BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109

June 19, 1996

Mr. Gary Gill, Director
State of Hawaii
Office of Environmental Quality Control
220 South King Street, Fourth Floor
Honolulu, Hawaii 96813

Dear Mr. Gill:

Subject: **MOKUHAU WATER TANK**

In accordance with the requirements of chapter 343, Hawaii Revised Statutes, and Chapter 200 of Title 11, Administration Rules, a Final Environmental Assessment has been prepared for the proposed project.

As the proposing agency, we are forwarding herewith one (1) copy of the OEQC Bulletin Publication form and four (4) copies of the Final Environmental Assessment (EA). Written comments received during the public comment period of the EA and applicable responses have been included. We have determined that the project will not have a significant environmental effect and have issued a negative declaration. Please publish this notice in the next edition of the "Environmental Notice".

Should you have any questions, please contact our engineering division at 808-243-7835.

Sincerely,

David R. Craddick
Director

/HK:sc
Enclosures
cc: Milton Arakawa, Munekiyo & Arakawa, Inc.

1996-07-08-MA-FEA-Mokuhau Water Tank

Final Environmental Assessment

Mokuhau Water Tank

Prepared for

County of Maui
Dept. of Water Supply

June 1996

MUNEKIYO & ARAKAWA, INC.

Final
Environmental Assessment

Mokuhau Water Tank

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Dept. of Water Supply

June 1996

MUNEKIYO & ARAKAWA, INC.

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Preface

The County of Maui, Department of Water Supply (DWS), proposes to construct a 3.0 million gallon water tank and other accessory improvements in Mokuhau, Maui, Hawaii. The new water tank will be constructed approximately 450 feet south of the existing 1.0 million gallon Mokuhau water tank located at the eastern extent of Mokuhau Road. Pursuant to Chapter 343, Hawaii Revised Statutes, and Chapter 200 of Title 11, Administrative Rules, Environmental Impact Statement Rules, this Final Environmental Assessment (EA) documents the project's technical characteristics and environmental impacts, and advances findings and conclusions relative to the significance of the project.

Summary

Proposing Agency and Landowner

The proposing agency for the proposed project is the County of Maui, Department of Water Supply. The landowner for the subject property is the County of Maui.

Property Location and Description

The project site is located on a portion of a County-owned parcel located north of and adjacent to the Iao Stream Flood Control project. This parcel, which encompasses approximately 26.926 acres, is not assigned a Tax Map Key (TMK) number; however, it has been recorded as Parcel "A" with the Bureau of Conveyances, and is identified on Tax Map 3-4-36. The improvements are proposed to occupy a portion of Parcel "A", approximately 450 feet south of the existing 1.0 million gallon Mokuhau water tank located at the western extent of Mokuhau Road. The Iao Stream Flood Control project, built by the U.S. Army Corps of Engineers, protects the proposed project site from existing streamflows. Existing vegetation within the project site includes various shade trees, haole koa, lowlying grasses and weeds.

Proposed Action

The proposed project involves the construction of a 3.0 million gallon water tank, installation of two (2) transmission lines (20-inch inlet and 24-inch outlet), and a 12-foot wide paved access road extending from Mokuhau Road to the proposed water tank. Other related improvements include a 0.30 acre-ft. detention basin and 18-inch overflow and drain lines. It is noted that approximately 90 feet of the proposed inlet/outlet transmission lines will be installed within the western extent of the Mokuhau Road right-of-way. This area of installation is necessary in order to connect the proposed 3.0 million gallon water tank system to existing waterlines within the Mokuhau Road right-of-way.

Pumping capabilities for the proposed 3.0 million gallon water tank will be provided by the existing pump station located at the westerly extent of Mokuhau Road (TMK 3-3-02:24). This pump station, which is currently servicing the existing 1.0 million gallon water tank located on the same parcel, will be upgraded to improve monitoring and operations in anticipation of the proposed project.

The proposed improvements are intended to provide additional water storage capacity to accommodate the water demands in the Central Maui and Kihei regions. It will also

allow the existing 1.0 million gallon water tank to be taken off-line for necessary repairs and renovations without interruption to the water service currently being provided.

Findings and Conclusions

The proposed project involves the construction of a 3.0 million gallon water tank, a 12-foot wide paved access easement, a 0.30 acre-ft. detention basin and other accessory improvements in Mokuhau (Happy Valley), Maui, Hawaii.

Every phase of the proposed action, expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action have been evaluated in accordance with the Significance Criteria of Section 11-200-12 of the Administrative Rules. Based on the analysis, the proposed project will not result in any significant impacts. Discussion of project conformance to the criteria is noted as follows:

1. ***No irrevocable commitment to loss or destruction of any natural or cultural resource would occur as a result of the proposed project***

   The project will not significantly affect slope and land use characteristics of the surrounding area. There are no known, rare, endangered or threatened species of flora, fauna or avifauna within the project site.

   An archaeological inventory survey found no evidence of historic sites or significant cultural resources. However, should any cultural remains be discovered during construction, applicable procedures to ensure compliance with Chapter 6E, HRS, will be followed.

2. ***The proposed action would not curtail the range of beneficial uses of the environment***

   The proposed project is located on existing vacant land adjacent to the Iao Stream Flood Control Project. The site is located approximately 150 feet north of the normal stream flows and will not affect the flood control levee built by the U.S. Army Corps of Engineers. The proposed project would not have a significant effect on the range of beneficial uses of the environment.

3. ***The proposed action does not conflict with the State's long-term environmental policies or goals or guidelines as expressed in Chapter 344, Hawaii Revised Statutes***

   The State Environmental Policy and Guidelines are set forth in Chapter 344, Hawaii Revised Statutes and were reviewed in connection with the proposed

project. The proposed action is in consonance with the State's long-term environmental policies and goals of Chapter 344, HRS.

4. ***The economic or social welfare of the community or State would not be substantially affected***

The proposed project provides additional water storage capacity to service a projected growth in population in the Central Maui and Kihei-Makena area. The construction of the new water tank also allows the existing tank to be taken off-line for repairs and refurbishment. Thus, the project is an indirect economic benefit to the community and should have no effect upon social welfare parameters.

5. ***The proposed action does not affect public health***

No impacts to the public's health and welfare are anticipated as a result of the project.

6. ***No substantial secondary impacts, such as population changes or effects on public facilities, are anticipated***

No significant secondary impacts are anticipated from the project.

The proposed project is not anticipated to have a significant effect upon the area's roadways. The project does not require a connection to the County's sewer system. Storm runoff will be directed via grassed swales into a detention basin area. The project is not expected to impact public services, such as police, fire and medical services. Impacts upon recreational, educational and solid waste parameters are also negligible.

7. ***No substantial degradation of environmental quality is anticipated***

During the construction phase of the project, there will be short-term air quality and noise impacts as a result of the project. In the long term, effects upon air quality and noise parameters should be minimal. The project is not anticipated to significantly affect the open space and scenic character of the area.

No substantial degradation of environmental quality resulting from the project is anticipated.

8. ***The proposed action does not involve a commitment to larger actions, nor would cumulative impacts result in considerable effects on the environment***

The proposed project does not involve a commitment to larger actions. However, the implementation of this project would allow the repair and refurbishment of the existing Mokuhau Water Tank which is intended to be done at a later point in time.

9. ***No rare, threatened or endangered species or their habitats would be adversely affected by the proposed action***

There are no rare, threatened or endangered species of flora or fauna or their habitats on the subject property.

10. ***Air quality, water quality or ambient noise levels would not be detrimentally affected by the proposed project***

Construction activities will result in short-term air quality and noise impacts. Dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions. Noise impacts will occur primarily from construction-related activities. It is anticipated that construction will be limited to daylight working hours.

In the long term, the project is not anticipated to have a significant impact on air quality or noise parameters.

11. ***The proposed project would not affect environmentally sensitive areas, such as flood plains, tsunami zones, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters or coastal waters***

The project is not located within and would not affect environmentally sensitive areas. The project site is located adjacent to the Iao Stream Flood Control Project and is not subject to flooding or tsunami inundation. Soils of the project site are not erosion-prone. There are no geologically hazardous lands, estuaries, or coastal waters within or adjacent to the project site.

Based on the foregoing findings, it is concluded that the proposed action will not result in any significant impacts.

Chapter I

Project Overview

I. PROJECT OVERVIEW

A. PROPERTY LOCATION, EXISTING USE, AND LAND OWNERSHIP

The County of Maui, Department of Water Supply (DWS), proposes to construct a 3.0 million gallon water tank, a 12-foot wide paved access easement, a 0.30 acre-ft. detention basin and other accessory improvements in Mokuhau (Happy Valley), Maui, Hawaii. See Figure 1 and Figure 2. The completed 3.0 million gallon water tank will provide additional water storage capacity to accommodate the water demands in the Wailuku-Kahului and Kihei areas, as well as allow the existing 1.0 million gallon water tank (located at the western terminus of Mokuhau Road) to be taken off-line for necessary repairs and renovations. The site of the existing 1.0 million gallon water tank is also the location of the existing water pump station that services the existing 1.0 million gallon water tank and will also provide pump service for the new 3.0 million gallon tank. It should be noted that the anticipated repairs and renovations to the existing water tank will be conducted at a later date and is not part of the scope of this project.

The project site is located on a portion of a parcel located north of and adjacent to the Iao Stream Flood Control project. This parcel, which encompasses approximately 26.926 acres, is not assigned a Tax Map Key (TMK) number; however, it has been legally recorded as Parcel "A" with the Bureau of Conveyances. See Appendix A. The boundary limit of Parcel "A" is further identified on Tax Map 3-4-36. See Figure 3.

It is noted that the proposed improvements will be located approximately 150 feet north of Iao Stream's normal streamflow routing. The site is protected by the Iao Stream flood control levee built by the U.S. Army Corps of Engineers.

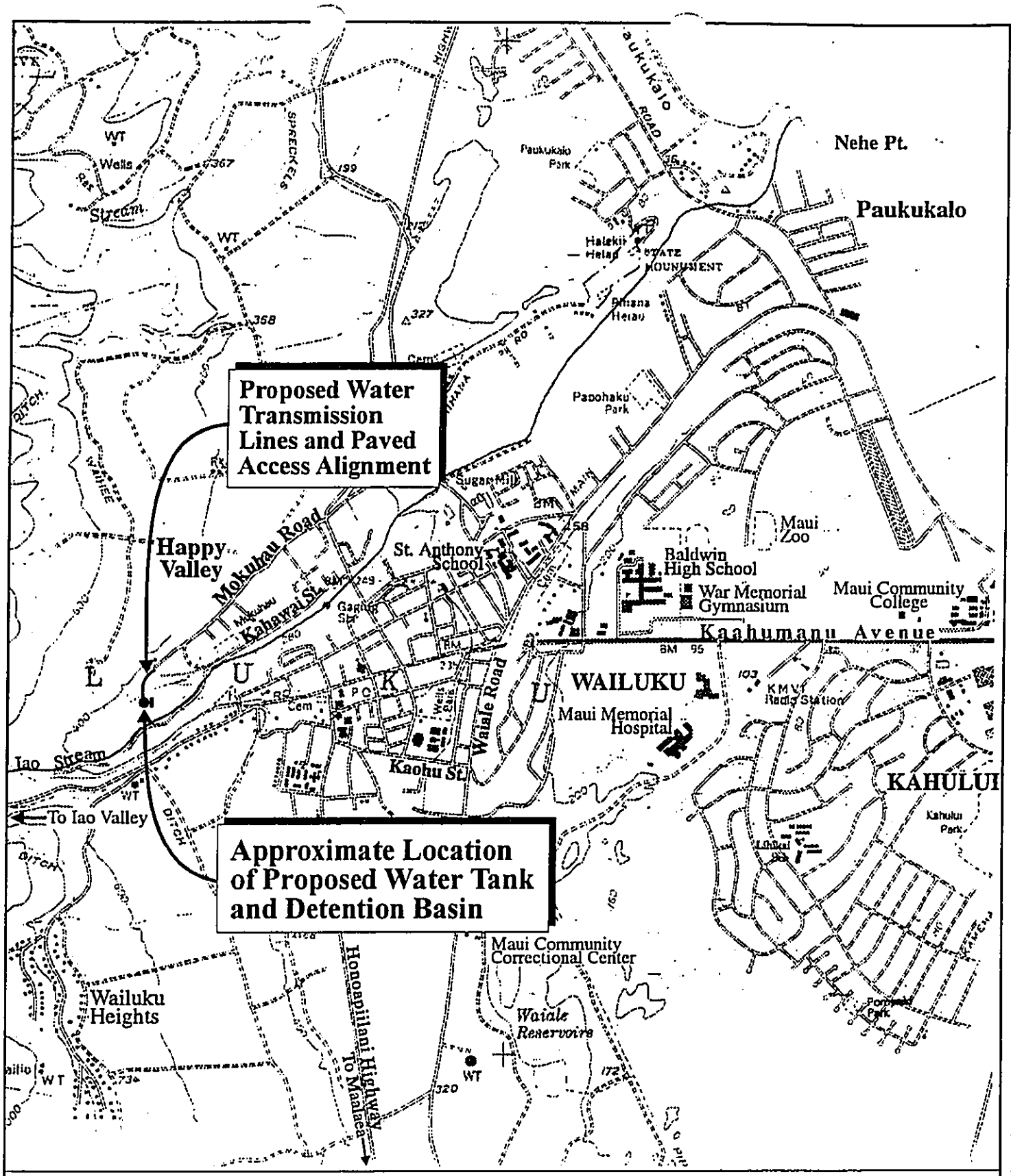


Figure 1

Mokuhau Water Tank
Regional Location Map

MUNEKIYO & ARAKAWA, INC.

Prepared for: County of Maui, Dept. of Water Supply

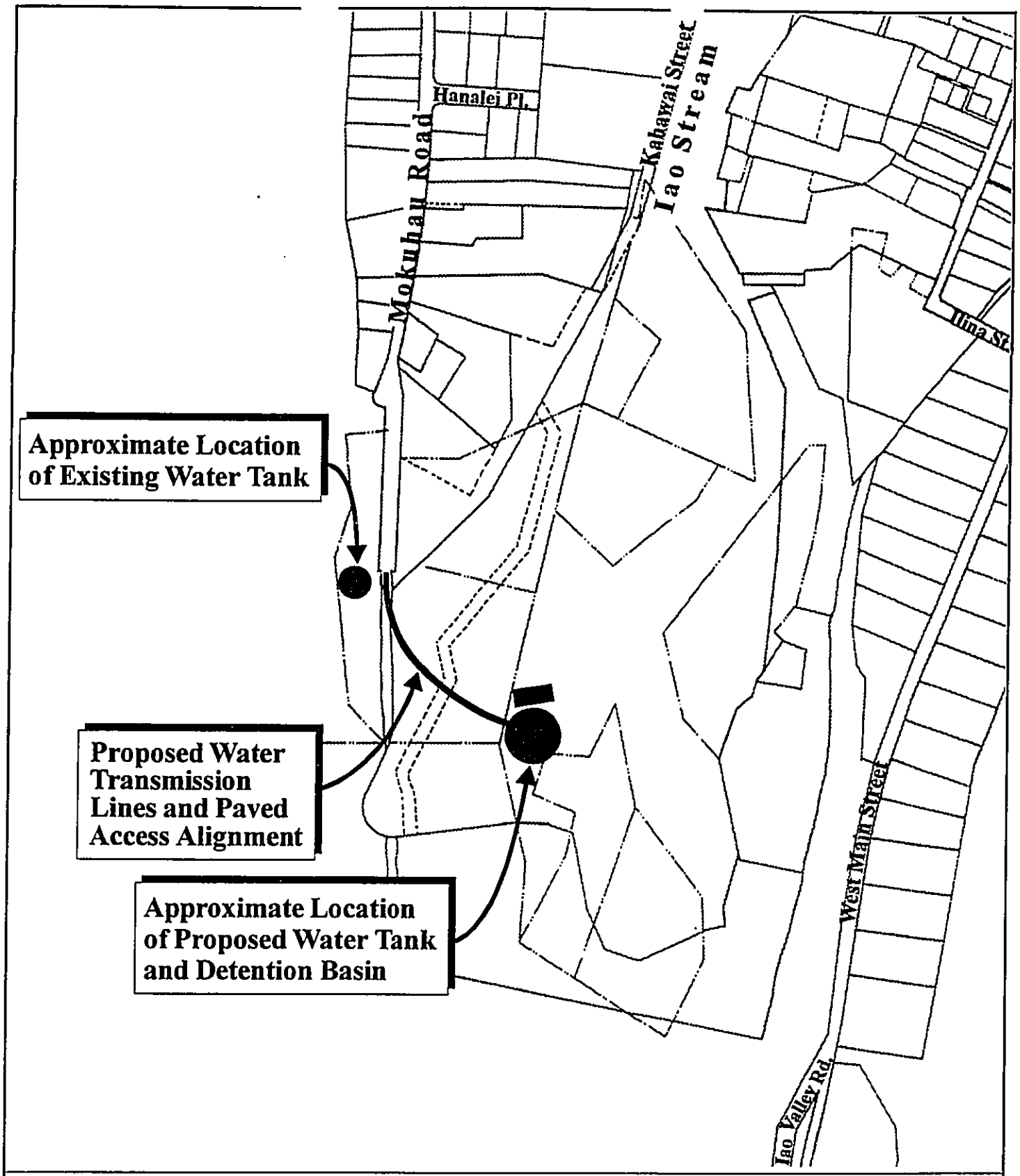


Figure 2

Mokuhau Water Tank

Site Location Map

MUNEKIYO & ARAKAWA, INC.

150 0 300 600 Feet

Prepared for: County of Maui, Dept. of Water Supply

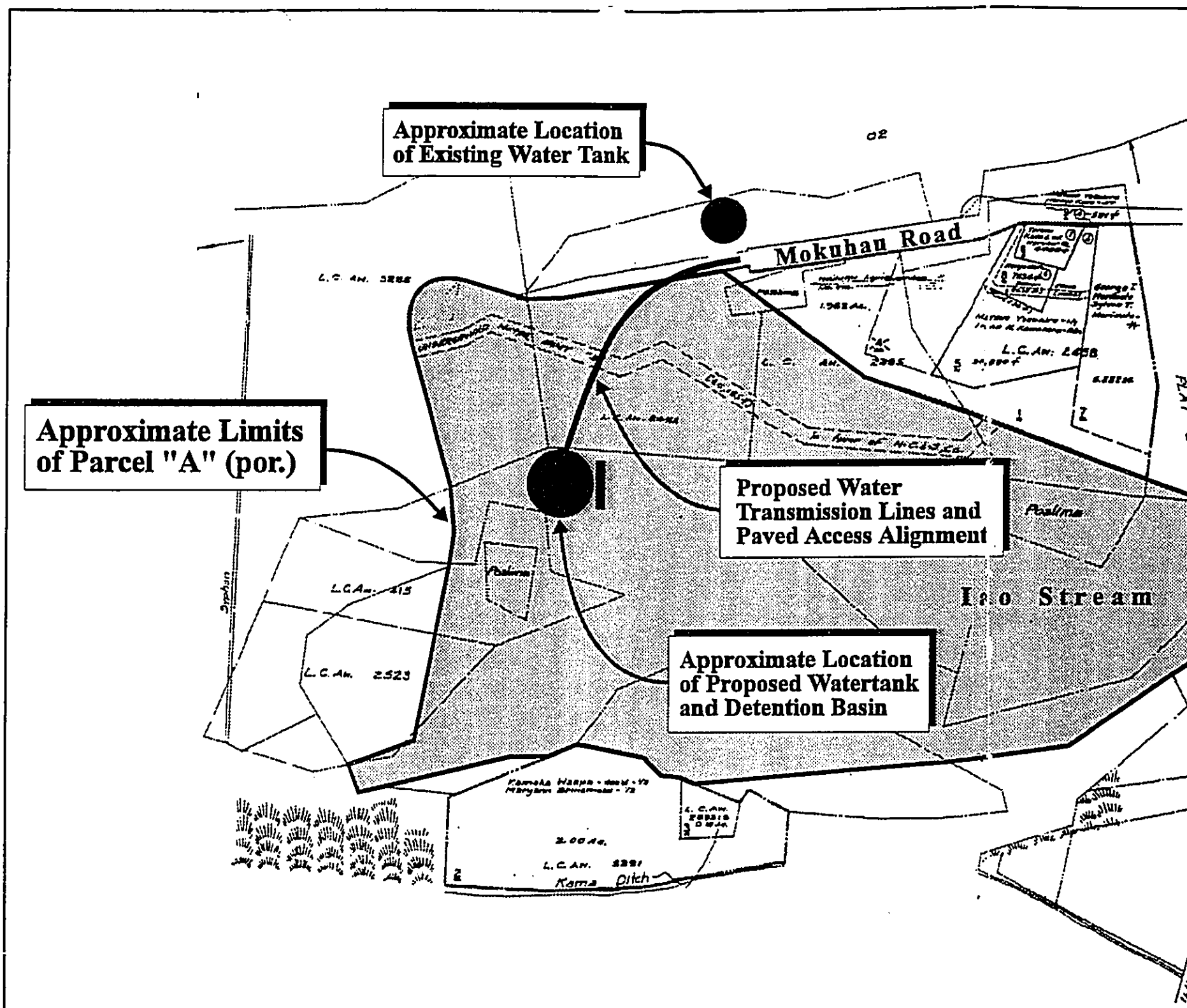
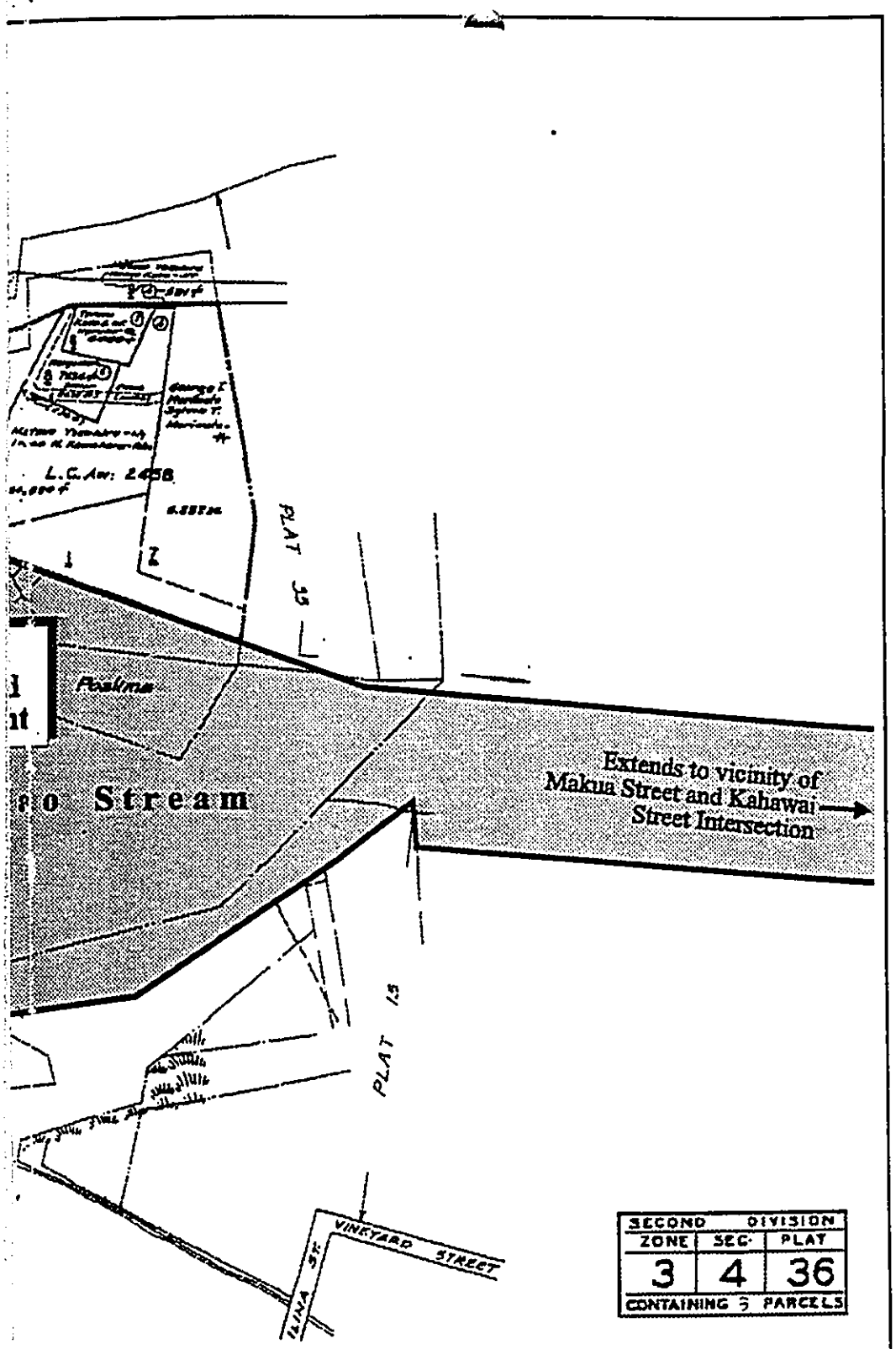


Figure 3

Mokuhau Water Tank

Approximate Limits of Parcel "A" (por.)

Prepared for: County of Maui, Dept. of Water Supply



Tank

el "A" (por.)

MUNEKIYO & ARAKAWA, INC.

NOT TO SCALE

The site of the proposed 3.0 million gallon water tank and detention basin is currently vacant and vegetated with large shade trees, haole koa, lowlying grasses and weeds. The alignment of the 20-inch inlet/24-inch outlet transmission lines, which will link the proposed water tank to the well pump station located at the terminus of Mokuhau Road, generally follows an existing dirt road and will be placed underground. The proposed 12-foot paved easement that will provide access to the proposed water tank will follow the same alignment as the transmission lines.

Surrounding uses in the vicinity of the proposed improvements include a small pig farm just east of the proposed inlet/outlet transmission lines alignment, near the western extent of Mokuhau Road. Single-family residences are located to the east of the existing water tank and pump station site, along Mokuhau Road. To the immediate south of the proposed water tank is a dirt maintenance road and a concrete-rubble-masonry (CRM) levee associated with the Iao Stream Flood Control project. A dirt road also extends from the Mokuhau Road terminus to the west of the new tank site. An unnamed stream and an underground kuleana ditch which meanders in an east to west direction are aligned between the site of the existing and proposed water tanks. Vacant undeveloped lands are also located to the north and west of the proposed improvements.

Parcel "A" is owned by the County of Maui.

B. ***PROJECT NEED***

The Central Maui Water System services the communities of Waihee, Waiehu, Wailuku, Kahului, Paia, Maalaea, Kihei and Makena. Virtually all of the water that supplies the Central Maui Water System is withdrawn

from the Iao Aquifer in the vicinity of Iao Stream and Waiehu Stream. The Central Maui wells that tap the Iao aquifer include the existing Mokuhau Wells, as well as the Kepaniwai, Waiehu Terrace, and Waihee wells (Maui Community Plan Update Infrastructure Assessment, 1992).

The existing Mokuhau Water Supply and Treatment System consists of an underground water source, three (3) wells with pumps, a liquid chlorine feed system, and a 1.0 million gallon above-ground storage tank. Water from the underground water source is pumped directly to the existing 1.0 million gallon water tank by the three (3) well pumps (two (2) 350-HP deepwell pump and one (1) 600-HP deepwell pump). During the month of January 1995, the pumps produced an average daily output of approximately 3.3 million gallons per day (Engineering Report for the Mokuhau Renovation and Reservoir Replacement Project, June 1995). All existing improvements are located on TMK 3-3-2:24. Other existing improvements on TMK 3-3-02:24 include two (2) control buildings and three (3) well pumps. An existing six (6) foot high chain-link security fence is located along the parcel's front (southern) boundary. Approximately 90 feet of the proposed inlet/outlet water transmission lines will be installed within Mokuhau Road's right-of-way in order to connect to the existing waterlines within Mokuhau Road.

Due to the deteriorating condition of the existing 1.0 million gallon Mokuhau water tank, near-term maintenance needs will require that the tank be taken off-line and repaired. In order to repair the existing tank without interrupting water service (i.e., water demands, fire flow requirements, etc.) to Central Maui and the Kihei areas, the construction and implementation of the proposed 3.0 million gallon water tank is essential. Upon the completion of repairs and renovations to the existing tank, both the new and repaired water tanks will remain in operation

concurrently to provide greater water storage capacity for the Central Maui and Kihei regions. It is noted that repairs to the existing 1.0 million gallon water tank will be done by DWS and is not within the scope of this project.

C. ***PROPOSED IMPROVEMENTS***

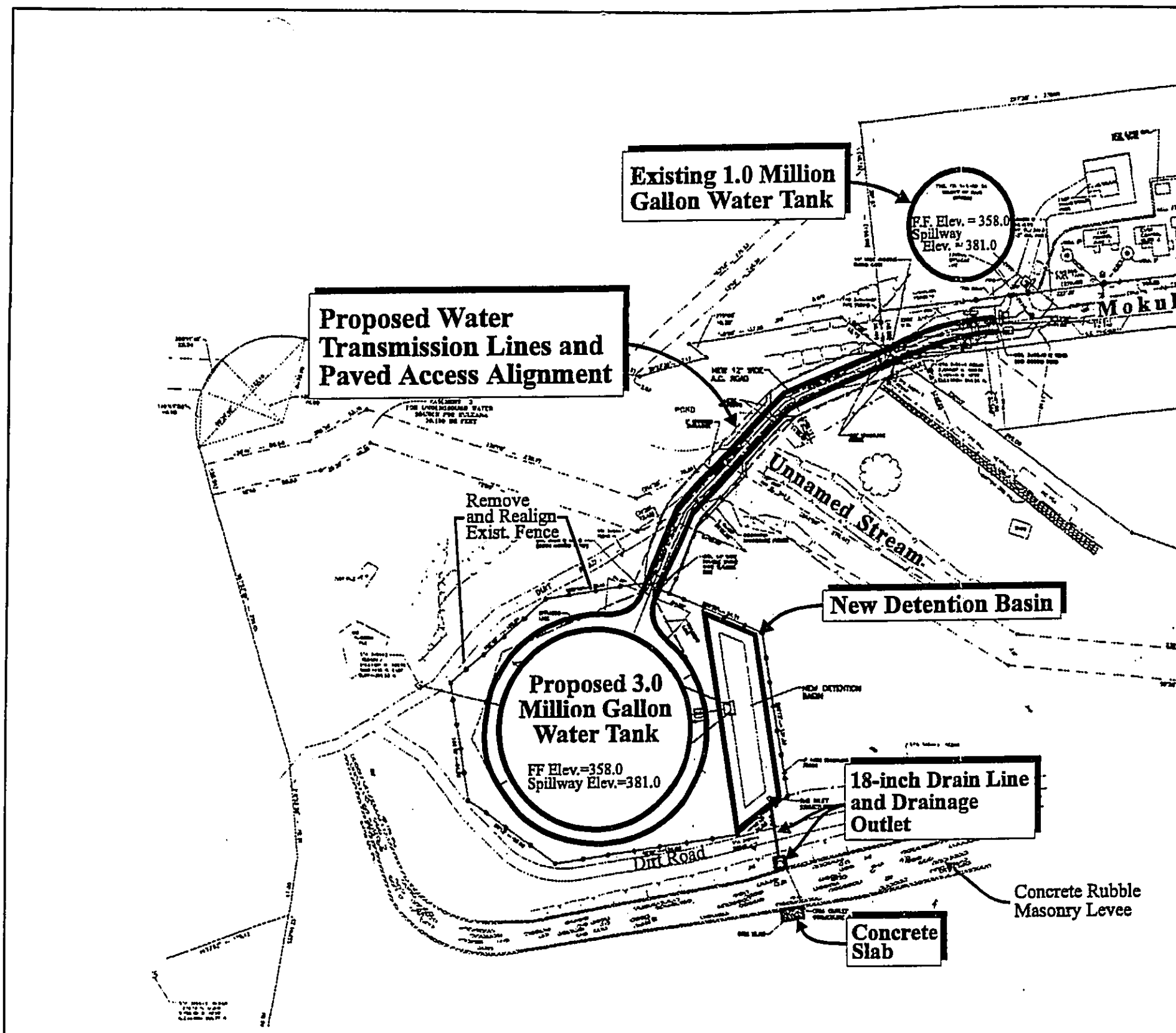
The design and construction of the 3.0 million gallon water tank and related improvements will conform to the "Water System Standards" for the County of Maui, Department of Water Supply (1985), the "Standard Details for Water System Construction" 1985 (revised 1989) and all other applicable requirements of the DWS.

Since County lands and funds are involved, an Environmental Assessment (EA) is being prepared in compliance with Chapter 343, HRS.

Components of the proposed improvements are described below.

1. ***Proposed 3.0 Million Gallon Water Tank***

The proposed project involves the construction of a 3.0 million gallon reinforced concrete water tank which will be located approximately 450 feet south of the existing 1.0 million gallon water tank. The proposed water tank will be 156 feet in diameter, 24 feet high, and anticipated to have a water depth of 23 feet. See Figure 4 and Figure 5. As previously mentioned, the existing water tank, which is deteriorating, will be kept in service until the new water tank is constructed and operational. In order for both water tanks to operate simultaneously and to prevent water in the tank from stagnating, the proposed water tank has been designed to have the same floor elevation (358 feet above mean sea level (msl)



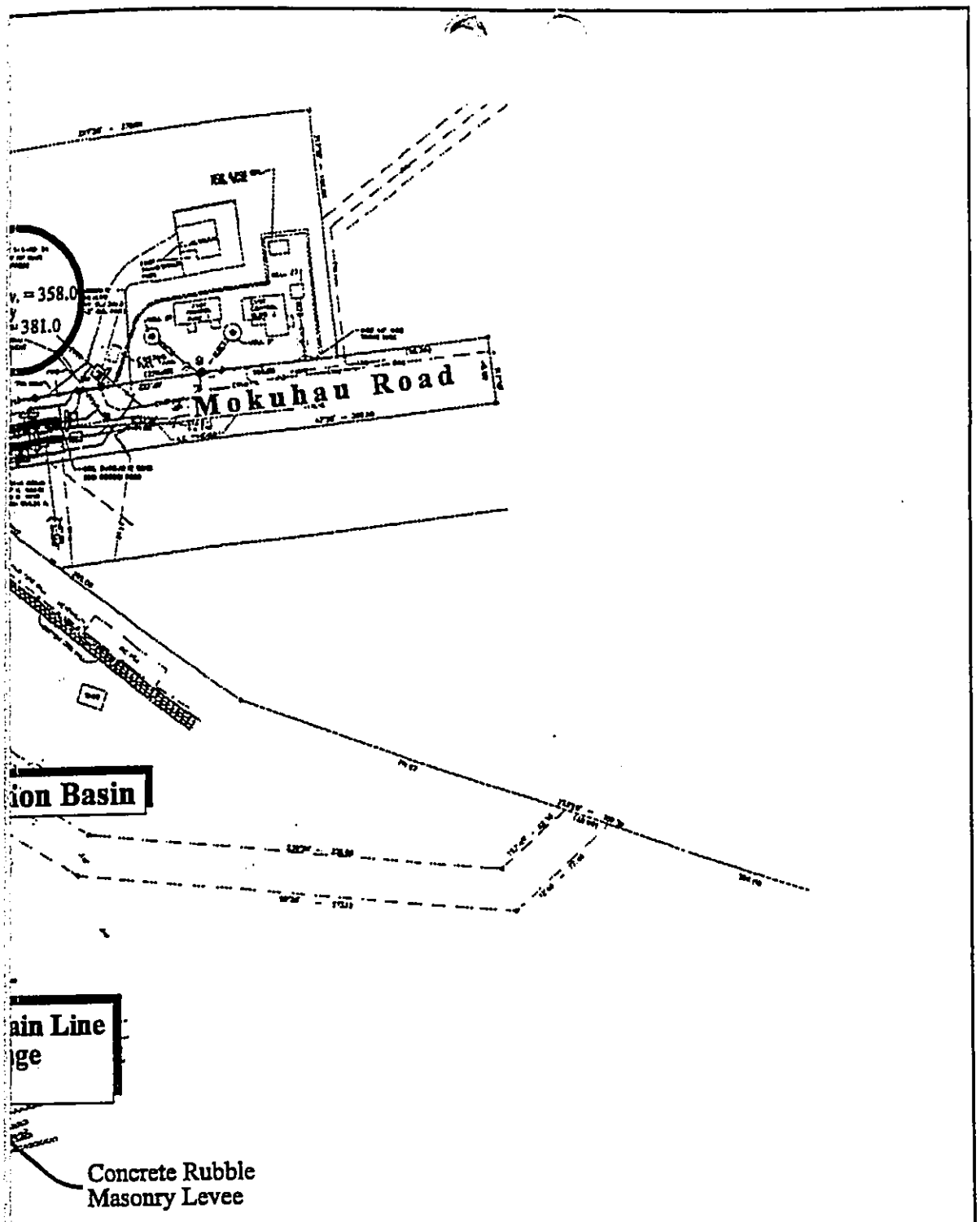
Source: Newcomer-Lee Land Surveyors

Figure 4

Mokuhau Water Tank

Site Plan

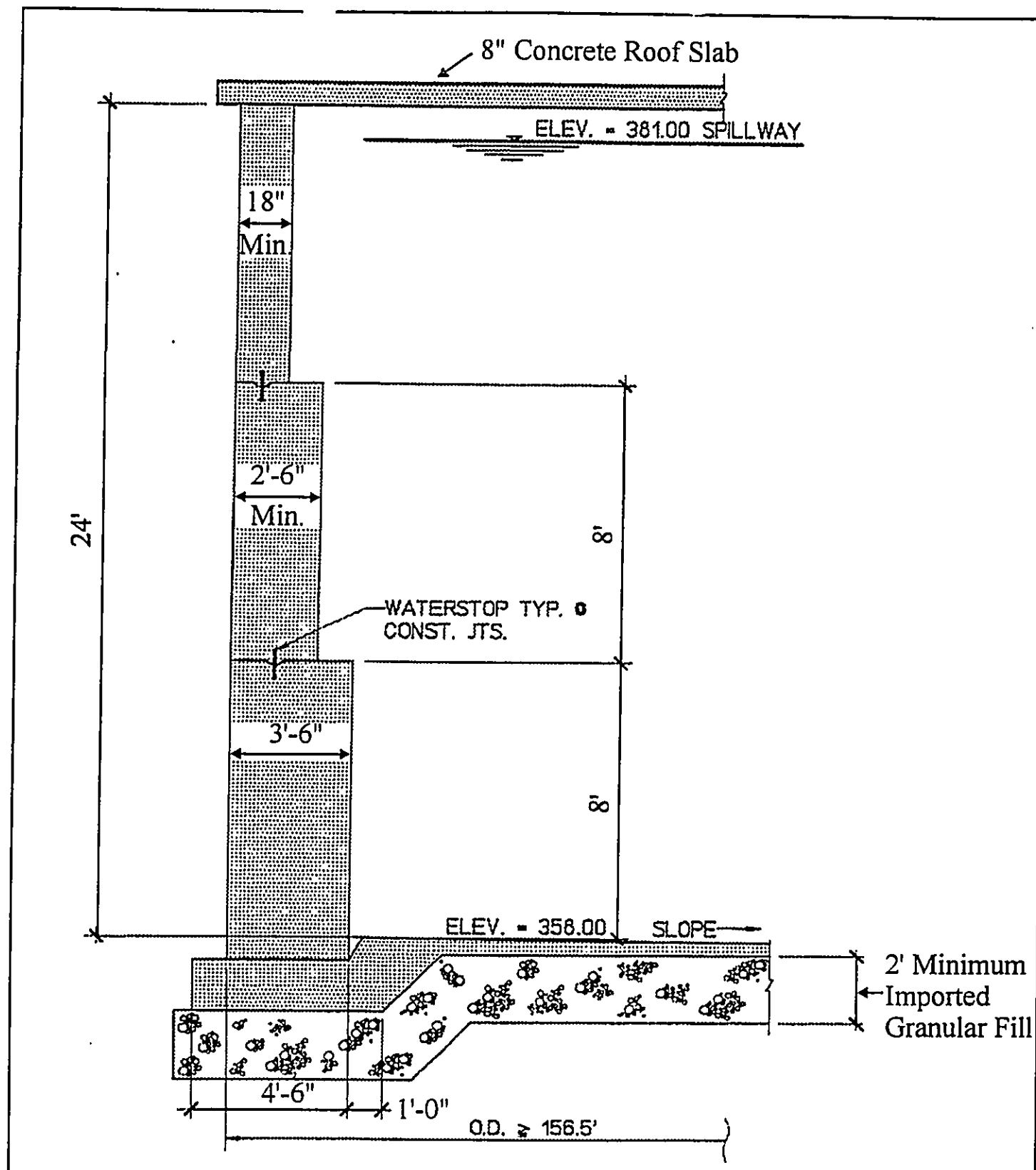
Prepared for: County of Maui, Dept. of Water Supply



Tank

MUNEKIYO & ARAKAWA, INC.

NOT TO SCALE



Source: Sato & Associates, Inc.

Figure 5

Mokuhau Water Tank

New Watertank Wall Schematic Section

MUNEKIYO & ARAKAWA, INC.

0 20 40 60 Feet

Prepared for: County of Maui, Department of Water Supply

and overflow elevation (381 msl) as the existing water tank. Access to the new water tank will be from a new 12-foot wide paved access road extending off of the western extent of Mokuhau Road.

A 20-inch inlet transmission line and a 24-inch outlet transmission line are proposed to be outfitted into the proposed water tank which will connect the new tank to existing 20-inch and 24-inch waterlines located at the western extent of Mokuhau Road, within the road right-of-way. Currently, the well pump station conveys water to the existing 20-inch waterline which connects with the existing 1.0 million gallon water tank. Water is then conveyed to the existing 24-inch waterline located within Mokuhau Road's right-of-way for distribution to Central Maui and Kihei.

The new waterlines will be of ductile iron construction and all fittings will be covered with polyethylene wrap. The size of the waterlines were based on transporting water through the pipes sufficiently while all three (3) deepwell pipes are running. The underground piping system, which will traverse in a curvilinear alignment from the proposed tank to the existing waterlines within Mokuhau Road, will provide the existing well pump station the capability to pump water to both tanks simultaneously or exclusively to either tank. It is noted that an unnamed stream located between the existing and proposed water tank sites intersect the proposed alignment of the water transmission line, in the vicinity of an existing dirt road. However, in this vicinity, the unnamed stream traverses through a culvert approximately 10 feet under existing grade. Thus, the transmission lines will not impact

the unnamed stream since invert elevations for the proposed transmission lines will be approximately 5 feet below grade.

2. ***Detention Basin and Overflow/Drain Lines***

The proposed water tank will include an 18-inch emergency overflow drainline which will transport potable water to a 0.30 acre-ft. detention basin. The 18-inch line allows for draining the tank before tank capacity is reached during a pump failure event. The 0.30 acre-ft. detention basin has been designed to store approximately 20 minutes of overflow (sized for largest well pump), which is sufficient time for response and shut-down by maintenance personnel. In order to prevent water from overflowing, however, the well pumps will be set to shut off before reaching the emergency overflow level and a telemetry alarm system is proposed to signal system failure to emergency response personnel (Engineering Report for the Mokuhau Renovation and Reservoir Replacement Project, June 1995).

In order to convey discharged water from the detention basin towards Iao Stream, an 18-inch drain line (underground) will extend approximately 50 feet from the detention basin in a southeasterly direction. The discharge towards Iao Stream will be accommodated by a drainage outlet to be constructed approximately two (2) feet above the Iao Stream flood control levee. Refer to Figure 4. In this regard, an 8-foot by 18-foot concrete rubble masonry (CRM) slab will be installed (at grade) at the foot of the existing concrete levee, directly below the drain line. The slab is intended to absorb flows from the line during a water discharge event to prevent soil erosion from occurring at the toe of

the levee. It is noted that the height from the drainage outlet structure to the toe of the levee is approximately 15 feet.

The proposed water tank site and detention basin will be fenced for security and safety reasons. Security and maintenance inspections will be conducted by the Department of Water Supply. A portion of the existing fence, located on the site of the proposed 3.0 million gallon water tank, will be removed and relocated along the perimeter of the proposed water tank and detention basin. An existing dirt road (located along the south and west wall of the proposed water tank), which is used for maintenance access for the Iao Flood Control project, will remain at its current alignment.

3. ***Pump Station Upgrades***

In order to provide the necessary pumping service to the existing and proposed water tanks, upgrades to the existing water pump station (located at the westerly terminus of Mokuhau Road) are required. The proposed improvements to the pump station include the replacement of the existing chlorination equipment with sodium hypochlorite solution to avoid the use of chlorine gas for disinfection. Additionally, to improve the monitoring and operations of the pump station, starters, motor controllers, control valves and other electrical equipment will be replaced. The installation of flow meters are also anticipated.

Construction of the proposed improvements is expected to begin during the first quarter of 1997 with a construction duration of approximately 6 to 7 months. Construction cost of the project is estimated at approximately $3.7 million.

Chapter II

Description of the Existing Environment

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. PHYSICAL ENVIRONMENT

1. Surrounding Land Uses

The proposed project site is located at the outskirts of Happy Valley, just north of Wailuku Town's civic center area.

The proposed site for the 3.0 million gallon water tank and appurtenant improvements will be situated approximately 450 feet south of the existing 1.0 million gallon Mokuhau water tank that is located at the westerly extent of Mokuhau Road. The site of the proposed water tank is currently vacant and undeveloped. Vegetation in the vicinity of the project site consists of various shade trees, haole koa bushes, lowlying grasses and weeds. A dirt road, CRM levee and the Iao Stream are located to the south of the subject property. A dirt road also extends from the Mokuhau Road terminus to the west of the new water tank site. To the east of the existing Mokuhau water tank are single-family residential uses.

2. Climate

Maui's climate is relatively uniform year-round. The project site experiences mild and uniform temperatures year round, moderate humidity, and a relatively consistent northeasterly tradewind. Variation in climate on the Island is largely left to local terrain.

Average temperatures at the project site range from lows in the 60's to highs in the 80's (Atlas of Hawaii, 1983). August is historically the warmest month, while January and February are the coolest. Rainfall in Wailuku averages approximately 30 to 40

inches per year. Winds in the region are predominantly out of the north-northeast and northeast.

3. ***Topography and Soil Characteristics***

The project site is located on gently sloping lands at an elevation ranging from approximately 330 to 360 feet above sea level. There are no significant topographical constraints within the water tank site. The proposed 20-inch inlet and 24-inch outlet water transmission line alignment will extend from the proposed water tank and travel in a generally northerly direction to the existing water distribution lines located within the western extent of Mokuhau Road. The underground water transmission lines will follow the same alignment as the proposed 12-foot wide paved access roadway which will provide access to the new water tank.

Underlying the project site and the surrounding lands is the Waiakoa-Keahua-Molokai soil association. See Figure 6. The soils belonging to this association are well-drained, moderately fine textured and are located on low uplands. This association was formed in material weathered from basic igneous rocks.

The soil type underlying the proposed tank site and the water transmission line corridor consists of Stony Alluvial Land (rSM), 3 to 15 percent slope. See Figure 7. This soil type consists of stones, boulders and soil deposited by streams along the bottom of gulches and alluvial fans. Soil of this series are suited to pasture in the dry areas and woodlands in the wet areas.

The Land Study Bureau's Detailed Land Classification rates the agricultural suitability of soils. A five (5) class productivity rating is

LEGEND

① Pulehu-Ewa-Jaucas association

② Waiakoa-Keahua-Molokai association

③ Honolua-Olelo association

④ Rock land-Rough mountainous land association

⑤ Puu Pa-Kula-Pane association

⑥ Hydrandepts-Tropaquods association

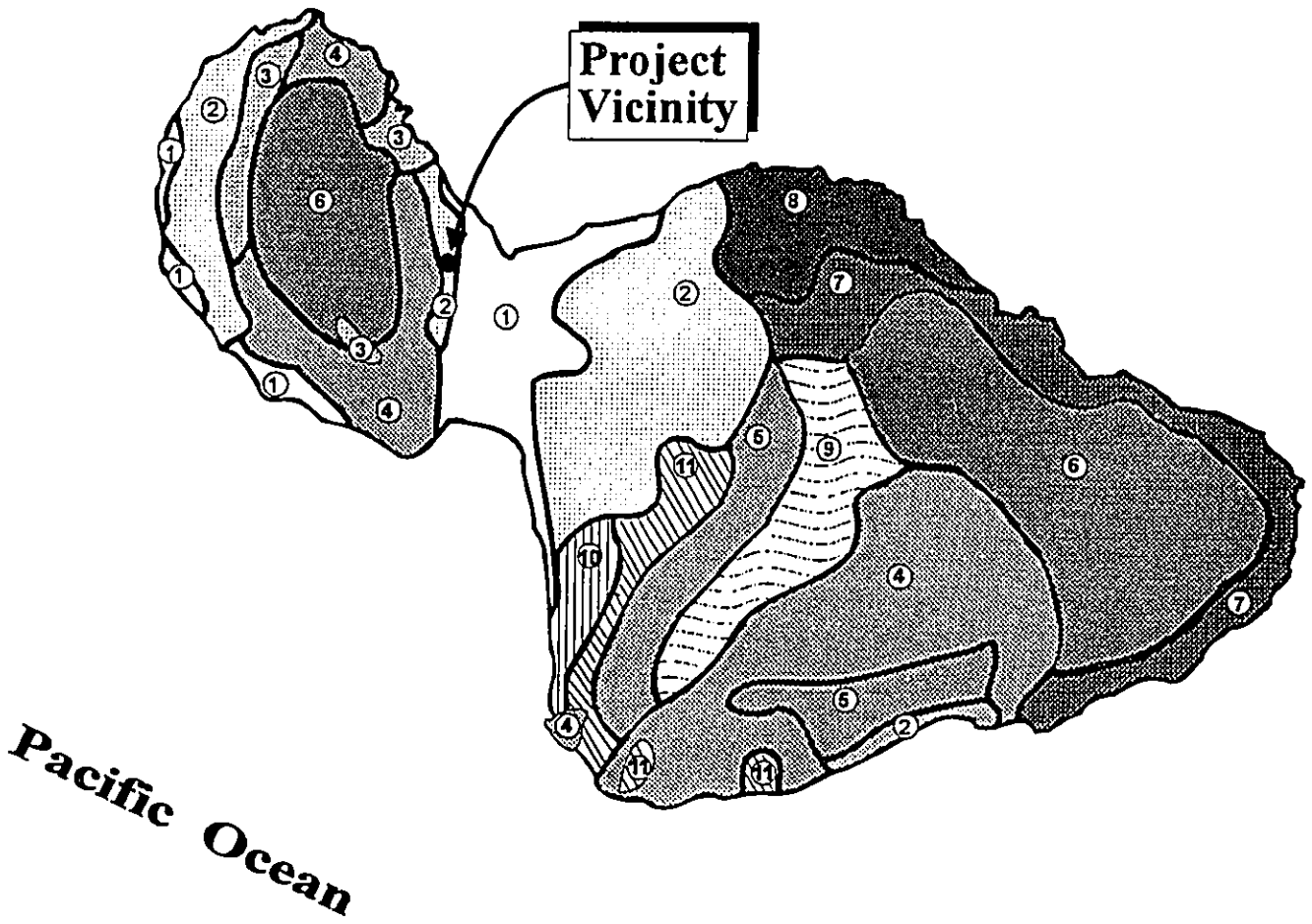
⑦ Hana-Makaalae-Kailua association

⑧ Pauwela-Haiku association

⑨ Laumaia-Kaipoipoi-Olinda association

⑩ Keawakapu-Makena association

⑪ Kamaole-Oanapuka association



Map Source: USDA Soil Conservation Service

Figure 6

Mokuhau Water Tank
Soil Association Map

MUNEKIYO & ARAKAWA INC.

Prepared for: County of Maui, Dept. of Water Supply

NOT TO SCALE

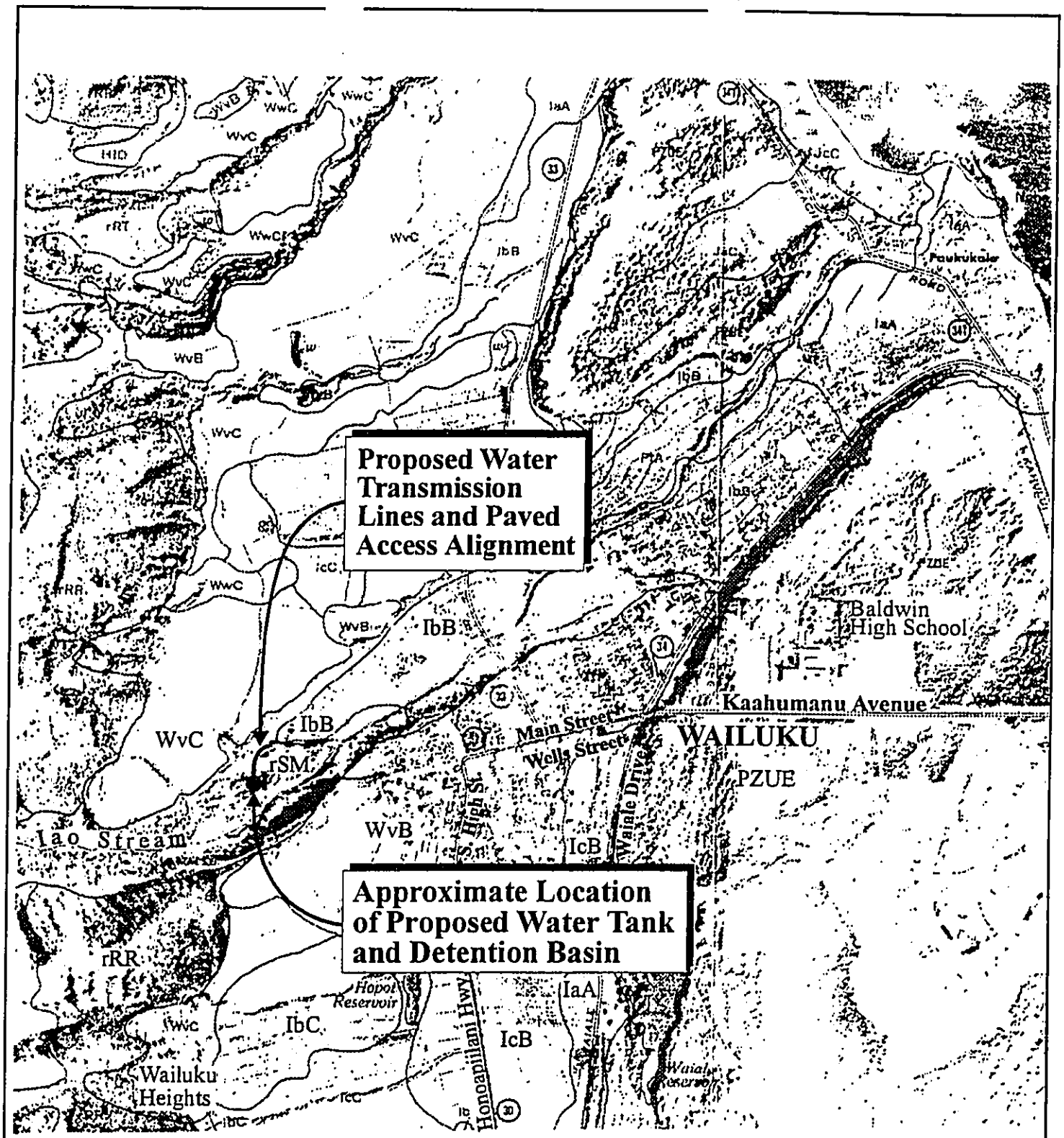


Figure 7

Mokuhau Water Tank

Soil Classification Map

MUNEKIYO & ARAKAWA, INC.

1000 0 2000 4000 Feet

Prepared for: County of Maui, Dept. of Water Supply

applied using the letters A, B, C, D, and E, with "A" representing lands of the highest productivity, or very good, and "E" the lowest, or very poorly suited for agricultural production. The Land Study Bureau identified all the lands within the existing and proposed water tank sites as "C".

The State Agricultural Lands of Importance to the State of Hawaii (ALISH) system classifies lands into "Prime", "Unique" and "Other Important Agricultural Land". The remaining lands are "Unclassified". According to the ALISH system, the land encompassing the proposed water tank site, as well as 200 feet of its water transmission alignment, are "Unclassified". Also, approximately 200 feet of the remaining transmission line (in the vicinity of the western terminus of Mokuhau Road) is within the "Existing Urban Development" designation. See Figure 8.

4. ***Flood and Tsunami Hazard***

The proposed 3.0 million gallon water tank site and appurtenant improvements are located within Zone "C" as determined by the Flood Insurance Rate Map (FIRM) for this region. See Figure 9. Zone "C" is an area of minimal flooding. The proposed project site is located adjacent to and north of the U.S. Army Corps of Engineers' Iao Stream Flood Control project. This project included the construction of levees to provide for safe streamwater conveyance and protection to preclude flooding from intense storm events.

5. ***Flora and Fauna***

The project site is located on vacant land within the State Agricultural district. Vegetation in the area include shade trees

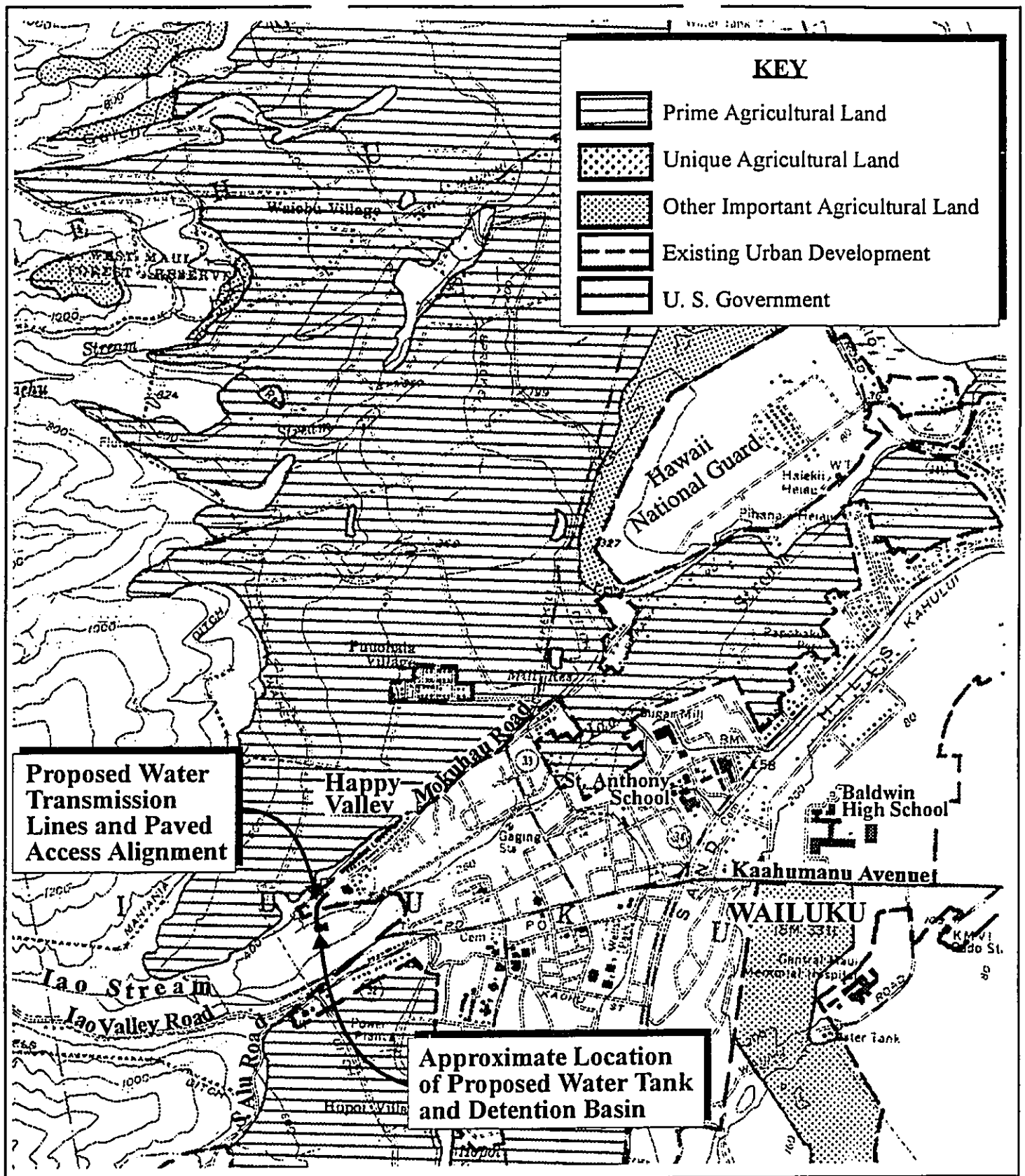


Figure 8

Mokuhau Water Tank

ALISH Classifications

MUNEKIYO & ARAKAWA, INC.

Prepared for: County of Maui, Dept. of Water Supply

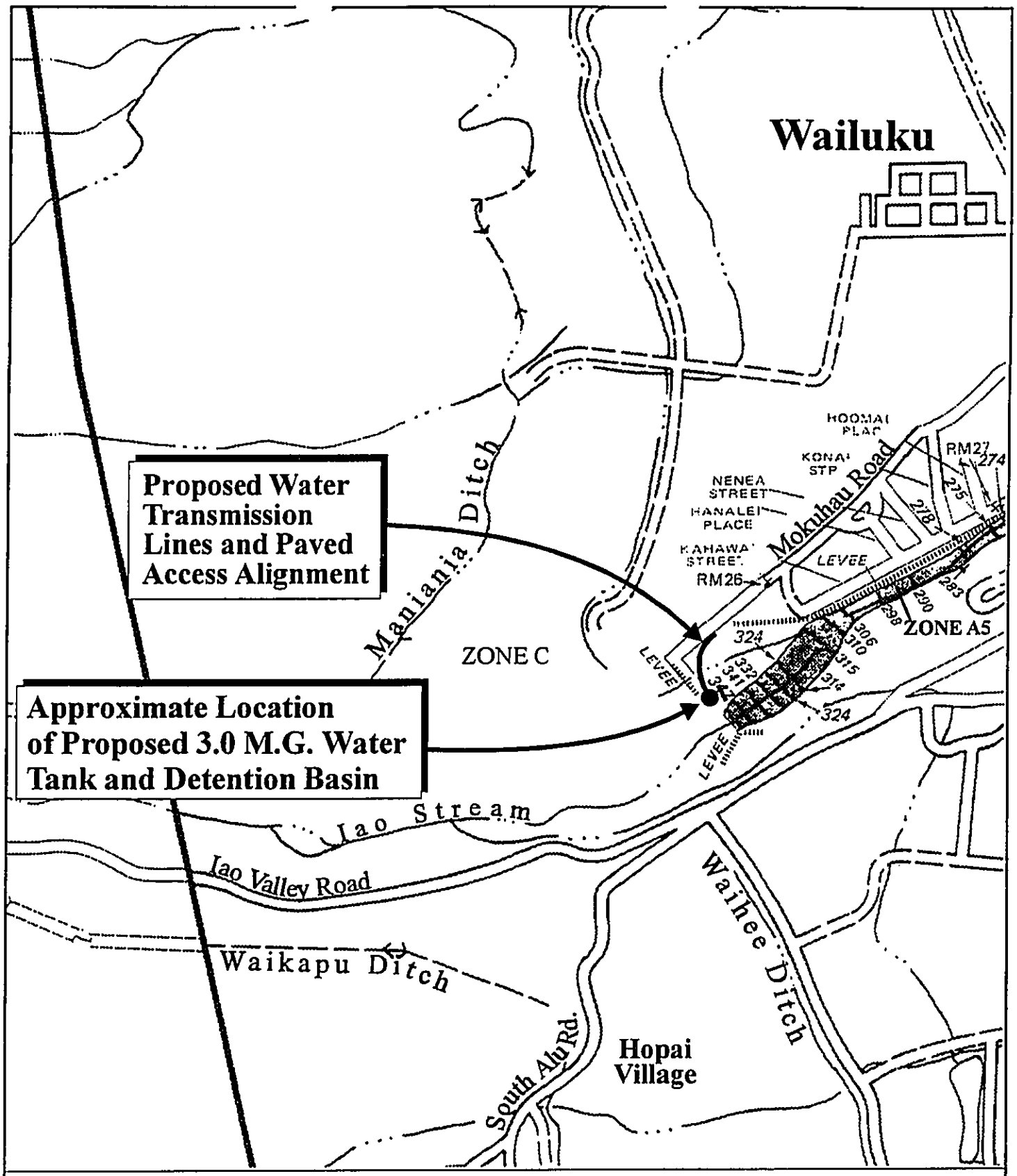


Figure 9

Mokuhau Water Tank

Flood Insurance Rate Map

MUNEKIYO & ARAKAWA, INC.

0 500 1000 2000 Feet

Prepared for: County of Maui, Dept. of Water Supply

(monkeypod, mango and plum), as well as lowlying grasses and weeds. There are no known rare, endangered or threatened species of plants within or surrounding the project site.

Fauna and avifauna found in the vicinity of the project site include mongoose, rats, dogs and cats. Avifauna typically include mynas, doves, cardinals and sparrows. There are no known rare, endangered or threatened species of fauna or avifauna found in the vicinity of the project site.

6. ***Air Quality and Noise Characteristics***

Air quality in the Wailuku region is considered good as point sources and non-point sources of emissions are not significant to generate high concentration of pollutants. The relatively high quality of air can also be attributed to the region's constant exposure to tradewinds which quickly disperse concentrations of emissions.

The adjacent Iao Stream and natural wind are the predominant source of background noises in the vicinity of the project.

7. ***Visual Resources***

The West Maui Mountains, Iao Stream and the Pacific Ocean are visible from the project site. However, the project site is not considered unique in terms of visual resource value.

8. ***Archaeological Resources***

A surface inventory and subsurface testing conducted within the project site during February, 1996 revealed no evidence of

significant *in situ* or disturbed material cultural remains. See Appendix B.

B. SOCIO-ECONOMIC ENVIRONMENT

1. Population

The population of the County of Maui has exhibited relatively strong growth over the past decade with the 1990 population estimated to be 100,504, a 41.9% increase over the 1980 population of 70,847. Growth in the County is expected to continue, with resident population projections to the years 2000 and 2010, estimated to be 124,560 and 145,870, respectively (Community Resources, Inc., 1994).

The Wailuku-Kahului Community Plan region follows the County-wide pattern of population growth, with the region's 1990 population of 32,816 expected to rise to 40,452 by the year 2000 and to 48,132 by the year 2010 (Community Resources, Inc., 1994).

2. Economy

As noted previously, the Wailuku region is the Island's center of governmental activities, as well as a focal point for professional and business services. Combined with neighboring Kahului, the region's economic character encompasses a broad range of commercial, service, and governmental activities. In addition, the region is surrounded by significant agricultural acreages which include pineapple fields and macadamia nut orchards. The vast expanse of agricultural land, managed by Hawaiian Commercial & Sugar (HC&S) and Wailuku Agribusiness Company, Inc., is considered a key component of the local economy.

C. *PUBLIC SERVICES*

1. *Police and Fire Protection*

Police protection for the Wailuku-Kahului region is provided by the County Police Department, headquartered at the Wailuku Station, approximately 2.0 miles from the project site. The region is served by the Department's Central Maui patrol.

Fire prevention, suppression, and protection services for the Wailuku-Kahului region is provided by the County Department of Fire Control's Wailuku Station, located in Wailuku Town, approximately 1.3 miles from the project site.

2. *Health Care*

Maui Memorial Hospital, the only major medical facility on the Island, services the Wailuku-Kahului region. Acute, general and emergency care services are provided by the 145-bed facility. In addition, numerous privately operated medical/dental clinics and offices are located in the area to serve the region's residents.

3. *Solid Waste*

Single-family residential solid waste collection service is provided by the County of Maui on a once-a-week basis. Residential solid waste collected by County crews are disposed at the County's 55-acre Central Maui Landfill, located four (4) miles southeast of the Kahului Airport. In addition to County-collected refuse, the Central Maui Landfill accepts commercial waste from private collection companies.

4. *Recreational Resources*

The Wailuku-Kahului region encompasses a full range of recreational opportunities, including shoreline and boating activities at the Kahului Harbor and adjoining beach parks, and individual and organized athletic activities offered at numerous County parks. The project site is in close proximity to Iao Valley State Park, the Wailuku Community Center, Mokuhau Park, and Papohaku Park.

5. *Schools*

The Wailuku-Kahului region is served by the State Department of Education's public school system, as well as several privately operated schools accommodating elementary, intermediate and high school students. Department of Education facilities in the Wailuku area include Wailuku Elementary School and Waihee School (Grades K to 5), Iao Intermediate School (Grades 6 to 8), and Baldwin High School (Grades 9 to 12). Maui Community College, a branch of the University of Hawaii, serves as the Island's only Community College.

D. *INFRASTRUCTURE*

1. *Roadways*

The Wailuku region is served by a roadway network which includes arterial, collector (minor and major), and local roads. Major roadways serving Wailuku Town include Honoapiilani Highway, Kaahumanu Avenue, Lower Main/Kahului Beach Road, Waiehu Beach Road and Kahekili Highway.

Access to the existing 1.0 million gallon water tank is via Mokuhau Road, a two-way County minor-collector roadway. Access to the

proposed 3.0 million gallon water tank site is currently provided by an existing dirt road extending from the Mokuhau Road terminus.

2. ***Wastewater***

Domestic wastewater generated in the Wailuku-Kahului region is conveyed to the County's Wailuku-Kahului Wastewater Reclamation Facility located one-half mile south of Kahului Harbor. The design capacity of the facility is 7.9 million gallons per day (mgd). Average daily flow currently processed through the plant is approximately 6.3 mgd (Department of Public Works and Waste Management (DPWWM), Wastewater Reclamation Division, February 1996).

3. ***Water***

The Wailuku-Kahului, Kihei-Makena, and Paia regions are served by the Board of Water Supply's domestic water system. Water drawn from the Iao Aquifer System is conveyed to these regions for distribution and consumption.

4. ***Drainage***

The majority of storm runoff generated in the vicinity of the proposed 3.0 million gallon water tank or along the proposed water tank transmission line alignment generally drains into an unnamed stream located towards the northeast of the proposed water tank. The unnamed stream flows in an easterly direction and outlets into Iao Stream. Remaining runoff on the project site collects in lowlying areas where percolation or evaporation occurs. Existing conditions on the project site have a peak runoff rate from a 50-year, 1-hour storm of 1.20 cubic feet per second (cfs). Refer to Appendix C.

5. ***Electric and Telephone Services***

Electrical and telephone services are provided by Maui Electric Company and GTE Hawaiian Telephone, respectively.

Chapter III

Potential Impacts and Mitigation Measures

III. POTENTIAL IMPACTS AND MITIGATION MEASURES

A. PHYSICAL ENVIRONMENT

1. Surrounding Uses

The project site is located in the midst of undeveloped vacant lands at the outskirts of Happy Valley. The proposed 3.0 million gallon water tank, which will be located approximately 1,000 feet south of the nearest residential area (Happy Valley), is not anticipated to have any adverse effects on surrounding land uses.

2. Topography and Soil Characteristics

The proposed project will involve the construction on the 3.0 million gallon water tank and appurtenant facilities and trenching for the inlet/outlet water transmission lines extending from the new water tank to Mokuhau Road. The finished contours will follow existing grades to minimize earthwork costs and maintain existing drainage patterns which tie into immediately surrounding lands. The project will not disturb the slope and land use characteristics of the Iao Stream and surrounding properties.

3. Flora and Fauna

There are no known significant habitats or rare, endangered or threatened species of flora and fauna at the subject property. The removal of the existing flora and the displacement of fauna from the site is not considered a negative impact upon these environmental features.

4. Air Quality and Noise

Air quality impacts attributed to the project will include dust generated by short-term construction-related activities. Site work such as clearing and grubbing, for example, will generate air-borne

particulates. Dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions.

Once the project is completed, project-related vehicular traffic will generate minimal automotive emissions. Security and maintenance inspections will be conducted by the Department of Water Supply's employees on an intermittent basis. Project-related emissions are not expected to adversely impact local and regional ambient air quality conditions.

Ambient noise conditions will be temporarily impacted by construction activities. Construction equipment, such as bulldozers and materials-carrying trucks, would be the dominant source of noise during the construction period. All construction activities will be limited to normal daylight working hours.

5. ***Visual Resources***

The proposed 3.0 million gallon water tank will be constructed in an area of various shade trees and lowlying vegetation. Also, the proposed transmission waterline alignment will be located underground and would have no impact on visual resources. The proposed project is not anticipated to adversely impact the open space and scenic character of the area.

6. ***Archaeological Resources***

An archaeological inventory conducted within the project site revealed no evidence of historic sites or significant cultural resources. Subsurface results indicate that at least portions of the subject property have been impacted by earth moving activities and that portable remains located during the inventory survey consisted

solely of modern materials. Accordingly, based on the findings of the archaeological inventory survey, no further archaeological work is warranted. Refer to Appendix B. However, should any cultural remains be identified during construction, work in the immediate vicinity will be stopped and the State Historic Preservation Division (SHPD) will be consulted to establish an appropriate mitigation strategy.

B. IMPACTS TO COMMUNITY SETTING

1. Population and Local Economy

On a short-term basis, the project will support construction and construction-related employment.

The proposed project provides additional water storage capacity to service projected growth in population. The deteriorating condition of the existing 1.0 million gallon water tank requires that repairs and renovations be done in the near future. The proposed water tank will allow the existing tank to be taken off-line for repairs while still providing the Central Maui and Kihei regions the capacity to adequately support its growing water demands and fireflow protection requirements.

2. Agriculture

Small-scale agriculture activities, such as a pig farm located at the northern limits of Parcel "A" and a remnant taro patch just south of the pig farm (within the unnamed stream), are evident. Cattle grazing also occurs in the general vicinity. The proposed improvements will not disturb agricultural activities during and after construction. Accordingly, there are no significant impacts to agricultural endeavors as a result of the project.

C. *IMPACTS TO PUBLIC SERVICES*

1. *Public Services*

The proposed use of the property is not expected to increase the resident or visitor population. As such, the proposed project is not anticipated to affect the service area limits or requirements for emergency services such as police, fire and medical services. Furthermore, the project will not affect recreational facilities and schools.

2. *Solid Waste*

A solid waste management plan will be developed in coordination with the Solid Waste Division of the County Department of Public Works and Waste Management for the disposal of clearing and grubbing material from the site during construction.

D. *IMPACTS TO INFRASTRUCTURE*

1. *Roadways*

A 12-foot wide paved roadway with grassed shoulders would provide vehicular access to the proposed 3.0 million gallon water tank. The roadway will extend from the western terminus of Mokuhau Road and follow the curvilinear alignment of an existing dirt road. Metal guardrails (approximately 50 lineal feet) on both sides of the access road are also proposed where the road crosses over the unnamed stream. The installation of the metal guardrails, however, will not impact the stream since construction-related work will be confined within the proposed access road limits.

The proposed access roadway is intended to be used by the Department of Water Supply personnel when maintenance or monitoring of the proposed water tank is required. Accordingly, the

proposed project will not generate a significant amount of vehicular traffic and is not anticipated to have an adverse traffic impact in the vicinity.

2. ***Water***

During grading and construction, non-potable water is intended to be used for dust control, as appropriate.

Upon its completion, the proposed project will enhance the Central Maui water transmission system by providing additional water storage capacity that will lessen the possibility of any adverse effect upon the water service capabilities to the Central Maui and Kihei areas. In addition, the completion of the new water tank will allow the existing 1.0 million gallon water tank to be taken off-line for necessary renovations and repairs.

3. ***Wastewater***

No impacts are anticipated to the County's wastewater system since the proposed project does not require connections to the County's sewer system.

4. ***Drainage***

Existing storm runoff generated in the vicinity of the proposed 3.0 million gallon water tank (Parcel "A") sheetflows in an east and northeasterly direction and drains into an unnamed stream. Proposed improvements include a 0.30 acre-ft. detention basin located to the immediate east of the proposed water tank. Drainage patterns anticipated will allow all storm runoff generated onsite to sheetflow into this detention basin area, via grassed swales.

Accordingly, development of the proposed project is not expected to cause any adverse effects to adjacent or downstream properties.

Chapter IV

Relationship to Governmental Plans, Policies and Controls

IV. RELATIONSHIP TO GOVERNMENTAL PLANS, POLICIES AND CONTROLS

A. STATE LAND USE DISTRICTS

Chapter 205, Hawaii Revised Statutes, relating to the Land Use Commission, establishes the four (4) small major land use districts in which all lands in the State are placed. These districts are designated "Urban", "Rural", "Agricultural", and "Conservation". The subject parcel is within the "Agricultural" district. See Figure 10. The proposed action involves the use of the property for a water storage tank and related appurtenances which is compatible with the "Agricultural" designation.

B. MAUI COUNTY GENERAL PLAN

The Maui County General Plan sets forth broad objectives and policies to help guide the long-range development of the County. As stated in Section 8-8.5 of the Maui County Charter, "The General Plan shall recognize and state the major problems and opportunities concerning the needs and the development of the County and the social, economic and environmental effects of such development and shall set forth the desired sequence, patterns and characteristics of future development."

The proposed action is in keeping with the following General Plan objective and policies:

Objective: To provide an adequate supply of potable and irrigation water to meet the needs of Maui County's residents.

Policies:

1. Support the improvement of water transmission systems to those areas which historically experience critical water supply problems provided the improvements are consistent with the water priorities and the County's Water Use Development Plan provisions for the

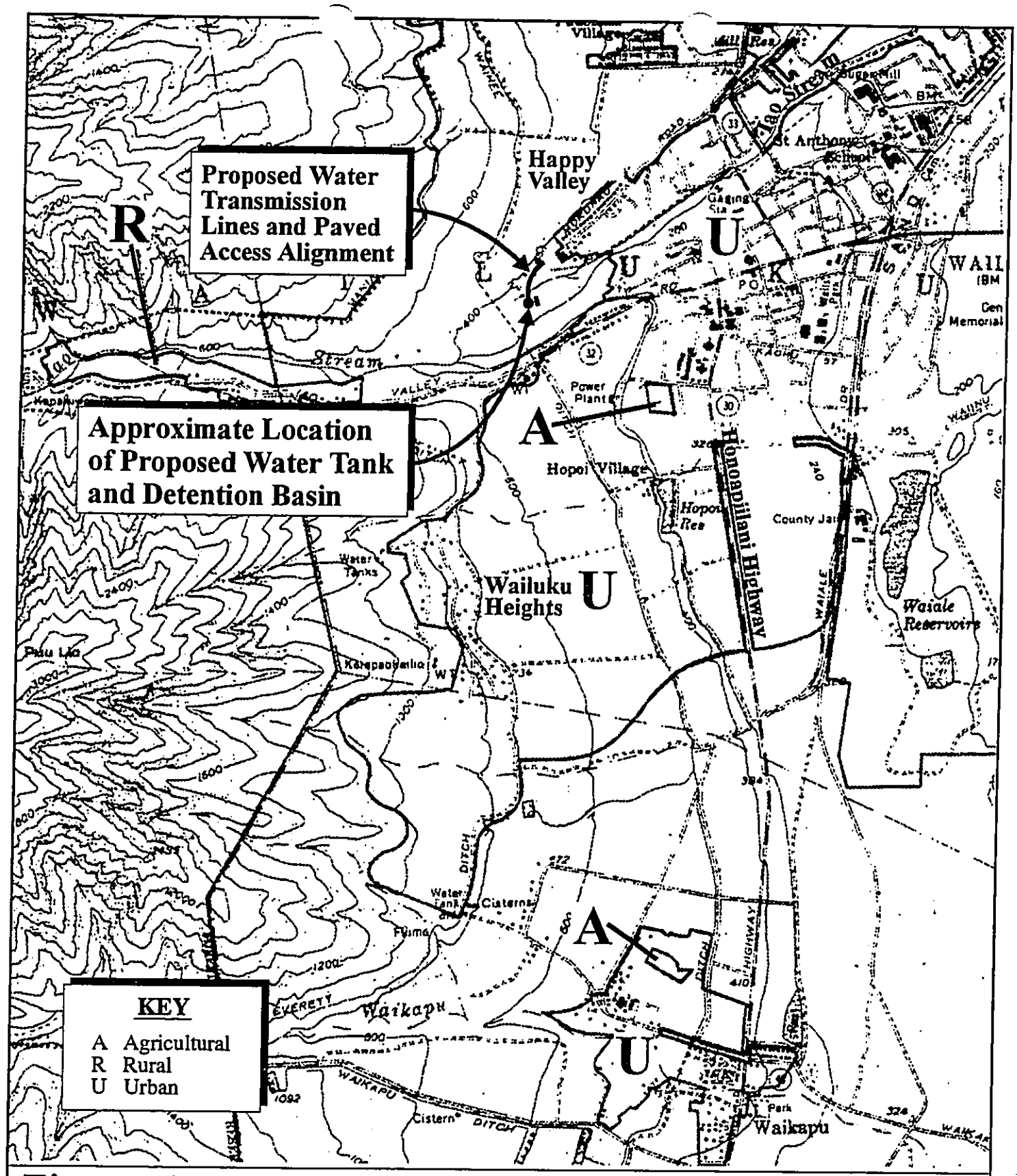


Figure 10

Mokuhau Water Tank

State Land Use Classifications

MUNEKIYO & ARAKAWA, INC.

Prepared for: County of Maui, Dept. of Water Supply

applicable community plan area.

2. Develop improved systems to provide better fire protection.

3. Maintain the right to manage the County's water sources and transmission systems at the County level.

Objective: To make more efficient use of our ground, surface and recycled water sources.

Policy:

1. Maximize use of existing water sources by expanding storage capabilities.

C. *WAILUKU-KAHULUI COMMUNITY PLAN*

The subject parcel is located in the Wailuku-Kahului Community Plan region which is one (1) of nine (9) Community Plan regions established in the County of Maui. Planning for each region is guided by the respective Community Plans, which are designed to implement the Maui County General Plan. Each Community Plan contains recommendations and standards which guide the sequencing, patterns and characteristics of future development in the region.

The project site is designated "Agriculture" and "Open Space" on the Wailuku-Kahului Community Plan Land Use Map. See Figure 11. The proposed project is in keeping with the following Wailuku-Kahului Community Plan recommendation for water distribution:

> Coordinate water system improvement plans with growth areas to ensure adequate supply and a program to replace deteriorating portions of the distribution system. Future growth should be phased to be in concert with the service capacity of the water system.

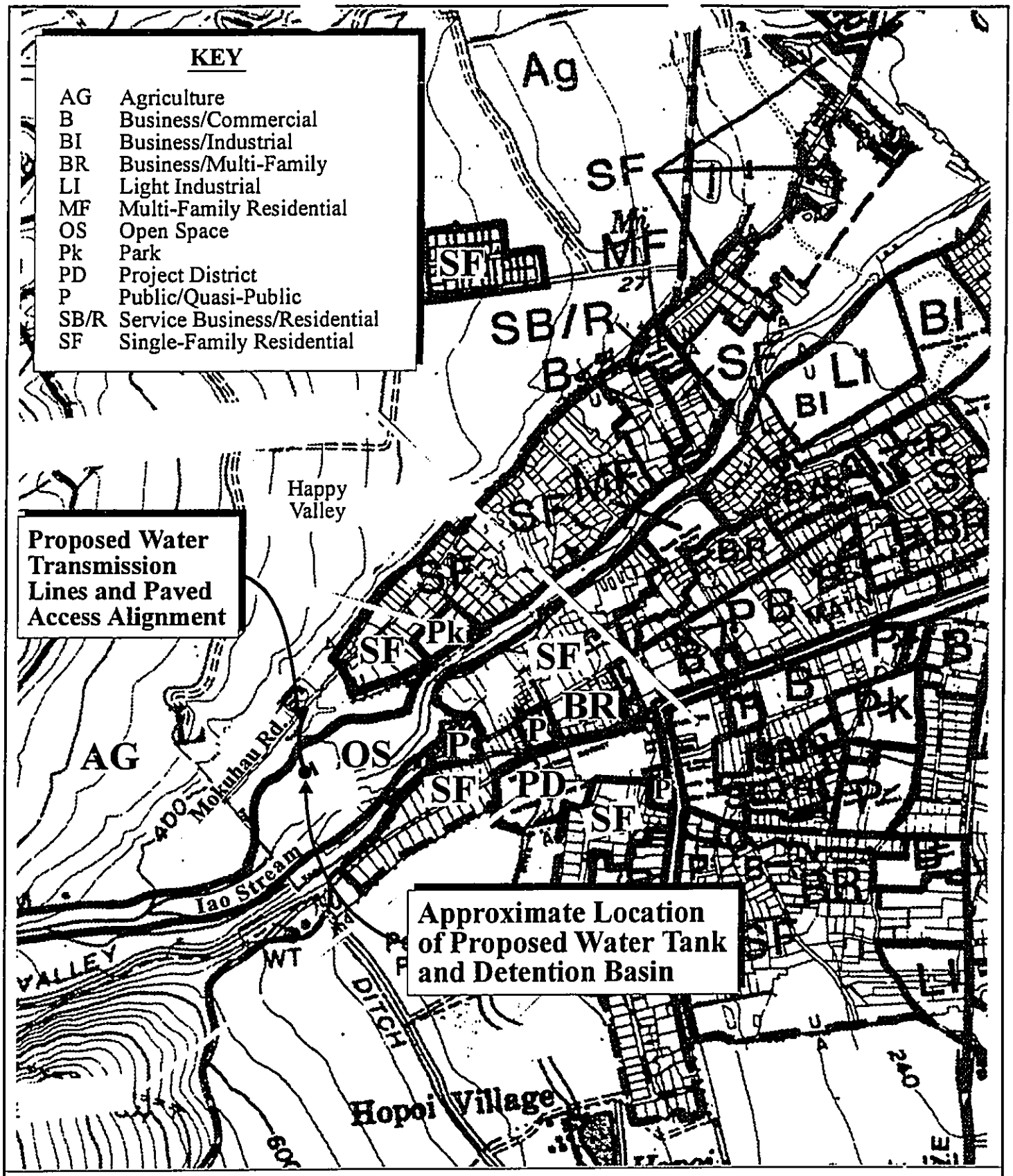


Figure 11

Mokuhau Water Tank
Wailuku-Kahului Community
Plan Land Use Designations

MUNEKIYO & ARAKAWA, INC.

0 500 1000 2000 Feet

Prepared for: County of Maui, Dept. of Water Supply

D. COUNTY ZONING

The County of Maui has no zoning designation for the subject property.

E. OTHER REGULATORY CONSIDERATIONS

1. Proposed Drain Line and CRM Concrete Slab

The proposed project involves the construction of an 18-inch drain line from the proposed detention basin to Iao Stream. The drain line is proposed to be constructed underground and extend approximately 50 feet from the detention basin in a southerly direction. Any discharge to Iao Stream will be accommodated by a drainage outlet to be constructed approximately two (2) feet above an existing concrete levee built by the Corps of Engineers for the Iao Stream Flood Control project. The drain line will collect discharged potable water from the detention basin should overflow occur. Located approximately 170 feet north of Iao Stream's average streamflow and approximately two (2) feet above the existing concrete levee, the drain line and drainage outlet will not directly impact "waters of the United States". Accordingly, regulatory permits, such as the Department of the Army (DA) permit, Section 401 Water Quality Certification (WQC) and the Hawaii Coastal Zone Management (CZM) Program Consistency Assessment are not applicable for this project improvement.

In connection with the proposed 18-inch drain line and drainage outlet, an 8-foot by 18-foot concrete rubble masonry (CRM) slab will be installed (at grade) at the foot of the existing concrete levee, directly below the drainage outlet. The slab is intended to absorb the force of the flows from the drain line during a water discharge event to prevent soil erosion from occurring at the toe of the levee. Located approximately 120 feet north of Iao Stream's normal

streamflow routing, however, the slab will not directly impact "waters of the United States". See Appendix D. Accordingly, regulatory permits such as a DA permit, Section 401 WQC, and CZM Assessment are not required for the construction of the CRM slab. Additionally, coordination with the Commission on Water Resource Management revealed that a Stream Channel Alteration permit is not required for this proposed improvement. See Appendix E.

There are no provisions of the project which trigger a National Pollutant Discharge Elimination System (NPDES) permit.

2. ***Proposed Crossing of an Unnamed Stream***

The proposed project also involves the installation of two (2) underground water transmission lines extending from the new water tank to the existing waterlines located at the western extent of Mokuhau Road's right-of-way. The proposed waterlines will intersect with an unnamed stream in the vicinity of an existing dirt road. The stream does not originate from Iao Stream; however, it traverses through a culvert approximately 10 feet below the existing grade of the dirt road. The proposed waterlines are designed to be placed several feet above the existing culvert, thus leaving the culvert undisturbed. Accordingly, based on this design, the Corps has indicated that this portion of the project (stream crossing) will not require a Department of the Army Permit. Refer to Appendix D.

Chapter V

Findings and Conclusions

V. FINDINGS AND CONCLUSIONS

The proposed project involves the construction of a 3.0 million gallon water tank, a 12-foot wide paved access easement, a 0.30 acre-ft. detention basin and other accessory improvements in Mokuhau (Happy Valley), Maui, Hawaii.

Every phase of the proposed action, expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action have been evaluated in accordance with the Significance Criteria of Section 11-200-12 of the Administrative Rules. Based on the analysis, the proposed project will not result in any significant impacts. Discussion of project conformance to the criteria is noted as follows:

1. *No irrevocable commitment to loss or destruction of any natural or cultural resource would occur as a result of the proposed project*

The project will not significantly affect slope and land use characteristics of the surrounding area. There are no known, rare, endangered or threatened species of flora, fauna or avifauna within the project site.

An archaeological inventory survey found no evidence of historic sites or significant cultural resources. However, should any cultural remains be discovered during construction, applicable procedures to ensure compliance with Chapter 6E, HRS, will be followed.

2. *The proposed action would not curtail the range of beneficial uses of the environment*

The proposed project is located on existing vacant land adjacent to the Iao Stream Flood Control Project. The site is located approximately 150 feet north of the normal stream flows and will not affect the flood control levee built by the U.S. Army Corps of Engineers. The proposed project

would not have a significant effect on the range of beneficial uses of the environment.

3. ***The proposed action does not conflict with the State's long-term environmental policies or goals or guidelines as expressed in Chapter 344, Hawaii Revised Statutes***

The State Environmental Policy and Guidelines are set forth in Chapter 344, Hawaii Revised Statutes and were reviewed in connection with the proposed project. The proposed action is in consonance with the State's long-term environmental policies and goals of Chapter 344, HRS.

4. ***The economic or social welfare of the community or State would not be substantially affected***

The proposed project provides additional water storage capacity to service a projected growth in population in the Central Maui and Kihei-Makena area. The construction of the new water tank also allows the existing tank to be taken off-line for repairs and refurbishment. Thus, the project is an indirect economic benefit to the community and should have no effect upon social welfare parameters.

5. ***The proposed action does not affect public health***

No impacts to the public's health and welfare are anticipated as a result of the project.

6. ***No substantial secondary impacts, such as population changes or effects on public facilities, are anticipated***

No significant secondary impacts are anticipated from the project.

The proposed project is not anticipated to have a significant effect upon the area's roadways. The project does not require a connection to the County's sewer system. Storm runoff will be directed via grassed swales into a detention basin area. The project is not expected to impact public services, such as police, fire and medical services. Impacts upon recreational, educational and solid waste parameters are also negligible.

7. ***No substantial degradation of environmental quality is anticipated***

During the construction phase of the project, there will be short-term air quality and noise impacts as a result of the project. In the long term, effects upon air quality and noise parameters should be minimal. The project is not anticipated to significantly affect the open space and scenic character of the area.

No substantial degradation of environmental quality resulting from the project is anticipated.

8. ***The proposed action does not involve a commitment to larger actions, nor would cumulative impacts result in considerable effects on the environment***

The proposed project does not involve a commitment to larger actions. However, the implementation of this project would allow the repair and refurbishment of the existing Mokuhau Water Tank which is intended to be done at a later point in time.

9. ***No rare, threatened or endangered species or their habitats would be adversely affected by the proposed action***

There are no rare, threatened or endangered species of flora or fauna or their habitats on the subject property.

10. ***Air quality, water quality or ambient noise levels would not be detrimentally affected by the proposed project***

Construction activities will result in short-term air quality and noise impacts. Dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions. Noise impacts will occur primarily from construction-related activities. It is anticipated that construction will be limited to daylight working hours.

In the long term, the project is not anticipated to have a significant impact on air quality or noise parameters.

11. ***The proposed project would not affect environmentally sensitive areas, such as flood plains, tsunami zones, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters or coastal waters***

The project is not located within and would not affect environmentally sensitive areas. The project site is located adjacent to the Iao Stream Flood Control Project and is not subject to flooding or tsunami inundation. Soils of the project site are not erosion-prone. There are no geologically hazardous lands, estuaries, or coastal waters within or adjacent to the project site.

Based on the foregoing findings, it is concluded that the proposed action will not result in any significant impacts.

Chapter VI

Agencies Contacted During the Preparation of the Environmental Assessment

VI. AGENCIES CONTACTED DURING THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

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

1. Ms. Terrell Kelley
U. S. Army Corps of Engineers
Pacific Ocean Division
Building 230
Fort Shafter, Hawaii 96858

2. Mr. Neal Fujiwara
U.S. Department of Agriculture
Natural Resources
Conservation Service
210 Imi Kala Street, Suite 209
Wailuku, Hawaii 96793

3. U.S. Fish and Wildlife Service
Pacific Islands Office
P. O. Box 50167
Honolulu, HI 96850

4. Herb Matsubayashi, Acting
Chief Sanitarian
State of Hawaii
Department of Health
54 High Street
Wailuku, Hawaii 96793

5. Denis Lau, Chief
State of Hawaii
Department of Health
Clean Water Branch
P. O. Box 3378
Honolulu, Hawaii 96801

6. Ms. Theresa Donham
Department of Land and
Natural Resources
State Historic
Preservation Division
1325 L. Main Street, #108
Wailuku, Hawaii 96793

7. Department of Land and Natural
Resources
Water Resources Management
Division
P. O. Box 621
Honolulu, Hawaii 96809

8. David W. Blane, Director
County of Maui
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

9. Charles Jencks, Director
County of Maui
Department of Public Works
and Waste Management
200 South High Street
Wailuku, HI 96793

10. Wailuku Main Street Association, Inc.
2062 Main Street
Wailuku, Hawaii 96793

Chapter VII

Comments Received During Public Comment Period and Applicable Responses

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813-5249
PHONE (808) 594-1888
FAX (808) 594-1865

May 24, 1996

Mr. Milton Arakawa, Project Manager
Munekiyo $ Arakawa
1823 Wells Street, Suite 3
Wailuku, HI 96793

Dear Mr. Arakawa:

Thank you for the opportunity to review the Draft Environmental Assessment (DEA) for the Mokuhau Water Tank, Island of Maui. The County of Maui proposes to construct a 3.0 million gallon water tank and accessory infrastructure in Mokuhau Valley at the outskirts of Wailuku town. The proposed tank will provide additional water storage capacity to meet water demands of Wailuku, Kahului, and Kihei areas.

After a careful review of the DEA and supporting documentation, the Office of Hawaiian Affairs has no objections to the proposed water tank. Based on the information contained in the DEA, the owner of the land is the County of Maui and the proposed water tank apparently bears no significant long-term adverse impacts on ecosystems in that portion of the Iao stream nor upon existing urban and rural settlements. Furthermore, no known archaeological remains exist and the proposed tank will not significantly alter the landscape of the Iao stream and surrounding scenery. Please contact me, or Linda K. Delaney, the Land and Natural Resources Division Officer (594-1938), or Luis A. Manrique (594-1755), should you have any questions on this matter.

Sincerely yours,

Linda M. Colburn
Administrator

LM:lm

BENJAMIN J. CAYETANO
GOVERNOR

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

June 7, 1996

The Honorable David R. Craddick, Director
Board of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Maui, Hawai'i 96793-7109

Dear Mr. Craddick:

We submit for your response (required by Section 343-5(b), Hawaii Revised Statutes) the following comments on an April 1996, draft environmental assessment for "Mokuhau Water Tank" prepared for the County of Maui Department of Water Supply by Munekiyo & Arakawa, Inc., submitted to our Office by your April 18, 1996, letter. Notice of availability of this draft environmental assessment was published in the May 8, 1996, and May 22, 1996, editions of the *Environmental Notice*.

1. Please describe in Section II (Description of the Existing Environment) the Iao stream system, including a topographic map to allow the reader to discern water flow pathways from the proposed project site to the low-lying areas. In this description, please indicate the nature and extent of channelization or human alteration to the Iao stream along with a description of stream fauna in the vicinity of the project.

2. Please describe in Section III (Potential Impacts and Mitigation Measures) direct, indirect and cumulative impacts of the proposed action to Iao stream. Please include a discussion on mitigative measures to prevent construction runoff (with sediment debris load) from entering the Iao stream system.

3. On page 28, mention is made in section B.1 (Population and Local Economy) that "[t]he proposed water tank will allow the existing tank to be taken off-line for repairs while still providing the Central Maui and Kihei regions the capacity to adequately support its growing water demands and fireflow protection requirements." Please discuss in the final environmental assessment the

relationship between the increase from one to two million gallons and the projected number of persons served by such an increase.

Please include this letter and your response in the final environmental assessment for this project. If there are any questions, please call Mr. Leslie Segundo, Environmental Health Specialist toll-free at 1-800-468-4644 extension 64185. Thank you.

Sincerely,

GARY GILL
Director

c: Mr. Herb Kogasaka, Board of Water Supply
Mr. Milton Arakawa, Munekiyo and Arakawa

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109

June 19, 1996

Mr. Gary Gill, Director
State of Hawaii
Office of Environmental Quality Control
220 South King Street, Fourth Floor
Honolulu, Hawaii 96813

Dear Mr. Gill:

Subject: **MOKUHAU WATER TANK**

We have reviewed your letter of June 7, 1996 and would like to offer the following comments.

1. A concrete levee, built by the U.S. Army Corps of Engineers in 1980, is located at the southerly extent of the project site. The levee in this vicinity is approximately 15 feet in height at elevations ranging from 345 feet above sea level at the top of the levee to 330 feet above sea level at the toe of the levee. See attachment. The majority of the proposed improvements will be located north of the levee and will not alter or impact the levee.

   With regard to Iao Stream, the southerly extent of the proposed improvements and the concrete levee are located approximately 150 feet north of Iao Stream's normal streamflow routing. The area between the normal streamflow and the levee is usually dry and primarily vegetated with low lying grasses and weeds. A maintenance dirt road is also located approximately 20 feet south of the levee while a rock revetment borders the northerly embankment of Iao Stream's normal streamflows. Refer to attachment. It is also noted that the normal streamflow of Iao Stream traverse at approximately the 320 foot elevation and is not anticipated to reach the vicinity of the levee except during periods of intense flooding conditions.

   According to the Hawaii Stream Assessment (December 1990), aquatic resources generally observed within Iao Stream include the oopu nakea and the oopu nopili.

2. Normal erosion control measures will be utilized during the construction period. This includes the following measures:

   a. Minimizing the time of construction.
   b. Retaining the existing ground cover until the latest date to complete construction.
   c. Early construction of the detention basin.

d. Watering and sprinkling of graded areas, as needed.
e. Sodding or planting of all cut and fill slopes immediately after grading work has been completed.

The above noted erosion control measures should control soil loss within tolerable limits thereby precluding significant effects upon Iao Stream's water quality. It is noted that the stream is not affected and so a Department of the Army Permit and a Stream Channel Alteration Permit are not applicable for the proposed project.

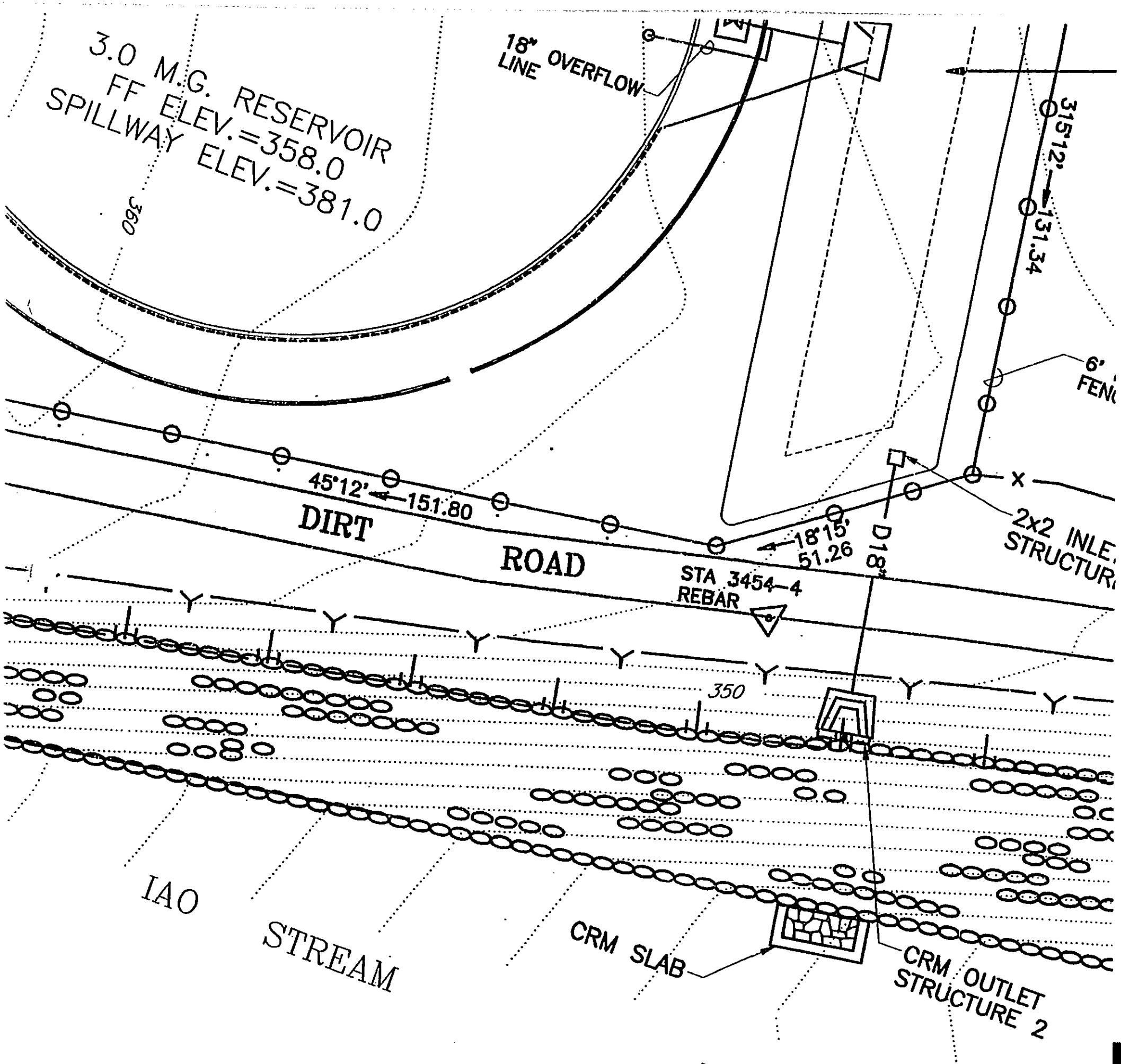
3. It is acknowledged that the proposed project would provide 3 million gallons of additional storage capacity. Moreover, this would allow the repair and maintenance of the existing 1 million gallon Mokuhau Water Tank. While the proposed project will help make up some of the shortfall in storage capacities needed for fire protection as well as provide operational flexibility in running the pumps, it should also be noted that the additional storage capacity does not automatically allow additional persons to be serviced. The more important factor in the amount of households or businesses to be serviced is source capacity which is not being increased by the project.

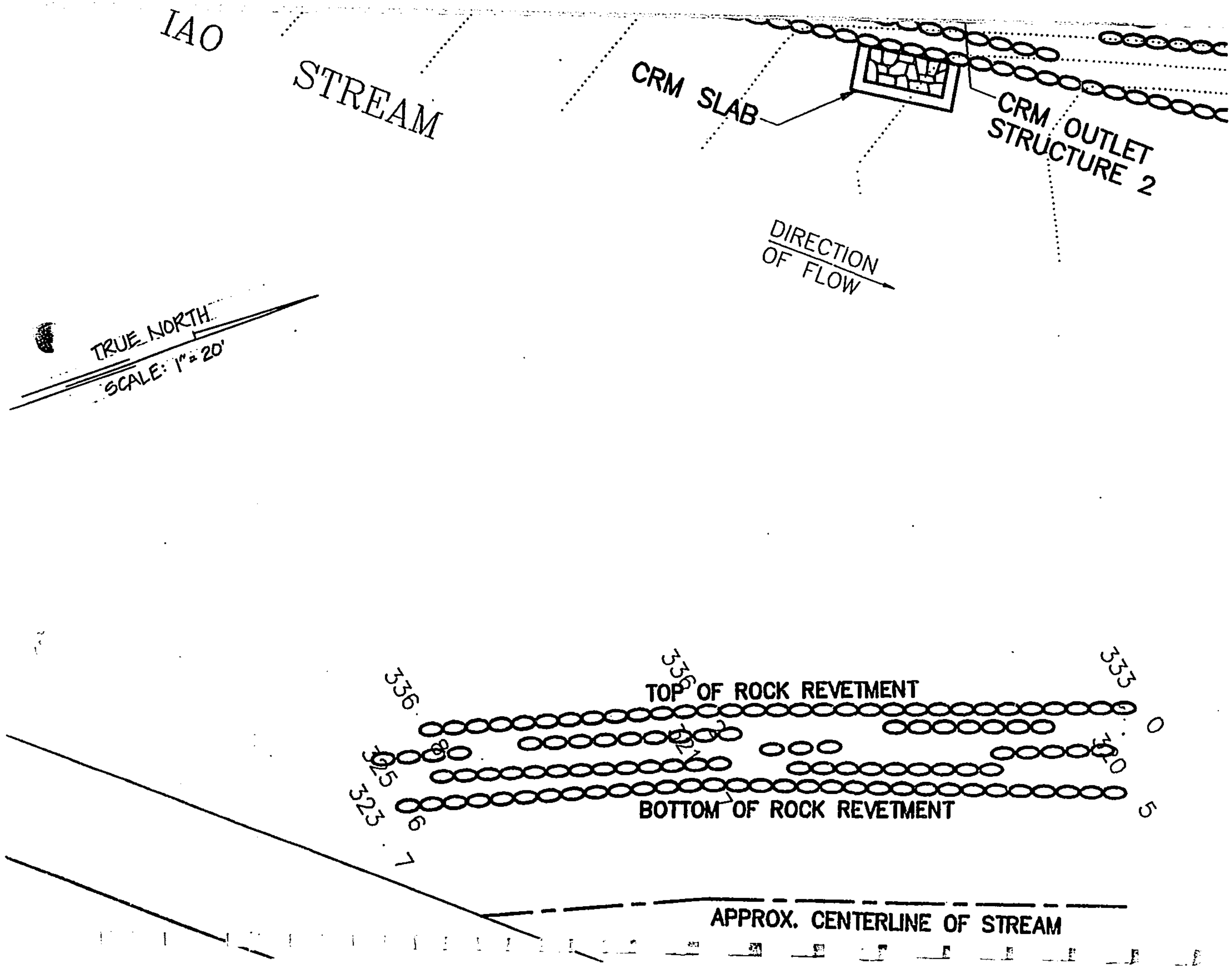
We hope that the above response addresses your concerns. If you have any questions, please feel free to call me. Thank you for your comments.

Sincerely,

David R. Craddick
Director

/HK:sc
Attachments
cc: Milton Arakawa, Munekiyo & Arakawa, Inc.


3.0 M.G. RESERVOIR
FF ELEV.=358.0
SPILLWAY ELEV.=381.0
360
18" OVERFLOW LINE
315°12'
131.34
6" FENCE
X
45°12'
151.80
DIRT
ROAD
18°15'
51.26
18"
2x2 INLET STRUCTURE
STA 3454-4
REBAR
350
IAO
STREAM
CRM SLAB
CRM OUTLET STRUCTURE 2


IAO STREAM
CRM SLAB
CRM OUTLET STRUCTURE 2
DIRECTION OF FLOW
TRUE NORTH
SCALE: 1"=20'
TOP OF ROCK REVETMENT
BOTTOM OF ROCK REVETMENT
APPROX. CENTERLINE OF STREAM
333
336
336
320
321
325
323
0
5
6
7
8

References

References

Community Resources, Inc., Maui County Community Plan Update Program Socio-Economic Forecast Report, January 1994.

County of Maui, The General Plan of the County of Maui 1990 Update, 1990.

Department of Public Works and Waste Management - Wastewater Reclamation Division, Wastewater Reclamation Division Plant Capacity Status, February 26, 1996.

Department of Water Supply, Fire Protection System for Maui and Molokai map, 1991.

Land Study Bureau, Detailed Land Classification - Island of Maui (map 28), May, 1967.

Munekiyo & Arakawa, Inc., Application for a Change in Zoning - Proposed Office Building at 2127 Wells Street, February 1995.

Munekiyo & Arakawa, Inc., Final Environmental Assessment-Hale Makua Kahului Expansion, December 1994.

Sato & Associates, Inc. Engineering Report for the Mokuhau Renovation and Reservoir Replacement Project, June 1995.

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U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, 1972.

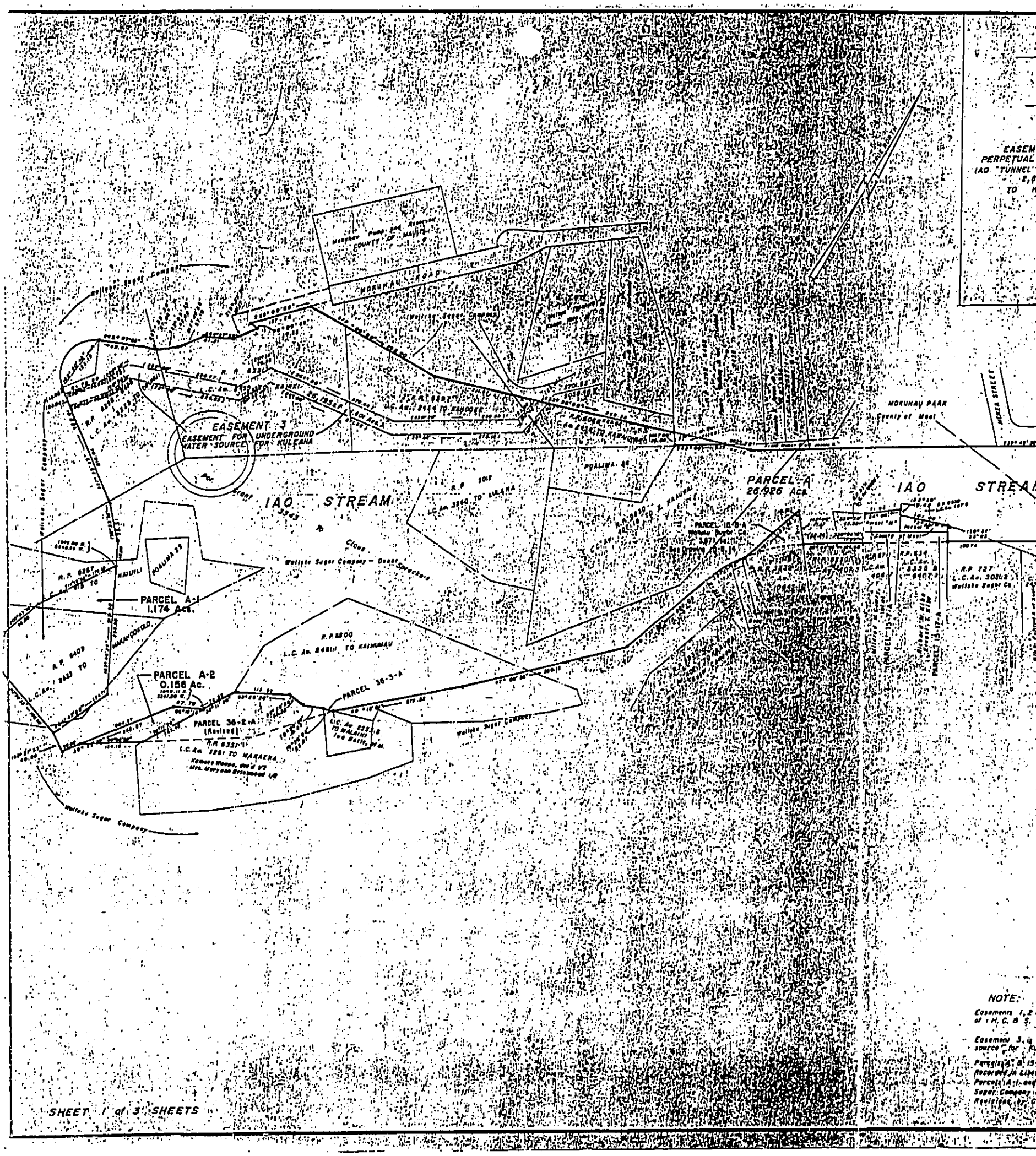
Wilson Okamoto & Associates, Inc. Maui Community Plan Update Infrastructure Assessment, September 1992.

Appendices

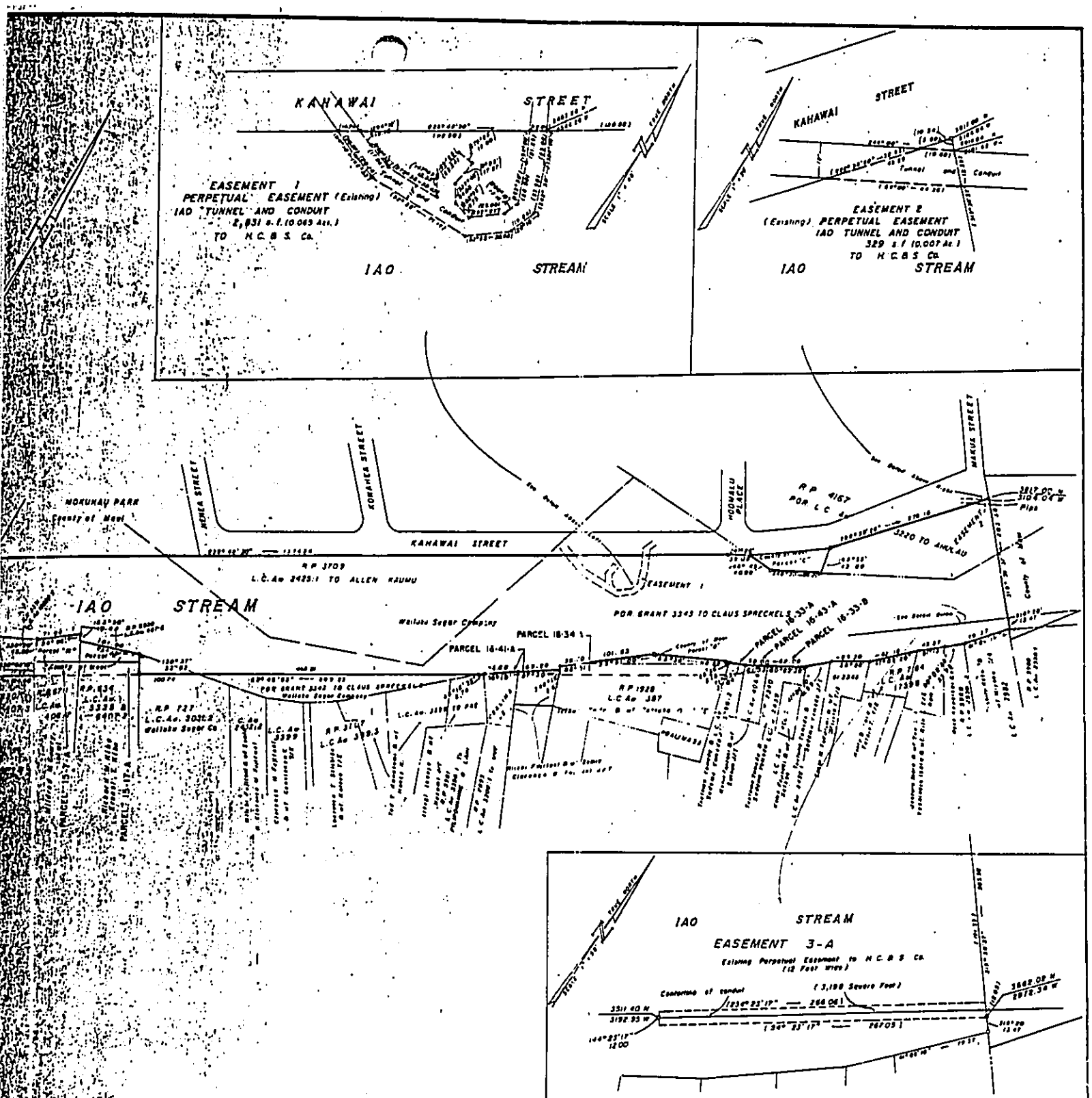
Appendix A

Legal Description of Parcel "A"

DOCUMENT CAPTURED AS RECEIVED



DOCUMENT CAPTURED AS RECEIVED



NOTE:

Easements 1, 2 and 3-A are existing Perpetual Easements in favor of H. C. & S. Co.

Easement 3-A is an existing easement for underground water source "for Kukona.

Parcels "A" & 15-8-A Deed from Wailuku Sugar Co. to County of Maui Recorded in Liber 15378 Pages 531 & 587, Dated: Feb. 27, 1981
Parcels A-1 and A-2 are supplement to Parcel "A" which Wailuku Sugar Company is conveying to County of Maui
Restricted to County of Maui, February 3, 1981

Revised - October 3, 1979
Revised - July 20, 1979

NOTES

1. Coordinates and azimuths shown hereon are referred to "LUKE" △ as per this survey and may differ from those of records, deeds.
2. Adjoining owners from tax map records.

SURVEYORS CERTIFICATE

I hereby certify that the survey shown hereon was made by me or under my direction.

GEORGE F. NEWCOMER

REGISTERED PROFESSIONAL LAND SURVEYOR CERTIFICATE NO. 3745-S

REVISIONS			
	Urgents	AM	CH
9/5/79	Parcel Description	KN	SN
DATE	DESCRIPTION	BY	APPROVED

IAO STREAM
LAND TRANSFER MAP
PARCEL A
WAILUKU SUGAR COMPANY
TO
COUNTY OF MAUI
LELEMAHO, POHAKUUHI, USUKU, KAPUKAKEEO
WAILUKU, MAUI, HAWAII
MAUKA END TO 3300 FEET MAUKA OF MARKET ST
TAX MAPS 3-4-15 & 16 & 3-4-16-1

DRAWN NM CHECKED KN DATE 8/31/79 Revised 9/11/79

SCALE 1" = 100' DRAWING NO MAUKA

RECORDATION REQUESTED BY:

COUNTY OF MAUI

AFTER RECORDATION, RETURN TO:
Office of the County Clerk
County of Maui
200 So. High Street
Wailuku, HI 96793
RETURN BY: MAIL (X) PICK-UP ( )

81- 20654

81 FEB 27 P 1:06

15378 531

REGISTRAR

SPACE ABOVE THIS LINE FOR REGISTRAR'S USE

THIS INDENTURE, made this 24th day of October, 1980, by and between WAILUKU SUGAR COMPANY, a Hawaii corporation, hereinafter called the "Grantor", and COUNTY OF MAUI, a municipal corporation of the State of Hawaii, whose principal office and post office address is 200 South High Street, Wailuku, Maui, Hawaii 96793, hereinafter called the "Grantee",

W I T N E S S E T H :

That the Grantor, for and as a charitable contribution for exclusively public purposes and benefit, does hereby grant and convey unto the Grantee, its successors and assigns, the following described property:

All of that certain parcel of land situate at Wailuku, Island and County of Maui, State of Hawaii, containing an area of 26.926 acres, more or less, as more particularly described in the description of Parcel A attached hereto and made a part hereof and marked "Exhibit A".

SUBJECT, HOWEVER, to the following:

1. The reservation unto the State of Hawaii of all mineral and metallic mines as may be set forth in any of the Royal Patents and Grants referred to in said Exhibit "A".

2. Easements 1, 2, 3 and 3-A in favor of Alexander & Baldwin, Inc., successor in interest to Hawaiian Commercial and Sugar Company, as set forth in Deed of Exchange dated June 23, 1924, recorded in Liber 740 at page 134, as

EXEMPT—HAWAII CONVEYANCE TAX

CERTIFICATE NOT REQUIRED

amended by Agreement dated March 24, 1937, recorded in Liber 1371 at page 227, said Easements 1, 2, 3 and 3-A being more particularly described in said Exhibit "A" attached hereto.

3. Easements for existing roadways, and electrical, gas, communications, sewer, drainage, water and other utility purposes over, across, along, upon and under portions of the granted premises.

AND EXCEPTING AND RESERVING, HOWEVER, unto the Grantor, its successors and assigns, as owner from time to time of adjoining properties, all existing rights to withdraw water from Iao Stream mauka of the land hereby conveyed and to use and convey water to the extent permissible under the laws of Hawaii, provided nothing herein shall be construed as a reservation, transfer or conveyance of any public water rights.

RESERVING AND EXCEPTING FURTHER, HOWEVER, unto the Grantor, its successors and assigns, as owner from time to time of adjoining property, easements for roadway purposes over the present roads within the granted premises, and any roads that may hereafter be constructed by any person, and easements for electrical, gas, communications, sewer, drainage, water and other utility purposes, together with cables, poles, wires, pipelines, flumes, conduits and other facilities in connection therewith, over, in, under, across, along, upon and through the granted premises, and together with the right to maintain, repair, enlarge, construct, reconstruct and relocate any of said roads or other easements, provided only that any such enlargement or new construction shall be subject to approval of the Grantee so as not to unduly restrict the flow of water in the flood control project of which the granted premises are a part, and subject also, however, to the right of the Grantee, its successors and assigns, as owner from time to time of the granted premises, to require the Grantor or its said successors and assigns to relocate any of said roads if they unreasonably interfere with the proper flow of water or the construction from the engineering standpoint of the levees, berms, maintenance roadways and other facilities of said flood control project, provided that any such relocation shall provide said Grantor and its successors and assigns with a facility of approximately the same usefulness as the present facility, all costs of such relocation to be borne by the Grantee or its successors

or assigns or other governmental agency, and the Grantor and its said successors and assigns shall have the right to grant to State of Hawaii, County of Maui or other appropriate governmental agency or to any public utility or other corporation easements for any of the purposes for which easements are hereinabove reserved, under the usual terms and conditions required by the grantee of such easement rights, and the Grantee agrees that the Grantee and any person claiming an interest in the granted premises by, through or under the Grantee will, upon request, join in and execute any and all documents granting any such easements.

TO HAVE AND TO HOLD the same, together with the rents, issues and profits thereof, the improvements thereon, and the tenements, rights, easements, privileges and appurtenances thereunto belonging or appertaining or held and enjoyed therewith unto the Grantee, its successors and assigns, forever.

The Grantor and the Grantee hereby agree that that certain Indenture dated May 8, 1958, recorded in Liber 3438 at page 204, between the Grantor and the Grantee, relating to the Iao Stream Flood Control, is hereby superseded, cancelled and terminated insofar as the granted premises are involved.

IN WITNESS WHEREOF, the parties hereto have executed these presents the day and year first above written.

WAILUKU SUGAR COMPANY

By James G. Higgins
Its Vice-President

By
Its Assistant Secretary

Grantor

APPROVED AS TO FORM, CONTENTS & AUTHORIZATION

PROPERTY PLANNING & CONTROL DEPT.
WAILUKU INVESTMENT CO., INC.

COUNTY OF MAUI

By Hannibal Tavares
Its Mayor

Grantee

APPROVED AS TO FORM AND LEGALITY:

[illegible]
County of Maui

STATE OF HAWAII)
) SS
CITY AND COUNTY OF HONOLULU)

On this 24th day of October, 1980,

before me appeared JAMES G. HIGGINS and

HAROLD P. LUSCOMB, to me personally known,

who, being by me duly sworn, did say that they are

Vice-President and Assistant Secretary,

respectively, of WAILUKU SUGAR COMPANY,

a Hawaii corporation; that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors; and

said JAMES G. HIGGINS and HAROLD P. LUSCOMB acknowledged the instrument to be the free act and deed of said corporation.

Stephanie A Nagata
Notary Public First Judicial Circuit
State of Hawaii

My Commission expires 2/10/84

STATE OF HAWAII)
) SS
COUNTY OF MAUI)

On this 24th day of February, ~~1980~~ 1981, before me appeared HANNIBAL TAVARES, to me personally known, who, being by me duly sworn, did say that he is the Mayor of the COUNTY OF MAUI, a municipal corporation, and that the seal affixed to said instrument is the corporate seal of said municipal corporation, and that the instrument was signed and sealed in behalf of said municipal corporation by authority of its Council, and said HANNIBAL TAVARES acknowledged the instrument to be the free act and deed of said municipal corporation.

Notary Public
State of Hawaii

My Commission expires: 9/26/82

EXHIBIT "A"

DESCRIPTION

15378 536

PARCEL A

All of that certain parcel of land, being all of Royal Patent 5012, Land Commission Award 3260 to Lulana; Royal Patent 5530, Land Commission Award 407:5 to Z. Kaauwai; Royal Patent 3651, Land Commission Award 10539:2 to Pa, and those two certain Poalimas being parts of Grant 3343 to Claus Spreckels; and portions of Grant 3343 to Claus Spreckels; Royal Patent 4167, Land Commission Award 3220 to Ahulau; Royal Patent 727, Land Commission Award 9031:2 to Kaniu; Royal Patent 5500, Land Commission Award 8461:1 to Kaihumau; Royal Patent 6409, Land Commission Award 2523 to Makahookolo; Royal Patent 5257, Land Commission Award 415 to Nailiili; Royal Patent 6298-6453, Land Commission Award 3225 to Opunui; Royal Patent 6331, Land Commission Award 2455 to Kahiki, Royal Patent 6397, Land Commission Award 2434 to Kahooke; Royal Patent 6066, Land Commission Award 2453 to Kawaiohia; Royal Patent 5530, Land Commission Award 407:15 to Z. Kaauwai; Royal Patent 3709, Land Commission Award 2425:1 to Allen Kaumu, situated at Hailuku, Island and County of Maui, State of Hawaii, and being more particularly described as follows:

Beginning at a found pipe at the Northeast corner of this parcel of land, the coordinates of said point of beginning referred to Government Survey Triangulation Station "LUKE" being:

3,817.00 feet North

3,104.04 feet West

and running by azimuths measured clockwise from true South:

1.	319° 38' 37"	203.38 feet along remainders of said L.C.Aw. 3220 and said Grant 3343 to Claus Spreckels;
2.	319° 20' 00"	13.47 feet along remainder of said Grant 3343 to Claus Spreckels;
3.	41° 06' 10"	79.57 feet along land owned by Toshimi Kato and wife Miyoko;
4.	50° 00' 20"	33.98 feet along land owned by Rose Kepoikai Estate;
5.	51° 13' 00"	43.27 feet along land owned by Jentaro Ibara and wife Yuu and Yoshikazu Ibara and wife Ruth;
6.	47° 09' 20"	82.18 feet along land owned by Henry B. Ibara and wife Tatsue T.;
7.	58° 58' 00"	65.30 feet along land owned by Chogi N. Fukutomi and wife Shizuko I.;

8.	47° 08' 20"	41.99 feet along land owned by Tsutomo Yamada and Sadamu Yamada;
9.	60° 52' 30"	62.09 feet along L.C.Aw. 2439 to Mikalapa;
10.	61° 52' 00"	38.00 feet along land owned by Kunio Fujisaka and wife Satsue;
11.	71° 03' 00"	27.04 feet along land owned by Tsutomo Yamada and Sadamu Yamada;
12.	65° 36' 00"	8.15 feet along land owned by Tetsuo Tada and wife Tetsuko O.;
13.	65° 36' 00"	118.59 feet along land owned by the County of Maui;
14.	52° 51' 00"	101.93 feet along same;
15.	52° 51' 00"	55.70 feet along said land owned by Tetsuo Tada and wife Tetsuko O.;
16.	340° 15' 00"	5.67 feet along same;
17.	57° 30' 00"	69.20 feet along land owned by Niichi Fujitani and wife Sumie;
18.	56° 10' 00"	56.60 feet along same;
19.	49° 16' 35"	2.74 feet along land owned by Itsugi Inouye and wife Harumi;
20.	59° 46' 05"	468.51 feet along remainder of said Grant 3343 to Claus Spreckels;
21.	59° 46' 05"	100.74 feet along remainder of said L.C.Aw. 9031:2 to Kaniu;
22.	150° 37' 00"	33.03 feet along land owned by Richard M. & Ernest T. Kibe and the County of Maui;
23.	73° 15' 00"	101.00 feet along land owned by County of Maui;
24.	153° 30' 00"	10.44 feet along same;
25.	54° 06' 00"	71.94 feet along same;
26.	336° 30' 00"	42.95 feet along L.C.Aw. 406:7 to Napela;
27.	330° 02' 10"	17.23 feet along L.C.Aw. 406:7 to Napela;

28.	59° 46' 05"	124.60 feet along L.C.Aw. 407:5 to Z. Kaauwai;
29.	143° 00' 00"	71.17 feet along L.C.Aw. 10645:1 to Paele;
30.	18° 51' 00"	138.32 feet along said L.C.Aw. 10645:1 to Paele and along Southeasterly side of Iao Stream to a point in the arc of a curve to the left concave Southeasterly and having a radius of 315.00 feet, the radial azimuth to said point being 129° 16' 45";

thence along the arc of said curve, the chord azimuth and distance being:

31.	29° 57' 10"	102.10 feet along remainder of said Grant 3343 to Claus Spreckels;
32.	20° 37' 35"	209.09 feet along same;
33.	47° 08' 35"	350.12 feet along remainder of said Grant 3343 to Claus Spreckels and said L.C.Aw. 8461:1 to Kaihumau;
34.	50° 12' 01"	272.32 feet along remainder of said L.C.Aw. 8461:1;
35.	75° 30' 00"	23.07 feet along land owned by Iwa Betts;
36.	70° 50' 20"	41.09 feet along land owned by Maryann Brinsmead;
37.	98° 20' 20"	35.32 feet along same;
38.	63° 29' 20"	112.93 feet along same;
39.	32° 11' 20"	74.85 feet along same;
40.	66° 18' 15"	57.70 feet along remainder of said Grant 3343 to Claus Spreckels;
41.	39° 23' 39"	243.97 feet along same;
42.	125° 37' 35"	40.00 feet along same;
43.	204° 42' 25"	134.71 feet along remainders of said Grant 3343 to Claus Spreckels and said L.C.Aw. 2523 to Makahookolo;

44.	153° 44' 25"	313.50 feet along remainders of said Grant 3343 to Claus Spreckels and said L.C.Aw. 2523 to Makahookolo and said L.C.Aw. 415 to Nailiili;
45.	138° 33' 35"	78.31 feet along remainder of said Grant 3343 to Claus Spreckels;
46.	127° 33' 35"	259.01 feet along remainders of said Grant 3343 to Claus Spreckels and said L.C.Aw. 3225 to Opunui;

thence along the arc of a curve to the right concave Southeasterly and having a radius of 70.00 feet, the chord azimuth and distance being:

47.	188° 20' 45"	122.19 feet along remainder of said L.C.Aw. 3225 to Opunui;
48.	249° 07' 55"	92.67 feet along same;
49.	257° 32' 30"	27.66 feet along same;
50.	233° 03' 35"	43.00 feet along remainder of said L.C.Aw. 3225 and said L.C.Aw. 2455 to Kahiki;
51.	217° 48' 25"	57.10 feet along remainder of said L.C.Aw. 2455;
52.	244° 27' 35"	61.21 feet along same;
53.	218° 23' 35"	57.17 feet along same;
54.	90° 00' 00"	18.32 feet along same;
55.	225° 00' 00"	127.28 feet along same;
56.	270° 00' 00"	295.00 feet along remainder of said L.C.Aw. 2455 and said L.C.Aw. 2434 to Kahooke;
57.	253° 28' 00"	509.35 feet along remainder of said L.C.Aw. 2434 and said L.C.Aw. 2458 to Kawaiohia;
58.	325° 00' 00"	25.09 feet along L.C.Aw. 2428 to Kaowao;
59.	242° 00' 00"	119.73 feet along same;
60.	253° 28' 00"	44.15 feet along remainder of said L.C.Aw. 407:15 to Z. Kaauwai;

61.	239° 42' 30"	1,374.24	feet along remainder of said L.C.Aw. 407:15, said Grant 3343 to Claus Spreckels and said L.C.Aw. 2425:1 to Allen Kaumu;
62.	241° 26' 00"	39.09	feet along remainder of said Grant 3343 to Claus Spreckels;
63.	266° 45' 00"	40.00	feet along L.C.Aw. 3220 to Ahulau;
64.	248° 30' 00"	85.20	feet along same;
65.	163° 55' 00"	45.00	feet along remainder of said L.C.Aw. 3220 to Ahulau;
66.	222° 38' 20"	275.15	feet along remainder of said L.C.Aw. 3220 to Ahulau to the point of beginning and containing an area of 26.926 Acres.

This description, map, and survey based on data supplied by the County of Maui, Wailuku Sugar Company, C. Brewer and Co., Ltd., Alexander and Baldwin Inc., and available record sources.

This work was prepared by me
or under my direct supervision.

GEORGE F. NEWCOMER JR. REGISTERED PROFESSIONAL LAND SURVEYOR No. 2715-S HAWAII, U.S.A.

George F. Newcomer
Registered Professional Land Surveyor
Certificate Number 2715-S

November 28, 1979
George Newcomer
File Number 537-4
kn

DESCRIPTION

15378 541

EASEMENT 1
EXISTING 12' PERPETUAL EASEMENT
IAO TUNNEL AND CONDUIT

All of that certain parcel of land being a portion of Grant 3343 to Claus Spreckels, situated at Wailuku, Island and County of Maui, State of Hawaii and being more particularly described as follows:

Beginning at the Northeasterly corner of this easement, on the Southerly side of Kahawai Street, the coordinates of said point of beginning referred to Government Survey Triangulation Station "LUKE" being:

3,453.28 feet North

3,544.26 feet West

and running by azimuths measured clockwise from true South:

1.	334° 00' 00"	23.08 feet along remainder of said Grant 3343 to Claus Spreckels;
2.	342° 30' 00"	33.50 feet along same;
3.	20° 15' 00"	19.84 feet along same;
4.	53° 25' 00"	30.92 feet along same;
5.	92° 35' 00"	71.19 feet along same;
6.	112° 33' 00"	20.14 feet along same;
7.	114° 10' 00"	20.87 feet along same;
8.	239° 42' 30"	14.74 feet along same and along said Southerly side of Kahawai Street;
9.	294° 10' 00"	12.13 feet along remainder of said Grant 3343 to Claus Spreckels;
10.	292° 33' 00"	17.86 feet along same;
11.	272° 35' 00"	39.43 feet along same;
12.	147° 45' 00"	13.35 feet along same;
13.	189° 25' 00"	22.24 feet along same;
14.	279° 25' 00"	12.00 feet along same;
15.	9° 25' 00"	17.67 feet along same;
16.	327° 45' 00"	14.08 feet along same;
17.	283° 55' 00"	12.75 feet along same;
18.	233° 25' 00"	23.08 feet along same;

19.	200° 15' 00"	12.16 feet along same;
20.	162° 30' 00"	28.50 feet along same;
21.	154° 00' 00"	21.29 feet along same;
22.	239° 42' 30"	12.04 feet along same and along said Southerly side of Kahawai Street to the point of beginning and containing an area of 2,831 Square Feet.

This work was prepared by me
or under my direct supervision.

GEORGE F. NEWCOMER
REGISTERED PROFESSIONAL LAND SURVEYOR
No. 2715-S
HAWAII, U.S.A.

George F. Newcomer

George F. Newcomer
Registered Professional Land Surveyor
Certificate No. 2715-S

July 26, 1979

DESCRIPTION

EASEMENT 2
EXISTING 12' PERPETUAL EASEMENT
IAO TUNNEL AND CONDUIT

All of that certain parcel of land being a portion of Royal Patent 4167, Land Commission Award 3220 to Ahulau, situated at Wailuku, Island and County of Maui, State of Hawaii and being more particularly described as follows:

Beginning at the Northeast corner of this easement, the coordinates of said point of beginning referred to Government Survey Triangulation Station "LUKE" being:

3,814.04 feet North

3,101.52 feet West

and running by azimuths measured clockwise from true South:

1.	319° 38' 37"	12.39 feet along remainder of said L.C.Aw. 3220 to Ahulau;
2.	64° 00' 00"	44.36 feet along remainder of said L.C.Aw. 3220 to Ahulau;
3.	222° 38' 20"	32.95 feet along the Southerly side of Kahawai Street;
4.	244° 00' 00"	10.60 feet along remainder of said L.C.Aw. 3220 to Ahulau to the point of beginning and containing an area of 329 Square Feet.

This description, map and survey based on data supplied by the County of Maui, Wailuku Sugar Company, C. Brewer and Co., Ltd., Alexander and Baldwin Inc., and available record sources.

This work was prepared by me or under my direct supervision.

GEORGE F. NEWCOMER
REGISTERED PROFESSIONAL LAND SURVEYOR
No. 2715-S
HAWAII, U.S.A.

George F. Newcomer
Registered Professional Land Surveyor
Certificate No. 2715-S

November 28, 1979
George Newcomer
File Number 537-4
kn

DESCRIPTION

EASEMENT 3
EASEMENT FOR UNDERGROUND
WATER SOURCE FOR KULEANA

All of that certain parcel of land being portions of Royal Patent 6066, Land Commission Award 2458 to Kawaiohia; Royal Patent 6397, Land Commission Award 2434 to Kahooke; Royal Patent 6331, Land Commission Award 2455 to Kahiki; Royal Patent 6298-6458, Land Commission Award 3225 to Opunui, situated at Wailuku, Island and County of Maui, State of Hawaii and being more particulary described as follows:

Beginning at the most Easterly corner of this easement, the coordinates of said point of beginning referred to Government Survey Triangulation Station "LUKE" being:

2,701.22 feet North

5,038.44 feet West

and running by azimuths measured clockwise from true South:

1.	12° 45' 00"	77.41	feet along remainders of said L.C.Aw. 2458 to Kawaiohia and said L.C.Aw. 2434 to Kahooke;
2.	59° 30' 00"	273.12	feet along remainder of said L.C.Aw. 2434 to Kahooke;
3.	84° 00' 00"	271.56	feet along same and along remainder of said L.C.Aw. 2455 to Kahiki;
4.	31° 35' 00"	73.45	feet along remainder of said L.C.Aw. 2455 to Kahiki;
5.	72° 00' 00"	229.23	feet along same and along remainder of said L.C.Aw. 3225 to Opunui;
6.	25° 30' 00"	46.30	feet along remainder of said L.C.Aw. 3225 to Opunui;
7.	40° 45' 00"	88.63	feet along same;
8.	127° 33' 35"	25.04	feet along same;
9.	220° 45' 00"	86.68	feet along same;
10.	205° 30' 00"	53.70	feet along same;
11.	252° 00' 00"	230.77	feet along same and along remainder of said L.C.Aw. 2455 to Kahiki;

12.	211° 35' 00"	76.55 feet along remainder of said L.C.Aw. 2455 to Kahiki;
13.	264° 00' 00"	278.44 feet along same and along remainder of said L.C.Aw. 2434 to Kahooke;
14.	239° 30' 00"	256.88 feet along remainder of said L.C.Aw. 2434 to Kahooke;
15.	192° 45' 00"	52.59 feet along same and along remainder of said L.C.Aw. 2458 to Kawaiohia;
16.	253° 28' 00"	28.66 feet along remainder of said L.C.Aw. 2458 to Kawaiohia to the point of beginning and containing an area of 26,195 Square Feet.

This work was prepared by me or under my direct supervision.

GEORGE F. NEWCOMER
REGISTERED PROFESSIONAL LAND SURVEYOR
CERTIFICATE NO. 2715-S

George F. Newcomer
Registered Professional Land Surveyor
Certificate Number 2715-S

July 26, 1979

DESCRIPTION

EASEMENT 3-A
EXISTING 12' PERPETUAL EASEMENT
IAO TUNNEL AND CONDUIT

All of that certain parcel of land being a portion of Grant 3343 to Claus Spreckels, situated at Wailuku, Island and County of Maui, State of Hawai, and being more particularly described as follows:

Beginning at the Southeast corner of this easement, the coordinates of said point of beginning referred to Government Survey Triangulation Station "LUKE" being:

3,662.02 feet North

2,972.34 feet West

and running by azimuths measured clockwise from true South:

1.	54° 23' 17"	267.05 feet along remainder of said Grant 3343 to Claus Spreckels;
2.	144° 23' 17"	12.00 feet along same;
3.	234° 23' 17"	266.06 feet along same;
4.	319° 38' 37"	12.05 feet along same to the point of beginning and containing an area of 3,198 Square Feet.

This description, map and survey based on data supplied by the County of Maui, Hailuku Sugar Company, C. Brewer and Co., Ltd., Alexander and Baldwin Inc., and available record sources.

This work was prepared by me or under my direct supervision.

GEORGE F. NEWCOMER
REGISTERED PROFESSIONAL LAND SURVEYOR
No. 2715-S
HAWAII, U.S.A.

George F. Newcomer
Registered Professional Land Surveyor
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November 28, 1979
George Newcomer
File Number 537-4
kn

Appendix B

Archaeological Inventory Survey Report

ARCHAEOLOGICAL INVENTORY SURVEY AT THE SITE OF THE MAKUHAU WATER STORAGE TANK, WAILUKU *AUHPUA`A*, WAILUKU DISTRICT, MAUI ISLAND (TMK: 3-4-36: Parcel A)

Prepared for:

Munekiyo & Arakawa, Inc.
Wailuku, Maui

Prepared by:

Erik M. Fredericksen
Demaris L. Fredericksen
Walter M. Fredericksen

Xamanek Researches
P.O. Box 131
Pukalani, Hawaii 96788

June 1996

ABSTRACT

An archaeological inventory survey was conducted on a c. 1 acre portion of a 26.926 parcel of land in Iao Valley, Wailuku *ahupua'a*, District of Wailuku, Maui, Hawaii (TMK 3-4-36: Parcel A). This survey consisted of a 100% surface reconnaissance, and subsurface testing.

A total of 8 hand auger tests and 12 backhoe trenches were placed on the c. 1.5 acre study area. Subsurface results indicate that at least portions of the subject property were part of the bed of Iao Stream in the past, and have also been impacted by earthmoving activities. Portable remains located during the inventory survey consisted solely of modern materials.

During the course of the inventory level survey, no evidence of significant *in situ* or disturbed material culture remains was found. No further archaeological work is recommended for the study area.

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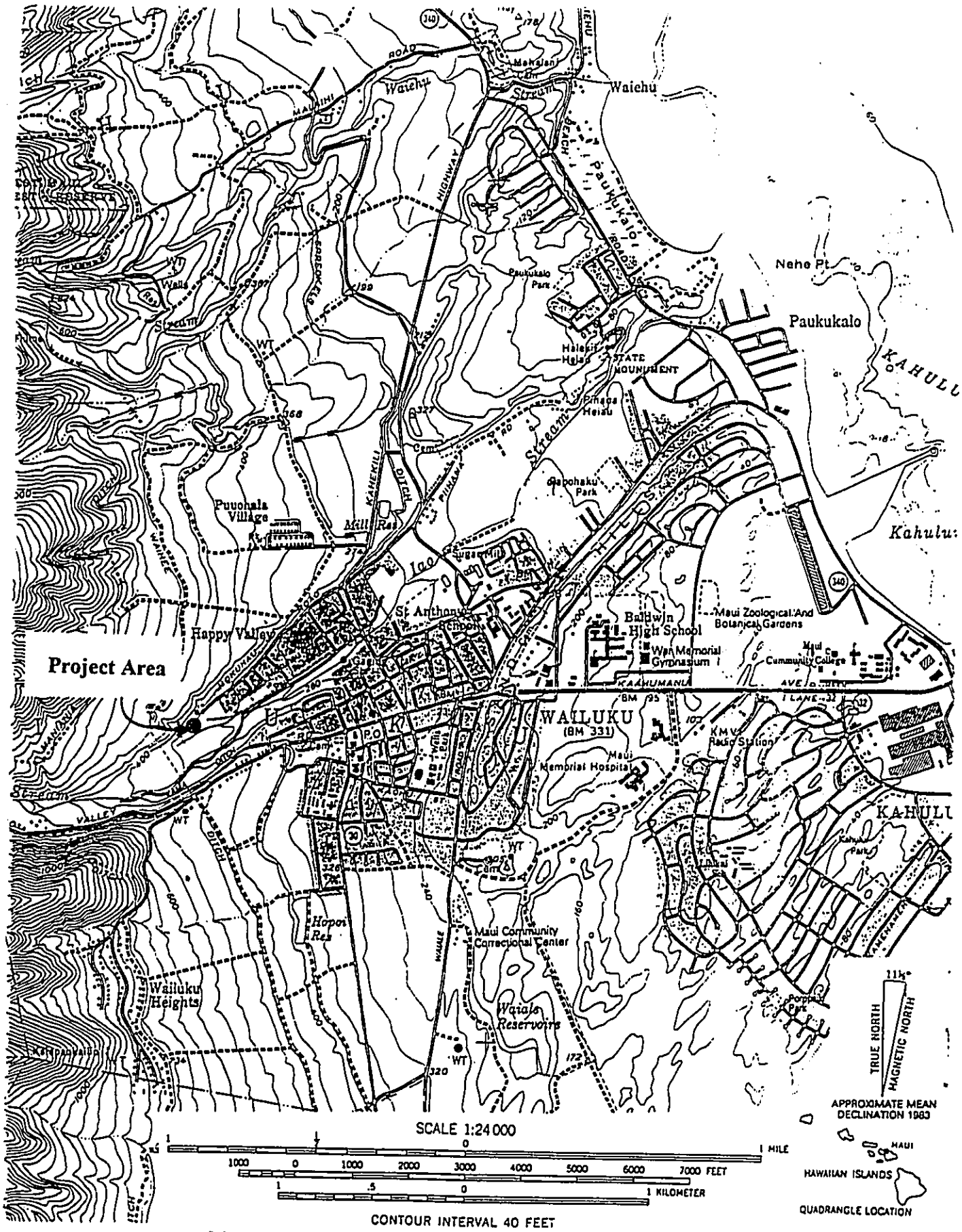
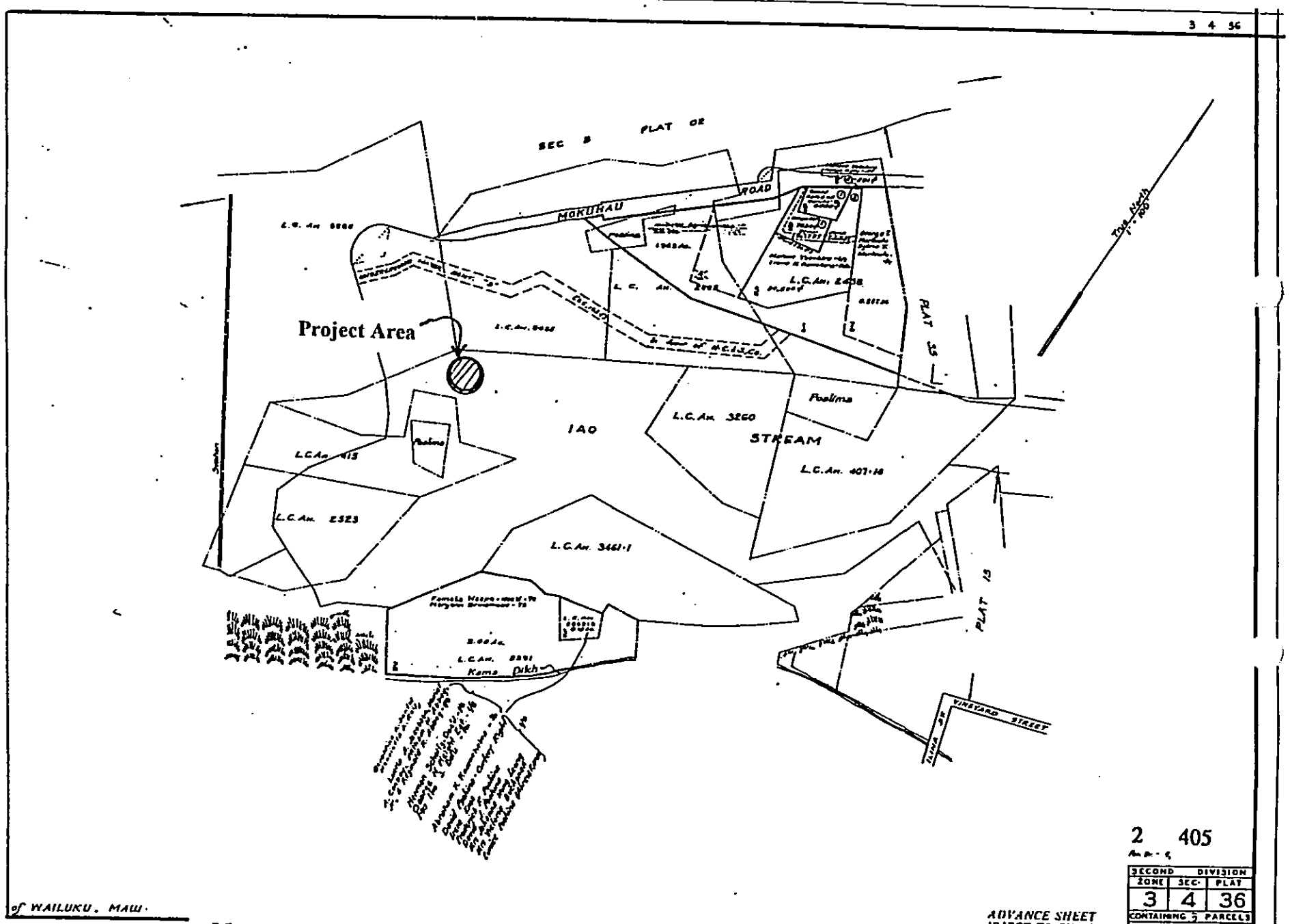


Map 1 - Topographic Map, U.S.G.S. Wailuku Quadrangle, 1983.



Map 2 - Tax Map, Zone 3, Section 4, Plat 36, State of Hawaii Tax Map Division.

INTRODUCTION

Munekiyo & Arakawa, Inc. asked us to prepare a proposal for an archaeological inventory survey of the site of the proposed new Mokuhau Water Tank, located on a portion of a parcel north of the Iao Flood Control project which contains Iao Stream. The site is located in the upper reaches of the reinforced concrete containment system. We undertook a preliminary site visit with Milton Arakawa, of Munekiyo & Arakawa, Inc., noting the conditions at the proposed site, methods of access and discussing general parameters of the project.

We prepared a proposal for the necessary archaeological survey and originally presented it to Munekiyo & Arakawa, Inc. on May 5, 1995. Modifications to the proposal were required, and a new proposal was submitted May 22, 1995. Further changes were made in the project scope and an additional proposal was made by us and submitted on November 15, 1995.

The archaeological inventory survey was undertaken and completed during February, 1996. Both a pedestrian surface reconnaissance survey and a subsurface testing survey utilizing a mechanical backhoe for test trench excavation constituted the fieldwork portions of the project.

A preliminary summary report presenting general results of the field research was prepared and submitted on March 7, 1996. The summary field report serves to support permit applications, pending the preparation and completion of this draft report on the research project.

STUDY AREA

The survey area lies within the *ahupua'a* of Wailuku, Wailuku District, Island of Maui (Map 1). The entire parcel consists of 26.926 acres and does not have a tax map key (TMK) number. However, it has been legally recorded as Parcel A with the bureau of conveyances. It is shown on Tax Map 3-4-36 (Map 2) as part of the bed of Iao Stream. The study parcel is located in Iao Valley and lies at c. 365 to 350 ft. AMSL, and is owned by the County of Maui. Cattle were allowed to graze the parcel understory plant community prior to the time of the survey. A portion of land to the east of and between the parcel and the end of Mokuhau Road is being used as a piggery. All of this land is fenced-off from the residential area by metal field fence and barbed wire, strung on metal and wood fence posts. A feeder stream runs between the survey parcel and a piggery.

Mokuhau Road, which runs west from Market Street as it passes through "Happy Valley", is a narrow, two-way residential street. An existing County of Maui water storage tank and associated pump houses are located at the end of Mokuhau Road, near the watershed reserve. Another residential street, Piihana Road runs eastward from the same intersection at Market Street, is paved for a portion of the way, and continues as a dirt road to the back of Pihana *heiau.*

The study area is c. 1 acre in area, and at the time of the survey was fairly heavily wooded. The site of the proposed new, c. three million gallon water storage tank was fenced around by field and barbed wire, serving to either exclude or contain cattle grazing in the general area (Figure 1). A dirt road borders the subject parcel and separates it from the existing Iao Stream flood-control bed. Several walking paths meander along the stream bed and in and out of wooded areas.

Natural History

Geologically, Iao Stream is an area resulting from interacting processes of late stage lava flows (University of Hawaii, 1983, pp. 38-43). *Mugearite* and *trachyte* are basic rock structures resulting from the lava flows, and these rocks are more alkaline than the East Maui (Haleakala) lava-formed rocks.

Foote (1972, p. 46) describes the soils:

".... as well-drained soils on valley fill and alluvial fans. These soils developed in alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from 100 to 500 feet. The annual rainfall amounts to 25 to 40 inches. The mean annual soil temperature is 74 degrees F. Iao soils are geographically associated with Paia, Pulehu, and Wailuku soils.

These soils are used for sugarcane.. Small acreages are used for pasture and homesites. The natural vegetation consists of bermudagrass, feather fingergrass, koa haole, lantana and Natal redtop."

These soil types are generally classified as *oxisols*, which occur only on old geomorphic surfaces and therefore only on the geologically older islands usually on relatively flat land in the lower elevations (University of Hawaii, 1983, pp. 46, 47).

The area is also classified as an example of the *cliff and valley* physiographic type (Ibid., p. 37). These are areas showing little evidence of former slope, with high, nearly vertical cliffs and amphitheater-headed valleys, with some gently sloping valley floors (Ibid., pp. 36-37).

Observed tree species were alien, or introduced types, e.g., monkeypod (*Samanea saman*), *kiawe* (*Prosopis pallida*), avocado (*Persea sp.*), and Java plum

(*Eugenia sp.*). The understory consists of several alien grasses and annuals, as described by Foote (1972, p. 46) above in this report.

BACKGROUND RESEARCH

Historical Research

Iao Stream is the largest of the major streams reaching the ocean, which originate in the West Maui mountains. It is one of the "Na Wai Eha" (the Four Waters) valleys of Maui, the others being Waikapu, Waiehu and Waihe'e (Cole, 1969). It is located in the large *ahupua'a* and district of Wailuku. The district stretches across the isthmus between East and West Maui, and Kahului and Maalaea Harbors. It encompasses the eastern flank of the West Maui mountains, and contains the other *ahupua'a* of Waiehu, and Waihe'e, Kahakuloa to the north, and Waikapu, and Pulehunui to the south. Wailuku *ahupua'a* is by far the largest. It was a population center, and the central place of religious and political power on Maui in pre-contact times. The core area of this center lay between the sand dunes situated on the north and south side of the Iao Stream bed.

In discussing the origin of the name of Iao, Cole (1969, pp. 4-5) relates a story of Hawaii-loa, the legendary discoverer of Hawaii. It is said that he embarked on his travels with 8 navigators who were called by the names of the stars used in inter-island voyaging. One of them was named Iao, after the star which is Jupiter as the Morning Star. She tells of another legend about Maui and his wife Hina having a beautiful daughter named Iao, who was so lovely that her father allowed no one to approach her. In spite of this, she became the lover of Puuokamoa, whom Maui turned in to a pillar of stone as punishment (Iao Needle). Iao is also said to mean "supreme point", and indeed it is quite likely that warriors could have used Iao Needle as a lookout (Ibid.).

Precontact Period

The two large *heiau* at the mouth of Iao Stream, Haleki`i and Pihana, are the only remaining precontact Hawaiian religious structures in the Wailuku area. Traditional history credits the *menehune* with construction of both structures in a single night with rocks collected from Paukukalo beach (Beckwith, 1907, pg. 333, in Naone, 1996). Other accounts credit Kihapi`ilani, Ki`ihewa and Kahekili as the builders. Haleki`i is thought to have been a chiefly compound which had thatched *hale* on top of the stone platform, guarded by the *ki`i* (images) placed on the surrounding terraces. Pihana, the full name of which is Pihanakalani or "gathering place of the ali`i ", is reported to be a *luakini*-type *heiau* (Naone, 1996).

Naone (Ibid.) goes on to describe the place of these *heiau* in the late precontact and early post-contact periods:

"Keopuolani, a chiefess of divine rank and descendant of the ruling chiefs of Maui and Hawaii was born at Pihana. She became the wife of Kamehameha I and mother of Liholiho (Kamehameha II) and Kauikeaouli (Kamehameha III). The body of Kamehameha Nui, and uncle of Kamehameha I, who ruled Maui before his brother Kahekili succeed [sic.] him, was laid at Pihana before being taken to a final resting place on Molokai. Kahekili lived at Haleki`i around 1765 and Kekaulike, father of Kahekili and Kamehameha Nui, died at Haleki`i in 1736 (Kamakau, 1961).

Kahekili's main residence at Wailuku was known as Kahalelani, although he also had residence at Paukukalo and Pihana. The Wailuku area was a major gathering place and residential site of the Maui chiefs and those of rank. The area from Waihe`e to Wailuku was the largest continuous area of wet taro cultivation in the Hawaiian Islands (Handy and Handy, 1972, pg. 496). To the southeast of Iao Stream, below Pihana Heiau, was Kauahea where warriors dwelt, and were trained in war skills. This was a boxing site in the time of Kahekili.

Pihana was demolished by Kalanimakamauali`i and Kauanaulu during Ka`ahumanu's proclamation in 1819 (Stokes, 1916) [Naone, 1996].

The seventeenth and eighteenth centuries saw a protracted period of frequent warfare on Maui—between chiefs on Maui, and with chiefs from Oahu and Hawaii. Wailuku was the political center under Pi'ilani, who had succeeded in unifying the districts of Maui by warfare. His two sons, Lono-a-Pi'ilani and Kiha-a-pi'ilani fought for political control after his death. Eventually, with the help of warriors from the Big Island, Kiha-a-pi'ilani became the ruler of Maui.

The last powerful ruler in precontact times was Kahekili, who ruled from about 1765 to 1790. Wailuku was the site of Kahalelani, his royal residence. He successfully defended his capital in the 1770s, when an army of warriors from Hawaii led by Kalani'opu'u invaded. Kahekili's warriors hid behind the sand dunes, surprised the invaders and slaughtered them (Speakman, 1978, pp. 16-17).

The most famous event in the history of Wailuku is the battle fought between the forces of Kahekili and those of Kamehameha I, which took place in 1790. Kamehameha came from the Big Island in a fleet so large it was said that the bay from Kahului to Hopukoa was filled with war canoes containing his huge army. Kamehameha brought along a cannon, Lopaka, and two Europeans, John Young and Issac Davis, to operate it. The forces fought for two days at Wailuku, where the Maui warriors were led by Kalanikapule, the son of the high chief Kahekili. On the third day Kamehameha brought out the cannon, and a great slaughter occurred, but no important chiefs were killed, according to Kamakau'a account (1992, pp. 148-149). Had the fighting been in the usual style of hand to hand combat, the forces would have been equally matched. As it was, the Maui army retreated into an ever narrowing Iao Valley, and fell under cannon fire, whereby the warriors desperately tried to escape by climbing up the steep face of the cliffs.

The battle was subsequently called Ka-'uwa'u-pali (Clawed off the cliff) and Ka-pani-wai (The damming of the waters)[Ibid.]. Most of the important chiefs escaped, however, and proceeded to take refuge on the islands of Oahu and Molokai.

Early Post-Contact Period

The reign of Kamehameha was intertwined with the increasing presence of foreigners (*haoles*). The arrival of Captain Cook offshore at Kahului Bay in 1778 began the steady flow of outside influences which forever altered the Hawaiian people and their environment. One of the first of these influences came with the missionaries, whose charge it was to save heathen souls. The first missionaries arrived in Wailuku in 1832, and the old religion began to wane under their influence. A girls' seminary (Central Female Boarding School) was established by Rev. Jonathan Green in 1836, and taught young Hawaiian women the language and customs of the foreigners, as well as their religion (Fredericksen and Fredericksen, 1995, p. 3).

Another influence which brought change was foreign commercialism. The first sugar production in Wailuku *ahupua'a* was begun in 1828 when Kamehameha III established a water-powered mill with the help of two Chinese technicians. This was known as Hung tai Sugar Works, and its location was fairly close to the later location of the Wailuku Sugar Mill, which was established in 1862. Hung tai Sugar Works continued to operate until the opening of the new mill.

The population of the *ahupua'a* in 1831-32 was listed as 2,256, with most of it being in the northern portion, presumably in Iao Valley (Cordy, 1978, p. 59).

Post-1850s Period

After the Great Mahele in 1848, most of the *ahupua'a* of Wailuku was designated as Crown Land, to be used in support of the royal "state and dignity". The *ili* of Owa (comprised of 743.4 acres, LCA 420) was granted to Kuihelani, a steward to Kamehameha I. The remainder of Crown Lands passed to Ruth Ke'elikolani, the sister of Kamehameha V, and to her half-sister Victoria Kamamalu (the *ili* of Kolua). The lands of Princess Ruth were traded to Claus Spreckels in order to settle his claim on one-half of the Crown Lands by King Kalakaua (Land Grant 3343) in 1878.

Environmental conditions in lower Iao Valley in precontact times were ideal for agricultural production necessary to support a large population. These favorable conditions included a wide valley floor, rich alluvial soils, and a constant supply of water from Iao Stream. Such factors combined with the access to Kahului Harbor, rich in marine resources, made this the prime precontact location on West Maui for a political and religious center. The lower portion of Iao Valley contained some of the most productive taro land on the island, and the abundance of Land Commission Awards in the

lower valley attest to this. There are 66 LCAs, primarily taro patch *kuleana*, and 39 *po'alima* between the old Wailuku Mill site and Paukukalo, on the southern side of Iao Stream. In addition, 13 awards were made directly to individual chiefs by Kamehameha IV (Theresa Donham, Minutes of the County of Maui Cultural Resources Commission [CMCRC] meeting, June 1, 1995). On the northern side of the stream near the beginning of Iao Valley, in the general area of the present study, there are 11 LCAs and 3 *po'alima* shown on Tax Map 3-4-36 alone, which were used presumably for taro production.[1]

Lower Main Street was built along the route of an old government road, which very likely followed the course of existing transportation routes from the ocean to the inland portions of Iao Valley on the southern side. Nearly all of the LCAs border on the road, indicating that it was an important transportation corridor at the time the *kuleana* were granted (Ibid.). The route of the Kahului Railroad, the construction of which began in the 1870s, paralleled Lower Main Street. Its route from Kahului Harbor to Wailuku Sugar Mill can be seen on the 1954 USGS topographic map. However, the railroad ceased operation to the mill in 1957.

Commercial and residential growth in Wailuku was primarily concentrated on the southern side of Iao Stream. With the exception of the concentration of residences along Mokuhau and Piihana Roads, and a few businesses in Happy Valley, there has been relatively little development on the northern side of Iao Stream.

In Iao Valley itself, people continued to live in traditional style long after economic changes were taking place in Wailuku. By the 1900s, the residential population in the valley had diminished, but people remaining there still maintained a more traditional life-style of taro farming and fishing from Iao Stream (Connolly, 1974, p. 5). As sugar became a major factor in the economic picture of Hawaii, water was needed to irrigate the sugarcane fields (Wailuku Sugar Company was formed in 1862 by James Robinson and Company, Thomas Cummins, J. Fuller, and C. Brewer and Company. In 1865 controlling interest was purchased by C. Brewer [Kennedy, 1992, p. 14]). Iao Stream was the logical source of this valuable resource, and lands were obtained in and around the valley, in order to build a system of waterways to supply the cane fields. A remnant of this system crosses beneath the access road to the proposed storage tank. It is identified as "Underground Water Easement #3—in favor of H. C. & S., Co." on the Tax Map (Map 2). On the southern side of the stream the Kama Ditch runs from its source in the valley about 1 kilometer *mauka* of the present study area, down to the Hopoi Reservoir located below Wailuku Heights.

According to oral testimony, there was a devastating flood in 1916 which swept through Iao Valley, destroying all of the taro *lo'i* and a Portuguese camp which had been built in the stream bed for the plantation workers. The flood deposited a great deal of

[1] Although surrounded by LCA grants, the study area was part of the stream bed, and not awarded to anyone. Grants include LCA 3225 of 15 acres to Opunui; LCA 2435 of 2.73 acres to Kahooke; LCA 2458 of 3.26 acres to Kawaiohia; LCA 3260 of 1.55 acres to Lulana; LCA 415 of 1.49 acres to Nailiili; and LCA 407.16 to Z. Kaauwai.

debris on the taro *lo'i* and the original *kamani* trees were replaced by *koa haole* and *kukui* which are the dominant trees today. (Connolly, pg. 6). This seemed to have been a turning point for many families, who moved out of the valley and took up their livelihood in the new society on Maui.

In the 1970s, the Iao Stream Flood Control project stabilized the path of the stream with a concrete channel and stone and concrete levees which were built by the U. S. Army Corps of Engineers. The proposed water storage tank site, which had been part of the active stream bed, is now protected by the levee.

Archaeological Research

While there has been no research in the study area, several studies have been undertaken in Iao Valley, and many have been conducted in the Lower Main Street and Waiale Road corridor. The studies in the latter area, on the southern side of the stream, have been reiterated in other reports (Fredericksen and Fredericksen, July 1995; May 1996), and a listing is included in Table 1. A summary of work undertaken in Iao Valley follows.

In 1974, the Bishop Museum conducted a detailed site recording survey on the proposed flood-control project for Iao Stream bed (Connolly, 1974). Two major areas of agricultural terracing were recorded, *mauka* of the present study area. Both were interpreted as historic structures, given the surface artifact and midden finds associated with them. The remnants of the Portuguese workers camp was also identified. "No positive structural evidence of a prehistoric occupation was observed, although ethno-historical information indicates cultivation of this area in prehistoric times." (Ibid., p. ii). All of these features had been impacted by the flood of 1916 mentioned above.

In 1975, Walton conducted an archaeological survey of the parking lot at Iao Valley State Park. Two stone alignments were identified, which were interpreted as water retention walls for agricultural purposes.

Archaeological Consultants of Hawaii conducted an inventory survey with subsurface testing on a 3½ acre parcel about 2 kilometers *mauka* of the study area (Kennedy, et. al., 1992). Eighteen backhoe test trenches, and two test units were excavated. No structures or deposits of historic significance were found. Much of the property lies within the flood zone. No further archaeological work was recommended.

Discussion of Settlement Patterns and Land Use

The lower Iao Valley portion of Wailuku *ahupua'a* was a central political and religious area of West Maui, because of its fertile taro lands, and close proximity to the sea. Given these conditions, a large population could be supported, and wherever large population clusters are found in the Hawaiian Islands, a social framework of chiefly importance and religious expression is also found. This is attested to by the existence of

TABLE 1

Listing of Archaeological Studies Done in Lower Iao Valley

AUTHORS	LOCATION	FINDINGS
Burgett and Spear, 1995	TMK: 3-8-37: 48, Lower Main St., Home Maid Bakery. Sites 3924 and 3925	Habitation sites; human burials. Dated c. AD 1430 to 1671.
Burgett and Spear, 1996	TMK: 3-4-39: 77, Lower Main St., Oceanhouse, Inc., Site 4004	Habitation site remnant; human burials. Dated 1420 to 1640 AD.
Connolly, 1973	TMK: 3-8-36: 94, Lower Main St., Site 1171	Habitation site; burials discovered 1994 eroding from dune face.
Donham, n.d. (1994)	TMK: 3-8-37: 49, Lower Main St., , Home Maid Bakery, Site 3556	Inadvertent burial discovery, both historic and precontact burials
Dunn and Spear, 1995	TMK: 3-4-02: 36, RR bed along Waiale Rd. Sites 4068, 4067; Site 3502 at Waiale Rd. and Kaohu Street	Habitation site and burials (4068); Habitation (4067).
Fredericksen and Fredericksen, December 1992 and November 1995	TMK: 3-8-07: 123, at Lower Main and Waiehu Road, Nisei Veterans Memorial Center, Site 3120	Large habitation site, continuous occupation from c. 1200 AD to c. 1740; numerous burials
Fredericksen, et. al., July 1995 and May 1996	TMK: 3-4-39: por. 81, 82, 83 at Lower Main and Mill Streets, Site 4127	Habitation site; dated c. AD 1450 to 1675.
Spear, 1995	TMK: 3-8-37: 48, Lower Main St., Site 4066	Human burials

the 2 *heiau* (Haleki`i and Pihana) atop the northern dune system, and others reported by Walker (1931) and Mr. Charles Keau (oral communication, 1992) within the Iao Stream corridor. The middle and upper reaches of Iao Valley also abounded with *lo`i* and *`auwai* which produced additional food stuffs to support the political and religious activities. The Upper Iao Valley had been traditionally known as a very significant sacred place in the history of Maui (Donham, CMCRC minutes, June 1, 1995).

Intensification of usage seems to have occurred during the 16th century, and appears to have been completed around the time of Pi`ilani, ca. 1600 AD (Ibid.). The area seems to have been the site of nearly constant warfare from the time of Pi`ilani's death to the time of Kamehameha I's defeat of Kahekili's warriors at the battle of Kepaniwai, in 1790.

The Great Mahele of 1848 saw the granting of much land in Wailuku *ahupua`a* to the Crown, along with numerous small LCAs as *kuleana*, mainly for taro production. The earliest sugar production in Wailuku began in 1828 with the establishment of Hung tai Sugar Works. Sugar production increased in the latter 19th century, and was dominated by 2 companies--Wailuku Sugar Company (C. Brewer) in the northwest, and Hawaiian Sugar and Commercial Company (H.C.& S.) in the southeast portion of Wailuku District.

ARCHAELOGICAL FIELD METHODS

Fieldwork was conducted by 3 to 4 persons. Erik M. Fredericksen (M.A.) was the field director, while Demaris L. Fredericksen (Professor emeritus) and Walter M. Fredericksen (Professor emeritus) were the overall project directors. Fieldwork was initiated and completed in February 1996.

The archaeological inventory survey consisted of two phases. A pedestrian walk-over of 100% of the wooded parcel was first undertaken. While numerous mature trees are established on the study area, the understory remains relatively open. Surface visibility was good and field personnel inspected the property at 5 m. intervals. During this inspection, it became apparent that at least the surface of the subject parcel had been impacted by past earthmoving activities, possibly associated with the Iao Stream flood control project in the 1970s. Because of this apparent surface disturbance, subsurface testing with a backhoe was selected.

The second portion of the inventory survey consisted of subsurface testing in the areas proposed for the placement of the water tank and drainage basin. A total of 12 backhoe trenches (BT) and 8 auger tests (AT) were placed on the subject parcel (see Figure 1). None of the auger tests penetrated below 0.3 m. All soil from the auger cores was sifted through 1/8" mesh screen. When possible, the backhoe trenches were excavated to decayed bedrock and/or bedrock. All back dirt was visually inspected and

spot checked with 1/8" screen. Trench profiles were inspected and drawn. Half of backhoe trenches fully or partly collapsed and it was not possible to record their profiles (BTs 2, 3, 7, 9, 11 and 12). All mapping on the subject parcel was carried out with a hand held electronic compass and metric survey tapes. Descriptive notes were recorded in the field and photographs were taken with T-Max 400 black and white film. Field notes are curated by Xamanek Researches, Maui, Hawaii.

ARCHAEOLOGICAL FIELD RESULTS

The walk-over survey yielded no evidence of significant cultural materials or architectural features. Rather, as noted earlier, results of the pedestrian survey indicated that at least the surface of the property had been impacted by historic earthmoving activities.

The subsurface investigation consisted of 8 auger tests and 12 backhoe trenches. The auger tests were c. 8 cm. in diameter and ranged from 0.1 to 0.3 mbs. The backhoe trenches were c. 0.8 m. wide by 4 m. long and ranged in depth from 1.2 m. to 2.3 m. Soil encountered during testing was loose and appeared in several instances to have been pushed by heavy equipment.

In general, 2 soil layers were present in sampled trenches. Layer I consisted of silt loam which ranged from dark brown (7.5 YR 3/2) to strong brown (7.5 YR 4/6) in color. Layer I also contained large waterworn cobbles, small boulders and stream gravel. Much of this layer appears to have been impacted by earthmoving activities. Modern materials were recovered from several of the sampled trenches. In addition, Backhoe Trench 5 contained a fill layer which overlaid the common Layer I. Layer II consisted of loose, yellowish red (5 YR 4/6 to 5/6) loamy clay which graded to decayed bedrock and/or bedrock. This stratum was sterile. In tested areas, Layer II ranged from c. 0.5 m. to 1 m. thick. A brief discussion of subsurface results follows. Refer to Table 2 for a summary of backhoe trench results, and Appendix A for soil profile descriptions.

Auger Tests

A total of 8 auger tests were placed on the subject parcel. The auger cores were utilized in order to quickly assess subsurface conditions. As previously noted, none of the auger tests penetrated beyond 0.3 mbs. All cores sampled only Layer I soil. Modern materials were found in 4 instances (ATs 2, 3, 5 and 7) and consisted of broken bottle glass and rusted metal. Due to the rocky nature of the soil, subsurface testing with a backhoe was next undertaken.

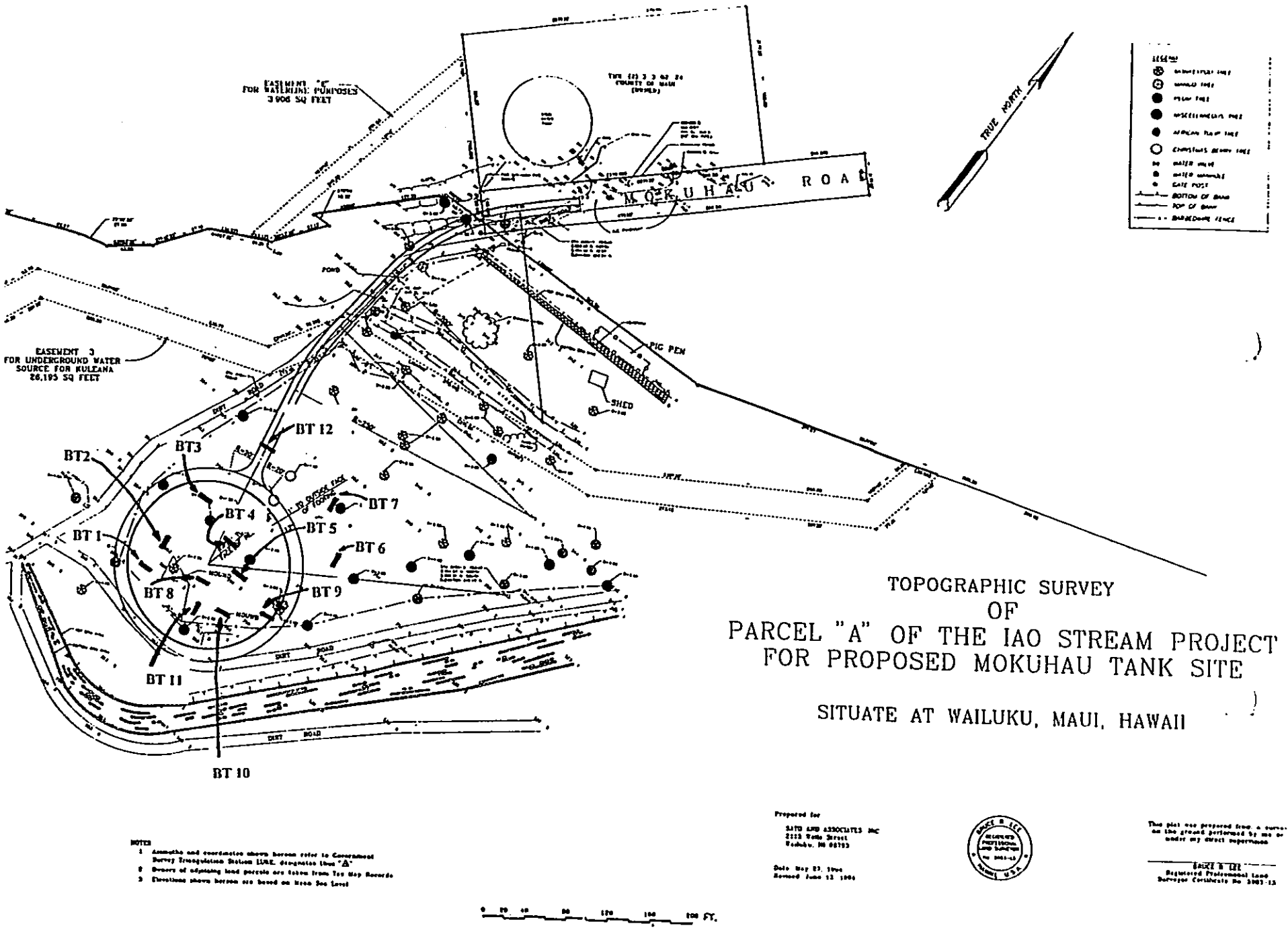


Figure 1: Proposed Mokuhau tank site, including location of Backhoe Trenches 1 -12.

Backhoe Trench 1

This subsurface test was located in a very rocky portion of the parcel. Unit orientation was approximately E-W and BT 1 dimensions were c. 0.8 m. wide by 4 m. long by a maximum of 2.3 m. deep. Two soil layers were located before excavation was halted in decayed bedrock (Figure 2).

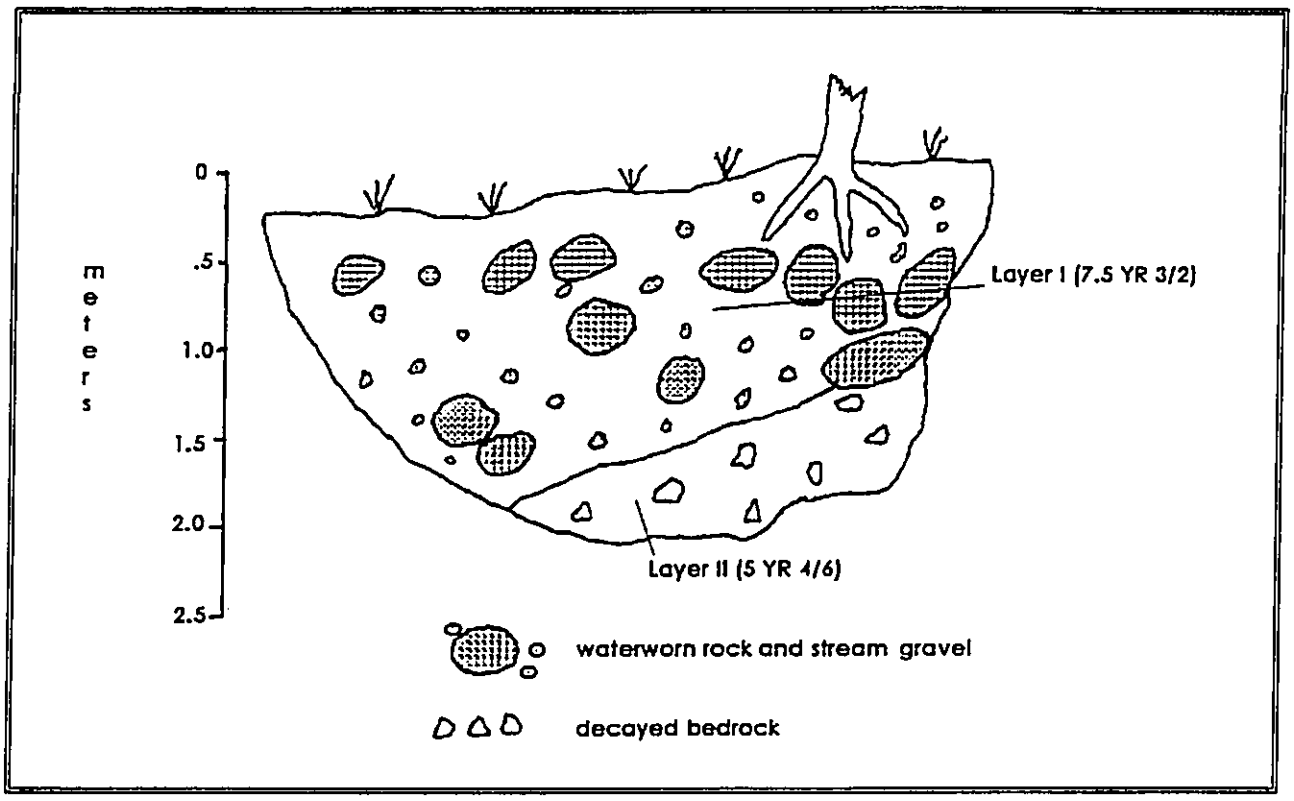


Figure 2 - East face profile of Backhoe Trench 1.

Layer I consisted of dark brown (7.5 YR 3/2) silt loam. This stratum was up to 1.8 m. thick and contained stream gravel and common waterworn cobbles and boulders. While Layer I did not yield any cultural materials, it appeared likely that the upper 0.5 to 1 m. of the layer had been impacted by bulldozing in the past. Given the development and estimated age of the trees on the parcel, it is possible that this historic disturbance is associated with the Iao Stream flood control project of the 1970s.

Layer II was composed of yellowish red (5 YR 4/6) loamy clay which contained weathered parent material. This stratum was sterile and graded to decayed bedrock. Excavation was halted at a maximum depth of 2.3 mbs.

Backhoe Trench 2

This unit was excavated c. 13 m. north of BT 1. Unit orientation was approximately N-S, and its dimensions were c. 0.8 m. wide by 4 m. long by a maximum depth of 1.9 m. Stratigraphy was similar to that found in BT 1 (see Figure 2). The dark brown (7.5 YR 3/2) silt loam of Layer I was a maximum of 1 m. deep and appeared to be sterile. This stratum contained stream gravel and waterworn cobbles and boulders. It was underlain by Layer II yellowish red (5 YR 4/6) loamy clay. This layer was sterile. Decayed bedrock was encountered c. 1.7 mbs. The unit was very unstable and collapsed before a profile could be drawn.

Backhoe Trench 3

This trench was located c. 13 m. northeast of BT 2. Orientation for BT 3 was E-W, while trench dimensions were c. 0.8 m. wide by 4 m. long by a maximum of 1.7 m. deep. Stratigraphy was again similar to that of BT 1 (see Figure 2). Layer I contained more stream bed material and was dark brown (7.5 YR 3/2) in color. No evidence of any indigenous cultural materials was encountered in BT 3. Modern materials, including bottle glass and rusted metal, were recovered. Layer I was approximately 0.8 to 1 m. thick. The stream bed material present in the stratum was mixed in with soil. The boundary between Layer I and Layer II appeared somewhat indistinct. It appears possible that much , if not all, of Layer I had been pushed into place. Layer II was composed of the common yellowish red (5 YR 4/6) loamy clay. The stratum contained parent material. Backhoe Trench 3 was very unstable and collapsed before a profile could be recorded.

Backhoe Trench 4

Backhoe Trench 4 was excavated c. 18 m. southeast of BT 3, and was located near the center of the proposed water tank. Two soil layers were encountered in this unit before excavation was terminated in decayed bedrock (Figure 3). Unit dimensions were c. 0.8 m. wide by 4 m. long by a maximum of 1.9 m. deep and trench orientation was approximately E-W.

Layer I consisted of the common silt loam and was strong brown (7.5 YR 4/6) in color. This stratum was 0.8 to 0.9 m. thick. It contained modern cultural materials including 1 ½" diameter galvanized pipe, a metal gear from a car, a piece of cement pipe, broken bottle glass, and pieces of rusted metal. This layer also contained stream gravel mixed with waterworn cobbles and boulders. It is probable that much of the layer was impacted by grading.

Layer II consisted of the common yellowish red (5 YR 5/6) loamy clay. This sterile layer extended to the bottom of BT 4 at 1.9 mbs. Excavation was halted at bedrock.

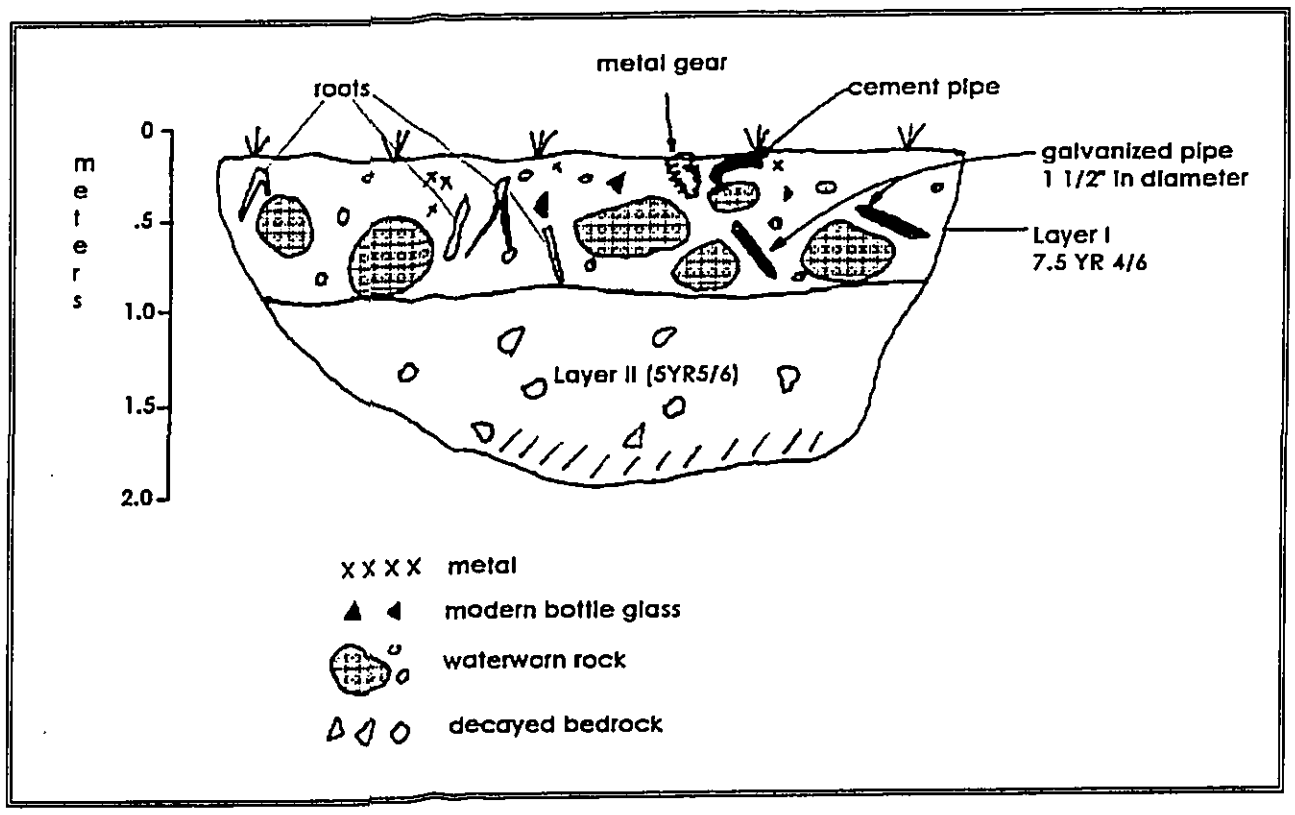


Figure 3 - West face profile of Backhoe Trench 4.

Backhoe Trench 5

This subsurface test was placed c. 11 m. southeast of BT 4 in an area of somewhat uneven ground. Unit orientation was approximately E-W, and BT 5 dimensions were 0.8 m. wide by 4m. long by a maximum depth of 1.3 m. Three soil layers including a fill layer were encountered before excavation was halted in decayed bedrock c. 1.3 mbs (Figure 4).

Layer I consisted of a dark brown (10 YR 3/3) sandy loam fill layer c. 0.3 to 0.7 m. thick. This fill contained modern materials including bottle glass fragments and rusted metal. The soil boundary between Layers I and II was indistinct.

Layer II was composed of the common brown to dark brown (7.5 YR 4/2) silt loam which was mixed with stream gravel and waterworn rocks. The upper portion of this stratum had been impacted by grading activities, possibly associated with the placement of Layer I fill. Layer II yielded some modern bottle glass fragments.

Layer III consisted of the common yellow red (5 YR 5/6) loamy clay found in Layer II elsewhere. This stratum was a maximum of 0.7 m. deep and yielded no significant cultural materials. Excavation was halted in decayed bedrock at c. 1.3 mbs.

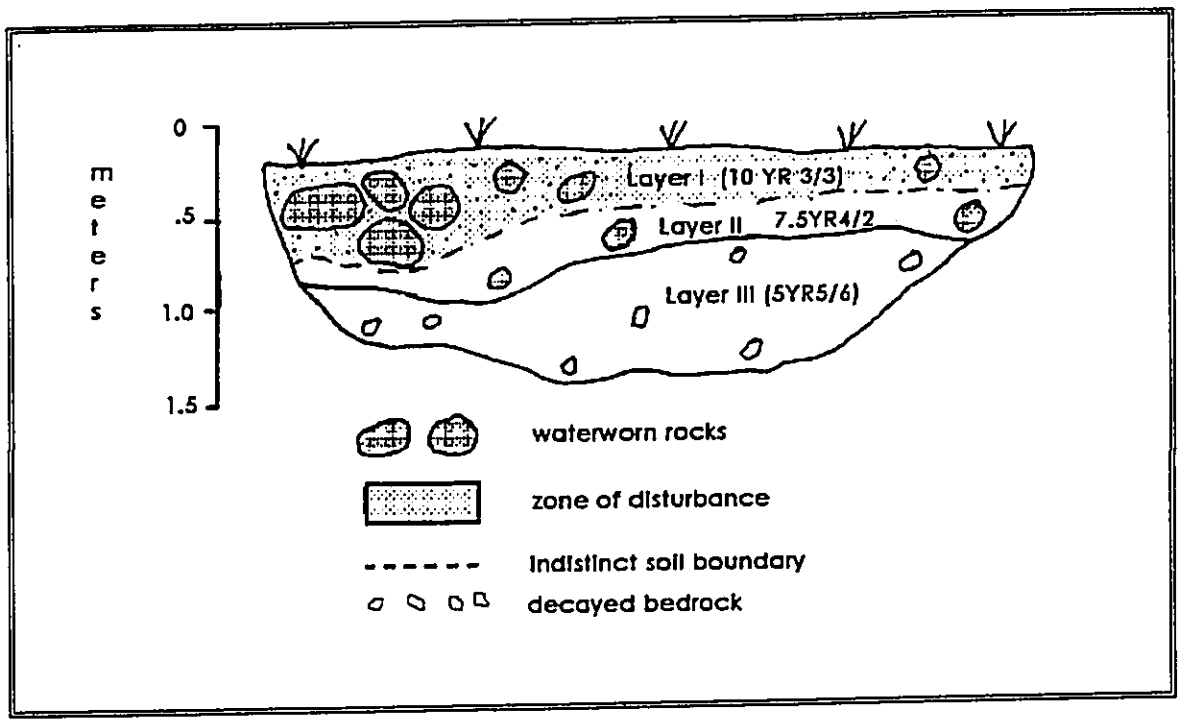


Figure 4 - North face profile of Backhoe Trench 5, including zone of distrubance.

Backhoe Trench 6

This unit was placed over 17 m. to the northeast of BT 5 near the approximate location of the proposed retention basin. Orientation of BT 6 was approximately N-S, and unit dimensions were 0.8 m. wide by 4 m. long by a maximum depth of 1.6 m. Two soil layers and 1 soil band were encountered before excavation was halted in decayed bedrock (Figure 5).

Layer I was up to 0.8 m. thick and composed of the common silt loam which was brown to dark brown (7.5 YR 4/4) in color. Modern materials located included broken bottle glass and rusted pieces of metal. These materials appeared to be located in the upper 40-50 cm. of Layer I which was likely impacted by grading activities.

A non-cultural pale brown (10 YR 6/3) silty clay soil lens was present in part of BT 6. This band appeared to be sterile and was less than 10 cm. thick.

Layer II consisted of the common yellowish red (5 YR 4/6) loamy clay. This sterile stratum graded to decayed bedrock and bedrock. Excavation was halted at 1.6 mbs.

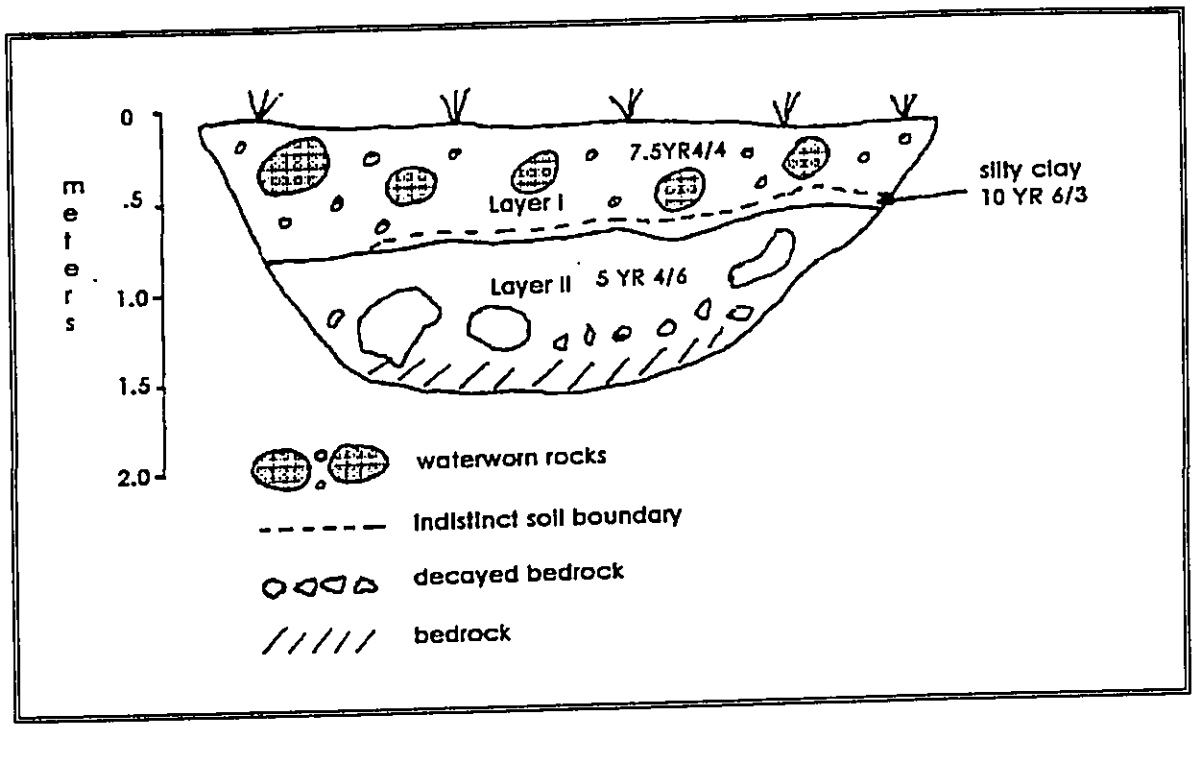


Figure 5 - East face profile of Backhoe Trench 6.

Backhoe Trench 7

Backhoe Trench 7 was excavated c. 18 m. to the northwest of BT 6 in the area of the proposed retention basin. Unit orientation was N-S, and BT 7 dimensions were c. 0.8 m. wide by 4 m. long by a maximum of 1.6 m. deep. Two soil layers similar to those in BT 6 were encountered in this trench (see Figure 4). The common brown to dark brown (7.5 YR 4/4) silt loam contained large waterworn cobbles and stream gravel. This layer was likely disturbed by earth moving activities. Layer I contained small amounts of modern materials including bottle glass and metal. Layer II consisted of the common yellowish red (5 YR 4/6) loamy clay. Backhoe Trench 7 was very unstable and repeatedly caved in. The unit was finally abandoned when it collapsed at a depth of 1.6 m. No profile was recorded.

Backhoe Trench 8

This unit was located near an area where running water crossed the study area. Trench orientation was roughly E-W and unit dimensions were c. 0.8 m. wide by 4 m. long by a maximum of 1.4 m. deep. Both common soil layers were encountered before excavation was halted at bedrock (Figure 6).

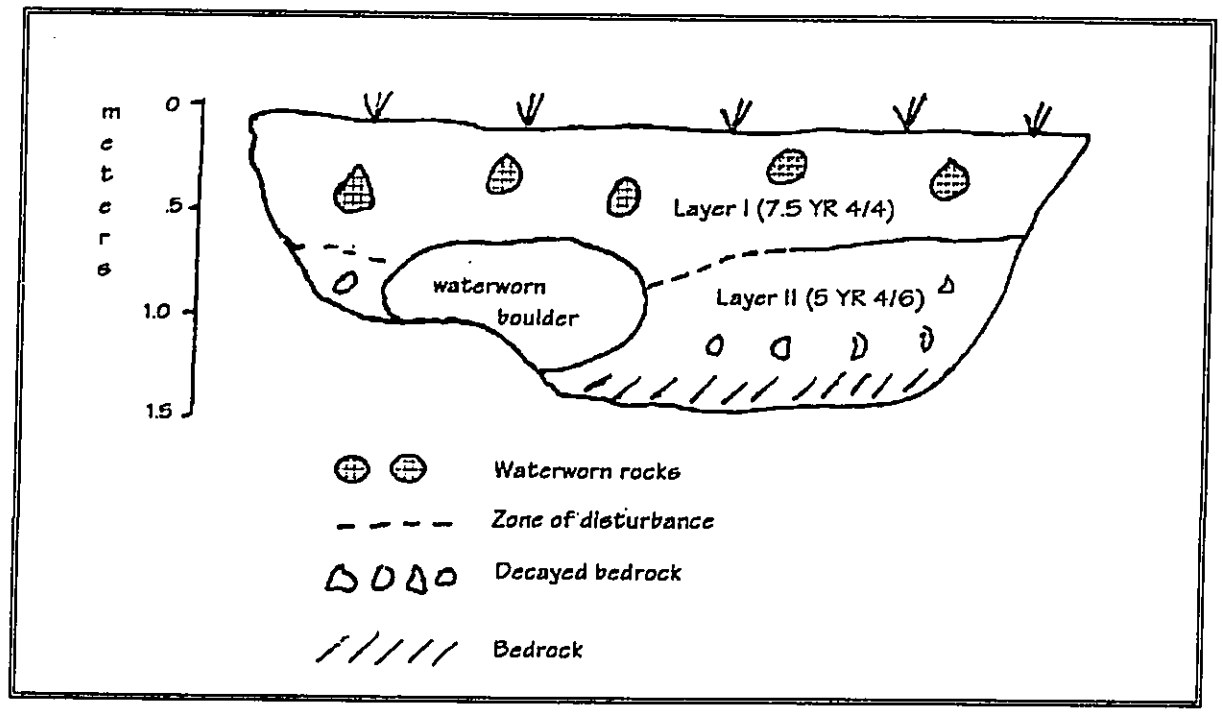


Figure 6 - North face profile of Backhoe Trench 8.

Layer I consisted of the common brown to dark brown (7.5 YR 4/4) silt loam which contained stream gravel and waterworn cobbles and boulders. This stratum was up to 0.7 m. deep in undisturbed portions of BT 8. A large waterworn boulder appeared to have been pushed into Layer II in a zone of disturbance. Some pieces of rusted metal were found in Layer I.

As noted above, a portion of Layer II had been impacted by earthmoving activities in the past. This loamy clay layer was yellowish red (5 YR 5/6) in color. The stratum was sterile and graded to decayed bedrock and bedrock. Excavation was halted at c. 1.4 mbs.

Backhoe Trench 9

This subsurface test was placed near the southeastern border fence of the study area. Trench orientation was approximately E-W, and BT 9 dimensions were c. 0.8 m. wide by 4 m. long by a maximum of 1.3 m. deep. Stratigraphy was similar to that located in BT 8 (see Figure 6). However, unstable trench conditions prevented close inspection of the BT 9 profile.

Layer I was approximately 0.8 m. thick. This brown to dark brown (7.5 YR 4/4) silt loam contained some modern fragments of bottle glass and some rusted pieces of metal. Stream gravel and waterworn cobbles and boulders were also mixed in with the

soil. It appears likely that at least the upper portion of Layer I was disturbed by historic activities.

Layer II consisted of the common loamy clay which was yellowish red (5 YR 5/6) in color. This stratum was sterile. The unit collapsed at c. 1.3 mbs and no profile was prepared.

Backhoe Trench 10

This trench was located on the top of what appeared to be a mound. Dimensions for BT 10 were 0.8 m. wide by 6 m. long by a maximum of 1.2 m. deep. Unit orientation was 120 degrees magnetic. One fill soil layer was encountered before excavation was halted in a very dense rock layer.

Layer I consisted of brown to dark brown (7.5 YR 4/2) silt loam which contained mixed stream bed gravel and waterworn rocks. In addition, plastic, pieces of concrete, and rusted metal machine parts were observed in the backdirt pile. Layer I was approximately 1 m. thick and overlaid large amounts of rocks. This rock layer appeared to be fill and consisted of somewhat angular decayed bedrock and waterworn boulders. This mound is interpreted as bulldozer push which may have been constructed for use during the Iao Stream flood control project or for ranching purposes. The unit was very unstable and excavation was abandoned at c. 1.2 mbs. No profile was prepared.

Backhoe Trench 11

This trench was placed into the above mentioned mound in order to determine that it was, indeed, bulldozer push. Unit orientation was N-S and dimensions were 0.8 m. wide by 4 m. long by a maximum depth of 1.3 m. This unit was also very unstable. One fill layer consisting of soil similar to that found in BT 10 was located. This brown to strong brown (7.5 YR 4/2) silt loam also contained modern materials including plastic sheeting, rusted metal, broken glass and concrete. Stream bed gravel and waterworn rocks were mixed with Layer I soil. The unit was excavated to c. 1.3 mbs. Excavation was halted due to dense tree roots and unstable unit conditions. No trench profile was recorded.

Backhoe Trench 12

This last unit was placed near the proposed retention basin, about 30 m. north of BT 4. Backhoe Trench 12 was oriented E-W, and it was c. 0.8 m. wide by 4 m. long by 1.2 m. deep. Two soil layers similar to those present in BT 4 were located (see Figure 3).

Layer I was composed of strong brown (7.5 YR 4/6) silt loam which contained modern materials such as plastic, metal machine parts, cement block fragments, and broken bottle glass. This stratum also contained mixed stream bed gravel and waterworn cobbles and boulders. This soil layer appeared to have been impacted by grading.

Layer II consisted of the common yellowish red (5 YR 5/6) loamy clay. This stratum was sterile. Excavation was halted at decayed bedrock after BT 12 fully collapsed. No profile was prepared.

SUMMARY AND CONCLUSIONS

Results from the 12 excavated backhoe trenches and 8 auger cores indicate that at least portions of the subject parcel have been impacted by historic activities, likely associated with the Iao Stream flood control project of the 1970s. Prior to this project, the area had been part of Iao Stream bed as shown on the tax map (Map 2). Portable remains located during the inventory survey consisted solely of modern materials including broken bottle glass, plastic agricultural sheeting, concrete, PVC pipe, galvanized pipe, rusted metal and machinery gears. Modern materials, when present, were found only in Layer I. Visual inspection of backfill from both this stratum and Layer II, as well as spot checking with 1/8" screen, indicates that no indigenous materials are present in sampled portions of the study area.

During the course of this survey, no evidence of significant *in situ* or disturbed material culture remains was located. Based on the results of this study, it appears unlikely that any intact cultural resources are present in the study area. Consequently, no further archaeological work is recommended for the study area.

TABLE 2

Summary of Backhoe Trench Results

BT #	DEPTH (mbs)	STRATA	RESULTS
1	2.3	L I - silt loam (7.5 YR 3/2) L II - loamy clay (5 YR 4/6)	L I - modern materials; disturbed L II - sterile
2	1.9	L I - silt loam (7.5 YR 3/2) L II - loamy clay (5 YR 4/6)	L I - disturbed, apparently sterile L II - sterile
3	1.7	L I - silt loam (7.5 YR 3/2) L II - loamy clay (5 YR 4/6)	L I - modern materials L II - sterile
4	1.9	L I - silt loam (7.5 YR 4/6) L II - loamy clay (5 YR 5/6)	L I - common modern materials; disturbed L II - sterile
5	1.3	L I - sand loam fill (10 YR 3/3) L II - silt loam (7.5 YR 4/2) L III loamy clay (5 YR 5/6)	L I - modern materials L II - modern materials; disturbed L III - sterile
6	1.6	L I - silt loam (7.5 YR 4/4) L II - loamy clay (5 YR 4/6)	L I - modern materials; disturbed L II - sterile
7	1.6	L I - silt loam (7.5 YR 4/4) L II - loamy clay (5 YR 4/6)	L I - modern materials; disturbed L II - sterile
8	1.4	L I - silt loam (7.5 YR 4/4) L II - loamy clay (5 YR 5/6)	L I - modern materials; disturbed L II - sterile
9	1.3	L I - silt loam (7.5 YR 4/4) L II - loamy clay (5 YR 5/6)	L I - modern materials; disturbed L II - sterile
10	1.2	L I - silt loam (7.5 YR 4/6) fill; rock fill	L I - modern materials
11	1.3	L I - silt loam (7.5 YR 4/6) fill	L I - modern materials; disturbed
12	1.2	L I - silt loam (7.5 YR 4/6) L II- loamy clay (5 YR 5/6)	L I - modern materials; disturbed L II - sterile

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Photo 1 - General view of study area, showing proximity to Iao Stream.

Photo 2 - General view showing the overstory of large trees.

Photo 3 - Backhoe testing near the center of the study area.

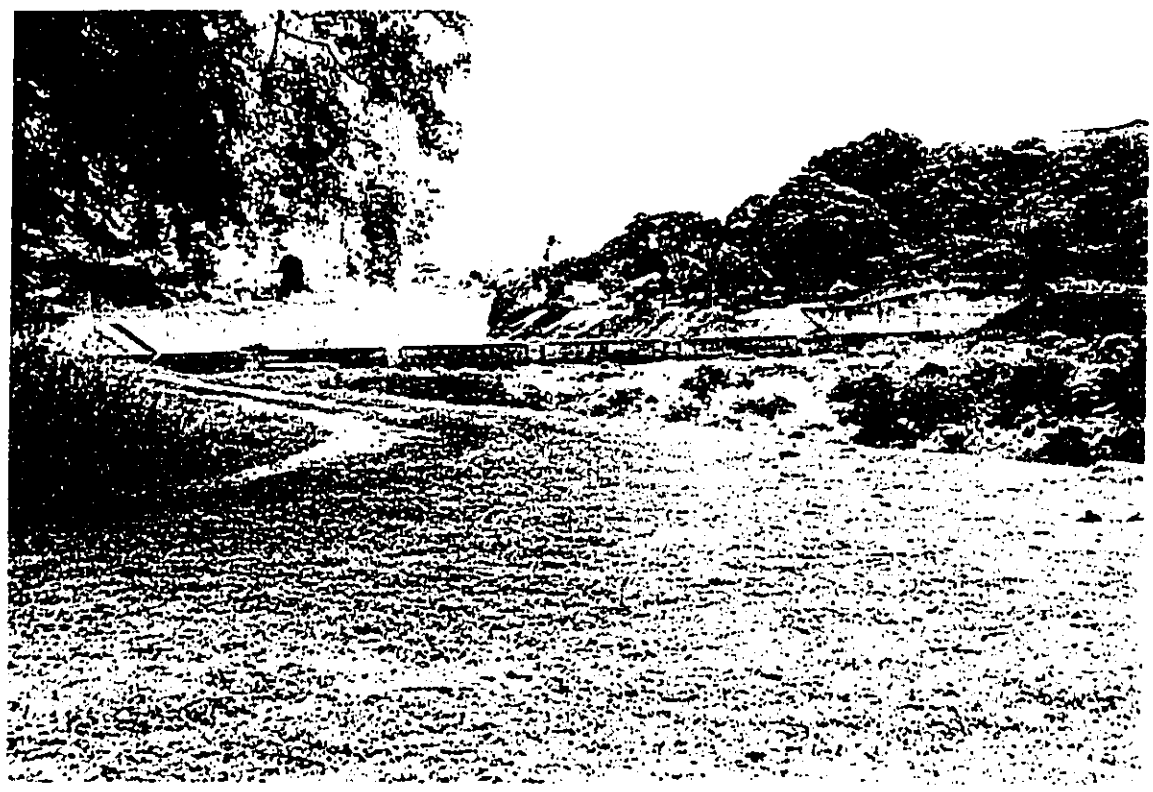


Photo 4 - Looking eastward toward the ocean, showing the Iao Stream Flood Control system.

APPENDIX A

Soil Descriptions for Backhoe Trenches

BT 1 (Representative Stratigraphy for BT 2, 3)

Layer I: Dark brown (7.5 YR 3/2); silt loam with stream gravel; common waterworn cobbles and boulders; weakly developed subangular blocky structure; loose, moist consistency; common live roots; apparently sterile. Layer I is up to 1.6 m. thick.

Layer II: Yellowish red (5 YR 4/6); loamy clay; common weathered rocks; weakly developed subangular blocky structure; loose, moist consistency; live roots; sterile; grades to decayed bedrock. Layer II extends c. 0.8 m. to bottom of trench.

BT 4 (Representative Stratigraphy for BT 12)

Layer I: Strong brown (7.5 YR 4/6); silt loam with stream gravel, common waterworn cobbles and boulders; weakly developed subangular blocky structure, loose, moist consistency; live roots; contain modern historic materials. Layer I is up to 1 m. thick.

Layer II: Yellowish red (5 YR 5/6) loamy clay; common weathered rocks; weakly developed subangular blocky structure; loose, moist consistency; few live roots; sterile; grades to decayed bedrock and bedrock. Layer II is c. 1 m. thick.

BT 5

Layer I: Dark brown (10 YR 3/3); sandy loam fill with stream gravel; contains pushed waterworn cobbles and boulders; weakly developed subangular blocky structure; loose, moist consistency; common live roots; contains modern bottle glass fragments and rusted metal pieces. Layer I ranges from 0.3 to 0.7 m. deep.

Layer II: Brown to dark brown (7.5 YR 4/2); silt loam with stream gravel and few waterworn cobbles; weakly developed subangular blocky structure; loose, moist consistency; common live roots; contains some modern bottle/glass fragments. Layer II is c. 0.2 to 0.4 m. thick.

Layer III: Yellowish red (5 YR 5/6); loamy clay; common weathered rocks; weakly developed subangular blocky structure; loose, moist consistency; live roots; sterile; grades to decayed bedrock. Layer II extends c. 0.3 to 0.7 to bottom of trench.

BT 6 (Representative Stratigraphy for BT 7)

Layer I: Brown to dark brown (7.5 YR 4/4); silt loam with fine stream gravel; common waterworn cobbles and boulders; weakly developed subangular blocky structure; loose, moist consistency; common live roots; contains modern bottle glass fragments and rusted metal. Layer I is c. 0.6 to 0.8 m. thick.

Layer II: Yellowish red (5 YR 4/6); loamy clay; common weathered rocks; weakly developed subangular blocky structure; loose, moist consistency; live roots; sterile; grades to decayed bedrock and bedrock. Layer II is c. 0.7 m. thick.

BT 8 (Representative Stratigraphy for BT 9)

Layer I: Brown to dark brown (7.5 YR 4/4); silt loam with stream gravel; common waterworn cobbles and pushed waterworn boulders; weakly developed subangular blocky structure; loose, moist consistency; common live roots; contains rusted metal. Layer I is up to 0.9 m. thick.

Layer II: Yellowish red (5 YR 5/6); loamy clay; common weathered rocks; weakly developed subangular blocky structure; loose, moist consistency; live roots; sterile; grades to decayed bedrock and bedrock. Layer II is c. 0.7 to 0.9 m. thick.

BT 10 (Representative Stratigraphy for BT 11)

Layer I: Strong brown (7.5 YR 4/6); silt loam fill with stream gravel and few waterworn cobbles; weakly developed subangular blocky structure; loose, moist consistency; common live roots; contains modern material. Layer I is at least 1.2 m. deep. Excavation halted at dense fill rock layer.

BT 12

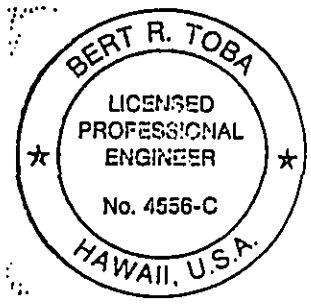
Layer I: Strong brown (7.5 YR 4/6) silt loam with stream gravel, common waterworn cobbles and boulders; weakly developed subangular blocky structure; loose, moist consistency; live roots; contains modern historic materials. Layer I is up to 0.9 m. thick.

Layer II: Yellowish red (5 YR 5/6) loamy clay; common weathered rocks; weakly developed subangular blocky structure; loose, moist consistency; few live roots; grades to decayed bedrock and bedrock. Layer II is c. 1 m. thick.

Appendix C

Drainage and Erosion Control Report

DRAINAGE AND EROSION CONTROL REPORT FOR MOKUHAU RENOVATION AND RESERVOIR REPLACEMENT PROJECT AT WAILUKU, MAUI, HAWAII TMK: 3-4-36



PREPARED FOR:

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET
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JANUARY 1996

TABLE OF CONTENTS

I. INTRODUCTION

The County of Maui Department of Water Supply plans to construct a 3 million gallon concrete reservoir and to modify the existing piping system to transport water to the new reservoir. This report examines how existing drainage patterns from lands surrounding the proposed site will affect the project. This report also evaluates how development of the project will affect downstream properties. Finally this report will study the movement of soil off the site as a result of erosion due to construction activities.

II. PROJECT LOCATION

The project is located in Wailuku on the Island of Maui as shown in Exhibit A. The proposed location of the new reservoir is approximately 450 feet south of the end of Mokuhau Road. The proposed site is on a portion of Tax Map Key (TMK) 3-4-36 which is owned by the County of Maui.

III. PROJECT DESCRIPTION

The subject project will consist of constructing a 3 million gallon concrete reservoir and installing a 20 inch influent line, 24 inch effluent line, and an 18 inch washdown and overflow line. Other improvements include a 12 inch wide paved access and perimeter road around the reservoir, and a 0.30 acre-feet detention basin.

IV. EXISTING STORM RUNOFF CONDITIONS

Presently the proposed reservoir site ground cover includes various types of weeds, grasses, and a few large trees. Elevations on the reservoir site range from 352 feet to 356 feet above mean sea level with an average slope of 1.6 percent. Under these conditions, the reservoir site has a peak runoff rate from a 50-year, 1-hour storm of 1.20 cfs, see Appendix A for calculations. Ground cover for the access road includes a dirt/gravel road and various weeds and grasses. Based on a 10-year, 1-hour storm, the peak runoff for the access road is 0.47 cfs.

Off-site runoff from land mauka of the reservoir site sheet flows onto the site. The off-site runoff which enters the reservoir site based on a 50-year, 1-hour storm is 0.29 cfs.

Surface runoff from the reservoir site and access road flows in an east and northeasterly direction toward Iao Stream and an existing stream. The existing stream flows east and outlets into Iao Stream. Iao Stream eventually outlets into the ocean.

V. DEVELOPED STORM RUNOFF CONDITION

Storm runoff for developed conditions were also calculated using the Rational Method. Based on a 50-year, 1-hour storm, runoff from the developed reservoir site increases by 2.55 cfs to a rate of 3.75 cfs, see Appendix A for calculations.

A 0.30 acre-ft (13,068 ft^3) detention basin will be used to store all developed runoff from the reservoir on-site. The amount of volume required to store the developed runoff including the existing off-site runoff is 2,600 ft^3, see Appendix B for calculations. Therefore, the new detention basin is adequate to store the developed runoff from the reservoir site.

The new paved access road will be designed to match existing ground slopes and the alignment of the existing dirt/gravel road. This will minimize cuts and fills and will allow the runoff to maintain existing drainage patterns. The proposed access road will not significantly increase storm water runoff. Based on a 1-hour, 10-year storm, the storm water runoff has been calculated to increase by 0.21 cfs to a rate of 0.68 cfs. This increase will not adversely affect adjacent and downstream properties.

VI. SOIL EROSION CONTROL

According to the U.S. Department of Agriculture (Reference 3), soil within the project site is classified as stony alluvial land, 3 to 15 percent slopes (rSM).

Calculations show that grading of the entire site will result in a total soil loss during construction of 7.1 tons/acre/year with a severity number of 92. The allowable erosion rate is 3876 tons/acre/year and present standards allow for a maximum severity number of 50,000. Therefore, normal erosion control measures implemented during construction should be adequate to control soil loss from the project site.

Estimated soil loss was calculated using the universal soil loss equation in accordance with the County of Maui's Grading Ordinance.

VII. CONCLUSION

Development of the Mokuhau Renovation and Reservoir Replacement Project is not expected to cause any adverse effects to adjacent or downstream properties. Storm runoff from the reservoir site will be stored on-site via a 0.30 acre-ft detention basin. Runoff from the access road is minimal and will follow existing drainage patterns. Finally, soil loss during construction is below the County's allowable rate therefore erosion during construction is not expected to be a problem.

VIII. REFERENCES

1. County of Maui, Department of Public Works and Waste Management, "Rules for the Design of Storm Drainage Facilities in the County of Maui", July 1995.

2. County of Maui, Hawaii, "Guidelines for Computing Allowable Erosion Rate, Uncontrolled Erosion Rate, and Reductions Needed to Meet the Standard, Island of Maui, Molokai, Lanai", March 1975.

3. Department of Public Works, City and County of Honolulu, Division of Engineering, "Storm Drainage Standards", March 1986.

4. U.S. Department of Agriculture, Soil Conservation Service, "Soil Survey of Island of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii", Washington, D.C., August 1972.

5. U.S. Department of Agriculture, Soil Conservation Service, "Erosion and Sediment Control Guide for Hawaii", Honolulu, Hawaii, March 1981.

IX. APPENDICES

APPENDIX A - DRAINAGE CALCULATIONS

APPENDIX B - DETENTION BASIN VOLUME CALCULATIONS

APPENDIX C - EROSION CONTROL CALCULATIONS

APPENDIX A

I. HYDROLOGIC RUNOFF COMPUTATIONS:

$Q = CiA$

Q = RUNOFF (CFS)

C = RUNOFF COEFFICIENT

i = RAINFALL INTENSITY (IN/HR)

A = DRAINAGE AREA (ACRES)

A. ON-SITE EXISTING CONDITIONS

AREA A

T_m = 10 YR RECURRENCE INTERVAL

I_{10} = 2.2 IN (1-HR RAINFALL)

C = 0.35

i_{10} = 5.2

L = 90 FT, S = 5.50%, T_c = 6.0 MIN

A = 0.26 AC.

$Q_{10} = 0.35(5.2)(0.26)$

$= 0.47$ CFS

AREA B

T_m = 50 YR RECURRENCE INTERVAL

I_{50} = 3.0 IN (1-HR RAINFALL)

C = 0.25

i_{50} = 5.6

L = 210 FT, S = 5.30%, T_c = 14 MIN

A = 0.86 AC.

$Q_{50} = 0.25(5.6)(0.86) = 1.20$ CFS

B. ON-SITE DEVELOPED CONDITIONS

AREA A (ACCESS ROAD)

T_m = 10 YR RECURRENCE INTERVAL

I_{10} = 2.2 IN (1-HR RAINFALL)

C_1 = 0.22 (GRASSED SHOULDERS) C_2 = 0.95 (ACCESS ROAD)

A_1 = 0.16 (" ") A_2 = 0.10 (" ")

WEIGHTED C

$$C = \frac{0.22(0.16) + 0.95(0.10)}{0.16 + 0.10} = 0.50$$

i_{10} = 5.2

L = 30 FT, S = 2.0%, T_c = 6.0 MIN

$Q_{10} = 0.50(5.2)(0.26)$
$= 0.68$ CFS

AREA B

T_m = 50 YR RECURRENCE INTERVAL

I_{50} = 3.0 IN (1-HR RAINFALL)

C_1 = 0.35 (GRASS) C_2 = 0.95 (ROOF, PAV'T)
A_1 = 0.10 (") A_2 = 0.31 (" , ")

WEIGHTED C

$$C = \frac{0.35(0.10) + 0.95(0.31)}{0.10 + 0.31} = 0.78$$

i_{50} = 5.65

T_c = 6.6 MIN (ALONG PERIMETER ROAD) T_c = 7.6 MIN (GRASS SWALE)
L = 200 FT, S = 0.48% L = 45', S = 5.5%

Sato & Associates, Inc.
Consulting Engineers

: 3 Of: 4
By: TT Date: 1/3/96
Chkd. by: Date:

PROJECT:

$Q_{50} = 0.78\,(5.65)(0.42)$
$= 1.85$ CFS

AREA C

$C_1 = 0.35$ (GRASS) $C_2 = 0.95$ (ROOF, PAV'T)
$A_1 = 0.06$ (") $A_2 = 0.30$ (" , ")

WEIGHTED C

$$C = \frac{0.35(0.06) + 0.95(0.30)}{0.06 + 0.30} = 0.85$$

$i_{50} = 5.5$

$T_c = 6.6$ MIN. (ALONG PERIMETER ROAD)
$L = 190$ FT, $S = 0.38\%$

$T_c = 8.7$ MIN. (GRASSED) SWALE)
$L = 60$ FT, $S = 4.5\%$

$Q_{50} = 0.85(5.5)(0.36)$
$= 1.68$ CFS

AREA D

$C = 0.35$

$i_{50} = 7.1$
$L = 40$ FT, $S = 6.0\%$, $T_c = 7.2$ MIN

$A = 0.09$ AC

$Q_{50} = 0.35(7.1)(0.09)$
$= 0.22$ CFS

C. OFF-SITE EXISTING CONDITIONS

AREA C

T_m = 50 YR RECURRENCE INTERVAL

I_{50} = 3.0 IN (1-HR RAINFALL)

C = 0.25

i_{50} = 5.8

L = 125 FT, S = 4.9%, T_c = 13 MIN

A = 0.15 AC

Q_{50} = 0.25(5.8)(0.15)
= 0.22 CFS

AREA D

C = 0.25

i_{50} = 5.8

L = 150 FT, S = 3.3%, T_c = 13.4 MIN

A = 0.05 AC

Q_{50} = 0.25(5.8)(0.05)
= 0.07 CFS

Sato & Associates, Inc.
Consulting Engineers

Sh: 1 Of: 2
By: Date: 1/8/96
Chkd. by: Date:

PROJECT:

APPENDIX B

DETENTION BASIN VOLUME CALCULATIONS

I. SCS METHOD FOR CALCULATING RUNOFF VOLUMES FOR 50 YEAR - 1 HOUR STORM

A. DRAINAGE AREA 1 (PAVED, ROOF)

$A = 0.61$ AC, $CN = 95$

$$Q_{inches} = \frac{(P-0.2S)^2}{P+0.8S} \quad \text{WHERE} \quad S = \frac{1000}{CN} - 10$$

$S = 0.5263$

$P_{50} = 3.0$

$$Q = \frac{[3.0 - 0.2(0.5263)]^2}{3.0 + 0.8(0.5263)}$$

$= 1.16$ in.

Volume Required

$V = 1.16 \times \frac{1\,ft}{12\,in} \times 0.61$

$= .059$ acre-ft

$= 0.059 \times 43{,}560$ ft²/acre

$= 2{,}573$ ft³

B. DRAINAGE AREA 2 (GRASS)

$A = 0.25$ AC, $CN = 39$, $P_{50} = 3.0$, $S = 15.6410$

$$Q = \frac{[3.0 - 0.2(15.6410)]^2}{3.0 + 0.8(15.6410)}$$

$= 0.0011$ in

Volume Required

$V = 0.0011 \times \frac{1\,ft}{12\,in} \times 0.25$

$= 2.2 \times 10^{-5}$ acre-ft $\times$ 43560 ft²/acre

$= 1.0$ ft³

Sato & Associates, Inc.
Consulting Engineers

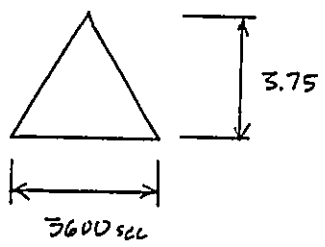
Sheet: 2 Of: 2
By: Date:
Chkd. by: Date:

PROJECT:

$V_{TOTAL} = 2,573 + 1 = 2574 \text{ ft}^3$

II. CHECK, TRIANGULAR ESTIMATION

TOTAL $Q_{50} = 1.85 + 1.68 + 0.22$
$= 3.75$ cfs



$\frac{1}{2}(3600) \times 3.75 = 6750 \text{ ft}^3$

SAY 2,600 ft³

PROJECT: MOKUHAU RENOVATION AND RESERVOIR REPLACEMENT PROJECT

RUNOFF SUMMARY

Computed by: TT

Date: 1/3/96

Area No.	Area (Ac)	Tm	Tc (min)	c	1 - Hr. Rainfall	Conver. Factor	Intensity (in/hr)	Q (cfs)	Inlet	Remarks
ON-SITE EXISTING CONDITIONS										
A	0.26	10	6.0	0.22	2.2	1.0	5.2	0.47	Sheet flows off site	
B	0.86	50	14.0	0.25	3.0	1.0	5.6	1.20	Sheet flows off site	
							Total	2.67		
OFF-SITE EXISTING CONDITONS										
C	0.15	50	13.0	3.0	3.0	1.0	5.8	0.22	Sheet flows off site	
D	0.05	50	13.4	3.0	3.0	1.0	5.8	0.07	Sheet flows off site	
							Total	0.29		
ON-SITE DEVELOPED CONDITIONS										
A	0.26	10	6.0	0.50	2.2	1.0	5.2	0.68	Sheet flows off site	
B	0.42	50	7.6	0.78	3.0	1.0	5.65	1.85	Detention Basin	
C	0.36	50	8.7	0.85	3.0	1.0	5.5	1.68	Detention Basin	
D	0.09	50	7.2	0.35	3.0	1.0	7.1	0.22	Detention Basin	
							Total	4.43		

APPENDIX C

EROSION CONTROL CALCULATIONS

A. SITE CONDITIONS

According to the "Soil Survey of Island of Kauai, Oahu, Maui, Molokai and Lanai", State of Hawaii, August 1972, the soil within the project site is classified as Stony alluvial land, 3 to 15 percent slopes (rSM). This soil consists of stones, boulders, and soil deposited by streams along the bottoms of gulches and on alluvial fans.

B. ESTIMATED SOIL LOSS

The equation used for estimating soil loss, as set forth by the County of Maui's Grading Ordinance is as follows:

E = R K Ls C P

Where:

E = Soil Loss in Tons/Acre/Year
R = Rainfall Factor = 190 Tons/Acre/Year
K = Soil Erodibility Factor = 0.05
Ls = Topographic Factor = 0.75
Slope Length (L) = 300
Average Slope (S) = 4.4%
C = Cover Factor = 1.0 (Bare Soil)
P = Erosion Control Practice Factor 1.0
(For Non-Agricultural Lands)
E = 190 x 0.05 x 0.75 x 1 x 1 =
7.1 Tons/Acre/Year

C. ALLOWABLE SOIL LOSS

Coastal Water Hazard (D) = 2 (Class "A" Water)
Downstream Hazard (F) = 4
Time Duration of Project (T) = 0.5 Year
Maximum Allowable Construction Area x Erosion Rate = 5,000 Tons/Acre
Area of Disturbance (A) = 1.29 Acres
Maximum Allowable Erosion Rate = 5,000/1.29 = 3,876 Tons/Acre/Year

D. SEVERITY RATING

ALLOWABLE RATING = 50,000

CALCULATED SEVERITY RATING (H) = (2FT + 3D)AE

WHERE:

Downstream Hazard (F) = 4 (Adjacent to an existing Subdivision)
Time Duration of Project (T) = 0.5 Year
Potential Sediment Damage (D) = 2 (Class "A" Water)
Area of Disturbance (A) = 1.29
Annual Soil Loss (E) = 7.1 Tons/Acre/Year

H = (2 x 4 x 0.5 + 3 x 2) (1.29) (7.1) =
92 < 50,000 allowable rating

E. EROSION CONTROL REPORT

The following procedures should be implemented during construction of the project.

1. Leave natural vegetation undisturbed in areas not needed for immediate construction.

2. Use waterwagons and/or sprinklers to control dust.

3. Water down graded areas after construction activity has ceased for the day and during weekend and holidays.

4. Construct drainage improvements as soon as possible.

5. Grass or landscape exposed areas immediately after grading work is finished.

Other erosion control measure may be implemented if necessary.

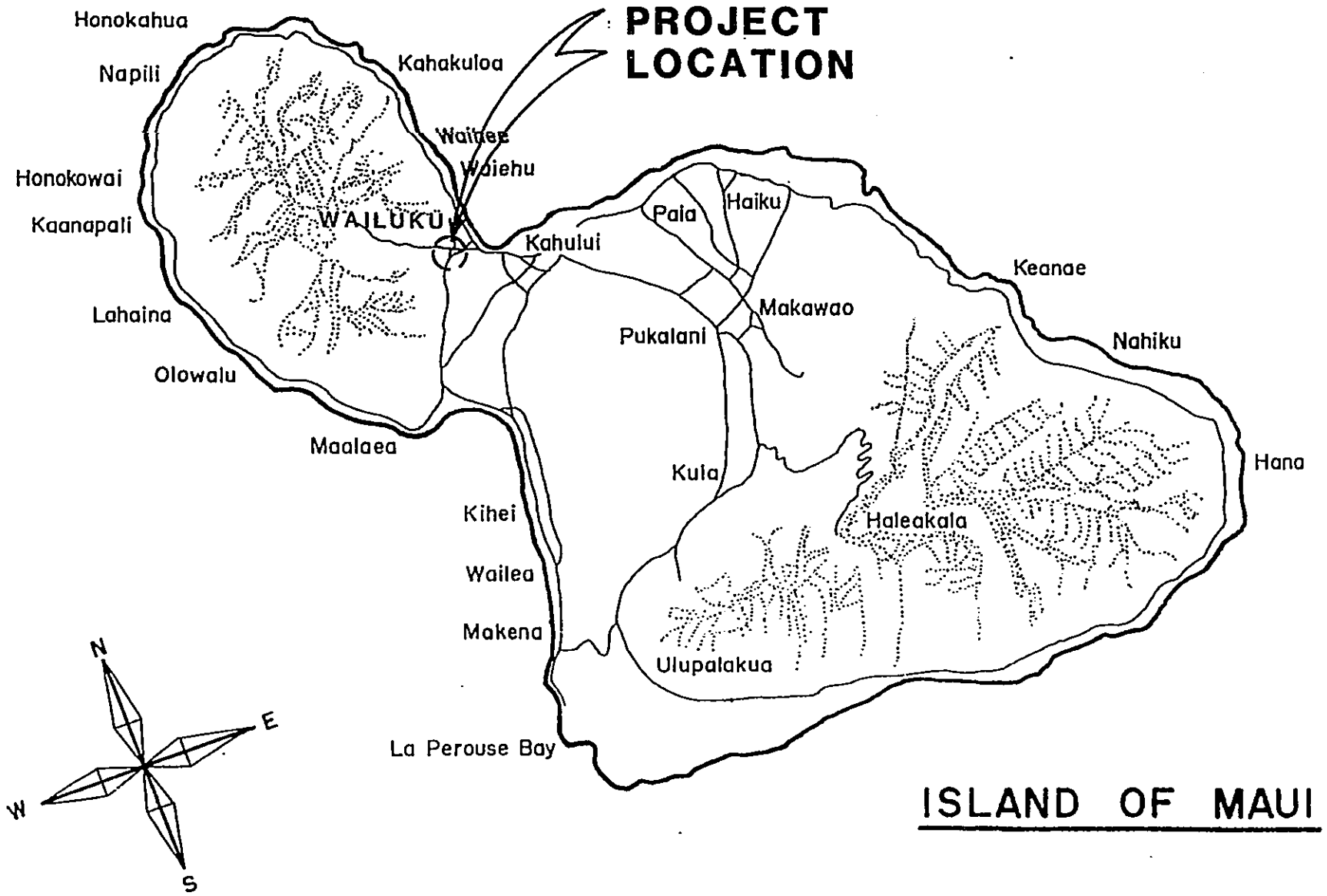
X. EXHIBITS

EXHIBIT A - PROJECT LOCATION MAP

EXHIBIT B - SITE LOCATION MAP

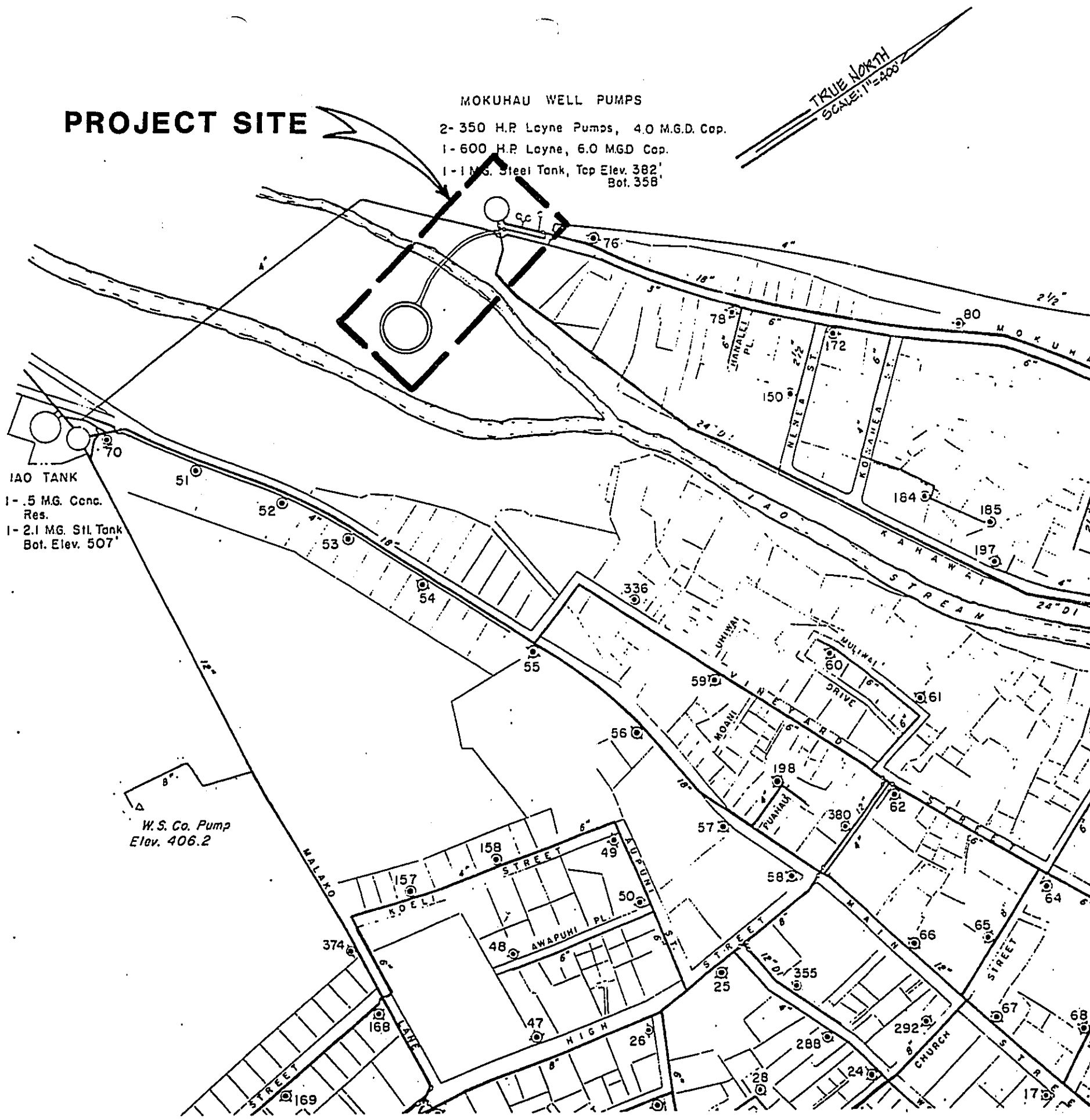
EXHIBIT C - EXISTING RUNOFF CONDITIONS

EXHIBIT D - DEVELOPED RUNOFF CONDITIONS



ISLAND OF MAUI

EXHIBIT A



SITE LOCATION M

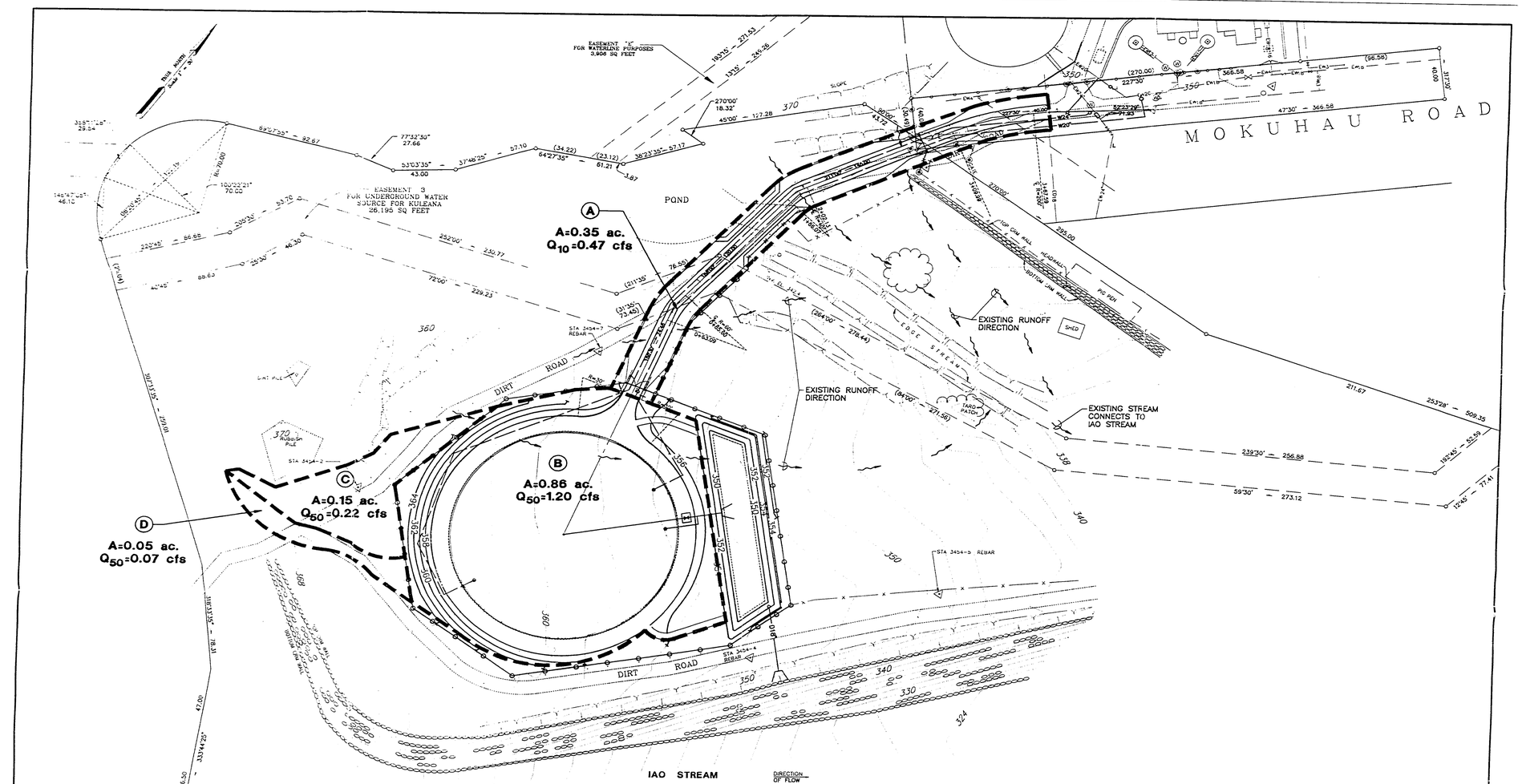
OCATION MAP

EXHIBIT B

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

0053



EXISTING RUNOFF CONDITIONS

SCALE: 1"=30'

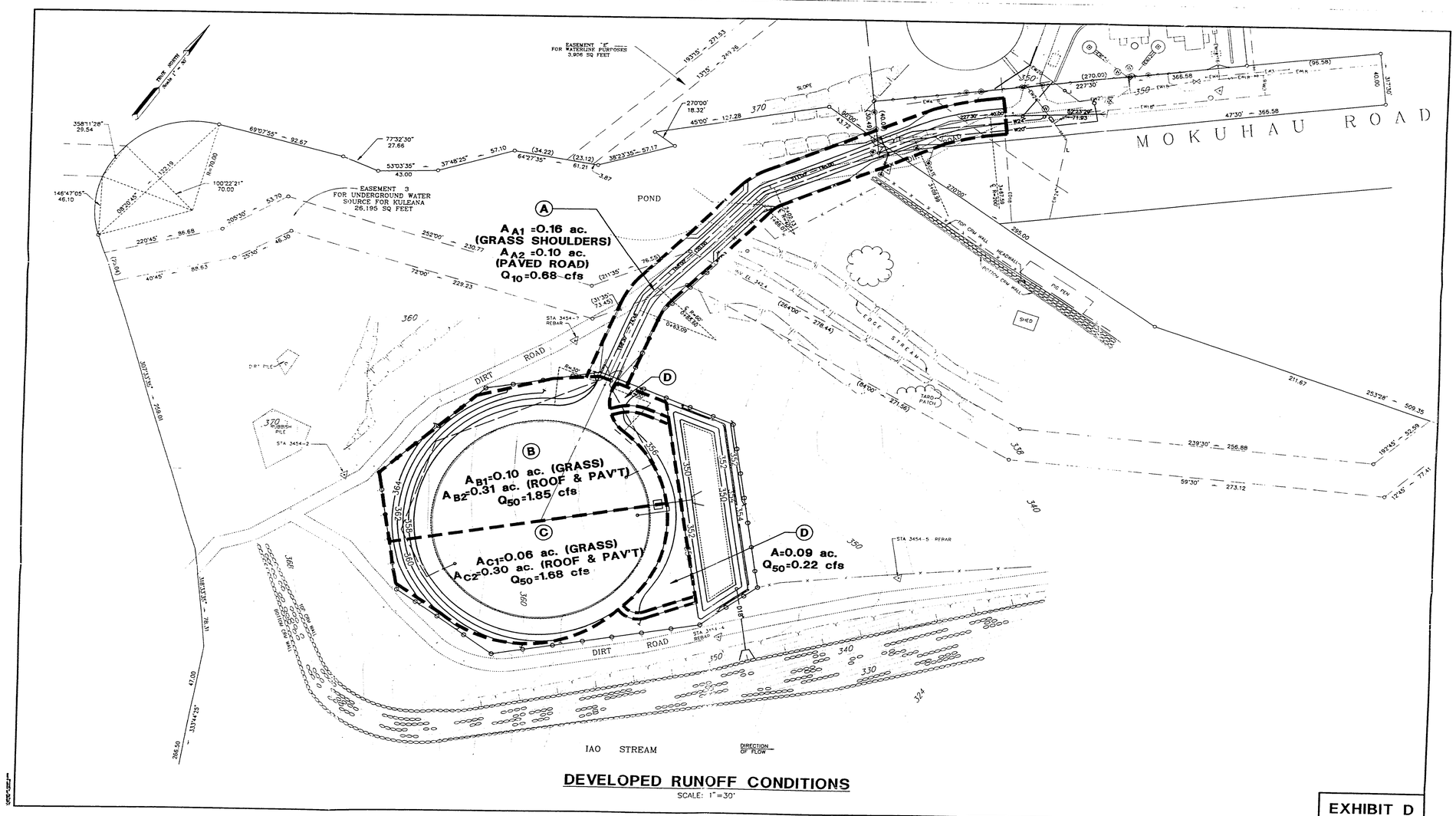
EXHIBIT C

0053

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

0054



DEVELOPED RUNOFF CONDITIONS

SCALE: 1"=30'

EXHIBIT D

D054

Appendix D

Letters from Department of the Army, Operations Branch

MAR 25 1996

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

REPLY TO
ATTENTION OF
Operations Branch

March 21, 1996

SUBJECT: Proposed Mokuhau Water Tank Overflow Outlet, Iao Valley, Wailuku, Maui, Hawaii, File No. NP 960000144

Mr. Ty Takeno
Sato and Associates, Inc.
2115 Wells Street
Wailuku, Hawaii 96793

Dear Mr. Takeno:

This letter is in response to your request to evaluate your revised plans for an outlet structure and concrete slab associated with the Mokuhau Water Tank Project in Iao Valley, Maui. The U.S. Army Corps of Engineers (Corps) reviewed the plans to determine compatibility with the Corps' existing flood control project in Iao Stream and to ascertain whether a Department of the Army (DA) permit would be necessary.

Mr. Patrick Tom of my staff and Mr. Jim Pennaz of the Corps Planning Branch reviewed the plans and determined that the design for a Concrete Rubble Masonry (CRM) overflow outlet and slab is adequate and should not interfere with the federal flood control project.

Ms. Terrell Kelley of my staff determined that the part of the stream to be impacted is not below the ordinary high water mark of Iao Stream and is therefore not under the Corps' regulatory jurisdiction. No DA permit will be necessary for the project.

The file number for this action is NP 960000144. Please refer to this number in any future correspondence. If you have any questions, please call Ms. Kelley at 438-9258, extension 13, or Ms. Lolly Silva at extension 17.

Sincerely,

Linda Hihara-Endo, Ph.D., P.E.
Acting Chief, Operations Branch

Copy Furnished:

/Munekiyo and Arakawa, Inc.

NOV 7 1995

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

REPLY TO
ATTENTION OF

November 7, 1995

Operations Branch

SUBJECT: Maui County, Department of Water Supply Proposed Mokuhau Water Tank Project, Iao Valley, Wailuku, Maui, Hawaii, File No. NP 96-029

Mr. Milton Arakawa
Munekiyo & Arakawa, Inc.
1823 Wells Street, Suite 3
Wailuku, Hawaii 96793

Dear Mr. Arakawa:

This letter is regarding the proposed project to build a three million gallon reservoir and attendant pipeline system that would add to existing capacity of the Mokuhau Reservior in Iao Valley, Maui. During a site visit on October 12, 1995, the Corps of Engineers determined that if the water line crossing of the small unamed stream was confined to the existing roadway, then no Department of the Army (DA) permit would be necessary. The site visit confirmed that the existing roadway does have a culvert that conveys water. This was unknown during a previous site visit, because flood waters were actually crossing the road, and we could not see the culvert on the downslope side.

Please send Maui County Department of Water Supply's current plans for the utility line crossing to our office to confirm that the project will not affect waters of the U.S. and will not need a DA permit. You must ensure that no fill sloughs off into the stream. If at a future date you would like to replace the culvert or otherwise work in the stream, a DA permit would be required.

In addition, we refer you to the August 28, 1995 letter (enclosed) from the District Engineer to Mr. Charles Jencks, Maui Department of Public Works. The conditions set forth in this letter must be met to ensure the subject project is compatible with the existing Corps flood control project.

This project file number has been changed from PO 95-070 to NP 96-029. Please refer to this number in any future correspondence. If you have any questions, please call me at 438-9258, extension 13, or Ms. Lolly Silva at extension 17.

Sincerely,

Terrell E. Kelley
Team Leader
Maui, Molokai, Lanai, and Kauai

Enclosure

Copies Furnished:

Maui County Department of Water Supply
Maui Department of Public Works

Appendix E

Letter from the Commission on Water Resource Management

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON
CHAIRPERSON

ROBERT G. GIRALD
DAVID A. HOOPIKOA
LAWRENCE H. MIKE
RICHARD H. COX
HERBERT M. RICHARDS, JR

RAE M. LOUI, P.E.
DEPUTY

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P. O. BOX 621
HONOLULU, HAWAII 96809

JUN 21 1996

Mr. Milton Arakawa
Munekiyo & Arakawa, Inc.
1823 Wells Street
Wailuku, Hawaii 96793

Dear Mr. Arakawa:

This letter is in response to your letter dated March 25, 1996 inquiring whether the construction of an overflow discharge pipe and an 8-foot x 18-foot CRM slab diffuser will require a stream channel alteration permit. The site is located near the Mokuhau Water Tank in Wailuku Maui.

Based on the information you provided and the faxed material from Sato and Associates, it appears the site is located outside of the 'bed or banks' of Iao Stream Channel. Therefore, a stream channel alteration permit will not be required for the construction of the discharge pipe and diffuser.

We apologize for not responding to you sooner. If you have any questions regarding this letter, please call David Higa at 587-0249.

Sincerely,

RAE M. LOUI
Deputy Director

DH:fc

c. County of Maui, Department of Water Supply