EXECUTIVE CHAMBERS

HONOLULU

BENJAMIN J. CAYETANO
GOVERNOR

May 9, 1997

TO: The Honorable James J. Nakatani, Chairperson
Board of Agriculture

SUBJECT: Acceptance of the Final Environmental Impact Statement for the Upcountry Maui Watershed

With this memorandum, I accept the Final Environmental Impact Statement for Upcountry Maui Watershed as satisfactory fulfillment of the requirements of Chapter 343, Hawaii Revised Statutes. The economic, social and environmental impacts which will likely occur should this project be implemented are adequately described in the statement. The analysis, together with the comments made by reviewers, provides useful information to policy makers and the public.

My acceptance of the statement is an affirmation of the adequacy of that statement under the applicable laws but does not constitute an endorsement of the proposed action.

I find that the mitigation measures proposed in the environmental impact statement will minimize the negative impacts of the project. Therefore, if this project is implemented, the Department of Agriculture and/or its agents should perform these or alternative and at least equally effective mitigation measures at the discretion of the permitting agencies. The mitigation measures identified in the environmental impact statement are listed in the attached document.

Benjamin J. Cayetano

BENJAMIN J. CAYETANO

Attachment

c: Lawrence Miike
✓Office of Environmental Quality Control

1997-02-MA-FEIS - UPCOUNTRY MAUI WATERSHED PLAN

USDA

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

Honolulu,
Hawaii

March 1997

Final
WATERSHED PLAN -
Environmental Impact Statement

Upcountry Maui Watershed
Maui County, Hawaii

ADDENDUM (12/18/95)
Draft Upcountry Maui Watershed Plan-
Environmental Impact Statement
December 1995

SECTION 6.3 CONSULTATIONS

The 1989 project notification and request for information was mailed to:

Federal

Agicultural Stabilization and Conservation Service
Farmers Home Administration
U.S. Forest Service
U.S. Fish and Wildlife Service
Environmental Protection Agency
U.S. Army Corps of Engineers
Senator Daniel K. Inouye
Senator Spark M. Matsunaga
Representative Daniel K. Akaka
Representative Patricia Saiki

State

Office of State Planning
Office of Environmental Quality Control
Department of Land and Natural Resources
DLNR Division of Parks and Historic Sites
DLNR Division of Forestry and Wildlife
Department of Business and Economic Development
Department of Hawaiian Home Lands
Department of Transportation
Department of Agriculture
University of Hawaii, College of Tropical Agriculture
State House of Representatives
State Senate

County of Maui

Mayor County of Maui
Maui County Council
Department of Public Works
Department of Economic Development

Others

Audubon Society
Bishop Museum and Planetarium
The Nature Conservancy
Hawaii Botanical Society
Hawaiian Historical Society
Wildlife Society
American Association of University Women
League of Women Voters

Hawaii's Thousand Friends
Conservation Council of Hawaii
Sierra Club
Alu Like
Tri-Isle RC&D Steering Committee

The agencies and organizations contacted through correspondence in May 1993 as part of the NEPA scoping process and the state Pre-Assessment Consultation process were:

Federal

Agricultural Stabilization and Conservation Service
Farmers Home Administration
U.S. Forest Service
U.S. Army Corps of Engineers
National Oceanic and Atmospheric Administration
Department of Health and Human Services
U.S. Environmental Protection Agency
Department of the Interior
U.S. Fish and Wildlife Service
U.S. Geological Survey
National Park Service
Department of Housing and Urban Development
U.S. Coast Guard
U.S. Department of Agriculture
Senator Daniel K. Inouye
Senator Daniel K. Akaka
Representative Patsy T. Mink

State

Office of Environmental Quality Control
Department of Health
Department of Health, Environmental Planning Office
Department of Health, Clean Water Branch
Department of Agriculture
State Historic Preservation Officer
Department of Land and Natural Resources
DLNR Division of Parks and Historic Sites
DLNR Division of Forestry and Wildlife
DLNR Division of Water and Land Development
DLNR Division of Aquatic Resources
Commission on Water REsources Management
Office of State Planning
Department of Business and Economic Development
Department of Transportation

County of Maui

Office of the Mayor
Maui County Council
Department of Economic Development
Department of Public Works

Department of Parks and Recreation
Department of Planning
Department of Fire Control

Others

Conservation Council of Hawaii
Hawaiian Historical Society
The Outdoor Circle
Life of the Land
Maui Historical Society
The Nature Conservancy
Sierra Club
Natural Resources Defense Council
National Wildlife Federation
National Audubon Society

SECTION 6.4 EIS REVIEW

The following agencies, organizations, and individuals were also mailed the EIS for review:

Federal

United States Army Support Command Hawaii
United States Naval Base Pearl Harbor
Senator Daniel K. Inouye
Senator Daniel K. Akaka
Representative Patsy T. Mink

State

DBEDT State Energy Office
DBEDT Library
Housing Finance and Development Corporation
State Archives
Water Resources Research Center
Environmental Center
Office of Hawaiian Affairs
Legislative Reference Bureau

County of Maui

Office of the Mayor
County Council
Department of Public Works
Department of Planning
Department of Fire Control

Others

National Wildlife Federation
Hawaiian Historical Society

The Outdoor Circle
Life of the Land
Maui Historical Society
Hawaiian Electric Company
American Lung Association
Mary Evanson
Elaine Wender
David Nobriga
Honolulu Advertiser
Honolulu Star Bulletin
Sun Press
Maui News
University of Hawaii Hamilton Library
Maui Community College Library
Kaimuki Regional Library
Kaneohe Regional Library
Pearl City Regional Library
Hilo Regional Library
Kauai Regional Library
Wailuku Regional Library
Kahului Library
Lahaina Library
Makawao Library

APPENDIX F - COMMENTS ON THE EIS PREPARATION NOTICE

One letter was received during the EIS Preparation Notice review from Maui Tomorrow. The letter is attached. Responses to the five areas of concern raised by Maui Tomorrow are discussed below with a pre-EIS perspective.

I. Stream Resources

The range of alternatives evaluated during plan formulation included modification and expansion of the collection system on the Waikamoi, Puohokamoa, Haipuaena, and other area streams to increase water supply. Consultation with the Commission on Water Resources Management, Division of Aquatic Resources, and other agencies and groups with responsibility or interest in stream resources indicated that avoidance of impacts to the streams was a high priority. Data will be collected to assess aquatic habitat in the subject streams.

II. Threatened or Endangered Species

Assessments will be conducted to evaluate the proposed projects impacts to threatened and endangered species.

III. Long Term Impacts

Possible long term impacts resulting from the range of alternatives to be evaluated were identified by reviewers during the scoping and pre-assessment consultation periods and listed in Section 5.2 of the Environmental Assessment. Avoidance of the impacts through plan selection would be the initial and primary mitigation strategy.

IV. Undesired Urban Growth and Development

The concern that a project to increase water supply in the Upper Kula could foster population growth and undesired urban growth was expressed during the scoping process. Alternative plans can be formulated to keep static domestic water supply while increasing untreated water supply for agricultural users. Ultimately, control of urban growth and development should be managed through land use planning and zoning rather than water resource rationing.

V. Hawaiian Home Lands

The project planners will be consulting with the Department of Hawaiian Home Lands to develop features of the project to expressly assist farmers in the Keokea Hawaiian Home Lands lots.

Maui Tomorrow
P.O. Box 1497
Wailuku, Maui, Hawaii 96793
phone & fax: (808) 877-2462

February 7, 1994

Governor, State of Hawai'i
c/o OEQC
220 S. King St., Ste. 400
Honolulu, HI 96813

Re: EIS Preparation Notice for
Proposed Upcountry Maui Watershed Project

Maui Tomorrow, representing hundreds of citizens concerned about ecologically and economically sound community planning in Maui County, has determined that several issues ought to be thoroughly addressed in the Environmental Impact Statement for this project.

I. Stream Resources. The Hawai'i Stream Assessment (HSA) of 1993 evaluates streams by four primary resource criteria -- aquatic, riparian, cultural, and recreational. The HSA lists several Maui streams that are within the project area, and admits to lack of information and lack of study of other streams that also are within the project area. In fact, various data is lacking in respect to some or all criteria for all affected streams.

The most notably affected large streams are the Waikamoi, Puohokamoa, and Haipua'ena, which feed a few smaller streams that are also listed in the HSA. At this juncture of water resource demand, development, inventory, and conservation/preservation, any agency proposing or accepting plans for a project of this scope, ought first commit to complete baseline studies of affected watersheds, including perennial and intermittent streams.

The State Commission on Water Resource Management has stated that it is their hope that the HSA "...will help policy-makers, resource managers, developers, scientists, and concerned citizens... understand stream resources... and work further to protect Hawai'i streams." The commission admits that the 1993 HSA is only the first step in inventorying stream resources, and recommends that citizens petition public agencies for stream protection.

Given that the Commission is only beginning to prepare a stream management plan, to "provide future direction for stream protection in the State of Hawai'i," other state agencies are beholden to support those efforts by providing as information about stream resources, information based on accurate and thorough studies.

It is our view that the proposing agency/applicant for the Upcountry Maui Watershed Project (UMWP), the Agricultural Resource Management Division of the State Department of Agriculture, with the aide of the Soil Conservation Service of the U.S. Dept. of Agriculture, would best support the goals of the Commission, and State policy on water resources, by engaging in detailed studies of the affected water resources. These studies ought to be part of the EIS process, as such complete information if necessary for an adequate and thorough environmental impact study. Detail should include reliable information for each affected stream using the four CWRM criteria.

II. Threatened or Endangered Species. According to maps provided in the applicant's Environmental Assessment, the project area overlaps area that are identified as having both medium and high-to-very-high concentrations of threatened or endangered species

Given that the State of Hawai'i is beset with the problem of the highest rate of species extinction in the nation, the actions proposed in this project ought not exacerbate or risk exacerbation of that problem. Areas of highest risk ought to be eliminated from the project scope. These areas would include:

- 1) rare habitats (where such species are identified as found only in that site, and nowhere else),
- 2) habitats of species particularly sensitive to the type of disruptions proposed in the project plan;
- 3) fragile habitats for which information is uncertain regarding the likely recovery chances subsequent to project impacts, including geological disruption, stream flow disruptions -- both volume and quality, and watershed purity; and,
- 4) habitats vulnerable to, and not currently extensively affected by, invasion of non-native plant and animal species.

Specialists in threatened and endangered species, from federal, state, county, private, and public interest agencies ought to be consulted for guidance in identifying and eliminating from project plans, the foregoing areas

In the remaining areas, of medium risk, mitigation measures ought to be of the highest practicable design and implementation.

III. Long Term Impacts (as identified by the applicant in the Environmental Assessment)

Detailed planning should be included in the EIS describing how the long term effects listed in 5.2 (page 7) of the Environmental Assessment (EA) will be prevented. Where prevention of an impact can be shown (evidenced) to be impracticable mitigation measures utilizing the appropriate highest available human and technological resources should be included in the plan for project implementation.

To address these issues in the EIS will require resolution of the conflict between section 5.2 and section 6 on page 7 of the EA. Admission of long term negative impacts signifies responsibility for mitigation measures

IV. Undesired Urban Growth and Development. The applicant's Environmental Assessment states that "... water improvements may spark undesired urban growth and development," going so far as to identify this as a long term impact.

Yet, the applicant states, "The purpose of the UMWP is to provide agricultural water management and increased agricultural water supply to the region...". Nowhere does it state that the purpose is to increase water supply for undesired urban growth and development.

As the applicant has identified this potential as an impact and not a purpose, the applicant is beholden to propose and plan measures that will prevent, where possible, and otherwise mitigate, this impact. The applicant must propose an alternative that does not instigate the impact of such urban growth and development.

In fact, if the applicant is committed to the purpose of providing agricultural water management and increased agricultural water supply, it must have an eye to the fact of competition for water and land resources between agricultural and urban interests. As water supply grows in the upcountry region serviced by the proposed project, pressure will build for urban development, in the form of urban, residential, and commercial projects. This pressure will come from influential development interests, against which Maui's small-scale agricultural entities cannot compete. The subsequent loss of important agricultural land in one of the State's best growing areas would be a tragic epilogue to the proposed UMWP, if the applicant does not detail a plan for implementation of prevention and mitigation measures.

Having admitted the impact, the applicant must accept responsibility for its mitigation. Alternatives should be researched and proposed which would fulfill the project purpose as described to the accepting authority, and which would also limit the negative impacts. The proposed single line alternative may be the answer to these conditions. Resources devoted to promoting and providing conservation and conversion (drip irrigation), would be effective components of an appropriate alternative plan. This is especially relevant considering that part of the project area encompasses lands which the State classifes as Conservation District.

V. Hawaiian Homelands. And finally, the area affected by the proposed project includes a section of Department of Hawaiian Homelands (DHH) planned for agricultural and residential development. The UMWP EIS ought to include detailed plans for protecting Native water rights, including access, supply, and distribution. The applicant must work with the DHH, the Native Hawaiian Advisory Council, and other Native organizations to effectively identify and address those rights.

Maui Tomorrow holds a strong interest in the matter before you. A large percentage of our membership is Upcountry Maui residents. The ecological scope of the proposal is broad, including the corollary ramifications of island-wide environmental, social, and economic impacts resulting from the potential long term impacts (such as undesired urban growth and development) in the service area. The proposed project actions will specifically impact the integrity of native ecosystems, and the existence of threatened and endangered species; upon these small cores of Maui's inherent uniqueness, its vital industries depend.

Community planning that is both ecologically and economically sound and sustainable springs from the willingness of "policy-makers, resource managers, developers, scientists, and concerned citizens... (to)... work further to protect..." resources.

Your cooperation in this regard would be most appreciated.

On behalf of Maui Tomorrow's membership,

Richard Joseph Lafond Jr.

Richard Joseph Lafond Jr.
Executive Director

cc: Paul Matsuo, Hawai'i State Department of Agriculture
Michael Kolman, USDA Soil Conservation Service
Commission on Water Resource Management
Maui News
Native Hawaiian Advisory Council
The Nature Conservancy, Maui
Sierra Club - Maui Group

FINAL

WATERSHED PLAN-ENVIRONMENTAL IMPACT STATEMENT

UPCOUNTRY MAUI WATERSHED

LOCATION:	Makawao District, Maui County, Hawaii
TAX MAP KEY:	2nd Division: 2-2-var., 2-3 var.
PROPOSING AGENCY:	State of Hawaii Department of Agriculture
ACCEPTING AUTHORITY:	Governor, State of Hawaii
PREPARED BY:	USDA Natural Resources Conservation Service P. O. Box 50004 300 Ala Moana Blvd., Room 4316 Honolulu, HI 96850

RESPONSIBLE OFFICIAL:

James J. Nakatani, Chairperson
Board of Agriculture

3/25/97
Date

FINAL

WATERSHED PLAN-ENVIRONMENTAL IMPACT STATEMENT

UPCOUNTRY MAUI WATERSHED
Maui County, Hawaii

Responsible Agencies:

Olinda-Kula Soil and Water Conservation District

State of Hawaii, Department of Agriculture

County of Maui, Department of Water Supply

United States Department of Agriculture
Natural Resources Conservation Service
(Lead Agency)

For further information, contact:
Kenneth M. Kaneshiro, State Conservationist
USDA Natural Resources Conservation Service
Hawaii State Office
PJKK Federal Bldg, Room 4316
300 Ala Moana Blvd.
P. O. Box 50004
Honolulu, Hawaii 96850
(808) 541-2600

ABSTRACT

This document describes a plan for agricultural water management in the Upcountry Maui Watershed, Maui County, Hawaii. Three alternatives were developed during planning, including a No Action Alternative, an irrigation water distribution system alternative, and an irrigation water distribution system with additional reservoir alternative. Alternative 2, the irrigation water system alternative is the National Economic Development Plan and was selected as the Recommended Plan. The Recommended Plan proposes the installation of a main distribution pipeline and lateral pipelines to service 473 acres of farmland in Upper Kula. The agricultural water system will provide 91 percent irrigation reliability. Project Sponsors will pay 48.6 percent or $4,484,300 of the total project installation cost which is estimated at $9,223,000. The remainder of the installation cost will be funded by PL-566 funds. Project costs are estimated to be $901,100 on an average annual basis including operation, maintenance, and replacement costs. Estimated economic benefits exceed the costs of installation, operation, and maintenance of the Recommended Plan. Average annual economic benefits are estimated to be $2,282,900. Environmental impacts include an increase in irrigated crop acreage, decreased demand on the Olinda Water Treatment Plant, and potential construction-related interference with captive breeding program at the Hawaii Endangered Species Propagation Facility at Olinda. Other social impacts include easing of the "Kula Rule" for farmers, agricultural water supply will be provided to Hawaiian farmers in the DHHL Keokea agricultural lots, and Prime and Other Important farmland will be better utilized.

Prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 U.S.C. 1002-1008) and in accordance with the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 U.S.C. 4321 et seq.)

CONVERSION FACTORS

The following conversion factors may be used to convert the U.S. customary measuring units, used in this report, to System International d'Unites (SI) measuring units.

Multiply U.S. customary units	By	To obtain SI units
Length		
inch (in.)	25.4	millimeter (mm)
foot (ft.)	0.3048	meter (m)
mile (mi.)	1.609	kilometer (km)
Area		
square foot (ft^2)	0.09294	square meter (m^2)
acre (ac.)	0.4047	hectare (ha)
Liquid Volume		
gallon (gal)	3.785	liter (L)
million gallons (MG)	3785.	cubic meter (m^3)
Discharge		
gallon/minute (gpm)	0.06309	liter/second
million gallons/day (MGD)	0.04381	cubic meter/second

WATERSHED AGREEMENT

between the

Olinda-Kula Soil and Water Conservation District

Department of Agriculture
State of Hawaii,

Department of Water Supply
County of Maui,

(referred to herein as Sponsors)

and the

Natural Resources Conservation Service
United States Department of Agriculture

(referred to herein as NRCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsors for assistance in preparing a plan for works of improvement for the Upcountry Maui Watershed, County of Maui, Hawaii under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to NRCS; and

Whereas, there has been developed through the cooperative efforts of the Sponsors and NRCS a plan for works of improvement for the Upcountry Maui Watershed, County of Maui, Hawaii, hereinafter referred to as the Watershed Plan-Environmental Impact Statement, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through NRCS, and the Sponsors hereby agree on this plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this watershed plan and including the following:

1. Landrights: The Sponsors will acquire, with other than PL-566 funds, such real property as will be needed in connection with the works of improvement. (Estimated Cost $226,600)

2. Relocation Payments and Assurances: The Sponsors hereby agree that they will comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4601 et. seq. as implemented by 7 C.F.R. Part 21) when acquiring real property interests for this federally assisted project. If the Sponsors are legally unable to comply with the real property acquisition requirements of the Act, they agree that, before any federal financial assistance is furnished, they will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement may be accepted as constituting compliance. In any event, the Sponsors agree that it will reimburse owners for necessary expenses as specified in 7 C.F.R. 21, 1006 (c) and 21.1007.

   The cost of relocation payments in connection with the displacements under the Uniform Act will be shared by the Sponsors and NRCS as follows:

Item	Sponsors (percent)	NRCS (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	48.6	51.4	0 1/

1/ Investigation of the watershed project area indicates that no displacements will be involved under present conditions. However, in the event that displacement becomes necessary at a later date, the cost of relocation assistance and payments will be cost shared in accordance with the percentages shown.

3. Water Rights: The Sponsors will acquire or provide assurance that they have acquired water rights pursuant to state law as may be needed in the installation and operation of the works of improvement. The Sponsors will retain the right to set water delivery charges to recover the annual operation and maintenance costs.

4. Permits: The Sponsors will obtain all necessary federal, state, and county permits required by law, ordinance, or regulation for installation of the works of improvement.

5. Construction Costs: The percentages of construction costs to be paid by the Sponsors and NRCS are as follows:

Works of Improvement	Sponsors (percent)	NRCS (percent)	Estimated Construction Costs (dollars)
Irrigation Water Supply	50	50	6,920,400

6. Engineering Services Costs: The percentages of the engineering services costs to be borne by the Sponsors and NRCS are as follows:

Works of Improvement	Sponsors (percent)	NRCS (percent)	Estimated Engineering Services Costs (dollars)
Irrigation Water Supply	0	100	827,000
Construction Inspection 1/			211,000

1/ The Sponsors and NRCS will bear the cost of construction inspection that each incurs, estimated to be $105,500 and $105,500, respectively.

7. Project Administration: The Sponsors and NRCS will each bear the costs of project administration that each incurs, estimated to be $346,000 for NRCS and $692,000 for the Sponsors.

8. Operation, Maintenance, and Replacement: The Sponsors will be responsible for the operation, maintenance, and replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with agreements to be entered into before issuing invitations to bid for construction work. Annual operation, maintenance, and replacement costs are estimated to be $168,800.

9. Costs: The costs shown in this plan are preliminary estimates. Final costs to be borne by the parties hereto, will be the actual costs incurred in the installation of works of improvement.

10. Funding: This agreement is not a fund-obligating document. Financial and other assistance to be furnished by NRCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose. Funding by the Sponsors of their share of installation costs is subject to legislative appropriation.

11. Financial Agreement: A separate agreement will be entered into between NRCS and Sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. Plan Revision: This plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may deauthorize or terminate funding at any time it determines that the Sponsors have failed to comply with the conditions of this agreement. In this case, NRCS shall promptly notify the Sponsors in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the Sponsors or recoveries by NRCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the Sponsor(s) having specific responsibilities for the measure involved.

13. Conflict of Interest: No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

14. Nondiscrimination: The program conducted will be in compliance with all requirements respecting nondiscrimination, as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 CFR 15), which provide that no person in the United States shall, on the grounds of race, color, national origin, sex, age, handicap, or religion, be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity receiving federal financial assistance from the Department of Agriculture or any agency thereof.

15. Certification Regarding Drug-Free Workplace Requirements (7 CFR 3017, Subpart F):

By signing this watershed agreement, the sponsors are providing the certification set out below. If it is later determined that the sponsors knowingly rendered a false certification, or otherwise violated the requirements of the Drug-Free Workplace Act, the NRCS, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

Controlled substance means controlled substance in Schedules I through V of the Controlled Substances Act (21 U.S.C. 812) and as further defined by regulation (21 CFR 1308.11 through 1308.15);

Conviction means a finding of (including a plea of nolo contendre) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the federal or state criminal drug statutes;

Criminal drug statute means a federal or non-federal criminal statute involving the manufacturing, distribution, dispensing, use, or possession of any controlled substance;

Employee means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all direct charge employees; (ii) all indirect charge employees unless their impact or involvement is insignificant to the performance of the grant; and, (iii) temporary personnel or consultants who are directly engaged in the performance of work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement; consultants or independent contractors not on the grantee's payroll; or employees of subreceipients or subcontractors in the covered workplaces).

A. The sponsors certify that they will or will continue to provide a drug-free workplace by:

(1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(2) Establishing an ongoing drug-free awareness program to inform employees about --

(a) The danger of drug abuse in the workplace;

(b) The grantee's policy of maintaining a drug-free workplace;

(c) Any available drug counseling, rehabilitation, and employee assistance programs; and

(d) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace

(3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1);

(4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee will --

(a) Abide by the terms of the statement; and

(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;

(5) Notifying the NRCS in writing, within ten calendar days after receiving notice under paragraph (4) (b) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice,

including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4) (b), with respect to any employee who is so convicted --

(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1), (2), (3), (4), (5), and (6)

B. The sponsors may provide a list of the site(s) for the performance of work done in connection with a specific project or other agreement.

C. Agencies shall keep the original of all disclosure reports in the official files of the agency.

16. Certification Regarding Lobbying (7 CFR 3018):

A. The sponsors certify to the best of their knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the sponsors, to any person for influencing or attempting to influence an officer or employee of a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The sponsors shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

B. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

17. Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions (7 CFR 3017) :

A. The sponsors certify to the best of their knowledge and belief, that they and their principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

(2) Have not within a three year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of the offenses enumerated in paragraph (1)(b) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

B. Where the primary sponsors are unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this agreement.

(This page has been left blank)

DEPARTMENT OF AGRICULTURE
STATE OF HAWAII

By:_____
Chair, Board of Agriculture

Date:_____

Approval as to Form:

Signed:_____
Deputy Attorney General

Date:_____

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI

By:_____

Date:_____

The signing of this plan was authorized by a resolution of the Maui County Board of Water Supply adopted on _____.

Signed:_____

Date:_____

OLINDA-KULA SOIL AND WATER
CONSERVATION DISTRICT

By:_____
Chairman

Date:_____

The signing of this plan was authorized by a resolution of the governing body of the Olinda-Kula Soil and Water Conservation District adopted on _____.

Signed:_____

Date:_____

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

By:_____
Kenneth M. Kaneshiro, State Conservationist

Date:_____

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Appendices

Develop and enforce pollution control measures for erosion and sediment during construction and maintenance.

Provide water resource data to county planners and policy-makers to ensure consideration of limited water resources in project area.

Compatibility with Land Use Plans and Policies

All project improvements are in Agricultural and Rural State Land Use Districts.

The State Agriculture Functional Plan supports productive use of agricultural lands and development of irrigation systems.

The Maui General Plan supports preservation of agricultural land and ensurng irrigation water availability during periods of limited rainfall.

The Makawao-Pukalani-Kula Community Plan seeks to preserve the agricultural land base and character of the Upcountry Maui area. The plan recommends support for a separate water system for agriculture.

The Maui County Water Use and Development Plan recognizes the need for irrigation water in Upcountry Maui and supports this watershed project.

The following permits and approvals may be required for project installation:

Grading, Grubbing, Excavating, and Stockpiling Permit
Building Permit
State Land Use Approval
State Highways Permit
Amendment to the Interim Streamflow Standard
Department of Army Permit

Major Conclusions:

Implementation of the Upcountry Maui Watershed Plan will alleviate the problem of inadequate and inconsistent agricultural water supply along the Upper Kula Water System with economic benefits exceeding economic costs and little adverse economic and social impacts.

Areas of Potential Controversy: None identified.

Issues to be Resolved:

Completion of Section 106, Historic Preservation Act consultation with Historic Preservation Division.

Development of an agreement between Maui Department of Water Supply and the State Department of Agriculture for operation of the agricultural water distribution system.

Principal Project Measures of Recommended Plan:

Project measures include 9.4 miles of eight- to 18-inch diameter high-density polyethylene main distribution pipeline, *20.4* miles of lateral and sublateral pipelines, appurtenant valves and devices, 9.2 miles of access road, gulch and road crossings, and *16.8* acres acquired as easements and rights of way.

Project Installation Costs:

Cost Item	PL-566 Funds $	PL-566 Funds %	Other Funds $	Other Funds %	Total $
Structural Measures					
Irrigation Structures	*4,738,700*	*51.4*	*4,484,300*	*48.6*	*9,223,000*
Total	*4,738,700*	*51.4*	*4,484,300*	*48.6*	*9,223,000*

Project Benefits:

Estimated Average Annual Benefits:

Crop Damage Reduction	*$ 294,900*
Additional Crop Production	*$1,771,100*
Water Treatment Cost Reduction	*$ 216,900*
Total	*$2,282,900*

Cropland Acres Benefited:	473 acres
Farms Benefited:	over 169

Other Impacts:

Potential erosion and sediment generation during construction.
Possible interference with captive breeding of native birds at Olinda facility.
Potential increase in efficiency of Olinda Water Treatment Plant.
Potential for cross-connection problems between the domestic and agricultural water distribution systems.
Agricultural water provided to native Hawaiian farmers in Department of Hawaiian Home Lands subdivision.

Proposed Mitigation Measures

Mitigate potential adverse impacts to OESPF by scheduling construction and traffic around critical periods. Explore relocation of breeding program.
Develop action plan to prevent domestic consumption of untreated water and to prevent cross-connections between water systems.

Wetlands Affected:	None
Floodplain Land Use:	None
Project Area Data:	
Population	5,000 persons (est.)
Farmlots	169 +
Average Size of Farmlot	3 acres
Minority Farmers	69 percent
Per Capita Income	$20,633 (1992)
Percentage of U.S. Average	103 percent

Threatened or Endangered Species: Mitigate construction phase impacts to captive breeding program for Hawaiian crow.

Cultural Resources: Three sites on open pastureland possibly affected by the distribution pipeline have been surveyed and determined to be post-contact Chinese agricultural sites. The pipeline alignment will be adjusted to avoid these sites. Where avoidance is not possible NRCS will consult with SHPO to develop mitigation measures and determine if further investigation is needed. It is likely that new sites will be found in presently inaccessible gulch areas. These will be recorded during the topographic survey when the pipeline alignment will be cleared.

Problem Identification:

Farmers suffer from inadequate and inconsistent water supply preventing full utilization of cropland and causing crop damage and losses during drought. Under-utilization of cropland results in *$1,771,100* loss on an average annual basis. Crop losses due to drought results in *$294,900* loss on an average annual basis.

Agricultural users use treated water from the domestic water system. Nonrequired treatment costs are estimated to be $216,900 per year.

Candidate Plans Considered:

Alternative 1 - No Action

Alternative 2 - Installation of an agricultural water distribution system to irrigate 473 acres of cropland with 91 percent reliability. Water supply will be provided from Kahakapao Reservoir.

Alternative 3 - Installation of an agricultural water distribution system and an additional 35 million gallon reservoir to irrigate 550 acres of cropland with 92 percent reliability. Water supply will be provided from Kahakapao Reservoir.

SUMMARY

Project Name:

Upcountry Maui Watershed
Makawao District, County of Maui, Hawaii

Local Sponsors:

Maui County Board of Water Supply
State of Hawaii Department of Agriculture
Olinda-Kula Soil and Water Conservation District

Project Purpose under Public Law 83-566:

The project purpose is agricultural water management. Measures will be provided to increase irrigation water availability and reliability.

Description of Recommended Plan:

The Recommended Plan proposes the installation of a separate agricultural water distribution system to supply untreated water for irrigation purposes to farmers in the Upper Kula area. The water source will be Kahakapao Reservoir. The main distribution pipeline will extend from Olinda to Keokea with nine lateral systems serving the areas of Olinda, Crater Road, Kimo Road, Pulehuiki/Kamehameiki, Kealahou, Waiakoa, Kaonoulu, Waiohuli, and Keokea/DHHL. The system will provide 473 acres of cropland with agricultural water supply at 91 percent reliability.

Watershed Resource Information:

Watershed Size:	63,800 acres
Project Area Size:	12,250 acres
Project Area TMK:	2nd Division, 2-2-var. and 2-3-var.
Land Ownership:	
Federal	2 acres
State-DHHL	730 acres
State-Other	1,098 acres
Private	10,420 acres
State Land Use Districts:	
Agriculture	10,348 acres
Rural	1,553 acres
Conservation	99 acres
Urban	250 acres
Prime/Important Farmland:	10,965 acres

1. INTRODUCTION

1.1 GENERAL

This document, the Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, presents a Recommended Plan to address agricultural water shortage. The Plan-EIS also describes the projected effects of implementation of the Recommended Plan on the human environment, which includes economic, social, and political impacts as well as impacts to the natural environment. The planning process is described beginning from the identification of problems and inventory of resources to the formulation of alternative solutions and selection of the Recommended Plan.

The Plan-EIS was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566 (PL-566), as amended (16 U.S.C. 1001-1008), and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA), Public Law 91-190, as amended (42 U.S.C. 4321 et seq.) and the Hawaii Environmental Review Process (HERP), Section 343, Hawaii Revised Statutes. Responsibility for compliance with NEPA rests with the United States Department of Agriculture Natural Resources Conservation Service (NRCS). Responsibility for compliance with the Hawaii Environmental Review Process rests with the Hawaii Department of Agriculture.

The sponsoring local organizations (Sponsors) that requested project planning assistance from NRCS are the Olinda-Kula Soil and Water Conservation District (SWCD), County of Maui Board of Water Supply (BWS), and State of Hawaii Department of Agriculture (DOA). Planning assistance was provided by the NRCS Wailuku Field Office in Wailuku, Hawaii and the Natural Resources Planning Staff stationed at the NRCS Hawaii State Office in Honolulu, Hawaii. Guidance during planning was provided by the Steering Committee for the Water Resources Study for Upcountry Maui which is composed of Sponsor representatives and others with interest in project implementation. The Sponsors, as well as other federal and local government agencies and private groups and individuals, participated in the planning process by providing data, developing project concepts, and reviewing project alternatives.

1.2 READER'S GUIDE

There are three versions of the Plan-EIS: Technical Review, Draft, and Final. The Technical Review Plan-EIS was reviewed by NRCS personnel and Sponsors. Comments from the technical review are incorporated into the Draft Plan-EIS. The Draft Plan-EIS was widely distributed for interagency and public review, as required by NEPA and

HERP. Review comments were incorporated into or reconciled in the Final Plan-EIS. The NEPA process culminates with a Record of Decision (ROD), a statement of action, rendered by the Responsible Federal Official, who is the State Conservationist, Hawaii, USDA Natural Resources Conservation Service. The Hawaii process requires the Governor or an authorized representative to accept this EIS before project implementation.

Environmental evaluation was conducted throughout the development of the Plan-EIS to assess the significance of the effects of the proposed measures on the human environment. Environmental and social concerns of the community were identified through the public participation process which involved meetings open to the public, interviews with watershed farmers and residents, and consultation with groups and agencies with interest in the watershed's resources.

The format of this Plan-EIS is directed by the NRCS National Watershed Manual and conforms with applicable federal regulations, policies, and guidelines. This document has also been conformed to meet the requirements of the Hawaii EIS law.

The Reader's Guide outlines the planning process and assists the reader in finding items of particular interest. Appendix E - Project Map can be used for reference while reviewing this plan.

The Watershed Agreement, included at the front of this report, is the culmination of the planning effort and serves as acceptance of the Plan-EIS by the Sponsors and NRCS *once signed*. The Agreement formalizes the intentions of the parties to implement the plan. Funding for project installation is not obligated by the Agreement.

The Contents lists the principal topics contained in this Plan-EIS.

The Summary describes the Plan-EIS in brief. It should not be used as the sole source of information if a complete understanding of the project is desired.

Project Setting begins the main body of the Plan-EIS by describing the Upcountry Maui Watershed and its resources in general terms.

The Watershed Problems and Opportunities section describes and quantifies resource problems in the watershed and opportunities for improving the quality of life for residents and enhancing the natural environment. Table A - Problems and Opportunities provides a summary of this information.

The Scope of the EIS section discusses the range of actions and alternatives, identifies concerns significant in the formulation of alternatives, evaluates existing resources, and

presents a forecast of future conditions without the project. Table B - Evaluation of Identified Concerns lists each concern and its degree of significance to decision making.

Formulation of Alternatives describes the formulation of alternative plans and rationale for selection of the Recommended Plan. Alternative plans are described, economic costs and benefits are shown, and effects of the alternative plans on resources are described. Table E - Summary and Comparison of Candidate Plans presents a tabular comparison of plans which were considered as the Recommended Plan.

Consultation and Public Participation describes the process through which the plan was developed with input from various individuals, organizations, and agencies.

The Recommended Plan describes the plan proposed for implementation and its effect on the economy and human environment. The following tables present pertinent structural and economic data covered in these two sections:

Table 1 - Estimated Installation Cost

Table 2 - Estimated Cost Distribution

Table 3C - Structural Work - Pipelines

Table 4 - Estimated Average Annual NED Costs

Table 6 - Comparison of NED Benefits and Costs

Plan Preparers, References, and Index are the last sections of the Plan-EIS.

The Appendices consist of A - Letters and Oral Comments on the Draft Plan-EIS, B - Supporting Documents, C - Supporting Maps, D - Investigation and Analyses Report, and E - Project Map.

All changes to the text of the draft Plan-EIS appearing in this document are italicized to allow the reader to distingish the revisions. Nearly all economic costs and benefits have been updated.

2. PROJECT SETTING

2.1 WATERSHED LOCATION AND SIZE

The Upcountry Maui Watershed is located in the Makawao District on the island of Maui in Maui County, Hawaii. Maui is located approximately 100 miles east-southeast of Honolulu, capital of the State of Hawaii, and approximately 2,400 miles west-southwest of Los Angeles, California.

The "watershed" is the drainage area that includes the collection, transmission, storage, and service areas of the Maui Department of Water Supply's Upper Kula Water System. The system is described in more detail in Section 5.1.1 below. The total watershed area is 63,800 acres. The watershed is situated on the western slope of Haleakala, the volcanic mountain forming East Maui, and extends from 2,000 feet in elevation to over 10,000 feet. (see Figure 1 - Watershed Map)

The Project Area for the Upcountry Maui Watershed, where improvements will be made and benefits attained, is a portion of the service area of the Upper Kula Water System. The upslope project area boundary, to the southeast, is the limit of agricultural activity on the Haleakala slope. The lower project area boundary, to the northwest, is the service area of the Lower Kula Water System. The northeastern boundary is the Makawao Forest Reserve at Kahakapao Gulch. The southwestern boundary is the Keokea-Kamaole ahupua'a boundary. The project area is located in the Second Tax Division, Zone 2, Sections 2 and 3. The project area is 12,250 acres. (see Figure 2 - Project Area Map)

2.2 LAND OWNERSHIP

There are 1,098 acres of state-owned land, less than two acres of federally-owned land, and 10,420 acres of privately-owned land in the project area. State-owned parcels include the Waihou Spring Forest Reserve. The Department of Hawaiian Homelands hold 730 acres of state land in the Keokea-Waiohuli area of the project area. Major private land owners in the project area include Alexander and Baldwin, Inc.; Haleakala Ranch Co.; Kaonoulu Ranch Co., Ltd.; and Von Tempsky Estate. (see Figure 3 - Land Ownership Map)

2.3 LAND USE

State Land Use Districts in the project area, as determined by the State Land Use Commission, include 99 acres of Conservation, 1,553 acres of Rural, 10,348 acres of Agriculture, and 250 acres of Urban. Conservation districts are lands in forest and watershed reserves, lands in National and State Parks, and lands generally unsuitable for

development due to steepness. Rural districts are lands generally in small farms mixed with low density residential lots. Agriculture districts are lands with a high capacity for intensive cultivation. Urban districts are lands in urban uses with additional area to accommodate projected expansion. (see Figure 4 - State Land Use District Map)

The County of Maui's land use categories in the project area include 10,520 acres of Agriculture, 260 acres of Conservation, 1,200 acres of Rural, 185 acres of Single-Family, 10 acres of Business/Commercial, 45 acres of Public/Quasi-Public, five acres of Project Development, and 25 acres of Park. (see Figure 5 - County Land Use Category Map)

2.4 TOPOGRAPHY AND GEOLOGY

The Upcountry Maui Watershed is located on the eroding volcanic shield of Haleakala. Topography is characterized by broad, rolling shield ridges separated by steep-sided, often deep, gulches. The depth and frequency of the gulches decreases toward the more arid southern portion of the watershed. (see Figure 6 - Geologic Map)

Haleakala was formed through three periods of volcanism. The base basalts, to an elevation of 8,500 feet, were produced by the Honomanu Volcanic Series during the Tertiary Period. The Honomanu lavas were completely covered during the Pleistocene Epoch by the Kula Volcanic Series which include andesite and andesitic and picritic basalts. Nearly all of the project area is located on Kula series deposits. The Kula lavas are composed primarily of thick andesitic a'a flows interbedded with thin ash-soil layers. Many large cinder cones and ash beds were created during this volcanic series. A more recent Hana Volcanic Series has deposited lava along the east and southwest rift zones.

The groundwater resource in the project area is the freshwater basal lens. It is estimated that the lens in the project area rises 10 to 15 feet above sea level. High level groundwater is confined in basaltic dike structures to the northeast, in the vicinity of the water collection area, and to the southeast of the project area.

Most earthquakes in the Hawaiian Islands are due to volcanic activity. The most powerful historical earthquake within 100 kilometers of the project area was a magnitude 7.0 earthquake occurring just west of the island of Lanai in 1871. The U.S. Geologic Survey's Probabilistic Earthquake Acceleration and Velocity Map for the United States and Puerto Rico, MF-2120, shows that for the island of Maui there is a 10 percent probability of a horizontal acceleration exceeding 20 percent of the force of gravity occurring in the next fifty years.

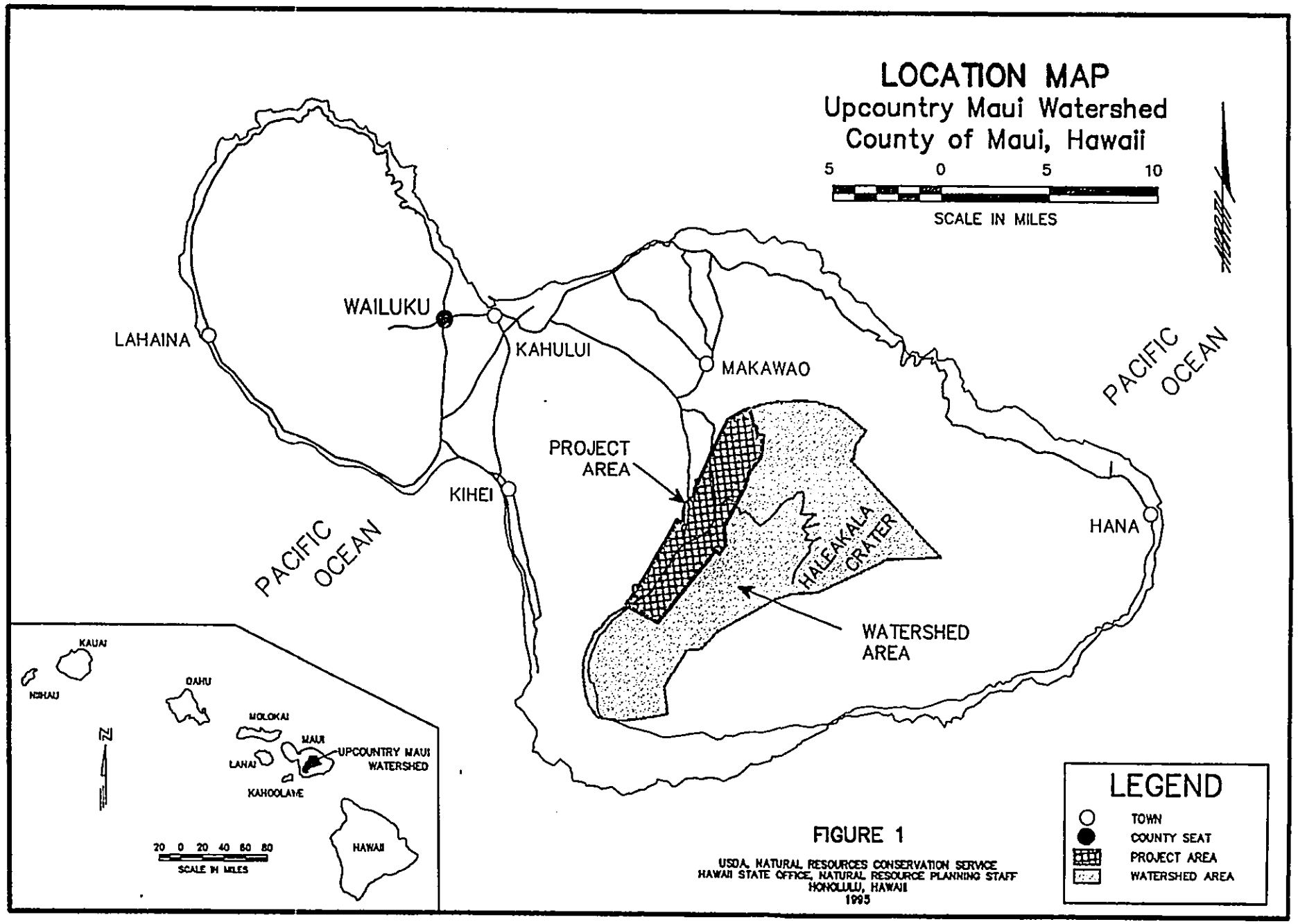
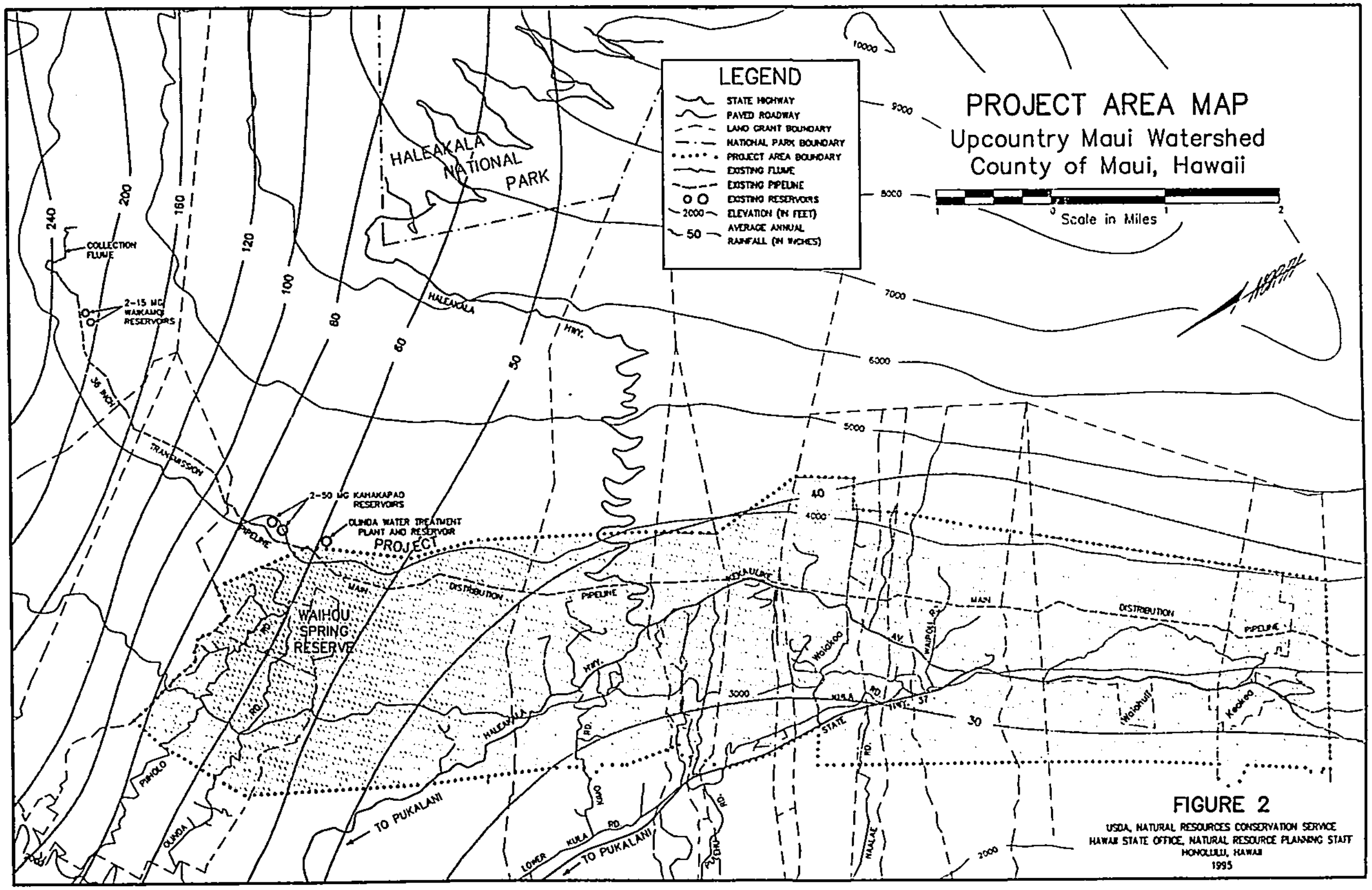


FIGURE 1

USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995



PROJECT AREA MAP
Upcountry Maui Watershed
County of Maui, Hawaii
Scale in Miles
LEGEND
STATE HIGHWAY
PAVED ROADWAY
LAND GRANT BOUNDARY
NATIONAL PARK BOUNDARY
PROJECT AREA BOUNDARY
EXISTING FLUME
EXISTING PIPELINE
EXISTING RESERVOIRS
ELEVATION (IN FEET)
AVERAGE ANNUAL RAINFALL (IN INCHES)
HALEAKALA NATIONAL PARK
COLLECTION FLUME
2-15 MG WAIKAMOI RESERVOIRS
36 INCH
TRANSMISSION
PIPELINE
2-50 MG KAHAKAPAO RESERVOIRS
OLINDA WATER TREATMENT PLANT AND RESERVOIR
PROJECT
WAIHOU SPRING RESERVE
MAIN
DISTRIBUTION
HALEAKALA HWY.
TO PUKALANI
LOWER KULA RD.
KULA HWY.
STATE
OLINDA
PIIHOLO
FIGURE 2
USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

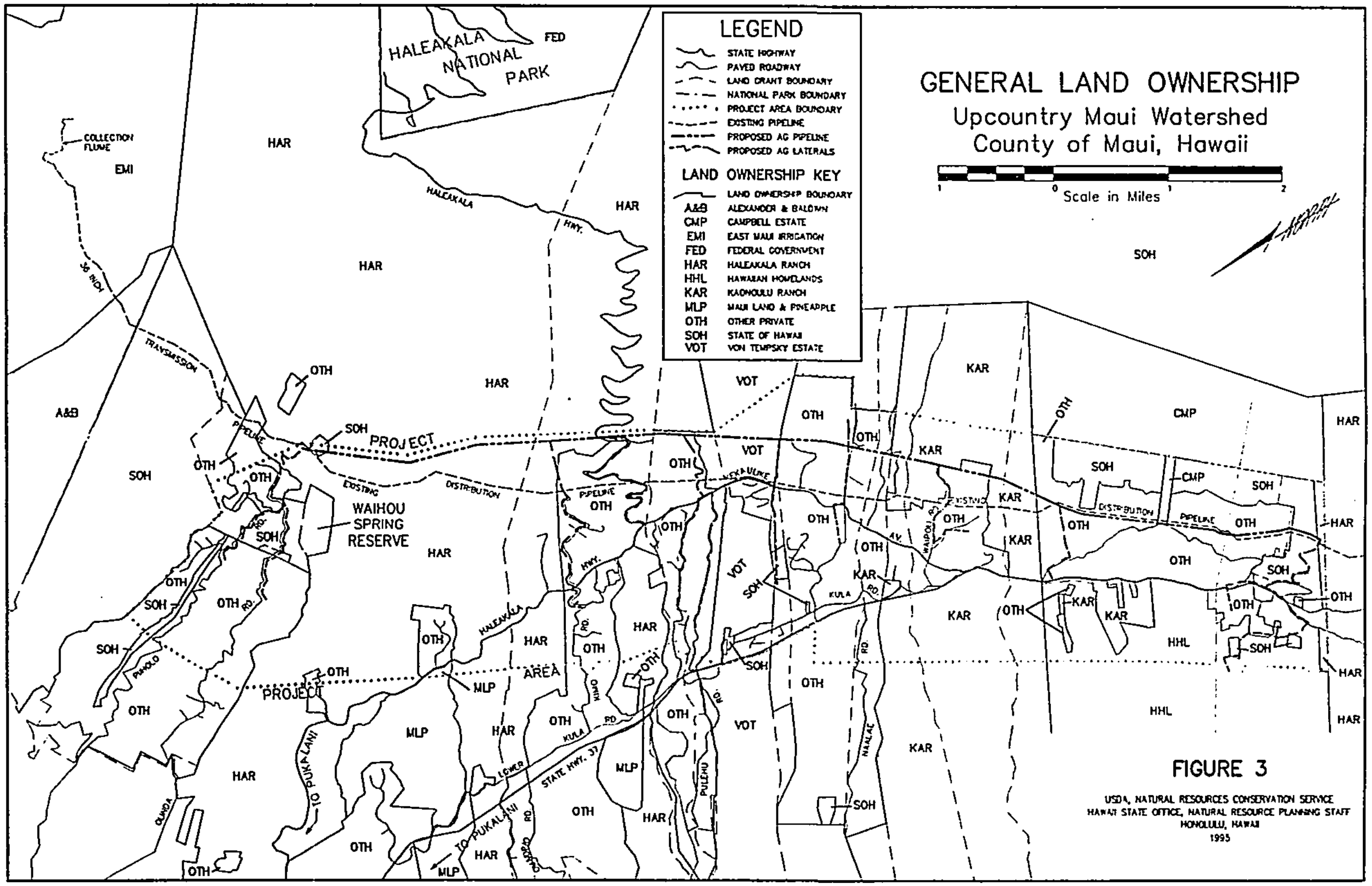
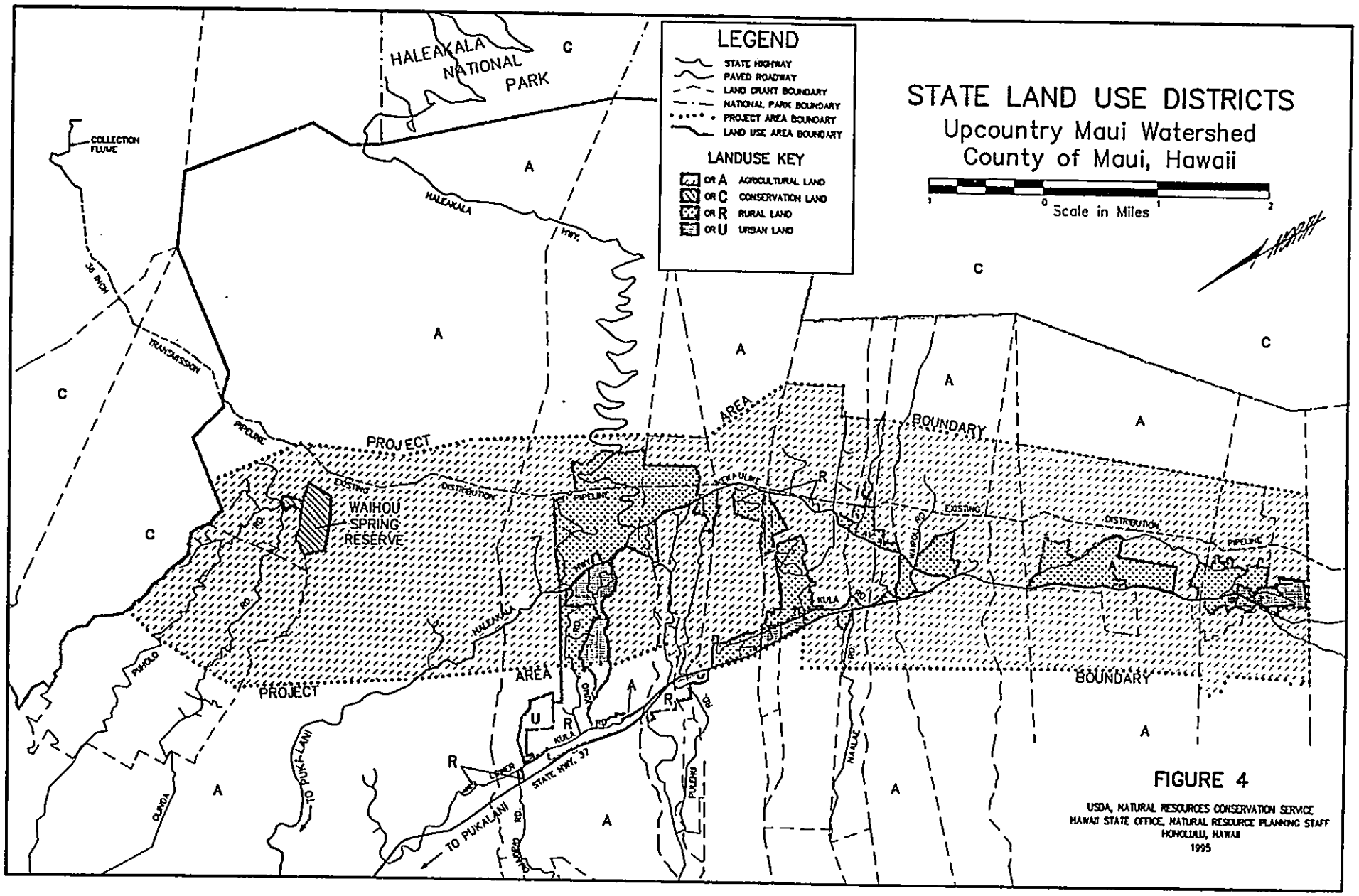

GENERAL LAND OWNERSHIP
Upcountry Maui Watershed
County of Maui, Hawaii
0 Scale in Miles 1 2
LEGEND
STATE HIGHWAY
PAVED ROADWAY
LAND GRANT BOUNDARY
NATIONAL PARK BOUNDARY
PROJECT AREA BOUNDARY
EXISTING PIPELINE
PROPOSED AG PIPELINE
PROPOSED AG LATERALS
LAND OWNERSHIP KEY
LAND OWNERSHIP BOUNDARY
A&B ALEXANDER & BALDWIN
CMP CAMPBELL ESTATE
EMI EAST MAUI IRRIGATION
FED FEDERAL GOVERNMENT
HAR HALEAKALA RANCH
HHL HAWAIIAN HOMELANDS
KAR KAONOULU RANCH
MLP MAUI LAND & PINEAPPLE
OTH OTHER PRIVATE
SOH STATE OF HAWAII
VOT VON TEMPSKY ESTATE
HALEAKALA NATIONAL PARK
FED
COLLECTION FLUME
EMI
HAR
A&B
SOH
HALEAKALA HWY.
PROJECT AREA
WAIHOU SPRING RESERVE
EXISTING DISTRIBUTION PIPELINE
TO PUKALANI
STATE HWY. 37
KULA RD.
LOWER KULA RD.
MLP
OTH
VOT
KAR
CMP
HHL
PULEHU RD.
NAALAE RD.
TRANSMISSION
36 INCH

FIGURE 3

USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995


LEGEND
STATE HIGHWAY
PAVED ROADWAY
LAND GRANT BOUNDARY
NATIONAL PARK BOUNDARY
PROJECT AREA BOUNDARY
LAND USE AREA BOUNDARY
LANDUSE KEY
OR A AGRICULTURAL LAND
OR C CONSERVATION LAND
OR R RURAL LAND
OR U URBAN LAND
STATE LAND USE DISTRICTS
Upcountry Maui Watershed
County of Maui, Hawaii
Scale in Miles
HALEAKALA NATIONAL PARK
COLLECTION FLUME
HALEAKALA HWY.
36 INCH TRANSMISSION PIPELINE
PROJECT AREA BOUNDARY
EXISTING DISTRIBUTION PIPELINE
WAIHOU SPRING RESERVE
WAIKULOA RD.
PUHOLO RD.
HALEAKALA HWY.
KULA HWY.
KULA RD.
OMAO RD.
PUKALANI RD.
LOWER KULA RD.
STATE HWY. 37
TO PUKALANI
TO PUU-O-LANI
OLINDA RD.
MAKAWAO AVE.
PUUNENE AVE.
HANA HWY.
FIGURE 4
USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

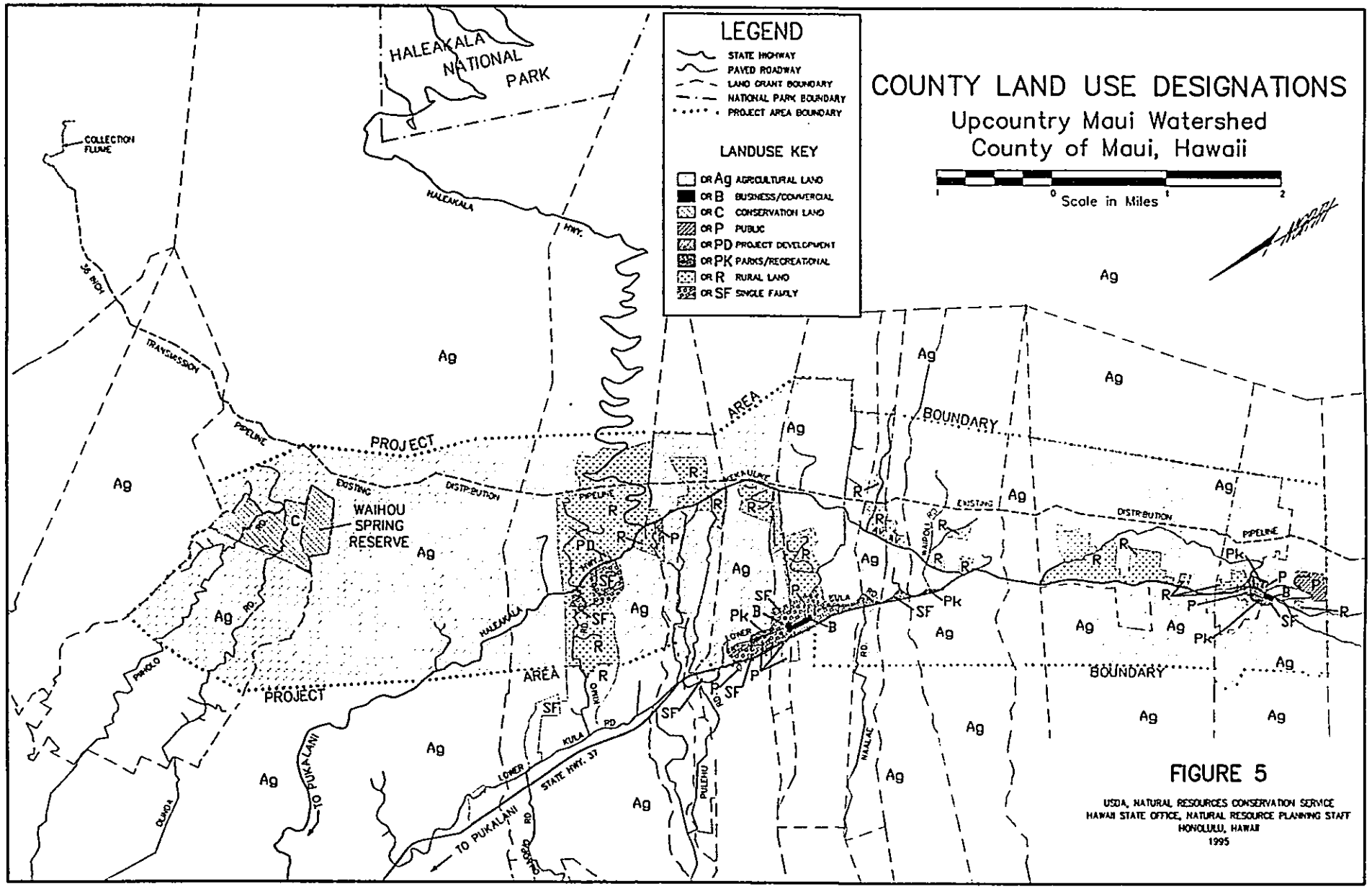
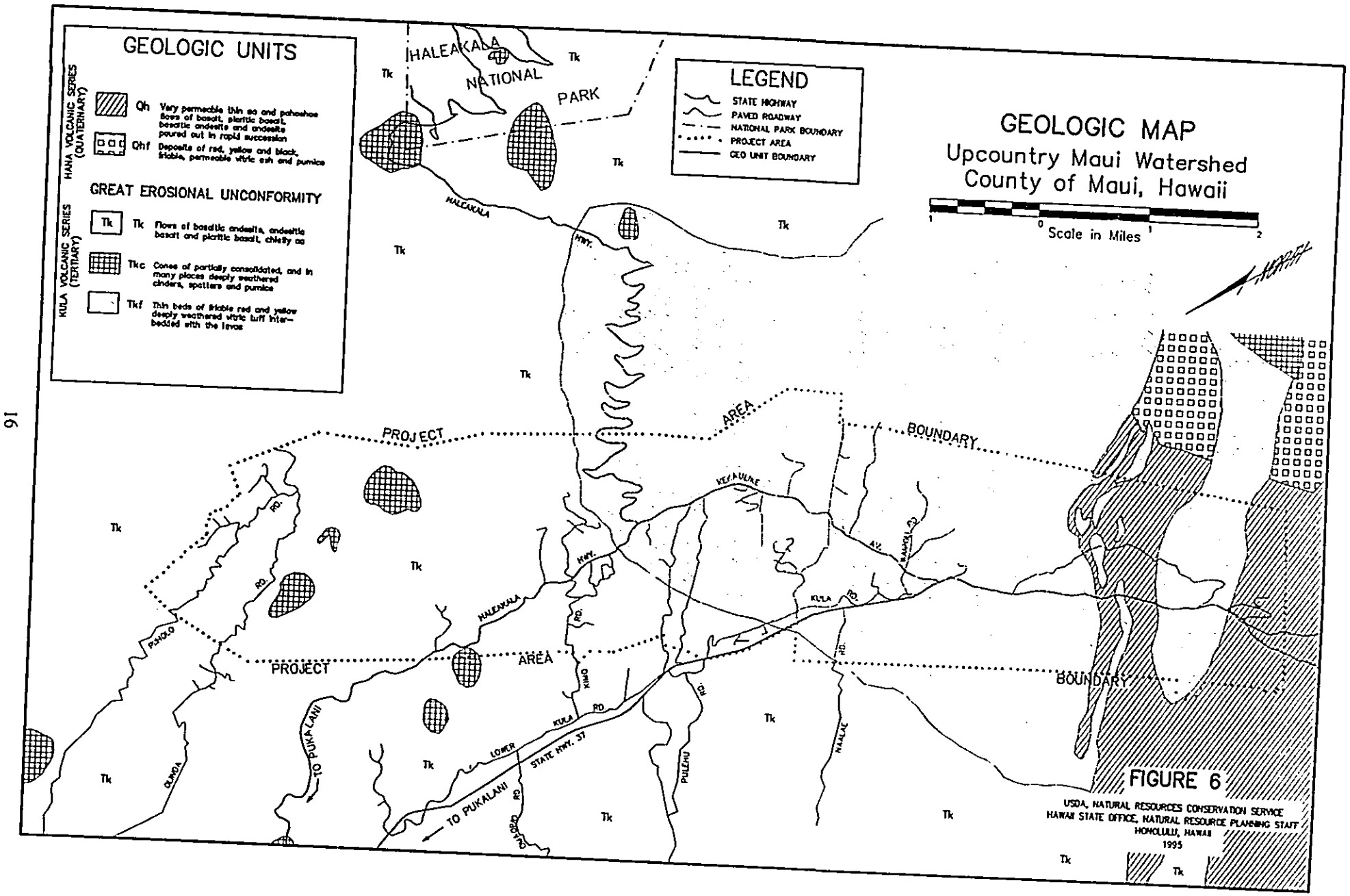


FIGURE 5

USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995


GEOLOGIC UNITS
HANA VOLCANIC SERIES (QUATERNARY)
Qh Very permeable thin aa and pahoehoe flows of basalt, picritic basalt, basaltic andesite and andesite poured out in rapid succession
Qhf Deposits of red, yellow and black, friable, permeable vitric ash and pumice
GREAT EROSIONAL UNCONFORMITY
KULA VOLCANIC SERIES (TERTIARY)
Tk Tk Flows of basaltic andesite, andesitic basalt and picritic basalt, chiefly aa
Tkc Cones of partially consolidated, and in many places deeply weathered cinders, spatters and pumice
Tkf Thin beds of friable red and yellow deeply weathered vitric tuff interbedded with the lavas
LEGEND
STATE HIGHWAY
PAVED ROADWAY
NATIONAL PARK BOUNDARY
PROJECT AREA
GEO UNIT BOUNDARY
GEOLOGIC MAP
Upcountry Maui Watershed
County of Maui, Hawaii
Scale in Miles
HALEAKALA NATIONAL PARK
HALEAKALA HWY.
PROJECT AREA BOUNDARY
KEALAULUA
KULA RD.
LOWER KULA RD
STATE HWY. 37
TO PUKALANI
OLINDA RD.
PIIHOLO RD.
HALEWALA RD.
KIMO DR.
PULEHU RD.
WAILAE RD.
KAUPO RD.
Tk
FIGURE 6
USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

2.5 CLIMATE

Rainfall varies significantly within the watershed. Rainfall exceeds an average of 250 inches per year near the 4,000-foot elevation of Haipuaena Stream and averages less than 30 inches per year below Keokea. The average annual rainfall in the project area varies between 30 and 80 inches. Approximately two-thirds of the rainfall occurs during the winter months of November through April. (Figure 7 - Rainfall Map)

The average temperature in the watershed is relatively low due to the higher elevation of the watershed. A decrease of 3°F can be expected for each 1,000 feet of elevation increase. Wailuku, outside of the watershed at an elevation of 180 feet, has average annual high and low temperatures of 82°F and 68°F. The Kula Sanatorium, at an elevation of 3,004 feet, has average annual high and low temperatures of 72°F and 55°F. The Halealaka Ranger Station at an elevation of 7,030 feet, has average annual high and low temperatures of 63°F and 44°F.

The tradewinds from the northeasterly direction prevail in Hawaii throughout the year. During the summer months tradewinds occur nearly 90 percent of the time. During the winter months tradewinds can be expected about 50 percent of the time.

2.6 SOILS

The predominant soil association in the project area is the Puu Pa-Kula-Pane association which is characterized by deep, gently sloping to steep, well-drained soils that have a medium textured or moderately fine textured subsoil or underlying material, on intermediate and high uplands. (Figure 8 - Soil Series Map)

The Kula series is the principal soil in the southern part of the project area. This series consists of well-drained loam soils on uplands developed in volcanic ash. Elevations range from 2,000 to 3,500 feet. Annual rainfall is 25 to 40 inches. The soil is suited to truck crops, pasture, orchard, and wildlife habitat.

The principal soil in the northern part of the project area is the Pane series. The soil is a well-drained silty loam developed in volcanic ash. Elevations range from 2,000 to 3,500 feet. Annual rainfall is 30 to 50 inches. The soil is used for pasture and wildlife habitat with small areas used for truck crops, pineapple, and homesites.

At the northern boundary of the project area, in the vicinity of Olinda and Piiholo Roads, are Olinda soils. These well-drained soils are developed in volcanic ash. Elevations range from 2,500 to 5,000 feet and annual rainfall is 40 to 60 inches. These soils are used

for pasture, woodland, and water supply with small acreages used for orchards and truck crops.

At the far south of the project area are Kaimu and Kamaole soils. Kaimu soils are very shallow, well-drained, peat soils developed on organic matter on rough, undulating, relatively young a'a lava flows. Elevations are 1,000 to 3,500 feet and annual rainfall is 30 to 50 inches. Kamaole soils are well-drained silt loam soils developed in volcanic ash. Elevations are 1,500 to 2,300 feet and annual rainfall is 15 to 25 inches. Kaimu and Kamaole soils are used for pasture and wildlife habitat.

Along the uphill boundary of the project area are Kaipoioi soils. These soils are well-drained loam developed from volcanic ash and cinders. Elevations range from 3,500 to 6,000 feet. Annual rainfall is about 30 to 50 inches. These soils are used for pasture and wildlife habitat.

The predominant soils in the high-rainfall collection area are Amalu silty, peaty clay and Honomanu-Amalu association. Amalu is poorly drained and is developed in organic matter and material weathered from basic igneous rock. Honomanu soils are well drained and developed in volcanic ash. The Honomanu soils occupy the more sloping, better drained side slopes while the Amalu soils occur on the less sloping tops of ridges.

2.7 ECONOMY, INCOME, AND EMPLOYMENT

The major sectors of economic activity on Maui are tourism and agriculture. Total visitor expenditures on the island of Maui was $2,222 million of a state-wide total of $9,559 million in 1992. Maui was second only to Oahu in tourism income.

In 1992, the value of crop and livestock in Maui County was $153 million of a total of $523 million for the entire state. Maui County was the only county in the state with a substantial increase in agricultural activity between 1982 and 1992. (Databook, 1994)

Approximately 54 percent of the watershed population is employed. Less than 11 percent of the work force is employed in agriculture. (Bureau of Census, 1990)

In 1992, per capita income in Maui County was $20,633 annually, as compared to the state average of $22,200 annually. (State of Hawaii, 1994) Approximately nine percent of the households receive incomes below poverty level. (Bureau of Census, 1990)

The median value of homes in the area is approximately $293,000. Sixty-three percent of the homes are owned by their occupants. (Bureau of Census, 1994)

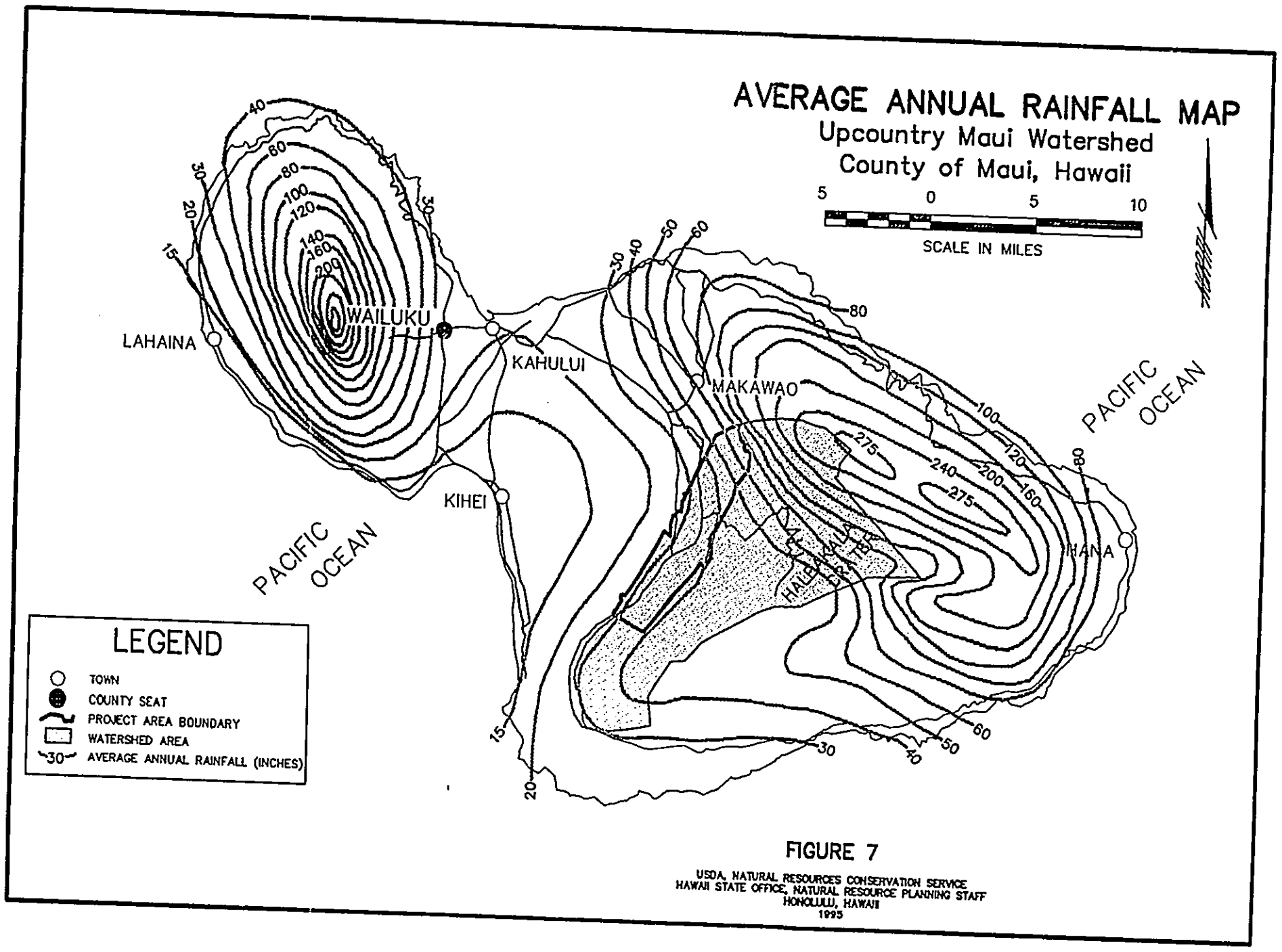
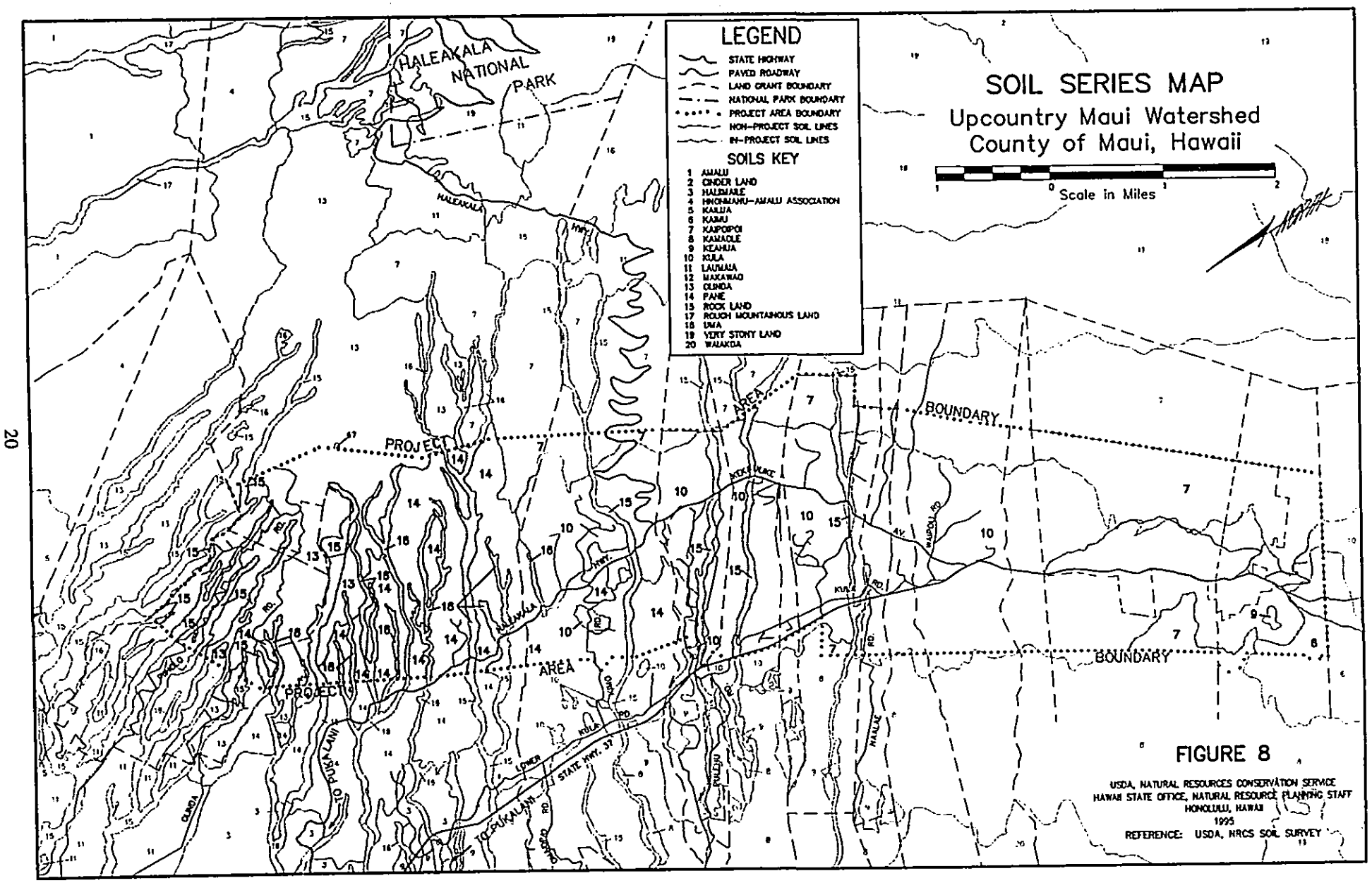


FIGURE 7

USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995


LEGEND
STATE HIGHWAY
PAVED ROADWAY
LAND GRANT BOUNDARY
NATIONAL PARK BOUNDARY
PROJECT AREA BOUNDARY
NON-PROJECT SOIL LINES
IN-PROJECT SOIL LINES
SOILS KEY
1 AMALU
2 CINDER LAND
3 HALEMAILE
4 HNONAHU-AMALU ASSOCIATION
5 KAILUA
6 KAMAU
7 KAIPOIPOI
8 KAMAOLE
9 KEAHUA
10 KULA
11 LAUMAIA
12 MAKAWAO
13 OLINDA
14 PANE
15 ROCK LAND
17 ROUGH MOUNTAINOUS LAND
18 UMA
19 VERY STONY LAND
20 WAIAKOA
SOIL SERIES MAP
Upcountry Maui Watershed
County of Maui, Hawaii
Scale in Miles
HALEAKALA NATIONAL PARK
PROJECT AREA BOUNDARY
PROJECT AREA
BOUNDARY
TO PUKALANI
STATE HWY. ST
FIGURE 8
USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995
REFERENCE: USDA, NRCS SOIL SURVEY

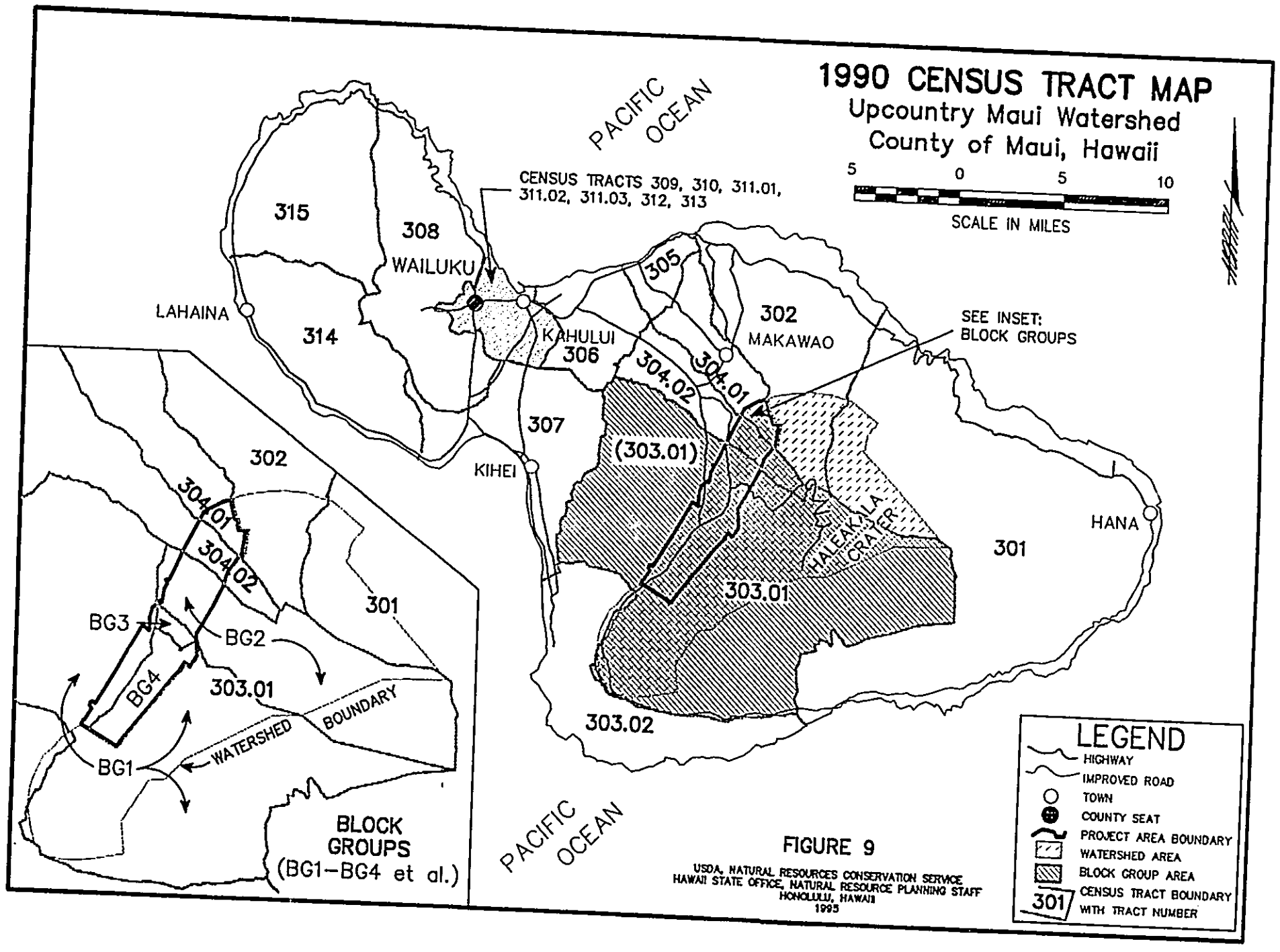


FIGURE 9

USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

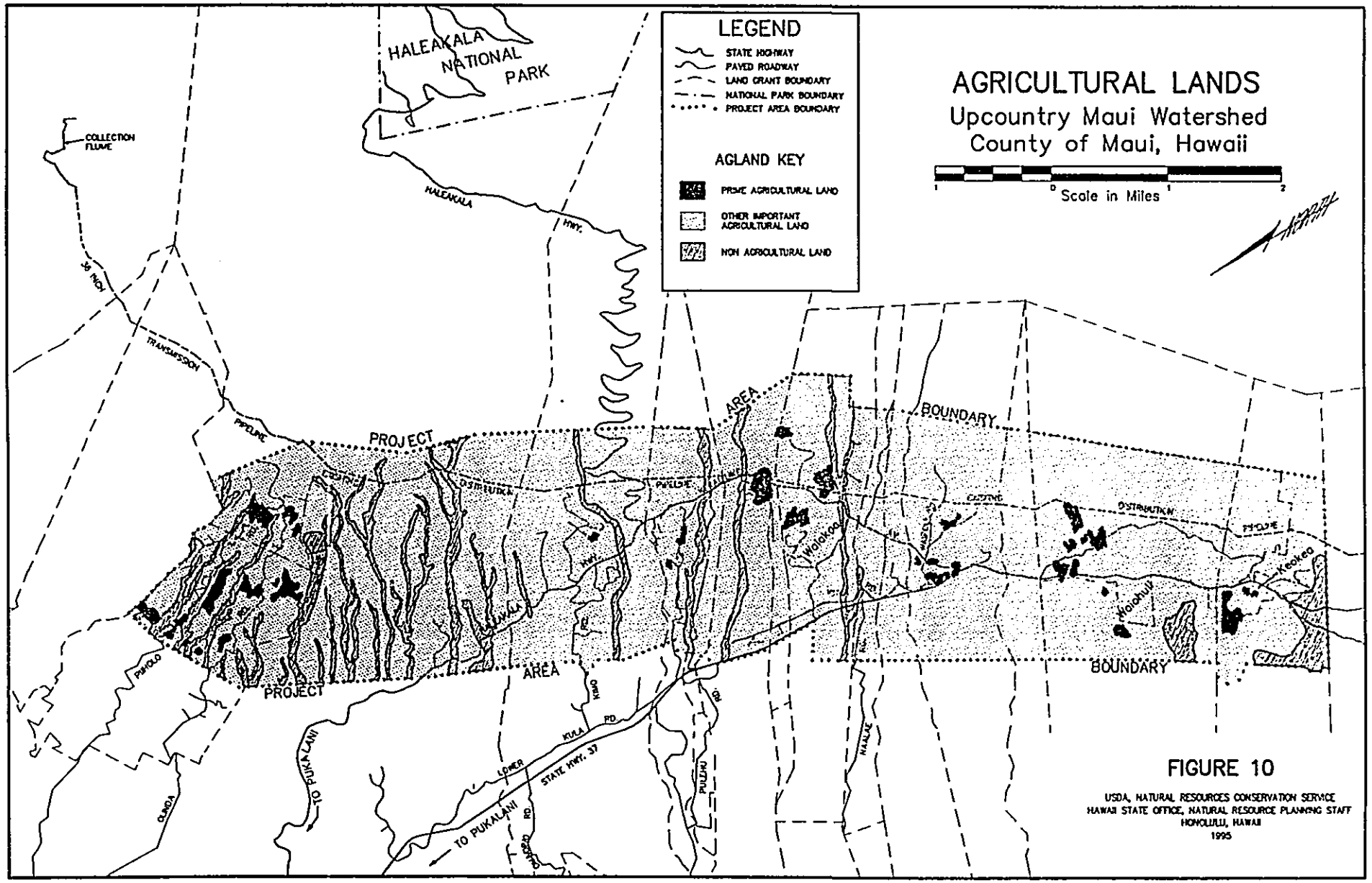


FIGURE 10

USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

2.8 POPULATION AND DEMOGRAPHY

The 1990 U.S. Census showed the population of Maui County to be 100,504 and 1,108,229 for the State of Hawaii. The census showed approximately 6,500 persons living in Block Groups 2, 3, and 4 of Census Tract 303.01; Block Group 1 of Census Tract 304.01; and Block Group 1 of Census Tract 304.02. (Bureau of Census, 1990) The populated areas of the Upcountry Maui Watershed are within the five Block Groups. (Figure 9 - Census Tract Map)

It is estimated that 5,000 persons live in the project area. Male and female populations are equally divided. Sixty-six percent of the residents classified themselves as White, while 32 percent were Asian/Pacific Islander. Over 85 percent of the population has completed high school. Approximately eight percent of the population live on farms.

2.9 AGRICULTURE AND PRIME AGRICULTURAL LAND

Maui County, including the islands of Molokai and Lanai, contains 355,000 acres of farmland or approximately 21 percent of the agricultural lands in the state. The value of crop and livestock sales in Maui County totaled $153 million in 1992 and accounted for 29 percent of agricultural sales in the state. The major crops of the island of Maui are sugarcane and pineapple.

In the project area, the major agricultural activities are livestock grazing, truck farming, flower production, and orchard crops. In 1992, the estimated value of sales for livestock was $280,000; for truck crops, $1,500,000; and for cut and lei flowers, $616,000.

Most truck farms are small family-run operations with one to two irrigated acres. The few larger farms with five to ten irrigated acres account for the bulk of the area's production. Two well-known crops that are identified with the Upper Kula farming area are Kula sweet onions and protea. Other commonly grown crops include head cabbage, head lettuce, Chinese cabbage, Romaine lettuce, and daikon.

Truck crops are grown throughout the year, except for round onions which is a summer crop. Farmers practice field rotation, continually planting small plots. In this way farmers have crops at various stages of growth and are able to continually provide produce to market. This practice allows three to four crops per year per field. Sprinkler irrigation is commonly used for leafy vegetable crops.

Olinda-Kula Soil and Water Conservation District records indicate 169 farm cooperators in agricultural conservation programs in the Upper Kula Area. Approximately 69 percent of the cooperators can be classified as minority farmers by national criteria,

although in Hawaii this is the standard mix of population. Most of the minority cooperators are of Japanese ancestry.

Through aerial photographs, 125 farm fields were identified in the project area with approximately 398 acres of cleared cropland. In 1994, the Upper Kula Water System supplied 223 agricultural meters. The discrepancies in the numbers may be a result of inactivity or minimal activity by some farm cooperators and the use of several water meters by some farming operations. It is assumed that more than 169 farms exist in the project area.

Of the 398 acres of cleared cropland about 175 acres were in active cultivation. Kula is the major truck crop production area on the island of Maui. The number of actively cultivated acres for various crop groups that benefit from irrigation was estimated as follows: truck crops, 81 acres; cut flowers, 19 acres; protea, 56 acres; orchard, 12 acres; and Christmas trees, 7 acres.

The State of Hawaii, in 1977, adopted an agricultural land classification system, Agricultural Lands of Importance to the State of Hawaii, to identify the extent and location of the best lands available for crop production for land use planning purposes. The criteria for suitable agricultural land include adequate moisture supply, favorable soil temperature, moderate pH, no water table effects or flooding, sufficient root zone depth, low to moderate erodibility, sufficient permeability rate, minimum rockiness, and non-thixotropic. Three categories of agricultural land were developed - Prime Agricultural Land, Unique Agricultural Land, and Other Important Agricultural Land.

Prime Agricultural Land is land best suited for production of food, feed, forage, and fiber crops. Unique Agricultural Land is land other than Prime Agricultural Land that is particularly suited for production of specific high-value crops. Other Important Agricultural Land is land other than Prime or Unique Agricultural Land that is of state or local importance for the production of crops. Lands in this last category may exhibit seasonal wetness or droughtiness, erodibility, limited rooting zone, or excessive slope to exclude them from being Prime Agricultural Land.

The project area includes 280 acres of Prime Agricultural Land and 10,685 acres of Other Important Agricultural Land. There is no Unique Agricultural Land within the project area. (Figure 10 - Agricultural Land Map)

2.10 WATER SUPPLY

The County of Maui Department of Water Supply (DWS) operates the water systems supplying the Upcountry area as part of its Makawao system. The Makawao system,

which extends from Haiku to Ulupalakua, is a collection of smaller distribution systems which use numerous sources and treatment facilities. The three major subsystems are Makawao/Pukalani, Lower Kula, and Upper Kula. All water provided by the Makawao system is treated with the exception of the supply to the Kula Agricultural Park.

Presently, the Makawao system is dependent completely on surface water sources. The DWS is pursuing conversion of potable systems to well sources through groundwater exploration and well development efforts. The Board of Water Supply maintains an agreement with the East Maui Irrigation Company (EMI) and the Hawaiian Commercial and Sugar Company to receive raw water supplies from EMI collection and transmission systems for the Upper and Lower Kula Water Systems and from the Wailoa Ditch. The DWS pays $.06 per 1,000 gallons for water transferred to the DWS systems. *As part of the agreement the Department of Water Supply has agreed to take actions to reduce its withdrawal from the Wailoa Ditch during dry periods. The current agreement will expire on December 31, 1997.*

3. WATERSHED PROBLEMS AND OPPORTUNITIES

3.1 GENERAL

The unique combination of high elevation, favorable climate, relatively mild slope, and deep, fertile volcanic soils makes the Kula area one of the most productive agricultural areas in the state. Well-known products of the Kula farming area include round onion, cabbage, and protea.

The Upper Kula area suffers from inconsistent and inadequate domestic and agricultural water supply. The shortage of irrigation water has forced farmers to cultivate smaller areas of their farms and has caused crop losses during periods of drought. The agricultural water shortage problem was described and evaluated in the Water Resources Study for Upcountry Maui (WRSUM) prepared by the USDA Soil Conservation Service in 1989.

Cooler climate, panoramic vistas, and country character have also made the Kula area a desirable residential area. Despite the moratorium on new water services, family subdivisions and other new construction continue to increase domestic water demand in the Kula area. Between July 1989 to May 1991, Single Family Residence (SFR) services increased from 914 to 1,088. (WUDP, 1992)

The development of the Department of Hawaiian Home Lands (DHHL) residential and agricultural subdivisions in Waiohuli and Keokea will require water connections and will further decrease water supplies available to existing users on the Upper Kula Water System. Projections made in 1991 indicate 308 residential and 68 agricultural lots will be developed in the first of several increments. The daily water demand for the first increment will be nearly 0.5 million gallons per day (MGD). At maximum development, the 4,716 projected residential lots and 211 agricultural lots will require 2.5 MGD of domestic water and 1.0 MGD of agricultural water. (DHHL, "Water Improvements to Enable Homesteading, Maui/Molokai", October 1991) Following discussions with personnel from the DHHL Planning Office, in 1994, it was decided by planners for this project that 1,000 residential units and 75 acres of irrigated cropland supplied by the Upper Kula Water System would be a realistic projection of development for the medium-term future. An extension of the Lower Kula Water System to the DHHL subdivision is also being planned to supply water to DHHL users.

Water use projections indicate the agricultural water shortage will worsen despite the new 36-inch transmission pipeline from Waikamoi to Olinda and the 100-million gallon (MG) Kahakapao reservoir that have been recently brought into operation.

By the year 2010 domestic water demand is estimated to increase to approximately 1.0 MGD due to continued growth of family subdivisions and the development of approximately 1,000 DHHL residential units in Waiohuli and Keokea. *Estimates of projected demand on the Upper Kula Water System are displayed on Table A below.*

Table A
Forecasted Average Daily Upper Kula Water Demand
(million gallons per day)

Source of Forecast	*Domestic Demand*	*Agricultural Demand*	*Total Demand*	*Forecast Year*
Maui County Water Use and Development Plan; M&E Pacific, Inc.; 1992	--	--	*1.63*	*2010*
Water Resources Study for Upcountry Maui; USDA SCS; 1989	*0.94*	*0.91*	*1.85*	*NA*
Upcountry Water System Improvement Master Plan; BWS; 1987	*1.06*	*1.20*	*2.26*	*2007*
Study of Surface Water Development for Maui Upcountry Water Systems; Belt, Collins & Assoc.; 1985	--	--	*2.1*	*2000*

3.2 PROBLEMS

The major problem in the project area is that the Upper Kula Water System will be unable to provide adequate water to its agricultural users. Agricultural water users will bear the brunt of water shortages due to their lower priority to domestic water users.

Effects of the water shortage problem include limitation of irrigated crop acreage, reduced crop yields, and prolonged irrigation periods and effort due to lowered pressures and small meter sizes.

A number of water conservation measures have been imposed by the County Board of Water Supply in the Upper Kula area. The "Kula Rule", imposed by the Board in 1977, has sought to limit demand by limiting the allocation of new meters and by restricting all new meters to 5/8-inch diameter on the Upper Kula Water System. An "Upcountry Pumping/ Conservation/Restriction Policy" has also been implemented which correlates initiation of pumping from lower water sources and issuance of voluntary conservation or

mandatory restriction announcements to water levels in the Waikamoi and Olinda reservoirs.

During the past 23 years, the Upper Kula area has been subjected to 11 periods of mandatory water restriction for a total of 414 days and 14 extended periods of voluntary restrictions.

During the past five years the County of Maui and the State of Hawaii have undertaken efforts to relieve the water shortage situation in Upper Kula. Two actions that were recommended for the Upper Kula Water System in the Water Resources Study for Upcountry Maui have been implemented by the Maui Board of Water Supply, with assistance from the State. The installation of the 36-inch diameter ductile iron pipeline from Waikamoi to Olinda increased the transmission capacity of the system from 1.5 MGD, with only a 12-inch diameter pipeline, to 31.5 MGD. The 100-MG Kahakapao reservoir increased system storage from the 30-MG that was provided by the Waikamoi Reservoir. The Waikamoi Reservoir will be used as a transfer reservoir and will be empty much of the time. The 9-MG reservoir at the Olinda Water Treatment Plant is used for water clarification and is not considered as part of the storage system.

With the improvements in transmission and storage, the Olinda Water Treatment Plant and the distribution system will be the constraints to effective delivery of water supply. The Olinda Water Treatment Plant which provides clarification and disinfection of all water in the Upper Kula Water System has an operational capacity of 1.7 MGD. After providing for domestic demand of 1.0 MGD, agricultural water will be limited to 0.7 MGD during periods of abundant water supply at the source. During times of water shortage, agricultural water will be rationed or curtailed to conserve water for domestic uses.

Improvements to the distribution system to provide adequate agricultural water were also identified in the WRSUM. The alternatives recommended either an increase in capacity of the existing distribution system, including water treatment plant capacity, or installation of a separate agricultural water distribution system.

In 1993, 125 active farms with approximately 398 acres of cropland were identified in the project area through aerial photography. Most of the farms are small operations with one or two acres in cultivation. Twenty-four of the farms have over five acres under cultivation and seven farms have over 10 acres under cultivation. Of the identified cultivated acres it is estimated that only about 175 acres, or 44 percent of the existing cropland, can be effectively irrigated with the existing Upper Kula Water System. Irrigation supply reliability for the 175 acres was estimated to be 85 percent. To

exacerbate the situation, an additional 75 acres of cropland in the DHHL Keokea agricultural lots to be developed will also require irrigation water in the near future.

Table B - Irrigated Crops in Future Without Project displays the estimated future irrigated crop acreages and annual net return per acre for the major crop categories without implementation of an agricultural water supply project.

Table B
Irrigated Crops in Future Without Project

Crop Category	Acres	Annual Net Return (dollars/acre)	Total (dollars)
Truck Crops	81	*4,590*	*371,800*
Flowers	19	*1,680*	*31,900*
Protea	56	*5,770*	*323,100*
Orchard	12	*340*	*4,100*
Christmas Trees	7	*1,120*	*7,800*
Total	175	*4,200* 1/	*738,700* 2/

1/ Composite average annual net return per acre.
2/ Does not equal total of individual crops or product of acres and composite net return due to rounding.

When protected from drought effects by fully adequate and consistent irrigation water, annual net returns per acre could potentially increase to as much as *$10,420, $7,620, $7,620, $560,* and *$1,230* for truck crops, flowers, protea, orchards, and Christmas trees, respectively. An increase in irrigation supply reliability will reduce drought-related damage to existing crops.

With increased irrigation water supply, the potential for fuller utilization of existing cropland can be realized. The development of new cropland is also possible. If all of the existing 398 acres of cropland and the additional 75 acres in the Hawaiian Home Lands subdivision are adequately irrigated an additional *$1,680,000* to *$2,240,000* in annual net returns can be achieved.

The inadequate agricultural water supply prevents farmers from installing some soil and water conservation measures. Effective windbreak plantings, both primary and in-field, require irrigation for effective development. Windbreaks have been shown to be effective in reducing soil and water losses while protecting crops from wind damage. Irrigated cover crops and green manure crops for fallowed fields can increase soil fertility and tilth while reducing water and wind caused soil erosion.

3.3 OPPORTUNITIES

The major goals of the Citizens' Advisory Committee to the Makawao-Pukalani-Kula Community Plan include continuance of the agricultural character of the Upcountry area and implementation of land use controls to retain farmland and open space. The Makawao-Pukalani-Kula Community Plan identifies the retention of agriculture as one of the five major problems facing the community planning area.

Project action to provide more agricultural water to the project area will serve to strengthen and retain the agricultural base of the Upper Kula area. In addition to the land use controls recommended in the Community Plan, the establishment of stable farming conditions is needed to maintain the viability of agriculture in the area.

The development of a separate agricultural water distribution system will enhance the level of service that can be provided to domestic customers by the Department of Water Supply by reducing demand on the Water Treatment Plant and on existing pipeline systems. The Water Treatment Plant for the Upper Kula Water System is frequently operated at or exceeding its capacity. The need to operate the Water Treatment Plant at or exceeding capacity causes higher failure rates and less effective treatment.

The capacity of the distribution system to supply water is dependent on pipe size, storage tank volume, and, often, pump capacity. The removal of high volume agricultural users from the domestic system may provide more stable pressures and efficient operation of pumps and storage.

The treatment of agricultural water supply to drinking water standards is unnecessary. Treatment costs are estimated to be $0.85 per 1,000 gallons, which totals $216,900 per year for water used for irrigation. The development of a separate agricultural water supply system will eliminate the costly treatment of irrigation water.

The Upper Kula Water System is connected to the other BWS water systems in the Makawao District which receive most of its supply through an agreement with EMI and Hawaiian Commercial and Sugar Company. In the current agreement, the BWS has agreed to reduce withdrawal from the Wailoa Ditch. The development of an untreated agricultural system in Upper Kula should relieve the Wailoa Ditch of some of the agricultural demand during droughts. All of the water withdrawn from the Wailoa Ditch that is used in the Kula systems is first treated thereby making it less likely to be used by farmers in Upper Kula.

The Olinda-Kula SWCD and the Steering Committee for the Water Resources Study for Upcountry Maui are committed to secure adequate agricultural water for all farmers in

the Upper and Lower Kula areas and to decrease dependence and withdrawal of water from the EMI's Wailoa Ditch. In April 1996, the Olinda-Kula SWCD requested consideration of an extension of a lateral to the Lower Kula area to transmit water to Lower Kula farmers when the Waikamoi and Kahakapao Reservoirs are at capacity and during the interim while agricultural activity in the Upper Kula area is developed to the levels projected. The connection to Lower Kula will be operated such that water transported to Lower Kula will not decrease supplies for domestic or agricultural users in Upper Kula.

3.4 PURPOSE AND NEED

The Upcountry Maui Watershed project is needed to reduce crop losses caused by irrigation water shortages and to allow farmers to more fully utilize their cropland. The project is intended to provide adequate and consistent agricultural water supply at the highest reliability practicable. State and federal for the watershed project assistance was requested by the Olinda-Kula Soil and Water Conservation District based on the frequency of drought and water restrictions in the Kula area and the resulting economic losses suffered by the farmers.

4. SCOPE OF THE EIS

4.1 SCOPING OF CONCERNS

A scoping process to identify the significant issues to be addressed or considered in the development of the Upcountry Maui Watershed Plan-EIS was begun soon after planning commenced and continued through the planning process. Comments were obtained from government agencies and from interested groups and individuals. The scoping process included meetings with individuals, telephone contacts, correspondence, and group meetings.

A broad array of economic, social, environmental, and cultural concerns were identified during project scoping and were rated according to their degree of concern and significance to decision-making. Concerns involving agricultural and domestic water shortages are discussed in Section 3. The degree of concern is based on the number of times an issue was brought up in discussions with the community and public agencies. The significance to decision-making is based on public or institutional importance of the affected resource, the existence of laws or policies regarding the resource, and whether the authorities of PL-566 could be applied to the resource. The rating reflects the degree to which a concern affects the formulation or selection of alternatives or the degree to which a concern may be affected by alternatives.

Concerns ranked "high" have a significant effect on decision-making and must be considered in the formulation and selection of alternatives. Concerns ranked "medium" may be affected by some alternatives. Those ranked "low" are not significant, but will be considered. Concerns ranked "none" will not be considered in the analysis of alternatives. Table B - Evaluation of Identified Concerns lists the concerns and indicates the degree of significance to decision-making. Following Table B are brief discussions of each concern. Discussion of inadequate agricultural and domestic water supply is found in Chapter 3 - Watershed Problems and Opportunities.

TABLE C - EVALUATION OF IDENTIFIED CONCERNS
Upcountry Maui Watershed, Hawaii

Economic, Social Environmental, and Cultural Concerns	Degree of Concern 1/	Degree of Significance to Decisionmaking 1/	Remarks
Inadequate agricultural water supply	High	High	Project purpose
Inadequate domestic water supply	Medium	High	Constrained by Water Treatment Plant
Impacts to native forest ecosystems	High	Medium	Outside of Project Area
Erosion due to construction activity	Medium	High	
Interference with Hawaii Endangered Species Propagation Facility at Olinda	High	High	Breeding of Hawaiian Crow
Disturbance to archaeological sites	High	High	
Impacts to remnant dry forest areas	Medium	Medium	Along pipeline alignment
Reduction in stream habitat for native freshwater fishes and other aquatic species	High	High	Streams in collection area
Undesired urban growth	High	Medium	Result of easing "Kula Rule"
Degradation of watershed by feral pigs and humans	Medium	Medium	
Wetlands	Medium	Medium	None significant in Project Area
Surface water quality and quantity	Medium	Medium	
Groundwater quality and quantity	Medium	Medium	
Air Quality	Low	Low	
Biodiversity and Threatened and Endangered Species	Medium	Medium	
Streamflow restoration	Medium	Low	
Water quality of water systems	Low	Medium	
Puu Nianiau ATCBI facility	Low	Low	
Water supply to DHHL and native Hawaiians	High	High	
Use of wind power for pumping	Low	Low	
Promotion of water conservation	Medium	Medium	
Agricultural lands	Medium	High	Keep productive land in agriculture
Afforestation	Low	Low	

1/ High - Must be considered in the analysis of alternatives.
Medium - May be affected by some alternatives
Low - Considered, but low significance
None - Not affected by any alternative

4.1.1 Impacts to native forest ecosystems and resources in the Makawao and Koolau Forest Reserves including invasion of non-native plant and animal species into construction areas and access roads - Medium

Construction and maintenance activity in the native rain forest may introduce and spread damaging, non-native plant and animal species. The most important areas, in this regard, are forested areas in the Conservation Districts in the water source area. Importing soil or other biological material into sensitive areas and disturbance of vegetative cover by clearing or grading increases opportunities for alien plant species to take hold.

Portions of the Forest Reserves in the northern portion of the watershed include essential habitat for the recovery of the listed endangered Maui Parrotbill (Pseudonestor xanthophrys), Maui Akepa (Loxops coccineus), Maui Nukupuu (Hemignathus lucidus), Poouli (Melamprosops phaeosoma), and Crested Honeycreeper (Palmeria dolei).

The Waihou Spring Reserve near Olinda is the only Forest Reserve land within the project area.

4.1.2 Erosion due to construction activity - High

Erosion during land clearing, grading, and construction can cause sedimentation of streams and wetlands, impact aquatic ecosystems, reduce soil fertility, and create favorable conditions for pest species. The problem is especially acute where pipelines or other structures are constructed on or across steep gulches.

Erosion of road surfaces and cuts and fills for road alignments must also be addressed to prevent long-term erosion problems from developing.

4.1.3 Interference with the captive breeding of the endangered Hawaiian Crow at the Hawaii Endangered Species Propagation Facility at Olinda and the impact of chlorination facilities - High

Construction activity near the Olinda Endangered Species Captive Propagation Facility may create noise and vibration and will likely require heavy equipment traffic on Olinda Road. Past experience has shown that the birds in the captive breeding program are affected by construction-related traffic. Helicopter noise can also negatively affect the birds, depending on the time of year and if the birds are nesting. The breeding season of the endangered Hawaiian Crow (Corvus tropicus) is mid-February to July during which time nearby construction should be avoided.

Negative effects can also be caused by nearby location of chlorination facilities. Chlorine leaks from nearby treatment facilities and high levels of residual chlorine in water used by the birds are two additional potential problems. (DOFAW correspondence, 6/30/93)

4.1.4 Disturbance of archaeological sites - High

The State Historic Preservation Division reports several previously-identified significant site types within the watershed boundaries. These sites consist of Native Hawaiian heiau, petroglyphs, burial caves, habitational structures, trails and associated temporary shelters, ahupua'a boundary walls, dryland agricultural features, and special purpose gathering sites. Site 1042, consisting of petroglyphs, is found in the vicinity of Kaakaulua Gulch near Kula Highway. Sites 1036, 1037, and 1038, three heiau, are located in Keokea. Other sites have been identified in the DHHL survey. (SHPD, 7/16/94; 4/13/89)

Three post-contact Chinese agricultural sites in the vicinity of the proposed distribution pipeline alignments were identified by F. Watanabe during the reconnaissance archaeological survey in 1994. The three sites are located at approximately the 4,000-foot elevation in the Omaopio, Pulehuiki, and Kohea 1-2 ahupua'a. (Watanabe, 1996)

Terraces were found in three gulches during an archaeological survey in January 1997 by the NRCS Cultural Resources Specialist. The terraces were located on the overbank areas within Hapapa, Na'alae, and an unnamed gulch at approximately the 4,000-foot elevation. Other terrace features may exist in gulches that were inaccessible due to overgrowth.

There is a concern that expansion of agricultural activity in the Upper Kula area may result in the clearing of previously undisturbed areas for farming with the potential of disturbance of cultural resources.

4.1.5 Impact to remnant dry forest areas - Medium

Remnant native dry forest species are reported to exist in gulches, such as Kaonoulu, in the project area. Identification, through a botanical survey, and protection of such native species was recommended by the Maui Planning Department.

A reconnaissance-level botanical survey was conducted in the area of the proposed distribution system during October 17 to 21, 1994. The botanist found 83 taxa in 45 families. Fourteen taxa are considered native of which five are endemic and nine are indigenous. The native species are mostly common species widespread throughout the islands. (Herbst, 1994)

Four vegetation communities or associations were identified: pasture vegetation association, alien forest vegetation association, open gulch vegetation association, and urban vegetation association. The open gulch vegetation association areas are more moist, better protected from the elements, often less grazed than the flatter adjacent pastures, usually have a richer diversity of species, and contain remnant populations of native plants. The native plants found in the gulches of the project site are mostly common species such as koa (Acacia koa), pukiawe (Styphelia tameiameiae), and the fern, Pteris cretica. (Herbst, 1994)

4.1.6 Reduction in stream habitat for native freshwater fishes and other aquatic species due to increased diversion of streamflows - High

Concerns were expressed that expansion of the surface water collection system or transfer of more water from the stream diversions may degrade aquatic habitat for native aquatic fauna. The collection works for the Upper Kula Water System exist at Haipuaena, Puohokamoa, and Waikamoi Streams at the 4,200-foot elevation. An aquatic survey to characterize the affected stream habitat and locate native rare, threatened, or endangered species was recommended.

An aquatic resources survey was conducted for Waikamoi Stream, between the 720-foot and 4,200-foot elevations during the period October 5 to 7, 1994. Flows below the diversion at 4,200 feet are normally discontinuous. Aquatic habitat is generally provided by singular or connected pools. The survey was conducted by observation by two biologists and net deployment at three locations for drift samples. At two higher elevation locations, 3,120 feet and 2,980 feet, the only vertebrate fauna found were tadpoles (Rana sp.). Invertebrates included aquatic snails (Lymnaea sp.), slugs (Limax maximus), and dragonfly larvae (Anax strenuus). Damselflies (Megalagrion sp.) were observed. At the 720-foot elevation, just above Hana Highway, fishes, including o'opu nakea (Awaous stamineus), and crustaceans, including 'opae (Atyoida bisulcata), were observed. (Moncrief and Galloway, 1994)

An aquatic survey report of the streams between the Waikamoi Reservoir and Olinda noted no endemic gobies, atyid shrimps, or neritid snails at an elevation of approximately 4,200 feet. Some of the streams diverted in this area drain into Opana Gulch and Kakipi Stream and reduced streamflow may affect aquatic habitat in the lower reaches of Kakipi Stream. An aquatic survey of the lower reaches of Kapiki Stream is recommended by DLNR if improvements to the collection system west of Waikamoi are proposed. (DLNR, 1988)

The project area does not include the collection system for the Upper Kula Water System. The source of water for the agricultural water system will be the Upper Kula Water

System at the Kahakapao Reservoir. Excess capacity of the collection and transmission elements of the Upper Kula Water System will be utilized.

4.1.7 Undesired urban growth due to easing of the Kula Moratorium - Medium

The proper balance of between agricultural and open land and residential and urban development is key to maintain the rural, "upcountry" character of the Kula area that most residents and visitors value.

The recent improvements made by the Maui Board of Water Supply to the Upper Kula Water System and improvements proposed by the watershed project will increase water supplied to users and may cause easing of restrictions imposed by the "Kula Rule." The transfer of irrigation water to the untreated agricultural system will free treatment capacity at the Olinda Water Treatment Plant. There is a concern that with expanded water supply will come relaxation on approvals of family subdivisions and other land development requests, the population of the Kula area may increase as a result of expanded water supply.

The retention of agricultural and open land and the rural character of the Kula area are key objectives of the General Plan of the County of Maui and the Makawao-Pukalani-Kula Community Plan.

The 1980 General Plan sets as a land use objective, "make available to our people lands that are well-suited for agricultural pursuits." Policies to be enacted by the county to attain the objective include, "Protect agricultural lands from urban encroachment."; "Discourage the conversion of agricultural lands to non-agricultural uses."; and "Provide adequate irrigation water and access to agricultural lands."

The Makawao-Pukalani-Kula Community Plan seeks to control urban growth through regulatory and land use policy means.

4.1.8 Degradation of canopy and forest cover by feral pigs and marijuana growers resulting in less water retention in watershed - Medium

Concerns relating to loss of watershed integrity due to rooting and wallowing by feral pigs and forest canopy alteration by marijuana growers were expressed during scoping. Feral pigs have overturned and bared significant amounts of native forest floor, increasing runoff and soil erosion and creating favorable conditions for establishment of unwelcomed plant species. Marijuana growers are known to have cleared both canopy and forest floor cover to cultivate marijuana plants.

4.1.9 Wetlands - Medium

The National Wetland Inventory prepared by the U.S. Fish and Wildlife Service indicates most of the collection area below 6,400 feet is in palustrine-forested wetlands with streams and gulches classified as Riverine-upper perennial wetlands. Riverine-upper perennial wetlands do not extend into the project area.

With the exception of open reservoirs and ponds, which are classified as palustrine-open water, no wetlands are identified by the National Wetland Inventory in the project area. The U.S. Army Corps Regulations in 33 CFR Part 328.3 considers such water bodies used exclusively for stock watering and irrigation not to be "waters of the U.S."

4.1.10 Surface Water Quality and Quantity - Medium

All of the water collected by the Upper Kula Water System is from surface water sources. The collection area is undeveloped and is designated as conservation land. Open flumes and open reservoirs are used in the water system before the Water Treatment Plant at Olinda. All system water is clarified and disinfected at the Water Treatment Plant after which the water system uses pipes and enclosed tanks to prevent contamination.

The collection system for the Upper Kula Water System is highly dependent on rainfall. The small watershed area has little storage capacity and exhibits "flashy" streamflow. Streamflows vary quickly from hundreds of gallons per minute to prolonged dry conditions. (Belt Collins, 1985)

The Clean Water Act and the Federal Antidegradation policy will guide the activities of the project to avoid or mitigate adverse aquatic impacts such as increased siltation and turbidity; changes in direction of stream flow, chemical composition, substrate, dissolved oxygen, temperature, and streambed configurations; changed hydrology to wetland complexes; and habitat deterioration.

4.1.11 Groundwater quantity and quality - Medium

The groundwater resource in the watershed consists of the basal aquifer rising 10 to 15 feet above sea level in the project area and higher elevation water contained in dike formations in vicinity of the collection area. Well depths to the basal lens will be on the order of 3,000 to 4,000 feet. No wells exist in or near the watershed. Tunnels exploiting water in dikes are not known to exist near the watershed.

The 1993 Safe Drinking Water Act places more stringent and costly treatment requirements on water from surface sources than it does on aquifer sources. The Maui

Board of Water Supply is considering the pumping of groundwater from the Maliko wellfield to service domestic users in the Upper Kula area in order to decrease costs.

4.1.12 Air Quality - Low

The air quality in the watershed is excellent. Vehicular and farm/construction equipment exhaust, agricultural burning, and home heating currently contribute to air quality degradation.

Short-term, localized air quality effects caused by construction activities can be expected. Project actions will conform to the requirements of the Clean Air Act including preparation of an approved air quality implementation plan. NRCS will consult and coordinate with the State Department of Health to ensure the proposed actions comply with existing laws and efforts to maintain and improve air quality.

4.1.13 Biodiversity and Threatened and Endangered Species - Medium

Because Hawaii has the highest rate of species extinction in the nation actions should be taken to preserve the unique and rare habitats found in the watershed.

Portions of the Makawao and Koolau Forest Reserves include essential habitat for the recovery of the endangered Maui Parrotbill (Pseudonestor xanthophrys), Maui Akepa (Loxops coccineus), Maui Nukupuu (Hemignathus lucidus), Poouli (Melamprosops phaeosoma), and Crested Honeycreeper (Palmeria dolei). The endangered Hawaiian Crow (Corvus tropicus) are kept for captive propagation at the Hawaii Endangered Species Propagation Facility at Olinda.

4.1.14 Streamflow restoration for East Maui streams - Low

Stream restoration through elimination of diversions on some East Maui streams has been suggested. Expressed benefits of stream restoration include riparian habitat enhancement, promotion of Hawaiian farming and gathering rights, and increased aesthetic values. The benefits of stream restoration must be considered in concert with the other beneficial uses of water including domestic water supply and agricultural irrigation.

The streams suggested for restoration during scoping are generally on state-owned land and located outside of the watershed. The collection system for the Upper Kula Water System is situated on East Maui Irrigation Company-owned land.

4.1.15 Water quality of system water, cross connections - Medium

Water to be used for crop irrigation can be of lesser quality than drinking water. Higher levels of dissolved solids, suspended particles, and turbidity are acceptable for agricultural water.

High-density polyethylene (HDPE) and polyvinyl chloride (PVC) pipelines can be used for conveyance of agricultural water. Open reservoirs can be used for water storage within the distribution system.

The use of untreated agricultural water for human consumption is potentially dangerous. Preventive actions will be required to ensure that the two water systems are not confused for each other and that cross connections between the two systems are not created.

4.1.16 Puu Nianiau ATCBI facility - Low

The Federal Aviation Administration maintains an Air Traffic Control Beacon Interrogator (ATCBI) facility at Puu Nianiau within the watershed. The facility is located near the Haleakala National Park boundary at an elevation of 6,600 feet. The facility is approximately three miles away and over 2,000 feet higher in elevation than proposed project improvements. No effect to the ATCBI facility by the watershed project is expected.

4.1.17 Water supply to DHHL and native Hawaiians - High

Successful development of the planned residential and agricultural Department of Hawaiian Home Lands subdivisions in Keokea requires adequate and consistent water supply. In 1986 the DHHL awarded 308 residential leases and 68 agricultural leases in the Waiohuli-Keokea area to be serviced, in part, by the Upper Kula Water System. The "Kula Rule" moratorium on new water services was cited as the chief impediment to development of the subdivisions. No infrastructure development has yet occurred.

State government commitments to provide water to the DHHL areas have recently been made. The State of Hawaii, through a 1991 amendment to the Hawaiian Home Lands Act, is required to provide a "reserve" from state-controlled water systems for DHHL lessees. The Citizens' Advisory Committee updating the Makawao-Pukalani-Kula Community Plan has recommended integration of the DHHL Keokea development plans into the community plan and prioritization of water resources allocation to DHHL in their December 1994 report to the County Planning Department.

4.1.18 Use of Wind Power for water pumping and pumped-storage - Low

In the past, a significant cost to operate the Upper Kula Water System is for pumping from lower systems. The use of wind power to power pumps, either through electrical generation or directly, has been suggested. The incorporation of hydrogeneration and pumped-storage systems in the water supply system was also suggested. It will be a part of the operating responsibility of the project sponsors to seek proposals to incorporate such features into the water system.

4.1.19 Water Conservation by Users - Medium

Increased application of water conservation practices, including drip irrigation, mulching, windbreaks, and irrigation scheduling, will decrease the unit area requirement for irrigation water. Water conservation practices in concert with soil erosion control and pest and nutrient management are included in farm conservation plans for farms participating in the USDA's conservation assistance programs.

4.1.20 Agricultural industry and prime farmlands - High

The goal of retention of agricultural activity in the Upper Kula area was expressed repeatedly during scoping. Agriculture provides both the economic base for workers and the means to maintain the rural character of the Upper Kula area.

The Farmland Protection Policy Act of 1981 states the Federal policy to protect prime and unique farmland.

4.1.21 Afforestation - Low

A comment was made during the Scoping Meeting that afforestation/reforestation of the Upper Kula area could alter the regional rainfall regime to result in increased precipitation. The effectiveness of afforestation efforts has not been thoroughly documented nor have the parameters required for success been identified. A separate effort will be needed to plan an afforestation project in Upper Kula.

5. FORMULATION OF ALTERNATIVES

5.1 GENERAL

Alternative plans were developed and evaluated to address the problem of agricultural water shortage in the Upcountry Maui Watershed. This section describes the rationale and process for plan formulation which began with evaluation of potential measures and culminated in the selection of an integrated watershed plan.

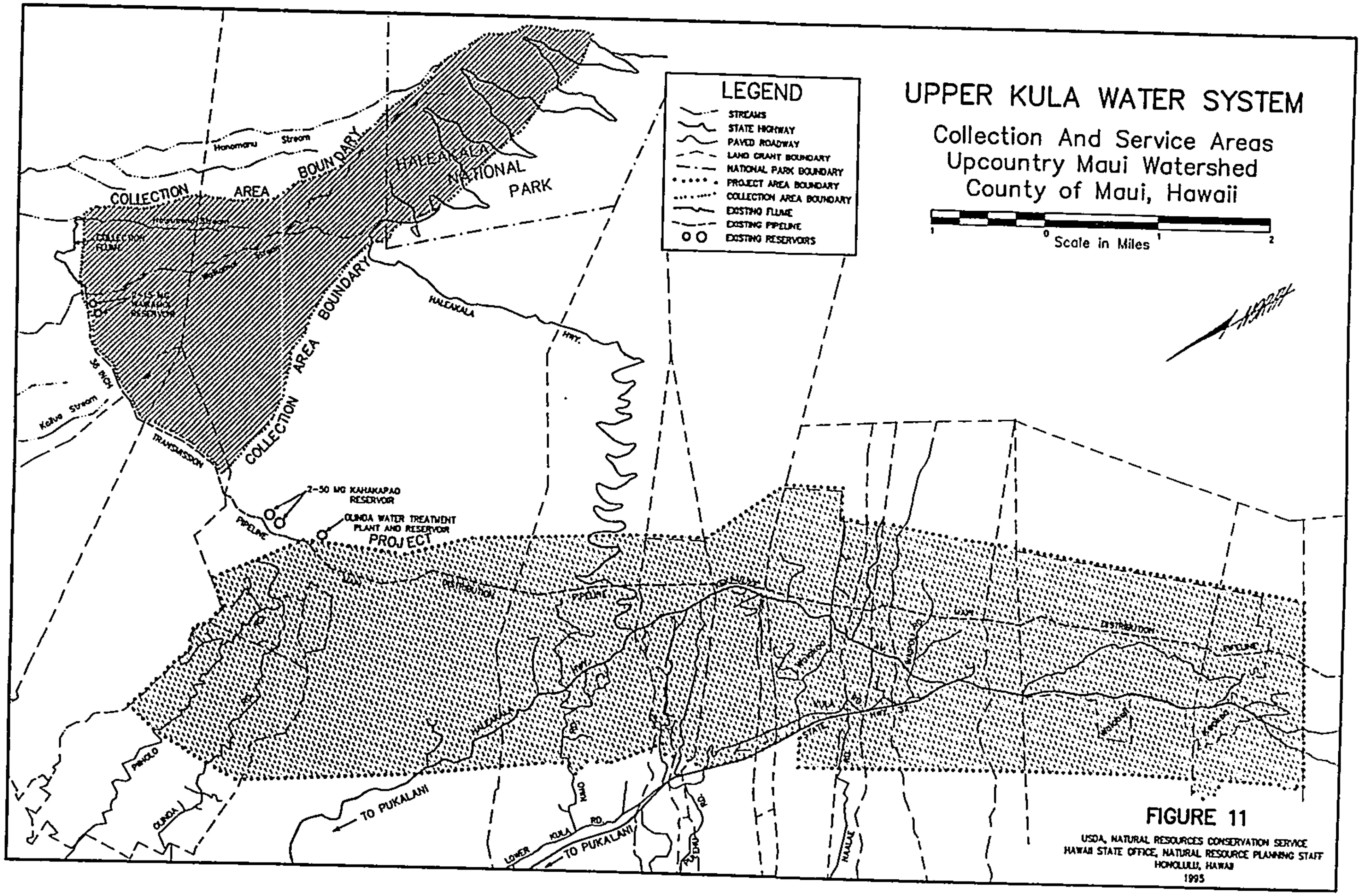
5.1.1 Upper Kula Water System

The Upper Kula Water System has been in existence, in various forms, since 1912 when a wooden dam and a 19-mile long wooden-stave pipeline were installed to convey water from Waikamoi Stream to Ulupalakua. Since that time, numerous improvements and additions to the water system have resulted in the current configuration. (see Figure 11 - Upper Kula Water System)

Major components of the Upper Kula Water System are intakes on Haipuaena and Puohokamoa Streams; intakes on nearly 50 additional small drainages; a 1-MG reservoir and dam on Waikamoi Stream with 40-MGD intake capacity; the twin Waikamoi Reservoir with 30-MG storage capacity; transmission pipelines with 31.5-MGD capacity; the two-cell Kahakapao Reservoir with 100-MG storage capacity; the Olinda Water Treatment Plant; and the domestic water distribution pipeline system with numerous enclosed storage tanks ranging from 5,000 gallons to 2.1 MG.

The land parcel on which the collection system is located is owned by East Maui Irrigation Company. Under the current agreement, which is an extension of the 1973 agreement between the Board of Water Supply, East Maui Irrigation Company, and the Hawaiian Commercial and Sugar Company, the East Maui Irrigation Company will collect and supply water to the Department of Water Supply from several sources including the Upper Kula collection system. The County of Maui owns the collection system infrastructure and is responsible for replacements and major repairs.

The major water sources are Haipuaena, Puohokamoa, and Waikamoi Streams. The Haipuaena Stream intake is a low, grated diversion dam. The amount of water collected from Haipuaena Stream and approximately one dozen smaller drainages is constrained to 6.7 MGD by the capacity of the 13-inch by 23-inch flume that leads to the Waikamoi dam. The capacity of the Puohokamoa diversion pipeline to Waikamoi dam is 2.5 MGD.


UPPER KULA WATER SYSTEM
Collection And Service Areas
Upcountry Maui Watershed
County of Maui, Hawaii
Scale in Miles
LEGEND
STREAMS
STATE HIGHWAY
PAVED ROADWAY
LAND GRANT BOUNDARY
NATIONAL PARK BOUNDARY
PROJECT AREA BOUNDARY
COLLECTION AREA BOUNDARY
EXISTING FLUME
EXISTING PIPELINE
EXISTING RESERVOIRS
HALEAKALA NATIONAL PARK
COLLECTION AREA BOUNDARY
Honomanu Stream
Kolea Stream
36 INCH
TRANSMISSION
HALEAKALA HWY.
2-50 MG KAHAKAPAO RESERVOIR
OLINDA WATER TREATMENT PLANT AND RESERVOIR
PIPELINE
PROJECT
DISTRIBUTION
TO PUKALANI
LOWER KULA RD.
PIIHOLO
OLINDA
FIGURE 11
USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

All water transfers in the system are gravity operated. A side inlet behind the 1.0-MG Waikamoi dam can convey 40 MGD to the Waikamoi Reservoir via a 48-inch diameter pipeline. Flows into the Waikamoi Reservoir in excess of the 30-MG capacity are released back into Waikamoi Stream.

The Waikamoi Reservoir is directly connected to the Kahakapao Reservoir by nearly 17,000 feet of 36-inch diameter steel pipeline and an older 12- and 16-inch pipeline with a combined capacity of 31.5 MGD. The 100-MG Kahakapao reservoir is the primary storage element of the Upper Kula Water System. Flow into the Kahakapao Reservoir is normally controlled by a float valve at the entry to the reservoir. Inflow into Kahakapao Reservoir in excess of its capacity are released into Kahakapao Gulch.

The Olinda Water Treatment Plant receives untreated water from the Kahakapao Reservoir through an extension of the 36-inch diameter pipeline. The Water Treatment Plant has an operating capacity of 1.7 MGD. The plant is currently run at capacity most of the time.

The main distribution pipeline, which extends from Olinda to Kanaio where it turns east to traverse the southern flank of Haleakala, is approximately 27 miles long. The main pipeline varies in diameter from 12 inches to two inches between Olinda and Kanaio. Storage facilities along the pipeline include the 2-MG Omaopio tank, 2.1-MG Alae tank, and numerous other tanks ranging from 5,000 gallons to 105,500 gallons. A pumped connection from the Lower Kula Water System exists at the Omaopio tank to allow augmentation from the Lower Kula Water System.

In May 1991 the Upper Kula Water System had 1,567 service accounts of which 223 were agricultural accounts. All users, domestic and agricultural, on the Upper Kula Water System receive water treated to current Safe Drinking Water Act standards.

5.2 FORMULATION PROCESS

The formulation of alternatives was begun by identifying and evaluating individual measures to solve the agricultural water shortage problem. The separate measures were evaluated in different combinations as alternative plans. Environmentally and socially acceptable alternative plans were further refined and detailed as Candidate Plans.

5.2.1 Measures

Land treatment practices and structural measures to alleviate the water shortage problem and other natural resource problems were considered. Land treatment practices are measures planned and installed on individual farms to protect or conserve soil and water

resources. Structural measures are improvements that require group or government involvement to implement. Land treatment measures were considered for water conservation purposes on individual farms. Structural measures were considered for the Upper Kula Water System to improve collection, transmission, storage, and distribution capabilities.

Land treatment measures such as water-conserving irrigation systems on the farms can make most efficient use of the limited water resources. Sprinkler irrigation requires about one and one-half times as much water as does drip irrigation. Nearly one-half of the irrigated cropland in the service area, including 80 percent of the truck crops, is currently sprinkler irrigated. Reasons for the use of sprinklers include the need for foliar application of water for wash, control of pests, and foliar intake of nutrients. Sprinkler irrigation has become an entrenched practice for many of the long-time farmers. The capital investment in sprinkler equipment makes it uneconomical to switch to drip irrigation. Additionally, some farmers are concerned about clogging and maintenance on drip systems.

Gradually, farmers are converting to drip irrigation. Continued change toward increased water conservation is supported by the Olinda-Kula Soil and Water Conservation District through their coordination of on-going conservation programs. Technical assistance for irrigation planning is be provided by the NRCS Wailuku Field Office. Financial cost-share assistance may be available through the USDA programs offered by NRCS and Farm Services Agency. Because of existing efforts encouraging water conservation, the Upcountry Maui Watershed project will not provide an additional water conservation component.

Structural measures to improve elements of the Upper Kula Water System were considered in order to supply adequate and consistent agricultural water supply to the Upper Kula farmers. The Upper Kula Water System was first evaluated to assess the limitations of its components - collection, transmission, storage, and distribution.

Rainfall and streamflow records in the watershed and, particularly, at the collection area were evaluated using a water budget model to assess the capability of the existing collection element. The consistency of the source was evaluated using the 15 years of available daily rainfall and streamflow data from 1953 to 1968. The analysis demonstrated that the existing collection system provided adequate collection capability. The collection system which diverts streamflow from Haipuaena, Puohokamoa, and Waikamoi Streams, in addition to nearly 50 small ephemeral drainages, has a capacity to transfer 40 MGD to the 30-MG Waikamoi Reservoir. Hydrologic analysis indicated that an average of 2 MGD can be expected for a three-month period 90 percent of the time.

Some collection system improvements that were considered during early planning included developing an intake behind the Waikamoi Arch Dam, extending the collection system eastward past Haipuaena Stream, improving the stream collection intakes to increase efficiency and reduce clogging, and piping flume flow from Haipuaena and Puohokamoa directly to the Waikamoi Reservoir. The primary reason for not pursuing any of the improvements was the determination that the collection system was adequate in its present form. An equally important consideration is avoidance of impacts to sensitive forest and stream ecosystems in the collection area that would have been affected by construction activity.

The transmission element is comprised of a recently-constructed 36-inch diameter steel pipeline and an older 12-inch to 16-inch diameter pipeline extending 3.2 miles from the Waikamoi Reservoir to Kahakapao Reservoir and the Olinda Water Treatment Plant. The pipelines have a capacity to transmit approximately 31.5 MGD from the Waikamoi Reservoir to the Kahakapao Reservoir. As the transmission capacity exceeds the interim storage capacity at the Waikamoi Reservoir no improvement was needed to the transmission element.

The main storage component of the Upper Kula Water System is the 100-MG Kahakapao Reservoir. The open reservoir is located one-half mile east of the Olinda Water Treatment Plant and stores water transferred from the 30-MG Waikamoi Reservoir for release to the Water Treatment Plant.

The Olinda Water Treatment Plant has an operational capacity to treat 1.7 MGD. At this rate of withdrawal, the Kahakapao Reservoir is expected to be able to provide water to the Water Treatment Plant nearly 100 percent of the time. While the Kahakapao Reservoir holds untreated water and is open, all reservoirs to the south of the Water Treatment Plant contain treated water and are fully enclosed.

Domestic water demand in 2010 will be approximately 1.0 MGD. (USDA, 1989; State of Hawaii, 1992) Additional domestic demand will come from the continued construction of "family subdivisions" and the construction of approximately 1,000 residential units in the DHHL project at Keokea. With the present system, future agricultural water supply will then be limited to an average of 0.7 MGD. It is estimated that this amount of water is sufficient to adequately irrigate only 175 acres of cropland in the project area, which is identical to the existing condition.

Ways to overcome the 1.7 MGD limit of the Water Treatment Plant are to upgrade the Water Treatment Plant to provide more treatment capacity or to bypass the WTP to allow untreated water to be used for agriculture.

Modification of the Water Treatment Plant to provide more capacity has been considered by the Department of Water Supply. However, the higher level of treatment for surface water mandated by federal Safe Drinking Water Act requirements and increasing cost of treatment materials make such expansion operationally costly. The Department of Water Supply is pursuing alternatives to surface water sources, such as wells, for domestic supply to lower water treatment costs. Increasing the capacity of the WTP may also require the upgrade of the distribution pipeline from Olinda to Omaopio which presently has a 2.0 MGD capacity.

A separate agricultural pipeline that bypasses the Water Treatment Plant and serves only agricultural users was discussed and evaluated in the Water Resources Study for Upcountry Maui. The dual water system concept for the Upper Kula area is supported by the Makawao-Pukalani-Kula Community Plan (1990), the Maui County Water Use and Development Plan (1992), and by the Steering Committee for the Water Resources Study for Upcountry Maui. A separate agricultural pipeline would provide the advantages of using untreated water for irrigation and allow the use of system materials and sizes to most efficiently supply irrigation volumes to farm areas, e.g. use of plastic pipe, pipe sizes to accommodate peak irrigation periods, and open reservoirs within the distribution system.

With a dedicated agricultural water system, farmers will be able to more fully utilize their farm plots, will suffer less frequent damage due to drought, and will be able to irrigate windbreaks, cover crops, and green manure crops.

The agricultural water distribution system will likely diverge from the Upper Kula Water System before the Olinda Water Treatment Plant and continue south toward Keokea generally along the alignment of the main distribution line of the existing system. Laterals, reservoirs, and pressure/vacuum devices will be provided. Tanks and pumps may be required to serve some farming areas uphill of the distribution line.

Additional reservoir storage in the Upper Kula area can provide increased reliability to both water systems. Several water storage improvements were evaluated. During preparation of the WRSUM, consideration was given to expansion of the capacity of the 30-MG Waikamoi Reservoir, development of a 75-MG reservoir at Waihou Spring Forest Reserve, and development of a 45-MG reservoir along Mahanalua gulch.

Enlarging the Waikamoi reservoirs by raising the sidewalls was limited in practicality due to system head (water level) considerations. The Waikamoi Reservoirs will be better used as a transfer reservoir to Kahakapao reservoir.

The Waihou site is downslope of the Upper Kula Water System and would require pumping with additional costs. The reservoir site is also in the proximity of the Olinda Endangered Bird Captive Propagation Facility which could be impacted during reservoir construction.

The Mahanalua site is situated near Puu Mahanalua, approximately 3,000 feet southwest of the Olinda Water Treatment Plant. A recent evaluation indicates a 35-MG open, lined reservoir can be sited there which can increase the agricultural water supply reliability approximately five percent over a separate agricultural water system without a storage reservoir.

A connection to Lower Kula farmers was requested by the Olinda-Kula SWCD to provide irrigation water when the Waikamoi and Kahakapao Reservoirs were filled to capacity and when excess water supply was available. (see Appendix B) One of the lateral pipelines could be enlarged and extended to provide system flexibility to transmit water supply to Lower Kula when the opportunity exists. The extension pipeline from the terminus at Kula Highway and reservoir storage will be provided by the sponsors.

Other sources of irrigation water supply were evaluated. The use of water catchments to harvest and store rainfall for irrigation is viable in areas if plentiful and consistent rainfall. In the project area, average annual rainfall varies from 30 inches to 80 inches per year with approximately two-thirds occurring during the wet months of November to April. In most parts of the project area irrigation is needed year around to maintain a commercial crop. The cost to harvest and store the approximately 4,000 gallons needed per acre per day during the dry season would be too costly for most farmers.

The reuse of wastewater was also evaluated. The principal limitation was the lack of any community wastewater treatment facility in or near the project area. The nearest community facility serves Pukalani and the treated effluent is used at the Pukalani Golf Course. All wastewater disposal in the project area is through cesspools or household septic systems. Effluent from cesspools and septic systems are not provided the level of treatment to ensure safe reuse of the wastewater.

5.3 ALTERNATIVE PLANS

Two structural alternative plans were developed to address the agricultural water shortage problem. One plan, Alternative 2, proposes the installation of a separate agricultural distribution system. Another plan, Alternative 3, adds an additional reservoir to the proposed agricultural distribution system. A "No Action" alternative, Alternative 1, is also discussed in this section to allow comparisons of the without-project conditions to conditions with the alternatives installed.

5.3.1 Incremental Analysis

The two structural alternatives were developed using an incremental analysis procedure which produced the most efficient combination of service area, cost, water supply reliability, and pipeline sizes. The reservoir size for Alternative 3 was held constant at 35-MG which optimizes use of the Mahanalua reservoir site.

Four levels of irrigated cropland service area acreages - 473, 550, 650, and 722 acres - were evaluated for each alternative. The 473-acre level reflects the area of currently opened cropland plus the initial portion of the DHHL agricultural subdivision and will be the smallest service area considered. The 722-acre level reflects maximum utilization of cropland in the areas of current farming activity.

Reliability of water supply is the measure of the percentage of time that fully adequate irrigation water supply is available. Crop water budgets accounting for rainfall, evapotranspiration, irrigation efficiency, deep percolation, and soil evaporation losses were developed to determine daily irrigation requirements. Profitable farming activity requires agricultural water supply reliability above 80 percent. Reliability of water supply of approximately 90 percent was sought for this project.

TABLE D - INCREMENTAL ANALYSIS OF ALTERNATIVE 2
AGRICULTURAL WATER DISTRIBUTION SYSTEM
Upcountry Maui Watershed, Maui County, Hawaii
(dollars)

Acres	Reliability	Incremental Cost	Total Annual Cost	Incremental Benefits	Total Annual Benefits	Net Benefits
473	91%	*893,400*	*893,400*	*2,458,100*	*2,458,100*	*1,564,700*
550	87%	*66,200*	*959,600*	*(84,100)*	*2,374,000*	*1,414,400*
650	84%	*28,100*	*987,700*	*(499,500)*	*1,874,500*	*886,800*
722	81%	*26,300*	*1,014,000*	*(391,300)*	*1,483,200*	*469,200*

Price base: *1996* *March 1997*

TABLE E - INCREMENTAL ANALYSIS OF ALTERNATIVE 3
AGRICULTURAL WATER DISTRIBUTION SYSTEM AND RESERVOIR
Upcountry Maui Watershed, Maui County, Hawaii
(dollars)

Acres	Reliability	Incremental Cost	Total Annual Cost	Incremental Benefits	Total Annual Benefits	Net Benefits
473	95%	*1,370,700*	*1,370,700*	*2,699,800*	*2,699,800*	*1,329,100*
550	92%	*56,200*	*1,426,900*	*139,700*	*2,839,500*	*1,412,600*
650	89%	*36,600*	*1,463,500*	*(42,000)*	*2,797,500*	*1,334,000*
722	86%	*19,300*	*1,482,800*	*(243,500)*	*2,554,000*	*1,071,200*

Price base: *1996* *March 1997*

Table D above indicates that the service area of 473 acres for Alternative 2 provides the greatest net benefits. Table E indicates that the 550-acre service area for Alternative 3 produces the maximum net benefits.

The alternative plans were evaluated in consideration of the extent to which all investments and actions necessary to realize planned results are accounted; the extent to which identified problems are alleviated and opportunities achieved; the extent to which the most cost-effective configuration of each alternative is developed; and the extent to which public acceptance and compatibility with existing laws, regulations, and policies is achieved.

5.3.2 Alternative 1 - No Action

This alternative foregoes project action. It is included so that consideration is given to the effects of not installing project measures to solve the irrigation water shortage.

Components: No project improvements are proposed with this alternative.

Cost: There is no installation cost associated with this alternative.

Effects: The shortage of agricultural water supply will continue to limit farming activity in the Upper Kula area. An estimated 175 acres of irrigated cropland can be farmed with 85 percent agricultural water supply reliability. In actuality, more than 175 acres of irrigated cropland will continue to be farmed in the project area at a water supply reliability of less than 85 percent. Farmers will continue to sustain crop damage due to

inadequate irrigation and crop losses during droughts. Farmers will not be able to effectively utilize portions of their farm lots.

The average annual composite net return per acre is estimated to be *$4,200.* The total net return in the project area from irrigated cropland will be approximately *$738,700* per year.

Farmers will be unable to install soil and water conservation practices requiring irrigation such as windbreaks, cover crops, and green manure crops. The ongoing conservation program administered by the Olinda-Kula SWCD, with technical assistance provided by the NRCS Wailuku Field Office, will continue to be offered to area farmers.

5.3.3 Alternative 2 - Agricultural Distribution System

Alternative 2 provides 473 acres of cropland with agricultural water supply through a main distribution pipeline from Olinda to Keokea serving nine service areas through lateral pipeline systems. Agricultural water reliability of 91 percent will be provided by this alternative. Daily agricultural water supply will average 1.0 MGD. Peak irrigation demand will be 3.0 MGD.

Components: Alternative 2 will provide 9.4 miles of main agricultural distribution pipeline, *18.5* miles of lateral pipelines, 1.9 miles of sublateral pipelines, and appurtenant valves and vacuum/pressure devices. Approximately 9.2 miles of access and maintenance road will be constructed. (Figure 12 - Alternative 2)

The distribution system will provide agricultural water to farmers in the Olinda, Crater Road, Kimo Road, Pulehuiki/Kamehameiki, Kealahou, Waiakoa, Kaonoulu, Waiohuli, and Keokea/DHHL service areas. The system will provide 473 acres of irrigated cropland with agricultural water supply at 91 percent reliability.

The 9.4-mile long main distribution pipeline extending from the Olinda Water Treatment Plant to Keokea will vary in diameter from 18 inches to eight inches. The pipeline will use high density polyethylene or ductile iron pipe segments. Elevation of the pipeline will drop from 4,120 feet at Olinda to 3,100 feet at Keokea. A 15-foot wide easement across private parcels will be obtained and a 10-foot wide maintenance road will be constructed.

Nine lateral systems with two-inch to eight-inch diameter high density polyethylene pipeline will provide flow capacities between 40 gpm and 630 gpm to the service areas. Lateral pipelines vary in length from 4,700 feet to 19,850 feet. Sublaterals ranging from 30 feet to 500 feet in length will provide water to the farmlot boundary. *The extension of*

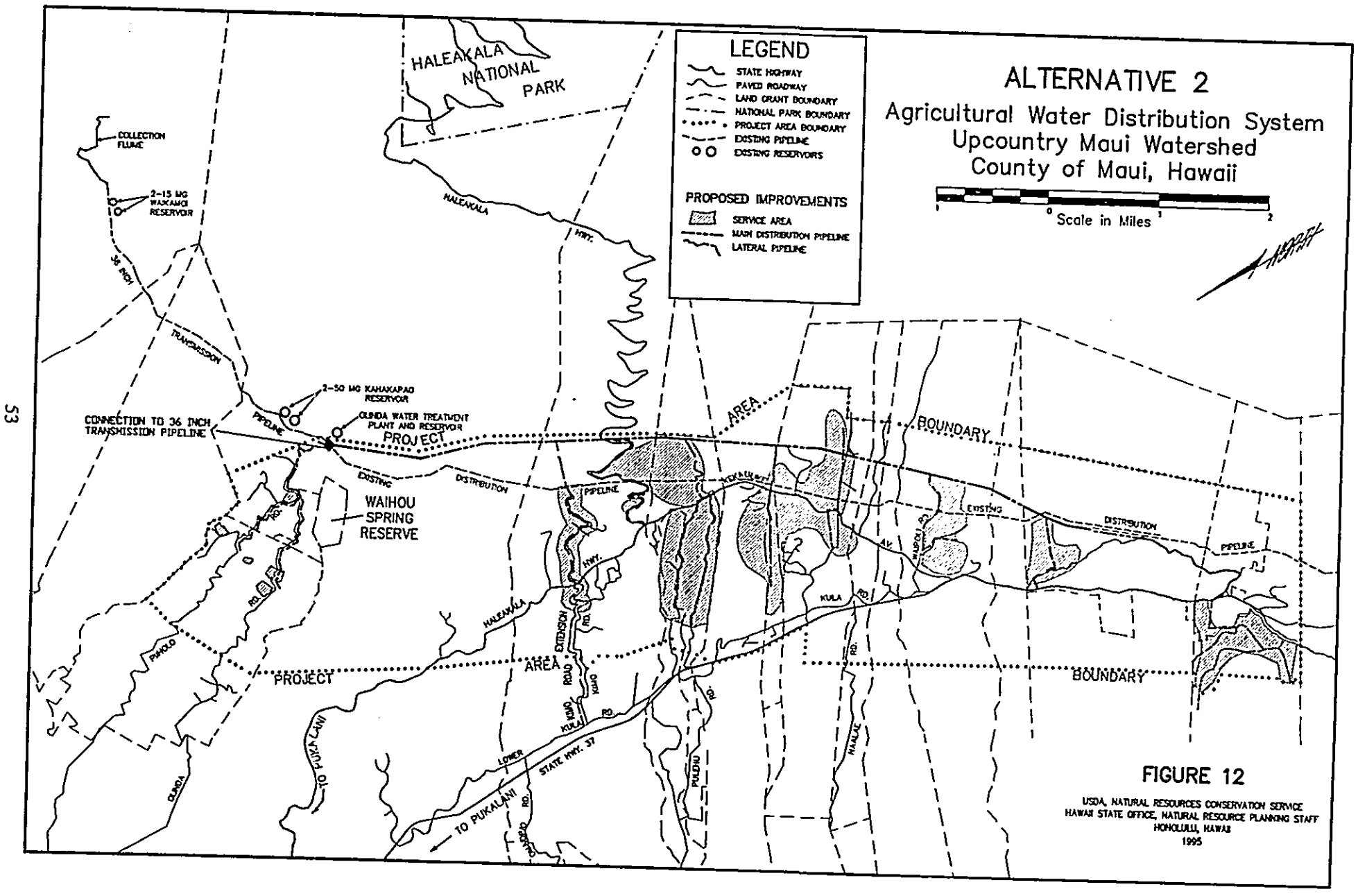


FIGURE 12

USDA, NATURAL RESOURCES CONSERVATION SERVICE
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the Kimo Road lateral will convey water to the Lower Kula area when excess supply exists.

Cost: The estimated installation cost is *$9,223,000* which includes *$6,920,400* for construction, *$1,038,000* for engineering assistance, *$1,038,000* for project administration, *$177,200* for real property rights, and *$49,400 for landrights improvements*. Estimated operation, maintenance, and replacement costs are *$168,800* annually.

Economic effects: Increased water supply reliability from an estimated 85 percent to 91 percent will decrease damage to crops due to drought by *$294,900* on an average annual basis for the existing 175 acres of irrigated acres. The average annual composite net return for each irrigated acre of cropland will increase from *$4,200* to *$5,930*. Increased water availability will allow irrigated crop acreage to increase from 175 acres to 473 acres which will increase annual net return by *$1,771,100*. Cessation of treatment of agricultural water to drinking water standards will reduce treatment costs by an average of $216,900 annually.

Other effects: Increased water availability will permit farmers to utilize vegetative conservation practices, such as windbreaks, cover crops, and green manure crops to conserve soil and water resources and improve soil fertility and tilth. The decrease in water treatment required at the Olinda Water Treatment Plant from its operating capacity of 1.7 MGD to 1.0 MGD may reduce treatment plant malfunction and improve water treatment effectiveness.

Increased crop production in Upper Kula will create employment opportunities and will stimulate secondary enterprises that support the agricultural industry. Improved produce quality due to consistent water supply could help maintain or increase market share in local markets.

5.3.4 Alternative 3 - Agricultural Distribution System and Reservoir

Alternative 3 provides a storage reservoir as part of the agricultural water distribution system. The service area for this alternative will total 550 acres. Agricultural water reliability will be 92 percent. Daily average agricultural water supply will be 1.3 MGD. Peak irrigation demand will be 3.5 MGD.

Components: The distribution pipeline system for this alternative is basically similar to the pipeline system described in Alternative 2. A shift of the main distribution pipeline downslope is required by the location of the reservoir. Slightly larger pipe sizes than in Alternative 2 will be required. (Figure 13 - Alternative 3)

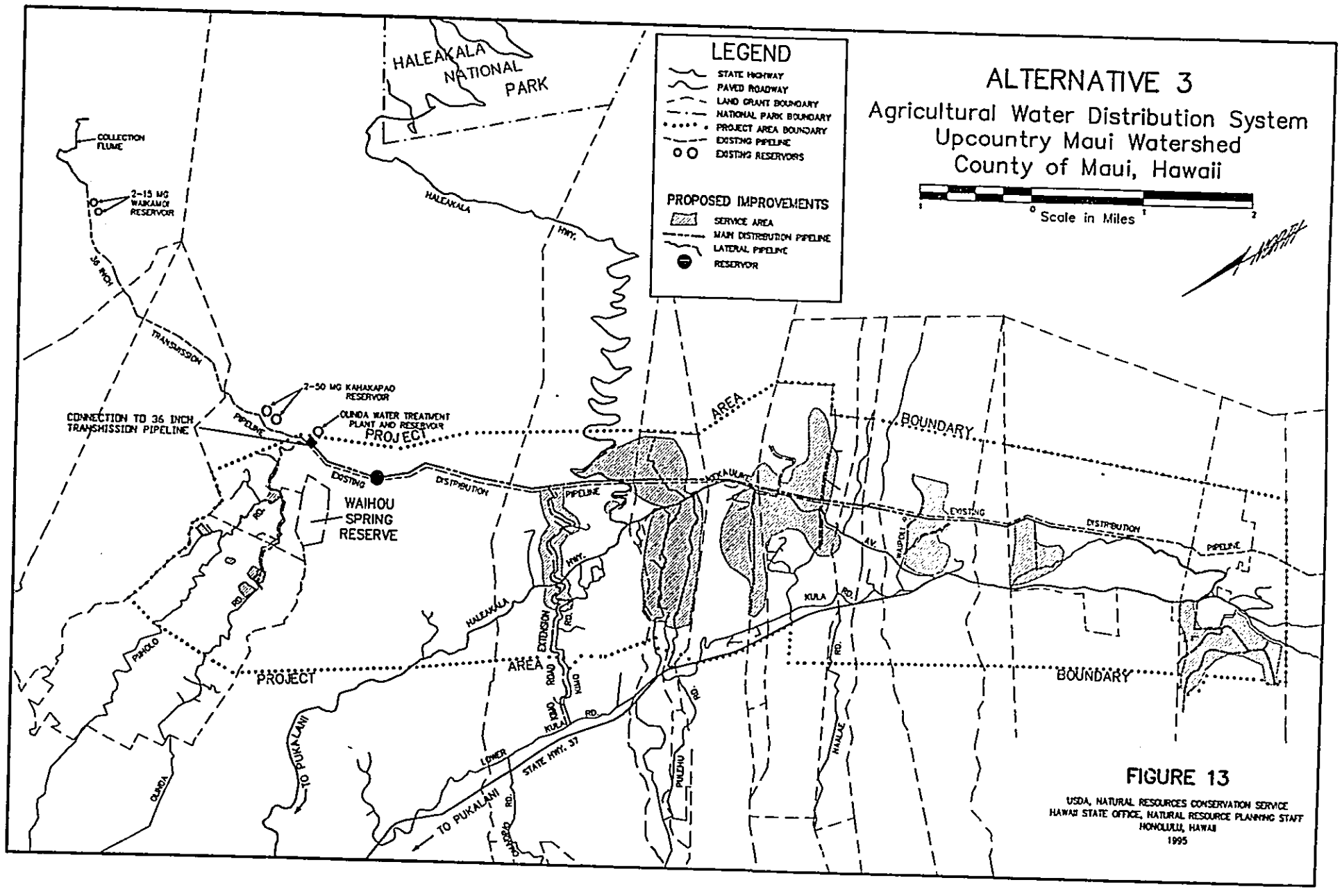


FIGURE 13

USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

This alternative proposes the construction of a 35-MG reservoir at Puu Mahanalua. The reservoir will be irregularly shaped and approximately 350 feet wide by 700 feet long at top of embankment. The compacted earth embankment will reach a maximum height of 40 feet. The reservoir will be lined with high density polyethylene or concrete.

Due to the lower alignment of the distribution system, three pump stations with storage tanks will be required to service uphill farmlots in the Crater Road-Pulehuiki/Kamehameiki, Waiakoa, and Kaonoulu service areas.

Cost: The estimated installation cost is *$13,767,000* which includes *$10,259,800* for construction, *$1,539,000* for engineering assistance, *$1,539,000* for project administration, *$379,800* for real property rights, *and $49,400 for landrights improvements*. Estimated operation, maintenance, and replacement costs are *$311,100* annually. Economic effects: Increased water supply reliability from an estimated 85 percent to 92 percent will decrease damage to crops due to drought by *$318,200* on an average annual basis for the existing 175 acres. The average annual composite net return for each irrigated acre of cropland will increase from *$4,200* to *$6,090*. Increased water availability will allow irrigated crop acreage to increase from 175 acres to 550 acres which will increase annual net return by *$2,290,800*. Cessation of treatment of agricultural water to drinking water standards will reduce treatment costs by an average of $216,900 annually. *The total average annual economic benefit is $2,825,900.*

Other effects: Increased water availability will permit farmers to utilize vegetative conservation practices, such as windbreaks, cover crops, and green manure crops to conserve soil and water resources and improve soil fertility and tilth. The decrease in water treatment required at the Olinda Water Treatment Plant from its operating capacity of 1.7 MGD to 1.0 MGD may reduce treatment plant malfunction and improve water treatment effectiveness.

Increased crop production in Upper Kula will create employment opportunities and will stimulate secondary enterprises that support the agricultural industry. Improved produce quality due to consistent water supply could help maintain or increase market share in local markets.

5.4 EFFECTS OF ALTERNATIVE PLANS

This section describes the economic, environmental, and social effects of the alternatives. The effectiveness of the alternatives to address the agricultural water shortage will be discussed. The impacts of the alternatives on the resources or environmental concerns ranked "high" or "medium", in Chapter 4, will also be discussed.

5.4.1 Agricultural Water Shortage

Without action an average of 0.7 MGD will be available to agricultural users. This amount will permit only 175 acres of cropland to be irrigated at a reliability of 85 percent. A total of 473 acres of cropland have been identified in the service area. If all 473 acres were irrigated, reliability would be 35 percent.

Alternative 2 would provide 473 acres of cropland with 91 percent agricultural water reliability. Average daily agricultural water supply will be 1.0 MGD with a 3.0 MGD peak supply.

Alternative 3 would provide 550 acres of cropland with 92 percent agricultural water reliability. Average daily agricultural water supply will be 1.3 MGD with a 3.5 MGD peak supply.

5.4.2 Domestic Water Supply Shortage

All alternatives will provide 100 percent reliability for domestic water supply. In future conditions without project improvements and no expansion of irrigated agriculture (Alternative 1), augmentation of water supply from lower sources will not be required. The Upper Kula Water System will provide at least 1.0 MGD of domestic water supply continually from Kahakapao Reservoir.

Alternative 2, with 473 acres of irrigated cropland, will require pumping of an average of 15 MG per year from lower sources to continually provide 1.0 MGD for domestic use.

Alternative 3, with 550 acres of irrigated cropland, will require pumping of an average of 13 MG per year from lower sources to continually provide 1.0 MGD for domestic use.

The average annual cost of pumping water from the lower system for domestic supply is estimated to be $22,800 for Alternative 2 and $12,600 for Alternative 3. The pumping costs are reflected in the annual Operation, Replacement, and Maintenance cost.

For Alternatives 2 and 3 the model assumed that domestic and agricultural water supply was not rationed or restricted until supply in Kahakapao Reservoir is depleted. In actuality, some restrictions will be first placed on agricultural water supply to conserve water for domestic use. The result would be to reduce the need to pump into the Upper Kula system while increasing water deficit days for farmers.

5.4.3 Impacts to native forest ecosystems and resources in the Makawao and Koolau Forest Reserves and invasion of non-native plant and animal species into construction areas and access roads

Except for the Waihou Spring Reserve the project area is outside of the Forest Reserve boundaries. No project activities will be conducted in the Waihou Spring Reserves in any of the alternatives.

There are no anticipated direct, indirect, or secondary impacts to nearby forest ecosystems.

5.4.4 Erosion due to construction activities

Alternative 1 will not require new construction and will not increase construction-related erosion. On-going maintenance and repair of the existing Upper Kula Water Sytem will continue to create the potential for soil erosion.

Nearly all of the area *in which construction will take place* for Alternatives 2 and 3 is in open pasture with occasional dry gulches. *Increased erosion potential can be expected during clearing and construction activities. Erosion and sediment control measures will be developed following site evaluation and will be specified in construction contracts. Measures that will be considered include staging of earthwork, seeding, mulching, diversions, sediment basins, and filters.* Pollution control measures will be utilized in accordance with the county grading ordinance *and NRCS construction specifications.*

Alternative 2 will require installation of buried and above-ground pipelines, gulch crossings, access road, and other appurtenant devices in the 4,200-foot to 3,100-foot elevations between Olinda and Keokea.

Alternative 3 will require construction of a 35-MG lined reservoir above Puu Mahanalua and installation of smaller storage tanks and pumps in addition to elements similar to those in Alternative 2.

5.4.5 Interference with the captive breeding of the endangered Hawaiian crow at the Hawaii Endangered species Propagation Facility at Olinda.

Alternative 1 will not cause any project activity near the Olinda facility.

Both Alternatives 2 and 3 propose the main agricultural pipeline to connect into the existing water system near the Olinda Water Treatment Plant. Construction equipment and supply traffic on Olinda Road may affect the breeding program at the Olinda facility. Both alternatives will provide agricultural water supply to farmers in the Olinda-Piiholo

region. Lateral pipelines, valves, and pressure/vacuum regulators will be installed along the roadways. Nearby construction and construction-related traffic may affect birds in the breeding program.

Consultation with managers of the Propagation Facility will be conducted to schedule construction activity to minimize impact to the propagation program.

No chlorination of the agricultural water supply is required. A reservoir in the Waihou Spring Forest Reserve was considered early during planning but was discounted due to the proximity to the Olinda Facility.

5.4.6 Disturbance of archaeological sites

No site types will be affected by Alternative 1.

There are no known historic properties listed on the Hawaii and National Registers of Historic Places or the Hawaii Inventory of Historic places that occur within the proposed construction corridors of Alternatives 2 and 3. In specific, no native Hawaiian heiau, burial caves, petroglyphs, and ahupua'a boundary walls were identified during archaeological fieldwork conducted in November 1994. Subsurface remains of habitational structures and dryland agricultural features have the potential to be present at several locations along the proposed waterline corridor for Alternatives 2 and 3 based on the information from Mahele maps, historic homestead maps, aerial photographs, and archaeological reconnaissance survey.

Alternative 2 has the potential to adversely impact newly identified areas containing post-contact Chinese surface dryland agricultural features and associated temporary shelters and trails. Three sites identified in the 1994 reconnaissance survey were recorded by the NRCS Cultural Resources Specialist in 1996. Site 4160, in Omaopio ahupua'a, contained 24 features consisting of 46 components. Most were of agricultural function: water control walls in swales, retaining walls along slopes, and clearing mounds. There were two platforms of indeterminate function. Site 4161, in Pulehuiki ahupua'a, consisted of four eroded earthen terraces, probably used for agriculture. Site 4162, in Kohea 1-2 ahupua'a, was the remains of a road bed which ended in a gully as a former land bridge. The pipeline alignment will be designed to avoid the identified features, as practicable.

Terraces were found on the stream overbanks in three deep gulches, Hapapa, Na'alae, and an unnamed gulch, in the vicinity of the distribution pipeline alignment for Alternative 2. Other similar terraces may exist in other overgrown and inaccessible gulch areas. The archaeological survey for such areas will be conducted when the area

is cleared for the topographic survey. The pipeline alignment will be adjusted to avoid the sites where possible. As the design of the project improvements are developed, NRCS will continue to consult with the SHPD to develop mitigation measures where impact is unavoidable.

Alternative 3, with the exception of the proposed Mahanalua reservoir and connecting waterline traverses the existing Upper Kula waterline corridor which has removed, disturbed, or otherwise destroyed any previous surface structures representative of significant historic site types.

The lateral pipeline corridors are along existing road and street rights-of-way and through dedicated easements through private lands. The lateral pipeline corridors were surveyed in January 1997 by the NRCS Cultural Resources Specialist who found no historic sites.

The service areas are existing farmland which have been previously disturbed.

5.4.7 Reduction in stream habitat for native freshwater fishes and other aquatic species

None of the alternatives propose alteration or expansion of the collection element of the Upper Kula Water System. Three major streams - Haipuaena, Puohokamoa, and Waikamoi - are presently diverted at the 4,200-foot elevation for the Upper Kula Water System. Collection rates at the stream diversions will be unaffected by any of the alternatives.

Overflow from the Waikamoi Reservoir back into Waikamoi Stream during periods of high rainfall will decrease with implementation of Alternative 2 or 3. *The average overflow from Waikamoi Reservoir without the project is estimated to average 650 million gallons per year. Alternative 2 will reduce overflow from Waikamoi Reservoir by approximately 140 million gallons per year. Alternative 3 will reduce overflow from Waikamoi Reservoir by approximately 210 million gallons per year. An amendment to the interim streamflow standard may be required by the State Commission on Water Resources Management.*

The Hawaii Stream Assessment rates the aquatic resources of the three streams, listed above, as "limited." The aquatic survey conducted October 5-7, 1994 confirmed that at higher elevations, 3,120 feet and 2,980 feet, there are no significant aquatic resources, including native vertebrate species, that may be affected.

5.4.8 Undesired urban growth due to easing of the "Kula Rule"

Even without project action, Alternative 1, the recent improvements to the Upper Kula Water System have improved reliability of domestic water supply and may cause easing of the "Kula Rule." *More building permits in areas with existing compatible zoning will likely be approved. Conversion of zoning and acquisition of variances to increase residential and commercial development will still require public input during the process.*

Alternatives 2 and 3 will alleviate the agricultural water shortage caused by inadequate distribution capacities and are not intended to expand domestic water supply. Neither improvement alternative will expand the supply source. The ultimate limitation to water supply in the Upper Kula area is the extreme variability of water collection at the source and storage of supply for use during dry periods. Even with the improvements, periods of drought will still cause restricted water supply for both domestic and agricultural users. With Alternatives 2 or 3 implemented, pumping water from lower sources during droughts will still be required to augment domestic water supply in Upper Kula.

The allocation of water meters for new residences and businesses and the easing of the "Kula Rule" are landuse decisions to be made by Maui County officials. The Citizens' Advisory Committee for the Makawao-Pukalani-Kula Community Plan has advocated increased landuse controls to protect agricultural activities, open land, and "up-country" atmosphere. Control of urban growth and development should be managed through landuse planning rather than water resource rationing.

5.4.9 Wetlands

All alternatives were assessed for wetlands and stream impacts. Alternative 1 will have no effects on wetlands.

Alternative 2 will not affect any wetlands or other "waters of the U.S." Although the National Wetland Inventory maps indicate that the reservoirs are palustrine-forested wetlands, these ponds are artificial pond crreated by excavating dry land to retain water and are used exclusively for stock watering and irrigation. These areas are defined by the U.S. Army Corps of Engineers in 33 CFR Part 328.3 as generally not considered to be a "water of the U.S." The NWI also classified gulches in the collection area as "riverine-upper perennial wetlands." These wetlands do not extend into the project area. The pipeline will be elevated over the bottoms of the intermittent gulches. No work is contemplated below the ordinary high water mark or within any riparian wetland areas.

Construction of the reservoir in Alternative 3 may affect waters of the U.S., however, this alternative is not the one recommended.

5.4.10 Surface water quality and quantity

None of the alternatives will alter the surface water collection system. The gravity-controlled collection system will continue to convey water to the Kahakapao Reservoir at the same rate for all alternatives. The Upper Kula Water System discharges overflow from Waikamoi Reservoir and Kahakapao Reservoir during periods of high rainfall. Overflow at the Waikamoi Reservoir will occur only during periods of exceptionally heavy runoff when the 40-MGD Waikamoi Dam intake exceeds the Waikamoi Reservoir storage capacity and the 31.5-MGD transmission capacity. Overflow from the system will mostly be into Kahakapao Gulch from the 100-MG reservoir.

There are no significant surface water resources in the project area. No discharge will be made into other non-agricultural water bodies from the agricultural water distribution system. On-farm irrigation will be planned and applied to conserve water and should not result in surface discharge from the farm fields.

An indirect effect of increased irrigated cropland acreage will be an increased volume of agricultural chemical usage in the project area. The risk of movement of pesticides and nutrients off of the farm field as surface runoff and infiltration will increase. When used properly, such as in accordance with the NRCS nutrient and pesticide standards, the risk of downstream pollution or groundwater contamination will not be significant. The sponsors will require or strongly recommend development of a conservation plan with pesticide and nutrient management practices of all users of the agricultural water system.

5.4.*11* Water quality in water systems and cross connection avoidance.

Without project action, Alternative 1, demand for water supply will continue to tax the capacity of the Olinda Water Treatment Plant and may cause plant malfunctions or inconsistent treatment during period of excessive demand.

The separate agricultural water distribution system will provide untreated water to agricultural users for irrigation purposes. The agricultural system will reduce the volume of water that needs to be treated by the Water Treatment Plant. Uniformly effective treatment of domestic water supply can be expected.

A potential problem of connections between the two water systems must be recognized by the users to prevent use of untreated agricultural water for human consumption.

Users on the agricultural system will be instructed on prevention of cross-connections by the management of the agricultural water system. The systems will be clearly labeled and physically separated. Backflow prevention and vacuum breakers will be required on the

agricultural water system to prevent siphoning of standing water and backflow of chemicals used in injection systems and hose-end applicators.

5.4.*12* Water supply to DHHL and native Hawaiians

Alternative 1 will provide a limited amount of water to DHHL farmers and residences. The addition of DHHL users to the existing Upper Kula Water System will exacerbate the water shortage situation. In the short term, 308 residential lots and 68 agricultural lots requiring nearly 0.5 MGD of water supply will be developed. Eventually, as many as 4,716 residential lots and 211 agricultural lots requiring 2.5 MGD may be developed. An extension of the Lower Kula Water System is being planned to handle most of the water need for the DHHL subdivisions.

Implementation of Alternative 2 or Alternative 3 will provide agricultural water to farmers in the DHHL Keokea agricultural lots. At least 75 acres of irrigated cropland is expected to be served by the agricultural water system.

With implementation of an agricultural water system, the Upper Kula domestic water system will be better able to provide treated water to those DHHL residential units that are served by the Upper Kula Water System.

5.4.*13* Water conservation efforts

Alternative 1 will maintain present irrigation trends in the project area. The existing conservation program supported by the Olinda-Kula Soil and Water Conservation District will continue to encourage use of water-conserving irrigation methods.

Alternatives 2 and 3 will stimulate development of new irrigation systems. Farmers seeking technical assistance and cost-sharing for the new systems through the Olinda-Kula SWCD conservation program will be directed to install water-efficient irrigation systems.

5.4.*14* Agriculture and prime farmland

Alternative 1 will continue agricultural activity at current levels. Prime and Other Important agricultural lands will be underutilized and may be converted to other uses contrary to the desires expressed in the Makawao-Pukalani-Kula Community Plan.

Alternatives 2 and 3 will encourage expansion of agricultural activity in the project area to more fully utilize the Prime and Other Important agricultural lands. Expansion of agricultural acreage may foster growth of secondary agricultural enterprises in the area.

5.4.15 Biodiversity and Threatened and Endangered Species

None of the alternatives will affect the essential forest habitat of endangered bird species. The U.S. Fish and Wildlife Service reviewed the project area maps with other information in their files including maps prepared by the Hawaii Heritage Program of the Nature Conservancy. Concern about possible effects to captive breeding of the Hawaiian crow still exists and is discussed Section 5.4.5. The letter from the U.S. Fish and Wildlife Service indicating compliance with Section 7 of the U.S. Endangered Species Act is included in Appendix B.

5.5 COMPARISON OF ALTERNATIVE PLANS

Table E - Summary and Comparison of Candidate Plans provides a condensed, side-by-side comparison of the three alternative plans developed.

TABLE E - SUMMARY AND COMPARISON OF CANDIDATE PLANS
Upcountry Maui Watershed, Maui County, Hawaii

PROJECT FEATURES AND EFFECTS	ALTERNATIVE 1 No Action	ALTERNATIVE 2 NED Plan	ALTERNATIVE 3 With Reservoir
MEASURES			
Structural Elements	None	9.4 miles of main distribution pipeline. *20.4* miles of lateral and sub-lateral pipeline. 9.2 miles of access and maintenance road. Gulch and road crossings. Valves, pressure/vacuum devices, and other apputenances.	9.4 miles of main distribution pipeline. *20.4* miles of lateral and sub-lateral pipeline. 9.2 miles of access and maintenance road. Gulch and road crossings. Valves, pressure/vacuum devices, and other apputenances. 35-MG lined storage reservoir. 3 pump/tank systems.
Real Property Elements	None	*16.8* acres of pipeline easement.	*16.8* acres of pipeline easement. 8 acres acquired for reservoir.
Relocation	None	None	None
PROJECT INVESTMENT			
Installation cost	Not applicable	*$9,223,000*	*$14,189,000*
Avg. annual cost		*$ 732,300*	*$ 1,126,600*
Avg. annual OM&R cost		*$ 168,800*	*$ 348,600*
NATIONAL ECONOMIC DEVELOPMENT ACCOUNT			
Beneficial, annual	Not applicable	*$2,282,900*	*$ 2,825,900*
Adverse, annual		*$ 901,100*	*$ 1,475,200*
Net beneficial		*$1,381,800*	*$ 1,350,700*
Benefit:Cost ratio		*2.5 : 1.0*	*1.9 : 1.0*

TABLE E - SUMMARY AND COMPARISON OF CANDIDATE PLANS
Upcountry Maui Watershed, Maui County, Hawaii

PROJECT FEATURES AND EFFECTS	ALTERNATIVE 1 No Action	ALTERNATIVE 2 NED Plan	ALTERNATIVE 3 With Reservoir
ENVIRONMENTAL QUALITY ACCOUNT			
Impacts to native forest ecosystems	No effect	No effect	No effect
Erosion due to construction	No effect	Pollution control in accordance with County grading ordinance utilized during pipeline installation.	Pollution control in accordance with County grading ordinance utilized during pipeline and reservoir installation.
Interference with Olinda captive breeding facility	No effect	Construction of distribution pipeline and Olinda lateral to be coordinated with Olinda facility to minimize effects.	Construction of distribution pipeline and Olinda lateral to be coordinated with Olinda facility to minimize effects.
Disturbance of archeological sites	No effect	No known, listed historic properties affected. Surface dryland agricultural features and undetermined subsurface features potentially affected.	No known, listed historic properties affected. Surface dryland agricultural features and undetermined subsurface features potentially affected.
Reduction in stream habitat for native fauna	No effect	No effect	No effect
Wetlands	No wetlands have been identified in the project area.	No effect	No effect

TABLE E - SUMMARY AND COMPARISON OF CANDIDATE PLANS
Upcountry Maui Watershed, Maui County, Hawaii

PROJECT FEATURES AND EFFECTS	ALTERNATIVE 1 No Action	ALTERNATIVE 2 NED Plan	ALTERNATIVE 3 With Reservoir
Surface water quality and quantity	Surface water is collected for the Upper Kula Water System. Excess overflows at Waikamoi Reservoir and Kahakapao Reservoir. No effect to surface water quality.	Decreased overflow at Kahakapao Reservoir. No effect to surface water quality.	Decreased overflow at Kahakapao Reservoir. No effect to surface water quality.
Water quality in water system	Agricultural users use treated water. Olinda WTP operated at capacity increasing risk of malfunction.	Agricultural users will be supplied untreated water and will reduce demand on the Olinda WTP. Cross-connection prevention between the two systems will be required	Agricultural users will be supplied untreated water and will reduce demand on the Olinda WTP. Cross-connection prevention between the two systems will be required
Water conservation	Existing conservation program by the Olinda-Kula SWCD will continue to promote water conservation.	Existing conservation program by the Olinda-Kula SWCD will continue to promote water conservation. New requests for irrigation assistance will be directed toward water conserving systems. Use of irrigated windbreaks for water conservation possible.	Existing conservation program by the Olinda-Kula SWCD will continue to promote water conservation. New requests for Irrigation assistance will be directed toward water conserving systems. Use of irrigated windbreaks for water conservation possible.
Soil conservation	Existing conservation program by the Olinda-Kula SWCD will continue to promote soil conservation.	Irrigated cover crops and green manure crops will increase effectiveness of soil conservation efforts.	Irrigated cover crops and green manure crops will increase effectiveness of soil conservation efforts.

TABLE E - SUMMARY AND COMPARISON OF CANDIDATE PLANS
Upcountry Maui Watershed, Maui County, Hawaii

PROJECT FEATURES AND EFFECTS	ALTERNATIVE 1 No Action	ALTERNATIVE 2 NED Plan	ALTERNATIVE 3 With Reservoir
Agriculture and prime farmland	Agricultural activity will continue at the present or reduced level. There is a danger that prime or other important farmland will be converted to other uses.	Agricultural activity will increase. Prime and other important farmland will be better utilized, reducing the threat of conversion to other uses.	Agricultural activity will increase. Prime and other important farmland will be better utilized, reducing the threat of conversion to other uses.
OTHER SOCIAL EFFECTS ACCOUNT			
Irrigated cropland	Approximately 175 acres can be irrigated at 85 percent water supply reliability.	Approximately 473 acres of cropland can be irrigated at 91 percent water supply reliability.	Approximately 550 acres of cropland can be irrigated at 92 percent water supply reliability.
Economic effects	Total farm net return estimated to be *$738,700.* Annual composite net income per acre estimated at *$4,200.*	Total farm net return estimated to be *$2,282,900.* Annual composite net income per acre estimated at *$5,930.* Damage reduction benefit estmated to be *$294,900.* Additional crop acreage benefit estimated to be *$1,771,100.* Reduction in water treatment cost estimated to be $216,900. Secondary economic effects of job creation and expansion of support enterprises. Improved quality of produce will increase market share.	Total farm net return estimated to be *$2,825,900.* Annual composite net income per acre estimated at *$6,090.* Damage reduction benefit estmated to be *$318,200.* Additional crop acreage benefit estimated to be *$2,290,800.* Reduction in water treatment cost estimated to be $216,900. Secondary economic effects of job creation and expansion of support enterprises. Improved quality of produce will increase market share.

TABLE E - SUMMARY AND COMPARISON OF CANDIDATE PLANS
Upcountry Maui Watershed, Maui County, Hawaii

PROJECT FEATURES AND EFFECTS	ALTERNATIVE 1 No Action	ALTERNATIVE 2 NED Plan	ALTERNATIVE 3 With Reservoir
Domestic water supply	100 percent reliability of domestic water supply. No pumping from lower sources required. Olinda Water Treatment Plant with greater likelihood of malfunction and ineffective treatment.	100 percent reliability of domestic water supply. Average of 15 MG per year to be pumped Olinda Water Treatment Plant operated at 1.0 MGD with less likelihood of malfunction and ineffective treatment.	100 percent reliability of domestic water supply. Average of 13 MG per year to be pumped Olinda Water Treatment Plant operated at 1.0 MGD with less likelihood of malfunction and ineffective treatment.
Water supply to Hawaiians	Development of DHHL residential and agricultural sudivisions in Keokea will increase demand on the Upper Kula Water System.	The agricultural water system will provide water to 75 acres of cropland in the DHHL area. More domestic water supply will be available to service DHHL residential lots.	The agricultural water system will provide water to over 75 acres of cropland in the DHHL area. More domestic water supply will be available to service DHHL residential lots.
Undesired urban growth	"Kula Rule" water restrictions are perceived as limiting development in Kula.	Landuse planning will be used to control urban growth in Kula.	Landuse planning will be used to control urban growth in Kula.
REGIONAL ECONOMIC DEVELOPMENT ACCOUNT			
Beneficial Effect, Annualized			
Region	Not applicable	*$ 2,282,900*	*$2,825,900*
Rest of Nation		$ 0	$ 0
Adverse Effect, Annualized			
Region	Not applicable	*$ 524,900*	*$ 917,800*
Rest of Nation		*$ 376,200*	*$ 557,400*

March 1997

5.6 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES, AND CONTROLS

5.6.1 State Land Use Districts

All lands in Hawaii are designated as one of four major land use categories by the State Land Use Commission as directed by Chapter 205, Hawaii Revised Statues. The intent of the legislation is to provide land use controls at the state level in order to preserve, protect, and encourage best use of lands in the state for the benefit of all of the people in the State of Hawaii. The Land Use Districts are Urban, Rural, Agricultural, and Conservation.

The Land Use Districts in the project area are described in Section 2.3 and shown on Figure 4. Project improvements will affect lands in Agricultural and Rural districts.

5.6.2 The Hawaii State Plan and State Functional Plans

The Hawaii State Plan, established by Chapter 226, Hawaii Revised Statutes, provides goals, objectives, policies, and priorities to guide long-range development of the State of Hawaii. Twelve State Functional Plans develop, in greater detail, policies and priorities in their subject areas.

The 1991 State Agriculture Functional Plan identified the need to "increase productive agricultural use of lands most suitable and needed for agriculture" and the "need for the efficient and equitable provision of an adequate supply of water for agricultural use." The State Agriculture Functional Plan promotes strategies for "continued development of State irrigation systems"; "increased efforts to use non-potable water for irrigation"; "giving priority to the maintenance of adequate water sources, supplies, and facilities for agriculture"; " increased support of the Soil and Water Conservation Districts"; and "inventory of the sources, irrigation methods, and uses of water by diversified agriculture."

The watershed project complements the goals and objectives of the Hawaii State Plan by implementing all of the water related strategies of the Agriculture Functional Plan and by contributing to the maintenance of agricultural use of lands best suited to agriculture.

5.6.3 County of Maui General Plan

The County General Plan, established by Section 8-8.4, Maui County Charter, sets forth broad policies for long-range development of the county. Objectives and supporting policies are developed through citizens groups and public input.

One of the five major themes that were developed during the latest General Plan review and revision in 1990 is: "Protect Maui County's agricultural land and rural identity.

Several objectives of the 1990 update of the County General Plan are directly supported by the proposed project. Land use Objective 3 is "to preserve lands that are well suited for agricultural pursuits." Agriculture Objective 1 is "to foster growth and diversification of agriculture and aquaculture throughout Maui County." Agriculture Objective 2 is "to maximize the use and yield of productive agricultural land throughout the County." A policy to achieve Agriculture Objective 2 is to "ensure the availability of adequate irrigation water for agricultural purposes during period of limited rainfall." Water Objective 1 is "to provide a adequate supply of potable and irrigation water to meet the needs of Maui County's residents." Water Objective 2 is "to make more efficient use of our ground, surface and recycled water sources."

The proposed project will enhance the viability of agricultural activity in the Upper Kula area by providing irrigation water supply during "periods of limited rainfall." The proposed project will make more efficient use of the water system that has developed the stream sources in the Upper Kula area.

The direct or indirect effects of the proposed project do not conflict with any of the objectives or policies of the County of Maui General Plan.

5.6.4 Makawao-Pukalani-Kula Community Plan

The Makawao-Pukalani-Kula Community Plan is one of the county-wide set of Community Plans established by the County General Plan to provide more detailed and shorter-termed guidelines for development in the communities and implementation of the objectives and policies of the General Plan. The Community Plans provide the basis for county land use zoning designations as shown in Figure 5.

Two of five major "problems and opportunities" identified in the 1990 update to the Community Plan are 1) Water Supply and Quality and 2) Retention of the Agricultural Base. Two of five "planning principles" that guided the development of the Community Plan were 1) Preservation of the Up-Country way of life and 2) Protection of the agricultural land base.

A recommendation made in the plan to preserve and enhance agricultural lands is to "support County plans to develop a separate water system for agriculture.

The proposed project addresses the problems and opportunities and supports the planning principles in the Makawao-Pukalani-Kula Community Plan.

5.6.5 Maui County Water Use and Development Plan

The Maui County Water Use and Development Plan is a part of the Hawaii State Water Plan as established by the State Water Code, HRS Chapter 174C. The Water Use and Development Plan, prepared for the Maui County Department of Water Supply, inventories the sources and uses of water by district and projects future demand. The State Commission on Water Resources and county planners will use the information to evaluate land and water use approvals and permits.

The Maui County Water Use and Development Plan projects growth of diversified agriculture in the Kula area. Support for the Upcountry Maui Watershed project by the Department of Water Supply is provided in the Water Use and Development Plan, "To serve this end [water for diversified agriculture], dual systems for the Kula area is strongly recommended." (Maui County WUDP, draft 2/1992)

5.7 RISK AND UNCERTAINTY

Throughout the planning process the best available data was obtained and used in order to minimize risks and uncertainties. When risk and uncertainty occur costs and benefits may not be actualized as estimated. The major areas of risk and uncertainty with regard to project costs and benefits are discussed below.

5.7.1 Hydrologic assumptions

The projections for water available at the collection area is based on fifteen years of stream records between 1953 and 1968 for Waikamoi and Haipuaena Streams. These records were expanded, using correlations derived from short period observations, to other streams in the collection area. Although the period of record includes two extremely droughty years, the period is relatively short to project for the 50 year evaluation period for this project.

5.7.2 Economic analysis

The benefit of implementation of the agricultural water distribution system is based on projections of marketability of the agricultural product. If availability of some produce increases beyond projections net economic return to the farmer may decrease. The

5.7.3 Department of Hawaiian Homelands projections

It is estimated that approximately 75 acres of irrigated cropland will be developed in the Department of Hawaiian Home Lands agricultural subdivision in the medium-term future. Infrastructure for the agricultural subdivision has not yet been constructed.

Much of the projected increase in domestic water demand is due to the estimate of 1,000 new household units in the DHHL area dependent on water from the Upper Kula Water System. This estimate is based on the plans, updated in 1991, estimating 4,716 residential lots and 211 farm lots units to be eventually developed in the Waiohuli/Keokea area. Many of the units will be supplied by the Lower Kula Water System.

5.8 RATIONALE FOR PLAN SELECTION

Alternative 2 was selected by the sponsors as the Recommended Plan to meet objectives stated in the General Plan of the County of Maui and the Makawao-Pukalani-Kula Community Plan of maintaining the vitality and profitability of agriculture in the Upper Kula area and efficiently utilizing the water resources and infrastructure of the Upper Kula Water System. Alternative 2 has been identified as the National Economic Development Plan and, as such, its implementation will maximize the net economic benefits to the nation.

Theme No.1 of the 1990 update to the General Plan seeks to "preserve agricultural lands for the continuing pursuit of both land intensive and labor intensive agricultural pursuits." A policy to "ensure the availability of adequate irrigation water for agricultural purposes during periods of limited rainfall" was also adopted in the 1990 update. The water resource objective of "adequate supply of potable and irrigation water to meet the needs of Maui County's residents" is supported by policies to "support the improvement of water transmission systems to those areas which historically experience critical water supply problems", "develop sufficient water supply during drought seasons so as to keep agricultural activities viable", and "support the planning, preservation and development of water resources and systems which service Hawaiian Home Lands." (General Plan)

Two of the five major problems identified in the Community Plan are addressed by Recommended Plan. The implementation of a separate agricultural water distribution system will end "water for irrigation being unnecessarily treated to domestic standards." Improved irrigation water supply will decrease the potential for "loss of viable agricultural activities and a corresponding loss of 'up-country' atmosphere." The Community Plan recommendations "support County plans to develop a separate water system for agriculture" in Kula. (Community Plan)

5.9 RELATIONSHIP BETWEEN THE SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The implementation of the recommended alternative will cause construction related impacts for a period of approximately three years at varying locations along the main

distribution pipeline and lateral pipelines. Impacts may include noise and air pollution and traffic disruption. Thereafter, maintenance and repair activities will cause similar impacts at infrequent intervals.

Throughout its 50-year life of project, the agricultural water system will improve conditions for area farmers, enhancing their economic viability and maintaining agricultural land in Upper Kùla. The agricultural water system will decrease demand on the Olinda Water Treatment Plant, thereby improving its efficiency and reliability and reducing costly treatment of agricultural water.

5.10 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The implementation of the agricultural water system will require the conversion of approximately 17 acres of agricultural land, primarily in pasture, to pipeline right-of-way and access road. The federal, state, and county governments will spend approximately $9.2 million dollars for project installation and the state and county governments will be committed to funding a additional $168,800 annually for operation, maintenance, and replacement costs. The annual operating costs are expected to be recovered through user fees.

The additional water supply to expand irrigated agriculture in Upper Kula will come from the collection system of the Upper Kula Water System. Return flow to Waikamoi Stream from Waikamoi reservoir will be diminished during high flow periods by approximately 137 million gallons per year.

5.11 PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Construction-related noise and air pollution effects and traffic disruptions will occur during a three-year installation period and infrequently, thereafter, during maintenance and repair activities.

Construction related effects will be felt at the Olinda Endangered Species Propagation Facility where captive breeding of the Hawaiian crow is located. In coordination with facility management, construction will be modified and scheduled to avoid significant impacts to their programs.

Increased residential and urban development may occur as a result of increased domestic water capacity in the existing Upper Kula Water System due to transfer of most agricultural users from the domestic system to the agricultural system. The resolve of the

county to enforce the policies regarding maintenance of open space and agricultural character will be the major factor in restraining urban development in the Kula area.

6. CONSULTATION AND PUBLIC PARTICIPATION

6.1 GENERAL

The Upcountry Maui Watershed Plan is an implementation action of the Water Resources Study for Upcountry Maui. Public input was sought during the study phase. A Steering Committee for the Water Resources Study for Upcountry Maui was formed in 1985 which included the U.S. Forest Service, State Department of Land and Natural Resources, Department of Hawaiian Home Lands, Olinda-Kula SWCD, Central Maui SWCD, Hana SWCD, Tri-Isle Resource Conservation and Development Council, Maui County Council, Maui Department of Water Supply, and the Maui Farm Bureau. The Steering Committee met approximately twice a year and as needed during preparation of the Upcountry Maui Water Resource Study.

Two series of public meetings to receive comments regarding the water shortage problem in the Kula area and to review preliminary alternatives to the problem were held on March 2-4, 1987 and July 7-9, 1987 in Makawao, Wailuku, Kula, and Haiku. Approximately 120 persons attended the March meetings and approximately 80 persons attended the July meetings.

6.2 MEETINGS

The Steering Committee for the Upcountry Maui Water Resources Study continued to provide guidance during development of the watershed plan. The committee has met biannually. Numerous meetings with the project Sponsors - Maui Board of Water Supply, Olinda-Kula Soil and Water Conservation District, and State Department of Agriculture - have been held to discuss roles and assign responsibilities for implementation and operation of the watershed project.

A Public Scoping Meeting was held at the Eddie Tam Memorial Community Center in Makawao on June 9, 1993. Announcement of the meeting was included in the Notice of Intent (to prepare an Environmental Impact Statement) which was published in the Federal Register, Honolulu Star-Bulletin, Honolulu Advertiser, and the Maui News in May 1993. Announcement of the Scoping Meeting was mailed to 61 agencies and organizations. A news release announcing the meeting was also prepared and appeared in the Maui News. Approximately 30 persons attended the meeting, where problems were defined, preliminary alternatives described, and comments from attendees received.

A Public Meeting to review and comment on the Draft Plan-EIS was conducted at the Eddie Tam Memorial Center in Makawao, Hawaii on February 14, 1996. The meeting was announced through mailing and publication of articles or announcements in the

Honolulu Star-Bulletin, Honolulu Advertiser, and the Maui News. Approximately 30 persons attended the meeting. The meeting notes which were mailed to attendees is included in Appendix A.

6.3 CONSULTATIONS

Consultations with groups and agencies with interests or responsibility for resources within the watershed were undertaken throughout the planning phase.

In March 1989 a fact sheet and request for information and comments was mailed to 60 groups and agencies.

Federal
Agicultural Stabilization and Conservation Service
Farmers Home Administration
U.S. Forest Service
U.S. Fish and Wildlife Service
Environmental Protection Agency
U.S. Army Corps of Engineers
Senator Daniel K. Inouye
Senator Spark M. Matsunaga
Representative Daniel K. Akaka
Representative Patricia Saiki

State of Hawaii
Office of State Planning
Office of Environmental Quality Control
Department of Land and Natural Resources
DLNR Division of Parks and Historic Sites
DLNR Division of Forestry and Wildlife
Department of Business and Economic Development
Department of Hawaiian Home Lands
Department of Transportation
Department of Agriculture
University of Hawaii, College of Tropical Agriculture
State House of Representatives
State Senate

County of Maui
Mayor County of Maui
Maui County Council

Department of Public Works
Department of Economic Development

Others
Audubon Society
Bishop Museum and Planetarium
The Nature Conservancy
Hawaii Botanical Society
Hawaiian Historical Society
Wildlife Society
American Association of University Women
League of Women Voters
Hawaii's Thousand Friends
Conservation Council of Hawaii
Sierra Club
Alu Like
Tri-Isle RC&D Steering Committee

Responses were received from The Nature Conservancy; Sierra Club-Maui Group; State Historic Preservation Division; U.S. Forest Service; State Division of Water and Land Development; Maui Department of Water Supply; U.S. Fish and Wildlife Service; State Department of Agriculture; Hawaiian Entomological Society; and Maui Planning Department.

In May 1993 an additional request for comments was made as a part of the formal federal Scoping process and state Pre-Assessment Consultation process. *The agencies and organizations contacted through correspondence in May 1993 as part of the NEPA scoping process and the state Pre-Assessment Consultation process were:*

Federal
Agricultural Stabilization and Conservation Service
Farmers Home Administration
U.S. Forest Service
U.S. Army Corps of Engineers
National Oceanic and Atmospheric Administration
Department of Health and Human Services
U.S. Environmental Protection Agency
Department of the Interior
U.S. Fish and Wildlife Service
U.S. Geological Survey

National Park Service
Department of Housing and Urban Development
U.S. Coast Guard
U.S. Department of Agriculture
Senator Daniel K. Inouye
Senator Daniel K. Akaka
Representative Patsy T. Mink

State of Hawaii
Office of Environmental Quality Control
Department of Health
Department of Health, Environmental Planning Office
Department of Health, Clean Water Branch
Department of Agriculture
State Historic Preservation Officer
Department of Land and Natural Resources
DLNR Division of Parks and Historic Sites
DLNR Division of Forestry and Wildlife
DLNR Division of Water and Land Development
DLNR Division of Aquatic Resources
Commission on Water REsources Management
Office of State Planning
Department of Business and Economic Development
Department of Transportation

County of Maui
Office of the Mayor
Maui County Council
Department of Economic Development
Department of Public Works
Department of Parks and Recreation
Department of Planning
Department of Fire Control

Others
Conservation Council of Hawaii
Hawaiian Historical Society
The Outdoor Circle
Life of the Land
Maui Historical Society

The Nature Conservancy
Sierra Club
Natural Resources Defense Council
National Wildlife Federation
National Audubon Society

Responses were received from the Maui Office of Economic Development, Maui County Council, State Division of Aquatic Resources, State Land Use Commission, State Department of Business, Economic Development and Tourism, State Department of Transportation, Department of the Army, State Division of Water and Land Development, State Division of Forestry and Wildlife, State Department of Accounting and General Services, State Department of Defense, Federal Aviation Administration, Maui Planning Department, State Department of Health, State Historic Preservation Division, Maui Department of Water Supply, and Maui Tomorrow.

Two meetings, in 1991 and 1993, were held with the Maui Farm Bureau to gather information about farming needs, describe the project, and to receive comments.

6.4 EIS REVIEW

The draft Plan-EIS was reviewed in accordance with the National Environmental Policy Act, 40 CFR Part 1506.10. *The draft Plan-EIS was distributed for review and comment on December 11, 1995. A Notice of Availability of the draft Plan-EIS was published in Hawaii Environmental Notice on January 8, 1996 and in the Federal Register on January 26, 1996 due to the delay caused by the federal government furlough.*

The Agencies and organizations to which the draft Plan-EIS was mailed are:

<u>Federal</u>
Department of Agriculture
- Farm Services Agency
- Forest Service
- Office of Equal Opportunity
- Rural Economic and Community Development Agency

Department of Defense
- U.S. Army Corps of Engineers
- *U.S. Army Support Command Hawaii*
- *U.S. Naval Base Pearl Harbor*

Department of Commerce
- NOAA, Ecology and Conservation Division
- National Marine Fisheries Service

Department of Housing and Urban Development
Department of Health and Human Services
Department of the Interior
    Office of the Secretary
    Office of Environmental Affairs
    U.S. Geologic Survey
    U.S. Fish and Wildlife Service
    National Park Service
    Office of Territorial and International Affairs
Environmental Protection Agency
Department of Transportation
    Federal Aviation Administration
    U.S. Coast Guard
Senator Daniel K. Inouye
Senator Daniel K. Akaka
Congresswoman Patsy T. Mink

State of Hawaii
Department of Agriculture
Department of Defense
Department of Hawaiian Home Lands
Department of Land and Natural Resources
Department of Business, Economic Development, and Tourism
    State Energy Office
    DBEDT Library
Department of Accounting and General Services
Office of State Planning
Department of Health
State Historic Preservation Officer
Department of Transportation
Office of Environmental Quality Control
Housing Finance and Development Office
State Archives
University of Hawaii
    Water Resources Research Center
    Environmental Center
Office of Hawaiian Affairs
Legislative Reference Bureau

County of Maui
Office of the Mayor
Maui County Council
Planning Department
Department of Public Works
Economic Development Agency
Department of Water Supply
Department of Parks and Recreation
Department of Fire Control

Others
Advisory Council on Historic Preservation
Natural Resources Defense Council
Sierra Club
Audubon Society
The Nature Conservancy
Hawaii Association of Conservation Districts
Maui Tomorrow
Conservation Council of Hawaii
Maui Farm Bureau
National Wildlife Federation
Hawaiian Historical Society
The Outdoor Circle
Life of the Land
Maui Historical Society
Hawaiian Electric Company
American Lung Association
Mary Evanson
Elaine Wender
David Nobriga
Honolulu Advertiser
Honolulu Star Bulletin
Sun Press
Maui News
University of Hawaii Hamilton Library
Maui Community College Library
Kaimuki Regional Library
Kaneohe Regional Library
Pearl City Regional Library
Hilo Regional Library

Kauai Regional Library
Wailuku Regional Library
Kahului Library
Lahaina Library
Makawao Library

Twenty-four comment letters on the draft Plan-EIS were received during the review period. A list of commentors and copies of comment letters and response letters are included in Appendix A.

6.5 STATE OF HAWAII ENVIRONMENTAL REVIEW

The watershed plan was reviewed through the Hawaii State Environmental Review Process as required and defined by Chapter 343, Hawaii Revised Statutes and associated Title 11, Chapter 200, Department of Health Administrative Rules. The State Department of Agriculture was the proposing agency for the state process.

A draft Environmental Assessment was prepared in November 1993 and notice of its availability was published in the OEQC Bulletin in December 1993. An EIS Preparation Notice was prepared and published in the OEQC Bulletin on January 8, 1994. *One comment letter, which is include in Appendix A, was received during the EIS Preparation Notice review from Maui Tomorrow. The notice of availability of the draft EIS was published in the Environmental Notice on January 8, 1996.*

7. RECOMMENDED PLAN

7.1 GENERAL

Alternative 2, the National Economic Development Plan, is the Recommended Plan. The Recommended Plan has been developed to meet the Federal and Sponsors' objectives of developing viable agricultural industry by providing adequate and consistent agricultural water supply. Installation of the structural measures included in the plan can be partially funded by NRCS under the authority of the Watershed Protection and Flood Protection Act, Public Law 83-566.

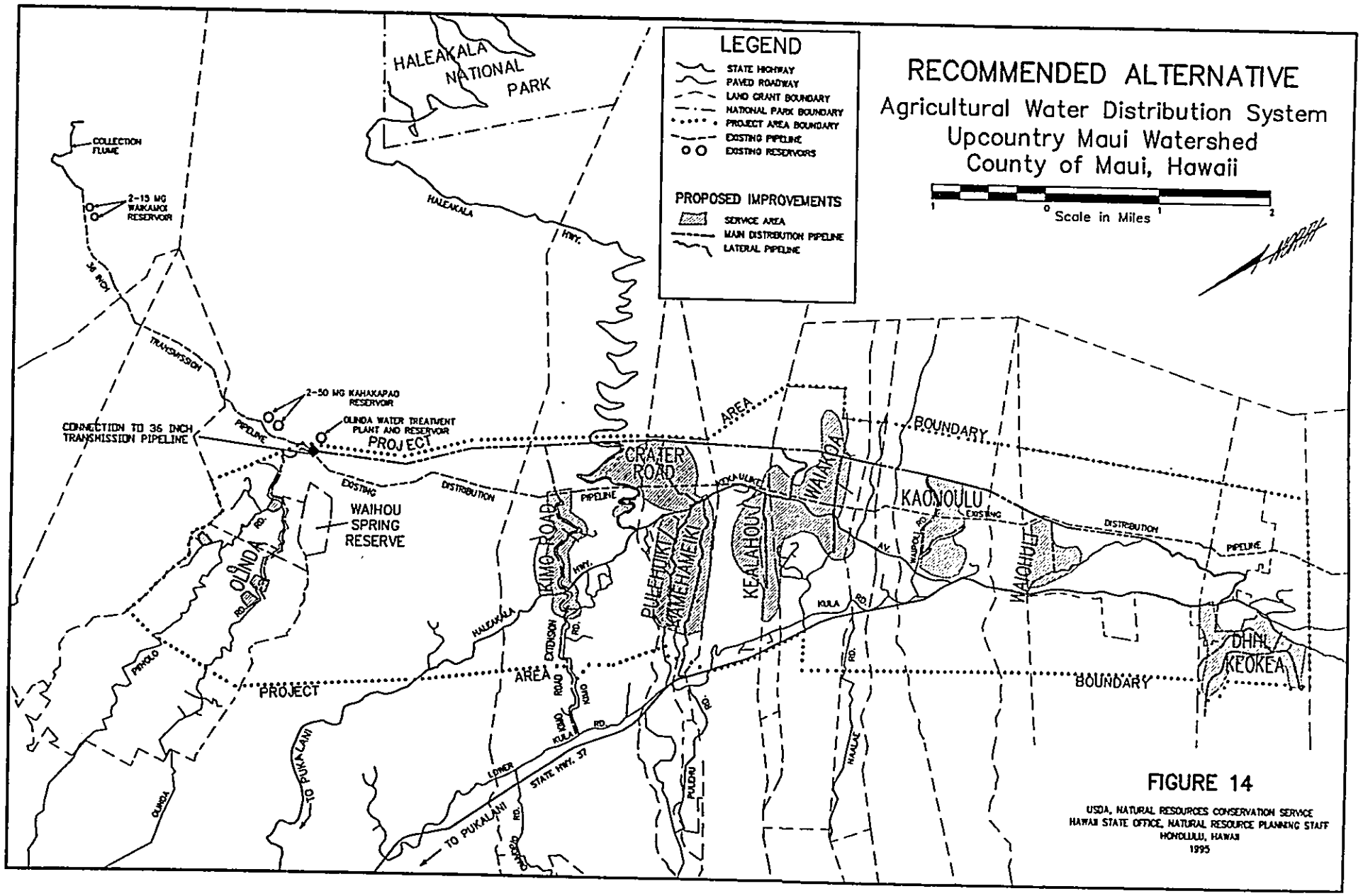
This section describes the Recommended Plan in detail including installation, contracting, and financing responsibilities; costs of installation; and operation, maintenance, and replacement requirements.

7.2 MEASURES TO BE INSTALLED

A total of 49,500 feet or 9.4 miles of distribution pipeline will be installed from the Olinda Water Treatment Plant to Keokea. The pipeline will begin at the 4,120-foot elevation at the Water Treatment Plant and drop to the 3,100-foot elevation at Keokea. In the central part of the project area the proposed agricultural pipeline will be approximately 2,000 feet upslope of the existing Upper Kula Water System pipeline with an elevation difference of approximately 300 feet. The ductile iron or high density polyethylene distribution pipeline will vary in diameter from 18 inches to eight inches. Approximately 12 acres of easements across private parcels will be acquired. The pipeline will be buried along most of its length. Thirteen crossings of gulches are identified. Most crossings will be designed as elevated trestles. (See Figure 13 - Recommended Alternative)

An unpaved, 10-foot wide access road will be installed along the distribution pipeline alignment. The road will connect to existing gulch crossings, where nearby, or will be constructed as grade crossings across the dry gulches. Measures will be taken to minimize erosion potential on the roadway.

Nine lateral systems for the service areas of Olinda, Kimo Road, Crater Road, Pulehuiki/Kamehameiki, Kealahou, Waiakoa, Kaonoulu, Waiohuli, and DHHL/Keokea will be installed. Lateral pipeline lengths will vary from 3,800 feet to *19,850* feet. High density polyethylene pipeline sizes will vary from eight inches to two inches in diameter. The pipelines will be buried within the existing road rights-of-way where possible. Approximately 4.8 acres of private land easements will be acquired. Sublateral pipelines will connect the water system to farmer-supplied meters at the farm boundaries.


LEGEND
STATE HIGHWAY
PAVED ROADWAY
LAND GRANT BOUNDARY
NATIONAL PARK BOUNDARY
PROJECT AREA BOUNDARY
EXISTING PIPELINE
EXISTING RESERVOIRS
PROPOSED IMPROVEMENTS
SERVICE AREA
MAIN DISTRIBUTION PIPELINE
LATERAL PIPELINE
RECOMMENDED ALTERNATIVE
Agricultural Water Distribution System
Upcountry Maui Watershed
County of Maui, Hawaii
Scale in Miles
HALEAKALA NATIONAL PARK
COLLECTION FLUME
2-15 MG WAKAMOI RESERVOIR
36 INCH TRANSMISSION PIPELINE
CONNECTION TO 36 INCH TRANSMISSION PIPELINE
2-50 MG KAHAKAPAO RESERVOIR
OLINDA WATER TREATMENT PLANT AND RESERVOIR
PROJECT AREA BOUNDARY
EXISTING DISTRIBUTION PIPELINE
WAIHOU SPRING RESERVE
OLINDA RD.
PIPIOLO
OLINDA
HALEAKALA HWY.
KIMO ROAD
CRATER ROAD
PULEHUNUI
KAMEHAMEHA III
KEALAHOU
WAIAKOA
KAONOULU
WAIOHULI
KULA RD.
LOWER KULA RD.
STATE HWY. 37
TO PUKALANI
PULONI
HAUOLE
DHHL KEOKEA
FIGURE 14
USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

The Kimo Road lateral is extended past Kula Highway and has a diameter of eight inches to transmit water supply to Lower Kula during periods of excess supply when the Upper Kula system reservoirs are at capacity.

7.3 PERMITS AND COMPLIANCE

Installation of the proposed measures will be performed in full compliance with all laws and policies of the County of Maui, State of Hawaii, and the federal government. The following is a list of permits and other entitlements that *may be required* and consultation which must be completed to implement the Recommended Plan.

County of Maui Requirements:

GRADING, GRUBBING, EXCAVATING AND STOCKPILING PERMIT
Department of Public Works
200 S. High Street
Wailuku, HI 96793

BUILDING PERMIT
Department of Public Works
200 S. High Street
Wailuku, HI 96793

State of Hawaii Requirements:

STATE LAND USE APPROVAL
Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, HI 96809

STATE HIGHWAYS PERMIT
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

AMENDMENT TO THE INTERIM STREAMFLOW STANDARD
Commission on Water Resource Management
1151 Punchbowl Street
Honolulu, HI 96809

Federal Requirements:

DEPARTMENT OF ARMY PERMIT
U.S. Army Corps of Engineers
Pacific Ocean Division
Building 230
Fort Shafter, HI 96858

7.4 COSTS

The installation cost for the Recommended Plan is estimated to be *$9,223,000* of which *$4,738,700* will be financed with PL-566 funds and the remaining *$4,484,300* will be financed with other funds. (Table 1) Total installation cost includes construction, engineering services, project administration, and landrights costs. (Table 2) All costs reflect a 1996 price base. Cost-sharing arrangements are set forth in the "Watershed Agreement" at the beginning of this Plan-EIS.

Construction costs include the cost of constructing all of the structural measures, including installation of the main distribution, lateral, and sublateral pipelines; gulch crossings; valves and appurtenant devices; and access road. Construction costs are based on quantity estimates and recent unit prices for similar work done in the state. Fifty percent of the *$6,920,400* in construction cost, *$3,460,200*, will be funded through PL-566. The remaining *$3,460,200* will be funded by the sponsors.

Engineering services costs are the direct costs of engineers and others to conduct design-level surveys and investigations; prepare engineering designs, construction specifications, and operation and maintenance plans; and to conduct inspection during construction. Engineering services costs have been estimated to be 15 percent of the total construction cost or *$1,038,000*. Of the engineering services cost *$211,000* is estimated to be construction inspection costs. The NRCS and the Sponsors will bear the costs of construction inspection which each incurs. The remaining *$827,000* will be borne by NRCS.

Project administration costs include the cost of preparing invitations to bid, administering contracts, government representatives, conducting acceptance inspections, relocation assistance, and overhead costs of project installation including permit acquisition and legal opinions. It is estimated to be 15 percent of the total construction cost. Because the State of Hawaii will be administering the construction contracts, two-thirds of the project administration costs have been allocated to the sponsors. Project administration costs have been estimated to be *$346,000* for PL-566 funds and *$692,000* for the sponsors.

Real property costs include the costs for acquisition of use of *16.8* acres of private land, related surveys, and legal costs; modification of existing fences, roads, and utilities made necessary by the improvements; and administrative costs directly associated with real property. *An estimated $177,200 will be needed for acquisition of private land. An estimated $49,400 will be required for infrastructure relocation and modification. All real property costs, $226,600, are sponsors' costs.*

Operation and maintenance costs are for the materials, equipment, services, and facilities needed to operate the agricultural water distribution system and make repairs and replacements necessary to maintain structural measures in sound operating condition during the life of the project. Operation and maintenance costs are estimated to be *$168,800* annually.

Annualized costs are calculated by amortizing construction, project administration, engineering services, and real property costs, at 7.75 percent, over the 50-year evaluation period of the project and adding annual operation and maintenance cost to the amortized installation cost. The amortized installation cost for the Recommended Alternative is *$732,300.* The average annual cost of the Recommended Alternative is *$901,100.*

7.5 INSTALLATION AND FINANCING

This section describes the framework for implementing the watershed plan. The sequence of installation, responsibilities of NRCS and the Sponsors for installation and financing, and preconditions that need to be met are described.

7.5.1 Sequence of installation

The installation period for the Recommended Plan is three years. During the first year, design of the main distribution pipeline, preparation of specifications, acquisition of real property rights, and design topographic survey will be completed. Construction of the main distribution pipeline and design of the laterals will be completed during the second year. Construction of the laterals will take place during the third year. Table F - Schedule of Obligations shows the estimated schedule for obligating PL-566 and other funds during the three-year installation period.

TABLE G - SCHEDULE OF OBLIGATIONS
Upcountry Maui Watershed
(Dollars) 1/

Year	Item	PL-566 Funds	Other Funds 2/	Total
1	Main Pipeline	*260,800*	*291,500*	*552,300*
	Gulch Crossings	*15,100*	*9,600*	*24,700*
	Access Road	*70,300*	*44,400*	*114,700*
	Total	*346,200*	*345,500*	*691,700*
2	*Mobilization*	*21,700*	*19,500*	*41,200*
	Main Pipeline	*1,679,700*	*1,583,800*	*3,263,500*
	Lateral Pipelines	*207,200*	*176,200*	*383,400*
	Sublateral Pipelines	*9,800*	*6,100*	*15,900*
	Gulch Crossings	*97,400*	*91,900*	*189,300*
	Access Road	*714,100*	*663,400*	*1,376,500*
	Paved Road Crossings	*0*	*4,900*	*4,900*
	Total	*2,729,900*	*2,544,800*	*5,274,700*
3	Demobilization	*21,700*	*19,500*	*41,200*
	Lateral Pipelines	*1,131,600*	*1,235,000*	*2,551,600*
	Sublateral Pipelines	*62,900*	*59,400*	*122,300*
	Access Road	*261,400*	*235,600*	*497,000*
	Paved Road Crossings	*0*	*44,500*	*44,500*
	Total	*1,662,600*	*1,594,000*	*3,256,600*
	TOTAL	*4,738,700*	*4,484,300*	*9,223,000*

1/ Price Base *1996* *March 1997*

7.5.2 Responsibilities

The Sponsoring Local Organizations, which are the State Department of Agriculture, County Department of Water Supply, and Olinda-Kula Soil and Water Conservation District, will be responsible for actions during installation and for operation of the project improvements. As the primary governmental Sponsor, the State Department of Agriculture will be responsible for the following:

1. Acquiring funds for installation costs listed as "Other Funds."

2. Acquiring necessary permits and ensuring compliance with county and state laws and policies.

3. Acquiring or verifying rights to the project-required water supply for the life of the project.

4. Acquiring rights-of-way and easements for construction and maintenance of project improvements.

5. Administering construction contracts.

6. Performing real property-related work items such as utility relocation.

7. Performing construction inspections as necessary.

8. Operating the completed agricultural water system, including conducting preventive maintenance and replacement of elements.

The Natural Resources Conservation Service will be responsible for:

1. Acquiring funds for installation cost items listed as "PL-566 Funds."

2. Ensuring compliance with federal laws and policies.

3. Designing all structural measures.

4. Performing construction inspections as necessary.

7.5.3 Contracting

Construction will be performed under formal contract which will be awarded following review of competitive bids. The State Department of Agriculture will be responsible for administration of all contracts and for coordination with NRCS during installation.

All contracts involving PL83-566 funds will comply with Office of Management and Budget Circular A-102, Uniform Administration Requuirements for Grants-in-Aid to State and Local Governments and the National Contracts and Grants and Cooperative Agreements Manual.

7.5.4 Real property and relocations

The State Department of Agriculture will ensure that the State Board of Land and Natural Resources acquires all land required for the installation of the proposed measures.

Affected properties are shown in Appendix C. The Sponsors will be responsible for modifications and relocation of roads and utilities that may be required for project installation.

No relocation of farms, businesses, or households is anticipated. If relocation needs do arise, relocation services will be provided in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646. Relocation services will be provided by the State Department of Agriculture and the costs shared by the State Department of Agriculture and NRCS in the same proportions as the project installation cost.

7.5.5 Involvement of other agencies

Cost-sharing on eligible water conservation and other resource conservation practices on the farms may be available through the *NRCS* and USDA Farm Services Agency. Development of a farm conservation plan and compliance with national natural resources policies is required to receive the cost-share assistance.

7.5.*6* Cultural resources

A reconnaissance archaeological survey was conducted in the project area October 17-20, 1994. Surface dryland agricultural features consisting of rock mounds, earthen and rock terraces, low retaining walls, rock clearings, and potential temporary shelters and trails were identified in the Alternative 2 corridor at the ahupua'a of Kalialianui, Omaopio, Pulehuiki, and Koheo 1,2.

Following consultation with the State Historic Preservation Division recording and test excavation of three sites were conducted by the NRCS Cultural Resources Specialist in June 1996. At Site 4160, a 150-foot wide by one mile long corridor, forty-nine archeological features were recorded and five test units were excavated. At Site 4161, consisting of four earthen embankments and a habitation site, one test unit was excavated. At Site 4162, a road feature, two test units were excavated. Background research indicates historical farming activity in the three areas near the turn of the century. Considerable erosion and disturbance by farming and ranching has affected the features. It has been determined by NRCS that the sites within the pipeline alignment do not possess attributes for National Register of Historic Places eligibility.

Terraces were found in three gulches to be crossed by the proposed main distribution pipeline. The terraces are located on the stream overbanks within Hapapa, Na'alae, and an unnamed gulch. Similar terraces may occur in other gulches that were inaccessible

due to overgrowth. These gulches will be surveyed during clearing for the topographic survey.

The final design of the pipeline alignments will be developed following completion of the topographic survey and land right work map. Most of the identified features can be avoided. NRCS will continue to consult with the SHPD during design of the project improvements to develop mitigation measures where impact is unavoidable.

A statement confirming compliance with Section 106 of the National Historic Preservation Act of 1966 will be obtained from the State Historic Preservation Officer prior to any construction activity.

If any unanticipated cultural resources are discovered during construction, appropriate notice will be given to the State Historic Preservation Officer and the U.S. Secretary of the Interior in accordance with the procedures outlined in the NRCS General Manual Title 420, Part 401, October 1983, as amended. NRCS will take actions to protect or recover, or both, any significant cultural resources discovered during construction.

7.5.*7* Financing

The Sponsors will finance their portion of the project installation costs through funds appropriated by the state legislature.

Federal funds for installation of the project will be allocated by NRCS under the authority the Watershed Protection and Flood Prevention Act, Public Law 566, 83rd Congress, 68 Stat, 666, as amended.

7.5.*8* Conditions for providing assistance

Financial or other assistance to be furnished by NRCS for installing the Recommended Plan is contingent on the fulfillment of the Sponsors' obligations as described in the Watershed Agreement and in Section 7.5.2 of this Plan-EIS and is contingent on congressional appropriation of funds for the PL-566 construction program.

Neither the Plan-EIS nor the Watershed Agreement constitute documents for obligation of PL-566 or other funds.

7.5.*9* Civil Rights Impact Analysis

A civil rights impact analysis was conducted, in accordance with USDA Departmental Regulation 4300-4, to identify, evaluate and address the civil rights implications of the implementation of the recommended plan. The purpose of the impact analysis is to

prevent any adverse impact on employees as well as on disadvantaged groups, minorities, women, and persons with disabilities.

The project area includes parts of Census Tracts 303.01, 304.01, and 304.02. Ethnic minority populations in these tracts are 41 percent, 54 percent, and 64 percent respectively. Assuming the same ratios in the project area, 235 of 492 persons residing on farms and 2,348 of the 5,321 person rural population are ethnic minorities. The proposed agricultural water system and resulting improvements to the domestic water system will benefit ethnic minority populations.

The State Department of Hawaiian Homelands has awarded 68 agricultural leases to lots in Keokea. Approximately 340 native Hawaiian persons will reside in the farming subdivision. These persons will be directly benefited by the implementation of the agricultural water system. If the entire DHHL farming area is developed, the 211 farm will support 1,055 native Hawaiians.

The resident population of Maui County is 49 percent female and the median age is 33.5 years. In 1992, the per capita income for Maui County was $20,633 as compared to the statewide per capita income of $22,200 and the national per capita income of 20,114. (State of Hawaii, 1994)

The NRCS Wailuku Field Office, located outside of the project area, provides employment for six persons. Five of the employees are ethnic minorities and two are women.

From the foregoing, it was determined by the NRCS Hawaii State Conservationist that implementation of the watershed project will have beneficial effects to ethnic minority populations, especially native Hawaiians, while causing no adverse civil rights impacts.

7.5.*10* Water Rights

The State Department of Agriculture will provide assurances that they possess the water rights needed to implement and operate the proposed improvements through the project life. An agreement maintaining water supply from the EMI's Upper Kula collection system will be executed by the sponsors. *The current agreement will expire on December 31, 1997.*

7.5.11 Mitigation Actions

Potential adverse impacts to the avian captive breeding facility will be mitigated by avoiding construction and traffic near the facility during critical periods. Meetings will be held with managers of the Olinda Endangered Species Propagation Facility during

design of project improvements to discuss the extent and intensity of construction activity, potential impacts to the OESPF, and scheduling and construction management strategies to avoid significant impacts.

Possible mitigation to discuss and explore include avoidance of nearby construction activity and rerouting of heavy vehicle traffic during the Hawaiian crow breeding season and support to expand or relocate the captive breeding program to another location during installation of the project improvements.

An action plan will be developed by the sponsors to prevent consumption of untreated agricultural water and cross connection between the untreated agricultural water system and the potable domestic system. The action plan will include a public information effort, labeling and signage for the agricultural water system warning of consumption and cross connection hazards, and requirements for physical separation of the two systems.

Pollution control measures for erosion and sediment control during construction and maintenance activities will be developed for each site in accordance with NRCS pollution control standards and specifications and the county grading ordinance. The considered measures will include mulching, seeding/revegetation, staging of earthwork, diversions, and sediment basins. The pollution control measures will be clearly detailed on design drawings.

Although the watershed project will not be able to control the pace of urban growth in the Kula area, information about the limited water resource can affect planning decisions. Project sponsors will communicate to planners and policy-makers the limited nature of water supply in Kula and that the watershed project has not developed any additional source.

7.6 OPERATION, MAINTENANCE AND REPLACEMENT

The operation, maintenance, and replacement of components (OM&R) of the Recommended Plan will be the responsibility of the State Department of Agriculture over the 50-year project life. The State Department of Agriculture may elect to contract out the operation and maintenance function through the State procurement process or with the Maui Department of Water Supply. Prior to commitment of funds through a Project Agreement, an Operation and Maintenance Agreement will be signed by the Sponsors and NRCS. The agreement will be based on the NRCS National Operation and Maintenance Manual 180-V, June 1982, and amendments, and will provide guidelines for operation, maintenance, and replacement of structural measures.

All works of improvement will be inspected annually and after unusually severe events or conditions to determine the maintenance or repair required. The inspection party will consist of representatives from all of the sponsoring organizations. An NRCS representative will participate in the annual inspection during the first five years of project operation. The State Department of Agriculture will prepare an OM&R report each year describing the inspection and operation for the year and submit a copy to NRCS throughout the life of the project.

The following is a description of the essential elements of the OM&R responsibilities of the State Department of Agriculture which will coordinate its activities with the other Sponsors.

1. Operate the agricultural water system in a responsible manner to provide consistent water supply to farmers.

2. Inspection of exposed sections of pipelines, bridges, valves, pressure/vacuum devices, and for illegal taps should be conducted. Leaks and damaged sections should be repaired. Appurtenant devices should be checked for proper operating condition.

3. Inspection of the inlet to the distribution system located before the Olinda Water Treatment Plant and related systems should be conducted to check for clogging and operating condition. Flow meters should be checked for proper calibration.

4. Storage tanks and pumps within the agricultural water system should be checked for proper operation.

5. The access road should be kept in good repair to assure timely correction of problems occurring in the distribution system.

6. Records of water withdrawal and customer water use should be collected and compared to assure efficient delivery of water to the farmer with minimal system losses.

7. Safety information regarding avoidance of cross-connections between the two water systems should be disseminated.

8. There shall be a water delivery charge assessed against all water system users to recover costs of operation and maintenance.

A plan of action to operate the agricultural water system will be developed by the sponsors. Issues to be addressed and other system operations guidelines and actions may include:

1. *A statement of the roles and relationships of the sponsoring agencies.*

2. *The formation of an advisory board of users to provide input into the operating policies of the water system and to assist with user information and outreach efforts.*

3. *The determination of the rate structure by the Department of Agriculture.*

4. *The development of operating procedures during periods of drought, including levels of water conservation/restriction, notifications, differential drought rates, and prioritization with respect to domestic supply and other uses.*

5. *The development of operating procedures for transmission of water to Lower Kula through the Kimo Road lateral extension so that adequate water supply to the Upper Kula area will not be reduced.*

6. *The development of a process for agricultural users to have their meters placed on the new water system.*

7. *The development and implementation of educational efforts and mechanical/signage system to prevent accidental cross-connections between the two water systems.*

8. *The development and implementation of programs to reduce treated water use for agricultural purposes and restriction of untreated water for domestic purposes.*

9. *The consideration of including firefighting flows in the agricultural water system.*

7.7 TABLES

The inclusion of the following tables is a requirement of the NRCS National Watershed Manual. The tables display project costs by purpose and funding source. Project benefits are compared to costs to demonstrate the economic efficiency of the project.

TABLE 1 - ESTIMATED INSTALLATION COST
Upcountry Maui Watershed, Hawaii
(Dollars) 1/

Installation Cost Item	Unit	Number	PL-566 Funds NRCS 2/3/	Other Funds 3/4/	Total
STRUCTURAL MEASURES					
Irrigation Structures	Mi.	*29.8*	*4,738,700*	*4,484,300*	*9,223,000*
SUBTOTAL STRUCTURAL			*4,738,700*	*4,484,300*	*9,223,000*
TOTAL PROJECT			*4,738,700*	*4,484,300*	*9,223,000*

1/ Price base *1996* *March 1997*
2/ Federal agency responsible for assisting in installation of works of improvement.
3/ All improvements to be installed on nonfederal land.

TABLE 2 - ESTIMATED COST CONTRIBUTION
STRUCTURAL
Upcountry Maui Watershed, Hawaii
(Dollars) 1/

ITEM	Installation Costs - PL-566				Installation Costs - Other Funds					TOTAL INSTALLATION
	Construction	Engineering	Project Administration	Total PL-566 Funds	Construction	Engineering 2/	Land Rights	Project Administration	Total Other Funds	
STRUCTURAL MEASURES										
Irrigation Structures	*3,460,200*	*932,500*	*346,400*	*4,738,700*	*3,460,200*	*105,500*	*226,600*	*692,000*	*4,484,300*	*9,223,000*

1/ Price Base *1996*
2/ Construction Inspection

March 1997

TABLE 3C - STRUCTURAL DATA - PIPELINE 1/
Upcountry Maui Watershed, Hawaii

Pipeline Segment	*Nominal Diameter (in)*	*Segment Length (ft)*	*Inside Diameter (in)*	*Xsection Area (sq in)*	*Flow Capacity (gpm) 2/*
Main Distribution Pipeline					
0+00 to 165+00	*18*	*16,500*	*14.73*	*1.18*	*2,660*
165+00 to 257+00	*16*	*9,200*	*13.09*	*0.93*	*2,100*
257+00 to 286+00	*14*	*2,900*	*11.45*	*0.72*	*1,600*
286+00 to 323+00	*12*	*3,700*	*10.43*	*0.59*	*1,330*
323+00 to 387+00	*10*	*6,400*	*8.80*	*0.42*	*950*
387+00 to 495+00	*8*	*10,800*	*7.06*	*0.27*	*610*
Olinda Road Lateral					
0+00 to 98+00	*3*	*9,800*	*2.86*	*0.04*	*100*
Kimo Road Lateral					
0+00 to 198+50	*8*	*19,850*	*7.06*	*0.27*	*610*
Crater Road Lateral					
0+00 to 124+00	*4*	*12,400*	*3.68*	*0.07*	*170*
Pulehuiki/Kamehameiki Lateral					
0+00 to 86+00	*3*	*8,600*	*2.86*	*0.04*	*100*
86+00 to 152+50	*2*	*6,650*	*1.94*	*0.02*	*50*
Kealahou Lateral					
0+00 to 86+80	*8*	*8,680*	*7.06*	*0.27*	*610*
Waiakoa Lateral					
0+00 to 47+00	*6*	*4,700*	*5.42*	*0.16*	*360*
Kaonoulu Lateral					
0+00 to 75+00	*6*	*7,500*	*5.42*	*0.16*	*360*
Waiohuli Lateral					
0+00 to 32+80	*4*	*3,280*	*3.68*	*0.07*	*170*
Keokea/DHHL Lateral					
0+00 to 164+00	*6*	*16,400*	*5.42*	*0.16*	*360*

1/ All pipe is High Density Polyethylene, 160 psi, SDR 11.
2/ 5 feet per second flow velocity.

March 1997

TABLE 4 - ESTIMATED AVERAGE ANNUAL ADVERSE NED EFFECTS
Upcountry Maui Watershed, Hawaii
(Dollars) 1/

Evaluation Unit	PROJECT OUTLAYS		
	Amortization of Installation Cost 2/	Operation, Maintenance, and Replacement Cost	Total
STRUCTURAL			
Irrigation Structures	*732,200*	*168,800*	*901,100*
GRAND TOTAL	*732,200*	*168,800*	*901,100*

1/ Price base *1996* *March 1997*
2/ Amortized at 7.75 percent for 50 years

TABLE 6 - COMPARISON OF NED BENEFITS AND COSTS
Upcountry Maui Watershed, Hawaii
(Dollars) 1/

Evaluation Unit	Agricultural: Damage Reduction	Agricultural: Intensification	Other Economic Benefits	Average Annual Benefit	Average Annual Costs	Benefit: Cost Ratio
STRUCTURAL						
Irrigation Structures	*294,900*	*1,771,100*	216,900	*2,282,900*	*901,100*	*2.5 : 1.0*
GRAND TOTAL	*294,900*	*1,771,100*	216,900	*2,282,900*	*901,100*	*2.5 : 1.0*

1/ Price base *1996* *March 1997*

8. LIST OF PREPARERS

NAME	PRESENT TITLE (Years)	EDUCATION (Years)	EXPERIENCE	OTHER
NRCS Hawaii Natural Resources Planning Staff				
Glenn G. Ahuna*	Hydrologist (16)	BS - CE	Civil Engineer (8)	PE - HI PE - CA
Dudley Kubo	Planning Engineer(10)	AB - History MA - History BS - CE	Civil Engineer (2)	PE - HI
Fen Hunt*	Economist (2)	BA - Economics MA - Economics PhD - Economics	Economist (2) University Instructor (4) Graduate Assistant (5)	
NRCS Wailuku Field Office				
Neal Fujiwara	District Conservationist (5)	BS - Agronomy	District Conservationist (16) Soil Conservationist (2)	
James Ino	Soil Conservationist (13)	BS - Agriculture	Soil Conservationist (1)	

* No longer with Natural Resources Planning Staff

9. REFERENCES

County of Maui; The General Plan of the County of Maui; Wailuku, rev. 1990

County of Maui, Planning Department; Makawao-Pukalani-Kula Community Plan; Wailuku; 1990(?)

Environmental Impact Study Corporation; Environmental Impact Statement for the Makawao and Kula Water Treatment Plants; Honolulu; 1982

Fukunaga and Associates; Final Environmental Impact Statement for the Kula Water System Improvements, Makawao, Maui, Hawaii; Honolulu; 1988

Herbst, Derral R.; "Botanical Survey Report for Up-Country Maui Watershed Project"; Fort Shafter; 1994

Kawachi, Carol T.; "Upcountry Maui Watershed Archeological Site Recordation, Kula, Maui Island, State of Hawaii"; Kona; 1996

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10. INDEX

APPENDIX A

COMMENTS ON DRAFT PLAN/EIS

APPENDIX A - COMMENTS ON DRAFT PLAN/EIS

During review of the draft Plan/EIS, comments were received from 24 reviewers, listed below in chronological order of receipt. The letters and written responses are attached.

Maui Tomorrow
P.O. Box 1497
Wailuku, Maui, Hawaii 96793
phone & fax: (808) 877-2462

February 7, 1994

Governor, State of Hawai'i
c/o OEQC
220 S. King St., Ste. 400
Honolulu, HI 96813

Re: EIS Preparation Notice for
Proposed Upcountry Maui Watershed Project

Maui Tomorrow, representing hundreds of citizens concerned about ecologically and economically sound community planning in Maui County, has determined that several issues ought to be thoroughly addressed in the Environmental Impact Statement for this project.

I. Stream Resources. The Hawai'i Stream Assessment (HSA) of 1993 evaluates streams by four primary resource criteria -- aquatic, riparian, cultural, and recreational. The HSA lists several Maui streams that are within the project area, and admits to lack of information and lack of study of other streams that also are within the project area. In fact, various data is lacking in respect to some or all criteria for all affected streams.

The most notably affected large streams are the Waikamoi, Puohokamoa, and Haipua'ena, which feed a few smaller streams that are also listed in the HSA. At this juncture of water resource demand, development, inventory, and conservation/preservation, any agency proposing or accepting plans for a project of this scope, ought first commit to complete baseline studies of affected watersheds, including perennial and intermittent streams.

The State Commission on Water Resource Management has stated that it is their hope that the HSA "...will help policy-makers, resource managers, developers, scientists, and concerned citizens... understand stream resources... and work further to protect Hawai'i streams." The commission admits that the 1993 HSA is only the first step in inventorying stream resources, and recommends that citizens petition public agencies for stream protection.

Given that the Commission is only beginning to prepare a stream management plan, to provide future direction for stream protection in the State of Hawai'i," other state agencies are beholden to support those efforts by providing as information about stream resources, information based on accurate and thorough studies.

It is our view that the proposing agency/applicant for the Upcountry Maui Watershed Project (UMWP), the Agricultural Resource Management Division of the State Department of Agriculture, with the aide of the Soil Conservation Service of the U.S. Dept. of Agriculture, would best support the goals of the Commission, and State policy on water resources, by engaging in detailed studies of the affected water resources. These studies ought to be part of the EIS process, as such complete information if necessary for an adequate and thorough environmental impact study. Detail should include reliable information for each affected stream using the four CWRM criteria.

II. Threatened or Endangered Species. According to maps provided in the applicant's Environmental Assessment, the project area overlaps area that are identified as having both medium and high-to-very-high concentrations of threatened or endangered species.

Given that the State of Hawai'i is beset with the problem of the highest rate of species extinction in the nation, the actions proposed in this project ought not exacerbate or risk exacerbation of that problem. Areas of highest risk ought to be eliminated from the project scope. These areas would include:

- 1) rare habitats (where such species are identified as found only in that site, and nowhere else),
- 2) habitats of species particularly sensitive to the type of disruptions proposed in the project plan;
- 3) fragile habitats for which information is uncertain regarding the likely recovery chances subsequent to project impacts, including geological disruption, stream flow disruptions -- both volume and quality, and watershed purity; and,
- 4) habitats vulnerable to, and not currently extensively affected by, invasion of non-native plant and animal species.

Specialists in threatened and endangered species, from federal, state, county, private, and public interest agencies ought to be consulted for guidance in identifying and eliminating from project plans, the foregoing areas

In the remaining areas, of medium risk, mitigation measures ought to be of the highest practicable design and implementation.

III. Long Term Impacts (as identified by the applicant in the Environmental Assessment)

Detailed planning should be included in the EIS describing how the long term effects listed in 5.2 (page 7) of the Environmental Assessment (EA) will be prevented. Where prevention of an impact can be shown (evidenced) to be impracticable, mitigation measures utilizing the appropriate highest available human and technological resources should be included in the plan for project implementation.

To address these issues in the EIS will require resolution of the conflict between section 5.2 and section 6 on page 7 of the EA. Admission of long term negative impacts signifies responsibility for mitigation measures.

IV. Undesired Urban Growth and Development. The applicant's Environmental Assessment states that "... water improvements may spark undesired urban growth and development," going so far as to identify this as a long term impact.

Yet, the applicant states, "The purpose of the UMWP is to provide agricultural water management and increased agricultural water supply to the region...". Nowhere does it state that the purpose is to increase water supply for undesired urban growth and development.

As the applicant has identified this potential as an impact and not a purpose, the applicant is beholden to propose and plan measures that will prevent, where possible, and otherwise mitigate, this impact. The applicant must propose an alternative that does not instigate the impact of such urban growth and development.

In fact, if the applicant is committed to the purpose of providing agricultural water management and increased agricultural water supply, it must have an eye to the fact of competition for water and land resources between agricultural and urban interests. As water supply grows in the upcountry region serviced by the proposed project, pressure will build for urban development, in the form of urban, residential, and commercial projects. This pressure will come from influential development interests, against which Maui's small-scale agricultural entities cannot compete. The subsequent loss of important agricultural land in one of the State's best growing areas would be a tragic epilogue to the proposed UMWP, if the applicant does not detail a plan for implementation of prevention and mitigation measures.

Having admitted the impact, the applicant must accept responsibility for its mitigation. Alternatives should be researched and proposed which would fulfill the project purpose as described to the accepting authority, and which would also limit the negative impacts. The proposed single line alternative may be the answer to these conditions. Resources devoted to promoting and providing conservation and conversion (drip irrigation), would be effective components of an appropriate alternative plan. This is especially relevant considering that part of the project area encompasses lands which the State classifes as Conservation District.

V. Hawaiian Homelands. And finally, the area affected by the proposed project includes a section of Department of Hawaiian Homelands (DHH) planned for agricultural and residential development. The UMWP EIS ought to include detailed plans for protecting Native water rights, including access, supply, and distribution. The applicant must work with the DHH, the Native Hawaiian Advisory Council, and other Native organizations to effectively identify and address those rights.

Maui Tomorrow holds a strong interest in the matter before you. A large percentage of our membership is Upcountry Maui residents. The ecological scope of the proposal is broad, including the corollary ramifications of island-wide environmental, social, and economic impacts resulting from the potential long term impacts (such as undesired urban growth and development) in the service area. The proposed project actions will specifically impact the integrity of native ecosystems, and the existence of threatened and endangered species; upon these small cores of Maui's inherent uniqueness, its vital industries depend.

Community planning that is both ecologically and economically sound and sustainable springs from the willingness of "policy-makers, resource managers, developers, scientists, and concerned citizens... (to)... work further to protect..." resources.

Your cooperation in this regard would be most appreciated.

On behalf of Maui Tomorrow's membership,

Richard Joseph Lafond Jr.
Executive Director

cc: Paul Matsuo, Hawai'i State Department of Agriculture
Michael Kolman, USDA Soil Conservation Service
Commission on Water Resource Management
Maui News
Native Hawaiian Advisory Council
The Nature Conservancy, Maui
Sierra Club - Maui Group

Responses to the five areas of concern raised by Maui Tomorrow are discussed below with a pre-EIS perspective.

I. Stream Resources

The range of alternatives evaluated during plan formulation included modification and expansion of the collection system on the Waikamoi, Puohokamoa, Haipuaena, and other area streams to increase water supply. Consultation with the Commission on Water Resources Management, Division of Aquatic Resources, and other agencies and groups with responsibility or interest in stream resources indicated that avoidance of impacts to the streams was a high priority. Data will be collected to assess aquatic habitat in the subject streams.

II. Threatened or Endangered Species

Assessments will be conducted to evaluate the proposed projects impacts to threatened and endangered species.

III. Long Term Impacts

Possible long term impacts resulting from the range of alternatives to be evaluated were identified by reviewers during the scoping and pre-assessment consultation periods and listed in Section 5.2 of the Environmental Assessment. Avoidance of the impacts through plan selection would be the initial and primary mitigation strategy.

IV. Undesired Urban Growth and Development

The concern that a project to increase water supply in the Upper Kula could foster population growth and undesired urban growth was expressed during the scoping process. Alternative plans can be formulated to keep static domestic water supply while increasing untreated water supply for agricultural users. Ultimately, control of urban growth and development should be managed through land use planning and zoning rather than water resource rationing.

V. Hawaiian Home Lands

The project planners will be consulting with the Department of Hawaiian Home Lands to develop features of the project to expressly assist farmers in the Keokea Hawaiian Home Lands lots.

BENJAMIN J. CAYETANO
GOVERNOR

ROY S. OSHIRO
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
HONOLULU, HAWAII 96813
FAX (808) 587-0600

IN REPLY REFER TO:
95:PPE/6937

December 19, 1995

Mr. Kenneth M. Kaneshiro
State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Service
Federal Building, Room 4316
300 Ala Moana Boulevard
Honolulu, Hawaii 96850

Dear Mr. Kaneshiro:

Re: Draft Watershed Plan-Environmental Impact Statement for Upcountry Maui Watershed

Thank you for the opportunity to review the subject draft environmental impact statement. We have no comments to offer.

Sincerely,

Roy S. Oshiro
Executive Director

HFDC

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Roy S. Oshiro, Executive Director
State of Hawaii
Department of Budget and Finance
Housing Finance and Development Corporation
677 Queen Street, Suite 300
Honolulu, Hawaii 96813

Dear Mr. Oshiro:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated December 19, 1995 indicating that you have no comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT, AND TOURISM

BENJAMIN J. CAYETANO
Governor
SEIJI F. NAYA
Director
RICK EGGED
Deputy Director

ENERGY DIVISION, 335 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813 PHONE: (808) 587-3800 FAX: (808) 587-3820

091 Kaneshiro

December 19, 1995

Mr. Kenneth M. Kaneshiro
State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
P. O. Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

SUBJECT: Draft Watershed Plan-Environmental Impact Statement for Upcountry Maui Watershed

We wish to inform you that we have no comments regarding the subject Draft Watershed Plan-EIS for Upcountry Maui Wateshed.

Thank you for the opportunity to submit any comments or recommendations.

Sincerely,

Maurice H. Kaya
Energy Program Administrator

MHK:aw

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Maurice H. Kaya, Energy Program Administrator
Department of Business, Economic Development, and Tourism
Energy Division
335 Merchant St., Room 110
Honolulu, HI 96813

Dear Mr. Kaya:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter of December 19, 1995 stating that you have no comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

AARON SHINMOTO, P.E.
Chief Staff Engineer

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

DAVID WISSMAR, P.E.
Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Divisions

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND WASTE MANAGEMENT
LAND USE AND CODES ADMINISTRATION
250 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

January 2, 1996

Mr. Kenneth M. Kaneshiro, State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850-0001

SUBJECT: *Draft Watershed Plan - Environmental Impact Statement*
UPCOUNTRY MAUI WATERSHED

Dear Mr. Kaneshiro:

We have reviewed the above request and have no comment.

If you have any questions regarding this letter, please call me at 243-7845.

Very truly yours,

CHARLES JENCKS
Public Works & Waste Management Director

ey
xc: Engineering Division
Solid Waste
f:\docs\nocommment

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Charles Jencks, Director
County of Maui
Department of Public Works and Waste Management
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Jencks:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 2, 1996 indicating that you have no comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

BENJAMIN J. CAYETANO
GOVERNOR

SAM CALLEJO
COMPTROLLER

MARY PATRICIA WATERHOUSE
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P. O. BOX 119, HONOLULU, HAWAII 96810

LETTER NO (P)1000.6

JAN 3 1996

Mr. Kenneth M. Kaneshiro
State Conservationist
Natural Resources Conservation Service
Department of Agriculture
P. O. Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

Subject: Upcountry Maui Watershed
Maui County, Hawaii
Draft Watershed Plan - EIS

Thank you for the opportunity to review the subject document. The proposed project will have no impact on our facilities. Therefore, we have no comments to offer.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Very truly yours,

GORDON MATSUOKA
State Public Works Engineer

RY:jy

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Gordon Matsuoka, State Public Works Engineer
State of Hawaii
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Matsuoka:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 9, 1996 indicating that you have no comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

DEPARTMENT OF
PARKS AND RECREATION
COUNTY OF MAUI

1580-C Kaahumanu Avenue, Wailuku, Hawaii 96793

LINDA CROCKETT LINGLE
Mayor
HENRY OLIVA
Director
ALLEN SHISHIDO
Deputy Director

(808) 243-7230
FAX (808) 243-7934

January 3, 1996

Kenneth M. Kaneshiro
State Conservationist
United States Department of
Agriculture
P. O. Box 50004
Honolulu, HI 96850-0001

Subject: Draft Watershed Plan-Environmental Impact Statement for Upcountry Maui Watershed

Dear Mr. Kaneshiro:

We have reviewed the draft Watershed Plan - EIS for Upcountry Maui Watershed, and we have no comments.

Thank you for the opportunity to review and make comments.

Sincerely,

HENRY OLIVA
Director

PM

a:\watershed

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Henry Oliva, Director
County of Maui
Department of Parks and Recreation
1580-C Kaahumanu Avenue
Wailuku, Hawaii 96793

Dear Mr. Oliva:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 3, 1996 indicating that you have no comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

U.S. Department
of Transportation
Federal Aviation
Administration

Real Estate and Utilities Team

P. O. Box 50109
Honolulu, Hawaii 96850-4983

January 9, 1996

Mr. Kenneth M. Kaneshiro
State Conservationist
United States Department of
Agriculture
Natural Resources Conservation Service
P. O. Box 50004
Honolulu, HI 96850-0001

Dear Mr. Kaneshiro:

Draft Watershed Plan-Environmental Impact Statement for Upcountry Maui Watershed

Your letter of December 11, 1995, requested comments regarding the subject project. As stated on Page 51 to 52, the Federal Aviation Administration's Air Traffic Control Beacon Interrogator (ATCBI) facility at Puu Nianiau should not be impacted by the proposed improvements. Should there be any impact once construction begins we will advise your office immediately.

We appreciate this opportunity to review your proposal. Please contact me at 541-1236, should there be any questions or ways we may be of assistance.

Sincerely,

Darice B. N. Young
Realty Specialist, AHNL-54B11

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Darice B. N. Young, Realty Specialist
U. S. Department of Transportation
Federal Aviation Administration
P.O. Box 50109
Honolulu, Hawaii 96850-4983

Dear Ms. Young:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 9, 1996 with your comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Although the Federal Aviation Administration's ATCBI facility should not be affected by implementation of the project improvements, please advise us of any impacts that occur during and following project construction.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

January 10, 1996

Planning and Operations Division

Mr. Kenneth M. Kaneshiro
State Conservationist
US Department of Agriculture
Natural Resources Conservation Service
PO Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

Thank you for the opportunity to review and comment on the Draft Watershed Plan and Environmental Impact Statement (DEIS) for the Upcountry Maui Watershed Project, Maui. The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. Based on the information provided, a DA permit may be required for this project. Please contact my Regulatory Section at 438-9258 for further information and refer to file number 960000033.

b. The floodplain information provided on page D-23 of the DEIS is correct.

Sincerely,

Paul Mizue, P.E.
Acting Chief, Planning
and Operations Division

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Paul Mizue, P.E.
Department of the Army
Pacific Ocean Division, Corps of Engineers
Fort Shafter, Hawaii 96858-5440

Dear Mr. Mizue:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 10, 1996 with your comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

The Corps of Engineers Regulatory Section will be consulted by the sponsoring local organizations regarding the need for a Department of Army permit prior to implementation of the watershed project.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO:
11010
Ser N44(23)/ 5808
JAN 10 1996

Mr. Kenneth M. Kaneshiro
State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Division
P.O. Box 50004
Honolulu, HI 96850-0001

Dear Mr. Kaneshiro:

Subj: DRAFT WATERSHED PLAN-ENVIRONMENTAL IMPACT STATEMENT FOR UPCOUNTRY MAUI WATERSHED, MAUI COUNTY, HAWAII OF DECEMBER 1995

Thank you for the opportunity to review the Draft Environmental Impact Statement for the Upcountry Maui Watershed, Maui County, Hawaii of December 1995.

The Navy has no comments to offer at this time and appreciates the opportunity to participate in your review process.

The Navy's point of contact is Mr. Stanford Yuen at 474-0439.

Sincerely,

Stanford B.C. Yuen, P.E.
By direction

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Stanford B. C. Yuen, P.E.
Department of the Navy
Commander, Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860-5020

Dear Mr. Yuen:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 10, 1996 indicating that you have no comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

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

January 16, 1996

Mr. Kenneth M. Kaneshiro
USDA, Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850-0001

Dear Mr. Kaneshiro:

Thank you for the opportunity to review the Draft Watershed Plan - Environmental Impact Statement, Upcountry Maui Watershed, Maui County, Hawaii. The plan proposes the installation of a main water distribution system and accessory lateral to service 473 acres of farmland in Upper Kula. According to the plan (p. 32, 84), the proposed system would meet water demands of DHHL projected 1,000 residential units and 75 acres of farmland.

After a careful review of the plan and supporting documentation, the Office of Hawaiian Affairs (OHA) has no objections to the proposed development. Furthermore, OHA acknowledges the efforts of the preparers to address not only water needs of current or future DHHL developments in the area but to develop and implement measures to mitigate potential adverse effects such as (i) runoff and soil erosion, (ii) interference with captive bird breeding grounds, (iii) water pollution, (iv) disturbance of archaeological sites, and (iv) alteration of stream habitats for native aquatic plants and freshwater fish species. Please contact me, or Linda K. Delaney, the Land and Natural Resources Division Officer (594-1938), or Luis A. Manrique (594-1935), should you have any questions on this matter.

Sincerely yours,

Linda M. Colburn
Administrator

LM:lm

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Linda M. Colburn, Administrator
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813-5249

Dear Ms. Colburn:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 16, 1996 stating that the Office of Hawaiian Affairs has no objections to the project proposed by the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

BENJAMIN J. CAYETANO
GOVERNOR

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
STP 8.7171

January 16, 1996

Mr. Kenneth M. Kaneshiro
State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

Subject: Draft Watershed Plan-Environmental Impact Statement
for Upcountry Maui Watershed

Thank you for your transmittal of December 11, 1996, requesting our comments on the subject plan.

The subject project is not anticipated to have an adverse impact on our State transportation facilities.

However, plans for any construction work within the State highway right-of-way must be submitted for our review and approval.

We appreciate the opportunity to provide comments.

Very truly yours,

KAZU HAYASHIDA
Director of Transportation

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Kazu Hayashida, Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Hayashida:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 16, 1996 with your comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

We also anticipate no effects of the project to State transportation facilities.

Plans for any construction work within State highway rights-of-way will be submitted to the Department of Transportation for review and approval.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

BENJAMIN J. CAYETANO
Governor
SEIJI F. NAYA
Director
RICK EGGED
Deputy Director

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

No. 1 Capitol District, 250 South Hotel Street, 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 586-2355
Fax: (808) 586-2377

January 29, 1996

MEMORANDUM

TO: Mr. Kenneth M. Kaneshiro
U.S. Department of Agriculture

FROM: Shelley M. Mark
Senior Advisor to Director

SUBJECT: Watershed Plan: Upcountry Maui Watershed, Maui County

The State Land Use Commission has prepared the attached comments regarding the subject project.

Thank you for allowing us to comment.

Enclosure

BENJAMIN J. CAYETANO
GOVERNOR

ESTHER UEDA
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone: 587-3822

December 27, 1995

SUBJECT: Director's Referral No. 95-203-C
Draft Watershed Plan - Environmental Impact Statement: Upcountry Maui Watershed, Maui County, Hawai'i

Director's Referral No. 95-205-D
Addendum to Draft Watershed Plan - Environmental Impact Statement: Upcountry Maui Watershed, Maui County, Hawai'i

We have reviewed the subject draft watershed plan - environmental impact statement plus addendum and have the following comments to offer:

1) We confirm that the project area, as shown in Figure 2 of the document, is within the State Land Use Conservation, Agricultural, Rural, and Urban Districts.

2) We confirm that the recommended plan (Alternative 2 - National Economic Development Plan) described in the document and shown in Figure 14 and Appendix E, would primarily be within the State Land Use Agricultural District.

   Additionally, we confirm that portions of the project, as delineated in the recommended plan, would be within the State Land Use Rural and Urban Districts.

We have no further comments to offer at this time.

United States
Department of
Agriculture

Natural
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Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Shelley M. Mark, Senior Advisor to Director
State of Hawaii
Department of Business, Economic Development, and Tourism
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Mark:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 29, 1996 with the Land Use Commission's confirmation of the State Land Use Districts within the watershed and project areas delineated in the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

The Peregrine Fund

HAWAIIAN ENDANGERED BIRD CONSERVATION PROGRAM

29 January, 1996

Kenneth M. Kaneshiro, State Conservationist
U.S. Department of Agriculture
P.O. Box 50004
Honolulu, HI 96850-0001

Dear Mr. Kaneshiro,

Thank you for providing us with a copy of the Draft EIS, Watershed Plan - Upcountry Maui Watershed, Maui, Hawaii.

Beginning on March 1, 1996 we will be responsible for the management and operation of the Olinda Endangered Species Propagation Facility (OESPF) located on Olinda Road. With the potential impact of the watershed project on this facility and its conservation objectives we have reviewed the plan with great interest.

There are two points that will require further discussion and resolution.

1) The pipeline which will cross the rear of the facility (tangent with Piholo Road).

2) The increase in tonnage and numbers of vehicles traveling Olinda Road and Piholo Road.

These two activities will negatively impact the reproduction of the `Alala housed at the facility. Their breeding season lasts from early April until mid-July. Although the project has offered a cessation of disruptive activities during this time of the year, we will need assurance that the breeding program at the OESPF will not be impacted.

Possible mitigation to discuss and explore further is:

- diversion and re-routing of heavy vehicle traffic during the `Alala breeding season.

- support from the watershed project to expand the current breeding/holding capacity at the Keauhou Bird Conservation Center (Big Island) for the relocation of the key breeding pairs of `Alala. With this relocation of breeding

P.O. Box 39 • Volcano, Hawai'i 96785
Telephone / Fax 808-985-7137

pairs, the pipeline construction can continue without interruption.

We look forward to discussing these issues further with you and the program managers as the project continues to develop.

Thank you again for allowing us the opportunity to review the plan and present our concerns.

Sincerely,

Alan Lieberman
Program Director

cc: Bill Burnham, President, The Peregrine Fund
Peter Shannon, OESPF

United States
Department of
Agriculture

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Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Alan Lieberman, Program Director
The Peregine Fund
Hawaii Endangered Bird Conservation Program
P.O. Box 39
Volcano, Hawaii 96785

Dear Mr. Lieberman:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your comments of January 29, 1996 on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

We look forward to discuss and resolve with you the impacts that construction of the main agricultural distribution pipeline and the Olinda lateral pipelines may have on the captive breeding program. The discussions should take place once project funds are appropriated and design of the pipeline systems commences, which are anticipated in late 1996 or early 1997.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

University of Hawaii at Manoa

Water Resources Research Center
Holmes Hall 283 • 2540 Dole Street
Honolulu, Hawaii 96822

8 February 1996

Mr. Kenneth M. Kaneshiro
State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

Subject: Draft Watershed Plan-Environmental Impact Statement for Upcountry Maui Watershed

We have reviewed the subject DEIS and offer the following comments.

Comment 1

Alternative water sources should be included for consideration; for example, rain catchment. Most of the project area has 30 to 40 inches of annual rainfall. Motivating domestic water users to catch rainwater may offer some relief in water demand, especially for project areas with 50 to 60 inches of annual rainfall. Self-sufficiency in water supply can be attended if the private sector is motivated and guided by public sector.

Comment 2

This DEIS describes a recommended plan for addition of a new separate agricultural irrigation distribution system to supply untreated surface water for irrigation of up to 473 acres of mostly currently inactive cropland in the upcountry Maui watershed. The idea of a dual distribution system is a good one since potable water is not required for agricultural irrigation. The additional use of surface water for agricultural irrigation that would result from this project would decrease instream water flows relative to the status quo. An alternative which would also allow all of the same benefits as the recommended plan but would not reduce existing instream flows is water reuse. Was

reuse of treated wastewater considered for the agricultural water distribution system? If it was not considered, why? If it was considered, why was it rejected?

For the existing distribution system, the source water must pass through the Olinda water treatment plant which removes any relatively large objects which could damage the distribution system as well as dirt, sand, silt, turbidity, and any pathogens. For many surface water sources, the quantity of dirt, sand, and silt can increase significantly during rainfall events. For the recommended plan, in which the source water will bypass the Olinda treatment plant and be passed directly into the new distribution system, will there be any provisions (such as racks or screens) for removal of large objects that could damage the distribution system? Was the potential for damage to the new distribution system from deposition of dirt, sand, or silt considered, and were controls such as sedimentation or flushing considered/provided?

Thank you for the opportunity to comment.

Sincerely,

Roger S. Fujioka, Ph.D.
Director, WRRC

RSF:jmn

cc: R. Babcock
H. Gee

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Roger S. Fujioka, Director
University of Hawaii
Water Resources Research Center
2540 Dole Street, Holmes Hall 283
Honolulu, Hawaii 96822

Dear Mr. Fujioka:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your comments of February 8, 1996 on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

COMMENT: Alternative water sources should be included for consideration; for example, rain catchment.

RESPONSE: A statement that rain catchment can be an effective irrigation water source in areas with plentiful and consistent rainfall will be included in the discussion of water conservation alternatives in Section 5.2.1.

COMMENT: Was agricultural reuse of treated wastewater considered?

RESPONSE: Wastewater reuse, i.e. use of treated wastewater for irrigation, was discussed with the Wastewater Reclamation Specialist for the Maui Department of Public Works. He observed that there are no community treatment facilities in the Upper Kula area; that all households are on individual septic systems or cesspools. The highest elevation community system is in Pukalani which discharges its effluent to the Pukalani Golf Course. He also stated that septic system effluent should not be used for irrigation as the treatment levels are not high enough to ensure safe use. Discussion of wastewater reuse will be added to Section 5.2.1.

COMMENT: Was the potential for damage to the new water system from sediment deposition considered?

RESPONSE: Much of the damaging sediment will be screened and settled in the collection system and in the Waikamoi and

Kahakapao reservoirs. The policy of the State Department of Agriculture for its agricultural water systems at Waimanalo, Hoolehua, and Waimea has been to provide untreated water to its users without claims to the quality of the water. Many farmers in those areas provide their own filtration before using the water in their trickle irrigation systems. It is assumed that a similar arrangement will exist for the Upper Kula agricultural water system.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIIKE
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:

February 13, 1996

95-246/epo

Mr. Kenneth M. Kaneshiro
State Conservationist
Natural Resources Conservation Service
U.S. Department of Agriculture
P. O. Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

Subject: Draft Environmental Impact Statement--Watershed Plan
Upcountry Maui Watershed

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

Drinking Water

The subject Plan-EIS indicates that the proposed development will have potential cross-connection problems between the domestic and agricultural water distribution system. The potable and nonpotable water systems must be carefully designed and operated to prevent cross-connections and backflow conditions. The two systems must be clearly labeled and physically separated by air gaps or reduced pressure principle backflow preventers to avoid contaminating the potable water supply. In addition, all nonpotable spigots and irrigated areas should be clearly labeled with warning signs to prevent the inadvertent consumption of nonpotable water.

If you should have any questions, please contact Ms. Queenie Tan of the Safe Drinking Water Branch at 586-4258.

Sincerely,

Lawrence Miike
Director of Health

c: SDWB

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Lawrence Miike, M.D., Director of Health
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801

Dear Dr. Miike:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated February 13, 1996 with comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

The project sponsors who will operate the agricultural water system recognized the hazard of cross connection between the agricultural and potable water systems and are committed to prevent its accidental occurrance. Labeling, backflow prevention, and community education will be included in a program to prevent cross connections and inadvertent consumption of untreated water. Experience from the Department of Agriculture's other irrigation water systems in Waimea, Hoolehua, and Waimanalo will be considered in development of operating policy.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

UNITED STATES DEPARTMENT OF COMMERCE
Office of the Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

February 15, 1996

Mr. Kenneth M. Kanesiro
State Conservationist, USDA
Natural Resources Conservation Office
P.O. Box 50004
Honolulu, HI 96850-0001

Dear Mr. Kaneshiro:

Enclosed are comments on the Draft Environmental Impact Statement for Upcountry Maui Watershed Maui County, Hawaii. We hope our comments will assist you. Thank you for giving us an opportunity to review this document.

Sincerely,

Donna S. Wieting
Acting Director
Ecology and Conservation Office

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
National Geodetic Survey
Silver Spring, Maryland 20910-3282

FEB 14 199?

MEMORANDUM FOR: Donna Wieting
Acting Director, Ecology and Conservation Office

FROM: for Captain Lewis A. Lapine, NOAA
Director, National Geodetic Survey

SUBJECT: DEIS-9512-08--Upcountry Maui Watershed Maui County, Hawaii

The subject statement has been reviewed within the areas of the National Geodetic Survey's (NGS) responsibility and expertise and in terms of the impact of the proposed actions on NGS activities and projects.

All available geodetic control information about horizontal and vertical geodetic control monuments in the subject area are on the attached diskettes. This information should be reviewed for identifying the location and destination of any geodetic control monuments that may be affected by the proposed project.

If there are any planned activities which will disturb or destroy these monuments, NGS requires not less than 90 days' notification in advance of such activities in order to plan for their relocation. NGS recommends that funding for this project include the cost of any relocation(s) required.

For further information about these monuments, please contact John Spencer; SSMC3, NOAA, N/NGS; 1315 East West Highway; Silver Spring, Maryland 20910; telephone: 301-713-4169; fax: 301-713-4175.

Attachments

United States
Department of
Agriculture

Natural
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Conservation
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P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Donna S. Wieting, Acting Director
Ecology and Conservation Office
U.S. Department of Commerce
Office of the Under Secretary for Oceans and Atmosphere
Washington, D.C. 20230

Dear Ms. Wieting:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated January 16, 1996 with comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

The geodetic control data was examined and four stations in the proximity of the project area were identified. The stations are:

TU2869 Keokea Kula Sanitorium Lightning Rod
TU0907 Kikalapuu
TU2964 Puu Pane Reset
TU2966 Waiakoa Holy Ghost Church.

The planned project will not disturb or destroy any of the monuments.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

February 16, 1996
RE:0669

Mr. Paul Matsuo
Department of Agriculture
P.O. Box 22159
Honolulu, Hawaii 96823-2159

Dear Mr. Matsuo:

Draft Environmental Impact Statement
Maui Upcountry Watershed Irrigation Project
Kula, Maui

The proposed project involves installation of an irrigation water distribution system which will supply untreated surface water to farms in Upper Kula. Water will be taken from the recently constructed Kahakapao Reservoir in Olinda, and transported via pipeline from Olinda to Keokea. Nine lateral systems will branch out from the main pipeline. The project will cost approximately $8 million, with federal and local sponsors splitting the burden almost equally.

We reviewed this Draft Environmental Impact Statement (EIS) with the assistance of Paul Ekern, Emeritus, Agronomy and Soils Science; Trae Menard, Geography; and Paul Berkowitz of the Environmental Center.

Scope of the Project

The document's title suggests that the scope of the project includes a comprehensive watershed management plan; however, after reading the draft EIS, it appears that the proposed plan is essentially an irrigation project. Instead of discussing land use policies, erosion control strategies, stream management, and other general watershed issues, the document focuses on how to distribute irrigation water to 473 acres of farmland in the Upper Kula area. Thus the title of the document seems both inappropriate and misleading.

Document Organization

The primary function of a draft EIS is to disclose information on potential environmental effects of a proposed action. Typically documents contain an easily identifiable "Potential Impacts" section, upon which the remainder of the document hinges. In the Upcountry Watershed EIS, the "Potential Impacts" section is both cursory and split in two pieces. Chapter 4 mentions issues of concern as identified in the scoping process but does not provide any detail about whether the project warrants these concerns. For instance, Section 4.1.2 states that "erosion during land clearing, grading, and construction can cause sedimentation of streams." While this statement is scientifically valid, it does not in any way provide information on how the proposed project affects streams. We have to turn to Chapter 5 entitled "Formulation and Comparison of Alternatives" to learn anything about the potential impacts of the proposed action. While Chapter 5 at least attempts to describe the specific effects of the proposed action, it does not provide an adequate level of detail. The next section concerning impacts to endangered birds illustrates this point.

Impacts to Forest Reserves and Endangered Birds

Section 4.1.1 identifies the northern portion of the watershed as essential habitat for the recovery of 5 endangered birds. Skipping to Section 5.4.3, we are informed that most of the project area is outside the Forest Reserves boundaries except for the Waihou Spring Reserve. Several questions appear unanswered. Where is the project site compared to the range of these birds? How much contiguous habitat is required by these birds? Will noise from the proposed construction affect these birds? All of these concerns may be unwarranted; however it is impossible to know based on the information provided in the document. Thus the document fails in its basic mission to provide sufficient detail to allow the public to adequately evaluate the proposed action.

Sketchy Weather Details

Since the proposed action focuses on irrigation, the document should provide a thorough description of the climatic factors which affect the water needs of agricultural crops in the region. At the minimum, the document should include sections on evaporation, drought frequency, wind, and fog drip. Evaporation represents one of the most significant elements in the water balance, particularly at high elevation and in dry leeward areas. At the proposed site, the irrigation needs cannot be adequately assessed without a good understanding of the evaporation regime. Evaporation data for east Maui can be found in the following papers:

(1) Giambelluca, T.W. and Nullet, D., 1991. Influence of the trade-wind inversion on the climate of a leeward mountain slope in Hawaii. *Clim. Res., 1: 207-216.*

(2) Giambelluca, T.W., McKenna, D.L., Ekern, P.C. 1992. An automated recording atmometer: 1. Calibration and testing. *Agric. For. Meteorol.* 62:109-125.

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

Document Organization

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(3) Giambelluca, T.W. and Nullet, D. 1992. An automated recording atmometer: 2. Evaporation measuremcnt on a high-elevation transect in Hawaii. *Agric. For. Meterol.* 00:000-000.

In terms of drought analysis, both the frequency and severity influence irrigation requirements. Thus the document should provide an assessment of the crop risks associated with drought. General drought information can be found in the following publications:

(1) Chu, P. 1989. Hawaiian drought and the southern oscillation. *International Journal of Climatology* 9:619-631.

(2) Drought in Hawaii. DLNR Report R88. 1991. *{n.b., p. 100, Fig. 45.}*

Wind speed and direction represent primary factors in determining the need for windbreaks. Although the document discusses windbreaks, it does not describe the wind patterns at the project site. These patterns are critical in assessing plant-deformation, crop damage, evaporation rates, and fog drip. Yasuo Noguchi's 1979 paper "Deformation of trees in Hawaii and its relation to wind" (*Journal of Ecology* 67:611-628)provides a good description of the wind regime on Haleakala.

On the windward side of Haleakala, where trade winds are dominant, fog drip constitutes a significant component of the hydrologic cycle. Thus at least a portion of the site should benefit from increased precipitation due to fog drip. This factor should be considered in assessing the area's water balance and irrigation needs, as crops in this region may need considerably less water than previously estimated.

Irrigation Technology and Water Treatment

In order to use water efficiently on the slopes of Upper Kula, the proposed project probably will utilize drip irrigation. If so, then irrigation water may require substantial treatment to remove sediment and other material which might clog the drip holes. Necessary treatment might include sand filters to remove sediment, chlorination to prevent algal growth, and ant insecticide to prevent ants from chewing on the drip lines. Many of trials associated with drip irrigation have been documented in the annual reports of the Hawaiian Sugar Planters' Association (HSPA). These trials should be reviewed, and knowledge gained from them should be incorporated into the final EIS.

Erosion and Runoff From Maintenance Roads

Alternative 2, the preferred alternative, involves 9.2 miles of access and maintenance road. Since road cuts often initiate slumping and other erosion features, some sort of assessment of the area's geologic stability should be provided. Furthermore, since road surfaces typically have greatly reduced infiltration capacities, runoff will almost certainly increase. Thus

the document should describe the volume of increased runoff and its potential to instigate downslope effects such as flooding and sedimentation.

Hydrologic Assumptions

Section 5.6.1 states that only fifteen years (1953-1968) of data were used to determine the amount of water available at the collection area. Why was the scope of data utilization so restricted? Was this the only information available for the region? The document should provide a more detailed description of what data were available, and what basis was used for data selection.

Conclusion

In general, the proposed action seems relatively benign, although several sections in the draft EIS are vague on details. In particular, we recommend that the document include more information on potential impacts on endangered birds and forest ecosystems, climate, water balance, drip technology, water treatment, and erosion problems. Without these data, the public cannot adequately assess the impacts of the proposed action, and hence the review process is rendered ineffective. Also, we suggest that the document be reorganized to more clearly describe the project impacts and suggested mitigative measures.

Thank you for opportunity to review this draft EIS.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Governor Benjamin Cayetano
USDA Natural Resources Conservation
Roger Fujioka
Kenneth Kaneshiro
Paul Ekern
Trae Menard
Paul Berkowitz

IRRB 1069/3

BENJAMIN J. CAYETANO
Governor

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

JAMES J. NAKATANI
Chairperson, Board of Agriculture

LETITIA N. UYEHARA
Deputy to the Chairperson

Mailing Address:
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Honolulu, Hawaii 96823-2159

FAX: (808) 973-9613

May 20, 1996

Mr. John T. Harrison, Environmental Coordinator
University of Hawaii
Environmental Center
2550 Campus Road, Crawford 317
Honolulu, HI 96822

Dear Mr. Harrison:

Re: Draft EIS Comments
UpCountry Maui Watershed

Enclosed is a response to your specific comments by our consultant, the USDA Natural Resources Conservation Service (NRCS). This is a federally assisted project under authority of Public Law 83-566 and the NRCS acts as the project manager. All aspects of this project are under their jurisdiction and the local co-sponsors (Department of Agriculture, Maui County Board of Water Supply and the Olinda-Kula Soil and Water Conservation District) have only supporting jurisdiction.

Any further clarification can be obtained by calling NRCS at 541-2612.

Sincerely,

Paul T. Matsuo

PAUL T. MATSUO
Administrator-Chief Engineer
Agricultural Resource Management
Division

c: K. Kaneshiro (NRCS)
Chairperson, Board of Agriculture

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

John T. Harrison, Environmental Coordinator
University of Hawaii
Environmental Center
2550 Campus Road, Crawford 317
Honolulu, Hawaii 96822

Dear Mr. Harrison:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your comments of February 16, 1996 on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

COMMENT: The document's title suggests that the scope of the project includes a comprehensive watershed management plan.

RESPONSE: It appears that the term "watershed" in the title has caused confusion. The primary reason for its use derives from the federal program authority under which the project is planned and implemented, the Watershed Protection and Flood Prevention Act of 1954, Public Law 83-566. Under this program planning was conducted for a "watershed" or a hydrographic region, in this case, the areas connected to the Upper Kula Water System, including areas for collection and transmission . Ancillary problems and opportunities were also evaluated during planning.

COMMENT: In the Upcountry Watershed EIS, the "Potential Impacts" section is both cursory and split in two pieces.

RESPONSE: The format of the Plan-EIS is directed by the USDA Natural Resources Conservation Service's (NRCS) National Watershed Manual, 2nd Edition, 1992. NRCS policy is to combine the watershed plan and EIS into a single document. The section, Scope of the EIS, described in your comments as a piece of "Potential Impacts", documents the results of the scoping process which identifies issues within the watershed significant in defining the problems and formulating and evaluating alternative solutions. The impacts of the alternative solutions is found in Chapter 5, Formulation and Comparison of Alternative Plans.

COMMENT: Questions about endangerd forest birds appear to be unanswered.

RESPONSE: A subsection for "Biodiversity and Threatened and Endangered Species" should have been included in Chapter 5, Formulation and Comparison of Alternative Plans. The paragraph below will be included in the final Plan-EIS.

> 5.4.16 Biodiversity and Threatened and Endangered Species
>
> None of the alternatives will affect the essential forest habitat of endangered bird species. The U.S. Fish and Wildlife Service reviewed the project area maps with other information in their files including maps prepared by the Hawaii Heritage Program of the Nature Conservancy. Concern about possible effects to captive breeding of the Hawaiian crow still exists and is discussed above. The letter from the U.S. Fish and Wildlife Service indicating compliance with Section 7 of the U.S. Endangered Species Act is included in Appendix B.

COMMENT: The document should provide a thorough description of the climatic factors which affect the water needs of agricultural crops in the region.

RESPONSE: An intensive crop water requirement analysis was conducted during planning of the project. Irrigation water requirements were determined for four general types of crops in ten rainfall zones in the benefitted area. The crop coefficients that factored crop evapotranspiration from pan evaporation resulted from a Modified Penman analysis which considered wind speed, air temperature, dewpoint, solar radiation, and elevation. The technical documentation is available for viewing at the Natural Resources Conservation Service, Hawaii State Office.

COMMENT: The document should provide an assessment of crop risks associated with droughts.

RESPONSE: One of the most severe droughts on the record for the project area, in 1962, is included in the period of record used for the reservoir/distribution system simulation. During a simulated drought identical to that in 1962, farmers would have experienced 117 water-short days.

COMMENT: Although the document discusses windbreaks, it does not describe the wind patterns at the project site.

RESPONSE: Windbreaks are not a proposed improvement of the project. Windbreaks will be designed and installed under other programs such as the Environmental Quality Incentives Program which uses as its technical reference the NRCS Field Office Technical Guide, Section IV, Practice Standards and Specifications.

COMMENT: Treatment of agricultural water to remove sediment, algae, and prevent other problems such as chewing ants should be discussed.

RESPONSE: The policy of the State Department of Agriculture for its agricultural water systems at Waimanalo, Hoolehua, and Waimea has been to provide untreated water to its users without claims to the quality of the water. Many farmers in those areas provide their own filtration before using the water in their trickle irrigation systems. It is assumed that a similar arrangement will exist for the Upper Kula agricultural water system.

COMMENT: Since road cuts cause slumping and erosion, geologic assessment should be provided. Infiltration capacities of the road surface will be reduced, increasing runoff. The document should describe the volume of increased runoff and its potential to cause downstream problems.

RESPONSE: The maintenence roads will generally traverse the gradual slope across pasture land. The roads will be designed to minimize erosion and sediment generation. A geologic assessment for road design purposes, including pollution control, will be conducted during the implementation phase. It is estimated that conversion of 9.2 acres of pasture to road surface will increase total runoff volume from the upper one-half of the project area, approximately 6,000 acres, by 0.1 percent.

COMMENT: The document should provide a more detailed description of the hydrologic data available and the basis for data selection.

RESPONSE: As explained in the Investigation and Analysis Report (pg. D-9), the available record for daily stream and flume gages in the collection area coincided in the years 1953 to 1968. The rainfall record for the period was tested to ensure that the 15 year was statistically representative of the longer record.

Thank you for your comments.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

cc: Paul Matsuo, Department of Agriculture, State of Hawaii

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) 587-2846, 587-2800

BENJAMIN J. CAYETANO, Governor

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

Ref. No. Z-0038

February 16, 1996

Mr. Kenneth M. Kaneshiro
State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

We have reviewed the Draft Environmental Impact Statement (DEIS) for the Upcountry Maui Watershed Plan and offer the following comments.

Implementation of the preferred alternative may result in increased growth pressures in the Upcountry watershed area. The DEIS contains only a cursory discussion of this growth factor. This issue needs a more thorough discussion since growth is not only the result of land use controls but also of infrastructure capacity.

In addition, the small size of the average farm indicated in this DEIS raises the question of whether these are all viable farming ventures. Supplemental social/economic data in the DEIS would provide more information on the farmers and farms which are "collaborators" with the local Soil and Water Conservation District.

If there are any questions, please call Charles Carole at 587-2804.

Sincerely,

Gregory G.Y. Pai, Ph.D.
Director

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Gregory G. Y. Pai, Ph.D., Director
Office of State Planning
Office of the Governor
P.O. Box 3540
Honolulu, Hawaii 96811-3540

Dear Dr. Pai:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated February 16, 1996 with comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

COMMENT: The issue of increased growth pressures due to expansion of infrastructure capacity needs more discussion.

RESPONSE: The discussion of economic development in Kula and state and county goals and policies regarding growth in the Kula area has been expanded in sections 4.1.7, 5.4.8, and 5.6.

Although implementation of an agricultural water system will free additional domestic capacity, no new water sources will be developed. An increase in domestic demand due to residential development will exacerbate the frequency and severity of water shortages during prolonged droughts. Controls to growth will need to be exercised by county planners. The Board of Water Supply will be encouraged to make planners and policy makers aware of drought effects issues.

COMMENT: The small size of the average farm indicated in the DEIS raises the question whether these are all viable farming ventures. Supplemental social/economic information should be provided for "cooperators" with the local Soil and Water Conservation District.

RESPONSE: The economic viability of farms in Upper Kula has been evaluated and documented in the economic analysis for this project. Many farmers in Upper Kula have been unable to optimize their crop acreage due to water supply constraints. This project intends to improve the viability of commercial agriculture in

Upper Kula, thereby achieving goals set by the Makawao-Pukalani-Kula Community Plan, the County of Maui General Plan, and the Hawaii State Plan. A more detailed description of farming activity in the Upper Kula area will be included in the Final EIS.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

February 21, 1996

Kenneth Kaneshiro, State Conservationist
USDA Natural Resources Conservation Service
Hawaii State Office
PJKK Federal Bldg. Room 4316
Honolulu, HI 96850

Dear Mr. Kaneshiro:

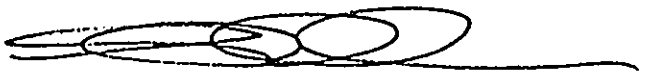
The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the project entitled **Upcountry Maui Watershed**, Maui County, Hawaii. Our review is provided pursuant to the National Environmental Policy Act (NEPA) [42 USC 4231 et seq.], Council on Environmental Quality (CEQ) regulations [40 CFR 1500-1508] and Section 309 of the Clean Air Act. Due to the federal furlough of December 18, 1995 through January 29, 1996, the completion of our review of this EIS was delayed by a few days. Verbal extension of our comment deadline was provided in a telephone conversation last week with with Dudley Kubo of your office.

The Natural Resources Conservation Service (NRCS) proposes the installation of an agricultural water distribution system to supply untreated water for irrigation to farmers in the Upper Kula area. The water source will be Kahakapao Reservoir. The system will provide 473 acres of cropland with agricultural water supply at 90.8 percent availability.

Based on our overall review, we have assigned the DEIS a rating of **EC-2 (Environmental - Concerns-Insufficient Information).** This EC-2 Rating is further defined in the attached "Summary of the EPA Rating System." We have assigned the EC-2 rating because the DEIS has substantial deficiencies in complying with basic NEPA requirements regarding impact assessment and format. The FEIS should include a more complete description of the environmental impacts of the action, mitigation measures and alternatives. EPA's concerns included potential impacts to fish and wildlife and riparian habitat under Alternative 3 due to construction of a new reservoir. We would be happy to meet with your staff to assist NRCS with NEPA requirements and compliance. Our specific comments are attached.

We appreciate the opportunity to review and provide comments on the DEIS. Please send one copy of the Final Environmental Impact Statement to this office at the same time it is officially filed with our Washington, D.C. office. If you have any questions, please contact me at (415) 744-1584, or have your staff contact Edward Yates at 744-1571.

Sincerely,



Dave Farrel, Chief
Office of Federal Activities

MI# 2140: maui-upc.dei
attachment

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommend for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

GENERAL COMMENTS

1. NEPA requires that an EIS discuss the project purpose and need. While the DEIS discusses the project needs or "problems" under "Watershed Problems and Opportunities" (pp. 33-37), the DEIS does not include a concise and clear description of the project purpose. The Final EIS (FEIS) should include a clear project purpose section and should identify in the Table of Contents where "purpose and need" can be found in the EIS.

2. Under "Watershed Problems and Opportunities," (pp. 31-35, 37) the DEIS generally discusses the growth in residential housing in the Kula watershed. It would be helpful if the FEIS further explained the relation between urban growth and agricultural land and the state or county policies regarding retaining agricultural land in production. The DEIS should also identify more specifically how the project will assist state or local goals regarding agricultural land. The FEIS should also discuss the possibility of project water being used for increased development due to relaxation of the "Kula Rule" (p.47). While the decision to allow further development will be made by local Maui County officials (p. 81), the EIS should still discuss whether the project will cause any growth inducing impacts (40 CFR 1508.8(b)).

3. While the specific impacts from Alternative 3 are not clearly described in the document, it appears that Alternative 3's additional structures will cause additional impacts to riparian habitat. Given the possibility that Alternative 3 will inundate archeological sites and riparian habitat, it appears that Alternative 2 is the preferable action alternative.

4. There is a general need to describe mitigation measures in more detail. CEQ regulations require that an EIS include "appropriate mitigation measures not already included in the proposed action or alternatives, " and "means to mitigate adverse environmental impacts" [40 CFR 1502.14, 1502.16]. The DEIS does not include a section on mitigation nor a specific or detailed discussion of these measures. The FEIS should contain information on implementation plans, feasibility, cost, monitoring and expected level of effectiveness for each mitigation measure-.

ALTERNATIVES

The DEIS briefly describes the no action alternative (Alternative 1) and states that it is being used "to allow comparison of the without-project conditions to alternatives with the alternatives installed" (p. 65)." The DEIS contains a useful alternative comparison chart on pages 86-90. Also, the DEIS does include some comparison between the no action alternative and the two project alternatives regarding project economic benefits. However, neither the Alternatives section nor the 'Effects of Alternatives Plans" section clearly describes the *environmental* conditions or impacts that would occur if the current management scheme (no action) continued. For instance, in regard to erosion, the DEIS says only that, "future conditions without project improvements... will require no new construction" (p. 77). The FEIS should include specific information so that the EIS is consistent with the statement on

page 65 and NEPA requirements to describe alternatives so that the reader will be able to compare the alternatives (40 CFR 1502.14).

ENVIRONMENTAL CONSEQUENCES

1. General Comments. Section 5.4, "Effects of Alternative Plans," does include a general "scoping" type discussion of what impacts may be caused by the project but the document does not include the specific impact assessment required by NEPA. Section 102(2)(C) sets out NEPA's basic mandate that Federal agencies prepare a detailed statement on the "environmental impact of the proposed action." [42 U.S.C. 4232(2)(C)]. CEQ regulations further specify that EISs must include an evaluation of direct, indirect and cumulative effects which are caused by the action (40 CFR 1508.8(b) and 1508.7). The DEIS does not include a clear or detailed description of the environmental consequences of the action as required by the regulations. EPA strongly recommends that NRCS include additional information in the required discussion of environmental impacts in the FEIS. In your efforts to produce a sufficient FEIS, you should closely follow the recommended format for EISs that is set out in the CEQ regulations [40 CFR 1502.10]. The document should contain separate and complete sections on "Affected Environment," "Environmental Consequences," etc.

2. On page 82, the DEIS briefly discusses water quality but does not include any information regarding a possible indirect impact of increased polluted runoff from farms due to increased pesticide use. The FEIS should discuss whether an increase in cultivation will result in increased pesticide use and whether NRCS plans to commit to supporting any programs intended to reduce pesticide use in the project area.

3. Regarding impacts to forest ecosystems (section 5.4.3), the FEIS should state whether there are any secondary impacts on these nearby forest ecosystems and describe any such impacts. Secondary impacts could include changes in drainage patterns that will affect forest resources or increased access to sensitive areas of the forest.

4. On p. 78, the DEIS states that project construction may affect birds in the Hawaiian crow captive breeding program. This general statement is not detailed or clear whatsoever. The FEIS should state whether the project would have certain impacts and should describe whether those impacts would be significant and to what extent the proposed project would adversely affect the program.

5. The DEIS states on page 81, that no wetlands have been identified in the project area "except for open reservoirs." This statement does not sufficiently explain the existence of wetlands in the project area. As Alternative 3 "provides a storage reservoir" (p. 72), there is a possibility that wetland areas would be inundated. The FEIS should describe whether wetlands or any other riparian habitat would be lost or affected due to the project.

POLLUTION PREVENTION

The DEIS includes very little description of measures to prevent and reduce water and air quality impacts during periods of construction. While certain sections of the DEIS do state that "pollution control measures will be utilized in accordance with County grading ordinances" (p. 77), the FEIS should state specific measures to reduce air and water quality impacts. The DEIS makes no mention of Executive Order 12856 and 12902 or the Pollution Prevention Act of 1990 regarding pollution prevention and energy conservation opportunities. EPA's position is that such opportunities should be discussed thoroughly and integrated into the project analysis and implementation. We urge the NRCS to implement a full range of pollution prevention measures: water and energy conservation measures, solid waste recycling, reductions in the use of hazardous materials, and hazardous waste minimization. You may wish to consult the CEQ guidance regarding pollution prevention, which is published in the January 29, 1993 Federal Register. Specific pollution prevention measures which may be incorporated in the proposed project include:

Hazardous Materials Use/Hazardous Waste Minimization

* Reducing the use of hazardous materials, and
* Reducing the quantity and toxicity of hazardous waste requiring proper treatment, storage or disposal.

Solid Waste Recycling

* Reducing construction-related waste, and
* Reusing and recycling demolition waste.

Air Quality

* Reducing construction related vehicle trips.

Water Quality

* Locating site access routes and equipment storage in areas to minimize erosion.
* Identifying watershed areas of concern including septic tank systems, animal wastes, etc. for pollution discharge reduction.

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Dave Farrel, Chief
Office of Federal Activities
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, California 94105

Dear Mr. Farrel:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated February 21, 1996 with comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

General Comments

COMMENT: The EIS is required to discuss the project purpose and need.

RESPONSE: A concise "purpose and need statement" will be inserted as Section 3.4.

The Upcountry Maui Watershed project is needed to reduce crop losses caused by irrigation water shortages and allow farmers to more fully utilize their cropland by providing adequate and more consistent agricultural water supply. State and federal assistance for the watershed project was requested by the Olinda-Kula Soil and Water Conservation District based on the frequency of drought and water restrictions in the Kula area and the resulting economic losses to farmers.

COMMENT: The EIS should further explain the relationship between urban growth and agricultural land and the state or county policies regarding retaining agricultural land in production.

RESPONSE: Sections 4.1.7 and 5.4.8 have been expanded to discuss the relationship between urban growth and agricultural land and state and county policies regarding retention of agricultural lands.

The proper balance between agricultural land/open land, and residential and urban development is key to maintain the rural, "upcountry" character of the Kula area that most residents and visitors value.

The retention of agricultural land and the rural, open character of the Kula area are key objectives of the General Plan of the County of Maui and the Makawao-Pukalani-Kula Community Plan.

The 1980 General Plan sets as a land use objective "To make available to our people lands that are well-suited for agricultural pursuits." Policies to be enacted by the county to attain the objective include "Protect agricultural lands from urban encroachment."; "Discourage the conversion of agricultural lands to non-agricultural uses."; and "Provide adequate irrigation water and access to agricultural lands."

COMMENT: It appears that Alternative 2 is the preferable action alternative.

RESPONSE: The sponsors have selected Alternative 2 for implementation.

COMMENT: There is a general need to describe mitigation measures in more detail.

RESPONSE: Mitigation measures will be discussed in more detail in Section 7.5 Installation and Financing.

Alternatives

COMMENT: The EIS does not clearly describe the environmental conditions or impacts that would occur if the current management scheme (no action) continued.

RESPONSE: Discussion of the resource conditions with the continuation of the current management scheme (no action)will be expanded in Section 5.4 Effects of Alternative Plans.

Environmental Consequences

COMMENT: The DEIS does not include clear or detailed description of the environmental consequences of the action. The format recommended in CEQ regulations should be followed.

RESPONSE: Reviewers of EISs for PL83-566 projects have reported problems locating the information required by CEQ regulations because of the unusual format of the combined document. The format of the plan-EIS is directed by the NRCS National Watershed Manual (390-V-NWSM, 2nd ed., 12/92) and is in compliance with CEQ regulations [40 CFR 1502.10]. The plan-EIS format is intended to allow readers to follow the steps of the planning process. We intend to adjust subsequent EIS formats to more closely follow that suggested in the CEQ regulations.

COMMENT: The FEIS shold discuss whether an increase in cultivation will result in increased pesticide use.

RESPONSE: Section 5.4.10 has been expanded to include discussion of the indirect impact of increased agricultural chemical usage in the project area.

COMMENT: The FEIS should state whether there are any secondary impacts to nearby forest ecosystems.

RESPONSE: A statement will be included in Section 5.4.3 that there are no anticipated direct, indirect, or secondary impacts to native forest ecosystems by any of the alternatives

COMMENT: The FEIS should state whether the project will have effects on the Hawaiian crow captive breeding program and whether those effects are significant.

RESPONSE: The potential impacts caused by construction-related noise on the captive breeding program for the Hawaiian crow are described in Section 4.1.3. Any disturbance that results in failure to mate or produce viable eggs is significant. Project planners have been communicating with the Program Manager for the Peregrine Fund which assumed operation of the Olinda Endangered Species Propagation Facility on March 1, 1996. We are committed to work out details of mitigation with the Peregrine Fund during the design phase of the project.

COMMENT: The FEIS should describe whether wetlands or any other riparian habitat would be lost or affected due to the project.

RESPONSE: The description of the types of reservoirs and ponds found in the project area has been expanded in Section 4.1.9. A statement that the project alternatives will not have an impact on wetlands except to provide an additional reservoir in Alternative 3 will be added to Section 5.4.9.

Pollution Prevention

COMMENT: The FEIS should state specific measures to reduce air and water quality impacts.

RESPONSE: Discussion of measures to be considered during design and construction to prevent and reduce water and air quality impacts during construction and maintenance will be included as Section 7.5.12.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

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

February 23, 1996

Mr. Paul T. Matsuo
Department of Agriculture
State of Hawaii
1428 South King Street
Honolulu, Hawaii 96814

Dear Mr. Matsuo:

Subject: Draft EIS for the Upcountry Maui Watershed Irrigation Project, Island of Maui

Thank you for the opportunity to review the subject document. We have the following comments.

1. The proposed irrigation system will be fed by the Kahakapao Reservoir. Where does the Kahakapao Reservoir get its water from? What is the sustainable yield of that water source?

2. Implementation of a separate agricultural water distribution system may free up to 0.7 mgd of domestic water. What is your estimate of the number of homes that could be supplied by this "surplus" water?

3. The EIS must consider mitigation measures proposed to minimize the project impacts. The document must include description of any mitigation measures included in the action plan to reduce significant, unavoidable, or adverse impacts to insignificant levels.

4. The EIS must contain a statement of the relationship of the proposed action to the land use plans, policies, and controls for the affected area.

5. Briefly discuss the following items:
   a) Relationship between local short term uses of humanity's environment and the maintenance and enhancement of long term productivity;
   b) Irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented; and
   c) Probable adverse environmental effects which cannot be avoided.

If you have any questions, please call Jeyan Thirugnanam at 586-4185. Thank you.

Sincerely,

Gary Gill
Director

c: USDA Natural Resources Conservation

IRRB 1069/2

BENJAMIN J. CAYETANO
Governor

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

JAMES J. NAKATANI
Chairperson, Board of Agriculture

LETITIA N. UYEHARA
Deputy to the Chairperson

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96823-2159

FAX: (808) 973-9613

May 20, 1996

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

Dear Mr. Gill:

Re: Draft EIS Comments
UpCountry Maui Watershed

Enclosed is a response to your specific comments by our consultant, the USDA Natural Resources Conservation Service (NRCS). This is a federally assisted project under authority of Public Law 83-566 and the NRCS acts as the project manager. All aspects of this project are under their jurisdiction and the local co-sponsors (Department of Agriculture, Maui County Board of Water Supply and the Olinda-Kula Soil and Water Conservation District) have only supporting jurisdiction.

Any further clarification can be obtained by calling NRCS at 541-2612.

Sincerely,

Paul T. Matsuo

PAUL T. MATSUO
Administrator-Chief Engineer
Agricultural Resource Management
Division

c: K. Kaneshiro (NRCS)
Chairperson, Board of Agriculture

Island Fresh

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Gary Gill, Director
Office of Environmental Quality Control
220 South King Street, Fourth Floor
Honolulu, HI 96813

Dear Mr. Gill:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated February 23, 1996 with comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

COMMENT: Where is the water source for Kahakapao Reservoir and what is its sustainable yield?

RESPONSE: The water source for the Kahakapao Reservoir is the collection system for the Upper Kula Water System and is described in the Hydrology section of the Investigation and Analysis Report, pages D-9 to D-13. The collection system includes diversions on three streams, Waikamoi, Puohokamoa, and Haipuaena, at the 4,200-foot elevation, in addition to near fifty other smaller intakes. A surface water development study conducted for the County of Maui by Belt, Collins Associates in 1985, estimated the average daily surface discharge from the collection area to be 7.53 MGD. The average daily projected diversion from the collection area for both domestic and agricultural supplies will be 1.93 MGD. If the Upper Kula agricultural water system is connected to an envisioned Lower Kula agricultural water system or more reservoir capacity is constructed, diversion during high flows will increase and the average daily withdrawal will increase.

COMMENT: What is the estimated number of homes that can be served with the 0.7 mgd "surplus" capacity of the domestic water system?

RESPONSE: Using 500 gallons as the average household demand per day, 0.7 MGD could supply an additional 1,400 homes.

COMMENT: The document must include descriptions of any mitigation measure included in the plan.

RESPONSE: Section 7.5.12 Mitigation Measures will be added to the FEIS to discuss mitigation measures proposed to minimize project impacts. Mitigation measures will include active coordination with the management of the Olinda Endangered Species Propagation Facility to reduce impacts to the Hawaiian Crow captive breeding program, development of an action plan to inform the public about the dangers of system cross connection and reduce its likelihood, and pollution control measures to minimize erosion during construction.

COMMENT: The EIS must contain a statement of the relationship of the proposed action to land use plans, policies, and controls for the affected area.

RESPONSE: Section 5.6 Relationship of the Proposed Action to Plans, Policies, and Controls has been added to discuss the project's relationship to the State General Plan and Functional Plans, State Land Use Districts, Maui County General Plan, and the Makawao-Pukalani-Kula Community Plan.

COMMENT: Briefly discuss the relationship between short term use of the environment and maintenance and enhancement of long term productivity, irreversible and irretrievable commitments of resources, and unavoidable adverse environmental effects.

RESPONSE: Section 5.9 Relationship between Short-Term use of the Environment and the Maintenance and Enhancement of Long-Term Productivity, Section 5.10 Irreversible and Irretrievable Commitment of Resources, and Section 5.11 Probable Adverse Environmental Effects which Cannot be Avoided have been included in the FEIS.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

cc: Paul Matsuo, Department of Agriculture, State of Hawaii

BENJAMIN J CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P.O. BOX 621
HONOLULU, HAWAII 96809

MICHAEL D WILSON
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT S. COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT
WATER RESOURCE MANAGEMENT

File 96-235

Mr. Kenneth M. Kaneshiro, State Conservationist
Natural Resources Conservation Services
P.O. Box 50004
Honolulu, Hawaii 96850-0001

MAR 5 1996

Dear Mr. Kaneshiro:

Subject: Draft Watershed Plan-Environmental Impact Statement for Upcountry Maui Watershed

We have completed our review of the subject Draft Environmental Impact Statement (EIS) and have the following comments:

Land Management Branch

1. We are concerned about the economic impact on the State of Hawaii on the land acquisition. Should the State or the County of Maui pay for the land acquisition? Who is going, to maintain the water distribution system?

2. Since the State of Hawaii constructed the Kahakapao reservoir at its expense; should the water users pay the State for the use of the water?

We commend the United States Department of Agriculture, Maui County Board of Water Supply, State of Hawaii Department of Agriculture and Olinda-Kula Soil and Water Conservation district for the planning and implication of the watershed project. We think the project is great for the farmers of the Kula, Maui area.

Division Of Forestry & Wildlife

1. The proposed project traverses mostly over private land and therefore, would not affect our programs or projects within the affected area.

2. We do not foresee any disturbance to the avian wildlife within the Olinda Endangered Species Program Facility during the construction of the pipeline unless the pipeline is directly adjacent to the facility. Construction noise could disturb nesting activities.

3. The Upcountry area has long needed an updated water management system for its farmers and homeowners. This project presents an opportunity to provide the needed service for the residents.

Commission on Water Resource Management

1. We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

2. If the proposed project diverts additional water from streams or if new or modified stream diversions are planned, the project may need to obtain a stream diversion works permit and petition to amend the interim instream flow standard for the affected stream(s).

3. Few wells exist in the area to determine whether or not local ground water is basal or high-level in the project area. Although they do not appear to be in the project area, various tunnels registered by Ulupalakua Ranch indicate the occurrence of high level water near the southern area of the project.

Since the existing Upper Kula Water System cannot meet the existing demands it is unclear how the three major streams - Haipuaena, Puahokanoa and Waikamoi would not be affected. Since there is to be a substantial increase in irrigated acreage from DHHL commitments, increased diversion from surface water sources seems inevitable and would require, at the least, petitions to amend interim instream flow standards from the Commission before such diversions are allowed. The document mentions that overflow from the Waikamoi Reservoir back into the Waikamoi Stream during periods of high rainfall may decrease with implementation of Alternative 2 or 3 (pg. 80). This may require an amendment to interim instream flow standards.

Planning & Technical Services Branch

According to the Draft EIS, out of the 12,250 - acre project area, ninety-nine acres are within the State Land Use Conservation District. For work performed within the Conservation District, a Conservation District Use Permit will be required. Please contact our Planning and Technical Services Branch for permitting requirements at 587-0377.

Thank you for the opportunity to comment on the subject matter. If you have any questions please contact Cathy Tilton of our Planning and Technical Services Branch at 587-0377.

Aloha,

for Michael Wilson

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

REF:CWRM-SS

DEC 21 1995

Mr. Kenneth M. Kaneshiro
U.S. Department of Agriculture
National Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850-0001

SUBJECT: Draft Watershed Plan-EIS for Upcountry Maui Watershed

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas which are important for the maintenance of streams and the replenishment of aquifers.

[X] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] A Well Construction Permit and a Pump Installation Permit from the CWRM would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the CWRM would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows. This may require an instream flow standard amendment.

[ ] We recommend that no development take place affecting highly erodible slopes which drain into streams within or adjacent to the project.

[X] If the proposed project diverts additional water from streams or if new or modified stream diversions are planned, the project may need to obtain a stream diversion works permit and petition to amend the interim instream flow standard for the affected stream(s).

[ ] Based on the information provided, it appears that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.

[ ] Based on the information provided, it does not appear that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.

[ ] An amendment to the instream flow standard from the CWRM would be required before any streamwater is diverted.

[ ] Any new development that is permitted along a stream that is not yet channelized should be based on the express condition that no streams will be channelized to prevent flooding of the development. Development in the open floodplain should not be allowed; other economic uses of the floodplain should be encouraged.

[X] OTHER:

Few wells exist in the area to determine whether or not local ground water is basal or high-level in the project area. Although they do not appear to be in the project area, various tunnels registered by Ulupalakua Ranch indicate the occurrence of high level water near the southern area of the project.

Since the existing Upper Kula Water System cannot meet the existing demands it is unclear how the three major streams - Haipuaena, Puahokanoa, and Waikamoi would not be affected. Since there is to be a substantial increase in irrigated acreage from DHHL commitments, increased diversion from surface water sources seems inevitable and would require, at the least, petitions to amend interim instream flow standards from the Commission before such diversions are allowed. The document mentions that overflow from the Waikamoi Reservoir back into the Waikamoi Stream during periods of high rainfall may decrease with implementation of Alternative 2 or 3 (pg. 80). This may require an amendment to interim instream flow standards.

If there are any questions, please contact Roy Hardy at 587-0274.

Aloha,

for MICHAEL D. WILSON

c: OCEA

BENJAMIN J CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P.O. BOX 621
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FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT
WATER RESOURCE MANAGEMENT

File 96-235

MAR 12 1996

Mr. Kenneth M. Kaneshiro, State Conservationist
Natural Resources Conservation Services
P.O. Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

Subject: Draft Watershed Plan-Environmental Impact Statement for Upcountry Maui Watershed -- Additional Comments

The following are additional comments to our March 5, 1996, letter to you regarding the subject matter.

Historic Preservation Division

The draft EIS for the Maui Upcountry Watershed addresses potential impacts resulting from two alternative proposed waterlines that would augment the existing Kula waterline between Olinda to Keokea. The Alternative 2 pipeline would be located at various distances east (mauka) of the existing pipeline. The Alternative 3 system would be located adjacent to the existing pipeline, following the same route.

According to the draft EIS (page 79), there are no known historic properties listed in the Hawaii Inventory of Historic Places within the proposed construction corridors of Alternative 2 and 3. It is also stated that, "Alternative 2 has the potential to adversely affect newly identified areas containing surface dryland agricultural features and associated temporary shelters and trails." This information is based on the results of archaeological fieldwork that was conducted in 1994 for the project. The report of the findings of the fieldwork is not attached to the draft EIS.

We received a partial draft of the cultural resources overview study for the project; however, it does not contain specific information regarding the location, type, probable age, extent, and significance of newly identified sites along the project corridor. We cannot comment on the text of the draft EIS, or provide specific recommendations regarding additional inventory survey or areas to be archaeologically monitored until we have reviewed a complete draft report of the overview and reconnaissance survey.

The draft EIS states on page 112 that "A statement confirming compliance with Section 106 of the National Historic Preservation Act of 1966 will be obtained from the State Historic Preservation Officer prior to finalization of the Plan-EIS."

In order for our office to determine project compliance with Section 106, we will need to review the full report on the cultural resources overview and findings of the reconnaissance survey that has been conducted of the project area. Based on the findings of the reconnaissance survey, we will then recommend areas for inventory survey. The inventory survey will need to be completed prior to a final determination of project impacts, and prior to formulation of specific mitigation measures, such as site avoidance, construction monitoring, or data recovery.

Based on the information presented in the Draft EIS, it appears that Alternative 3 will cause fewer impacts to historic sites than would Alternative 2.

Thank you for the opportunity to comment on the subject matter. If you have any questions please contact Cathy Tilton of our Planning and Technical Services Branch at 587-0377.

Aloha,

Gilbert S. Coloma-Agaran
for Michael Wilson

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Michael Wilson, Chair
Board of Land and Natural Resources
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Wilson:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your comments of December 21, 1995, March 5, 1996, and March 12, 1996 on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

Land Management Branch

COMMENT: Should the State or the County of Maui pay for the land acquisition?

RESPONSE: The project has been conceived as a State Department of Agriculture-developed agricultural water system. As such, the State government will be responsible for land acquisition.

COMMENT: Who is going to maintain the water distribution system?

RESPONSE: The Department of Agriculture will develop an agreement with the Maui County Department of Water Supply to contract operation and maintenance to the Department of Water Supply.

COMMENT: Since the State constructed Kahakapao reservoir; should the water users pay the State for the use of water?

RESPONSE: The agricultural water users will likely be charged rates by the Department of Agriculture that are similar to those in the other State-developed systems in Waimea, Hoolehua, and Waimanalo. It is expected that the operation and maintenance expenses will be covered by user fees.

Division of Forestry and Wildlife

COMMENT: The proposed project traverses mostly over private land and therefore, would not affect our programs or projects within the affected area.

COMMENT: We do not foresee any disturbance to the avian wildlife within the Olinda Endangered Species Program Facility during construction of the pipeline unless the pipeline is directly adjacent to the facility. Construction noise could disturb nesting activities.

RESPONSE: We recognize the potential impacts to the captive breeding program and will coordinate with the facility management, The Pregrine Fund, during the project design period to identify and resolve impacts to the facility's operations.

COMMENT: The Upcountry area has long needed an updated water management system for its farmers and homeowners. This project presents an opportunity to provide the needed service for the residents.

Commission on Water Resources Management

COMMENT: We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

RESPONSE: This project will be incorporated into the Island of Maui Water Use and Development Plan by the Maui Department of Water Supply, a project sponsor.

COMMENT: If the proposed project diverts additional water from streams or if new or modified stream diversions are planned, stream diversion permits and amendments to interim instream flow standards need to be obtained. The decrease in overflow from the Waikamoi Reservoir back into Waikamoi Stream as a result of the project during periods of high rainfall may require an amendment to the interim instream flow standard.

RESPONSE: No new stream diversions nor modification of existing diversions are proposed. The implementation of the project will reduce the overflow of Waikamoi Reservoir back into Waikamoi Stream which occurs during high runoff events. The project will utilize the recently increased transmission and storage capacities of the Upper Kula Water system to provide the increased irrigation water for the additional crop acreage. Water collection during low flow periods will not change. We acknowledge that an amendment to the instream flow standard may be required for the reduced overflow from Waikamoi Reservoir. The needed permits and approvals will be obtained once federal and local funding of the project is assured.

Planning and Technical Services Branch

COMMENT: A Conservation District Use Permit will be required for any work within the 99 acres in the project area identified as State Land Use Conservation District.

RESPONSE: The land identified as Conservation District in the project area is within the Waihou Spring Forest Reserve. No project activity is expected to occur in the Forest Reserve.

Historic Preservation Division

COMMENT: The draft cultural resources overview study, which is not attached to the draft EIS, does not contain specific information regarding location, type, probable age, extent, and significance of newly identified sites along the project corridor.

RESPONSE: As indicated in the draft EIS, the completed draft cultural resources reconnaisance survey report is currently being prepared. Upon completion, the report will be submitted for review by the State Historic Preservation Office. We understand that a final determination of project impacts to cultural resources and specific mitigation measures for the impacts will be developed before your office can determine project compliance with Section 106 of the National Historic Preservation Act of 1966.

Thank you for your comments.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

A&B-HAWAII, INC.
HONOLULU

TELEPHONE: (808) 877-0081

HAWAIIAN COMMERCIAL & SUGAR COMPANY

P. O. BOX 266, PUUNENE, MAUI, HAWAII 96784

March 7, 1996

Mr. Paul Matsuo
Department of Agriculture
State of Hawaii
P. O. Box 22159
Honolulu, Hawaii 96823-2159

Dear Mr. Matsuo:

Reference: Maui Upcountry Watershed Project Draft Environmental Impact Statement

Thank you for this opportunity to provide comments on the Draft Environmental Impact Statement dated December 1995 for the Upcountry Maui Watershed Plan. This plan is of great interest and concern to the Hawaiian Commercial and Sugar Company (HC&S), as it will ultimately impact water resources upon which HC&S depends to keep its 36,000 acre sugar plantation economically efficient.

HC&S currently cultivates more than 36,000 acres in the central valley of Maui, and is the largest and most productive of the surviving sugar plantations in the State, employing over 1,000 Maui residents. Eight thousand of these 36,000 acres depend totally on our Upcountry Wailoa Ditch water source for irrigation. HC&S's two mills also depend on this clean source of water for its generators. In addition, HC&S's sister company, East Maui Irrigation Company, Limited (EMI), is the gatherer of most of Upcountry Maui's water, collecting and delivering the surface water from streams and transmitting it to the BWS at convenient delivery points. Thus, it is clear that HC&S has a vested interest in the Upcountry Maui water supply.

Before addressing our concerns with the subject EIS, let me first state that HC&S fully supports government's efforts to provide a lower cost supply of water to Maui's farmers. As a fellow farmer, HC&S is well aware of the importance of water, and reasonably priced water, to the viability of its operation.

Allow me to highlight our general concerns with the EIS and the proposed agricultural water system. First, we find that the EIS fails to adequately address the impacts that the proposed water system will have on HC&S's farming activities and viability. HC&S's Wailoa Ditch, which collects water from the East Maui watershed, is currently the back-

up source of water for all of Upcountry Maui. During times of low rainfall, when the Upper and Lower Kula systems do not have sufficient source to meet demand, the County Department of Water Supply (DWS) takes water from HC&S's Wailoa Ditch and pumps it up to these upper systems. Although the proposed agricultural water project will draw water from the Upper Kula water system and will not itself be linked to (fed by) the Wailoa Ditch/Kamole Weir system, it will allow for (and in fact encourage) additional demand (both domestic and agricultural) on the Upper Kula water system thus, increasing the likelihood of domestic water shortages on the Upper Kula system and, therefore, the frequency of occurrences (and volume) when water will have to be taken from HC&S's Wailoa Ditch to meet Upper Kula demand. It is precisely these times of drought or low rainfall that HC&S will be most injured by these withdrawals of water. The Wailoa Ditch is our sole source of water to keep our factories going (thus power supplied to the plantation and 12% of the general public), and to keep 8,000 acres of cane healthy.

To partially mitigate this negative impact on HC&S, we propose that certain water use policies be established as part of the proposed project. For example, domestic uses off the Upper Kula line should receive priority access to the Upper Kula sources, (before the proposed agricultural line) or that DWS's withdrawals from the Wailoa Ditch shall not be increased as a result of this project. HC&S, or any other existing farmer, should not be injured as a result of new users in Upcountry, whether domestic or agricultural, encouraged by this project.

The Wailoa Ditch is primarily a surface water source which is already overburdened during low rainfall or drought periods. This is a fact well known to existing Upcountry residents and farmers. The proposed project will not result in any new or additional source for Upcountry communities. This is a fact that needs to be clarified in the EIS. Numerous statements are made that infer that this plan will provide new water for both agricultural and domestic expansion Upcountry. While this project will indeed make more of the existing source (supply) usable at times, this is only true when water is plentiful. When there is insufficient source to meet both domestic and agricultural needs -- which needs are being encouraged to increase by the proposed project in the EIS -- this project will not create new sources and will not alleviate the situation. Only additional sources, such as wells or storage reservoirs, can achieve that goal. David Craddick, the Maui Department of Water Supply Director, recently stated that the County needs from 260 to 270 million gallons of additional reservoir storage to meet current needs in the Maui Upcountry area (Maui News, February 28, 1996).

Secondly, the EIS does not adequately address EMI's Upcountry water agreement with the DWS. On page 30, it states that "The DWS maintains agreements with the East Maui Irrigation Company (EMI) to receive raw water supplies from EMI collection and transmission system." It should be noted in the EIS that the current agreement will expire on December 31, 1996 and that in this agreement, the DWS has agreed to take action to

reduce its draw of water from the Wailoa Ditch in low flow times, i.e., when the water level drops below 55 MGD. And, on page 115 under section 7.5.11 Water Rights, we note that it is assumed that the sponsors of this project will be able to access water from the Upper Kula collection system through an agreement with EMI. Please note that HC&S has not been approached on this issue and that we may be limited by the terms of our agreement with the DWS which also encumbers the Upper Kula system.

Thirdly, the EIS needs to show more details on the present and expected irrigation water needs for the project area and the pipeline design flow capacities. If the total area of 473 acres is planted, the peak water use will be 3.0 MGD (page 75). [Note: the pipeline design flow capacity is twice the peak use or 6 MGD for the 18" pipe, according to Dudley Kubo, NRCS.]

In conclusion, unless certain policies are put in place regarding the use of the Upper Kula water sources by *this project*, particularly during times of low rainfall, we believe that it may only exacerbate an already stressful situation -- insufficient water for everyone during times of drought. This should be clearly stated in the EIS as an impact of the proposed plan. We would, in fact, advocate that the addition of source be added to the recommended course of action. The Plan should address the worst case scenario of low rainfall and drought, rather than addressing the average rainfall situation. Farmers and residents alike desire (depend on) reliability of their water supply.

We request that the potential impacts on HC&S's existing operations mentioned above be addressed in the Environmental Impact Statement for this project and that HC&S be consulted in the preparation of the EIS.

We look forward to future discussions with the DOA and its consultants on this proposed project. Thank you for this opportunity to express our concerns.

Sincerely yours,

R. F. Cameron
Plantation General Manager

cc: M. J. Ching
State of Hawaii OEQC
USDA, NRCS - Honolulu
USDA, NRCS - Maui

BENJAMIN J. CAYETANO
Governor

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

JAMES J. NAKATANI
Chairperson, Board of Agriculture

LETITIA N. UYEHARA
Deputy to the Chairperson

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96823-2159

FAX: (808) 973-9613

May 20, 1996

Mr. R. F. Cameron, Plantation General Manager
Hawaiian Commercial and Sugar Company
P. O. Box 266
Puunene, HI 96784

Dear Mr. Cameron:

Re: Draft EIS Comments
UpCountry Maui Watershed

Enclosed is a response to your specific comments by our consultant, the USDA Natural Resources Conservation Service (NRCS). This is a federally assisted project under authority of Public Law 83-566 and the NRCS acts as the project manager. All aspects of this project are under their jurisdiction and the local co-sponsors (Department of Agriculture, Maui County Board of Water Supply and the Olinda-Kula Soil and Water Conservation District) have only supporting jurisdiction.

Any further clarification can be obtained by calling NRCS at 541-2612.

Sincerely,

Paul T. Matsuo

PAUL T. MATSUO
Administrator-Chief Engineer
Agricultural Resource Management
Division

c: K. Kaneshiro (NRCS)
Chairperson, Board of Agriculture

United States Department of Agriculture

Natural Resources Conservation Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

R. F. Cameron, Plantation General Manager
Hawaiian Commercial and Sugar Company
P.O. Box 266
Puunene, Hawaii 96784

Dear Mr. Cameron:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated March 7, 1996 with comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

COMMENT: The EIS fails to adequately address the impacts that the proposed water system will have on HC&S's farming activities and viability...it will allow for (and in fact encourage) additional demand (both domestic and agricultural) on the Upper Kula water system thus, increasing the likelihood of domestic water shortages on the Upper Kula system ... water will have to be taken from HC&S's Wailoa Ditch to meet Upper Kula demand.

RESPONSE: The farms in Upper Kula that connect to the agricultural water system will no longer be served by the domestic system for irrigation purposes. Potable water pumped from the Kamole Weir on the Wailoa Ditch will be used only to meet domestic needs in Upper Kula. Operating policies will be established by the Department of Agriculture and the Department of Water Supply for water allocation from the Kahakapao Reservoir to ensure that domestic users will be provided water at all times with the minimum need to transfer water from lower sources.

While the potential exists for an increase in residential development due to additional domestic water capacity, the fact that no additional source has been developed should indicate to planners that more water will not be available during critical drought periods. The controls to growth will need to be exercised by county planners. The Board of Water Supply will be encouraged to make planners and policy makers aware of drought effects issues.

COMMENT: The proposed project will not result in any new or additional source for Upcountry communities. This is a fact that needs to be clarified in the EIS.

RESPONSE: You are correct that the present project will not create any new storage or water source. The project, however, is only one phase of the implementation of the expanded water supply concept developed during the Water Resources Study for Upcountry Maui conducted in the late 1980s. The improvement of the transmission pipeline from Waikamoi to Olinda and development of additional reservoir storage (Kahakapao) were also identified during the study and implemented by the state and county. The combination of all phases increases water supply to Upper Kula most of the time. While the increased reservoir capacity on the Upper Kula system can be operated to increase protection against drought even with expanded agricultural activity, droughts events will continue to occur.

COMMENT: The EIS does not adequately address EMI's Upcountry water agreement with DWS.... It should be noted that the current agreement will expire on December 31, 1996 and that in this agreement the DWS has agreed to take action to reduce its draw of water from the Wailoa Ditch in low flow times.

RESPONSE: The expiration date of the current agreement and the particular term of the agreement mentioned above will be noted in the Final EIS.

COMMENT: In Section 7.5.11, Water Rights, we note that it is assumed that the sponsors of this project will be able to access water from the Upper Kula collection system through and agreement with EMI.

RESPONSE: Section 7.5.11 restates the PL83-566 requirement that the project sponsors assure the federal government that they have the legal or contractural right to the water supply needed to operate the project for the life of the project.

COMMENT: The EIS needs to show more details on the present and expected irrigation water needs for the project area and pipeline design flow capacities.

RESPONSE: More details on irrigation needs, presently and in the future with the project installed, will be included in the FEIS. A table showing pipeline capacities will be included in the FEIS.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

cc: Paul Matsuo, Department of Agriculture, State of Hawaii

United States Department of the Interior
OFFICE OF THE SECRETARY

Office of Environmental Policy and Compliance
600 Harrison Street, Suite 515
San Francisco, CA 94107-1376

March 11, 1996

ER 96/0022

Mr. Kenneth M. Kaneshiro, State Conservationist
USDA Natural Resources Conservation Service
Hawaii State Office
PJKK Federal Building, Room 4316
300 Ala Moana Blvd.
P.O. Box 50004
Honolulu, HI 96850

Dear Mr. Kaneshiro:

The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement for the Watershed Plan, Upcountry Maui Watershed, Maui County, Hawaii, and does not have any comments to offer.

Thank you for the opportunity to comment on this document.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

cc: Director, OEPC, w/original incoming
Regional Director, FWS, Region I, Portland

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Patricia Sanderson Port, Regional Environmental Officer
United States Department of the Interior
Office of Environmental Policy and Compliance
600 Harrison Street, Suite 505
San Francisco, California 94107-1376

Dear Ms. Port:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated March 11, 1996 indicating that you have no comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

331-9 Waialoa Road
Kula, HI 96790
18 March 1996

Kenneth Kaneshiro, Soil Conservationist
USDA Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

Dear Mr. Kaneshiro:

Last month I attended the public meeting on the proposed Upper Kula Agricultural Waterline. Since then I have spoken with several individuals and groups about the waterline and shared with them the materials distributed during and after the meeting.

Based on my understanding of the materials and pending review of the full plan I tentatively support the proposed project. While I would not benefit directly from the increased availability of agricultural water, it will benefit my neighbors and enhance upcountry by making agriculture a more viable pursuit.

I appreciate the informative briefing and materials provided by your staff and look forward to periodic briefings on the status of the project.

Sincerely,
Elliott M. Kaaa

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

Elliott M. Krash
331-9 Waiakoa Road
Kula, HI 96790

Dear Ms. Krash:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter with supportive comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

LINDA CROCKETT LINGLE
Mayor

DAVID W. BLANE
Director

GWEN OHASHI HIRAGA
Deputy Director

COUNTY OF MAUI
PLANNING DEPARTMENT
250 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

April 16, 1996

Mr. Kenneth M. Kaneshiro, State Conservationist
USDA Natural Resources Conservation Service
Hawaii State Office
PJKK Federal Building, Room 4316
Honolulu, Hawaii 96850

Dear Mr. Kaneshiro:

RE: Upcountry Maui Watershed DEIS

Thank you for the opportunity to comment on the Draft EIS for the Upcountry Maui Watershed project dated December, 1995. The proposed project will include 9.4 miles of main distribution pipeline, 14.8 miles of lateral and sub-lateral pipelines, as well as appurtenant valves and devices. This project is intended to provide untreated water to 473 acres of cropland for agricultural irrigation purposes.

The Planning Department is in support of this project as proposed. As noted in the DEIS, Theme 1 of Maui's General Plan is to, "Protect Maui County's Agricultural Land and Rural Identity." This basic theme is further supported by numerous policy statements in the current and proposed Makawao-Pukalani-Kula Community Plans. In fact, one of the policy statements in the proposed community plan states, "Support the development of separate domestic and irrigation water systems." As such, we find the proposed project consistent with Maui County planning policy.

There have been some comments regarding the potential for additional urbanization as a result of this project. We believe this potential is minimal because the project will not develop any additional source which would allow this to happen.

We are concerned, however, that there is a potential for misuse of connections with this system for domestic purposes. Since there are currently a number of controls in place which restrict the issuing of additional domestic meters, demand for this use is high. If the system is placed into operation without some form of control over the use, it could be very easy for a customer to safely use the water for domestic purposes by using a simple home purification system. Because of this, we would

recommend that some mitigation mechanism be developed or identified in the document to assure that this water is used for its intended purpose, to support agriculture in the Upcountry area.

If you have any questions regarding our comments, please contact William Spence at 243-7735.

Very truly yours,

DAVID W. BLANE
Director of Planning

DWB:wrs
cc: William Spence
Julie Higa
David Craddick
Central File
c:\docs\corspond\umeis.com

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

May 22, 1996

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

Dear Mr. Blane:

Subject: Draft Watershed Plan and Environmental Impact Statement
Upcountry Maui Watershed, Maui County, Hawaii

Thank you for your letter dated April 16, 1996 with comments on the draft Watershed Plan and Environmental Impact Statement (Plan-EIS) for the Upcountry Maui Watershed, Maui County, Hawaii. We wish to respond to your comments.

We agree with your comment that the proposed plan is consistent with the Maui County planning policy as stated in the Maui County General Plan and the Makawao-Pukalani-Kula Community Plan.

We also agree that the potential for increased urbanization in Upper Kula as a result of the proposed project is minimal.

The potential for misuse of agricultural connections for domestic water supply certainly exists. Operating policies for the agricultural water system will be developed among the sponsors, including the Maui Department of Water Supply and the State Department of Agriculture, to recognize and prevent such situations. The Department of Agriculture will draw upon their experience with the agricultural water systems in Waimea (Kamuela), Hoolehua, and Waimanalo to help develop operating policies. The developed policy will be in place prior to commencement of agricultural water service.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

February 6, 1996

Dear Sir/Madam:

Subject: Upcountry Maui Watershed Public Meeting

A Public Informational Meeting for the Upcountry Maui Watershed will be held:

Wednesday, February 14, 1996
7:00 PM
Mayor Eddie Tam Memorial Center
Makawao, Hawaii

The Natural Resources Conservation Service (NRCS) Planning Team will discuss the Upcountry Maui Watershed plan to provide consistent agricultural water supply to cropland in Upper Kula. The planning team will answer questions and receive comments on the draft Watershed Plan-Environmental Impact Statement which is currently in review. The steps to be taken to finalize the plan and EIS will be described.

The local sponsoring organizations are the Olinda-Kula Soil and Water Conservation District, the State of Hawaii Department of Agriculture, and the County of Maui Board of Water Supply.

If you have any questions please call Neal Fujiwara, District Conservationist, NRCS Wailuku Field Office, at (808) 244-3729 or Michael Kolman, Assistant State Conservationist, NRCS Hawaii State Office, at (808) 541-2602.

Sincerely,

ACTING
KENNETH M. KANESHIRO
State Conservationist

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

February 26, 1996

Dear Meeting Attendee:

Subject: Upcountry Maui Watershed Public Meeting

Thank you for your attendence at the Upcountry Maui Watershed public meeting held on February 14, 1996 in Makawao.

Attached are the meeting notes including audience comments and the responses from the meeting organizers. If you have additional comments or questions please call Neal Fujiwara, District Conservationist, Wailuku Field Office, at 244-3729 or Michael Kolman, Assistant State Conservationist, in Honolulu, at 541-2602.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

Enclosure

UPCOUNTRY MAUI WATERSHED
PUBLIC MEETING
FEBRUARY 14, 1996

The public informational meeting of the Upcountry Maui Watershed started 7:15 p.m., at the Mayor Eddie Tam Memorial Center. Approximately 30 people attended this meeting.

Neal Fujiwara, Natural Resource Conservation Service (NRCS) District Conservationist, opened the meeting with an introduction of the sponsors, and a brief background of the project. The sponsors of the project are the Olinda-Kula Soil and Water Conservation District, Maui Department of Water Supply, and State Department of Agriculture.

Dudley Kubo, NRCS Civil Engineer, described the planning and implementation processes, the social and environmental concerns raised during scoping, the various alternatives considered for the project, and details of the selected plan.

The attendees where asked to voice their questions and concerns:

1. Is it possible to use easements that are already in place?

   Yes, to the extent that the agricultural water system is co-located with the existing system. For the most part, the main agricultural distribution pipeline will be nearly one-half mile uphill of the existing Upper Kula pipeline in an area without existing easements.

2. Is delivery for this project gravity flow?

   Nearly all of the proposed agricultural system will be gravity flow, except for a portion of the Waiakoa service area which is above the distribution pipeline where a pump and storage tank system will probably be installed.

3. Can the maintenance road use existing roads?

   Where the distribution or lateral pipeline is in the proximity of an existing road, maintenance activities can be provided from the road.

4. Would individual farmers in the service areas be responsible to provide a pipeline from the lateral pipeline to their individual farm?

   The project intends to extend laterals and sublaterals to the farm boundary within the service areas. The farmer will pay for a meter at the property line and all on-farm pipelines.

5. How will the farm operator be approached to sign up?

   Development of the subscriber list will be an operational matter that has yet to be worked out. Current agricultural users on the Upper Kula system within the identified service areas will be the first to be converted to the proposed agricultural system.

6. Will the white areas on map be served?

   There is a possibility that service can be extended outside of the identified service areas. The benefit of providing such service must be demonstrated to the agricultural water system operator. Much of the white areas are gulches and other land uses that do not

support irrigated cropland.

7. What agency will be owning and obtaining revenue from the system? Who will set rates? How and who is responsible for operation and maintenance?

   The Hawaii Department of Agriculture is charged with organizing irrigation systems under Chapter 167, Hawaii Revised Statutes, and will control the system and set rates. The Maui County Department of Water Supply controls the Kahakapao Reservoir source and has staff, equipment, and knowledge to assist the Department of Agriculture with operation and maintenance of the agricultural system.

8. Is the Department of Agriculture the customer of the Department of Water Supply?

   It is likely that the Department of Agriculture will contract with the Department of Water supply to operate and maintain the agricultural system.

9. What are the comparison on water rates with other agricultural systems?

   The Department of Agriculture operates three agricultural systems - Waimea, Molokai, and Waimanalo. The current rate is $.16 per 1,000 gallons in addition to varying acreage charges. The Department of Agriculture is currently planning to restructure the rates.

10. Would this system be able to increase water availability? Will it decrease the domestic water supply?

    The recently installed 36-inch transmission pipeline and the 100-million gallon Kahakapao Reservoir have increased water availability considerably in Upper Kula. The proposed system will increase the capability to distribute water to farmers. The existing water system is limited by the capacity of the Olinda Water Treatment Plant. Bypassing treatment will provide expanded untreated water supply to farmers. Domestic users will benefit from decreased demand on the treatment plant.

11. Would hooking up to the agricultural system require giving up my domestic meter?

    If the domestic supply is needed for household uses the domestic meter can be retained. Most farm properties will be connected to both systems.

12. Every year, for many years, there's not enough water. Will this system alleviate the problem?

    As stated above, the recently installed 36-inch transmission pipeline and the 100-million gallon Kahakapao Reservoir have increased water availability considerably in Upper Kula. Water shortage problems due to prolonged droughts will still exist, although less frequently. The agricultural system will also utilize excess water that is diverted from Waikamoi Stream but overflows the reservoirs at Waikamoi and Kahakapao when they are full.

13. Where and how much water overflows from the Upper Kula system?

    After water is collected from Waikamoi Streams and other streams in the vicinity, it is moved, using gravity, to the Waikamoi Reservoir and on to the Kahakapao Reservoir. Both reservoirs have the capability of safely releasing water when they become full during rainy periods. It is estimated that an average of 750 million gallons per year was

released in this manner before the 36-inch transmission pipeline and Kahakapao Reservoir were constructed.

14. What is the size of the new pipeline? What is the size of the existing pipeline?

    The proposed distribution pipeline will be 18 to 8 inches in diameter with lateral pipelines from 8 to 2 inches in diameter. The existing pipeline is between 12 and 2 inches in diameter.

15. Do you see the agricultural pipeline used for domestic use in the future?

    No, that the proposed water system will remain in agricultural use is a condition for federal financial involvement in this project.

16. Would the cost of the water be more than domestic rates? If so, this project is not beneficial.

    As stated above, the water rates for the agricultural system will be similar to that charged users of the other state agricultural water systems. The rates should be less than the domestic water rate. The farmers *will not be asked to fund* the installation of the agricultural water system.

17. If farmers are not expected to pay back the cost of installing the system why the concern about amortization of the installation cost?

    Although the federal and state governments will fund the installation by appropriation or bond issuance, amortizing the installation cost, like is done with a home mortgage, allows decision-makers to be able to compare average annual costs to average annual benefits.

18. Will the Department of Hawaiian Home Lands (DHHL) be participating in this project?

    Yes, the DHHL has been a part of the steering committee since the inception of the project. In the medium-term future, approximately 75 acres of DHHL cropland in Keokea is included for service from the proposed system. The DHHL cropland will also receive water from an extension of the Lower Kula water system.

19. DHHL is at the end of the line. Would this system provide enough water to the end of the line? How do you regulate usage?

    The agricultural water system will be designed to provide water equally to its users. Regulation and control of water use is an operational matter that is yet to be determined.

20. What is the flow estimate for the installed system?

    The average agricultural water use for 473 irrigated acres is estimated to be 1 million gallons per day with a peak use of 3 million gallons per day.

21. What is the meter cost?

    The hardware cost for a 1-1/2 inch meter is about $3,500. Additional fees, to be determined, may be added to the cost.

22. Is the water source owned by EMI?

Yes, the land is owned by EMI. The county has contracted EMI to operate and maintain the intakes for DWS.

23. What is the procedure of allocating water for drought?

Agricultural water users will be told that during droughts irrigation will take lower priority to domestic and livestock needs. In addition, the users will acknowledge that system operators will not be responsible for the quality of the water, that water conservation by the farmer will be assumed, and that the agricultural system will not be used for firefighting supply.

24. Would the Kamole Wier/Wailoa Ditch be tapped during drought?

Treated water from the Kamole treatment plant may be pumped to the Upper Kula domestic system in time of drought.

25. Would service be provided to the Kula Ag Park?

No, the Kula Ag Park will not be served by the Upper Kula system. An expansion of the Lower Kula system may provide agricultural water to the Ag Park.

26. What is the time line for the project?

If the Plan-EIS can be finalized without problems, funding can be secured at the state and federal levels, and permits and landrights can be secured, construction could begin as soon as within a year. Construction of the entire system may take up to three years. The earliest that all farmers will be connected is three or four years from today.

27. Would the residential properties within the service area have a dual system?

Not unless a need for agricultural water is demonstrated. An application for a agricultural meter will be required and appropriate fees will be collected.

28. Crops grow better with untreated water. Will this ag water system be treated in any way?

No treatment of the agricultural water supply is planned.

David Craddick, Director, Department of Water Supply, stated that with implementation of a separate agricultural system the operational cost of the existing domestic system will decrease. The agricultural meters will be charged the nonpotable agricultural rate likely set by the Department of Agriculture. The decreased demand on the Olinda Water Treatment Plant will decrease the cost of the upgrade to the plant required by the EPA compliance order. The agricultural water system project will require a joint effort and close coordination by the sponsoring agencies. The agricultural project will not increase domestic water demand in Upper Kula.

The meeting adjourned at 9:00 p.m.

APPENDIX B

SUPPORTING DOCUMENTS

APPENDIX B - SUPPORTING DOCUMENTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Ecoregion
300 Ala Moana Blvd, Room 6307
P.O. Box 50167
Honolulu, Hawaii 96850

In Reply Refer To: DLB

MAR 8 1995

Mr. Kenneth M. Kaneshiro
State Conservationist
U. S. Department of Agriculture
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850-0001

Dear Mr. Kaneshiro:

The U.S. Fish and Wildlife Service (Service) has received your February 6, 1995, letter requesting concurrence by the Service that federally listed, proposed, and candidate endangered and threatened species would not be affected by the UpCountry Watershed Project in Kula on the island of Maui. The proposed project involves the construction of a separate agricultural water distribution pipeline to provide adequate and consistent agricultural water distribution to the farmers in upper Kula.

The Service has reviewed the map and information provided with your request along with pertinent information in our files, including maps prepared by the Hawaii Heritage Program of the Nature Conservancy. As stated in our July 18, 1994, letter, our main concern deals with the Olinda Endangered Species Captive Propagation Facility (OESCPF). The OESCPF has ongoing breeding programs for two federally endangered bird species, the Hawaiian goose or nene (*Nesochen* (=*Branta*) *sandvicensis*) and the Hawaiian crow or 'alala (*Corvus hawaiiensis*). Of these two species, the construction activities associated with the proposed project may disturb the 'alala. Also, although not previously mentioned, you should be aware that the Hawaiian hoary bat or 'ope'ape'a (*Lasiurus cinereus semotus*), a federally listed endangered species, has been sighted throughout various portions of the project area.

In our July 18, 1994, letter, we stated that the 'alala should be taken into consideration during the project planning period and that the project should not be implemented during the breeding season (April through July). During a February 28, 1995, telephone conversation, Dudley Kubo of your staff informed Diane Bowen of my staff that the construction activities will not take place during the breeding season and that this will be coordinated with the staff of OESCPF. In view of this commitment, the Service concurs with your findings of no adverse effect under section 7 of the U.S. Endangered Species Act. We would recommend that noise be kept to a minimum and, in particular, horn honking. The 'alala appears to be distressed by increased traffic noise and becomes quite agitated when horns are honked.

The Service appreciates your concern for endangered species. If you have any questions, please contact our Branch Chief for Interagency Cooperation, Ms. Margo Stahl, or Fish and Wildlife Biologist Diane Bowen at 808/541-2749.

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

AQUATIC RESOURCES REPORT

FOR

UP-COUNTRY MAUI WATERSHED PROJECT

Prepared for:
U. S. Department of Agriculture
Soil Conservation Service
Honolulu, Hawaii

Prepared by:

Robert M. Moncrief
Peter C. Galloway
U.S. Army Corps of Engineers
Pacific Ocean Division
Fort Shafter, Hawaii

November 22, 1994

AQUATIC RESOURCES REPORT

FOR

UP-COUNTRY MAUI WATERSHED PROJECT

I. Existing Upper Kula Water System

The origins of the Kula water system can be traced back to 1912 when the local government installed a wooden dam and intake in Waikamoi Stream and a wooden-stave pipeline from Waikamoi to Ulupalakua (a distance of about nineteen miles). The existence of the original water system allowed the establishment of truck farming and cattle raising operations within the Kula District.

A 6.0 million gallon (MG) reinforced concrete reservoir was constructed at Olinda in 1918 to provide storage during periods of low rainfall. The original wooden dam at Waikamoi was replaced with a boulder concrete dam in 1930. The spillway of the concrete Waikamoi Dam was established at elevation 4276 feet, and the dam had an impoundment capacity of about 1.0 MG. The 6.0 MG Olinda Reservoir was increased in capacity to 8.5 MG during 1933 by constructing vertical masonry walls around the perimeter of the structure. The Waikamoi Dam was also raised in 1933, to a spillway elevation of 4282 feet. These storage facilities modifications greatly improved the system reliability.

Subsequent improvements to the Upper Kula Water System included the replacement of the original (1912) wood-stave pipeline from Waikamoi Dam to the Olinda Reservoir with a cast iron pipe in 1934. The original wooden flume from Haipuena Stream to Waikamoi Dam was also replaced in 1934.

Improvements to the original Upper Kula Water System since 1934 included the Waikamoi Arch Dam constructed in 1956 and located approximately 400 feet upstream of the Waikamoi Dam. The impoundment capacity of the Waikamoi Arch Dam was originally about 10 MG. Deposition of silt over the years has greatly decreased this capacity. Two 15 MG reinforced concrete open storage reservoirs were constructed at Waikamoi in 1959 for additional storage. Most recently, two 50 MG reservoirs were constructed at Kahakapao and a new 36-inch pipeline supplying these reservoirs with water from Waikamoi Reservoir has been installed.

Major components of the present Upper Kula Water System include the Waikamoi Dam, two 15 MG concrete reservoirs, 2000 linear feet of 24-inch corrugated metal pipe (CMP) from Kailua Stream tributary to the two 15 MG concrete reservoirs, and 17,000 feet of new 36-inch corrugated metal pipe from the two 15 MG reservoirs at Waikamoi to the recently completed 100 MG Kahakapao Reservoir and from there to the Olinda Water Treatment Plant.

The major water resources for the Upper Kula Water System are surface runoffs collected from the Haipuaena, Puohokamoa and Waikamoi Streams. The amount of water withdrawn from Haipuaena Stream is constrained to 6.7 MGD by the capacity of the 13-x 23-inch flume. The withdrawal increases as a proportion of the stream flow between 1 and 20 MGD. Maximum withdrawal of 6.7 MGD is reached at a stream flow of 20 MGD. Nothing is collected from the flows exceeding 20 MGD. The Puohokamoa diversion has a maximum withdrawal capacity of 2.5 MGD. The withdrawal increases as a proportion of the stream flow between 1 and 10 MGD. At a stream flow of 10 MGD the 2.5 MGD withdrawal capacity is attained. Stream flows above 10 MGD are not collected.

Water collected from Haipuaena and Puohokamoa Streams is conveyed to the 1 MG Waikamoi Dam. A side inlet behind the dam collects water from Waikamoi Stream and conveys it to the Waikamoi Reservoir via a 40 MGD capacity pipeline. The first 20 MGD of flow from Waikamoi, which includes the water diverted from Haipuaena and Puokokamoa, is collected. With flows between 20 MGD and 60 MGD a proportionate increase in withdrawal occurs until the 40 MGD capacity is reached. None of the flow greater than 60 MGD is collected by this system.

Flows from the intermittent (usually dry) streams west of Waikamoi are collected in two systems. Four of the nine intakes are on a 24-inch diameter pipeline, with a 10 MGD capacity, that conveys the collected water to Waikamoi Reservoir. The five remaining intakes are on the old 12-inch diameter pipeline, with a 1.5 MGD capacity, leading directly to Olinda WTP.

In addition to the Upper Kula Collection System, water is presently collected from Waikamoi at several sites down stream from the 1 MG Waikamoi Dam. At an elevation of 3120 feet a low dam, pump house, and intake structure are the remnants of a flume system which is no longer in use. The dam is perched on the edge of a steep falls that drops approximately 100 vertical feet in a series of deep plunge pools. Not far below this, at an elevation of 2900 feet, is an intake structure that diverts water into a pipeline which is part of the Lower Kula Collection System. (Stream flows from Puohokamoa and Haipuaena are also collected by this system at approximately the same elevation). About three miles further down the slope, at elevation 1280 feet, the stream flow is diverted to the Wailoa Ditch, an open ditch and tunnel system conveying water to central Maui. Almost immediately below Wailoa Ditch, at elevation 1240 feet, the New Hamakua Ditch system collects water during periods of high flow that exceed the capacity of the Wailoa Ditch intake. The last diversion structure is located at an elevation of 720 feet, just above Waikamoi Ridge trailhead which abuts Hana Highway. A low concrete dam and channel shunt water to the Center Ditch collection system.

During periods of low rainfall, all of the stream flow is collected by these various diversion structures. Below the 1 MG

Waikamoi Dam, stream flow during these dry periods is the result of seepage through cracks and fissures along the basalt stream bed and its channel walls. The steep stream elevation gradient (from 7000 feet to sea level in 10 miles) also facilitates this nearly continuous infusion of water along the entire length of Waikamoi Stream. During periods of high rainfall, flows will sometimes exceed the capacity of the intake structures and, for a limited time, flow may be continuous along the entire length of the stream. However, at the Waikamoi 1 MG Dam on the Upper Kula System, Department of Water Supply data indicate that flows exceed 20 MGD an average of only seven days per year, (Kubo, pers. comm.). Thus, flows in stream reaches below the 1 MG Dam are normally discontinuous. This must be considered in any evaluation of potential effects on the aquatic resources of Waikamoi Stream.

II. Aquatic Resources

An initial literature search determined that no information on aquatic resources existed for the higher elevations of Waikamoi Stream and only limited information was available on the lower reaches (Hana Highway and below) of the stream. In its recent appraisal of Hawaii's stream resources, the National Park Service (Hawaii Cooperative Park Service Unit, 1990) ranked Waikamoi Stream as "W" (no native species present).

More recent information from the Division of Aquatic Resources (DAR) Data-Base summarizes observation made during surveys in 1988 and 1990. The 1988 survey site was somewhere in the upper reaches of Waikamoi but no exact location or elevation was given. The 1988 observations noted only the presence of aquatic insects and insect larvae. The 1990 survey was located at a site just below the Waikamoi Bridge on Hana Highway at approximately 550 feet elevation. In addition to aquatic insects and insect larvae, a native goby (Lentipes concolor) was observed here. DAR biologist Skippy Hao (pers. comm.) has observed that all of the native gobies and crustaceans occur in the lower reaches of Waikamoi Stream below the Hana Highway. Steven Cabral of East Maui Irrigation Co. (pers. comm.) has observed large populations of the native shrimp (Atyoida bisulcata) in the Wailoa Ditch System at elevation 1400 feet over the years, although recently their numbers have declined.

The most recent aquatic resource survey for Waikamoi Stream was conducted between 5-7 October 1994 by the U.S. Army Corps of Engineers, Pacific Ocean Division, Environmental Resources Branch staff. This survey included in-water inspection and drift sampling of accessible sites shown in Figure 1. Observations are summarized in Tables 1-3.

At the higher elevation of Waikamoi Stream, observations were made at two accessible sites (indicated as locations A and B in Table 1). At Location A, elevation 3,120 feet (951m), a quiet pool (maximum depth approximately 10 feet) is maintained by an

old (now unused) diversion structure. In-water observations indicated the presence of abundant invertebrates (aquatic snails and insect larvae). Vertebrates included occasional tadpoles but no fish. No additional taxa were observed in small pools immediately below the impoundment.

At Location B, elevation 2,980 (908m) feet, a shallow riffle and pool complex was surveyed. Fauna observed were similar to those noted for Location A, except that tadpoles were not seen. The collection data and results of analysis of two drift samples obtained at this location are summarized in Tables 2 and 3. The results indicate the presence of various invertebrates (predominantly aquatic snails, annelids and insects) including a few juvenile specimens of the native fresh water shrimp, Atyoida bisulcata). Vertebrate fauna were absent from the samples.

At Location C, elevation 720 (220m) feet, just above the lowest diversion of Waikamoi Stream, rocky riffle and pool complexes were surveyed. In-water observations noted the presence of native and introduced crustaceans and fishes. Although no damselfly or dragonfly larvae were observed, an adult native damselfly was collected. Identification by Dr. Dan Polhemus of B.P. Bishop Museum (pers. comm.) determined it to be Megalogion hawaiiense, recently designated a category 2 candidate endangered species by the Department of the Interior, Fish and Wildlife Service. The collection data and results for the two drift samples obtained at this location are summarized in Tables 2 and 3. The results indicate the presence of various invertebrates, predominantly insects and crustaceans. No vertebrates (including juveniles, larvae, or eggs) were present in the samples, although adult gobies and other non-native fishes were observed in the stream directly above the sampling locations.

In addition to the results summarized in Tables 1 thru 3, incidental observations were made at the pools behind the 1 MG Waikamoi Dam and 10 MG Arch Dam. At these pools, adult native dragonflies (Anax sp.) were observed but dragonfly nymphs or other aquatic insect larvae were not seen. No native fishes or crustaceans were expected to occur at this elevation and none were observed at or near the surface of the pools. However, the high concentration of tannin had stained the water of both pools a dark opaque color, resulting in significantly diminished light penetration and very limited visibility. No drift samples were collected at the dams because flow velocities were insufficient.

III. Probable Effects of the Proposed Improvements on Aquatic Resources

The proposed improvements would provide 9 miles of main agricultural water distribution pipeline and 15 miles of lateral pipelines running from the Kahakapao Reservoir west to Keokea. The proposed pipeline would supply upper Kula farmers with up to

2 MGD of untreated irrigation water. The Upper Kula Collection System would not be altered in any way by the proposed project.

The existing collection, storage and transmission system is entirely gravity operated. In the absence of mechanical controls, all of the water collected at the Waikamoi 1 MG Dam is continuously withdrawn. During the infrequent periods in which water collected exceeds the system storage capacity, excess water overflows through a weir structure at each reservoir. Excess water at Kahakapao Reservoir is channeled into Kahakapao Gulch. At Waikamoi Reservoir it flows back into Waikamoi Stream below the 1 MG Dam. Irrespective of the addition of water delivery capacity (2 MGD in this case) to the overall system, the amount of water diverted from Waikamoi 1 MG Dam would remain unchanged. Thus, there would be no effect on the aquatic ecosystems of any of the streams in the Upper Kula Water Collection System resulting from this project.

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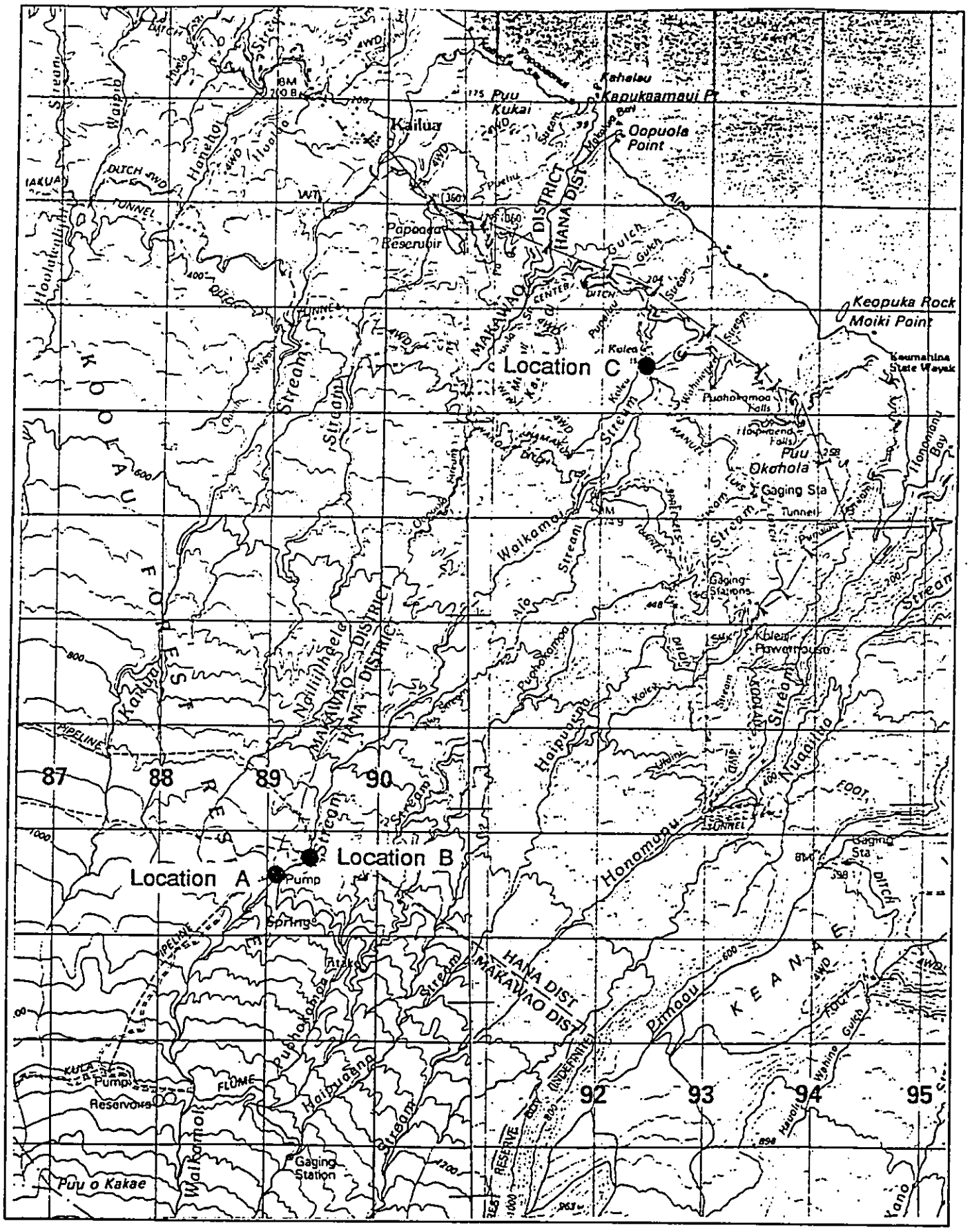

FIGURE 1
Sampling
Locations

TABLE 1. Aquatic macrofauna observed at Waikamoi Stream during the 6-7 October 1994 survey. See Note 1 for location information.

	STATUS	LOCATION A	B	C
AMPHIBIANS				
Rana sp.	int	X		
FISHES				
Awaous stamineus (*'o'opu nakea*)	end			X
Cyprinus carpio (carp)	int			X
Poecilia reticulata (*topminnow*)	int			X
Xiphophorus sp. (swordtail)	int			X
MOLLUSCS				
Lymnaea sp. (snail) (see Note 2)	ind?	X	X	
Limax maximus (slug) (Note 3)	int	X	X	
CRUSTACEANS				
Atyoida bisulcata (*'opae kala'ole*)	ind			X
Macrobrachium lar (Tahitian prawn)	int			X
INSECTS				
Anax strenuus (dragonfly) (Note 4)	end	X	X	
Megalagrion hawaiiense (damselfly) (Note 5)	end			X
Megalagrion sp. (Note 6)	end	X	X	
Paratettix mexicanus (riparian cricket) (Note 7)	int			X

TABLE 1 (Continued)

NOTES:

1. Locations of the 6-7 October 1994 observations at Waikamoi Stream:

a. Elevation 3,120 (951m) feet, quiet impoundment behind water diversion structure no longer in use.

b. Elevation 2,980 (908m) feet, riffle and pool complex just above diversion structure.

c. Elevation 720 (220m) feet, riffle and pool complex just above diversion structure.

2. Collected specimen deposited in B.P. Bishop Museum (BPBM), Honolulu, with preliminary identification by Dr. Robert Cowie of the Malacology Department.

3. Identification by Dr. Cowie based on photograph taken in field. These "terrestrial" slugs were observed grazing algal turf in shallow water.

4. Collected naiads identified by Dr. Dan Polhemus of BPBM Entomology Department (not deposited in BPBM).

5. Collected adult identified by Dr. Polhemus and deposited in BPBM collection.

6. Adults observed with binoculars but not collected.

7. Collected specimen identified by Dr. Polhemus (not deposited in BPBM).

8. Introduced = int, Endemic = end, Indigenous = ind

TABLE 2. Sample collection data for drift samples collected at Waikamoi Stream during the 6-7 October survey. Two drift samples were collected at each of locations B and C.

Upon collection, samples were placed in dilute formalin for approx. 30 to 90 minutes. They were then rinsed three times with stream water over a No. 60 mesh screen and finally stored in approx. 40 percent isopropyl alcohol.							
Location				B	B	C	C
Sample number				1	2	3	4
Elevation (feet)				2980	2980	720	720
Elevation (meters)				908	908	220	220
Date				6-Oct-94	6-Oct-94	7-Oct-94	7-Oct-94
Start time				855	1050	1030	1115
End time				925	1120	1100	1215
Sampling duration (minutes)				30	30	30	60
Total area of net opening (sq ft)				1.5	1.5	1.5	1.5
Estimated portion of net submerged				0.5	0.5	0.6	0.3
Estimated velocity (ft/s) at net opening				1	1	1.5	1.5
Estimated total flow of stream (cfs)				1	1	2	2
Calculated portion of stream flow entering net				0.75	0.75	0.68	0.34

TABLE 3. Summary of taxonomic results of drift samples collected at Waikamoi Stream, 6-7 October 1994. This summary is derived from an analysis of the samples performed at the Department of Biology, University of Dayton, under direction of Dr. Albert J. Burky.

TAXA	SAMPLE NUMBER 1	2	3	4
ANNELIDA				
Oligochaeta	35	17	5	4
Hirudinea?	1	0	0	0
NEMATODA				
Nematoda	0	0	0	1
MOLLUSCA				
Gastropoda/Ancylidae	1	0	1	0
Gastropoda(mostly *Physa*)	62	26	0	0
Gastropoda(unidentified)	0	0	1	1
ARTHROPODA				
Arachnida/Acari/Hydracarinidae	3	0	1	8
Crustacea/Amphipoda/Talitridae	0	0	1	0
Crustacea/Isopoda/Asellidae	0	0	1	0
Crustacea/Copepoda	2	0	1	1
Crustacea/Decapoda/Atyidae(juveniles)	4	1	16	14
Insecta/Coleoptera/Elmidae(larvae)	0	0	0	2
Insecta/Coleoptera/Hydrophilidae	0	1	1	0
Insecta/Coleoptera/Psephenidae(larvae)	0	0	1	1
Insecta/Coleoptera(unidentified)	2	1	2	1
Insecta/Collembola/Isotomatidae	6	1	10	52
Insecta/Collembola/Sminthuridae	0	0	0	11
Insecta/Diptera/Chironomidae	34	45	131	42
Insecta/Diptera/Statiomyidae	0	0	0	?1
Insecta/Diptera/Ephydridae	0	0	10	0
Insecta/Diptera(dipteran pupae)	15	26	4	9
Insecta/Diptera(dipteran larva)	0	0	1	0
Insecta/Lepidoptera/Cosmopterigidae?	1	1	0	1
Insecta/Odonata/Libellulidae	0	1	0	0
Insecta/Trichoptera/Hydropsychidae	0	3	1	0
Insecta/Trichoptera/Hydroptilidae	0	1	1	0
Insecta/unidentified terrestrial(mostly winged; and ants)	21	14	30	110
Unknowns	0	0	2	1
TOTALS	187	138	221	260

BOTANICAL SURVEY REPORT

FOR

UP-COUNTRY MAUI WATERSHED PROJECT

Prepared by:

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November 10, 1994

Flora and Vegetation of the Up-Country Maui Watershed Project Site

Five days (October 17 to 21, 1994) were spent surveying the flora and vegetation of the proposed project site. The primary purpose of the survey was to assess the botanical resources of the area to determine if any were significant or were protected by local or federal regulations.

Methodology

A walk-through, reconnaissance-level survey of the site was conducted. The survey extended from the Olinda Reservoir south to just beyond the Kula Sanitarium, ranging between 4,000 and 3,300 feet in elevation. Observations concerning the flora and vegetation were recorded and a species list was prepared (Appendix 1).

Flora

The vascular flora of the proposed project site comprises 83 taxa in 45 families. Fourteen taxa are considered native of which five are endemic and nine are indigenous. The native species are mostly common species widespread throughout the islands. The remaining 68 taxa are adventive, persisting, or naturalized plants (Table 1).

Table 1: Status of species

	Native	Adventive or naturalized	TOTAL
Pteridophyta	9 (64%)	5 (36%)	14
Gymnospermae	0 (0%)	0 (0%)	0
Monocotyledoneae	0 (0%)	14 (93%)	15
Dicotyledoneae	5 (9%)	49 (91%)	54
TOTAL	14 (17%)	68 (82%)	83

Vegetation

The entire land surface of the proposed project site has been disturbed at various times over the past two centuries resulting in a predominantly secondary growth vegetation. Little remains of the native vegetation, and these remnants are found mostly along the steep sides of some of the gulches out of the reach of cattle and other grazing and browsing animals.

The vegetation of the project site can be divided into four different communities or associations: pasture, alien forest, open gulch, and urban. A brief description of each of the vegetation associations is given below. For a complete list of all plant species known from the project site and their distribution see Appendix 1.

Pasture Vegetation Association:

This is the most common vegetation association in the project site. It has a very low species diversity, comprising a small number of mostly introduced grasses and forbs. Dominant species include Kikuyu grass (Pennisetum clandestinum), meadow ricegrass (Ehrharta stipoides), smutgrass (Sporobolus africanus), narrow-leaved plantain (Plantago lanceolata), and several species of clover (Trifolium spp.). Occasionally, individual or small groves of trees are encountered in this association; some, such as black wattle (Acacia mearnsii) and eucalyptus or gum trees (Eucalyptus spp.), have seeded themselves, while others, such as the edible fig (Ficus carica) and the white mulberry (Morus alba), persist around old house or agricultural sites. The pastures at the southern end of the project site are lower in elevation, drier, rockier, and have a greater number of weedy species of herbs, shrubs, and trees such as Christmas berry (Schinus terebinthifolius), prickly pear or panini (Opuntia ficus-indica), lantana (Lantana camara), and fennel (Foeniculum vulgare).

Alien Forest Vegetation Association:

Part of the project site is forested with introduced species of trees, mostly black wattle and several species of eucalyptus. Usually the forested areas are monocultures with litter or a sparse growth of alien grasses or herbs as groundcovers. Recently, some of the forested slopes have been cleared and converted to pastures or subdivisions leaving chiefly the gulches and less desirable land forested.

Open Gulch Vegetation Association:

The vegetation of several gulches, especially in the northern part of the project site, basically is a continuation of the adjacent pasture lands. As the gulches are moister, better protected from the elements, and often less grazed that the flatter adjacent pastures, they usually have a richer diversity of species, especially herbaceous weeds, and may contain remnant populations of native plants. The native plants found in the gulches of the project site are mostly common species widespread throughout the islands; examples of these species are koa (Acacia koa), pukiawe (Styphelia tameiameiae), and the fern, Pteris cretica.

Urban Vegetation Association:

Parts of the former forest or pasture lands over the years have been converted into small truck farms or residential areas. More recently, subdivisions have been developed. No attempt was made to compile a list of the species of this vegetative community. This vegetation association comprises a minimum of 500 species ranging from orchard trees to vegetables to flowers to roadside weeds, and nothing would be gained for this report by recording them. Species occurring in this vegetation association as well as in other associations in the project site have been noted in Appendix 1; these are mostly roadside weeds.

Conclusions

No candidate, proposed, or listed threatened or endangered species as set forth in the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543), were seen during the survey. The vegetative communities of the site are not pristine nor unique and are not considered worthy of preservation. None of the trees on the site are on the county exceptional tree list.

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CEPOD-ED-ES

APPENDIX 1: Checklist of the Vascular Plants of the Up-Country Maui Watershed Project Site

The following checklist is based upon observations made on October 17 - 21, 1994, during a reconnaissance survey of the Up-Country Maui Watershed Project Site, Maui Island, Hawaii. The entries are arranged alphabetically under their family names and include the scientific name, the common name, the status of the species, and its relative abundance. With a few modifications, the nomenclature follows that of Wagner, Herbst, and Sohmer (1990) for the higher plants and Wagner and Wagner (1994) for the ferns.

SCIENTIFIC NAME	STATUS	ABUNDANCE			
		Pasture	Forest	Gulch	Urban
PTERIDOPHYTA					
ASPLENIACEAE					
Asplenium adiantum-nigrum L.	I	-	-	U	-
BLECHNACEAE					
Blechnum occidentale L.	X	-	-	R	-
Sadleria cyatheoides Kaulf.	E	O	-	C	-
DENNSTAEDTIACEAE					
Pteridium decompositum Gaud.	E	O	-	C	-
DRYOPTERIDACEAE					
Polystichum haleakakense Brack.	E	-	-	O	-
GLEICHENIACEAE					
Dicranopteris linearis (N.L. Burm.) Underw. (uluhe)	I	-	-	U	-
NEPHROLEPIDACEAE					
Nephrolepis multiflora (Roxb.) Morton (swordfern)	X	R	-	U	-
POLYPODIACEAE					
Lepisorus thunbergianus (Kaulf.) Ching	I	-	-	R	-
PSILOTACEAE					
Psilotum nudum (L.) P. Beauv. (moa)	I	-	-	U	-
PTERIDACEAE					
Adiantum hispidulum Sw.	X	-	-	O	-
Pityrogramma austroamericana Domin (gold fern)	X	U	-	O	U
Pteris cretica L.	I	O	-	C	-
Pellaea ternifolia (Cav.) Link	I	-	-	O	-
THELYPTERIDACEAE					
Thelypteris dentata (Forsk.) E. St. John (oak fern)	X	U	-	O	-

SCIENTIFIC NAME	STATUS	ABUNDANCE			
		Pasture	Forest	Gulch	Urban
MONOCOTYLEDONEAE					
ARACEAE					
Colocasia esculenta (L.) Schott (taro)	P	C	-	-	-
CYPERACEAE					
Kyllinga brevifolia Rottb. (kili'o'opu)	X	U	-	U	U
POACEAE					
Anthoxanthum odoratum L. (sweet vernalgrass)	X	C	-	C	-
Dactylis glomerata L. (cocksfoot)	X	C	-	C	U
Digitaria ciliaris (Retz.) Koeler (kukaepua'a)	X	C	-	-	U
Ehrharta stipoides Labill. (meadow ricegrass)	X	C	-	U	-
Holcus lanatus L. (common velevt grass, Yorkshire fog)	X	C	-	C	-
Melinis minutiflora P. Beauv. (molasses grass)	X	O	-	U	U
Panicum dichotomiflorum Michx. (fall panicum)	X	-	O	-	-
Pennisetum clandestinum Chiov. (Kikuyu grass)	X	A	-	C	U
Paspalum dilatatum Poir. (Dallis grass)	X	C	-	-	U
Rhynchelytrum repens (Willd.) Hubb. (Natal redtop)	X	O	-	O	U
Sporobolus africanus (Poir.) Robyns & Tournay (smutgrass)	X	A	-	O	O
Sporobolus indicus (L.) R. Br. (West Indian dropseed)	X	C	-	O	O
SMILACACEAE					
Eustrephus latifolius R. Br. (Australian climbing lily) ?	X	-	-	O	R
DICOTYLEDONAE					
ANACARDIACEAE					
Schinus terebinthifolius Raddi (Christmas berry)	X	O	U	U	O
APIACEAE					
Foeniculum vulgare Mill. (fennel)	X	O	-	O	O
ASCLEPIADACEAE					
Asclepias physocarpa (E. Mey.) Schlechter (balloon plant)	X	O	-	-	-
ASTERACEAE					
Ageratina adenophora (Spreng.) King & Robinson (Maui pamakani)	X	U	-	O	-
Cirsium vulgare (Savi) Ten. (bull thistle)	X	U	-	U	-
Conyza bonariensis (L.) Cronq. (hairy horseweed)	X	O	-	O	U
Erigeron karvinskianus DC (daisy fleabane)	X	-	-	C	-
Hypochoeris glabra L. (smooth cat's ear)	X	C	-	O	-

SCIENTIFIC NAME	STATUS	ABUNDANCE			
		Pasture	Forest	Gulch	Urban
Hypocharis radicata L. (hairy cat's ear)	X	C	-	C	-
Taraxacum officinale W.W. Weber (common dandelion)	X	U	-	R	-
BALSAMINACEAE					
Impatiens oliveri Will. Wats. (touch-me-not)	X	-	R	-	-
BIGNONIACEAE					
Jacaranda mimosifolia D. Don (jacaranda)	X	U	-	-	C
CACTACEAE					
Opuntia ficus-indica (L.) Mill. (prickly pear, panini)	X	O	-	-	-
CAMPANULACEAE					
Wallenbergia marginata (Thunb.) A. DC	X	R	-	-	-
CHENOPODIACEAE					
Chenopodium album L. (goosefoot)	X	R	-	-	R
EPACRIDACEAE					
Styphelia tameiameiae (Cham. & Schlectend.) F.v. Muell. (pukiawe)	I	U	-	C	-
EUPHORBIACEAE					
Euphorbia peplus L. (petty spurge)	X	-	-	U	-
Ricinus communis L. (castor bean)	X	U	-	R	U
FABACEAE					
Acacia koa A. Gray (koa)	E	U	-	O	U
Acacia mearnsii De Wild. (black wattle)	X	O	A	-	O
Trifolium arvense L. (rabbit-foot clover)	X	U	-	R	-
Trifolium pratense L. (red clover)	X	O	-	U	-
Trifolium repens L. (white clover)	X	O	-	O	-
Ulex europaeus L. (gorse)	X	U	-	O	-
Vicia sativa L. (common vetch)	X	O	-	U	-
GERANIACEAE					
Geranium homeanum Turcz. (cranesbill)	X	U	-	U	-
LAMIACEAE					
Lepechinia hastata (A. Gray) Epling (pakaha)	I?	-	-	R	-
MALVACEAE					
Sida rhombifolia L.	X	U	-	R	U

SCIENTIFIC NAME	STATUS	ABUNDANCE			
		Pasture	Forest	Gulch	Urban
MELIACEAE					
Melia azedarach L. (Chinaberry)	X	U	-	-	R
MORACEAE					
Ficus carica L. (fig)	X	R	-	-	O
Morus alba L. (white mulberry)	X	R	-	-	-
MYRICACEAE					
Myrica faya Aiton (firetree)	X	R	-	-	U
MYRTACEAE					
Eucalyptus globulus Labill. (blue gum)	X	O	C	-	O
Eucalyptus spp. (eucalyptus, gum tree)	X	O	O	-	O
Metrosideros polymorpha Gaud. ('ohi'a)	E	-	-	O	-
OXALIDACEAE					
Oxalis corniculata L. (yellow wood sorrel)	P?	-	-	U	O
Oxalis corymbosa DC (pink wood sorrel)	X	-	-	U	-
PAPAVERACEAE					
Bocconia frutescens L.	X	O	-	-	R
PASSIFLORACEAE					
Passiflora mollissima (Kunth) L.H. Bailey (banana poka)	X	-	-	-	R
PLANTAGINACEAE					
Plantago lanceolata L. (narrow-leaved plantain)	X	C	-	O	O
POLYGONACEAE					
Rumex acetosella L. (sheep sorrel)	X	U	-	U	-
PRIMULACEAE					
Anagallis arvensis L. (scarlet pimpernel)	X	U	-	O	-
PROTEACEAE					
Grevillea robusta R. Br. (silk oak)	X	-	U	-	-
ROSACEAE					
Prunus persica (L.) Batsch (peach)	X	-	-	U	U
Rubus argutus Link (prickly Florida blackberry)	X	U	-	O	-
Rubus rosifolius Sm. (thimbleberry)	X	U	-	U	-

SCIENTIFIC NAME	STATUS	ABUNDANCE			
		Pasture	Forest	Gulch	Urban
RUBIACEAE					
Galium divaricatum Lam.	X	-	-	R	-
Richardia brasiliensis Gomes	X	-	-	R	-
SAPINDACEAE					
Dodonaea viscosa Jacq.	I	-	-	U	-
SOLANACEAE					
Nicandra physalodes (L.) Gaertn. (apple of Peru)	X	R	-	-	R
Nicotiana glauca R.C. Graham (tree tobacco)	X	R	-	-	R
Solanum linnaeanum Hepper & P. Jaeger (apple of Sodom)	X	U	-	-	-
VERBENACEAE					
Lantana camara L. (lantana)	X	O	U	-	U
Verbena litoralis Kunth (owi)	X	O	-	U	U

STATUS: E = endemic (native only to the Hawaiian Islands), I = indigenous (native to the Hawaiian Islands and elsewhere), C = cultivated plant, P = Polynesian introduction, X = naturalized exotic (non-native species of accidental or deliberate introduction). ABUNDANCE: A = abundant, C = common, O = occasional, U = uncommon, R = rare; these ratings of abundance are based upon the frequency with which the species occurs in the area as compared to all other species present. It does not indicate the abundance of the species throughout the Hawaiian Islands.

UPCOUNTRY MAUI WATERSHED

ARCHAEOLOGICAL SITES RECORDATION

KULA, MAUI ISLAND

STATE OF HAWAII

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

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March 1997

ABSTRACT

The United States Department of Agriculture-Natural Resouces Conservation Service (USDA-NRCS) in conjunction with the Olinda-Kula Soil and Water Conservation District, Hawaii State DOA, and the Maui County Department of Water Supply is proposing a pipeline at about the 4000 foot (1219m) elevation level on the northwest slopes of Haleakala for water agricultural management in Upcountry Maui.

The Army Corps of Engineers did extensive background research as well as the reconnaissance survey which identified three sites (Watanabe 1996). These post-contact Chinese agricultural sites were recorded by NRCS in 1996. This paper reports on the recordation and limited excavation of these three sites.

Four more sites (three terraces, a modern road) were found in the gulches previously not investigated. These will be further explored and recorded during the topographic survey yet to be done.

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INTRODUCTION

The United States Department of Agriculture-Natural Resouces Conservation Service in conjunction with the Olinda-Kula Soil and Water Conservation District, Hawaii State DOA, and the Maui County Department of Water Supply is proposing a pipeline at about the 4000 foot (1219m) elevation level on the northwest slopes of Haleakala (Figure 1). This is for water agricultural management in the Upcountry Maui Watershed, Maui County, Hawaii.

Three alternatives were considered. Alternative 2 was chosen. This irrigation water system alternative proposes the installation of a main distribution pipeline and lateral pipelines to service 473 acres of farmland in Upper Kula with water supply provided from Kahakapao Reservoir (Figure 2). This plan "proposes the installation of a separate agricultural distribution system" (Draft EIS 1995:65).

The "main distribution pipeline [will be] from Olinda to Keokea serving nine service areas through lateral pipeline systems. . . . Approximately 9.2 miles [14.8km] of access [10foot/3m wide and unpaved] and [a 10 foot/3m wide] maintenance road will be constructed" (Draft EIS 1995:68). The pipeline will be "buried and above-ground pipelines, gulch crossings, access road, and other appurtenant devices in the 4,200-foot to 3,100-foot [1280m to 945m] elevations between Olinda and Keokea. Nearly all of this area is in open pasture with occasional dry gulches (Draft EIS 1995:77).

"In the central part of the project area the proposed agricultural pipeline will be approximately 2,000 feet [610m] upslope of the existing Upper Kula Water System pipeline . . . The pipeline will be buried along most of its length. . . . within the existing road rights-of-way where possible"" (Draft EIS 1995:101).

Preliminary background research and reconnaissance survey was done by Farley Watanabe of the Army Corps of Engineers October 17-20, 1994. "Surface dryland agricultural features consisting of rock mounds, earthen and rock terraces, low retaining walls, rock clearings, and potential temporary shelters and trails were identified in the alternative 2 corridor at the ahupua'a of Kalialianui, Omaopio, Pulehuiki, and Koheo 1,2" (Draft EIS 1995:111).

"Alternative 2 has the potential to adversely impact newly identified areas containing surface dryland agricultural

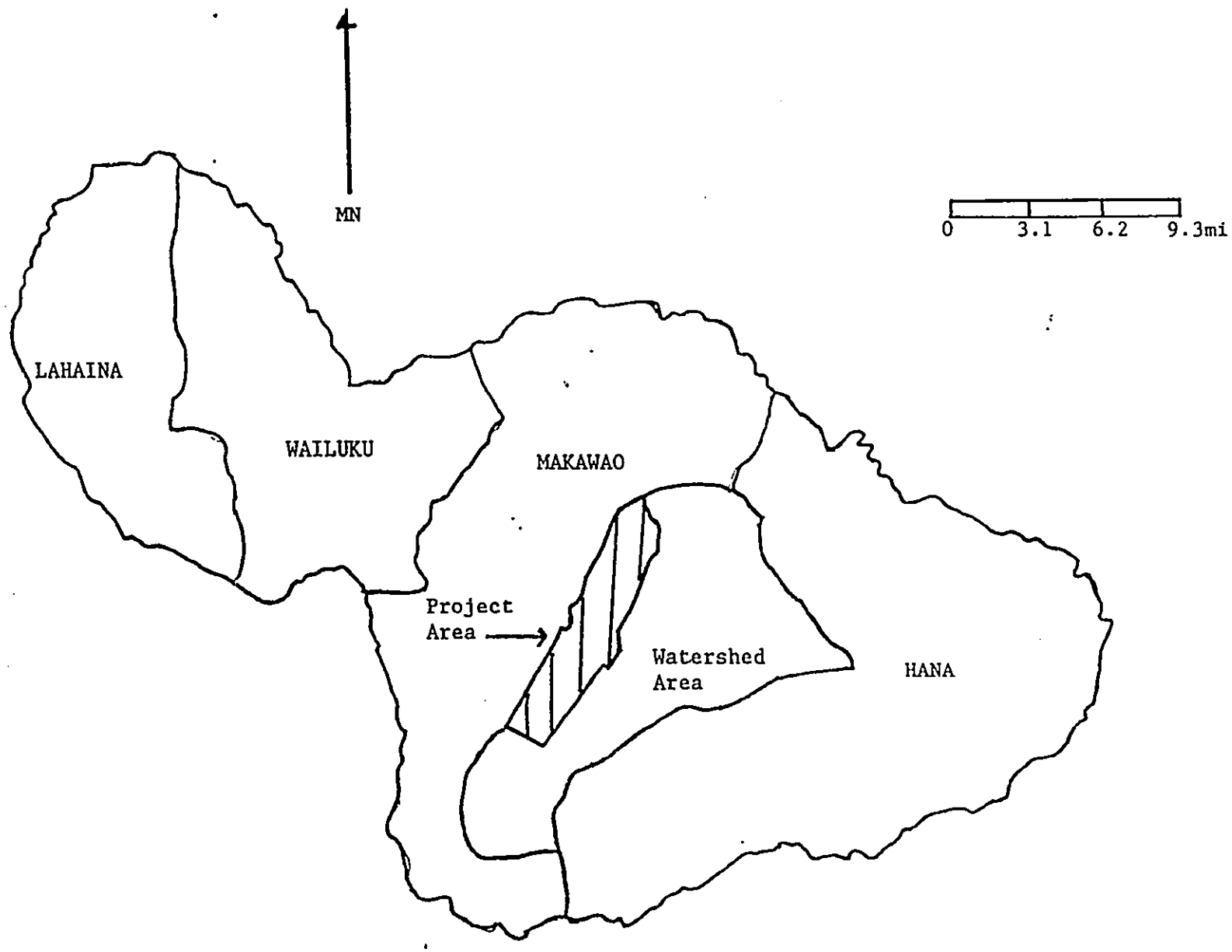


Figure 1. Project location.

reduced, combined portions of USGS Topo "Puu O Kali", 1983, and "Kilohana", 1983

Figure 2. Main pipeline, lateral distribution lines and service areas.
From Watanabe 1996: Figure 3. Color and ahupua'a names added.

features and associated temporary shelters and trails" (Draft EIS 1995:79). "Subsurface remains of habitational structures and dryland agricultural features have the potential to be present at several locations along the proposed waterline corridors for Alternatives 2 and 3 based on information from Mahele maps, Historic homestead sites, aerial photographs, and archeological reconnaissance survey" (Draft EIS 1995: D-21).

This report is a follow-up of Watanabe's reconnaissance survey. Three sites were recorded in June 1996 (Figure 3). Site 4160, located between 1244 to 1268m (4080 to 4160ft) in Oma'opio *ahupua'a*, had 24 features consisting of 48 components. Most were of agricultural function: water control walls in swales, retaining walls along the slopes, and clearing mounds. Site 4161, just north of Hapapa gulch at the 1268m (4160ft) elevation, consisted of four eroded earthen terraces, probably used for agriculture. Site 4162, in Koheo 1-2 *ahupua'a* at the 1207m (3960ft) elevation, was the remains of a road bed which ended in a gully as a former land bridge.

In January 1997 eleven out of the thirteen gulches which the main distribution pipeline will cross were surveyed. Terrace remains were found in three gulches (Hapapa, Na'alae, unnamed). An abandoned modern road was found on the northern bank of Keahuaiwi gulch. Two gulches (Ka'ono'ulu, Waiohuli) were inaccessible due to dense vegetation. None of the sites were recorded at this time. The sites will be recorded during the topographic survey.

No historic sites were uncovered in the roadways during a survey of the lateral distribution corridors.

Koheo is misspelled as Kohea on the USGS Kilohana quad map. It is Koheo on the Puu o Kali quad and the tax map keys.

In the following, an archaeological site will be defined as a geographic area with one or more similar features (agricultural). Features will be the individual mounds, walls, etc. A cultural resource may be a site, a feature, or an artifact. It is anyplace that has been the scene of past human activity or anything made by human hands (artifacts).

ENVIRONMENTAL SETTING

The Upcountry Maui Watershed is located on the eroding volcanic shield on the western slope of Haleakala (Figure 1). Topography is characterized by broad, rolling shield ridges separated by steep-sided, often deep, gulches" (Draft EIS 1995:16). The project area is slightly dissected upland, which "slopes cut by widely spaced erosional

reduced, combined portions of USGS Topo "Puu O Kali", 1983, and "Kiluhana", 1983

Figure 3. Location of archaeological sites. From Watanabe 1996:Figure 3. Site locations and <u>ahupua'a</u> names added.

gullies" (Dept of Geography UH 1983:37). "The average annual rainfall in the project area varies between 30 and 80 inches [760 and 2030mm]" (Draft EIS 1995:19). Temperature ranges approximately 40-60 degrees Farenheit.

The Upper Kula Water System watershed area "has little storage capacity and exhibits 'flashy' streamflow. Streamflows vary quickly from hundreds of gallons per minute to prolonged dry conditions (Belt Collin, 1985)" (Draft EIS 1995:48). The topography is such that erosion by sheet wash was probably common in times of heavy rains. The north-south tree line planted upslope of the project area probably helps to lessen sheet wash today (pers comm Neal Fujiwara Sept 1996).

"Nearly all of the project area is located on Kula series deposits. The Kula lavas are composed primarily of thick andesitic a'a flows interbedded with thin ash-soil layers (Draft EIS 1995:16). The soil in the area of Site 4160, at 4160 feet (1268m) elevation, is Kaipoioi very rocky loam (KDVE) where rock outcrops cover 10-25 percent of the surface of 7-40 percent slopes (USDA 1972:54). Site 4161, also at 4160 feet (1268m) elevation, is Kula loam (KxD), well-drained soils developed in volcanic ash on 12 to 20 percent slopes (USDA 1972:54). Site 4162 at 3960 feet (1207m) elevation is in an area of Kaipoioi loam (KDIE) on 7-40 percent slopes which includes smooth to rolling high mountain slopes (USDA 1972:54).

The main distribution pipeline corridor begins at 1256m (4120ft) at Olinda, descends to approximately 1244m (4080ft) in Kalialinui, ascends to nearly 1280m (4200 ft) in Omao'pio and continues at approximately 1219m (4000ft) till Koheo where it descends gradually to parallel with the existing Kula pipeline to the water tank in Keokea. Most of the corridor is in montane grasslands and shrublands. "The extensive pasturelands now found in the montane zone of Maui and Hawai'i are not natural but are converted forests and shrublands" (Cuddihy & Stone 1993:15).

The following is taken from the Botanical Survey Report by Derral R. Herbst, PhD, US Army Corps of Engineers included in Appendix B of the Draft EIS.

The entire land surface of the proposed project area has been disturbed at various times over the past two centuries resulting in a predominantly secondary growth vegetation. Little remains of the native vegetation, and these remnants are found mostly along the steep sides of some of the gulches out of reach of cattle and other grazing and browsing animals.

The vegetation of the project are can be divided into four different communities or associations: pasture, alien forest, open gulch and urban.

The pasture vegetation association has a very low species diversity, comprising a small number of mostly introduced grasses and forbs. Dominant species include Kikuyu grass (Pennisetum clandestinum), meadow ricegrass (Ehrharta stipoides), smutgrass (Sporobolus africanus), narrow-leaved plantain (Plantago lanceolata), and several species of clover (Trifolium spp.).

No candidate, proposed, or listed threatened or endangered species as set forth in the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543), were seen during the survey. The vegetative communities of the project area are not pristine nor unique and are not considered worthy of preservation.

Site 4160, located north of Haleakala Crater Road, is downslope and parallel to a tree break line (north-south) of eucalyptus (Eucalyptus spp.) with a single line (east-west) of eucalyptus marking the northern boundary. The southern boundary was the deep and wide Pohakuokala Gulch.

Site 4161 is south of Haleakala Crater Road, north of Hapapa gulch with a large eucalyptus tree marking the western edge of the site. An unnamed gulch dense with black wattle (Acacia mearnsii) marked the northern boundary.

Site 4162 is upslope of Kula highway, in pasture land at the head of a small unnamed gully. There was a black mulberry tree (Morus nigra L.) just downslope on the northern side of the gully.

The main distribution pipeline will cross thirteen gulches. Eucalyptus is the dominant vegetation from Kailua to Pohakuokala gulch. South of Pohakuokala to the end of the project, the dominant vegetation in the gulches is black wattle (Acacia mearnsii).

The nine lateral distribution pipelines will be buried mostly along existing roadways and dedicated easements. Grass was the dominant vegetation.

HISTORICAL OVERVIEW

Much of the following information is extracted from Watanabe (1996).

"There are few ethnohistoric references that associate this area [Upcountry Maui] with the residences of ruling chiefs, sacrificial heiau and places of refuge" (Watanabe 1996:47).

Instead, the area had been "a productive agricultural area renown for the growing of dry taro, sweet potatoes and the raising of pigs, the string of distinctly notched agricultural heiau in each ahupua'a" (Watanabe 1996:53).

The death of Kamehameha I in 1819 brought about many changes. His son Liholiho and Dowager Queen Ka'ahumanu abolished the old *kapu* system by eating together. With the old traditions and a powerful king gone, the highly stratified Hawaiian society began to disintegrate.

The sandalwood trade which had begun in 1791 was still going strong. Under order of their *ali'i* (chiefs) to collect sandalwood, the *maka'ainana* (commoners) abandoned their fields and ravaged the sandalwood groves.

Whaling ships were beginning to stop in Hawaii for firewood, water and food. Kalepolepo Beach, on the coast of Ka'ono'ulu *ahupua'a*, was suggested to have been an unofficial port of call during the whaling period (Watanabe 1996:57). The active "giving [of] lands to encourage agricultural plantings for trade" by the *konohiki* of Ka'ono'ulu (Watanabe 1996:58) also strengthens this hypothesis.

The ships needed food that would store well for long periods. Both Irish and sweet potatoes can be kept up to six months if kept at the right temperature (Knott 1957:185). The sweet potato was already being grown by the Hawaiians. Don Marin introduced the Irish potato to Hawaii sometime in the early 1800s (Neal 1965:745).

Both potatoes were grown for export to the West Coast spurred by the California Gold Rush in the 1840s (Cuddihy & Stone 1993:37). They both appear to have been the main cultivated crops in the project area in the mid-1800s.

In 1843 Kula had only one field of Irish potatoes but more fields were planted in 1844 (Watanabe 1996:57). In 1846, potato was growing "between 2000 and 5000 feet [610 and 1524m] elevation, for the distance of 12 miles [19km] . . . . over the broad surface of the mountain" (Kuykendall, II:313 in Watanabe 1996:57).

New people were moving in and taking over. "An emerging theme of the early history of Kula [was] the role of seamen and ship captains, primarily American, who settled upon the land and established businesses. . . . primarily asociated with the developing industries of sugar and ranching, . . ." (Watanabe 1996:56). The missionaries arrived from New England.

By 1836, the Chinese were in Makawao (Watanabe 1996:59) and in the 1840s, established residences and farmlots in Kula,

"leasing and subleasing planting areas from native Hawaiians and cattle ranchers, . . ." (Watanabe 1996:57). Cattle were invading "the cultivated areas on the slopes of Haleakala . . . and caused a great amount of damage" during the 1840s (Kuykendall I:319 in Watanabe 1996:57).

Not only had the crops and cultivators changed but the lifestyles of both the remaining *maka'ainana* and the *ali'i* had also changed. It was a cash economy now. The *ali'i* were into an extravagant and expensive Western lifestyle. Shrewd businessmen saw how this need for cash could be utilized to their advantage.

Under the influence of his foreign advisors, Kamehameha III (Kauikeaouli), son of Kamehameha I, introduced the Great Mahele. The Great Mahele established private land ownership. Previously, the land was held by the ruling chief with the land overseen by lesser chiefs (*konohiki*). Some chiefs were given land for services rendered. The commoners were allowed to move as they wished. If they did not like a chief, they could leave.

The Great Mahele divided the land and gave private ownership of land not only to the king but to the government and the commoners as well. Although much of the land still remained with the king, he had to give one-third of all his lands to the government for commutation. This land the government was allowed to sell to whomever could afford it. The *maka'ainana*, if informed and allowed by their *konohiki*, could only claim land that they subsisted on and/or had lived on, or had inherited. The land they claimed had to be officially surveyed. Many had no money to pay for these services. Those who could sometimes received their claimed house lots, and/or cultivated fields, some received nothing at all.

These Land Commission Awards (LCA) were also known as *kuleana*. The smaller awards were clustered near the road in Waiakoa with the largest concentration both *mauka* and *makai* in Waiohuli-Keokea Homesteads. None of the smaller awards were above 3800ft (1158m) elevation.

Analea Keohokalole was one of three *ali'i nui* besides Kamehameha III and William Charles Lunalilo who were in control of the 15 *ahupua'a* in the total study area prior to the Mahele (Watanable 1996:59). Keohokalole was the mother of David Kalakaua, Lydia Liliuokalani, William Pitt Leleiohoku II, and Miriam Likelike. Prior to the Mahele, she held 25 parcels of land in Kula. Keohokalole was awarded *ahupua'a* Kamehame (Nui and Iki), Alae 1-4, Koheo 1-2, and half of Kealahou 1-4, over 9,000 acres (3,642ha).

In Koheo 1-2, Nahinu received 14.64 acres (6ha) as LCA 5292, downslope of Site 4162.

Oma'opio 1-5 *ahupua'a* of Site 4160 was under the control of *konohiki* Ali (Watanabe 1996:59). Ali received one parcel of 1,052.72 acres (426ha) as LCA 281-B. Oma'opio 5 was one of the parcels relinquished by Keohokalole (Watanabe 1996:63).

Ahupua'a Pulehu Iki was under *konohiki* Wahine but not awarded to her. It appears to have been government land which upper part was sold as Grant 3502 and the lower part became Kamehame Iki-Pulehu Iki Homesteads.

Although the main distribution pipeline and lateral lines will cross some small *kuleana* claims (TMK: 2-2-05; -06; -10) they have all been previously disturbed by ranching, farming, highways, roads and housing developments. It is not likely that intact *kuleana* sites still remain.

LAND USE PATTERNS

Watanabe's (1996) research suggest that the project area may have been in forest in pre-contact times and at the upper reaches of early post-contact cultivation. "Dryland cultivation greatly altered the vegetation cover of the islands . . . long before the arrival of Europeans. The forest zone above cultivated areas was used for wild plant products, canoe logs, and for collecting feathers . . .only above 760 m (2,500 ft) elevation was the original vegetation essentially untouched by Hawaiians (Kirch 1982)" (Cuddihy & Stone 1993:103).

The project corridor was probably once a koa/sandalwood forest (pers comm Derral Herbst 17 Sept 1996). The forest would have been impacted by Hawaiians collecting sandalwood. In what is left of the koa (*Acacia koa* Gray) forest, "clearcutting and burning had been going on since the 1840s (Culliney 1988). As early as 1873, the koa of the lower slopes of Haleakala was severely depleted, evidenced by the desolation that Bird observed in the Makawao ara (Bird 1966). Ironically, the literal meaning of Makawao is "forest beginning" (Pukui et al. 1974)" (Cuddihy & Stone 1993:46).

Deforestation by sandalwood harvesting and gathering of firewood appear to have occurred in the early to mid 1800s. This would have opened up the forests and encouraged ranching where cattle were not quite so sensitive to temperature, rainfall or soil conditions.

This last seem to suggest that till about 1846, most of the cultivation was at the lower elevations. In or by 1846, the forest at the upper elevations were being cleared for planting: potato was planted in the "virgin soil of the

partially cleared forests" (Watanabe 1996:57). The project corridor may not have been cleared till about 1846. Dry taro and sweet potato were probably cultivated on the lower slopes by the early Hawaiians. The project corridor might have been too cold or at the upper end of either dry taro or sweet potato cultivation. The yield would not have justified the labor (pers comm Holly McEldowney).

In the 1840s, on the lower slopes of Kula, the Chinese established residences and farmlots, "leasing and subleasing planting areas from native Hawaiians and cattle ranchers, . . ." (Watanabe 1996:57). Wheat, sweet potatoes and Irish potatoes were being cultivated to supply first the sandalwood ships then later, whaling ships that came to port.

It is not clear when corn was introduced into Hawaii but it has grown here for more than a century and "suffered from insect pests and diseases until the introduction of a resistant form" (Neal 1965:82). The Chinese were cultivating corn in the project area by 1900 (Watanabe 1996:13). In the early 1990s, "the major agricultural activities [in upcountry Maui were] livestock grazing, truck farming, flower production, and orchard crops" (Draft EIS 1995:26).

The present land owner of Site 4160 in *ahupua'a* Oma'opio, is Haleakala Ranch (TMK 2-3-05:04) and is in active use as grazing lands. Trails for horseback tours crisscross the area. Watanabe described the area of Site 4160 to have been "Chinese corn farming fields ca. 1900-1910 (pers. com. Haleakala Ranch Manager)" (1996:13).

Site 4161, in *ahupua'a* Pulehu Iki, is on land presently owned by the Von Tempsky Estate and leased by Haleakala Ranch Company (TMK 2-3-01:87). The area was once owned by hay dealer J.T. Baker of Wailuku (Watanabe 1996:14) but the specific land use was not stated. The land does not appear to be in active present use.

Site 4162 in Koheo 1-2 *ahupua'a*, was "farmed by Chinese agriculturalists leasing the land from Harold Rice (pers. com. Ka'ono'ulu Ranch hands)" (Watanabe 1996:14). It is presently owned by Ka'ono'ulu Ranch and is still actively used for grazing. It was awarded to Keohokalole, *ali'i nui* (see above), as LCA 8452:19 during the Great Mahele (Watanabe 1996:60). Downslope of Site 4162 was a small *kuleana*, LCA 5292, awarded to Nahinu.

The data gathered by Watanabe confirm the observances in 1843, by Brown in 1844 and Jarves in 1846 regarding the cultivation of Irish and Sweet potatoes in the Kula region. There appears to have been very little dry taro cultivated probably due to the cooler temperatures at the higher

elevations. The 1840s saw the end of the sandalwood trade and the heyday of whaling. Provisioning these ships and not subsistence was the impetus for cultivation at this time. These crops are not a true representation of traditional practices.

Water supply in Kula appears to have been a problem for some time. "The Upper Kula Water System has been in existence, in various forms, since 1912 when a wooden dam and a 19-mile long wooden-stave pipeline were installed to convey water from Waikamoi Stream to Ulupalakua" (Draft EIS 1995:55).

PREVIOUS ARCHAEOLOGY

Watanabe did the preliminary fieldwork and background research in preparation for this project. Much of the information in this report is taken from his.

Many of the early archaeological studies were focused on heiau (Thrum 1909; Walker 1931; Stokes, Emory 1938). The sacredness of these places were respected and often left alone. These were often all that remained of a habitation or agricultural complex. Sometimes legends helped to maintain respect but as these tales were forgotten so were the heaiu.

The Statewide Inventory of Historic Places in 1970-74 appeared to have basically followed the pattern of earlier work. That is, they tried to re-locate the described heiau and if they happened to see anything else during their search, noted these.

Despite the destruction modern development has wrought, many new sites have been found and recorded. In Makawao District, Waiohuli and Keokea *ahupua'a* especially, (Riford 1987, Brown & Haun 1989, Donham 1990; Kolb 1994, Kennedy 1994) with surveys in the uplands and on the coast.

In Waiohuli and Keokea, at the 1800-3000ft (549-914m) elevation, heaiu, religious features, human burials, agricultural field systems and residential complexes dating AD 680-AD 1617 were recorded (Brown & Haun 1989). This is just downslope of the pipeline. Closer to the coast, a dryland agricultural complex (Site 2475) was identified in what was traditionally believed to be a "barren zone" (Donham 1990 in Watanabe 1996:12).

Molohai heiau in Keokea was investigated and found to have been in traditional use AD 1057-AD 1819 (Kolb 1994). There was evidence to suggest the structure had been used for agricultural purposes during the historic period.

Table 1. Previous Archaeology
(*Watanabe 1996:11)

*Thrum	1909	heiau
*Walker	1931	sites along Makahiki route
*Stokes & Emory	1938	heiau
*Bishop Museum	1970-74	recorded previously known sites
Riford	1987	DHHL Waiohuli, Keokea subdivisions: agricultural, habitation, religious features, prehistoric-historic periods
*Brown & Haun	1989	DHHL, 1800-3000ft elev, 351ac, Keokea: 108 sites, AD680-1157; 674ac, Waiohuli: 51 sites,AD 1617; heiau,religious features, human burials, ag field systems, residential complexes
*Donham	1990	coastal Waiohuli & Keokea: Site 2475: dryland ag complex
*Kolb	1994	DHHL, Molohai heiau, Keokea, AD 1057-AD1819
*Kennedy	1994	DHHL, Waiohuli, 9 sites-8 NLS, historic ranching, traditional Hawaiian upland field system
Fredericksen & Fredericksen	1994	2500-2670ft AMSL, Waiakoa, historic period boundary wall
Burgett & Spear	1995	2800-3000ft AMSL, Ka'ono'ulu, post-contact agriculture or habitation
Moore & Kennedy	1995	2650ft AMSL, Koheo, Ka'ono'ulu, Alae, historic ranching, field system, habitation

In Waiakoa, at approximately the 762-814m (2500-2670ft) elevation, a historic boundary wall was excavated prior to the installation of County water lines and the widening of Calasa Road (Fredericksen & Fredericksen 1994).

A proposed water main corridor at approximately 808m (2650ft) elevation through Koheo, Ka'ono'ulu and Alae *ahupua'a* uncovered historic ranching, agricultural and

habitation sites (Moore & Kennedy 1995). At a slightly higher elevation (853-914m/2800-3000ft) in Ka'ono'ulu, agricultural and habitation sites were of late nineteenth or early twentieth century origin (Burgett & Spear 1995:30).

METHODOLOGY AND FIELDWORK

Watanabe walked two corridors roughly 100ft (30.5m) wide from Olinda Reservoir to twin water storage tanks in Keokea in October 1994. He identified sites 4160-4162.

Dudley Kubo, project engineer and Neal Fujiwara, DC at the Wailuku office, prior to the author going into the field, had gone out and flagged the 150ft (45.7m) wide corridor by approximately one mile (1.6km) long at Site 4160. Carol Kawachi, Cultural Resources Specialist with NRCS, with Earth Team volunteer Basil Hansen recorded twenty-two features consisting of 38 components including walls, mounds, platforms, earthern terraces and a road bed during the week of June 24 - 28, 1996. With the help of soil conservationist Jon Schlegel (Lihue F.O.), soil conservation technicians Edwin Miranda and Carl Hashimoto, civil engineer Michelle Tomboc (Wailuku F.O.), and volunteer Gabriel Garcia, two more features consisting of ten components were recorded at Site 4160. Sites 4161 and 4162 were also recorded as well as eight shovel tests dug. The later work was done July 1 - 3, 1996.

All of Ms. Kawachi's assistants were volunteers and not familiar with archaeological recording or excavating procedures. Some time was spent giving instructions. Misters Schlegel and Miranda were somewhat familiar with soils and therefore were able to describe soils independently.

Only shovel tests were done in lieu of the time available and the inexperience of the excavators. The first two units done at Site 4162 were close enough that Ms. Kawachi was able to go back and forth between the two units. It was then decided that work would go a lot faster if each did a specific task and worked as a team. The rest of the units were done as a team. Misters Miranda and Schlegel alternated digging and doing the soil descriptions. Mr. Garcia screened the soil. Ms. Kawachi did the profiles and assisted Mr. Garcia.

In January 1997 James Ino, Soil Conservationist (Wailuku Office), drove Mr. Kubo, and Ms. Kawachi through the pasture lands and access roads to the thirteen gulches that the main distribution pipeline will be crossing. Eleven were surveyed on foot by Mr. Kubo and Ms. Kawachi. Pohakuokala and Waiohuli gulches were inaccessible due to the dense growth of black wattle.

Carl Hashimoto, Bobby Lani and Ms. Kawachi did a windshield survey of the nine lateral distribution corridors on existing roadways. The pipeline will be buried along existing roadways, dedicated easements and fencelines. No cultural resources were noted on the nine lateral pipeline corridors. The Department of Hawaiian Home Lands at the southern end were archaeologically surveyed by Brown et al (PHRI:1989).

Those properties or areas that were inaccessible during the earlier surveys will be investigated during the topographic survey.

FINDINGS

This report is a follow-up of Watanabe's 1996 reconnaissance survey. It appears that Mr. Watanabe had an earlier tax map key book for the landowners have changed since his report. Those areas which were inaccessible in the earlier surveys will be investigated during the topographic survey. Following Watanabe's Assessment and Recommendations (p15-16):

A. Unsurveyed areas

1. Gulch crossings: 14 (Kailua, Kaluapulani, Waiale [2], Pohakuokala, Pulehu, Waiakoa, Kolaloa, Keahuaiwi, Na'alae, Kaipoioi) were investigated; sites were found in 3 (Hapapa, Na'alae, unnamed); 2 (Ka'ono'ulu, Waiohuli) were inaccessible.

2. Harada property (TMK: 2-2-09:15): this parcel is not within the pipeline corridor.

3. Hawaiian Securities and Realty (TMK: 2-2-09:79): not investigated.

Laterals Distribution System (not investigated)

1. Kimo Road Lateral: Ventura easement.

2. Waiohuli Lateral: Wong easement.

3. Waiohuli Lateral: multiple owners. The pipeline will follow the existing road.

B. Sites 4160, 4161, 4162 were recorded and tested. Until the topographic survey is done, exactly where and how the pipeline will go, will not be decided.

Laterals Distribution System

1, 2. Keokea/DHHL Lateral: TMK: 2-2-03: 6, 48, 49. The area is currently farmed and accessed by dirt roads.

3. Keokea/DHHL Lateral: The following information is from Brown et al 1989.

Five numbered sites (2050, 2088, 2089, 2091, 2093) were found to be adjacent to or crossing the existing roaday (Figure 4). A set of terraces , "minor agricultural features . . .[that] are referred to in the records of formally recorded sites as being present in the site area (1989:16) also cross the roadway. These sites are described in Appendix B. The proposed lateral distribution line will be buried within the existing roadway and therefore, will have no adverse effect on these historic sites. If however, there are any changes in the alignment of the pipeline, NRCS will work in cooperation with the Department of Hawaiian Home Lands.

These features were not clearly visible at the time of our windshield survey.

C. Parcels recommended to be eliminated for further work are identified in Appendix B (Watanabe 1996).

D. Specific areas where potential sites may be present are in Tables 1 and 2 (Watanabe 1996). Mr. Watanabe ascertained four "potential themes sequentially organized by time periods and related to evolving patterns of land use:"

1. Prehistoric and early historic native Hawaiian settlement and subsistence;
2. Historic Chinese settlement and susbsistence;
3. Historic Portuguese settlement and subsistence; and
4. Historic agricultural use.

Specific areas not yet investigated and with potential are:

Ahupua'a		Historic context (1-4)
Pulehu Nui	Kolaloa gulch	1
Alae 3-4	TMK: 2-2-06: 83, 2	3
Waiohuli	TMK: 2-2-05: 33	1

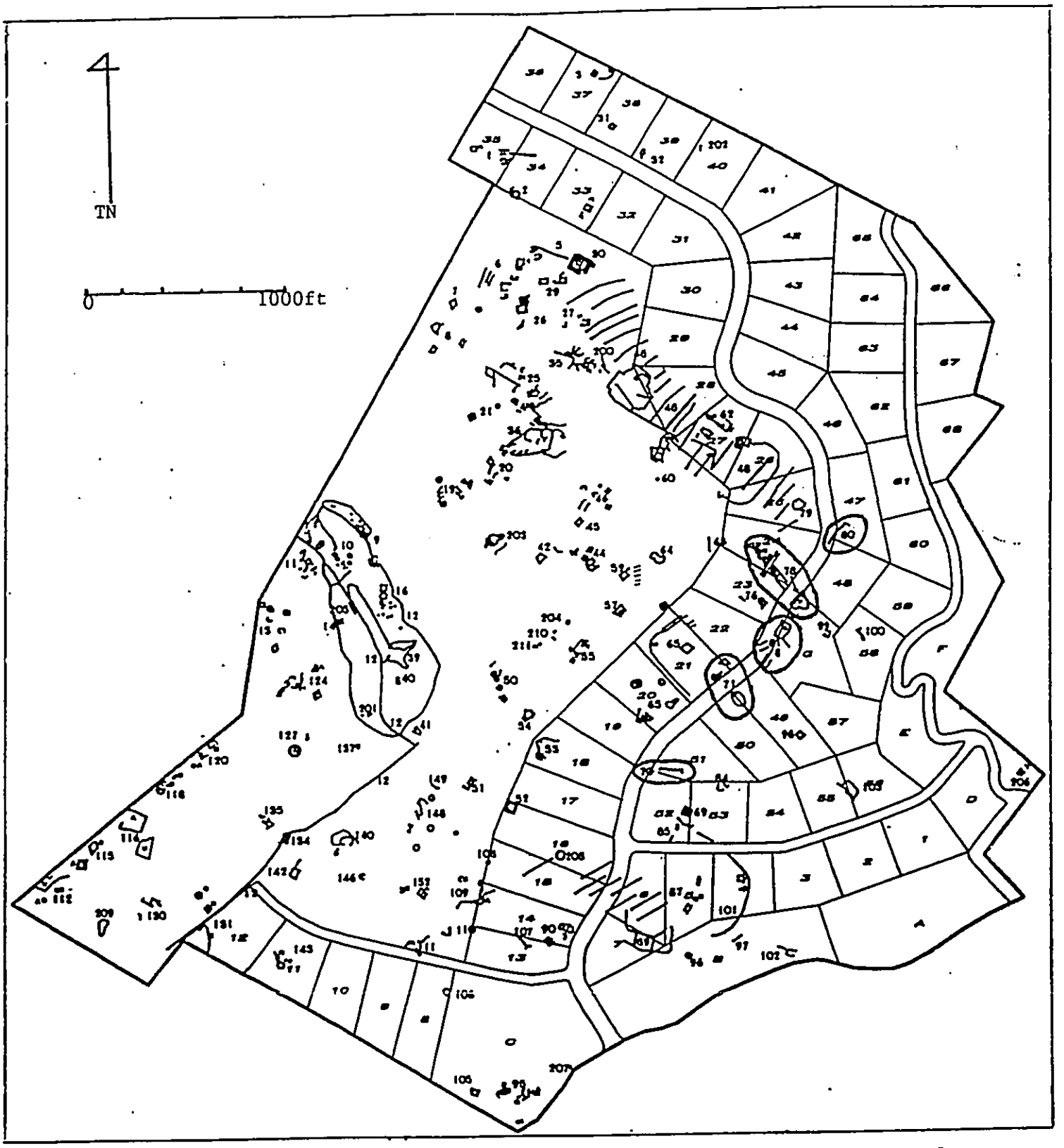


Figure 4. Site location map, DHHL Keokea subdivision. From Brown et al 1989: Figure 3. Note circled sites (80, 78, 8, 71, 70).

Three sites were recorded in June 1996: site 4160 in Oma'opio *ahupua'a*, site 4161 in Pulehu Iki *ahupua'a* and site 4162 in Koheo 1-2 *ahupua'a*. In January 1997, terrace remains were found in three gulches (Hapapa, Na'alae, unnamed). An abandoned modern road was found on the northern bank of Keahuaiwi gulch. None of the later sites were recorded at this time. The sites will be recorded and the previously inaccesible gulches (Ka'ono'ulu, Waiohuli) will be investigated during the topographic survey.

Feature descriptions are in Appendix A.

Site 4160 is 0.5 mile (0.8km) long (horizontal distance) by 150 feet (46m) wide and contains 24 features (Figure 5). Horizontal distance is half a mile but the actual ground distance is probably a mile with the many swales and ridges. Many features, especially those in the swales could not be seen from the top of the ridges. The northern boundary of site 4160 was the tree line separating Kalialinui and Oma'opio *ahupua'a*. The southern boundary was Pohakuokala Gulch. The site is located at approximately 4160 feet (1268m) elevation north of Haleakala Crater Road in Oma'opio *ahupua'a* approximately 11 miles (18km) from Kalepolepo Beach.

Twenty-four features consisting of 48 components were recorded for site 4160:

Mounds	28	Alignment	1
Modified outcrop	5	Wall	11
Wall w/mound	1	Modified outcrop w/U-shape	1
U-shape	1		

Many appeared to be retaining walls laterally following the slopes or water control structures spanning the swales.

Many had been damaged over the years either by cattle or heavy flooding where only remnants in a line remain. Or some of the wall remnants may also have been clearing mounds. The features were recorded north to south with Feature A at the north end and X1-X3 at the southern end.

Feature I is actually outside the project area but because of its close proximity to the project corridor and its unusual design, was included in the recording. Other similar features are within the large complex but this was the closest to the project corridor. This U-shape feature is dug into the side of a small hill. The side walls have deteriorated but their alignment is clear. TU8 was placed near the back wall. A charcoal lens 7-9mm thick was found at 16/23cm below surface in the eastern and southern wall within a red cinder layer beneath a loam layer and above a clay-loam layer. Since the unit is outside the project

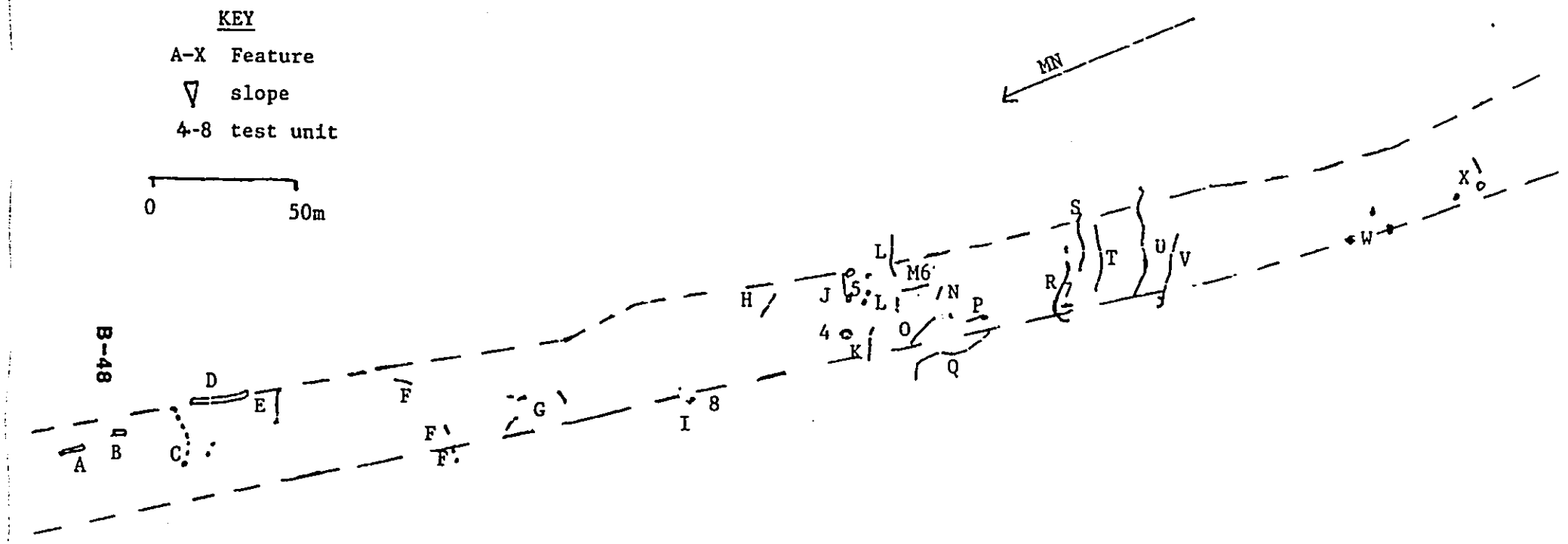


Figure 5. Site 4160 map in main distribution pipeline corridor. Site extends both west and east of the corridor.

Table 2. ARCHAEOLOGICAL SITES

Site 4160

A	1	wall (north-south)
B	1	mound
C	3	modified outcrop (east-west) mounds (C-2, -3)
D	2	wall (north-south), mound
E	1	wall (east-west)
F	4	alignment (northeast-southwest) (F-1) mounds (F-2, -3, -4)
G	4	mounds (G-1, -2, -3), retaining wall (north-south) (G-4)
H	1	wall (northwest-southeast)
I	1	U-shape, probable habitation/storage area (outside project corridor)
J	7	mounds
K	2	mound, modified outcrop
L	1	wall (east-west)
M	1	wall (north-south)
N	1	wall (east-west)
O	1	wall (north-south)
P	1	wall with mound
Q	1	wall, serpentine, retaining (only 10m is within project corridor)
R	1	modified outcrop (east-west) with terrace on west end
S	1	wall (southeast-northwest)
T	1	wall (southeast-northwest)
U	1	modified outcrop (northwest-southeast)
V	1	modified outcrop (northwest-southeast)
W	3	mounds
X	7	mounds

Site 4161
4 earthen terraces

Site 4162
1 road bed and land bridge

corridor, a sample was not collected. Small charcoal flecks were also observed.

In the initial draft, Features J, K1 and L of site 4160 were thought to be probable habitation features (Figure 6). However, after further research and discussion with colleagues, it appears that all of the features were of historic-period Chinese farming. Regarding Feature K1, thought to be a Hawaiian burial mound, per Marc Smith (pers.comm Jan 1997), the Chinese faced their clearing mounds so the rocks would not tumble down. A test unit (TU4) was placed northwest of Feature K1 in what may have been a planting area. No significant cultural materials were uncovered (Figure 6, Appendix B). Soil descriptions for the test units are given in Appendix B.

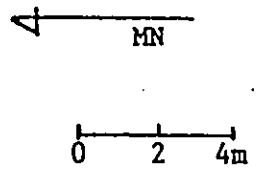
In regards to Feature J, the complex of mounds, per Mr. Watanabe (pers. comm. Jan 1997), these were probably clearing mounds as well and not a habitation site. Test unit 5 was placed in the middle of the circle of seven mounds (Figure 6) but no significant material was excavated. It is not likely that the early Hawaiians would have built such a substantial house structure this far up in what was probably then a forest. If they were gathering materials up here, a temporary shelter would be more likely with the people returning to the warmer sea coast as soon as possible. After 150 years of farming and ranching, it is not likely that remnants of temporary shelters would remain.

Feature L is a core-filled wall just south of Feature J (Figure 7). It does not correspond to any present day boundaries. However, there is no information as to how many Chinese farmers might have been in this specific area and how they may have defined their farms. The wall is on the north side of a small swale parallel to the slope so it probably did not serve as retaining wall. It is likely to have been a boundary wall of the historic-period Chinese.

Feature M is a stacked, core-filled wall perpendicular to the slope in a gentle swale (Figure 7). It appears to have functioned as a water control feature. TU6 was placed upslope of the wall in hopes that cultural materials might have been caught by the structure during flooding, etc. No significant cultural materials were obtained.

Feature R is a modified outcrop with a terrace at the northeastern side of a small ridge (Figure 8). The modified outcrop serves as a retaining wall at the eastern base of a small ridge. It begins further east and extends and curves around to the southwest. The southeastern edge of the terrace is delineated by a rock alignment. The terrace is approximately 9m wide by 12m long and relatively flat, suggesting a probable house site or a planting area. TU7

Upcountry Maui Watershed Project
Site 4160 Features J1-J7, K1-K2
Clearing Mounds, Planting areas
TU4 NW of Feature K1
TU5 in middle of J mounds



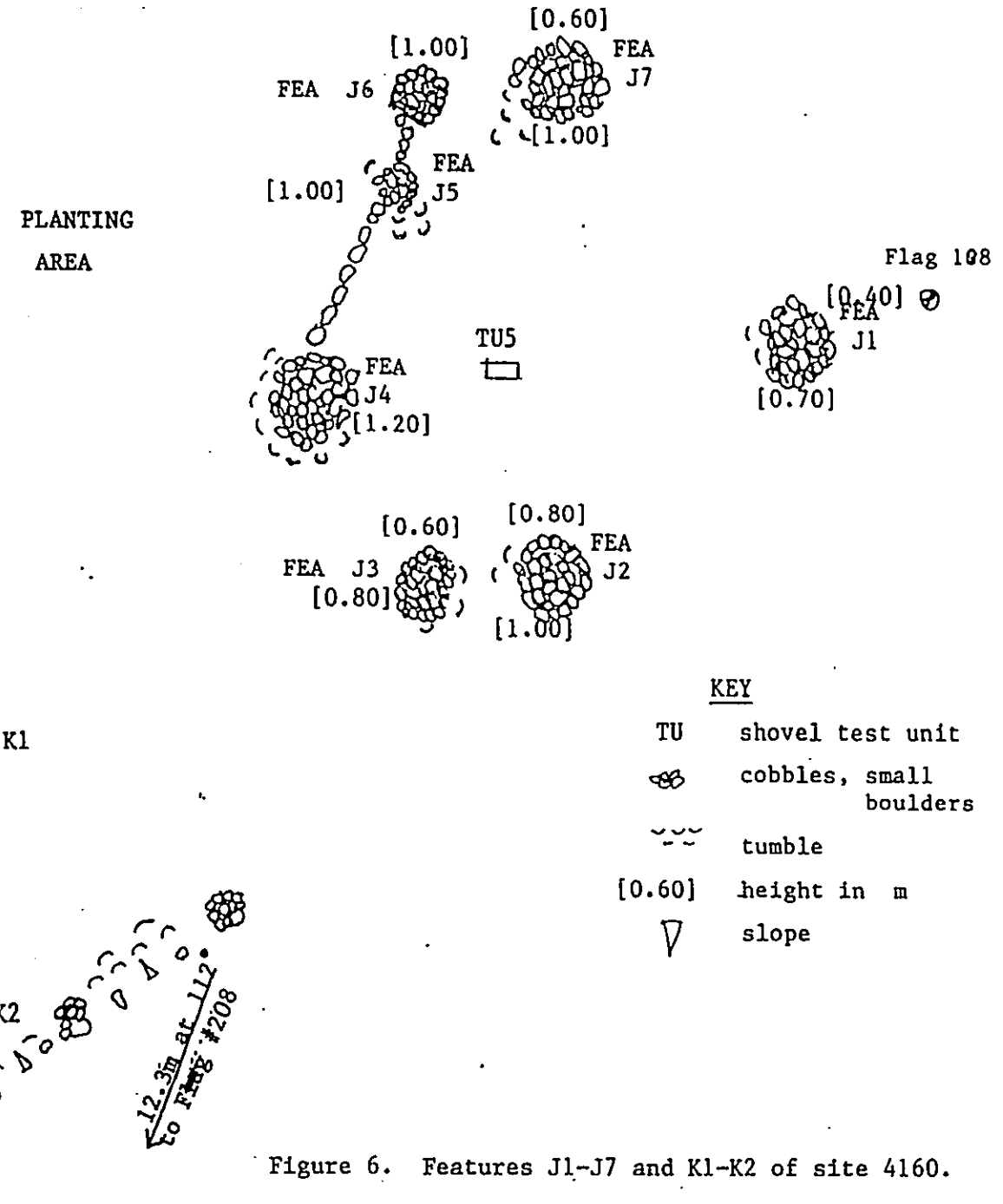


Figure 6. Features J1-J7 and K1-K2 of site 4160.

Upcountry Maui Watershed Project
Site 4160 Features L, M, N Walls
TU6 east of Feature M

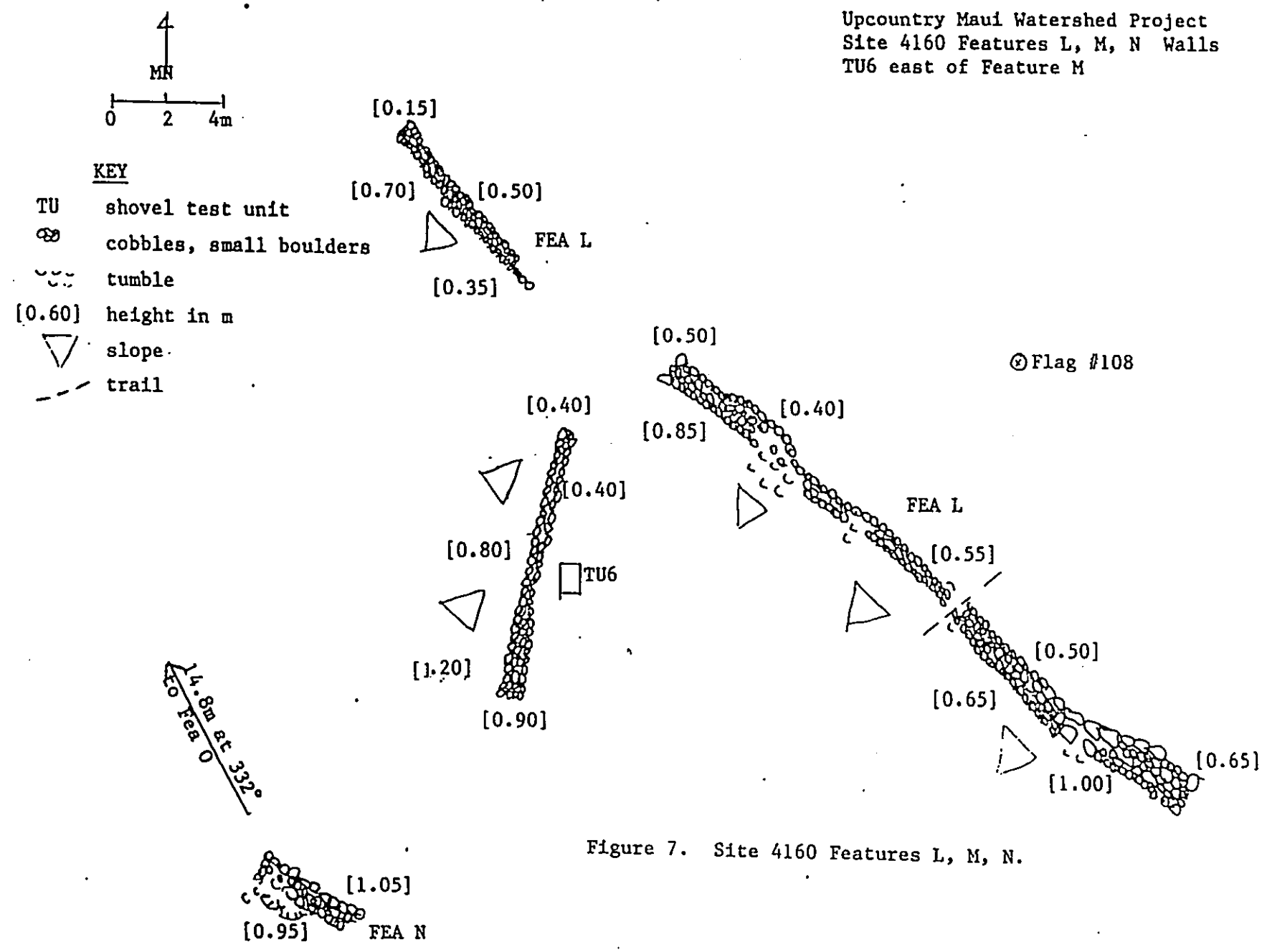


Figure 7. Site 4160 Features L, M, N.

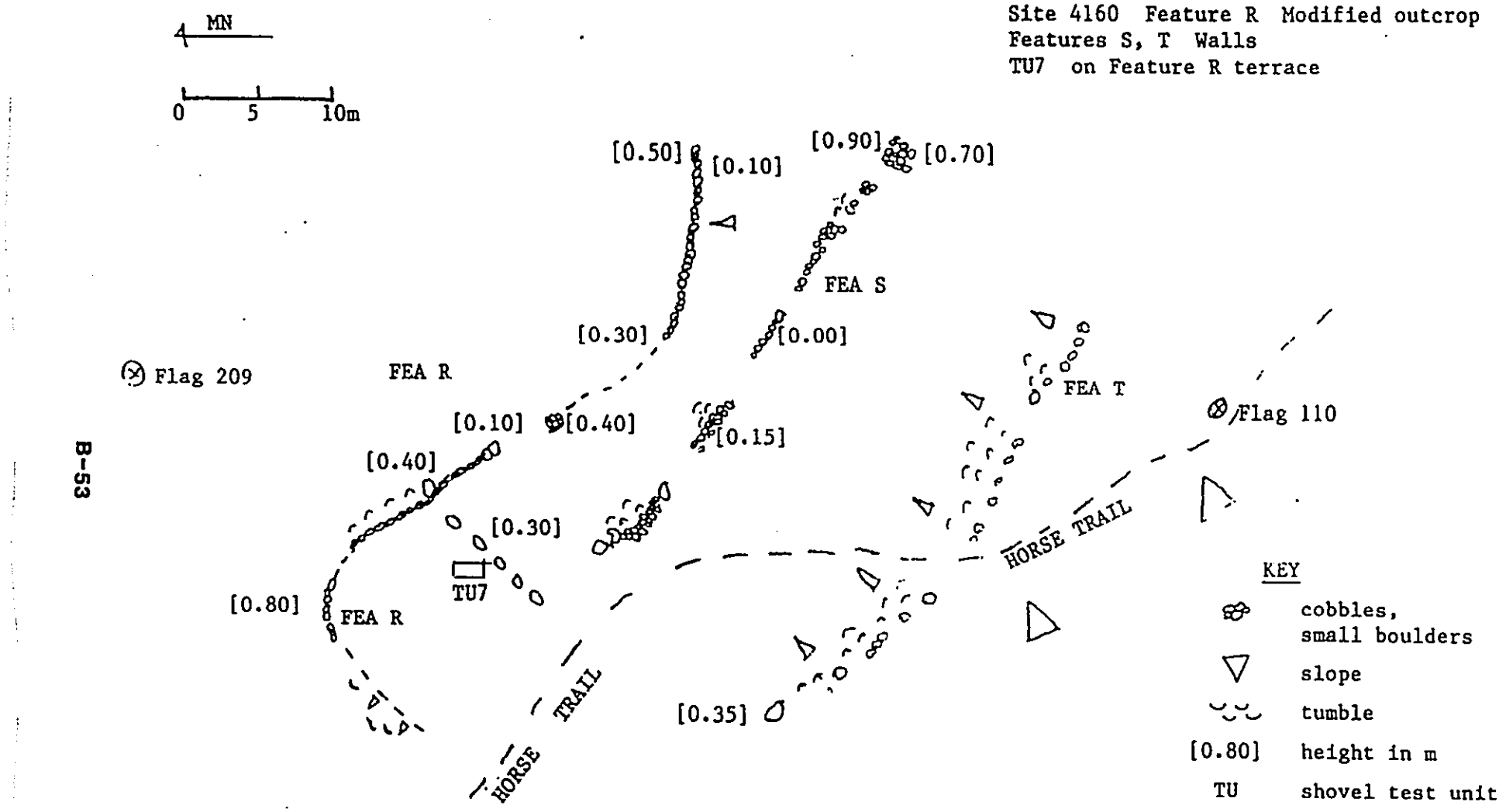


Figure 8. Site 4160 Features R, S and T.

was placed on top of the terrace in a flat area but no significant cultural materials were recovered.

Five shovel tests were placed on or near features in Site 4160 where it appeared most likely that cultural materials might have collected via flooding or cultural activity. The soil in all five test units were similar. TU8 was most different but is outside the project corridor. Per Robert Gavenda (pers. comm 2/97): these soils are well-suited for agriculture. No significant cultural materials were uncovered in the test units within the project corridor in site 4160.

Site 4161 is north of Hapapa Gulch in Pulehu Iki *ahupua'a*, south of Haleakala Crater Road (Figure 9). It is 48m long by 36m wide and consists of four eroded earthen terraces and what appeared to be buried stone foundation remains of a probable historic house. TU3 was placed in the center of the last but no significant cultural materials were encountered. This site is slightly less than 11 miles (18km) from Kalepolepo Beach in the *ahupua'a* of Pulehu Iki.

Site 4162, east of Kula Highway, totalling 22m in length, appeared to be the remains of a road bed 2m wide which may have once crossed the gully as a land bridge (Figure 10). A retaining wall 0.9m high and 1m wide was probably the remains of the former land bridge with the southwestern half washed out. What appears to be faint remains of the continuation of this old road can be seen northward and southward both in the field and in aerial photos (MA 14-144, 2-2-91). No roads are indicated on the present tax map or on the USGS 1983 Kilohana quad map. Downslope of the land bridge, the base and south side of the gully are bedrock.

A test unit (TU1) was placed upslope of the retaining wall but no cultural materials were uncovered. An isolated animal bone was found 26cm below datum. The gully appears to begin at the land bridge.

Watanabe had noted a retaining wall in the north side of the gully (1996: photo 18) in October 1994. The wall was not visible in July 1996 and was probably hidden behind the large mulberry tree growing out of the north side of the gully.

The road bed is approximately two meters wide by 14.5m to the gully (Figure 10). The road bed had been cut into the slope and had an alignment of rocks (20cm high) on the west side. A cow wallow had been dug into the southern end of the road bed at the northern edge of the gully. A shovel test (TU2) was dug to 1.00m depth but yielded no cultural materials (Appendix A). Site 4162 is approximately 10 miles (16km) from Kalepolepo Beach in Koheo 1-2 *ahupua'a*.

PLAN VIEW MAP - UPCOUNTRY MAUI WATERSHED PROJECT - SITE 4161

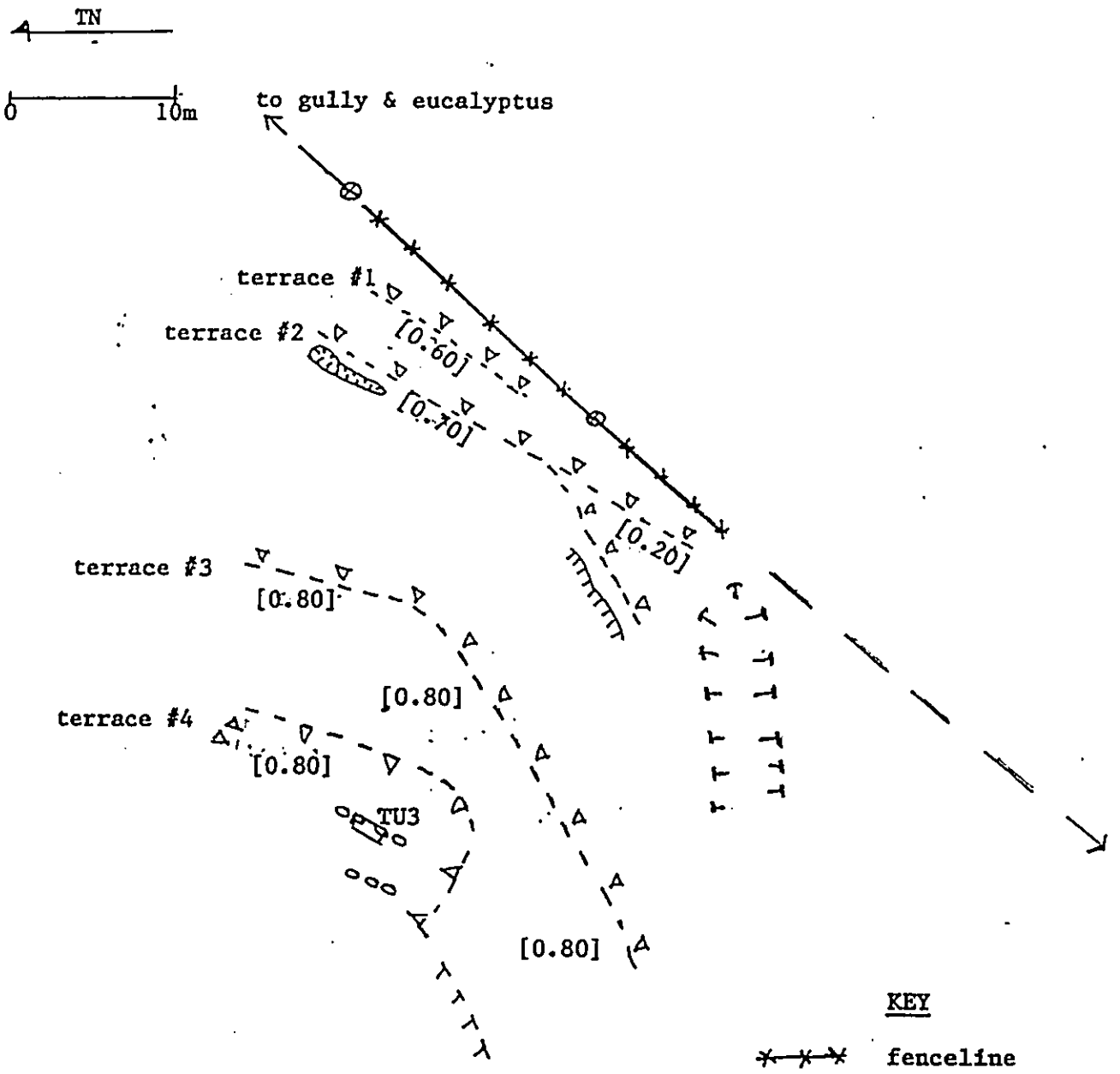


Figure 9. Site 4161.

PLAN VIEW MAP - UPCOUNTRY MAUI WATERSHED PROJECT - SITE 4162

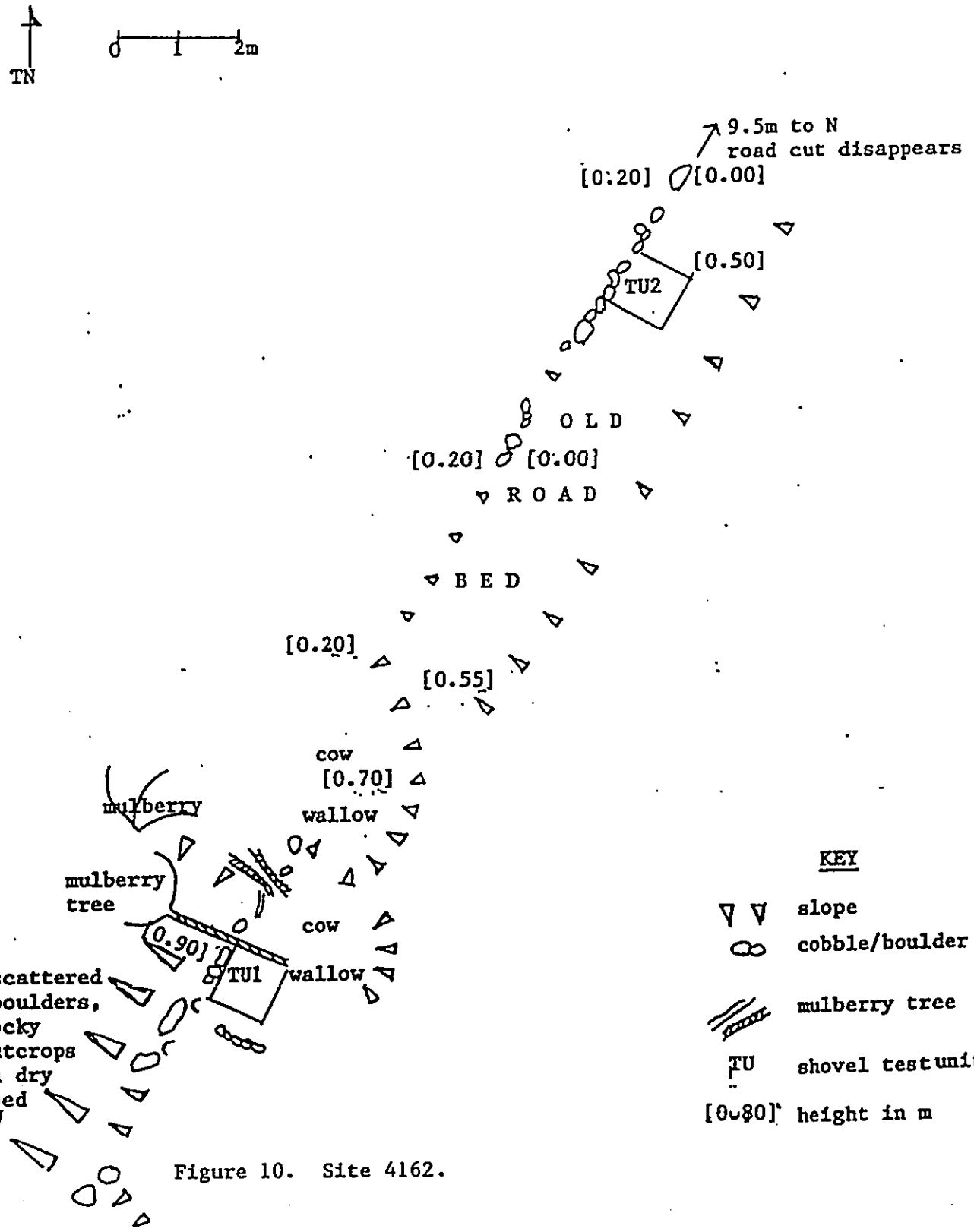


Figure 10. Site 4162.

All three sites, according to Mr. Watanabe's research, were historic-period Chinese agricultural sites. Mr. Watanabe found that corn had been cultivated at Site 4160 ca 1900-1910. Corn would have done well at this temperature provided there was continuous moisture supply (Thompson and Kelly 1957:547) but it does not store well beyond a few days.

It has been suggested that the terraces built in the swales served not only as water control devices but also as retaining walls. The soil carried by the flowing rain water would be caught upslope of the walls. Per Mr. Ino (pers comm January 1997), farming in this area was probably seasonal - maybe only during the rainy season when there was soil and water. Per Mr. Watanabe (pers comm January 1997), The various U-shapes (Feature I outside the project coridor) suggest historic period storage structures, possibly for potatoes or corn. Potatoes, kept cool enough, will keep in storage up to 6 months (Knott 1957:185).

The following sites were uncovered in January 1997. They will be recorded during the topopgraphic survey.

On the south side of the bottom of Hapapa gulch, on a relatively level earthen shelf, one low retaining wall (north-south) was observed. On the same level, at the base of the southern bank, a small rectangular mound was also noted. On the upper surface to the south, a wire fenceline (north-south) is hooked to a pile of stones.

On the north bank of Keahuaiwi gulch, a retaining wall once supported a modern vehicular road. The walls have collapsed and the road is presently blocked off. It is not clear if the road was to access the homes on the south side of the gulch.

In Na'alae gulch, an east-west retaining wall along the northern bank and another wall perpendicular to the first were found close to some old marijuana (*Cannabis sativa L.*) growing paraphernalia. Although Ka'ono'ulu gulch was 228.6m (750ft) to the south, we were unable to access it. Nor could we access Ka'ono'ulu gulch from Waipoli road to the south due to dense growth of black wattle.

At the southern end, north of the existing watertank in Keokea *ahupua'a*, in an unnamed gulch, remains of at least one terrace (north-south) was found. The dense black wattle made it difficult to see as well as get through. The gulch is approximately 30.5m (100ft) wide with 9m (30ft) high walls on the south side.

EVALUATION OF RESEARCH

The three recorded sites, according to Mr. Watanabe's extensive research, are likely to be remnants of the post-contact period.

Prior to 1778, the project corridor had probably been a sandalwood/koa forest where the early Hawaiians came to gather and hunt.

The arrival of foreigners changed old Hawaii forever. The forest was devasted, the Hawaiian population decimated. The land now lay open to newcomers.

The Chinese moved into the upcountry and began farming corn, potatoes, etc. to provision the many ships which stopped at the nearby ports. The rock structures which now dot the pasture lands are probably remnants of this time period.

Shovel tests units at all three sites in the project corridor recovered no dateable materials.

The sites were assessed as significant solely for information content (criterion D) (Table 4). Eight test units were excavated in the three sites. The seven in the project corridor did not yield cultural material to determine the age of the site. Further excavation will probably not yield further information or dateable material.

Per Mr. Ino (pers comm January 1997), these post-contact period Chinese agricultural features are common in upcountry Maui. In the context of Kula agricultural /habitation settlement patterns, they are common and abundant and can be readily seen in the pasture lands.

The Keokea lateral will be buried along the existing roadway which cuts through or are adjacent to five sites identified on Department of Hawaiian Home Lands (DHHL). Thus, there will be no adverse impact upon these sites. Should there be any changes in the pipeline alignments, NRCS will work in cooperation with DHHL to minimize effect.

The actual impact within the the 45.7m (150ft) wide corridor will be 4.6m (15ft) for the pipeline and 3m (10ft) for a maintenance road. The recommendations for the pipeline routing and maintenance road within the corridor as it passes through the sites, in view of the swales, ridges and gulches, will be determined after the topographic survey. Per Mr. Kubo (pers com 9/16/96), generally and as much as possible, the pipeline will be laid subsurface throughout. Figure 11 shows how the pipeline will be laid in a typical gulch crossing.

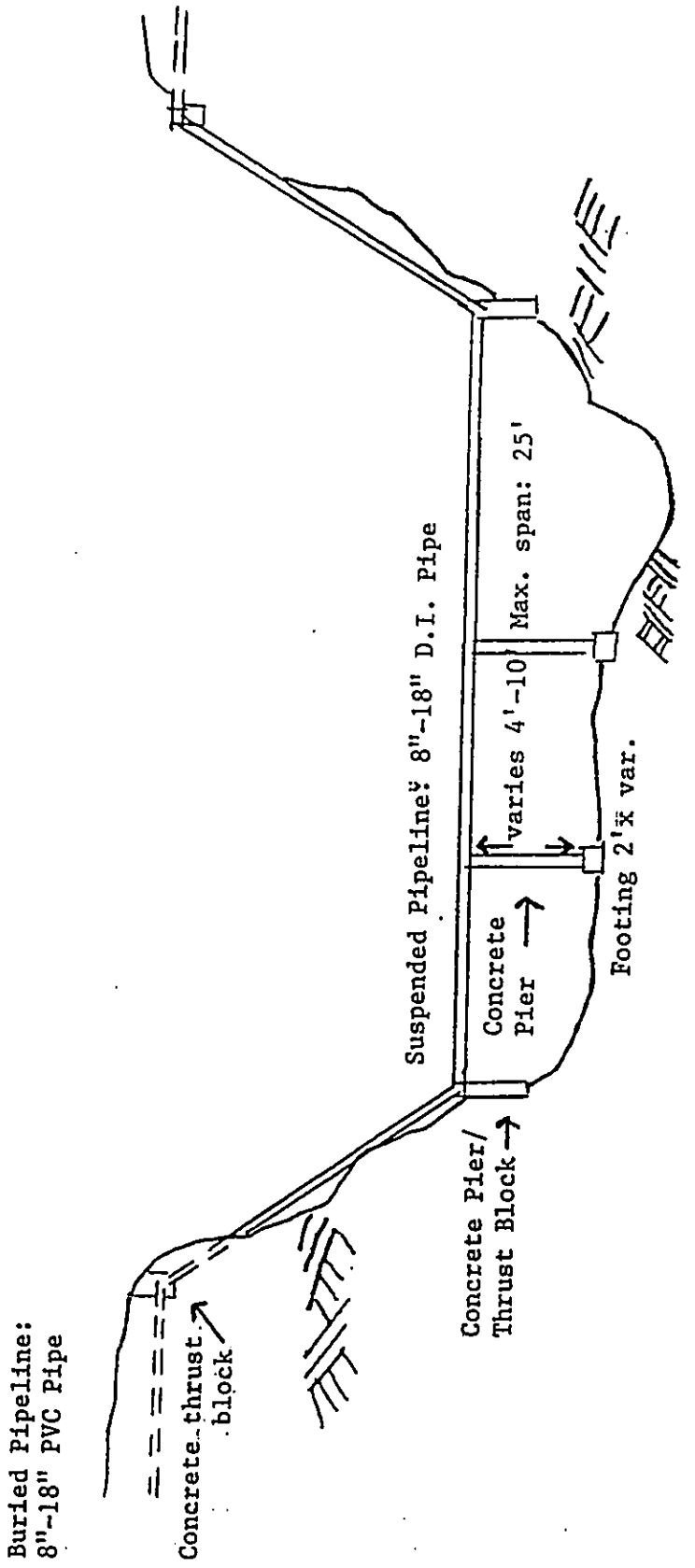


Figure 11. Typical gulch crossing. Upcountry Maui Watershed. Not to scale.
Sketch by D. Kubo.

Table 3. Summary of General Significance Assessments and Recommended General Treatments

Site No.	Function	Significance Category						Recommended Treatment		
		A	B	C	D	E	FDC	NFW	PID	PAI
4160	agricultural				x			x		
4161	agricultural				x			x		
4162	agricultural				x			x		

General Significance Categories:

The National Register criteria as described by the Department of the Interior regulations for National Register listing is as follows:

The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and

A = that are associated with events that have made a significant contribution to the broad patterns of our history; or

B = that are associated with the lives of persons significant in our past; or

C = that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D = that have yielded or may likely to yield, information important in prehistory or history. [36 CFR Part 60.4]

The Hawaii State Historic Preservation Division utilize an additional criterion:

E = it must have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to association with traditional cultural practices, beliefs, events or oral accounts.

Recommended General Treatments:

FDC = Further Data Collection necessary
NFW = No Further Work
PID = Preservation with some level of Interpretive Development recommended
PAI = Preservation "As Is," with no further work, or minimal further data collection necessary

The maintenance road will connect to existing roads and gulch crossings. The lateral distribution pipelines will be buried within existing roadways and therefore will have no effect upon historic sites.

RECOMMENDATIONS

Based upon our work conducted thus far, a determination of "no adverse effect" is our recommendation. After the topographic survey, should new information emerge to change the determination, Ms. Kawachi will be in consultation with Ms. Sara Collins at SHPO.

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APPENDIX A

UPCOUNTRY MAUI WATERSHED PROJECT
ARCHAEOLOGICAL SITES

FEATURE DESCRIPTIONS

FEATURE: A
TYPE: Mound CONDITION: Fair
ELEVATION: 4202.5ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.78-1.12 high x 11.3 long x 1.95-2.20m wide
ORIENTATION: Northeast-Southwest
DESCRIPTION: This rectangular shaped mound, constructed of 8 courses of loosely-stacked angular cobbles and core-filled, had its downslope side originally faced. It is now tumbled in a couple of areas. Its top may originally have been flat. This feature is built on a relatively level area along the contour of the slope. It is approximately 24m (79ft) south of the tree-lined boundary and is the first feature of Site 4160 within this project corridor.

FEATURE: B
TYPE: Mound CONDITION: Fair
ELEVATION: Approximately 4203.0ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 1.00 high x 6.00 long x 2.50m wide
ORIENTATION: Northeast-Southwest
DESCRIPTION: This rectangular mound constructed of piled cobbles and a few boulders, is approximately 16.5m (54ft) south of Feature A. The terrain is relatively level and this feature is built along the contour. Its downslope (western) edge appears to have once been faced but is mostly tumbled now. It may have functioned as a clearing mound.

FEATURE: C1-C4
TYPE: Modified outcrop CONDITION: Poor
ELEVATION: 4188.8 - 4205.3ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.32-1.00 high x 41.0 long x 1.00-1.50m wide
ORIENTATION: East-west
DESCRIPTION: This line of small mounds of piled pebbles and cobbles along the southern slope of a small ridge may once have been a single feature: a wall or a linear mound. Two small mounds (C3-C4) may once have been also a part of it but somehow has ended up at the base of the ridge. Or they may have been clearing mounds deliberately built there.

FEATURE: D
TYPE: Wall CONDITION: Good
ELEVATION: 4197.5ft AMSL
FUNCTION: Water control
DIMENSIONS: 0.85 high x 31.0 long x 1.3m wide
ORIENTATION: Northeast-Southwest
DESCRIPTION: This long narrow wall of stacked cobbles and boulders is built approximately 10.6m (35ft) south of and perpendicular to Feature C. It appears to have been built along the contour line probably as a water control device across this swale.

FEATURE: E
TYPE: Wall CONDITION: Good
ELEVATION: 4190.1ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.40 high x 14.3 long x 0.83m wide
ORIENTATION: East-West
DESCRIPTION: This long narrow wall of stacked small boulders and cobbles has been built along the northern edge of a small gully. It appears to once been faced on both sides. A cow trail cuts across it at its western end. A eucalyptus tree is west of this feature.

FEATURE: F1
TYPE: Alignment CONDITION: Good
ELEVATION: 4184.9ft AMSL
FUNCTION: Water control
DIMENSIONS: 0.30-0.55 high x 9.00 long x 0.50m wide
DESCRIPTION: This is a single boulder alignment at the "head" of a small swale. It is situated across the mouth, suggesting a water control function. It is faced on the downslope side. A line of small mounds (F2-F4) appear to be remnants of a retaining wall on the further downslope on the south side of the swale.

FEATURE: F2, F3, F4
TYPE: Modified outcrop CONDITION: Poor
ELEVATION: 4174.8ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.70-0.80 high x 22.0 long x 1.00m wide
ORIENTATION: Northeast-Southwest
DESCRIPTION: These are three small mounds of small boulders in a line along the northern slope of a small ridge. They are probably remnants of a modified outcrop, a slope retaining wall. Feature F1 is east of these features.

FEATURE: G1, G2
TYPE: Modified outcrop CONDITION: Poor
ELEVATION: 4180.3ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.00-0.80 high x 22.5 long x 1.00-1.20m wide
ORIENTATION: Northeast-Southwest
DESCRIPTION: These are two mounds which once may have been part of the same retaining wall: they appear to be on the same contour along the northwest slope of a swale. Feature G3 is northeast, Feature G4 northwest, of this feature.

FEATURE: G3
TYPE: Modified outcrop CONDITION: Fair
ELEVATION: 4180.6ft AMSL
FUNCTION: Unknown
DIMENSIONS: 0.00-0.80 high x 2.80 high x 1.20m wide
ORIENTATION: Northeast-Southwest
DESCRIPTION: This is a small rectangular shaped mound of stacked boulders and cobbles on the western slope of a small hill. Its location suggest it might once have been part of a retaining wall similar to Feature G1-G2 downslope but it is the only one on this contour. It is the uppermost feature of three wall-like features on this slope.

FEATURE: G4
TYPE: Wall remnants CONDITION: Poor
ELEVATION: 4165.9-4168.0ft AMSL
FUNCTION: Water control
DIMENSIONS: 0.00-1.00 long x 12.0 high x 1.00-1.20m wide
ORIENTATION: North-South
DESCRIPTION: This feature consists of two mounds along the same contour. These stacked cobbles and boulders appear to once been part of the same wall which may once have functioned as a water control feature. It is located at the eastern edge of a swale. A 9m long water-control wall is downslope of this feature but is outside the project corridor. Features G1-G3 are upslope and southeast of this feature.

FEATURE: H
TYPE: Wall CONDITION: Poor
ELEVATION: 41966.9ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.50-0.89 high x 9.40 long x 0.96m wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This retaining wall of stacked angular boulders and cobbles appears faced where it has not collapsed on its northeastern side. It is constructed on the eastern slope of a small hill.

FEATURE: I
TYPE: U-shape CONDITION: Fair
ELEVATION: 4192.5ft AMSL
FUNCTION: Storage/Temporary habitation?
DIMENSIONS: .35-1.30 high x 3.00 long x 2.40m wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This feature is just outside the project boundary on the west side downslope of a small ridge. Its interior is flat with scattered small boulders. Stacked small boulders make up its three sides. It faces two circular mounds at the bottom of a swale to the south which are also outside the project corridor.

A shovel test (TU8) revealed red cinders over a 6-9cm charcoal lens at 16-27cm below surface.

FEATURE: J1-J7
TYPE: Mounds CONDITION: Fair
ELEVATION: 4197.0-4203.8ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.40-1.00 high x 1.50-3.00 long x 2.00-2.50m wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This is a complex of seven mounds in a nearly square shape in an area of 16m square (52.5ft square). Feature J4, J5 and J6 are inter-connected by an alignment of boulders. The relatively flat area in between may have been used as a planting area. Feature L (wall) 7.5m (25ft) to the southwest may have functioned as a boundary wall.

A shovel test (TU 5) in the middle of the complex down to 62cm below surface did not yield any cultural material.

FEATURE: K1
TYPE: Mound CONDITION: Fair
ELEVATION: 4190.6ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.10-0.70 high x 5.7 long x 4.50 wide
ORIENTATION: North-South
DESCRIPTION: This five-sided polygon is located 12m (39.4ft) northwest of the complex of seven mounds. The area in between is relatively flat and may have been used as a planting area. Southwest of this feature, an outcrop has been modifed with small mounds along its eastern edge (Feature K2).

A shovel test (TU4) 4m (13ft) northwest in a relatively flat area did not yield any cultural material. This area may have functioned as a planting area.

FEATURE: K2
TYPE: Modified outcrop CONDITION: Poor
ELEVATION: 3988.8-4195.7ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.88 high x 1.29 long x 1.05 wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This feature consists of two small mounds of stacked boulders, cobbles and pebbles along the eastern edge of an outcrop. These may be clearing mounds or remnants of what was once a retaining wall. It is located southwest of Feature K1 and northwest of the J mound complex.

FEATURE: L
TYPE: Wall CONDITION: Good
ELEVATION: 4197.3-4207.4ft AMSL
FUNCTION: Boundary marker
DIMENSIONS: 0.15-1.00 high x 37.00 long x 0.30-1.00 wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This stacked boulder and cobble core-filled wall consists of two parts separated by about 10m (33ft) along the southern slope of a small ridge. Most of the northern side is intact but part of the southern side is tumbled. A trail crosses the eastern wall. This feature is perpendicular to Feature M.

FEATURE: M
TYPE: Wall CONDITION: Good
ELEVATION: 4196.5ft AMSL
FUNCTION: Water control
DIMENSIONS: 0.40-1.20 high x 10.0 long x 0.50-1.00m wide
ORIENTATION: North-South
DESCRIPTION: This wall is at the eastern edge of a swale south of a probable boundary wall (Feature L). This seven-course stacked boulders and cobbles, core-filled wall appear to have functioned as a water control device. Further downslope in the swale are two other walls (Features O, Q) which appeared to have had similar functions.

A shovel test upslope of this feature did not yield any cultural material.

FEATURE: N
TYPE: Wall CONDITION: Fair
ELEVATION: Approximately 4188ft AMSL
FUNCTION: Unknown
DIMENSIONS: 0.95-1.05 high x 4.25 long x 1.00 wide
DESCRIPTION: This stacked boulder and cobble core-filled seven-course wall appears to be of similar construction as Feature M. This feature, however, is perpendicular to Feature M.

FEATURE: O1
TYPE: Wall CONDITION: Good
ELEVATION: 4186.4ft AMSL
FUNCTION: Water control
DIMENSIONS: 0.05-1.30 high X 19.0 long X 1.00m wide
ORIENTATION: North-South
DESCRIPTION: A 4-7 courses stacked pebble, cobble and boulder, core-filled wall is located in a small swale west of Features L and M. Its locations suggest a water control function.

FEATURE: O2
TYPE: Mound CONDITION: Fair
ELEVATION: Approximately 4186.0ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.30-0.50 high x 1.4 long x 0.86m wide
ORIENTATION: North-South
DESCRIPTION: This is a small mound about 6m south of Feature O wall. It is constructed of piled cobbles and a boulder. It was probably a clearing mound.

FEATURE: P
TYPE: Wall with mound CONDITION: Poor
ELEVATION: 4185.5ft AMSL
FUNCTION: Unknown
DIMENSIONS: Wall 0.25-1.00 high x 6.0 long x 0.50-1.50 wide
Mound 0.90-1.00 high x 3.00 long x 2.25 wide
ORIENTATION: North-South
DESCRIPTION: This feature consists of a wall with a mound on its southern end. The wall, constructed of stacked small boulders and cobbles, is collapsed on the eastern side. Kikuyu grass covers the wall. The mound is constructed of piled small boulders and cobbles.

FEATURE: Q
TYPE: Wall CONDITION: Good
ELEVATION: 4181.9-4179.6ft AMSL
FUNCTION: Retaining wall for terrace.
DIMENSIONS: Approximately 10.5m of southern end is in project area. Rest of 35.75m is outside of project corridor.
ORIENTATION: North-South
DESCRIPTION: Most of this feature lies outside the project corridor. This S-shaped wall retains a terrace 8-10m wide eastward. Feature O wall is upslope (east) and Feature P near the south end. There is an unusual amount of rocks between Features O, O-2 and P but it was not mapped because neither its boundaries or probable function could be ascertained.

FEATURE: R
TYPE: Wall CONDITION: Fair
ELEVATION: 4179.5-4180.2ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.80 high x 55.0 long x 0.30-1.00 wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This feature is a slope retaining wall on the east end becoming a retaining wall for a terrace at the western end, at the base of the northeastern slope of a small ridge. The terrace is approximately 6m square with an alignment delineating its southeastern end. Standing 1-3 courses high, the wall is constructed of stacked boulders and cobbles, collapsed in some places and totally missing in others. A horse trail runs downslope atop the ridge. Features S and T are upslope and south of this feature.

A shovel test (TU7) to 70cm below surface on the terrace did not yield any significant cultural material.

FEATURE: S
TYPE: Wall CONDITION: Poor
ELEVATION: 4197.3-4184.8ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.90 high X 35.0 long X 0.40-0.60m wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This is a slope retaining wall above Feature R and below Feature T on the northern slope of a small ridge. This feature consists of several collapsed remnant pieces of piled cobbles and boulders 1-5 courses high. A horse trail winds its way down westward.

FEATURE: T
TYPE: Alignment CONDITION: Poor
ELEVATION: 4191.0-4200.7ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.35 high x 36.0 long x 1.00 wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This is an alignment of tumbled boulders near the top of the northern slope of a small ridge above Features R and S. It may once have been a retaining wall or may just be rocks tossed here during clearing. A horse trail winds downlope westward.

FEATURE: U
TYPE: Modified outcrop CONDITION: Poor
ELEVATION: 4191.9-4201.3ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.45-0.88 high x 42.6 long x 1.00m wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: An outcrop has been modified by the linear piling of boulders, cobbles and pebbles along the southwestern base of a small ridge facing Feature V. It

continues outside the project corridor and turns northward following the ridge base. It was probably constructed by rocks tossed during ground clearing in preparation for planting.

FEATURE: V
TYPE: Modified outcrop with a U-shape.
CONDITION: Poor
ELEVATION: 4186.5-4193.6ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.45-0.88 high x 41.6 long x 1.00 wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: An outcrop at the northern base of a small ridge has been modified by a linear piling of boulders, cobbles and pebbles tossed here while clearing the swale floor. Feature V faces Feature U across the swale.

At the western end of this feature is a U-shape. The interior measures 2.0m wide with its back wall 1.00m high. The eastern arm is 2 courses high by 1.40m long; the western arm is 1 course high by 1.25m long. It was constructed of stacked cobbles and boulders.

FEATURE: W1
TYPE: Mound **CONDITION:** Fair
ELEVATION: 4209.9ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.65-0.90 high x 4.0 long x 3.00 wide
ORIENTATION: Northwest-Southeast
DESCRIPTION: This is a rectangular shaped mound in a shallow swale sloping slightly to the west. Three sides are faced, the fourth (west) is tumbled. This is constructed of stacked cobbles and boulders 2-5 courses high. The closest features (W2,W3) are 11.5m and 15m respectively to the south.

This feature is along the western boundary of the project corridor.

FEATURE: W2
TYPE: Mound **CONDITION:** Fair
ELEVATION: 4214.1ft AMSL
FUNCTION: Unknown
DIMENSIONS: 0.20-1.20 high x 2.60 long x 2.00 wide
ORIENTATION: Southwest-Northeast
DESCRIPTION: This is a rectangular shaped mound constructed of cobbles piled on top of boulders in 3-6 courses in a shallow swale sloping slightly to the west. The southwest and northeast sides are tumbled. W1 is 11.5m to the north, W3 10m to the west.

FEATURE: W3
TYPE: Mound CONDITION: Fair
ELEVATION: 4211.1ft AMSL
FUNCTION: Unknown
DIMENSIONS: 0.20-0.80 high x 2.00 long x 1.50 wide
ORIENTATION: East-West
DESCRIPTION: This is a rectangular shaped mound of piled boulders 2-5 courses on the south side of a shallow swale sloping slightly to the west. It is 10m west of W2 and 15m southwest of W1.

FEATURE: X1, X2
TYPE: Mound CONDITION:
ELEVATION: 4206.1ft, 4205.5ft AMSL
FUNCTION: Agricultural
DIMENSIONS: 0.10-1.00 high x 1.00-2.50 long x 1.00-1.50 wide
ORIENTATION: East-West
DESCRIPTION: Feature X1 is an amorphous shaped mound of piled small boulders and cobbles on the southern slope of a small ridge. This is probably a clearing mound. It is 12m northwest of X2.

Feature X2 is a pile of boulders about a meter square which is probably a clearing mound. It is downslope and east of X1 and west of X3.

FEATURE: X3
TYPE: Alignment CONDITION: Fair
ELEVATION:
FUNCTION: Unknown
DIMENSIONS: 0.30 high x 3.25 long x 0.50m wide
ORIENTATION: Southwest-Northeast
DESCRIPTION: This is an alignment of small boulders on the western slope of a small ridge east of X1 and X2. This is the southernmost feature in Site 4160.

Four more mounds along the northern slope of a small ridge is to the southwest of Feature X3 but are outside of the project corridor. They are either clearing mounds or remnants of a slope retaining wall.

APPENDIX B

Upcountry Maui Watershed Project
Site 4162 Land bridge
TU1 Soil profile West face

0 10 20

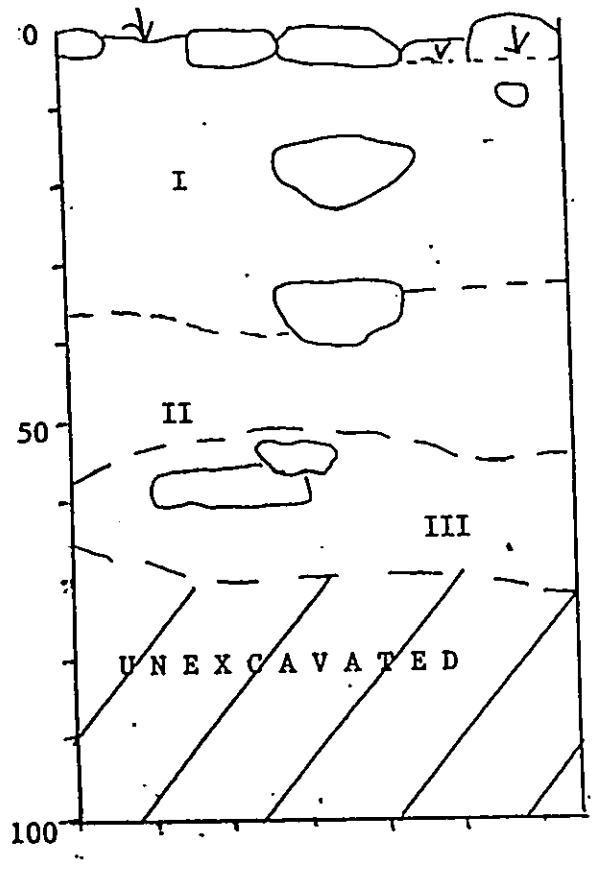
KEY

surface

boundaries

I layer

cobbles, small boulders



Layer	cmbd	Soil description
I	0-34	7.5YR 2.5/2, loam, weak subangular blocky, common very fine roots, friable, non-sticky, non-plastic, isolated non-human bone
II	34-58	7.5YR 3/2, loam, fine subangular blocky, less fine roots, friable, non-sticky, non-plastic, larger cobbles
III	55-87	7.5YR 3/3, loam, fine subangular blocky, cobbles, few roots, friable, non-sticky, non-plastic

B-76

B-1

pcountry Maui Watershed Project
ite 4162 Old Road Bed
U2 Soil profile West face

0 10 20

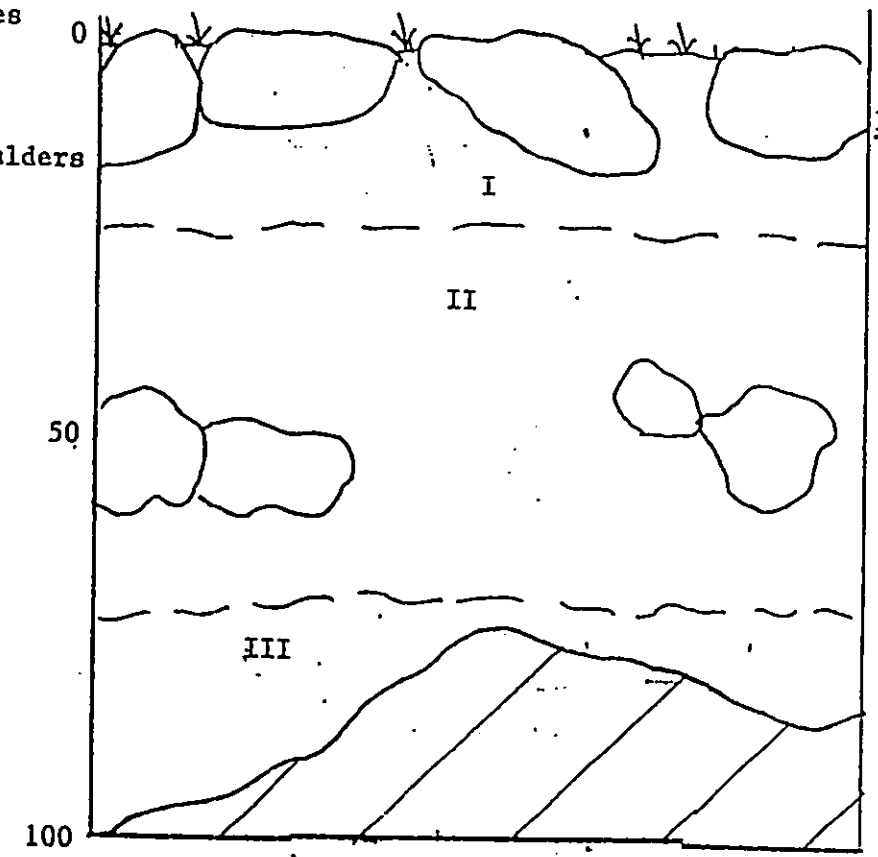
KEY

surface

boundaries

I layer

cubbles, small boulders



Layer	cmbd	Soil description
I	0-25	10YR 3/2, loam, weak subangular blocky, moderately few fine roots, friable, non-sticky, non-plastic, 5% gravel
II	25-75	10YR 4/4, loam, weak subangular blocky, very few roots, friable, non-sticky, non-plastic, 5% gravel
III	75-100	10YR 3/2, mottled, loam, weak subangular blocky, no roots, friable, non-sticky, non-plastic, 5% gravel

country Maui Watershed Project
te 4161 Earthen
3 Soil profile West face

0 10 20cm

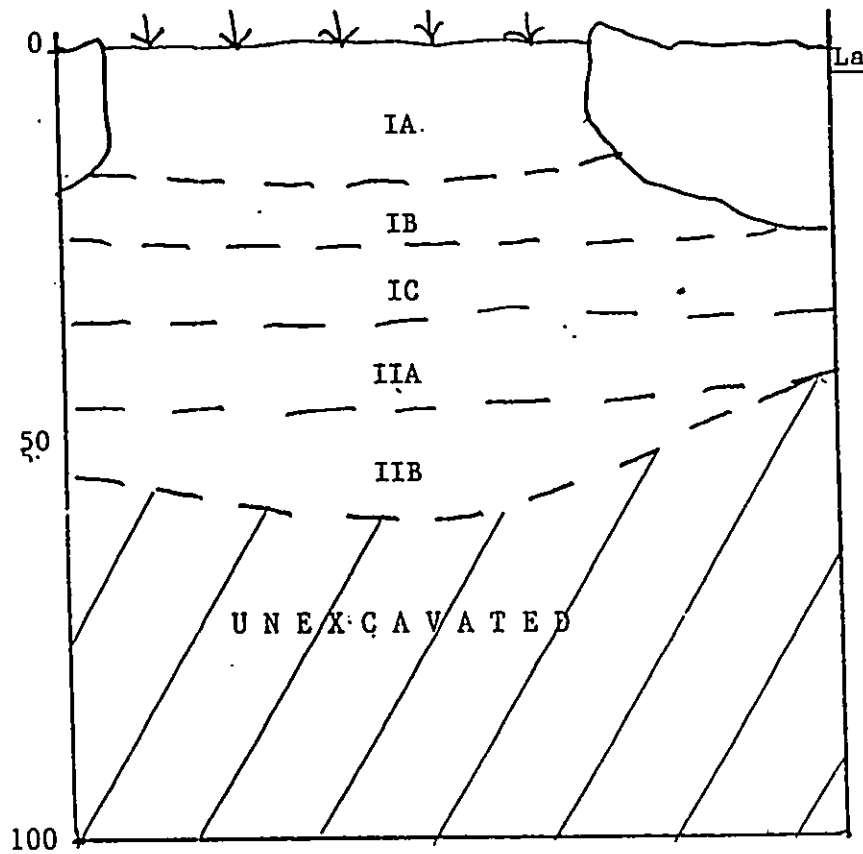
KEY

surface

boundaries

I layer

A level



Layer	cmbd	Soil description
IA	0-17	10YR 3/2, sandy loam, weak subangular blocky, very few very fine roots, friable, non-sticky, non-plastic
IB	17-23	10YR 3/1, sandy loam, slightly mottled, moderate subangular blocky, very few very fine roots, friable, non-sticky, non-plastic, more compacted, mottled
IC	23-34	7.5YR 3/3, loam, weak medium subangular blocky, few very fine roots, friable, non-sticky, non-plastic, mottled
IIA	34-45	7.5YR 3/2, loam, weak medium subangular blocky, few very fine roots, friable, non-sticky, non-plastic, charcoal flecks at 37cmbs
IIB	45+	7.5YR 3/2, loam, weak medium subangular blocky, few roots, non-sticky, non-plastic

B-78

B-3

pcountry Maui Watershed Project
ite 4160 TU4 in planting area NW of
Feature K1
oil profile South face

0 10 20cm

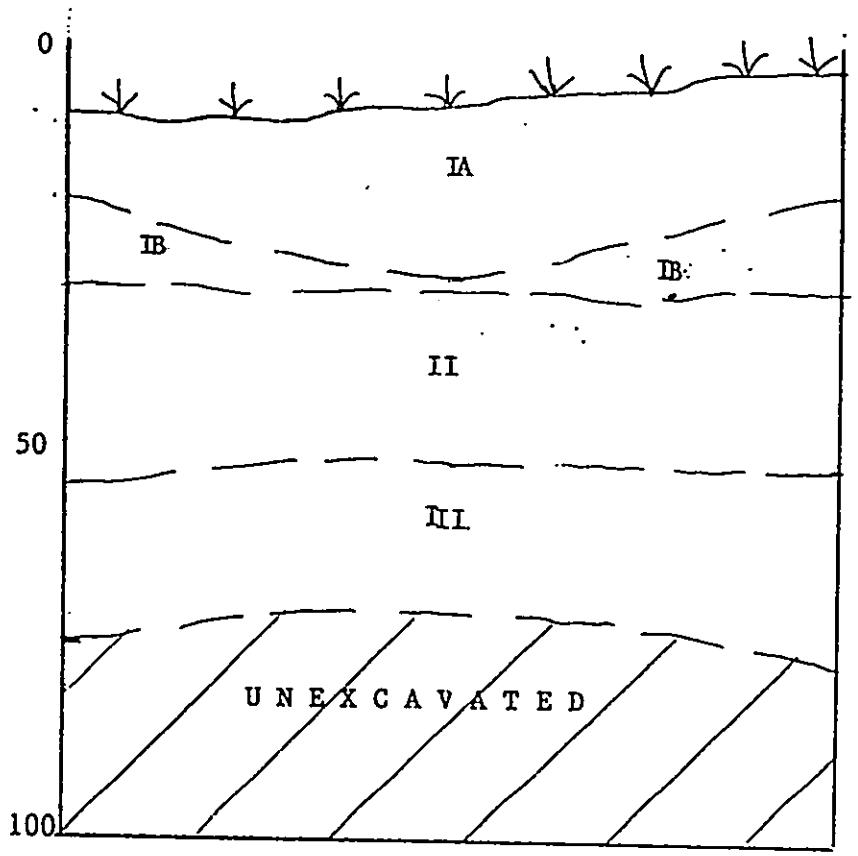
KEY

surface

boundaries

I layer

A level

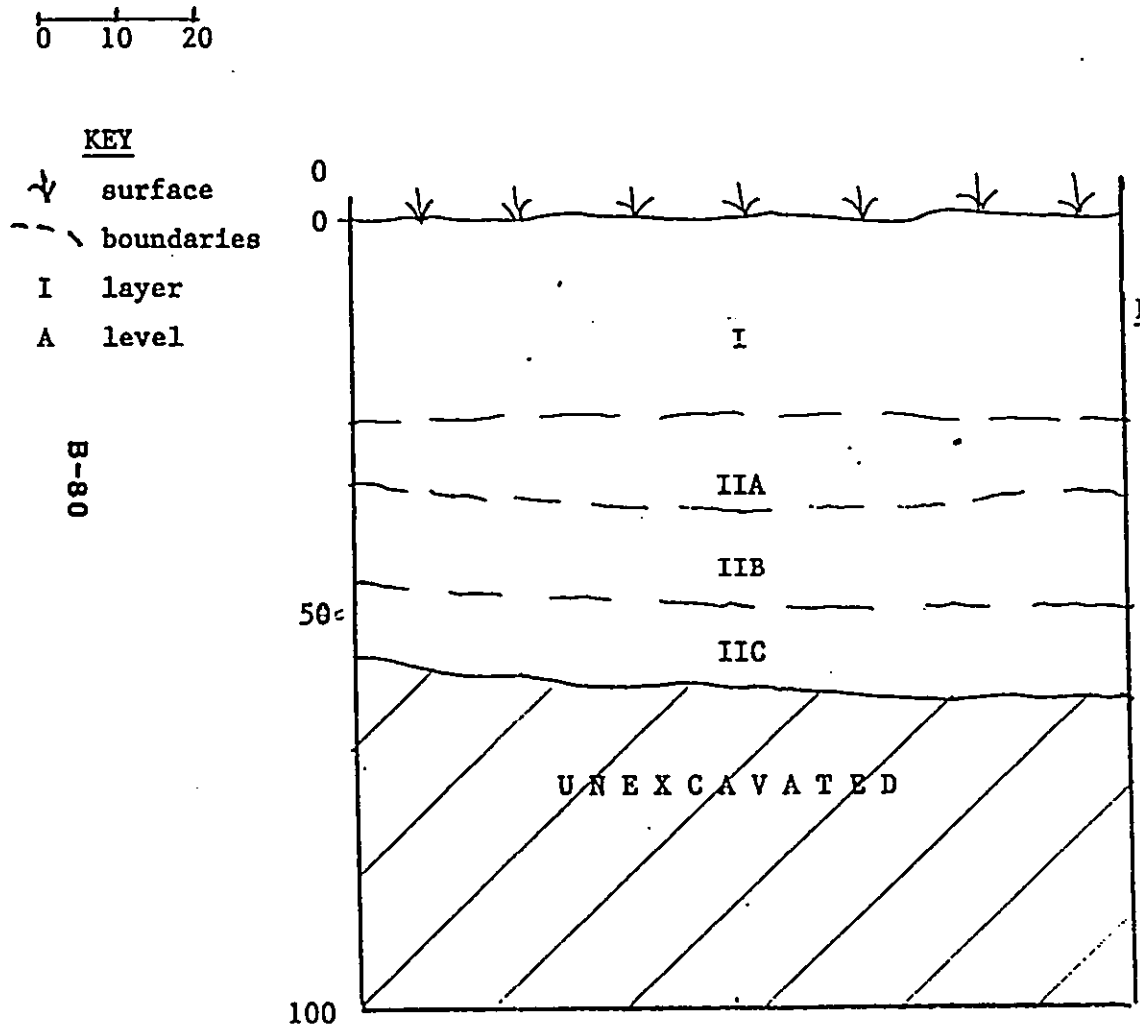


Layer	cmbd	soil description
IA	0-16	10YR 3/1, loam, weak medium subangular blocky, common very fine roots, friable, non-sticky, non-plastic, 5-10% gravel
IB	16-33	10YR 3/1, loam, weak medium subangular blocky, very few very fine roots, friable, non-sticky, non-plastic, 5-10% gravel
II	33-48	10YR 3/1, loam, moderate medium subangular blocky, common very fine roots, friable, non-sticky, non-plastic, 5% gravel
III	48-76	10YR 4/3, loam, moderate medium subangular blocky, common very fine roots, friable, slightly-sticky, slightly-plastic

B-79

B-4

pcountry Maui Watershed Project
ite 4160 T05 in center of mound complex
Feature J
oil profile East face

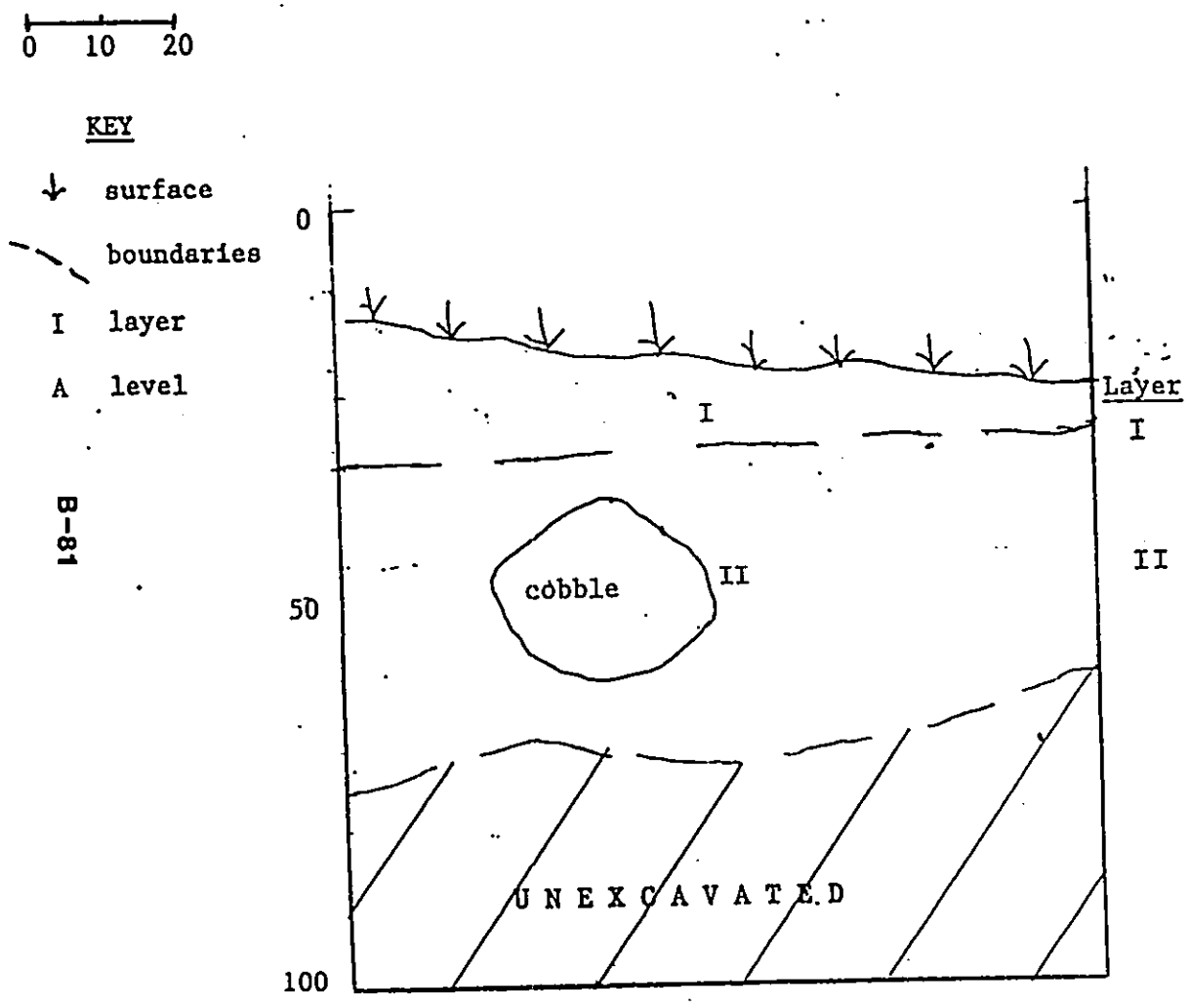


Layer	cmbd	Soil Description
I	0-26	10YR 3/1, loam, 5-10% gravel, moderate subangular blocky, common very fine roots, friable, non-sticky, non-plastic
IIA	26-30	10YR 3/1, loam, moderate subangular blocky, very few very fine roots, friable, non-sticky, non-plastic
IIB	30-49	10YR 3/1, loam, moderate subangular blocky, few very fine roots, friable, non-sticky, non-plastic
IIC	49+	10YR 3/1, loam, moderate subangular blocky, common very fine roots, friable, non-sticky, non-plastic

B-80

B-5

Upcountry Maui Watershed Project
Site 4160 Feature M N-S wall
SU 6 Soil profile West face

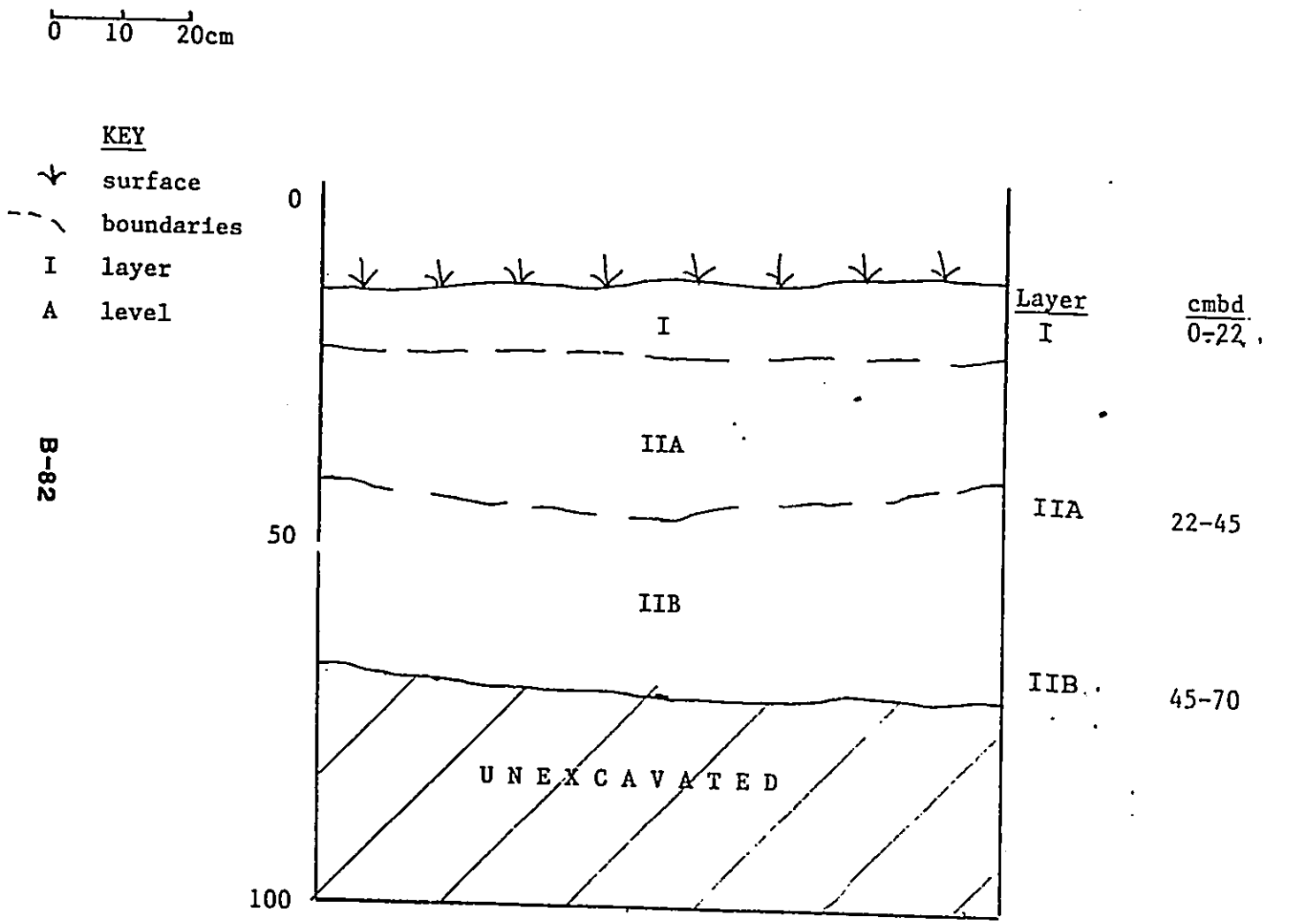


Layer	cmbd
I	0-33
II	33-75

Soil Description

10YR 3/1, loam, moderate subangular blocky, very few coarse, friable, non-sticky, non-plastic
10YR 3/2, cobbly loam, moderate subangular blocky, very few very fine roots, non-sticky, non-plastic

Upcountry Maui Watershed Project
Site 4160 Feature R Terrace
TU 7 Soil Profile East face



Layer	cmbd	Soil Description
I	0-22	10YR 2/1, cobbly loam, moderate subangular blocky, common very fine-medium roots, friable, slightly-sticky, slightly-plastic
IIA	22-45	10YR 2/2, cobbly loam, moderate subangular blocky, very few very fine-fine roots, friable, slightly-sticky, slightly-plastic
IIB	45-70	10YR 2/2, cobbly loam, moderate subangular blocky, few very fine roots, friable, slightly-sticky, slightly-plastic

APPENDIX C

APPENDIX C

The following information is from Brown et al 1989.

Site 2093 (K-80, T-46) was probably a historic period ranch wall. No further data collection is necessary (1989: Table 7).

Site 2091 (K-78) is northeast of site 2089 along the existing roadway (Figure 4). A probable religious/habitation/agicultural complex of terraces, enclosures and a platform, it has high research, interpretive and cultural resource managemement value. It yet needs to be recorded in detail, surface artifacts collected and test excavated. It is an excellent example of a site type and is culturally significant. Recommended general treatment is preservation with some level of interpretive development recommended (1989: Table 7)

Site 2050 (K-8), a habitation/agricultural complex of three enclosures was assessed to be important for information content and further data collection necessary (1989: Table 7). It is of moderate value for cultural resource management and of low interpretive and cultural value (1989:B-2).

Site 2089 (K-71) is a probable burial/habitation site with medium to high scientific research and a low to high cultural resource management value. It is located adjacent to and east of the existing roadway (Figure 4). Further data collection is necessary to determine its cultural value and preservation status (1989: Table 7).

Site 2088 (K-70, T-27), an agricultural terrace, was assessed to be of moderate value for cultural resource management and of low interpretive and cultural value (1989:B-2). Further data collection is necessary (1989: Table 7).

Near the southern entrance of the existing roadway going *makai*, a complex of terraces in parcels 6,15 and 16, cross the road (Figure 4). These have no site number. They were considered to be "minor agricultural features" (1989:16) whose distribution were plotted and are "referred to in the records of formally recorded sites as being present in the site area" (1989:16).

Olinda-Kula Soil and Water Conservation District

P.O. Box 818
Wailuku, HI 96793
April 10, 1996

Mr. Kenneth Kaneshiro, State Conservationist
USDA - Natural Resources Conservation
P.O. Box 50004
Honolulu, HI 96850

Dear Mr. Kaneshiro:

The Olinda-Kula Soil and Water Conservation District has reviewed the plans for the Upper Kula agricultural water system as contained in the Upcountry Maui Watershed Plan and Environmental Impact Statement. The District and others represented on the Steering Committee are still committed to providing adequate agricultural water to all farmers in the Kula area while reducing withdrawal from the Wailoa Ditch.

Although the proposed plan improves the water situation for farmers in Upper Kula it does little for the farmers in Lower Kula. We recognize that the second phase of planning and implementing an agricultural water system in Lower Kula, using the PL83-566 program, will take many years. In the meantime, commercial farmers in Lower Kula will continue to suffer with an uncertain water situation which reduces their competitiveness in the marketplace.

To ease the irrigation needs of the Lower Kula farmers, we feel that agricultural water should be transferred from the Upper Kula line to the lower line during periods of plentiful water supply.

The District proposes an extension of a lateral from the upper to lower line to allow future development of storage and distribution facilities. When the PL83-566 project for Lower Kula is implemented, the pipeline can be used to connect the two agricultural water systems.

Thank you for your consideration of our request.

Sincerely,

Paul Otani
Chairman

APPENDIX C

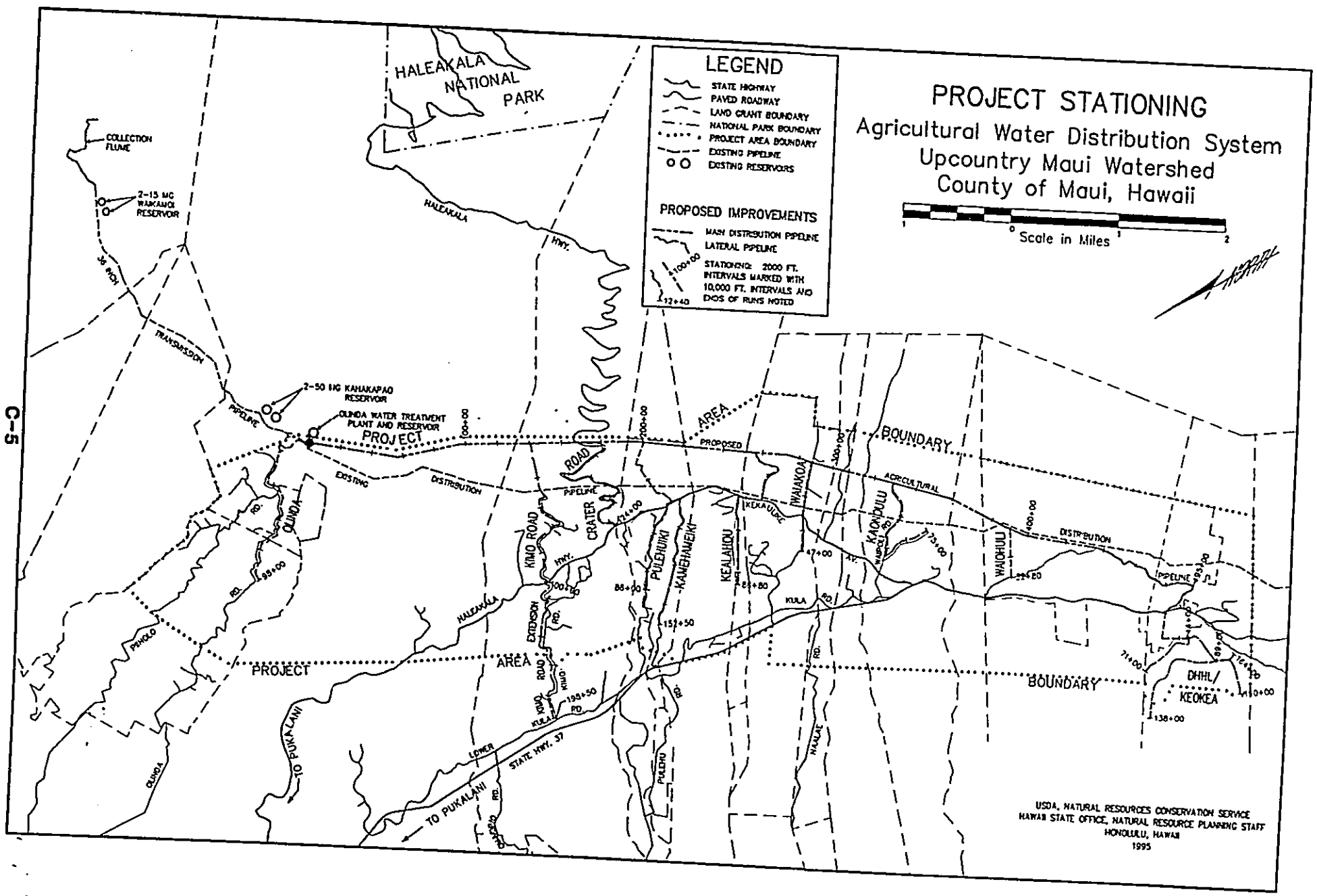
SUPPORTING MAPS

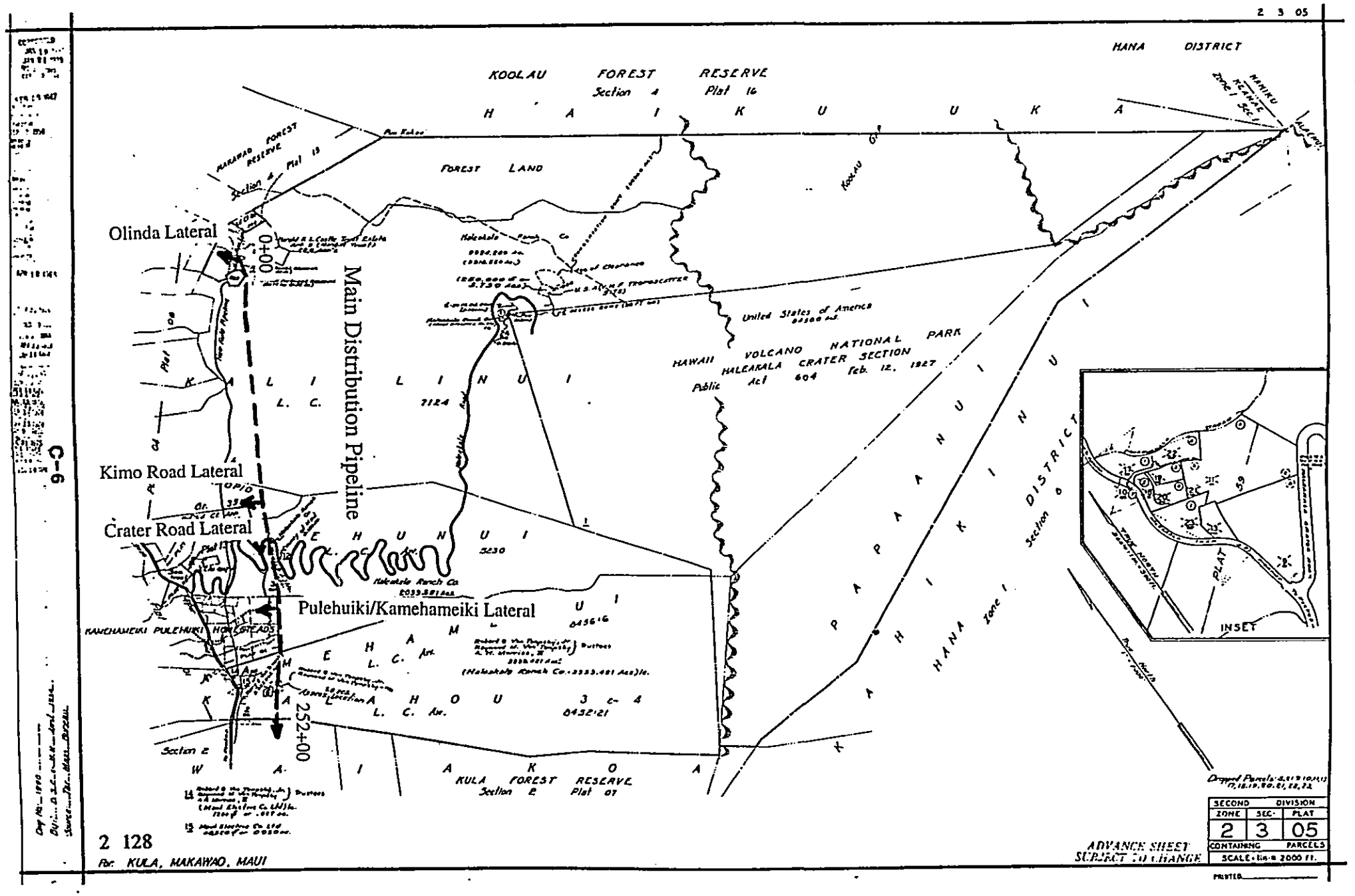
APPENDIX C - SUPPORTING MAPS

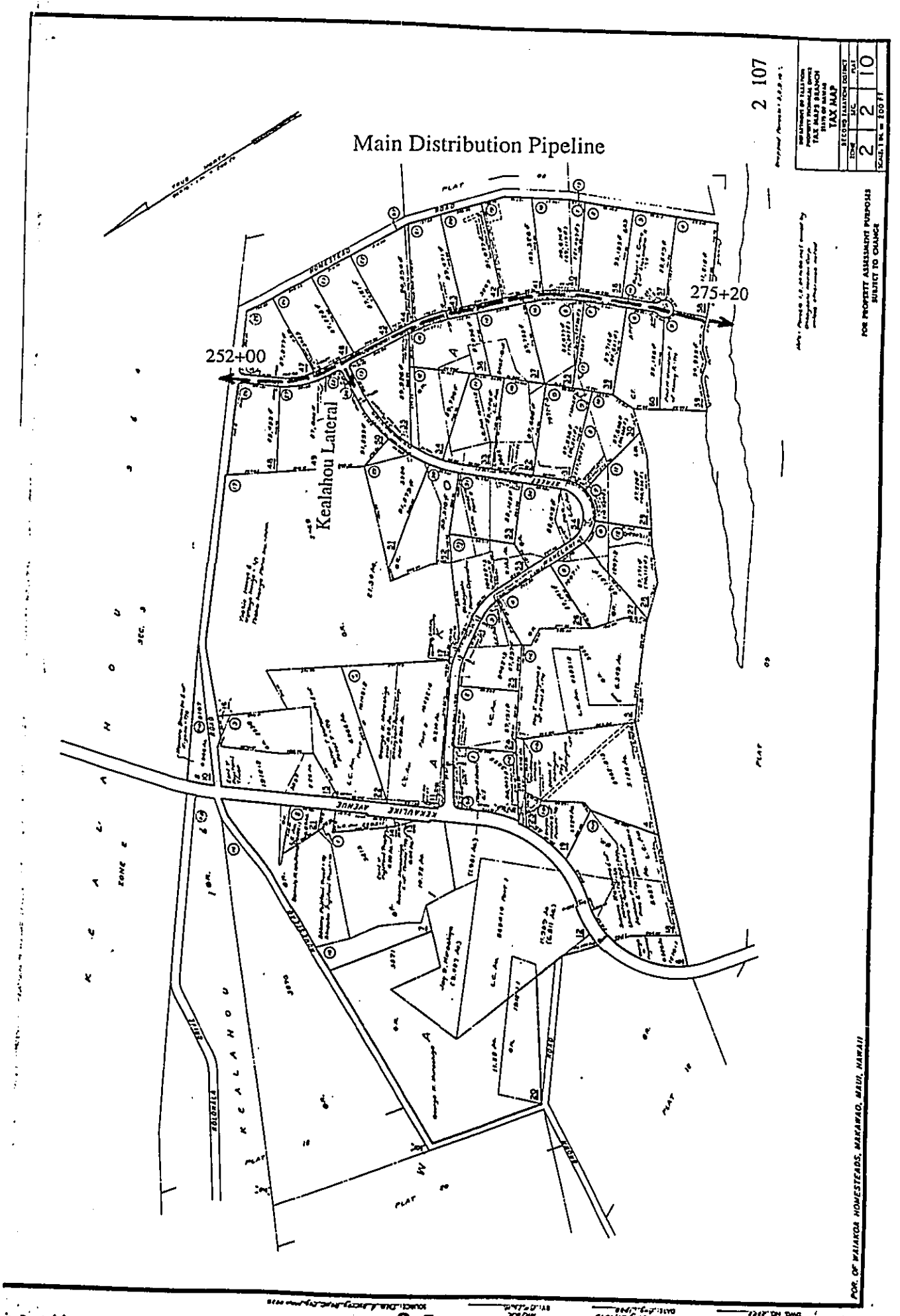
UPCOUNTRY MAUI WATERSHED DISTRIBUTION PIPELINE

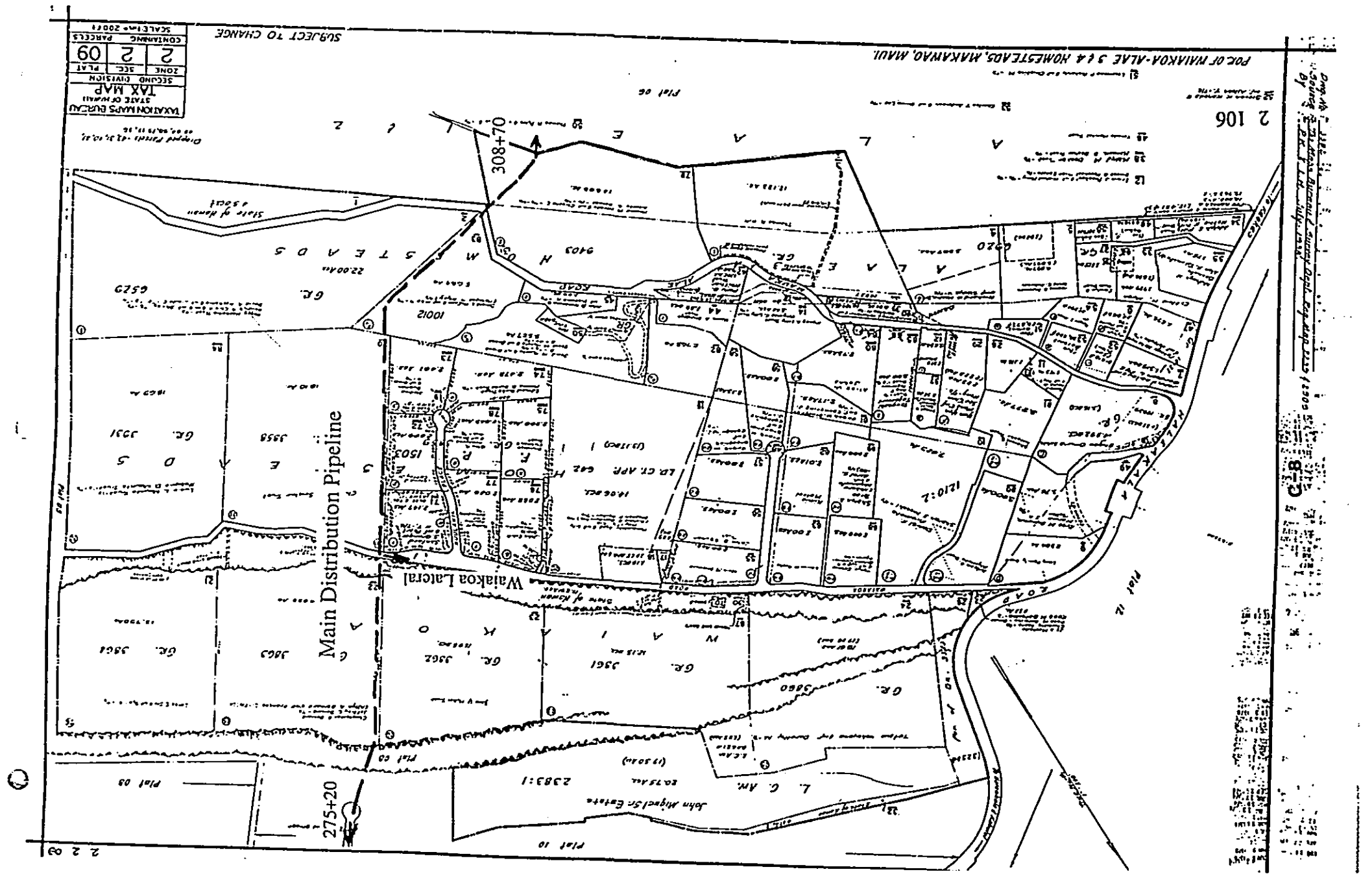
REACH	LENGTH	TMK	OWNER 1/
Main distribution line			
0+00 to 165+00	16500	2-3-05-4	Haleakala Ranch
165+00 to 165+80	80		Haleakala Crater Road
165+80 to 222+00	5620	2-3-05-3	Haleakala Ranch
222+00 to 252+00	3000	2-3-05-2	Von Tempsky
252+00 to 252+20	20		Homestead Road
252+20 to 273+60	2140		Ululani Street
273+60 to 275+20	160	2-2-10-59	Ohbayashi
275+20 to 276+70	150	2-2-08-2	State of Hawaii
276+70 to 285+20	850	2-2-09-22	Bernard
285+20 to 286+00	80	2-2-09-30	State of Hawaii
286+00 to 286+20	20		Waiakoa Road
286+20 to 296+80	1060	2-2-09-20	Lufkin Trust
296+80 to 305+00	820	2-2-09-15	Harada
305+00 to 305+20	20		Alae Road
305+20 to 308+70	350	2-2-09-79	Haw'n Securities and Realty
308+70 to 322+70	1400	2-2-06-32	Kaonoulu Ranch
322+70 to 323+00	30		Kula Forest Res. Road
323+00 to 338+00	1500	2-2-06-9	Kaonoulu Ranch
338+00 to 343+50	550	2-2-06-100	Var.
343+00 to 352+50	950	2-2-06-58	Thurber
352+50 to 374+50	2200	2-2-06-9	Kaonoulu Ranch
374+50 to 495+00	12050		Middle Road
Olinda Lateral			
0+00 to 21+00	2100	2-3-05-4	Haleakala Ranch
21+00 to 98+00	7700		Olinda Road
Kimo Road Lateral			
0+00 to 7+00	700	2-3-05-4	Haleakala Ranch
7+00 to 25+00	1800	2-3-21-1	Ventura
25+00 to 102+00	7700		Kimo Road
102+00 to 103+50	150		Haleakala Hwy.
103+50 to 123+50	2000		Kimo Road
123+50 to 190+50	6700		Kimo Road
190+50 to 193+50	300		Lower Kula Road
193+50 to 197+50	400	2-3-18-16	Agena-Road Parcel
197+50 to 198+50	100		Kula Highway
Crater Road Lateral			
0+00 to 124+00	12400		Haleakala Crater Road

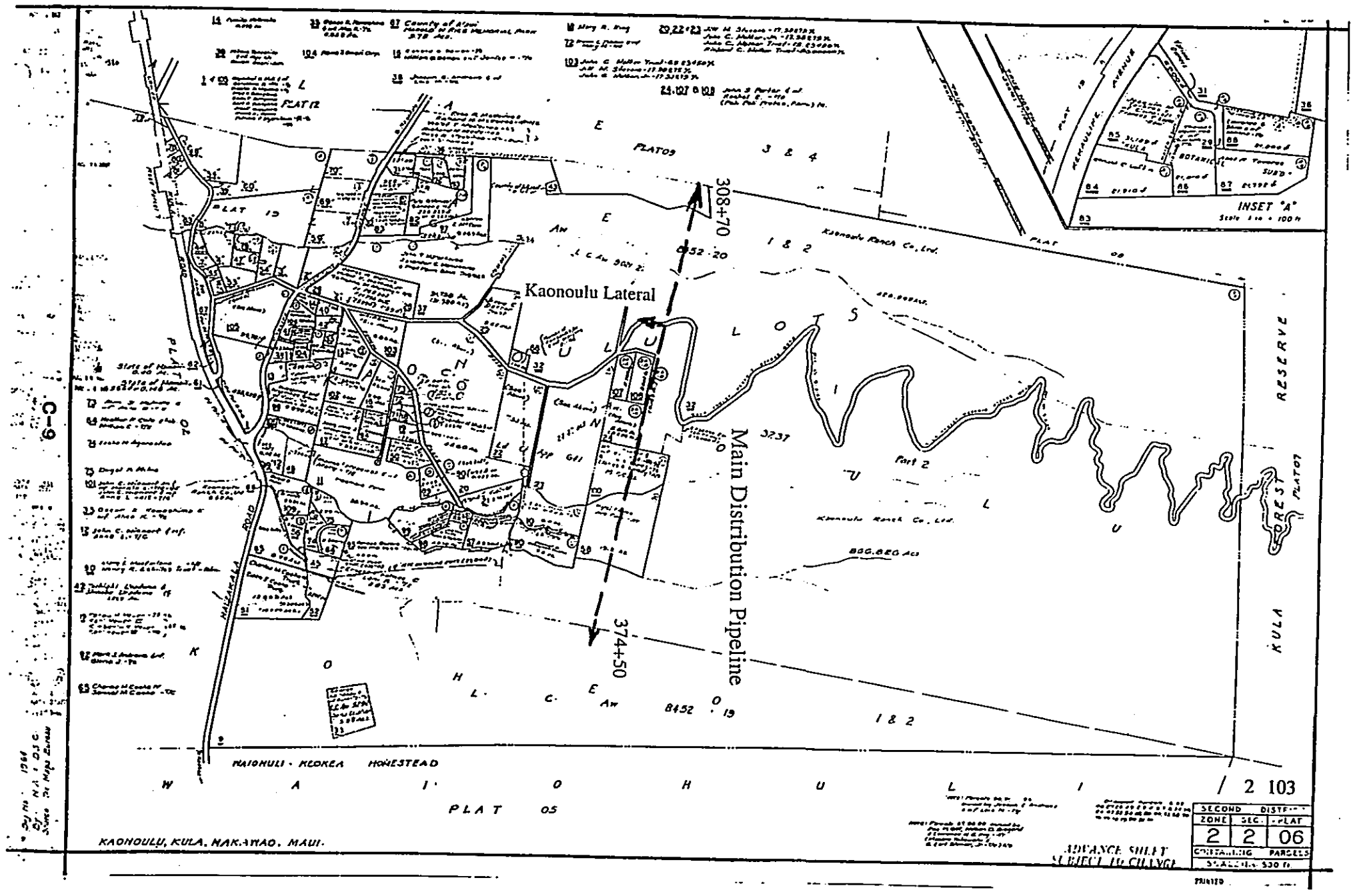
REACH	LENGTH	TMK	OWNER 1/
Pulehuiki/Kamehameiki Lateral			
0+00 to 5+20	520	2-3-39-1	Cooke
5+20 to 9+00	380	2-3-39-2	Woolaway (exist. easement)
9+00 to 13+00	400	2-3-39-10	Woolaway (exist. easement)
13+00 to 16+00	300	2-3-39-9	Holroyde (exist. easement)
16+00 to 39+80	2380		Hapapa Road
39+80 to 43+00	320		Kekaulike Hwy.
43+00 to 86+00	4300		Pulehuiki Road
86+00 to 90+50	450		Kekaulike Hwy.
90+50 to 152+50	6200		Kamehameiki Road
Kealahou Lateral			
0+00 to 32+00	3200		Wahelani Street
32+00 to 43+00	1100		Kekaulike Hwy.
43+00 to 70+00	2700		Kolohala Drive
70+00 to 72+80	280	2-2-18-8	Hanada
72+80 to 86+80	1400	2-2-11-33	State of Hawaii
Waiakoa Lateral			
0+00 to 33+00	3300		Waiakoa Road
33+00 to 34+50	150		Kekaulike Hwy.
34+50 to 47+00	1250		Baldwin Road
Kaonolu Lateral			
0+00 to 45+00	4500		Waipoli Road
45+00 to 75+00	3000		Kawehi Place
Waiohuli Lateral			
0+00 to 8+00	800	2-2-05-45	Wong
8+00 to 23+00	1500	2-2-05-42	Var.
23+00 to 23+30	30		Koheo Road
23+30 to 26+80	350	2-2-16-92	Wong
26+80 to 30+30	350	2-2-16-93	Zane
30+30 to 32+80	250	2-2-16-94	Zane
Keokea/DHHL Lateral			
0+00 to 20+00	2000		Kula Sanitorium Road
20+00 to 24+00	400		Kekaulike Hwy.
24+00 to 25+50	150	2-2-03-49	Seki (exist. easement)
25+50 to 31+00	550	2-2-03-54	Ichikawa (exist.easement)
31+00 to 36+00	500	2-2-03-48	Tanji
36+00 to 44+00	800	2-2-03-6	Tanji
44+00 to 164+00	12000		DHHL Agricultural lots

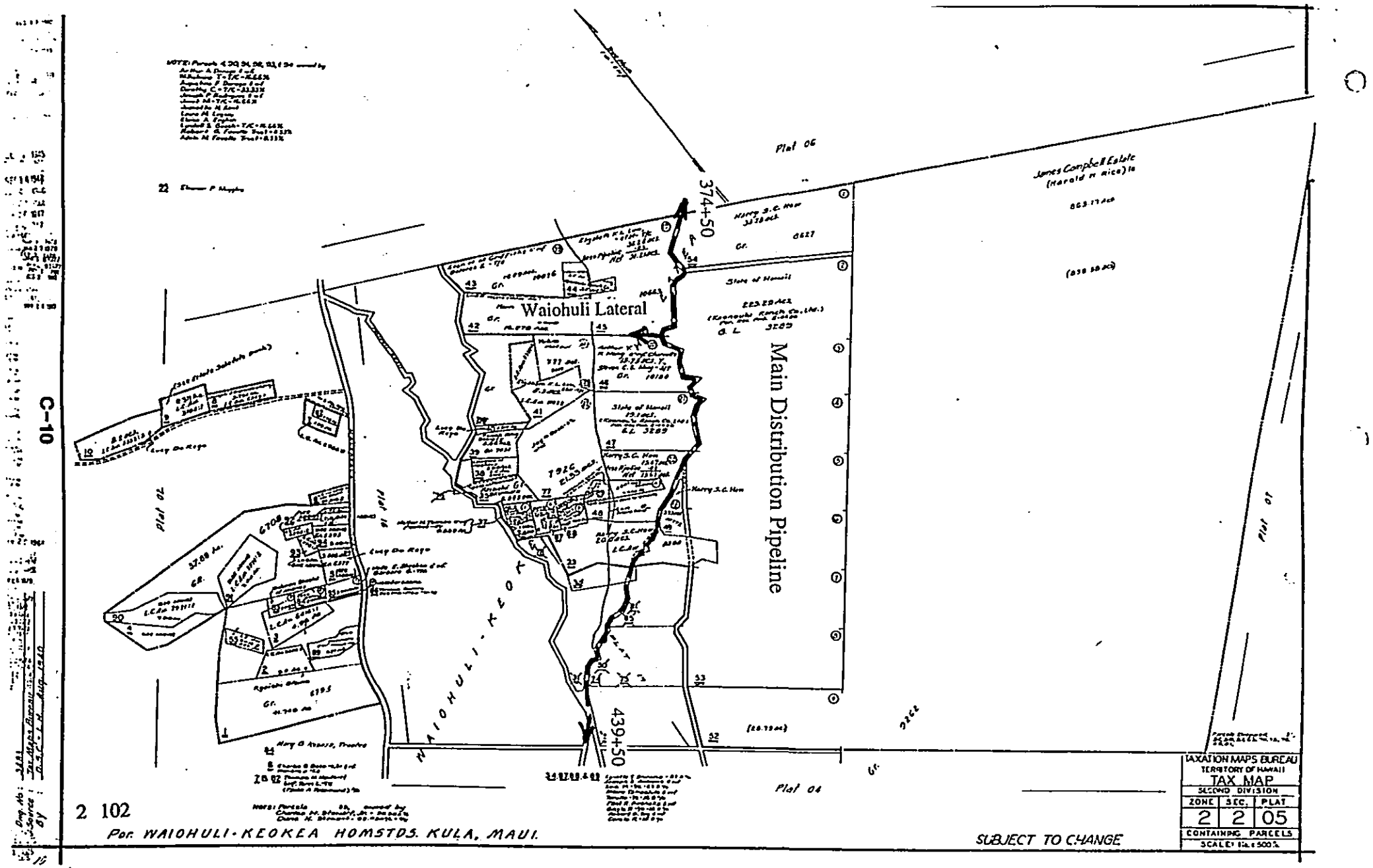

PROJECT STATIONING
Agricultural Water Distribution System
Upcountry Maui Watershed
County of Maui, Hawaii
Scale in Miles
LEGEND
STATE HIGHWAY
PAVED ROADWAY
LAND GRANT BOUNDARY
NATIONAL PARK BOUNDARY
PROJECT AREA BOUNDARY
EXISTING PIPELINE
EXISTING RESERVOIRS
PROPOSED IMPROVEMENTS
MAIN DISTRIBUTION PIPELINE
LATERAL PIPELINE
STATIONING: 2000 FT. INTERVALS MARKED WITH 10,000 FT. INTERVALS AND ENDS OF RUNS NOTED
HALEAKALA NATIONAL PARK
COLLECTION FLUME
2-15 MG WAKAMOI RESERVOIR
36" INCH TRANSMISSION PIPELINE
2-50 MG KAHAKAPAO RESERVOIR
OLINDA WATER TREATMENT PLANT AND RESERVOIR
PROJECT AREA BOUNDARY
EXISTING DISTRIBUTION PIPELINE
KIMO ROAD
CRATER ROAD
PULEHUIKI
KANEHAMEIKY
KEALAHOU
KEKAULIKE
KAONOULU
WAIOHULI
DHHL/ KEOKEA
OLINDA RD.
PIINOLO
HALEMAUA
KULA RD.
LOWER KULA RD.
TO PUKALANI
STATE HWY. 37
NAHALE
USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

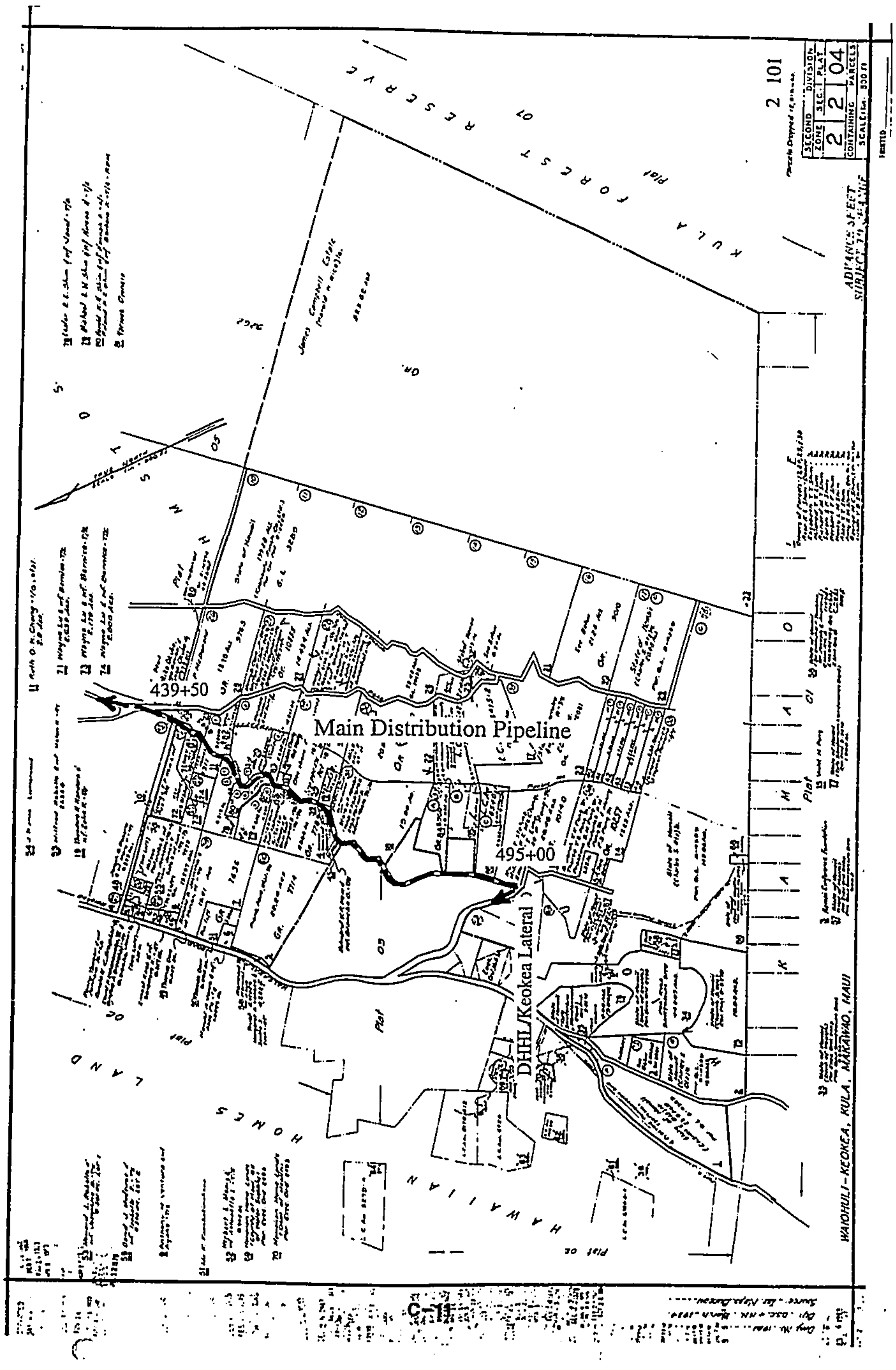

2 3 05
HANA DISTRICT
KOOLAU FOREST RESERVE
Section 4 Plat 16
H A I K U U K A
MANIKU KEANAE Zone 1 Sec 1
HALEAKALA
FOREST LAND
Olinda Lateral
0+00
Main Distribution Pipeline
United States of America
HAWAII VOLCANO NATIONAL PARK
HALEAKALA CRATER SECTION
Public Act 604 Feb. 12, 1927
K A L I L I N U I
L. C.
7124
Kimo Road Lateral
Crater Road Lateral
E H U N U I
3230
Pulehuiki/Kamehameiki Lateral
KAMEHAMEIKI PULEHUIKI HOMESTEADS
E H A M A
L. C. Aw.
A H O U
3 & 4
0432:21
252+00
Section 2
W A I A K O A
KULA FOREST RESERVE
Section 2 Plat 07
P A P A A N U I
A H I K I
HANA Zone 1 Section 6
INSET
PLAT 59
C-6
2 128
For KULA, MAKAWAO, MAUI
SECOND DIVISION
ZONE SEC. PLAT
2 3 05
CONTAINING PARCELS
SCALE 1in. = 2000 ft.
ADVANCE SHEET
SUBJECT TO CHANGE
PRINTED

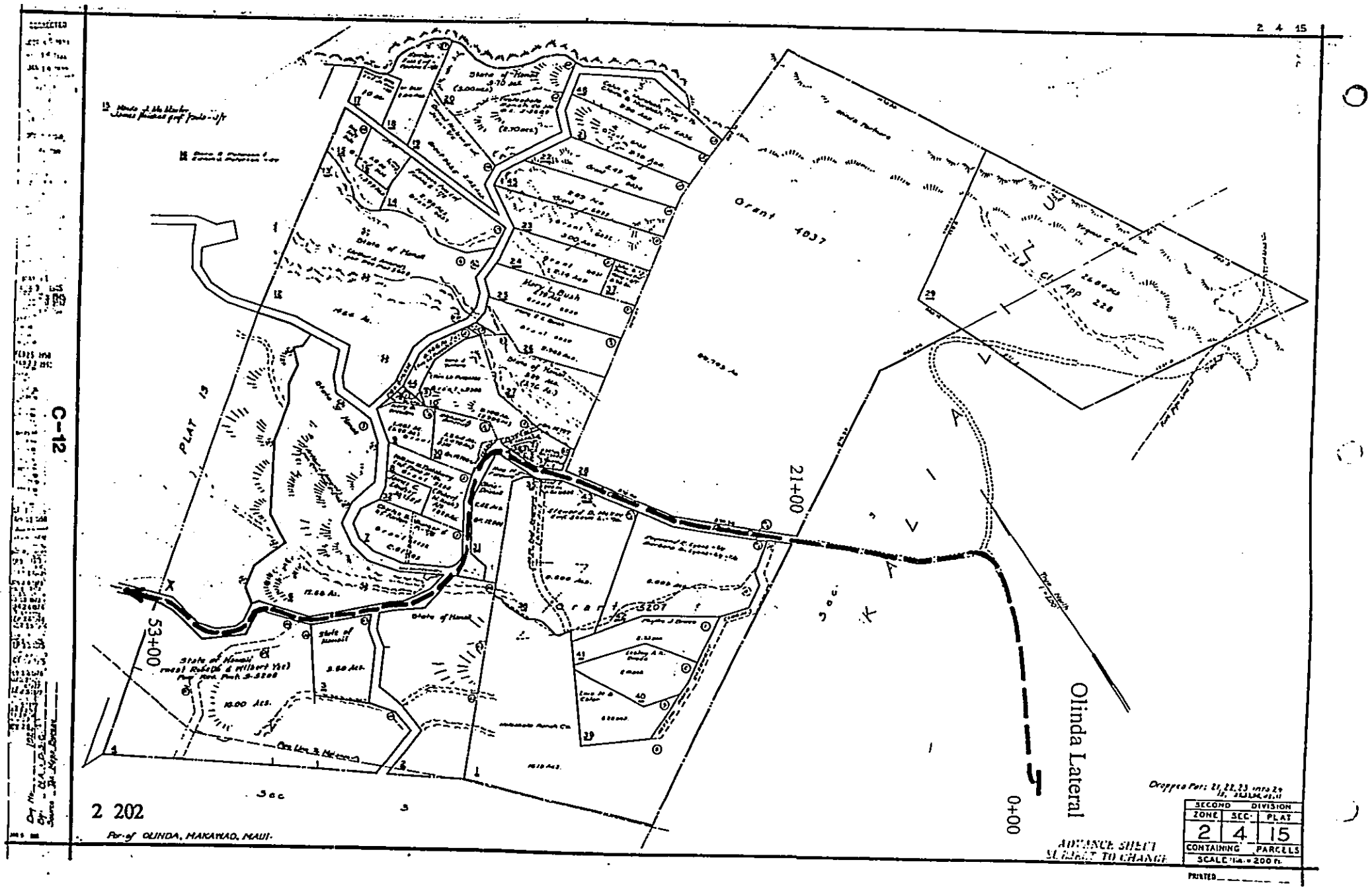

Main Distribution Pipeline
252+00
275+20
Kealahou Lateral
2 107
TAX MAP
KEALAHOU
FOR PROPERTY ASSESSMENT PURPOSES
SUBJECT TO CHANGE
FOR. OF WAIAKOA HOMESTEADS, MAKAWAO, MAUI, HAWAII

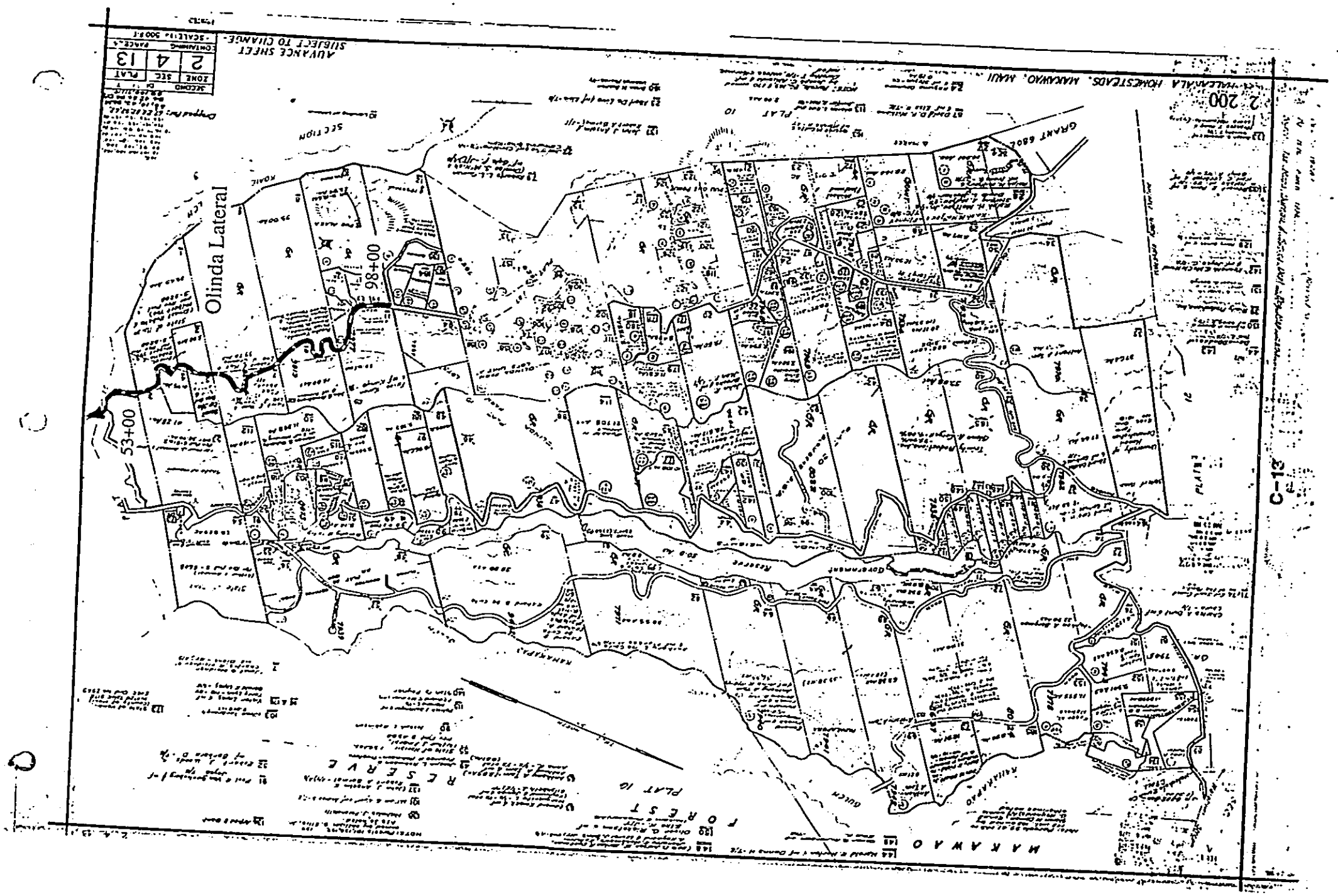

Main Distribution Pipeline
Waiakoa Lateral
308+70
275+20
SUBJECT TO CHANGE
POR. OF WAIAKOA-ALAE 3 & 4 HOMESTEADS, MAKAWAO, MAUI.
TAX MAP
2 106
2 2 09

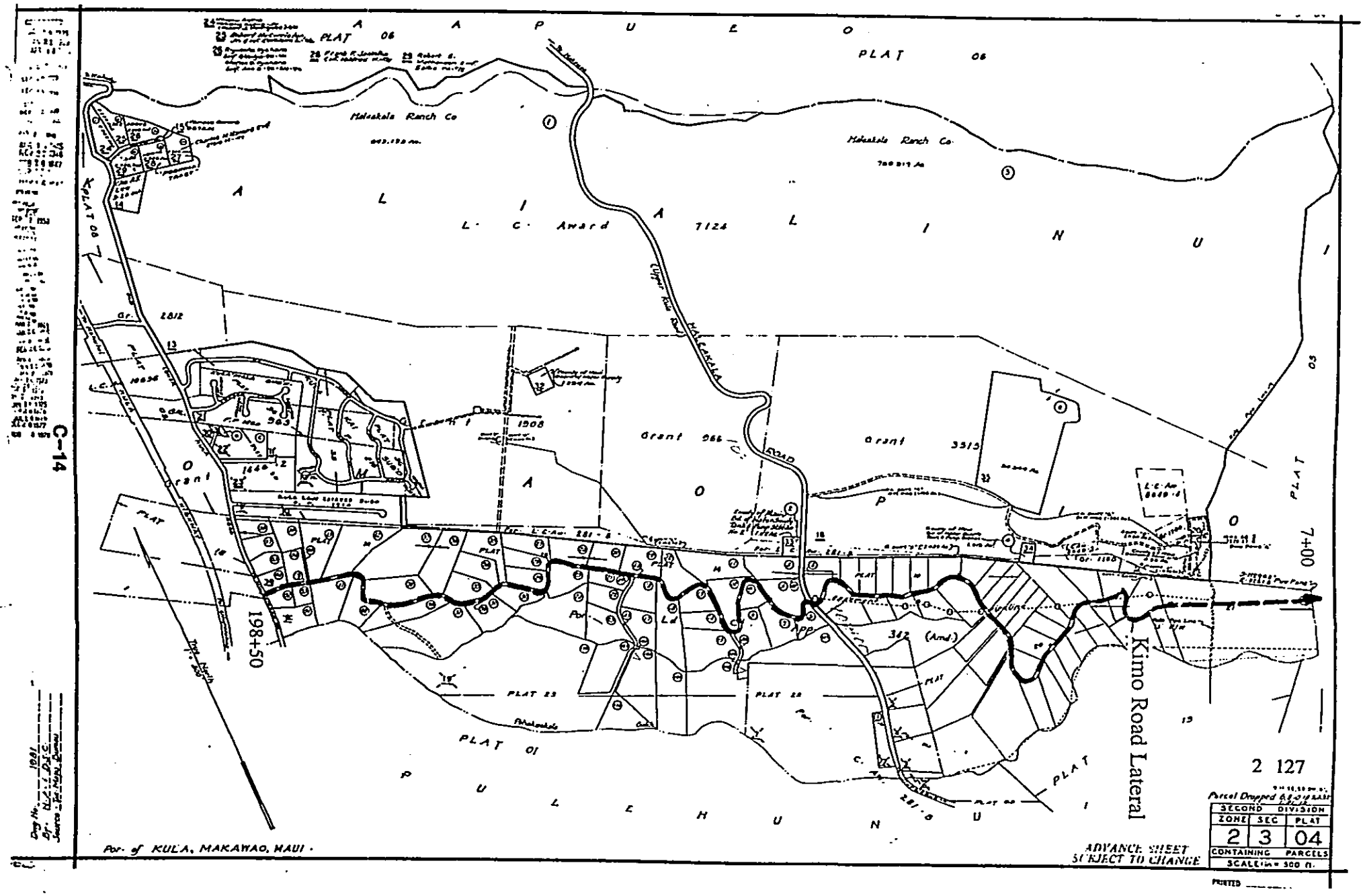

Kaonoulu Lateral
Main Distribution Pipeline
308+70
374+50
INSET "A"
Scale 1 in. = 100 ft.
KAONOULU, KULA, MAKAWAO, MAUI.
HAIONULI - KEOKEA HOMESTEAD
PLAT 05
SECOND DIST.
ZONE 2 | SEC. 2 | PLAT 06
ADVANCE SHEET
SUBJECT TO CHANGE
C-9

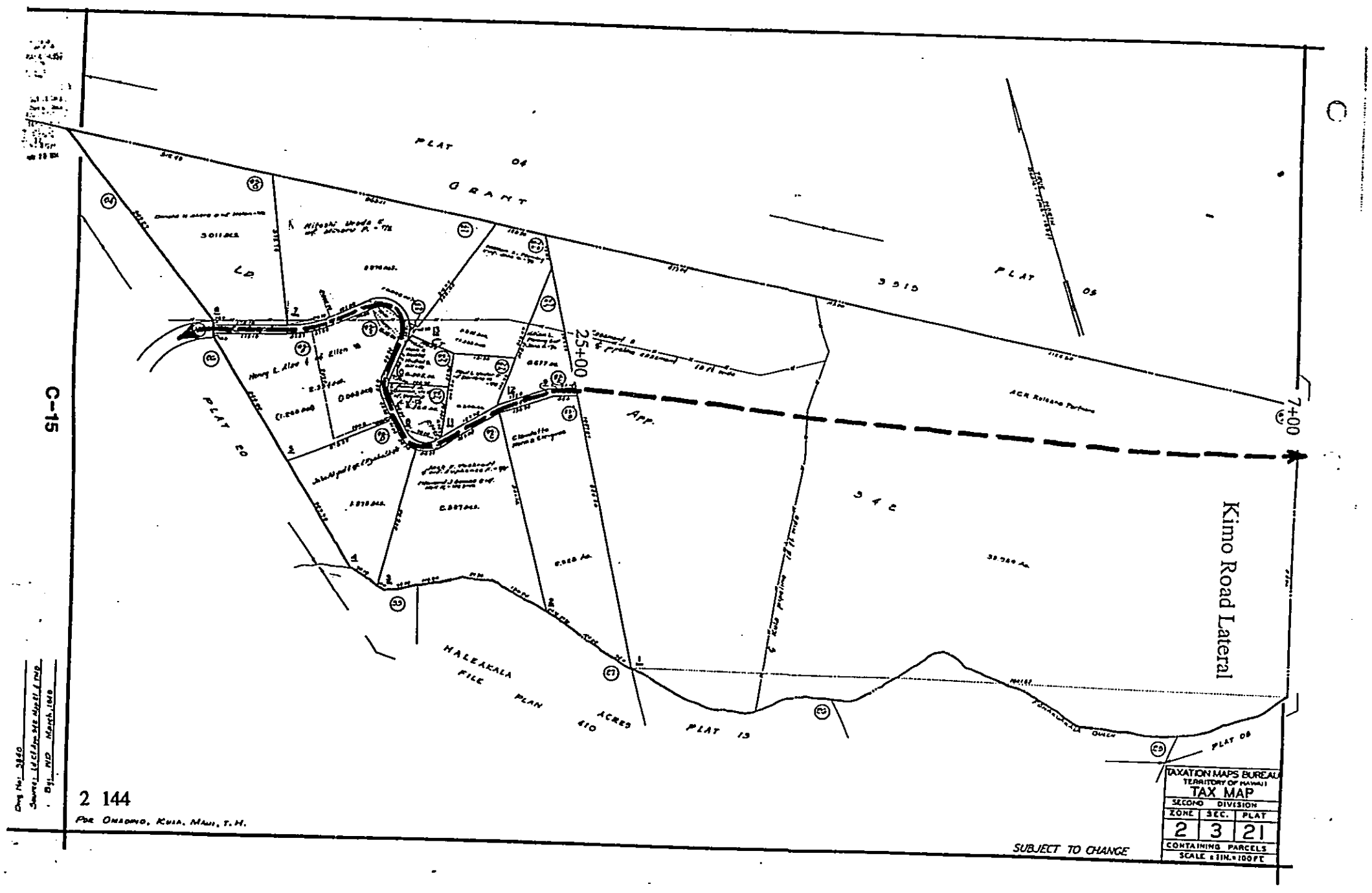

Waiohuli Lateral
Main Distribution Pipeline
374+50
439+50
Plat 06
Plat 02
Plat 01
Plat 04
WAIOHULI-KEOKEA
James Campbell Estate
(Harold M. Rice) Ltd
State of Hawaii
Gr.
2 102
Por. WAIOHULI-KEOKEA HOMSTDS. KULA, MAUI.
SUBJECT TO CHANGE
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 2 | SEC. 2 | PLAT 05
CONTAINING PARCELS
SCALE: 1in = 500ft
C-10

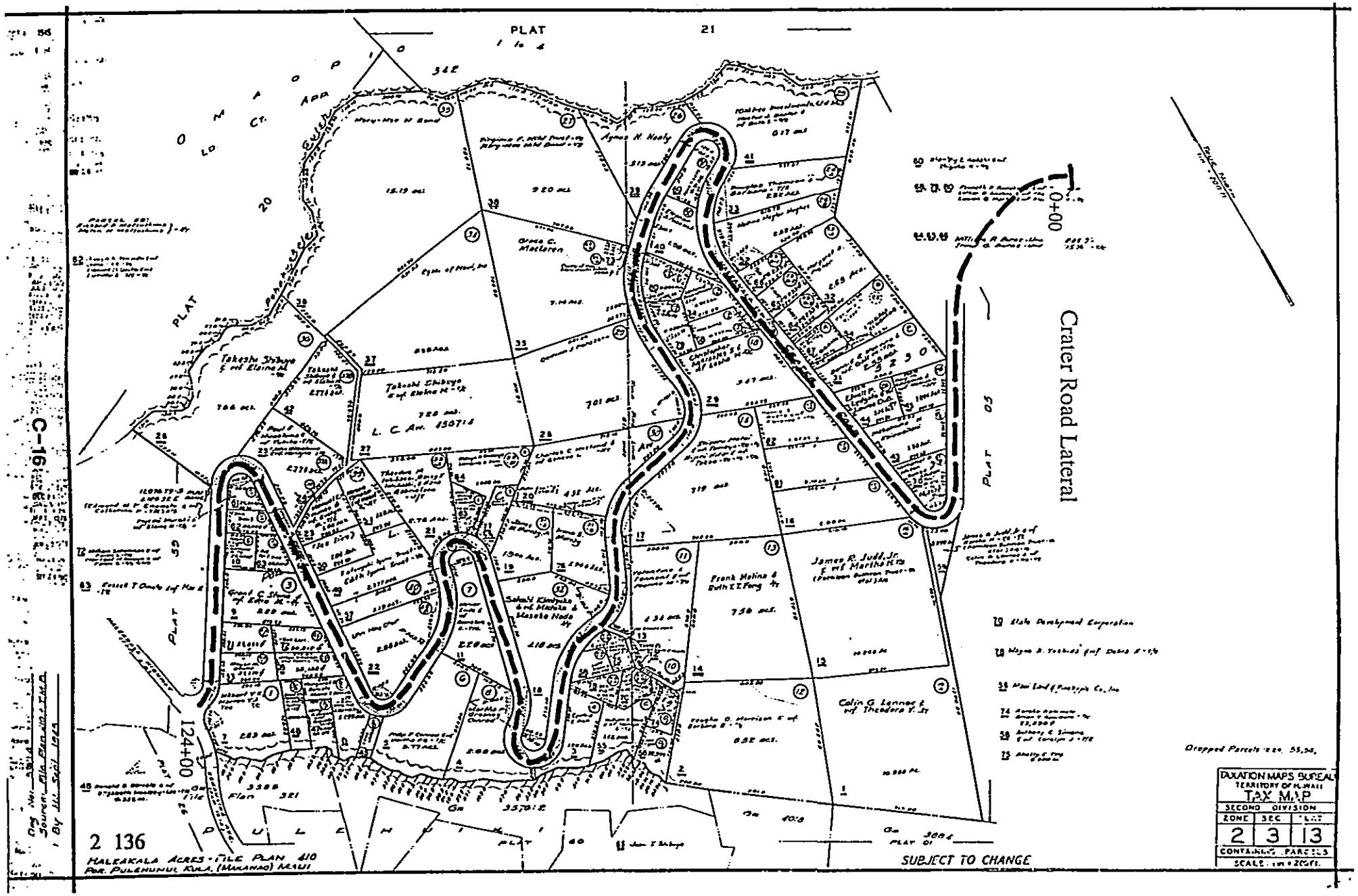

439+50
Main Distribution Pipeline
495+00
DHHL/Keokea Lateral

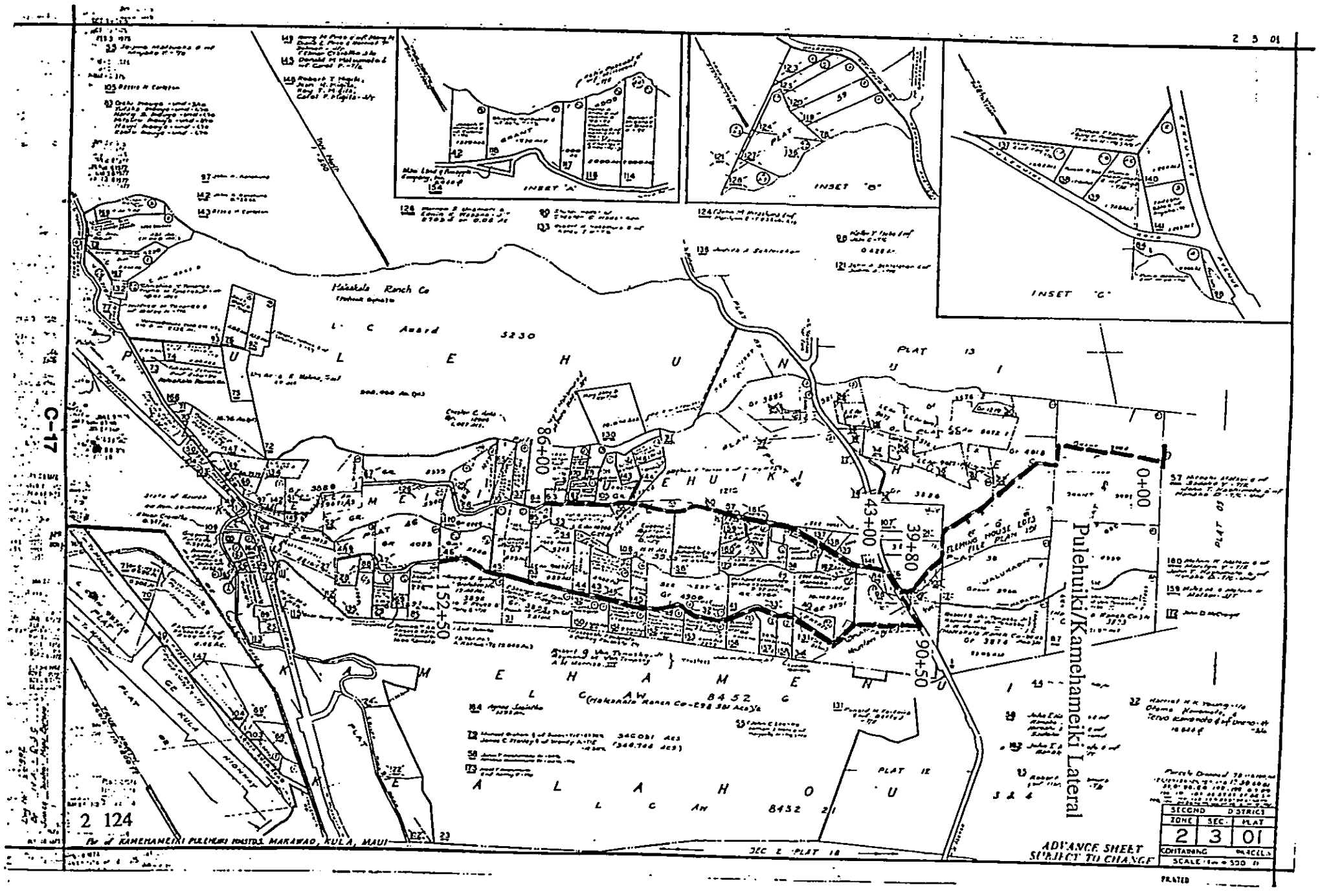


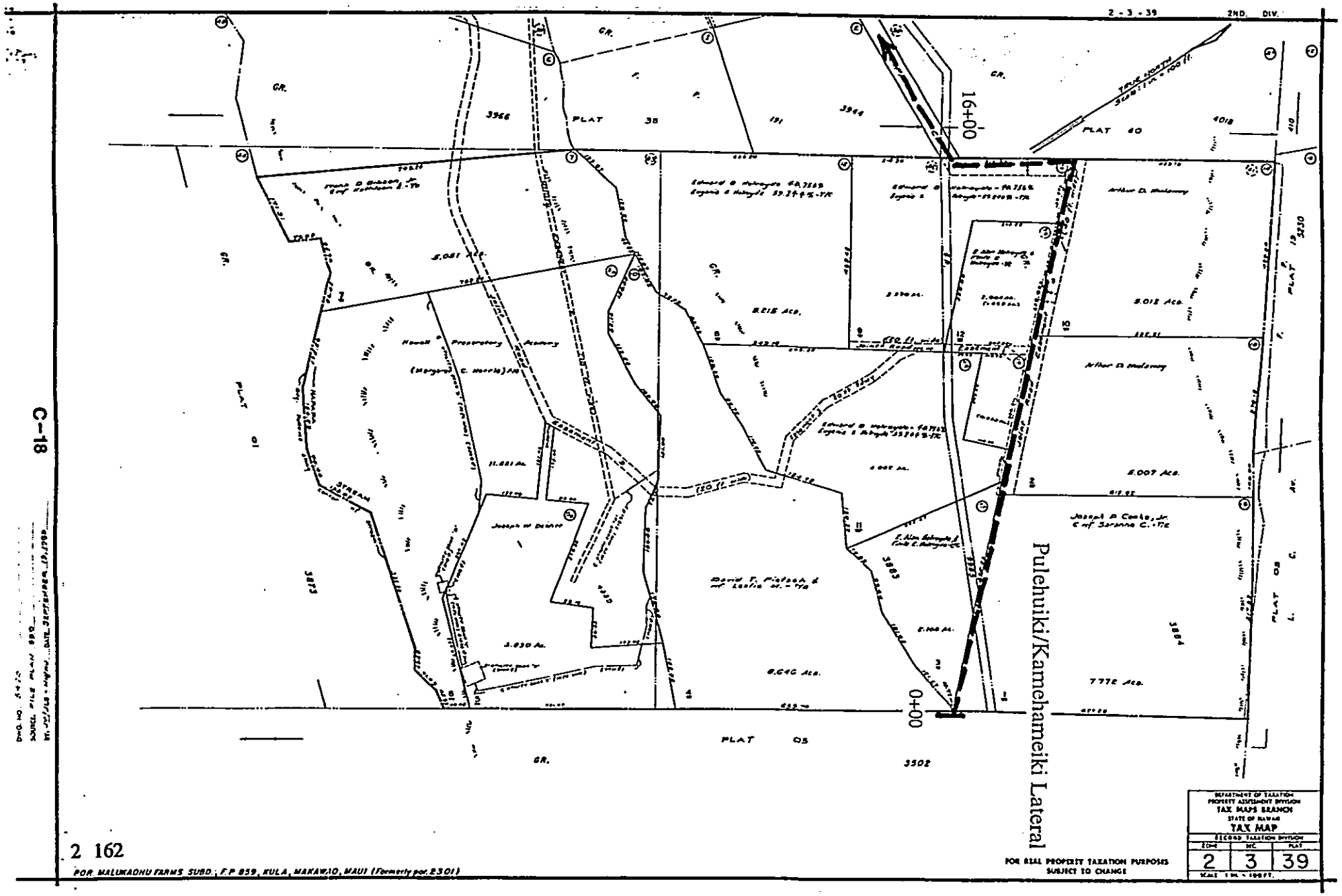








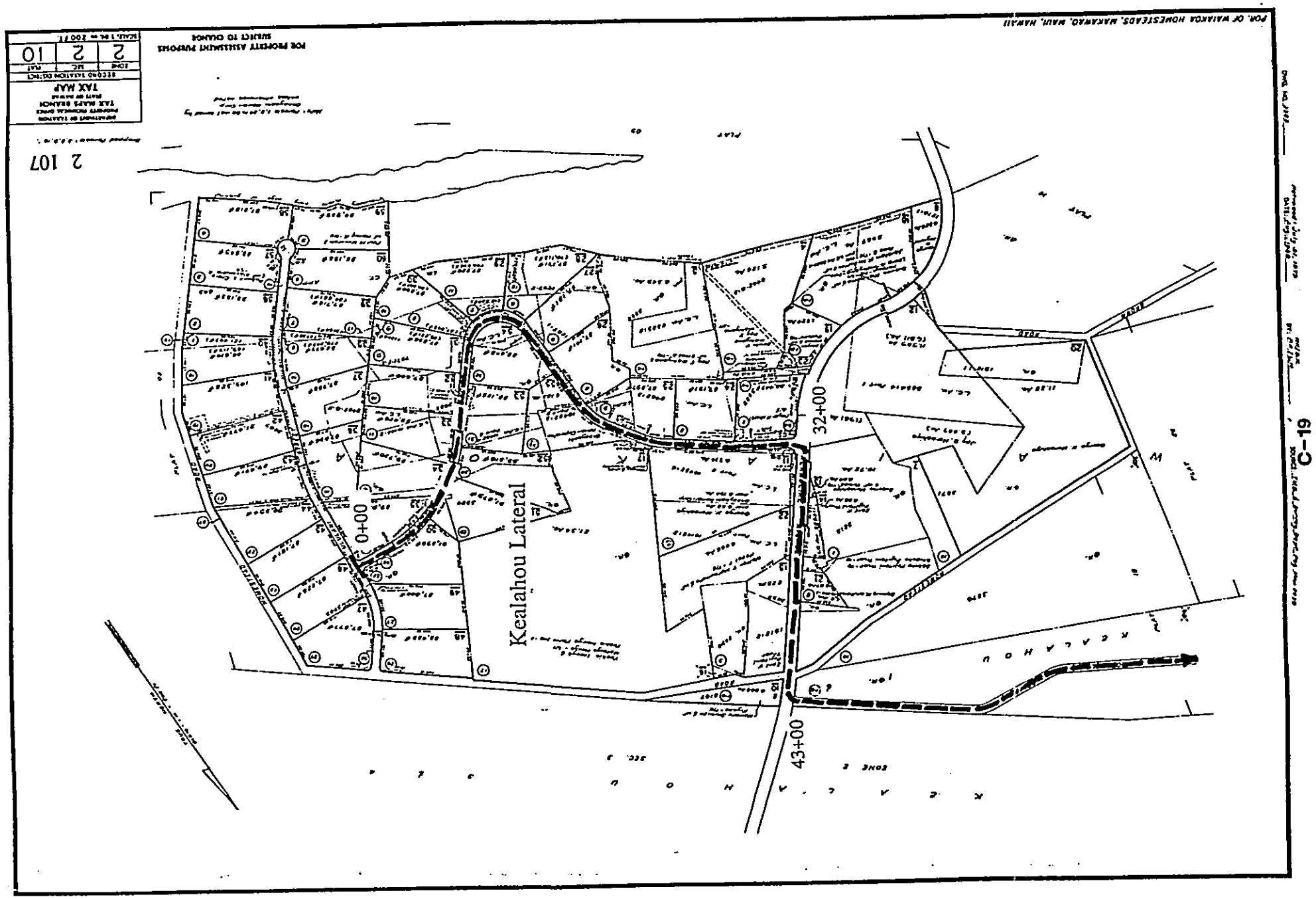


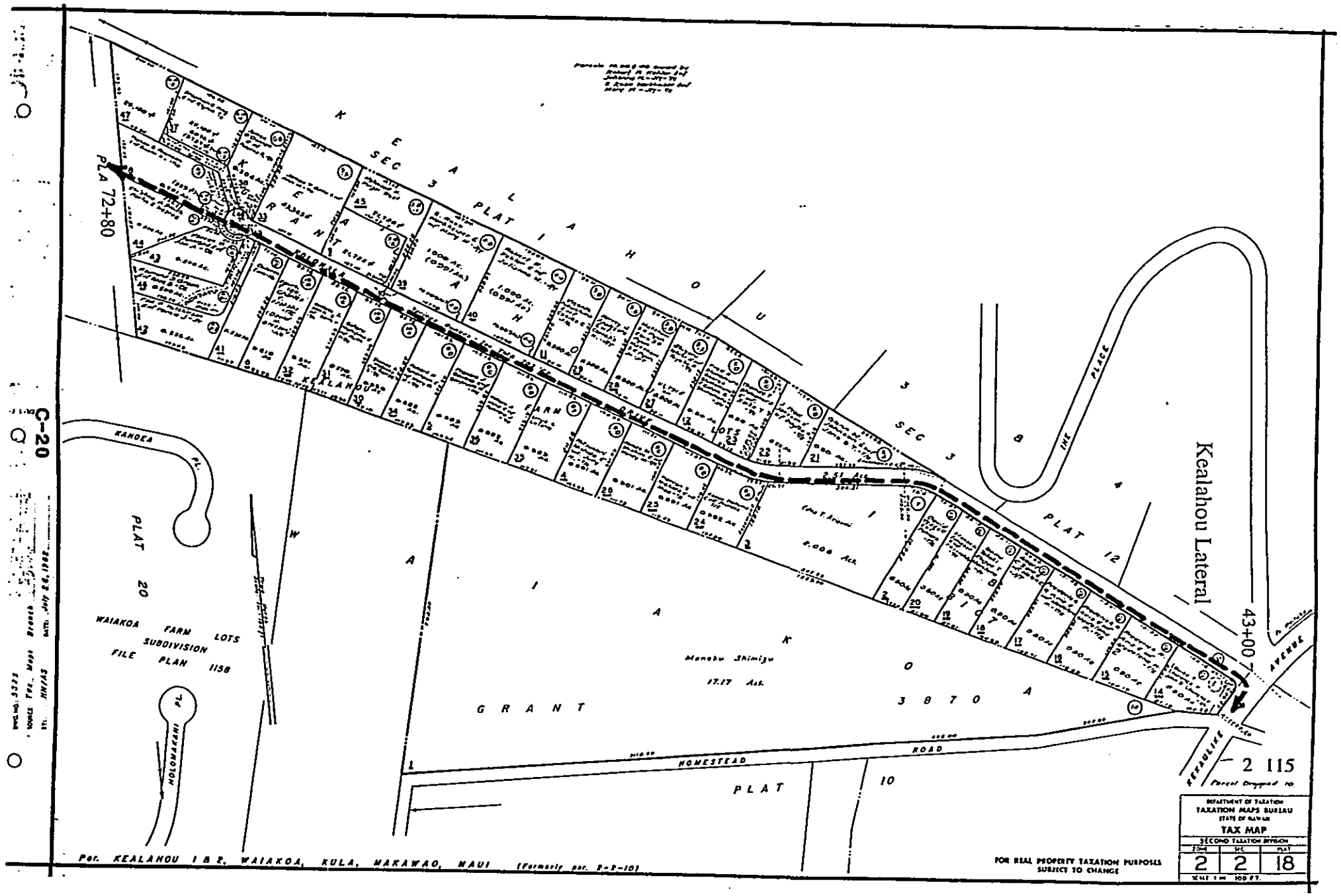


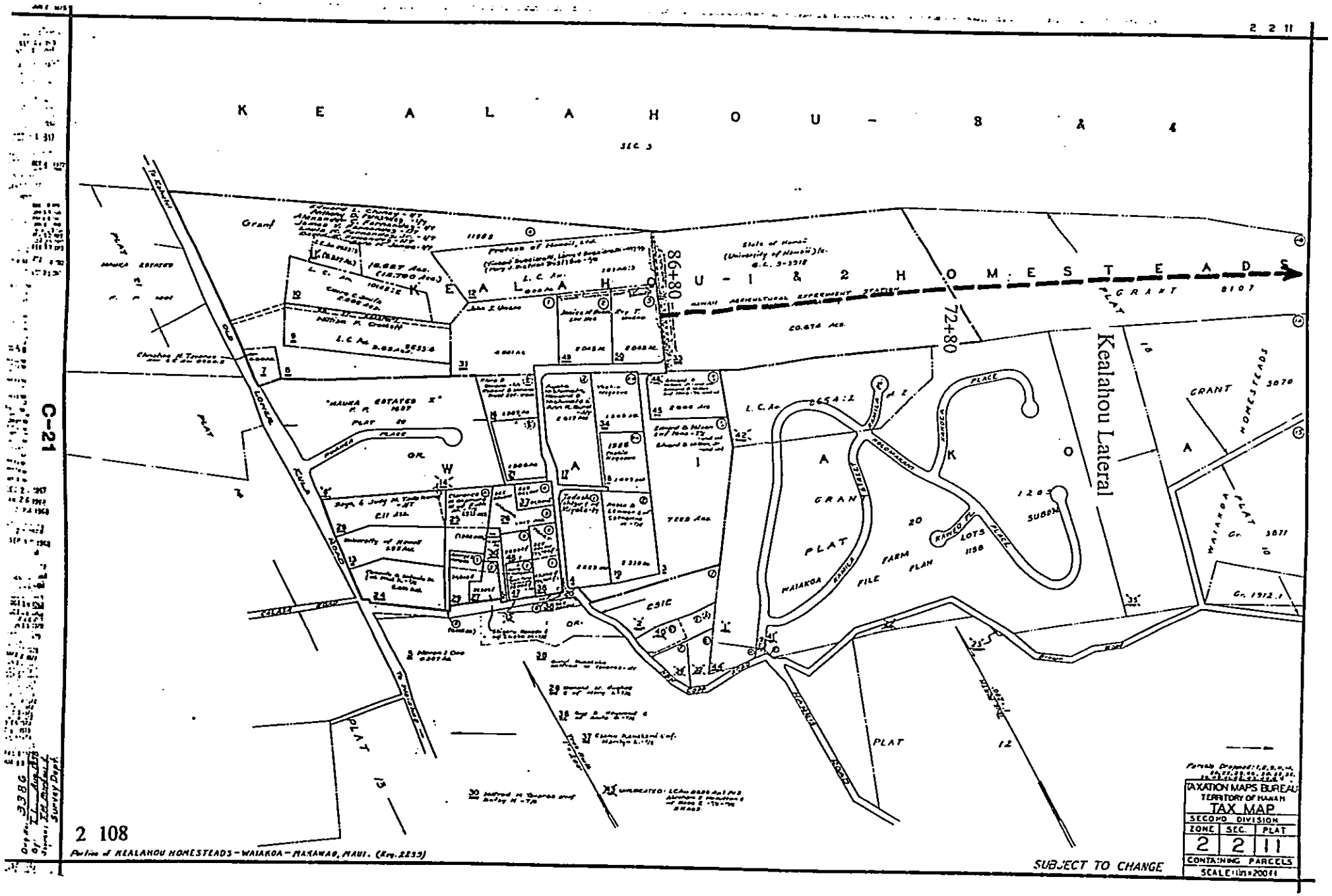
C-18

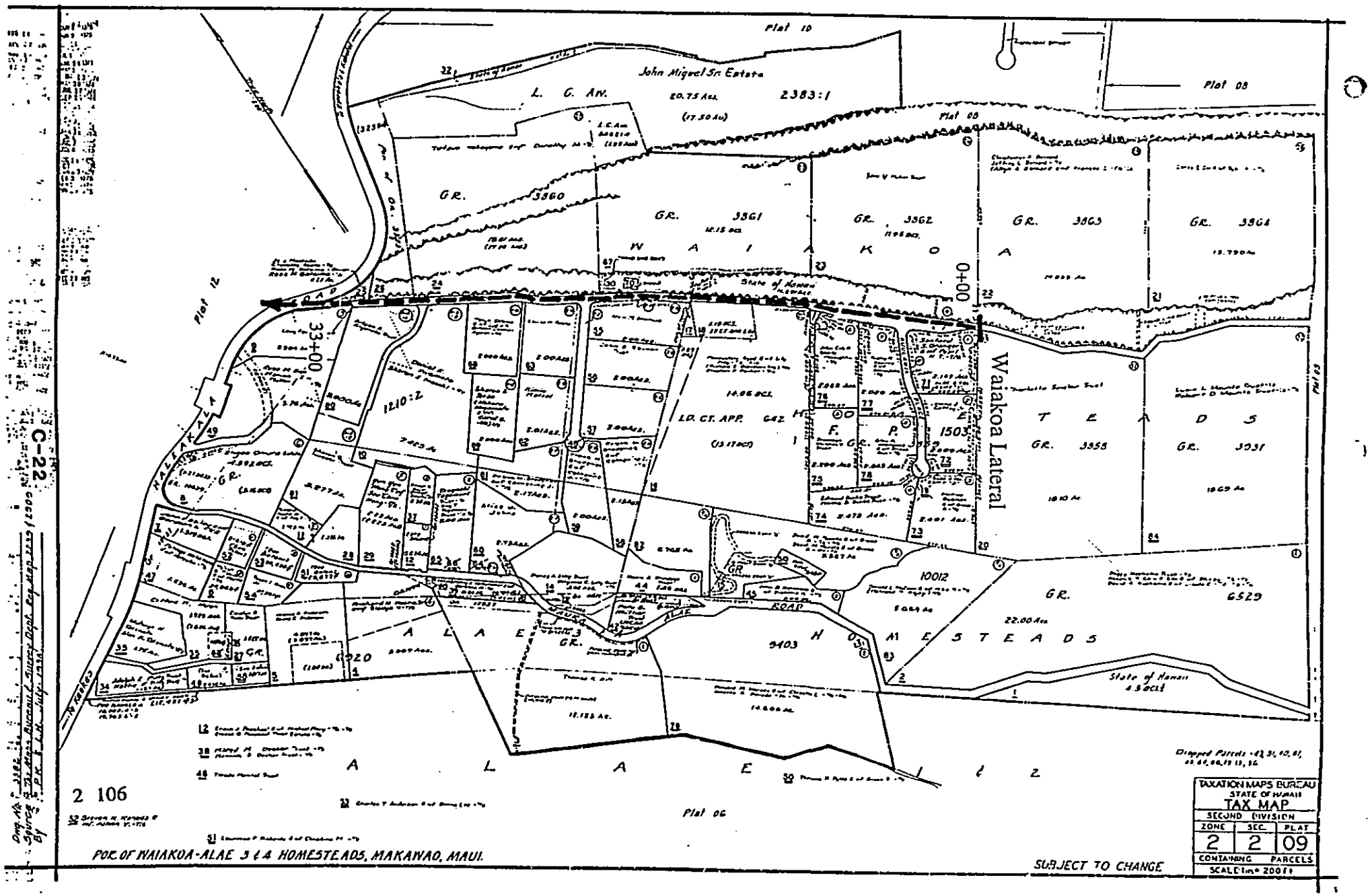
2 162

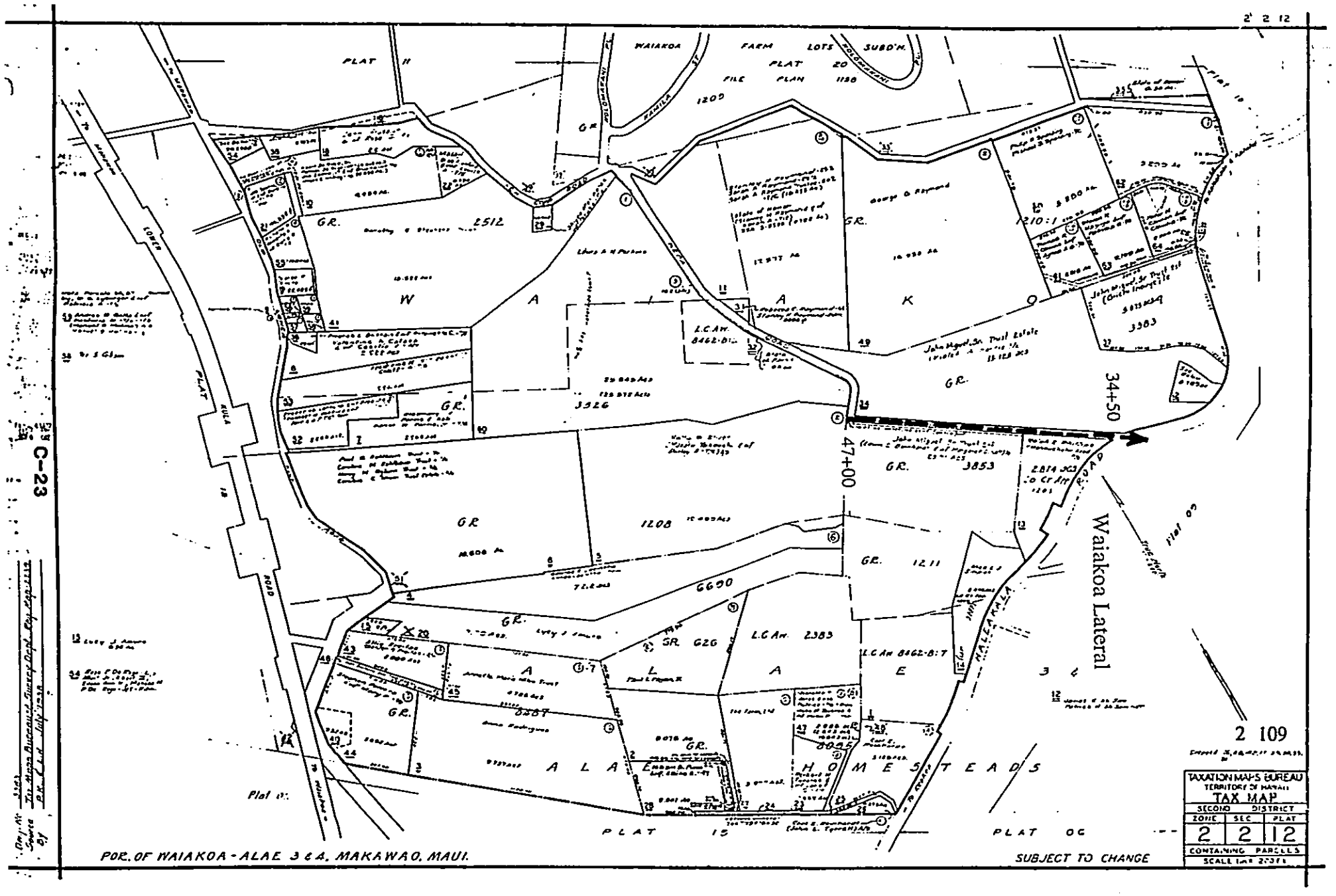
POR. MALUKAOHU FARMS SUBD., F.P. 859, KULA, MAKAWAO, MAUI (Formerly por. 8301)

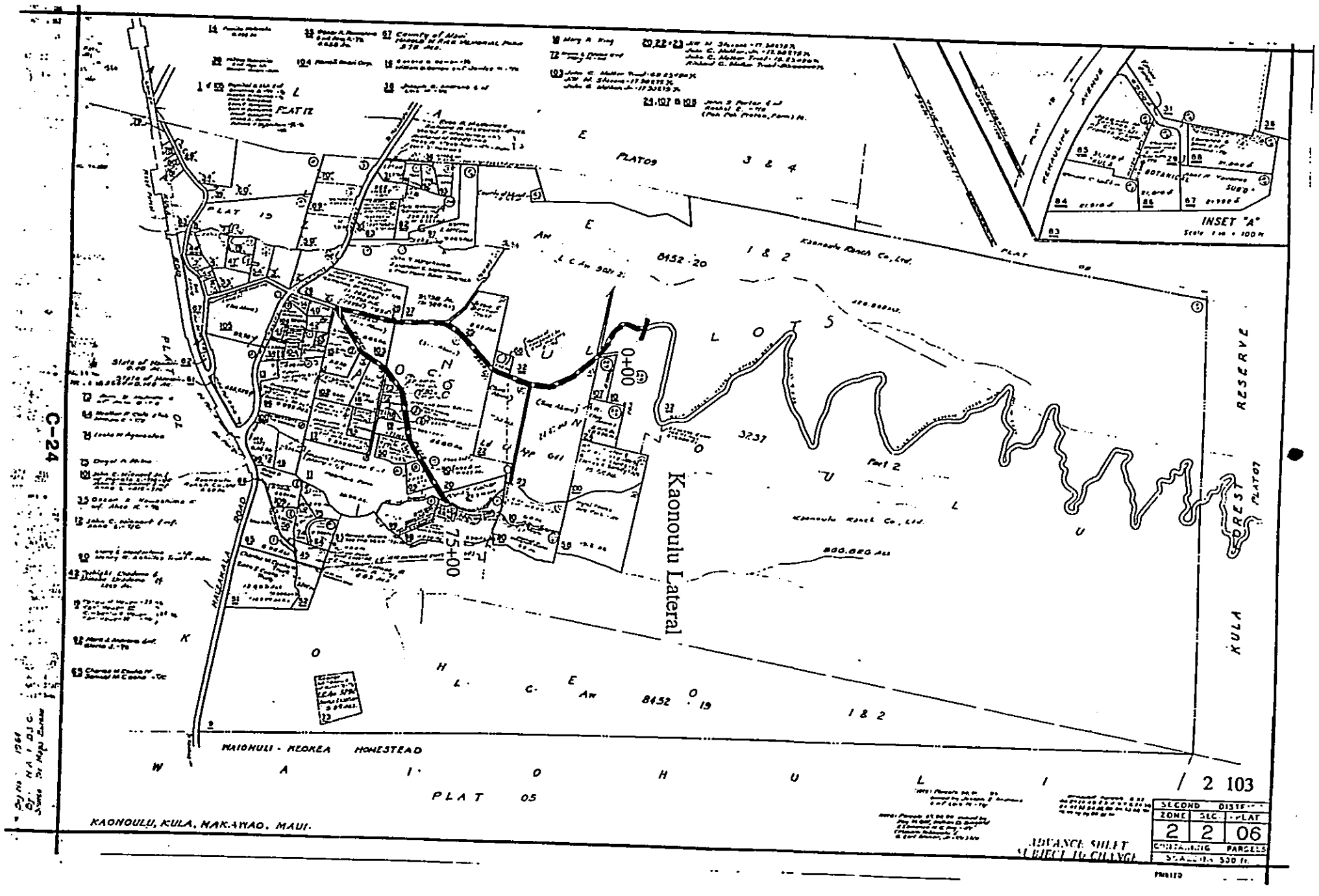


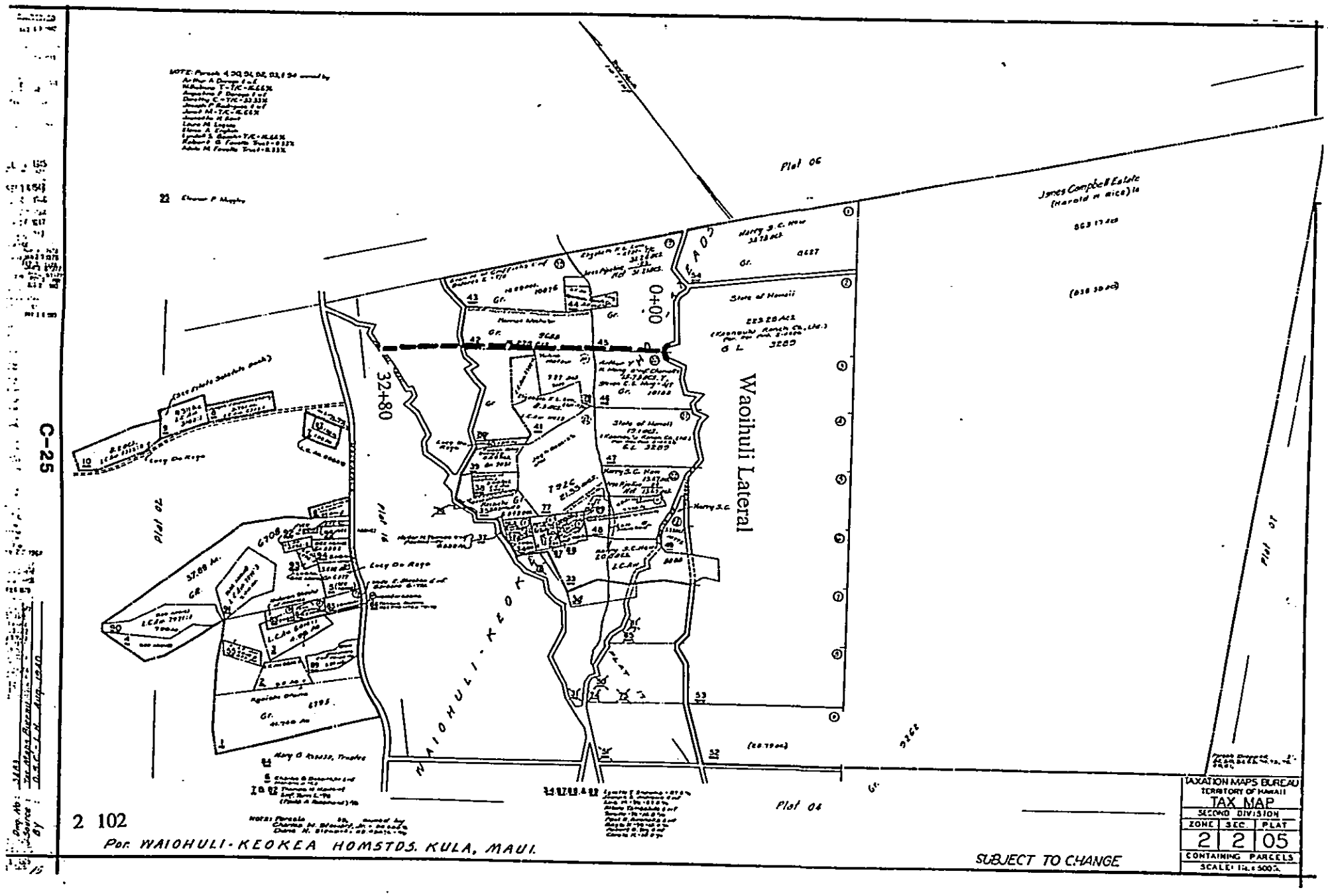




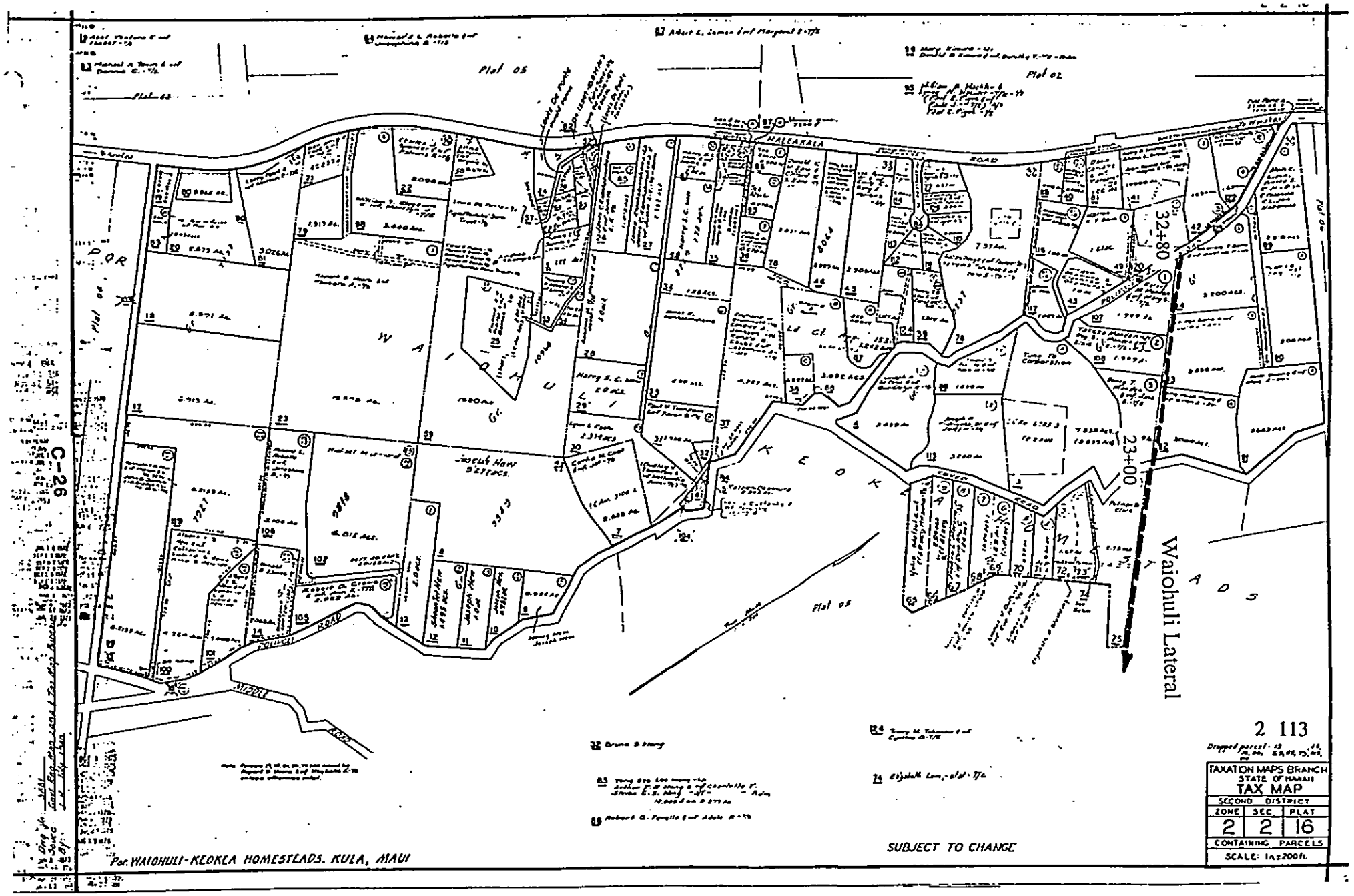


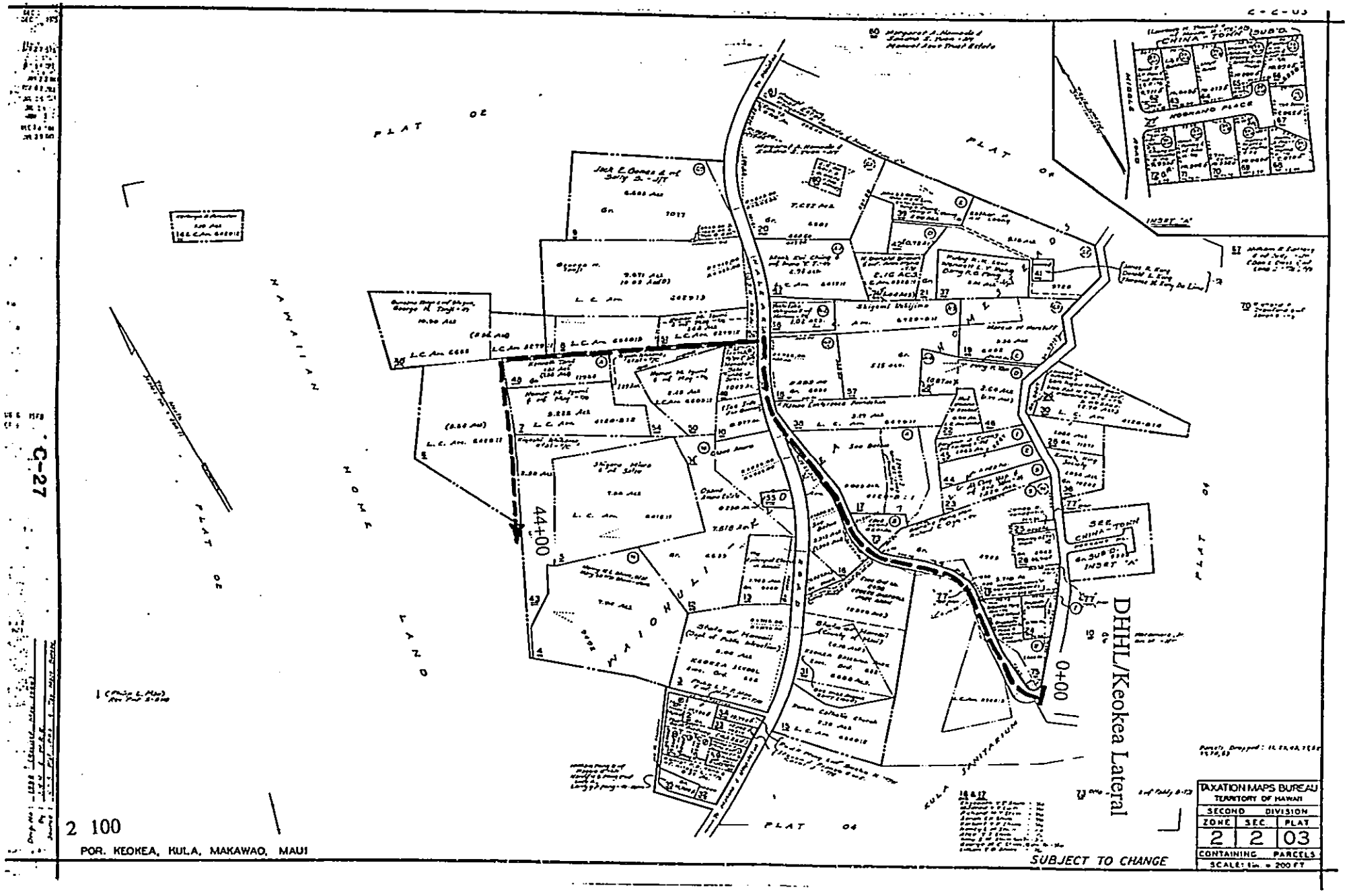


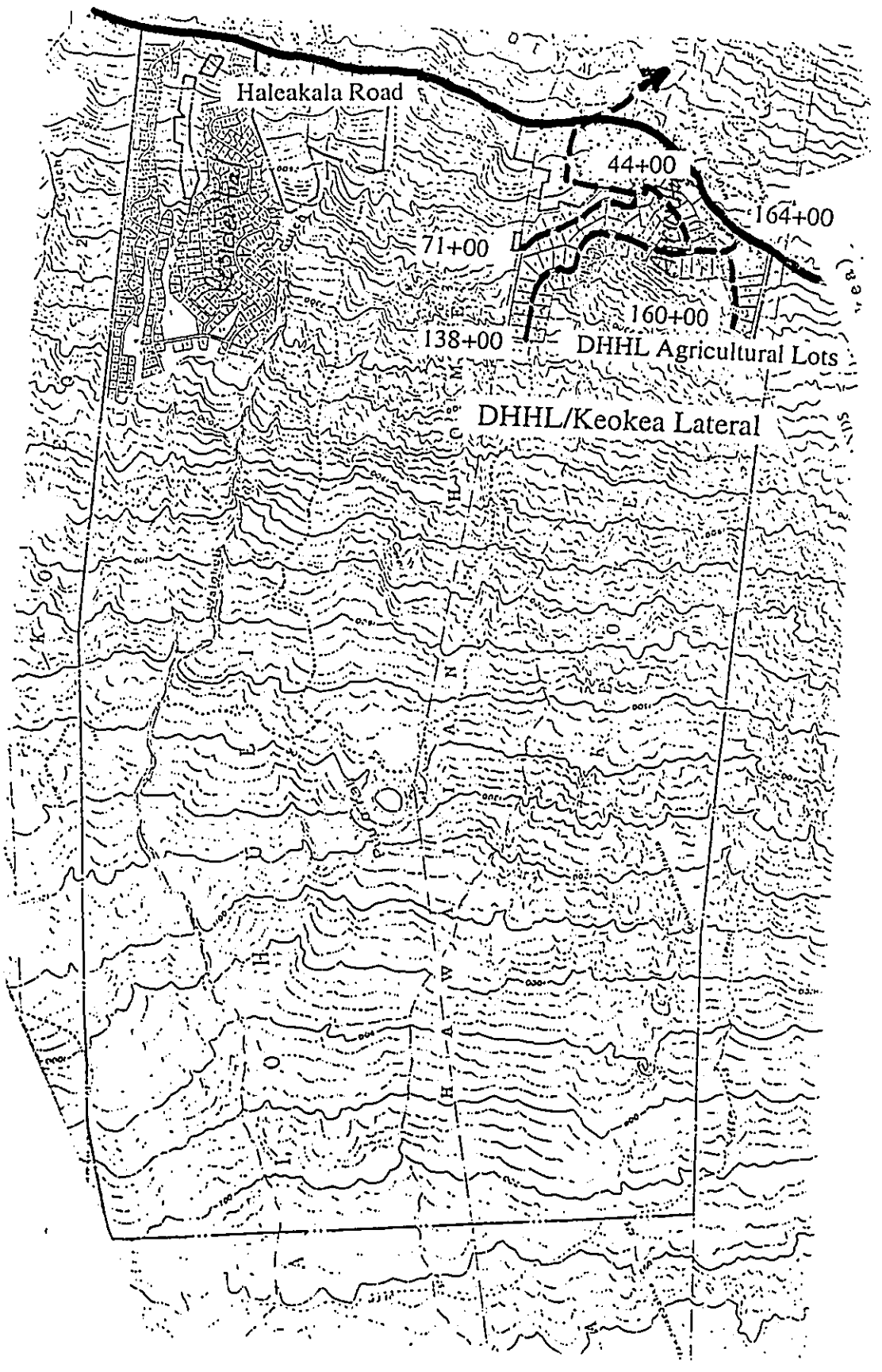




C-25







APPENDIX D

INVESTIGATION AND ANALYSIS

INVESTIGATION AND ANALYSIS
(Revised March 1997)

ECONOMICS

Introduction

The economic evaluation for the Upcountry Maui Watershed Project in Maui, Hawaii, measures the beneficial contributions to national economic development (NED). The major economic activity in the watershed area is agricultural production. The benefits are estimated from the differences in farm income between without project conditions and with project conditions.

It is identified that Alternative 2 Increment 1, i.e., an **irrigation water distribution system** with irrigated cropland of 473 acres, is the recommended plan. Under this alternative, the water reliability is at 91 percent and the service area will be 473 acres.

The economic evaluation follows the standard NRCS procedures in accordance with *The Economics and Environmental Principles and Guidelines for water and Related Land Resources Studies* issued by the Water Resources Council on March 10, 1983.

The project evaluation horizon is fifty years, which is consistent with projects of this type and scope. The discount rate used is seven and three quarter percent, as directed by USDA-NRCS for the Fiscal Year 1995 water and related resources planning projects (January 6, 1995). The production costs were estimated in 1992 dollar, while the normalized prices of the products were the average of the last five years (1988-1992). These were the latest available data at this time of project evaluation. The project benefits were updated in 1996 using the National Agricultural Statistics Service's Index of Prices Received from Farmers.

Production information used in the evaluation was obtained from both primary and secondary data. Primary data collection includes field investigation, interviews with the local farmers, extension agents, and other local experts. Major secondary data includes the Statistics of Hawaiian Agriculture (Hawaii State Department of Agriculture), State of Hawaii Data Book (State Department of Business, Economic Development, & Tourism), NRCS Field Technical Guide, and other relevant publications.

Background

Upcountry Maui is one of the most productive agricultural areas in the State. However, it lacks an adequate irrigation water supply. According to the Federal Crop Insurance Corporation, drought is historically the major peril to crop production. Fifty-five percent of the crop loss was caused by drought. In this area, water conservation or mandatory restriction during the drought period imposed on farming activities by Maui County

Department of Water Supply (see Table 1) is a constant fear and concern to farmers. Consequently, farmers grow poor quality crops and production is at an average of less than 40 percent of the potential yield (information from interviewing with farmers).

There is also a moratorium on water meters imposed by Maui County Department of Water Supply. Therefore, farmers are constrained from expanding cultivated acreages even though new plots may be located on prime agricultural land or soils.

Table 1 Upcountry Maui Watershed Project
Upper Kula Line
Historical Record of Drought Periods and/or Conservation

Date: 09/14/94
File: \maui1\wtrstn.wk3

Date			Policy	Impacts
Beginning	Lifting	Duration	County Record a/	Drought in HI a/
07/29/71	10/18/71	82 days	Consv. Notice	Wtr, Crop, Lvsk
06/23/72	07/19/72	27 days	Consv. Notice	Crop, Lvsk
Dec. '72				Crop
Jan. '73				Lvsk
07/11/73	07/16/73	6 days	Wtr. Restriction	
08/21/73	10/16/73	57 days	Declaration of Drought, Wtr. Restriction	
Sept '75				Crop
01/06/77	02/25/77	51 days	Wtr. Restriction, Drought Decl.	
Feb. '78				Crop, Lvsk
June '81				Wtr, Crop
07/06/81	unknown		Wtr. Restriction	
07/07/82	unknown		Wtr. Restriction	
03/02/83	unknown		Consv. Notice	
July '84				Wtr, Crop, Lvsk
09/19/84			Consv. Notice	
10/05/84			Mandatory Wtr. Restrn.	
10/07/84	11/23/84	48 days	Drought Declaration Wtr. Restrn., 25% reduc.	Wtr, Crop, Lvsk, Fire
Feb. '85	03/01/85		Cnsv. Notice	
03/10/86			Voluntary Consv.	Wtr, Crop
03/12/86	03/18/86	7 days	Drought Declr., Mandatory Wtr. Restrn., 25% reduc.	
03/18/86	unknown		Change to Voluntary Consv.	
10/04/86			Consv. Notice	
09/08/87			Consv. Notice	
09/12/88	09/30/88	19 days	Consv. Notice	
12/08/89			Voluntary Consv.	
02/13/91	03/15/91	31 days	Voluntary Consv.	
11/14/91			Drought warning	
11/19/91			Mandatory Wtr. Restriction	
11/20/91	12/06/91	17 days	Mandatory Reduction	
12/06/91	12/23/91	18 days	Voluntary 10% Consv.	
03/05/92			Drought Warning	
04/06/92			Mandatory 10% cut back	
04/21/92	06/10/92	51 days	Drought Declr., Mandatory Restriction	

Note:
a/ Sources of the information.

Future without Project Conditions:

This is the condition prevailed if no action is taken.

It is mentioned in the Makawao-Pukalani-Kula Community Plan that water for irrigation is being unnecessarily treated to domestic standards. Separate systems would be more cost-efficient by reducing treatment and pumping costs. If there is no action taken, then:

1. The moratorium on new meters in this region will continue to be in effect. This will have impacts on both the agricultural and residential usage, and thereby impede any economic development in this region.

2. There will be no expansion of agricultural production. On the contrary, there might be a small reduction in agricultural production due to shortage in water supply.

3. Water pumping from the Kamole weir to serve the Upcountry area will continue. Namely, the electricity costs incurred from pumping and the maintenance costs for the pump will remain.

4. The water supply continues to be operated under the single line system which results in the continuation of the agricultural water being treated. In other words, the amount of water treated will be high and so do the costs incurred.

5. Shortage in agricultural water supply remains whenever there is a drought. This in turn will have impacts on the agricultural sector both in Maui and the State, as well as impacts on the overall economy.

A consensus among farmers regarding the impacts of water shortage on agricultural production are: (1) increasing stress for the farm manager, (2) reducing yield, (3) lowering water pressure which prolongs irrigation duration, (4) increasing pests which in turn increases the pest control costs, (5) poor quality products, (6) unable to expand production, and (7) loss of market due to inconsistent supply and unreliable quality of the products. However, it is very difficult to know the exact timing of the drought and to quantify the damages as a result of the water shortage.

Future with Project Conditions:

This is the condition prevailed if the action is taken:

1. The water supply system will change from the single line to a dual line system which in turn will reduce the amount of water treated (only water supplied to the domestic needs to be treated), and thereby the treatment costs (benefit quantified).

2. The moratorium will be lifted, which will increase the possibilities to install additional water meters and enlarge the size of the meters for agricultural production (benefit incorporated in the estimates of crop net returns).

3. The increased and consistent water supply will ensure the agricultural production both in yield and in acreage planted (benefit quantified), improve the quality of the products (benefit not quantified), and in turn maintain and increase the local market share (benefit not quantified), and benefit the economy in employment and family economic status (Regional Economic Development).

4. Water pumping from the lower line will be reduced or even eliminated. The electricity costs from pumping and the maintenance costs for the pump will be saved (benefit incorporated in the engineer's structure cost estimates).

Methodology of Analysis

In terms of crop budget analyses, machinery and equipment costs are derived by the University of Hawaii Electronic generator's information which includes fixed and variable costs. Crop partial budgets were developed either from primary data and/or other secondary data. The results of the estimates were consulted with extension agents, farmers, and other experts. However, the cultural practices, pesticide, fertilizer and other inputs for the production, and management techniques vary from grower to grower, and area by area. These estimates will not accurately reflect the costs of all growers. They serve only as a general sample or guide.

Predominant crops in this region are truck crops, which is estimated at 46% of the agricultural land use (see Table 2). They include Chinese cabbage, head cabbage, lettuce, Romaine, dry onion, and daikon (turnip). In addition to truck crops, there are protea (33%), carnations (11%), orchard (7%), and Christmas trees (4%). Truck crop production yield was derived from the last five years (1988-1992) and used to estimate the income for future without project. Whereas potential yield documented in the literature was used for future with project. Weighted composite net returns for future without and future with project were estimated accordingly.

Market condition was evaluated in order to assess the demand for the products. All indications are that consumers have become more health and lifestyle conscious, and they have made changes in their food purchasing patterns. A continuation of the market trend revealed a strong increase in demand for fresh vegetables from fast food outlets, restaurants, and supermarkets.

A quick review of the truck crops produced on Maui indicates that the harvested acreage of Chinese cabbage, lettuce, Romaine, and daikon compared with the State has increased from 28%, 26%, 50%, and 41%, to 45%, 38%, 61%, and 55%, respectively, in the last five years; while onion remains at the range between 92% and 97% of the State total harvested acreage.

A potential increase in the demand for fresh vegetables can be anticipated from the growth of the population, gains in per capita consumption, the growth of the tourism industry, as well as exports to California and Canada during the winter seasons.

Crop damage reduction and enhancement benefits accounted for the major benefits from this irrigation water distribution project. The impacts of water deficiency on crops were investigated in order to estimate the damage reduction. In addition, there were a small amount of water treatment reduction benefits.

Economic evaluation was done by calculating the difference in net farm income between without project conditions and with project conditions. Alternative 1 is Future Without Project Conditions, which is the most likely future conditions without a plan. Alternative 2 and 3 are Future With Project Conditions, where Alternative 2 is an irrigation water distribution system and Alternative 3 is an irrigation water distribution system with an additional reservoir.

Estimated construction, operation, and maintenance costs at four increments (473, 550, 650, and 722 acres) were compared with the total benefits estimated. Estimated net benefits of Alternative 2 Increment 1 was the highest at $1.56 million. It had irrigated production acreage of 473 acres and water reliability of 91%. The benefit-cost ratio of this alternative was estimated at 2.75. It was identified and proposed as the NED Plan. Subsequent refinements to Alternative 2 resulted in the Recommended Alternative presented in this plan.

Annualized installation costs, OM&R costs, total benefits, and net benefits of this proposed NED Plan - Alternative 2 Increment 1, are revealed in Table 3.

Risk and Sensitivity Analysis

The risks associated with producing and marketing agricultural products can not be minimized. While this study makes every effort to model a production system on typical, real world practices, it may not fully represent financial, agronomic and market risks which affect the profitability and economic viability of the production.

The market for agricultural products is very volatile for both price and quantity. Growers do not control either of these market components. Namely, agricultural production is a high risk enterprise. Risk is caused by uncontrollable factors such as weather, disease, and thereby the supply, or even the demand for the product. In the case without project, there would be the risks due to water conservation also.

Table 2 Upcountry Maui Watershed Project
Proposed Land Use -- Upper Line

Date: 04/14/94
File: maui1\land.wk3

	Truck crops	Flower	Protea	Orchard	X-Tree	Total */
FWO Project	219	50	154	32	18	473
FW Project						
Increment 1 (FWP_473)	219	50	154	32	18	473
Increment 2 (FWP_550)	275	52	162	34	27	550
Increment 3 (FWP_650)	325	52	165	58	51	650
Increment 4 (FWP_722)	361	52	183	67	59	722

Note: Total may not add up due to rounding.
Increment 1: Crop land is the same as FWO Project, i.e., 473 acres.
Increment 2: Crop land increases to 550 acres.
Increment 3: Crop land increases to 650 acres.
Increment 4: Crop land increases to 722 acres.

Percentage of Various Land Uses

	Truck crops	Flower	Protea	Orchard	X-Tree	Total */
FWO Project	46%	11%	33%	7%	4%	100%
FW Project						
Increment 1 (FWP_473)	46%	11%	33%	7%	4%	100%
Increment 2 (FWP_550)	50%	9%	29%	6%	5%	100%
Increment 3 (FWP_650)	50%	8%	25%	9%	8%	100%
Increment 4 (FWP_722)	50%	7%	25%	9%	8%	100%

Note: See footnote of the Table above.

Table 3 Annualized Costs and Benefits of the NED Plan

Upcountry Maui Watershed Project, Maui, Hawaii
Present Values - Costs, Benefits, and Net Benefits

Date: 05/07/96
File: maui1/pv.wk3

Discount Rate: 7.75%
Evaluation Period: 50 years
Condition: Agricultural Water Distribution System (Alternative 2, Increment 1)

(1) Year	(2) PV Factor	(3) Installation Costs	(4) OM&R	(5) Benefits g/	(6) Net Benefits	(7) PV Costs	(8) PV OM&R	(9) PV Benefits	(10) PV Net Benefits
1	0.92807	694,650	240	0	(694,890)	644,684	223	0	(644,907)
2	0.86132	4,960,680	39,787	208,910 a/	(4,791,557)	4,272,733	34,269	179,939	(4,127,064)
3	0.79937	3,086,670	79,333	600,405 b/	(2,565,598)	2,467,391	63,416	479,946	(2,050,862)
4	0.74188	0	158,426	1,391,405 c/	1,232,979	0	117,533	1,032,256	914,723
5	0.68852	0	158,426	1,808,379 d/	1,649,953	0	109,079	1,245,105	1,136,026
6	0.63899	0	158,426	2,042,762 e/	1,884,336	0	101,233	1,305,304	1,204,072
7	0.59303	0	158,426	2,042,762 e/	1,884,336	0	93,951	1,211,419	1,117,468
8	0.55038	0	158,426	2,053,916 f/	1,895,490	0	87,195	1,130,434	1,043,240
9	0.51079	0	158,426	2,053,916 f/	1,895,490	0	80,922	1,049,120	968,197
10	0.47405	0	158,426	2,061,500 g/	1,903,074	0	75,102	977,254	902,152
11	0.43996	0	158,426	2,061,500	1,903,074	0	69,701	906,978	837,276
12	0.40831	0	158,426	2,061,500	1,903,074	0	64,687	841,731	777,044
13	0.37894	0	158,426	2,061,500	1,903,074	0	60,034	781,185	721,151
14	0.35169	0	158,426	2,061,500	1,903,074	0	55,717	725,009	669,292
15	0.32639	0	158,426	2,061,500	1,903,074	0	51,709	672,853	621,144
16	0.30292	0	158,426	2,061,500	1,903,074	0	47,990	624,470	576,479
17	0.28113	0	158,426	2,061,500	1,903,074	0	44,538	579,549	535,011
18	0.26091	0	158,426	2,061,500	1,903,074	0	41,335	537,866	496,531
19	0.24214	0	158,426	2,061,500	1,903,074	0	38,361	499,172	460,810
20	0.22473	0	158,426	2,061,500	1,903,074	0	35,603	463,281	427,678
21	0.20856	0	158,426	2,061,500	1,903,074	0	33,041	429,946	396,905
22	0.19356	0	158,426	2,061,500	1,903,074	0	30,665	399,024	368,359
23	0.17964	0	158,426	2,061,500	1,903,074	0	28,460	370,328	341,868
24	0.16672	0	158,426	2,061,500	1,903,074	0	26,413	343,693	317,280
25	0.15473	0	158,426	2,061,500	1,903,074	0	24,513	318,976	294,463
26	0.14360	0	158,426	2,061,500	1,903,074	0	22,750	296,031	273,281
27	0.13327	0	158,426	2,061,500	1,903,074	0	21,113	274,736	253,623
28	0.12368	0	158,426	2,061,500	1,903,074	0	19,594	254,966	235,372
29	0.11479	0	158,426	2,061,500	1,903,074	0	18,186	236,640	218,454
30	0.10653	0	158,426	2,061,500	1,903,074	0	16,877	219,612	202,734
31	0.09887	0	158,426	2,061,500	1,903,074	0	15,664	203,821	188,157
32	0.09176	0	158,426	2,061,500	1,903,074	0	14,537	189,163	174,626
33	0.08516	0	158,426	2,061,500	1,903,074	0	13,492	175,557	162,066
34	0.07903	0	158,426	2,061,500	1,903,074	0	12,520	162,920	150,400
35	0.07335	0	158,426	2,061,500	1,903,074	0	11,621	151,211	139,590
36	0.06807	0	158,426	2,061,500	1,903,074	0	10,784	140,326	129,542
37	0.06318	0	158,426	2,061,500	1,903,074	0	10,009	130,246	120,236
38	0.05863	0	158,426	2,061,500	1,903,074	0	9,289	120,866	111,577
39	0.05442	0	158,426	2,061,500	1,903,074	0	8,622	112,187	103,565
40	0.05050	0	158,426	2,061,500	1,903,074	0	8,001	104,106	96,105

Table 3 Annualized Costs and Benefits of the NED Plan

Upcountry Maui Watershed Project, Maui, Hawaii
Present Values - Costs, Benefits, and Net Benefits (continued)

Date: 05/07/96
File: maui1/pv.wk3

Discount Rate: 7.75%
Evaluation Period: 50 years
Condition: Agricultural Water Distribution System (Alternative 2, Increment 1)

(1) Year	(2) PV Factor	(3) Installation Costs	(4) OM&R	(5) Benefits g/	(6) Net Benefits	(7) PV Costs	(8) PV OM&R	(9) PV Benefits	(10) PV Net Benefits
41	0.04687	0	158,426	2,061,500	1,903,074	0	7,425	96,623	89,197
42	0.04350	0	158,426	2,061,500	1,903,074	0	6,892	89,675	82,784
43	0.04037	0	158,426	2,061,500	1,903,074	0	6,396	83,223	76,827
44	0.03747	0	158,426	2,061,500	1,903,074	0	5,936	77,244	71,308
45	0.03477	0	158,426	2,061,500	1,903,074	0	5,508	71,678	66,170
46	0.03227	0	158,426	2,061,500	1,903,074	0	5,112	66,525	61,412
47	0.02995	0	158,426	2,061,500	1,903,074	0	4,745	61,742	56,997
48	0.02780	0	158,426	2,061,500	1,903,074	0	4,404	57,310	52,905
49	0.02580	0	158,426	2,061,500	1,903,074	0	4,087	53,187	49,099
50	0.02394	0	158,426	2,061,500	1,903,074	0	3,793	49,352	45,560
51	0.02222	0	158,426	600,405	441,979	0	3,520	13,341	9,821
52	0.02062	0	158,426	208,910	50,484	0	3,267	4,308	1,041
53	0.01914	0	158,426	0	(158,426)	0	3,032	0	(3,032)
Total		8,742,050				7,384,808	1,692,867	20,601,433	11,558,950
Avg. Annual						586,360	134,415	1,635,772	917,791
Annualized Costs: [(7)+(8)]							720,776		
B/C Ratio		2.27							

Sources:
(3) & (4): See Section 12, estimated by the planning engineer.
(5): See Section 2, estimated by the economist.
(6) = (5)-[(3)+(4)]
(7) to (10) = Respective column * (2)

Notes: Assuming --
a/ Benefits realized in yr 2 are: 20% damage reduction, & 10% enhancement benefits from truck crops, carnation, & protea.
b/ Benefits realized in yr 3 are: 50% damage reduction, & 30% enhancement benefits from truck crops, carnation, & protea.
c/ Benefits realized in yr 4 are: 90% damage reduction, 60% enhancement benefits from truck crops, carnation, & protea, plus water treatment reduction benefits.
d/ Benefits realized in yr 5 are: 100% damage reduction, 85% enhancement benefits from truck crops, carnation, & protea, plus water treatment reduction benefits.
e/ Benefits realized in yrs 6-7 are: total annual benefits except enhancement benefits from orchard and Christmas tree.
f/ Benefits realized in yrs 8-9 are: total benefits except enhancement benefits from orchard.
g/ Total annual benefits fully realized.

HYDROLOGY

Introduction

The Upcountry Maui Watershed hydrologic analysis to develop structural alternatives required modelling of future conditions without any project improvements and future conditions with project improvements in order to identify and quantify the benefits of implementing the watershed project. The recent installation of some of the Upper Kula Water System elements created some modelling difficulty. Performance data is not yet available for the Upper Kula Water System with the 36-inch transmission pipeline and 100-MG Kahakapao reservoir in operation and was modelled using computed capacities. The structural alternatives were also modelled using the same hydrologic assumptions and inputs.

The models accounted for available water in the collection area, collection system efficiency, transmission and storage capabilities, irrigation and domestic water demand, and storage system water balance.

Streamflow and Rainfall Records

Streamflow records were used in the analysis of the collection area. Rainfall records were used for the irrigation requirement analysis.

USGS daily streamflow records exist for Kula Diversion (5310) from August 1945 to September 1984, for Haipuaena Stream (5311) from May 1946 to September 1968, and Waiakamoi Stream (5528) from August 1953 to September 1968. The East Maui Irrigation Company (EMI) kept daily flow records for Haipuaena flume from January 1958 to March 1975.

Belt-Collins conducted three months of gaging on Waikamoi Stream and five of the nine intakes on the smaller streams to the west in mid-1984.

Approximately 20 rain gages are found in or around the project area. Records from nine rain gage stations, 322, 323.2, 330, 324.4, 324, 328, 267.3, 267.4, and 267 were used to estimate irrigation water requirements throughout the project area.

Methods

A set of streamflow data in the collection area was needed to estimate the reliability of the existing system and with improvements to system components.

A fifteen year period of record from August 1953 to September 1968 was selected to model operation of the collection, transmission, storage, distribution elements of the existing water system and alternative plan improvements. Actual daily flow records of Waikamoi Stream at Station 5528 were used. Actual daily records for Kula Diversion

(5310) and Haipuaena Stream (5311) were combined to provide a daily record for Haipuaena Stream at the flume diversion. The total flow from Puohokamoa Stream, the east Waikamoi tributary, and smaller intakes in the vicinity was assumed to be one-half of the Haipuaena streamflow as proportioned by drainage area. The contribution from the nine intakes to the west of Waikamoi Stream was correlated to Waikamoi streamflows by a function developed using the streamflow data obtained by Belt-Collins in 1984.

Streamflows from the Haipuaena, Puohokamoa, Waikamoi, and west of Waikamoi collection systems for the 15-year period were used to model existing and proposed water systems through database programs created using dBase IV software.

The appropriateness of using the relatively short 1953 to 1968 period to model the operation of the agricultural water system was evaluated. The inclusion of water system-testing droughts in the evaluation period was essential. The report Drought in Hawaii, Report R88 (DLNR, 1991) evaluates climatic (rainfall) drought events in Hawaii between 1880 and 1986 using records from approximately 50 rain gage stations. Droughts are characterized by deficiency of rainfall measured by the Bhalme and Mooley Drought Index (BMDI) and duration. The severity of the drought is computed as the sum of the BMDI for the drought months.

Severe droughts have affected Maui during the evaluated period. Four of the ten most severe regional events occurred on Maui. The 1st, 2nd, and 6th most severe droughts were recorded at station #374 on the west facing slope of the West Maui mountains. Six of the twenty Maui events listed in the 120 most severe droughts occur at station #374.

The nearest gage station from the Upper Kula System collection area is #333 at Ukulele Camp which is on the drainage area boundary at the 5200' elevation. One drought event at Station #333 appears in the most severe list. The drought, ranked 63rd overall, lasted from January 1962 to December 1962.

The reporting of the Maui island droughts appear to be strongly influenced by conditions at Station #374. Cross-correlation between Stations #374 and #333 is 0.46 indicating a lack of strong correlation.

It appears reasonable to use the 1953 to 1968 streamflow records for evaluation of the operation of the Upper Kula Water System. The 1962 drought at Station #333 falls within our streamflow record period and provides an excellent benchmark

A second test for the appropriateness of using the 1953 to 1968 data compared the Log Pearson Type III (LP3) distribution of rainfall at the Haleakala Ranger Station (338) for the 15-year period to that for a longer 40-year period from 1950 to 1990. The LP3 distributions for monthly and annual series for both periods were found to have high correlations, indication that the 1953 to 1968 period would be representative for hydrologic conditions in the model.

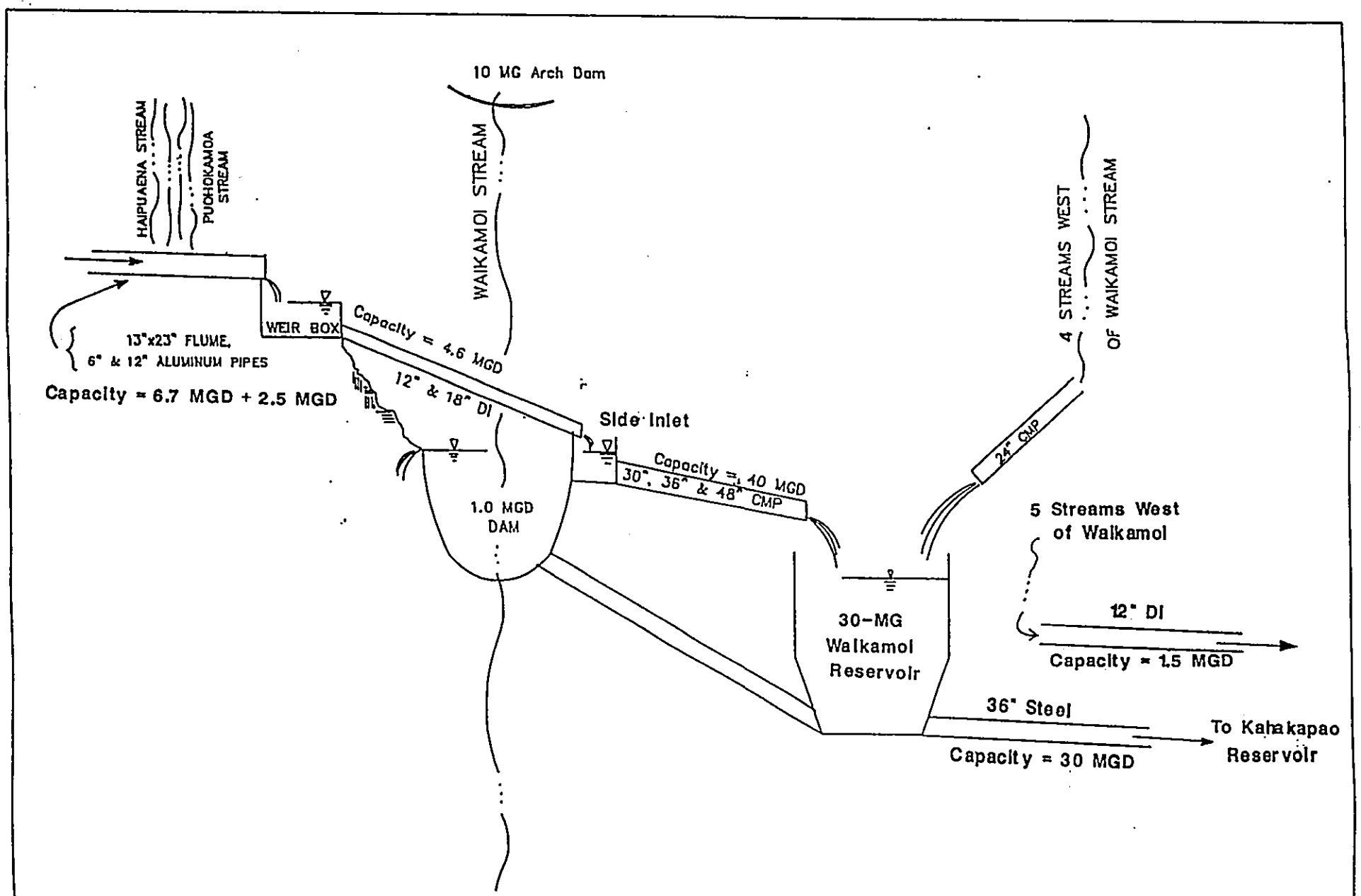


FIGURE A

SCHEMATIC OF UPPER KULA SYSTEM COLLECTION ELEMENT

Intake Capacity

A variety of intakes, numbering about 50, and conveyances comprise the Upper Kula Water System collection system. (See Figure A) Larger intakes are grated wiers and most smaller intakes are pipes projecting through low dams. Conveyances consist of PVC pipe, corrugated metal pipe, and wooden flume. Most intakes collect the low flow and gradually allow overflow as streamflow increases. Temporary clogging of intakes by vegetative debris is common. Collection capacity can be limited by by either intakes or conveyances. Assumptions about the effectiveness of the collection systems are described below.

Haipuaena collection is constrained to 6.7 MGD by the capacity of the 13"X 23" flume. It is assumed that the first 1 MGD is collected completely, from 1 MGD to 20 MGD flows are proportioned such that at 20 MGD will result in 6.7 MGD collected, and flows in excess of 20 MGD are not collected. The collected flow is reduced by a factor of 0.6 to account for cloggage of the intake.

Puohokamoa collection is constrained to 2.5 MGD by the capacity of the 6" and 12" diameter pipes. The first 1 MGD is assumed to be completely collected, flow to 10 MGD are proportioned to result in 2.5 MGD collected from 10 MGD of streamflow, and flows in excess of 10 MGD are not collected. The collected flow is reduced by a factor of 0.6 to account for cloggage of the intake.

Collected flows from Haipuaena and Puohokamoa are combined in a wier box next to Waikamoi Stream. A pair of pipes with a 4.6-MGD capacity conveys the flow to the inlet box to the 30-MG Waikamoi reservoir. Flows in excess of 4.6 MGD are assumed to overflow into Waikamoi Stream above the 1-MG dam. No retention capacity is assumed at the wier box.

A side inlet at the 1-MG Waikamoi Dam collects water from Waikamoi Stream and conveys it to the 30-MG Waikamoi reservoir. The conveyance pipeline to the reservoir has a capacity of 40 MGD. It is assumed that the first 20 MGD (which includes up to 4.6 MGD from Haipuaena and Puohokamoa) in Waikamoi Stream is collected, the next 40 MGD are proportined to result in 40 MGD collected when streamflow is 60 MGD, and all flow in excess of 60 MGD are not collected. No reduction in collected flow is made at the Waikamoi side inlet due to its size.

Flow from the streams west of Waikamoi are collected in two systems. Four of the nine intakes are on a 24" diameter pipeline, with a 10-MGD capacity, that conveys the collected water to Waikamoi Reservoir. It is assumed that the four intakes have a 1 MGD capacity each. If (4/9)*West_total is less than 4 MGD all water is collected and flow in excess of 4 MGD is uncollected. The five remaining intakes are on the old 12" diameter pipeline, with a 1.5-MGD capacity, leading to Olinda. If (5/9)*West_total is less than 1.5 MGD all water is collected. Flow in excess of 1.5 MGD is not collected. The collected flows are reduced by a factor of 0.6 to account for cloggage of the intakes.

Storage and Transmission

The Waikamoi reservoir has a capacity of 30 MG and is assumed to be operated as a transfer reservoir. No permanent storage will occur. Water will be transfered to Kahakapao reservoir as quickly as possible through the 36-inch diameter pipeline with a 30 MGD capacity. If transmission of 30 MGD is not possible due to lack of storage in Kahakapao Reservoir, water will be carried over to the next day in Waikamoi Reservoir. If total inflow from Waikamoi, Haipuaena, Puohokamoa, the four west streams, and water carried over in the reservoir exceeds 30 MGD the excess overflows back into Waikamoi Stream.

The old 12-inch diameter pipeline was assumed to service only the five intakes west of Waikamoi in this analysis. No connection between Waikamoi Reservoir and Kahakapao Reservoir with the 12-inch diameter line was assumed.

The Kahakapao Reservoir with 100-MG storage receives inflow from the 36-inch diameter transmission pipeline and the 12-inch diameter pipeline with five inlets. Outflow is to the Olinda Water Treatment Plant and the proposed agricultural water system. No evaporation or rainfall was assumed in the analysis as they are thought to be roughly equal.

Irrigation Water Requirement

Irrigation water requirements were determined for the crops grown in the Upcountry Maui area using the consumptive use method. Three general composite groups were used in the analysis - Truck Crops with drip irrigation, Truck Crops with sprinkler irrigation, and Orchards/Christmas Trees/Protea using drip irrigation.

Twelve rain gage stations in the service area were identified. Records from these gages were used generate monthly gross irrigation requirements for crops for 50 to 90 percent rainfall probability conditions. Average irrigation requirements within the service area for the three crop groups were used.

The rainfall probability in the service area during the 1953 to 1968 simulation period was computed by month from daily records from Station 338. The monthly rainfall probability was used to determine the gross irrigation demand per acre of each crop group. Crop acreages were varied in the simulation to observe the capacity of the water system to provide adequate water.

Reservoir Operation

The fifteen years of daily streamflow records described above were used to simulate operation of the Upper Kula Water System both with and without an agricultural water project.

The domestic demand was held constant for all analyses at 1.0 MGD. This increased future demand accounts for expansion of residential homesteads in Keokea and increases in family-type subdivisions and other development. The total domestic demand will be about 450 gallons per day per household.

Future without Project Condition

Reservoir operation for the future without project (FWOP) condition was conducted using fwop_res.prg.

The FWOP condition assumed farming of the 398 acres identified on the 1992 aerial photographs and on 75 acres of the DHHL land in Keokea. Approximately 43 percent of the crops would consist of orchards, protea, and Christmas trees. The rest will consist of truck crops of which 20% will be drip irrigated and 80% will be sprinkler irrigated.

The water supply system consists of the existing collection system, 36-inch diameter transmission pipeline, 100-MG Kahakapao Reservoir, the Olinda Water Treatment Plant, and the existing distibution system. Also assumed was 60% collection efficiency on all intakes due to cloggage except for the grated weir on Waikamoi Stream which was assumed to be unaffected by cloggage. The two 15-MG reservoirs at Waikamoi were used to retain high flows before transmission to the Kahakapao reservoir. Due to the water treatment functions of the Olinda reservoirs they have not been included as system storage in our analysis.

The limiting factor is the Water Treatment Plant which is limited to 1.7 MGD. The existing distribution system has a 2.0 MGD capacity in its Olinda to Omaopio section of pipeline.

Modeling analysis showed that for the FWOP condition an average of 65 percent of the time inadequate water supply was provided to the 473 acres of cropland for a system reliability of 35 percent. The constriction at the WTP is the cause of the low reliability. Using the existing WTP, 165 acres of proportionally the same mix of crops can be irrigated at 90 percent reliability and 190 acres at 80 percent reliability. during the simulation, the Kahakapao reservoir supply was never exhausted.

Future with Project Conditions

Two alternatives were evaluated - agricultural water distribution pipeline and agricultural water pipeline with an additional reservoir. Reservoir operations for future with project (FWP) conditions were conducted using fut_res.prg.

The FWP condition assumed between 473 and 722 acres of irrigated cropland. The 473 acres are those that were identified for the FWOP condition. The percentage breakdown

of crops remains the same. The expanded acres are only assumed to be within the project area and in the same proportions as the 473 acres.

The water supply system for both FWP alternatives assumes the same collection, transmission, and storage as the FWOP condition. Both FWP alternatives propose a separate agricultural water distribution system attached to the Kahakapao Reservoir which will bypass the Water Treatment Plant. The agricultural water reservoir in the second FWP alternative will be placed after Kahakapao reservoir on the agricultural water distribution system.

Domestic water demand is assumed constant at 1.0 MGD for both FWP alternatives.

The primary limiting factor for the FWP alternatives is storage. The storage reservoir(s) are drained frequently during dry periods in the simulation resulting in water shortages. Transmission also plays a minor limiting role by providing ony 31.5 MGD capacity against the 45.5 MGD of the collection system capacity. All agricultural distribution system pipelines will be sized to accommodate demand for 80 percent rainfall, irrigating on a 12-hour cycle.

Modeling analysis indicated that the pipeline alternative can provide 90.8 percent irrigation water reliability to 473 cropland acres and 81.1 percent reliability to 722 cropland acres. The pipeline and 35-MG reservoir alternative will provide 95.1 percent reliability to 473 cropland acres and 86.3 percent reliability to 722 cropland acres.

ENGINEERING

Introduction

Three alternatives were developed for consideration by the sponsors. Alternative 1 is a No Action alternative and assumes the FWOP condition. Alternative 2 proposes the installation of a separate agricultural water distribution system. Alternative 3 proposes the installation of a separate agricultural water distribution system and a 35-MG agricultural water reservoir. Development of the two structural alternatives is described in the Plan.

The distribution of agricultural water is intended to be gravity-powered. Pipeline alignments were decided considering hydraulic head and land acquisition needs. The distribution pipelines were modelled and sized using the NRCS-developed IPIPE computer program. All project-installed pipes are assumed to be 160 psi, SDR 11 High Density Polyethylene plastic pipe.

A 35-MG reservoir was designed at Mahanalua for Alternative 3. Several other sites had been identified during the Water Resources Study phase but were given low consideration for various reasons. Refinements in design at the Mahanalua site resulted in a reduction in the storage capacity that could be efficently developed at the site from earlier estimates.

The location and operation of the agricultural reservoir forces the distribution pipeline to a more downslope alignment than Alternative 2. Three service areas will need pumping to provide water to higher elevation farms in Alternative 3.

Costs

Total installation cost sums construction, engineering, project administration, and real property costs. The average annual cost of the installed project is the amortized installation cost, for 50 years at the federal Fiscal Year 1995 discount rate of 7.75 percent, plus the average annual operation, maintenance, and replacement cost. The costs were updated in 1996 usin the Engineering News Record's Construction Cost Index.

Table 4 provides quantities of construction items, unit costs, construction costs, and other installation costs.

Construction Costs

Construction costs include materials and labor for the construction and installation of the main and lateral pipelines, appurtenent devices, bridges, and access roads. Construction costs also include pollution control during construction, revegetation of bared ground surfaces, and mobilization/demobilization costs.

Project cost estimates were made based on work item quantities and unit costs. Unit costs were developed using past estimates and bids for similar work performed in Hawaii by NRCS and the Maui Department of Water Supply. Update of costs used the Engineering News Record's Construction Cost Index. Quantities for each work item were estimated through the preparation of low- to medium-intensity engineering designs.

For agricultural water management purposes, PL-566 will provide up to 50 percent of construction costs.

Real Property Costs

Real property costs include acquisition of construction and maintenance rights-of-way, relocation and repair of utilities and road surfaces, acquisiton of water rights, and legal costs for these items. All real property costs are the responsibility of the sponsors.

Land value for pipeline easements is estimated to be $10,000 per acre. Approximately 16 acres of privately owned land will be required for the pipeline and access road.

TABLE 4
ALTERNATIVE 2 - RECOMMENDED PLAN
(Revised March 1997)

CONSTRUCTION ITEM	UNITS	QUANT.	UNIT COST	TOTAL COST
Mobilization	LS	1	52750	52750
			0	0
Main Pipeline (HDPE)			0	0
18 in	ft	16500	61.19	1009635
16 in	ft	9220	52.75	486355
14 in	ft	2880	45.36	130651
12 in	ft	3700	36.92	136622
10 in	ft	6450	31.65	204142
8 in	ft	10800	26.38	284850
Appurtenances	ls	1	112613	112613
			0	0
			0	0
Lateral Pipeline (HDPE)			0	0
8 in	ft	28530	26.38	752479
6 in	ft	28600	18.99	543114
5 in	ft	0	15.82	0
4 in	ft	15680	13.71	215051
3 in	ft	18400	10.55	194120
2 in	ft	6650	8.44	56126
Appurtenances	ls	1	88044	88044
			0	0
			0	0
Sublateral Pipeline (HDPE)			0	0
2 in	ft	10000	8.44	84400
Appurtenances	ls	1	4220	4220
			0	0
Road Crossings	ft	3000	10.55	31650
			0	0
Gulch Crossings	ea	13	10550	137150
			0	0
Access Road	ft	48320	26.38	1274440
				5798413
CONTINGENCY (20%)				1159683
TOTAL CONSTRUCTION				6958096
ENGINEERING SERVICES (15%)				1043714
PROJECT ADMINISTRATION (15%)				1043714
REAL PROPERTY	ac	16.8	10550	177240
TOTAL INSTALLATION				9222765

Engineering Costs

Engineering costs include surveys for pipeline alignment and installation, design of the pipeline and connections, preparation of the design plans and specifications, and quality assurance during construction. All engineering costs except those associated with real property elements and construction inspection are the responsibility of NRCS.

Engineering costs have been estimated to be 15 percent of total construction cost.

Project Administration Costs

Project administration costs costs include contract administration, government representatives during construction, costs associated with permit acquisition, and relocation assistance costs. Project administration costs will be shared by PL-566 and local funding sources.

Contracts will be administered by the State Department of Agriculture and will be guided by state and federal contract requirements. Project costs are estimated to be 15 percent of total construction costs and two-thirds of the cost will be borne by the sponsors.

Operation, Maintenance, and Replacement

Operation, maintenance, and replacement costs include the costs of keeping project improvements in good working order, accounting for water sales, billing, and coordination with the Department of Water Supply and the East Maui Irrigation Company. Operation, maintenance, and replacement costs are the responsibility of the sponsors.

PUBLIC PARTICIPATION

Introduction

Public input to the development of the Upcountry Maui Watershed Plan and Environmental Impact Statement was encouraged and maintained throughout the planning process. The Upcountry Maui Watershed Plan is an implementation action of the Water Resources Study for Upcountry Maui conducted by the USDA Soil Conservation Service between 1985 and 1989. As such, many elements of public participation were carried over from the study phase to the plan preparation phase. The community concerns generated during the study phase through public meetings and agency contacts directed the initial formulation of project alternatives.

The Steering Committee, with representatives from the U.S. Forest Service, State Department of Land and Natural Resources, Department of Hawaiian Home Lands, Olinda-Kula SWCD, Hana SWCD, Tri-Isle Resource Conservation and Development

Council, Maui County Council, Maui Department of Water Supply, and the Maui Farm Bureau, continued to provide input and review through both study and planning phases. The Steering Committee generally met twice a year and as needed. The committee was able to bring to the plan formulation process discussion of other projects in the Upper Kula area that may impact the Upcountry Maui project; concerns of farmers, other water and land users, and landowers in the project area; and integration of State and County perspectives and plans regarding water use, development and distribution. The committee continued to meet approximately twice a year and as needed and provided an important forum for project planners, Sponsors, and the community to discuss and mold the Upcountry Maui Watershed Plan.

In March 1989, following authorization of planning funds for the Upcountry Maui Watershed by the Chief, Soil Conservation Service, a fact sheet and a preliminary alternative depicting an agricultural water reservoir and distribution system was mailed to 60 agencies, groups, businesses, and individuals with a request for data and concerns. Responses were received from The Nature Conservancy; Sierra Club-Maui Group; State Historic Preservation Division; U.S. Forest Service; State Division of Water and Land Development; Maui Department of Water Supply; U.S. Fish and Wildlife Service; State Department of Agriculture; Hawaiian Entomological Society; and Maui Planning Department.

The federal Scoping for EIS preparation and State of Hawaii Environmental Review process were conducted concurrently. In June 1993, correspondence, including a fact sheet and displays of the preliminary alternative plan, was sent by the Chairperson, Board of Agriculture to over 60 agencies and groups with a request for comments as part of the state's Pre-Assessment Consultation. Responses were received from the Maui Department of Water Supply; State Division of Water and Land Development; U.S. Army Corps of Engineers; State Department of Transportation; Maui County Council; State Division of Aquatic Resources; State Department of Business, Economic Development and Tourism; State Land Use Commission; State Department of Accounting and General Services; State Division of Forestry and Wildlife; State Department of Health; Maui Planning Department; State Department of Defense; Federal Aviation Administration, and U.S. Environmental Protection Agency.

The federal Notice of Intent was published in the Federal Register, Honolulu Star-Bulletin, Honolulu Advertiser, and Maui News in May 1993. The Notice of Intent announced a public meeting to be held on June 9, 1993 in Makawao. News releases announcing the meeting were sent to major radio stations on Maui. The meeting was attended by 23 persons. Comments were received from the audience both orally and from survey forms.

A final Environmental Assessment was completed in November 1993 and its availability and the Notice of Determination to prepare an EIS was published in the State Office of Environmental Quality Bulletin in December 1993.

ENVIRONMENTAL ANALYSIS

Introduction

The analysis of the environmental effects of the watershed project was an ongoing effort throughout planning. Environmental analysis consisted of the following major steps.

1. Scoping of Concerns - Environmental, cultural, and social concerns are identified and available data collected.

2. Preliminary Assessment - Those concerns that may be significantly impacted by project installation are identified.

3. Detailed Investigation/Inventory - Field survey by specialists to develop information base for concerns identified in preliminary assessment phase.

4. Detailed Assessment - Determination of the impacts of project implementation.

Many of the environmental, cultural, and social concerns were identified during the Water Resources Study for Upcountry Maui. Additional concerns were raised during early project consultations and through the Scoping/Pre-assessment consultation phase. The concerns are displayed as Table B - Evaluation of Identified Concerns and are discussed in Chapter 4 - Scoping of the EIS. The concerns are ranked by the impact of the project on the particular resource or situation and for the significance of the concern to decisionmaking. Those concerns that rank low or none in the two catagories are not discussed beyond Chapter 4.

Threatened and Endangered Species

Reponses from The Nature Conservancy, U.S. Forest Service, U.S. Fish and Wildlife Service, State Department of Agriculture, Hawaii Entomological Society, and the Maui Department of Planning received during the 1989 correspondence with agencies cited treatened and endangered species concerns in the Upcountry Maui Watershed.

Correspondence from The U.S. Environmental Protection Agency, State Division of Forestry and Wildlife, State Division of Aquatic Resources, and Maui Tomorrow; comments made at scoping consultation meetings with the U.S. Fish and Wildlife Sevice and the State Commission on Water Resources Management; and concerns voiced at the Public Scoping Meeting also cited T&E species concerns.

Four categories of concerns were raised - impacts to the native rainforest habitat for T&E bird species and native vegetation in the water collection area, disruption to the captive breeding program for the endangered Hawaiian crow, impacts to aquatic habitat for native freshwater gobies, atyid shrimps, and other aquatic fauna, and impacts to remnant native dryforest plants in the gulches of the service area.

The Makawao and Koolau Forest Reserves contain areas of undisturbed native rainforest that provide essential habitat for the recovery of the listed endangered Maui Parrotbill (Pseudonestor xanthophrys), Maui Akepa (Loxops Coccineus), Maui Nukupuu (Hemignathus lucidus), Poouli (Melaprosops phaesoma), and Crested Honeycreeper (Palmeria dolei). Invasion of alien plant species into the native forests by way of road and structure construction, clearing of vegetation, importation of materials, feral pig rooting, and marijuana cultivation was cited as a threat to native ecosystems. No actions of the Recommended Plan will be in the Forest Reserves or native rainforest areas and will have no effect on T&E species found in those areas.

The Olinda Endangered Species Captive Propagation Facility is within the Project Area of the Recommended Plan. Construction traffic for the agricultural distribution system and construction of the Olinda lateral may disturb the propagation program for the 'alala (Corvus hawaiiensis). Project activities near the propagation facility will not take place between April and July which is the breeding season for the 'alala. All activities near the facility will be coordinated with the OESCPF staff.

The effect of the Recommended Plan on stream habitat for T&E species was investigated through an aquatic survey conducted in November 1994 (Moncrief and Galloway, 1994). No T&E species were observed or collected in reaches of Waikamoi Stream above the lowest diversion at the 720-foot elevation. The Upper Kula Water System collection system is situated at the 4,200-foot elevation. A native damselfly (Megalogian hawaiiense), a candidate 2 species for federal lissting, was collected at the 720-foot elevation. A 1988 survey observed a native goby (Lentipes concolor), a candidate 1 species for federal listing at the 550-foot elevation of Waikamoi Stream.

A botanical survey was conducted along the pipeline alignment to identify T&E plant species affected by project installation (Herbst, 1994). No T&E species were observed along the alignment of the distribution pipeline.

According to the U.S Fish and Wildlife Service the Hawaiian hoary bat (Lasiurus cinereus semotus), a federally-listed endangered species, has been sighted throughout various portions of the project area.

In a March 8, 1995 letter, the U.S. Fish and Wildlife Service concurred with the NRCS determination that, with the actions described above, the proposed project will have no adverse impact under Section 7 of the U.S. Endangered Species Act.

Cultural Resources

In April 1989 and July 1993 correspondence, the State Historic Preservation Officer stated that there are a number of significant historic sites listed in our inventory that may potentially be affected by the proposed project. Several heiau and petroglyph sites exist in Keokea and are listed in the Hawaii Register of Historic Places. The letter also stated that

an archeological survey conducted for the Department of Hawaiian Home Lands identified numerous historic sites within the DHHL property. The letter recommended that an archeological survey be undertaken along the selected pipeline route to identify historic sites and assess the significance of sites that may be affected by the project.

An archeological survey consisting of archival research, review of literature, and a field survey of the proposed pipeline alignments was conducted in November 1994.

There are no known historic properties listed on the Hawaii or National Registers of Historic places or the Hawaii Inventory of Historic Places that occur within the proposed construction corridors of Alternatives 2 and 3. Specifically, no Native Hawaiian heiau, burial caves, petroglyphs, and ahupua'a walls were identified during the archeological fieldwork. Alternative 2 has the potential to disturb newly identified areas containing surface dryland agricultural features and associated temporary shelters and trails. Sections of the deeper gulches which have streamflow may contain potential, but at present unidentified, special purpose botanicals. Alternative 3, with the exception of the proposed Mahanalua reservoir and connecting waterline, traverses the existing Upper Kula waterline corridor which has removed, disturbed, or otherwise destroyed any previous surface structures representative of significant historic site types. Subsurface remains of habitational structures and dryland agricultural features have the potential to be present at several locations along the proposed waterline corridors for Alternatives 2 and 3 based on information from Mahele maps, Historic homestead sites, aerial photographs, and archeological reconnaissance survey.

Consultation with the State Historic Preservation Division to meet the requirements of Section 106 of the National Historic Preservation Act of 1966 is in progress.

Reduction in Streamflow and Aquatic Habitat due to Increased Diversion of Streamwater

Concerns regarding effects to aquatic habitat due to proposed diversion of Kakipi Stream was cited in their July 1989 correspondence. Oral and written survey comments received at the Public Scoping Meeting on June 9, 1993 asked for consideration of downstream uses of streamwater in the stream systems.

The collection area for the Upper Kula Water System is owned by the East Maui Irrigation Company which has registered water diversion with the State Commission on Water Resources Management. The East Maui Irrigation Company contractually supplies the Maui Department of Water Supply with water from the collection area. Improvements have been made to the transmission and storage elements of the Upper Kula Water System in recent years.

The existing collection and transmission elements are completely gravity operated. All of the water collected at the stream diversions not exceeding the intake, collection flume, or pipeline capacities is conveyed through the 1-MG Waikamoi reservoir to the 30-MG

Waikamoi reservoir at maximum rate of 40-MGD. Occasionally during high flows, overflow from the 30-MG Waikamoi reservoir spills back into Waikamoi Stream. Water is transferred from the 30-MG Waikamoi reservoir to the 100-MG Kahakapao reservoir via the 31.5-MGD capacity transmission pipeline. Most excess water in the system overflows the wier at the Kahakapao reservoir into Kahakapao gulch.

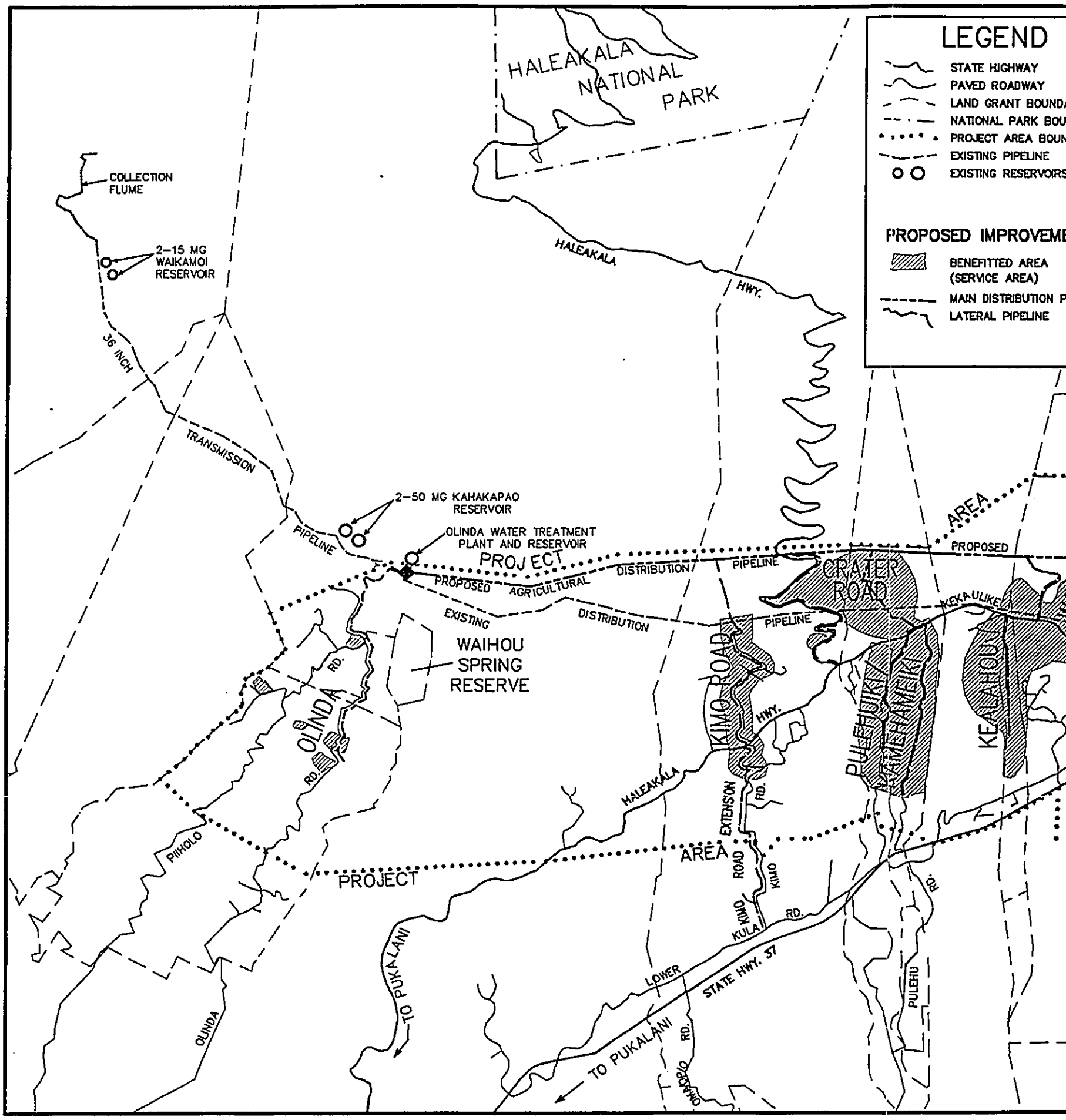
The alternative plans for the Upcountry Maui Watershed, developed in 1993-1994, proposed no improvement to the existing collection system of the Upper Kula Water System primarily to avoid further environmental impacts to aquatic habitats and to prevent adverse effects to the native forest ecosystems of the collection area. Thus, there would be no effect to the aquatic ecosystems of any of the streams in the collection area of the Upper Kula Water System resulting from this project.

TABLE 5 - EFFECTS OF THE RECOMMENDED PLAN ON RESOURCES OF PRINCIPAL NATIONAL RECOGNITION
UpCountry Maui Watershed, Hawaii

Type of Resource	Principal Source of National Recognition	Measurement of Effects
Air quality	Clean Air Act, as amended (42 U.S.C. 1857h-7 et seq.)	No effect
Areas of particular concern within the coastal zone	Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et seq.)	No effect
Endangered and threatened species critical habitat	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)	No effect
Fish and wildlife habitat	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.)	No effect
Floodplains	Executive Order 11988, Floodplain Management	No effect
Historic and cultural properties	National Historic Preservation vation Act of 1966, as amended (16 U.S.C. Sec. 470 et seq.)	
Prime and unique farmland	CEQ Memorandum of August 1, 1980: Analysis of Impacts on Prime or Unique Agricultural Land in Implementing the National Environmental Policy Act, Farmland Protection Policy Act of 1981	473 acres of farmland to be improved with adequate and consistent irrgation water supply.
Water quality	Clean Water Act of 1977 (33 U.S.C. 1251 et seq.)	No effect
Wetlands	Executive Order 11990, Protection of Wetlands Clean Water Act of 1977 (42 U.S.C. 185h-7, et seq.)	No effect
Wild and scenic Rivers	Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271 et seq.)	Not present in planning area

APPENDIX E

PROJECT MAP


LEGEND
STATE HIGHWAY
PAVED ROADWAY
LAND GRANT BOUNDA
NATIONAL PARK BOU
PROJECT AREA BOUN
EXISTING PIPELINE
EXISTING RESERVOIRS
PROPOSED IMPROVEME
BENEFITTED AREA (SERVICE AREA)
MAIN DISTRIBUTION P
LATERAL PIPELINE
HALEAKALA NATIONAL PARK
COLLECTION FLUME
2-15 MG WAIKAMOI RESERVOIR
36 INCH TRANSMISSION PIPELINE
2-50 MG KAHAKAPAO RESERVOIR
OLINDA WATER TREATMENT PLANT AND RESERVOIR
PROJECT
PROPOSED AGRICULTURAL DISTRIBUTION PIPELINE
EXISTING DISTRIBUTION PIPELINE
WAIHOU SPRING RESERVE
OLINDA RD.
HALEAKALA HWY.
KIMO ROAD
CRATER ROAD
PROPOSED PROJECT AREA
KEKAULIKE
PULEHUIKI
KAMEHAMEHA
KEALAHOU
HALEAKALA HWY. EXTENSION
KIMO ROAD
KIMO KULA RD.
PIIHOLO
OLINDA RD.
TO PUKALANI
LOWER PULEHU RD.
STATE HWY. 37
TO PUKALANI
OMAOPIO RD.

PROJECT MAP

Agricultural Water Distribution System
Upcountry Maui Watershed
County of Maui, Hawaii

LEGEND

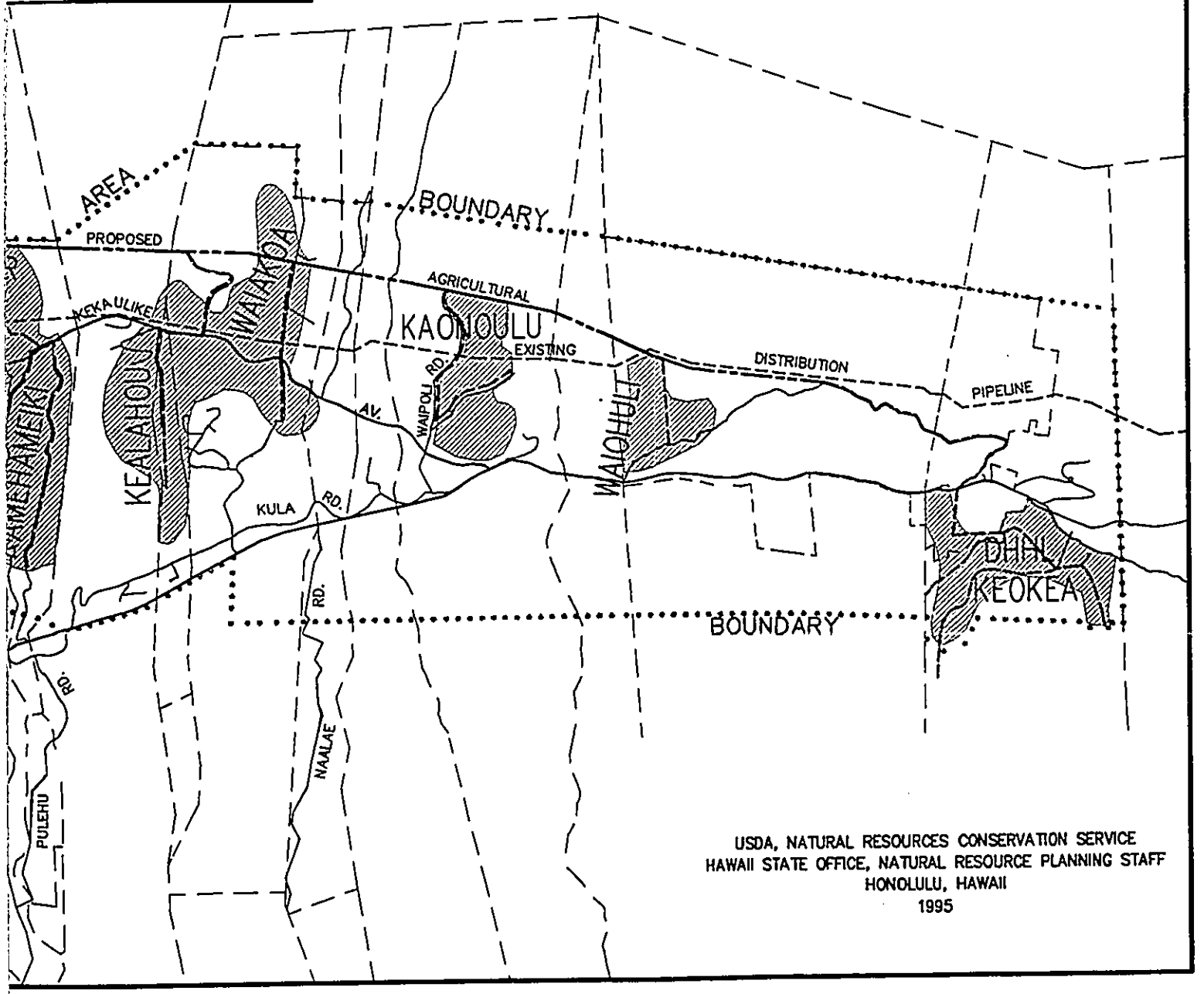
- STATE HIGHWAY
- PAVED ROADWAY
- LAND GRANT BOUNDARY
- NATIONAL PARK BOUNDARY
- PROJECT AREA BOUNDARY
- EXISTING PIPELINE
- EXISTING RESERVOIRS

PROPOSED IMPROVEMENTS

- BENEFITTED AREA (SERVICE AREA)
- MAIN DISTRIBUTION PIPELINE
- LATERAL PIPELINE

1 0 1 2
Scale in Miles

HAWAII



USDA, NATURAL RESOURCES CONSERVATION SERVICE
HAWAII STATE OFFICE, NATURAL RESOURCE PLANNING STAFF
HONOLULU, HAWAII
1995

(X) RETAKE
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( ) ADDITION

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CAMERA

CERTIFICATE

I hereby certify that the microphotographs appearing between "START OF (X) RETAKE" and this CERTIFICATE are true copies of records described below. ( ) OMISSION" ( ) ADDITION"

It is further certified that the microphotographic processes were accomplished in a manner and on film which meets the requirements of the National Bureau of Standards and American National Standards Institute for permanent microphotographic copy.

1997-02-MA-FEIS.
Upcountry Maui Watershed Plan (all)

March 15, 2007
Date

Advanced Micro. Image Systems. HI.
Vendor

J. Kaai
Camera Operator

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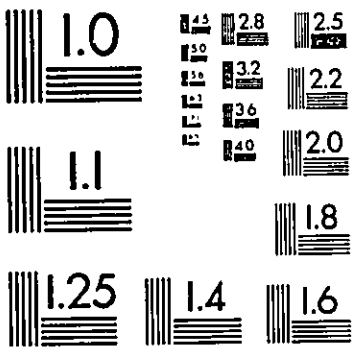
PRECISION[SM] RESOLUTION TARGETS



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PA-3 8½″x11″ PAPER PRINTED GENERAL TARGET

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