaua'i and as a result closed its East Kaua'i Water Company that operated an irrigation system consisting of reservoirs and ditches serving approximately 6,000 acres above Kapa‘a. This system no longer operates today and is currently under the control of the DLNR Kaua'i District. Nearly all of the system’s conduits or ditches are

State-owned, either because they are on large parcels of State land or because the State owns a 15-foot wide right of way through private lands.

At the Drainage Site, where the new drainage line and outlet are proposed, there is a ditch easement along the southern edge of the property fronting Ka‘apuni Road, identified as Easement F (see Figure 2-4). The current design of the new drainage line will pass through Easement F and will not discharge any water into the irrigation ditch system.

The existing surface runoff from the Ornellas Tank site flows to an existing gulch. The gulch flows to the existing Moikeha Stream at the Drainage Site and flows to Moikeha Canal further downstream.

FIGURE 2-4 PLAT MAP – EASEMENT F LOCATION



2.7 SOILS

A geotechnical field investigation was conducted on the project site in 2008 by Geolabs, Inc., a soils engineering company based in Honolulu, Hawai‘i. The field investigation encountered medium stiff to stiff residual soil underlain by stiff saprolite soil. Both soils generally contain clayey silts with some embedded sand and gravel. The saprolite soil extends to the maximum depth explored, approximately 41 feet below the ground surface. Laboratory tests showed the soils to have low expansion potential but high moisture content.

According to the U.S. Soil Conservation Service’s *Soil Survey of Islands of Kaua‘i, O‘ahu, Maui, Moloka‘i, and Lāna‘i, State of Hawai‘i*, the soils on the property consist of the Puhi series soil. This series is known to contain well-drained soils of the island’s upland areas. They are developed in material derived from basic igneous rock.

The soil in the Ornellas Tank Site is classified as *Puhi silty clay loam, 3 to 8 percent slopes* (PnB) (see Figure 2-5). Runoff on this soil is characterized as slow with a slight erosion hazard. The soil is typically used for agricultural crops, pasture, woodland, wildlife habitat, water supply, and homesites. Its Capability Classification is IIe, irrigated or non-irrigated, which on a scale of I to VIII indicate that the soil has “moderate limitations that reduce the choice of plants or that require moderate conservation practices.” Class I soils have few limitations; Class VIII soils have limitations that preclude their use for commercial plant production. The “e” indicates that the main limitation in the soil is the risk of erosion, unless close-growing plant cover is maintained.

The soil at the Drainage Site consists of PnB and rough broken land (rRR) in the rear of the property where the land drops into a natural gulch.

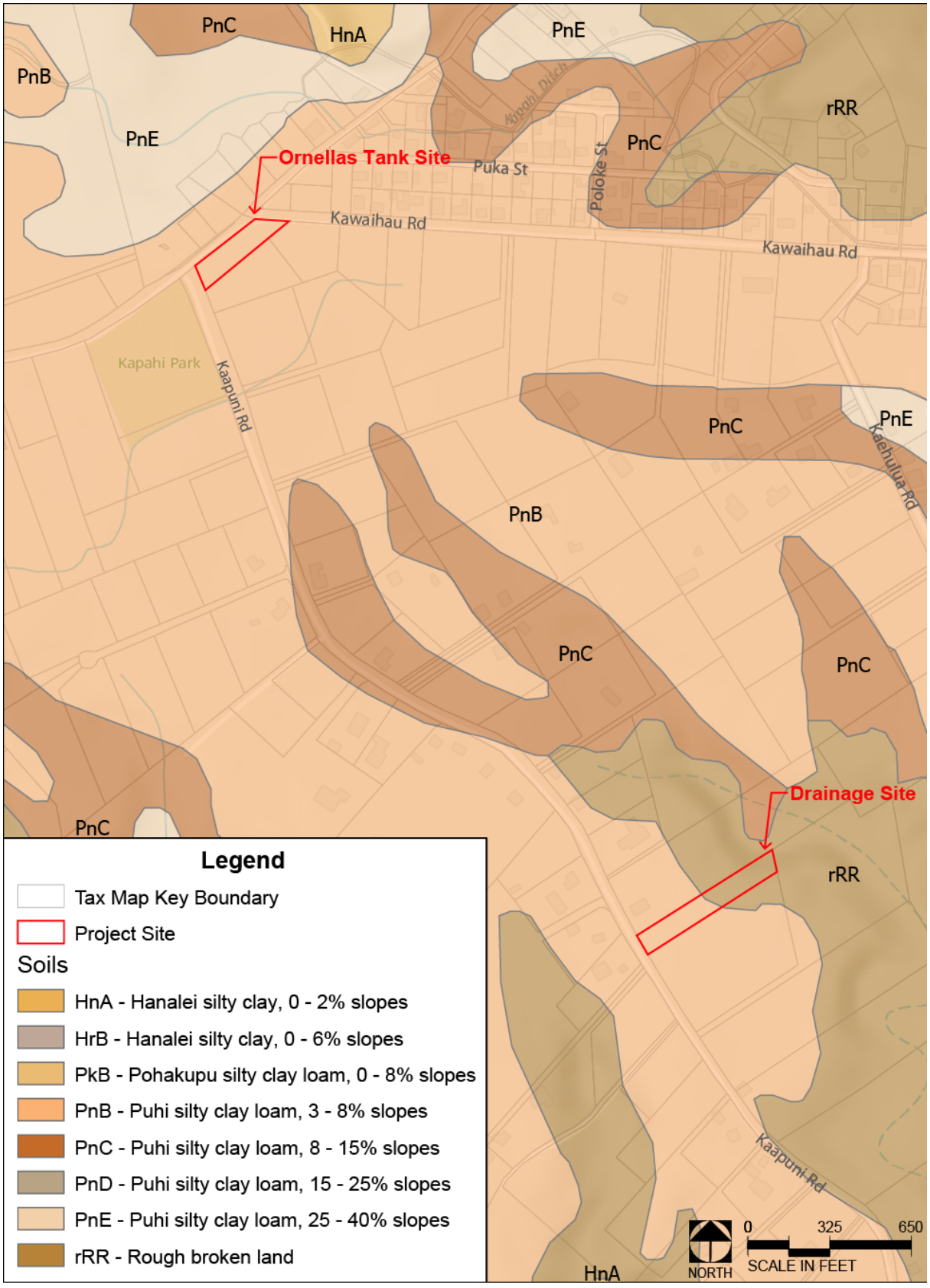
2.8 FLORA

SWCA Environmental Consultants (SWCA) completed a terrestrial flora and fauna biological survey report on November 2023 (see Appendix C). SWCA’s biologists conducted the field survey at the Ornellas Tank Site and the Drainage Site on September 15, 2023. Below is a summary of their findings.

At the Ornellas Tank Site, the survey area consisted mostly of nonnative grasses such as Guinea grass (*Urochloa maxima*) and Napier grass (*Cenchrus purpureus*). Ruderal species such as false ragweed (*Parthenium hysterophorus*), sow thistle (*Sonchus oleraceus*), maunaloa (*Canavalia cathartica*), and castor bean (*Ricinus communis*) making up a much smaller proportion of the overall vegetation.

Portions of the Drainage Site contained cultivated species, including a variety of edible and ornamental plants, including banana (*Musa* hybrid), coconut (*Cocos nucifera*), ti (*Cordyline fruticosa*), passion fruit (*Passiflora edulis*), avocado (*Persea americana*), common guava (*Psidium guajava*), and sandpaper vine (*Petreavolubilis*).

FIGURE 2-5 SOIL MAP



In total, 42 plant species were observed at the survey area. The vegetation types and plant species identified during the survey are not considered unique. Only two indigenous plant species, hau (*Hibiscus tiliaceus*) and Cyperus polystachyos, were observed in the survey area. These species are not considered rare nor are they federally or state-listed threatened or endangered species, species proposed for listing, or candidate species. No special-status species or U.S. Fish and Wildlife Service (FWS)-designated critical habitat for federally listed endangered plant species were observed within either the Ornellas Tank Site or the Drainage Site. Therefore, the proposed project is not expected to have a significant, adverse effect on terrestrial vegetation.

2.9 FAUNA

SWCA’s biologists conducted an avifaunal and mammal survey at the Ornellas Tank Site and the Drainage Site on September 15, 2023 (see Appendix C). Below is a summary of their findings.

2.9.1 AVIFAUNA

No native or migratory birds were recorded in the survey area. Table 2-5 below lists the six species of birds recorded over the course of the survey. Endangered Hawaiian waterbirds were not detected during the field survey, and the project footprint does not consist of potential foraging habitat such as lowland streams with herbaceous riparian vegetation or tidal mudflats that would support waterbird foraging.

Seabirds were not observed in the survey area but may potentially fly over the survey area to and from higher elevation nesting areas during the seabird fledgling period.

TABLE 2-5 OBSERVED AVIFAUNA SPECIES

Common Name	Scientific Name	Status*	Scientific Name
Red junglefowl	*Gallus fallus*	NN	No
Spotted Dove	*Streptopelia chinensis*	NN	No
Japanese White-Eye	*Zosterops japonicas*	NN	No
House Finch	*Carpodacus mexicanus*	NN	No
Common Myna	*Acridotheres tristis*	NN	No
House Sparrow	*Passer domesticus*	NN	No

* NN = Nonnative permanent resident

Source: SWCA

2.9.2 MAMMALS

Although feral cat (*Felis catus*), house mouse (*Mus musculus*), and rats (*Rattus* spp.) were not detected, they are likely to occur in the survey area.

2.9.3 TERRESTRIAL REPTILES, AMPHIBIANS, INSECTS AND OTHER INVERTEBRATES

No reptiles or amphibians were detected. No terrestrial reptiles and amphibians are native to Hawai‘i. No native insects or other invertebrates were observed during the survey. Nonnative invertebrates observed were black earwig (*Chelisoches morio*) and Surinam cockroach (*Pycnoscelus surinamensis*).

2.9.4 HAWAIIAN HOARY BAT

While the endangered Hawaiian hoary bat was not observed during the field survey, its forage and roost habitat does occur in the survey area within the vegetation type.

2.10 CLIMATE

Rainfall in the project area is approximately 80 to 90 inches per year. Average monthly temperatures range from the mid-70s (degrees Fahrenheit) to the mid-80s. Winds are predominantly from the northeast.

2.11 NATURAL HAZARDS

Mount Wai‘ale‘ale, the dominant volcano on the island, is extinct and will not be a threat to the proposed storage tanks.

The project site is located approximately two and one-half miles from the shoreline and will not be affected by shoreline erosion, high surf, or tsunami inundation.

According to the Federal Emergency Management Agency’s (FEMA) Flood Insurance Rate Map (FIRM), updated December 2, 2022, the property is located in Flood Zone X. The National Flood Insurance Program (NFIP) does not have any regulations for development in these zoned areas.

Located in a rural community surrounded by residential and agricultural development, the property would not be subject to wildfire or heavy brush fire.

2.12 AIR QUALITY

There are no major air pollutant generators, including incinerators, quarries, manufacturing plants, or mass drying beds in the project area. The surrounding lands are comprised primarily of rural residential homes, agricultural lands, grazing pastures, and open space.

Development of the storage tanks and exploratory well will involve earthwork for foundation and finish grade, placement of water lines, and construction of concrete structures. Installation of the drilling rig will consist of minimal site alterations. Together, the proposed improvements and drilling operation would generate temporary fugitive dust. The quantity of dust from the construction work, however, is expected to be minor and dust control measures are expected to be in place to reduce potential impacts to surrounding properties.

2.13 ACOUSTICAL ENVIRONMENT

Major sources of sounds in this rural/agricultural community include predominantly low-volume vehicular traffic, activities from nearby rural residences, ranches, and agricultural properties, play activities from the adjacent County park, and sounds from wildlife.

The dominant source of noise during project construction would likely be the construction equipment involved in site clearing and grading, deep shaft drilling, installation of pipelines, and construction of the water tank’s foundation and structure.

During the operational stage of the storage tanks and exploratory well, project impact will be minimal except when facility repair or maintenance is performed. These operations are typically minor and do not generate significant noise.

When the exploratory well is installed, pump tests will be conducted to determine the availability of water and the capacity to draw from the resource at a sustainable rate over a long period of time. Noise from the drilling operations and pump testing procedures are expected to occur over a six-month period during regular day-light working hours. Noise levels are expected to be in the same general range as the other construction activities on the property.

2.14 SCENIC RESOURCES

The visual characteristics of the project area could be described as rural, agricultural, and open space with narrow, paved country roads. In the upland areas, rainfall is abundant, and the landscape is predominantly green. Distant views toward the west include open space, pasture lands, shrub lands, forest lands, and mountains.

The project site is located at the corner of Kawaihau Road, Kapahi Road, and Ka‘apuni Road. The new tanks and exploratory well will be visible from the three County rights-of-way. The appearance of the tanks, however, will be shorter than a typical storage facility of the combined size. The two 0.5-MG reservoirs each will be approximately 72 feet in diameter and 22 feet in height. The site will be landscaped and will include indigenous plants to screen the new facility.

2.15 ARCHAEOLOGICAL RESOURCES

In June 2004, an archaeological study was conducted by Cultural Surveys Hawai‘i, Inc. (CSH) on two sites in Kapa‘a: one at the Makaleha Tank site at an elevation of 510 feet msl and the other at the Ornellas Tank Site (see Appendix D). The study included historical research of archival sources, historic maps, Land Commission Awards, and previous archaeological reports

to determine the history of land use in the area and if archaeological sites have ever been recorded on or near the property. The study also included a field inspection to identify any surface archaeological features and an assessment of potential impacts to such sites.

The study’s findings indicated there are no archaeological features on the Ornellas Tank Site. CSH recommended that no further historic preservation work is necessary for the area. In a letter dated February 25, 2010, the State Historic Preservation Division (SHPD) of the DLNR reviewed the area and determined that improvements to the site will have “no effect on historic properties”. Considering that underground cultural deposits may still be a possibility, the County is committed to the responsibility of stopping work in the immediate area of any unexpected discovery during construction, and promptly notifying the SHPD. Work will not resume in the construction area until specifically authorized by the SHPD.

The 2004 archaeological study did not include an assessment of the Drainage Site. However, the historical background discussed in the archaeological study suggests that the Ornellas Tank Site and surrounding area was most likely used for sugarcane, rice, or pineapple cultivation during the later 1800s and early 1900s. A survey map from 1905 shows the Drainage Site as an undeveloped field of land (see Figure 2-67). Based on the Copy of Survey Furnished (C.S.F.) description dated 1913, the Drainage Site was part of land for the Kapa‘a Pineapple Lease, and by 1939 it became Kapa‘a Agricultural Land held under a general lease. By 1956, the Drainage Site was designated within Lot 13 of the Kapahi Farm Lots (see Figure 2-7) and in 1959 the lot was conveyed under Land Patent No. S-13, 745 to a private landowner. Based on the history of the Drainage Site and surrounding area as suggested in the archaeogical study and land survey maps, it is anticipated that there would be a low likelihood of encountering archaeological features on the site due to its past and on-going agricultural use and designation. As previously mentioned, should any cultural deposits or archaeological resources be encountered during construction, the SHPD will be notified immediately and all work will be stopped until specifically authorized by the SHPD.

2.16 CULTURAL RESOURCES

In addition to the archaeological survey, a cultural impact assessment (CIA) was conducted (see Appendix E) and included in the CSH study. Historic research was carried out to identify cultural resources or traditional cultural practices associated with the area.

Hawaiian traditions that centered on Kapa‘a in pre-contact times suggest the significance of and association with the ali‘i. A survey of traditional mythological literature shows that Kapa‘a was prominently associated with some of the most famous legendary and historical figures including Maui, Kawelo, Mō‘ikeha, Maweke, Palila, Pāka‘a and Kanaka Nunui Moe. The 14 documented heiau of Kapa‘a is a testament to both the substantial population and social/political/religious importance of the ahupua‘a.

Historic research has also provided information on sugar cane cultivation, settlement patterns, rice cultivation, the opening of Hawaiian Canneries, and the construction of the Ahukini Terminal & Railway Company in 1820.

Previous research of the region shows that the majority of archaeological studies were conducted within urban Kapa‘a near the shore and that little data was obtained for more inland areas.

Throughout the course of the CIA preparation, efforts were made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices specifically related to the project area. The effort was made by letter, e-mail, telephone, and in-person contact. From an attempt to contact 21 parties, 4 of the 6 individuals who responded had no cultural concerns. Two of the organizations contacted (the Kaua‘i/Ni‘ihau Island Burial Council and the Kaua‘i County Planning Department, Historic Preservation Review Commission) indicated an intention to discuss the matter at their September 2004 meetings. No comments or concerns have been received from those agencies by CSH.

In an email dated February 23, 2024, the Office of Hawaiian Affairs (OHA) provided comments on the DEA, which included a recommendation to re-engage the Kaua‘i Island Burial Council and Historic Preservation Commission. The DOW has conducted follow-up consultation with the Kaua‘i Island Burial Council and the Historic Preservation Commission as recommended by OHA. The Kaua‘i/Ni‘ihau Island Burial Council's Kawaihau Geographic Representative, Ms. Carol Lovell, was consulted and provided with information on the project along with an offer by DOW for additional consultation if needed. Ms. Lovell stated in an email response dated April 13, 2024 that she had no concerns at this time. Phone conversations between the consultant (Bowers + Kubota Consulting, Inc.) and the County Planning Department were held on multiple occasions in April and May 2024 regarding the letter submitted to the Historic Preservation Review Commission. In summary, the Planning Department had no further comments to offer at this time in anticipation that future County permits needed for the action would offer the Kaua'i Historic Preservation Review Commission additional opportunities to comment on the project.

In consideration of the above, it is anticipated that the proposed project will have minimal or no impact on Hawaiian culture, its practices, or its traditions.

FIGURE 2-6 SURVEY MAP FROM 1905

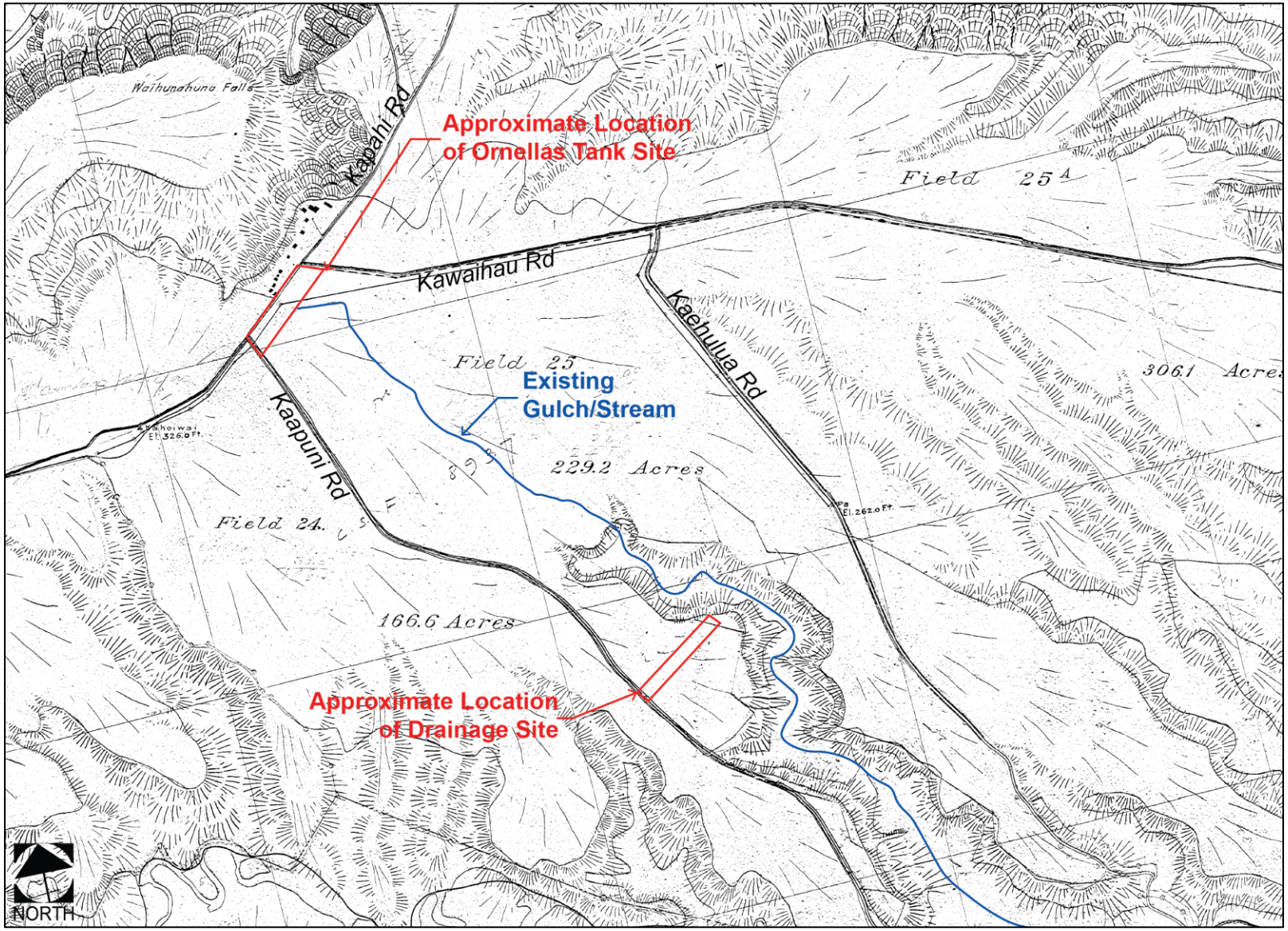
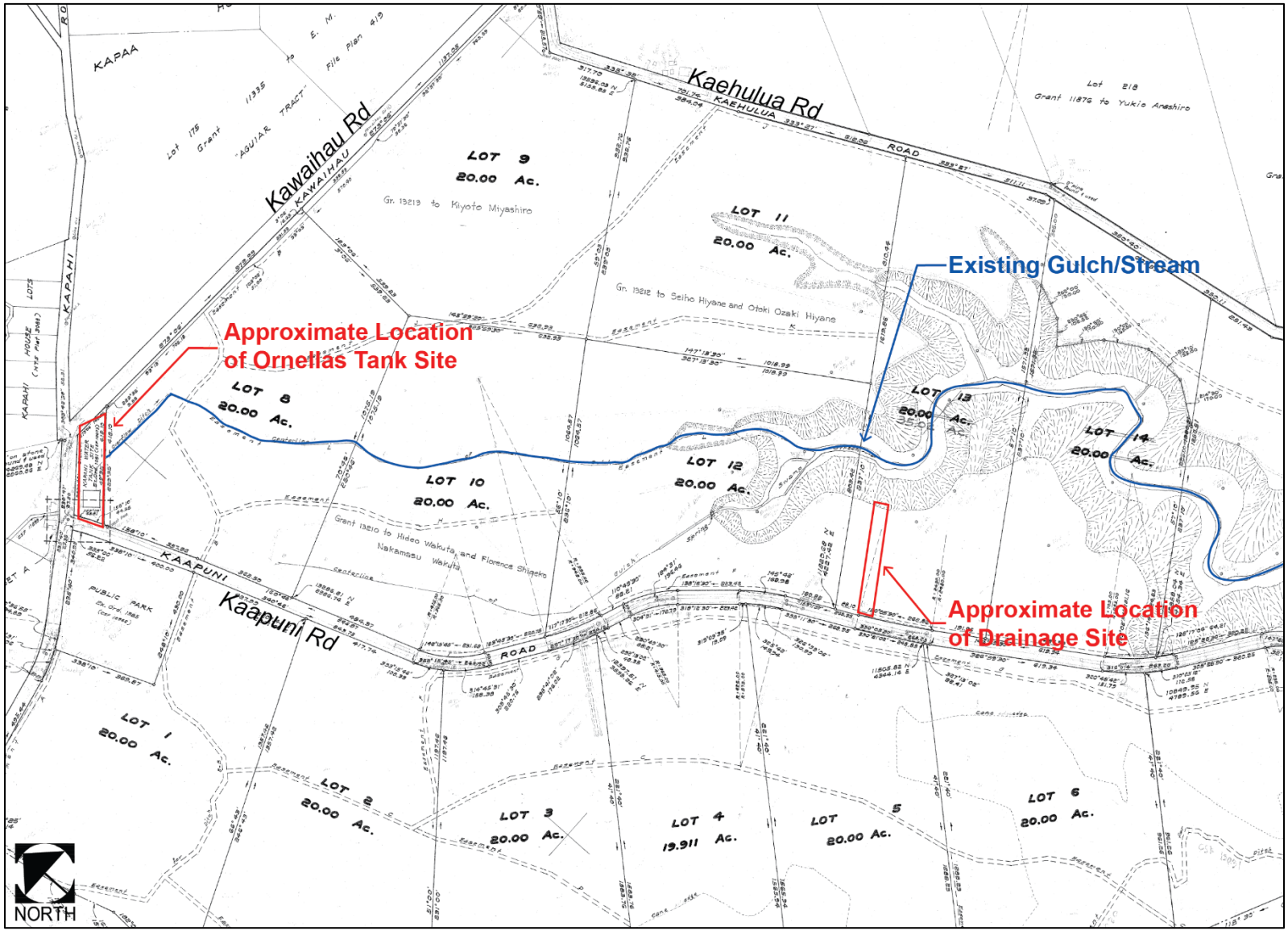


FIGURE 2-7 SURVEY MAP FROM 1956



3 SOCIO-ECONOMIC SETTING

3.1 SOCIO-ECONOMIC BACKGROUND OF THE REGION

The Wailua-Kapa‘a region can be identified by three geographic subareas: the coastal urban area of Wailua-Waipouli Resort and Kapa‘a town, the inland homesteads lands of Wailua, and the mauka homesteads of Kapa‘a.

The Wailua-Waipouli Resort and Kapa‘a town area has become a resort and town center with hotels and shopping complexes for visitors as well as a business and shopping district for local residents. Wailua-Kapa‘a is the largest populated area on Kaua‘i. Its growth has spurred the development of support businesses and services and created traffic needs that justify major roadway improvements. The population of this region is currently about 19,583.[2]

In the 2021 American Community Survey 5-year estimates, the Kapa‘a Census Designated Place had a median household income is $94,457 and had a per capita income of $36,103.

The lands mauka of the coastal urban areas were subdivided for agricultural homesteads during the days of the Territorial Government. Agriculture was the primary activity but with the economy and culture changing the area is now more in residential use.[3] Home building continues to increase as small land holdings are divided up, contributing to the increase in Wailua-Kapa‘a’s population. Local roads and water systems, as a result, are not keeping up with the new land uses, which in turn are affecting the provision of adequate access and fire protection for the community.

3.2 ECONOMIC IMPACTS ASSESSMENT

Installation of the new tanks and exploratory well for the Wailua-Kapa‘a Water System will help fulfill the need to upgrade the existing system and address storage and source facilities identified in the DOW’s Water Plan 2020. During the construction phase of the project, short-term economic impacts would be generated, including the mobilization of labor in the construction industry and its impact and multiplier effect on the rest of the island economy.

During the tanks and well’s operational stage, repair and maintenance will be administered by existing DOW staff. Over the long term, operations of the project will contribute to the continued economic stability of the region’s ongoing agricultural and small business activities. Having a solid economic base will help maintain strong personal and business incomes and produce continued property and sales taxes for government revenues.

---

2 U.S. Census, 2021 *American Community Survey 5-year Estimates*.

3 County of Kaua‘i, Planning Department. November 2000. *Kauai General Plan.*

3.3 SOCIAL CONSIDERATIONS

The Proposed Action is not considered as a land use that generates direct social impacts. Its purpose is to provide a utility that serves and supports land uses, such as residential homes, commercial centers, agricultural lands, public facilities, institutions, etc. The proposed tanks and exploratory well will improve the County’s capacity to accommodate anticipated water demand during prolonged peak day periods in high usage seasons, have sufficient reserve for fire flow protection needs, and maintain adequate control over water pressure flow within the respective pressure zones.

The exploratory well is presently being programmed for investigative purposes. When the pump tests are completed and a decision is made to place the well into long-term use as a production well, another EA will be prepared to assess the long-term impacts of groundwater withdrawal on the regional aquifer, impacts on the Wailua-Kapa‘a community, and impacts on the surrounding natural environment.

The focus of public concerns on the tanks and exploratory well, if any, would be on impacts generated during construction, particularly if there would be any fugitive dust, sedimentation from stormwater runoff, construction noise, and deterioration of water quality in nearby streams. During the project’s operational stage, the primary activities will be monitoring, maintenance, and repair of the tanks and exploratory well. Overall, these activities will have a negligible impact on the environment. As previously mentioned, should it be decided that the exploratory well will be used as a long-term production well, another EA will be prepared to assess the long-term impacts of the well on the surrounding environment and the community. In addition, the preparation of the EA will include a consultation period where government agencies and surrounding landowners will be consulted regarding the construction of the long-term production well.

4 PUBLIC FACILITIES AND SERVICES

4.1 CIRCULATION AND TRAFFIC

Kawaihau Road provides access to the project site from Kūhiō Highway. It is the main access through the uplands of Kapa‘a Homesteads. Ka‘apuni Road provides an alternative route to the project site from Kapa‘a town. Both Kawaihau Road and Ka‘apuni Road are two-way, paved County rights-of-way. Ka‘apuni Road connects with Kawaihau Road at a T-intersection at the western corner of the project site. Traffic signs control vehicular movement through the intersection. There is a bus stop on Route 60, operated by the Kaua'i Bus.

Approximately 350 feet to the east of the Ka‘apuni Road – Kawaihau Road intersection and directly across the tank site, Kapahi Road connects with Kawaihau Road at a T-intersection. Traffic movement through this intersection is also controlled by traffic signs, with vehicles on Kawaihau Road having the right-of-way.

The typical section of these rural roads consists of a road pavement for two lanes (bi-directional) and grass shoulders. In the shoulder area of Kawaihau Road fronting the project site is an asphalt-concrete pedestrian sidewalk. At the curve of Kawaihau Road, a steel guardrail is installed as a safety guard for pedestrians on the sidewalk.

There is no sidewalk on the Ka‘apuni Road shoulder fronting the project site. The shoulder area presently contains a grass drainage swale.

The posted speed limit is 25 miles per hour (mph) on Kawaihau Road and Ka‘apuni Road. The volume of traffic on Kawaihau Road in the project area is low and reflective of the agricultural/rural character of the upland area.

4.2 WATER, SEWER, ELECTRICITY, AND TELEPHONE

The Ornellas Tank presently connects with the Wailua-Kapa‘a Water System which serves the Wailua-Waipolu Resort area, Wailua Houselots, Wailua Homesteads, Kapa‘a town, and Kapa‘a Homesteads. As described in Section 1.1, sources for this water system have been developed throughout the region. In the project area, distribution lines that serve the community are located along Kawaihau Road, Ka‘apuni Road, and Kapahi Road. These lines provide water service to homes and properties below the existing water tank. Fire hydrants are connected to these lines along the County rights-of-way including one located within 400 feet of the property.

There are no public wastewater collection and disposal systems at either the Ornellas Tank Site or the Drainage Site. Only private individual wastewater systems are currently in use in the surrounding area.

Overhead electrical and telephone lines are located on utility poles along Kawaihau Road, Kapahi Road, and Ka‘apuni Road. Electrical power for the DOW facility is provided by Kaua‘i Island Utility Cooperative (KIUC) and telephone service is provided by Hawaiian Telcom.

4.3 SOLID WASTE

Debris generated from the project construction site will be removed from the property and hauled to the County landfill in Kekaha.

No solid waste will be generated during the facility’s normal daily operations, except for waste that is produced by DOW’s periodic repair and maintenance activities. The quantity of these wastes will be nominal and infrequent and will be removed from the site by DOW maintenance personnel.

4.4 PUBLIC FACILITIES AND SERVICES

4.4.1 FIRE STATIONS

The nearest fire station is the new Kaiakea Fire Station 8 in Kapa‘a along Kūhiō Highway, which is approximately three miles from the project site via Kawaihau Road. The second closest fire station is the Kapa‘a Fire Station 2 in Waipouli, which is approximately four miles from the project site via Ka‘apuni Road. The response time for emergencies at the project site should be relatively low due to the close proximity to two fire stations. Figure 4-1 shows the location of the fire stations and other public facilities in relation to the project site.

4.4.2 POLICE STATIONS

Police headquarters is located in Līhu‘e and a district substation is located near Kapa‘a Town Park on Kahau Road approximately three miles from the property. Although regular police surveillances do not occur in the project area, police service is provided to all locations on the island.

4.4.3 HOSPITALS

Samuel Mahelona Memorial Hospital, located in lower Kawaihau adjacent to Kapa‘a High School, provides long-term care service with 70 beds and a small, 9-bed psychiatric ward. There are no emergency services at the hospital, so such services would be obtained from the Wilcox Hospital in Līhu‘e.

4.4.4 PUBLIC SCHOOLS AND RECREATION

Public school facilities in Kapa‘a include Kapa‘a Elementary, Middle and High School. Across Ka‘apuni Road from the project site is Kapahi Park, a County neighborhood park. The large open play field includes play areas for baseball, soccer, and a basketball court. There are also playground apparatus and equipment for young children.

Other public facilities in the area include Kapa‘a Public Library, parks, beach parks, a refuse transfer station, a green waste diversion site, and a U.S. Post Office.

4.4.5 PUBLIC TRANSPORTATION

The County currently provides public bus service to the Kapa‘a upland area via the Kaua‘i Bus Route 60 Kapahi Shuttle. The Route 60 bus line travels in a loop within the Kapa‘a area, starting and ending at Kapa‘a Skate Park with 14 stops along the way (see Figure 4-2). The nearest bus stop to the project site is located at the corner of Kawaihau Road and Ka‘apuni Road.

FIGURE 4-1 PUBLIC FACILITIES

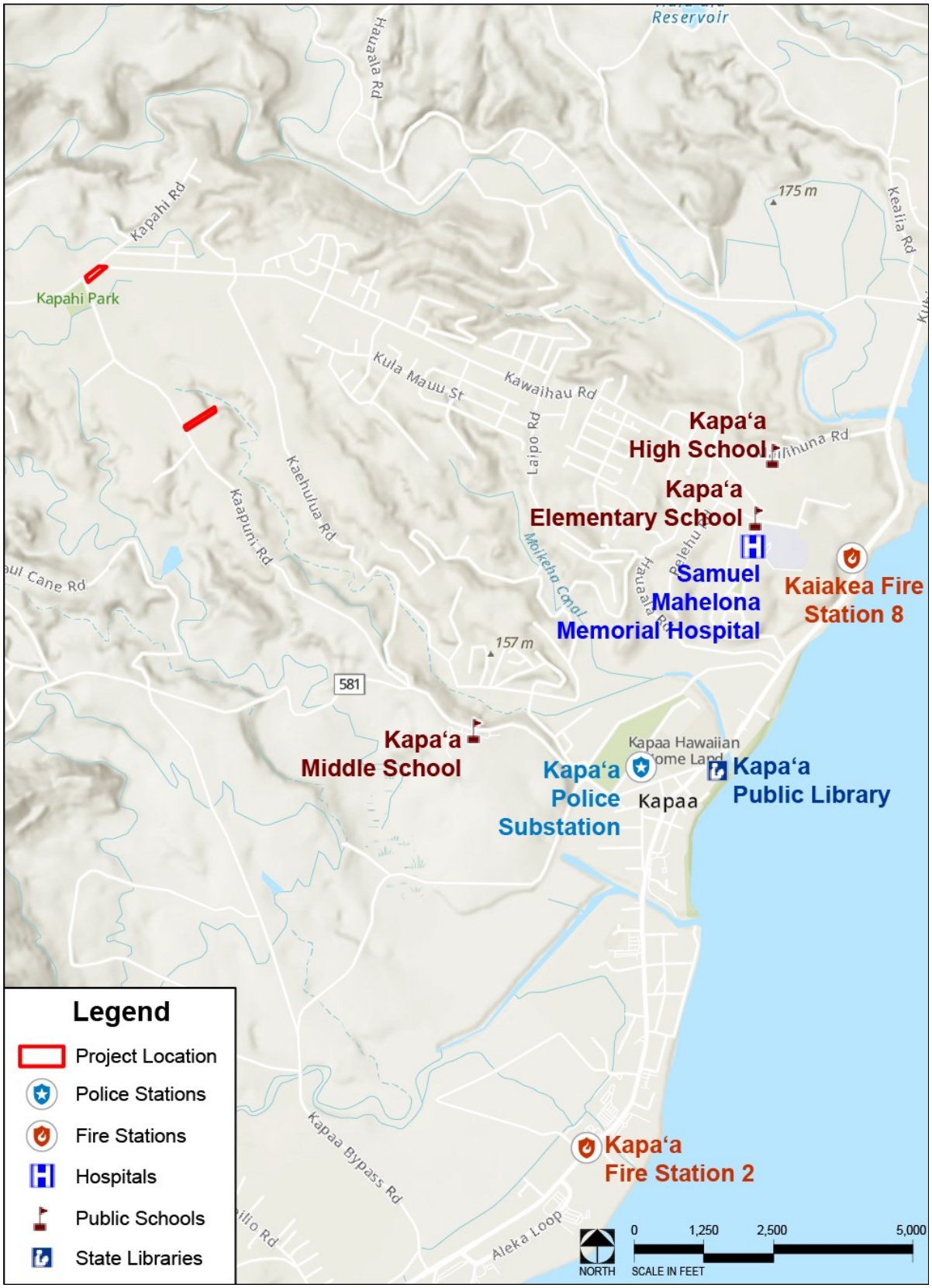
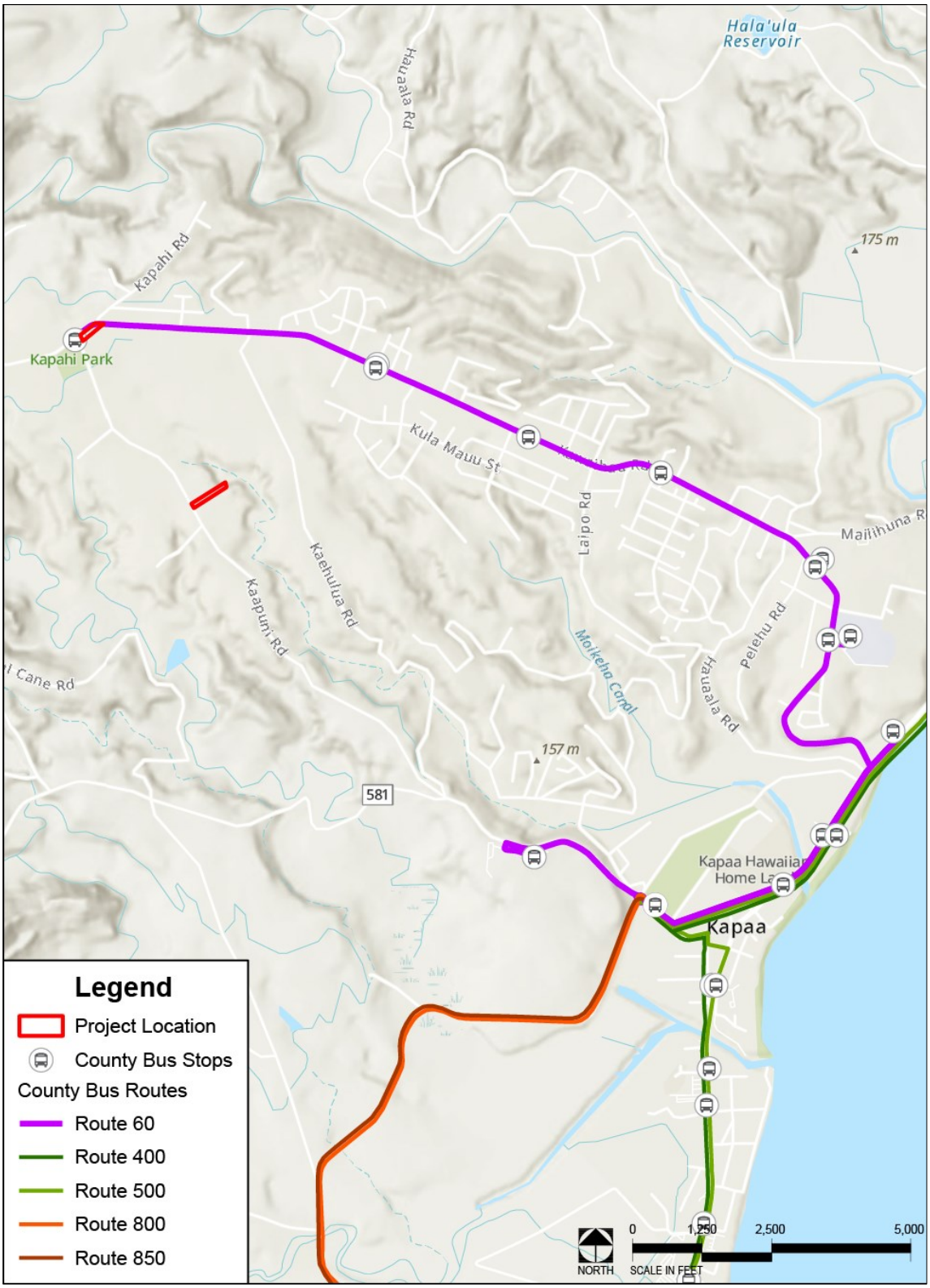


FIGURE 4-2 COUNTY BUS ROUTES



5 RELATIONSHIP TO PUBLIC LAND USE POLICIES

5.1 HAWAI‘I STATE PLAN

The Hawai‘i State Plan was established by State law to serve as a guide for the future long-range development of the state. It is intended to identify the goals, objectives, policies, and priorities for the state government to: (1) provide a basis for determining priorities and allocating limited resources, such as public funds, services, human resources, land, energy, water, and other resources; (2) improve coordination of federal, state, and county plans, policies, programs, projects, and regulatory activities; and (3) establish a system for plan formulation and program coordination to provide for an integration of all major state and county activities.

The relevant objectives of the State Plan on water and for the Proposed Action are:

- ***HRS §226-13 Objectives and policies for the physical environment--land, air, and water quality.***

  2) Promote the proper management of Hawaii's land and water resources.

- ***HRS §226-14 Objective and policies for facility systems--in general.***

  1) Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.

  2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.

  3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.

- ***HRS §226-16 Objective and policies for facility systems--water.***

  4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use, and

  5) Support water supply services to areas experiencing critical water problems.

Discussion: The overall objective of the Proposed Action is to provide additional water storage and water source for the Wailua-Kapa‘a community. As noted in Section 1.1, the current water system that serves the Wailua-Kapa‘a community lacks adequate storage capacity to meet MDD and County fire flow requirements. In addition, additional sources of water will be required to meet the future demand projected with the population growth. The Proposed Action would accommodate the current and future needs of the Wailua-Kapa‘a community by providing additional potable water storage capacity, and a potential water source to supplement the Wailua-Kapa‘a Water System. As noted in Section 1.3.3, should the pump tests of the exploratory well show that the site will not provide sufficient yield, or has organic contamination that may require treatment, the DOW may seek an alternative site for a new water source to ensure adequate service is provided to meet the current and future source demand for the Wailua-Kapa‘a Water System and the community.

5.2 STATE LAND USE LAW

The State Land Use District Maps, administered by the State Land Use Commission, designate the project site in the Agricultural District[4] (see Figure 5-1). The Proposed Action is a permitted land use in this designated district.

5.3 STATE ENVIRONMENTAL POLICY

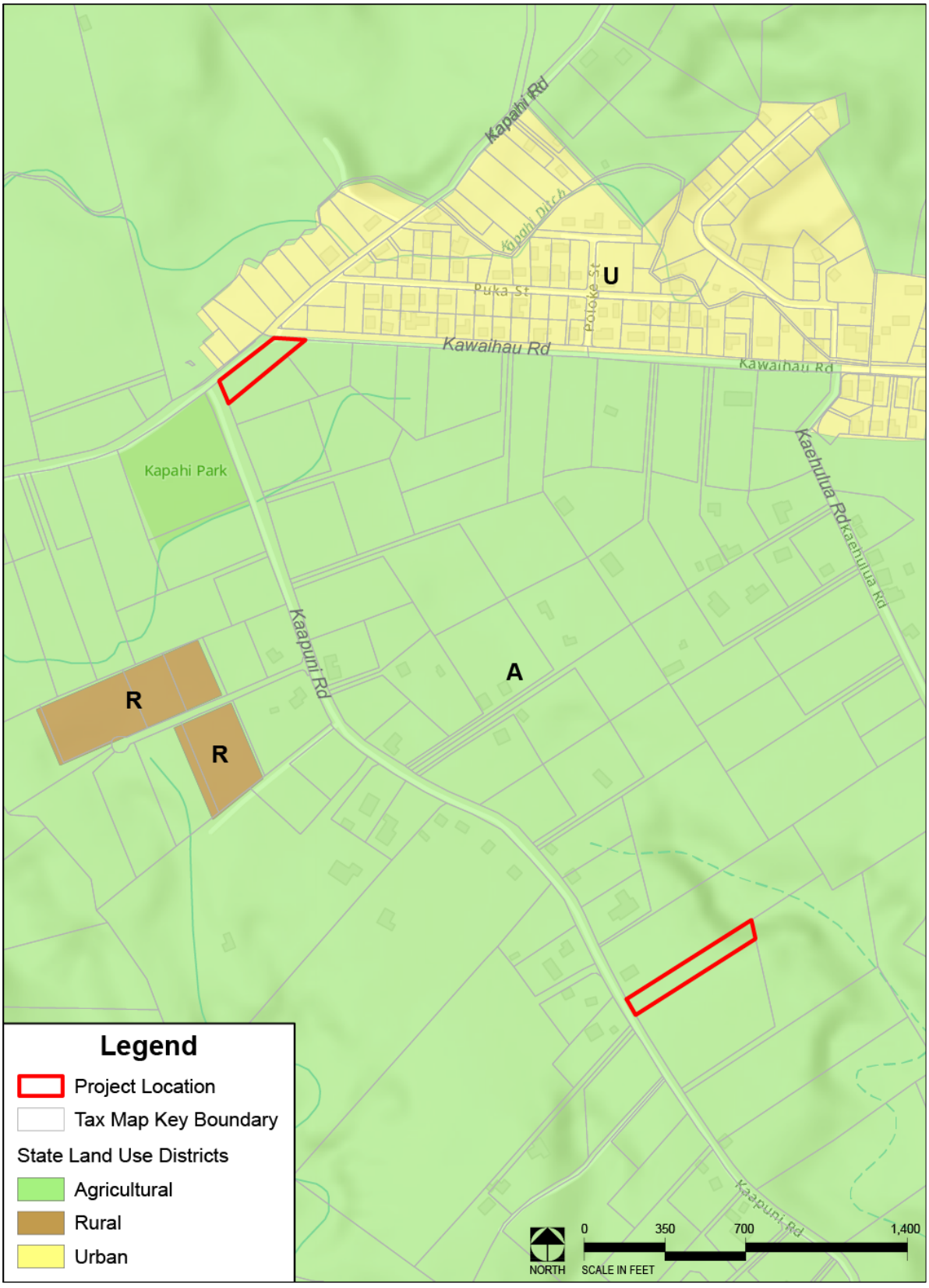
The Proposed Action is consistent with the State Environmental Policy, as stated in Hawai‘i Revised Statutes (HRS) Chapter 344, to “enhance the quality of life” by “creating opportunities for the residents of Hawai‘i to improve their quality of life through diverse economic activities which are stable and in balance with the physical and social environments.” The Proposed Action will provide the necessary utility and infrastructure to support such economic opportunities, allowing them to flourish and establish themselves in the county.

Further, the following guidelines of the State Environmental Policy relate to the management of the proposed project:

- Encourage management practices that conserve and fully utilize all natural resources.
- Encourage management practices that conserve and protect watersheds and water sources, forest, and open space areas.

[4] Established by HRS §205.

FIGURE 5-1 STATE LAND USE DISTRICTS



5.4 HAWAI‘I COASTAL ZONE MANAGEMENT PROGRAM

The Federal Coastal Zone Management (CZM) Program was created through passage of the CZM Act of 1972, which was intended to assist states in better managing coastal and estuarine environments. Hawai‘i’s CZM Program was created in 1977 (codified under HRS §205A) and provides a basis for protecting, restoring, and responsibly developing coastal communities and resources across the State. In Hawai‘i, the "coastal zone management area" means all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the territorial sea.

Hawai‘i’s CZM Program’s objectives and policies are provided under HRS §205A-2. A discussion on the Proposed Action’s compliance with the objectives and policies is provided below.

(1) Recreational Resources
   a. Objective: Provide coastal recreational opportunities accessible to the public.
   b. Policies:
      (A) Improve coordination and funding of coastal recreational planning and management; and
      (B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:
         (i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;
         (ii) Requiring restoration of coastal resources that have significant recreational and ecosystem value, including but not limited to coral reefs, surfing sites, fishponds, sand beaches, and coastal dunes, when these resources will be unavoidably damaged by development; or requiring monetary compensation to the State for recreation when restoration is not feasible or desirable;
         (iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;
         (iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;
         (v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;
         (vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;
         (vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and
         (viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county

authorities; and crediting that dedication against the requirements of section 46-6;

Discussion: The Proposed Action is not anticipated to negatively impact any coastal recreational resources within proximity of the project site.

(2) Historic Resources
   a. Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.
   b. Policies:
      (A) Identify and analyze significant archaeological resources;
      (B) Maximize information retention through preservation of remains and artifacts or salvage operations; and
      (C) Support state goals for protection, restoration, interpretation, and display of historic resources;

Discussion: As previously discussed in Sections 2.15 and 2.16, the archaeological study prepared by CSH indicated there are no archaeological features on the Ornellas Tank Site. Considering that underground cultural deposits may still be a possibility, the County is committed to the responsibility of stopping work in the immediate area of any unexpected discovery during construction, and promptly notifying the SHPD. Work will not resume in the construction area until specifically authorized by the SHPD. The CIA prepared by CSH included consultation with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices that specifically related to the project area. The assessment did not find any cultural resources or practices that may potentially be impacted by the Proposed Action.

In addition, the DOW conducted follow-up consultation with the Kaua‘i Island Burial Council and the Historic Preservation Commission as recommended by OHA and described in Section 2.16. The Kaua‘i/Ni‘ihau Island Burial Council's Kawaihau Geographic Representative, Ms. Carol Lovell, had no concerns at this time. The County of Kaua‘i Planning Department had no further comments to offer at this time in anticipation that future County permits needed for the action would offer the Kauai Historic Preservation Review Commission additional opportunities to comment on the project.

(3) Scenic and Open Space Resources;
   a. Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.
   b. Policies:
      (A) Identify valued scenic resources in the coastal zone management area;
      (B) Ensure that new developments are compatible with their visual environment by designing and locating those developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;
      (C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and

(D) Encourage those developments that are not coastal dependent to locate in inland areas;

Discussion: The Proposed Action is not located in a coastal area and thus will not negatively impact any coastal scenic and open space resources. As previously noted in Section 2.14, the project site is located at the corner of Kawaihau Road, Kapahi Road, and Ka‘apuni Road. The new tanks and exploratory well will be visible from the three County rights-of-way. The appearance of the tanks, however, will be shorter than a typical storage facility of the combined size. The site will be landscaped and will include indigenous plants to screen the new facility. The proposed tanks and exploratory well are not anticipated to negatively impact any open space resources within proximity of the project site.

(4) Coastal Ecosystems
   a. Objective: Protect valuable coastal ecosystems, including reefs, beaches, and coastal dunes, from disruption and minimize adverse impacts on all coastal ecosystems.
   b. Policies:
      (A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;
      (B) Improve the technical basis for natural resource management;
      (C) Preserve valuable coastal ecosystems of significant biological or economic importance, including reefs, beaches, and dunes;
      (D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and
      (E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures;

Discussion: The Proposed Action is not located in a coastal area and thus will not negatively impact any coastal ecosystems.

(5) Economic Uses
   a. Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.
   b. Policies:
      (A) Concentrate coastal dependent development in appropriate areas;
      (B) Ensure that coastal dependent development and coastal related development are located, designed, and constructed to minimize exposure to coastal hazards and adverse social, visual, and environmental impacts in the coastal zone management area; and
      (C) Direct the location and expansion of coastal development to areas designated and used for that development and permit reasonable long-term growth at those areas, and permit coastal development outside of designated areas when:
         (i) Use of designated locations is not feasible;
         (ii) Adverse environmental effects and risks from coastal hazards are minimized; and

(iii) The development is important to the State's economy;

Discussion: While the Proposed Action is not being developed in a coastal area, the proposed improvements are intended to provide public facilities and infrastructure that support the DOW’s mission in providing safe, affordable, and sufficient drinking water to the Wailua-Kapa‘a community. The Proposed Action will provide additional potable water storage capacity to serve the needs of the Wailua-Kapa‘a community as there is currently inadequate capacity to meet the MDD and County fire flow requirements, which may potentially affect DOW’s capability to sufficiently serve its customers. The Proposed Action is consistent with the objective in providing public facilities and improvements that will serve the Wailua-Kapa‘a community residents and businesses, in a location that is suitable for the development.

(6) Coastal Hazards
   a. Objective: Reduce hazard to life and property from coastal hazards.
   b. Policies:
      (A) Develop and communicate adequate information about the risks of coastal hazards;
      (B) Control development, including planning and zoning control, in areas subject to coastal hazards;
      (C) Ensure that developments comply with requirements of the National Flood Insurance Program; and
      (D) Prevent coastal flooding from inland projects;

Discussion: The Proposed Action is not located in a coastal area and thus will not be vulnerable to coastal hazards.

(7) Managing Development
   a. Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.
   b. Policies:
      (A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;
      (B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and
      (C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process;

Discussion: The Proposed Action is not located in a coastal area and thus will not require management of coastal resources and hazards.

(8) Public Participation
   a. Objective: Stimulate public awareness, education, and participation in coastal management.
   b. Policies:

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

Discussion: The Proposed Action is not located in a coastal area and does not provide for public awareness, education, and participation in coastal management. The EA process includes a statutory public comment period, which includes consultation with government agencies, organizations, and surrounding landowners. Consultation conducted as part of the EA process is summarized in Section 10.

(9) Beach and Coastal Dune Protection
a. Objectives:
(A) Protect beaches and coastal dunes for:
(i) Public use and recreation;
(ii) The benefit of coastal ecosystems; and
(iii) Use as natural buffers against coastal hazards; and
(B) Coordinate and fund beach management and protection.
b. Policies:
(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;
(B) Prohibit construction of private shoreline hardening structures, including seawalls and revetments, at sites having sand beaches and at sites where shoreline hardening structures interfere with existing recreational and waterline activities;
(C) Minimize the construction of public shoreline hardening structures, including seawalls and revetments, at sites having sand beaches and at sites where shoreline hardening structures interfere with existing recreational and waterline activities;
(D) Minimize grading of and damage to coastal dunes;
(E) Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor; and
(F) Prohibit private property owners from creating a public nuisance by allowing the private property owner's unmaintained vegetation to interfere or encroach upon a beach transit corridor;

Discussion: The Proposed Action is not located in a coastal area and thus will not impact beaches and/or coastal dunes.

(10) Marine and Coastal Resources
a. Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

b. Policies:
   (A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;
   (B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;
   (C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;
   (D) Promote research, study, and understanding of ocean and coastal processes, impacts of climate change and sea level rise, marine life, and other ocean resources to acquire and inventory information necessary to understand how coastal development activities relate to and impact ocean and coastal resources; and
   (E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion: The Proposed Action is not located in a coastal area and thus will not impact marine and coastal resources.

5.5 KAUA‘I COUNTY GENERAL PLAN

The General Plan was updated and adopted by the County of Kaua‘i in March 2018. The plan sets forth policies that govern the future development of the County. It is intended to improve the physical environment of the island and the health, safety, and general welfare of its people.

The General Plan establishes the objective for domestic water as “To ensure water for Kaua‘i’s water needs under the Public Trust Doctrine and integrate traditional ahupua‘a methods of preserving water for future generations—not taking more than is needed and leaving enough for everyone.”

While Kaua‘i’s aquifers contain an ample supply of water, the distribution system needs to be improved to meet projected demands through 2035. One such improvement includes providing additional storage and source facilities for its water system.

The Land Use Map of the General Plan designates the Ornellas Tank Site as “Residential Community” (see Figure 5-2). One of the intents of the Residential Community designation is to include lands that would be used predominantly for low- to high-density housing in towns and other residential areas. Densities for these residential areas should be one to 20 units per acre. They apply to locations throughout the island and include lands previously designated “Urban Residential” and “Rural Residential” as well as outlying areas such as Wailua Homesteads, ‘Ōma‘o, and Anahola. Residential Community may be used also for commercial and industrial businesses, government facilities, and institutions.

The Proposed Action will support the County’s policies on Residential Community designation. Further, the new facilities will be located adjacent to an existing water tank and will not affect any rare, endangered, or threatened wildlife or botanical habitat. The site has been surveyed and

there are no recorded archaeological features. The Proposed Action will be designed to maintain the overall character of the land and account for any potential soil erosion or flooding condition.

The drainage improvements located at the Drainage Site are within an Agricultural designation. The County’s policy is to preserve and protect agriculture lands to preserve Kaua‘i’s rural character and ensure land is available to contribute to self-sufficiency.

Overall, the Proposed Action is a utility that is designed to serve the public and support its basic needs.

5.6 KAPA‘A-WAILUA DEVELOPMENT PLAN

Adopted in 1975, the Kapa‘a–Wailua Development Plan sets forth the County’s development guidelines for the Kapa‘a–Wailua region. It establishes specific provisions that are more detailed than the island wide General Plan.

Although the project site is located in the Development Plan’s study region, it is not specifically covered by the plan’s land use provisions. The primary focus of the plan is on the region’s built-up areas. A description of needed water system improvements, however, is provided through a reference to *A General Plan for Domestic Water/Island of Kaua‘i*, which was prepared by the State DLNR in cooperation with the County Department of Water in 1972. The County DOW currently uses the *Water Plan 2020* as its guide for water system improvements on the island.

5.7 WATER PLAN 2020

The *Water Plan 2020* is an update of DOW’s previous long-range water system improvement plan for Kaua‘i. It is a 20-year comprehensive planning document that includes the objective to ensure that the department continues to provide safe, affordable, and sufficient drinking water to the island community. The plan reviews existing facilities and service standards, and provides an outline for new and replacement facilities, a capital improvement program for the next 5 to 7 years, a financial plan, and a water rate study. DOW is currently in the process of updating Water Plan 2020 with its Water Systems Investment Plan, however until this is completed, *Water Plan 2020* is still the current planning document used by DOW.

Water Plan 2020 currently identifies a need for an additional 2.2 MG of storage by the year 2020 for the Wailua-Kapa‘a service area, based on current needs and projected demand. The present storage capacity of the Wailua-Kapa‘a System is 3.8 MG. The plan also identifies a need for an additional water supply of 2,168 gpm total for Zones 530 and 538. Thus, the Proposed Action is part of DOW’s effort to meet the present and near-term storage and supply demand for the area.

5.8 KAUA‘I COUNTY ZONING ORDINANCE

The Comprehensive Zoning Ordinance (CZO) of the County of Kaua‘i regulates land use on the island of Kaua‘i. Land use regulations consist of development standards, application procedures, and criteria for granting permits and other approvals. Based on the Kaua‘i County Code §8-1.5, the proposed action would fall under the definition of “Utility facility, public” and “Utility line”.

The CZO currently designates the Ornellas Tank Site as Agricultural and the Drainage Site as Agricultural and Open Space (see Figure 5-3). Based on the Kaua‘i County Code §8-2.4(r)(15) and §8-2.4(t)(12), it is assumed that a Use Permit is required for the Proposed Action. A Class IV Zoning Permit would also be required for development within the Agricultural and Open Zones. The design of the new facility will comply with the development standards as set forth in the CZO. The chain link fence design will exceed the six-foot maximum height that is permitted for fences within the yard setback, as promulgated in Kaua‘i County Code §8-4.3(b)(4). As such, a variance permit will be sought from the County Planning Commission.

5.9 SPECIAL MANAGEMENT AREA

The Proposed Action is located outside of the Special Management Area (SMA) and, as a result, is not subject to SMA rules and regulations.

5.10 REQUIRED PERMITS AND APPROVALS

As a public facility in the County’s Agricultural and Open Zones, the Proposed Action will require a Class IV Zoning Permit and Use Permit from the County of Kaua‘i, Planning Department. A variance permit will be obtained to permit a six-foot-tall chain link fence with one-foot-tall extension of barbed wire. The total fence height will exceed the six-foot height permitted within a yard setback. The Ornellas Tank Site’s dimensions prevents the fence from being build outside of the setback line while maintaining a service access and apron around the storage tanks and exploratory well.

A National Pollutant Discharge Elimination System (NPDES) general permit application will be submitted to the State Department of Health (DOH) for the proposed tank, drainage improvements, and exploratory well.

For the construction of the tanks and exploratory well, a grading permit will not be required. As a County agency, the DOW will apply its grading standards in the project’s site preparation and grading work.

If applicable, a noise variance permit will be obtained from the DOH for the construction of the project.

FIGURE 5-2 COUNTY OF KAUA'I GENERAL PLAN LAND USE DESIGNATIONS

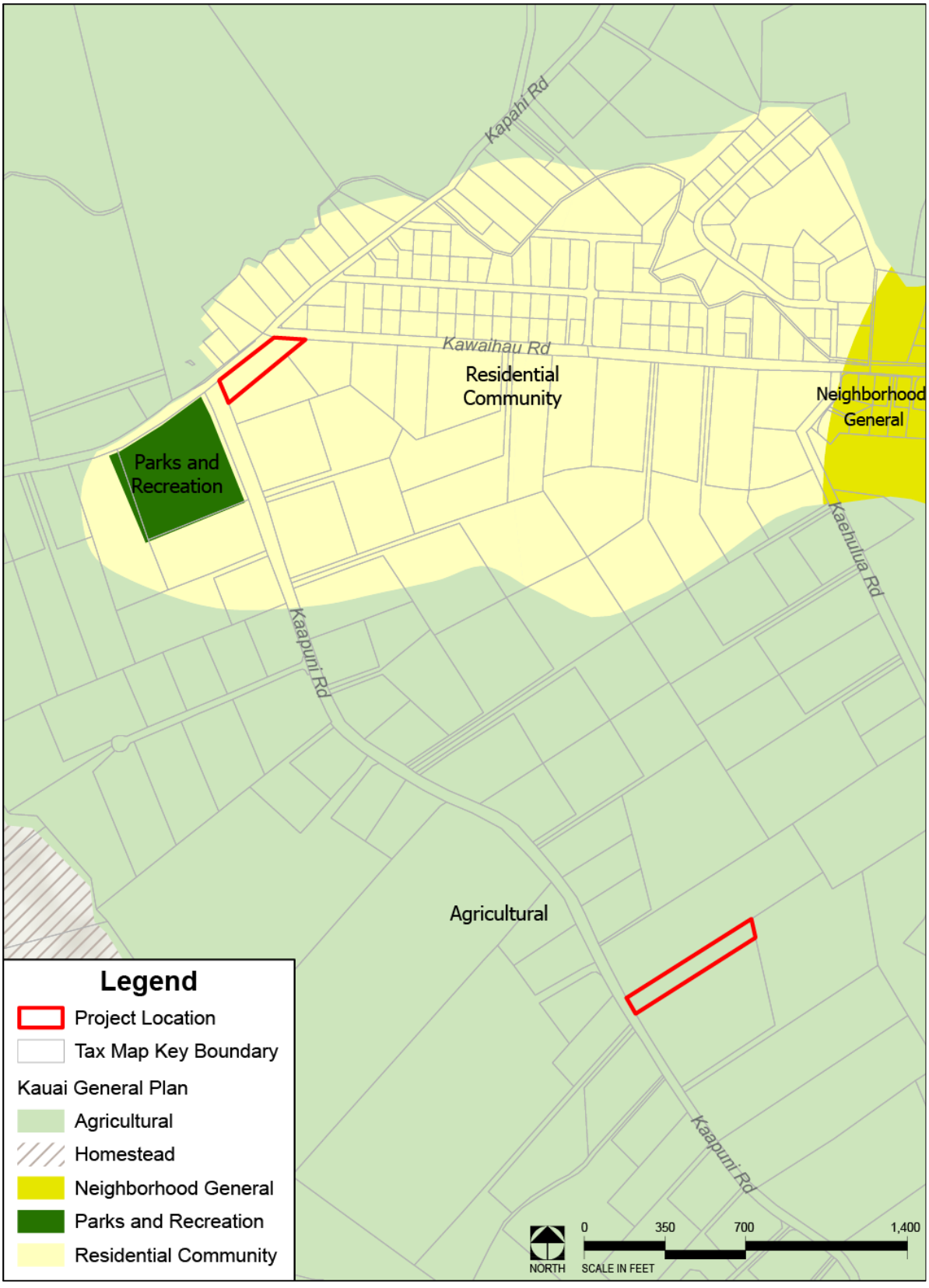
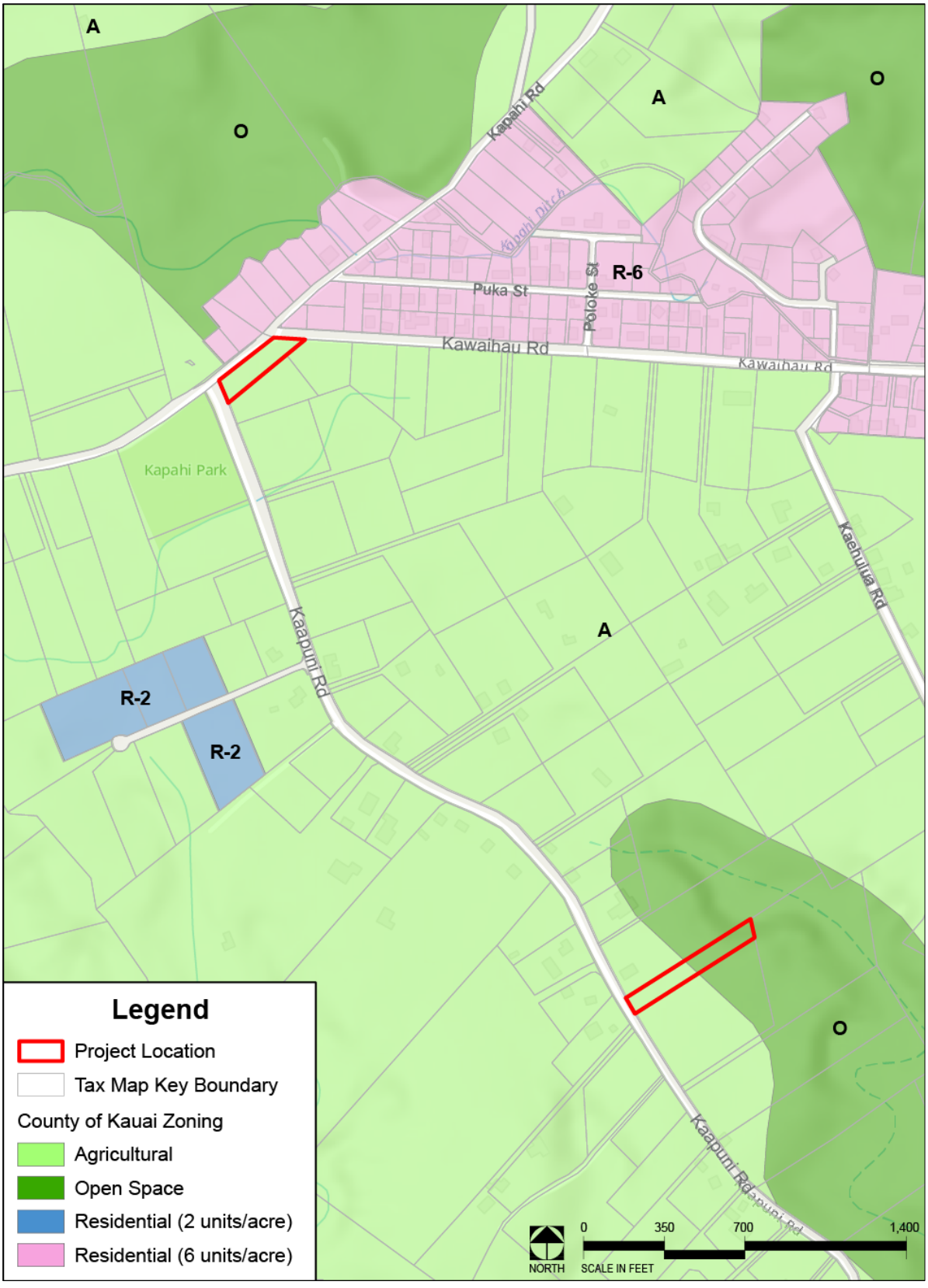


FIGURE 5-3 COUNTY OF KAUA'I ZONING



6 DESCRIPTION OF AFFECTED ENVIRONMENT AND MITIGATION MEASURES

6.1 CONSTRUCTION METHODOLOGY AND IMPACTS

Best management practices (BMPs) will be employed to retain potential runoff at both the Ornellas Tank Site and Drainage Site. All construction work is to be constructed in accordance with the current versions of the "Hawai‘i Standard Specifications for Road and Bridge Construction”, the "Hawai‘i Department of Transportation Highways Division Standard Plans”, and the "Standard Details for Public Works Construction, City and County of Honolulu, and the Counties of Kaua‘i, Maui and Hawai‘i”. The standard details are available at the County of Kaua‘i Clerk’s Office. All grading, grubbing, and stockpiling work shall be performed in accordance with the County of Kaua‘i Ordinance No. 808.

6.2 SURFACE WATER AND SOIL

Potential runoff and sedimentation from the construction area to adjacent properties may occur during heavy rainfall. To address potential runoff and sedimentation on the adjacent properties during construction, the contractor will develop a BMP plan for County review. The plan will describe how on-site generated runoff and sediment movement will be controlled and prevented from entering other properties, and how the applicant will implement the plan. The plan will not be approved unless the applicant first meets all of the grading standards that are designed to safeguard life and limb, protect property, promote public welfare, and preserve and enhance the natural environment including, but not limited to, water quality.

Potential mitigation measures for controlling runoff and sediment movement include the development of sedimentation basins, cut-off swales and ditches, rock filter berms, hydromulching, and wattles. These may be included in the BMP plan, if appropriate, and will be submitted to the County for review.

Discharges from overflows and tank cleaning will seldom occur and will be conducted in a manner that complies with all NPDES Permit conditions. Discharges from the hydraulic capacity testing of the exploratory well will be performed over a period of 4 – 7 days and will be conducted in a manner that complies with all NPDES Permit conditions. Precautionary measures will be taken to ensure that nearby streams are not directly impaired or deteriorated by the Proposed Action.

No discharge will be allowed to flow into the State irrigation ditch system.

Discharge that flows from the Ornellas Tank Site through the new drainage outlet at the Drainage Site will flow into a natural gulch and will be potable water from the tanks or exploratory well or surface water from the Ornellas Tank Site. Therefore, no adverse impacts are anticipated.

6.3 GROUNDWATER

Groundwater is not expected to be encountered during the tank project's grading, excavating, and construction. The exploratory well will be looking to extract groundwater to be a source for the water system. Once the borehole of the well is capped, the exploratory well will be in an idle state until a decision is made to convert the well for production or for monitoring of the region's groundwater. As an idle well, there will be no generated impacts to the surrounding environment. Should the well be converted into a production well, another EA will be prepared to assess the probable short-term and long-term impacts of the converted well on the aquifer's groundwater resource and the region's land use and resident population.

6.4 AIR QUALITY

During construction, heavy equipment will be used during the Proposed Action. In order to control dust generated by earthwork on the construction site, mitigation measures such as the installation of dust screens, covering dirt stockpiles, and sprinkling of water on exposed dirt areas, may be employed.

6.5 NOISE

During construction, heavy equipment will be used during the Proposed Action. Construction noise will be generated but it will be temporary and restricted to daylight hours and regular weekdays. The construction contractor will comply with the noise control requirements of HAR Chapter 11-46, Community Noise Control, and their compliance will be part of the project's construction contract. Potential noise from the operations of the water system will also be subject to the State Community Noise Control regulations.

6.6 ARCHAEOLOGICAL RESOURCES

At the Ornellas Tank Site, ground disturbance in the form of grading will occur to prepare the surface for the construction of the new storage tanks and exploratory well. At the Drainage Site, a trench will be dug to install the underground pipe. According to the archaeological assessment (Appendix D), no archaeological sites were found within the project area. As a result, there are no anticipated impacts to archaeological resources and no further archaeological work or assessment is necessary. Should any unexpected archaeological features be uncovered during construction, all work within the immediate area of the find will be halted and the SHPD will be contacted for proper treatment. Work will not resume in the affected area until authorized by the SHPD.

6.7 SOLID WASTE

All solid waste or debris generated by the construction work will be collected and hauled away to a County-approved landfill or authorized commercial disposal site.

6.8 VIEW PLANE

The planned landscaping of the Ornellas Tank Site will enhance the visual appearance of the public facility but will also soften the visual effect of the two new storage tanks and exploratory well and will also serve as a permanent erosion control measure. At the Drainage Site, following construction, the drainage line will be buried and will not have any impact to the view plane.

6.9 TRAFFIC

During construction, there will be a slight increase in traffic near the project site from construction crews. There is enough land available for off-street parking and will not have an impact on traffic flow. Following the completion of the project, traffic will return to normal levels and no long-term impacts are anticipated.

6.10 BIOLOGICAL RESOURCES

No special-status species were observed at either the Ornellas Tank Site or the Drainage Site. Although endangered Hawaiian waterbirds were not detected during the field survey, and the project site does not consist of potential foraging habitat that would support waterbird foraging, the project may result in the creation of standing water or open water that could potentially attract Hawaiian waterbirds to the project site. Per the DLNR Division of Forestry and Wildlife’s (DOFAW) pre-assessment comment letter dated June 19, 2023, State-listed waterbirds such as the Ae‘o or Hawaiian stilt (*Himantopus mexicanus knudseni*), ‘Alae ke‘oke‘o or Hawaiian coot (*Fulica alai*), ‘Alae ‘Ula or Hawaiian gallinule (*Gallinula chloropus sandvicensis*), Kōloa Maoli or Hawaiian Duck (*Anas wyvilliana*), and Nēnē or Hawaiian Goose (*Branta sandvicensis*) could potentially occur at or in the vicinity of the proposed project site. Ae‘o may also be found wherever ephemeral or persistent standing water may occur. To avoid and minimize potential project impacts to Hawaiian waterbirds, the following mitigation measures are recommended and will be adhered to during the construction of the project:

- If any of the species listed are present during construction, all activities within 100 feet (30 meters) should cease and the bird or birds should not be approached. Work can continue after the bird or birds leave the area of their own accord.
- If a nest is discovered, contact the Kaua‘i Branch DOFAW Office at (808) 274-3433.
- In areas where waterbirds are known to be present, post and implement reduced speed limits, and inform project personnel and contractors about the presence of endangered species on-site.
- If water resources are located within or adjacent to the project site, incorporate applicable best management practices regarding work in aquatic environments into the project design.
- Have a biological monitor that is familiar with the species’ biology and conduct Hawaiian waterbird nest surveys where appropriate habitat occurs within the vicinity of the proposed project site prior to project initiation.

Although seabirds were not observed in the project area, they may potentially fly over the area to and from higher elevation nesting areas during the seabird fledging period. Seabirds such as the endangered Hawaiian petrel (*Pterodroma sandwichensis*) and the threatened Newell’s shearwater (*Puffinus newelli*) are attracted to bright lights while traveling between their nest sites and the ocean and are sometimes grounded when they become disoriented by lights. To avoid and minimize light attraction in the project area, the following mitigation measures are recommended and will be adhered to during construction of the project:

- Construction activity should be restricted to daylight hours as much as practicable during the seabird breeding season (April – November) to avoid the use of nighttime lighting that could attract seabirds.
- All outdoor lights should be shielded to prevent upward radiation. This has been shown to reduce the potential for seabird attraction.
- Outside lights that are not needed for security and safety should be turned off from dusk through dawn during the fledgling fallout period (September 15 – December 15).

While the endangered Hawaiian hoary bat was not observed during the field survey, its forage and roost habitat does occur in the survey area within the vegetation type. Hawaiian hoary bats typically roost in trees greater than 16 feet (5 meters) with dense canopy foliage or in the subcanopy when the canopy is sparse and there is open access for launching into flight (Gorresen et al. 2013; U.S. Department of Agriculture 2009). In the vicinity of the project area, hau trees may be used as a site to roost.

To prevent direct impacts to the Hawaiian hoary bat, the following measures are recommended:

- No trees taller than 15 feet (4.6 meters) in the survey area should be trimmed or removed between June 1 and September 15 when flightless juvenile bats may be roosting in the trees.
- Any fences erected as part of the project should have a barbless top-strand wire to prevent the Hawaiian hoary bat from becoming entangled on barbed wire.

Implementation of these measures, which have been promulgated by the FWS (1998), is expected to result in avoidance of all direct impacts to Hawaiian hoary bats. The project proposes to install a six-foot-tall chain link fence with one-foot-tall extension of barbed wire for security purposes. While it is recommended to install barbless top-strand wire fences, the proposed chain link fence with barbed wire is not anticipated to impact the Hawaiian hoary bat as they are often observed in higher elevation areas and in trees greater than 16 feet in height. Because all impacts to the Hawaiian hoary bat will be discountable, the proposed project *may affect, but is not likely to adversely affect*, individuals or populations of the species.

The U.S. Fish and Wildlife Service (FWS) provided a pre-assessment comment letter dated May 18, 2023 that provided additional details on the Hawaiian goose or Nēnē. While the Nēnē was not observed during the field survey, they are found on the islands of Hawai‘i, Maui, Moloka‘i, and Kaua‘i. Nēnē are observed in a variety of habitats, but prefer open areas, such as pastures, wetlands, and natural grasslands and shrublands. To avoid and minimize potential project impacts to Nēnē, the following mitigation measures are recommended and will be adhered to during the construction of the project:

- Do not approach, feed, or disturb nēnē.
- If nēnē are observed loafing or foraging within the project area during the breeding season (September through April), have a biologist familiar with nēnē nesting behavior survey for nests in and around the project area prior to the resumption of any work. Repeat surveys after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest).
- Cease all work immediately and contact the FWS for further guidance if a nest is discovered within a radius of 150 feet of proposed project, or a previously undiscovered nest is found within the 150-foot radius after work begins.
  In areas where nēnē are known to be present, post and implement reduced speed limits, and inform project personnel and contractors about the presence of endangered species on-site.

To minimize the risk of spreading invasive species, all equipment, materials, and personnel should be cleaned of excess soil and debris. This will help to minimize the movement of plant or soil material between worksites, as these materials may contain detrimental fungal pathogens, vertebrate and invertebrate pests, or invasive plant parts that could harm native species and ecosystems.

7 ALTERNATIVES CONSIDERED

7.1 NO ACTION

If the Proposed Action were not implemented, the site would remain vacant. The present water system would continue to under-serve its customers, and the system would continue to operate at capacity as the service area’s population grows. In particular, the system in the Kapa‘a sector would lack adequate storage reserve to meet maximum day demand and fire flow requirements. An inadequate storage system may result in an interruption of service during peak day demand through the highest usage season and inadequate supply during severe fire emergencies.

No exploration of potable groundwater at the project site would trigger the search for other water resources in the region or a termination for now of any further investigation of potential sources to serve the Kapa‘a region. Additional discussions on alternative sites are provided in Section 2.6.1 and Appendix B. Termination of any search for potential sources in the project area may result in an exploration of other ideas or concepts to bring water into the region; whether that calls for piping water from another water system or region, restricting further residential growth in Kapa‘a, developing permanent water conservation practices, and/or establishing a water re-use program or dual-water system consisting of potable water for domestic use and brackish water for irrigation, washing activities, and wastewater flushing.

Restricting further residential growth in Kapa‘a would be counter-productive to the implementation of the County General Plan which has officially adopted long-term growth policies for the region. Changing these policies would require amending the General Plan and obtaining approval from the County Council.

Implementing water conservation practices, if voluntary, would involve heavy ad programs or, if mandatory, changes to government rules and regulations. Information on conservation measures and other public outreach material are listed and available on DOW’s website. Engaging the community to fully participate in the County’s water conservation program may take time and initially have limited effects. Establishing mandatory conservation practices may require a long legislative or agency review and approval process for setting the changes.

A dual-water system will initially require a feasibility study, a policy change, financing, and then construction. It would require a serious commitment by the County to implement it on a large scale to have any significant results.

7.2 INCREASING EXISTING TANK SIZE

Although increasing the size of the existing tank is an alternative, it is usually dismissed from consideration. Existing tanks are typically designed to structurally support its original holding capacity. Further, it would be a very complex operation to undertake a tank expansion while continuing to serve the system’s customers and maintain a high water quality in the storage facility. These problematic uncertainties raise risks which are not preferrable to the DOW.

7.3 ALTERNATIVE TANK CONFIGURATIONS

Different designs for the 1.0-MG capacity were considered for the proposed project. The small, narrow configuration of the project site presented a constraint on the design for the 1.0-MG facility. Several designs were considered including a circular-shaped tank and a multi-sided shaped tank. Some designs encroached into the adjacent property.

Tanks with floor elevations below existing grade were also considered. The final design of two circular 0.5-MG tanks was determined because it allowed for 1.0 MG of storage to be added on the property. As a bonus, the final design will also have visual benefits as the overall height of the new tanks will be less imposing.

7.4 ALTERNATIVE LOCATION

7.4.1 STORAGE TANK LOCATION

An alternative site to the north of the project site near the Kapa‘a Stream and in the same pressure zone was evaluated and found to be physically unfeasible. The State-owned land contained topographic constraints that would have resulted in a costly development. Other vacant State or County sites in the same pressure zone were investigated but were not available.

7.4.2 EXPLORATORY WELL LOCATION

A well site investigative study was prepared by Tom Nance Water Resource Engineering where six potential sites were reviewed and evaluated. Three sites were in upland locations around Kapa‘a Homesteads and three sites were in the lower elevations of Kawaihau. The sites in the lower elevations were potential candidates because they were in an area occupied by very productive wells. Unfortunately, a well in a lower elevation area would pump directly into the distribution system rather than into a nearby storage tank. In effect, there would be no storage opportunity for the water to serve as a reserve for peak period demand and fire flow emergencies.

The three upland wells were all at existing tank sites, which have adequate room for a potential well. The Kulana Tank site (elevation 300 feet) is occupied by a 0.25 MG tank. If tests of an exploratory well on this site prove successful, a production well could be developed. However, there would be limited opportunity to expand or construct a supplemental storage tank on the property to accommodate a full operational production well.

The Stable Tank site is located in the lower pressure zone at elevation 214 feet (Zone 214). It has an existing 0.20 MG tank that is planned for demolition and replacement with a 1.0 MG tank. Sufficient space is available on the site for a well and control building.

The present project site is in the 313 feet pressure zone (Zone 313) and occupied by the existing 0.2 MG Ornellas Tank. There is sufficient space for a well and control building as well as a 1.0 MG storage tank. Development of a production well at this site would provide better distribution

advantages to service Zones 313 and 214 than the Stable Tank site. Hence, the present project site was selected as the preferred site for the exploration well project.

7.5 ALTERNATIVE DRAINAGE IMPROVEMENTS

An alternative drainage plan was originally designed for the Proposed Action. The drainage plan proposed that the washout and overflow line from the existing tank would connect with the washout and overflow line from the new tanks. Additionally, a perimeter drain line from the new tanks would connect with the new 18” diameter drain line from the property. The new 18” drain line would extend into Kawaihau Road on the northwest side of the site and run down Kapahi Road approximately 950 feet (primarily under the road pavement) to discharge its flow into an existing 18” diameter drainage line within Kapahi Road right-of-way.

In 2011, a FEA-FONSI was completed with this drainage design, however, there were concerns that the runoff from the project site would run along Kapahi Road and deposit onto private properties downhill of the project site. Upon consultation with the surrounding landowners and review by the County it was determined that the original drainage design was not adequate and thus it was removed from consideration. The drainage design in the Proposed Action has replaced this alternative.

8 DETERMINATION

The Proposed Action is anticipated to have no significant or adverse impacts on the environment and an Environmental Impact Statement (EIS) is not warranted. Therefore, a Finding of No Significant Impact (FONSI) is issued for the Proposed Action covered in this FEA.

9 FINDINGS AND REASONS SUPPORTING DETERMINATION

The following findings and reasons indicate that the Proposed Action will have no significant adverse impact on the environment based on the 13 criteria for significant impact as provided in Hawai‘i Administrative Rules 11-200.1-13.

1) Irrevocably commit a natural, cultural, or historic resource;

Alternative plans in project location, size, and configuration were considered in determining the best design for upgrading and improving the Wailua-Kapa‘a Water System while minimizing or avoiding negative impacts on natural and cultural resources. As detailed in Section 2.8, the vegetation types and plant species identified during the flora and fauna survey are not considered unique. Only two indigenous plant species, hau (*Hibiscus tiliaceus*) and Cyperus polystachyos, were observed in the survey area. These species are not considered rare nor are they federally or state-listed threatened or endangered species, species proposed for listing, or candidate species. In addition, no endangered or threatened seabirds or native insects or invertebrates were detected during the flora and fauna survey. While there were no seabirds detected in the project site, they may potentially fly over the project site while traveling between their nest sites and the ocean. The mitigation measures listed in Section 6.10 will be adhered to during construction of the project to minimize light attraction and potential impacts to seabirds in the area.

While the endangered Hawaiian hoary bat was not observed during the field survey, its forage and roost habitat does occur in the survey area within the vegetation type. In addition, the project proposes to install a six-foot-tall chain link fence with one-foot-tall extension of barbed wire for security purposes. While it is recommended to install barbless top-strand wire fences, the proposed chain link fence with barbed wire is not anticipated to impact the Hawaiian hoary bat as they are often observed in higher elevation areas and in trees greater than 16 feet in height.

As noted in Section 6.6, the archaeological assessment did not find any archaeological sites within the project area. As discussed in Section 2.16, CSH contacted and consulted with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices that specifically related to the project area. Based on the consultation efforts, no cultural practices or concerns were found to be within the project area.

Based on the studies and assessments conducted in support of this EA, it is anticipated that the Proposed Action will not result in a significant loss or destruction of the project area’s natural, cultural, or historic resources.

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

The Proposed Action calls for the construction of additional storage facilities to supplement an existing storage tank at the 305-foot elevation of the Wailua–Kapa‘a Water System and an exploratory well. No new or different land use is being proposed

on the project site. The new facility will not require changes that would curtail the range of beneficial uses of the environment.

3) Conflict with the State's environmental policies or long-term environmental goals established by law;

As demonstrated in Section 5.3, *State Environmental Policy,* of this document, the Proposed Action is consistent with the state's long-term environmental policies and guidelines as expressed in HRS Chapter 344.

4) Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State;

The Proposed Action is expected to sustain and improve the positive economic and social benefits that an adequate utility provides to a community. The economic stimulus associated with the construction of the proposed project, however, will not be substantial on the local economy as the size of the projected construction work will be moderate.

No negative effects from improvements to the water system are anticipated on the social welfare of the local community. As previously noted, no cultural practices or concerns were identified in the project site, thus the project is not anticipated to have an adverse effect on the cultural practices of the community and State.

5) Have a substantial adverse effect on public health;

The Proposed Action would not result in the use of hazardous materials or construction methodology that could be detrimental to the public health and safety of the area residents. Existing DOH regulations are in effect to protect water quality in the communities. Construction and operational noise will be minimized through compliance with HAR Chapter 11-46, Community Noise Control.

6) Involve adverse secondary impacts, such as population changes or effects on public facilities;

There will be no significant adverse social impact generated by the Proposed Action. The new water storage facilities and exploratory well will supplement an existing storage tank on the project site. They will not change the character of the immediate vicinity nor generate direct undue increased resident population. The unmanned storage tanks and exploratory well will not result in any notable long-term negative impact on traffic or overburden existing public facilities or services.

7) Involve a substantial degradation of environmental quality;

The Proposed Action is located in a developed environment surrounded by existing homes and public roads. The Ornellas Tank Site is on an existing water tank parcel overgrown with common vegetation. The Drainage Site is also mostly comprised of overgrown common vegetation. Development of both sites will be consistent with existing uses in the area and will not result in long-term degradation of the natural environment.

8) Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions;

The Proposed Action is designed to supplement an existing storage tank and to explore a possible water supply option. The project is not intended to spur the development of additional facilities on the project sites or be part of a larger action and/or development. No future on-site phases are planned and no further commitment to a larger action is being contemplated.

9) Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat;

As noted in Section 6.10, no special status species were found during the flora and fauna survey conducted at the project sites. While no special status species were found during the flora and fauna survey, the FWS and DOFAW have provided a list of waterbirds, seabirds, and other special status species that may potentially occur or traverse through the site. A list of these species, along with recommended mitigation measures, have been included in Section 6.10.

10) Have a substantial adverse effect on air or water quality or ambient noise levels;

The anticipated impacts associated with the project construction, such as dust and noise, will be short-term and temporary. These impacts will be minimized by the implementation of mitigation measures in accordance with applicable laws, statutes, ordinances, and rules and regulations of the federal, state, and county governments. Erosion/sedimentation controls and best management practices will be employed to prevent construction-related runoff from impacting adjacent properties. Mitigation measures to reduce impacts to air or water quality and ambient noise levels are provided in Sections 6.4 and 6.5.

11) Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;

The Proposed Action will be located away from the shoreline area and outside of any major flood zones. Flooding from severe storms will not be a hazard to operators of the new storage facility, as regular operations of the new storage tanks will be unmanned.

12) Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies; or

The Proposed Action will have minor visual impacts on the general public. The new storage tanks each will be approximately 22 feet high and 72 feet wide. Configuration of the new storage facility into two smaller tanks will help reduce the overall mass and visual impact on motorists traveling on Kawaihau Road. Additionally, planned landscaping around the storage facility will provide a visual screen for the project. The Drainage Site would not consist of any aboveground improvements and thus would not have an impact on scenic vistas or viewplanes.

13) Require substantial energy consumption or emit substantial greenhouse gases.

The Proposed Action will require nominal energy consumption for its operation but will not result in a significant drain on the power supply for the County. In addition, the water storage tank operations and drainage improvements will not emit substantial greenhouse gases.

10 AGENCIES AND ORGANIZATIONS CONSULTED

As a requirement of HAR §11-200.1-18, this chapter identifies agencies, citizen groups, and individuals solicited for comment in the preparation of this EA. Table 10-1 provides a list of the agencies and organizations that were consulted during the pre-assessment consultation period and the Draft Environmental Assessment (DEA) comment period; those who provided a comment have been marked with an "X". Written comments received during the DEA public comment period, along with responses are provided in Table 10-2; a copy of the comment and response letters are contained in Appendix A.

TABLE 10-1 AGENCIES AND ORGANIZATIONS CONSULTED

Agency or Organization Solicited	Pre-Assessment Consultation Letter Recipient	Pre-Assessment Comments Received	DEA Consultation Letter Recipient	DEA Comments Received
FEDERAL AGENCIES				
U.S. Fish and Wildlife Service	X	X	X	
STATE AGENCIES				
Office of Planning and Sustainable Development	X		X	X
Department of Health	X		X	
Environmental Advisory Council	X		X	
Department of Land & Natural Resources, State Historic Preservation Division	X	X	X	
Department of Land & Natural Resources			X	

Agency or Organization Solicited	Pre-Assessment Consultation Letter Recipient	Pre-Assessment Comments Received	DEA Consultation Letter Recipient	DEA Comments Received
Office of Hawaiian Affairs	X		X	X
Department of Agriculture	X		X	
Department of Accounting and General Services	X	X	X	X
Department of Hawaiian Homelands	X		X	
Department of Transportation	X	X	X	X
Senator Ronald Kouchi, Senate District 8	X		X	
Representative Nadine Nakamura, House District 15	X		X	
COUNTY OF KAUA‘I AGENCIES				
Department of Public Works	X		X	
Kaua‘i Fire Department	X		X	
Department of Planning	X		X	
Kaua‘i Police Department	X		X	
Transportation Agency	X		X	

Agency or Organization Solicited	Pre-Assessment Consultation Letter Recipient	Pre-Assessment Comments Received	DEA Consultation Letter Recipient	DEA Comments Received
Department of Water Supply	X		X	
Kaua‘i County Council	X		X	
County of Kaua‘i, Office of the Mayor	X		X	
LIBRARIES AND NEWS OUTLETS				
Hawai‘i State Main Library & Document Center	X		X	
Kapa‘a Public Library	X		X	
UTILITY COMPANIES				
Kaua‘i Island Utility Cooperative	X		X	
Hawaiian Telcom	X	X	X	
Spectrum	X		X	
COMMUNITY GROUPS, STAKEHOLDERS, AND NEARBY LANDOWNERS				
Sherman Shiraishi (Sherman Shiraishi Attorney at Law, A Law Corporation)	X		X	
Gary Yamamoto	X		X	

Agency or Organization Solicited	Pre-Assessment Consultation Letter Recipient	Pre-Assessment Comments Received	DEA Consultation Letter Recipient	DEA Comments Received
Edward Tydingco	X		X	
Patience Elkins	X	X	X	
Souza Family Trust c/o Laurie Souza	X		X	
Godwin Esaki	X		X	X
Paul Esaki	X		X	
Barney and Merle Endo	X		X	
Clement Esaki	X		X	

TABLE 10-2 PRE-ASSESSMENT CONSULTATION COMMENTS AND RESPONSES

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
2/14/2024	State of Hawai‘i, Department of Accounting and General Services	The project does not impact any of the Department of Accounting and General Services’ projects or existing facilities in the Kapa‘a area, and we have no comments to offer at this time.	The DOW acknowledges that the Department of Accounting and General Services’ projects or existing facilities will not be impacted by the proposed project.	N/A
2/19/2024	State of Hawai‘i, Department of Transportation	In reviewing the Draft EA’s project description and location, HDOT’s position remains the same as our prior review during the pre-assessment consultation in letter STP 8.3616, dated May 30, 2023. We do not anticipate a significant impact to State roadways; therefore, we have no comments to provide.	The DOW acknowledges that the HDOT’s position remains the same as the prior review during the pre-assessment consultation and that the project will not have a significant impact to State roadways.	N/A
2/22/2024	State of Hawai‘i, Office of Planning and Sustainable Development	The Office of Planning and Sustainable Development (OPSD) has reviewed the submitted materials and has the following comments to offer: 1. <u>Issues of Programmatic Concern</u> The Draft EA sufficiently addresses many of the issues of programmatic concern for OPSD. It evaluates project alignment with the Hawai‘i State Planning Act, Hawai‘i Revised Statutes (HRS) Chapter 226; HRS § 205 – State Land Use Law; impacts to surface water resources; alternative drainage options; soil erosion; sea-level rise impacts; and related environmental concerns. 2. <u>Hawai‘i Coastal Zone Management (CZM) Program</u> We note that the Draft EA does not contain	The DOW acknowledges the OPSD's comments on the DEA and offers the following responses: <u>1. Issues of Programmatic Concern</u> The DOW acknowledges that the DEA sufficiently addresses issues of programmatic concern for OPSD. <u>2. Hawai‘i Coastal Zone Management (CZM) Program</u> A new subsection (Section 5.4) has been added to the FEA to provide an analysis of the CZM objectives and supporting policies that are applicable to this project.	Section 5.4

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		analysis on the project and its adherence with the objectives and supporting policies of the Hawai‘i CZM Program, as listed in HRS § 205A-2. The Final Environmental Assessment should include an in-depth analysis of all ten of the CZM objectives and supporting policies as they apply to this project. These goals and supporting objectives include: Recreational Resources; Historic Resources; Scenic and Open Space Resources; Coastal Ecosystems; Economic Uses; Coastal Hazards; Managing Development; Public Participation; Beach Protection; and Marine Resources.		
2/23/2024	Office of Hawaiian Affairs	OHA offers the following comments pertaining to archaeological and cultural resources: <u>Archaeological Resources</u> OHA observes that an archaeological assessment was done in 2004 at the Makaleha Tank Site and Ornellas Tank Site. No archaeological features were found at the Ornellas Site. No further work was recommended at the time. The DEA notes that prior State Historic Preservation Division (SHPD) review of the area concurred with a no adverse effect determination to historic properties in 2010. For the current proposed scope of work and respective permitting, OHA recommends that SHPD be consulted for HRS 6E-8 compliance. SHPD may be aware of any additional findings in the area in the last 14 years that could potentially lead to a re-evaluation of current project.	The DOW acknowledges OHA's comments on the DEA and offers the following responses: <u>1. Archaeological Resources</u> The DOW will consult the SHPD for HRS 6E-8 Review and compliance at an appropriate time in the project process. <u>2. Cultural Resources</u> The DOW conducted follow-up consultation with the Kaua‘i Island Burial Council and the Historic Preservation Commission as recommended by OHA; a summary of the follow-up consultation has been added to Section 2.16 of the FEA. The Kaua‘i/Ni‘ihau Island Burial Council's Kawaihau Geographic	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		Cultural Resources OHA observes that cultural impact assessment (CIA) was done as part of the 2004 archaeological work. While 21 parties were contacted, only a few parties expressed interest in participating in the CIA. Two of the parties (Kaua‘i Island Burial Council and the Historic Preservation Commission) indicated an intention to discuss the matter in September 2004. However, the DEA or CIA does not say if these follow-ups occurred. The DEA only reports that no comments were received and concludes that there would be minimal or no impact on Hawaiian cultural, practices, or its traditions. OHA recommends that updated outreach be done for the CIA as nearly 2 decades have passed since the original work. The County or their contractor can now further take the opportunity to re-engage the Kaua‘i Island Burial Council and Historic Preservation Commission as originally requested.	Representative, Ms. Carol Lovell, was consulted and provided with information on the project along with an offer by DOW for additional consultation if needed. Ms. Lovell stated in an email response dated April 13, 2024 that she had no concerns at this time. Phone conversations between the consultant (Bowers and Kubota Consulting, Inc.) and the County Planning Department were held on multiple occasions in April and May 2024 regarding the letter submitted to the Historic Preservation Review Commission. In summary, the Planning Department had no further comments to offer at this time in anticipation that future County permits needed for the action would offer the Kaua‘i Historic Preservation Review Commission additional opportunities to comment on the project.	
3/11/2024	Godwin and Janet Esaki	We write to provide comments on the Draft Environmental Assessment (DEA) for the Kapa‘a Homesteads 325’ Tanks and Exploratory Well. We are the owners of the private property on Ka‘apuni Road, identified as TMK (4) 4-6-011:125 (the “Drainage Site”), which the Kaua‘i Department of Water (DOW) proposes to traverse with an 18” drainage pipe that would dump water into what it calls a “natural gulch.”	The DOW acknowledges your comments dated March 11, 2024 on the DEA and offers the following responses: 1) The washout and overflow line from the existing tank will connect with the washout and overflow line from the new tanks to the existing 18-inch drain line along Ka‘apuni Road and outlet through a 20-ft wide easement on the Drainage Site,	Sections 1.2, 1.3.3, 1.3.4, 2.6.2, 3.1.6, 6.2, 7, 7.4.2

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		Preliminary Comment: As an initial matter we point out that, unlike the new tanks and exploratory well, there is no detailed depiction in the DEA of the proposed improvements on the Drainage Site. Presumably, that is because, as you acknowledged in your February 6, 2024 response to the DLNR's Land Division, the location of the proposed drain line has not yet been agreed to (nor have the terms of a grant of easement over the Drainage Site). This project has caused us considerable anguish, including having a large reservoir dug on our property against our wishes. For several years now, DOW has promised to "make it right." We are hopeful we can reach a resolution soon and put this behind us. Additional Comments: The DEA repeatedly states that the drainage line will convey water from the Ornellas Tank Site to a "natural gulch" on the Drainage Site. (pp. 1-2, 1-5,6-1.) However, even the maps in the DEA identify the "natural gulch" as a stream (known as Kaehulea Stream). (Figures 2-4, 2-7, 4-4, 4-5). When Kaehulea Stream is flowing, it discharges directly into the ocean through Moikeha Canal. (Figure 4-5). The DEA does not disclose the stream in section 2.6.2.	a privately-owned parcel (your property) identified as TMK (4) 4-6-011:125. At the Drainage Site, a new 18-inch diameter drainage pipe will be installed and will discharge through an outlet headwall into a natural gulch named Moikeha Stream in the northern corner of the property. The new drain line will be designed to avoid and prevent any potential discharge into any State irrigation ditches. Following the installation of the line, the soil dug out for the trench will be replaced. The drainage site improvements are described in Sections 1.2 and 1.3.4 of the Final Environmental Assessment (FEA). The project team met with the State Department of Land and Natural Resources, Land Division (DLNR-LD) on January 19, 2024 at the Drainage Site to discuss the project and to determine the location of the proposed discharge point in relation to the State's irrigation ditch. Access was not provided on this day, so another site visit occurred on February 14, 2024, where the DLNR-LD was able to confirm the location of the proposed discharge point. Per a follow up email from Alison Neustein, DLNR-LD District Land Agent dated June 24, 2024, it was confirmed that there is no conflict with	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
			the location of the proposed discharge point. 2) Based on our research, the stream is identified as Moikeha Stream. We were not able to confirm the stream named Kaehulea Stream. The FEA has been updated to change the un-named stream name to Moikeha Stream. This information has been updated in Section 2.6.2 of the FEA for clarity.	
		Your February 6, 2024 response to the DLNR Land Division disclosed that, on “rare occasions,” chlorinated water would be discharged into the drain line (which would then be discharged into the stream at the Drainage Site and carried to the ocean through Moikeha Canal). And, when we protested to DOW about the “pond” constructed in the center of our property, and reminded DOW that we had agreed to a drainage line on the property boundary from which we could draw water for our farm, we were told that the drainage water could not be used for farming because, in the event of a pump break, toxic chemicals could be released into the water that would be discharged through the drainage line. The DEA does not discuss the potential impacts of discharging chlorine and other toxic chemicals into the stream and nearshore waters. a) What “precautionary measures will be taken to assure that nearby streams are not directly impaired or deteriorated by the proposed action”? (P. 6-1.)	3) The normal discharge into the storm drain system will consist of well and storm water, which are not chlorinated. The well water flowing into the water storage tanks is chlorinated before entering the tanks. On the rare occasion that the tanks need to be drained, a de-chlorination apparatus will be used to remove the residual chlorine from the water. De-chlorination is also currently utilized for disposal of chlorinated hydrotesting water and must be approved by the State of Hawai'i, Department of Health, Clean Water Branch. All discharge from the Ornellas Tank Site will be potable water, therefore no adverse impacts are anticipated to any stream or nearshore waters. Sections 1.3.3 and 6.2 of the FEA have been updated to include this information.	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		b) Does the "NPDES Permit" referred to in section 6.2 allow the discharge of chlorine and other toxic chemicals into streams or nearshore waters?	a) As noted in Section 6.2 of the FEA, precautionary measures to protect surface water quality will include construction best management practices (BMPs) to minimize potential runoff and sedimentation during construction to adjacent properties. The contractor will develop a BMP plan for County review which will describe how on-site generated runoff and sediment movement will be controlled and prevented from entering other properties, and how the applicant will implement the plan. Potential mitigation measures for controlling runoff and sediment movement include the development of sedimentation basins, cut-off swales and ditches, rock filter berms, hydro mulching, and wattles. These may be included in the BMP plan, if appropriate. During operations, as indicated previously, the flow to the stream will not increase and no discharge of toxic chemicals is anticipated. b) The NPDES permit referred to in section 6.2 addresses erosion and sediment control requirements during construction. The NPDES permit does not permit the discharge of chlorine or other toxic chemicals. Should chlorinated water require disposal when	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
			the tanks need to be drained, or for disposal of chlorinated hydrotesting water, a de-chlorination apparatus will be used to remove the residual chlorine from the water.	
		Alternative Not Discussed: The DEA makes clear that the timing of the installation of the 18” drainage line down Ka‘apuni Road that disrupted the community for an extended period and the construction of the pond that severely damaged our property, as well as the proposed drainage improvements on the Drainage Site and the proposed storage tanks at the Ornellas Tank Site, is driven by the need to contain and dispose of water generated over a 4-7 day period of pump testing the proposed exploratory well that may, or may not, be put into service. Is it feasible to use, and has DOW considered using, the existing Ornellas Tank with its current drainage for that purpose? The DEA indicates in section 1.3.3. (and elsewhere) that, if the pump tests show insufficient yield or contaminated water requiring treatment, the exploratory well would be abandoned (but potentially used as a monitoring well). In that case, the proposed new tanks at the Ornellas Tank Site and drainage improvements on the Drainage Site, like the recently-installed drainage line down Ka‘apuni Road, will not be needed. If, on the other hand, the pump tests produce favorable results and	4) The Proposed Action includes two major improvements. One improvement is to provide additional water storage capacity to meet the maximum day demand and County fire flow requirements to serve the Wailua-Kapa‘a community, which is addressed by the two new 0.5 MG water storage tanks and ancillary improvements and the Drainage Site improvements. Additional water storage is needed to service the Wailua-Kapa‘a Water System, and alternatives to address the water storage capacity, including increasing the existing Ornellas Tank size, tank configurations, and an alternative site, are discussed in Section 7 of the FEA. The Kapa‘a Tank improvements are necessary whether or not the exploratory well is put into production at the project site. The second purpose of the Proposed Action is to provide an additional water source to serve the DOW's Wailua-	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		DOW decides to use the exploratory well as a long-term production well, DOW has committed to preparing a new EA “to assess the potential impacts that might result from the operation of the new well.” (P. 1-5). That would appear to allow plenty of time to construct the storage tanks and improvements on the Drainage Site after it was determined they would actually be used, and would save considerable taxpayer money if the tanks and drainage improvements were not needed because the pump tests did not produce favorable results.	Kapa‘a Water System. Additional water sources are needed for this region based on projected future need and growth. As noted in Section 7.4.2, a well site investigative study was conducted to assess potential sites for a well, and the Ornellas Tank Site was deemed to be the preferred site. If the existing exploratory well pump tests produce favorable results, then it may be recommended for use as a long-term production well, and may become a new water source for the Ornellas Tank and the two new 0.5 MG water storage tanks. Should the pump tests not produce favorable results, the DOW may seek an alternative site for a production well. However, this would not affect the purpose and need for the two new 0.5 MG water storage tanks at the Ornellas Tank site.	
		Cultural Impact Assessment: There is no Cultural Impact Assessment attached to the DEA as published in The Environmental Notice on February 8, 2024.	5) It is acknowledged that the CIA was not attached to the DEA published on February 8, 2024. The CIA has been included as Appendix E of the FEA. In addition, the DOW has conducted follow-up consultation with the Kaua‘i Island Burial Council and the Historic Preservation Commission as recommended by OHA; a summary of the follow-up consultation has been added to Section 2.16 of the FEA. The	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
			Kaua‘i/Ni‘ihau Island Burial Council’s Kawaihau Geographic Representative, Ms. Carol Lovell, was consulted and provided with information on the project along with an offer by DOW for additional consultation if needed. Ms. Lovell stated in an email response dated April 13, 2024 that she had no concerns at this time. Phone conversations between B+K and the County Planning Department were held on multiple occasions in April and May 2024 regarding the letter submitted to the Historic Preservation Review Commission. In summary, the Planning Department had no further comments to offer at this time in anticipation that future County permits needed for the action would offer the Kaua‘i Historic Preservation Review Commission additional opportunities to comment on the project.	
3/11/2024	Friends of Mahaulepu	Please accept this comment filed on behalf of Friends of Mahaulepu (FOM) some of whose members reside in the project area. Out of an interest in protecting the project area environment, we offer the following: The existing 18" storm sewer line which will be used to carry water from the new tanks is assumed to be a storm water line in the DEA, however, it is	1) The Final Drainage Report prepared for this project has been approved by the DPW and is included as an appendix in the Final Environmental Assessment (FEA). The drainage report estimates the runoff from the Ornellas Tank site with the proposed project to be 4.72 cubic feet per	Section 1.1, 1.3.3, Appendix F

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		unclear what volume of water is anticipated during storm events or whether there are catchment basins along the route. It is also unclear how much of this water will be dumped to the gulch through the new drainage line proposed on the private property. This is an important piece of missing information which can directly impact erosion in the unsafe erosion in the area. While this project may be overdue, we support KDOW's plan to meet the need for more storage and supply to cover maximum daily demand and fire flow requirements for this service area in Kapahi. These deficiencies were identified in the KDOW Water Plan 2020. On the supply side, it's ideal to have water sources located near storage tanks since they can use the tank volume for chlorine contact time. Production wells should be on the mauka side of the Underground Injection Control Line which the proposed site is. It is evident that the plan is to bring groundwater up at a high enough elevation to provide pressure to the service area with unmet water demand. Tom Nance recommended looking at available well data for the area and advise on system improvements, and he recommended the option KDOW appears to be pursuing. The only potential downside is that the test well may not find the water supply hoped for. It wasn't clear if the test well was going to be more than	second (cfs) which is the same as the existing flow. Under current conditions, the existing runoff from the Ornellas Tank site discharges into an existing gulch. With the proposed project, the discharge from the new drain line will discharge into the Moikeha Stream, which is connected to the gulch utilized by the existing Ornellas Tank. A map showing the project area and proposed drainage improvements is shown in Figure 1-2 of the FEA. As shown on the drainage map, no runoff is collected along the route of the new drain line. Section 1.1 of the FEA has been updated to provide these additional details and information. The test well is located on the same site as the Ornellas Tank Site. The current source that supplies the Ornellas Tank Site is the Makaleha Tunnel and the Kapa‘a Homesteads Well No. 1, which are located off site. As noted in the DEA, if the well pump tests indicate the site will not provide sufficient yield or has organic contamination that may require treatment then the DOW may seek an alternative site. 2) The exploratory well is located on the Ornellas Tank Site. The current	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		1,000 feet from the source that supplies the Ornellas Tank site. It may be prudent to have a backup plan for an HDD source development project. If that were to move forward, KDOW would still likely need the 1MG of new storage in the 313-foot pressure zone, but they may be relieved of the need to pump from the new proposed well at the Ornellas Tank. The well construction cost ($4.5m) is a bit of a gamble given the uncertain nature of the hydrogeology in this area. Nance's report basically made a disclaimer statement that, "Any selected drilling site should be viewed as having an inherent risk of not producing the desired yield, regardless of the depth drilled." Based on the other deep wells in this area, the exploratory well may produce the yield desired. Tom Nance recommended testing for nitrate and several organic compounds that are residuals from plantation chemicals in the exploratory well. KDOW acknowledges that the well could become 1.) a production well (if the yield and quality are good), 2.) a monitoring well (if not), or 3.) abandoned and backfilled with grout. Neither the Nance report or the DEA presented any contaminant water quality data from other wells in the area. The chance of finding tainted water is unknown. The Nance report did present chloride info for several other wells in the area, and the groundwater in the aquifer here seems quite fresh (chlorides of 20-30 mg/L compared to the drinking water standard of 250).	sources that supply the Ornellas Tank Site is the Makaleha Tunnel and the Kapa‘a Homesteads Well No. 1, which are located off site. As noted in the FEA, if the well pump tests indicate the site will not provide sufficient yield or has organic contamination that may require treatment, then the DOW may seek an alternative site. 3) The well has not been pump tested and the water quality has not been determined. Following the completion of the EA process, the pump test will be conducted, and the water samples will be collected and tested to determine the water quality.	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		Regarding another aspects of the project, the drainage line is of interest as indicated above. The plan is to use an existing 18" storm sewer line in Ka‘apuni Rd to route water from the site through a private property to the gulch on the east side of the road. Not much info was given about the new drainage line that would carry water from the existing line in Ka‘apuni Rd to the gulch, other than that the new drainage pipe would be buried and it would outlet at a headwall structure into the natural gulch. The anticipated volume of water to run through these pipes is not stated. Since this is an alteration to the current drainage pattern, there could be potential for erosion of a channel from the drain pipe outlet to the bottom of the gulch. While it is stated that BMPs will be used, there is no mention of erosion mitigation beyond the end of the new pipe.	4) See response to comment #1 and the attached Final Drainage Report. The drainage report documents that the flow into the gulch will not increase due to the construction of the new tanks. A detention basin is proposed to be constructed on the Ornellas Tank site to maintain the existing flow. Since the flow is not increased, downstream areas of the proposed drain outlet would not be negatively impacted.	
		This new drain pipe would carry water from the tank/well site during several situations. First, during the pump testing of the exploratory well, they will likely pump at rates up to 700gpm (1 MGD) to establish the well's hydraulic capacity, and all of this water would be going to the new drain pipe. While this would only be for a period of 4-7 days during the pump tests, infrequently, the tanks at this site will need to be drained for inspection and/or maintenance, and the drain water would also go to the new drain pipe into the gulch. While it was not evident on their site plan (Fig 1-4), but the DEA describes a new detention basin near the tanks that would also overflow to the 18"	5) Figure 1-4 in the FEA identifies the proposed detention basin on the eastern corner of the Ornellas Tank Site next to Tank B. As noted in the previous response, the proposed detention basin would maintain the existing flow to the new drainage line on Ka‘apuni Road. The pump test rate of 700 gmp (1.56 CFS) is less than the runoff from the Ornellas Tank Site.	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		drainage line at Ka‘apuni Rd. Over time, the largest volume of water will likely move from the project site to the gulch through the new drain pipe.		
		It is not clear from the DEA where the storm drains are for the existing 18" drain line in Ka‘apuni Rd, but if there are existing drains connected to it, then there could be much more water delivered to the new drainage pipe during heavy rainfall events than just the runoff from the KDOW site causing greater erosion to the gulch. There is no mention of the size of the new drainage pipe making it difficult to determine how much water could be conveyed through the private property to the gulch. If this is configured in a way that a lot of stormwater could be dumped on the gulch slope below the new drain pipe outlet, it would make significant gully erosion a concern. The DEA didn't say anything about it, but apparently there was a previous attempt to drill a well at this same site based on public comments offered to the prior DEA from a resident who lived across the street from the Ornellas Tank site (on p 10-7). There was mention of a 'crooked well' which was never described in the DEA. It would have been helpful to know if KDOW's contractor ever pump-tested or if any water quality samples were analyzed.	6) As noted in response to comment #1, no runoff is collected along the route of the new drainage line on Ka‘apuni Road. The existing drain line will convey runoff collected from the Ornellas Tank Site and adjacent Kawaihau Road and will discharge to an existing gulch. In addition, the flow into the gulch will not increase due to the construction of the new tanks. The proposed detention basin will maintain the existing flow to the new drainage line. 7) Section 1.3.3 of the FEA has been updated to note that although the entire length of the well casing does not meet the plumbness required by the DOW, the section of the well that does not meet the plumbness requirement is located below the anticipated pump location and will not impact the performance of the pump and well. The DOW has accepted the exploratory well, and pump testing will occur once the EA process is complete.	

Date Received	Agency/ Organization/ Sender	Comment	Response	Referenced Section
		Another comment from DLNR raised the possibility of water from the new drain line ending up in part of the East Kauai Irrigation System which may be unresolved. KDOW disputed this, and they set up a site visit, but didn't get access to the property. The comment response on p 10-14 to 10-17 says that this issue remains unsettled. It would seem prudent to resolve this issue before expenditure a large sum of rate payer money and/or, if resolved, can be addressed in the FEA. The foregoing is offered to address information and potential impacts that could be determined from the content of KDOW's DEA. On behalf of our members in the project area and elsewhere, the missing information and impact analysis would be appreciated.	8) The proposed 18” drainage line will not impact the East Kaua‘i Irrigation System. The project team met with the State Department of Land and Natural Resources, Land Division (DLNR-LD) on January 19, 2024 at the Drainage Site to discuss the project and to determine the location of the proposed discharge point in relation to the State’s irrigation ditch. Access was not provided on this day, so another site visit occurred on February 14, 2024, where the DLNR-LD was able to confirm the location of the proposed discharge point. Per a follow up email from Alison Neustein, DLNR-LD District Land Agent dated June 24, 2024, it was confirmed that there is no conflict with the location of the proposed discharge point.	

11 REFERENCES

County of Kaua‘i, Planning Commission. December 1973. *Kapaa–Wailua Development Plan.* Prepared by LMLI Architects/Planners, Inc. and Hawaii Real Estate Research, Inc.

County of Kaua‘i, Planning Department. March 2018. *Kaua‘i Kākou - Kaua‘i County General Plan.*

County of Kaua‘i, Department of Water. March 2001. *Water Plan 2020.*

County of Kaua‘i, Department of Water. February 1990. *Kaua‘i Water Use and Development Plan.* Prepared by R.M. Towill Corporation.

Cultural Surveys Hawai‘i, Inc. September 2004. *An Archaeological Assessment For The Proposed Water Reservoir, Kapa‘a Ahupua‘a, Kaua‘i. TMK 4-6-03:10.*

Cultural Surveys Hawai‘i, Inc. October 2004. *A Cultural Impact Assessment for a Proposed Water Reservoir, Kapa‘a Ahupua‘a, Kawaihau District, Kaua‘i, TMKs 4-6-11:3, 4-6-08:24, 4-6-03:10.*

Federal Emergency Management Agency. *Flood Insurance Rate Map.* Accessed July 2023.

State of Hawai‘i, Department of Land and Natural Resources. 1972. *General Plan for Domestic Water/Island of Kaua‘i.*

State of Hawai‘i, Department of Land and Natural Resources, Commission on Water Resource Management. July 2019. *Water Resource Protection Plan (2019 Update)*.

State of Hawai‘i, Department of Land and Natural Resources, Commission on Water Resource Management. July 2013. *2004 Hawaii Water Reuse, Survey and Report, Final (2013 Update).*

State of Hawai‘i, Office of Governor. *The Hawaii State Plan.*

State of Hawai‘i, State Land Use Commission. No date. *State Land Use District Maps.*

SWCA Environmental Consultants. November 2023. *Ka‘apuni Road Project Flora and Fauna Survey Report*.

Tom Nance Water Resource Engineering. July 2008. *Phase 1 Site Selection Report for Kapa‘a Homesteads Well No. 4 as an Addition to the Kaua‘i Department of Water’s Kapa‘a System.*

U.S. Census Bureau. 2021. *American Community Survey 5-year Estimates.* Accessed August 2023.

U.S. Department of Agriculture, *Web Soil Survey.* Accessed August 2023.

APPENDIX A

DRAFT EA COMMENT AND RESPONSE LETTERS

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

KEITH A. REGAN
COMPTROLLER
KA LUNA HO'OMALU HANA LAULĀ

MEOH-LENG SILLIMAN
DEPUTY COMPTROLLER
KA HOPE LUNA HO'OMALU HANA LAULĀ

STATE OF HAWAI'I | KA MOKU'ĀINA O HAWAI'I
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES | KA 'OIHANA LOIHELU A LAWELAWE LAULĀ
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P) 24.021

FEB 14 2024

Jared Chang, AICP, Planning Manager
Bowers & Kubota Consulting, Inc.
2153 North King Street, Suite 200
Honolulu, Hawaii 96819

Dear Jared Chang:

Subject: Kapaa Homesteads 325' Tanks and Exploratory Well
Kapaa, Island of Kauai, Hawaii
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125
Notification of Draft Environmental Assessment Publication

Thank you for the opportunity to provide comments on the subject project. The project does not impact any of the Department of Accounting and General Services' projects or existing facilities in the Kapaa area, and we have no comments to offer at this time.

If you have any questions, your staff may call Dennis Chen of the Planning Branch at (808) 586-0491 or e-mail him at dennis.yk.chen@hawaii.gov.

Sincerely,

GORDON S. WOOD
Acting Public Works Administrator

DE:mc

Water has no substitute..... Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

August 30, 2024

Mr. Gordon S. Wood,
Public Works Administrator
State of Hawai'i,
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawai'i 96810

Dear Mr. Wood:

Subject: Kapa'a Homesteads 325' Tanks and Exploratory Well
Kapa'a, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125
Response to Draft Environmental Assessment Comment

Thank you for your letter dated February 14, 2024, commenting on the Draft Environmental Assessment (DEA) for the proposed Kapa'a Homesteads 325' Tanks and Exploratory Well Project. The County of Kaua'i, Department of Water (DOW) acknowledges that the Department of Accounting and General Services' projects or existing facilities will not be impacted by the proposed project.

Thank you for participating in the Hawai'i Revised Statutes, Chapter 343 environmental review process. Your letter and this response will be included in the Final Environmental Assessment. If you have any questions, please contact Scott Suga at (808) 245-5411 or by email at sisuga@kauaiwater.org.

Sincerely yours,

Scott Suga

Scott Suga
Project Management Officer

4-6-011:003 and 4-6-011:125, 20240829, Gordon S. Wood/SS:jrp

4398 Pua Loke Street, Līhu'e, Kaua'i, Hawai'i 96766 ● (808) 245-5400 (business) ● www.kauaiwater.org
An Equal Opportunity Employer

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
ROBIN K. SHISHIDO

IN REPLY REFER TO:

DIR 0000048
STP 8.3715

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

February 19, 2024

VIA EMAIL: bkplanning_comments@bowersandkubota.com

Mr. Jared Chang, AICP
Planning Manager
Bowers + Kubota Consulting, Inc.
2153 N. King Street, Suite 200
Honolulu, Hawaii 96819

Dear Mr. Chang:

Subject: Draft Environmental Assessment (EA)
Kapaa Homesteads 325' Tanks and Exploratory Well
Kapaa, Kauai, Hawaii
Tax Map Keys: (4) 4-6-011: 003 and 125

Thank you for your letter, dated February 6, 2024, requesting the Hawaii Department of Transportation's (HDOT) review and comments on the Draft EA for the subject project. HDOT understands the County of Kauai, Department of Water proposes to improve water service for the Wailua-Kapaa community by constructing two 0.5-million-gallon reservoirs at the Ornellas Tank Site in Kawaihau, Kauai, as well as adding an exploratory well.

In reviewing the Draft EA's project description and location, HDOT's position remains the same as our prior review during the pre-assessment consultation in letter STP 8.3616, dated May 30, 2023. We do not anticipate a significant impact to State roadways; therefore, we have no comments to provide.

Please submit any subsequent land use entitlement related requests for review or correspondence to the HDOT Land Use Intake email address at DOT.LandUse@hawaii.gov.

If there are any questions, please contact Mr. Blayne Nikaido, Planner, Land Use Section of the HDOT Statewide Transportation Planning Office at (808) 831-7979 or via email at blayne.h.nikaido@hawaii.gov.

Sincerely,

EDWIN H. SNIFFEN
Director of Transportation

Water has no substitute……. Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

Department of Water County of Kaua'i

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

August 29, 2024

Mr. Edwin H. Sniffen,
Director of Transportation
State of Hawai'i,
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai'i 96813

Dear Mr. Sniffen:

Subject: Kapa'a Homesteads 325' Tanks and Exploratory Well
Kapa'a, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125
Response to Draft Environmental Assessment Comment

Thank you for your letter dated February 19, 2024, commenting on the Draft Environmental Assessment (DEA) for the proposed Kapa'a Homesteads 325' Tanks and Exploratory Well Project. The County of Kaua'i, Department of Water (DOW) acknowledges that the State of Hawai'i, Department of Transportation's position remains the same as the prior review during the pre-assessment consultation and that the project will not have a significant impact to State roadways.

Thank you for participating in the Hawai'i Revised Statutes, Chapter 343 environmental review process. Your letter and this response will be included in the Final Environmental Assessment. If you have any questions, please contact Scott Suga at (808) 245-5411 or by email at sisuga@kauaiwater.org.

Sincerely yours,

Scott Suga

Scott Suga
Project Management Officer

(4) 4-6-011:003 and 4-6-011:125, 20240829, Edwin H. Sniffen/SS:jrp

Signature: Scott Suga

Email: sisuga@kauaiwater.org

STATE OF HAWAI'I
OFFICE OF PLANNING
& SUSTAINABLE DEVELOPMENT

235 South Beretania Street, 6th Floor, Honolulu, Hawai'i 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawai'i 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: https://planning.hawaii.gov/

JOSH GREEN, M.D.
GOVERNOR

SYLVIA LUKE
LT. GOVERNOR

MARY ALICE EVANS
INTERIM DIRECTOR

DTS 202402081227NA

February 22, 2024

Mr. Jared K. Chang, AICP
Planning Manager
Bowers + Kubota Consulting, Inc.
2153 N. King Street, Suite 200
Honolulu, Hawai'i 96819

Subject: Kapa'a Homesteads 325' Tanks and Exploratory Well
Kapa'a, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125

Thank you for the opportunity to provide comments on the Draft Environmental Assessment (Draft EA) on the proposed Kapa'a Homesteads 325' Tanks and Exploratory Well Project. The notification request was received by our office via memo dated February 6, 2024.

It is our understanding that this action, proposed by the County of Kaua'i, Department of Water seeks to construct two 0.5-million-gallon (MG) reservoirs, named Kapa'a Homesteads Tanks at the Ornellas Tank Site in Kawaihau.

The new tanks will supplement the site's existing 0.2-MG storage facility. An exploratory well will also be drilled at this site adjacent to the tanks. The overall objective of the proposed action is to improve water service for the Wailua-Kapa'a community. A new drainage pipe and outlet for the tanks and well are planned to be constructed on a non-contiguous, privately-owned parcel along Ka'apuni Road.

The Office of Planning and Sustainable Development (OPSD) has reviewed the submitted materials and has the following comments to offer:

1. Issues of Programmatic Concern
The Draft EA sufficiently addresses many of the issues of programmatic concern for OPSD. It evaluates project alignment with the Hawai'i State Planning Act, Hawai'i Revised Statutes (HRS) Chapter 226; HRS § 205 – State Land Use Law; impacts to surface water resources; alternative drainage options; soil erosion; sea-level rise impacts; and related environmental concerns.

2. Hawai'i Coastal Zone Management (CZM) Program
We note that the Draft EA does not contain analysis on the project and its adherence with the objectives and supporting policies of the Hawai'i CZM Program, as listed in HRS § 205A-2. The Final Environmental Assessment should include an in-depth analysis of all ten of the CZM objectives and supporting policies as they apply to this project.

These goals and supporting objectives include: Recreational Resources; Historic Resources; Scenic and Open Space Resources; Coastal Ecosystems; Economic Uses; Coastal Hazards; Managing Development; Public Participation; Beach Protection; and Marine Resources.

For any questions regarding this comment letter, please contact Joshua Hekekia at (808) 587-2845 or by email to Joshua.K.Hekekia@hawaii.gov. If you wish to respond to this comment letter, please include DTS 202402081227NA in the subject line.

Sincerely,

Mary Alice Evans

Mary Alice Evans,
Interim Director

Water has no substitute..... Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

August 29, 2024

Ms. Mary Alice Evans,
Director
State of Hawai'i,
Office of Planning and Sustainable Development
P.O. Box 2359
Honolulu, Hawai'i 96804

Dear Ms. Evans:

Subject: Kapa'a Homesteads 325' Tanks and Exploratory Well
Kapa'a, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125
Response to Draft Environmental Assessment Comment

Thank you for your letter dated February 22, 2024, commenting on the Draft Environmental Assessment (DEA) for the proposed Kapa'a Homesteads 325' Tanks and Exploratory Well Project. The County of Kaua'i, Department of Water (DOW) acknowledges the Office of Planning and Sustainable Development's (OPSD) comments on the DEA and offers the following responses:

1) Issues of Programmatic Concern
The DOW acknowledges that the DEA sufficiently addresses issues of programmatic concern for OPSD.

2) Hawai'i Coastal Zone Management (CZM) Program
A new subsection (Section 5.4) has been added to the FEA to provide an analysis of the CZM objectives and supporting policies that are applicable to this project.

Thank you for participating in the Hawai'i Revised Statutes, Chapter 343 environmental review process. Your letter and this response will be included in the Final Environmental Assessment. If you have any questions, please contact Scott Suga at (808) 245-5411 or by email at sisuga@kauaiwater.org.

Sincerely yours,

Scott Suga

Scott Suga
Project Management Officer

(4) 4-6-011:003 and 4-6-011:125, 20240829, Mary Alice Evans/SS:jrp

4398 Pua Loke Street, Lihu'e, Kauai, Hawai'i 96766 ● (808) 245-5400 (business) ● www.kauaiwater.org
An Equal Opportunity Employer

From: Kamakana Ferreira <kamakanaf@oha.org>
Sent: Friday, February 23, 2024 2:36 PM
To: BKplanning_comments
Subject: [External] OHA Comment Re: DEA for Kapa'a Homesteads 325 Ft Tanks and Exploratory Well

[CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe]

Aloha,

The Office of Hawaiian Affairs (OHA) is in receipt of your letter dated February 6, 2024, notifying us of the draft environmental assessment (DEA) for the Kapa'a Homesteads 325 foot Tanks and Exploratory Well on Kauai, TMKs (4) 4-6-011:003 and 125. Bowers and Kubota is preparing the DEA on behalf of the County of Maui, Department of Water Supply, pursuant to HRS Chapter 343. The County is proposing to construct two .5 million gallon reservoirs (72 feet in diameter, 22 feet in height) at the Ornellas tank Site in Kawaihau. The new tanks will supplement the site's existing .2 million gallon storage facility. An exploratory well (19 inch diameter, up to 550 feet deep) will also be drilled at this site adjacent to the tanks. A new drainage pipe and outlet for the tanks and well are planned to be constructed on a non-continguous, privately owned parcel along Ka'apuni Road. A 6 foot high chain link fence will be placed around the facility.

OHA offers the following comments pertaining to archaeological and cultural resources:

Archaeological Resources

OHA observes that an archaeological assessment was done in 2004 at the Makaleha Tank Site and Ornellas Tank Site. No archaeological features were found at the Ornellas Site. No further work was recommended at the time. The DEA notes that prior State Historic Preservation Division (SHPD) review of the area concurred with a no adverse effect determination to historic properties in 2010.

For the current proposed scope of work and respective permitting, OHA recommends that SHPD be consulted for HRS 6E-8 compliance. SHPD may be aware of any additional findings in the area in the last 14 years that could potentially lead to a re-evaluation of current project.

Cultural Resources

OHA observes that cultural impact assessment (CIA) was done as part of the 2004 archaeological work. While 21 parties were contacted, only a few parties expressed interest in participating in the CIA. Two of the parties (Kauai Island Burial Council and the Historic Preservation Commission) indicated an intention to discuss the matter in September 2004. However, the DEA or CIA does not say if these follow-ups occurred. The DEA only reports that no comments were received and concludes that there would be minimal or no impact on Hawaiian cultural, practices, or its traditions.

OHA recommends that updated outreach be done for the CIA as nearly 2 decades have passed since the original work. The County or their contractor can now further take the opportunity to re-engage the Kauai Island Burial Council and Historic Preservation Commission as originally requested.

Closing Remarks

Mahalo for the opportunity to comment. We look forward to our comments being taken into consideration. Please let me know if you have any questions at this time.

Mahalo,

Kamakana C. Ferreira, M.A.
Lead Compliance Specialist
Office of Hawaiian Affairs
560 N. Nimitz Hwy
Honolulu, Hi. 96817

(808)594-0227

Water has no substitute……. Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

August 29, 2024

Mr. Kamakana C. Ferreira, M.A.
Lead Compliance Specialist
Office of Hawaiian Affairs
560 N. Nimitz Highway
Honolulu, Hawai'i 96817

Dear Mr. Ferreira:

Subject: Kapa'a Homesteads 325' Tanks and Exploratory Well
Kapa'a, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125
Response to Draft Environmental Assessment Comment

Thank you for your email dated February 23, 2024, commenting on the Draft Environmental Assessment (DEA) for the proposed Kapa'a Homesteads 325' Tanks and Exploratory Well Project. The County of Kaua'i, Department of Water (DOW) acknowledges the Office of Hawaiian Affairs' (OHA) comments on the DEA and offers the following responses:

1) Archaeological Resources
The DOW will consult the State Historic Preservation Division (SHPD) for Hawai'i Revised Statutes, Chapter 6E-8 Review and compliance at an appropriate time in the project process.

2) Cultural Resources
The DOW conducted follow-up consultation with the Kaua'i Island Burial Council and the Historic Preservation Commission as recommended by OHA; a summary of the follow-up consultation has been added to Section 2.16 of the FEA. The Kaua'i/Ni'ihau Island Burial Council's Kawaihau Geographic Representative, Ms. Carol Lovell, was consulted and provided with information on the project along with an offer by DOW for additional consultation if needed. Ms. Lovell stated in an email response dated April 13, 2024 that she had no concerns at this time. Phone conversations between B+K and the County Planning Department were held on multiple occasions in April and May 2024 regarding a follow-up letter submitted to the Historic Preservation Review Commission. In summary, the Planning Department had no further comments to offer at this time in anticipation that future County permits needed for the action would offer the Kauai Historic Preservation Review Commission additional opportunities to comment on the project.

Thank you for participating in the Hawai'i Revised Statutes, Chapter 343 environmental review process. Your letter and this response will be included in the Final Environmental Assessment. If you have any questions, please contact Scott Suga at (808) 245-5411 or by email at sisuga@kauaiwater.org.

Sincerely yours,

Scott Suga

Scott Suga
Project Management Officer

(4) 4-6-011:003 and 4-6-011:125, 20240829, Kamakana C. Ferreira/SS:jrp

Signature: Scott Suga

Email: sisuga@kauaiwater.org

From: Bridget Hammerquist <kiaiwaialeale@gmail.com>
Sent: Monday, March 11, 2024 5:52 PM
To: sisuga@kauaiwater.org; Jared Chang
Subject: [External] Draft DEA-AFONSI

[CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe]

Aloha,

- RE: Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (AFONSI) Kapa'a Homesteads 325' Tanks and Exploratory Well Kawaihau District, Kapa'a, Kaua'i, Hawai'i Tax Map Keys: (4) 4-6-011 : 003 and (4) 4-6-011: 125

Please accept this comment filed on behalf of Friends of Maha`ulepu (FOM) some of whose members reside in the project area. Out of an interest in protecting the project area environment, we offer the following:

The existing 18" storm sewer line which will be used to carry water from the new tanks is assumed to be a storm water line in the DEA, however, it is unclear what volume of water is anticipated during storm events or whether there are catchment basins along the route. It is also unclear how much of this water will be dumped to the gulch through the new drainage line proposed on the private property. This is an important piece of missing information which can directly impact erosion in the unsafe erosion in the area.

While this project may be overdue, we support KDOW's plan to meet the need for more storage and supply to cover maximum daily demand and fire flow requirements for this service area in Kapahi. These deficiencies were identified in the KDOW Water Plan 2020.

On the supply side, it's ideal to have water sources located near storage tanks since they can use the tank volume for chlorine contact time. Production wells should be on the mauka side of the Underground Injection Control Line which the proposed site is. It is evident that the plan is to bring groundwater up at a high enough elevation to provide pressure to the service area with unmet water demand. Tom Nance recommended looking at available well data for the area and advise on system improvements, and he recommended the option KDOW appears to be pursuing. The only potential downside is that the test well may not find the water supply hoped for. It wasn't clear if the test well was going to be more than 1,000 feet

from the source that supplies the Ornellas Tank site. It may be prudent to have a backup plan for an HDD source development project. If that were to move forward, KDOW would still likely need the 1MG of new storage in the 313-foot pressure zone, but they may be relieved of the need to pump from the new proposed well at the Ornellas Tank. The well construction cost ($4.5m) is a bit of a gamble given the uncertain nature of the hydrogeology in this area. Nance's report basically made a disclaimer statement that, "Any selected drilling site should be viewed as having an inherent risk of not producing the desired yield, regardless of the depth drilled."

Based on the other deep wells in this area, the exploratory well may produce the yield desired. Tom Nance recommended testing for nitrate and several organic compounds that are residuals from plantation chemicals in the exploratory well. KDOW acknowledges that the well could become 1.) a production well (if the yield and quality are good), 2.) a monitoring well (if not), or 3.) abandoned and backfilled with grout. Neither the Nance report or the DEA presented any contaminant water quality data from other wells in the area. The chance of finding tainted water is unknown. The Nance report did present chloride info for several other wells in the area, and the groundwater in the aquifer here seems quite fresh (chlorides of 20-30 mg/L compared to the drinking water standard of 250).

Regarding another aspects of the project, the drainage line is of interest as indicated above. The plan is to use an existing 18" storm sewer line in Ka'apuni Rd to route water from the site through a private property to the gulch on the east side of the road. Not much info was given about the new drainage line that would carry water from the existing line in Ka'apuni Rd to the gulch, other than that the new drainage pipe would be buried and it would outlet at a headwall structure into the natural gulch. The anticipated volume of water to run through these pipes is not stated. Since this is an alteration to the current drainage pattern, there could be potential for erosion of a channel from the drain pipe outlet to the bottom of the gulch. While it is stated that BMPs will be used, there is no mention of erosion mitigation beyond the end of the new pipe.

This new drain pipe would carry water from the tank/well site during several situations. First, during the pump testing of the exploratory well, they will likely pump at rates up to 700gpm (1 MGD) to establish the well's hydraulic capacity, and all of this water would be going to the new drain pipe. While this would only be for a period of 4-7 days during the pump tests, infrequently, the tanks at this site will need to be drained for inspection and/or maintenance, and the drain water would also go to the new drain pipe into the gulch. While it was not evident on their site plan (Fig 1-4), but the DEA describes a new detention basin near the tanks that would also overflow to the 18" drainage line at Ka'apuni Rd. Over time, the largest volume of water will likely move from the project site to the gulch through the new drain pipe.

It is not clear from the DEA where the storm drains are for the existing 18" drain line in Ka'apuni Rd, but if there are existing drains connected to it, then there could be much more water delivered to the new drainage pipe during heavy rainfall events than just the runoff from the KDOW site causing greater erosion to the gulch. There is no mention of the size of the new drainage pipe making it difficult to determine how much water could be conveyed through the private property to the gulch. If this is configured in a way that a lot of stormwater could be dumped on the gulch slope below the new drain pipe outlet, it would make significant gully erosion a concern.

The DEA didn't say anything about it, but apparently there was a previous attempt to drill a well at this same site based on public comments offered to the prior DEA from a resident who lived across the street from the Ornellas Tank site (on p 10-7). There was mention of a 'crooked well' which was never described in the DEA. It would have been helpful to know if KDOW's contractor ever pump-tested or if any water quality samples were analyzed. Another comment from DLNR raised the possibility of water from the new drain line ending up in part of the East Kauai Irrigation System which may be unresolved. KDOW disputed this, and they set up a site visit, but didn't get access to the property. The comment response on p 10-14 to 10-17 says that this issue remains unsettled. It would seem prudent to resolve this issue before expenditure a large sum of rate payer money and/or, if resolved, can be addressed in the FEA.

The foregoing is offered to address information and potential impacts that could be determined from the content of KDOW's DEA. On behalf of our members in the project area and elsewhere, the missing information and impact analysis would be appreciated.

Mahalo nui loa,

Bridget Hammerquist, President
Friends of Maha`ulepu, a 501(c)(3)
Kia`i Wai o Wai`ale`ale, Co-founder
PO Box 1654
Koloa, HI 96756
Donate
friendsofmahaulepu.org
friendsofmahaulepu@hawaiiantel.net
(808)742-1037 home

(808) 346-1973 cell

Water has no substitute..... Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

August 29, 2024

Ms. Bridget Hammerquist
Friends of Maha`ulepu
Kia`i Wai o Wai`ale`ale, Co-founder
PO Box 1654
Koloa, HI 96756

Dear Ms. Hammerquist:

Subject: Kapa'a Homesteads 325' Tanks and Exploratory Well
Kapa'a, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125
Response to Draft Environmental Assessment Comment

Thank you for your email dated March 11, 2024, commenting on the Draft Environmental Assessment (DEA) for the proposed Kapa'a Homesteads 325' Tanks and Exploratory Well Project. The County of Kaua'i, Department of Water (DOW) acknowledges the comments provided by the Friends of Mahaulepu (FOM) and offers the following responses to your comments below:

1) **The existing 18" storm sewer line which will be used to carry water from the new tanks is assumed to be a storm water line in the DEA, however, it is unclear what volume of water is anticipated during storm events or whether there are catchment basins along the route. It is also unclear how much of this water will be dumped to the gulch through the new drainage line proposed on the private property. This is an important piece of missing information which can directly impact erosion in the unsafe erosion in the area.**
The Final Drainage Report prepared for this project has been approved by the DPW and is included as an appendix in the Final Environmental Assessment (FEA). The drainage report estimates the runoff from the Ornellas Tank site with the proposed project to be 4.72 cubic feet per second (cfs) which is the same as the existing flow. Under current conditions, the existing runoff from the Ornellas Tank site discharges into an existing gulch. With the proposed project, the discharge from the new drain line will discharge into the Moikeha Stream, which is connected to the gulch utilized by the existing Ornellas Tank.

A map showing the project area and proposed drainage improvements is shown in Figure 1-2 of the FEA. As shown on the drainage map, no runoff is collected along the route of the new drain line. Section 1.1 of the FEA has been updated to provide these additional details and information.

2) **The only potential downside is that the test well may not find the water supply hoped for. It wasn't clear if the test well was going to be more than 1,000 feet from the source that supplies the Ornellas Tank site. It may be prudent to have a backup plan for an HDD source development project.**
The exploratory well is located on the Ornellas Tank Site. The current sources that supply the Ornellas Tank Site is the Makaleha Tunnel and the Kapa'a Homesteads Well No. 1, which are located off site. As noted in the FEA, if the well pump tests indicate the site will not provide sufficient yield or has organic contamination that may require treatment, then the DOW will seek an alternative site.

3) **Neither the Nance report or the DEA presented any contaminant water quality data from other wells in the area. The chance of finding tainted water is unknown.**
The well has not been pump tested and the water quality has not been determined. Following the completion of the EA process, the pump test will be conducted, and the water samples will be collected and tested to determine the water quality.

4) **Not much info was given about the new drainage line that would carry water from the existing line in Ka'apuni Rd to the gulch, other than that the new drainage pipe would be buried and it would outlet at a headwall structure into the natural gulch. The anticipated volume of water to run through these pipes is not stated. Since this is an alteration to the current drainage pattern, there could be potential for erosion of a channel from the drain pipe outlet to the bottom of the gulch. While it is stated that BMPs will be used, there is no mention of erosion mitigation beyond the end of the new pipe.**
See response to comment #1 and the attached Final Drainage Report. The drainage report documents that the flow into the gulch will not increase due to the construction of the new tanks. A detention basin is proposed to be constructed on the Ornellas Tank site to maintain the existing flow. Since the flow is not increased, downstream areas of the proposed drain outlet would not be negatively impacted.

Water has no substitute..... Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

5) **First, during the pump testing of the exploratory well, they will likely pump at rates up to 700gpm (1 MGD) to establish the well's hydraulic capacity, and all of this water would be going to the new drain pipe. While this would only be for a period of 4-7 days during the pump tests, infrequently, the tanks at this site will need to be drained for inspection and/or maintenance, and the drain water would also go to the new drain pipe into the gulch. While it was not evident on their site plan (Fig 1-4), but the DEA describes a new detention basin near the tanks that would also overflow to the 18" drainage line at Ka'apuni Rd. Over time, the largest volume of water will likely move from the project site to the gulch through the new drain pipe.**
Figure 1-4 in the FEA identifies the proposed detention basin on the eastern corner of the Ornellas Tank Site next to Tank B. As noted in the previous response, the proposed detention basin would maintain the existing flow to the new drainage line on Ka'apuni Road. The pump test rate of 700 gmp (1.56 CFS) is less than the runoff from the Ornellas Tank Site.

6) **It is not clear from the DEA where the storm drains are for the existing 18" drain line in Ka'apuni Rd, but if there are existing drains connected to it, then there could be much more water delivered to the new drainage pipe during heavy rainfall events than just the runoff from the KDOW site causing greater erosion to the gulch. There is no mention of the size of the new drainage pipe making it difficult to determine how much water could be conveyed through the private property to the gulch. If this is configured in a way that a lot of stormwater could be dumped on the gulch slope below the new drain pipe outlet, it would make significant gully erosion a concern.**
As noted in response to comment #1, no runoff is collected along the route of the new drainage line on Ka'apuni Road. The existing drain line will convey runoff collected from the Ornellas Tank Site and adjacent Kawaihau Road and will discharge to an existing gulch. In addition, the flow into the gulch will not increase due to the construction of the new tanks. The proposed detention basin will maintain the existing flow to the new drainage line.

7) **There was mention of a 'crooked well' which was never described in the DEA. It would have been helpful to know if KDOW's contractor ever pump-tested or if any water quality samples were analyzed.**
Section 1.3.3 of the FEA has been updated to note that although the well casing does not meet the plumbness required by the DOW, the section of the well that does not meet the plumbness requirement is located below the anticipated pump location and will not impact the performance of the pump and well. The DOW has accepted the exploratory well, and pump testing will occur once the EA process is complete.

4398 Pua Loke Street, Lihu'e, Kauai, Hawai'i 96766 ● (808) 245-5400 (business) ● www.kauaiwater.org
An Equal Opportunity Employer

Water has no substitute..... Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

Ms. Bridget Hammerquist
Subject: Kapa'a Homesteads 325' Tanks and Exploratory Well, Kapa'a, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125 , Response to Draft Environmental Assessment Comment
August 29, 2024
Page 4

8) **Another comment from DLNR raised the possibility of water from the new drain line ending up in part of the East Kauai Irrigation System which may be unresolved. KDOW disputed this, and they set up a site visit, but didn't get access to the property. The comment response on p 10-14 to 10-17 says that this issue remains unsettled. It would seem prudent to resolve this issue before expenditure a large sum of rate payer money and/or, if resolved, can be addressed in the FEA.**
The proposed 18" drainage line will not impact the East Kaua'i Irrigation System. The project team met with the State Department of Land and Natural Resources, Land Division (DLNR-LD) on January 19, 2024 at the Drainage Site to discuss the project and to determine the location of the proposed discharge point in relation to the State's irrigation ditch. Access was not provided on this day, so another site visit occurred on February 14, 2024, where the DLNR-LD was able to confirm the location of the proposed discharge point. Per a follow up email from Alison Neustein, DLNR-LD District Land Agent dated June 24, 2024, it was confirmed that there is no conflict with the location of the proposed discharge point.

Thank you for participating in the Hawai'i Revised Statutes, Chapter 343 environmental review process. Your letter and this response will be included in the Final Environmental Assessment. If you have any questions, please contact Scott Suga at (808) 245-5411 or by email at sisuga@kauaiwater.org.

Sincerely yours,

Scott Suga

Scott Suga
Project Management Officer

(4) 4-6-011:003 and 4-6-011:125, 20240829, Bridget Hammerquist/SS:jrp

Signature: Scott Suga
Email: sisuga@kauaiwater.org

March 11, 2024

Jared Chang, AICP
Bowers & Kubota Consulting, Inc.
2153 N. King St., Suite 200
Honolulu, HI 96819
Bkplanning_comments@bowersandkubota.com

Dear Mr. Chang,

We write to provide comments on the Draft Environmental Assessment (DEA) for the Kapa'a Homesteads 325' Tanks and Exploratory Well. We are the owners of the private property on Ka'apuni Road, identified as TMK (4) 4-6-011:125 (the "Drainage Site"), which the Kaua'i Department of Water (DOW) proposes to traverse with an 18" drainage pipe that would dump water into what it calls a "natural gulch."

Preliminary Comment: As an initial matter we point out that, unlike the new tanks and exploratory well, there is no detailed depiction in the DEA of the proposed improvements on the Drainage Site. Presumably, that is because, as you acknowledged in your February 6, 2024 response to the DLNR's Land Division, the location of the proposed drain line has not yet been agreed to (nor have the terms of a grant of easement over the Drainage Site). This project has caused us considerable anguish, including having a large reservoir dug on our property against our wishes. For several years now, DOW has promised to "make it right." We are hopeful we can reach a resolution soon and put this behind us.

Additional Comments: The DEA repeatedly states that the drainage line will convey water from the Ornellas Tank Site to a "natural gulch" on the Drainage Site. (pp. 1-2, 1-5, 6-1.) However, even the maps in the DEA identify the "natural gulch" as a stream (known as Kaehulea Stream). (Figures 2-4, 2-7, 4-4, 4-5). When Kaehulea Stream is flowing, it discharges directly into the ocean through Moikeha Canal. (Figure 4-5). The DEA does not disclose the stream in section 2.6.2.

Your February 6, 2024 response to the DLNR Land Division disclosed that, on "rare occasions," chlorinated water would be discharged into the drain line (which would then be discharged into the stream at the Drainage Site and carried to the ocean through Moikeha Canal). And, when we protested to DOW about the "pond" constructed in the center of our property, and reminded DOW that we had agreed to a drainage line on the property boundary from which we could draw water for our farm, we were told that the drainage water could not be used for farming because, in the event of a pump break, toxic chemicals could be released into the water that would be discharged through the

drainage line. The DEA does not discuss the potential impacts of discharging chlorine and other toxic chemicals into the stream and nearshore waters.

- What "precautionary measures will be taken to assure that nearby streams are not directly impaired or deteriorated by the proposed action"? (P. 6-1.)
- Does the "NPDES Permit" referred to in section 6.2 allow the discharge of chlorine and other toxic chemicals into streams or nearshore waters?

Alternative Not Discussed: The DEA makes clear that the timing of the installation of the 18" drainage line down Ka'apuni Road that disrupted the community for an extended period and the construction of the pond that severely damaged our property, as well as the proposed drainage improvements on the Drainage Site and the proposed storage tanks at the Ornellas Tank Site, is driven by the need to contain and dispose of water generated over a 4-7 day period of pump testing the proposed exploratory well that may, or may not, be put into service. Is it feasible to use, and has DOW considered using, the existing Ornellas Tank with its current drainage for that purpose? The DEA indicates in section 1.3.3. (and elsewhere) that, if the pump tests show insufficient yield or contaminated water requiring treatment, the exploratory well would be abandoned (but potentially used as a monitoring well). In that case, the proposed new tanks at the Ornellas Tank Site and drainage improvements on the Drainage Site, like the recently-installed drainage line down Ka'apuni Road, will not be needed. If, on the other hand, the pump tests produce favorable results and DOW decides to use the exploratory well as a long-term production well, DOW has committed to preparing a new EA "to assess the potential impacts that might result from the operation of the new well." (P. 1-5). That would appear to allow plenty of time to construct the storage tanks and improvements on the Drainage Site after it was determined they would actually be used, and would save considerable taxpayer money if the tanks and drainage improvements were not needed because the pump tests did not produce favorable results.

Cultural Impact Assessment: There is no Cultural Impact Assessment attached to the DEA as published in The Environmental Notice on February 8, 2024.

Thank you for the opportunity to comment.

Sincerely,

Godwin and Janet Esaki

Water has no substitute..... Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

August 29, 2024

Godwin and Janet Esaki
Landowners of Tax Map Key: (4) 4-6-011:125
Email: godwin.esaki@gmail.com and esakijan@gmail.com

Dear Mr. and Mrs. Esaki:

Subject: Kapa'a Homesteads 325' Tanks and Exploratory Well
Kapa'a, Island of Kaua'i, Hawai'i
Tax Map Keys: (4) 4-6-011:003 and 4-6-011:125
Response to Draft Environmental Assessment Comment

Thank you for your email dated March 11, 2024, commenting on the Draft Environmental Assessment (DEA) for the proposed Kapa'a Homesteads 325' Tanks and Exploratory Well Project. The County of Kaua'i, Department of Water (DOW) acknowledges the comments you provided and offers the following responses below:

Preliminary Comment

1) **As an initial matter we point out that, unlike the new tanks and exploratory well, there is no detailed depiction in the DEA of the proposed improvements on the Drainage Site. Presumably, that is because, as you acknowledged in your February 6, 2024 response to the DLNR's Land Division, the location of the proposed drain line has not yet been agreed to (nor have the terms of a grant of easement over the Drainage Site). This project has caused us considerable anguish, including having a large reservoir dug on our property against our wishes. For several years now, DOW has promised to "make it right." We are hopeful we can reach a resolution soon and put this behind us.**
The washout and overflow line from the existing tank will connect with the washout and overflow line from the new tanks to the existing 18-inch drain line along Ka'apuni Road and outlet through a 20-ft wide easement on the Drainage Site, a privately-owned parcel (your property) identified as TMK (4) 4-6-011:125. At the Drainage Site, a new 18-inch diameter drainage pipe will be installed and will discharge through an outlet headwall into a natural gulch named Moikeha Stream in the northern corner of the property. The new drain line will be designed to avoid and prevent any potential discharge into any State irrigation ditches. Following the installation of the line, the soil dug out for the trench will be replaced. The drainage site improvements are described in Sections 1.2 and 1.3.4 of the Final Environmental Assessment (FEA).

The project team met with the State Department of Land and Natural Resources, Land Division (DLNR-LD) on January 19, 2024 at the Drainage Site to discuss the project and to determine the location of the proposed discharge point in relation to the State's irrigation ditch. Access was not provided on this day, so another site visit occurred on February 14, 2024, where the DLNR-LD was able to confirm the location of the proposed discharge point. Per a follow up email from Alison Neustein, DLNR-LD District Land Agent dated June 24, 2024, it was confirmed that there is no conflict with the location of the proposed discharge point.

Additional Comments

2) **The DEA repeatedly states that the drainage line will convey water from the Ornellas Tank Site to a "natural gulch" on the Drainage Site. (pp. 1-2, 1-5, 6-1.) However, even the maps in the DEA identify the "natural gulch" as a stream (known as Kaehulea Stream). (Figures 2-4, 2-7, 4-4, 4-5). When Kaehulea Stream is flowing, it discharges directly into the ocean through Moikeha Canal. (Figure 4-5). The DEA does not disclose the stream in section 2.6.2.**
Based on our research, the stream is identified as Moikeha Stream. We were not able to confirm the stream named Kaehulea Stream. The FEA has been updated to change the un-named stream name to Moikeha Stream. This information has been updated in Section 2.6.2 of the FEA for clarity.

3) **The DEA does not discuss the potential impacts of discharging chlorine and other toxic chemicals into the stream and nearshore waters.**
The normal discharge into the storm drain system will consist of well and storm water, which are not chlorinated. The well water flowing into the water storage tanks is chlorinated before entering the tanks. On the rare occasion that the tanks need to be drained, a de-chlorination apparatus will be used to remove the residual chlorine from the water. De-chlorination is also currently utilized for disposal of chlorinated hydrotesting water and must be approved by the State of Hawai'i, Department of Health, Clean Water Branch. All discharge from the Ornellas Tank Site will be potable water, therefore no adverse impacts are anticipated to any stream or nearshore waters. Sections 1.3.3 and 6.2 of the FEA have been updated to include this information.

Water has no substitute..... Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

a) **What "precautionary measures will be taken to assure that nearby streams are not directly impaired or deteriorated by the proposed action"? (P. 6-1.)**
As noted in Section 6.2 of the FEA, precautionary measures to protect surface water quality will include construction best management practices (BMPs) to minimize potential runoff and sedimentation during construction to adjacent properties. The contractor will develop a BMP plan for County review which will describe how on-site generated runoff and sediment movement will be controlled and prevented from entering other properties, and how the applicant will implement the plan. Potential mitigation measures for controlling runoff and sediment movement include the development of sedimentation basins, cut-off swales and ditches, rock filter berms, hydro mulching, and wattles. These may be included in the BMP plan, if appropriate. During operations, as indicated previously, the flow to the stream will not increase and no discharge of toxic chemicals is anticipated.

b) **Does the "NPDES Permit" referred to in section 6.2 allow the discharge of chlorine and other toxic chemicals into streams or nearshore waters?**
The NPDES permit referred to in section 6.2 addresses erosion and sediment control requirements during construction. The NPDES permit does not permit the discharge of chlorine or other toxic chemicals. Should chlorinated water require disposal when the tanks need to be drained, or for disposal of chlorinated hydrotesting water, a de-chlorination apparatus will be used to remove the residual chlorine from the water.

Alternative Not Discussed

4) **The DEA makes clear that the timing of the installation of the 18" drainage line down Ka'apuni Road that disrupted the community for an extended period and the construction of the pond that severely damaged our property, as well as the proposed drainage improvements on the Drainage Site and the proposed storage tanks at the Ornellas Tank Site, is driven by the need to contain and dispose of water generated over a 4-7 day period of pump testing the proposed exploratory well that may, or may not, be put into service. Is it feasible to use, and has DOW considered using, the existing Ornellas Tank with its current drainage for that purpose? The DEA indicates in section 1.3.3. (and elsewhere) that, if the pump**

4398 Pua Loke Street, Lihu'e, Kauai, Hawai'i 96766 ● (808) 245-5400 (business) ● www.kauaiwater.org
An Equal Opportunity Employer

tests show insufficient yield or contaminated water requiring treatment, the exploratory well would be abandoned (but potentially used as a monitoring well). In that case, the proposed new tanks at the Ornellas Tank Site and drainage improvements on the Drainage Site, like the recently-installed drainage line down Ka'apuni Road, will not be needed. If, on the other hand, the pump tests produce favorable results and DOW decides to use the exploratory well as a long-term production well, DOW has committed to preparing a new EA "to assess the potential impacts that might result from the operation of the new well." (P. 1-5). That would appear to allow plenty of time to construct the storage tanks and improvements on the Drainage Site after it was determined they would actually be used, and would save considerable taxpayer money if the tanks and drainage improvements were not needed because the pump tests did not produce favorable results.

The Proposed Action includes two major improvements. One improvement is to provide additional water storage capacity to meet the maximum day demand and County fire flow requirements to serve the Wailua-Kapa'a community, which is addressed by the two new 0.5 MG water storage tanks and ancillary improvements and the Drainage Site improvements. Additional water storage is needed to service the Wailua-Kapa'a Water System, and alternatives to address the water storage capacity, including increasing the existing Ornellas Tank size, tank configurations, and an alternative site, are discussed in Section 7 of the FEA. The Kapa'a Tank improvements are necessary whether or not the exploratory well is put into production at the project site.

The second purpose of the Proposed Action is to provide an additional water source to serve the DOW's Wailua-Kapa'a Water System. Additional water sources are needed for this region based on projected future need and growth. As noted in Section 7.4.2, a well site investigative study was conducted to assess potential sites for a well, and the Ornellas Tank Site was deemed to be the preferred site. If the existing exploratory well pump tests produce favorable results, then it may be recommended for use as a long-term production well, and may become a new water source for the Ornellas Tank and the two new 0.5 MG water storage tanks. Should the pump tests not produce favorable results, the DOW will need to seek an alternative site for a production well. However, this would not affect the purpose and need for the two new 0.5 MG water storage tanks at the Ornellas Tank site.

Water has no substitute……. Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

Cultural Impact Assessment

5) **There is no Cultural Impact Assessment attached to the DEA as published in The Environmental Notice on February 8, 2024.**
It is acknowledged that the Cultural Impact Assessment (CIA) was not attached to the DEA published on February 8, 2024. The CIA has been included as Appendix E of the FEA. In addition, the DOW conducted follow-up consultation with the Kaua'i Island Burial Council and the Historic Preservation Commission as recommended by the Office of Hawaiian Affairs (OHA); a summary of the follow-up consultation has been added to Section 2.16 of the FEA. The Kaua'i/Ni'ihau Island Burial Council's Kawaihau Geographic Representative, Ms. Carol Lovell, was consulted and provided with information on the project along with an offer by DOW for additional consultation if needed. Ms. Lovell stated in an email response dated April 13, 2024 that she had no concerns at this time. Phone conversations between the consultant (Bowers and Kubota Consulting, Inc.) and the County Planning Department were held on multiple occasions in April and May 2024 regarding the letter submitted to the Historic Preservation Review Commission. In summary, the Planning Department had no further comments to offer at this time in anticipation that future County permits needed for the action would offer the Kauai Historic Preservation Review Commission additional opportunities to comment on the project.

Thank you for participating in the Hawai'i Revised Statutes, Chapter 343 environmental review process. Your letter and this response will be included in the Final Environmental Assessment. If you have any questions, please contact Scott Suga at (808) 245-5411 or by email at sisuga@kauaiwater.org.

Sincerely yours,

Scott Suga

Scott Suga
Project Management Officer

(4) 4-6-011:003 and 4-6-011:125, 20240829, Godwin and Janet Esaki/SS:jrp

4398 Pua Loke Street, Līhu'e, Kaua'i, Hawai'i 96766 ● (808) 245-5400 (business) ● www.kauaiwater.org
An Equal Opportunity Employer

APPENDIX B

PHASE 1 SITE SELECTION REPORT FOR KAPA‘A HOMESTEADS WELL NO. 4

Phase 1 Site Selection Report for Kapaa Homesteads Well No. 4 as an Addition to the Kauai Department of Water's Kapaa System

Prepared by:

Tom Nance Water Resource Engineering
680 Ala Moana Boulevard - Suite 406
Honolulu, Hawaii 96813

Prepared for:

Hawaii Pacific Engineers, Inc.
1132 Bishop Street - Suite 1003
Honolulu, Hawaii 96813

July 2008

Table of Contents

	Page
Introduction	1
Hydro-Geologic Circumstances	1
Assessment of Existing Wells in the Kapaa Area	1
Well 0419-05 in Kapaa Highlands	1
Wells 0519-01 and 04 Inland of Kapaa New Park	1
Wells 0618-01 to 07 and 09 and 10	3
Well 0521-03 at Kulana	3
Well 0620-01 Along Kawaihau Road	3
Well 0519-05 Along Kanaele Road	4
Possible Sites for Kapaa Homesteads Well No. 4	4
Inland Locations	4
0.25 MG, 313-Foot Kulana Tank	4
1.0 MG, 214-Foot Stable Tank	4
0.2 MG, 313-Foot Ornellas Tank	4
Lower Elevation Locations	4
TMK 4-3-03:1 (Kapaa Highlands Site)	6
TMK 4-3-03:20 (State of Hawaii)	6
TMK 4-5-15:30 (State of Hawaii)	6
Recommended Site and Approach to the Well's Construction and Pump Testing	6

List of Figures

No.	Title	Page
1	Wells in the Service Area of DOW's Kapaa 313' System	2
2	Possible Locations for Kapaa Homesteads Well No. 4	5
3	Well and Control Building Locations in the Ornellas Tank Lot	7

Introduction

The Kauai Department of Water (DOW) would like to develop a new well source, to be known as Kapaa Homesteads Well No. 4, at a suitable location within the service area of is 313- or 214-foot service zones of its Kapaa System. This report presents the basis for the selected site which is next to DOW's 313-foot Ornellas Tank.

Hydro-Geologic Circumstances

Except near to and along the shoreline where alluvium and marine sediments are found, the entire area of DOW's 313- and 214-foot service zones of its Kapaa System are blanketed by Koloa series volcanics. This name is applied to the island's later stage volcanics that were laid down long after the original volcanism that built the main mass of Kauai had ceased and a long period of erosion and sedimentation had followed. The original, island-building volcanics, referred to as the Waimea series volcanics, is generally very permeable and yields water readily to wells. In comparison, the Koloa series volcanics are generally moderately to poorly permeable. With a few notable exceptions, wells drawing water from the Koloa volcanics have relatively modest yields.

The thickness of the Koloa series volcanics in the Kapaa area is not known but can reasonably assumed to be substantial. For the purposes of this report, a well started in the Koloa volcanics with the intent of fully penetrating the Koloa series and the unconformity below these volcanics to tap the Waimea series would require drilling to an impractically expensive depth. As such, a well of this depth is not considered further. The selection of a suitable site for the Kapaa Homesteads Well No. 4 has focused exclusively on the Koloa volcanics.

Assessment of Existing Wells in the Kapaa Area

Figure 1 identifies all the wells that have been drilled within and near to DOW's 313- and 214-foot service zones of its Kapaa System. As far as is known, all of the wells end in and draw water from the Koloa volcanics. The yields of these wells vary widely, from as low as 10 GPM to as much as 700 GPM. In the Kapaa area, the highest producing wells have been relatively near to the shore, have been at relatively low elevation, and have been drilled 200 or more feet below sea level. All of these tap groundwater confined by overlying strata. These highest producing wells, from south to north in the Kapaa area, are identified and described below.

- Well 0419-05 in Kapaa Highlands. This 6-inch test hole is at 25-foot elevation and was drilled 260 feet deep (to 235 feet below sea level). The yielding strata are between 190 to 235 feet below sea level. The piezometric head is approximately 13 feet (MSL). A short term pump test indicated that a production well at this site could probably accommodate a 450 GPM pump and would produce water with chlorides of less than 60 MG/L.

- Wells 0519-01 and 04 Inland of Kapaa New Park. Well 0519-01 was drilled in 1986 as a possible wastewater disposal well, but it was never used as such. In 2004, it was sealed with cement and Well 0519-04 was drilled next to it. This well, known as Kapaa Homesteads Well No. 3, is to be a new source of supply for DOW's system. Ground elevation at these wells is on the order of 10 feet (MSL) and the well depths are 221 and 263 feet, respectively. Both wells draw from groundwater in the Koloa volcanics which is confined by overlying alluvium. The piezometric head of the confined groundwater is about 12 feet (MSL). During a 500 GPM constant rate pump test of Well 0591-04, chlorides appeared to stabilize at about 90 MG/L.

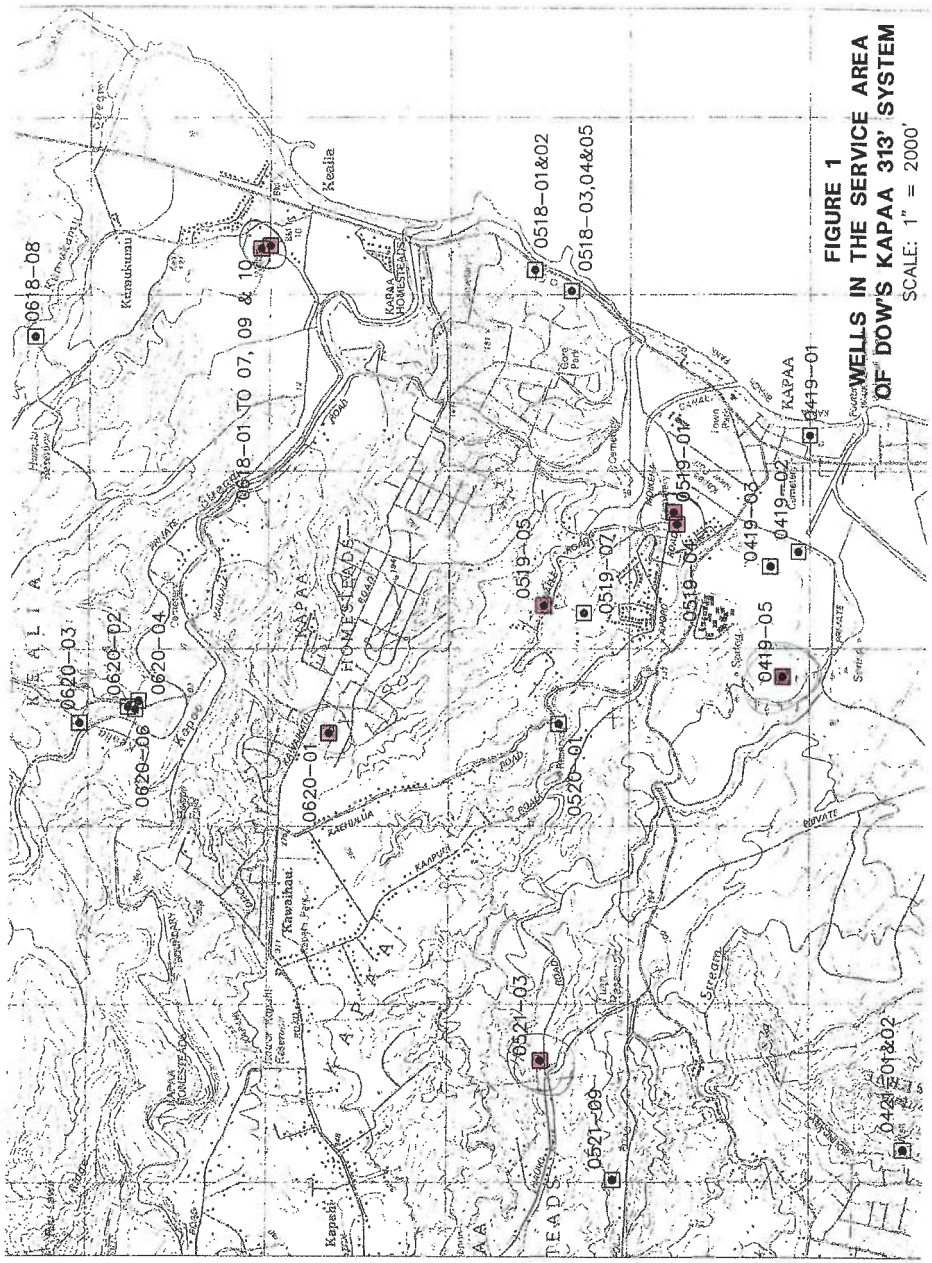


FIGURE 1
WELLS IN THE SERVICE AREA
OF DOW'S KAPAA 313' SYSTEM
SCALE: 1" = 2000'

- Wells 0618-01 to 07 and 09 and 10. This battery of former plantation wells is on the north side of Kapaa Stream, so they are beyond the extent of DOW's Kapaa service area. However, groundwater occurrence at this location is similar to Wells 0519-01 and 04, chlorides are lower (40 to 50 MG/L), and the wells are even more productive (in the range of 500 to 700 GPM per well).

Most of the wells drilled further inland than those discussed above are relatively shallow (ie. they do not go to 200 feet below sea level), are of modest capacity (typically less than 50 GPM), and tap groundwater at widely varying water levels substantially higher than 10 feet. However, there are three wells, the results of which are of particular relevance to possible locations for Kapaa Homesteads Well No. 4. These are identified and described below.

- Well 0521-03 at Kulana. This well is located at 282-foot elevation off Hauiki Road. It was drilled and pump tested in 2001 and has never been used. The well was drilled to a depth of 495 feet (213 feet below sea level) and taps groundwater with a piezometric head of 13 feet (MSL). Its 6-inch casing limited the capacity of the test pump, but an extrapolation of the step test data suggests that a 12-inch well at this site, if drilled to the same depth and properly developed, could produce 450 GPM of low salinity water (chlorides of 20 MG/L) with an acceptable drawdown.

- Well 0620-01 Along Kawaihau Road. This "Cannery Well" was completed in 1960 with 8-inch casing. It was reportedly drilled to 463-foot depth (214 feet below sea level) and finished with 403 feet of solid casing and 60 feet of open hole. The piezometric head of the groundwater it taps was reported to be 11.6 feet (MSL). It was outfitted with a 300 GPM line shaft turbine pump and produced water of 30 MG/L chlorides. Data on the well's hydraulic performance could not be found in the Commission on Water Resource Management (CWRM) files.

  A private party interested in using this well recently had the line shaft turbine pump removed and a video log of the entire depth made. Although video log depths are typically about 1 foot per 100 feet different than actual, the log showed conditions somewhat different than reported in the CWRM files:

  - The casing depth is 255 feet, not the reported 403 feet.
  - The total depth is 449 feet, not the reported 463 feet.
  - It is open hole from the bottom of the casing at 255 feet to the bottom of the well.
  - There are two holes in the casing, through which perched water is coming into the well at obviously high pressure. The first and smaller of the two holes is at 194-foot depth. The second and larger hole is at 219 feet (about 16 feet above the water table).

  It is clear from the video that the annular space between the casing and borehole, at least for a substantial distance, is not filled with cement grout. Relining the well with a seal between the new liner and original casing would not leave a practical space to accommodate a pump of any significant capacity. This well is simply not useable in its present condition nor is it even salvageable. Further, the well in its present condition provides a conduit for the top or perched water to potentially contaminate the aquifer at depth. This well should be backfilled with cement in accordance with CWRM standards.

- Well 0519-05 Along Kanaele Road. This well is about midway between the lower elevation wells and the two inland wells described above. As such, its results provide a promising link between the productive lower elevation wells and the two successful inland wells. Well 0519-05 was only drilled to 186 feet below sea level, but its 12.2-foot static water level is consistent with the area's other relatively productive wells. It produced 250 GPM with a drawdown of 8.3 feet. It appears that its production (both drawdown and yield) could probably be improved by drilling deeper followed by development by surging.

With the consistency of piezometric heads and well depths of the area's most productive wells, it is tempting to conclude that there is a regional aquifer that can be tapped at almost any location simply by drilling to the appropriate depth. However, there is too much heterogeneity (ie. unpredictability) in the Koloa volcanics to draw that conclusion. Any selected drill site should be viewed as having an inherent risk of not producing the desired yield regardless of the depth drilled.

Possible Sites for Kapaa Homesteads Well No. 4

Inland Locations. DOW has three tank sites, each of which provides a possible location for a new well (Figure 2). The tank sites provide obvious advantages over sites remote from a tank: there would be no land acquisition cost; start and stop of the well pump could be controlled by the water level in the adjacent tank; and contact time for chlorine would be provided by storage in the tank. The prospects for a well at each tank site are discussed below.

- 0.25 MG, 313-Foot Kulana Tank. The property to be dedicated to DOW for the Kulana Tank has sufficient room for a well, although a well at this location would eliminate the possibility of developing a second tank at this site at a future date. The near proximity of the successfully developed Kulana well provides some confidence for a well at this tank site.

- 1.0 MG, 214-Foot Stable Tank. The Stable Tank site is on a rise along Kaapuni Road. Plans have been prepared to demolish the abandoned 0.20 MG tank and replace it with a 1.0 MG tank with a 214-foot spillway. There is sufficient room to install a well on the right side of tank's access driveway to accommodate a well and control building. Well 0519-05 along Kanaele Road is about 3200 feet east of Stable Tank. It was drilled to 186 feet below sea level, had a static water level of 12.2 feet, and produced 250 GPM with a drawdown of 8.3 feet, a relatively encouraging result for the Stable Tank as a site for the new well.

- 0.2 MG, 313-Foot Ornellas Tank. The Ornellas Tank is at the Kawaihau-Kaapuni Road intersection. There appears to be sufficient room to install a well and related facilities in the southeast corner of the existing lot or in the larger area between the Ornellas Tank and the planned 1.0 MG Kapahi Tank. The Cannery Well (0620-01), which is about 4000 feet down Kawaihau Road from the Ornellas Tank, is the nearest drilled well. Although that 8-inch well's hydraulic capacity is not documented, its static water level and 300 GPM installed pump capacity are generally encouraging.

Lower Elevation Locations. The most productive wells in the area of DOW's 313- and 214-foot service zone have been drilled at lower elevations. The disadvantage of these sites is that, as a practical matter, they would pump directly into the distribution system rather than into a nearby tank. Possible locations for a lower elevation well are described below.

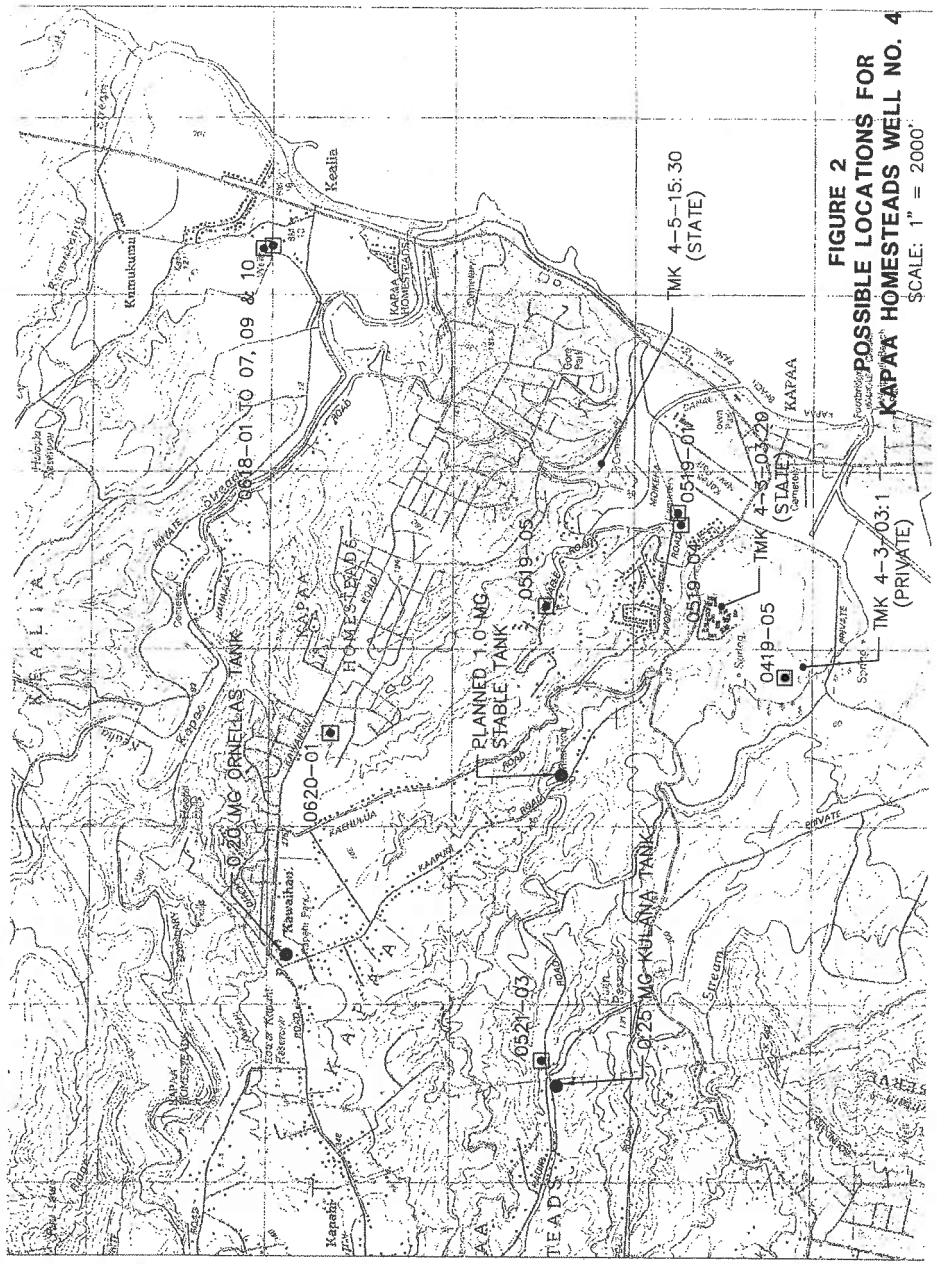


FIGURE 2
POSSIBLE LOCATIONS FOR
KAPAA HOMESTEADS WELL NO. 4
SCALE: 1" = 2000'

- TMK 4-3-03:1 (Kapaa Highlands Site). The success of test hole 0419-05 has identified substantial potential yield in confined strata at depth. The logical point of connection would be DOW's 16-inch main in Olohena Road. In a brief discussion, the landowner has indicated an interest in participating in such a project.

- TMK 4-3-03:20 (State of Hawaii). A well on this 16-acre State parcel along Olohena Road would hopefully tap into the same water bearing strata identified by nearby test hole 0419-05.

- TMK 4-5-15:30 (State of Hawaii). A well in this 35-acre State parcel off Kanaele Road would presumably tap into the same strata as Wells 0519-01 and 0519-04. As nearby DOW distribution lines are small in size, connection costs may be greater at this site than at other locations.

Recommended Site and Approach to the Well's Construction and Pump Testing

The potential well sites identified above were provided to DOW with a preliminary recommendation to select one of the three inland sites in an existing DOW tank lot. The Ornellas Tank site would provide the greatest flexibility for distributing the well's water within the 313- and 214-foot service zones in Kapaa. As the well will draw water from the Koloa volcanics, the yield is not assured and the recommended approach to the well's construction and testing listed below reflects this.

- Available space within the Ornellas Tank lot is quite limited, but it does appear that a well and a control building could be fit on the site on opposite sides of the tank itself (Figure 3).

- A pilot borehole of 12-inch diameter should be drilled to at least a depth of 550 feet (ie. to about 240 feet below sea level).

- A pump test should be run in the pilot borehole to establish the well's potential yield and to sample the pumped water for selected potential contaminants. At a minimum, these constituents would include NO_3-N and EDB, DBCP, and TCP.

- There is a significant possibility of encountering higher elevation, perched water which would be undesirable as a source of supply due to its susceptibility to contamination. Contract documents should anticipate this possibility and require an inflatable packer or other means to seal off this "top" water during the pilot borehole pump test.

- 12-inch (ID) casing would be adequate. The expectable piezometric head of the aquifer to be tapped is 10 to 15 feet above sea level, but the aquifer itself will be substantially below sea level. This will enable the solid casing to be extended below sea level and function as a shroud if a submersible pump and motor is used.

- Data compiled at the completion of the pilot borehole pump test will provide a decision point. If the site at the Ornellas Tank will not provide sufficient yield or has organic contamination that may require treatment, the contract documents should provide for the Contractor to move to the Stable Tank site and proceed with drilling there.

APPENDIX C

FLORA AND FAUNA SURVEY REPORT

Ka‘apuni Road Project Flora and Fauna Survey Report

NOVEMBER 2023

PREPARED FOR

Bowers and Kubota Consulting

PREPARED BY

SWCA Environmental Consultants

KA‘APUNI ROAD
FLORA AND FAUNA SURVEY REPORT

Prepared for

Bowers and Kubota Consulting
94-408 Akoki Street, #201A
Waipahu, Hawai‘i 96797
Attn: Mathew Kodama

Prepared by

SWCA Environmental Consultants
1200 Ala Moana Boulevard, #380
Honolulu, Hawai‘i 96814
(808) 548-7922
www.swca.com

November 2023

EXECUTIVE SUMMARY

Bowers and Kubota requested that SWCA Environmental Consultants (SWCA) conduct a terrestrial flora and fauna biological resources survey for the proposed Kaʻapuni Road project area on the island of Kauaʻi. SWCA Botanist Andrew Andrade and Natural Resource Expert Francis Quitazol conducted the biological resources survey on September 15, 2023, and this report summarizes the survey findings. The survey area is approximately 4 acres in size and consists of two properties along Kaʻapuni Road. All vascular plant species (and their relative abundance), vegetation types, and wildlife species were recorded.

The vegetation types and plant species identified during the survey are not considered unique. Two indigenous plant species, hau (*Hibiscus tiliaceus*) and *Cyperus polystachyos*, were observed in the survey area. These species are not considered rare nor are they federally or state-listed threatened or endangered species, species proposed for listing, or candidate species. Therefore, the proposed project is not expected to have a significant, adverse effect on terrestrial vegetation.

No federally or state-listed endangered birds were observed in the survey area. In total, three bird species were observed in the survey area, all of which are common, nonnative, introduced bird species. No federally or state-listed endangered wildlife species were observed in or near the survey area; however, potential roosting trees for the Hawaiian hoary bat (*Lasiurus cinereus semotus*), or ʻopeʻapeʻa, a federally and state-listed endangered mammal, exist in the survey area, and mitigation recommendations to address potential roosting habitat are outlined in this report. The survey area does not overlap the critical habitat of any listed terrestrial faunal species. For these reasons, the proposed project is not expected to have a significant, adverse effect on terrestrial wildlife.

This page intentionally left blank.

CONTENTS

1 Introduction 1
2 Regulatory Environment 1
2.1 Endangered Species Act 1
2.2 Migratory Bird Treaty Act 1
2.3 Hawai'i Revised Statutes 195D 2
3 Literature Review 2
4 Site Information 2
5 Methods 3
6 Results 5
6.1 Flora 5
6.2 Vegetation Types 5
6.2.1 Mixed Nonnative Grass/Ruderal 5
6.2.2 Cultivated Species 6
6.3 Fauna 6
6.3.1 Avifauna 6
6.3.2 Mammals 7
6.3.3 Terrestrial Reptiles and Amphibians 7
6.3.4 Insects and Other Invertebrates 7
7 Special-Status Species and Critical Habitat 7
7.1 Flora 7
8 discussion and recommendations 7
8.1 Flora 8
8.2 Fauna 8
8.2.1 Seabirds 8
8.2.2 Hawaiian Hoary Bat 9
9 Literature Cited 10

Appendices

Appendix A. Survey Plant List

Figures

Figure 1. Ka'apuni Road survey areas. 4
Figure 2. Nonnative mixed grass and ruderal vegetation in the survey area. 5
Figure 3. Cultivated vegetation in the survey area. 6

Tables

Table 1. Birds Observed in and Near the Survey Area on September 15, 2023 6

1 INTRODUCTION

Bowers and Kubota requested that SWCA Environmental Consultants (SWCA) conduct a terrestrial flora and fauna biological resources survey for the proposed Ka‘apuni Road project area on the island of Kaua‘i. This report summarizes the findings of the survey, which was conducted by SWCA Botanist Andrew Andrade and Natural Resource Expert Francis Quitazol on September 15, 2023. The survey area is approximately 4 acres in size and consists of two properties along Ka‘apuni Road. All vascular plant species (and their relative abundance), vegetation types, and wildlife species were recorded.

2 REGULATORY ENVIRONMENT

This section describes laws and regulations applicable to aquatic and terrestrial flora and fauna in the context of the project.

2.1 Endangered Species Act

The Endangered Species Act of 1973, as amended (ESA), is regulated by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), and protects wildlife and plant species that have been listed as threatened or endangered. It is designed to conserve the ecosystems on which species depend. Candidate species, which may be listed in the near future, are not afforded protection under the ESA until they are formally listed as endangered or threatened. Section 9 of the ESA and rules promulgated under Section 4(d) of the ESA prohibit the unauthorized take of any endangered or threatened species of wildlife listed under the ESA. Under the ESA, the term *take* means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect species listed as endangered or threatened, or to attempt to engage in any such conduct." As defined in regulations, the term *harm* means "an act that actually kills or injures wildlife; it may include significant habitat modification or degradation, which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering" (50 Code of Federal Regulations [CFR] 17.3). The rules define *harass* to mean "an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent, as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR 17.3).

The ESA affords maximum legal protections to species listed as threatened or endangered under the law, and also provides authorization for incidental take permits for take that occurs incidental to otherwise legal operations. To comply with federal laws, additional measures must be taken to ensure that take of federally listed species does not occur. Any fatality of a listed species should be reported to the USFWS and the Hawai‘i Department of Land and Natural Resources Division of Forestry and Wildlife as soon as possible, and an incident report should be filed within 24 hours of detection.

The ESA also provides for the designation of critical habitat for listed species if there are areas of habitat believed to be essential to conservation of the species. Critical habitat can be designated for a single species or a group of species. A critical habitat designation does not necessarily restrict further development but prevents federal actions from destroying or adversely modifying that habitat.

2.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918, as amended (MBTA), is regulated by the USFWS and prohibits the take of migratory birds. A list of birds protected under MBTA is published under 50 CFR 10.13.

Unless permitted by regulations, under the MBTA, "it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product" (16 United States Code 703–712). The MBTA provides no process for authorizing incidental take of MBTA-protected birds. As a result, birds that are not covered under the ESA that may be adversely affected by the project cannot be covered by take authorizations. Regardless, incidental take of individual MBTA-protected species is unlikely to adversely affect MBTA-protected species as a whole; however, any take of MBTA-protected species should be documented and reported in a similar manner as any endangered or threatened species of wildlife listed under the ESA.

2.3 Hawai‘i Revised Statutes 195D

The purpose of Hawai‘i Revised Statutes (HRS) 195D is "to ensure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems" and is regulated by the Hawai‘i Department of Land and Natural Resources Division of Forestry and Wildlife. HRS 195D-4 states that any endangered or threatened species of fish or wildlife recognized by the ESA shall be so deemed by the state statute. Similar to the ESA, the unauthorized take of such endangered or threatened species is prohibited (HRS 195-D-4(e)), but incidental take licenses can be obtained (HRS 195D-21). In addition to species protected under the ESA, rules adopted under HRS 195D-4 allow for the listing of indigenous species as threatened or endangered for the following reasons:

- Habitat destruction or alteration (current or predicted)
- Overexploitation
- Disease or predation
- Lack of regulatory mechanisms
- Other factors threatening the species' continued existence

Determinations are made based on all available sources of data (scientific, commercial, and other) and consultation with appropriate agencies (federal, state, and county) and interested organizations and parties.

3 LITERATURE REVIEW

SWCA performed a literature review before conducting the field survey. The purpose of the literature review was to conduct a preliminary desktop habitat assessment to evaluate whether special-status species (or their habitats) and sensitive natural communities are known to occur in the survey area.

4 SITE INFORMATION

The survey area is within the ahupua‘a (land division) of Kapa‘a in the moku (district) of Puna on the mokupuni (island) of Kaua‘i. The survey area covers two properties along Ka‘apuni road and encompasses approximately 4 acres (1.6 hectares). Mean annual rainfall for the survey area is approximately 51 inches (129 centimeters). Rainfall is typically highest November through April and lowest May through October (Giambelluca et al. 2013).

5 METHODS

SWCA reviewed available scientific and technical literature regarding natural resources in and near the survey area. This literature review encompassed a thorough search of referenced scientific journals, technical journals and reports, environmental assessments, environmental impact statements, relevant government documents, USFWS online data, and unpublished data that provide insight into the area's natural history and ecology. SWCA also reviewed available geospatial data, aerial photographs, and topographic maps of the survey area.

On September 15, 2023, two SWCA biologists conducted a comprehensive survey of the proposed access road footprint (Figure 1). The survey was conducted on foot and documented all vascular plant, vertebrate (birds, mammals, and amphibians), and macroinvertebrate (gastropods and arthropods) species within the survey area. The survey focused on locating populations of special-status species; however, specific acoustic surveys for the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or 'ope'ape'a, were not conducted. Identification of birds was aided by 10 × 42–millimeter binoculars, as well as auditory vocalization identifications. Any signs of animals, such as scat or tracks, were noted. All vegetation types in the survey area were described and mapped in ArcGIS Field Maps on a Samsung Galaxy 2 tablet. Figures were created using ArcGIS Pro 2.7. Photographs were taken during the survey using a Samsung Galaxy S20.

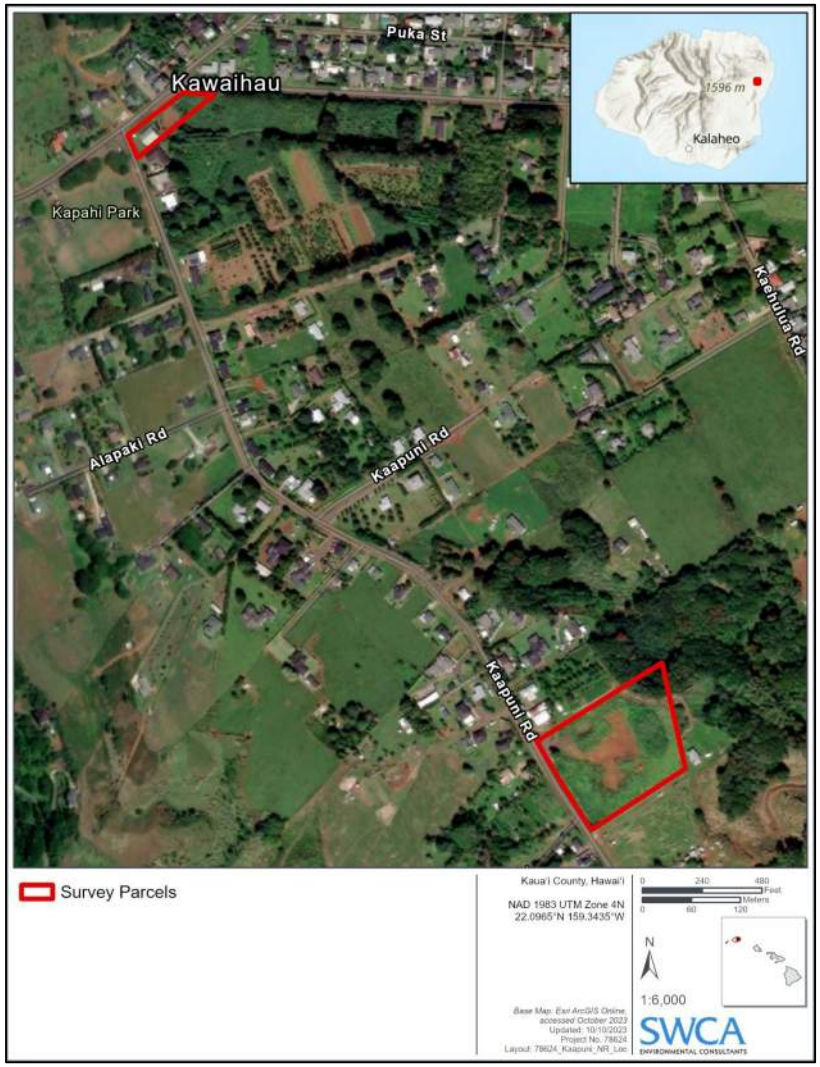


Figure 1. Ka'apuni Road survey areas.

6 RESULTS

6.1 Flora

In all, 42 plant species were recorded in the survey area, two of which, hau (*Hibiscus tiliaceus*) and *Cyperus polystachyos*, are native to the Hawaiian Islands. No special-status plant species were observed in the survey area. Appendix A provides a list of all vascular plant species observed during the survey on September 15, 2023.

6.2 Vegetation Types

The vegetation in the survey area consists of two vegetation types, mixed nonnative grass/ruderal and cultivated. These vegetation types are described in detail below.

6.2.1 Mixed Nonnative Grass/Ruderal

Most of the vegetation in the survey area consisted of the mixed nonnative grass/ruderal vegetation type. This vegetation type was dominated by Guinea grass (*Urochloa maxima*) and Napier grass (*Cenchrus purpureus*), with ruderal species such as false ragweed (*Parthenium hysterophorus*), sow thistle (*Sonchus oleraceus*), maunaloa (*Canavalia cathartica*), and castor bean (*Ricinus communis*) making up a much smaller proportion of the overall vegetation (Figure 2).

Figure 2. Nonnative mixed grass and ruderal vegetation in the survey area.

6.2.2 Cultivated Species

A portion of the survey area was planted with a variety of edible and ornamental plant species, including banana (*Musa* hybrid), coconut (*Cocos nucifera*), ti (*Cordyline fruticosa*), passion fruit (*Passiflora edulis*), avocado (*Persea americana*), common guava (*Psidium guajava*), and sandpaper vine (*Petrea volubilis*) (Figure 3).

Figure 3. Cultivated vegetation in the survey area.

6.3 Fauna

6.3.1 Avifauna

Six nonnative bird species were observed during the survey (Table 1). All three of these species are common in disturbed mid-elevation areas on Kaua'i.

Table 1. Birds Observed in and Near the Survey Area on September 15, 2023

Common Name	Scientific Name	Status*	MBTA Species (Yes or No)
Spotted dove	*Streptopelia chinensis*	NN	No
House finch	*Haemorhous mexicanus*	NN	No
Japanese white-eye	*Zosterops japonicus*	NN	No

Common Name	Scientific Name	Status*	MBTA Species (Yes or No)
Red junglefowl	*Gallus gallus*	NN	No
Common myna	*Acridotheres tristis*	NN	No
House sparrow	*Passer domesticus*	NN	No

* NN = nonnative permanent resident

Endangered Hawaiian waterbirds were not detected during the field survey, and the project footprint does not consist of potential foraging habitat such as lowland streams with herbaceous riparian vegetation or tidal mudflats that would support waterbird foraging.

Seabirds were not observed in the survey area but may potentially fly over the survey area to and from higher elevation nesting areas during the seabird fledging period.

6.3.2 Mammals

Although feral cat (*Felis catus*), house mouse (*Mus musculus*), and rats (*Rattus* spp.) were not detected, they are likely to occur in the survey area. In addition, federally and state-listed endangered Hawaiian hoary bat forage and roost habitat does occur in the survey area within the vegetation type.

6.3.3 Terrestrial Reptiles and Amphibians

No reptiles or amphibians were detected. No terrestrial reptiles and amphibians are native to Hawai'i.

6.3.4 Insects and Other Invertebrates

No native insects or other invertebrates were observed during the survey. Nonnative invertebrates observed were black earwig (*Chelisoches morio*) and Surinam cockroach (*Pycnoscelus surinamensis*).

7 SPECIAL-STATUS SPECIES AND CRITICAL HABITAT

No special-status species were observed in the survey area.

7.1 Flora

No USFWS-designated critical habitat for federally listed endangered plant species were observed within the survey area.

8 DISCUSSION AND RECOMMENDATIONS

The following avoidance and mitigation measures are provided to reduce or eliminate project-related impacts and to avoid adverse effects on special-status species. These measures should be implemented as part of the project.

8.1 Flora

The vegetation types and species identified during the survey are not considered unique, and the native plant species recorded at the site are not threatened or endangered, proposed for listing, or candidate species. In total, 95 percent of the plant species observed in the survey area are not native to the Hawaiian Islands. The proposed project is not expected to have a significant adverse impact on botanical resources.

Weedy nonnative plant species are common in the survey area. Most of these weedy species are widespread in Hawai'i, and their control is not expected to result in a significant decrease in their number or distribution. However, construction activities are known to spread invasive species to new areas through the movement of vehicles and materials. For this reason, SWCA recommends the following invasive species minimization measures to avoid the unintentional introduction or transport of new terrestrial invasive species to Kaua'i:

- All construction equipment and vehicles arriving from outside of Kaua'i should be washed and inspected before they enter the survey area.
- Construction materials arriving from outside of Kaua'i should also be washed and/or visually inspected (as appropriate) for excessive debris, plant materials, and invasive or harmful nonnative species (plants, amphibians, reptiles, and insects).
- Inspection and cleaning activities for equipment, vehicles, or material should be conducted at a designated location before they enter the survey area. The inspectors should be qualified botanists and/or entomologists able to identify invasive species that are of concern relevant to the point of origin of the equipment, vehicle, or material.
- When possible, raw materials (e.g., gravel, rock, soil) should be purchased from a local supplier on Kaua'i to avoid introducing nonnative species not present on the island.
- If landscaping is included as part of the project, native Hawaiian plants or non-invasive plants should be used to the maximum extent possible. Additional information on selecting appropriate (non-invasive) plants for landscaping can be obtained from the following online sources:
    - http://www.plantpono.org
    - http://www.hear.org/alternativestoinvasives/pdfs/mcaac_hpwra_a2i_list.pdf
    - http://www.hear.org/oisc/oahuearlydetectionproject/pdfs/oedposterwhatnottoplant.pdf

8.2 Fauna

8.2.1 Seabirds

Major threats to the endangered Hawaiian petrel (*Pterodroma sandwichensis*) and threatened Newell's shearwater (*Puffinus newelli*) include the attraction of adults and newly fledged juveniles to bright lights while transiting between their nest sites and the ocean. Juvenile birds are particularly vulnerable to light attraction and are sometimes grounded when they become disoriented by lights (Mitchell et al. 2005). Many of these grounded birds are vulnerable to mammalian predators or to being struck by vehicles. The following recommendations are provided to avoid and minimize light attraction in the survey area that could affect the endangered Hawaiian petrel and threatened Newell's shearwater:

- Construction activity should be restricted to daylight hours as much as practicable during the seabird breeding season (April–November) to avoid the use of nighttime lighting that could attract seabirds.

- All outdoor lights should be shielded to prevent upward radiation. This has been shown to reduce the potential for seabird attraction (Reed et al. 1985; Telfer et al. 1987).
- Outside lights that are not needed for security and safety should be turned off from dusk through dawn during the fledgling fallout period (September 15–December 15).

8.2.2 Hawaiian Hoary Bat

Hawaiian hoary bats occur on Kauaʻi in native, nonnative, agricultural, and developed landscapes (U.S. Department of Agriculture 2009; USFWS 1998). Hawaiian hoary bats forage in open, wooded, and linear habitats with a wide range of vegetation types. These animals are insectivores and are regularly observed foraging over streams, reservoirs, and wetlands up to 300 feet (100 meters [m]) offshore (U.S. Department of Agriculture 2009). Hawaiian hoary bats typically roost in trees greater than 16 feet (5 m) with dense canopy foliage or in the subcanopy when the canopy is sparse and there is open access for launching into flight (Gorresen et al. 2013; U.S. Department of Agriculture 2009). Hawaiian hoary bats have been documented roosting in mango trees (*Mangifera indica*) and may roost in other trees (e.g., hau) in the survey area. In addition, the Hawaiian hoary bat could forage over the mixed nonnative grass/ruderal vegetation type and within the corridor created by the road.

Direct impacts to bats could occur during vegetation removal if a juvenile bat that is too small to fly but too large to be carried by a parent is in a tree or branch when it is cut down. To prevent direct impacts to the Hawaiian hoary bat, the following measures are recommended:

- No trees taller than 15 feet (4.6 m) in the survey area should be trimmed or removed between June 1 and September 15 when flightless juvenile bats may be roosting in the trees.
- Any fences erected as part of the project should have a barbless top-strand wire to prevent the Hawaiian hoary bat from becoming entangled on barbed wire.

Implementation of these measures, which have been promulgated by the USFWS (1998), is expected to result in avoidance of all direct impacts to Hawaiian hoary bats. Because all impacts to the Hawaiian hoary bat will be discountable, the proposed project *may affect, but is not likely to adversely affect*, individuals or populations of the species.

9 LITERATURE CITED

Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.L. Chen, P.S. Chu, J.K. Eischeid, and D.M. Delparte. 2013. Rainfall Atlas of Hawai'i. *Bulletin of the American Meteorological Society* (94) 313–316. Available at: http://rainfall.geography.hawaii.edu. Accessed May 23, 2023.

Gorresen, M.P., F.J. Bonaccorso, C.A. Pinzari, C.M. Todd, K. Montoya-Aiona, and K. Brinck. 2013. *A Five-Year Study of Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) Occupancy on the Island of Hawai'i (HSCU-041).* Hilo, Hawai'i: Hawai'i Cooperative Studies Unit.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung. 2005. *Hawaii's Comprehensive Wildlife Conservation Strategy*. Department of Land and Natural Resources, Honolulu, Hawai'i. Available at: http://dlnr.hawaii.gov/wildlife/files/2013/09/CWCS-Full-Document-2005Oct01.pdf. Accessed June 2023.

Reed, J.R., J.L. Sincock, and J.P. Hailman. 1985. Light attraction in endangered procelliariiform birds: Reduction by shielding upward radiation. Auk 102:377–383.

Staples, G.W., and D.R. Herbst. 2005. A tropical garden flora: plants cultivated in the Hawaiian Islands and other tropical places. Bishop Museum Press, Honolulu, 908 pp.

U.S. Department of Agriculture. 2009. Bats of the U.S. Pacific Islands. Biology Technical Note No. 20. Natural Resources Conservation Service, Pacific Islands Area.

U.S. Fish and Wildlife Service (USFWS). 1998. *Recovery Plan for the Hawaiian Hoary Bat* (Lasiurus cinereus semotus). Portland, Oregon: U.S. Fish and Wildlife Service.

Wagner, W.L., D.R. Herbst, N. Khan, and T. Flynn. 2012. *Hawaiian Vascular Plant Updates: A Supplement to the Manual of the Flowering Plants of Hawai'i and Hawai'i's Ferns and Fern Allies*. Version 1.3. Available at: https://naturalhistory2.si.edu/botany/hawaiianflora/Hawaiian_vascular_plant_updates_1.3.pdf. Accessed May 23, 2023.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999. *Manual of the Flowering Plants of Hawai'i.* Volumes 1 and 2. Revised edition. Honolulu: University of Hawai'i Press.

APPENDIX A

Survey Plant List

Table A-1 provides a checklist of plant species observed by SWCA on September 15, 2023, during surveys of the Ka‘apuni Road survey area. The plant names are arranged alphabetically by family and then by species into two groups: monocots and dicots. The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999) and Staples and Herbst (2005). Recent name changes are those recorded in Wagner et al. (2012).

Table A-1. List of Vascular Plants Observed within the Proposed Survey Area on September 15, 2023

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status*
Monocots			
Agavaceae	*Cordyline fruticosa* (L.) A.Chev.	kī, ti	P
Arecaceae	*Cocos nucifera* L.	niu, ololani, coconut	P
Commelinaceae	*Commelina diffusa* Burm.f.	honohono, honohono wai, mākolokolo, dayflower	X
Cyperaceae	*Cyperus polystachyos* Rottb.		I
Musaceae	*Musa* hybrid	banana, apple banana	X*
Poaceae	*Cenchrus echinatus* L.	common sandbur, ‘ume‘alu, mau‘u kukū	X
Poaceae	*Cenchrus purpureus* (Schumach.) Morrone	elephant grass, Napier grass	X
Poaceae	*Chloris virgata* Sw.	feather fingergrass	X
Poaceae	*Cynodon dactylon* (L.) Pers.	Bermuda grass, mānienie, mānienie haole	X
Poaceae	*Panicum virgatum* L.	switchgrass	X
Poaceae	*Paspalum notatum* Flūggé		X
Poaceae	*Urochloa maxima* (Jacq.) R.D.Webster	Guinea grass	X
Dicots			
Apocynaceae	*Thevetia peruviana* (Pers.) K.Schum.	be-still tree	X
Asteraceae	*Ageratum conyzoides* L.	maile hohono, maile honohono, maile kula	X
Asteraceae	*Bidens pilosa* L.	Spanish needle, beggartick, kī, kī nehe, kī pipili, nehe	X
Asteraceae	*Conyza bonariensis* (L.) Cronquist	hairy horseweed	X
Asteraceae	*Emilia fosbergii* Nicolson	pualele (Ni‘ihau)	X
Asteraceae	*Parthenium hysterophorus* L.	false ragweed, Santa Maria	X
Asteraceae	*Pluchea carolinensis* (Jacq.) G.Don	sourbush, marsh fleabane	X
Asteraceae	*Sonchus oleraceus* L.	sow thistle	X
Asteraceae	*Sphagneticola trilobata* (L.) Pruski	wedelia	X
Asteraceae	*Synedrella nodiflora* (L.) Gaertn.	nodeweed	X
Bignoniaceae	*Spathodea campanulata* P.Beauv.	African tulip tree	X
Euphorbiaceae	*Euphorbia hyssopifolia* L.	spurge	X
Euphorbiaceae	*Macaranga tanarius* (L.) Mūll.Arg.		X
Euphorbiaceae	*Phyllanthus debilis* Klein ex Willd.	niruri	X
Euphorbiaceae	*Ricinus communis* L.	castor bean	X
Fabaceae	*Canavalia cathartica* Thouars	maunaloa	X
Fabaceae	*Chamaecrista nictitans* subsp. *patellaria* var. *glabrata* (Vogel) H.S.Irwin & Barneby	partridge pea, laukī	X

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status*
Fabaceae	*Desmodium intortum* (Mill.) Urb.	tick trefoil, tick clover	X
Fabaceae	*Falcataria moluccana* (Miq.) Barneby & J.W.Grimes		X
Fabaceae	*Indigofera suffruticosa* Mill.	indigo, ‘inikō, ‘inikoa, kolū	X
Fabaceae	*Leucaena leucocephala* (Lam.) de Wit	koa haole	X
Fabaceae	*Neonotonia wightii* (Wight & Arn.) Lackey	perennial soybean	X
Lauraceae	*Cinnamomum burmannii* (Nees) Blume	padang cassia	X
Lauraceae	*Persea americana* Mill.	avocado	X
Malvaceae	*Hibiscus tiliaceus* L.	hau	I
Malvaceae	*Sida rhombifolia* L.		X
Myrtaceae	*Psidium guajava* L.	common guava	X
Passifloraceae	*Passiflora edulis* Sims	passion fruit, liliko‘i	X
Plantaginaceae	*Plantago lanceolata* L.	narrow-leaved plantain, English plantain, buckhorn	X
Verbenaceae	*Petrea volubilis* L.	sandpaper vine	X*

Notes: P = Polynesian introduced, I = indigenous, X = nonnative, X* = nonnative cultivated.

APPENDIX D

ARCHAEOLOGICAL ASSESSMENT

An Archaeological Assessment For The Proposed Water Reservoir, Kapa'a Ahupua'a, Kaua'i

TMK 4-6-03:10

by

Karl Van Ryzin, B.A.
and
Hallett H. Hammatt, PhD

Prepared for:
Belt Collins Hawaii, Ltd.
2153 N. King Street, Suite 200
Honolulu, Hi 96819

by

Cultural Surveys Hawai'i, Inc.

SEPTEMBER 2004

TABLE OF CONTENTS

1. INTRODUCTION 5
A. Project Background 5
B. Scope of Work 5
C. Methods 8
D. Natural Setting 8
1. Mauka Locale Project Area 8
II. HISTORICAL BACKGROUND 10
A. From Puna District to Kawaihau District 10
B. Traditional and Legendary Accounts of Kapa'a 10
1. Palila and Ka'ea 10
2. Ka Lulu o Mō'īkeha 10
3. Paka'a and the wind gourd of La'amaomao (Keahiahi) 12
4. Kaweloleimākua 12
5. *Kalukalu* grass of Kapa'a 13
C. Heiau of Kapa'a 13
D. The Mahele: Kapa'a Land Commission Awards 14
E. Early Historic Accounts of Kapa'a (1830's-1900's) 16
F. 20th Century History of Kapa'a (1900-Present) 18
III. PREVIOUS ARCHAEOLOGICAL RESEARCH 20
A. Archaeological Studies and Sites in Kapa'a Ahupua'a 20
B. Pattern of Archaeological Sites in Kapa'a 27
IV. RESULTS OF FIELD CHECK 28
A. Mauka Locale 28
V. RECOMMENDATIONS 32
VI. REFERENCES 33
VII. APPENDIX 38
A. Methods 38
B. Natural Setting 38
1. Makai Locale 1 Project Area 38
2. Makai Locale 2 Project Area 38

C. Results of fielDwork....43
I. Makai Locale 1....43
A. Makai Locale 2....45
B. Recommendations....47

LIST OF FIGURES

Figure 1. Portion of USGS map showing project location. 6
Figure 2 TMK 4-6-03 showing project area location....7
Figure 3. TMK 4-6-03 showing Mauka Locale project area 9
Figure 4. Map showing previous archaeological sites in Kapa'a. The majority of study areas are located within urban Kapa'a away from the shore and mountain areas. 23
Figure 5. Map showing previously documented archaeological sites in Kapa'a. 26
Figure 6. Mauka Locale project area, view to the south. 28
Figure 7. Existing water tank northwest of *mauka* project area, view to the northwest 29
Figure 8. Mauka Locale project area, view to the south. 30
Figure 9. Mauka Locale project area showing modern day trash along northeast boundary, view to the north. 31
Figure 10 Portion of USGS map showing location of alternative sites Makai Site 1 and Makai Site 2 40
Figure 11 TMK 4-6-11 showing Makai Locale 1 project area 41
Figure 12. TMK 4-6-08 showing Makai Locale 2 project area. 42
Figure 13. Fenced section of Makai Locale 1 project area, view to the southwest....43
Figure 14. Makai Locale 1 project area, view to the east 44
Figure 15. Makai Locale 1 project area, view to the southeast....45
Figure 16. Makai Locale 2 project area south of Kapa'a stream showing steep slope, view to the west. 46
Figure 17. Makai Locale 2 project area showing dense vegetation and steep slope, view to the east. 47

LIST OF TABLES

Table 1. *Heiau* of Kapa'a 13
Table 2. Mahele Land Claims in Kapa'a Ahupua'a 14
Table 3. Previous Archaeological Studies in coastal Kapa'a 20
Table 4. Historic Properties in Coastal Kapa'a Ahupua'a 24

I. INTRODUCTION

A. Project Background

At the request of Belt Collins Hawai'i Ltd., Cultural Surveys Hawai'i, Inc. (CSH) conducted an archaeological assessment of a parcel of land (referred to hereafter as "Mauka Locale") in Kapa'a (in TMK 4-6-3:10) (Figures 1 & 2). In addition, CSH surveyed and assessed two additional parcels as alternative sites (referred to hereafter as "Makai Locale 1" and "Makai Locale 2") in (TMKs 4-6-11:3, 4-6-8:23). The survey was accomplished to address any historic preservation or cultural impact issues that might be raised by the proposed development of a water reservoir within one of the three parcels. The county of Kaua'i owns the three parcels.

B. Scope of Work

Archaeological and Historical Concerns

The purpose of this archaeological assessment is to address any archaeological and/or historical concerns. The assessment included a surface survey and a report detailing methods and any finds. The archaeological assessment does not meet the requirements of an inventory-level survey per the rules and regulations of SHPD/DLNR. However, the level of work is sufficient enough to address site types, locations, and allow for future work recommendations.

The scope of work includes:

1. Historical research included study of archival sources, historic maps, Land Commission Awards and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near this property.
2. Field inspection of the project area identified any surface archaeological features and investigated and assessed the potential for impact to such sites. The assessment identified any sensitive areas that may require further investigation or mitigation before the project proceeds.
3. Preparation of a report included the results of the historical research and the fieldwork with an assessment of archaeological potential based on that research with recommendations for further archaeological work, if appropriate. It also provided mitigation recommendations if there were archaeologically sensitive areas that need to be taken into consideration.

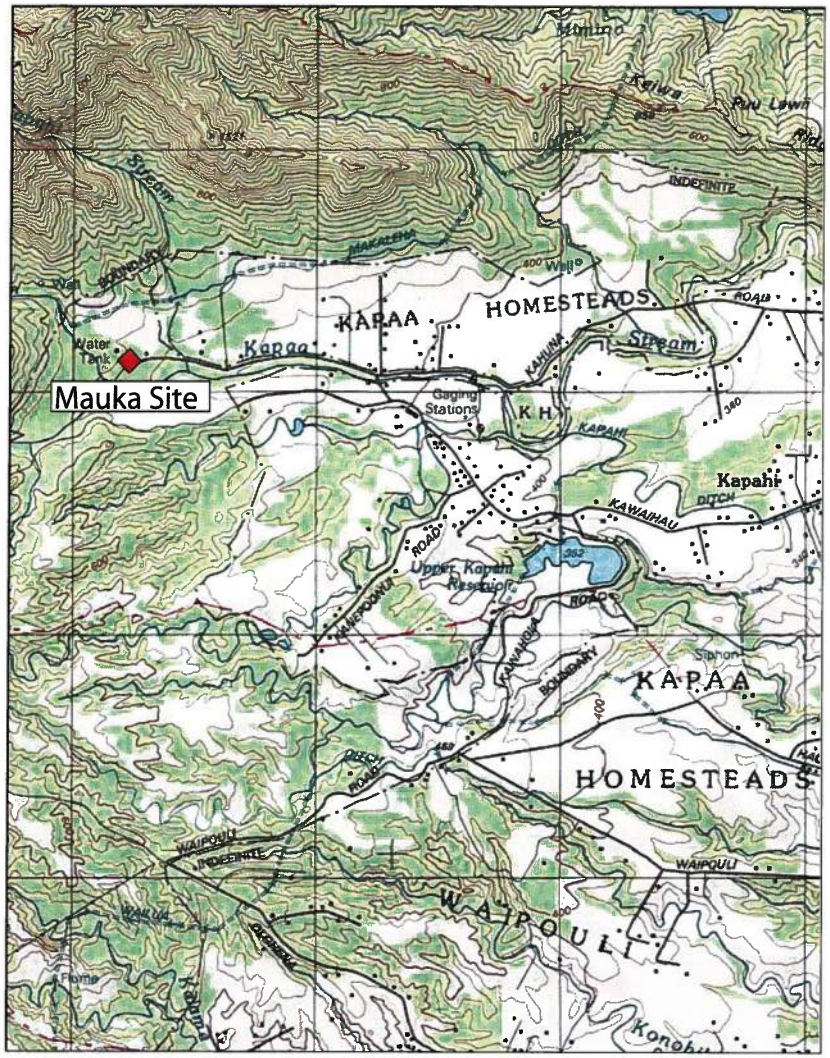


Figure 1. Portion of USGS map showing project location.

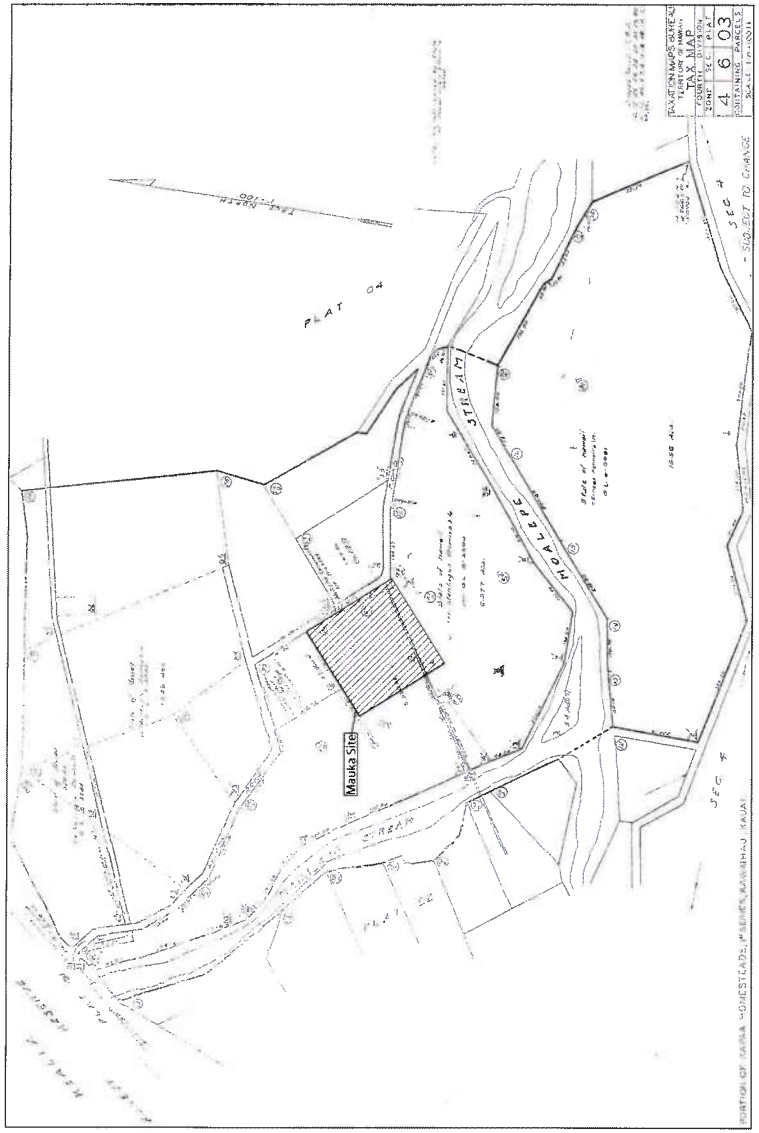


Figure 2 TMK 4-6-03 showing project area location

C. Methods

On June 10th, 2004 a field inspection of the Mauka Locale proposed water tank installation project area was conducted by Cultural Surveys Hawai'i Inc. archaeologist Karl Van Ryzin, B.A., and supervising archaeologist David Perzinski, B.A. Survey transects oriented north-south were conducted with archaeologists spaced apart 10 m. Field observations were recorded and photographs were taken of the project area. The work was conducted under the overall supervision of principal archaeologist Hallett H. Hammatt, Ph.D.

Historical research included a review of previous archaeological studies on file at the State Historic Preservation Division of the Department of Land and Natural Resources; studies of documents at Hamilton Library of the University of Hawai'i, and study of maps at the Survey Office of the Department of Land and Natural Resources. Nineteenth-century Land Commission Award claim records were accessed via the Internet from the Mahele Database prepared by Waihona 'Aina Corp.

D. Natural Setting

1. Mauka Locale Project Area

The Mauka Locale project area is located immediately south of where Kahuna Road terminates, just northeast of Makaleha Stream. The project areas elevation is 150 m (500 ft) and is approximately 7.56 km (4.7 mi) to the coast. A significant landmark is an existing water tank that lies just west of the project area (Figure 7). Foote et al (1972) described the soil in this area as being Kapa'a Silty clay. Kapa'a Silty clay consists of "well-drained soils on the uplands on the islands of Kaua'i and Oahu. These soils developed in material weathered from basic igneous rock. They are gently sloping to extremely steep. Elevations range from 200 to 800 feet." (Foote et al.1972). Mauka Locale receives an average an annual rainfall of approximately 2000 mm (79 inches) (Giambelluca 1986:47). A brief summary of observations on the natural setting is presented in the results of field check section of this study.

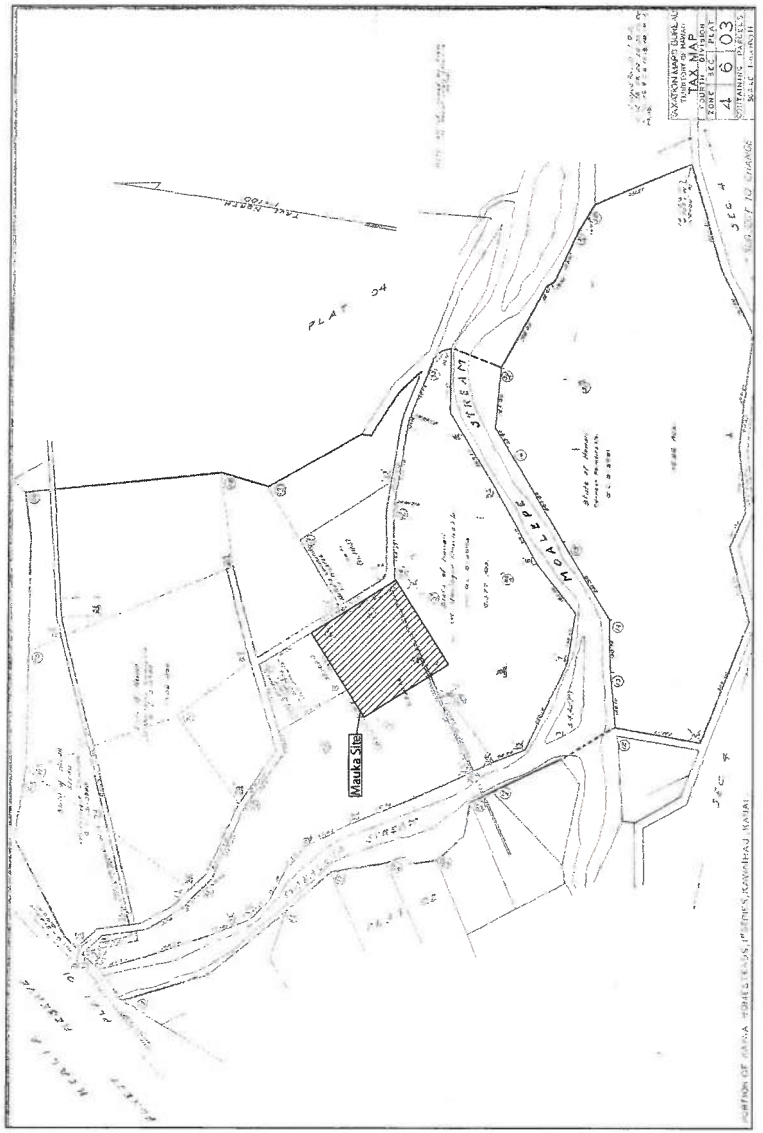


Figure 3. TMK 4-6-03 showing Mauka Locale project area

II. HISTORICAL BACKGROUND

A. From Puna District to Kawaihau District

The *ahupua'a* of Kapa'a belongs in the ancient district of Puna, one of five ancient districts on Kaua'i (King 1935: 228). Puna was the second largest district on Kaua'i, behind Kona, and extended from Kīpū, south of Līhue to Kamalomalo'o, just north of Keālia. For taxation, educational and judicial reasons, new districts were created in the 1840's. The Puna District, with the same boundaries became the Līhue District, named for an important town in that district. In 1878, by act of King Kalākaua in securing a future and name for the new Hui Kawaihau, created the new district of Kawaihau. This new district encompassed the *ahupua'a* ranging from Olohena on the south to Kīlauea on the north. Subsequent alterations to district boundaries in the 1920's left Kawaihau with Olohena as its southernmost boundary and Moloa'a as its northernmost boundary (King 1935:222).

B. Traditional and Legendary Accounts of Kapa'a

1. Palila and Ka'ea

High in the *mauka* region of Kapa'a in the Makaleha mountains at a place called Ka'ea, is reported to be the supernatural banana grove of the Kaua'i *kupua* or demigod Palila, grandson of Hina (Handy and Handy 1972:424). Joseph Akina for *Kū'oko'a* Newspaper in 1913 describes Palila's banana grove:

> The stalk could hardly be surrounded by two men, and was about 35 feet high from the soil to the lowest petiole. The length of the cluster from stem to lowest end of the bunch of bananas was about 1 ¾ fathoms long (one *anana* and one *muku*). There were only two bananas on each about 4 ½ inches around the middle. There were just two bananas, one on the east side and one on the west, each about a foot or more in length. The one on the east side was tartish, like a *waiawi* (Spanish guava) in taste and the one on the west was practically tasteless. The diameter of the end of the fruit stem of this banana seemed to be about 1½ feet. This kind of banana plant and its fruit seemed almost supernatural… (Akina, 1913:5).

2. Ka Lulu o Mō'īkeha

Kapa'a was the home of the legendary *ali'i*, Mō'īkeha. Born at Waipi'o on the island of Hawai'i, Mō'īkeha sailed to Kahiki (Tahiti), the home of his grandfather Maweke, after a disastrous flood. On his return to Hawai'i, he settled at Kapa'a, Kaua'i. Kila, Mō'īkeha's favorite of three sons by the Kaua'i chiefess Ho'oipoikamalani, was born at Kapa'a and was said to be the most handsome man on the island. It was Kila who was sent by his father back to Kahiki to slay his old enemies and retrieve a foster son, the high chief La'amaikahiki (Handy and Handy 1972:424; Beckwith 1970:352-358; Kalākaua 1888:130-135; Fornander 1916, vol.4 pt.1:160). Mō'īkeha's love for Kapa'a is recalled in the *'ōlelo no'eau*: *Ka lulu o Mō'īkeha i ka laulā o Kapa'a*. "The calm of Mō'īkeha in the breadth of Kapa'a" (Pukui, 1983: 157).

"Lulu-o-Moikeha" is described as being situated "near the landing and the school of Waimahanalua" (Akina, 1913: 5). The landing in Kapa'a was known as the Makee Landing and was probably constructed in the late 1870s, along with the Makee sugar mill. Today, in place of the old Makee Landing is part of a breakwater located on the north side of Mō'īkeha Canal near the present day Coral Reef Hotel, and approximately half-a-mile north of Waikaea Bridge.

Akina (1913) tells the story of how Mō'īkeha's son, Kila stocks the islands with the fish *akule*, *kawakawa* and *'ōpelu*. When Kila travels to Kahiki, he seeks out his grandfather Maweke and explains that he is the child of Mō'īkeha. When Maweke asks Kila if Mō'īkeha is enjoying himself, Kila answers with the following chant:

> My father enjoys the billowing clouds over Pohaku-pili,
>
> The sticky and delicious poi,
>
> With the fish brought from Puna,
>
> The broad-backed shrimp of Kapalua,
>
> The dark-backed shrimp of Pōhakuhapai,
>
> The potent *awa* root of Maiaki'i,
>
> The breadfruit laid in the embers at Makialo,
>
> The large heavy taros of Keahapana
>
> The crooked surf of Makaīwa too
>
> The bending hither and thither of the reed and rush blossoms,
>
> The swaying of the *kalukalu* grasses of Puna
>
> The large, plump, private parts of my mothers,
>
> Of Ho'oipoikamalanai and Hinau-u,
>
> The sun that rises and sets,
>
> He enjoys himself on Kaua'i,
>
> All of Kaua'i is Mō'īkeha's. (Akina, 1913: 6)

Maweke was delighted and when the boy is questioned as to his purpose, Kila tells his grandfather he is seeking fish for his family. Maweke tells Kila to lead the fish back to his homeland. This is how Kila led the *akule*, *kawakawa* and *'ōpelu* to Hawai'i.

3. Paka'a and the wind gourd of La'amaomao (Keahiahi)

Kapa'a also figures prominently in the famous story of Pāka'a, and the wind gourd of La'amaomao. Pāka'a was the son of Kūanu'uanu, a high-ranking retainer of the Big Island ruling chief Keawenuia'umi (the son and heir to the legendary chief 'Umi), and La'amaomao, the most beautiful girl of Kapa'a and member of a family of high status kahuna. Kūanu'uanu left the island of Hawai'i, traveled throughout the other islands and finally settled on Kaua'i, at Kapa'a. It was there that he met and married La'amaomao, although he never revealed his background or high rank to her until the day a messenger arrived, calling Kūanu'uanu back to the court of Keawenuia'umi.

By that time, La'amaomao was with her child but Kūanu'uanu could not take her with him. He instructed her to name the child, if it turned out to be a boy, Pāka'a. Pāka'a was raised on the beach at Kapa'a by La'amaomao and her brother Ma'ilou, a bird snarer. He grew to be an intelligent young man and it is said he was the first to adapt the use of a sail to small fishing canoes. Although Pāka'a was told by his mother from a very young age that his father was Ma'ilou, he suspected otherwise and after constant questioning La'amaomao told her son the truth about Kūanu'uanu.

Intent on seeking out his real father and making himself known to him, Pāka'a prepared for the journey to the Big Island. His mother presented to him a tightly covered gourd containing the bones of her grandmother, also named La'amaomao, the goddess of the winds. With the gourd and chants taught to him by his mother, Pāka'a could command the forces of all the winds in Hawai'i. While this story continues on at length about Pāka'a and his exploits on the Big Island and later on Moloka'i, it will not be dwelt upon further here. It is important to note that several versions of this story do include the chants which give the traditional names of all of the winds at all the districts on all the islands, preserving them for this and future generations (Nakuina 1990; Rice 1923:69-89; Beckwith 1970:86-87; Thrum 1923:53-67; Fornander 1918-19 vol. 5 pt.1:78-128).

Frederick Wichman (1998:84) writes that Pāka'a grew up on a headland named Keahiahi. Here, Pāka'a learned to catch *mālolo*, his favorite fish. After studying the ocean and devising his plan to fabricate a sail, Pāka'a wove a sail in the shape of a crab claw and tried it out on his uncle's canoe. One day, after going out to catch *mālolo*, he challenged the other fishermen to race to shore. He convinced them to fill his canoe with fish suggesting it was the only way he could truly claim the prize if he won:

> The fishermen began paddling toward shore. They watched as Pāka'a paddled farther out to sea and began to fumble with a pole that had a mat tied to it. It looked so funny that they began to laugh, and soon they lost the rhythm of their own paddling. Suddenly Pāka'a's mast was up and the sail filled with wind. Pāka'a turned toward shore and shot past the astonished fishermen, landing on the beach far ahead of them. That night, Pāka'a, his mother, and his uncle had all the *mālolo* they could eat (Wichman 1998:85).

4. Kaweloleimākua

Kapa'a is also mentioned in traditions concerning Kawelo (Kaweloleimākua), Ka'ililauokekoa (Mō'īkeha's daughter, or granddaughter, dependent on differing versions of the tale), the *mo'o* Kalamainu`u and the origins of the *hīna'i hīnālea* or the fish trap used to catch the

hīnālea fish, and the story of Lonoikamakahiki (Fornander 1917, vol.4 pt.2:318, vol.4 pt.3:704-705; Rice 1923:106-108; Thrum 1923:123-135; Kamakau 1976:80).

5. *Kalukalu* grass of Kapa'a

"*Kūmoena kalukalu Kapa'a*" or "Kapa'a is like the *kalukalu* mats" is a line from a chant recited by Lonoikamakahiki. Kalukalu is a sedge grass, apparently used for weaving mats (Fornander 1917, Vol. IV, Pt. 2, pp. 318-19). Pukui (1983: 187) associates the *kalukalu* with lovers in "*ke kalukalu moe ipo o Kapa'a*; the *kalukalu* of Kapa'a that sleeps with the lover". According to Wichman (1998:84), "a *kalukalu* mat was laid on the ground under a tree, covered with a thick pile of grass, and a second mat was thrown over that for a comfortable bed", thus the association with lovers. Kaua'i was famous for this peculiar grass, and it probably grew around the marshlands of Kapa'a. It is thought to be extinct now, but an old-time resident of the area recalled that it had edible roots, "somewhat like peanuts." Perhaps it was a famine food source (Kapa'a Elementary School 1933:VI).

C. Heiau of Kapa'a

During their expeditions around Hawai'i in the 1880's, collecting stories from *ka pō'e kahiko*, Lahainaluna students stopped in Kapa'a and Keālia and gathered information regarding heiau of the region. All together, fourteen *heiau* were named in Kapa'a and Keālia, suggesting the two *ahupua'a* were probably more politically significant in ancient times. Table 1 lists the names of the ten heiau identified in the *ahupua'a* of Kapa`a, their location if known, their type, and associated chief and priest.

Table 1. *Heiau* of Kapa'a

Name	Location	Type	Associated
Mailehuna	Kapa'a (Mailehuna is the area of the present day Kapa'a School)	unknown	Kiha, Kaumuali'i/ Lukahakona
Pueo	Kapa'a	unknown	Kiha, Kaumuali'i/ Lukahakona
Pahua	Kapa'a/Keālia	unknown	Kiha/ Lukahakona
Kumalae	Kapa'a/Keālia	unknown	Kiha/ Lukahakona
Waiehumalama	Kapa'a/Keālia	unknown	Kiha/ Lukahakona
Napuupaakai	Kapa'a/Keālia	unknown	Kiha/ Lukahakona
Noeamakalii	Kapa'a/Keālia	"*heiau* for birth of Kaua'i Chiefs, like Holoholoku"	Unknown
Puukoa	Kapa'a/Keālia	"*unu* type heiau"	Unknown
Piouka	Kapa'a/Keālia	"*unu* type heiau"	Unknown
Una	Kapa'a/Keālia	Unknown	Kiha/ Lukahakona
Mano	Kapa'a/Keālia	Unknown	Kiha/ Lukahakona

Name	Location	Type	Associated
Kuahiahi	Kapa'a (govn't school stands on site now)	Unknown	Kaumuali`i/ Lukahakona
Makanalimu	Upland of Kawaihau	Unknown	Kaumuali'i
Kaluluomō'īkeha	Kapa'a	Unknown	Mō'īkeha

The exact locations of these heiau are unknown. The locations of two of the *heiau* correlate with the locations of *wahi pana* which are known to be in close to Kuahiahi and Kaluluomō'īkeha. Kuahiahi (also spelled Kaahiahi and Keahiahi) is the rocky headland at the north end of Kapa'a where the first Kapa'a School was once located. Kaluluomō'īkeha is thought to be the general area near the Mō'īkeha Canal and the present day Coral Reef Hotel

D. The Mahele: Kapa'a Land Commission Awards

The Organic Acts of 1845 and 1846 initiated the process of the Mahele, the division of Hawaiian lands, which introduced private property into Hawaiian society. In 1848 the crown and the ali`i received their lands. The common people received their *kuleana* in 1850. It is through records for Land Commission Awards (LCAs) generated during the Mahele that specific documentation of traditional life in Kapa'a Ahupua'a comes to light.

During the Mahele, Kapa'a was taken as Crown Lands (Office of the Commissioner of Public Lands of the Territory of Hawaii, 1929). The *'Ili* of Paikahawai and Ulakiu in Kapa'a Ahupua'a were retained as Government Lands.

Table 2. Mahele Land Claims in Kapa'a Ahupua'a

LCA	CLAIMANT	`ILI	LAND USE	AWARD
08843	Kiau and son, Apahu	Apopo, Kalolo Village	6 *lo'i,* small *kula* and house lot	2 *'āpana*; 2,75 acres
10564	Oleloa, Daniela	Kapa'a, Puna;	with one fish pond; 10 *lo'i* and a fish pond	No award in Kapa'a, Puna; award in Waioli, Halelea
08247	Ehu	Moalepe	approx. 20 *lo'i* lying waste, some orange trees	1 *'āpana*, Kapa'a
08837	Kamapaa	Awawaloa, Ulukiu Village	9 *lo'i*, and adjoining *kula*; house lot	Awawaloa: 1 *'āpana*; Wakiu 3 *'āpana*

LCA	CLAIMANT	`ILI	LAND USE	AWARD
03638	Huluili, Kahoiu (Kadaio)	Maeleele, Kaloko Village	15 *lo'i* in Maeleele and adjoining *kula*; house lot in village of Kaloko (Kalolo)	Maeleele: 2 apana, 5 acs.
03971 and 03243	Honolii, Ioane	Kahana, Kupanihi	6 uncultivated *lo'i*, house lot in Kupanihi Village	Kupanihi: 2 *'āpana*, 1 ac
03554 and 03599	Keo	Hahanui,	Entire *'ili* of Kahanui, 15 *lo'i*, house lot in Puhi Village	No Award in Kapa`a, Puna; Award in Waila`au, Kona.

The land claims during this period show that only five individuals were awarded land parcels in the relatively large *ahupua'a* of Kapa'a. The five awardees include Kiau (#08843), Kamapaa (#08837), Ioane Honolii (#03971) Huluili (#03638) and Ehu (#08247). In addition, two land claims (#10564 and #03554, 3559) were not awarded in Kapa'a. Four of the five awardees received multiple parcels which show similarities. All four had *lo'i* or irrigated *kalo* fields on the mauka side of the lowland swampy area, sometimes extending a short distance up into small, shallow gulches and valleys. Many of these *lo'i* parcels name pali or hills/cliffs as boundaries. Each LCA also had a separate house lot located on the *makai* side of the swamp, near the beach. Three of the land claims name ponds on their lands, including Puhi Pond (LCA #03554), Fishponds in Kupanihi 'Ili (LCA #03971) and Hahanui 'Ili (LCA #10564). Loko Kihapai may be the same as the Fishpond in Hahanui as it was named in the same land claim. The other two *loko* are associated with house lots, situated on the *makai* edge of the Kapa'a swamplands suggesting modification of the natural swamplands. Other natural and cultural resources mentioned in the LCAs include freshwater springs, pig pens, *hau* bushes, *hala* clumps, streams, *'auwai*, and *kula* or pasturelands.

Interestingly, the residential "village" of Kapa'a did not exist as a single entity, but was a series of probably small settlements or compounds, perhaps even individual house lots which stretched along the shoreline of the *ahupua'a* and included (south to north) Kupanihi (Makahaikupanihi), Kalolo (Kaulolo), Puhi, and Uluki.

The fifth individual, Ehu (LCA #08247), was the only person to be awarded a single parcel in the upland area of Kapa'a, Moalepe Valley, approximately five miles *mauka* of the coast and one mile southwest of the Mauka Locale project area. In 1848, when Ehu made his claim, he was the only one living there. A few years later, according to Honolii's testimony to support Ehu's claim, "There are no houses and no people now living on the land. Ehu found himself lonely there, all his neighbors having either died or left the land. Ehu now lives in Wailua." Evidently Ehu may have been the last person to live at and cultivate in the traditional way, the far *mauka* region of Kapa'a.

E. Early Historic Accounts of Kapa'a (1830's-1900's)

Although most of the historic record documents for Kaua'i in this period revolve around missionary activities and the missions themselves, there was indication that the Kapa'a area was being considered for new sugar cane experiments, similar to those occurring in Kōloa. In a historic move, Ladd and Company received a 50 year lease on land in Kōloa from Kamehameha III and Kaua'i Governor Kaikio'ewa of Kaua'i. The terms of the lease allowed the new sugar company "the right of someone other than a chief to control land" and had profound effects on "traditional notions of land tenure dominated by the chiefly hierarchy" (Donohugh, 2001: 88). In 1837, a very similar lease with similar terms was granted to Wilama Ferani, a merchant and U.S. citizen based in Honolulu (Hawai'i State Archives, Interior Dept., Letters, Aug. 1837). The lease was granted by Kauikeaouli for the lands of Kapa'a, Keālia and Waipouli for twenty years for the following purpose:

> ...for the cultivation of sugar cane and anything else that may grow on said land, with all of the right for some place to graze animals, and the forest land above to the top of the mountains and the people who are living on said lands, it is to them whether they stay or not, and if they stay, it shall be as follows: They may cultivate the land according to the instructions of Wilama Ferani and his heirs and those he may designate under him... (Hawai'i State Archives, Interior Dept., Letters, Aug. 1837).

Unlike Ladd & Company which eventually became the Kōloa Sugar Company, there is no further reference to Wilama Ferani and his lease for lands in Kapa'a, Keālia and Waipouli. In a brief search for information on Honolulu merchant, Wilama Ferani, nothing was found. It is thought that perhaps Wilama Ferani may be another name for William French, a well known Honolulu merchant who is documented as having experimented with grinding sugar cane in Waimea, Kaua'i at about the same time the 1837 lease for lands in Kapa'a, Keālia and Waipouli was signed (Joesting, 1984: 152).

In 1849, son of Wai'oli missionary, William P. Alexander, recorded a trip he took around Kaua'i. Although, he focuses on the larger mission settlements like Kōloa and Hanalei, he does mention Kapa'a.

> A few miles from Wailua, near Kapa'a we passed the wreck of a schooner on the beach, which once belonged to Capt. Bernard. It was driven in a gale over the reef, and up on the beach, where it now lies. A few miles further we arrived at Keālia. We had some difficulty crossing the river at this place, owing to the restiveness of our horses. The country here near the shore was rather uninviting, except the valley which always contained streams of water (Alexander, 1991: 123).

In later years, the notorious Kapa'a reef was to become the location of many shipwrecks once a landing was built there in the 1880s.

The first large scale agricultural enterprise in Kapa'a began in 1877 by the Makee Sugar Plantation and the *Hui* Kawaihau (Dole, 1916: 8). The *Hui* Kawaihau was originally a choral society begun in Honolulu whose membership consisted of many prominent names, both Hawaiian and *haole*. It was Kalākaua's thought that the *Hui* members could join forces with

Makee, who had previous sugar plantation experience on Maui, to establish a successful sugar corporation on the east side of Kaua'i. Captain Makee was given land in Kapa'a to build a mill and he agreed to grind cane grown by Hui members. Kalākaua declared the land between Wailua and Moloa'a, the Kawaihau District, a fifth district and for four years the *Hui* attempted to grow sugar cane at Kapahi, on the plateau lands above Kapa'a. After a fire destroyed almost one half of the *Hui's* second crop of cane and the untimely death of one of their principal advocates, Captain James Makee, the Hui began to disperse and property and leasehold rights passed on to Makee's son-in-law and new Makee Plantation owner, Colonel Z.S. Spalding (Dole, 1916: 14).

As part of the infrastructure of the new plantation, a sugar mill was erected and the Makee Landing was built in Kapa'a during the early years of the Makee Sugar Plantation. Following Captain Makee's death, Colonel Spalding took control of the Plantation and in 1885 moved the mill to Keālia (Cook, 1999: 51). The deteriorating stone smokestack and landing were still there well into the 1900s (Damon, 1931:359). Condè and Best (1973:180) suggest that railroad construction for the Makee Plantation started just prior to the mid 1890's. There is one reference to a railroad line leading from the Kapa'a landing to Keālia in 1891. During Queen Lili'uokalani's visit to Kaua'i in the summer of 1891, the royal party was treated to music by a band, probably shipped in from O'ahu. "The band came by ship to Kapa'a and then by train to Keālia" (Joesting, 1984:252). This line is depicted on a 1910 USGS map which shows the line heading south from Keālia Mill and splitting near the present Coral Reef Hotel, one finger going to the old Kapa'a Landing (Makee Landing) and another line heading *mauka*, crossing the present Mō'īkeha Canal, traveling southwest up Lehua Street and through what is now goat pasture, along a plateau and into the *mauka* area behind Kapa'a swamplands. This railroad line was part of a twenty mile network of plantation railroad with some portable track and included a portion of Keālia Valley and in the *mauka* regions of the plateau lands north of Keālia (Condé and Best, 1973:180).

By the late 1800's, Makee Plantation was a thriving business with more than one thousand workers employed (Cook, 1999:51). Hundreds of Portuguese and Japanese immigrants found work on Makee Plantation and the new influx of immigrants required more infrastructure. In 1883, a lease for a school lot was signed between Makee Sugar Company and the Board of Education (Kapa'a School, 1983: 9). Stipulations found in the Portuguese immigrant contracts with Makee Sugar Company stated that "children shall be properly instructed in the public schools" (Garden Island, April 1, 1983). The original Kapa'a School was constructed in 1883 on a rocky point adjacent to the Makee Sugar Company railroad. Traditionally, this point was known as Kaahiahi (Kapa'a School, 1983: 10). In 1908, Kapa'a School was moved to its present site directly *mauka* and up the hill at Mailehune.

A 1905 map of Kapa'a by Fred E. Harvey shows sugarcane cultivation (field 25) where the present day Makai Locale 1 project area is located. Also shown are railroad tracks running just northeast of the Makai Locale 1.

As in much of the rest of Hawai'i, the Chinese rice farmers began cultivating the lowlands of Kapa'a with increasing success in the latter half of the 1800s. Several Hawaiian *kuleana* owners leased or sold their parcels *mauka* of the swamp land to Chinese rice cultivators. Other Chinese rice cultivators appeased to the government for swamplands first leasing and later buying. As a result of the growing rice and sugar industries, the economic activity displaced the house lot *kuleana* on the *makai* side of the marsh for increasing commercial and residential development (Lai, 1985:148-161).

Narrow wagon roads gave way to macadamized roads in the early part of the 20th century. This new road was called the Kaua'i Belt Road and parts of it are thought to have followed the "Old Government Road" (Cook, 1999). In Kapa'a, the present day Kūhiō Highway probably follows the same route as the original Government Road and subsequent Kaua'i Belt Road. The location of the *kuleana* awards in Kapa'a indicates that the majority of the house lots were situated along the Government Road. LCA 3243 names a "road" as one of its boundaries.

F. 20th Century History of Kapa'a (1900-Present)

In the early 1900's, government lands were auctioned off as town lots in Kapa'a to help with the burgeoning plantation population. One *kama'āina* mentioned that in the 1930's and 1940's, the area north of Mō'īkeha Canal in Kapa'a was mostly settled by Portuguese families (Bushnell et al. 2002). The Japanese were also very prominent in the 1920s and 1930s largely replacing the Chinese merchants of the turn of the century in the Kapa'a business sector (Bushnell et al. 2002). The Board of Health, Territory of Hawaii ran a dispensary in Kapa'a at the *makai* edge of Niu Street near the Kapa'a Beach Park parking lot, adjacent to the bike path starting 1926. The lot is presently vacant. A Fire Station was once located in the area now occupied by the Coral Reef Hotel and a Courthouse and jail cell once stood at the location of the present Kapa'a Neighborhood Center. It is not known when these structures were removed or abandoned.

In 1913, Hawaiian Canneries opened in Kapaa at the site now occupied by Pono Kai Resort (Cook, 1999: 56). Through the Hawaiian Organic Act, Hawaiian Canneries Company, Limited purchased the land they were leasing, approximately 8.75 acres, in 1923 (Bureau of Land Conveyances, Grant 8248). A 1923 sketch of the cannery shows only four structures, one very large structure assumed to be the actual cannery and three small structures *makai* of the cannery. A 1933 historic photograph of Kapa'a Town shows an ironwood windbreak on the *makai* side of the cannery adjacent to the railroad. By 1956, 1.5 million cases of pineapple were being packed. By 1960, 3400 acres were in pineapple and there were 250 full time employees and 1000 seasonal employees for the Kapa'a Cannery (Honolulu Advertiser, March 20, 1960). In 1962, Hawaiian Canneries went out of business due to competition from third world countries.

The Ahukini Terminal & Railway Company was formed in 1920 to establish a railroad to connect Anahola, Keālia, Kapa'a to Ahukini Landing and "provide relatively cheap freight rates for the carriage of plantation sugar to a terminal outlet" (Condé and Best, 1973: 185). This company was responsible for extending the railroad line from the Makee Landing, which was no longer in use, to Ahukini Landing, and for constructing the original Waika'ea Railroad Bridge and the Mō'īkeha Makai Railroad Bridge.

In 1934, the Lihue Plantation Company absorbed the Ahukini Terminal & Railway Company and Makee Sugar Company (Condé and Best, 1973: 167). The railway and rolling stock formerly owned by Makee Sugar Company became the Makee Division of the Lihue Plantation. At this time, besides hauling sugar cane, the railroad was also used to haul plantation freight including "fertilizer, etc...canned pineapple from Hawaiian Canneries to Ahukini and Nawiliwili, pineapple refuse from Hawaiian Canneries to a dump near Anahola and fuel oil from Ahukini to Hawaiian Canneries Co., Ltd." (Hawaiian Territorial Planning Board, 1940: 11). Former plantation workers and *kama'āina* growing up in Kapa'a remember when the cannery would send their waste to the pineapple dump, a concrete pier just north of Kumukumu Stream (State Site No. 50-30-08-789:H) by railroad. The structure is built over the water where the rail cars would dump

the pineapple waste. The current would carry the waste to Kapa'a which would attract fish and sharks (Bushnell et al. 2002).

Lihue Plantation was the last plantation in Hawai'i to convert from railroad transport to trucking (Condé and Best, 1973: 167). "By 1957 the company was salvaging a part of their plantation railroad, which was being supplanted by roads laid out for the most part on or close to the old rail bed" (Ibid: 167). By 1959, the plantation had completely converted over to trucking. The Cane Haul Road which begins near the intersection of Haua'ala Road and Kūhiō Highway is thought to date to the late 1950s and follows the alignment of the old railroad until just before or near 'Āhihi Point.

Severe floods in Kapa'a in 1940 led to the dredging and construction of the Waika'ea and Mō'īkeha Canals sometime in the 1940s (Hawaii Territorial Planning Board, 1940: 7). Although the Waika'ea Canal, bordering the Kapa'a Pineapple Cannery, had been proposed as early as 1923, nothing was constructed until after the floods (Bureau of Land Conveyances, Grant 8248). A Master Plan for Kapa'a, published in 1940, asks the Territorial Legislature for funds to be set aside for the completion of a drainage canal and for filling *makai* and *mauka* of the canal (Hawaii Territorial Planning Board, 1940:7). In 1955, reports came out on the dredging for coral proposed for the reef fronting Kapa'a Beach Park (*Garden Island Newspaper*, September 21, 1955). The coral was to be used for building plantation roads. This dredging was later blamed for accelerated erosion along Kapa'a Beach (Garden Island Newspaper, October 30, 1963).

Today, there are several sea walls along the Kapa'a Beach Park to check erosion. Old time residents claim the sandy beach in Kapa'a was once much more extensive than it is now (Bushnell et al. 2002).

Keālia Town slowly dispersed after the incorporation of Makee Sugar Company into Lihue Plantation in the 1930s. Many of the plantation workers bought property of their own and moved out of plantation camps. The plantation camps which bordered Kūhiō Highway were disbanded in the 1980s. The Lihue Plantation began to phase out in the last part of the 20th century. Kapa'a Town suffered after the closing of the Kapa'a Cannery, however the growing tourist industry helped to ease the economic affects of the Cannery's closing.

III. PREVIOUS ARCHAEOLOGICAL RESEARCH

A. Archaeological Studies and Sites in Kapa'a Ahupua'a

The following table outlines the archaeological research (Table 3) and historic properties (Table 4) identified in Kapa'a Ahupua'a. These tables are followed by discussion of the research and historic properties. Table 3 provides a list of archaeological research conducted within Kapa'a Ahupua'a, including columns for source, location, nature of study, and findings. The locations of these archaeological studies are shown in Figure 4. Table 4 is a list of known historic properties within the ahupua'a and includes columns for state site numbers, site type, location and reference. The locations of identified sites within Kapa'a Ahupua'a are shown in Figure 5.

Table 3. Previous Archaeological Studies in coastal Kapa'a

Source	Location	Nature of Study	Findings
Bennett 1931	Island wideIdentifies 2 sites: Site 110 Taro terraces and bowl and Site 111 A large simple dirt Hawaiian ditch	Archaeological Reconnaissance	Identifies 2 sites: Site 110 Taro terraces and bowl and Site 111 A large simple dirt Hawaiian ditch
Handy and Handy 1972	Archipelago-wide	Native Planter study	Discusses "highly developed irrigation system"
Ching 1976	Just south of the Waikaea Drainage Canal	Archaeological Reconnaissance	No significant findings
Hammatt 1981	Upland Kapa'a	Archaeological Reconnaissance	No significant findings
Hammatt 1986	Upper reaches of the Makaleha stream valley.	Archaeological Reconnaissance	No significant findings
Hammatt 1991	Along Kūhiō Highway	Subsurface Testing	Identifies two sub-surface cultural layer sites
Kikuchi and Remoaldo 1992	Around Kapa'a Town	Cemeteries of Kaua'i	Identifies six cemeteries
Spear 1992	South side Waikaea Canal, *mauka* of Kūhiō Highway. (TMK: 4-5-05:04, 09)	Monitoring Report	Designated subsurface site 50-30-08-547

Source	Location	Nature of Study	Findings
Chaffee, Burgett & Spear 1994a	A house lot near the corner of Kukui and Ulu Streets in *mauka* Kapa'a Town. (TMK: 4-5-09:10)	Archaeological Inventory Survey	No significant findings
Chaffee, Burgett & Spear 1994b	Māmane Street Kapa'a Town. (TMK: 4-5-09:51	Archaeological Inventory Survey	No significant findings
Hammatt, Ida & Chiogioji 1994	Proposed bypass routes *mauka* of Kapa'a Town	Archaeological Assessment	No new field work, reviews literature
Hammatt, Ida & Folk 1994	South side Waikaea Canal, *mauka* of Kūhiō Highway (TMK: 4-5-05:06)	Archaeological Inventory Survey	Weak cultural layer designated site 50-30-08-748
Kawachi 1994	Inia Street (Jasper) TMK 4-5-08:33	Burial Report	Designates Site 50-30-08-871
McMahon 1994	"behind the armory in Kapa'a near the god stones" The location is uncertain & "Buzz's near the Coconut Marketplace"	Documents second hand report of burials in two locations	Bones in 3 places reported from behind the armory, 16 bodies reported from the Buzz' s restaurant. No site numbers assigned
Creed, Hammatt, Ida, Masterson & Winieski 1995	Kapa'a Sewer line project, Kūhiō Highway, south and central Kapa'a Town	Archaeological Monitoring Report	Documents cultural layer of site -1848 and (an enlarged) site -1849 & recovery of thirty burials at sites –867, -868, -871, & -1894
Jourdane 1995	1382-A 'Inia Street, *makai* of Kūhiō Highway, central Kapa'a Town	Burial Report	Site 626
McMahon 1996	South side Waikaea Canal, *mauka* of Kūhiō Highway (TMK: 4-5-05:08)	Archaeological Inventory Survey	No significant cultural material
Hammatt, Chiogioji, Ida & Creed 1997	Test excavations focused inland of Kapa'a Town	Archaeological Inventory Survey	Four test trenches were excavated inland of Kapa'a Town
Borthwick and Hammatt 1999	Kapa'a Seventh-Day Adventist Church at 1132 Kūhiō Highway	Archaeological Monitoring and Burial Treatment Plan	Monitoring was indicated as this parcel lay within the designated Site 50-30-08-1848.

Source	Location	Nature of Study	Findings
Bushnell and Hammatt 2000	Seventh-Day Adventist Church, *makai* of Kūhiō Highway, south of the Waikaea Canal	Archaeological Monitoring Report	Minimal findings (one piece of worked bone)
Callis 2000	Kapa'a Beach Park	Burial Removal and Archaeological Monitoring Report	Human Burial
Perzinski and Hammatt 2001	Kūhiō Highway on the margins of the Waikaea Canal	Archaeological Monitoring Report	No significant cultural material
Elmore and Kennedy 2003	Kūhiō Highway	Archaeological Monitoring Report	No significant cultural material
Dega, Michael F. and James Powell 2003	Kūhiō Highway	Archaeological Monitoring Report	Human Burials

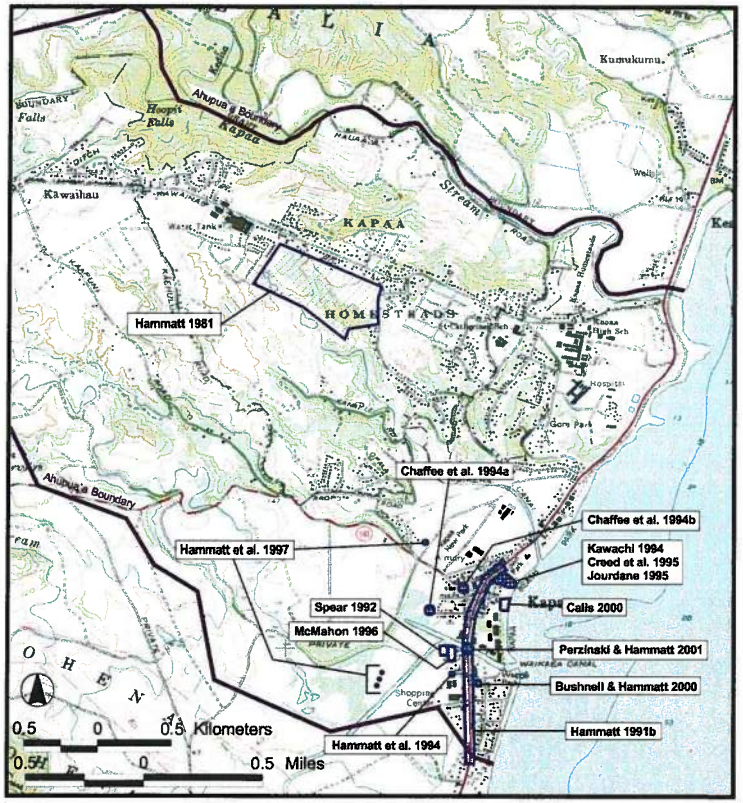


Figure 4. Map showing previous archaeological sites in Kapa'a. The majority of study areas are located within urban Kapa'a away from the shore and mountain areas.

Table 4. Historic Properties in Coastal Kapa'a Ahupua'a

Site # 50-30-08-	Site Type/ Name (if any)	Location	Site Constraints	Reference
B001	Historic Cemetery	South of bend of Kapa'a Stream, a kilometer *mauka* from Kūhiō Highway	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B002	Historic Cemetery	Just *mauka* from Kūhiō Highway, south of Kapa'a Stream	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B003	Kapa'a Public Cemetery	South of Kanaele Road, approximately one kilometer inland of Kūhiō Highway	Appears to be a discrete historic cemetery	Kanaele Road; Kikuchi and Remoaldo 1992
B004	Historic Cemetery	North of Apopo Road, approximately one kilometer inland of Kūhiō Highway	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B013	Historic Cemetery	Just *mauka* from Kūhiō Highway, north of the Waikaea Canal	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B014	All Saints Episcopal Church Cemetery	Just *mauka* from Kūhiō Highway, south of the Waikaea Canal	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992:62-65
-547	sub-surface features including a fire pit and a possible house foundation	South of bend of Waikaea Canal, *mauka* of Kūhiō Highway	Archaeological monitoring in the vicinity is recommended	Spear 1992:3

Site # 50-30-08-	Site Type/ Name (if any)	Location	Site Constraints	Reference
-626	Burial	Inia Street, *makai* of Kūhiō Highway, central Kapa`a	Consultation and monitoring in vicinity indicated	Jourdane 1995
-748	Minimal findings, a weak cultural layer (buried A-horizon)	South of the bend of the Waikaea Canal, *mauka* of Kūhiō Highway	Considered no longer significant within project area	Hammatt, Ida & Folk 1994
-867	1 set of human remains	Kukui Street, just *mauka* of Kūhiō Highway, Kapa`a Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50
-868	1 set of human remains	Lehua Street *mauka* of Kūhiō Highway, Kapa'a Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50
-871	13 sets of human remains (Creed et al. 1995:50)	Inia Street, *makai* of Kūhiō Highway	Consultation and monitoring in vicinity indicated	Kawachi 1994, Creed et al. 1995:50
1848	Cultural layer & sub	Along Kūhiō Highway between Wana Road and the Waikaea Drainage Canal	Archaeological monitoring in the vicinity is recommended	Hammatt 1991; Creed et al. 1995
-1849	Cultural layer & sub-surface features; Creed et al. 1995:53 expands boundaries to incl. burial sites, -626, -867, -868 - 871, and -1894	Along Kūhiō Highway between Inia Street and Kauwila Street extending to the coast	Consultation and monitoring in vicinity indicated	Hammatt 1991; Creed et al. 1995
-1894	11sets of human remains	Ulu Street, just N of Kūhiō Highway, Kapa'a Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50

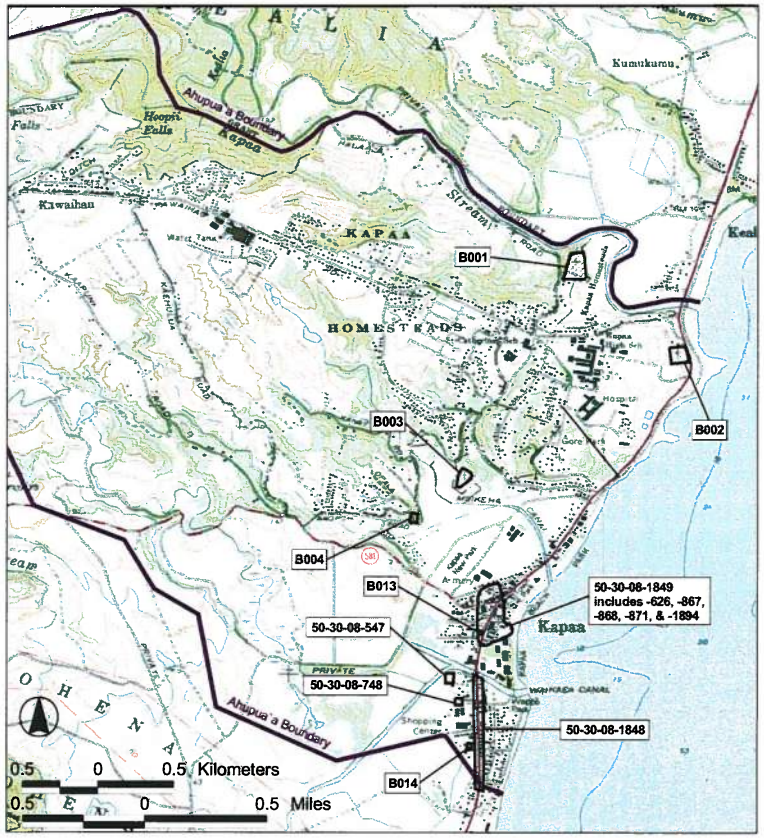


Figure 5. Map showing previously documented archaeological sites in Kapa'a.

B. Pattern of Archaeological Sites in Kapa'a

The pattern of archaeological studies in Kapa'a Ahupua'a is somewhat skewed with a dozen projects in urban Kapa'a Town and very little work along the coast (Figure 4). Major archaeological sites have been found in the Kapa'a Town area including extensive cultural layers with burials and other cultural features underlying Kūhiō Highway near All Saints Gym and near the older part of Kapa'a Town between Waika'ea Canal and Kapa'a Beach Park, *makai* of Kūhiō Highway (Hammatt 1991; Kawachi 1994; Creed et al. 1995; Jourdane 1995; Callis 2000). The *mauka-makai* extent of these cultural layers has not been clearly defined. These extensive cultural deposits associated with pre-historic and early historic habitation are known to exist in a relatively narrow sand berm that makes up the physiogeography of Kapa'a. The areas *mauka* of Kapa'a Town are marshy although much of it has been filled in recent decades. The five *kuleana* awarded during the Mahele are located adjacent to the present highway. The more *mauka* studies (Spear 1992,Chaffee et al. 1994a & 1994b, Hammatt et al. 1994, 1997, McMahon 1996) are thought to be located towards the *mauka* fringe of the sand berm, approaching more marshy conditions and have generally reported no significant or minimal findings. Less than 1.5 km to the south of Waika'ea Canal is another extensive subsurface, cultural deposit which is associated with a pre-contact fishing encampment located at the southern boundary of Waipouli adjacent to Uhalekawa'a Stream (Waipouli Stream) and the ocean (Hammatt et al. 2000).

Anticipated Sites based on historic and archaeological studies in *mauka* Kapa'a would be evidence of cane cultivation and historic railroad tracks for alternative Sites Makai Locale 1 and 2, and possible terracing for lo'i cultivation within the Mauka Locale.

IV. RESULTS OF FIELD CHECK

A. Mauka Locale

On June 10th, 2004, Cultural Surveys Hawai'i Inc. archaeologist Karl Van Ryzin, B.A., and supervising archaeologist David Perzinski, B.A., made a field inspection on the Mauka Locale proposed water tank installation project area. Access was made via Kahuna Road.

Survey transects oriented north-south were conducted within the project area. The Mauka Locale is relatively level with vegetation in the project area dominated by albezia, ginger, bamboo, papaya, *ti*, ferns, banana, California grass, and various weeds and vines (Figures 6 and 8). Modern-day trash was scattered along the northeast boundary near Kahuna Road (Figure 9). No archaeological sites were observed.

Figure 6. Mauka Locale project area, view to the south.

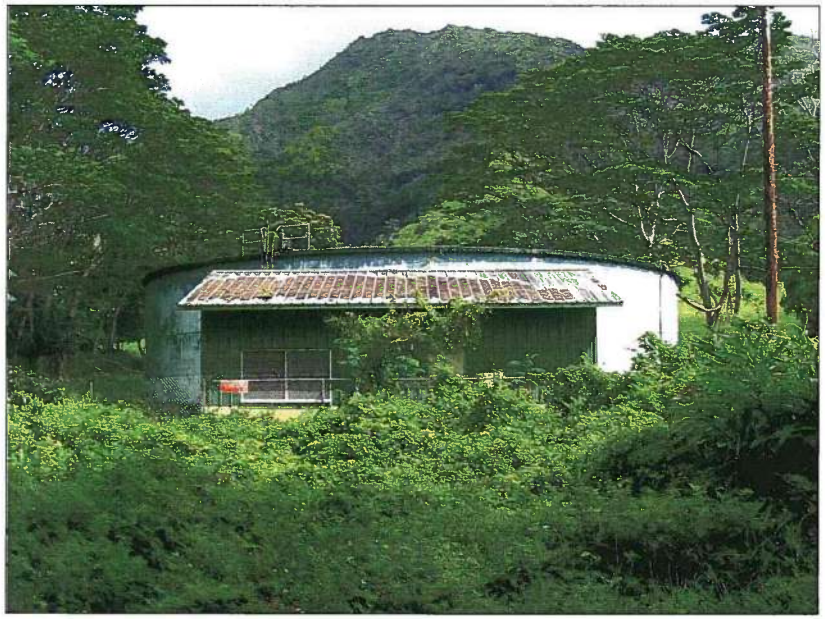


Figure 7. Existing water tank northwest of *mauka* project area, view to the northwest

Figure 8. Mauka Locale project area, view to the south.

Figure 9. Mauka Locale project area showing modern day trash along northeast boundary, view to the north.

V. RECOMMENDATIONS

The field checks examined the areas of proposed impact and found no archaeological sites or historic preservation concerns in the vicinity of any of the parcel. We recommend no further historic preservation work. As always, if in the unlikely event that any human remains or other significant subsurface deposits are encountered during the course of development activities all work in the immediate area should stop and the State Historic Preservation Division should be promptly notified.

VI. REFERENCES

Akina, Joseph

1913 "*I Ke hou i Ka Lulu-o-Moikeha i ka laula o Kapa'a*", *Kuokoa.* May 2-9, 1913. Bishop Museum Archives HEN Place Names, Kaua'i.

Alexander, William Patterson

1991 "A Tour of Kaua'i in 1849: Private Journal of William DeWitt Alexander," *The Kaua'i Papers*, Kaua'i Historical Society, A Kaua'i Historical Society Publication, Lihue, Kaua'i, HI.

Bass, William M.

1995 Human Osteology: A Laboratory and Field Manual of the Human Skeleton (4th edition), Missouri Archaeological Society, Columbia, MO.

Beckwith, Martha

1970 Hawaiian Mythology, The University Press of Hawai`i, Honolulu.

Bennett, Wendell C.

1931 The Archaeology of Kaua`i, Bishop Museum Bulletin 80, Honolulu, HI.

Bishop Museum Archives

HEN I: 214 "Heiaus of Kealia and Kapa'a" and "Well Known Things [or Places]".

HEN I: 215 "Famous Things mentioned by Two Men".

HEN I: 216 "Heiaus from Kapa'a to Kealia" and "Things for which Kapa'a was Known".

Bureau of Land Conveyances

Grant 8248

Bushnell, K.W., Melanie Mann, Douglas Borthwick, Tony Bush, Todd Tulchin, David Shideler and Hallett H. Hammatt

2002 Archaeological Inventory Survey for the Proposed Kapa`a/Keālia Bike and Pedestrian Path, Kapa`a and Keālia, Kawaihau District, Kaua`i Island, Hawaii (TMK 4-5, 4-6-14, 4-7-03 & 04). Cultural Surveys Hawai`i, Inc. Kailua, HI.

Chafee, David B. , Berdena Burgett and Robert L. Spear

1994a An Inventory Survey of a Kukui Street Houselot, Kapa`a Ahupua`a, Kawaihau District, Puna, Island of Kaua`i (TMK: 4-5-09:10), SCS Inc., Kāne`ohe, HI.

1994b An Inventory Survey of a Māmane Street Houselot, Kapa`a Ahupua`a, Kawaihau District, Puna, Island of Kaua`i (TMK: 4-5-09:51), SCS Inc., Kāne`ohe, HI.

Ching, Francis K. W.

1968 Archaeological Surface Survey; Wailua State Park, Kaua`i, State of Hawaii, Dept. of Land and Natural Resources, Honolulu, HI.

1976 Letter Report: Archaeological Reconnaissance - Report, Kapa'a "Wastewater Treatment and Disposal System, ARCH 14-96, Letter to R. M Towill Corporation, ARCH, Lawai, Kaua'i, HI.

Condé, Jesse C. and Gerald M. Best
1973 Sugar Trains, Narrow Gauge Rails of Hawaii, Glenwood Publishers, Felton, CA.

Cook, Chris
1999 "Kaua`i, the Garden Island: A Pictorial History of the Commerce and Work of the People", Donning Co., Virginia Beach, VA.

Creed, Victoria, Hallett H. Hammatt, Gerald K. Ida, Ian Masterson and John Winieski
1995 A Summary of the Archaeological Monitoring for the Kapa'a Sewerline Project Waipouli and Kapa'a Ahupua'a, Puna Disctric, Kaua'I (TMK:4-3-09 and 4-5-03 to 11), Cultural Surveys Hawaii, Kailua, HI.

Damon, Ethel M.
1934 The Heiau at Wailua, The Kaua'i Historical Society by the Garden Island Press, Līhu`e, Kaua`i, HI.

1931 Koamalu, two vols. Privately printed at the Honolulu Star-Bulletin Press, Honolulu.

Dega, Michael F. and James Powell
2003 Archaeological Monitoring During Phase I of the Kaua'i Rural Fiber Optic Duct Lines Project, Kaua'i Island, Hawai'i. Scientific Consultant Services

Dole, Charles S.
1916 "The Hui Kawaihau" pp.8-15. A Paper read at the November meeting of the Kaua'i Historical Society on November 16, 1916. In Lihue, Kaua`i.

Donohugh, Donald
2001 The Story of Kōloa, A Kaua'i Plantation Town, Mutual Publishing, Honolulu, HI.

Foote, Donald E. E. L. Hill, S. Nakamura and F. Stevens
1972 Soil Survey of the Islands of Kaua'I, O'ahu, Maui, Molokai and Lanai, State of Hawai'i U.S. Department of Agriculture, U.S. Government Printing Office, Washington D.C.

Fornander, Abraham
1916-19 Fornander Collection of Hawaiian Antiquities and Folk-Lore, with translations edited and illustrated with notes by Thomas G. Thrum, Volume 4, First series, 1916 - l917 notes by Thomas G. Thrum, Memoirs of the Bernice P. Bishop Museum, Vols. 4, 5, 6, Honolulu, HI.

Garden Island Newspaper
1955 "Geologists Says Kapa'a Coral Removal No Threat to Town". September 21, 1955.

1963 "Kapa'a Blames Federal Role As Erosion Continues. Says Barrier on Reef is Required". October 30, 1963.

1983 "Centennial Year, Kapa`a School Wants Pix of its 100 Years". April 1, 1983.

Giambelluca, Thomas W., Michael A. Nullet and Thomas A. Schroeder
1986 Rainfall Atlas of Hawai'i, Department of Land and Natural Resources, Honolulu, HI.

Hammatt, Hallett H.
1981 Archaeological Reconnaissance of 52.56 Acres for a Proposed subdivision, TMK:4-6-13-1, Kapa`a, Puna, Kaua`i Island, ARCH Report 14-236, Prepared for Waialeale Partners.

1986 Archaeological Reconnaissance of the Makaleha Springs Water Source Development, Kapa`a, Kaua`i TMK: 4-6-01:1, Cultural Surveys Hawaii, Kailua, HI.

1991 Archaeological Subsurface Testing for the Proposed Kapa'a Sewer line, Wailua, Olohena, Waipouli and Kapa'a, Kaua'i, Cultural Surveys Hawaii, Kailua, HI.

Hammatt, Hallett H., Rodney Chiogioji, Gerald K. Ida and Victoria S. Creed
1996 An Archaeological Inventory Survey for the Kūhiō Highway Widening and Bypass Options Within the Ahupua'a of Wailua, South Olohena, North Olohena, Waipouli & Kapa`a, Island of Kaua'i, Cultural Surveys Hawai'i, Inc., Kailua, HI.

Hammatt, Hallett H., Gerald K. Ida and William H. Folk
1994 Archaeological Inventory of a 1.87-Acre Parcel, Kapa'a, Kaua'I (TMK 4-5-05:6), Rev. August 1994, Cultural Surveys Hawai'i, Kailua, HI.

Handy, E.S. Craighill and Elizabeth G. Handy
1972 Native Planters in Old Hawaii: Their Life, Lore, and Environment, B.P. Bishop Museum Bulletin 233, B.P. Bishop Museum, Honolulu, HI.

Hawaii State Archives
1837 Interior Department, Land, Incoming Letter. August 1837.

1882 Interior Department, Letter book, Vol. 20, p. 426, Letter from Spalding to the Honorable Jacob Hardy, Circuit Judge–Fourth Circuit Kaua'i.

Hawaiian Territorial Planning Board
1940 Master Plan of the Town of Kapa'a, In collaboration with the Kaua'i County Board of Supervisors, Publication No. 8. Advertiser Publishing Co., Honolulu, HI.

Honolulu Advertiser
1997 "Amfac to put more land up for sale: Tracts on Kaua'i, Big Island" by Mike Gordon. July 7, 1997. Section B1.

1960 "Kaua'i Tries to See into Future. March 20, 1960.

Joesting, Edward
1984 Kaua'i, The Separate Kingdom, University of Hawaii Press and Kaua'i Museum Association, Ltd., Honolulu.

Jourdane, Elaine
1995 Inadvertent Discovery of Human Remains at 1382-A Inia Street, Kapa'a, Kaua'i (Kapa'a Sewerline Project Laterals) Site 626, SHPD, Honolulu, HI.

Kalakaua, David
1888 The Legends and Myths of Hawaii, Edited by R.M. Dagget, Charles L. Webster and Co., New York.

Kamakau, Samuel Manaiakalani
1976 The Works of the People of Old, Na Hana a ka Po`e Kahiko, Bishop Museum Special Publication, No. 61, Honolulu, HI.

Kapa'a Elementary School
1982 Kapa`a School 1883-1983: A "Century of Knowledge". Kapa'a Elementary, Kapa`a, Kaua`i.

Kawachi, Carol T.
1994 Inadvertent Burial at 1316 Inia Street (Jasper) TMK 4-5-08:33, Kapa'a, Kawaihau, Kaua'I 50-30-08-871, State Historic Preservation Division, Honolulu, HI.

Kikuchi, William K. and Susan Remoaldo
1992 Cemeteries of Kaua`i, Volume 1, Kaua`i Community College and University of Hawai`i, Puhi, Kaua`i, HI.

King, Robert D.
1935 "Districts in the Hawaiian Islands" In Coulter, John Wesley (compiler)

A Gazetteer of the Territory of Hawaii, University of Hawaii Research Publications, No. 11, University of Hawaii, Honolulu, Hi.

Krogman, W.M. and M.Y. Isçan
1986 The Human Skeleton in Forensic Medicine (2nd Edition), Springfield, IL.

Lai, Violet L. assisted by Kum Pui Lai
1985 He Was a Ram, Wong Aloiau of Hawaii, Published for the Hawaii Chinese History Center and the Wong Aloiau Association by University Press of Hawaii, Honolulu.

Martini, Frederic H. and Michael J. Timmons
1995 Human Anatomy. Prentic Hall, Inc., Englewood Cliffs, NJ.

Mc Kern, T.W. and T.D. Stewart
1957 Skeletal Age Changes in young American Males. Quartermaster Research and Development Command Technical Report EP-45, Natick, MA.

McMahon, Nancy A.
1994 Inadvertent Burial Find, Kapa`a, Kawaihau, Kaua'i, SHPD, Honolulu, HI.

1996 Archaeological Inventory Survey for 5 Unit Apartment, TMK: 4-5-05:8, Kapa'a, Kawaihau, Kaua'i, Exploration Associates, LTD., Koloa, Kaua'i, HI.

Meindl, R.S. and C.O. Lovejoy
1985 Ectocranial Suture Closure: A Revised Method for the Determination of Skeletal Age at Death Based on the Lateral-Anterior Sutures. American Journal of Physical Anthropology 68: 57-66.

Nakuina, Moses K.
1990 The wind Gourd of La`amaoma, Translated by Esther T. Mookini and Sarah Nakoa, Kalamaku Press, Honolulu.

Office of the Commissioner of Public Lands
1929 Indices of Awards, Made by the Board of Commissioners to Quiet Land Title in the Hawaiian Islands.

Pukui, Mary Kawena
1983 `Ōlelo No`eau: Hawaiian Proverbs and Poetical Sayings, Bishop Museum Special Publication No.71, Bishop Museum Press, Honolulu, HI.

1986 Hawaiian Dictionary, 2nd Edition, University of Hawaii Press, Honolulu, HI.

1974 Place Names of Hawaii, University of HawaiiPress, Honolulu, HI.

Rice, William Hyde
1974 Hawaiian Legends, Bernice P. Bishop Museum Bulletin 3, Honolulu, HI; originally published 1923, Kraus Reprint, Millwood, New York, N.Y.

1923 Hawaiian Legends, Bernice P. Bishop Museum Bulletin 3, Honolulu.

Snow, Charles E.
1974 Early Hawaiians: An Initial Study of Skeletal Remains from Mokapu, O`ahu. The University Press of Kentucky, Lexington, KY.

Spear, Robert L.
1992 Letter Report Concerning Monitoring for the Cost-U-Less Project Kapa`a, Kaua'i, HI.(TMK: 4-5-5:4&9), Scientific Consultant Services Inc., Honolulu, HI.

Thrum, Thomas G.
1906 "Heiaus and Heiau Sites Throughout the Hawaiian Islands, Kaua'i, in: Hawaiian Almanac and Annual 1907, pp. 36-48, Honolulu, HI.

1923 More Hawaiian Folk Tales, A.C. McClurg & Co., Chicago, IL.

Ubelaker, D.H.
1989 Human Skeletal Remains: Excavation, Analysis, Interpretation (2nd Edition). Washington D.C.: Taraxacum.

White, Tim D. and Pieter A. Folkens
1991 Human Osteology. Academic Press, Inc., San Diego, CA.

Wichman, Frederick B.
1998 Kaua`i Ancient Place Names and Their Stories. University of Hawaii Press: Honolulu

VII. APPENDIX

A. Methods

On June 10th, 2004 a field inspection of alternative sites (Makai Locale 1 and Makai Locale 2) for the proposed water tank installation project area was conducted by Cultural Surveys Hawai'i Inc. archaeologist Karl Van Ryzin, B.A., and supervising archaeologist David Perzinski, B.A. Survey transects oriented north-south were conducted in both parcels with archaeologists spaced apart 10 m. Field observations were recorded and photographs were taken of the project areas. The work was conducted under the overall supervision of principal archaeologist Hallett H. Hammatt, Ph.D.

Historical research included a review of previous archaeological studies on file at the State Historic Preservation Division of the Department of Land and Natural Resources; studies of documents at Hamilton Library of the University of Hawai'i, and study of maps at the Survey Office of the Department of Land and Natural Resources. Nineteenth-century Land Commission Award claim records were accessed via the Internet from the Mahele Database prepared by Waihona 'Aina Corp.

B. Natural Setting

1. Makai Locale 1 Project Area

The Makai Locale 1 project area is located at the corner of Kawaihau Road and Ka'apuni Road (Figures 10 and 11) at an elevation of 91m (300ft) and approximately 4.18 km (2.6 mi) from the coast. Foote et al (1972) describes the soil in this area as being "Puhi Silty clay loam" (PnB) which is defined as being "well-drained soils on uplands on the island of Kaua'i. These soils developed in material derived from basic igneous rock. They are nearly level to steep. Elevations range from 175 to 500 feet." (Foote et al.1972). Makai Locale 1 receives an average annual rainfall of approximately 2000 mm (79 inches) (Giambelluca 1986:47). A brief summary of observations on the natural setting is presented in the results of field check section of this study.

2. Makai Locale 2 Project Area

The Makai Locale 2 project area is located approximately 400 m north of Lower Kapahi Reservoir and immediately south of Kapa'a Stream (Figures 10 and 12). The elevation runs from 60 m to 91 m (200-300 ft) and is approximately 4.59 km (2.85 mi) to the coast. Foote et al (1972) described three types of soils within this project area – rough broken land (rRR), rock outcrop (rRO), and Hanalei silty clay (HrB). Rough broken land consists of "very steep land broken by numerous intermittent drainage channels. In most places it is not stony. It occurs in gulches and on mountainsides on all the islands except Oahu. The slope is 40 to 70 percent. Elevations range from nearly sea level to about 8,000 feet. The local relief is generally between 25 and 500 feet. Runoff is rapid, and geologic erosion is active." (Foote et al.1972). Rock outcrop consists of "areas where exposed bedrock covers more than 90 percent of the surface. It occurs on all five islands. The rock outcrops are mainly basalt and andesite. This land type is gently sloping to precipitous. Elevations range from nearly seal level to 10,000 feet. … This land

type is not suited to farming. It is used for water supply, wildlife habitat, and recreation" (Foote et al.1972). Hanalei silty clay consists of "somewhat poorly drained to poorly drained soils on bottom lands of the islands of Kaua'i and O'ahu. These soils developed in alluvium derived from basic igneous rock. They are level to gently sloping." (Foote et al.1972). Makai Locale 2 receives an average an annual rainfall of approximately 2000 mm (79 inches) (Giambelluca 1986:47). A brief summary of observations on the natural setting is presented in the results of field check section of this study.

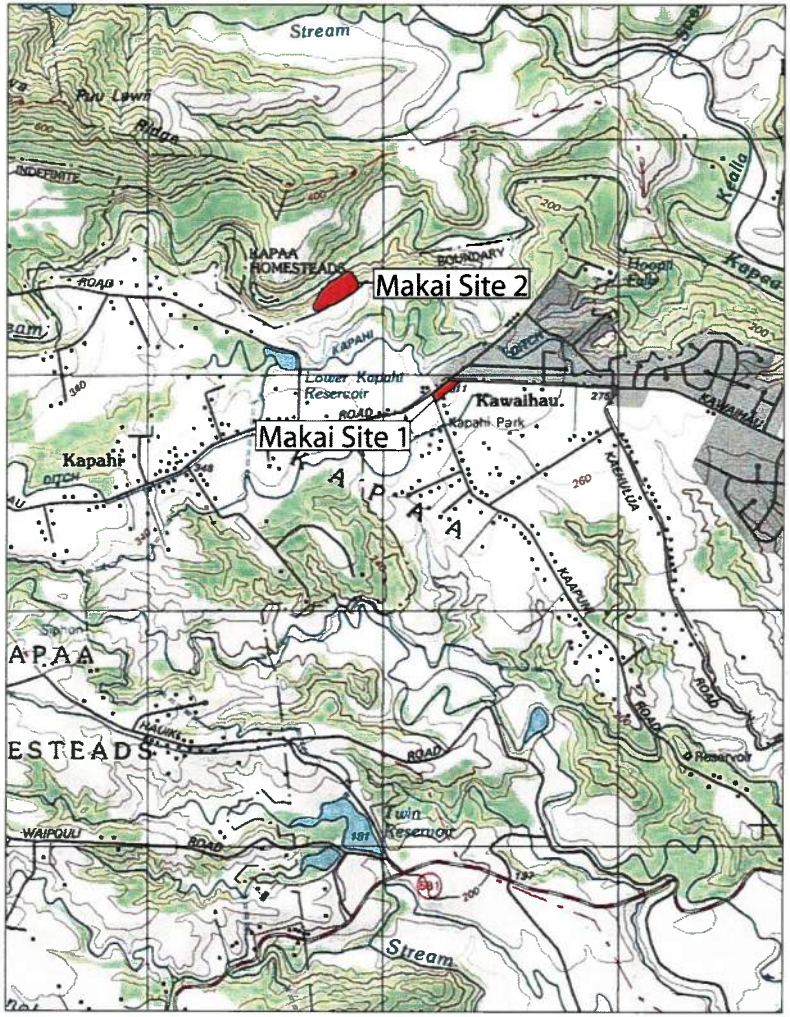


Figure 10 Portion of USGS map showing location of alternative sites Makai Site 1 and Makai Site 2

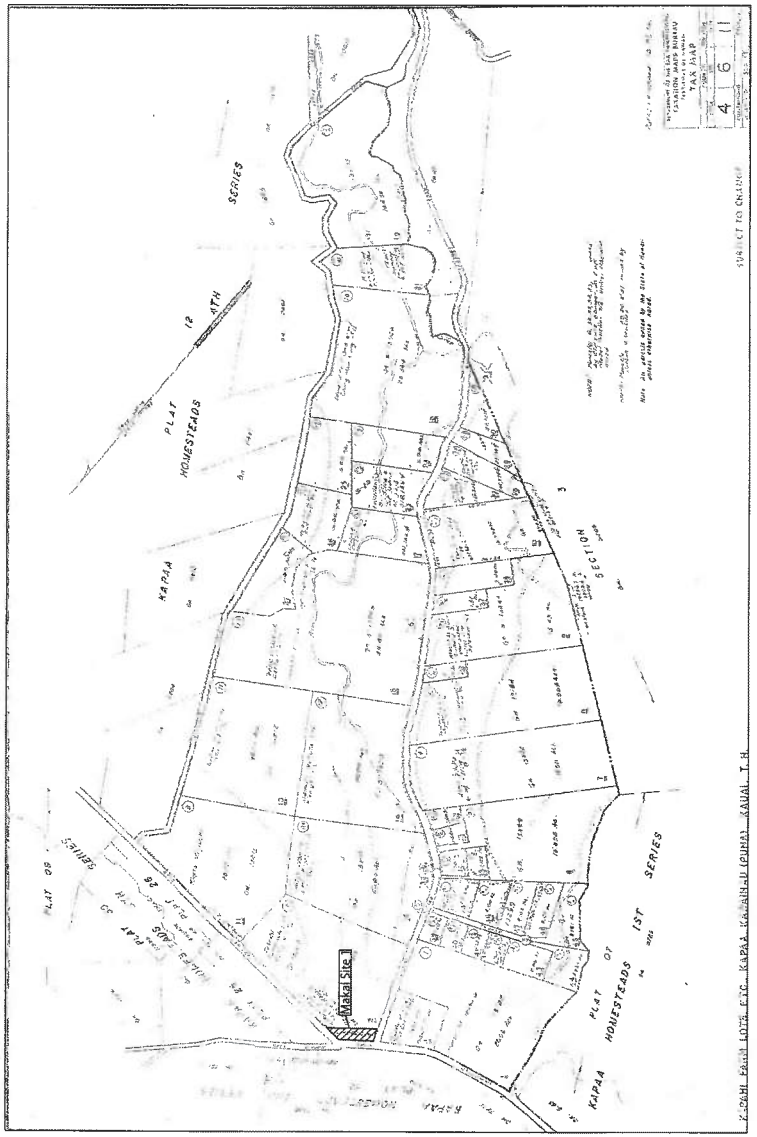


Figure 11 TMK 4-6-11 showing Makai Locale 1 project area

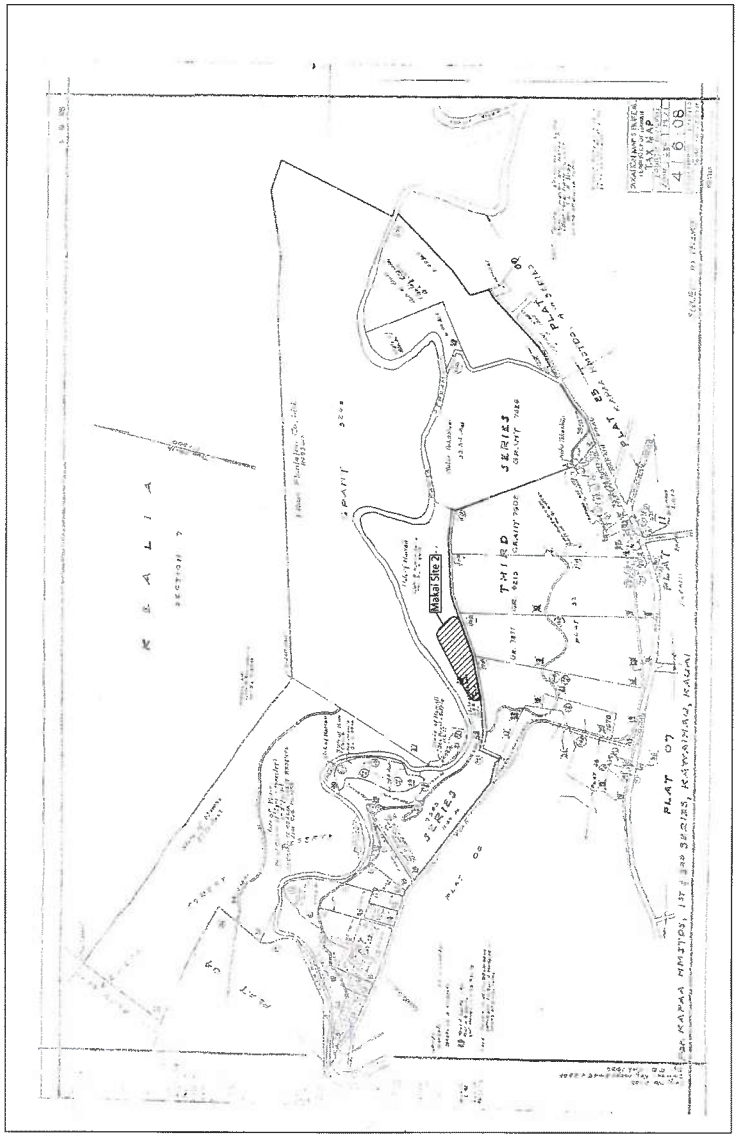


Figure 12. TMK 4-6-08 showing Makai Locale 2 project area.

C. Results of fieldwork

I. Makai Locale 1

On June 10th, 2004, Cultural Surveys Hawai'i Inc. archaeologist Karl Van Ryzin, B.A., and supervising archaeologist David Perzinski, B.A., made a field inspection of the Makai Locale 1 alternative water tank installation project area. Access was via Highway 56, turning off to the west on Highway 581, then turning off to the northwest on Kaehulua Road.

Makai Locale 1 is comprised of a 0.84-acre State property of which a portion is fenced and contains an existing 0.2 MG wooden reservoir (Figure 13). Survey transects oriented north-south were conducted through the project area. Based on observations the entire existing and proposed tank locale had previously been bulldozed and graded. The existing tank area consists of mowed grass lawn. The remainder of the property is an open, level pasture containing large patches of California grass, bananas, and various weeds and vines (Figures 14 and 15). No archaeological sites were observed. Based on background research Makai Locale 1 was, during the early 20th century, under sugar cane cultivation.

Figure 13. Fenced section of Makai Locale 1 project area, view to the southwest.

Figure 14. Makai Locale 1 project area, view to the east

Figure 15. Makai Locale 1 project area, view to the southeast.

A. Makai Locale 2

On June 10th, 2004, Cultural Surveys Hawai'i Inc. archaeologist Karl Van Ryzin, B.A., and supervising archaeologist David Perzinski, B.A., made a field inspection on the Makai Locale 2 alternative water tank installation project area. Access was via an unmarked privately owned dirt road that runs northeast from Kahuna Road.

The Makai Locale 2 is comprised of an unmarked, approximately 3.7 acre site off a dirt access road and is located immediately south of Kapa'a Stream (Figure 12). The majority of the project area lies on a 45 to 90 degree angle slope that descends down into Kapa'a Stream (Figures 16 and 17). Survey transects oriented north-south were conducted throughout the relatively level upper portion of the project area. For the lower portion of the project area transects were done along the contour of the slope. Vegetation is dense with the project area dominated by ginger, ferns, *ti*, palms, albezia, and exotic grasses. No archaeological sites were observed.

Figure 16. Makai Locale 2 project area south of Kapa'a stream showing steep slope, view to the west.

Figure 17. Makai Locale 2 project area showing dense vegetation and steep slope, view to the east.

B. Recommendations

The field checks examined the areas of proposed impact and found no archaeological sites or historic preservation concerns in the vicinity of any of the two alternative parcels. We recommend no further historic preservation work. As always, if in the unlikely event that any human remains or other significant subsurface deposits are encountered during the course of development activities all work in the immediate area should stop and the State Historic Preservation Division should be promptly notified.

APPENDIX E

CULTURAL IMPACT ASSESSMENT

A Cultural Impact Assessment For A Proposed Water Reservoir, Kapa'a Ahupua'a, Kawaihau District, Kaua'i

TMKs 4-6-11:3, 4-6-08:24, 4-6-03:10

by

Auli'i Mitchell B.A.

and

Hallett H. Hammatt Ph.D.

Prepared for

Belt Collins Hawai'i Ltd.

by

Cultural Surveys Hawai'i, Inc.

October 2004

TABLE OF CONTENTS

LIST OF FIGURES iii
LIST OF TABLES iii
I. INTRODUCTION 1
A. Project Background 1
B. Scope of Work 1
C. Methods 1
D. Natural Setting 4
II. MYTHOLOGICAL AND TRADITIONAL ACCOUNTS OF KAPA'A 6
A. Introduction to the Mythological and Traditional Accounts of Kapa'a 6
B. Mythological and Traditional accounts of Kapa'a 6
1. Traditional Place Names of Kapa'a 6
2. Heiau of Kapa'a 8
3. Kaililauokekoa the Chiefess of Kapa'a and the Lute Kanikawi 9
4. *Kalukalu* grass of Kapa'a 9
5. Ka Lulu o Mō'īkeha 10
6. Kaweloleimākua 11
7. Kanaka-Nunui-Moe-The Sleeping Giant 11
8. Lepeamoa 13
9. Pāka'a and the Wind Gourd of La'amaomao (Keahiahi) 13
10. Palila and Ka'ea 14
C. Summary of the Mythological and Traditional accounts of Kapa'a 15
III. HISTORICAL ACCOUNTS 16
A. Early Historic Period 16
B. The Mahele: Kapa'a Land Commission Awards 17
C. Post Mahele 18
D. 20th Century History of Kapa'a (1900-Present) 20
IV. PREVIOUS ARCHAEOLOGICAL RESEARCH 22
A. Archaeological Studies and Sites in Kapa'a Ahupua'a 22
B. Archaeological Studies within the Present Project Area 24
V. COMMUNITY CONSULTATIONS 28
VI. TRADITIONAL CULTURAL PRACTICES 31

A. Gathering for Plant Resources 31
B. Historic Properties 31
C. Burials 31
D. Trails 31
VII. SUMMARY AND RECOMMENDATIONS 32
VIII. REFERENCES CITED 33
IX. APPENDIX 38
A. *Makai* Locale 1 Project Area 38
B. *Makai* Locale 2 Project Area 44

LIST OF FIGURES

Figure 1. Portion of U.S. Geological Survey map showing, *mauka* project area 2
Figure 2. TMK Map 4-6-03 showing *mauka* project area 3
Figure 3. *Mauka* Locale project area, view to the south 4
Figure 4. Existing water tank northwest of *Mauka* Locale project area, view to the northwest 5
Figure 5. *Mauka* Locale project area showing modern day trash along northeast boundary, view to the north. 5
Figure 6. Map showing previous archaeological studies in Kapa'a. 25
Figure 7. Portion of U. S. Geological Survey map showing alternative *Makai* 1 Locale and *Makai* 2 Locale 39
Figure 8. TMK map 4-6 Showing alternative locations *Makai* 1 Locale and *Makai* 2 Locale 40
Figure 9. TMK Map 4-6-11:33 Showing *Makai* 1 Locale 41
Figure 10. TMK Map 4-6-08:24 Showing *Makai* 2 Locale 42
Figure 11. Fenced section of *Makai* Locale 1 project area, view to the southwest 43
Figure 12. *Makai* Locale 1 project area, view to the southeast 43
Figure 13. *Makai* Locale 2 project area south of Kapa'a stream showing steep slope, view to the west. 45
Figure 14. *Makai* Locale 2 project area showing dense vegetation and steep slope, view to the east. 45

LIST OF TABLES

Table 1. *Heiau* of Kapa'a 8
Table 2. Mahele Land Claims in Kapa'a Ahupua'a 17
Table 3. Previous Archaeological Studies in Kapa'a 22
Table 4. Historic Properties in Kapa'a Ahupua'a 26
Table 5 Community Consultations 29

I. INTRODUCTION

A. Project Background

At the request of Belt Collins Hawai'i Ltd., Cultural Surveys Hawai'i, Inc. (CSH) has conducted a cultural impact assessment for a proposed inland (*mauka)* water reservoir locality at Kapa'a, Kaua'i Island (TMK 4-6-3:10) (Figures 1 & 2). Two other alternate seaward (*makai*) possible localities (*Makai* 1 locale and *Makai* 2 locale) in Kapa'a (TMK 4-6-11:3, 4-6-08:24) were also assessed prior to the selection of the *mauka* locality as a preferred alternative for the proposed reservoir (See Appendix for data developed on the *makai* localities). This assessment was accomplished to address any historic preservation or cultural impact issues that might be raised by the proposed development of a water reservoir within one of the three parcels.

B. Scope of Work

Because of previous disturbance associated with the construction of the existing *mauka* and *makai* reservoirs and access roads a relatively modest scope of work was recommended. The agreed upon scope of work includes:

1) Examination of historical documents, Land Commission Awards, and historic maps, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal and other resources or agricultural pursuits as may be indicated in the historic record to develop a Cultural landscape background study,
2) A review of the existing archaeological information pertaining to the sites in the vicinity as they may allow us to reconstruct traditional land use activities and identify and describe the cultural resources, practices and beliefs associated with the parcel and identify present uses, if appropriate.
3) Limited consultations with agencies and individuals knowledgeable regarding the project area vicinity.
4) Preparation of a report on items 1-3 summarizing the information gathered related to traditional practices and land use. The report will assess the impact of the proposed action on the cultural practices and features identified.

C. Methods

Historical documents, maps and existing archaeological information pertaining to historical properties in the vicinity of this project were researched at the State Historic Preservation Division Library, Cultural Surveys Hawai'i Library, Asian Pacific Digital Library of Kapi'olani Community College, and the University of Hawai'i's Hamilton Library. The Office of Hawaiian Affairs, O'ahu Island Burial Council, Hui Mālama O Nā Kūpuna, and members of other community organizations were contacted in order to identify potentially knowledgeable individuals with cultural expertise and or knowledge of the study area and the surrounding vicinity. A discussion of the consultation process can be found in the section on "Community Consultations." Please refer to Table 5 for a complete list of individuals and organizations contacted.

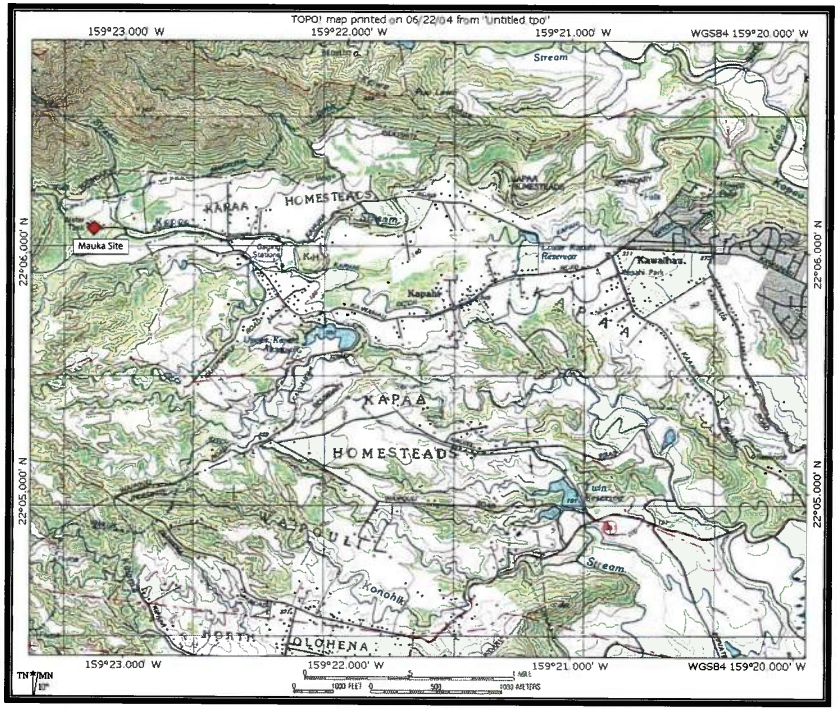


Figure 1. Portion of U.S. Geological Survey map showing, *mauka* project area

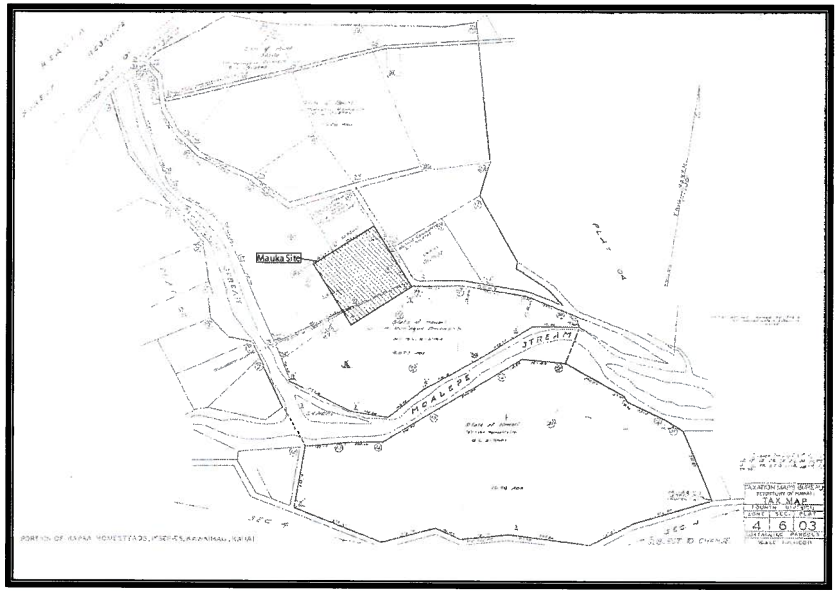


Figure 2. TMK Map 4-6-03 showing *mauka* project area

D. Natural Setting

The *Mauka* Locale project area is located in the uplands of Kapa'a Stream Valley west (*mauka*) of Kapa'a Town at Kapa'a Ahupua'a, Kawaihau District, on the east side of Kaua'i Island. The project area is located immediately south of where Kahuna Road terminates, just northeast of Makaleha Stream. The project area lies at an elevation of 150 m (500 ft) and is approximately 7.56 km (4.7 mi) from the coast. A significant landmark is an existing water tank that lies just west of the project area (see Figure 4). Foote et al (1972) described the soil in this area as being Kapa'a Silty clay. Kapa'a Silty clay consists of "well-drained soils on the uplands on the islands of Kaua'i and Oahu. These soils developed in material weathered from basic igneous rock. They are gently sloping to extremely steep. Elevations range from 200 to 800 feet." (Foote et al. 1972). The Mauka Locale receives an average an annual rainfall of approximately 2000 mm (79 inches) (Giambelluca et al. 1986:47). The area is relatively level with vegetation dominated by albezia, ginger, bamboo, papaya, *ti*, ferns, banana, California grass, and various weeds and vines (Figures 3-6). Modern-day trash was scattered along the northeast boundary near Kahuna Road (Figure 6). No archaeological sites were observed in the course of a companion archaeological assessment study (Van Ryzin and Hammatt 2004).

Figure 3. *Mauka* Locale project area, view to the south

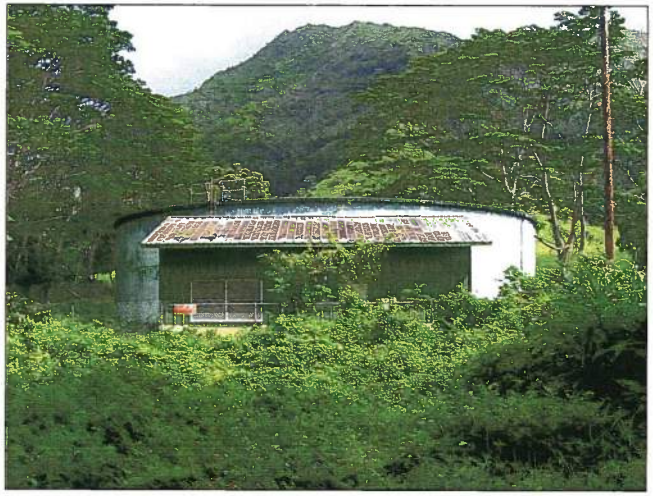


Figure 4. Existing water tank northwest of *Mauka* Locale project area, view to the northwest

Figure 5. *Mauka* Locale project area showing modern day trash along northeast boundary, view to the north.

II. MYTHOLOGICAL AND TRADITIONAL ACCOUNTS OF KAPA'A

A. Introduction to the Mythological and Traditional Accounts of Kapa'a

Wichman (1998:84) notes the paradox that Kapa'a "is one of the largest *ahupua'a* of the Puna District [of Kaua'i] and the most bereft of legends." A brief overview of somer of the better documented mythological and traditional accounts of Kapa'a is presented below and is followed by a brief summation of their import.

B. Mythological and Traditional accounts of Kapa'a

1. Traditional Place Names of Kapa'a

Place Name	Reference	Meaning	Source
Apopo	*'Ili , pali*	"Tomorrow"?	LCA 8343, Soehren (2002:265)
Awawaloa	*'Ili*	long valley, gulch, ravine	LCA 8837, Soehren (2002:265)
Hahanui	*'Ili, pali,* stream	Lobelia plant?	LCA 10564, Soehren (2002:265)
Hoa	*Pali*	"Friend"?	Claim 3638:1, Soehren (2002:265)
Ho'opi'i	*Wailele*	"To cause to rise?"	Soehren (2002:265)
Humu'ula	*Pu'u*	"Jasper stone"?	Claim 8247, Soehren (2002:265)
Kahana	*'Ili*	"Cutting?"	Claim 3971 & 3243 Soehren (2002:265)
Kaloko	*Kauhale, kula*	"The pond"	Claim 3638
Kalolo	*Kauhale, kula*	"Liquor"?	Claim 3638, Soehren (2002:265)
Kamahuna	Pu'u	?	Soehren (2002:265)
Kamali'i	Ridge	"Children"	Soehren (2002:265)
Kapa'a	*Ahupua'a* name	The "solid"or "the closing"	Wichman (1998:84) Soehren (2002:265)
Kapahi	Village, stream	"The knife"	Soehren (2002:266)
Kapeku	*Lo'i*	"The kick"	Claim 8837, Soehren (2002:266)
Kaulolo	*Kauhale*	?	LCA 3638, Soehren (2002:266)
Keahiahi	Headland on the north associated with hero Pāka'a	"twilight"	Wichman (1998:84)

Keiwa	Ridge, boundary point	"The ninth"?	Soehren (2002:266)
Koalua	Surf	"Two coral heads"	Finney 1959, ʻĪʻī 1963, Soehren (2002:266)
Kolehaka	*Pali*	?	Claim 3971 & 3243, Soehren (2002:266)
Kolokolo	Name of a deep fresh water pond	"Soap Plant"	Wichman (1998:84)
Kolouna	*Pali*	*?*	Claim 8247, Soehren (2002:266)
Kupanihi	*ʻIli, kauhale*	*?*	LCA 3971 & 3243, Soehren (2002:266)
Māʻeleele	*ʻIli*	*"Numb"*	LCA 7638, Soehren (2002:266)
Makaleha	*Puʻu,* boundary point	Eyes looking about as in wonder and admiration	Boundary Commission, Soehren (2002:266)
Makanalimu	Place, *heiau*	"Gift of seaweed"	Pukui et al. (1974:141)
Makea	*ʻAuwai*	"Fallow land?	Claim 3599 & 3554, Soehren (2002:267)
Moalepe	*ʻIli*, stream	"Chicken comb"	LCA 8247, Soehren (2002:267)
Naele	*Pali*	"Swamp, bog"	Claim 8837, Soehren (2002:267)
Paikahawai	*ʻIli ku*	*?*	Soehren (2002:267)
Pōhākiʻikiʻi	*Puʻu*	Tilted stone	Soehren (2002:267)
Pōhakupili	*Puʻu,* boundary point	"Joined stone"	Soehren (2002:267)
Poʻo	Surf	"Head"	Finney 1959, Soehren (2002:267)
Pueo	*Pali*	"Owl"	Claim 8843, Soehren (2002:267)
Puhi	*Kauhale*, pond	"Eel?"	Claim 3599 & 3554, Soehren (2002:267)
Puohomaka	*Pali*	?	Claim 8837, Soehren (2002:267)
Pupukai	*Pali*	?	Claim 3638, Soehren (2002:267)

Puʻu Ekeeke	*Pali*	*?*	Claim 8837, Soehren (2002:267)
Puʻu Lauʻiʻi	*Puʻu*, boundary point	*Lauʻiʻi* fern hill	Boundary Commission, Soehren (2002:267)
Ulakiu	*ʻIli ku*		LCA 8837, Soehren (2002:267)
Waikaea	Ditch	?	Soehren (2002:268)
Wailēʻia	Rock, boundary point	"Abundant water"	Boundary Commission, Soehren (2002:268)

2. Heiau of Kapaʻa

During their expeditions around Hawaiʻi in the 1880's, collecting stories from *ka pōʻe kahiko*, Lahainaluna students stopped in Kapaʻa and Keālia and gathered information regarding heiau of the region. All together, fourteen *heiau* were named in Kapaʻa and Keālia, suggesting the two *ahupuaʻa* were probably more politically significant in ancient times. Table 1 lists the names of the ten *heiau* identified in the *ahupuaʻa* of Kapaʻa, their location if known, their type, and associated chief and priest.

Table 1. *Heiau* of Kapaʻa

Name	Location	Type	Associated
Mailehuna	Kapaʻa (Mailehuna is the area of the present day Kapaʻa School)	unknown	Kiha, Kaumualiʻi/ Lukahakona
Pueo	Kapaʻa	unknown	Kiha, Kaumualiʻi/ Lukahakona
Pahua	Kapaʻa/Keālia	unknown	Kiha/ Lukahakona
Kumalae	Kapaʻa/Keālia	unknown	Kiha/ Lukahakona
Waiehumalama	Kapaʻa/Keālia	unknown	Kiha/ Lukahakona
Nāpuʻupaʻakai	Kapaʻa/Keālia	unknown	Kiha/ Lukahakona
Noeamakaliʻi	Kapaʻa/Keālia	"*heiau* for birth of Kauaʻi Chiefs, like Holoholoku"	Unknown
Puʻukoa	Kapaʻa/Keālia	"*unu* type heiau"	Unknown
Piouka	Kapaʻa/Keālia	"*unu* type heiau"	Unknown
Una	Kapaʻa/Keālia	Unknown	Kiha/ Lukahakona
Mano	Kapaʻa/Keālia	Unknown	Kiha/ Lukahakona
Kuahiahi	Kapaʻa (govn't school stands on site now)	Unknown	Kaumualiʻi/ Lukahakona
Makanalimu	Upland of Kawaihau	Unknown	Kaumualiʻi
Kaluluomōʻīkeha	Kapaʻa	Unknown	Mōʻīkeha

The exact locations of these *heiau* are unknown. The locations of two of the *heiau* correlate with the locations of *wahi pana* or sacred places which are known to be in close to Kuahiahi and Kaluluomōʻīkeha. Kuahiahi (also spelled Kaahiahi and Keahiahi) is the rocky headland at the north end of Kapaʻa where the first Kapaʻa School was once located. Kaluluomōʻīkeha is thought to be the general area near the Mōʻīkeha Canal and the present day Coral Reef Hotel

3. Kaililauokekoa the Chiefess of Kapaʻa and the Lute Kanikawi

The tradition of Kaililauokekoa ("The leaf-bark of the Koa") tells the story of a daughter of Mōʻīkeha who goes of to have adventures in the uplands with a certain youth of Pihanakalani who plays artfully on the musical instrument named Kanikawi. The residence of Mōʻīkeha and Kaililauokekoa is said to have been at Kapaʻa with a poetic reference to the grass ("the night drooping grass of Kapaʻa"; see the discussion of the *Kalukalu* grass below). Mōʻīkeha commanded his subjects to search for his errant daughter and "The valleys, pits, cliffs, hills and plains, were crowded with the common people." (Thrum 1923:131). Her lover is captured and is imprisoned down in Kapaʻa. A boy surreptitiously brings the prisoner food by sneaking through the *Kalukalu* grass and *Ahuawa* rushes. Kahuna end up giving their blessing to the marriage of the young couple.

4. *Kalukalu* grass of Kapaʻa

"*Kūmoena kalukalu Kapaʻa*" or "Kapaʻa is like the *kalukalu* mats" is a line from a chant recited by Lonoikamakahiki. *Kalukalu* is a sedge grass, apparently used for weaving mats (Fornander 1917, Vol. IV, Pt. 2, pp. 318-19). According to Wichman (1998:84), "a *kalukalu* mat was laid on the ground under a tree, covered with a thick pile of grass, and a second mat was thrown over that for a comfortable bed", thus the association with lovers. Kauaʻi was famous for this peculiar grass, and it probably grew around the marshlands of Kapaʻa. It is thought to be extinct now, but an old-time resident of the area recalled that it had edible roots, "somewhat like peanuts." Perhaps it was a famine food source (Kapaʻa Elementary School 1983: VI).

Hawaiian sayings collected, translated, and annotated by Mary Kawena Pukui offer a unique opportunity to relish the wisdom, poetic beauty, and earthy humor of the Hawaiian Language. They reveal deeper layers of meaning, giving understanding not only of Hawaiʻi and its people but of all humanity. These sayings are considered to be the highest form of cultural expression in old Hawaiʻi, they bring one closer to the everyday thoughts and lives of the Hawaiians who created them (Pukui 1983: VII).

The following poetic sayings refer to the place of study, Kapaʻa, Kauaʻi: Pukui (1983: 187) associates the *kalukalu* with lovers in "*ke kalukalu moe ipo o Kapaʻa*; the *kalukalu* of Kapaʻa that sleeps with the lover":

Ka lulu o Mō ʻīkeha I ka laulā o Kapaʻa.

The calm of Mō ʻīkeha in the breadth of Kapaʻa.

The chief Mōʻīkeha enjoyed the peace of Kapaʻa, Kauaʻi, the place he chose as his permanent home

It is said the *kalukalu* is a fern somewhat like the *palapalai* (*Microlepia setosa*) famous to Kapaʻa, Kauaʻi. Mōʻīkeha's love for Kapaʻa is recalled in the *ʻōlelo noʻeau*, "*Ka lulu o Mō ʻīkeha i ka laulā o Kapaʻa.*" "The calm of Mōʻīkeha in the breadth of Kapaʻa" (Pukui, 1983: 157):

Ke kalukalu moe ipo o Kapaʻa.

The *kalukalu* of Kapaʻa that sleeps with the lover.

Lovers were said to like whiling the time in the soft kalukalu plants.

5. Ka Lulu o Mōʻīkeha

Kapaʻa was the home of the legendary *aliʻi*, Mōʻīkeha. Born at Waipiʻo on the island of Hawaiʻi, Mōʻīkeha sailed to Kahiki (Tahiti), the home of his grandfather Maweke, after a disastrous flood. On his return to Hawaiʻi, he settled at Kapaʻa, Kauaʻi. Kila, Mōʻīkeha's favorite of three sons by the Kauaʻi chiefess Hoʻoipoikamalani, was born at Kapaʻa and was said to be the most handsome man on the island. It was Kila who was sent by his father back to Kahiki to slay his old enemies and retrieve a foster son, the high chief Laʻamaikahiki (Handy and Handy 1972:424; Beckwith 1970:352-358; Kalākaua 1888:130-135; Fornander 1916, vol.4 pt.1:160). "Lulu-o-Moikeha" understood as a place of ease of Mōʻīkeha, is described as being situated "near the landing and the school of Waimahanalua" (Akina, 1913: 5). The landing in Kapaʻa was known as the Makee Landing and was probably constructed in the late 1870s, along with the Makee sugar mill. Today, in place of the old Makee Landing is part of a breakwater located on the north side of Mōʻīkeha Canal near the present day Coral Reef Hotel, and approximately half-a-mile north of Waikaea Bridge.

Akina (1913) tells the story of how Mōʻīkeha's son, Kila stocks the islands with the fish *akule*, *kawakawa* and *ʻōpelu*. When Kila travels to Kahiki, he seeks out his grandfather Māweke and explains that he is the child of Mōʻīkeha. When Māweke asks Kila if Mōʻīkeha is enjoying himself, Kila answers with the following chant:

My father enjoys the billowing clouds over Pōhaku-pili,

The sticky and delicious poi,

With the fish brought from Puna,

The broad-backed shrimp of Kapalua,

The dark-backed shrimp of Pōhakuhapai,

The potent *ʻawa* root of Maiakiʻi,

The breadfruit laid in the embers at Makialo,

The large heavy taros of Keahapana

The crooked surf of Makaīwa too

The bending hither and thither of the reed and rush blossoms,

The swaying of the *kalukalu* grasses of Puna

The large, plump, private parts of my mothers,

Of Hoʻoipoikamalanai and Hinau-u,

The sun that rises and sets,

He enjoys himself on Kauaʻi,

All of Kauaʻi is Mōʻīkeha's. (Akina, 1913: 6)

Māweke was delighted and when the boy is questioned as to his purpose, Kila tells his grandfather he is seeking fish for his family. Māweke tells Kila to lead the fish back to his homeland. This is how Kila led the *akule*, *kawakawa* and *ʻōpelu* to Hawaiʻi. See also accounts of Mōʻīkeha at Kapaʻa in Kalākaua (1888:124)

6. Kaweloleimākua

Kapaʻa is also mentioned in traditions concerning Kawelo (Kaweloleimākua), Kaʻililauokekoa (Mōʻīkeha's daughter, or granddaughter, dependent on differing versions of the tale), the *moʻo* or reptile Kalamainuʻu and the origins of the *hīnaʻi hīnālea* or the fish trap used to catch the *hīnālea* fish, and the story of Lonoikamakahiki (Fornander 1917, vol.4 pt.2:318, vol.4 pt.3:704-705; Rice 1923:106-108; Thrum 1923:123-135; Kamakau 1976:80).

7. Kanaka-Nunui-Moe-The Sleeping Giant

Frederick B. Wichman relates an account of Kauaʻi's Sleeping Giant:

> A long time ago, there was a giant living in Kawaihau among the low hills behind Kapaʻa town. He was so tall he could see above the coconut trees. If he sat very still, it was easy to mistake him for one of the hills. Anyone who did not know him was afraid of his great size, fearing the damage he might cause. However the people of Kawaihau loved him, for he was very friendly and went out of his way to be useful.
>
> This giant was always careful where he stepped so that he would not injure anyone and he never destroyed taro patches or houses with a careless foot. When he wished to rest, he sat on one of the small hills above Kapaʻa. The villagers were glad when this happened for his weight flattened the hilltop, making another plot of ground fit for cultivation.
>
> "He is very helpful," the Kapaʻa people said to astonished stranger who came to their land. "He does many things for us quickly that otherwise we could not do in many months."
>
> Wherever this giant stepped he left keep footprints and in these deep holes the people planted banana trees. The villagers threw leaves, taro peelings, and other vegetable rubbish into these holes. When a compost had been formed, they planted banana sprouts. In this way, the people of Kapaʻa always had ripe bananas to give to the giant, for banana was his favorite food.
>
> The giant yawned very often, for he was always sleepy. The gust of wind from his mouth often knocked down houses and blew the grass thatch into the sea. The giant was always very apologetic whenever this happened and he quickly brought logs from the uplands to rebuild the fallen houses and gathered *pili* for the thatching.
>
> He found it difficult to stay awake more than a hundred years at a time. When he could no longer fight against the drowsiness overpowering him, he would sleep using a small hill for a pillow. Because of this, the people called him Kanaka-nunui-moe, the sleeping giant.

> When he slept, Nunui slept for hundreds of years while the winds blew dirt over him and seeds were dropped there by the birds. The gently showers sent by Ka-hale-*lehua*, goddess of the gentle rains, fed these seeds and forest grew up over the giant. When Nunui awoke and stretched, the people of Kapaʻa fled in great fear, for what they had thought to be a hill had come alive.
>
> One time, while Nunui was still awake, the high chief of Kawaihau wanted to build a large *heiau* to honor one of his gods. This was to be no ordinary temple. The chief wanted water-polished rocks for the walls and hard *koa* wood from Kōkeʻe for the framework of the god's house.
>
> So the chief told the Kawaihau people what he wanted them to do. They must gather rocks from the golden brown waters of the Kōkeʻe streams and cut *koa* trees on the edges of Waimea canyon, and gather *pili* grass that grew at Mānā. "All this must be done in the turn of one moon," he ordered.
>
> The unhappy people left their chief and silently returned to their village. The giant Nunui, stepping carefully among them, saw the long faces of the people.
>
> "What is wrong?" he asked.
>
> The Kapaʻa villagers told him what they must do within the impossibly short time. "This cannot be done," the people said in low, sad voices. "How can we go to Kōkeʻe and bring back stones enough to build the walls in that time? And cut down the *koa* trees and bring the logs here and build the sacred house? And even if we do these things, who will cultivate our fields?"
>
> Nunui smiled gently. "Tend to your fields," he said. "This work is nothing for me, and I'll gladly help you. Besides, it will give me something to do."
>
> The giant went to Kōkeʻe and scooped up smooth, round boulders from the golden brown waters and brought them to Kapaʻa. "Chief," he called to the astonished ruler, "show me where you wish to build this *heiau*."
>
> The amazed chief pointed out the place set aside for the temple. Nunui placed the rocks to form a wall, fitting them so closely together that not even a mouse could squeeze between the cracks. Within a week, he had built a strong, thick, handsome wall around the sacred place.
>
> Nunui returned to the edge of Waimea Canyon and cut down *koa* trees and trimmed them into the shaped he needed. He carried these back and made the framework of the house. He gathered *pili* grass form Mānā and wrapped the stems into bundles, tied these bundles to the framework, and within half the time the chief had set, the *heiau* was finished.

Everyone was happy. The farmers had been able to keep up with their chores, the chief had his *heiau*, and Nunui had something to do. There was even time enough a celebration. The chief ordered all his people to gather bananas and to pound sweet potatoes and taro into poi. Some people hurried to slaughter pigs and dogs to be cooked in the *imu*, while other paddled out to sea to fill their canoes with fish and sent their wives to gather seaweed and *'opihi* from the reef. At last, enough food for everyone was ready, and the chief, the villagers, and Nunui sat down before the overflowing bowls and platters.

"Eat," said the chief to Nunui. "After the work you have done, you must be hungry."

The giant ate all the food that had been put before him. When he was through, his stomach bulged and he was very sleepy. He chose a comfortable hill just a short distance above Kapa'a town. Nunui stretched a last time, lay down along the top of the hill, and soon was sound asleep.

As he slept through the years, the winds blew dirt over him and the birds brought seeds. Ka-hale-*lehua*, goddess of the gentle rains, sent showers to water the plants that now covered the giant.

So Kanaka-nunui-moe sleeps and sleeps and has come to resemble a long hill with a lump at one end where his nose is and lumps at the other ends where his feet are. He no long looks like a living being, but one day, perhaps soon, his eyes will open, he'll yawn and stretch his arms, and sit up. [Wichman 1985:13-16]

8. Lepeamoa

In the Legend of "Lepeamoa (The Chicken Girl of Pālama)"(Thrum 1923:177) is a reference to a fantastic battle at Kapa'a between Lepeamoa's brother, the hero Kauilani and a supernatural kupua called Akuapehuale ("god of swollen billows"):

Kauilani struck him a heavy blow and the spear leaped again and again upon him, till he rolled into a mountain stream at a place called Kapa'a, out of which he crawled, almost drowned. Then he was driven along even to the image houses, where a fierce battle took place, in which the wooden images took part, many of them being torn to pieces by the teeth of Akuapehuale.

9. Pāka'a and the Wind Gourd of La'amaomao (Keahiahi)

Kapa'a also figures prominently in the famous story of Pāka'a, and the wind gourd of La'amaomao. Pāka'a was the son of Kūanu'uanu, a high-ranking retainer of the Big Island ruling chief Keawenuia'umi (the son and heir to the legendary chief 'Umi), and La'amaomao, the most beautiful girl of Kapa'a and member of a family of high status *kahuna*. Kūanu'uanu left the island of Hawai'i, traveled throughout the other islands and finally settled on Kaua'i, at Kapa'a. It was there that he met and married La'amaomao, although he never revealed his background or high rank to her until the day a messenger arrived, calling Kūanu'uanu back to the court of Keawenuia'umi.

By that time, La'amaomao was with child but Kūanu'uanu could not take her with him. He instructed her to name the child, if it turned out to be a boy, Pāka'a. Pāka'a was raised on the

beach at Kapa'a by La'amaomao and her brother Ma'ilou, a bird snarer. He grew to be an intelligent young man and it is said he was the first to adapt the use of a sail to small fishing canoes. Although Pāka'a was told by his mother from a very young age that his father was Ma'ilou, he suspected otherwise and after constant questioning La'amaomao told her son the truth about Kūanu'uanu.

Intent on seeking out his real father and making himself known to him, Pāka'a prepared for the journey to the Big Island. His mother presented to him a tightly covered gourd containing the bones of her grandmother, also named La'amaomao, the goddess of the winds. With the gourd and chants taught to him by his mother, Pāka'a could command the forces of all the winds in Hawai'i. While this story continues on at length about Pāka'a and his exploits on the Big Island and later on Molokai, it will not be dwelt upon further here. Several versions of this story include chants which give the traditional names of all of the winds at all the districts on all the islands, preserving them for this and future generations (Nakuina 1990; Rice 1923:69-89; Beckwith 1970:86-87; Thrum 1923:53-67; Fornander 1918-19 vol. 5 pt.1:78-128). The wind of Kapa'a is the Kēhau wind.

Frederick Wichman (1998:84) writes that Pāka'a grew up on the northern headland of Kapa'a named Keahiahi. Here, Pāka'a learned to catch *mālolo or flying fish*, his favorite fish. After studying the ocean and devising his plan to fabricate a sail, Pāka'a wove a sail in the shape of a crab claw and tried it out on his uncle's canoe. One day, after going out to catch *mālolo*, he challenged the other fishermen to race to shore. He convinced them to fill his canoe with fish suggesting it was the only way he could truly claim the prize if he won:

The fishermen began paddling toward shore. They watched as Pāka'a paddled farther out to sea and began to fumble with a pole that had a mat tied to it. It looked so funny that they began to laugh, and soon they lost the rhythm of their own paddling. Suddenly Pāka'a's mast was up and the sail filled with wind. Pāka'a turned toward shore and shot past the astonished fishermen, landing on the beach far ahead of them. That night, Pāka'a, his mother, and his uncle had all the *mālolo* they could eat (Wichman 1998:85).

10. Palila and Ka'ea

High in the *mauka* region of Kapa'a in the Makaleha mountains at a place called Ka'ea, is reported to be the supernatural banana grove of the Kaua'i *kupua* or demigod Palila, grandson of Hina (Handy and Handy 1972:424). Joseph Akina for *Kū'oko'a* Newspaper in 1913 describes Palila's banana grove:

The stalk could hardly be surrounded by two men, and was about 35 feet high from the soil to the lowest petiole. The length of the cluster from stem to lowest end of the bunch of bananas was about 1 ¾ fathoms long (one *anana* and one *muku*). There were only two bananas on each about 4 ½ inches around the middle. There were just two bananas, one on the east side and one on the west, each about a foot or more in length. The one on the east side was tartish, like a *waiawi* (Spanish guava) in taste and the one on the west was practically tasteless. The diameter of the end of the fruit stem of this banana seemed to be about 1½ feet. This kind of banana plant and its fruit seemed almost supernatural... (Akina, 1913:5).

C. Summary of the Mythological and Traditional accounts of Kapa'a

A survey of traditional mythological literature shows Kapa'a prominently associated with some of the most famous legendary and historical figures including Maui, Kawelo, Mō'īkeha, Māweke, Palila, Paka'a and Kanaka Nunui Moe. The fourteen documented *heiau* of Kapa'a is a testament to both the substantial population and the social/political/religious importance of this *ahupua'a*.

What few specific references there are suggest that high status habitation was focused near the coast with less intensive utilization of the uplands which were regarded as wild places. The most notable feature of the traditional accounts are the references to grasses and sedges (*Kalukalu* grass and *Ahuawa* rushes) which undoubtedly reflects in part the natural marsh lands near the coast but may also reflect transformation of the landscape through a denudation of trees by the activities of a relatively dense population harvesting slow growing trees for firewood and construction materials over many centuries.

III. HISTORICAL ACCOUNTS

The project area lies in the traditional *ahupua'a* of Kapa'a belong to the ancient district of Puna (now the district is more commonly called "Kawaihau"), one of five ancient districts on Kaua'i (King 1935: 228). Puna was the second largest district on Kaua'i, behind Kona, and extended from Kīpū, south of Līhu'e to Kamalomalo'o, just north of Keālia. For taxation, educational and judicial reasons, new districts were created in the 1840's. The Puna District, with the same boundaries became the Līhu'e District, named for an important town in that district. In 1878, by act of King Kalākaua in securing a future and name for the new Hui Kawaihau, created the new district of Kawaihau. This new district encompassed the *ahupua'a* ranging from Olohena on the south to Kīlauea on the north. Subsequent alterations to district boundaries in the 1920's left Kawaihau with Olohena as its southernmost boundary and Moloa'a as its northernmost boundary (King 1935:222).

A. Early Historic Period

Although most of the historic record documents for Kaua'i in this period revolve around missionary activities and the missions themselves, there was indication that the Kapa'a area was being considered for new sugar cane experiments, similar to those occurring in Kōloa. In a historic move, Ladd and Company received a 50 year lease on land in Kōloa from Kamehameha III and Kaua'i Governor Kaikio'ewa of Kaua'i. The terms of the lease allowed the new sugar company "the right of someone other than a chief to control land" and had profound effects on "traditional notions of land tenure dominated by the chiefly hierarchy" (Donohugh, 2001: 88). In 1837, a very similar lease with similar terms was granted to Wilama Ferani, a merchant and U.S. citizen based in Honolulu (Hawai'i State Archives, Interior Dept., Letters, Aug. 1837). The lease was granted by Kauikeaouli or Kamehameha III for the lands of Kapa'a, Keālia and Waipouli for twenty years for the following purpose:

> ...for the cultivation of sugar cane and anything else that may grow on said land, with all of the right for some place to graze animals, and the forest land above to the top of the mountains and the people who are living on said lands, it is to them whether they stay or not, and if they stay, it shall be as follows: They may cultivate the land according to the instructions of Wilama Ferani and his heirs and those he may designate under him... (Hawai'i State Archives, Interior Dept., Letters, Aug. 1837).

Unlike Ladd & Company which eventually became the Kōloa Sugar Company, there is no further reference to Wilama Ferani and his lease for lands in Kapa'a, Keālia and Waipouli. In a brief search for information on Honolulu merchant, Wilama Ferani, nothing was found. It is thought that perhaps Wilama Ferani may be another name for William French, a well known Honolulu merchant who is documented as having experimented with grinding sugar cane in Waimea, Kaua'i at about the same time the 1837 lease for lands in Kapa'a, Keālia and Waipouli was signed (Joesting, 1984: 152).

B. The Mahele: Kapa'a Land Commission Awards

The Organic Acts of 1845 and 1846 initiated the process of the *Mahele*, the division of Hawaiian lands, which introduced private property into Hawaiian society. In 1848 the crown and the *ali'i* received their lands. The common people received their *kuleana* in 1850. It is through records for Land Commission Awards (LCAs) generated during the *Mahele* that specific documentation of traditional life in Kapa'a Ahupua'a comes to light.

During the *Mahele*, Kapa'a was taken as Crown Lands (Office of the Commissioner of Public Lands of the Territory of Hawaii, 1929). The *'Ili* of Paikahawai and Ulakiu in Kapa'a Ahupua'a were retained as Government Lands.

Table 2. Mahele Land Claims in Kapa'a Ahupua'a

LCA	CLAIMANT	'ILI	LAND USE	AWARD
08843	Kiau and son, Apahu	Apopo, Kalolo Village	6 *lo'i*, small *kula* and house lot	2 *'āpana*; 2,75 acres
10564	Oleloa, Daniela	Kapa'a, Puna;	with one fish pond; 10 *lo'i* and a fish pond	No award in Kapa'a, Puna; award in Waioli, Halelea
08247	Ehu	Moalepe	approx. 20 *lo'i* lying waste, some orange trees	1 *'āpana*, Kapa'a
08837	Kamapa'a	Awawaloa, Ulukiu Village	9 *lo'i*, and adjoining *kula*; house lot	Awawaloa: 1 *'āpana*; Wakiu 3 *'āpana*
03638	Huluili, Kahoiu (Kadaio)	Maeleele, Kaloko Village	15 lo'i in Maeleele and adjoining *kula*; house lot in village of Kaloko (Kalolo)Maeleele: 2 *'āpana*, 5 acs.	Maeleele: 2 *'āpana*, 5 acs.
03971 and 03243	Honoli'i, Ioane	Kahana, Kupanihi	6 uncultivated *lo'i*, house lot in Kupanihi Village	Kupanihi: 2 *'āpana*, 1 ac
03554 and 03599	Keo	Hahanui,	Entire 'ili of Kahanui, 15 *lo'i*, house lot in Puhi Village	No Award in Kapa'a, Puna; Award in Waila'au, Kona.

The land claims during this period show that only five individuals were awarded land parcels in the relatively large *ahupua'a* of Kapa'a. The five awardees include Kiau (#08843), Kamapa'a (#08837), Ioane Honoli'i (#03971) Huluili (#03638) and Ehu (#08247). In addition, two land claims (#10564 and #03554, 3559) were not awarded in Kapa'a. Four of the five awardees received multiple parcels which show similarities. All four had *lo'i* or irrigated *kalo* fields on the *mauka* side of the lowland swampy area, sometimes extending a short distance up into small,

shallow gulches and valleys. Many of these *lo'i* parcels name *pali* or hills/cliffs as boundaries. Each LCA also had a separate house lot located on the *makai* side of the swamp, near the beach. Three of the land claims name ponds on their lands, including Puhi Pond (LCA #03554), Fishponds in Kupanihi 'Ili (LCA #03971) and Hahanui 'Ili (LCA #10564). Loko Kihapai may be the same as the Fishpond in Hahanui as it was named in the same land claim. The other two *loko* are associated with house lots, situated on the *makai* edge of the Kapa'a swamplands suggesting modification of the natural swamplands. Other natural and cultural resources mentioned in the LCAs include freshwater springs, pig pens, *hau* bushes, *hala* clumps, streams, *'auwai*, and *kula* or pasturelands.

Interestingly, the residential "village" of Kapa'a did not exist as a single entity, but was a series of probably small settlements or compounds, perhaps even individual house lots which stretched along the shoreline of the *ahupua'a* and included (south to north) Kupanihi (Makahaikupanihi), Kalolo (Kaulolo), Puhi, and Uluki.

The fifth individual, Ehu (LCA #08247), was the only person to be awarded a single parcel in the upland area of Kapa'a, Moalepe Valley, approximately five miles *mauka* of the coast and one mile southwest of the *Mauka* Locale project area. In 1848, when Ehu made his claim, he was the only one living there. A few years later, according to Honoli'i's testimony to support Ehu's claim, "There are no houses and no people now living on the land. Ehu found himself lonely there, all his neighbors having either died or left the land. Ehu now lives in Wailua." Evidently Ehu may have been the last person to live at and cultivate in the traditional way, the far *mauka* region of Kapa'a.

There were no *kuleana* claims found within the project area north of the Kapa'a Homesteads.

C. Post Mahele

In 1849, a son of Wai'oli missionaries, William P. Alexander, recorded a trip he took around Kaua'i. Although, he focuses on the larger mission settlements like Kōloa and Hanalei, he does mention Kapa'a:

> A few miles from Wailua, near Kapa'a we passed the wreck of a schooner on the beach, which once belonged to Capt. Bernard. It was driven in a gale over the reef, and up on the beach, where it now lies. A few miles further we arrived at Keālia. We had some difficulty crossing the river at this place, owing to the restiveness of our horses. The country here near the shore was rather uninviting, except the valley which always contained streams of water (Alexander, 1991: 123).

In later years, the notorious Kapa'a reef was to become the location of many shipwrecks particularly once a landing was built there in the 1880s.

The first large scale agricultural enterprise in Kapa'a began in 1877 by the Makee Sugar Plantation and the *Hui* Kawaihau (Dole, 1916: 8). The *Hui* Kawaihau was originally a choral society begun in Honolulu whose membership consisted of many prominent names, both Hawaiian and *haole*. It was Kalākaua's thought that the *Hui* members could join forces with Makee, who had previous sugar plantation experience on Maui, to establish a successful sugar corporation on the east side of Kaua'i. Captain Makee was given land in Kapa'a to build a mill and he agreed to grind cane grown by *Hui* members. Kalākaua declared the land between Wailua and Moloa'a, the Kawaihau District, a fifth district and for four years the *Hui* attempted to grow sugar cane at Kapahi, on the plateau lands above Kapa'a. After a fire destroyed almost one half

of the *Hui's* second crop of cane and the untimely death of one of their principal advocates, Captain James Makee, the *Hui* began to disperse and property and leasehold rights passed on to Makee's son-in-law and new Makee Plantation owner, Colonel Z. S. Spalding (Dole, 1916: 14).

As part of the infrastructure of the new plantation, a sugar mill was erected and the Makee Landing was built in Kapa'a during the early years of the Makee Sugar Plantation. Following Captain Makee's death, Colonel Spalding took control of the Plantation and in 1885 moved the mill to Keālia (Cook, 1999: 51). The deteriorating stone smokestack and landing were still there well into the 1900s (Damon, 1931:359). Condè and Best (1973:180) suggest that railroad construction for the Makee Plantation started just prior to the mid 1890's. There is one reference to a railroad line leading from the Kapa'a landing to Keālia in 1891. During Queen Lili'uokalani's visit to Kaua'i in the summer of 1891, the royal party was treated to music by a band, probably shipped in from O'ahu. "The band came by ship to Kapa'a and then by train to Keālia" (Joesting, 1984:252). This line is depicted on a 1910 USGS map which shows the line heading south from Keālia Mill and splitting near the present Coral Reef Hotel, one finger going to the old Kapa'a Landing (Makee Landing) and another line heading *mauka*, crossing the present Mō'īkeha Canal, traveling southwest up Lehua Street and through what is now goat pasture, along a plateau and into the *mauka* area behind Kapa'a swamplands. This railroad line was part of a twenty mile network of plantation railroad with some portable track and included a portion of Keālia Valley and in the *mauka* regions of the plateau lands north of Keālia (Condé and Best, 1973:180).

By the late 1800's, Makee Plantation was a thriving business with more than one thousand workers employed (Cook, 1999:51). Hundreds of Portuguese and Japanese immigrants found work on Makee Plantation and the new influx of immigrants required more infrastructure. In 1883, a lease for a school lot was signed between Makee Sugar Company and the Board of Education (Kapa'a School, 1983: 9). Stipulations found in the Portuguese immigrant contracts with Makee Sugar Company stated that "children shall be properly instructed in the public schools" (*Garden Island*, April 1, 1983). The original Kapa'a School was constructed in 1883 on a rocky point adjacent to the Makee Sugar Company railroad. Traditionally, this point was known as Kaahiahi (Kapa'a School, 1983: 10). In 1908, Kapa'a School was moved to its present site directly *mauka* and up the hill at Mailehune.

As in much of the rest of Hawai'i, the Chinese rice farmers began cultivating the lowlands of Kapa'a with increasing success in the latter half of the 1800s. Several Hawaiian *kuleana* owners leased or sold their parcels *mauka* of the swamp land to Chinese rice cultivators. Other Chinese rice cultivators appeased to the government for swamplands first leasing and later buying. As a result of the growing rice and sugar industries, the economic activity displaced the house lot *kuleana* on the *makai* side of the marsh for increasing commercial and residential development (Lai, 1985:148-161).

Narrow wagon roads gave way to macadamized roads in the early part of the 20th century. This new road was called the Kaua'i Belt Road and parts of it are thought to have followed the "Old Government Road" (Cook, 1999). In Kapa'a, the present day Kūhiō Highway probably follows the same route as the original Government Road and subsequent Kaua'i Belt Road. The location of the *kuleana* awards in Kapa'a indicates that the majority of the house lots were situated along the Government Road. LCA 3243 names a "road" as one of its boundaries.

D. 20th Century History of Kapa'a (1900-Present)

In the early 1900's, government lands were auctioned off as town lots in Kapa'a to help with the burgeoning plantation population. One *kama'āina* mentioned that in the 1930's and 1940's, the area north of Mō'īkeha Canal in Kapa'a was mostly settled by Portuguese families (Bushnell et al. 2002). The Japanese were also very prominent in the 1920s and 1930s largely replacing the Chinese merchants of the turn of the century in the Kapa'a business sector (Bushnell et al. 2002). The Board of Health, Territory of Hawaii ran a dispensary in Kapa'a at the *makai* edge of Niu Street near the Kapa'a Beach Park parking lot, adjacent to the bike path starting 1926. The lot is presently vacant. A Fire Station was once located in the area now occupied by the Coral Reef Hotel and a Courthouse and jail cell once stood at the location of the present Kapa'a Neighborhood Center. It is not known when these structures were removed or abandoned.

In 1913, Hawaiian Canneries opened in Kapa'a at the site now occupied by Pono Kai Resort (Cook, 1999: 56). Through the Hawaiian Organic Act, Hawaiian Canneries Company, Limited purchased the land they were leasing, approximately 8.75 acres, in 1923 (Bureau of Land Conveyances, Grant 8248). A 1923 sketch of the cannery shows only four structures, one very large structure assumed to be the actual cannery and three small structures *makai* of the cannery. A 1933 historic photograph of Kapa'a Town shows an ironwood windbreak on the *makai* side of the cannery adjacent to the railroad. By 1956, 1.5 million cases of pineapple were being packed. By 1960, 3400 acres were in pineapple and there were 250 full time employees and 1000 seasonal employees for the Kapa'a Cannery (*Honolulu Advertiser*, March 20, 1960). In 1962, Hawaiian Canneries went out of business due to competition from third world countries.

The Ahukini Terminal & Railway Company was formed in 1920 to establish a railroad to connect Anahola, Keālia, Kapa'a to Ahukini Landing and "provide relatively cheap freight rates for the carriage of plantation sugar to a terminal outlet" (Condé and Best, 1973: 185). This company was responsible for extending the railroad line from the Makee Landing, which was no longer in use, to Ahukini Landing, and for constructing the original Waika'ea Railroad Bridge and the Mō'īkeha Makai Railroad Bridge.

In 1934, the Lihue Plantation Company absorbed the Ahukini Terminal & Railway Company and Makee Sugar Company (Condé and Best, 1973: 167). The railway and rolling stock formerly owned by Makee Sugar Company became the Makee Division of the Lihue Plantation. At this time, besides hauling sugar cane, the railroad was also used to haul plantation freight including "fertilizer, etc...Canned pineapple from Hawaiian Canneries to Ahukini and Nāwiliwili, pineapple refuse from Hawaiian Canneries to a dump near Anahola and fuel oil from Ahukini to Hawaiian Canneries Co., Ltd." (Hawaii Territorial Planning Board, 1940: 11). Former plantation workers and *kama'āina* growing up in Kapa'a remember when the cannery would send their waste to the pineapple dump, a concrete pier just north of Kumukumu Stream (State Site No. 50-30-08-789: H) by railroad. The structure is built over the water where the rail cars would dump the pineapple waste. The current would carry the waste to Kapa'a which would attract fish and sharks (Bushnell et al. 2002).

Lihue Plantation was the last plantation in Hawai'i to convert from railroad transport to trucking (Condé and Best, 1973: 167). "By 1957 the company was salvaging a part of their plantation railroad, which was being supplanted by roads laid out for the most part on or close to the old rail bed" (Ibid: 167). By 1959, the plantation had completely converted over to trucking. The Cane Haul Road which begins near the intersection of Haua'ala Road and Kūhiō Highway is

thought to date to the late 1950s and follows the alignment of the old railroad until just before or near ʻĀhihi Point.

Severe floods in Kapaʻa in 1940 led to the dredging and construction of the Waikaʻea and Mōʻīkeha Canals sometime in the 1940s (Hawaii Territorial Planning Board, 1940: 7). Although the Waikaʻea Canal, bordering the Kapaʻa Pineapple Cannery, had been proposed as early as 1923, nothing was constructed until after the floods (Bureau of Land Conveyances, Grant 8248). A Master Plan for Kapaʻa, published in 1940, asks the Territorial Legislature for funds to be set aside for the completion of a drainage canal and for filling *makai* and *mauka* of the canal (Hawaii Territorial Planning Board, 1940:7). In 1955, reports came out on the dredging for coral proposed for the reef fronting Kapaʻa Beach Park (*Garden Island Newspaper*, September 21, 1955). The coral was to be used for building plantation roads. This dredging was later blamed for accelerated erosion along Kapaʻa Beach (Garden Island Newspaper, October 30, 1963).

Today, there are several sea walls along the Kapaʻa Beach Park to check erosion. Old time residents claim the sandy beach in Kapaʻa was once much more extensive than it is now (Bushnell et al. 2002).

Keālia Town slowly dispersed after the incorporation of Makee Sugar Company into Lihue Plantation in the 1930s. Many of the plantation workers bought property of their own and moved out of plantation camps. The plantation camps which bordered Kūhiō Highway were disbanded in the 1980s. The Lihue Plantation began to phase out in the last part of the 20th century. Kapaʻa Town suffered after the closing of the Kapaʻa Cannery, however the growing tourist industry helped to ease the economic affects of the Cannery's closing.

IV. PREVIOUS ARCHAEOLOGICAL RESEARCH

A. Archaeological Studies and Sites in Kapaʻa Ahupuaʻa

The following table outlines the archaeological research (Table 3) and historic properties (Table 4) identified in Kapaʻa Ahupuaʻa. These tables are followed by discussion of the research and historic properties. Table 3 provides a list of archaeological research conducted within Kapaʻa Ahupuaʻa, including columns for source, location, nature of study, and findings. The locations of these archaeological studies are shown in Figure 6. Table 4 is a list of known historic properties within the ahupuaʻa and includes columns for state site numbers, site type, location and reference. The locations of identified sites within Kapaʻa Ahupuaʻa are shown in Figure 7.

Table 3. Previous Archaeological Studies in Kapaʻa

Source	Location	Nature of Study	Findings
Bennett 1931	Island wide Identifies 2 sites: Site 110 Taro terraces and bowl and Site 111 A large simple dirt Hawaiian ditch	Archaeological Reconnaissance	Identifies 2 sites: Site 110 Taro terraces and bowl and Site 111 A large simple dirt Hawaiian ditch
Handy and Handy 1972	Archipelago-wide	Native Planter study	Discusses "highly developed irrigation system"
Ching 1976	Just south of the Waikaea Drainage Canal	Archaeological Reconnaissance	No significant findings
Hammatt 1981	Upland Kapaʻa	Archaeological Reconnaissance	No significant findings
Hammatt 1986	Upper reaches of the Makaleha stream valley.	Archaeological Reconnaissance	No significant findings
Hammatt 1991	Along Kūhiō Highway	Subsurface Testing	Identifies two sub-surface cultural layer sites
Kikuchi and Remoaldo 1992	Around Kapaʻa Town	Cemeteries of Kauaʻi	Identifies six cemeteries
Spear 1992	South side Waikaea Canal, mauka of Kūhiō Highway. (TMK: 4-5-05:04, 09)	Monitoring Report	Designated subsurface site 50-30-08-547
Chaffee, Burgett & Spear 1994a	A house lot near the corner of Kukui and Ulu Streets in mauka Kapaʻa Town. (TMK: 4-5-09:10)	Archaeological Inventory Survey	No significant findings

Source	Location	Nature of Study	Findings
Chaffee, Burgett & Spear 1994b	Māmane Street Kapa'a Town. (TMK: 4-5-09:51	Archaeological Inventory Survey	No significant findings
Hammatt, Ida & Chiogioji 1994	Proposed bypass routes mauka of Kapa'a Town	Archaeological Assessment	No new field work, reviews literature
Hammatt, Ida & Folk 1994	South side Waikaea Canal, mauka of Kūhiō Highway (TMK: 4-5-05:06)	Archaeological Inventory Survey	Weak cultural layer designated site 50-30-08-748
Kawachi 1994	Inia Street (Jasper) TMK 4-5-08:33	Burial Report	Designates Site 50-30-08-871
McMahon 1994	"behind the armory in Kapa'a near the god stones" The location is uncertain & "Buzz's near the Coconut Marketplace"	Documents second hand report of burials in two locations	Bones in 3 places reported from behind the armory, 16 bodies reported from the Buzz' s restaurant. No site numbers assigned
Creed, Hammatt, Ida, Masterson & Winieski 1995	Kapa'a Sewer line project, Kūhiō Highway, south and central Kapa'a Town	Archaeological Monitoring Report	Documents cultural layer of site -1848 and (an enlarged) site -1849 & recovery of thirty burials at sites –867, -868, -871, & -1894
Jourdane 1995	1382-A 'Inia Street, makai of Kūhiō Highway, central Kapa'a Town	Burial Report	Site 626
McMahon 1996	South side Waikaea Canal, *mauka* of Kūhiō Highway (TMK: 4-5-05:08)	Archaeological Inventory Survey	No significant cultural material
Hammatt, Chiogioji, Ida & Creed 1997	Test excavations focused inland of Kapa'a Town	Archaeological Inventory Survey	Four test trenches were excavated inland of Kapa'a Town
Borthwick and Hammatt 1999	Kapa'a Seventh-Day Adventist Church at 1132 Kūhiō Highway	Archaeological Monitoring and Burial Treatment Plan	Monitoring was indicated as this parcel lay within the designated Site 50-30-08-1848.
Bushnell and Hammatt 2000	Seventh-Day Adventist Church, makai of Kūhiō Highway, south of the Waikaea Canal	Archaeological Monitoring Report	Minimal findings (one piece of worked bone)

Source	Location	Nature of Study	Findings
Callis 2000	Kapa'a Beach Park	Burial Removal and Archaeological Monitoring Report	Human Burial
Perzinski and Hammatt 2001	Kūhiō Highway on the margins of the Waikaea Canal	Archaeological Monitoring Report	No significant cultural material
Hammatt et al. 2003	Kūhiō Highway Bypass Options	Archaeological Assessment	Summarizes work
Bushnell et al. 2003	Kapa'a/Keālia Bike & Pedestrian Path	Archaeological Inventory Survey	Documents 5 new sites & a new feature for another site
Elmore and Kennedy 2003	Kūhiō Highway	Archaeological Monitoring Report	No significant cultural material
Dega, Michael F. and James Powell 2003	Kūhiō Highway	Archaeological Monitoring Report	Human Burials
Hammatt and Shideler 2004	Pedestrian Pathway Options	Archaeological Assessment	Summarizes work

B. Archaeological Studies within the Present Project Area

A companion *Archaeological Assessment For The Proposed Water Reservoir, Kapa'a Ahupua'a, Kaua'i TMK 4-6-03:10* (Van Ryzin, and Hammatt 2004) was recently completed. This study examined the areas of proposed impact and found no archaeological sites or historic preservation concerns in the vicinity.

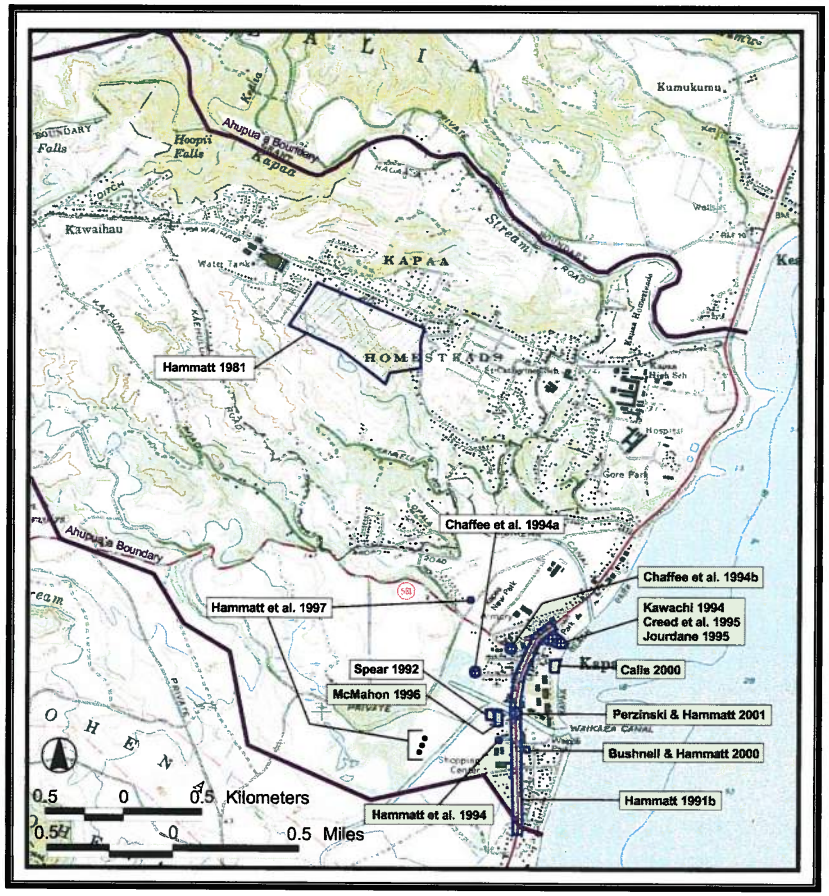


Figure 6. Map showing previous archaeological studies in Kapa'a.

Table 4. Historic Properties in Kapa'a Ahupua'a

Site # 50-30-08-	Site Type/ Name (if any)	Location	Reference
B001	Historic Cemetery	South of bend of Kapa'a Stream, a kilometer *mauka* from Kūhiō Highway	Kikuchi and Remoaldo 1992
B002	Historic Cemetery	Just *mauka* from Kūhiō Highway, south of Kapa'a Stream	Kikuchi and Remoaldo 1992
B003	Kapa'a Public Cemetery	South of Kanaele Road, approximately one kilometer inland of Kūhiō Highway	Kanaele Road; Kikuchi and Remoaldo 1992
B004	Historic Cemetery	North of Apopo Road, approximately one kilometer inland of Kūhiō Highway	Kikuchi and Remoaldo 1992
B013	Historic Cemetery	Just *mauka* from Kūhiō Highway, north of the Waikaea Canal	Kikuchi and Remoaldo 1992
B014	All Saints Episcopal Church Cemetery	Just *mauka* from Kūhiō Highway, south of the Waikaea Canal	Kikuchi and Remoaldo 1992:62-65
-547	sub-surface features including a fire pit and a possible house foundation	South of bend of Waikaea Canal, *mauka* of Kūhiō Highway	Spear 1992:3
-626	Burial	Inia Street, *makai* of Kūhiō Highway, central Kapa'a	Jourdane 1995
-748	Minimal findings, a weak cultural layer (buried A-horizon)	South of the bend of the Waikaea Canal, *mauka* of Kūhiō Highway	Hammatt, Ida & Folk 1994
-789	Historic road	Coastal Kapa'a	Bushnell et al. 2003
-867	1 set of human remains	Kukui Street, just *mauka* of Kūhiō Highway, Kapa'a Town	Creed et al. 1995:50
-868	1 set of human remains	Lehua Street *mauka* of Kūhiō Highway, Kapa'a Town	Creed et al. 1995:50
-871	13 sets of human remains (Creed et al. 1995:50)	Inia Street, *makai* of Kūhiō Highway	Kawachi 1994, Creed et al. 1995:50

Site # 50-30-08-	Site Type/ Name (if any)	Location	Reference
-884	Human burial	N. Coastal Kapa'a	SHPD communication, Bushnell et al. 2003
1848	Cultural layer & sub	Along Kūhiō Highway between Wana Road and the Waikaea Drainage Canal	Hammatt 1991; Creed et al. 1995
-1849	Cultural layer & sub-surface features; Creed et al. 1995:53 expands boundaries to incl. burial sites, -626, -867, -868 -871, and -1894	Along Kūhiō Highway between Inia Street and Kauwila Street extending to the coast	Hammatt 1991; Creed et al. 1995
-1894	11sets of human remains	Ulu Street, just N of Kūhiō Highway, Kapa'a Town	Creed et al. 1995:50
-2075	Hwy bridge	Across Kapa'a Stream	Bushnell et al. 2003
-2076	Petroglyph	Central coastal Kapa'a	Bushnell et al. 2003
-2077	Steps to former pavilion	S. coastal Kapa'a	Bushnell et al. 2003
-2078	Railroad bridges and foundations	Coastal Kapa'a	Bushnell et al. 2003

V. COMMUNITY CONSULTATIONS

Throughout the course of this study, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices specifically related to the project area of Kapa'a. This effort was made by letter, e-mail, telephone and in-person contact. In the majority of cases, letters along with a map of the project area were mailed with the following text:

> Cultural Surveys Hawai'i is conducting a Limited Cultural Impact Assessment for the proposed Water Reservoir *Mauka* Locale in Kapa'a, Kaua'i Island. The purpose of the cultural study is to assess potential impacts to traditional cultural practices. This study is meant to satisfy requirements related to Chapter 343 HRS Articles IX and XII and Act 50 and t heir applicability to the project area.
>
> We are seeking your input regarding the following issues:
>
> General history and present and past land use of the study area.
>
> Knowledge of cultural sites which may be impacted by the project, e.g., historic sites, archaeological sites, burials, etc…
>
> Knowledge of traditional gathering practices in the study area-both past and present.
>
> Cultural associations with the study area through legends, traditional use or otherwise.
>
> Referrals of *kūpuna* who might be willing to share their cultural knowledge of the study area in general.
>
> Any other cultural concerns the community might have related to Hawaiian or other cultural practices in this area of Kapa'a, Island of Kaua'i.

The individuals, organizations, and agencies we attempted to contact and the results of any consultations are presented in Table 5. Cultural Surveys Hawai'i starts out with a list of community contacts and then follows up on their referrals.

Table 5 Community Consultations

Name	Organization, Affiliation	Comments
Ako, Valentine	Kapa'a Resident and *Kupuna*	Referred to Ernest Garcia
Batisite, Brian	Kaua'i County Council	No comment.
Garcia, Ernest	Hunter	No longer uses the area. More familiar with areas west of project area.
Iida, Ron	Royal Order of Kamehameha Kaumauali'i Chapter No. 3	No comment.
Kaneakua, James	Kapa'a Resident	No comment.
Kanoho, Ezra	Hawai'i State Capitol State Representative 13th District	No comment.
Kapaka-Arboleda,La France	Kaua'i/Ni'ihau Island Burial Council, Kapa'a Representative, and Office of Hawaiian Affair, Kaua'i Office Community Resource Coordinator	It is unlikely that SHPO will require various test pits along the project proposed, if something is found burial council will be asked for their recommendation etc. I am not privy to any burial sites in the area.
Kapeliela, Kana'i	State Historic Preservation Division Cultural Historian	No comment.
Kekua, Kehaulani	Kaua'i Cultural Center Director	No comment.
Lauretta, Mike	Department of Land and Natural Resources Kaua'i Land Division	DLNR has no input to offer regarding traditional Hawaiian activities; archaeological or cultural sites; nor cultural associations that could be recommended as they affect the project area.
Markell, Kai	State Historic Preservation Division Burials Director	No comment.
McMahon, Nancy	State Historic Preservation Division Kaua'i Archaeologist	No cultural concerns.
Muraoka, Beverly	Kapa'a Resident and Kupuna	No Comment.
Napōka, Nathan	State Historic Preservation Division Cultural and History Branch	No comment.

Requilman, Mary	Kaua'i Historical Society Executive Director	No comment.
Rogers, Lucille	Ke Ola Pono No Nā Kūpuna Project Coordinator	No comment.
Rogers, Nancy	Hui Ho'okipa O Kaua'i Contact Person	No comment.
Sugiyama, Richard	Kapa'a Resident	No cultural concerns or impacts in the project area. He thanks CSH for keeping him informed on different project in his area.
Tsuchiya, Rick	Kaua'i Historic Preservation Review Commission, Kaua'i County Planning	The project will be reviewed at the September meeting. A written statement will be sent to CSH.

VI. TRADITIONAL CULTURAL PRACTICES

Traditional cultural practices are based on a profound awareness concerning harmony between man and their natural resources. The Hawaiians of old depended on these cultural practices for survival. Based on their familiarity with specific places and through much trial and error, Hawaiian communities were able to devise systems that fostered sustainable use of nature's resources. Many of these cultural practices have been passed down from generation to generation and are still practiced in some of Hawaii's communities today.

This project seeks to assess traditional cultural practices as well as resources pertaining to the project area within Kapa'a Ahupua'a. This section will convey the different types of traditional practices and cultural resources associated with the vicinity.

A. Gathering for Plant Resources

Hawaiians utilized upland resources for a multitude of purposes. Forest resources were gathered, for not only the basic needs of food and clothing, but for tools, weapons, canoe building, house construction, dyes, adornments, hula, medicinal and religious purposes. The present project area is dominated by alien vegetation (albezia, ginger, California grass) although some traditional cultigens (banana, bamboo, *kī*) and historically introduced food plants (papaya) are present as well. Within the project area itself no specific documentation was found regarding gathering of plants during traditional Hawaiian times. During this assessment there were no ongoing practices related to traditional gathering of plant resources identified in the present project area. None of the individuals contacted for this assessment identified any native plant gathering practices within the project area.

B. Historic Properties

No historic properties were identified within the project area or in the vicinity. The density of identified historic properties is far greater near the coast of Kapa'a Ahupua'a. For a listing of the historic properties of Kapa'a, Kaua'i, see Table 4.

C. Burials

No burials are believed to be present within the project area and none are known in the vicinity.

D. Trails

Based on nineteenth and twentieth century maps the primary transportation routes *mauka/makai* correlated closely to the existing major roadways. During this assessment there were no trail systems identified in the proposed project area.

VII. SUMMARY AND RECOMMENDATIONS

In summary, a cultural impact assessment was conducted for a proposed mauka reservoir locality in Kapa'a Ahupua'a, Kaua'i. Historic research of the project areas was carried out to identify any cultural resources or traditional cultural practices associated with the area encompassing the proposed study area(s). An attempt was made to contact 21 parties regarding cultural knowledge, land use history, cultural sites and traditional Hawaiian or other cultural practices in the vicinity of the project area. Four of the six individuals who responded had no cultural concerns in the project study area(s) or in the vicinity of the project areas. Two of the organizations contacted, the Kaua'i/Ni'ihau Island Burial Council and the Kaua'i County Planning Departments, Historic Preservation Review Commission indicated an intention to discuss the matter at scheduled meetings for September 2004. No comments or concerns have been received.

Hawaiian traditions centered on Kapa'a suggest the area's significance and association with the *ali'i* in pre-contact times. A survey of traditional mythological literature shows Kapa'a prominently associated with some of the most famous legendary and historical figures including Maui, Kawelo, Mō'īkeha, Māweke, Palila, Paka'a Kanaka Nunui Moe. The fourteen documented *heiau* of Kapa'a is a testament to both the substantial population and the social/political/religious importance of this *ahupua'a*.

A famous O'ahu chief, Mō'ikeha (dates ca. A.D. 1340-1360 by the 20 years per generation count), according to tradition, sailed off to Kahiki and on his return settled in Wailua, Kaua'i, where the Puna family of chiefs welcome him. "On the death of Puna, Mō'īkeha became the principal chief (*Ali'i nui*) of Kaua'i, and remained there the balance of his life" (Fornander 1969:54).

Historic research provided information regarding sugar cane cultivation, settlement patterns, rice cultivation, the opening of Hawaiian Canneries and the construction of the Ahukini Terminal & Railway Company in 1820.

Previous archaeological research shows that the majority of study areas are located within urban Kapa'a near the shore and that little data has been developed for more inland areas. Archaeological research has identified numerous historic properties along the coastal regions of Kapa'a (see Table 4).

Based on the above findings, the proposed project will have minimal or no impact on Hawaiian culture, its practices and traditions.

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

VIII. REFERENCES CITED

Akina, Joseph
1913 *"I Ke hou i Ka Lulu-o-Moikeha i ka laula o Kapa'a", Kū'oko'a.* May 2-9, 1913. Bishop Museum Archives HEN Place Names, Kaua'i.

Alexander, William Patterson
1991 "A Tour of Kaua'i in 1849: Private Journal of William DeWitt Alexander," *The Kaua'i Papers*, Kaua'i Historical Society, A Kaua'i Historical Society Publication, Lihue, Kaua'i, HI.

Beckwith, Martha
1970 *Hawaiian Mythology*, The University Press of Hawai'i, Honolulu.

Bennett, Wendell C.
1931 *The Archaeology of Kaua'i*, Bishop Museum Bulletin 80, Honolulu, HI.

Borthwick, Douglas F. and Hallett H. Hammatt
1999 *Archaeological Monitoring and Burial Treatment Plans for the Proposed Improvements to the Kapa'a Seventh-day Adventist Church, Kapa'a Ahupua'a, Puna District, Kaua'i Island (TMK 4-5-03: 19),* Cultural Surveys Hawai'i, Kailua, HI.

Bishop Museum Archives
HEN I: 214 "Heiaus of Kealia and Kapa'a" and "Well Known Things [or Places]".

HEN I: 215 "Famous Things mentioned by Two Men".

HEN I: 216 "Heiaus from Kapa'a to Kealia" and "Things for which Kapa'a was Known".

Bureau of Land Conveyances
Grant 8248

Bushnell, K.W., and Hallett H. Hammatt
2000 *An Archaeological Monitoring Report for Improvements to the Kapa'a Seventh-Day Adventist Church, 1132 Kuhio Highway, Kapa'a Ahupua'a, District of Puna, Island of Kauai (TMK 4-5-03:19),* Cultural Surveys Hawaii, Kailua, HI.

Bushnell, K.W., Melanie Mann, Douglas Borthwick, Tony Bush, Todd Tulchin, David Shideler and Hallett H. Hammatt
2003 *Archaeological Inventory Survey for the Proposed Kapa'a/Keālia Bike and Pedestrian Path, Kapa'a and Keālia, Kawaihau District, Kaua'i Island, Hawai'i (TMK 4-5, 4-6-14, 4-7-03 & 04).* Cultural Surveys Hawai'i, Inc. Kailua, HI.

Calis, Irene
2000 *End of Field Work Report: Human Burial Removal and Archaeological Monitoring, Kapa'a Beach Park Public Bathroom Installation, Kapa'a, Kaua'i* Scientific Consultant Services

Chafee, David B., Berdena Burgett and Robert L. Spear
1994a *An Inventory Survey of a Kukui Street Houselot, Kapa'a Ahupua'a, Kawaihau District, Puna, Island of Kaua'i (TMK: 4-5-09:10),* SCS Inc., Kāne'ohe, HI.

1994b *An Inventory Survey of a Māmane Street Houselot, Kapa'a Ahupua'a, Kawaihau District, Puna, Island of Kaua'i (TMK: 4-5-09:51),* SCS Inc., Kāne'ohe, HI.

Ching, Francis K. W.
1976 *Letter Report: Archaeological Reconnaissance - Report, Kapa'a "Wastewater Treatment and Disposal System*, ARCH 14-96, Letter to R. M Towill Corporation, ARCH, Lāwa'i, Kaua'i, HI.

Condé, Jesse C. and Gerald M. Best
1973 *Sugar Trains, Narrow Gauge Rails of Hawaii*, Glenwood Publishers, Felton, CA.

Cook, Chris
1999 *"Kaua'i, the Garden Island: A Pictorial History of the Commerce and Work of the People*", Donning Co., Virginia Beach, VA.

Creed, Victoria, Hallett H. Hammatt, Gerald K. Ida, Ian Masterson and John Winieski
1995 *A Summary of the Archaeological Monitoring for the Kapa'a Sewerline Project Waipouli and Kapa'a Ahupua'a, Puna District, Kaua'i (TMK:4-3-09 and 4-5-03 to 11),* Cultural Surveys Hawai'i, Kailua, HI.

Damon, Ethel M.
1931 *Koamalu*, two vols. Privately printed at the Honolulu Star-Bulletin Press, Honolulu.

Dega, Michael F. and James Powell
2003 *Archaeological Monitoring During Phase I of the Kaua'i Rural Fiber Optic Duct Lines Project, Kaua'i Island, Hawai'i.* Scientific Consultant Services

Dole, Charles S.
1916 "The Hui Kawaihau" pp.8-15. A Paper read at the November meeting of the Kaua'i Historical Society on November 16, 1916. In Līhu'e, Kaua'i.

Donohugh, Donald
2001 *The Story of Kōloa, A Kaua'i Plantation Town*, Mutual Publishing, Honolulu, HI.

Elmore, Michelle and Joseph Kennedy
2003 *An Archaeological Monitoring Report for the Proposed Kūhiō Drainage Improvements Kapa'a and Anahola (Project # 56AC-01-01) Located in Kawaihau District, Island of Kaua'i*, ACPI.

Foote, Donald E. E. L. Hill, S. Nakamura and F. Stevens
1972 *Soil Survey of the Islands of Kaua'i, O'ahu, Maui, Molokai and Lanai, State of Hawai'i* U.S. Department of Agriculture, U.S. Government Printing Office, Washington D.C.

Fornander, Abraham
1916-19 *Fornander Collection of Hawaiian Antiquities and Folk-Lore, with translations edited and illustrated with notes by Thomas G. Thrum*, Volume 4, First series, 1916 - 1917 notes by Thomas G. Thrum, Memoirs of the Bernice P. Bishop Museum, Vols. 4, 5, 6, Honolulu, HI.

Garden Island Newspaper
1955 "Geologists Says Kapa'a Coral Removal No Threat to Town". September 21, 1955.

1963 "Kapa'a Blames Federal Role As Erosion Continues. Says Barrier on Reef is Required". October 30, 1963.

1983 "Centennial Year, Kapa'a School Wants Pix of its 100 Years". April 1, 1983.

Giambelluca, Thomas W., Michael A. Nullet and Thomas A. Schroeder
1986 *Rainfall Atlas of Hawai'i,* Department of Land and Natural Resources, Honolulu, HI.

Hammatt, Hallett H.
1981 *Archaeological Reconnaissance of 52.56 Acres for a Proposed subdivision, TMK 4-6-13-1, Kapa'a, Puna, Kaua'i Island,* ARCH Report 14-236, Prepared for Waialeale Partners.

1986 *Archaeological Reconnaissance of the Makaleha Springs Water Source Development, Kapa'a, Kaua'i TMK: 4-6-01:1,* Cultural Surveys Hawai'i, Kailua, HI.

1991 *Archaeological Subsurface Testing for the Proposed Kapa'a Sewer line, Wailua, Olohena, Waipouli and Kapa'a, Kaua'i,* Cultural Surveys Hawai'i, Kailua, HI.

Hammatt, Hallett H., Rodney Chiogioji, Gerald K. Ida and Victoria S. Creed
1997 *An Archaeological Inventory Survey for the Kūhiō Highway Widening and Bypass Options Within the Ahupua'a of Wailua, South Olohena, North Olohena, Waipouli & Kapa'a, Island of Kaua'i,* Cultural Surveys Hawai'i, Inc., Kailua, HI.

Hammatt, Hallett H., Gerald K. Ida, and Rodney Chiogioji
1994 *Archaeological Document Review and Assessment of Three Alternative Widening and Bypass Options for the Kūhiō Highway Within the Ahupua'a of Hanamā'ulu, Wailua, South Olohena, North Olohena, Waipouli & Kapa'a, Līhu'e and Kawaihau Districts, Island of Kaua'i,* Revised 1994, Cultural Surveys Hawaii, Kailua, HI.

Hammatt, Hallett H., Gerald K. Ida and William H. Folk
1994 *Archaeological Inventory of a 1.87-Acre Parcel, Kapa'a, Kaua'i (TMK 4-5-05:6),* Rev. August 1994, Cultural Surveys Hawai'i, Kailua, HI.

Hammatt, Hallett H. and David W. Shideler
2004 *Archaeological Assessment of Alternative Routes Proposed for the Lydgate to Kapa'a Bike and Pedestrian Pathway Project Within the Ahupua'a of Wailua, South Olohena, North Olohena, Waipouli and Kapa'a,* Cultural Surveys Hawai'i, Kailua, HI.

Hammatt, Hallett H., David W. Shideler and William H. Folk
2002 *Archaeological Study in Support of Proposed Kūhiō Highway Improvements (Kapa'a By-Pass) Hanamā'ulu to Kapa'a Ahupua'a, Kaua'i,* Cultural Surveys Hawai'i, Kailua, HI.

Handy, E.S. Craighill and Elizabeth G. Handy
1972 *Native Planters in Old Hawaii: Their Life, Lore, and Environment,* B.P. Bishop Museum Bulletin 233, B.P. Bishop Museum, Honolulu, HI.

Hawaii State Archives
1837 Interior Department, Land, Incoming Letter. August 1837.

1882 Interior Department, Letter book, Vol. 20, p. 426, Letter from Spalding to the Honorable Jacob Hardy, Circuit Judge–Fourth Circuit Kaua'i.

Hawaii Territorial Planning Board
1940 *Master Plan of the Town of Kapa'a,* In collaboration with the Kaua'i County Board of Supervisors, Publication No. 8. Advertiser Publishing Co., Honolulu, HI.

Honolulu Advertiser
1997 "Amfac to put more land up for sale: Tracts on Kaua'i, Big Island" by Mike Gordon. July 7, 1997. Section B1.

1960 "Kaua'i Tries to See into Future. March 20, 1960.

Joesting, Edward
1984 *Kaua'i, The Separate Kingdom,* University of Hawaii Press and Kaua'i Museum Association, Ltd., Honolulu.

Jourdane, Elaine
1995 *Inadvertent Discovery of Human Remains at 1382-A Inia Street, Kapa'a, Kaua'i (Kapa'a Sewerline Project Laterals) Site 626,* SHPD, Honolulu, HI.

Kalākaua, David
1888 *The Legends and Myths of Hawaii,* Edited by R.M. Dagget, Charles L. Webster and Co., New York.

Kamakau, Samuel Manaiakalani
1976 *The Works of the People of Old, Nā Hana a ka Pō'e Kahiko,* Bishop Museum Special Publication, No. 61, Honolulu, HI.

Kapa'a Elementary School
1983 *Kapa'a School 1883-1983: A "Century of Knowledge".* Kapa'a Elementary, Kapa'a, Kaua'i.

1933 *Kapa'a Elementary School, Kula O Kapa'a, 1883-1933,* Published by the school on its fiftieth anniversary, Kapa`a, Kauai, HI.

Kawachi, Carol T.
1994 *Inadvertent Burial at 1316 Inia Street (Jasper) TMK 4-5-08:33, Kapa'a, Kawaihau, Kaua'I 50-30-08-871,* State Historic Preservation Division, Honolulu, HI.

Kikuchi, William K. and Susan Remoaldo
1992 *Cemeteries of Kaua'i,* Volume 1, Kaua'i Community College and University of Hawai'i, Puhi, Kaua'i, HI.

King, Robert D.
1935 "Districts in the Hawaiian Islands" In Coulter, John Wesley (compiler) *A Gazetteer of the Territory of Hawaii,* University of Hawaii Research Publications, No. 11, University of Hawaii, Honolulu, Hi.

Lai, Violet L. assisted by Kum Pui Lai
1985 *He Was a Ram, Wong Aloiau of Hawaii,* Published for the Hawaii Chinese History Center and the Wong Aloiau Association by University Press of Hawaii, Honolulu.

McMahon, Nancy A.
1994 *Inadvertent Burial Find, Kapa'a, Kawaihau, Kaua'i,* SHPD, Honolulu, HI.

1996 *Archaeological Inventory Survey for 5 Unit Apartment, TMK: 4-5-05:8, Kapa'a, Kawaihau, Kaua'i*, Exploration Associates, LTD., Koloa, Kaua'i, HI.

Nakuina, Moses K.
1990 *The Wind Gourd of La'amaomao*, Translated by Esther T. Mookini and Sarah Nakoa, Kalamaku Press, Honolulu.

Office of the Commissioner of Public Lands
1929 *Indices of Awards, Made by the Board of Commissioners to Quiet Land Title in the Hawaiian Islands.*

Perzinski, Mary and Hallett H. Hammatt
2001 *A Summary of Archaeological Monitoring for the Kūhiō Highway, Waikaea Bridge Widening Project Kapa'a Ahupua'a, Kawaihau District, Kaua'i Island (TMK: 4-3-06 to 4-3-08),* Cultural Surveys Hawai'i, Kailua, HI.

Pukui, Mary Kawena
1983 *'Ōlelo No'eau: Hawaiian Proverbs and Poetical Sayings*, Bishop Museum Special Publication No.71, Bishop Museum Press, Honolulu, HI.

1986 *Hawaiian Dictionary*, 2nd Edition, University of Hawaii Press, Honolulu, HI.

1974 *Place Names of Hawaii*, University of Hawai'i Press, Honolulu, HI.

Rice, William Hyde
1974 *Hawaiian Legends*, Bernice P. Bishop Museum Bulletin 3, Honolulu, HI; originally published 1923, Kraus Reprint, Millwood, New York, N.Y.

1923 *Hawaiian Legends*, Bernice P. Bishop Museum Bulletin 3, Honolulu.

Spear, Robert L.
1992 *Letter Report Concerning Monitoring for the Cost-U-Less Project Kapa'a, Kaua'i, Hi.*(TMK: 4-5-5:4&9), Scientific Consultant Services Inc., Honolulu, HI.

Thrum, Thomas G.
1906 "Heiaus and Heiau Sites Throughout the Hawaiian Islands, Kaua'i, in: *Hawaiian Almanac and Annual 1907*, pp. 36-48, Honolulu, HI.

1923 *More Hawaiian Folk Tales*, A.C. McClurg & Co., Chicago, IL.

Van Ryzin, Karl and Hallett H. Hammatt
2004 *An Archaeological Assessment For The Proposed Water Reservoir, Kapa'a Ahupua'a, Kaua'i TMK 4-6-03:10* Cultural Surveys Hawai'i, Kailua, HI.

Wichman, Frederick B.
1998 *Kaua'i Ancient Place Names and Their Stories*. University of Hawaii Press: Honolulu

Wichman, Frederick B.
1985 *Kauai Tales*, Bamboo Ridge Press, Honolulu, HI.

IX. APPENDIX

At the request of Belt Collins Hawai'i Ltd., Cultural Surveys Hawai'i, Inc. (CSH) conducted a Cultural Impact Assessment for the Proposed Water Reservoir Location, *Mauka* Locale in the uplands of Kapa'a, Kaua'i Island. During this assessment two other locations (the "*Makai* 1 Locale" and the "*Makai* 2 Locale") in seaward Kapa'a were also assessed as possible alternatives for the *Mauka* Locale, (Figures 7 to 10):

A. *Makai* Locale 1 Project Area

The *Makai* Locale 1 (TMK 4-6-11:3) project area is located at the corner of Kawaihau Road and Ka'apuni Road at an elevation of 91 m (300 ft) at a distance of approximately 4.18 km (2.6 mi) from the coast. Foote et al (1972) describes the soil in this area as being "Puhi Silty clay loam" (PnB) which is defined as being "well-drained soils on uplands on the island of Kaua'i. These soils developed in material derived from basic igneous rock. They are nearly level to steep. Elevations range from 175 to 500 feet." (Foote et al.1972). *Makai* Locale 1 receives an average annual rainfall of approximately 2000 mm (79 inches) (Giambelluca 1986:47).

On June 10th, 2004, Cultural Surveys Hawai'i staff made a field inspection of the *Makai* Locale 1 alternative water tank installation project area. Access was via Highway 56, turning off to the west on Highway 581, then turning off to the northwest on Kaehulua Road.

The *Makai* Locale 1 is comprised of a 0.84-acre State property of which a portion is fenced and contains an existing 0.2 MG wooden reservoir (Figure 11). Survey transects oriented north-south were conducted through the project area. Based on observations the entire existing and proposed tank locale had previously been bulldozed and graded. The existing tank area consists of mowed grass lawn. The remainder of the property is an open, level pasture containing large patches of California grass, bananas, and various weeds and vines (Figures 11 and 12). No archaeological sites were observed. Based on background research *Makai* Locale 1 was, during the early 20th century, under sugar cane cultivation. The field check examined the areas of proposed impact and found no archaeological sites or historic preservation concerns in the vicinity. No further historic preservation work was recommended.

In the course of the present Cultural Impact Assessment work the nineteen parties contacted (summarized in "Table 5 Community Consultation") were asked if they had any concerns for the *Makai* Locale 1 area that was initially under consideration. No concerns were expressed.

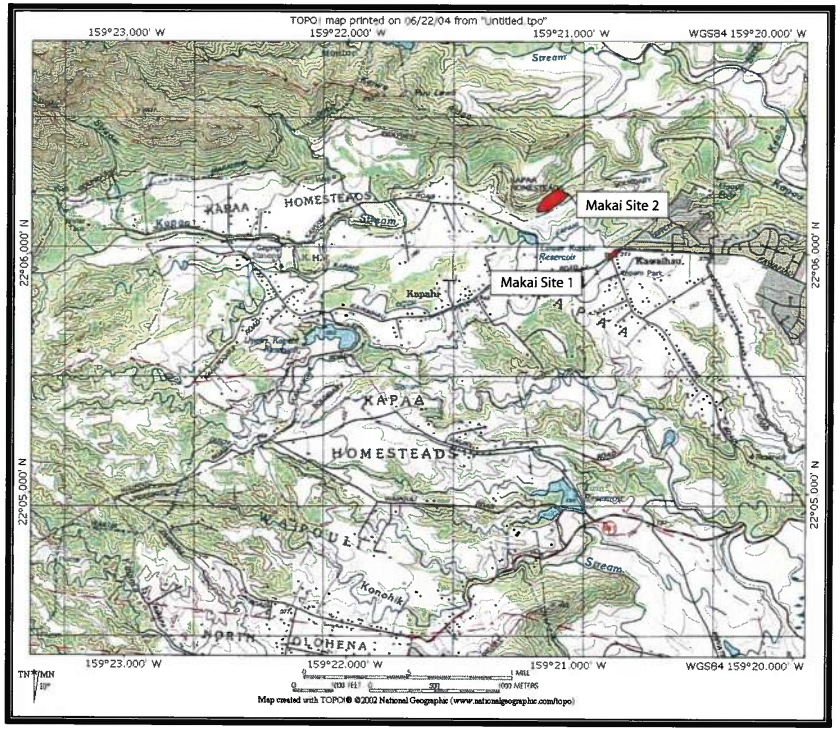


Figure 7. Portion of U. S. Geological Survey map showing alternative *Makai* 1 Locale and *Makai* 2 Locale

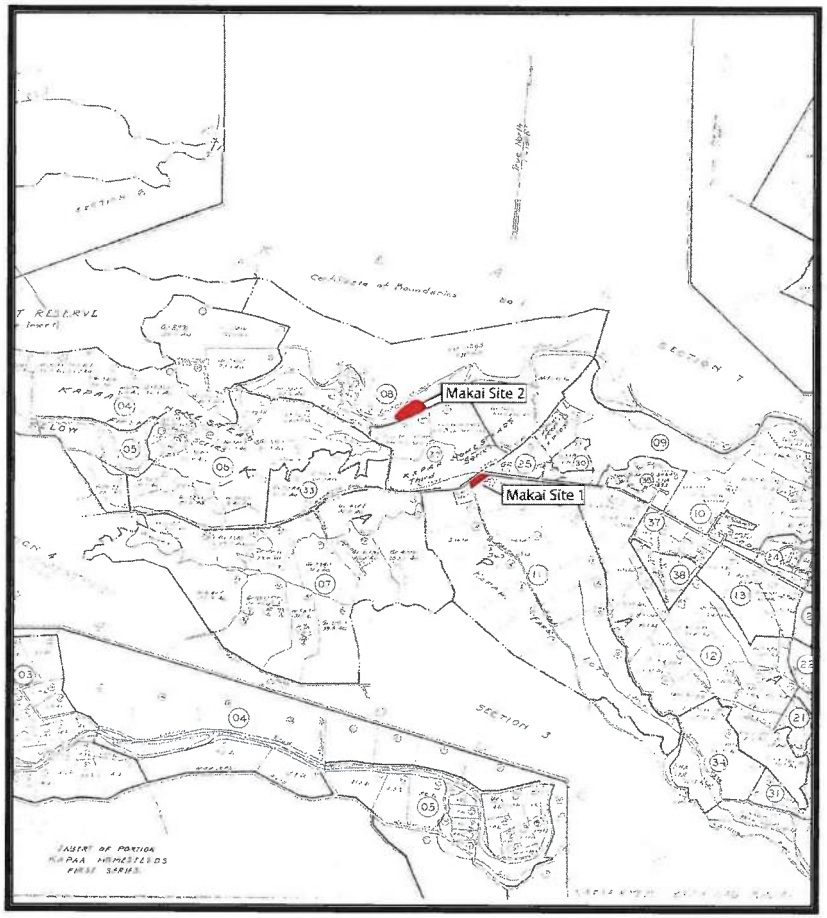


Figure 8. TMK map 4-6 Showing alternative locations *Makai* 1 Locale and *Makai* 2 Locale

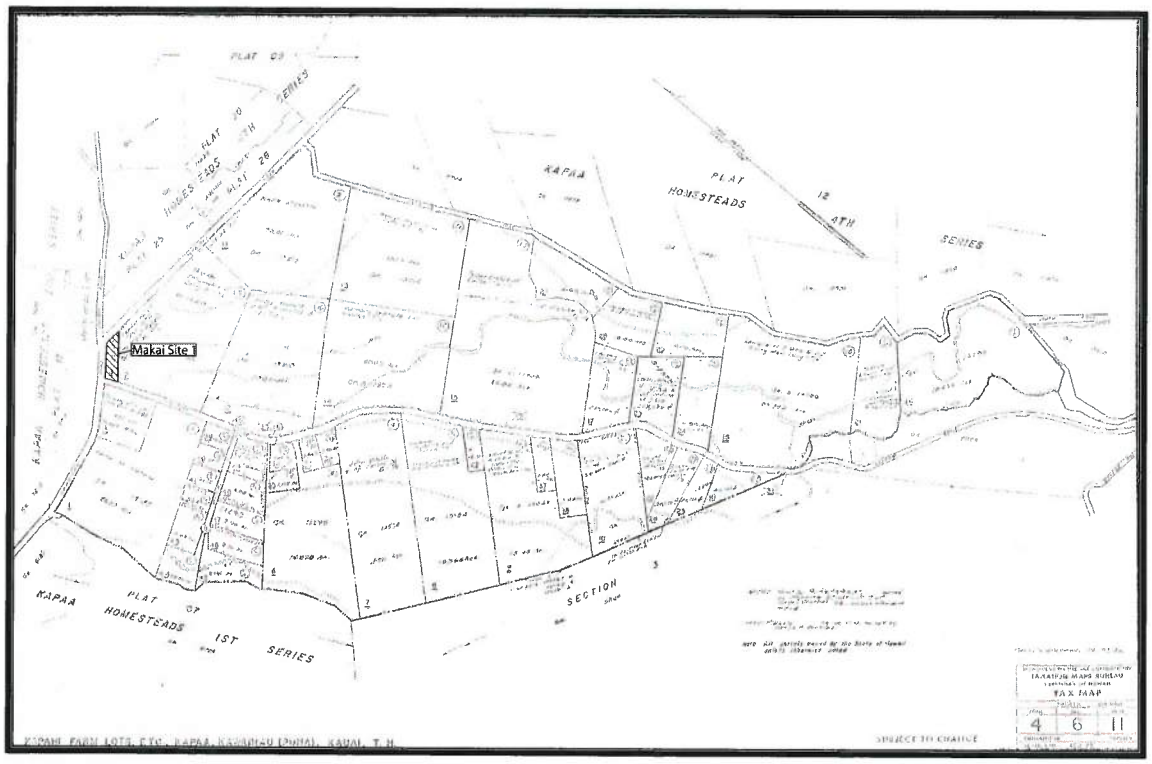


Figure 9. TMK Map 4-6-11:33 Showing *Makai* 1 Locale

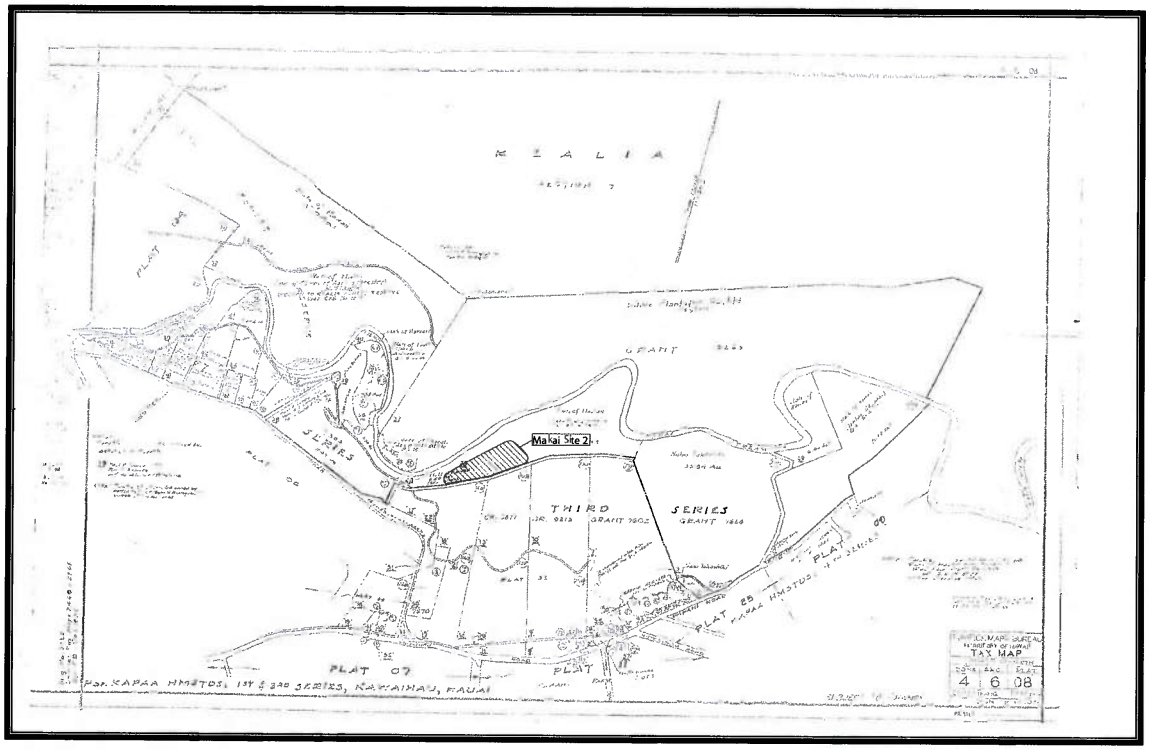


Figure 10. TMK Map 4-6-08:24 Showing *Makai* 2 Locale

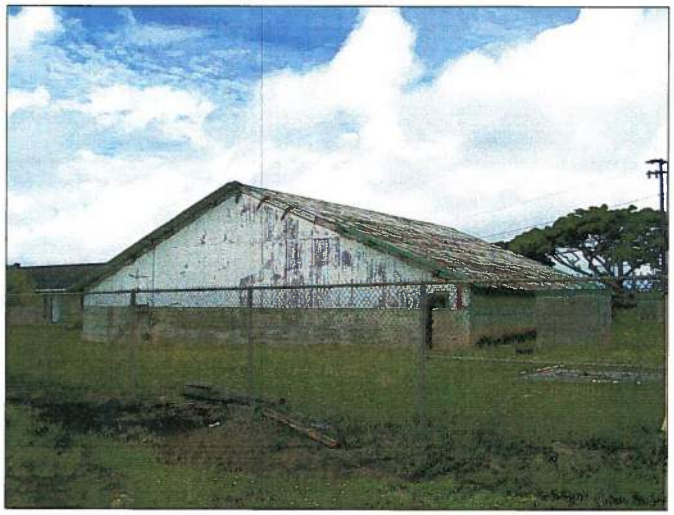


Figure 11. Fenced section of *Makai* Locale 1 project area, view to the southwest.

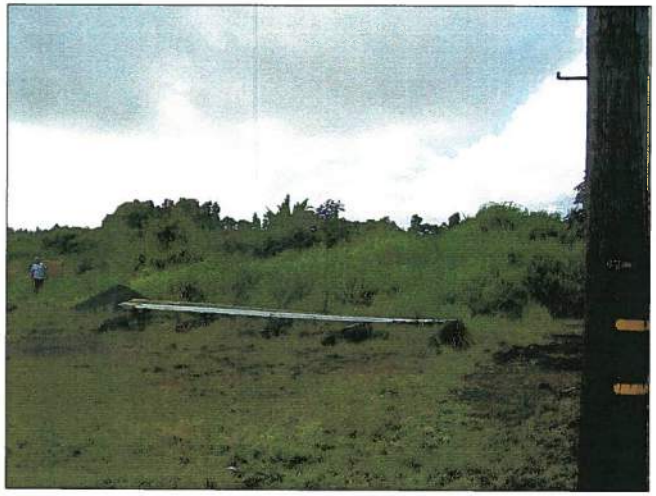


Figure 12. *Makai* Locale 1 project area, view to the southeast.

B. *Makai* Locale 2 Project Area

The *Makai* Locale 2 (TMK 4-6-08:24) project area is located approximately 400 m north of Lower Kapahi Reservoir and immediately south of Kapa'a Stream. The elevation runs from 60 m to 91 m (200-300 ft) and the project area is approximately 4.59 km (2.85 mi) from the coast. Foote et al (1972) described three types of soils within this project area – rough broken land (rRR), rock outcrop (rRO), and Hanalei silty clay (HrB). Rough broken land consists of "very steep land broken by numerous intermittent drainage channels. In most places it is not stony. The slope is 40 to 70 percent. Runoff is rapid, and geologic erosion is active." (Foote et al.1972). Rock outcrop consists of "areas where exposed bedrock covers more than 90 percent of the surface. The rock outcrops are mainly basalt and andesite. This land type is gently sloping to precipitous. ... This land type is not suited to farming. It is used for water supply, wildlife habitat, and recreation" (Foote et al.1972). Hanalei silty clay consists of "somewhat poorly drained to poorly drained soils on bottom lands of the islands of Kaua'i and O'ahu. These soils developed in alluvium derived from basic igneous rock. They are level to gently sloping." (Foote et al.1972). *Makai* Locale 2 receives an average an annual rainfall of approximately 2000 mm (79 inches) (Giambelluca 1986:47).

On June 10th, 2004, Cultural Surveys Hawai'i Inc. archaeologist Karl Van Ryzin, B.A., and supervising archaeologist David Perzinski, B.A., made a field inspection on the Makai Locale 2 alternative water tank installation project area. Access was via an unmarked privately owned dirt road that runs northeast from Kahuna Road.

The *Makai* Locale 2 is comprised of an unmarked, approximately 3.7 acre site off a dirt access road and is located immediately south of Kapa'a Stream. The majority of the project area lies on a 45 to 90 degree angle slope that descends down into Kapa'a Stream (Figures 13 and 14). Survey transects oriented north-south were conducted throughout the relatively level upper portion of the project area. For the lower portion of the project area transects were done along the contour of the slope. Vegetation is dense with the project area dominated by ginger, ferns, *ti*, palms, albezia, and exotic grasses. No archaeological sites were observed. The field check examined the areas of proposed impact and found no archaeological sites or historic preservation concerns in the vicinity. No further historic preservation work was recommended.

In the course of the present Cultural Impact Assessment work the nineteen parties contacted (summarized in "Table 5 Community Consultation") were asked if they had any concerns for the *Makai* Locale 2 area that was initially under consideration. No concerns were expressed.

Figure 13. *Makai* Locale 2 project area south of Kapa'a stream showing steep slope, view to the west.

Figure 14. *Makai* Locale 2 project area showing dense vegetation and steep slope, view to the east.

APPENDIX F

FINAL DRAINAGE REPORT

FINAL DRAINAGE REPORT

FOR

KAPA‘A HOMESTEADS 325’ TANKS, TWO 0.5 MG TANKS
PACKAGE A AND PACKAGE B

Kapa‘a, Kaua‘i, Hawai‘i

Tax Map Key: 4-6-11: por. 003

PW 05.15.043

Executive Order 1091

PREPARED FOR:

Department of Water
County of Kaua‘i

PREPARED BY:

Belt Collins Hawaii LLC
2153 North King Street, Suite 200
Honolulu, Hawai‘i 96819

January 2023

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

APRIL 30, 2024
EXPIRATION DATE OF THE LICENSE

TABLE OF CONTENTS

		Page No.
1.0	PURPOSE	1
2.0	GENERAL PROJECT DESCRIPTION	1
3.0	DESIGN CRITERIA	1
4.0	EXISTING DRAINAGE	2
5.0	PROPOSED DRAINAGE	6
6.0	ANALYSIS	8
7.0	CONCLUSION	10
8.0	REFERENCES	10

LIST OF FIGURES

Figure 1 - Location Map

Figure 2 - Project Area and Proposed Drainage Improvements

Figure 3 - Existing Site Drainage

Figure 4 - Proposed Site Drainage

APPENDICES

Appendix A - Plates from the *Storm Water Runoff System Manual*

Appendix B - Drain Line Calculations

Appendix C - Runoff Calculations, 2-Year, 24-Hour

Appendix D - Water Quality Calculation

Appendix E - Swale Calculations

Appendix F - Grate Calculations

Appendix G - Downspout Sizing

1.0 PURPOSE

This drainage report presents the basis of design for the proposed drainage improvements for the Kapa‘a Tank Site.

2.0 GENERAL PROJECT DESCRIPTION

The County of Kaua‘i Department of Water (DOW) proposes to install two (2), 0.5 million gallon storage tanks adjacent to the existing Ornellas Tank within the parcel, Tax May Key 4-6-11:03. The Ornellas Tank is part of the DOW’s Wailua-Kapa‘a Water System. The Ornellas Tank site is located at the intersection of Kawaihau Road, Ka‘apuni Road, and Kapahi Road. This project is situated within the Kapahi Homesteads, approximately 2.5 miles mauka of Kūhiō Highway. See Figures 1 and 2.

The project includes installation of concrete storage tanks, water system appurtenances, grass cell access and perimeter roads, concrete walkways, retaining walls, on-site and off-site drainage system, and a chain link fence enclosing the tank site. The total disturbed area is approximately 1.4 acres.

The project will be constructed in two (2) packages, Packages A and B. Package A includes an 18-inch high-density polyethylene (HDPE) drain line from the existing overflow/washout line from Ornellas tank, down Ka‘apuni Road and discharging to an existing gulch via TMK 4-6-11:125. The drainage discharges to the HDPE drain line.

Package B consists of the on-site improvements including two (2) water storage tanks, related sitework, roads, water lines, and the remainder of the drainage system including a detention basin. See Figures 3 and 4.

3.0 DESIGN CRITERIA

Hydrology

The project drainage area limit is less than 100 acres. Consequently, the surface water collection system is designed to handle the runoff generated from a storm with a recurrence interval of two years with a duration of one hour. The flow is computed utilizing the rational method, as outlined in the *Department of Public Works (DPW), County of Kaua‘i, Storm Water Runoff System Manual*, hereinafter referred to as the *Manual*.

The rational method is defined as:

Q = C I A

where: Q = flow rate, cubic feet per second (cfs)
C = runoff coefficient
I = Intensity of 1-hour rainfall intensity (inches/hour) at time of concentration, Tc
A = drainage area, acres

Recurrence Interval, Tm:
Tm= 2 years

Time of Concentration, Tc:
Tc = 5 minutes for all basins

The National Resources Conservation Service (NRCS) Technical Release 20 (TR-20) method is used to compute runoff quantities for storms with a recurrence interval of 2 year with a 24-hour duration. A recurrence interval of two (2) years is used in calculations. A time of concentration of five (5) minutes is used for all basins.

Detention Basin Design

The detention basin is designed to provide water storage for agricultural use, and the upper portion of the ditch is utilized to retain the flow at the existing level. HydroCAD is used to confirm adequate storage is provided. HydroCAD utilizes TR-20 and TR-55 to create the hydrograph utilized to confirm the adequacy of the size of the detention basin. The detention basin is sized to keep the proposed conditions peak discharge below the existing conditions peak flow resulting from the 2-year storm with 24-hour duration, in accordance with the *Manual*.

4.0 EXISTING DRAINAGE

The existing drainage basins are shown in Figure 3. The existing ground in this area predominantly slopes makai at 3% from Kawaihau Road. The existing ground elevation is between 302 and 311 feet above mean sea level. There are no prominent or distinguishing geographic features on the property. The site ground cover consists of unmaintained California grass and the impervious areas associated with the Ornellas Tank roof.

No County drainage systems exist in the vicinity of the Ornellas Tank parcel. Runoff from Kawaihau Road sheet flows makai onto the Ornellas Tank site and continues to the neighboring lot. An existing earthen ditch within the site receives the flow from the overflow and washout lines from Ornellas Tank and discharges into the neighboring parcel. The DOW does not have an easement over the existing ditch. The owner of the neighboring parcel is not willing to grant an easement to DOW. The runoff from the eastern end of the Ornellas Tank parcel also sheet flows in a southeast direction to an adjacent parcel. Flow from the project area ultimately enters an existing gulch between Kaehulua Road and Ka'apuni Road as shown on Figure 1.

Existing Runoff

There are four existing drainage basins at the project site described below:

Basin A: The largest basin consists of a portion of Kawaihau Road and most of the tank site. Runoff sheet flows from Kawaihau Road and the Ornellas Tank roof collects at the existing earthen ditch and discharges into the neighboring lot. Discharge from Ornellas Tank overflow and washout line is directed to an earthen swale and discharges to the neighboring lot. See Figure 3.

The basin consists of an area adjacent to Kawaihau Road at the eastern side of the tank site parcel. Runoff sheet flows from Kawaihau Road through a grassed area and into the neighboring property. See Figure 3.

Basin B: The basin consists of a portion of Kawaihau Road and most of the north-eastern side of the tank site parcel. The runoff from this basin sheet flows from Kawaihau Road through the grassed parcel and onto the neighboring property. See Figure 3.

Basin C: The basin consists of the area adjacent to Ka'apuni Road. The runoff from this basin discharges to Ka'apuni Road from the south corner of the tank site. See Figure 3.

Flow generated from each basin is summarized below. The runoff for the 2-year design storm with 1-hour duration is summarized in Table 1. The detailed runoff calculations for existing and proposed conditions are shown in Table 2.

Table 1: Summary of Existing Runoff, 2-year, 1-hour

BASIN	Drainage Pipe Sizing 2-year 1-hour storm runoff (cfs)
A	2.10
B	1.89
Total Basin A & B	**3.99**
C	0.23
TOTAL	**4.22**

Runoff quantities for the 2-year design storm with 24-hour duration is summarized in Table 1A. Calculations conditions are shown in Appendix C.

Table 1A: Summary of Existing Flow, 2-year, 24-hour

BASIN	2-year 24-hour Storm Runoff (cfs)
A	2.70
B	2.15
Total Basin A & B	**4.85**
C	0.42
TOTAL	**5.27**

TABLE 2

RUNOFF CALCULATIONS (2-year, 1-hour)

Recurrence Interval	2-Year	
Rainfall Intensity, I	3.3	inches (from Plate 3; 1-hour Rainfall)
Runoff Coefficient, C	0.87	Paved Areas (includes other hardscape such as tanks)
	0.71	Grasscell paved areas (using "Industrial Limited") from Table 1
	0.2	Grassed Areas

Existing Conditions

Drainage Basin	A (acre)	A_{grass} (acre)	$A_{pavement}$ (acre)		C composite	T_c (min)	Correction Factor	$I_{2\ year}$ (in/hr)	$I_{(corr)}$	Q_2 (cfs)	Flows to:
Drain Basin A	0.62	0.46	0.16		0.37	5.0	2.75	3.3	9.1	2.10	Flow in ditch to neighboring parcel
Drain Basin B	0.47	0.30	0.17		0.44	5.0	2.75	3.3	9.1	1.89	Sheet flow to neighboring parcel
									Subtotal =	**3.99**	
Drain Basin C	0.12	0.118	0.002		0.21	5.0	2.75	3.3	9.1	0.23	Ka'apuni Road
Totals	1.21									**0.23**	
									Total Q =	**4.22**	

Developed Conditions

Drainage Basin	A (acre)	A_{grass} (acre)	$A_{pavement}$ (acre)	$A_{grasscell}$ (acre)	C composite	T_c (min)	Correction Factor	$I_{2\ year}$ (in/hr)	$I_{(corr)}$	Q_2 (cfs)	Flows to:
Drain Basin 1	0.37	0.14	0.15	0.08	0.58	5.0	2.75	3.3	9.1	1.96	Drain Inlet 1
Drain Basin 2	0.21	0.02	0.10	0.09	0.74	5.0	2.75	3.3	9.1	1.41	Drain Inlet B2
Drain Basin 3	0.31	0.08	0.23	0.00	0.70	5.0	2.75	3.3	9.1	1.96	Drain Inlet B4
Drain Basin 4	0.17	0.07	0.06	0.04	0.56	5.0	2.75	3.3	9.1	0.86	Drain Inlet B3
									Total Q Entering Site Drainage System =	**6.19**	
Drain Basin 5	0.12	0.08	0.02	0.02	0.40	5.0	2.75	3.3	9.1	0.43	Ka'apuni Road
Drain Basin 6	0.03	0.027	0.004	0.00	0.29	5.0	2.75	3.3	9.1	0.08	Sheet flow to neighboring parcel
Totals	1.21								**Total Q not Entering Site Drainage System =**	**0.51**	
									Total Q =	**6.70**	

5.0 PROPOSED DRAINAGE

The proposed site grading and drainage basins are shown in Figure 4. The tank site will be graded to slope south from Kawaihau Road towards the makai property line. The proposed site consists of a grass cell pavement access road, improved grassed areas, and impervious area associated with the existing Ornellas Tank and the two proposed Tanks A and B. The existing earthen swale will be removed and will no longer discharge directly to the neighboring property.

Proposed Drainage Basins

The proposed project site is divided into six (6) drainage basins, Basins 1 through 6, based on grading changes to the site, as shown in Figure 4 and described below.

Basin 1: Runoff generated from Basin 1 is from Ornellas Tank and approximately half of Tank A. The makai half of the Ornellas tank roof is collected in a roof gutter by a downspout and piped to DMH 1. The runoff from Basin 1 is collected by Drain Inlet 1 (DI 1).

Basin 2: Runoff generated from Basin 2 includes flow from both Tanks A and B and is collected by Drain Inlet B2 (DI B2).

Basin 3: Runoff from Kawaihau Road sheet flows into the roadside grass swale. The collected runoff from the swale flows into Drain Inlet B4 (DI B4).

Basin 4: Runoff generated from Basin 4 is at the eastern side of the site around Tank B and grassed areas and collects in the detention basin and overflows to Drain Inlet B3 (DI B3). The runoff from this basin will continue to sheet flow toward the neighboring property and Kawaihau Road.

Basin 5: Runoff generated from Basin 5 will continue to sheet flow to the roadside swale on Ka'apuni Road.

Basin 6: Runoff generated from Basin 6 is from the grassed areas at the eastern portion of the site. Runoff from this basin will continue to sheet flow toward the neighboring property and Kawaihau Road.

A summary of the computed flow generated by the proposed drainage basins for the two-year one-hour design storm event is shown in Table 3 below.

Table 3: Summary of Runoff for Proposed Basins, 2-year, 1-hour

BASIN	Drainage Pipe Sizing 2-year 1-hour storm runoff (cfs)
1	1.96
2	1.41
3	1.96
4	0.86
TOTAL BASINS 1-4	**6.19**
5	0.43
6	0.08
TOTAL BASINS 5 and 6	**0.51**
TOTAL BASINS 1-6	**6.70**

Proposed Drainage Improvements

The proposed drainage system collects runoff from Basins 1-4 and conveys the flow via the Ka'apuni Road drain line to the existing gulch in TMK 4-6-11:125. Drain Line A begins at DI B4 which discharges to a grass lined ditch in the eastern portion of the tank site. The grass lined ditch retains water and provides infiltration of stormwater runoff. The ditch discharges by overflowing into DI B3 back into Drain Line A. If the ditch overflows beyond the basin boundaries, it would to a roadside drainage swale. Calculations for the ditch are shown in Appendix C.

Drain Line A continues to collect flow through DI B2 and DI B1. After leaving the project site the drain line continues down Ka'apuni Rd to the ultimate discharge point in TMK 4-6-11:125. Drain Line A will utilize smooth wall HDPE pipe and traverses along

the middle of the northern lane of Ka'apuni to minimize damage to the existing pavement. Drain Line A will be maintained by the Department of Water. The new drain line is designed to convey 6.19 cfs, the total of the 2-year 1-hour flows computed for Basins 1 through 4. Within the tank site, the drainage pipe diameters will be 12" and 18". The off-site drain line on Ka'apuni Road is an 18-inch diameter HDPE pipe. Freeboard is a minimum of 1.0' at drainage structures. See Appendix B for the hydraulic analysis of Drain Line A.

Drain Line A terminates at the bottom of the existing gulch at the downstream parcel TMK 4-6-11:125. The drain line discharges through a headwall onto grouted rubble pavement slope protection.

6.0 ANALYSIS

Swale Capacity - Kawaihau Road Runoff (Basin 3)

Runoff from Kawaihau Road will be intercepted by a roadside grass swale between the roadway pavement and the walkway. This swale will prevent road runoff from entering the tank site. Since the swale section varies, its capacity is computed at various locations. Calculations indicate the swale has a minimum capacity of 1.96 cfs (Basin 3 runoff into Kawaihau Road). Runoff intercepted by the swale will be captured by drain inlet B4. Any runoff which bypasses drain inlet B4 will flow along Kawaihau Road and not exceed existing flow for 2-year storm of 1-hour duration.

Grate Capacity

Grate capacity for DI B1 is shown in Appendix F.

Gutter Sizing Capacity

Gutter capacity to justify the size of the rain gutter on the Ornellas Tank roof shown in Appendix E.

Runoff Volume

The proposed project will increase the total amount of runoff generated. As noted in Tables 1 and 2, for the 2-year 1-hour design storm, runoff from the project area increases from 4.22 cfs in existing conditions to 6.70 cfs under proposed conditions. Flow from Drainage Basins 1 through 4, a total of 6.19 cfs, will enter the pipe, while runoff from Drainage Basins 5 and 6, or 0.51 cfs, will flow off the tank site.

Of the flow not entering the drainage system, 0.43 cfs from Basin 5 is directed to Ka'apuni Road. Under existing conditions 0.23 cfs enters Ka'apuni Road (Basin C). Sheet flow onto the neighboring parcel from Basin 6 on the east side of the site is 0.08 cfs.

Detention Basin

A summary of the computed flow generated by the proposed drainage basins for the two-year 24-hour design storm event is shown in Table 3A below. Calculations conditions are shown in Appendix C.

Table 4: Summary of Runoff for Proposed Basins, 2-year, 24-hour

BASIN	2-year 24-hour Storm Runoff (cfs)	Reduction in Flow from Detention Basin
1	1.80	-
2	1.08	-
3	1.76	-
4	0.81	0.08
TOTAL BASINS 1-4	**5.45**	**4.72 < 4.85**
5	0.50	-
6	0.13	-
TOTAL BASINS 5 and 6	**0.63**	**-**
TOTAL BASINS 1-6	**6.08**	**5.35**

A detention basin designed for 2-year 24-hour conditions will receive flow and reduce the peak flow off the site. The detention basin reduces the flow generated by Basin 4 from 0.81 cfs to 0.08 cfs. Under existing conditions, the 2-year 24-hour flow

from Basins A and B is 4.85 cfs. Under proposed conditions, the 2-year 24-hour flow from approximately the same area, Basins 1 through 4, is 4.72 cfs.

Water Quality

As stated in Section 5.8 of the *Manual*, provisions for water quality protection are required. Water quality protection sediment storage facilities are sized for one-half inch of runoff per acre made impermeable by the project. Approximately 0.58 acres are made impermeable by the project and approximately 1,060 cubic feet (cf) of sediment storage would be required. Approximately 1,400 cf is available. See Appendix D for calculations.

7.0 CONCLUSION

The proposed project design provides drainage improvements to maintain the existing runoff flow and mitigate the peak flow from the site.

8.0 REFERENCES

Storm Water Runoff System Manual, County of Kaua'i, Department of Public Works, July 2001.

FIGURES

Thu, 05 Jan 2023 - 2:28pm
T:\Kapaa Homesteads Tank\2004740100 Kapahi Tank\CAD\Drainage Report\Figure 1 - Location Map.dwg

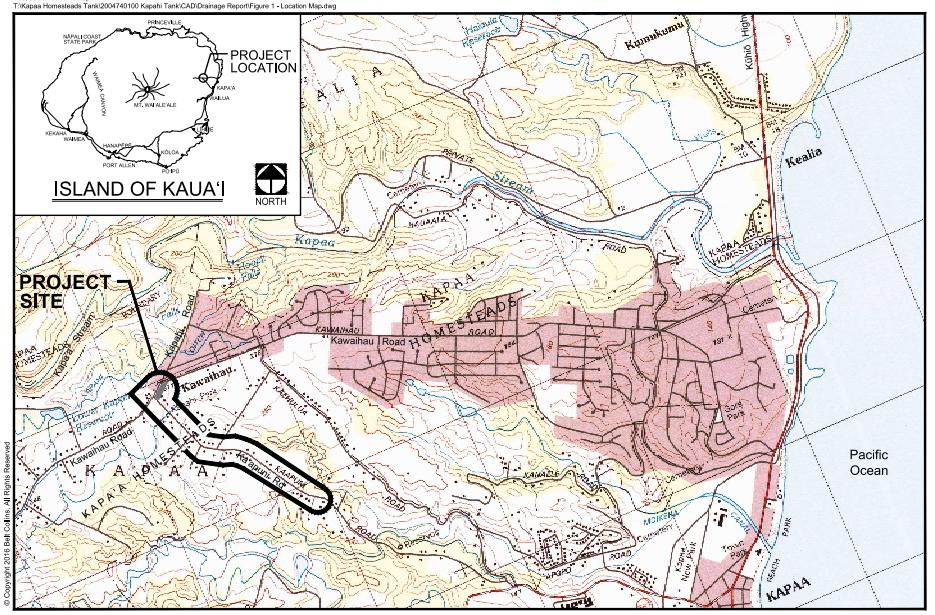


Figure 1
LOCATION MAP
KAPA'A HOMESTEADS 325' TANKS, TWO 0.5 MG TANKS
KAPA'A, KAUA'I
JANUARY 2023

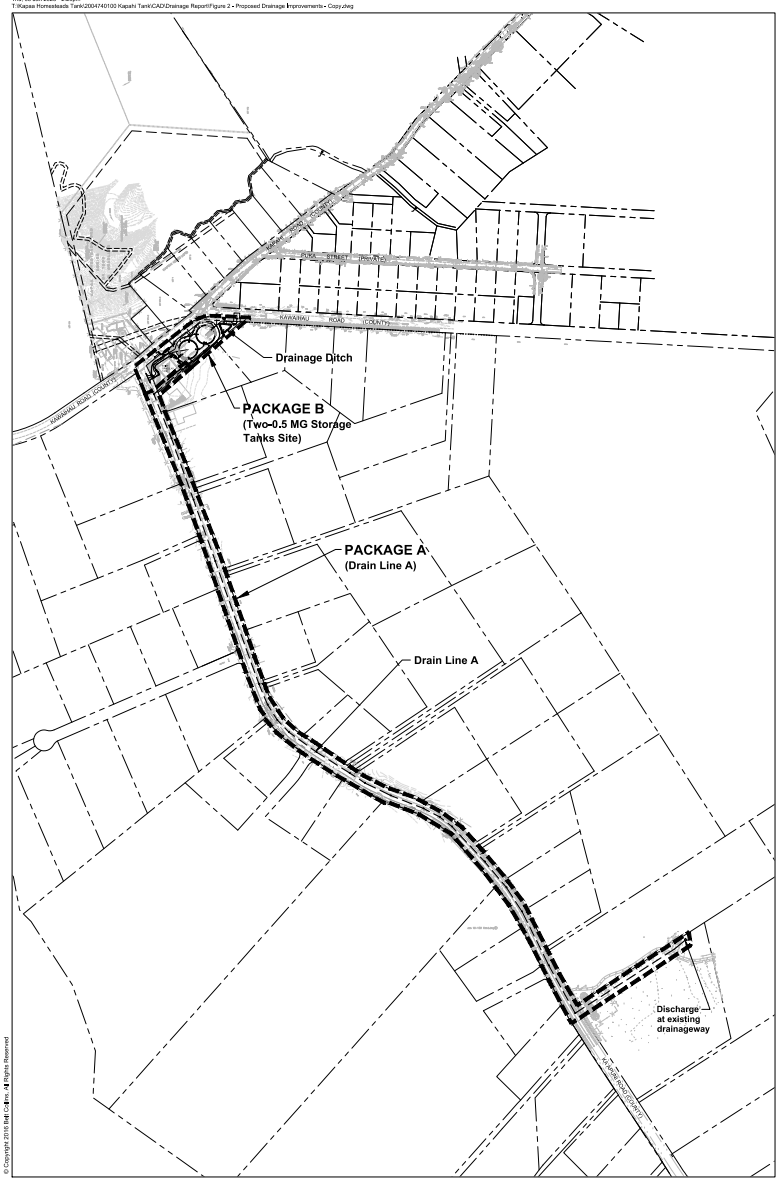


Figure 2
PROJECT AREA AND PROPOSED DRAINAGE IMPROVEMENTS
KAPA'A HOMESTEADS 325' TANKS, TWO 0.5 MG TANKS
KAPA'A, KAUA'I
JANUARY 2023

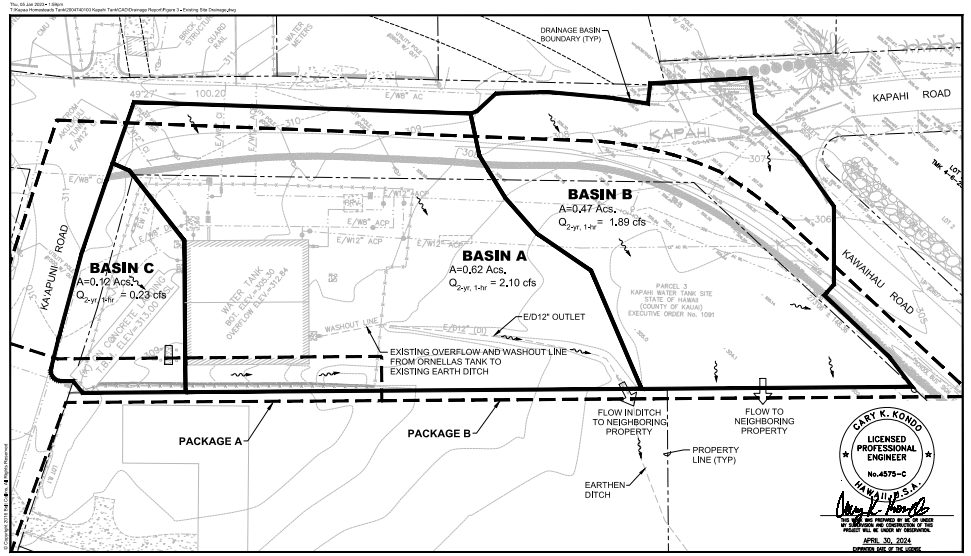


Figure 3
EXISTING SITE DRAINAGE
KAPA'A HOMESTEADS 325' TANKS, TWO 0.5 MG TANKS
KAPA'A, KAUA'I
JANUARY 2023

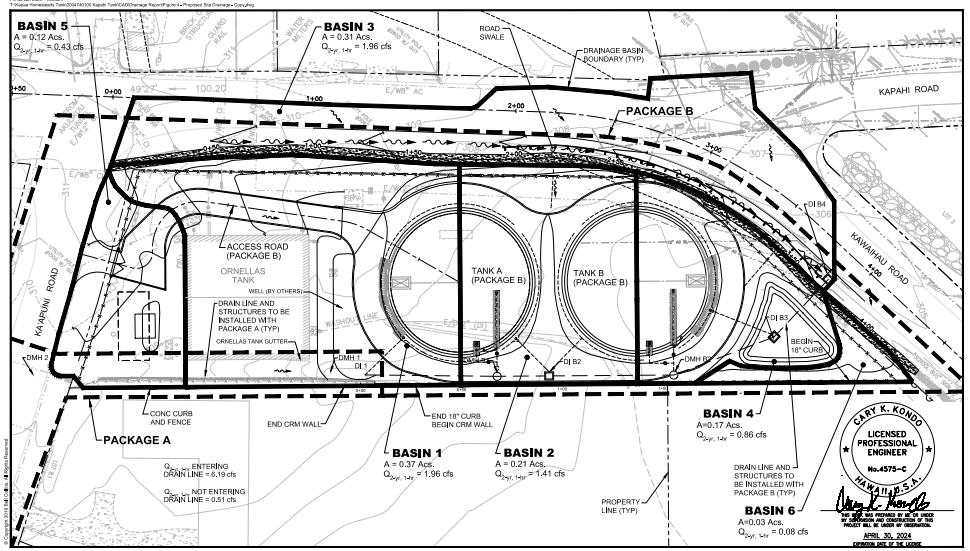


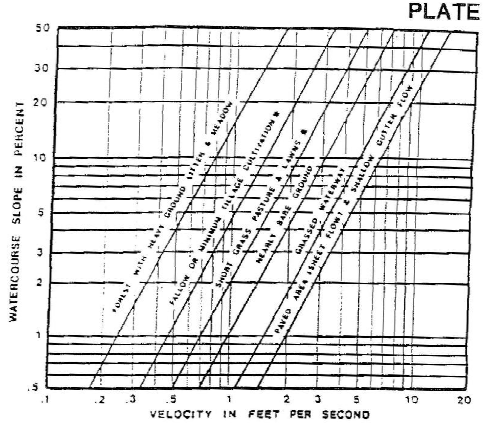
Figure 4
PROPOSED SITE DRAINAGE
KAPA'A HOMESTEADS 325' TANKS, TWO 0.5 MG TANKS
KAPA'A, KAUA'I
JANUARY 2023

APPENDIX A

PLATES

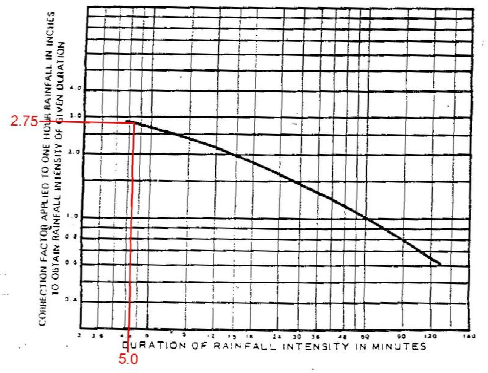
From the Storm Water Runoff System Manual

PLATE 1



ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

PLATE 2



CORRECTION FACTOR

FOR CONVERTING 1 HR. RAINFALL TO RAINFALL INTENSITY OF VARIOUS DURATIONS

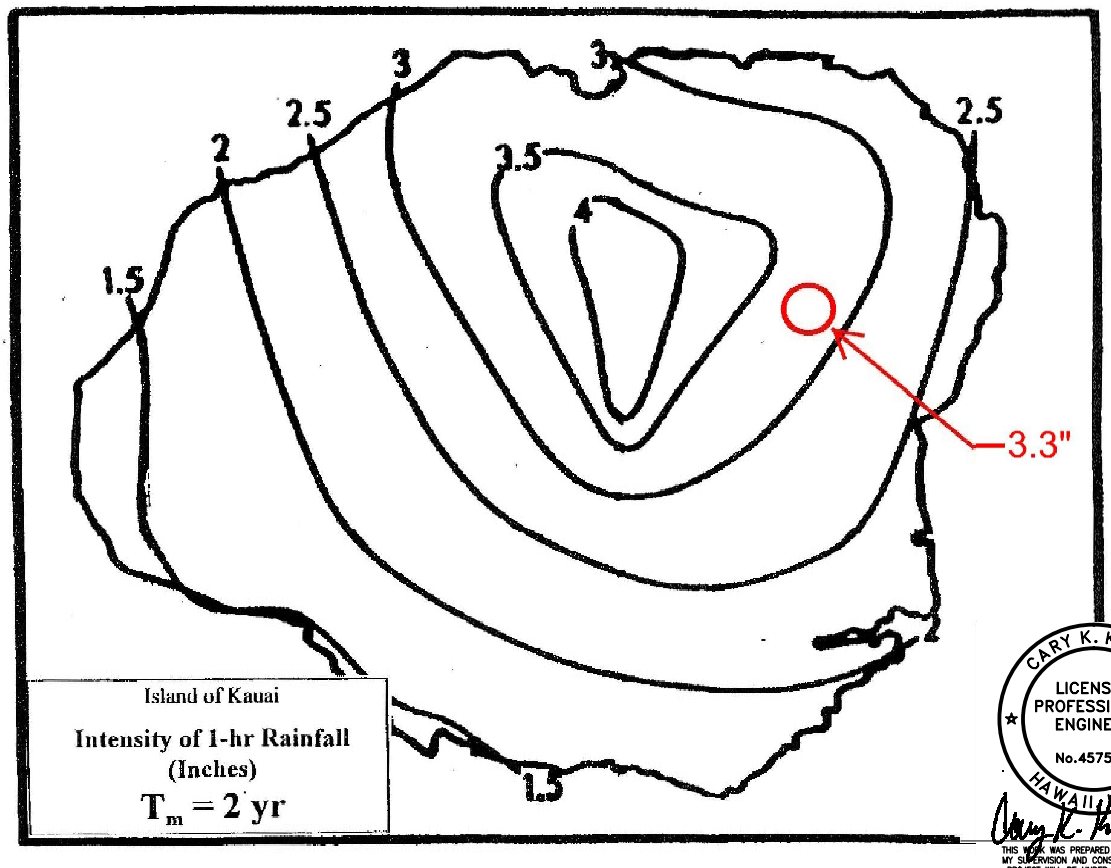
TO BE USED FOR AREA LESS THAN 100 ACRES

CARY K. KONDO
LICENSED PROFESSIONAL ENGINEER
No. 4575-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

APRIL 30, 2018
EXPIRATION DATE OF THE LICENSE

PLATE 3

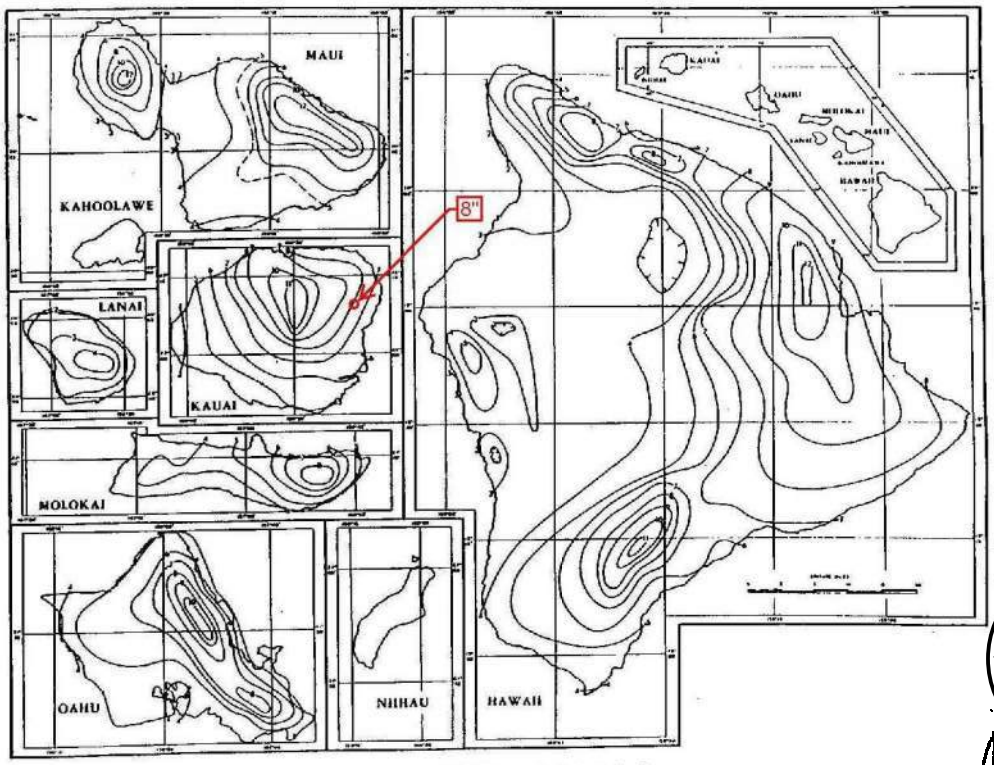


CARY K. KONDO
LICENSED PROFESSIONAL ENGINEER
No.4575-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

APRIL 30, 2018
EXPIRATION DATE OF THE LICENSE

PLATE 5



2-Year 24-Hour Rainfall (in.)

CARY K. KONDO
LICENSED PROFESSIONAL ENGINEER
No.4575-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

APRIL 30, 2018
EXPIRATION DATE OF THE LICENSE

APPENDIX B

DRAIN LINE CALCULATIONS

Belt Collins Hawaii LLC

PROJECT: Kapahi Homesteads Two-0.5 MG Storage Tanks DATE: 1/5/23
CLIENT: Department of Water
SUBJECT: **Drain Line Calcs for 2 yr, 1 hr storm**
FILE: T:\Kapaa Homesteads Tank\2004740100 Kapahi Tank\Design\Calculations\Drainage\2021 Design\[basedon20210527 Drain Line_12 inch.xls]Road D18" Site D12" (2)

DRAINAGE DESIGN DATA
Rational Method

Kapahi Road Drain Line

Inlet	STA	Tm (yr)	Runoff Q (cfs)	Accumulated Q (cfs)	Dn	Vf (fps)	Vn (fps)	Pipe Size (in)	Pipe Length (ft)	Sf	S	Invert Elevation In (ft)	Invert Elevation Out (ft)	Hf	H	Ent Control	Ent Control	DOWN 1.00	DOWN 2.00	UP ENT	UP OUT	UP 1.00	UP 2.00	Hydraulic Grade Elevation DOWN	Hydraulic Grade Elevation UP	Finished Grade Elev	Free Board (ft)	Minimum Cover (ft)	Calculated Cover (ft)	Pipe Capacity (cfs)
OUTLET	34+83											203.00	203.00			*TW Elevation @ Outlet (say higher than finished grade elevation) =*									210.00	206.0	-4.00	2.00	1.50	
		2	0.00	6.19	0.34	3.50	20.86	18	184	0.003	0.240			0.54	44.17									247.51						55.91
DMH 24	35+49											247.17	247.17			1.49	1.60	210.54	247.51	248.77	210.83	247.59	248.68		248.77	254.0	5.23	2.00	5.33	
		2	0.00	6.19	0.99	3.50	5.03	18	250	0.003	0.005			0.74	1.25									249.51						8.07
DMH 23	32+99											248.42	248.42			1.49	1.60	249.51	249.41	250.02	249.79	249.60	249.83		250.02	258.0	7.98	2.00	8.08	
		2	0.00	6.19	0.97	3.50	5.16	18	148	0.003	0.005			0.44	0.79									250.48						8.32
DMH 22	31+51											253.18	249.21			1.49	1.60	250.46	250.18	250.81	250.74	250.57	250.74		250.81	257.8	6.99	2.00	3.12	
		2	0.00	6.19	0.99	3.50	5.03	18	210	0.003	0.005			0.62	1.05									255.22						8.07
DMH 21	29+41											254.23	254.23			1.49	1.60	251.43	255.22	255.83	251.71	255.30	255.74		255.82	260.0	4.16	2.00	4.26	
		2	0.00	6.19	0.99	3.50	5.03	18	230	0.003	0.005			0.68	1.15									256.51						8.07
DMH 20	27+11											255.38	255.38			1.49	1.60	256.51	256.37	256.98	256.79	256.60	256.89		256.98	262.4	5.40	2.00	5.50	
		2	0.00	6.19	0.99	3.50	5.03	18	110	0.003	0.005			0.33	0.55									257.31						8.07
DMH 19	26+01											255.93	255.93			1.49	1.60	257.31	256.92	257.53	257.59	257.39	257.44		257.59	263.8	6.33	2.00	6.49	
		2	0.00	6.19	0.99	3.50	5.03	18	130	0.003	0.005			0.38	0.65									257.97						8.07
DMH 18	24+71											256.58	256.58			1.49	1.60	257.97	257.57	258.18	258.26	258.06	258.09		258.26	265.0	6.70	2.00	6.88	
		2	0.00	6.19	0.98	3.50	5.04	18	183	0.003	0.005			0.54	0.92									258.86						8.09
DMH 17 (DROP)	22+88											262.44	257.50			1.49	1.60	258.80	258.48	259.10	259.08	258.88	259.01		259.10	266.1	6.99	2.00	2.15	
		2	0.00	6.19	0.88	3.50	5.75	18	60	0.003	0.007			0.18	0.42									263.74						9.55
DMH 16	22+28											262.86	262.86			1.49	1.60	259.28	263.74	264.46	259.56	263.83	264.37		264.46	266.7	2.24	2.00	2.34	
		2	0.00	6.19	0.99	3.50	5.04	18	70	0.003	0.005			0.21	0.35									264.67						8.07
DMH 15	21+58											263.21	263.21			1.49	1.60	264.67	264.20	264.81	264.95	264.75	264.72		264.95	267.8	2.85	2.00	3.09	
		2	0.00	6.19	0.71	3.50	7.48	18	135	0.003	0.014			0.40	1.89									265.81						13.50
DMH 14	20+23											265.10	265.10			1.49	1.60	265.35	265.81	266.70	265.63	265.90	266.81		266.70	268.9	2.20	2.00	2.30	
		2	0.00	6.19	0.88	3.50	5.72	18	110	0.003	0.007			0.33	0.76									267.03						9.48
DMH 13	19+13											265.86	265.86			1.49	1.60	267.03	266.74	267.46	267.31	267.11	267.37		267.46	269.9	2.48	2.00	2.58	
		2	0.00	6.19	0.70	3.50	7.67	18	70	0.003	0.015			0.21	1.05									267.67						13.97
DMH 12	18+43											266.91	266.91			1.49	1.60	267.67	267.61	268.51	267.95	267.75	268.42		268.51	271.0	2.44	2.00	2.54	
		2	0.00	6.19	0.65	3.50	8.54	18	150	0.003	0.020			0.00	3.00									270.06						16.14
DMH 11	16+93											269.91	269.91			1.49	1.60	268.51	270.56	271.51	269.24	270.64	271.42		271.51	274.2	2.69	2.00	2.79	
		2	0.00	6.19	0.75	3.50	7.04	18	130	0.003	0.012			0.38	1.55									272.21						12.46
DMH 10	15+63											271.46	271.46			1.49	1.60	271.89	272.21	273.06	272.18	272.29	272.97		273.00	275.5	2.40	2.00	2.50	

Belt Collins Hawaii LLC

PROJECT: Kapahi Homesteads Two-0.5 MG Storage Tanks DATE: 1/5/23
CLIENT: Department of Water
SUBJECT: **Drain Line Calcs for 2 yr, 1 hr storm**
FILE: T:\Kapaa Homesteads Tank\2004740100 Kapahi Tank\Design\Calculations\Drainage\2021 Design\[basedon20210527 Drain Line_12 inch.xls]Road D18" Site D12" (2)

DRAINAGE DESIGN DATA
Rational Method

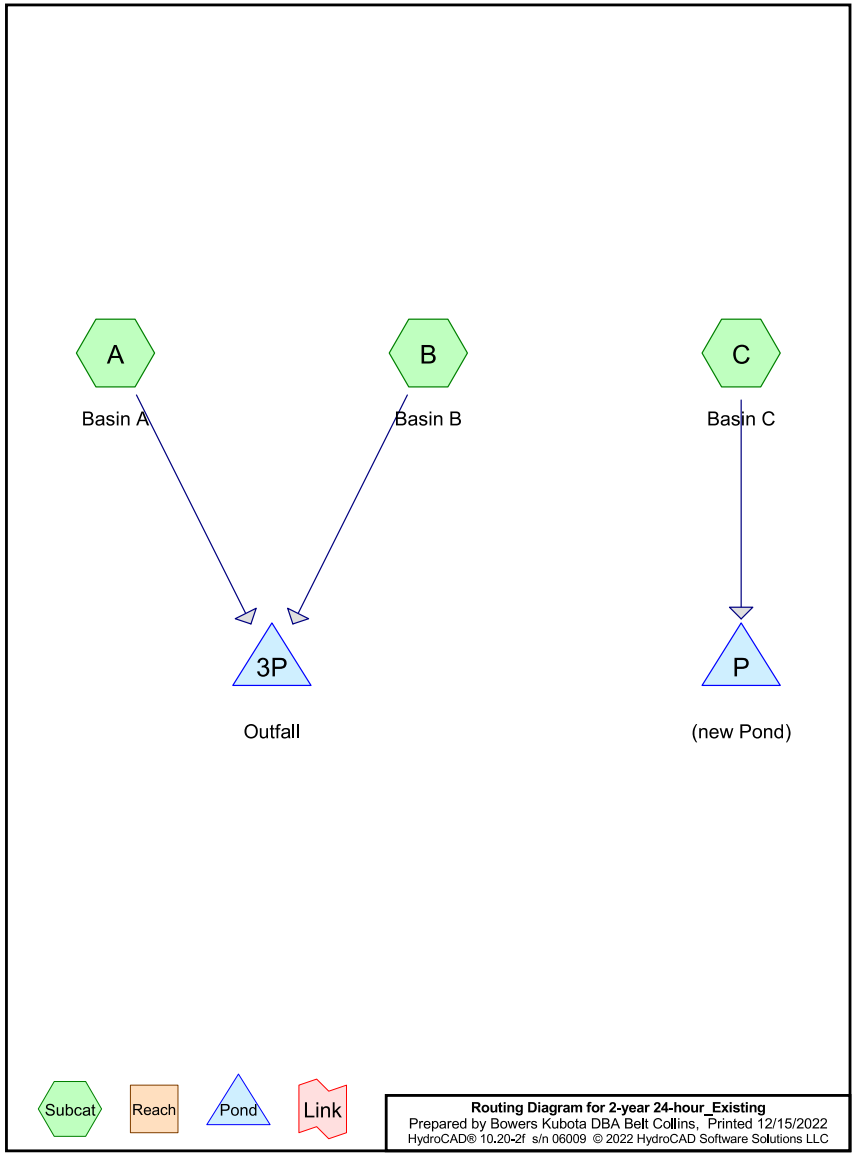
Inlet	STA	Tm (yr)	Runoff Q (cfs)	Accumulated Q (cfs)	Dn	Vf (fps)	Vn (fps)	Pipe Size (in)	Pipe Length (ft)	Sf	S	Invert Elevation In (ft)	Invert Elevation Out (ft)	Hf	H	Ent Control	Ent Control	DOWN 1.00	DOWN 2.00	UP ENT	UP OUT	UP 1.00	UP 2.00	Hydraulic Grade Elevation DOWN	Hydraulic Grade Elevation UP	Finished Grade Elev	Free Board (ft)	Minimum Cover (ft)	Calculated Cover (ft)	Pipe Capacity (cfs)
		2	0.00	6.19	0.99	3.50	5.00	18	65	0.003	0.005			0.19	0.32									273.25						8.01
DMH 9	14+98											271.78	271.78			1.49	1.60	273.25	272.77	273.38	273.54	273.34	273.29		273.54	277.5	3.95	2.00	4.21	
		2	0.00	6.19	0.99	3.50	5.03	18	70	0.003	0.005			0.21	0.35									273.74						8.07
DMH 8	14+28											**275.23**	**272.13**			1.49	1.60	273.74	273.12	273.73	274.03	273.83	273.84		274.03	279.0	4.97	2.00	2.27	
		2	0.00	6.19	0.65	3.50	8.54	18	85	0.003	0.020			0.25	1.70									277.58						16.14
DMH 7	13+43											**276.93**	**276.93**			1.49	1.60	274.28	277.58	278.53	274.56	277.69	278.46		278.53	281.0	2.48	2.00	2.58	
		2	0.00	6.19	0.70	3.50	7.67	18	250	0.003	0.015			0.74	3.75									281.38						13.97
DMH 6	10+93											**280.68**	**280.68**			1.49	1.60	279.27	281.38	282.28	279.55	281.46	282.18		282.28	284.4	2.13	2.00	2.23	
		2	0.00	6.19	0.62	3.50	8.98	18	250	0.003	0.023			0.74	5.75									287.08						17.30
DMH 5	8+43											**286.43**	**286.43**			1.49	1.20	283.02	287.05	287.63	283.30	287.13	287.93		287.63	294.8	7.17	2.00	6.87	
		2	0.00	6.19	0.61	3.50	9.26	18	250	0.003	0.025			0.74	6.25									293.26						18.04
DMH 4	5+93											**292.68**	**292.68**			1.49	1.20	288.37	293.29	293.88	288.65	293.37	294.18		293.88	296.4	2.47	2.00	2.17	
		2	0.00	6.19	0.75	3.50	7.03	18	250	0.003	0.012			0.74	2.96									296.39						12.42
DMH 3	3+43											**295.64**	**295.64**			1.49	1.20	294.62	296.39	296.84	294.90	296.47	297.14		296.84	304.7	7.90	2.00	7.60	
		2	0.00	6.19	0.99	3.50	5.01	18	182	0.003	0.005			0.54	0.90									297.53						8.02
DMH 2	1+61											**296.54**	**296.54**			1.49	1.20	297.38	297.53	297.74	297.66	297.61	298.34		297.74	309.0	11.27	2.00	10.97	
		2	0.00	6.19	0.99	3.50	5.03	18	146	0.003	0.005			0.43	0.73									298.31						8.07
DMH 1	0+15											**297.27**	**297.27**			1.49	1.00	297.38	297.53	298.27	297.66	297.64	298.80		298.27	305.5	**7.23**	2.00	6.73	
		2	1.96	6.19	0.79	3.50	6.59	18	15	0.003	0.010			0.04	0.15									298.31						11.41
DI 1	0+00											**297.42**	**297.42**			1.49	0.80	298.31	298.21	298.22	298.60	298.48	298.51		298.60	305.5	**6.90**	2.00	6.58	
		2	0.00	4.23	0.63	2.39	5.98	**18**	68	0.001	0.010			0.09	0.68									298.73						11.41
DMH B1	-0+68											**298.10**	**298.10**			1.17	0.80	298.69	298.73	298.90	298.83	298.90	299.27		298.90	305.50	**6.60**	2.00	5.90	
		2	1.41	4.23	0.63	2.39	5.98	**18**	26	0.001	0.010			0.04	0.26									298.98						11.41
DI B2	-0+94											**298.36**	**298.36**			1.17	0.80	298.94	298.99	299.16	299.07	299.20	299.53		299.16	305.10	**5.94**	2.00	5.24	
		2	0.00	2.82	0.51	1.60	5.35	**18**	62	0.001	0.010			0.04	0.62									299.49						11.41
DMH B2 (12" in, 18" out)	-1+56											**299.48**	**298.98**			0.91	0.80	299.20	299.49	299.78	299.26	299.55	299.89		299.78	305.25	**5.47**	2.00	4.77	
		2	0.86	2.82	0.60	3.59	5.76	**12**	53	0.005	0.012			0.28	0.63									300.71						4.22
DI B3	-2+09											**300.11**	**300.11**			1.16	0.80	300.06	300.71	300.91	300.36	300.87	301.27		300.91	303.75	**2.84**	2.00	2.64	
		2	1.96	1.96	0.50	2.50	4.94	**12**	39	0.003	0.010			0.10	0.39									301.01						3.87
DI B4	-2+48											**300.50**	**300.50**			0.91	0.80	301.01	301.00	301.30	301.15	301.26	301.41		301.30	304.50	**3.20**	2.00	3.00	

APPENDIX C

RUNOFF CALCULATIONS

2-Year, 24-Hour

EXISTING CONDITIONS



Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type I 24-hr		Default	24.00	1	8.00	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.878	69	50-75% Grass cover, Fair, HSG B (A, B, C)
0.332	98	Paved parking, HSG B (A, B, C)
1.210	**77**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
1.210	HSG B	A, B, C
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.210		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.878	0.000	0.000	0.000	0.878	50-75% Grass cover, Fair	A, B, C
0.000	0.332	0.000	0.000	0.000	0.332	Paved parking	A, B, C
0.000	**1.210**	**0.000**	**0.000**	**0.000**	**1.210**	**TOTAL AREA**	

Time span=0.00-28.00 hrs, dt=0.01 hrs, 2801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Basin A Runoff Area=0.620 ac 25.81% Impervious Runoff Depth=5.16"
Tc=5.0 min CN=76 Runoff=2.70 cfs 0.266 af

Subcatchment B: Basin B Runoff Area=0.470 ac 36.17% Impervious Runoff Depth=5.51"
Flow Length=200' Tc=6.0 min CN=79 Runoff=2.15 cfs 0.216 af

Subcatchment C: Basin C Runoff Area=0.120 ac 1.67% Impervious Runoff Depth=4.35"
Tc=5.0 min CN=69 Runoff=0.43 cfs 0.043 af

Pond 3P: Outfall Inflow=4.84 cfs 0.482 af
Primary=4.84 cfs 0.482 af

Pond P: (new Pond) Inflow=0.43 cfs 0.043 af
Primary=0.43 cfs 0.043 af

Total Runoff Area = 1.210 ac Runoff Volume = 0.526 af Average Runoff Depth = 5.21"
72.56% Pervious = 0.878 ac 27.44% Impervious = 0.332 ac

Summary for Subcatchment A: Basin A

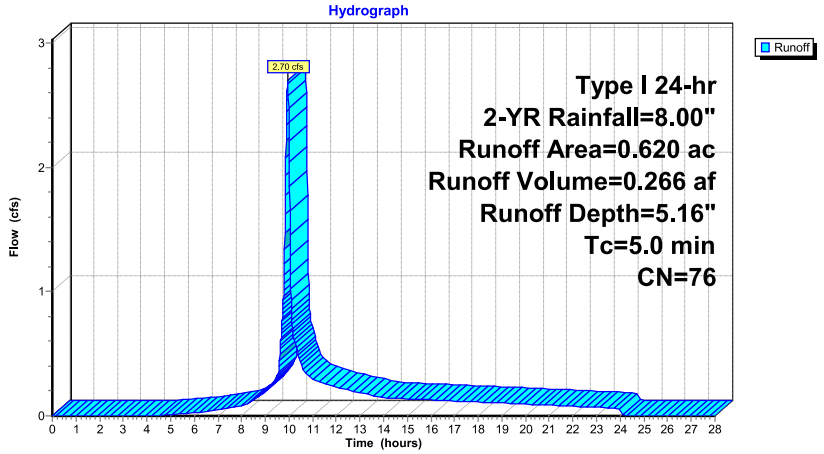
Runoff = 2.70 cfs @ 9.95 hrs, Volume= 0.266 af, Depth= 5.16"
Routed to Pond 3P : Outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

Area (ac)	CN	Description
0.460	69	50-75% Grass cover, Fair, HSG B
0.160	98	Paved parking, HSG B
0.620	76	Weighted Average
0.460		74.19% Pervious Area
0.160		25.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Win TR-55 TC**

Subcatchment A: Basin A



Hydrograph for Subcatchment A: Basin A

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	5.16	0.00
0.50	0.07	0.00	0.00	26.50	8.00	5.16	0.00
1.00	0.14	0.00	0.00	27.00	8.00	5.16	0.00
1.50	0.21	0.00	0.00	27.50	8.00	5.16	0.00
2.00	0.28	0.00	0.00	28.00	8.00	5.16	0.00
2.50	0.35	0.00	0.00				
3.00	0.43	0.00	0.00				
3.50	0.52	0.00	0.00				
4.00	0.61	0.00	0.00				
4.50	0.70	0.00	0.00				
5.00	0.80	0.01	0.01				
5.50	0.90	0.02	0.02				
6.00	1.00	0.04	0.02				
6.50	1.11	0.06	0.04				
7.00	1.25	0.10	0.05				
7.50	1.40	0.15	0.06				
8.00	1.55	0.21	0.08				
8.50	1.75	0.29	0.13				
9.00	2.03	0.43	0.20				
9.50	2.42	0.65	**0.32**				
10.00	4.12	1.83	**2.36**				
10.50	4.66	2.26	0.42				
11.00	4.98	2.52	0.30				
11.50	5.24	2.74	0.26				
12.00	5.47	2.93	0.23				
12.50	5.67	3.10	0.21				
13.00	5.86	3.26	0.19				
13.50	6.02	3.40	0.17				
14.00	6.16	3.52	0.15				
14.50	6.29	3.63	0.14				
15.00	6.42	3.74	0.14				
15.50	6.54	3.85	0.13				
16.00	6.66	3.95	0.13				
16.50	6.77	4.05	0.12				
17.00	6.88	4.15	0.12				
17.50	6.99	4.24	0.12				
18.00	7.09	4.34	0.11				
18.50	7.19	4.42	0.11				
19.00	7.28	4.51	0.10				
19.50	7.37	4.59	0.10				
20.00	7.46	4.67	0.10				
20.50	7.54	4.74	0.09				
21.00	7.62	4.81	0.09				
21.50	7.69	4.88	0.08				
22.00	7.76	4.94	0.08				
22.50	7.83	5.00	0.07				
23.00	7.89	5.06	0.07				
23.50	7.95	5.11	0.06				
24.00	**8.00**	**5.16**	0.06				
24.50	8.00	5.16	0.00				
25.00	8.00	5.16	0.00				
25.50	8.00	5.16	0.00				

Summary for Subcatchment B: Basin B

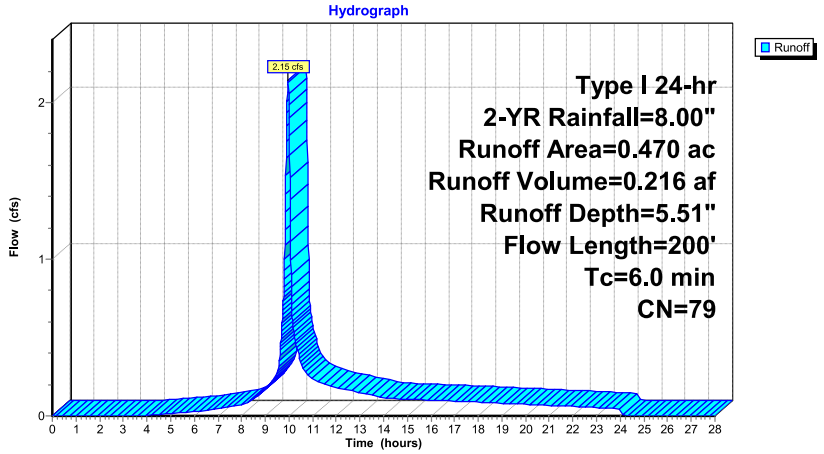
Runoff = 2.15 cfs @ 9.96 hrs, Volume= 0.216 af, Depth= 5.51"
Routed to Pond 3P : Outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

Area (ac)	CN	Description
0.300	69	50-75% Grass cover, Fair, HSG B
0.170	98	Paved parking, HSG B
0.470	79	Weighted Average
0.300		63.83% Pervious Area
0.170		36.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	200		0.56		**Direct Entry,**

Subcatchment B: Basin B



Hydrograph for Subcatchment B: Basin B

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	5.51	0.00
0.50	0.07	0.00	0.00	26.50	8.00	5.51	0.00
1.00	0.14	0.00	0.00	27.00	8.00	5.51	0.00
1.50	0.21	0.00	0.00	27.50	8.00	5.51	0.00
2.00	0.28	0.00	0.00	28.00	8.00	5.51	0.00
2.50	0.35	0.00	0.00				
3.00	0.43	0.00	0.00				
3.50	0.52	0.00	0.00				
4.00	0.61	0.00	0.00				
4.50	0.70	0.01	0.01				
5.00	0.80	0.02	0.02				
5.50	0.90	0.04	0.02				
6.00	1.00	0.07	0.03				
6.50	1.11	0.10	0.04				
7.00	1.25	0.15	0.05				
7.50	1.40	0.21	0.06				
8.00	1.55	0.28	0.07				
8.50	1.75	0.38	0.11				
9.00	2.03	0.54	0.17				
9.50	2.42	0.79	**0.27**				
10.00	4.12	2.06	**1.99**				
10.50	4.66	2.51	0.34				
11.00	4.98	2.79	0.24				
11.50	5.24	3.01	0.21				
12.00	5.47	3.21	0.18				
12.50	5.67	3.39	0.16				
13.00	5.86	3.55	0.15				
13.50	6.02	3.70	0.13				
14.00	6.16	3.82	0.12				
14.50	6.29	3.94	0.11				
15.00	6.42	4.05	0.11				
15.50	6.54	4.16	0.10				
16.00	6.66	4.27	0.10				
16.50	6.77	4.37	0.10				
17.00	6.88	4.47	0.09				
17.50	6.99	4.57	0.09				
18.00	7.09	4.66	0.09				
18.50	7.19	4.75	0.08				
19.00	7.28	4.84	0.08				
19.50	7.37	4.92	0.08				
20.00	7.46	5.00	0.07				
20.50	7.54	5.08	0.07				
21.00	7.62	5.15	0.07				
21.50	7.69	5.22	0.06				
22.00	7.76	5.28	0.06				
22.50	7.83	5.35	0.06				
23.00	7.89	5.40	0.05				
23.50	7.95	5.46	0.05				
24.00	**8.00**	**5.51**	0.05				
24.50	8.00	5.51	0.00				
25.00	8.00	5.51	0.00				
25.50	8.00	5.51	0.00				

Summary for Subcatchment C: Basin C

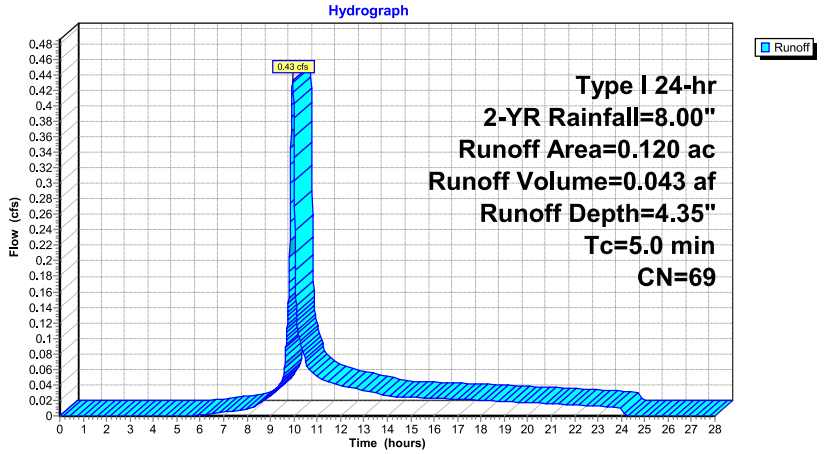
Runoff = 0.43 cfs @ 9.95 hrs, Volume= 0.043 af, Depth= 4.35"
Routed to Pond P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

Area (ac)	CN	Description
0.118	69	50-75% Grass cover, Fair, HSG B
0.002	98	Paved parking, HSG B
0.120	69	Weighted Average
0.118		98.33% Pervious Area
0.002		1.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment C: Basin C



Hydrograph for Subcatchment C: Basin C

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	4.35	0.00
0.50	0.07	0.00	0.00	26.50	8.00	4.35	0.00
1.00	0.14	0.00	0.00	27.00	8.00	4.35	0.00
1.50	0.21	0.00	0.00	27.50	8.00	4.35	0.00
2.00	0.28	0.00	0.00	28.00	8.00	4.35	0.00
2.50	0.35	0.00	0.00				
3.00	0.43	0.00	0.00				
3.50	0.52	0.00	0.00				
4.00	0.61	0.00	0.00				
4.50	0.70	0.00	0.00				
5.00	0.80	0.00	0.00				
5.50	0.90	0.00	0.00				
6.00	1.00	0.00	0.00				
6.50	1.11	0.01	0.00				
7.00	1.25	0.03	0.00				
7.50	1.40	0.05	0.01				
8.00	1.55	0.08	0.01				
8.50	1.75	0.14	0.02				
9.00	2.03	0.23	0.03				
9.50	2.42	0.39	**0.05**				
10.00	4.12	1.35	**0.38**				
10.50	4.66	1.72	0.07				
11.00	4.98	1.95	0.05				
11.50	5.24	2.14	0.04				
12.00	5.47	2.31	0.04				
12.50	5.67	2.46	0.04				
13.00	5.86	2.60	0.03				
13.50	6.02	2.73	0.03				
14.00	6.16	2.84	0.03				
14.50	6.29	2.94	0.02				
15.00	6.42	3.04	0.02				
15.50	6.54	3.14	0.02				
16.00	6.66	3.23	0.02				
16.50	6.77	3.33	0.02				
17.00	6.88	3.42	0.02				
17.50	6.99	3.50	0.02				
18.00	7.09	3.59	0.02				
18.50	7.19	3.67	0.02				
19.00	7.28	3.74	0.02				
19.50	7.37	3.82	0.02				
20.00	7.46	3.89	0.02				
20.50	7.54	3.96	0.02				
21.00	7.62	4.03	0.02				
21.50	7.69	4.09	0.01				
22.00	7.76	4.15	0.01				
22.50	7.83	4.20	0.01				
23.00	7.89	4.25	0.01				
23.50	7.95	4.30	0.01				
24.00	**8.00**	**4.35**	0.01				
24.50	8.00	4.35	0.00				
25.00	8.00	4.35	0.00				
25.50	8.00	4.35	0.00				

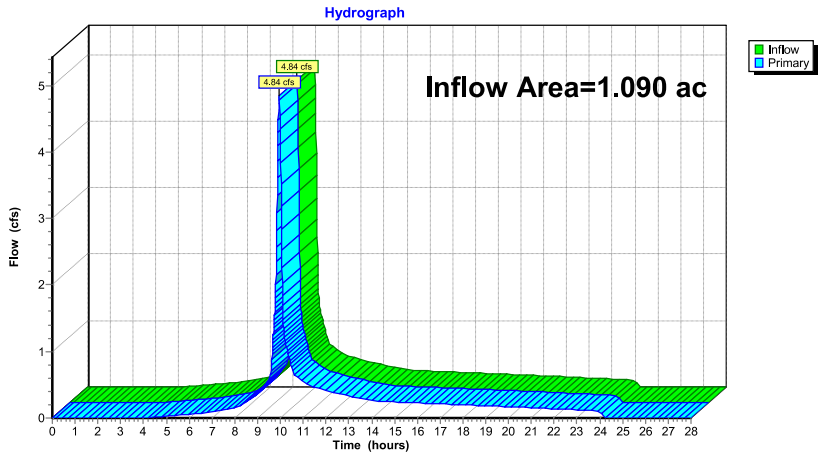
Summary for Pond 3P: Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.090 ac, 30.28% Impervious, Inflow Depth = 5.31" for 2-YR event
Inflow = 4.84 cfs @ 9.95 hrs, Volume= 0.482 af
Primary = 4.84 cfs @ 9.95 hrs, Volume= 0.482 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Pond 3P: Outfall



Hydrograph for Pond 3P: Outfall

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00		0.00	26.00	0.00		0.00
0.50	0.00		0.00	26.50	0.00		0.00
1.00	0.00		0.00	27.00	0.00		0.00
1.50	0.00		0.00	27.50	0.00		0.00
2.00	0.00		0.00	28.00	0.00		0.00
2.50	0.00		0.00				
3.00	0.00		0.00				
3.50	0.00		0.00				
4.00	0.00		0.00				
4.50	0.01		0.01				
5.00	0.03		0.03				
5.50	0.04		0.04				
6.00	0.05		0.05				
6.50	0.07		0.07				
7.00	0.10		0.10				
7.50	0.13		0.13				
8.00	0.15		0.15				
8.50	0.24		0.24				
9.00	0.36		0.36				
9.50	**0.59**		**0.59**				
10.00	**4.35**		**4.35**				
10.50	0.77		0.77				
11.00	0.53		0.53				
11.50	0.47		0.47				
12.00	0.41		0.41				
12.50	0.37		0.37				
13.00	0.34		0.34				
13.50	0.30		0.30				
14.00	0.26		0.26				
14.50	0.25		0.25				
15.00	0.24		0.24				
15.50	0.24		0.24				
16.00	0.23		0.23				
16.50	0.22		0.22				
17.00	0.21		0.21				
17.50	0.21		0.21				
18.00	0.20		0.20				
18.50	0.19		0.19				
19.00	0.18		0.18				
19.50	0.18		0.18				
20.00	0.17		0.17				
20.50	0.16		0.16				
21.00	0.15		0.15				
21.50	0.15		0.15				
22.00	0.14		0.14				
22.50	0.13		0.13				
23.00	0.12		0.12				
23.50	0.11		0.11				
24.00	0.11		0.11				
24.50	0.00		0.00				
25.00	0.00		0.00				
25.50	0.00		0.00				

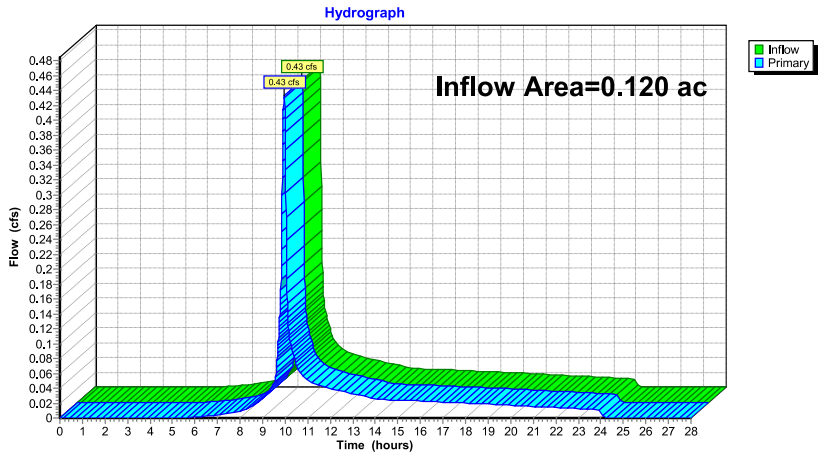
Summary for Pond P: (new Pond)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.120 ac, 1.67% Impervious, Inflow Depth = 4.35" for 2-YR event
Inflow = 0.43 cfs @ 9.95 hrs, Volume= 0.043 af
Primary = 0.43 cfs @ 9.95 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Pond P: (new Pond)



Hydrograph for Pond P: (new Pond)

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00		0.00	26.00	0.00		0.00
0.50	0.00		0.00	26.50	0.00		0.00
1.00	0.00		0.00	27.00	0.00		0.00
1.50	0.00		0.00	27.50	0.00		0.00
2.00	0.00		0.00	28.00	0.00		0.00
2.50	0.00		0.00				
3.00	0.00		0.00				
3.50	0.00		0.00				
4.00	0.00		0.00				
4.50	0.00		0.00				
5.00	0.00		0.00				
5.50	0.00		0.00				
6.00	0.00		0.00				
6.50	0.00		0.00				
7.00	0.00		0.00				
7.50	0.01		0.01				
8.00	0.01		0.01				
8.50	0.02		0.02				
9.00	0.03		0.03				
9.50	**0.05**		**0.05**				
10.00	**0.38**		**0.38**				
10.50	0.07		0.07				
11.00	0.05		0.05				
11.50	0.04		0.04				
12.00	0.04		0.04				
12.50	0.04		0.04				
13.00	0.03		0.03				
13.50	0.03		0.03				
14.00	0.03		0.03				
14.50	0.02		0.02				
15.00	0.02		0.02				
15.50	0.02		0.02				
16.00	0.02		0.02				
16.50	0.02		0.02				
17.00	0.02		0.02				
17.50	0.02		0.02				
18.00	0.02		0.02				
18.50	0.02		0.02				
19.00	0.02		0.02				
19.50	0.02		0.02				
20.00	0.02		0.02				
20.50	0.02		0.02				
21.00	0.02		0.02				
21.50	0.01		0.01				
22.00	0.01		0.01				
22.50	0.01		0.01				
23.00	0.01		0.01				
23.50	0.01		0.01				
24.00	0.01		0.01				
24.50	0.00		0.00				
25.00	0.00		0.00				
25.50	0.00		0.00				

Events for Subcatchment A: Basin A

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-YR	**8.00**	**2.70**	**0.266**	**5.16**

Events for Subcatchment B: Basin B

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-YR	**8.00**	**2.15**	**0.216**	**5.51**

Events for Subcatchment C: Basin C

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-YR	**8.00**	**0.43**	**0.043**	**4.35**

Events for Pond 3P: Outfall

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-YR	**4.84**	**4.84**	**0.00**	**0.000**

Events for Pond P: (new Pond)

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-YR	**0.43**	**0.43**	**0.00**	**0.000**

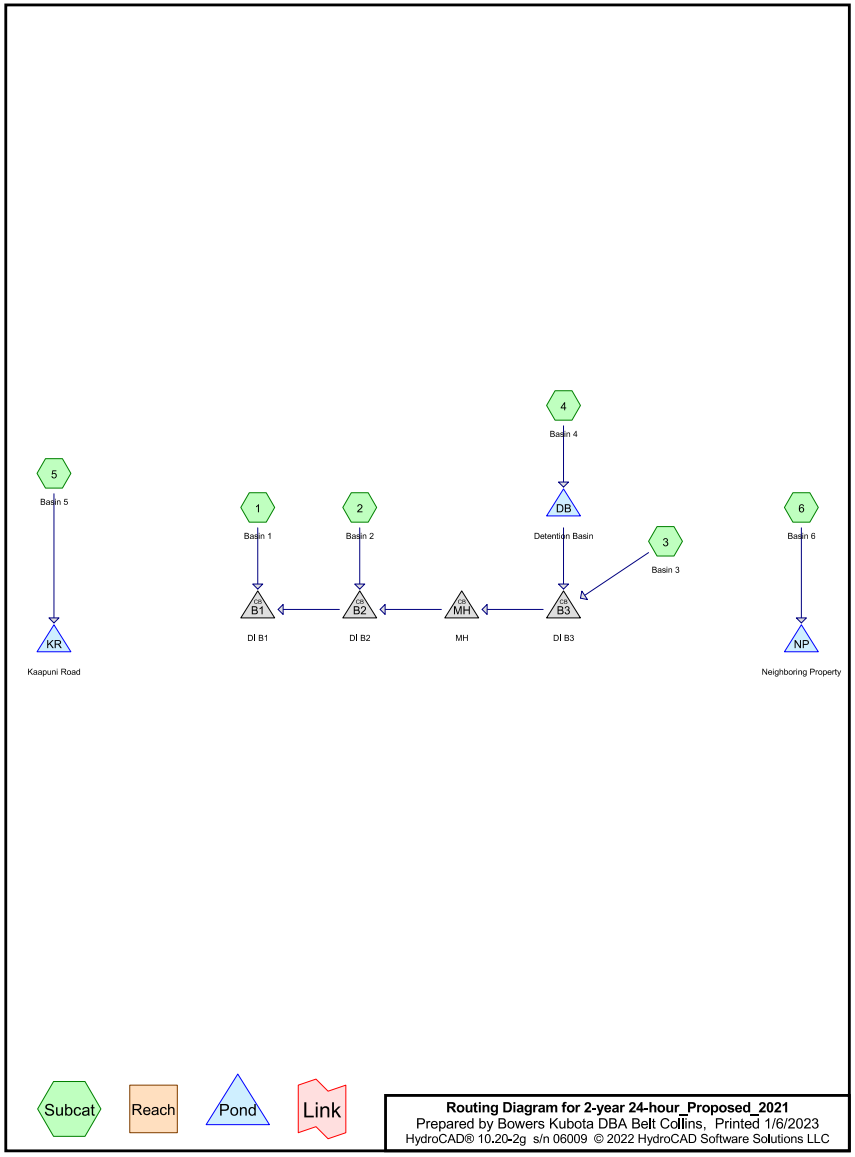
TABLE OF CONTENTS

Project Reports
1 Routing Diagram
2 Rainfall Events Listing (selected events)
3 Area Listing (all nodes)
4 Soil Listing (all nodes)
5 Ground Covers (all nodes)

2-YR Event
6 Node Listing
7 Subcat A: Basin A
9 Subcat B: Basin B
11 Subcat C: Basin C
13 Pond 3P: Outfall
15 Pond P: (new Pond)

Multi-Event Tables
17 Subcat A: Basin A
18 Subcat B: Basin B
19 Subcat C: Basin C
20 Pond 3P: Outfall
21 Pond P: (new Pond)

PROPOSED CONDITIONS



Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type I 24-hr		Default	24.00	1	8.00	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.417	69	Grass (1, 2, 3, 4, 5, 6)
0.230	71	Grass Cell Pavement (1, 2, 4, 5)
0.564	98	Pavement (1, 2, 3, 4, 5, 6)
1.211	**83**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
1.211	Other	1, 2, 3, 4, 5, 6
1.211		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.417	0.417	Grass	1, 2, 3, 4, 5, 6
0.000	0.000	0.000	0.000	0.230	0.230	Grass Cell Pavement	1, 2, 4, 5
0.000	0.000	0.000	0.000	0.564	0.564	Pavement	1, 2, 3, 4, 5, 6
0.000	**0.000**	**0.000**	**0.000**	**1.211**	**1.211**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	B1	297.42	297.27	15.0	0.0100	0.012	0.0	18.0	0.0
2	B2	298.36	298.10	26.0	0.0100	0.012	0.0	18.0	0.0
3	B3	300.11	299.48	53.0	0.0119	0.012	0.0	12.0	0.0
4	MH	298.48	298.36	62.0	0.0019	0.020	0.0	18.0	0.0

Time span=0.00-28.00 hrs, dt=0.01 hrs, 2801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Basin 1 Runoff Area=0.370 ac 40.54% Impervious Runoff Depth=5.74"
Tc=5.0 min CN=81 Runoff=1.80 cfs 0.177 af

Subcatchment 2: Basin 2 Runoff Area=0.210 ac 47.62% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=84 Runoff=1.08 cfs 0.107 af

Subcatchment 3: Basin 3 Runoff Area=0.310 ac 74.19% Impervious Runoff Depth=6.92"
Tc=5.0 min CN=91 Runoff=1.76 cfs 0.179 af

Subcatchment 4: Basin 4 Runoff Area=0.170 ac 35.29% Impervious Runoff Depth=5.63"
Tc=5.0 min CN=80 Runoff=0.81 cfs 0.080 af

Subcatchment 5: Basin 5 Runoff Area=0.120 ac 16.67% Impervious Runoff Depth=4.93"
Tc=5.0 min CN=74 Runoff=0.50 cfs 0.049 af

Subcatchment 6: Basin 6 Runoff Area=0.031 ac 12.90% Impervious Runoff Depth=4.81"
Tc=5.0 min CN=73 Runoff=0.13 cfs 0.012 af

Pond B1: DI B1 Peak Elev=298.82' Inflow=4.64 cfs 0.504 af
18.0" Round Culvert n=0.012 L=15.0' S=0.0100 '/' Outflow=4.64 cfs 0.504 af

Pond B2: DI B2 Peak Elev=299.33' Inflow=2.84 cfs 0.327 af
18.0" Round Culvert n=0.012 L=26.0' S=0.0100 '/' Outflow=2.84 cfs 0.327 af

Pond B3: DI B3 Peak Elev=301.25' Inflow=1.76 cfs 0.221 af
12.0" Round Culvert n=0.012 L=53.0' S=0.0119 '/' Outflow=1.76 cfs 0.221 af

Pond DB: Detention Basin Peak Elev=303.79' Storage=1,701 cf Inflow=0.81 cfs 0.080 af
Outflow=0.08 cfs 0.042 af

Pond KR: Kaapuni Road Inflow=0.50 cfs 0.049 af
Primary=0.50 cfs 0.049 af

Pond MH: MH Peak Elev=299.66' Inflow=1.76 cfs 0.221 af
18.0" Round Culvert n=0.020 L=62.0' S=0.0019 '/' Outflow=1.76 cfs 0.221 af

Pond NP: Neighboring Property Inflow=0.13 cfs 0.012 af
Primary=0.13 cfs 0.012 af

Total Runoff Area = 1.211 ac Runoff Volume = 0.604 af Average Runoff Depth = 5.98"
53.43% Pervious = 0.647 ac 46.57% Impervious = 0.564 ac

Summary for Subcatchment 1: Basin 1

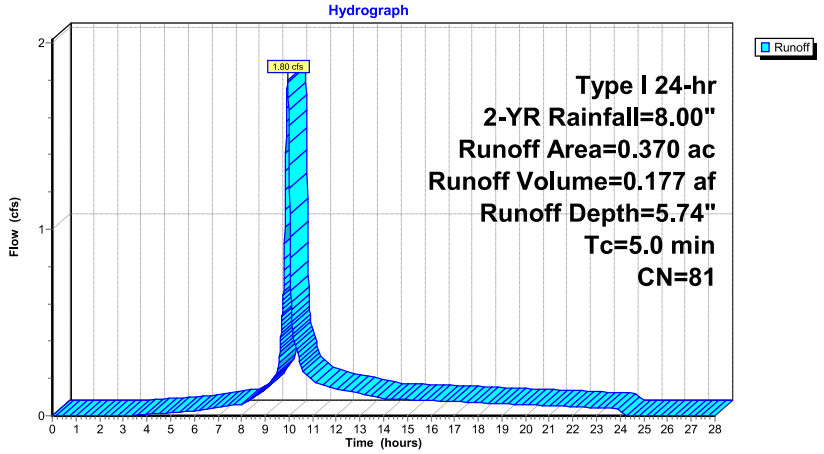
Runoff = 1.80 cfs @ 9.95 hrs, Volume= 0.177 af, Depth= 5.74"
Routed to Pond B1 : DI B1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

	Area (ac)	CN	Description
*	0.140	69	Grass
*	0.150	98	Pavement
*	0.080	71	Grass Cell Pavement
	0.370	81	Weighted Average
	0.220		59.46% Pervious Area
	0.150		40.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 1: Basin 1



Hydrograph for Subcatchment 1: Basin 1

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	5.74	0.00
0.50	0.07	0.00	0.00	26.50	8.00	5.74	0.00
1.00	0.14	0.00	0.00	27.00	8.00	5.74	0.00
1.50	0.21	0.00	0.00	27.50	8.00	5.74	0.00
2.00	0.28	0.00	0.00	28.00	8.00	5.74	0.00
2.50	0.35	0.00	0.00				
3.00	0.43	0.00	0.00				
3.50	0.52	0.00	0.00				
4.00	0.61	0.01	0.01				
4.50	0.70	0.02	0.01				
5.00	0.80	0.04	0.02				
5.50	0.90	0.07	0.02				
6.00	1.00	0.10	0.02				
6.50	1.11	0.14	0.03				
7.00	1.25	0.19	0.05				
7.50	1.40	0.26	0.05				
8.00	1.55	0.34	0.06				
8.50	1.75	0.45	0.10				
9.00	2.03	0.62	0.14				
9.50	2.42	0.89	**0.23**				
10.00	4.12	2.22	**1.56**				
10.50	4.66	2.69	0.27				
11.00	4.98	2.97	0.19				
11.50	5.24	3.20	0.17				
12.00	5.47	3.41	0.15				
12.50	5.67	3.59	0.13				
13.00	5.86	3.75	0.12				
13.50	6.02	3.90	0.11				
14.00	6.16	4.03	0.09				
14.50	6.29	4.15	0.09				
15.00	6.42	4.26	0.09				
15.50	6.54	4.38	0.08				
16.00	6.66	4.49	0.08				
16.50	6.77	4.59	0.08				
17.00	6.88	4.69	0.08				
17.50	6.99	4.79	0.07				
18.00	7.09	4.89	0.07				
18.50	7.19	4.98	0.07				
19.00	7.28	5.07	0.06				
19.50	7.37	5.15	0.06				
20.00	7.46	5.23	0.06				
20.50	7.54	5.31	0.06				
21.00	7.62	5.38	0.05				
21.50	7.69	5.45	0.05				
22.00	7.76	5.52	0.05				
22.50	7.83	5.58	0.05				
23.00	7.89	5.64	0.04				
23.50	7.95	5.69	0.04				
24.00	**8.00**	**5.74**	0.04				
24.50	8.00	5.74	0.00				
25.00	8.00	5.74	0.00				
25.50	8.00	5.74	0.00				

Summary for Subcatchment 2: Basin 2

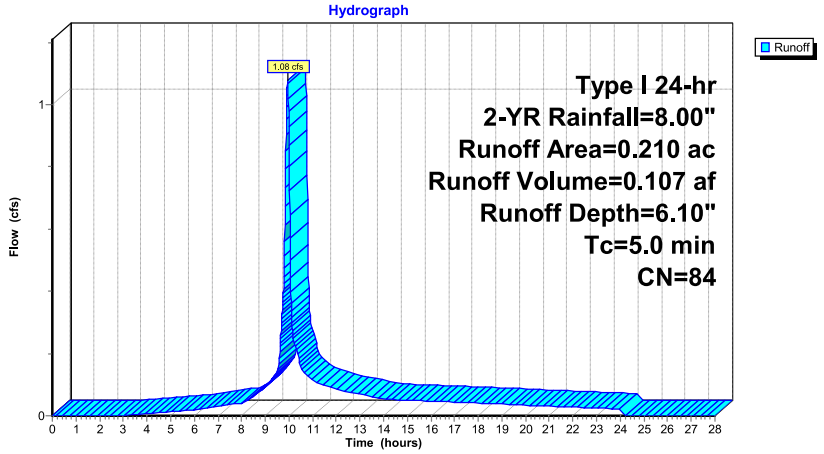
Runoff = 1.08 cfs @ 9.94 hrs, Volume= 0.107 af, Depth= 6.10"
Routed to Pond B2 : DI B2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

	Area (ac)	CN	Description
*	0.020	69	Grass
*	0.100	98	Pavement
*	0.090	71	Grass Cell Pavement
	0.210	84	Weighted Average
	0.110		52.38% Pervious Area
	0.100		47.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2: Basin 2



Hydrograph for Subcatchment 2: Basin 2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	6.10	0.00
0.50	0.07	0.00	0.00	26.50	8.00	6.10	0.00
1.00	0.14	0.00	0.00	27.00	8.00	6.10	0.00
1.50	0.21	0.00	0.00	27.50	8.00	6.10	0.00
2.00	0.28	0.00	0.00	28.00	8.00	6.10	0.00
2.50	0.35	0.00	0.00				
3.00	0.43	0.00	0.00				
3.50	0.52	0.01	0.00				
4.00	0.61	0.02	0.01				
4.50	0.70	0.05	0.01				
5.00	0.80	0.08	0.01				
5.50	0.90	0.11	0.02				
6.00	1.00	0.15	0.02				
6.50	1.11	0.20	0.02				
7.00	1.25	0.27	0.03				
7.50	1.40	0.35	0.04				
8.00	1.55	0.45	0.04				
8.50	1.75	0.57	0.06				
9.00	2.03	0.77	0.09				
9.50	2.42	1.06	**0.14**				
10.00	4.12	2.48	**0.93**				
10.50	4.66	2.96	0.16				
11.00	4.98	3.26	0.11				
11.50	5.24	3.49	0.10				
12.00	5.47	3.70	0.08				
12.50	5.67	3.89	0.08				
13.00	5.86	4.06	0.07				
13.50	6.02	4.21	0.06				
14.00	6.16	4.35	0.05				
14.50	6.29	4.47	0.05				
15.00	6.42	4.59	0.05				
15.50	6.54	4.70	0.05				
16.00	6.66	4.81	0.05				
16.50	6.77	4.92	0.05				
17.00	6.88	5.03	0.04				
17.50	6.99	5.13	0.04				
18.00	7.09	5.22	0.04				
18.50	7.19	5.32	0.04				
19.00	7.28	5.41	0.04				
19.50	7.37	5.49	0.04				
20.00	7.46	5.57	0.03				
20.50	7.54	5.65	0.03				
21.00	7.62	5.73	0.03				
21.50	7.69	5.80	0.03				
22.00	7.76	5.87	0.03				
22.50	7.83	5.93	0.03				
23.00	7.89	5.99	0.02				
23.50	7.95	6.04	0.02				
24.00	**8.00**	**6.10**	0.02				
24.50	8.00	6.10	0.00				
25.00	8.00	6.10	0.00				
25.50	8.00	6.10	0.00				

Summary for Subcatchment 3: Basin 3

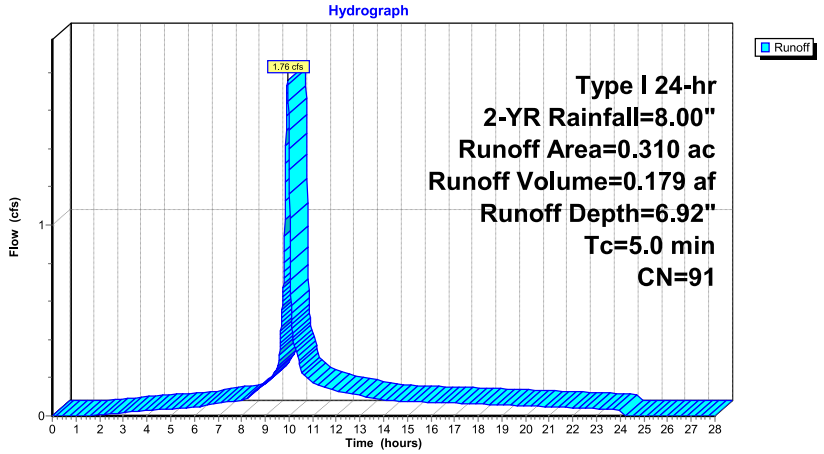
Runoff = 1.76 cfs @ 9.94 hrs, Volume= 0.179 af, Depth= 6.92"
Routed to Pond B3 : DI B3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

	Area (ac)	CN	Description
*	0.080	69	Grass
*	0.230	98	Pavement
	0.310	91	Weighted Average
	0.080		25.81% Pervious Area
	0.230		74.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3: Basin 3



Hydrograph for Subcatchment 3: Basin 3

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	6.92	0.00
0.50	0.07	0.00	0.00	26.50	8.00	6.92	0.00
1.00	0.14	0.00	0.00	27.00	8.00	6.92	0.00
1.50	0.21	0.00	0.00	27.50	8.00	6.92	0.00
2.00	0.28	0.01	0.01	28.00	8.00	6.92	0.00
2.50	0.35	0.02	0.01				
3.00	0.43	0.04	0.02				
3.50	0.52	0.08	0.02				
4.00	0.61	0.12	0.03				
4.50	0.70	0.17	0.03				
5.00	0.80	0.23	0.04				
5.50	0.90	0.29	0.04				
6.00	1.00	0.36	0.04				
6.50	1.11	0.44	0.05				
7.00	1.25	0.54	0.07				
7.50	1.40	0.66	0.07				
8.00	1.55	0.78	0.08				
8.50	1.75	0.95	0.12				
9.00	2.03	1.19	0.17				
9.50	2.42	1.54	**0.25**				
10.00	4.12	3.13	**1.50**				
10.50	4.66	3.66	0.25				
11.00	4.98	3.97	0.18				
11.50	5.24	4.22	0.15				
12.00	5.47	4.44	0.13				
12.50	5.67	4.64	0.12				
13.00	5.86	4.82	0.11				
13.50	6.02	4.97	0.09				
14.00	6.16	5.11	0.08				
14.50	6.29	5.24	0.08				
15.00	6.42	5.36	0.08				
15.50	6.54	5.48	0.07				
16.00	6.66	5.60	0.07				
16.50	6.77	5.71	0.07				
17.00	6.88	5.82	0.07				
17.50	6.99	5.92	0.06				
18.00	7.09	6.03	0.06				
18.50	7.19	6.12	0.06				
19.00	7.28	6.21	0.06				
19.50	7.37	6.30	0.05				
20.00	7.46	6.39	0.05				
20.50	7.54	6.47	0.05				
21.00	7.62	6.55	0.05				
21.50	7.69	6.62	0.04				
22.00	7.76	6.69	0.04				
22.50	7.83	6.75	0.04				
23.00	7.89	6.81	0.04				
23.50	7.95	6.87	0.03				
24.00	**8.00**	**6.92**	0.03				
24.50	8.00	6.92	0.00				
25.00	8.00	6.92	0.00				
25.50	8.00	6.92	0.00				

Summary for Subcatchment 4: Basin 4

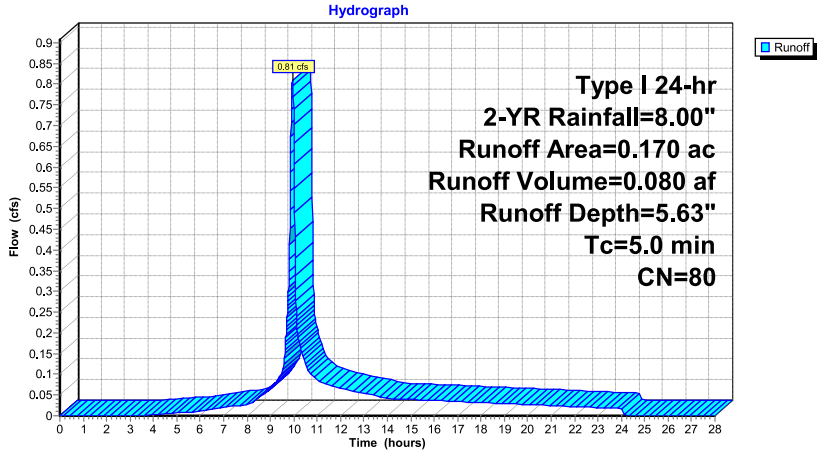
Runoff = 0.81 cfs @ 9.95 hrs, Volume= 0.080 af, Depth= 5.63"
Routed to Pond DB : Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

	Area (ac)	CN	Description
*	0.070	69	Grass
*	0.060	98	Pavement
*	0.040	71	Grass Cell Pavement
	0.170	80	Weighted Average
	0.110		64.71% Pervious Area
	0.060		35.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4: Basin 4



Hydrograph for Subcatchment 4: Basin 4

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	5.63	0.00
0.50	0.07	0.00	0.00	26.50	8.00	5.63	0.00
1.00	0.14	0.00	0.00	27.00	8.00	5.63	0.00
1.50	0.21	0.00	0.00	27.50	8.00	5.63	0.00
2.00	0.28	0.00	0.00	28.00	8.00	5.63	0.00
2.50	0.35	0.00	0.00				
3.00	0.43	0.00	0.00				
3.50	0.52	0.00	0.00				
4.00	0.61	0.00	0.00				
4.50	0.70	0.02	0.00				
5.00	0.80	0.03	0.01				
5.50	0.90	0.05	0.01				
6.00	1.00	0.08	0.01				
6.50	1.11	0.12	0.01				
7.00	1.25	0.17	0.02				
7.50	1.40	0.24	0.02				
8.00	1.55	0.31	0.03				
8.50	1.75	0.42	0.04				
9.00	2.03	0.58	0.06				
9.50	2.42	0.84	**0.10**				
10.00	4.12	2.14	**0.70**				
10.50	4.66	2.60	0.12				
11.00	4.98	2.88	0.09				
11.50	5.24	3.11	0.08				
12.00	5.47	3.31	0.07				
12.50	5.67	3.49	0.06				
13.00	5.86	3.65	0.05				
13.50	6.02	3.80	0.05				
14.00	6.16	3.93	0.04				
14.50	6.29	4.04	0.04				
15.00	6.42	4.16	0.04				
15.50	6.54	4.27	0.04				
16.00	6.66	4.38	0.04				
16.50	6.77	4.48	0.04				
17.00	6.88	4.58	0.03				
17.50	6.99	4.68	0.03				
18.00	7.09	4.78	0.03				
18.50	7.19	4.87	0.03				
19.00	7.28	4.95	0.03				
19.50	7.37	5.04	0.03				
20.00	7.46	5.12	0.03				
20.50	7.54	5.19	0.03				
21.00	7.62	5.27	0.02				
21.50	7.69	5.33	0.02				
22.00	7.76	5.40	0.02				
22.50	7.83	5.46	0.02				
23.00	7.89	5.52	0.02				
23.50	7.95	5.57	0.02				
24.00	**8.00**	**5.63**	0.02				
24.50	8.00	5.63	0.00				
25.00	8.00	5.63	0.00				
25.50	8.00	5.63	0.00				

Summary for Subcatchment 5: Basin 5

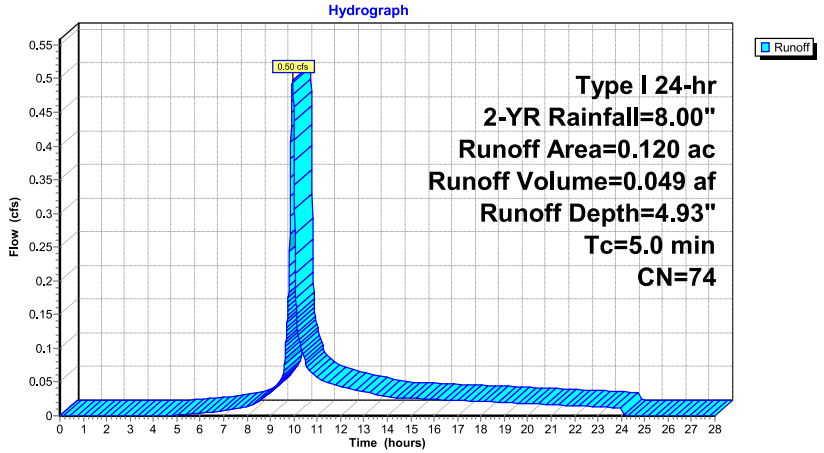
Runoff = 0.50 cfs @ 9.95 hrs, Volume= 0.049 af, Depth= 4.93"
Routed to Pond KR : Kaapuni Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

	Area (ac)	CN	Description
*	0.080	69	Grass
*	0.020	98	Pavement
*	0.020	71	Grass Cell Pavement
	0.120	74	Weighted Average
	0.100		83.33% Pervious Area
	0.020		16.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 5: Basin 5



Hydrograph for Subcatchment 5: Basin 5

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	4.93	0.00
0.50	0.07	0.00	0.00	26.50	8.00	4.93	0.00
1.00	0.14	0.00	0.00	27.00	8.00	4.93	0.00
1.50	0.21	0.00	0.00	27.50	8.00	4.93	0.00
2.00	0.28	0.00	0.00	28.00	8.00	4.93	0.00
2.50	0.35	0.00	0.00				
3.00	0.43	0.00	0.00				
3.50	0.52	0.00	0.00				
4.00	0.61	0.00	0.00				
4.50	0.70	0.00	0.00				
5.00	0.80	0.00	0.00				
5.50	0.90	0.01	0.00				
6.00	1.00	0.02	0.00				
6.50	1.11	0.04	0.01				
7.00	1.25	0.07	0.01				
7.50	1.40	0.11	0.01				
8.00	1.55	0.17	0.01				
8.50	1.75	0.24	0.02				
9.00	2.03	0.36	0.03				
9.50	2.42	0.57	**0.06**				
10.00	4.12	1.68	**0.44**				
10.50	4.66	2.10	0.08				
11.00	4.98	2.35	0.06				
11.50	5.24	2.56	0.05				
12.00	5.47	2.75	0.04				
12.50	5.67	2.91	0.04				
13.00	5.86	3.06	0.04				
13.50	6.02	3.20	0.03				
14.00	6.16	3.32	0.03				
14.50	6.29	3.43	0.03				
15.00	6.42	3.54	0.03				
15.50	6.54	3.64	0.03				
16.00	6.66	3.74	0.02				
16.50	6.77	3.84	0.02				
17.00	6.88	3.94	0.02				
17.50	6.99	4.03	0.02				
18.00	7.09	4.12	0.02				
18.50	7.19	4.20	0.02				
19.00	7.28	4.29	0.02				
19.50	7.37	4.37	0.02				
20.00	7.46	4.44	0.02				
20.50	7.54	4.51	0.02				
21.00	7.62	4.58	0.02				
21.50	7.69	4.65	0.02				
22.00	7.76	4.71	0.01				
22.50	7.83	4.77	0.01				
23.00	7.89	4.83	0.01				
23.50	7.95	4.88	0.01				
24.00	**8.00**	**4.93**	0.01				
24.50	8.00	4.93	0.00				
25.00	8.00	4.93	0.00				
25.50	8.00	4.93	0.00				

Summary for Subcatchment 6: Basin 6

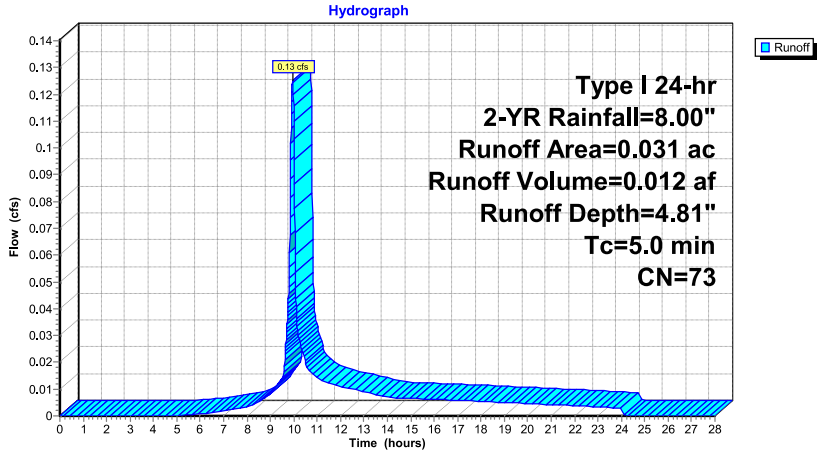
Runoff = 0.13 cfs @ 9.95 hrs, Volume= 0.012 af, Depth= 4.81"
Routed to Pond NP : Neighboring Property

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type I 24-hr 2-YR Rainfall=8.00"

	Area (ac)	CN	Description
*	0.027	69	Grass
*	0.004	98	Pavement
	0.031	73	Weighted Average
	0.027		87.10% Pervious Area
	0.004		12.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 6: Basin 6



Hydrograph for Subcatchment 6: Basin 6

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.00	4.81	0.00
0.50	0.07	0.00	0.00	26.50	8.00	4.81	0.00
1.00	0.14	0.00	0.00	27.00	8.00	4.81	0.00
1.50	0.21	0.00	0.00	27.50	8.00	4.81	0.00
2.00	0.28	0.00	0.00	28.00	8.00	4.81	0.00
2.50	0.35	0.00	0.00				
3.00	0.43	0.00	0.00				
3.50	0.52	0.00	0.00				
4.00	0.61	0.00	0.00				
4.50	0.70	0.00	0.00				
5.00	0.80	0.00	0.00				
5.50	0.90	0.01	0.00				
6.00	1.00	0.02	0.00				
6.50	1.11	0.03	0.00				
7.00	1.25	0.06	0.00				
7.50	1.40	0.10	0.00				
8.00	1.55	0.15	0.00				
8.50	1.75	0.22	0.01				
9.00	2.03	0.33	0.01				
9.50	2.42	0.53	**0.01**				
10.00	4.12	1.61	**0.11**				
10.50	4.66	2.02	0.02				
11.00	4.98	2.27	0.01				
11.50	5.24	2.47	0.01				
12.00	5.47	2.66	0.01				
12.50	5.67	2.82	0.01				
13.00	5.86	2.97	0.01				
13.50	6.02	3.10	0.01				
14.00	6.16	3.22	0.01				
14.50	6.29	3.33	0.01				
15.00	6.42	3.44	0.01				
15.50	6.54	3.54	0.01				
16.00	6.66	3.64	0.01				
16.50	6.77	3.74	0.01				
17.00	6.88	3.83	0.01				
17.50	6.99	3.92	0.01				
18.00	7.09	4.01	0.01				
18.50	7.19	4.10	0.01				
19.00	7.28	4.18	0.01				
19.50	7.37	4.26	0.00				
20.00	7.46	4.33	0.00				
20.50	7.54	4.40	0.00				
21.00	7.62	4.47	0.00				
21.50	7.69	4.54	0.00				
22.00	7.76	4.60	0.00				
22.50	7.83	4.66	0.00				
23.00	7.89	4.71	0.00				
23.50	7.95	4.76	0.00				
24.00	**8.00**	**4.81**	0.00				
24.50	8.00	4.81	0.00				
25.00	8.00	4.81	0.00				
25.50	8.00	4.81	0.00				

Summary for Pond B1: DI B1

[57] Hint: Peaked at 298.82' (Flood elevation advised)

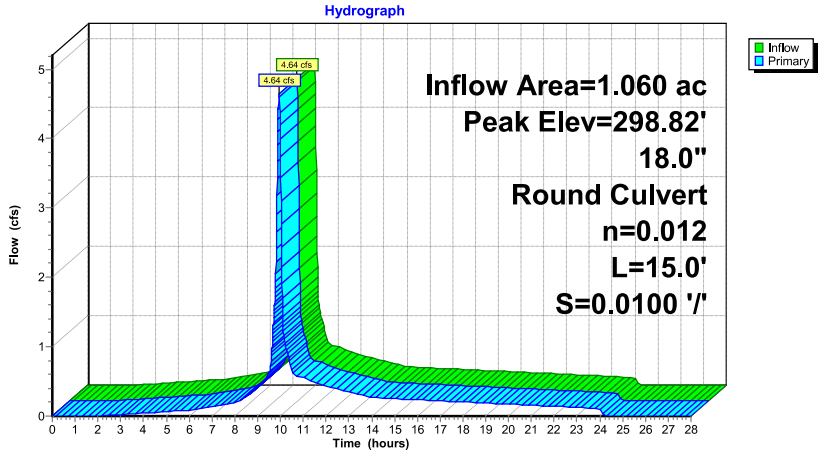
Inflow Area = 1.060 ac, 50.94% Impervious, Inflow Depth = 5.71" for 2-YR event
Inflow = 4.64 cfs @ 9.94 hrs, Volume= 0.504 af
Outflow = 4.64 cfs @ 9.94 hrs, Volume= 0.504 af, Atten= 0%, Lag= 0.0 min
Primary = 4.64 cfs @ 9.94 hrs, Volume= 0.504 af

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 298.82' @ 9.94 hrs

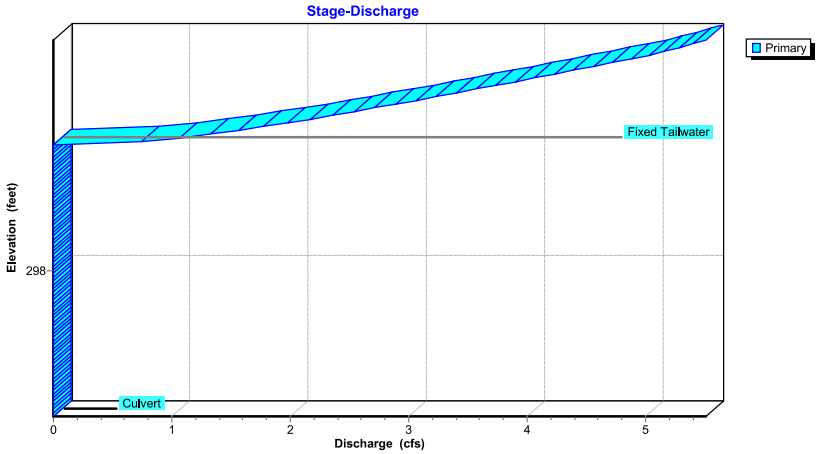
Device	Routing	Invert	Outlet Devices
#1	Primary	297.42'	**18.0" Round Culvert** L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 297.42' / 297.27' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=4.64 cfs @ 9.94 hrs HW=298.82' TW=298.50' (Fixed TW Elev= 298.50')
↑**1=Culvert** (Outlet Controls 4.64 cfs @ 3.51 fps)

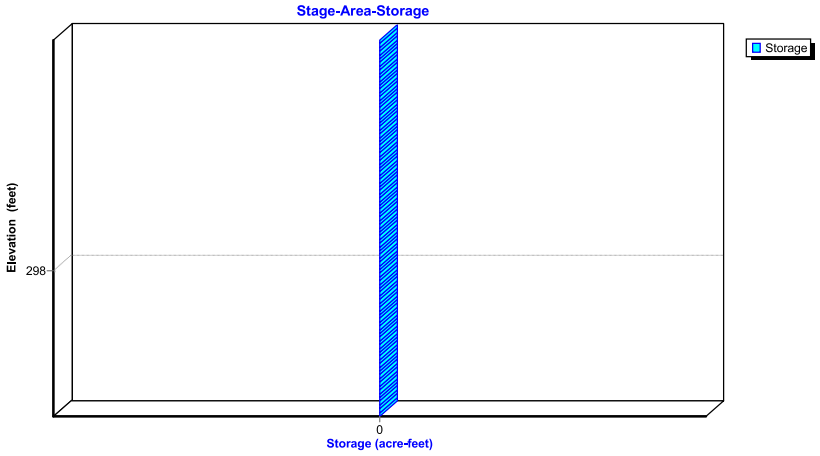
Pond B1: DI B1



Pond B1: DI B1



Pond B1: DI B1



Hydrograph for Pond B1: DI B1

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	297.42	0.00	26.00	0.00	298.50	0.00
0.50	0.00	297.42	0.00	26.50	0.00	298.50	0.00
1.00	0.00	297.42	0.00	27.00	0.00	298.50	0.00
1.50	0.00	298.50	0.00	27.50	0.00	298.50	0.00
2.00	0.01	298.50	0.01	28.00	0.00	298.50	0.00
2.50	0.01	298.50	0.01				
3.00	0.02	298.50	0.02				
3.50	0.03	298.50	0.03				
4.00	0.04	298.50	0.04				
4.50	0.06	298.50	0.06				
5.00	0.07	298.50	0.07				
5.50	0.08	298.50	0.08				
6.00	0.09	298.50	0.09				
6.50	0.11	298.50	0.11				
7.00	0.14	298.50	0.14				
7.50	0.16	298.50	0.16				
8.00	0.18	298.50	0.18				
8.50	0.28	298.51	0.28				
9.00	0.40	298.51	0.40				
9.50	**0.62**	**298.51**	**0.62**				
10.00	**3.99**	**298.76**	**3.99**				
10.50	0.69	298.51	0.69				
11.00	0.56	298.51	0.56				
11.50	0.49	298.51	0.49				
12.00	0.43	298.51	0.43				
12.50	0.39	298.51	0.39				
13.00	0.35	298.51	0.35				
13.50	0.31	298.51	0.31				
14.00	0.27	298.51	0.27				
14.50	0.26	298.51	0.26				
15.00	0.25	298.51	0.25				
15.50	0.24	298.50	0.24				
16.00	0.24	298.50	0.24				
16.50	0.23	298.50	0.23				
17.00	0.22	298.50	0.22				
17.50	0.21	298.50	0.21				
18.00	0.20	298.50	0.20				
18.50	0.20	298.50	0.20				
19.00	0.19	298.50	0.19				
19.50	0.18	298.50	0.18				
20.00	0.17	298.50	0.17				
20.50	0.16	298.50	0.16				
21.00	0.16	298.50	0.16				
21.50	0.15	298.50	0.15				
22.00	0.14	298.50	0.14				
22.50	0.13	298.50	0.13				
23.00	0.12	298.50	0.12				
23.50	0.12	298.50	0.12				
24.00	0.11	298.50	0.11				
24.50	0.00	298.50	0.00				
25.00	0.00	298.50	0.00				
25.50	0.00	298.50	0.00				

Summary for Pond B2: DI B2

[57] Hint: Peaked at 299.33' (Flood elevation advised)

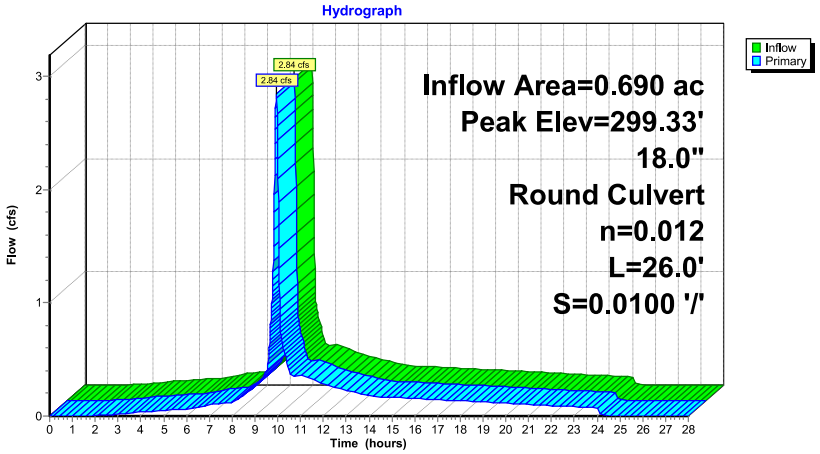
Inflow Area = 0.690 ac, 56.52% Impervious, Inflow Depth = 5.69" for 2-YR event
Inflow = 2.84 cfs @ 9.94 hrs, Volume= 0.327 af
Outflow = 2.84 cfs @ 9.94 hrs, Volume= 0.327 af, Atten= 0%, Lag= 0.0 min
Primary = 2.84 cfs @ 9.94 hrs, Volume= 0.327 af
Routed to Pond B1 : DI B1

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 299.33' @ 9.94 hrs

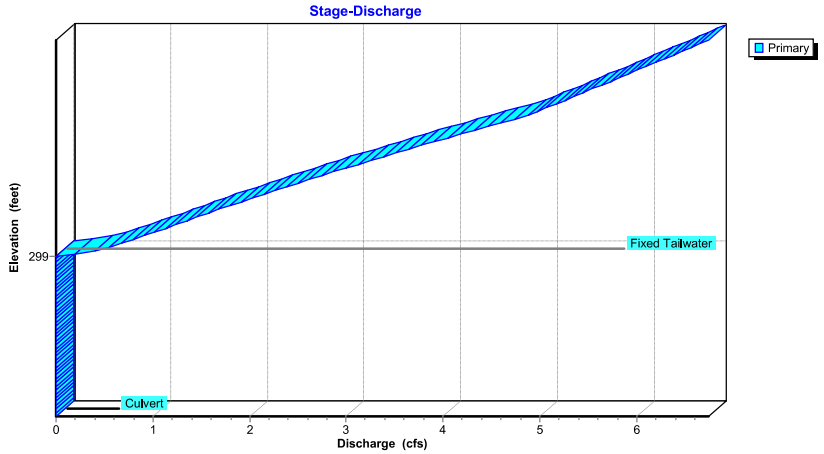
Device	Routing	Invert	Outlet Devices
#1	Primary	298.36'	**18.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 298.36' / 298.10' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=2.84 cfs @ 9.94 hrs HW=299.33' TW=299.00' (Fixed TW Elev= 299.00')
1=Culvert (Outlet Controls 2.84 cfs @ 3.34 fps)

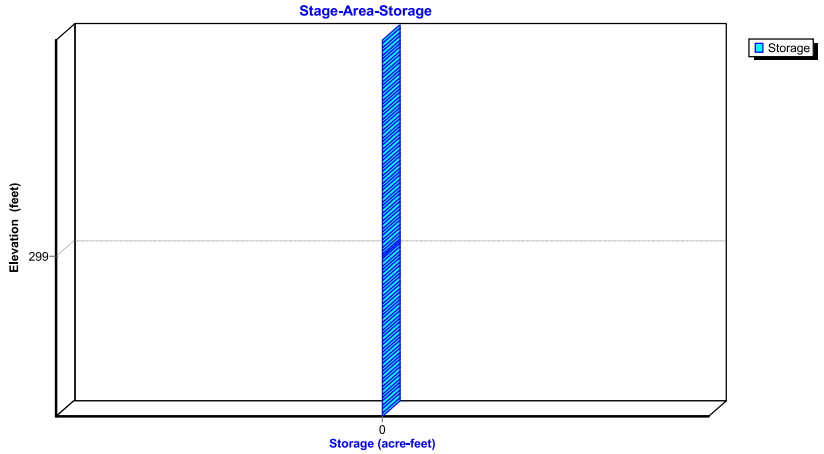
Pond B2: DI B2



Pond B2: DI B2



Pond B2: DI B2



Hydrograph for Pond B2: DI B2

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	298.36	0.00	26.00	0.00	299.00	0.00
0.50	0.00	298.36	0.00	26.50	0.00	299.00	0.00
1.00	0.00	298.36	0.00	27.00	0.00	299.00	0.00
1.50	0.00	299.00	0.00	27.50	0.00	299.00	0.00
2.00	0.01	299.00	0.01	28.00	0.00	299.00	0.00
2.50	0.01	299.00	0.01				
3.00	0.02	299.00	0.02				
3.50	0.03	299.00	0.03				
4.00	0.04	299.00	0.04				
4.50	0.04	299.00	0.04				
5.00	0.05	299.00	0.05				
5.50	0.06	299.00	0.06				
6.00	0.06	299.00	0.06				
6.50	0.08	299.00	0.08				
7.00	0.10	299.00	0.10				
7.50	0.11	299.00	0.11				
8.00	0.12	299.00	0.12				
8.50	0.18	299.00	0.18				
9.00	0.26	299.01	0.26				
9.50	**0.39**	**299.02**	**0.39**				
10.00	**2.43**	**299.28**	**2.43**				
10.50	0.41	299.02	0.41				
11.00	0.37	299.02	0.37				
11.50	0.33	299.01	0.33				
12.00	0.29	299.01	0.29				
12.50	0.26	299.01	0.26				
13.00	0.23	299.01	0.23				
13.50	0.21	299.01	0.21				
14.00	0.18	299.00	0.18				
14.50	0.17	299.00	0.17				
15.00	0.17	299.00	0.17				
15.50	0.16	299.00	0.16				
16.00	0.16	299.00	0.16				
16.50	0.15	299.00	0.15				
17.00	0.15	299.00	0.15				
17.50	0.14	299.00	0.14				
18.00	0.13	299.00	0.13				
18.50	0.13	299.00	0.13				
19.00	0.12	299.00	0.12				
19.50	0.12	299.00	0.12				
20.00	0.11	299.00	0.11				
20.50	0.11	299.00	0.11				
21.00	0.10	299.00	0.10				
21.50	0.10	299.00	0.10				
22.00	0.09	299.00	0.09				
22.50	0.09	299.00	0.09				
23.00	0.08	299.00	0.08				
23.50	0.08	299.00	0.08				
24.00	0.07	299.00	0.07				
24.50	0.00	299.00	0.00				
25.00	0.00	299.00	0.00				
25.50	0.00	299.00	0.00				

Summary for Pond B3: DI B3

[57] Hint: Peaked at 301.25' (Flood elevation advised)

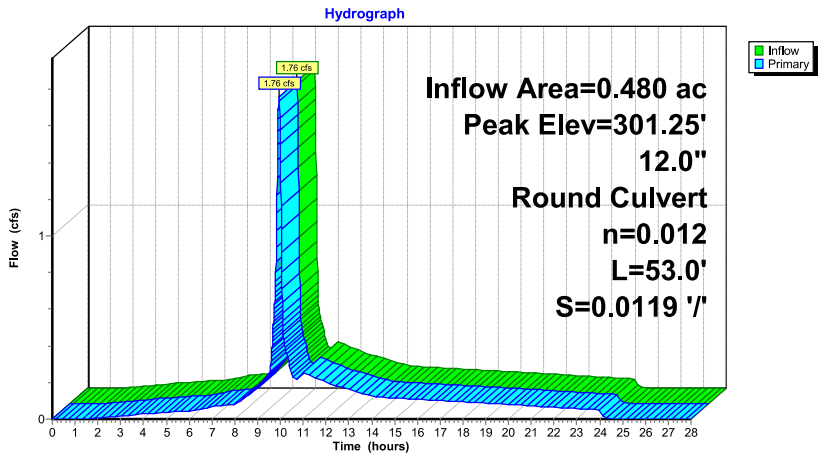
Inflow Area = 0.480 ac, 60.42% Impervious, Inflow Depth = 5.51" for 2-YR event
Inflow = 1.76 cfs @ 9.94 hrs, Volume= 0.221 af
Outflow = 1.76 cfs @ 9.94 hrs, Volume= 0.221 af, Atten= 0%, Lag= 0.0 min
Primary = 1.76 cfs @ 9.94 hrs, Volume= 0.221 af
Routed to Pond MH : MH

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 301.25' @ 9.94 hrs

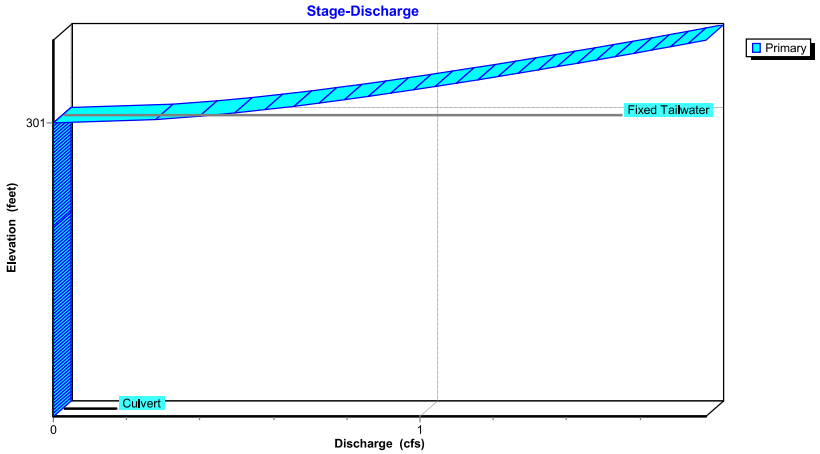
Device	Routing	Invert	Outlet Devices
#1	Primary	300.11'	**12.0" Round Culvert** L= 53.0' Ke= 0.500 Inlet / Outlet Invert= 300.11' / 299.48' S= 0.0119 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=1.76 cfs @ 9.94 hrs HW=301.25' TW=301.00' (Fixed TW Elev= 301.00')
↑**1=Culvert** (Outlet Controls 1.76 cfs @ 2.47 fps)

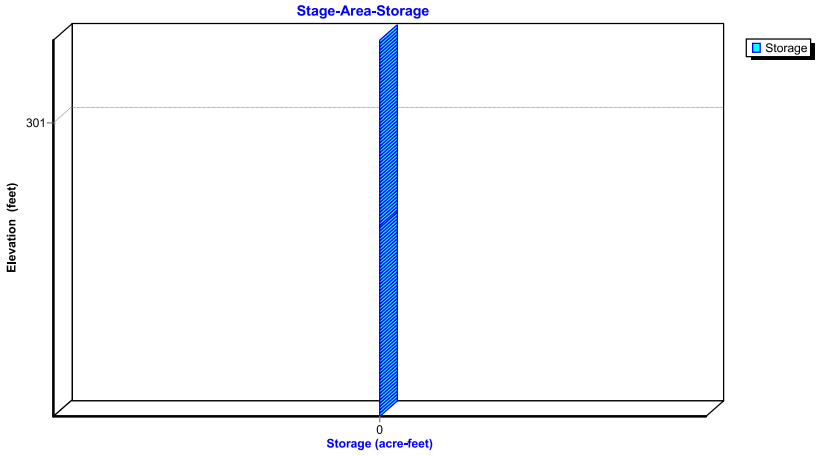
Pond B3: DI B3



Pond B3: DI B3



Pond B3: DI B3



Hydrograph for Pond B3: DI B3

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	300.11	0.00	26.00	0.00	301.00	0.00
0.50	0.00	300.11	0.00	26.50	0.00	301.00	0.00
1.00	0.00	300.11	0.00	27.00	0.00	301.00	0.00
1.50	0.00	301.00	0.00	27.50	0.00	301.00	0.00
2.00	0.01	301.00	0.01	28.00	0.00	301.00	0.00
2.50	0.01	301.00	0.01				
3.00	0.02	301.00	0.02				
3.50	0.02	301.00	0.02				
4.00	0.03	301.00	0.03				
4.50	0.03	301.00	0.03				
5.00	0.04	301.00	0.04				
5.50	0.04	301.00	0.04				
6.00	0.04	301.00	0.04				
6.50	0.05	301.00	0.05				
7.00	0.07	301.00	0.07				
7.50	0.07	301.00	0.07				
8.00	0.08	301.00	0.08				
8.50	0.12	301.00	0.12				
9.00	0.17	301.01	0.17				
9.50	**0.25**	**301.01**	**0.25**				
10.00	**1.50**	**301.19**	**1.50**				
10.50	0.25	301.01	0.25				
11.00	0.26	301.01	0.26				
11.50	0.23	301.01	0.23				
12.00	0.20	301.01	0.20				
12.50	0.18	301.01	0.18				
13.00	0.16	301.01	0.16				
13.50	0.14	301.01	0.14				
14.00	0.13	301.00	0.13				
14.50	0.12	301.00	0.12				
15.00	0.12	301.00	0.12				
15.50	0.11	301.00	0.11				
16.00	0.11	301.00	0.11				
16.50	0.11	301.00	0.11				
17.00	0.10	301.00	0.10				
17.50	0.10	301.00	0.10				
18.00	0.09	301.00	0.09				
18.50	0.09	301.00	0.09				
19.00	0.09	301.00	0.09				
19.50	0.08	301.00	0.08				
20.00	0.08	301.00	0.08				
20.50	0.08	301.00	0.08				
21.00	0.07	301.00	0.07				
21.50	0.07	301.00	0.07				
22.00	0.06	301.00	0.06				
22.50	0.06	301.00	0.06				
23.00	0.06	301.00	0.06				
23.50	0.05	301.00	0.05				
24.00	0.05	301.00	0.05				
24.50	0.00	301.00	0.00				
25.00	0.00	301.00	0.00				
25.50	0.00	301.00	0.00				

Summary for Pond DB: Detention Basin

Inflow Area = 0.170 ac, 35.29% Impervious, Inflow Depth = 5.63" for 2-YR event
Inflow = 0.81 cfs @ 9.95 hrs, Volume= 0.080 af
Outflow = 0.08 cfs @ 11.10 hrs, Volume= 0.042 af, Atten= 90%, Lag= 69.0 min
Primary = 0.08 cfs @ 11.10 hrs, Volume= 0.042 af
Routed to Pond B3 : DI B3

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 303.79' @ 11.10 hrs Surf.Area= 1,189 sf Storage= 1,701 cf

Plug-Flow detention time= 382.1 min calculated for 0.042 af (52% of inflow)
Center-of-Mass det. time= 192.1 min (956.5 - 764.5)

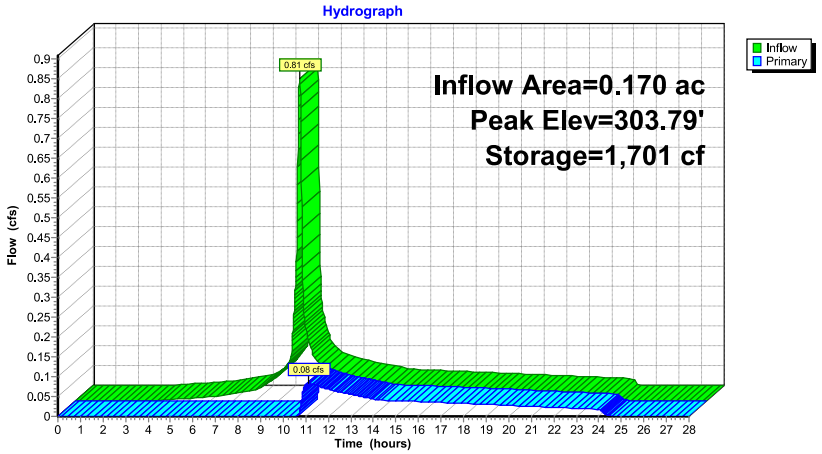
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	2,642 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
302.00	724	0	0
303.00	972	848	848
304.00	1,247	1,110	1,958
304.50	1,490	684	2,642

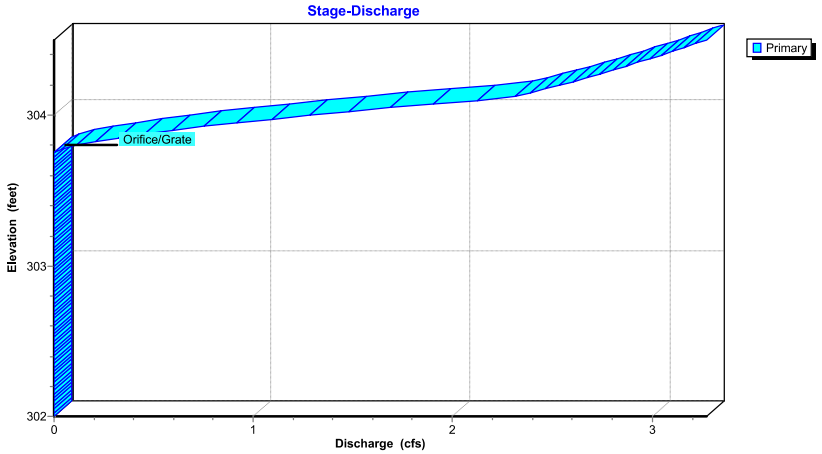
Device	Routing	Invert	Outlet Devices
#1	Primary	303.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.08 cfs @ 11.10 hrs HW=303.79' TW=301.00' (Fixed TW Elev= 301.00')
1=Orifice/Grate (Weir Controls 0.08 cfs @ 0.65 fps)

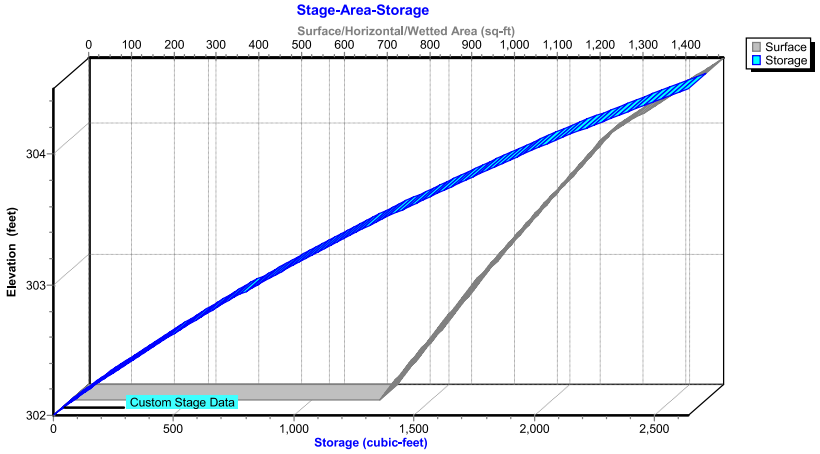
Pond DB: Detention Basin



Pond DB: Detention Basin



Pond DB: Detention Basin



Hydrograph for Pond DB: Detention Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	302.00	0.00
1.00	0.00	0	302.00	0.00
2.00	0.00	0	302.00	0.00
3.00	0.00	0	302.00	0.00
4.00	0.00	2	302.00	0.00
5.00	0.01	18	302.02	0.00
6.00	0.01	48	302.07	0.00
7.00	0.02	101	302.14	0.00
8.00	0.03	185	302.24	0.00
9.00	**0.06**	341	302.44	0.00
10.00	**0.70**	1,169	303.32	0.00
11.00	0.09	**1,700**	**303.79**	**0.08**
12.00	0.07	**1,695**	**303.78**	**0.07**
13.00	0.05	1,690	303.78	0.06
14.00	0.04	1,685	303.78	0.04
15.00	0.04	1,683	303.77	0.04
16.00	0.04	1,681	303.77	0.04
17.00	0.03	1,680	303.77	0.03
18.00	0.03	1,678	303.77	0.03
19.00	0.03	1,676	303.77	0.03
20.00	0.03	1,674	303.77	0.03
21.00	0.02	1,673	303.77	0.02
22.00	0.02	1,671	303.76	0.02
23.00	0.02	1,669	303.76	0.02
24.00	0.02	1,667	303.76	0.02
25.00	0.00	1,654	303.75	0.00
26.00	0.00	1,654	303.75	0.00
27.00	0.00	1,654	303.75	0.00
28.00	0.00	1,654	303.75	0.00

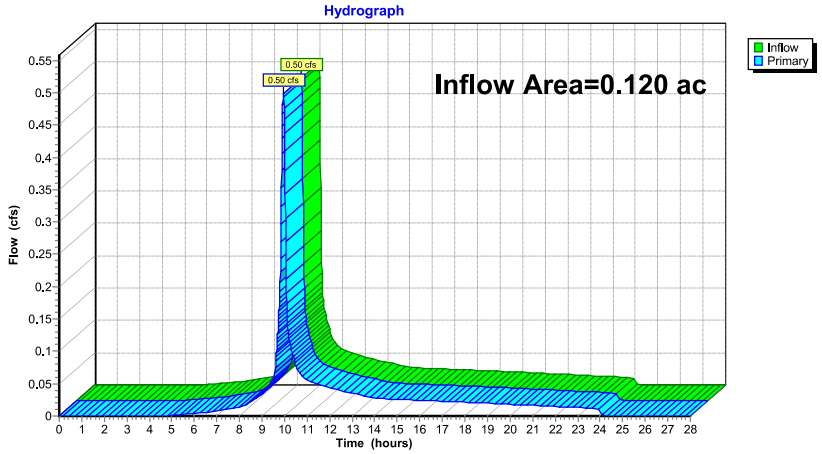
Summary for Pond KR: Kaapuni Road

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.120 ac, 16.67% Impervious, Inflow Depth = 4.93" for 2-YR event
Inflow = 0.50 cfs @ 9.95 hrs, Volume= 0.049 af
Primary = 0.50 cfs @ 9.95 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Pond KR: Kaapuni Road



Hydrograph for Pond KR: Kaapuni Road

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00		0.00	26.00	0.00		0.00
0.50	0.00		0.00	26.50	0.00		0.00
1.00	0.00		0.00	27.00	0.00		0.00
1.50	0.00		0.00	27.50	0.00		0.00
2.00	0.00		0.00	28.00	0.00		0.00
2.50	0.00		0.00				
3.00	0.00		0.00				
3.50	0.00		0.00				
4.00	0.00		0.00				
4.50	0.00		0.00				
5.00	0.00		0.00				
5.50	0.00		0.00				
6.00	0.00		0.00				
6.50	0.01		0.01				
7.00	0.01		0.01				
7.50	0.01		0.01				
8.00	0.01		0.01				
8.50	0.02		0.02				
9.00	0.03		0.03				
9.50	**0.06**		**0.06**				
10.00	**0.44**		**0.44**				
10.50	0.08		0.08				
11.00	0.06		0.06				
11.50	0.05		0.05				
12.00	0.04		0.04				
12.50	0.04		0.04				
13.00	0.04		0.04				
13.50	0.03		0.03				
14.00	0.03		0.03				
14.50	0.03		0.03				
15.00	0.03		0.03				
15.50	0.03		0.03				
16.00	0.02		0.02				
16.50	0.02		0.02				
17.00	0.02		0.02				
17.50	0.02		0.02				
18.00	0.02		0.02				
18.50	0.02		0.02				
19.00	0.02		0.02				
19.50	0.02		0.02				
20.00	0.02		0.02				
20.50	0.02		0.02				
21.00	0.02		0.02				
21.50	0.02		0.02				
22.00	0.01		0.01				
22.50	0.01		0.01				
23.00	0.01		0.01				
23.50	0.01		0.01				
24.00	0.01		0.01				
24.50	0.00		0.00				
25.00	0.00		0.00				
25.50	0.00		0.00				

Summary for Pond MH: MH

[57] Hint: Peaked at 299.66' (Flood elevation advised)

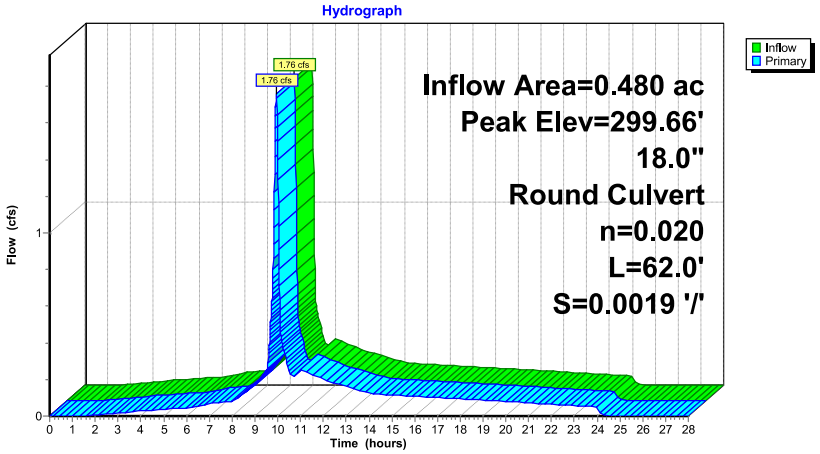
Inflow Area = 0.480 ac, 60.42% Impervious, Inflow Depth = 5.51" for 2-YR event
Inflow = 1.76 cfs @ 9.94 hrs, Volume= 0.221 af
Outflow = 1.76 cfs @ 9.94 hrs, Volume= 0.221 af, Atten= 0%, Lag= 0.0 min
Primary = 1.76 cfs @ 9.94 hrs, Volume= 0.221 af
Routed to Pond B2 : DI B2

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 299.66' @ 9.94 hrs

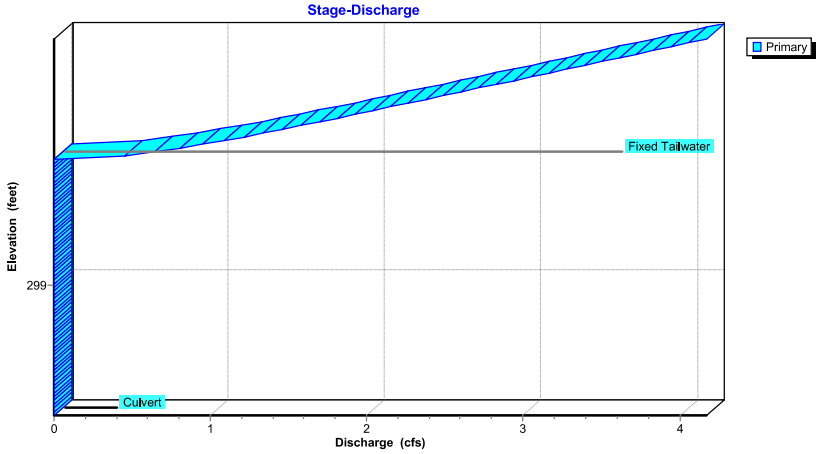
Device	Routing	Invert	Outlet Devices
#1	Primary	298.48'	**18.0" Round Culvert** L= 62.0' Ke= 0.500 Inlet / Outlet Invert= 298.48' / 298.36' S= 0.0019 '/' Cc= 0.900 n= 0.020, Flow Area= 1.77 sf

Primary OutFlow Max=1.76 cfs @ 9.94 hrs HW=299.66' TW=299.50' (Fixed TW Elev= 299.50')
1=Culvert (Outlet Controls 1.76 cfs @ 1.63 fps)

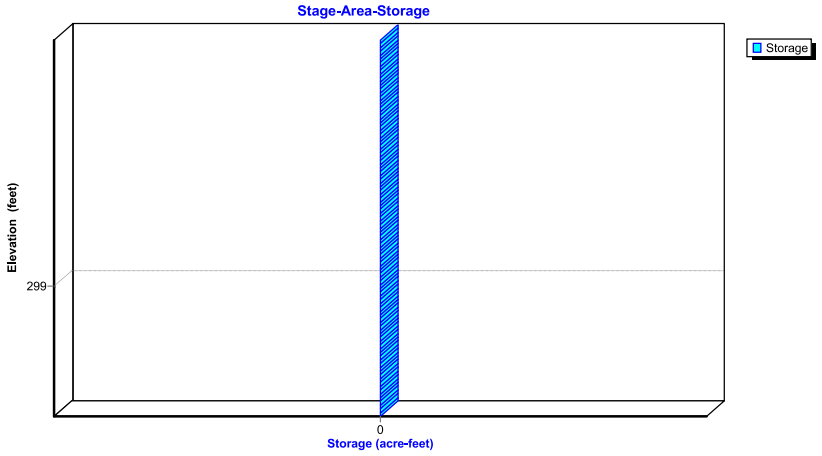
Pond MH: MH



Pond MH: MH



Pond MH: MH



Hydrograph for Pond MH: MH

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	298.48	0.00	26.00	0.00	299.50	0.00
0.50	0.00	298.48	0.00	26.50	0.00	299.50	0.00
1.00	0.00	298.48	0.00	27.00	0.00	299.50	0.00
1.50	0.00	299.50	0.00	27.50	0.00	299.50	0.00
2.00	0.01	299.50	0.01	28.00	0.00	299.50	0.00
2.50	0.01	299.50	0.01				
3.00	0.02	299.50	0.02				
3.50	0.02	299.50	0.02				
4.00	0.03	299.50	0.03				
4.50	0.03	299.50	0.03				
5.00	0.04	299.50	0.04				
5.50	0.04	299.50	0.04				
6.00	0.04	299.50	0.04				
6.50	0.05	299.50	0.05				
7.00	0.07	299.50	0.07				
7.50	0.07	299.50	0.07				
8.00	0.08	299.50	0.08				
8.50	0.12	299.50	0.12				
9.00	0.17	299.51	0.17				
9.50	**0.25**	**299.51**	**0.25**				
10.00	**1.50**	**299.63**	**1.50**				
10.50	0.25	299.51	0.25				
11.00	0.26	299.51	0.26				
11.50	0.23	299.51	0.23				
12.00	0.20	299.51	0.20				
12.50	0.18	299.51	0.18				
13.00	0.16	299.51	0.16				
13.50	0.14	299.50	0.14				
14.00	0.13	299.50	0.13				
14.50	0.12	299.50	0.12				
15.00	0.12	299.50	0.12				
15.50	0.11	299.50	0.11				
16.00	0.11	299.50	0.11				
16.50	0.11	299.50	0.11				
17.00	0.10	299.50	0.10				
17.50	0.10	299.50	0.10				
18.00	0.09	299.50	0.09				
18.50	0.09	299.50	0.09				
19.00	0.09	299.50	0.09				
19.50	0.08	299.50	0.08				
20.00	0.08	299.50	0.08				
20.50	0.08	299.50	0.08				
21.00	0.07	299.50	0.07				
21.50	0.07	299.50	0.07				
22.00	0.06	299.50	0.06				
22.50	0.06	299.50	0.06				
23.00	0.06	299.50	0.06				
23.50	0.05	299.50	0.05				
24.00	0.05	299.50	0.05				
24.50	0.00	299.50	0.00				
25.00	0.00	299.50	0.00				
25.50	0.00	299.50	0.00				

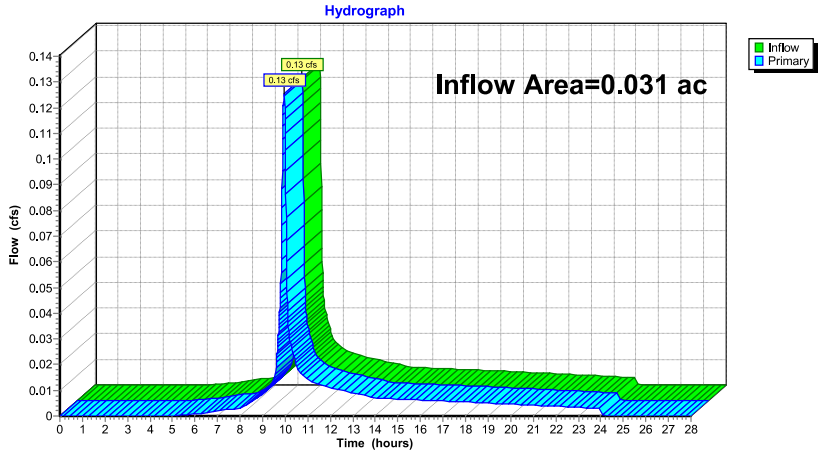
Summary for Pond NP: Neighboring Property

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.031 ac, 12.90% Impervious, Inflow Depth = 4.81" for 2-YR event
Inflow = 0.13 cfs @ 9.95 hrs, Volume= 0.012 af
Primary = 0.13 cfs @ 9.95 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Pond NP: Neighboring Property



Hydrograph for Pond NP: Neighboring Property

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00		0.00	26.00	0.00		0.00
0.50	0.00		0.00	26.50	0.00		0.00
1.00	0.00		0.00	27.00	0.00		0.00
1.50	0.00		0.00	27.50	0.00		0.00
2.00	0.00		0.00	28.00	0.00		0.00
2.50	0.00		0.00				
3.00	0.00		0.00				
3.50	0.00		0.00				
4.00	0.00		0.00				
4.50	0.00		0.00				
5.00	0.00		0.00				
5.50	0.00		0.00				
6.00	0.00		0.00				
6.50	0.00		0.00				
7.00	0.00		0.00				
7.50	0.00		0.00				
8.00	0.00		0.00				
8.50	0.01		0.01				
9.00	0.01		0.01				
9.50	**0.01**		**0.01**				
10.00	**0.11**		**0.11**				
10.50	0.02		0.02				
11.00	0.01		0.01				
11.50	0.01		0.01				
12.00	0.01		0.01				
12.50	0.01		0.01				
13.00	0.01		0.01				
13.50	0.01		0.01				
14.00	0.01		0.01				
14.50	0.01		0.01				
15.00	0.01		0.01				
15.50	0.01		0.01				
16.00	0.01		0.01				
16.50	0.01		0.01				
17.00	0.01		0.01				
17.50	0.01		0.01				
18.00	0.01		0.01				
18.50	0.01		0.01				
19.00	0.01		0.01				
19.50	0.00		0.00				
20.00	0.00		0.00				
20.50	0.00		0.00				
21.00	0.00		0.00				
21.50	0.00		0.00				
22.00	0.00		0.00				
22.50	0.00		0.00				
23.00	0.00		0.00				
23.50	0.00		0.00				
24.00	0.00		0.00				
24.50	0.00		0.00				
25.00	0.00		0.00				
25.50	0.00		0.00				

TABLE OF CONTENTS

Project Reports
1 Routing Diagram
2 Rainfall Events Listing (selected events)
3 Area Listing (all nodes)
4 Soil Listing (all nodes)
5 Ground Covers (all nodes)
6 Pipe Listing (all nodes)

2-YR Event
7 Node Listing
8 Subcat 1: Basin 1
10 Subcat 2: Basin 2
12 Subcat 3: Basin 3
14 Subcat 4: Basin 4
16 Subcat 5: Basin 5
18 Subcat 6: Basin 6
20 Pond B1: DI B1
23 Pond B2: DI B2
26 Pond B3: DI B3
29 Pond DB: Detention Basin
33 Pond KR: Kaapuni Road
35 Pond MH: MH
38 Pond NP: Neighboring Property

APPENDIX D

WATER QUALITY
CALCULATIONS

Water Quality Control

Volume required for sediment storage

0.5 inch of sediment per acre of impervious surface (Section 5.8 of Manual)

0.58 acres made impermeable

Volume required = **1,053** cubic feet

Volume available

Check volume available between elevation 302' and 303.5'

Elevation	Area (sf)
302 ft	724
303 ft	972
303.5 ft	1,110

Elevation Difference = 1.5 ft

Average Area = 935

Volume available = **1,403** cubic feet

Volume available > volume required

APPENDIX E

SWALE CALCULATIONS

Swale at Road Sta. 2+52

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01700	ft/ft
Discharge	1.96	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+11.0	307.17
-0+06.0	307.07
0+00.0	306.95
0+02.0	307.05
0+13.0	308.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.0, 307.17)	(-0+06.0, 307.07)	0.013
(-0+06.0, 307.07)	(0+02.0, 307.05)	0.035
(0+02.0, 307.05)	(0+13.0, 308.00)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.20	ft
Elevation Range	306.95 to 308.00 ft	
Flow Area	1.33	ft²
Wetted Perimeter	13.05	ft
Hydraulic Radius	0.10	ft
Top Width	13.04	ft

Swale at Road Sta. 2+52

Results

Normal Depth	0.20	ft
Critical Depth	0.18	ft
Critical Slope	0.02648	ft/ft
Velocity	1.47	ft/s
Velocity Head	0.03	ft
Specific Energy	0.23	ft
Froude Number	0.81	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.18	ft
Channel Slope	0.01700	ft/ft
Critical Slope	0.02648	ft/ft

Messages

Notes

Cross Section for Swale at Road Sta. 2+52

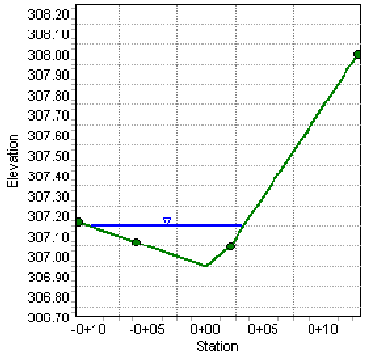
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01700	ft/ft
Normal Depth	0.20	ft
Discharge	1.96	ft³/s

Cross Section Image



Swale at Road Sta. 2+80

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01800	ft/ft
Discharge	1.96	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+03.0	306.60
0+00.0	306.28
0+02.0	306.38
0+07.0	307.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+03.0, 306.60)	(0+00.0, 306.28)	0.035
(0+00.0, 306.28)	(0+02.0, 306.38)	0.035
(0+02.0, 306.38)	(0+07.0, 307.00)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.29	ft
Elevation Range	306.28 to 307.00 ft	
Flow Area	1.03	ft²
Wetted Perimeter	6.32	ft
Hydraulic Radius	0.16	ft
Top Width	6.29	ft
Normal Depth	0.29	ft

Swale at Road Sta. 2+80

Results

Critical Depth		0.27	ft
Critical Slope		0.02712	ft/ft
Velocity		1.90	ft/s
Velocity Head		0.06	ft
Specific Energy		0.35	ft
Froude Number		0.83	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.29	ft
Critical Depth	0.27	ft
Channel Slope	0.01800	ft/ft
Critical Slope	0.02712	ft/ft

Cross Section for Swale at Road Sta. 2+80

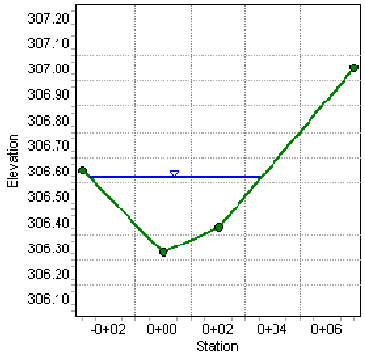
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01800	ft/ft
Normal Depth	0.29	ft
Discharge	1.96	ft³/s

Cross Section Image



Swale at Road Sta. 3+05

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01600	ft/ft
Discharge	1.96	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+03.0	306.30
0+00.0	306.00
0+02.0	306.10
0+19.0	307.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+03.0, 306.30)	(0+00.0, 306.00)	0.035
(0+00.0, 306.00)	(0+02.0, 306.10)	0.035
(0+02.0, 306.10)	(0+19.0, 307.00)	0.016

Options

Current Roughness Weighted Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results

Normal Depth	0.27	ft
Elevation Range	306.00 to 307.00 ft	
Flow Area	1.07	ft²
Wetted Perimeter	7.89	ft
Hydraulic Radius	0.14	ft
Top Width	7.87	ft
Normal Depth	0.27	ft

Swale at Road Sta. 3+05

Results

Critical Depth		0.26	ft
Critical Slope		0.02094	ft/ft
Velocity		1.84	ft/s
Velocity Head		0.05	ft
Specific Energy		0.32	ft
Froude Number		0.88	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	

GVF Output Data

Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Downstream Velocity		Infinity	ft/s
Upstream Velocity		Infinity	ft/s
Normal Depth		0.27	ft
Critical Depth		0.26	ft
Channel Slope		0.01600	ft/ft
Critical Slope		0.02094	ft/ft

Cross Section for Swale at Road Sta. 3+05

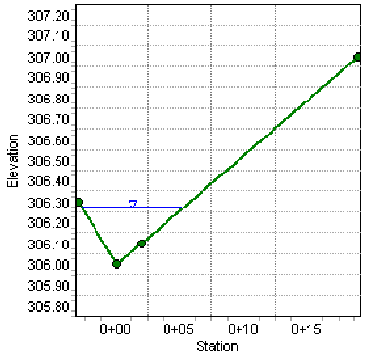
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01600	ft/ft
Normal Depth	0.27	ft
Discharge	1.96	ft³/s

Cross Section Image



Swale at Road Sta. 3+17

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01600	ft/ft
Discharge	1.96	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+03.0	306.20
0+00.0	305.93
0+02.0	306.03
0+22.0	307.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+03.0, 306.20)	(0+00.0, 305.93)	0.035
(0+00.0, 305.93)	(0+02.0, 306.03)	0.035
(0+02.0, 306.03)	(0+22.0, 307.00)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.27	ft
Elevation Range	305.93 to 307.00 ft	
Flow Area	1.14	ft²
Wetted Perimeter	8.52	ft
Hydraulic Radius	0.13	ft
Top Width	8.50	ft
Normal Depth	0.27	ft

Swale at Road Sta. 3+17

Results

Critical Depth		0.25	ft
Critical Slope		0.02418	ft/ft
Velocity		1.72	ft/s
Velocity Head		0.05	ft
Specific Energy		0.32	ft
Froude Number		0.83	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	

GVF Output Data

Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Downstream Velocity		Infinity	ft/s
Upstream Velocity		Infinity	ft/s
Normal Depth		0.27	ft
Critical Depth		0.25	ft
Channel Slope		0.01600	ft/ft
Critical Slope		0.02418	ft/ft

Cross Section for Swale at Road Sta. 3+17

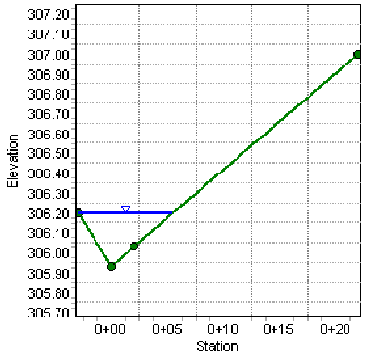
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01600	ft/ft
Normal Depth	0.27	ft
Discharge	1.96	ft³/s

Cross Section Image



APPENDIX F

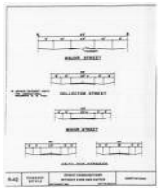
GRATE CAPACITY
CALCULATIONS

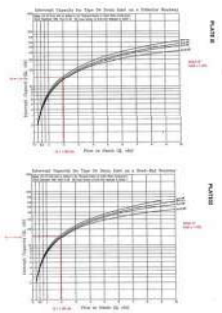
Kapahi Homesteads Two - 0.5 MG Storage Tanks
Inlet Capacity at Continuous Grade Condition

Check Drain Inlet DI B4 (Type G4) for all Road Classifications

Road Classification	Manual Plate	Structure	Drainage Report Basin	Top Elevation of DI	ESTIMATED Q_2 (cfs)	Height difference between selected location and Drain Inlet			Max depth from crown of street used in sump calculations (ft)	Intercept Capacity (cfs)	Bypass (cfs)
						Approximate Elevation	Location	Difference (ft)			
Collector Road	Plate 30	DI B4	Basin 4	304.50	1.96	305.60	Centerline of Kawaihau Road	1.10	0.723	1.40	0.56
Minor Road	Plate 31	DI B4	Basin 4	304.50	1.96	305.60	Centerline of Kawaihau Road	1.10	0.583	1.40	0.56
Dead-End Street	Plate 32	DI B4	Basin 4	304.50	1.96	305.60	Centerline of Kawaihau Road	1.10	0.533	1.50	0.46

say 0.56 cfs bypass





APPENDIX G

RAIN GUTTER/DOWNSPOUT SIZING

TABLE 11-1
Sizing Roof Drains, Leaders, and Vertical Rainwater Piping[1,2,3]

Size of Drain, Leader, or Pipe, Inches	Flow, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1 in./h	2 in./h	3 in./h	4 in./h	5 in./h	6 in./h
2	23	2,176	1,088	725	544	435	363
3	67	6440	3,220	2,147	1,610	1,288	1,073
4	144	13,840	6,920	4,613	3,460	2,768	2,307
5	261	25,120	12,560	8,373	6,280	5,024	4,187
6	424	40,800	20,400	13,600	10,200	8,160	6,800
8	913	88,000	44,000	29,333	22,000	17,600	14,667

Roof Area = 1800 sf
Rainfall = 3.3 in/hr
(2-year, 1-hour, from Plate 3)
Use 4" min for vertical piping

TABLE 11-1 (Metric)
Sizing Roof Drains, Leaders, and Vertical Rainwater Piping[1,2,3]

Size of Drain Leader or Pipe, mm	Flow, L/s	Maximum Allowable Horizontal Projected Roof Areas Square Meters at Various Rainfall Rates					
		25 mm/h	50 mm/h	75 mm/h	100 mm/h	125 mm/h	150 mm/h
50	1.5	202	101	67	51	40	34
80	4.2	600	300	200	150	120	100
100	9.1	1,286	643	429	321	257	214
125	16.5	2,334	1,117	778	583	467	389
150	26.8	3,790	1,895	1,263	948	758	632
200	57.6	8,175	4,088	2,725	2,044	1,635	1,363

Notes:
1. The sizing data for vertical conductors, leaders, and drains are based on the pipes flowing 7/24 full.
2. For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch/hour (25 mm/hour) column by the desired rainfall rate.
3. Vertical piping may be round, square, or rectangular. Square pipe shall be sized to enclose its equivalent round pipe. Rectangular pipe shall have at least the same cross-sectional area as its equivalent round pipe, except that the ratio of its side dimensions shall not exceed 3 to 1.

TABLE 11-2
Sizing of Horizontal Rainwater Piping[1,2]

Size of Pipe, Inches	Flow at 1/8 in./ft. Slope, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1 in./h	2 in./h	3 in./h	4 in./h	5 in./h	6 in./h
3	34	3,288	1,644	1,096	822	657	548
4	78	7,520	3,760	2,506	1,880	1,504	1,253
5	139	13,360	6,680	4,453	3,340	2,672	2,227
6	222	21,400	10,700	7,133	5,350	4,280	3,566
8	478	46,000	23,000	15,330	11,500	9,200	7,670
10	860	82,800	41,400	27,600	20,700	16,580	13,800
12	1,384	133,200	66,600	44,400	33,300	26,650	22,200
15	2,473	238,000	119,000	79,333	59,500	47,600	39,650

Size of Pipe, Inches	Flow at 1/4 in./ft. Slope, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1 in./h	2 in./h	3 in./h	4 in./h	5 in./h	6 in./h
3	48	4,640	2,320	1,546	1,160	928	773
4	110	10,600	5,300	3,533	2,650	2,120	1,766
5	196	18,880	9,440	6,293	4,720	3,776	3,146
6	314	30,200	15,100	10,066	7,550	6,040	5,033
8	677	65,200	32,600	21,733	16,300	13,040	10,866
10	1,214	116,800	58,400	38,950	29,200	23,350	19,450
12	1,953	188,000	94,000	62,600	47,000	37,600	31,350
15	3,491	336,000	168,000	112,000	84,000	67,250	56,000

Size of Pipe, Inches	Flow at 1/2 in./ft. Slope, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1 in./h	2 in./h	3 in./h	4 in./h	5 in./h	6 in./h
3	68	6,576	3288	2,192	1,644	1,310	1096
4	156	15,040	7,520	5,010	3,760	3,010	2500
5	278	26,720	13,360	8,900	6,680	5,320	4450
6	445	42,800	21,400	14,267	10,700	8,580	7140
8	956	92,000	46,000	30,650	23,000	18,400	15,320
10	1,721	165,600	82,000	55,200	41,400	33,150	27,600
12	2,768	266,400	133,200	88,800	66,600	53,200	44,400
15	4,946	476,000	238,000	158,700	119,000	95,200	79,300

Roof Area = 1800 sf
Rainfall = 3.3 in/hr
(2-year, 1-hour, from Plate 3)
Use 4" min for horizontal piping

Notes:

1. The sizing data for horizontal piping are based on the pipes flowing full.
2. For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch/hour (25 mm/hour) column by the desired rainfall rate.

TABLE 11-3
Size of Gutters

Diameter of Gutter in Inches 1/16 in./ft. Slope	Maximum Rainfall in Inches per Hour 2	3	4	5	6
3	340	226	170	136	113
4	720	480	360	288	240
5	1,250	834	625	500	416
6	1,920	1,280	960	768	640
7	2,760	1,840	1,380	1,100	918
8	3,980	2,655	1,990	1,590	1,325
10	7,200	4,800	3,600	2,880	2,400

Diameter of Gutter in Inches 1/8 in./ft. Slope	Maximum Rainfall in Inches per Hour 2	3	4	5	6
3	480	320	240	192	160
4	1,020	681	510	408	340
5	1,760	1,172	880	704	587
6	2,720	1,815	1,360	1,085	905
7	3,900	2,600	1,950	1,560	1,300
8	5,600	3,740	2,800	2,240	1,870
10	10,200	6,800	5,100	4,080	3,400

Diameter of Gutter in Inches 1/4 in./ft. Slope	Maximum Rainfall in Inches per Hour 2	3	4	5	6
3	680	454	340	272	226
4	1,440	960	720	576	480
5	2,500	1,668	1,250	1,000	834
6	3,840	2,560	1,920	1,536	1,280
7	5,520	3,680	2,760	2,205	1,840
8	7,960	5,310	3,980	3,180	2,655
10	14,400	9,600	7,200	5,750	4,800

Diameter of Gutter in Inches 1/2 in./ft. Slope	Maximum Rainfall in Inches per Hour 2	3	4	5	6
3	960	640	480	384	320
4	2,040	1,360	1,020	816	680
5	3,540	2,360	1,770	1,415	1,180
6	5,540	3,695	2,770	2,220	1,850
7	7,800	5,200	3,900	3,120	2,600
8	11,200	7,460	5,600	4,480	3,730
10	20,000	13,330	10,000	8,000	6,660

Roof Area = 1800 sf
Rainfall = 3.3 in/hr
(2-year, 1-hour, from Plate 3)
for gutter at 1/8"/foot, use 7" gutter
for gutter at 1/4"/foot, use 6" gutter
for gutter at 1/2"/foot, use 5" gutter