ENGINEERING REPORT
FOR
THE DEVELOPMENT OF
KALAHEO WELL NO. 5631-02,
KALAHEO AND LAWAI-OMAO
WATER SYSTEM
KALAHEO, KAUAI, HAWAII

PREPARED FOR:
THE DEPARTMENT OF WATER
COUNTY OF KAUAI

BY
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LIHUE, KAUAI, HAWAII 96766
I. INTRODUCTION

The purpose of this report is to provide comprehensive information on the development of the Kalaheo Well No. 5631-02 as a domestic water source. (Well No. 5631-02 is existing and a cross section of the existing well is shown on Fig. 4).

This report is prepared in accordance with the requirements of Section 11-20-29 of Chapter 20, Title 11, Administrative Rules, entitled "Potable Water Systems", Department of Health, State of Hawaii, and the report follows the State Department of Health's "Guidelines of New Potable Water Source".

The proposed project consists of the development of the existing Kalaheo Well No. 5631-02 which will serve as a standby to the existing pump that is located at Well No. 5631-01. The existing well and pump site is shown on Fig. 5.

This project will be developed in accordance with the Department of Water requirements for stand-by pumps.

II. GENERAL INFORMATION

A. PROJECT LOCATION

The project is located in the uplands of Kalaheo at an approximate elevation of 892+ mean sea level.
Identified by Tax Map Key 2-4-04:Parcel 5 (owned by the State of Hawaii), this project will be located at the end of Poohiwi Road, approximately 4,500 feet north of Kaumualii Highway. The site is the location of an existing pump station operated by the Department of Water, County of Kauai. (The existing well is identified as Kalaheo Well No. 5631-01). Access to the site is by way of Poohiwi Road, which is a paved roadway approximately ten (10) feet in width.

Exhibit 1 and Figure 1 show the location of the project.

B. PROJECT DESCRIPTION

The existing Kalaheo and Lawai-Omao water systems cover an extensive area with service levels ranging from 300 feet to 1,100 feet above mean sea level. The Kalaheo system is the larger of the two systems and the proposed project will be constructed on the Kalaheo System (Fig. 2). Primary storage for the Kalaheo System consists of the 100,000 gallon nursery storage tank at elevation 1,105 feet (+) and the 200,000 gallon and 250,000 gallon Kukuiolono tanks at elevation 870 feet (+). The main distribution system consists of 12-inch asbestos cement pipe and 8-inch and 6-inch cast iron pipes.
Due to the hilly terrain of the area, pressure regulating valves are located at selected locations within the distribution system to control the wide variations in pressure.

The primary source of water for the Kalaheo System is the Alexander Reservoir that is located in the forest reserve above Kalaheo.

During emergencies, the Kalaheo System can be supplemented by the Lawai-Omao system. Conversely, the Kalaheo System can supplement the Lawai-Omao system when needed.

Additional source of water to supplement the Alexander Reservoir source comes from an existing deep well (No. 5631-01) shown on Fig. 2. Pump facilities are in place at this location to withdraw approximately 900 gpm to service the Kalaheo System.

Adjacent to Deep Well No. 5631-01 is Deep Well No. 5631-02. (See Fig. 2 and Fig. 5.)

Job No. 83-2 proposes to install at Deep Well No. 5631-02 the associated pumping facilities and control system to withdraw approximately 1200 gpm of water to supplement the Kalaheo Water System. Chlorination facilities will be included in the project development.

The existing pumping system and the proposed
pumping system will not operate concurrently, i.e. when one system is in operation, the other system acts as a stand-by system and vice versa.

Presently, the existing pumping system at Deep Well No. 5631-01 does not have back-up capabilities. When the existing system is shut down for repairs and maintenance, additional water cannot be supplied to the Kalaheo System except from the smaller Lawai-Omao System.

Also, while the existing pump system can now supply only the Kukuiolono Storage Tanks, the new system will incorporate work to install valve and controls to allow the pumping system to also replenish the existing nursery tank at elevations 1,105.0+, if required. (See Fig. 3.)

Besides providing flexibility and efficiency to the operation of the Kalaheo Water System, the new facilities will also provide for a maintenance program that will not interrupt water service to the consumers.

Included in the proposed actions are:

a) Installation of one (1) 1200 gpm pump with the necessary control systems;

b) Construction of one (1) control building (12'x24') approximately);
c) Installation of connecting pipeline system; and

d) Installation of two (2) control valves and two (2) pressure regulating valves.

The layout of the proposed project is shown on Fig. 7.

Since the project is to be constructed adjacent to existing Department of Water facilities, no additional lands need be acquired.

Construction of this project will be under the control of the Department of Water, and upon completion and final acceptance of the project, maintenance and operation will be the responsibility of the Department of Water.

C. OWNER

The Project, when completed will be owned and operated by the Department of Water.

III. PHYSICAL AND HYDROLOGICAL CHARACTERISTICS OF THE AREA

A. TOPOGRAPHY

The project is located in the Lihue-Koloa forest reserve at the end of Poohiwi Road in Kalaheo. The existing well and pump site is level with a sloping driveway leading up to Poohiwi Road. The site is enclosed by a six (6) feet high chain link fence with a fifteen (15) feet wide access gate.
The site contains a control building, approximately sixteen feet by sixteen feet (16'x16') in floor area, an underground diesel fuel tank (2,000 gallon capacity), a 900 gpm diesel pump and discharge piping. The existing well 5631-02 is also located within the enclosed area. (To accommodate the new development, the existing fence line has to be relocated.) The site is surrounded by large trees and heavy vegetation on three sides. The existing ground elevation at the site is 892+ MSL.

B. GEOLOGY AND HYDROLOGY

The island of Kauai is the oldest of the major Hawaiian Islands and is one of the most structurally complex. The island is comprised of two distinct rock types. The first type is known as the Waimea Volcanic series and the second type is known as the Koloa Volcanic Series. Large basal water sources are found more so in the older Waimea Volcanic Series than in the Koloa Volcanic Series. The highly permeable soils and rocks permit much of the rainfall to infiltrate to ground water supplies.

The existing Kalaheo Well Nos. 5631-01 and 5631-02 have been drilled to tap the thick basal water body saturating the Waimea Canyon lava flows.
### DATA FOR KALAHEO WELL NO. 5631-02

<table>
<thead>
<tr>
<th>WELL</th>
<th>DLNR WELL NO.</th>
<th>OWNER</th>
<th>COORDINATES</th>
<th>CSG DIA (IN.)</th>
<th>YEAR DRILLED</th>
<th>CL- (mg/l)</th>
<th>GRD SURF ELEV. (MSL)</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>5631-02</td>
<td>Kauai Dept. of Water</td>
<td>21°56'29&quot;</td>
<td>159°31'45&quot;</td>
<td>14</td>
<td>1985</td>
<td>25</td>
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<table>
<thead>
<tr>
<th>WELL</th>
<th>ELEV STATIC HEAD</th>
<th>CASING</th>
<th></th>
<th></th>
<th>RATE (GPM)</th>
<th>DRAW DOWN (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5631-02</td>
<td>41.13 ft. MSL</td>
<td>Bot of Hole</td>
<td>-138.00 feet MSL</td>
<td>31.59 feet MSL</td>
<td>-21.41 feet MSL</td>
<td>900</td>
</tr>
</tbody>
</table>
Well Number: Six digit numbers are assigned by the Department of Land and Natural Resources, Division of Water and Land Development and are based on the latitude and longitude position of the well.

- minute of latitude
- minute of longitude
- sequential number within minute grid.

C. CLIMATE

The island of Kauai generally has a mild climate, as characterized by its comfortable temperatures and cooling tradewinds. The average temperature is 78 degrees Fahrenheit. The tradewinds blow from the Northeast and occur 80 percent of the time. At times, normal wind patterns are interrupted by tropical storms or Kona winds which usually bring heavy rains to all parts of the island.

Due to the prevailing tradewinds, distinct windward and leeward sections of the island exist. The windward district of Kauai receives much rainfall from the moist tradewind air. The moist air is cooled and condensed as it moves upward and
over the mountains, thus creating the high rainfall.

The project site is located in the leeward district of the island. The annual rainfall at the project site and its surrounding area ranges between 60 and 75 inches, while the island's average annual rainfall is between 45 and 50 inches.

D. SOILS

The soils in the project area are dark brown to dark reddish brown, deep, well-drained, and generally non-stoney. The soil at this site generally belongs to the moderately productive group of soils. Run-off is medium to rapid and erosion hazard is medium. The soil is used for pasture, woodlands and forests.

E. GROUND WATER CONDITIONS

Subterranean aquifers provide Kauai with its most dependable source of water because underground storage is less affected by droughts and seasonal changes in rainfall. Ground water is the islands principal source of domestic water.

A high percentage of Kauai's heavy rainfall infiltrates into the ground and the islands principal source of basal ground water occurs in the highly permeable Waimea Volcanic Series rock layers.
F. **EARTHQUAKE CONSIDERATIONS**

The Island of Kauai is located in seismic zone 0, based on the Uniform Building Code, Seismic Zone Maps. Seismic Zone 0 refers to little or no earthquake activity on the Modified Mercator Scale (MM).

G. **FLOOD CONSIDERATIONS**

The project is in the Lihue-Koloa forest reserve above Kalaheo and there are no streams or rivers to threaten the site from inundation. No tsunami problems are anticipated to affect the site.

H. **LOCAL LAND USE AND ZONING**

The proposed project is situated within the Open District under the County of Kauai, General Plan and is within the Conservation District of the State Land Use District Boundary Map. The site is further sub-zoned as a Limited (L) sub-zone under the Conservation Sub-Zone Map.

I. **WATER RIGHTS**

The Department of Water, County of Kauai, presently operates the well site. The Department of Water is responsible for operation and maintenance of the Kalaheo and Lawai-Omao Water System.

IV. **EXTENT OF WATERWORKS SYSTEM**

A. Figure 3 shows the extent of the Kalaheo and
Lawai-Omao waterworks system. The diagram shows both present and planned improvements to the system. The Kalaheo and Lawai-Omao system presently serves 3,000 consumers and water consumption for the period July 1, 1984 to June 30, 1985 amounted to 199,557,000 gallons. Water consumption for the area is expected to increase at a steady rate. The 1980 population census for Kauai shows that the Kalaheo area population was 2,500. The anticipated population for the same area for the year 2000 is 4,000.

By the year 2000, the water consumption for the Island of Kauai is expected to increase from 160 gallons per day per capita to 223 gallons per day per capita.

B. FUTURE REQUIREMENTS FOR SERVICE

To accommodate the ever increasing demands for water service in the Kalaheo area, several improvement projects are planned to augment the existing water system.

Several deep well sites have already been explored and their developments may be forthcoming. New storage facilities at the Kukuiolono Tank sites have been proposed to augment the existing tanks at that site. Major water mains have recently been installed to replace the smaller and older distribution mains. Further developments in the Kukuiolono Park area will require additional mains for water supply and for maintaining
adequate firefighting capabilities.

All provisions for extending the water systems are or will be in State or County lands.

C. FIRE PROTECTION AND PRESSURE REQUIREMENTS

The proposed project will ensure a continuous and reliable supply of water for domestic and fire flow demands for the Kalaheo area. Adequate pressure will be available to satisfy the fire flow demands.

D. ALTERNATIVE SOLUTIONS

The alternative to this project is the "No Action" alternative, which would be contrary to the Department of Water General Plan and requirements.

Pumping tests have confirmed that the existing Well No. 5631-02 can provide a reliable, high quality water source to augment the existing well and pump system at Well No. 5631-01.

E. ANTICIPATED IMPACTS OF THE PROPOSED PROJECT

The project is located at a remote site away from the dense population areas.

During the contractor's mobilization phase for the project, traffic along the route to the project site may be delayed to some extent, but no serious traffic problems are anticipated.

Construction of the project, except for some valve relocation work, will be confined entirely within
Department of Water facilities areas. No encroachment onto the existing travelway is anticipated.

The public may be subjected to temporary noise and dust caused by heavy equipment during the construction of the facilities.

To minimize hazards from any trench work, the contractor shall be directed to backfill all trenches as soon as all the necessary tests have been completed. Temporary steel plates will be used to cover open trenches during non-working hours.

While work is underway, all State and County construction and safety standards applicable to the project will be enforced by the Department of Water for the protection of the public and workers.

The construction of these projects will not require displacement of residences, nor will it require clearing of any forest areas.

At valve relocation areas, necessary safety barricades and flagmen will be utilized to direct traffic around the work areas.

Roadways and ground affected by the construction will be restored to its original condition and all precaution will be taken to minimize erosion, dust, noise and other nuisance.

There will be no destruction or removal of natural
vegetation and/or forest areas and there are no known archaeological/historical sites in or adjacent to the project area.

The following mitigating measures will be imposed upon the Contractor during construction of the project:

1. The Contractor will be required to remove all silt and debris resulting from his work and deposited in drainage facilities, roadways and other areas.

2. The Contractor will be required to keep the project areas and surrounding areas free from dust nuisance. The work will be done in accordance with the air pollution control standards of the State Department of Health.

3. All grading operations will be performed in conformance with the applicable provisions of the Water Pollution Control and Water Quality Standards contained in the Public Health Regulations, State Department of Health, on Water Pollution Control and Water Quality Standards.

4. Construction debris and wastes will be deposited at an appropriate site. The Contractor will inform the Engineer of the location of disposal sites. The disposal site
must fulfill the requirements of the grading ordinance.

5. All work will be performed in accordance with the Department of Public Works, County of Kauai, "Standard Details for Public Works Construction" dated August 1976 and the "Standard Specifications for Public Works Construction" dated May 1975.

6. The Contractor will be required to provide, install and maintain all necessary signs, lights, flares, barricades and other necessary protective facilities and take all necessary precautions for the protection of the work and the convenience and safety of public traffic. Adequate provisions for traffic control will be provided in accordance with "Rules and Regulations Governing the Traffic Control Devices at Work Sites on or Adjacent to Public Streets and Highways of the State of Hawaii" and with the Federal Highway Administration "Manual on Uniform Traffic Control Devices/(MUTCD)."
V. POTENTIAL SOURCES OF CONTAMINATION

A. DESCRIPTION OF WELL SITE

1. A topographic map of the well site is shown on Fig. 8.

2. The well site is located at the end of Poohiwı Road in Kalaheo at elevation 892+.

3. The amount of run-off from the surrounding area is very limited due to swales cut around the site.

4. The closest residential dwelling (with cesspools) is approximately 1,500 feet away from the well site.

5. Figure 4 shows the cross-section of existing Well No. 5631-02.

B. WATER QUALITY DATA

Table I shows water quality data for water samples taken from Well No. 5631-02. The tests show that no treatment of the water is necessary. Chlorination facilities for disinfection of the water will be provided within the proposed control building.

C. POTENTIAL SOURCES OF CONTAMINATION

Groundwater recharge occurs through the percolation of rainfall on the island. The
potential sources of contamination of water drawn from the proposed standby well may be attributed to urban/agricultural activities, sea water intrusion, and storm inundation.

The proposed standby well is located within the existing well site. The closest residential dwelling (with cesspool) is located approximately fifteen hundred (1500) feet away from the well site. Due to the design and location of the proposed well, which is situated in the Lihue-Koloa Forest Reserve, away from urban and residential activities, contamination from these sources are not anticipated.

Potential contamination from surface infiltration due to sea intrusion and storm inundation, would be negligible due to the well casing being constructed about a foot above the finished ground with the annular space between the drilled hole and the well casing being filled with cement grout.

C. CONTROL MEASURES

The proposed standby well is located within the existing well site (situated in the Lihue-Koloa Forest Reserve). Due to its location, contamination sources (which are found in more
urbanized areas) are believed to be minimal. Continued monitoring of the well's water, using chemical and biological analysis will insure a continuous, high quality supply of water for the residents of the Kalaheo area.

E. SUMMARY

The water quality of the Kalaheo Well No. 5631-02 falls within the limits of potable waters and complies with the standards of the Safe Drinking Water Act and other Department of Health Regulations. The water quality of the proposed standby well will be monitored on a regular basis to insure that a high water quality is maintained.

VI. WATER DISTRIBUTION SYSTEM

A. EXISTING SYSTEM LAYOUT

The schematic diagram of the Kalaheo System is shown on Fig. 3. The Lawai-Omao System which is connected to the Kalaheo System is also shown in the diagram. The main components of the existing Kalaheo System are as follows:

1. Alexander Reservoir intake;
2. Water Treatment Facilities (Filter Plant);
3. Nursery Tank;
4. Pump at Well No. 5631-01;
5. Kukuiolono Storage Tank (1 -200,000 gallon
tank and 1 -250,000 gallon tank);  
6. 12" Asbestos Cement, 8" and 6" C.I. distribution mains with pressure regulating valves, and fire hydrants at selected locations.

B. **EXISTING UTILITIES**

Overhead electric lines presently service the site. Telemetry wires for pump control are also located on utility poles along Poohiwi Road.

There are no underground utilities (gas, sewer, drains) within the project area.

VII. **PROPOSED WATER TREATMENT FACILITIES**

A. The proposed project development will act as a standby to the existing Well No. 5631-01. Water from the proposed development at Well No. 5631-02 will be chlorinated by utilizing an automatic gas chlorinator injection system. The chlorination system will be located inside the proposed control building. A chain link fence, with locked gates, will entirely enclose the pump site. Only Department of Water personnel will have access to the well site.

VIII. **PUMP FACILITIES**

A. **EXISTING SYSTEM**

*REFER TO FIG. 6*

Presently, the primary water storage for the
Kalaheo system consists of the Nursery Tank and the Kukuiolono tanks. The primary water source is the Alexander Reservoir in upper Kalaheo, where water flows from the reservoir to the existing treatment plant. After treatment, the water flows to the Nursery Tank and then into the Kalaheo distribution system. The Kukuiolono Tanks are also supplied from the Alexander Reservoir and Nursery tanks.

An existing 900 gpm diesel pump that is located at the end of Poohiwi Road and at approximate elevation 892+ provides a supplementary water source for the Kalaheo System. Level controls are in place at the Kukuiolono tanks to signal the pump's start-up and shut-off operations.

To control excessive pressure variations due to the hilly terrain of the area, pressure regulating valves are in place at selected locations with the distribution system.

The present pumping and distribution system are unable to replenish the nursery tank which is located adjacent to Puuwai Road at Elevation 1,111+. (See Fig. 2).

B. PROPOSED IMPROVEMENTS

This project proposes to install a stand-by pump (1200 gpm) at the existing well No. 5631-02,
which is located adjacent to the existing well No. 5631-01. (See Fig. 5).

New control valves and additional pressure regulating valves will be installed to allow the pumps to replenish the nursery tank in addition to the Kukuiolono tanks.

The pump valve control systems will be designed to accomplish this task.

C. PUMP OPERATIONS (Refer to Fig. 7)

The pump and control system shall be designed to perform the following operations automatically.

1. NORMAL OPERATION
   a) Water supply from Alexander Reservoir;
   b) Control valve 1 - normally closed;
   c) Control valve 2 - normally open;
   d) Pumps off.

2. KUKUIOLONO TANK - LOW
   a) Level control at tank signals pump start-up to begin tank filling operation;
   b) High level control signals pump shut-off;
   c) Valve 1 remains closed;
   d) Valve 2 remains open.

3. NURSERY TANK - LOW
   a) Level control at nursery tank signals valve 1 to open;
b) Also signals valve 2 to close.
c) Level control also signals pump start-up to begin nursery tank filling operation;
d) High level control signals pump shut-off;
e) High level control signals valve 1 to close and valve 2 to open (back to normal conditions).

D. CONTROL BUILDING

A new building will be constructed to house the motor control system for the new pump. The building will also house the chlorination system that will be incorporated with this project.

The building will be approximately twelve feet by twenty-four feet (12'x24') in floor size and will be constructed of hollow tile with wooden roof framing. The location of the proposed control building is shown on Fig. 5.
IX. FINANCING

Funding for this project will be provided by the Department of Water, County of Kauai. Operation and maintenance will be the responsibility of the Department of Water.

X. AGENCIES CONSULTED

Department of Land & Natural Resources
State of Hawaii
3060 Eiwa Street
Lihue, Kauai, Hawaii 96766

Department of Water, County of Kauai
4398 Pua Loke Street
Lihue, Kauai, Hawaii 96766

Department of Health
State of Hawaii
3040 Umi Street
Lihue, Kauai, Hawaii 96766

XI. REFERENCES

1. County of Kauai, Department of Water, A General Plan for Domestic Water/Island of Kauai. (Division of Water and Land Development, Department of Land and Natural Resources, State of Hawaii) Honolulu, 1972

2. Detailed Land Classification, Island of Kauai, Land


HANALEI DISTRICT

ISLAND OF KAUAI

PROJECT LOCATION

EXHIBIT I
KALAEHO 2 5631-02

AS BUILT SECTION

Drilled: February 1985
Driller: Roscoe Moss Company
Job No. 51-KW-27

Nipple
892.04 Ft. MSL - Top of Casing
891.59 Ft. MSL - Finish Grade

41.13 Ft. Above MSL on 2-6-85
Static Water Level
(Steel Tape)

Casing Guide

EXISTING KALAEHO WELL 5631-02
NOT TO SCALE
EXIST. CHAIN LINK FENCING

EXIST. CONTROL BUILDING

EXIST. FUEL TANK
(BURIED)

EXIST. DIESEL PUMP
WELL NO. 5631-01

EXIST. A.C. PARKING AREA

EXIST. A.C. ROADWAY

EXIST. 12' DISCHARGE LINE

POOHIFI ROAD

PROPOSED PUMP
CONTROL BUILDING

SCALE: 1" 20'

PLAN
PUMP SITE AT WELL
NO. 5631-01 & 5631-02

SCALE: 1" 20'
THE EXISTING PRESSURE REGULATING VALVE IS DESIGNED TO MAINTAIN BACK PRESSURE TO PREVENT THE NURSERY TANK FROM EMPTYING.
AXANDER RESERVOIR -> DAM

TREATMENT PLANT

PRESSURE REGULATING VALVE

SPILLNER TANK

NURSERY TANK

PROPOSED BOOSTER PUMP

EXISTING PUMP STATION AT WELL SITE 5631-01

PROPOSED PUMP AT WELL SITE 5631-02

KUKUIOLONO TANKS

PARTIAL SCHEMATIC OF EXISTING KALAEHO WATER SYSTEM WITH PROPOSED IMPROVEMENTS

NOTE:
NEW WORK IS DENOTED IN BOX

NOT TO SCALE
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

KALAHEO 2: 5631-02
PUMP TEST 1
KALAHEO, KAUA'I, HAWAII

PHYSICAL DATA
Ground Elevation 892 FT
Size of Casing: 14 INCH
Depth of Casing (solid): 880 FT (33 FT MSL)
Depth of Casing (screened): 820 FT (-29 FT MSL)
Depth of Hole: 1030 FT (-138 FT MSL)
Water Temperature: 68.9° (19.3° C)
Latitude: 21° 56' 29"
Longitude: 159° 31' 45"

Test Conducted By: M. OHYE
EXISTING DEEP WELL NO. 5831-02 WITH EXISTING PUMPING FACILITIES (900 gpm)

EXISTING WATER TREATMENT PLANT

EXISTING DEEP WELL NO. 5831-02

EXISTING WATER TREATMENT PLANT

NEW PUMP FACILITIES LOCATION JOB No. 83-2

EXISTING KALAHEO WATER SYSTEM

PLAN
EXISTING KALAHEO WATER SYSTEM

FIGURE 2
# TABLE I

**ANALYTICAL RESULTS**

**FOR**

**KALAHEO WELL NO. 5631-02**

![Table Image](image-url)

**UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY**

21563C159314GJ1 - 2-5631-C2 STATE: KALAHEO 2 KAUAI

**WATER QUALITY DATA**

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<tr>
<th>Date</th>
<th>Sample Type</th>
<th>Conduct</th>
<th>EC (mS/cm)</th>
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</thead>
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<tr>
<td>FEB, 1985</td>
<td>0730</td>
<td>.30</td>
<td>10</td>
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</tbody>
</table>
SCHEMATIC DIAGRAM OF KALAHEO AND LAWAI-OMAO WATER SYSTEMS SHOWING EXISTING FACILITIES, PROPOSED FULL-GROWTH IMPROVEMENTS, PROPOSED CONSTRUCTION

EXISTING FACILITIES

PROPOSED FULL-GROWTH IMPROVEMENTS

PROPOSED CONSTRUCTION

ELEVATION ABOVE M.S.L. (FEET)

ELEVATION ABOVE M.S.L. (FEET)