

1995-08-23-0A-PEA- Installation of 8-inch water main
between Kuahea Street to Wilhelmina ~~Street~~
to 3 storage reservoir and various parcels

NOV 23 1995
FILE COPY

FINAL ENVIRONMENTAL ASSESSMENT

FOR
INSTALLATION OF 8-INCH WATER MAIN
BETWEEN THE PALOLO CHLORINATOR
AND PALOLO TUNNEL, AND FROM
KUAHEA STREET TO WILHELMINA RISE
811 STORAGE RESERVOIR

DLNR
OCEAN

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This Environmental document prepared pursuant to Chapter 343, HRS

Prepared for:
Board of Water Supply
City & County of Honolulu
630 South Beretania Street
Honolulu, HI 96813

JULY 1995

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I. EXECUTIVE SUMMARY

An Environmental Assessment (EA) was prepared for the installation of two segments of 8-inch water mains between the Palolo Water Tunnel in Palolo Valley and the Palolo Chlorinator at the end of Waiomao Road. This segment called Segment "A", is approximately 6000 feet long. The second segment, (Segment "B") will link the Palolo Valley portion of the transmission main to the Wilhelmina No. 3 Storage Reservoir from Kuahea Street, approximately 2400 feet long. This project is being prepared for the Board of Water Supply (BWS) and pending final design of the alignment, and project permit review by the State Department of Land and Natural Resources for a Conservation District Use Application (CDUA) permit, construction is tentatively scheduled to commence in 1995.

The EA is a preliminary document prepared to determine if a particular action has potentially significant environmental impacts. Based on this document, the proposing agency or approving agency determines whether or not an Environmental Impact Statement (EIS) will be required.

Based on the results of this EA, it is concluded that an EIS is not required. Significant long term impacts from the installation of these two segments of water main transmission lines are not expected. However, when the project reaches Segment "B", there may be minor short term impacts resulting from fugitive dust and noise from construction equipment. These impacts can be mitigated by strict adherence to applicable guidelines set by the State Department of Health. Further, in Segment "A", the portions of the installation that will cross certain streams, the instream installation will involve trenching, laying of the pipeline and backfill to cover the pipe. All other lines will be above ground for easier maintenance and leak detection.

II SUMMARY INFORMATION

CHAPTER 343, HAWAII REVISED STATUTES (HRS)
ENVIRONMENTAL ASSESSMENT

Proposing Agency: Board of Water Supply
City & County of Honolulu

Accepting Agency: Department of Land and Natural Resources

Project Name: "Installation of 8-inch Water Main between the Palolo Chlorinator and Palolo Tunnel, and from Kuahea Street to Wilhelmina Rise 811 Reservoir"

Project Description: The proposed project involves the design and installation of 8-inch water main lines from the Palolo Tunnel to the Waiomao Road chlorination station of Segment "A", and then from Kuahea Street to the Wilhelmina No. 3 Storage Reservoir in Segment "B". (See Figure 2)

Project Location: Palolo Valley, Oahu (See Figure 1)

Tax Map Key: (See attached list)

Land Area: Segment "A": approximately 6000 feet
Segment "B": approximately 2400 feet

State Land Use Designation: Conservation

Land Owner: State of Hawaii & various (See attached list)

Public Facilities Map: P-1

County Zoning: R-5, P-1

Tax Map Keys and Landowners

1.	Segment "A":	3-4-22:1	State of Hawaii
2.	Segment "B":	3-4-14:4	Hatsue Futa
		3-4-14:12	Joseph Leng
		3-4-14:14	Jon Martin
		3-4-14:19	Edward Wakabayashi
		3-4-15:12	Susan Cho
		3-4-15:17	Edith Shoma / Matsuno Saiki
		3-4-30:16	Arthur Suzui
		3-4-30:56	Matsuo Tamanaha
		3-3-37:2	George Lee
		3-3-37:3	Michael Schwinn
		3-3-37:4	Stephen Sydow
		3-3-37:5	Patrick Donald Gray
		3-3-37:6	Michael Hadfield
		3-3-37:7	Masaru Yoshioka
		3-3-37:8	Hideto Marumoto
		3-3-37:9	Richard Carlson
		3-3-37:10	Gerald Muranaka
		3-3-37:11	Etsuo Nakaya Trust
		3-3-37:12	Frederick Nakandakare
		3-3-37:13	Glenn Himeda / Larry Rutkowski
		3-3-37:14	Mitsu Oshiro
		3-3-37:15	Minoru Takahashi
		3-3-37:18	Genji Murakami
		3-3-37:19	George Lee
		3-3-37:20	David Gomes
		3-3-37:22	Yukio Nimori
		3-3-37:24	Bernaldo Vaba
		3-3-37:25	Marvin Javillo
		3-3-37:26	Tayabas Family 1987 Trust / Teresa Shimoda Tayabas
		3-3-37:27	Eddie Mansanas
		3-3-29:3	Willis Kleinenbroich, Jr.
		3-3-29:7	George Sakurai

III. PROJECT DESCRIPTION

A. Project Location

The Board of Water Supply Palolo Water Tunnel is located approximately one mile in Palolo Valley at the end of Waiomao Road. (See Figure 1) It is a source of approximately 300,000 gallons per day of dike or perched water which services the Maunalani Heights/Wilhelmina Rise areas. The terrain is typical of deep interior valleys and is classified as *Rough Mountainous Land* (rRT). "Rough mountainous land in mountainous areas on all islands. It consists of very steep land broken by numerous intermittent drainage channels. In most places, it is not stony. Elevations range from nearly sea level to more than 6000 feet. The annual rainfall amounts to 70 to more than 400 inches. The land surface is dominated by deep, V-shaped valleys that have extremely steep side slopes and narrow ridges between the valleys. This land type is used for water supply, wildlife habitat, and recreation. The natural vegetation consists of ohia, false staghorn, treefern, yellow foxtail, lantana, kukui, and puakeawe."¹ Segment "A" is located in this area and is identified as connecting from the tunnel headworks to an existing chlorination station at the end of Waiomao Road. (See Figure 2) This segment of the waterline traverses from the Tunnel along steep and narrow trails, across ravines, up and down gullies, and across streams to Waiomao Road chlorination station. The second segment of waterline (Segment "B") links the Palolo Valley portion of the transmission main to the Wilhelmina No. 3 Storage Reservoir from Kuahea Street. The second link also covers steep, heavily forested terrain as it crosses from the east side of Palolo Valley to the reservoir. Soil type in Segment "B" is identified as *Rock Land* (rRK) and "is made up of areas where exposed rock covers 25 to 90 percent of the surface. The rock outcrops and very shallow soils are the main characteristics. Elevations range from nearly sea level to nearly 6000 feet. Annual rainfall amounts to 15 to 60 inches. Rock Land is used mainly for pasture, wildlife habitat, and water supply. Vegetation types at the lower elevations consist mainly of kiawe, klu, pilgrass, Japanese tea and koa haole."²

B. Environmental Characteristics

The Project site is segmented into two separate locations, with Segment "A" situated deep in the Palolo Valley, approximately one mile mauka from the end of Waiomao Home Road. Segment "B" crosses the easterly slopes of Palolo Valley to the Wilhelmina No. 3 Storage Reservoir. Both alignments are typified by steep and narrow trails, across ravines, up and down gullies, and for Segment "A", across streams to the chlorination station. The water source is the Palolo Water Tunnel

1. Soil Survey of The Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, USDA Soil Conservation Service, August, 1972.

2. Ibid

which provides approximately 300,000 gallon per day of dike water to service customers in the upper Maunalani Heights/Wilhelmina Rise area. Water is transmitted via a eight-inch pipeline from the tunnel at the approximate 995 feet elevation to the 811 feet reservoir at Wilhelmina Storage No. 3 Reservoir. The Segment "A" pipeline is approximately 70+ years old and in need of replacement. This eight-inch line has had increasingly frequent instances of repair and maintenance due to age and exposure to the elements. The difficult terrain has made it necessary to carry in repair materials to the repair site. The above ground pipeline placement has resulted in corrosion and damage from the extremely wet valley conditions. Segment "B" is also subject to damage from the elements and has suffered corrosion damage. The terrain features of Segment "B" are even more pronounced in terms of steep, heavily forested slopes on the eastern portion of Palolo Valley. The vertical drop from Kuahea Street along the valley wall, across the valley floor, and up to Wilhelmina No. 3 Storage Reservoir near Maunalani Playground is approximately 400 feet.

C. Proposed Improvements

This Project is limited to the two segments, ("A" & "B") of the eight-inch pipeline which has deteriorated to a point where numerous leaks and breaks in the line has required continuous repairs and maintenance. The principal focus of this document will be on the preliminary engineering and planning activities that are necessary so that the Board of Water Supply can prepare final design plans and specifications for the construction of the replacement water mains. The identification of alternatives for corrective actions, selection of the tentative alignment, are included in this preliminary design and evaluation phase. The construction methodology to be employed is basic in the sense that there will be little if any site preparation involved since the existing pipeline is above ground. This is for ease of repair accessibility when leaks or breaks in the line occur. The existing site alignments have been surveyed so that topographic mapping can be made to determine slope factors/terrain features and also to insure the gravity flow capability from tunnel to storage reservoir. There will be limited excavation if at all, and at the various stream crossing points, the pipeline will be placed in the stream bed. This will involve simple trenching at the crossing point, installation of the line, and backfilling to cover the newly installed line. Temporary interference to the stream flow may take place, but stream diversion channels will be used to temporarily de-water the crossing point. The two sites are in Zone "X", "Areas determined to be outside the 500 year flood plain".³ See Article "D" for further comment on stream crossing work for Segment "A".

An archaeological investigation of Segment "A" has been conducted and is provided as Exhibit A. The findings of the report indicate that "No archaeological surface

3. Flood Insurance Rate Map FIRM 9-4-87 Panel 120 of 135

remains or other evidence of any significant cultural activities were encountered during the walk through survey in Segments A & B. Based upon the limited area of the study corridors, the absence of any cultural remains, and the steepness of the topography; subsurface testing was deemed unnecessary".⁴

Terrestrial flora and fauna consist of essentially exotic (introduced) species with some indigenous species of plant varieties and as such, are not considered rare, threatened, or endangered varieties. Plant species encountered include ohia, false staghorn fern, tree fern, yellow foxtail, lantana, kukui, and puakeawe. Animal species would include feral dogs, cats, Indian mongoose, wild pigs, and introduced species of avifauna, i.e. Indian Mynah, Gray Dove, white-eyed ricebird, red vented bulbul, Kentucky cardinal, and English sparrow. In the back reaches of the valley, the Hawaiian elepaio may be found, though none were observed or heard during the site inspection.

D. Proposed Work at Stream Crossings for Segment "A"

A majority of the new pipeline will be installed at grade next to the existing pipeline. However, for stream crossings, the pipe will be installed four feet below the stream bed and will be concrete encased.

The work anticipated are as follows:

1. Mechanical equipment is not expected to be used in the excavation except for compressor driven jack hammers.
2. Construction work within the stream bed area is expected to be performed in sections to maintain continuous stream flow. Cofferdams maybe the most feasible solution to accomplish the work in sections. Initially, hand-placed sandbags may be used to form the base of the cofferdam. All excavated material would be bagged and used to finish the required cofferdams. Proper placement and bagging of the excavated material will control the release of excavated material into the stream.
3. Concrete used for the concrete jacket will not be discharged into the stream with the use of cofferdams.
4. Chlorinated water used to disinfect the completed lines will be pumped into tanker trucks and disposed of in the City's sanitary sewer system.

4. p. 5 Archaeological Inventory Survey of Segments A & B corridors for the Proposed Palolo Waterline Replacement Project, Palolo, Kona, O'Ahu.

5. In general, only minimal amounts of excavated material will reach the stream.
6. Gasoline used to fuel the compressor is highly volatile and will be handled with care to prevent accidental discharge into the stream. Within stream crossing work areas, any spillage will be contained by the cofferdam which will facilitate a speedy cleanup.
7. The water used to hydrotest the new 8" water main will be discharged into the stream.

E. General Quantitative Work for Segment "A" Regarding Environmental Concerns

1. Clearing: Most of the pipes will be installed adjacent to the existing water main on the 2.5 feet wide trail. Of the 6250 L.F. of pipes, approximately 4170 L.F. is exposed. The difference of 2080 L.F. is expected to be buried and will require the clearing of approximately $2080 \times 3 = 6240$ sq. ft. or 0.14 acres of area.
2. Excavation: The total amount of excavation is approximated at 355 cu. yds. Depth of excavation varies from 1 foot to 5 feet, depending on the terrain surrounding the buried portion of pipe. Trench excavation for an 8-inch pipe will typically be 24 inches wide.
3. Fill: Trench excavation material will be used for trench backfill. No other fill material will be required.
4. Grubbing: Within the cleared area, it is anticipated that grubbing will either be very limited or negligible. If grubbing is required, it will need to be done manually.
5. Stream Crossing: Stream crossings occur at the following locations and are indicated on the construction plans:

STREAM CROSSING	BEGIN STATION	END STATION	PIPE LENGTH	CONC. JACKET LENGTH
1	± 2+45	± 3+25	80 L.F.	50 L.F.
2	± 8+25	± 8+60	35 L.F.	30 L.F.
3	± 11+30	± 11+80	50 L.F.	45 L.F.
4	± 13+70	± 14+30	60 L.F.	35 L.F.
5	± 16+50	± 17+10	60 L.F.	45 L.F.
TOTALS			285 L.F.	205 L.F.

6. Special Order for Shorter Length Pipes: Special order for pipes of shorter length is possible, whereby the weight of the pipe will be approximately 240 lbs. for an 8 feet segment pipe as compared to 540 lbs. for a standard 18 feet length pipe. With a shorter length pipe, two construction laborers will be able to carry a pipe segment, thus greatly reducing the need for helicopter transport.
7. Stream Crossing Mechanical Equipment: Air compressor driven jack hammers with various attachment will most likely be used.

E. Best Management Practice for Segment "A"

Unless other construction techniques or methods are proposed, construction material and equipment for this project will be transported to the job site with helicopters.

Helicopters may be used for the following:

1. Transporting pipes and fittings and support blocks from the rendezvous area. Transporting of pipes could be done manually by construction workers provided shorter length pipes are special-ordered in lieu of standard length pipes.
2. Transporting and placing compressors at selected locations to power jack hammers for excavation.
3. Transporting construction materials from rendezvous area to point of construction.

4. Transporting and pouring ready-mix concrete from rendezvous area.
5. Transporting manhole frames and covers and other heavy materials such as new, steel portal door, etc.

Excavation and/or leveling-off for pipe supports will most likely be done by manual means. Excess material should be negligible since excavated material will be used to fill the low spots, prior to positioning pipe support blocks.

Although the stream flow is low, excavation and installation for the stream crossing is anticipated to be done as follows:

1. Excavation to commence during anticipated dry days.
2. Begin construction of a cofferdam for half of the stream cross section by laying sandbags to temporarily divert stream flow.
3. Once the initial diversion is established, begin excavating and place excavated material into bags to use in completing the cofferdam.
4. Begin installing pipe in excavated trench and prepare reinforcing steel for pouring of concrete for reinforced concrete pipe jacket.
5. Pour the concrete and allow three days for curing. After the third day, backfill trench with excavated material and place larger rocks at top portion of the trench.
6. Proceed with the remaining half of the stream crossing, by repeating steps 2. through 5. above.

Installation of the new 8 inch pipe will be done predominantly by manual methods. The pipes will be laid at grade, on concrete supports, adjacent to the existing 8-inch pipe.

Pressure testing of the pipe should be done in 2000 feet segments. Testing may occur in shorter segments if the contractor deems it necessary. Water for testing the top segment of the new line will come from the junction box at the water tunnel. Water for testing the other segments of the pipe will be supplied from the existing 8" pipe by providing a connection at the existing blow-off valves. This water for hydro-testing will be discharged into the stream.

After the entire length of new 8-inch water main is installed, it must be chlorinated in accordance with the disinfection standards of the Board of Water Supply.

Upon completion of the chlorination process, the chlorinated water shall be drained from the new 8" pipe main into mobile tankers. This chlorinated water shall be discharged into the City's sanitary sewerage system.

The only mitigative measure necessary to control stream discharge for this project will be to control the excavated material from the stream crossing operation by bagging it and using it for a cofferdam. Then, upon completion of the pipe installation with reinforced concrete jacket, the same excavated material can be reused for backfilling. Any excess excavated material can be hauled away by helicopter. Regular monitoring of the stream quality by the Board of Water Supply's Water Quality Section will be performed to monitor for the presence of pollutants discharged into the stream. The focus of the monitoring program shall be to detect pollutant levels that are elevated above baseline water quality data obtained prior to construction.

Once the new 8 inch main is placed in service and the old 8 inch line is severed from the system, the contractor will remove all construction material and equipment from the project site.

This project is expected to be undertaken without the use of any heavy equipment or machinery in order to preserve the natural flora of the area.

IV. SUMMARY OF MAJOR IMPACTS AND PROPOSED MITIGATION MEASURES

The proposed installation of the 8-inch water main will not have any significant long term adverse environmental impact in the project alignment site. The replacement pipeline will be installed in a parallel alignment to the existing pipeline and as such, will also be above ground. The terrain features will dictate to a great extent, the methodology to be used in the construction phase. Materials for construction will have to be brought in by hand, or by helicopter transport. The obvious cost factors between the two methods will bear heavily on the final selection and the periodic helicopter noise will also be a consideration. Typical pipe lengths will be 16' - 20' and a storage yard location will also be a factor that the Contractor of record will have to take into consideration. As described previously in earlier sections, the terrain features are such that installation will be difficult. The actual installation will not have significant adverse impacts since the placement of the new pipeline will be for the most part above ground. It is only at the stream crossings that minor and temporary disturbances can take place. At these intervals, portions of the stream will be temporarily blocked by cofferdams so trenching in the stream bed to place the pipe can be accomplished. After the pipe has been placed and backfilled, the stream will be revert back to normal flow. All work will be done during normal construction hours, i.e. 7:00 a.m. to 3:30 p.m. This will alleviate the potential noise intrusion if helicopter transport for the pipe is selected. For segment "B", the alignment is less restrictive and pipe placement can be done with mechanical means, i.e. trucks and cranes. The terrain however is of a more rocky and drier type, and could involve trenching equipment if placement is underground. This decision is still under review and will not be made until final drawings for the project are completed.

V. ALTERNATIVES CONSIDERED

Beyond the "Do-Nothing" alternative, the extremely deteriorated condition of the existing pipeline leaves little choice but to replace the 70 year old system. To "Do-Nothing" would result in continued and increasing loss of water to the BWS customers being served by this facility.

VI. FUNDING AND PHASING

This project is planned in two segments, alignment "A" and "B". The decision as to which alignment to begin with will rest with the BWS and the Contractor of record. The work will be done in one continuous phase and estimated costs are:

Segment "A": \$500,000.00
Segment "B": \$200,000.00

VII DETERMINATION, FINDINGS, AND REASONS SUPPORTING DETERMINATION

After completing an assessment of the potential environmental effects of the proposed project, and consulting with other governmental agencies, it has been determined that an Environmental Impact Statement (EIS) is not required. Therefore, this document constitutes a Notice of Negative Declaration.

Reasons supporting the Negative Declaration determination are as follows, using as the criteria, the policy, guideline, and portions of Chapters 342, 343, and 344 Hawaii Revised Statutes (HRS).

1. The proposed action will not adversely affect the physical and social environment. There will be minor disruptions to the ambient stream biota during temporary blocking and pipe placement, but these temporary interruptions will dissipate upon completion of the pipe placement.
2. There will be no permanent degradation of the ambient air or noise quality standards. In the event that helicopter transport is selected as the mode of material transport, there will be noise impacts, but these will take place during normal construction hours and will not be significant.
3. No residences or businesses will be displaced by this project. All work will take place within existing City land or new water main easements.
4. There are no known endangered plant species along the proposed alignment. Temporary intrusion by the project to the avifauna will be minor and at the completion of the project, the affected flora and fauna will revert back to their normal habits.
5. There are no known natural, historic, or archaeological sites within the proposed alignment. In the event that sites are uncovered, the Historic Sites Division, Department of Land and Natural Resources, State of Hawaii, will be notified to determine the value of the sites uncovered. All work will be halted until a determination is provided.
6. The project is compatible with the Development Plan Land Use Map and the Public Facilities map for Oahu.

7. There are no adverse secondary effects on future development, population, and public facilities.
8. The proposed project is considered essential to maintaining service to the customers on the existing BWS pipeline. Without the project, it is not impossible, that service would be halted.

This Notice of Negative Declaration shall serve to meet the requirements of Chapter 343, HRS.

VII. LIST OF AGENCIES CONSULTED DURING THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

ORGANIZATIONS AND AGENCIES		
AGENCY	AGENCY CONTACT	RESPONSE RECEIVED
FEDERAL		
U.S. Army Corps of Engineers		
U.S. Department of Agriculture, Soil Conservation Service		
U.S. Department of Interior, Fish & Wildlife Service	X	X
STATE OF HAWAII		
Department of Land and Natural Resources	X	X
Office of State Planning	X	X
Office of Hawaiian Affairs	X	X
Department of Health Environmental Management		
CITY AND COUNTY OF HONOLULU		
Department of Public Works	X	X
Department of Land Utilization	X	X
Department of General Planning	X	X
Department of Transportation Services		
Building Department		

IX. COPIES OF AGENCIES' CORRESPONDENCES

- A. Department of Land and Natural Resources, June 29, 1995.
- B. United States Department of the Interior, Fish & Wildlife Service, May 10, 1995.
- C. Department of Public Works, City and County of Honolulu, April 11, 1995.
- D. Department of Land Utilization, City and County of Honolulu, April 5, 1995.
- E. Planning Department, City and County of Honolulu, March 29, 1995.
- F. Office of State Planning, Office of the Governor, State of Hawaii, March 30, 1995.
- G. Office of Hawaiian Affairs, State of Hawaii, March 23, 1995.

BENJAMIN J. CAYETANO
Governor of Hawaii



Chairperson
MICHAEL D. WILSON
Board of Land and Natural Resources

Deputy Director
GILBERT COLOMA-AGARAN

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

REF:OCEA:ST

P. O. Box 621
Honolulu, Hawaii 96809

FILE NO.: OA-2755

Aquaculture Development
Aquatic Resources
Boating and Ocean Recreation
Bureau of Conveyances
Conservation and Environmental Affairs
Conservation and Resources Enforcement
Forestry and Wildlife
Historic Preservation
Land Management
State Parks
Water and Land Development

The Honorable Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96813

JUN 29 1995

Attn: Mr. James Yamauchi

Dear Mr. Sato:

Subject: Final Environmental Assessment for the Construction of
the New 8-inch Water Transmission Line from the Palolo
Water Tunnel to the Palolo Chlorinator at Waiomao Road,
Honolulu, TMK: 3-4-22: por. 1

The public comment deadline for the Draft Environmental Assessment (DEA) ended on May 8, 1995. Enclosed are the comments which we received on subject DEA which should have also been sent to you directly. Our own Department's comments on this project were as follows:

Division of Land Management

The Division of Land Management (DLM) finds that as the existing water transmission line was originally placed on portions of State-owned land in the Forest Reserve (Circa 1921), they can find no evidence of an easement granted to the Board of Water Supply (BWS) for pipeline purposes at the subject area. As such, BWS must apply for an easement from the State for the water line following the approval of the pending CDUP.

In addition, please be sure to incorporate the clearing, excavation, fill and grubbing information previously requested into the Final Environmental Assessment (FEA).

*added
section
p. 7*

Your responses to all comments made on the DEA, as well as any necessary revisions, should be incorporated into the FEA.

Please submit at least six (6) copies of the FEA as soon as possible. Four (4) copies of the FEA will be filed with the Office of Environmental Quality Control (OEQC) pursuant to Title 11, Chapter 200, Hawaii Administrative Rules.

Mr. R. Sato

- 2 -

File No.: OA-2755

Thank you for your cooperation on this matter. Please feel free to contact Steve Tagawa of our Office of Conservation and Environmental Affairs at 587-0377, should you have any questions.

Aloha,

Michael D. Wilson
MICHAEL D. WILSON

Enclosures

c: Peter Nakanishi, ParEn, Inc. (w/encl.)

ST:tes



Suite 300, Kawaiahao Plaza □ 567 South King Street, Honolulu, Hawaii 96813-3036 □ Telephone (808) 531-1676 □ FAX (808) 536-5996

ParEn, Inc. □ dba park engineering

August 7, 1995

Mr. Michael Wilson
Chairperson
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Attention: Steve Tagawa

Dear Mr. Wilson:

Subject: Final Environmental Assessment (EA) for the Construction of the
New 8-inch Water Transmission Line from the Palolo Water Tunnel to
the Palolo Chlorinator at Waiomao Road, Honolulu, TMK 3-4-22:
por. 1

Thank you for your comments on the Draft EA provided in your letter dated June 29, 1995. In response to the comment from your Division of Land Management, an easement map with descriptions has been prepared for the Board of Water Supply. This map along with the necessary easement documents will be filed with the State in the very near future.

If you have any additional questions or comments, please contact me at 531-1676.

Sincerely yours,

ParEn, Inc.
dba PARK ENGINEERING

for Peter Nakanishi
Project Manager

c: Steve Tagawa, DLNR - 6 copies



United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
500 ALA MOANA BLVD, SUITE 3-530
HONOLULU, HI 96813

tel:(808) 541-3441 fax:(808) 541-3470

IN REPLY REFER TO:

In Reply Refer To: AAP

MAY 10 1995

Mr. Michael D. Wilson
Director
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Re: Conservation District Use Application (CDUA) No. 0A-2755 for the Construction and Replacement of a Water Transmission Line, Palolo Valley, Oahu, Hawaii TMK: 3-4-22:1

Dear Mr. Wilson:

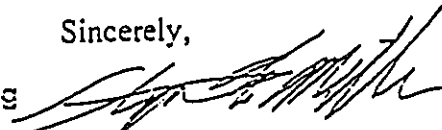
The U.S. Fish and Wildlife Service (Service) has reviewed the proposal to replace an existing 6-inch (15.2 - centimeter) cast iron water transmission main with a new 8-inch (20.3 - centimeter) ductile iron water line in Palolo Valley, Oahu, Hawaii. The applicant is the City and County of Honolulu Board of Water Supply. The proposed action will follow the existing alignment of the existing line, and a segment of the pipe will cross the Waiomao Stream at four locations. The pipe will be installed under the stream bed and be encased in concrete at those crossings. The Service offers the following comments for your consideration.

The draft Environmental Assessment (EA) for the proposed project provided limited information on the proposed methods of construction and the anticipated project-related impacts to water quality in the Waiomao Stream. Specific details regarding (a) the type of excavation equipment to be used, (b) the location and width of the access route needed to reach each of the stream crossings, and (c) the proposed mitigation measures to prevent or minimize the degradation of water quality in the stream during project excavation and backfilling are needed by the Service to assess project-related impacts to fish and wildlife. Therefore, we request that the above-mentioned information be provided to us for review, and we recommend that the results of our review be incorporated into the final EA.

MAY 15 8 43 AM '95

CDUA No. OA-2755
Water Transmission Line
Palolo Valley, Oahu, Hawaii

We appreciate the opportunity to provide these comments. If you have any questions regarding our comments, please do not hesitate to contact Fish and Wildlife Biologist Arlene Pangelinan at 808/541-3441.

Sincerely,
Acting 
Brooks Harper
Field Supervisor
Ecological Services

cc: Board of Water Supply



Suite 300, Kawaiahao Plaza □ 567 South King Street, Honolulu, Hawaii 96813-3036 □ Telephone (808) 531-1676 □ FAX (808) 536-5996

ParEn, Inc. □ dba park engineering

August 7, 1995

Brooks Harper, Field Supervisor
United States Department of the Interior
Fish and Wildlife Service
Pacific Islands Office
500 Ala Moana Blvd, Suite 3-580
Honolulu, Hawaii 96813

Attention: Arlene Pangelinan

Dear Mr. Harper:

Subject: Environmental Assessment (EA) for Construction of a Replacement 8-
inch Water Transmission Line, Palolo Valley, Oahu, Hawaii,
TMK 3-4-22

Thank you for providing comments on the Draft EA for the subject project. We have prepared the following responses to the questions listed in your May 10, 1995 letter.

- a) It is anticipated that much of the excavation work will be done manually or with jack hammers driven by air compressors.
- b) Access to the stream crossing locations will be by foot and/or by helicopter drop. The existing hiking trail will be used for much of the access route and a three feet wide trail may be cut to provide access in areas where there is no established trail.
- c) Construction methods at stream crossings will employ cofferdams to isolate a partial section of stream for installation of the pipe and concrete jacket while the remaining section passes the streamflow. The cofferdam will contain the construction activity and minimize the discharge of sediments and concrete into the stream during the excavation and backfilling processes.

If you have any additional questions or comments, please contact me at 531-1676.

Sincerely yours,

ParEn, Inc.
dba PARK ENGINEERING

Keith S. Nemura

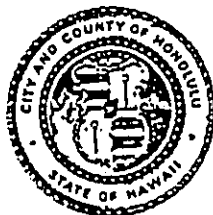
for Peter Nakanishi
Project Manager

c: Steve Tagawa, DLNR - 6 copies

ENGINEERS, SURVEYORS, PLANNERS

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



JEREMY HARRIS
MAYOR

KENNETH E. SPRAGUE
DIRECTOR AND CHIEF ENGINEER

IN REPLY REFER TO:

95-14-0179

April 11, 1995

ST

Mr. Michael D. Wilson
Chairperson
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

RECEIVED
DCEA

95 APR 19 AM 8:13

RECEIVED

Dear Mr. Wilson:

Subject: Your Letter of March 17, 1995, Relating to a Conservation District Use Application No. OA-2755 for the Construction of a Replacement 8-Inch Water Transmission Line, Palolo Valley. Tax Map Key: 3-4-22

We have reviewed the subject application and have the following comments:

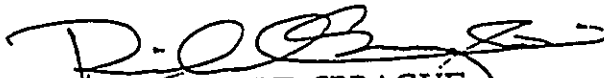
Page 6 of the EA implies only simple trenching and backfill required at stream crossings. However, plan and profile sheets show concrete jacketing (30 to 50 feet in length) at each of the five (5) stream crossings.

Request inclusion of the Best Management Practices (BMPs) to address wash water from concrete work, especially at stream crossings.

Request addition of typical sections for both above and underground installation of pipe.

Should there be any questions, please call Gerald Takayesu of our Division of Engineering at 527-6104.

Very truly yours,


KENNETH E. SPRAGUE
Director and Chief Engineer



Suite 300, Kawaiahao Plaza □ 567 South King Street, Honolulu, Hawaii 96813-3036 □ Telephone (808) 531-1676 □ FAX (808) 536-5996

ParEn, Inc. □ dba park engineering

August 7, 1995

Mr. Kenneth Sprague
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street, 15th Floor
Honolulu, Hawaii 96813

Attention: Gerald Takeyasu

Dear Mr. Sprague:

Subject: Environmental Assessment (EA) for Construction of a Replacement 8-
inch Water Transmission Line, Palolo Valley, Oahu, Hawaii
TMK 3-4-22

Thank you for your comments on the Draft EA provided in your letter dated April 11, 1995. In response to your concern regarding wash water from concrete work, we have enclosed a copy of the Best Management Practices (BMPs) which have been incorporated into the Final EA.

If you have any additional questions or comments, please contact me at 531-1676.

Sincerely yours,

ParEn, Inc.
dba PARK ENGINEERING

Keith S. Uemura

for Peter Nakanishi
Project Manager

Enclosure

c: Steve Tagawa, DLNR - 6 copies

BEST MANAGEMENT PRACTICE

Unless other construction techniques or methods can be thought of, construction of this project will most likely be done by use of helicopter.

Anticipated use of helicopter may or will be for the following:

- 1) transporting pipes and fittings and support blocks from rendezvous area
- 2) transporting and placing compressors at selected locations for use of jack hammers for excavation
- 3) transporting construction materials from rendezvous area to point of construction
- 4) transporting and pouring ready-mix concrete from rendezvous area
- 5) transporting manhole frames and covers and other heavy materials such as new portal steel door, etc.

Excavation or leveling-off for pipe supports which are to be laid on grade will be done most likely by manual means. Excavated material is negligible since same scraped-off material will be used for the low spots, prior to positioning pipe support blocks.

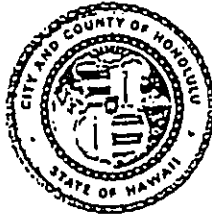
Although the stream flow is low, excavation and installation for the stream crossing is anticipated to be done as follows:

- 1) Excavation to commence mostly during anticipated dry days.
- 2) Construct temporary cofferdam for half of the stream. Begin with laying of sandbags to divert stream flow temporarily.
- 3) Complete cofferdam for half the stream with excavated material placed in bags to prevent from running off downstream.
- 4) Begin installing pipe in excavated trench and prepare form work for pouring of concrete for reinforced concrete pipe jacket.
- 5) After 3-days of setting time, backfill trench with excavated material and place larger rocks at top portion of the trench.
- 6) Then proceed with the remaining half of the stream crossing, repeating same procedure with the installation of sandbags and construction of a cofferdam, etc.

The predominant portion of the new 8-inch pipe installation work is anticipated to be done mostly manually. The pipes will be laid adjacent to the existing 8-inch pipe which will be laid on grade on concrete supports.

0002

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432



JEREMY HARRIS
MAYOR

PATRICK T. ONISHI
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

95-01533 (DT)

April 5, 1995

IS

The Honorable Michael D. Wilson, Director
Department of Land and
Natural Resources
State of Hawaii
Kalanimoku Building
1151 Punchbowl Street, Room 130
Honolulu, Hawaii 96813

DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

95 APR 7 P 1:37

RECEIVED

Dear Mr. Wilson:

Conservation District Use Application (CDUA)
Replace Water Transmission Line in Palolo, Oahu
Tax Map Key: 3-4-22: por. 1

This is in response to the above CDUA application (File No. OA-2755) to construct a new replacement 8-inch ductile iron water transmission line from the existing Palolo Water Tunnel to the Palolo Chlorinator at Kuahea Street. We have reviewed the application and note that the project is not within the Special Management Area. We have no further comments to offer at this time.

Very truly yours,

Patrick T. Onishi
PATRICK T. ONISHI
Director of Land Utilization

95 APR 10 PM 12:45

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PTO:am

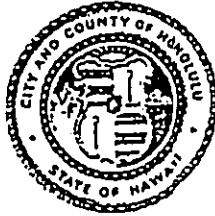
cc: City & County of Honolulu,
Board of Water Supply

g:OA-2755.djt

DINR
OCEA

PLANNING DEPARTMENT
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



JEREMY HARRIS
MAYOR

CHERYL D. SOON
CHIEF PLANNING OFFICER
CAROLL TAKAHASHI
DEPUTY CHIEF PLANNING OFFICER

RH 3/95-0542

March 29, 1995

Honorable Michael D. Wilson, Chairperson
Board of Land and Natural Resources
Department of Land Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

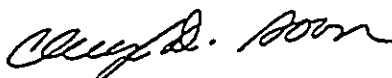
Dear Mr. Wilson:

Conservation District Use Application (CDUA)
No. OA-2755: Construction of a Replacement 8-Inch
Water Transmission Line, Palolo, Oahu, TMK: 3-4-22

We appreciate the opportunity to review the subject Conservation District Use Application and have no comments.

Should you have any questions, please contact Randolph Hara at 523-4483.

Sincerely,


CHERYL D. SOON
Chief Planning Officer

CDS:lh

ST

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

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95 APR

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

4 PM 1: 02

RECEIVED



OFFICE OF STATE PLANNING

Office of the Governor

MAILING ADDRESS: P.O. BOX 3540, HONOLULU, HAWAII 96811-3540
STREET ADDRESS: 250 SOUTH HOTEL STREET, 4TH FLOOR
TELEPHONE: (808) 587-2848, 587-2800

Benjamin J. Cayetano, Governor

FAX: Director's Office 587-2848
Planning Division 587-2824

RECEIVED

'95 APR 5 AM 11:22

Ref. No. C-1118

DINR
OCEA

March 30, 1995

DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

95 APR 3 12:20

RECEIVED

MEMORANDUM

TO: The Honorable Michael D. Wilson, Chairperson
Department of Land and Natural Resources

FROM: Gregory G.Y. Pai, Ph.D. *Gregory G.Y. Pai*
Director

SUBJECT: Conservation District Use Application for Replacement
of an 8-inch Water Transmission Line Between the Palolo
Chlorinator and the Palolo Water Tunnel and from Kuahea Street
to Wilhelmina Rise 811 Storage Reservoir, File No. OA-2755

We have reviewed the proposed Conservation District Use Application for the replacement of an 8-inch water transmission line between the Palolo chlorinator and the Palolo water tunnel, and from Kuahea Street to Wilhelmina Rise 811 storage reservoir and do not have any comments at this time.

We appreciate the opportunity to review the application.

KEY

RECEIVED
'95 MAR 23 PM 3:22

DLNR
OCEA



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

DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

95 MAR 28 P 2:08

RECEIVED

March 23, 1995

Mr. Michael D. Wilson
Dept. of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Wilson:

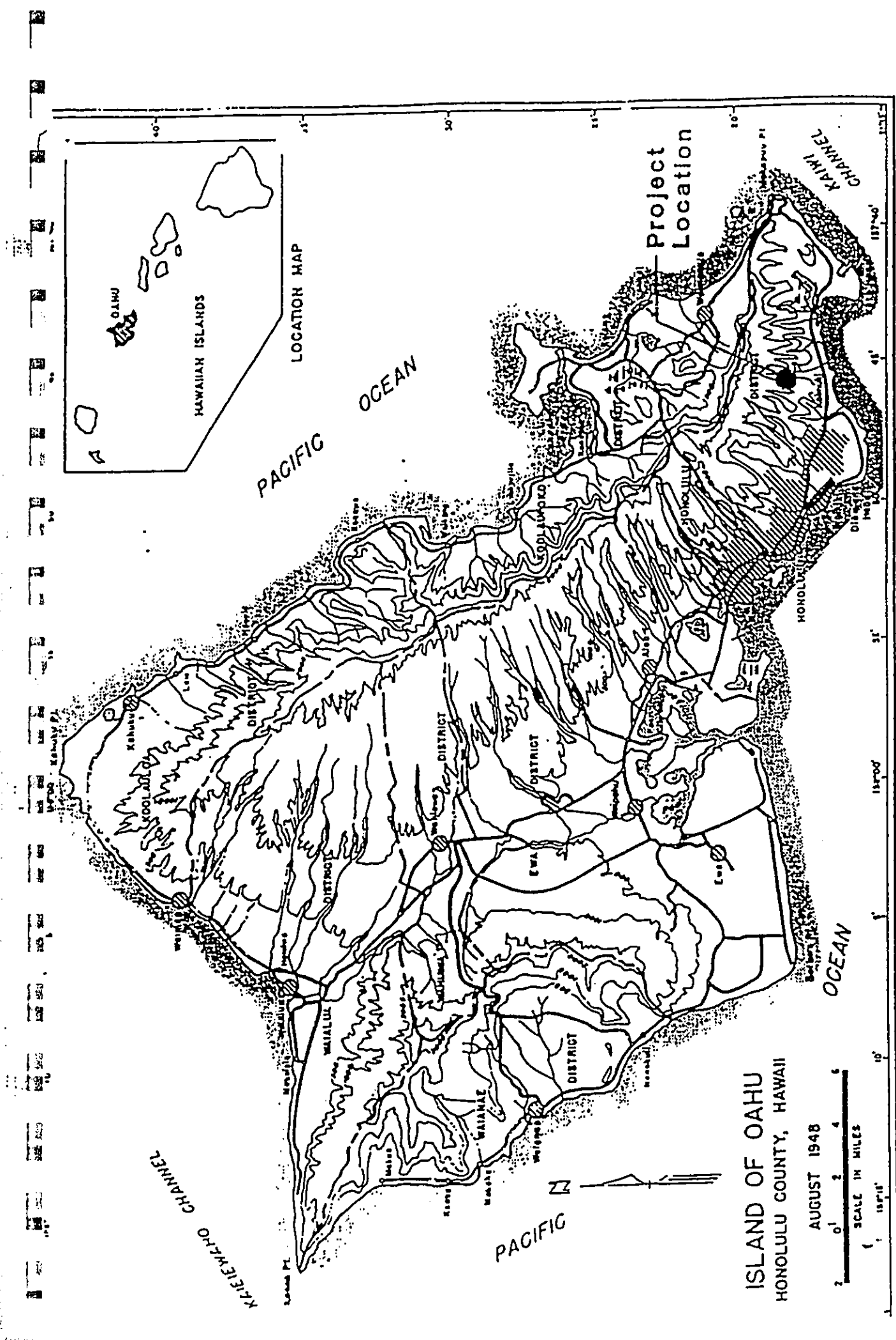
Thank you for the opportunity to review the Conservation District Use Application and the Environmental Assessment (EA) for the proposed construction of a replacement 8-inch water transmission line between the Palolo Chlorinator and the Palolo Water Tunnel, Palolo Valley, Island of Oahu.

We find the application and supporting documentation sufficient and have no objections to the proposed development. Please contact me or Linda Delaney, Land and Natural Resources Division Officer, at 594-1938, should you have any questions on this matter.

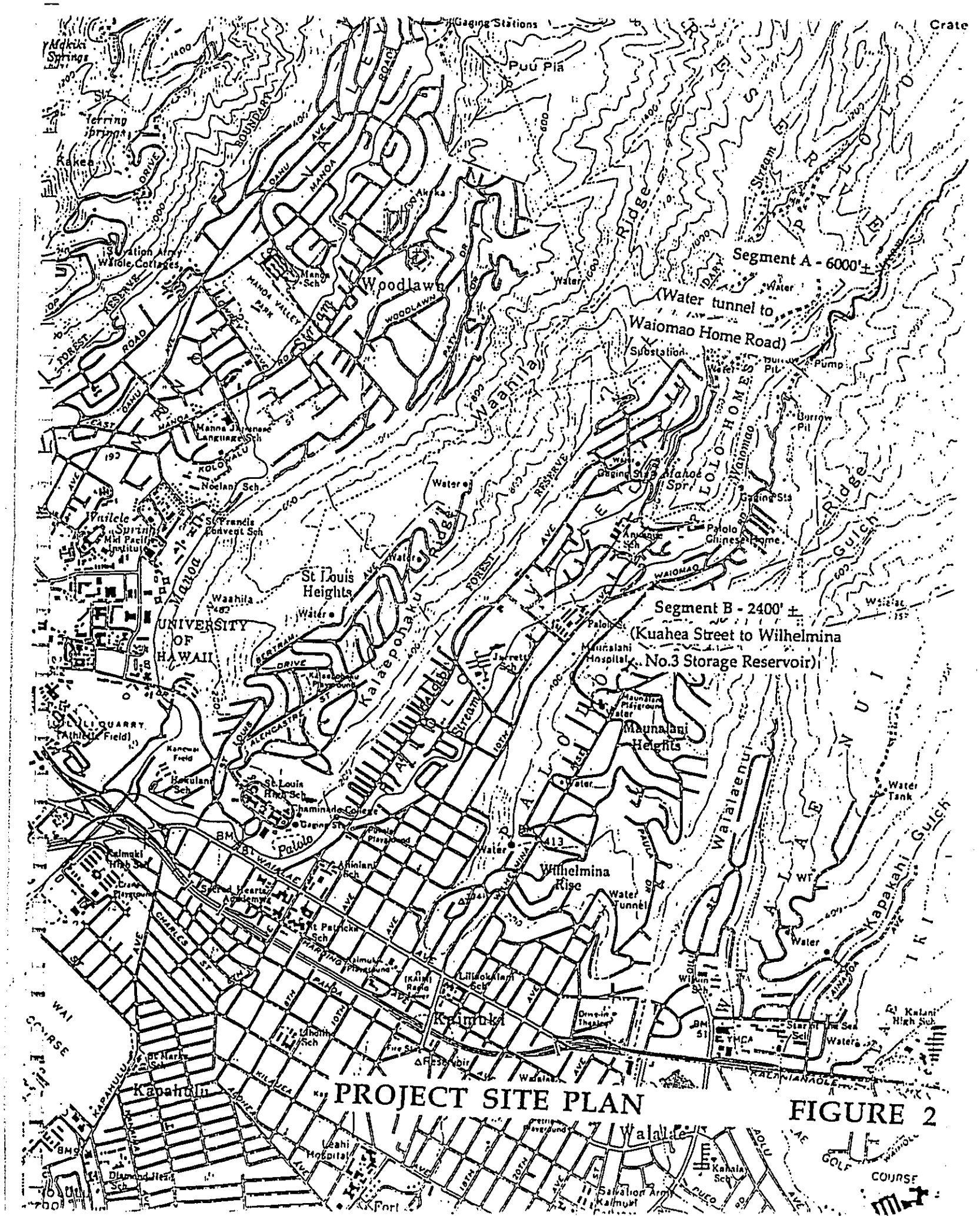
Sincerely yours,

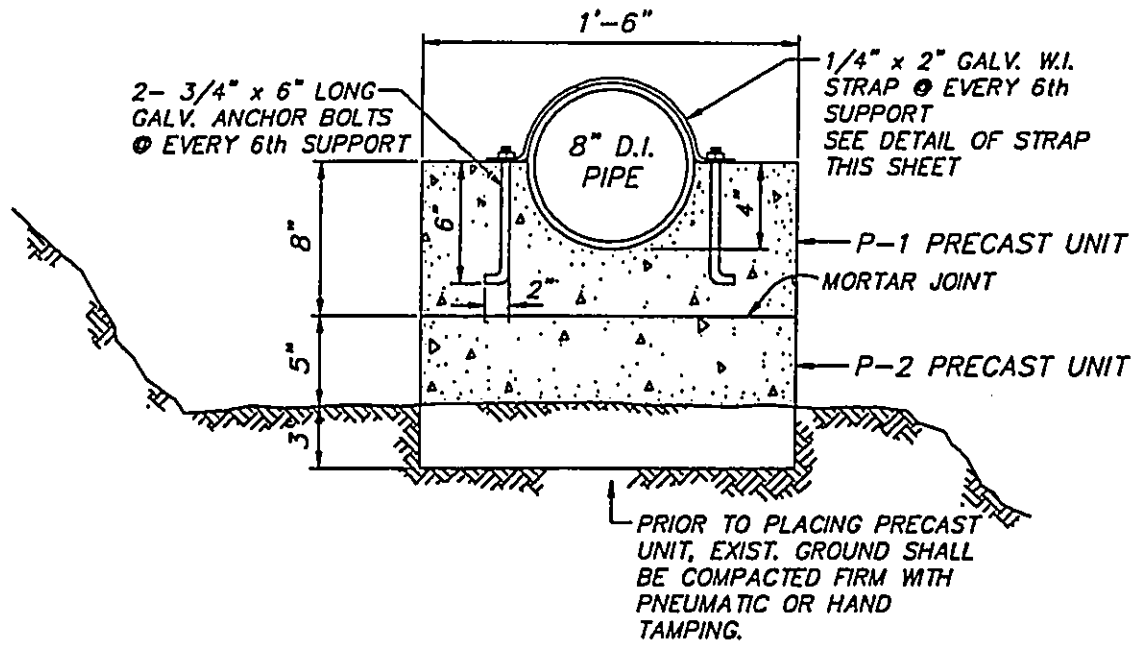
Dante K. Carpenter
Administrator

LM:lm
cc BOT



PROJECT LOCATION MAP FIGURE 1

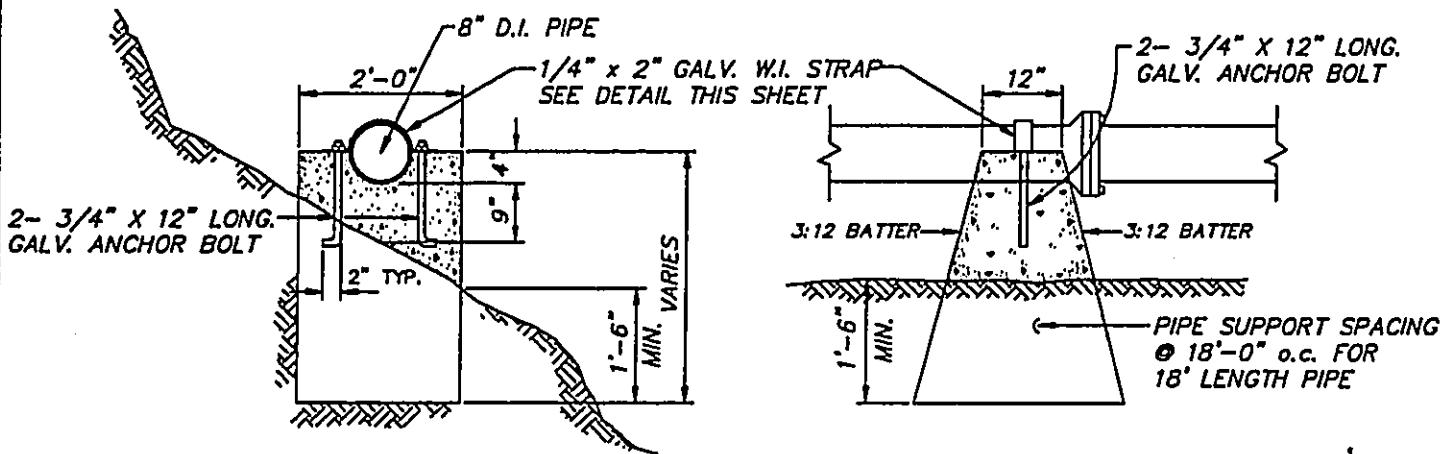




ELEVATION
NOT TO SCALE

TYPICAL TYPE "A" PRECAST CONCRETE PIPE SUPPORT
"FOR NEAR LEVEL AREAS"

NOT TO SCALE



FRONT ELEVATION
NOT TO SCALE

SIDE ELEVATION
NOT TO SCALE

TYPICAL TYPE "B" CONCRETE PIPE SUPPORT
"FOR PIPES INSTALLED ON SLOPES - PARALLEL"

NOT TO SCALE

PIPESUPP 07/06/95 KSU



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

INSTALLATION OF 8-INCH WATER MAIN
FROM PALOLO CHLORINATOR TO PALOLO TUNNEL
HONOLULU, OAHU, HAWAII

TYPICAL PIPE SUPPORT DETAIL



Park Engineering, Inc.
Engineers, Surveyors, Planners

Figure 3

ASC92-6

ARCHAEOLOGICAL INVENTORY SURVEY
OF SEGMENTS A AND B CORRIDORS
FOR THE PROPOSED
PALOLO WATERLINE REPLACEMENT PROJECT
PALOLO, KONA, O'AHU

by

Aki Sinoto

and

Jeffrey Pantaleo, M.A.

June 1992

for

Environmental Communications, Inc.
1146 Fort Street Mall, Suite 200
Honolulu, Hawai'i 96813

Aki Sinoto Consulting
2333 Kapiolani Blvd. #2704
Honolulu, Hawai'i 96826

EXHIBIT A

INTRODUCTION

At the request of Environmental Communications, Inc., Aki Sinoto Consulting conducted an archaeological inventory survey of two segments of the proposed Palolo Waterline Replacement Project. The project area is located in Palolo Valley, Palolo *ahupua'a*, Kona District, O'ahu Island. The existing waterlines in the two segments are slated to be replaced by new lines roughly paralleling the old alignment within a fifteen foot-wide corridor. The survey was conducted by the two authors of this report between Tuesday, 31 March 1992 and Thursday, 2 April 1992. A 1"=100' scale topographic map of the Segment A corridor completed in January 1992 was provided by Engineers Surveyors Hawaii, Inc.

PROJECT AREA

The project area is comprised of two separate linear segments, primarily located in Palolo Valley with a short segment on Mau'umae Ridge to the southeast, in the *ahupua'a* of Palolo, District of Kona, in leeward O'ahu Island (Fig. 1). The *mauka* portion, Segment A, measuring c. 6000 feet runs from the Waiomao Stream Water Tunnel located at the 1000 foot elevation to Waiomao Home Road at 600 feet and is in a portion of the Honolulu Watershed/Forest Reserve. All of Segment A is in TMK 3-4-22:1. The *makai* portion, Segment B, measuring c. 2400 feet is located between Kuahea Street at the 400 foot elevation of Palolo Valley and the Wilhelmina No.3 Storage Reservoir at 800 feet on Mau'umae Ridge. Segment B runs through portions of the following 32 parcels:

3-3-29: 3 and 7;
3-3-37: 2 - 15, 18-20, 22, 24, and 25-27;
3-4-14: 4, 12, 14, and 19;
3-4-15: 12 and 17; and
3-4-30: 16 and 56.

ENVIRONMENT

Segment A runs along the steep sides of the narrow Waiomao Stream valley, a fairly typical, small, leeward valley formed by the eastern tributary of Palolo Stream. Excluding a few short sections that cross the stream, the existing pipeline runs along a man-made corridor, a 3-4 foot wide trail. The soils of the area include Kawaihapai stony clay loam, a well-drained soil derived from igneous rock in humid uplands; Lolekaa silty clay, a well-drained soil developed in old gravelly colluvium and alluvium; and rockland, made-up of areas of shallow soils where exposed rock covers 25 to 90% of the surface.

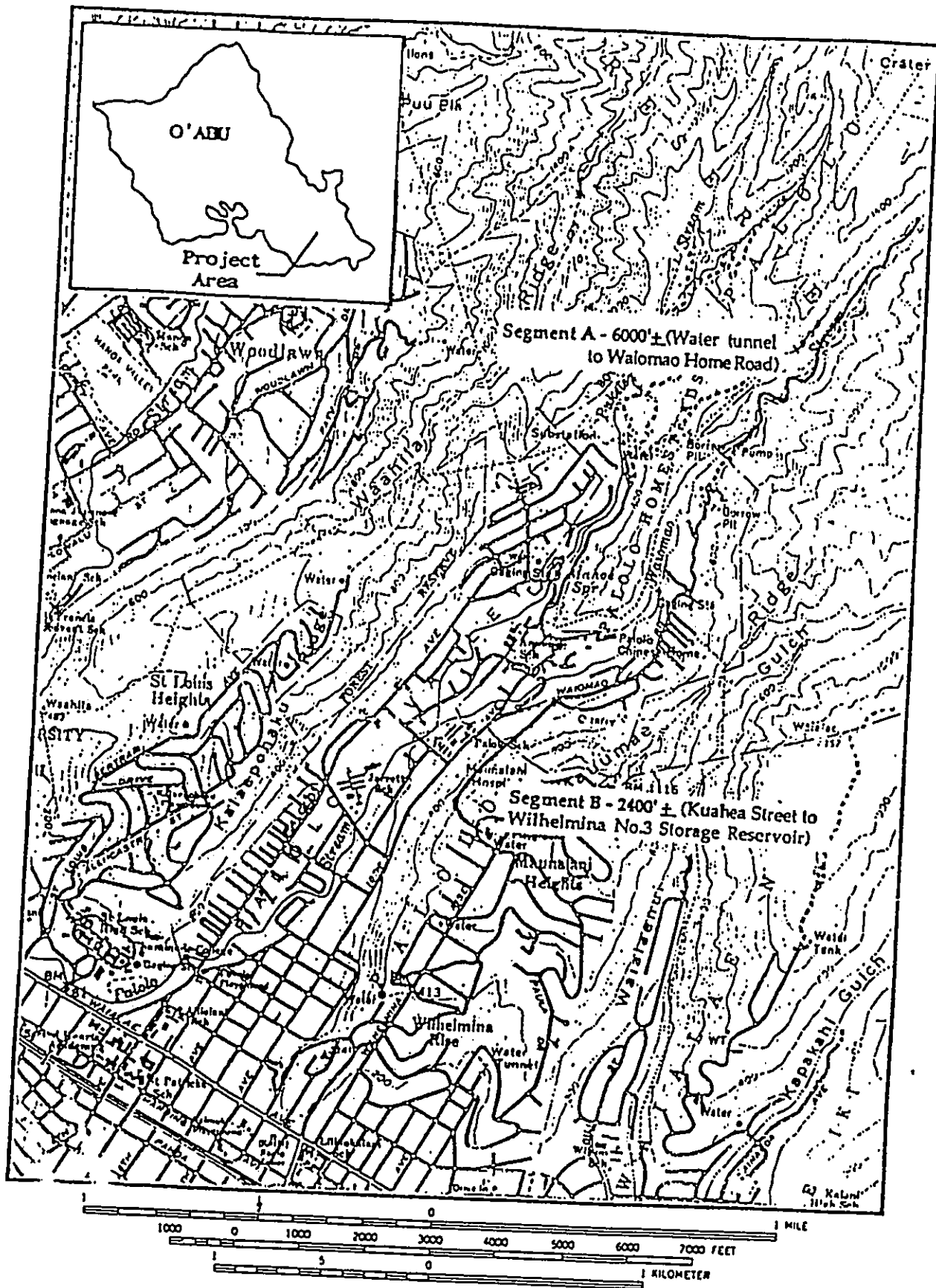


Figure 1. Location of Project Area Showing Segments A and B

Rainfall ranges from 50 to 90 inches annually depending on the elevation. Vegetation consists of ferns and shrubs in the understory with banyan (*Ficus* sp.), mango (*Mangifera indica*), kukui (*Aleurites moluccana*), and eucalyptus (*Eucalyptus* sp.) as high cover.

Segment B runs along the steep northwestern face of Mau'umae Ridge. Aside from a few sections of elevated pipeline supported by cement footings, the pipe runs on or under the ground surface. This segment is located almost entirely on rockland. Annual rainfall ranges from 30 to 40 inches. Notable vegetation consists of Christmas-berry (*Schinus terebinthifolius*), guava (*Psidium guajava*), a few stands of sisal (*Agave sisalana*), and various exotics encroaching from the homes at the upper sections of this segment.

Being located in a watershed area and on a steep ridge-side, no current usage was evident in either segment.

PAST LAND USE

The project corridors do not pass through portions of any L.C.A.'s, although portions of 4 grants are crossed. The *makai* sections of Segment A pass through portions of Grants 5259 and 5487 while Segment B crosses portions of Grants 5690 and 6349. No historical significance is attributable to any of these Grants which were all conveyed during the early 20th century.

A description given by Handy in the *Hawaiian Planter*, states:

Palolo Valley has extensive areas of low terraces throughout its lower portion on the land now covered by houses and golf links, running along both sides of Palolo Stream. Above the junction of Waiomao and Pukele Streams, which form Palolo Stream, there are many high terraces on the hillside to inland, and there were a few terraces on the outer sides of the streams. Some of the upper terraces between the streams are now under cultivation by a Hawaiian planter. Farther up the valleys of Waiomao and Pukele Streams there are a few terraces, and wild taro is said to grow abundantly in the upper reaches (Handy 1940:74).

The area described by Handy is considerably *makai* of the project area closer to the confluence of Waiomao and Pukele Streams.

PREVIOUS ARCHAEOLOGY

No archaeological surveys have taken place in the vicinity of the project area and no previously recorded sites occur in the area. A search of the Historic Preservation Division library at the State Department of Land and Natural Resources determined that only three archaeological studies have been undertaken for the whole of Palolo Valley.

Sites of Oahu, lists two heiau, both named "Maumae" (sic), in Palolo. One reported by Thrum was "a medium-sized heiau of pookanaka class, credited to the line of Olopana. Foundations only remain." The other reference attributed to Fornander indicates that "Maumae (sic) was also the name of a heiau that stood on the right hand, or southern, side of Palolo hill at entrance of the valley." (Sterling and Summers 1978:276-277)

Two surveys by Archaeological Consultants of Hawaii investigated parcels in the western side of the valley. Only one significant site, a previously recorded burial cave, was reported.

The other report was a class paper written for an University of Hawaii Anthropology 460E course by Lisa Nagaoka. This report consisted of cursory descriptions and comparisons of agricultural systems in Palolo, Wai'alaie, and Wailupe based on data obtained from testimonies for Land Court Awards. The section devoted to Palolo indicates, for the historic period, that taro lo'i was the most prevalent form of agriculture with comparatively only a few *kula* lots. Most of the cultivation took place near and *makai* of the Pukele and Waiomao Stream confluence. A very small number of claims occurred on the lower portions of Waiomao Stream.

SITE EXPECTABILITY

Much of Palolo Valley, as with most of the currently inhabited neighboring leeward valleys, was developed before archaeological surveys were done. The early archaeological survey by McAllister concentrated more along the coastal areas. Thus, very little data exists from which inferences can be drawn regarding traditional Hawaiian land use and settlement patterns. This is especially true of the more inland areas such as the Segment A study area. However, based on site distribution patterns from other leeward valleys, some generalized inferences can be made for the current study area.

Agricultural terrace systems normally occupy areas along the sides of streams when the banks or valley sides are not too narrow or steep. Plateau areas often exhibit dryland agricultural features. Heiau and other prominent structural features are often present on dividing ridges between valleys. Also in areas of rockland, caves and overhang shelters that function as habitation or burial sites are often present in rock outcrops and vertical exposures of bedrock.

SURVEY RESULTS

No archaeological surface remains or other evidence of any significant cultural activities were encountered during the the walk-through survey in Segments A and B. Based upon the limited area of the study corridors, the absence of any cultural remains, and the steepness of the topography; subsurface testing was deemed unnecessary.

DISCUSSION

The survey corridors for Segments A and B of the Palolo Waterline Replacement Project both occur in areas of low potential for archaeological remains. Segment A, located in the wet, upper reaches of a narrow stream valley, runs along the steep valley sides where sites, other than natural features such as caves and overhang shelters, normally do not occur. Segment B runs along an even steeper valley side on exposed bedrock and outcrops, again where only natural features occur. The only areas with potential for archaeological remains, at the base of the steep valley side and at the top of the ridge, have been extensively altered over the past eighty years for residential development.

RECOMMENDATIONS

In view of the negative results of the survey, the topographic location of the Segments A and B corridors, and the alignment of the replacement pipeline closely paralleling the existing line; no further archaeological work is recommended prior to commencement of the pipeline replacement activities. With the replacement project planned for minimal ground surface alteration during installation of the new pipeline through such measures as sections of pipe being transported by helicopter and above-ground installation of pipeline, archaeological monitoring also appears to be unnecessary.

If a stockpile area or helipad is needed in the lower Waiomao Home Road area, a surface survey should be conducted prior to construction.

Should any unanticipated discoveries be made during construction, any activities in the immediate area should be immediately halted to avoid further disturbance to the find, and Dr. Thomas Dye, staff archaeologist in charge of O'ahu Island for the Historic Preservation Division, State Department of Land and Natural Resources, should be contacted at 587-0014.

REFERENCES

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1973 Atlas of Hawaii; The University Press of Hawaii; Honolulu.
- Foote, Donald E. et al.
1972 Soil Survey of Islands of Kauai, Oahu, Molokai, and Lanai, State of Hawaii; U.S. Dept. of Agriculture; Soil Conservation Service; U.S. Government Printing Office; Washington, D.C.
- Kennedy, Joseph
1984 An Archaeological Walk-through Reconnaissance in Palolo Valley; Archaeological Consultants of Hawaii, Inc.; Ms. Report.
1987 Archaeological Investigations at TMK 3-4-09:1, 3-4-11:135; Archaeological Consultants of Hawaii, Inc.; Letter Report.
- Nagaoka, Lisa
1985 The Agriculture of Palolo, Waialae, and Wailupe; University of Hawaii at Manoa, Dept. of Anthropology; Anthro 460E class paper.
- Neal, Marie C.
1965 In Gardens of Hawaii; Bernice P. Bishop Museum Special Publication 50; Bishop Museum Press; Honolulu.
- State Bureau of Conveyances
Grant 5259, Liber 334, p. 19.
Grant 5487, Liber 355, p. 72.
Grant 5690, Liber 383, p. 159.
Grant 6349, Liber 435, p. 202.