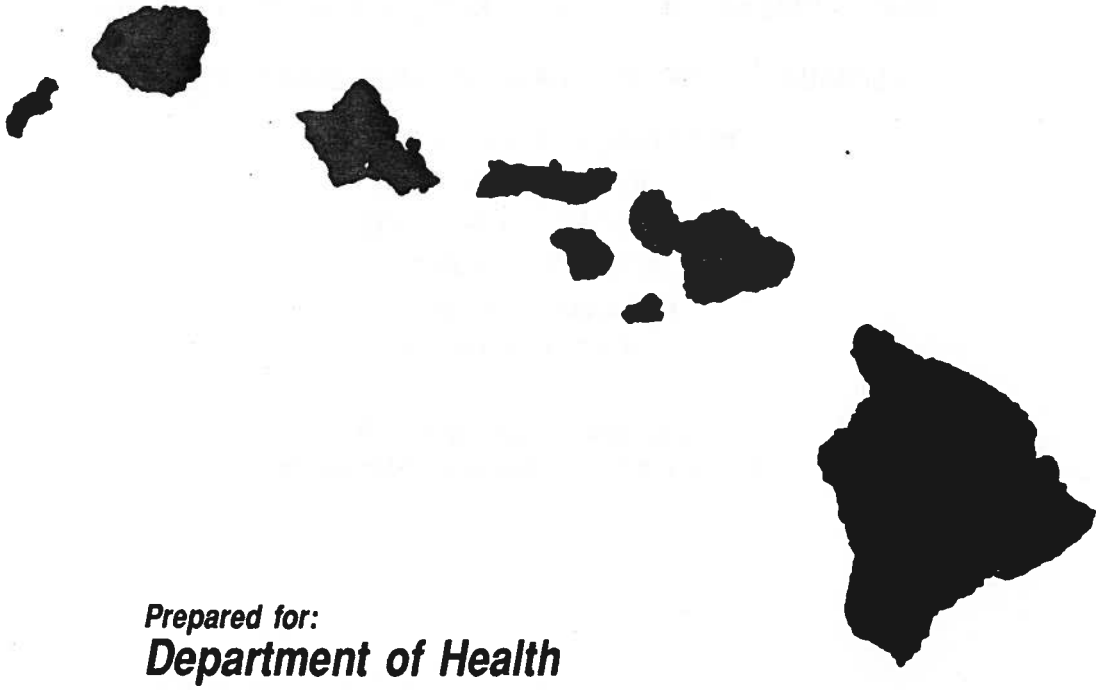
HAWAII WATER PLAN

WATER QUALITY PLAN



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Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawaii

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JOHN WAIHEE
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Preface

In 1987, the State Legislature passed the State Water Code (HRS Chapter 174C) to protect and manage Hawaii's surface and ground water resources. Part III and Part V of the State Water Code calls for the formulation of a Hawaii Water Plan, an integrated program for the protection, conservation, and management of the waters of the State. The **Water Quality Plan** is one of seven subplans which collectively comprise the Hawaii Water Plan, and will serve as a continuing long-range guide for water resource management.

On June 27, 1990, the State Commission on Water Resource Management accepted the Water Quality Plan for incorporation into the Hawaii Water Plan, with the following stipulations:

(1) The State Department of Health (DOH) will continue to refine its Water Quality Plan and establish water quality criteria for the designation of ground water and surface water management areas, pursuant to Sections 174C-44 and 174C-45 of the State Water Code.

(2) The DOH, in collaboration with the Commission, will establish a long-term arrangement for the interchange of water quality/quantity information, pursuant to Section 174C-67 of the State Water Code.

(3) The DOH will review and revise its Water Quality Plan by July 1, 1991, and every two years thereafter.

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SUMMARY

Description

The State Water Quality Plan is one of the plans that together comprise the Hawaii Water Plan required by the State Water Code (Chapter 174C, HRS) adopted by the Legislature in 1987. The Code provides for the development of a comprehensive water resources planning program culminating in the preparation and adoption of a state water plan consisting of two main parts. One part addresses water use and protection and the other, water quality.

The water quality plan describes the Department of Health (DOH) and other programs that are in place and in the process of development that provide protection for ground and surface waters, particularly those that are existing or potential sources of drinking water. The document is organized as follows: Chapter I provides the historical background and an overview of water planning in Hawaii. Chapter II describes those Federal, State and County goals, objectives, and policies which have been adopted by law or administrative rule. Water quality criteria and standards, monitoring and enforcement activities, and current problems are addressed in Chapter III. Existing water quality management programs and recommended policies and strategies are described and discussed in Chapter IV, and Chapter V identifies future research needs.

Related Water Quality Planning Efforts

Because water quality is a major national concern, numerous laws, regulations and programs have been enacted and adopted to address various types of pollution. The federal government has been the dominant force in water quality planning since the passage of the Federal Water Pollution Control Act Amendments of 1972, also known as Public Law 92-500. In 1977 this law became the Clean Water Act. It is administered by the U. S. Environmental Protection Agency (EPA). The comparable state law is the Water Pollution Act (Chapter 342D, HRS).

The Clean Water Act is mainly concerned with surface waters. In 1974, the Federal Safe Drinking Water Act was enacted. It was the first official recognition of the importance of ground water as a source of drinking water. The state law which implements this program is the Safe Drinking Water (Chapter 340E, HRS). Both laws have two distinct parts. One part sets up the regulatory mechanism to protect developed public drinking water supplies "at the tap." The provisions of this part of the act, along with those of state law, make up the state Safe Drinking Water Program, described later on in this document.

The other part of the Safe Drinking Water Act provides for protection of groundwaters that are existing or potential sources of drinking water from pollution by subsurface injection of waste materials. It is the basis for the State's Underground Injection Control (UIC) program.

Other laws and programs that provide regulatory protection of ground and surface waters from potential pollutant address solid and hazardous wastes and underground storage tanks. These are also described in the plan. Related water planning efforts include the State and County "208" Water Quality Management Plans, the Hawaii Water Resources Plan, the Hawaii State Plan, and the Health and Water Resources Development Functional Plans developed pursuant to the Hawaii State Plan.

Water Quality and Drinking Water Standards

The state policy on water quality is anti-degradation. Waters whose quality is higher than established water quality standards shall not be lowered in quality unless it has been affirmatively demonstrated that the change is justifiable. The burden of proving justification is on the applicant. The state as also declared that it is the public policy of the state to conserve the waters of the state and to protect, maintain, and improve the quality of state waters to protect the legitimate beneficial water uses identified in the standards.

The water quality standards include classification of state waters, both by their physical characteristics and by their beneficial uses, and numeric criteria applicable to the several classifications.

The state safe drinking water act provides for the promulgation and enforcement of both primary and secondary drinking water standards. Primary drinking water standards "shall protect health to the extent feasible, using technology, treatment techniques, and other means which are generally available, taking cost into consideration." Secondary drinking water standards are directed more at the aesthetics of water and are not as well defined, being those "requisite to protect the public welfare." The administrative rules establish maximum contaminant levels and requirements for public water systems.

Groundwater Protection Program

The major policy document for protection of groundwater sources is the state groundwater quality protection strategy. The stated goal of the strategy is to "protect human health and sensitive ecosystems through the protection and enhancement of the quality of groundwater throughout the State of Hawaii." The goal establishes the basis for a program to prevent pollution and provide protection for the entire groundwater resource.

Water Quality Monitoring

Groundwater quality is currently monitored by more than a dozen independent county, state, federal, and private institutions. Their monitoring activities are designed to obtain specific information and are limited to drinking water wells and synthetic organic contaminants.

Because the great majority of wells used for drinking water purposes are not located in the vicinity of pollutant sources, the actual degree of contamination resulting from pollutant sources can rarely be determined. Without site-specific monitoring, the magnitude and extent of potential groundwater contamination can only be estimated or modeled based on factors such as waste characteristics, geology, and the quality of underlying water bodies. DOH has undertaken a program to develop a systematic means of screening Hawaii's groundwater resources for compounds which are most likely to be present due to environmental contamination. This program is described in Chapter III.

DOH's surface water monitoring program is confined to estuary and coastal waters. No streams used for drinking water are monitored on a regular basis.

Water Quality Problems

The quality of water in Hawaii is generally excellent. Most of the domestic water supplied to consumers does not undergo any significant treatment for physical or biological contaminants. With the exception of chlorination, no additional treatment is required. There are abundant quantities of groundwater for domestic water supply on all the major islands. Even in areas that may be subject to contamination, groundwater can usually be developed at a safe distance from the source of contamination. Water quality problems are mainly associated with small systems that utilize surface water from streams or ditches. Problems include undesirable taste, odor, turbidity, and bacterial levels.

On Oahu, where 99 percent of the water furnished by the Board of Water Supply comes from groundwater, only about 20 percent requires chlorination, and only where the pure groundwater is contaminated by bacteria entering storage tanks or transmission facilities or coming in contact with surface water. Treatment for removal of minute quantities of TCP, EDB, and/or DBCP is provided at Waipahu 1 and Kunia 2 wells and wells in Upper Mililani. The U.S. Army Schofield Shafts wells also receive treatment to remove small quantities of volatile contaminants.

The situation is similar on Kauai, where 98 percent of the drinking water supplied by the Department of Water Supply comes from groundwater. All of the system's water is chlorinated on general principles. Kalaheo, the only part of the system utilizing surface water, is the site of the only county water treatment plant.

Hawaii and Maui utilize more surface water than Oahu and Kauai. For the Big Island, 72 percent of domestic water supplies come from groundwater and 28 percent from surface sources. The only treatment plant is at Waimea. All drinking water receives chlorination.

On Maui, the percentage of potable water supplied by ground and surface water in the county systems varies between the hydrologic districts of the island. The proportions are 70 percent from groundwater sources, and 30 from surface sources. Treatment plants are used for Makawao and Kula. The rest of the water supply is filtered but untreated except for chlorination.

Groundwater

Compared to mainland states, Hawaii has very few groundwater problems, and those it has are well under control. The focus of the groundwater protection program is therefore on prevention rather than clean-up. Hawaii has long utilized controls on land use to protect groundwater resources. Even before the state land use law was adopted in 1961, forest and water reserves had been established on the major islands. These watershed reserves became part of the new Conservation District classification and have been kept in as natural a state as possible to protect the purity of the rainfall that percolates into the area. Activities are strictly regulated by the Department of Land and Natural Resources.

On Oahu, the Board of Water Supply established an informal "no-pass" line (denoting areas where direct injection of wastewater is prohibited) that was officially recognized by DOH in 1977. The UIC program also established "no-pass" lines restricting placement of injection wells for the other islands.

However, not all aquifers are within these protected areas, and not all potential sources of pollution are controlled. Direct sources that may affect groundwater quality include injection wells and individual household wastewater disposal systems such as seepage pits and cesspools. Less direct pollution may come from leachates from landfill sites or leakage from surface impoundments or underground storage tanks. Groundwater may also become contaminated by even more diffuse forms of pollution such as agricultural return flows.

The aquifer classification program now being undertaken will provide the mechanism to address the remaining land areas which are underlain by unconfined aquifers and potentially vulnerable to contamination that are not protected by the UIC program or Conservation District designation. The aquifer classification program and other activities designed to prevent groundwater pollution are described in more detail in Chapter IV.

Surface Water

Although almost all of the existing problems in meeting potable water quality standards are associated with surface water sources, none of the problems are attributable to direct discharge. While mainland states have used their rivers and streams for both wastewater discharge and as sources of drinking water, the limited amount of industrial development in Hawaii has grown up adjacent to or near the shoreline and coastal harbors. Wastewater has been discharged into coastal waters rather than streams. In the unusual instance where discharges enter streams, they are well downstream of water intake pipes.

The failure of surface water to meet water quality standards is generally attributable to natural causes, such as excessive organic material and soil particles, or from diffuse or nonpoint sources of pollution such as agricultural runoff. Since these are the kinds of problems that are extremely difficult to prevent, the preferred solution is to replace surface water sources with ground water sources wherever possible. The programs to control the various activities that cause or contribute to surface water pollution are described further in Chapter IV.

Future Research Needs

Although knowledge about Hawaii's water resources has increased greatly over the last decade, there are still a number of areas that require further research. Some of these additional research needs are as follows:

Characterization of Aquifers: Characterization of ambient groundwater quality and aquifer delineation should be completed for all islands except Niihau and Kahoolawe.

Prediction of Pollutant Migration Through Soils. This type of activity has been initiated at the University of Hawaii Water Resources Research Center and College of Tropical Agriculture. The results of this type of research could form the basis for the strategy for the proposal for restricting pesticide registration.

Alternatives to Pesticide Use. The state's effort to find alternatives to the use of pesticides should be expanded, especially alternatives to the use of termaticides. Alternative building construction methods and biological controls are of prime interest.

Well Design. Additional research on preventing pollution by improved well design, well drilling methods, and the design and operation of well-head facilities should be undertaken.

Chapter I

INTRODUCTION AND BACKGROUND

Description

The State Water Quality Plan is one of four plans that together comprise the Hawaii Water Plan required by the State Water Code (Chapter 174C, HRS). The Plan addresses ground and surface waters that are existing or potential sources of drinking water, and is organized as follows: This Chapter provides the historical background and an overview of water planning in Hawaii. Chapter II describes those federal, state and county goals, objectives, and policies which have been adopted by law or administrative rule. Water quality criteria and standards, monitoring and enforcement activities, and current problems are addressed in Chapter III. Existing water quality management programs and recommended policies and strategies are described and discussed in Chapter IV. Chapter V identifies future research needs.

Water Code Legislative History

The 1978 Hawaii state constitutional convention proposed and the electorate approved a number of significant changes to the State constitution. Among these was the addition of a new provision for comprehensive management of the State's water resources. In 1982, the Hawaii legislature created an Advisory Study Commission on Water Resources to review the issues relating to the State's water resources and formulate a water code for the State.

A major recommendation of the Advisory Commission was the development of a comprehensive water resources planning program that would culminate in the preparation and adoption of a state water plan consisting of two main parts. One part would address water use and protection and the other, water quality. The Commission envisioned the water quality portion of the plan as consisting of (a) water quality standards and (b) water quality objectives for planning and operating water resource development projects, for water control activities, and for improving existing water quality. It was the clear intent of the Commission that discharges which contaminate water supplies be strictly controlled (Advisory Commission on Water Resources 1985).

The Water Code subsequently adopted by the Legislature in 1987 includes the Commissions's recommendation for the preparation and adoption of a water quality plan to protect existing and potential sources of drinking water The task of preparing the water quality plan was assigned to the Department of Health, the lead state agency for the protection of water quality.

Other Laws & Regulations & Previous Water Quality Planning Efforts

Federal Clean Water Act

The federal government has been the dominant force in water quality planning since the passage of the Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500, which has been described as the most comprehensive and complicated law ever passed. PL 92-500, which in 1977 became the Clean Water Act, is administered by U. S. Environmental Protection Agency (EPA). Specific planning efforts aimed at improving water quality are mandated in four separate sections of the Act:

- Section 102 provides for state and interstate river basin planning. Other sections of Title I provide for developing specific plans involving more than one state such as the Great Lakes and Cheasapeake Bay. Title I applies to Hawaii only generally; no specific plans are required.

- Section 201 requires and assists in the development and implementation of municipal waste treatment management plans and facilities. The counties have developed "201" or "facilities" ("fac") plans for each sewage treatment system and service area, e.g., Honouliuli, Hilo, Lahaina, etc. in the state. The plans are frequently reviewed and updated to address changing growth policies and land use patterns, take advantage of newly available technologies, and meet new state and federal treatment requirements.

- Section 208 requires areawide waste treatment management planning. In Hawaii, the "208" plans were initially developed during 1976-1978 on a statewide basis, with a plan for each county and an overall state plan. After public hearings and changes made in response to public comments and EPA review, the plans were revised and adopted in 1980. The "201" plans are subsets of the "208" plans. The "208" plans are in the process of being updated (the City and County of Honolulu plan has been completed).

- Section 303(e) requires planning for the water quality of regions and entire river basins. On the mainland, the "208" plans are subsets of the basin plans. Since there are no actual river basins in Hawaii, each of the counties has been designated as a river basin to meet the requirements of the law. The "208" plans are thus also "303(e)" plans.

Hawaii Water Pollution Act

Hawaii's version of the Clean Water Act, the Water Pollution Act (Chapter 342D, HRS) was initially adopted in 1972 as one section of Act 100 and entitled the "Hawaii Statute on Environmental Quality." It has been amended several times to ensure that

its provisions continue to be equal to or more stringent than the changing federal legislation.

Federal Safe Drinking Water Act

The Safe Drinking Water Act (42 USC 300 et seq.) was enacted in 1974 and was the first official recognition of the importance of ground water as a source of drinking water. The law has two distinct parts. One part sets up the regulatory mechanism to protect developed public drinking water supplies "at the tap." The provisions of this part of the act, along with those of state law, make up the state Safe Drinking Water Program, described later on in this document.

The other part of the Safe Drinking Water Act provides for protection of groundwaters that are existing or potential sources of drinking water from pollution by subsurface injection of waste materials. It is the basis for the state's Underground Injection Control (UIC) program.

Hawaii Safe Drinking Water Act

The state Safe Drinking Water Act (Chapter 340E, HRS) was adopted in 1976 and is similar to the federal legislation. It establishes two separate programs, one for the protection of underground sources of drinking water from pollution and the other the supervision of public water system. It has also been amended to keep current with new federal legislation.

Hawaii Water Resources Plan

The Hawaii Water Resources Plan (HWRP) was prepared by the Hawaii Water Resources Regional Study, an intergovernmental team representing nearly 50 agencies, under the auspices of the U.S. Water Resources Council. The plan, published as a review draft in 1977 and finalized in January, 1979, has a much broader approach than the Clean Water Act plans described above, addressing both water quality and quantity issues. The major emphasis of the study is on an appropriate balance of economic and environmental considerations in water and related land resources planning. The planning period of primary concern in the plan is the decade 1990-2000.

Hawaii State Plan

In 1978, by approving Act 100, the Hawaii State Legislature became the first in the nation to adopt a state plan. Act 100, codified as Chapter 226 of the Hawaii Revised Statutes (HRS) and updated and revised in 1986, serves as a policy document guiding

state and county land use and program decisions. Twelve functional plans have been developed by state agencies and adopted by the legislature. These plans are designed to provide a detailed linkage between programs and policy. The functional plan most directly relevant to this water quality plan is the Health Functional Plan developed by the Department of Health (DOH). The Water Resources Development Functional Plan prepared by the State Department of Land and Natural Resources focuses on water supply and addresses water quality only in relation to salt water intrusion.

Chapter II

PLANNING FRAMEWORK

Goals, Objectives, and Policies

The overall goal of the water quality plan is to protect the public health and sensitive ecological systems by preserving, protecting, restoring and enhancing the quality of ground and surface waters throughout the State of Hawaii.

In addition to the overall goal, there are numerous federal, state and county goals, objectives, and policies for water quality that are set forth in laws, regulations, and various planning documents. The major pieces of legislation, administrative rules and water planning documents and the policies articulated therein are presented in the following paragraphs.

Federal Goals, Objectives, and Policies

Clean Water Act (33 USC 1251 et seq.)

Foremost among the environmental laws pertinent to surface water quality is the Federal Water Pollution Control Act (PL 92-500), amended by the Clean Water Act in 1977 and since then commonly known as the Clean Water Act. The most recent amendments to the Act were adopted in 1987. The goals, objectives and policies of the Congress are set forth in Title I of the Act as a "declaration of goals and policy:" These are as follows:

> The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act---
>
> (1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985;
>
> (2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;
>
> (3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;

(4) it is the national policy that federal financial assistance be provided to construct publicly owned waste treatment works;

(5) it is the national policy that areawide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each ; and

(6) it is the national policy that a major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone, and the oceans.

Safe Drinking Water Act (42 USC 300 et seq.)

The Safe Drinking Water Act regulates private and public providers of drinking water and sets up mechanisms to protect ground water sources of drinking water. The Act does not have a list of goals like the Clean Water Act; however, the intent of the law is quite clear. The objective of the first part of the law is to ensure that public systems provide drinking water that is not injurious to health. It should be noted that the word "public" refers to the size of the system. Public water systems may be privately or publicly owned. Public water systems are defined as those systems which have at least fifteen service connections or which regularly serve an average of at least twenty-five people daily at least sixty days a year. The policy is limited to these systems; drinking water standards do not apply to individual home systems or systems smaller than those described above.

The other part of the Safe Drinking Water Act provides for protection of groundwater. Here the objective and policies are much broader, encompassing all underground water resources that are now or may in the future be used for potable water. However, the regulatory scope of the Act is quite limited, focusing on protection of underground sources of drinking water from pollution by subsurface injection. As presently written, it does not address the nonpoint sources of potential pollution such as agricultural runoff.

Resource Conservation and Recovery Act (42 USC 6901 et seq.)

A major objective of the Resource Conservation and Recovery Act (RCRA) is to protect all sources of drinking water, both surface and ground, from pollution from the release of hazardous constituents or leachates from both ordinary solid waste and hazardous waste storage, treatment, and disposal sites.

State Goals, Objectives, and Policies

Environmental Policy Act (Chapter 344, HRS)

Chapter 344 outlines the state's overall environmental policy and states in part that:

> It shall be the policy of the state . . . to . . . conserve the natural resources, so that land, water, mineral, visual, air, and other natural resources are protected by controlling pollution, by preserving and augmenting natural resources, and by safeguarding the state's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic. and other requirements of the people of Hawaii. Guidelines for the development of programs in pursuance of this policy that relate to water quality include the following:
>
> Encourage management practices which conserve and protect watersheds and water sources, forest, and open space areas.

State Water Code (Chapter 174C, HRS)

The State Water Code addresses all aspects of water management. The declaration of policy for water quality is as follows:

> The state water code shall be liberally interpreted to protect and improve the quality of waters of the state and to provide that no substance be discharged into such waters without first receiving the necessary treatment or other corrective action. The people of Hawaii have a substantial interest in the prevention, abatement, and control of both new and existing water pollution and in the maintenance of high standards of water quality.

Water Pollution Act (Chapter 342D, HRS)

This law establishes the state policy of protection of water quality by prohibiting the discharge of "any pollutant" into state waters except as in compliance with the provisions of the act. "State waters" are defined to include all waters of the state, including groundwater.

The administrative rules adopted to carry out the provisions of the act are as follows:

- Water Quality Standards (Chapter 11-54). This rule sets forth the state policy on anti-degradation of surface waters. Waters whose quality is higher than established water quality standards shall not be lowered in quality unless it has been affirmatively demonstrated that the change is justifiable. The burden of proving justification is on the applicant.

- Water Pollution Control (Chapter 11-55). This rule establishes the state equivalent of the federal NPDES program to control point source discharges. It declares that it is the public policy of the state to conserve the waters of the state and to protect, maintain, and improve the quality of state waters to protect the legitimate beneficial water uses identified in the standards.

- Wastewater Systems (Chapter 11-62). This rule contains a preamble which sets forth state goals for wastewater treatment systems, as follows:

  The State Department of Health seeks to insure that the disposal of wastewater does not contaminate or pollute any valuable water resource, does not give rise to public nuisance, and does not become a hazard or potential hazard to the public health, safety and welfare.

  The State Department of Health seeks to migrate towards an ultimate goal of regional sewage collection, treatment and disposal systems which are consistent with state and county wastewater planning policies. Off-site treatment and disposal systems, followed in priority by on-site systems, meeting health and environmental standards will be allowed whenever they are consistent with state and county wastewater planning policies and on the premise that these systems will eventually connect to regional sewage systems. Individual wastewater systems may be utilized in remote areas and in areas of low density. A goal has been established such that the construction of wastewater disposal systems depositing untreated sewage into the environment will not be allowed after the year 2000. As a means to this end, upon the adoption of these rules, new publicly owned buildings shall utilize a method of sewage disposal other than cesspools.

Safe Drinking Water (Chapter 340E, HRS)

The state safe drinking water act is similar to the federal legislation. It establishes two separate programs, one for the protection of underground sources of drinking water from pollution and the other the supervision of public water system.

The state underground injection control program is designed to protect the quality of the state's underground sources of drinking water (USDW) from pollution by subsurface disposal of liquids. The administrative rule that implements this portion of the law is Underground Injection Control (Chapter 11-23).

The state safe drinking water act also provides for the promulgation and enforcement of both primary and secondary drinking water standards. Primary drinking water standards "shall protect health to the extent feasible, using technology, treatment techniques, and other means which are generally available, taking cost into consideration." Secondary drinking water standards are directed more at the aesthetics

of water and are not as well defined, being those "requisite to protect the public welfare." The administrative rule specific to this program is Potable Water Systems (Chapter 11-20). This rule establishes maximum contaminant levels and requirements for public water systems.

Groundwater Protection Program

The major policy document for protection of groundwater sources is the state groundwater quality protection strategy. The stated goal of the strategy is to "protect human health and sensitive ecosystems through the protection and enhancement of the quality of groundwater throughout the State of Hawaii." The goal establishes a basis for programs to prevent pollution of the entire groundwater resource, not just protection of established beneficial uses.

Solid Waste Pollution (Chapter 342H, HRS)

This act focuses on solid waste disposal, which is defined to include "discharge, deposit, injection, dumping, spilling, leaking, and spilling" of solid waste materials on land or into any water, including ground water. It establishes a permitting system which specifically addresses the prevention of water pollution. The administrative rule that implements this portion of the law is Solid Waste Management Control, Chapter 11-58.

Hazardous Waste (Chapter 342J, HRS)

The Hazardous Waste act stated purposes are to protect both the health, safety, and welfare of the citizens of the state and to protect and conserve the state's natural resources and environment. The protection of ground and surface waters is not specifically addressed but is implicit in the law's mandate. The hazardous waste management program includes treatment and storage as well as disposal of hazardous wastes and is intended to be preventive as well as regulatory. Administrative rules are currently being developed and are tentatively scheduled for public review and comment in August, 1990.

Underground Storage Tanks (Chapter 342L)

Unlike the Hazardous Waste law, the Underground Storage Tank Act has no preamble or stated purpose. However, it is clear from the legislative background of the act that existing and potential pollution of ground and surface waters was a major concern leading to its passage. Administrative rules are currently being developed.

County Goals, Objectives, and Policies

County water quality goals, objectives, and policies are generally part of broad policy statements relating to environmental quality, contained in their general and development plans. Of all the states, Hawaii has the most centralized pollution control regulatory system. Almost all pollution control regulations are at the state level. Although the counties operate and maintain municipal water supply systems and sewage treatment facilities, policies and standards are mostly determined by the state and federal government.

Related Planning Activities

Hawaii State Plan

The Hawaii State Plan objectives for the physical environment include "the maintenance and pursuit of improved quality in Hawaii's land, air, and water resources." Policies to achieve these objectives include "promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters."

State Functional Plans for Health and Water Resources

The Health Functional Plan developed by the Department of Health has several objectives, policies and implementing actions relating to water quality. These are as follows:

- Objective: To prevent degradation and enhance the quality of Hawaii's air, land, and water.

  Policy: Prevent and control the pollution of air, water and land through long-range planning, environmental impact assessments, interagency coordination, programs, regulations, and financial assistance to local government.

- Objective: To minimize the threat to public health from insanitary conditions by ensuring that facilities are built and maintained so that products and services are provided in a healthful manner.

  Policy: Use a combination of education, technical assistance, and regulations to achieve compliance with applicable standards.

Hawaii Water Resources Plan

The Hawaii Water Resources Plan contains objectives and recommended actions to address the quality of both ground and surface water. (The programs that have been

developed to implement these recommended actions are discussed in Chapter IV). The Plan recommendations are as follows:

Ground Water Quality

- Prevent salt water intrusion into basal fresh water aquifers.

  Design and space wells to prevent excessive drawdown and upconing.

  Regulate pumping to minimize fluctuations and avoid thinning of the basal lens.
  Increase infiltration of fresh water to recharge the basal lens.

- Regulate subsurface injection of wastewater.

  Strengthen licensing and monitoring of injection wells, including treatment of injected wastes.

  Restrict wastewater injection to geologically isolated saline aquifers.

- Regulate the use of cesspools, seepage pits, and solid waste dumps which might contaminate ground water.

  Replace cesspools with sewers or other suitable systems.

  Require treatment of all water disposed of in seepage pits.

  Allow solid waste disposal only where leachates will not pose a hazard to ground water.

Surface Water Quality

- Reduce nonpoint source discharges.

  Control feral animal populations to minimize pollution in surface water and to improve vegetal cover in watershed areas.

  Enforce sanitary conditions and good drainage in streams and canals.

County Land Use Controls

The counties manage growth within their areas of jurisdiction through general plans, development plans and zoning ordinances. See the County Water Use and Development Plans for additional information on this subject.

Chapter III

WATER QUALITY STANDARDS, MONITORING, AND CURRENT PROBLEMS

Water Quality Standards

Hawaii's Water Quality Standards are set forth in Administrative Rules, Title 11, Chapter 54. These standards apply to streams and other surface waters, and are relevant to groundwater only to the extent that streamflows discharge into aquifers.

Although certain states and regional water commissions had developed and adopted water quality standards earlier, standards were not adopted generally in the United States until the passage of the National Clean Water Act of 1965. Hawaii's standards were adopted in 1968 following the provisions of this law, and amended in 1974, 1979, 1982, and 1988. Public hearings on additional revisions to the standards were held during August and September 1989. The proposed revisions were adopted without substantial changes on January 18, 1990.

Water quality standards were developed as a result of the problems that arose from depending on the traditional methods of dilution and self-purification to handle increasing amounts of waste. By the 1960'3, urban settlements and industrial activities had created waste loads that overstressed the assimilative capacity of the receiving waters, primarily lakes and streams. Since stream waters are frequently the source of drinking water for downstream users in many areas, and both streams and beaches are used for swimming and other body contact sports, concern for public health led to the development of standards to protect water users and consumers.

The standards include classification of state waters, both by their physical characteristics and by their beneficial uses, and numeric criteria applicable to the several classifications. Chapter 11-54 also contains the rules on Water Quality Certification.

Inland (fresh) waters are classified as either Class 1A, 1B or Class 2. The standards state that:

> It is the objective of class 1 waters that these waters remain in their natural state as nearly as possible with an absolute minimum of pollution from any human-caused source. To the extent possible, the wilderness character of these areas shall be protected. Waste discharge into these waters is prohibited.
>
> The uses to be protected in class 1.a waters are scientific and educational purposes, protection of breeding stock and baseline references from which

human-caused changes can be measured, compatible recreation, aesthetic enjoyment, and other nondegrading uses which are compatible with the protection of the ecosystems associated with waters of this class.

The uses to be protected in class 1.b waters are domestic water supplies, food processing, the support and propagation of aquatic life, compatible recreation, and aesthetic enjoyment. Public access to waters in this class may be restricted to protect water quality.

The objective of class 2 waters is to protect their use for recreation purposes, propagation of fish and other aquatic life, and agricultural and industrial water supplies, shipping, navigation and propagation of shellfish. The uses to be protected in this class of waters are all uses compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible with the criteria established for this class.

Basic water quality criteria applicable to all waters state that:

"all waters shall be free of substances attributable to domestic, industrial, or other controllable sources of pollutants."

Specific criteria for streams set allowable levels of nitrogen, phosphorus, nonfilterable residues (suspended solids), turbidity, pH, dissolved oxygen, temperature and conductance. Specific criteria for inland recreational waters limit the fecal coliform content of the water, an indicator of possible contamination from human or animal wastes.

The new amendments add numeric standards for approximately 100 toxic pollutants including, but not limited to, metals and organic chemicals. These standards are intended to prevent acute and chronic toxicity to aquatic life and protect human health from the consumption of toxic pollutants in aquatic organisms. In addition, the amendments include basic standards limiting the discharge of toxic pollutants to state waters. These will be enforced through effluent limitations in National Pollutant Discharge Elimination System (NPDES) wastewater discharge permits.

The complete Water Quality Standards including the recent revisions are attached as Appendix A.

Drinking Water Standards

Chapter 11-20, Potable Water Systems, regulates Public Water Systems. As noted earlier, "public water system" means a system which provides piped water for human consumption if the system has at least fifteen service connections or regularly serves

at least twenty-five individuals. The term includes any collection, treatment, storage, and distribution facilities controlled by the system and used primarily in connection with the system; and any collection or pretreatment storage facilities not under the control of, but which are used primarily in connection with, the system.

Certain public water systems are exempt from the regulations. To be exempt, the system must meet all of the following criteria:

- Consists only of distribution and storage facilities (and which does not have any collection and treatment facilities);
- Obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;
- Does not sell water to any person; and,
- Is not a carrier which conveys passengers in interstate commerce.

Chapter 11-20 sets maximum contaminant levels (MCL) for inorganic and organic chemicals, turbidity, coliform bacteria, and radionuclides.

MCL is defined as the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system; that is, at the faucet or tap, except for turbidity. The maximum permissible level for turbidity is measured at the point of entry to the distribution system. See Appendix B for the specific MCL's for each contaminant.

Water Quality Monitoring

Groundwater

Groundwater quality is currently monitored by more than a dozen independent county, state, federal, and private institutions. The monitoring activities of these groups--whether ongoing, proposed, or completed--is described in a summary prepared by the Office of Environmental Quality Control (see A Survey of Groundwater Monitoring Efforts in Hawaii, OEQC, August 1986.) Their monitoring activities are generally designed to obtain specific information and are limited to drinking water wells and synthetic organic contaminants.

Because groundwater is reasonably abundant in most areas throughout Hawaii, the great majority of wells used for drinking water purposes, or wells with good chemical quality monitoring information, are not located in the vicinity of pollutant sources. Further, drinking water wells are generally located inland and away from areas where salt water intrusion could create water quality problems. These wells provide useful regional background water quality information, but the actual degree of contamination

resulting from pollutant sources can rarely be determined.

Another challenge to determining pollutant impacts on groundwater bodies, besides the location of wells, is the depth zone within the aquifer that the sample of groundwater represents. Most drinking water supply wells are designed to produce a sufficient quantity of water and to optimize the quality of water within the column to be pumped. Because the upper zones of the aquifer are generally cased off, most wells do not draw their water from the top of the water table where infiltrating groundwater would have the most impact on overall water quality.

Although site-specific observation wells to monitor water near pollution sources are in theory desirable in order to assess and evaluate the impacts of contaminant sources on groundwater quality, in actual practice the monitoring wells may contribute to pollution by creating a pathway for contaminants to enter unpolluted water. Samples must be taken far enough away from an existing drinking water source to ensure that this will not occur. In addition, proper monitoring requires sampling the part of the water column that could be affected by the type of contamination source being evaluated.

Without site-specific monitoring, the magnitude and extent of potential groundwater contamination can only be estimated or modeled based on factors such as waste characteristics, geology, and the quality of underlying water bodies. The Department of Health's surface impoundment assessment, completed in 1980, was the first systematic attempt to relate these three conditions to potential groundwater contamination.

The groundwater monitoring system in Hawaii is designed to be investigative and anticipatory, as well as preventive. Predictive modeling is planned to be utilized in the future to evaluate potential sources of contamination. The Department has undertaken a program to develop a systematic means of screening Hawaii's groundwater resources for compounds which are most likely to be present due to environmental contamination. The objectives of the program are to:

(1) identify previously unconfirmed and undocumented compounds likely to have contaminated groundwater wells used as sources of drinking water, and

(2) assess the risks to human health posed by the exposure to contaminants in Hawaii's groundwater.

Establishing the monitoring program included selection of 39 preliminary target compounds for monitoring; collection of chemodynamic, toxicological, analytical and cost data, and ranking target compounds; selection of monitoring sites and prioritization of target compounds; selection of sampling, analytical, quality assurance and reporting protocols; and selection of laboratories to analyze the compounds.

The program also includes sample collection and computerized reporting of analyses.

Since one of the objectives of the program is to identify previously unconfirmed and undocumented compounds likely to have contaminated groundwater wells used as sources of drinking water, the primary focus is on municipal and domestic wells. Irrigation wells, which may serve as backup sources of drinking water, are being sampled at a lower frequency. The analyses of irrigation well water is not only to confirm previously undocumented findings or reports of contamination by synthetic organic chemicals, but to sample wells when a high suspicion of contamination exists. According to data published by DLNR, there are approximately 273 municipal wells and 157 domestic wells--totaling 430--in the State of Hawaii. Table 1 shows a summary of water wells in Hawaii by island and major use. Table 2 shows water use for individual islands by use category and source.

Determining the compounds to be screened at each well requires the integration of target compound rankings and site-specific environmental factors linked to the geographic location of each site. The WRRC's Technical Memorandum Report No. 75: Aquifer Classification, State of Hawaii will eventually serve as a systematic, geographically-based framework for determining which wells will be screened for particular target compounds. Agricultural land use map patterns for the island of Oahu will be overlain on this framework once it is completed, along with additional data on other potential contaminant sources, e.g., injection wells, as they become available or time allows. Integrating these site-specific data can maximize the efficiency and cost-effectiveness of the program. For example, although a particular compound might have top statewide priority for monitoring, it could be excluded from analysis if there were no historical use of that compound at a particular site.

Conversely, a low priority compound might be elevated to top priority if large quantities of that compound were used up gradient of a particular well site for a long period of time.

Until a final ranking methodology can be developed and validated, an interactive aquifer-by-aquifer assessment of agricultural and industrial activities will be performed to determine which wells will be screened for particular target compounds. These assessments will be conducted through joint technical meetings with the county departments of water supply and Department of Agriculture until a more systematic approach can be developed by DOH. To assist the counties and DOA, the Department of Health's UIC maps will be overlaid on the DOA's Agricultural Use Maps. The UIC maps identify topographic lines, geographical features, well sites and numbers, and the UIC line. The Agricultural Land Use Maps indicate major uses of agricultural lands as recorded by USGS and DOA in 1980. The island of Oahu has been mapped using the above-mentioned overlays; and the islands of Maui, Kauai, Hawaii, Lanai and Molokai will be done as funds are available.

Table 1

SUMMARY OF WATER WELLS IN HAWAII BY ISLAND AND MAJOR USE
SOURCE: DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

Well Status	Statewide		Oahu		Hawaii		Maui		Kauai		Molokai		Lanai		Niihau	
Municipal	273	(10%)	173		42		16		39		2		1		0	
Domestic	157	(5%)	98		13		12		14		20		0		0	
Irrigation	603	(21%)	341		36		162		31		30		3		0	
Industrial	110	(4%)	48		42		11		9		0		0		0	
Observer	156	(5%)	109		7		29		6		5		0		0	
Subtotal			769	(27%)	140	(5%)	230	(8%)	99	(3%)	57	(2%)	4	(1%)		
Unused	484	(17%)	261		82		60		56		20		3		2	
Lost	87	(3%)	24		8		6		42		7		0		0	
Sealed	333	(12%)	314		8		7		2		2		0		0	
Disposal	66	(2%)	30		5		26		5		0		0		0	
Recharge	2	(1%)	1		1		0		0		0		0		0	
Other	120	(4%)	77		3		18		2		19		0		0	
No data	464	(16%)	193		61		156		13		10		7		24	
Total	2855		1669	(58%)	308	(11%)	503	(18%)	219	(8%)	115	(4%)	14	(1%)	27	(1%)

Table 2

Water use for individual islands by use category and source in 1985

(million gallons per day)

Use category:	Hawaii	Maui	Lanai	Molokai	Oahu	Kauai	Niihau
(Ground water)							
Agricultural	0.30	135.04	2.58	3.99	144.62	46.55	0.03
Commercial	.58	0	--	--	28.54	2.50	0
Domestic	15.71	14.79	.41	1.32	140.53	10.48	.03
Industrial (thermal)	51.62	--	--	0	34.42	--	0
Industrial (others)	4.68	.59	--	--	10.03	.31	0
(Surface water)							
Agricultural	46.12	310.25	--	7.38	43.42	160.68	--
Commercial	0	0	--	--	--	--	0
Domestic	9.00	7.56	--	.07	--	.33	0
Hydroelectric	37.79	4.42	0	0	0	122.18	0
Industrial (thermal)	0	0	0	0	0	3.80	0
Industrial (others)	0	0	--	--	--	2.70	0
(Recycled water)							
Agricultural	--	--	--	--	.88	--	0
Industrial (others)	--	--	--	--	0	--	0

Source: *Water Use in Hawaii*, I. Matsuoka. 1985. Prepared by USGS with Dept. of Land and Natural Resources, Division of Water and Land Development.

Surface Water

The surface water monitoring program of the Department of Health is confined to estuary and coastal waters. No streams used for drinking water are monitored on a regular basis.

Water Quality Problems

The quality of water in Hawaii is generally excellent. Most of the domestic water supplied to consumers does not undergo any significant treatment for physical or biological contaminants. With the exception of chlorination, no additional treatment is required. There are abundant quantities of groundwater for domestic water supply on all the major islands. Even in areas that may be subject to contamination, groundwater can usually be developed at a safe distance from the source of contamination. Water quality problems are mainly associated with small systems that utilize surface water from streams or ditches. Problems include undesirable taste, odor, turbidity, and bacterial levels.

On Oahu, where 99 percent of the water furnished by the Board of Water Supply comes from groundwater, only about 20 percent requires chlorination, and only where the pure groundwater is contaminated by bacteria entering storage tanks or transmission facilities or coming in contact with surface water. Treatment for removal of minute quantities of TCP, EDB, and/or DBCP is provided at Waipahu 1 and Kunia 2 wells and wells in Upper Mililani (Pers. Comm. George Hiu, BWS, 1989). The U.S. Army Schofield Shafts wells also receive treatment to remove small quantities of volatile contaminants. Maps indicating the locations where confirmed groundwater contaminants have been detected are at the end of this chapter.

The situation is similar on Kauai, where 98 percent of the drinking water supplied by the Department of Water Supply comes from groundwater. All of the system's water is chlorinated on general principles. Kalaheo, the only part of the system utilizing surface water, is the site of the only county water treatment plant (Pers. Comm. Greg Fujikawa, Kauai DWS, 1989).

Hawaii and Maui utilize more surface water than Oahu and Kauai. For the Big Island, 72 percent of domestic water supplies come from groundwater and 28 percent from surface sources. The only treatment plant is at Waimea. All drinking water receives chlorination (Pers. Comm. Joy Kawakami, Hawaii DWS/Megumi Kon,1989).

On Maui, the percentage of potable water supplied by ground and surface water in the county systems varies between the hydrologic districts of the island. The proportions are 70 percent from groundwater sources, and 30 from surface sources. The Makawao and Kula systems utilize only surface water while Central Maui relies solely on groundwater. The Lahaina and Hana areas use roughly equal portions of ground and surface waters. Treatment plants are used for Makawao and Kula. The rest of the

water supply is filtered but untreated except for chlorination. (Pers. Comm. Tatsumi Imada, Maui DWS, 1989).

The percentages of domestic water obtained from groundwater sources as opposed to surface water sources on each of the major islands are shown in Table 3.

Table 3
Sources of County Drinking Water Supplies (percent)

	Oahu	Kauai	Hawaii	Maui	Molokai
Groundwater	99	98	72	70	95
Surface Water	1	2	28	30	5

Groundwater

Compared to mainland states, Hawaii has very few groundwater problems, and those it has are well under control. The focus of the groundwater protection program is on prevention rather than clean-up. Hawaii has long utilized controls on land use to protect groundwater resources. Even before the state land use law was adopted in 1961, forest and water reserves had been established on the major islands. These watershed reserves became part of the new Conservation District classification and have been kept in as natural a state as possible to protect the purity of the rainfall that percolates into the area. Activities are strictly regulated by the Department of Land and Natural Resources.

On Oahu, the Board of Water Supply established an informal "no-pass" line (denoting areas where direct injection of wastewater is prohibited) that was officially recognized by DOH in 1977 (Pers. Comm. George Hiu, 1989). The UIC program also established "no-pass" lines restricting placement of injection wells for the other islands.

However, not all aquifers are within these protected areas, and not all potential sources of pollution are controlled. Natural conditions also affect groundwater quality. The Water Resources Research Center report on aquifer classification states that:

> The quality of native groundwater is the result of the environments through which infiltration water passes and in which water moves and accumulates. Among the obvious contributors to the chemistry of groundwater in an aquifer is the quality of the original water that recharges into the ground, the chemical properties of soils and rocks through which the water passes, the residence time of the water in the saturated zone, and quality of waters with which the new water mixes. Seawater intrusion also adds salts to all basal groundwater in Hawaii (Mink and Lau, 1987).

The quality of native groundwater can be affected by diverse sources of pollution. Direct sources include injection wells and individual household wastewater disposal systems such as seepage pits and cesspools. Less direct pollution may come from leachates from landfill sites or leakage from surface impoundments or underground storage tanks. Groundwater may also become contaminated by even more diffuse forms of pollution such as agricultural return flows. Maps prepared by the Department of Health showing the location of wells with confirmed results of contamination are at the end of this chapter.

Activities such as these may significantly alter groundwater quality. Moderate increases in concentrations of nitrates, chlorides, sulfates, and silica are attributable to prolonged irrigation of sugarcane. Introduction of organic chemicals from the use of pesticides, herbicides, and nematicides accompany modern agriculture. Virtually any large-scale use of the land may result in some degree of contamination (Mink and Lau, 1987).

The aquifer classification program now being undertaken will provide the mechanism to address the remaining land areas not protected by the UIC program or Conservation District designation. These land areas are largely underlain by unconfined aquifers that are potentially vulnerable to contamination. The aquifer classification program and other activities designed to prevent groundwater pollution are described in more detail in the next chapter.

Surface Water

As noted above, almost all of the existing problems in meeting potable water quality standards are associated with surface water sources. However, none of the problems are attributable to direct discharge. While mainland states have used their rivers and streams for both wastewater discharge and as sources of drinking water, requiring massive and expensive clean-up efforts, the limited amount of industrial development in Hawaii has grown up adjacent to or near the shoreline and coastal harbors. Wastewater has been discharged into coastal waters rather than streams. In the unusual instance where discharges enter streams, they are well downstream of water intake pipes.

For these reasons, the failure of surface water to meet water quality standards is generally attributable to natural causes, such as excessive organic material and soil particles, or from diffuse or nonpoint sources of pollution such as agricultural runoff. Since these are the kinds of problems that are extremely difficult to prevent, the preferred solution is to replace surface water sources with ground water sources wherever possible. The programs to control the various activities that cause or contribute to surface water pollution are described further in Chapter IV.

A preliminary list of streams providing domestic water through municipal systems is presented in Table 4. This table was compiled by the Hawaii Stream Assessment, a

Table 4

Streams Used for Domestic (Municipal) Consumption
(preliminary)

Oahu

Lulumahu Stream

Kauai

Wahiawa Stream

Hawaii

Wailuku River	Kohakuhau Stream
Kahoama Stream	Waikoloa Stream

Maui

Kanaha	Honokohau	Kaupo	Wailua
East Opana	West Opana	Haipuena	Puohokamoa
Waikamoi	Nailiilihaele	Waiohiwi	Hanawi
Makapipi	Kapaula	Waiaaka	Paakea
Waiohue	East Kopiliula	West Kopiliula	East Wailua-iki
West Wailua-iki	Wast Wailua-nui	West Wailua-nui	Kualani
Waiokamilo	Kano	Lalahai	Lalapipi
Kaauau	Hauolo Wahine	Piinaau	Kolea
Puakea	Nuaailua	Honomanu	Uluini
Kolea	Kaaiea	Makanali	Oopuola
West Oopuola	Waihinepee	Alo	East Kolea
West Kolea	Punaluu	Kailua	Ohanui
Hoalua	Hanehoi	Hoolawa-liilii	Hoolawa-nui
West Hoolawa-nui	Honopou	Piiloi	Halenaku
Waipio			

Source: Hawaii Stream Assessment

cooperative project of DLNR and the National Parks Service and is still in draft form. The list is based on information provided by the Counties and other sources and does not include private water systems. It is anticipated that this additional information will become available when DOWALD completes the water certification process, making it possible to prepare a complete table and also maps of all surface domestic water sources.

Chapter IV

WATER QUALITY MANAGEMENT PROGRAMS

Introduction

The following sections describe existing programs for protecting ground and surface water sources, identify the major issues needing resolution, and describe some alternative policies and strategies that are under consideration.

Safe Drinking Water Program

The Safe Drinking Water Program operated by DOH includes surveillance of drinking water, review of drinking water quality data, assistance to suppliers of water, review of plans for public water supply systems, certification of drinking water laboratories, training and certification of public water supply personnel, enforcement of laws, maintenance and inventory of public water suppliers and of records of water quality, and public participation activities.

The Administrative Rule (Potable Water Systems, Chapter 11-20) adopted to implement the law provides for the review and evaluation of the quality of both existing and new domestic water supply sources. It establishes maximum contaminant levels and requirements for sampling and monitoring for inorganic and organic chemicals, turbidity, radionuclides and microbiological contaminants in public water systems. In drinking water regulatory terminology, the word "public" refers to the size of the system. Public water systems may be privately or publicly owned. Public water systems are those systems which have at least fifteen service connections or which regularly serve an average of at least twenty-five people daily at least sixty days a year. Drinking water standards do not apply to individual home systems.

One of the issues facing the program is addressing problems associated with small water supply systems not covered by drinking water legislation, including individual residential systems such as catchment basins, and the degree to which state government should get involved in monitoring and remedying system deficiencies. An example of this problem is the level of lead in catchment systems which became a concern during 1988, resulting in the Department of Health committing considerable resources to address the question.

Ground Water Protection Activities

Industrial, Domestic and Agricultural Discharges

The major administrative rule for protecting groundwater from pollution is the Underground Injection Control or UIC program (Chapter 11-23). It establishes a state underground injection control program to protect the quality of the state's underground sources of drinking water (USDW) from pollution by subsurface disposal of waste materials.

Section 4 provides criteria for the classification of "exempted aquifers," i.e., aquifers or portions thereof that are exempted from being designated as USDW. Section 5 identifies the boundary between exempted aquifers and USDW, or the "UIC line." These boundaries have been drawn and mapped for each county. Maps can be obtained from the Department of Health and the County Departments of Water Supply.

Section 6 describes the five different classes of injection wells and their uses. Wells in Class I through IV are used for the disposal of hazardous wastes, industrial and municipal waste fluids, by-products from oil and natural gas production, mineral mining wastes, and radioactive wastes. Class V wells are used for the disposal of sewage, industrial wastes, cooling and air conditioning waters, storm water runoff, aquaculture effluent, and the recharge of aquifers to restore water or prevent the intrusion of salt water into fresh water. Without exception, only Class V wells are permissible in Hawaii.

Section 11 provides for the permitting of all UIC activities in the state and prescribes the conditions for their operation. Chapter 11-23 requires that all UIC wells be operated in such a manner that they will not violate the provisions of Chapter 20, Potable Water Systems and Chapter 11-55, Water Pollution Control.

Household Waste Disposal Systems

Discharges of sewage from individual household systems not utilizing injection wells are regulated by Chapter 11-62. Under present regulations, acceptable disposal systems include aerobic units, septic tanks, seepage pits, and cesspools.

In December, 1988, the Director of Health indicated the intention of the DOH to implement and enforce a statewide policy to not allow the installation of cesspools in any area where water resources may be threatened. The Director announced that, effective January 1, 1990, no new cesspools will be approved in any "critical wastewater disposal" area. The policy states that individual wastewater disposal systems utilizing septic tanks, aerobic units or any other treatment methodologies will continue to be considered on a case-by-case basis.

The Director has established Wastewater Advisory Committees for each county to assist

DOH in implementing the policy by designating critical wastewater disposal areas on each island. Once agreement has been reached on tentative boundaries for the proposed critical wastewater disposal areas, amendments to Chapter 11-62 will be prepared and the changes presented at public hearings.

This policy does not affect sensitive groundwater areas where cesspools are already in use. State and county policy is to eventually replace all existing cesspools in urban areas with sewers and require owners of lots utilizing cesspools to hook up to new sewer systems within a specified time period.

In rural areas, however, hook-up to sewer systems is not practical or even feasible. Ordinarily, the potential for contamination of drinking water supplies for isolated individual systems is very low because of the small quantities of potential contaminants relative to the size of the resource, and the assimilative capacity of soils. Problems are usually due to a specific cesspool contaminating a specific well because they are too close to one another or because of the existence of a subsurface lava tube or some other connection allowing contamination. These problems can be resolved by relocation of one or the other, and prevented with proper siting.

Where cesspools are currently in use above critical wastewater disposal areas and it is physically or economically impractical to connect to a regional public sewer system, alternate methods of wastewater disposal will have to be utilized to meet the Department's required level of treatment. Consideration will also be given to system maintenance requirements.

Solid Waste Disposal

Leachates caused by rain water percolating through landfills have the potential to contaminate ground water. Fortunately, most landfills in the state have been located near population centers at lower elevations, away from drinking water sources. The location and construction of future solid waste disposal sites is controlled by Chapter 11-58, Solid Waste Management Control.

This rule provides for the establishment of minimum standards governing the design, construction, installation, operation, and maintenance of solid waste disposal systems in order to prevent pollution of drinking water supplies or waters of the state; conserve natural resources; and preserve and enhance the beauty and quality of the environment. Chapter 58 also provides for a solid waste management permit system and solid waste management responsibility. Solid waste disposal is allowed only in landfills permitted by the Department of Health.

Section 4 requires solid wastes to be deposited in a sanitary manner to prevent waste materials, leachate, or eroded soil particles from entering the waters of the state (which include groundwater) without receiving the best practicable treatment or control. Provisions to maintain landfills in order to control problems which result from

leachate are included. Permittees may be required to install, maintain, and operate monitoring equipment for the detection of pollution or contamination resulting or tending to result from the operation of a facility.

Section 5 requires that the disposal of chemical wastes at a landfill be in specifically constructed trenches or pits that are designed to retain the wastes and prevent infiltration into ground and surface waters. It also dictates specific procedures for the disposal of pesticides and pesticide containers in landfills.

Revisions to Chapter 11-58 are being considered to provide specific protection to groundwater resources from pollution or contamination resulting or tending to result from the operation of solid waste disposal facilities.

State policy is to allow solid waste disposal only where leachates will not pose a hazard to potable groundwater.

Hazardous Waste

The Department of Health currently works with Region 9 of the U.S. Environmental Protection Agency to administer and implement the hazardous waste management program under a cooperative agreement. As noted in Chapter II, administrative rules under Chapter 342J are currently being developed. The Department will be seeking delegation of the Federal RCRA program from EPA.

Since there is no hazardous waste disposal site in Hawaii, the major focus of the program is on treatment and storage facilities. Fortunately there are no such facilities located above a USDW in Hawaii.

Underground Storage Tanks and Pipelines

Leaking underground storage tanks and pipelines are capable of releasing large amounts of potentially hazardous chemicals to groundwater over a long period of time without being detected. Under the Underground Storage Tank (UST) Program, EPA has developed performance standards for new tanks and regulations for leak detection, prevention, and corrective action at existing underground tank sites. The standards, which were adopted in September, 1989 and replace interim standards which have been in place since May, 1985, bar installation of unprotected (from corrosion) tanks under most conditions and require owners to inform appropriate state or local agencies of tanks currently used or abandoned during the past 14 years.

EPA is gathering information to determine the extent of the problem with leaking underground storage tanks nationwide. The Agency has also issued a chemical advisory on the potential dangers from leaking fuel tanks in order to bring the problem to the attention of tank owners and operators. Congress has asked for other

studies and, when they are completed, EPA will make recommendations concerning any additional regulatory actions which may be needed.

The Department of Health implements a regulatory UST program to oversee UST owner and operator compliance with the federal UST technical and financial responsibility requirements. It is also responsible for administering the Leaking Underground Storage Tank (LUST) Trust Fund program.

Hawaii's Underground Storage Tanks statute, Chapter 342L, provides procedures for the issuance of permits and variances; authority to conduct investigations, inspections and take corrective action; authority for enforcement; and authority to establish performance standards for new tanks. The law also establishes a response program for petroleum releases which includes authority to take corrective action in case of leaks and establish a trust fund to pay for such actions, and to institute a technical assistance program to assist operators. The Department is in the process of promulgating rules to implement the new law.

Salt Water Intrusion

The State Water Code designates the DLNR as the lead agency to prevent deterioration of groundwater quality caused by the unregulated withdrawal of water from an aquifer. Strategies identified in the Hawaii Water Resources Plan to control salt water intrusion are to (1) design and space new wells and regulate pumping schedules of all wells to prevent excess thinning of fresh water lenses; (2) increase fresh water recharge to basal aquifers; and (3) determine the long-term effects of periodic overdraft on ground water quality.

In order to prevent salt water intrusion, all new wells should be designed to maximize sustainable yields. When use changes, that is, when water from an existing well is reallocated to a new use such as from sugar plantation irrigation to urban development, the method of pumping should be re-evaluated. Wells that are no longer in use should be reviewed by the Department of Land and Natural Resources for their value as observation wells. Wells that are not usable should be sealed.

Pesticide Runoff

The Hawaii Pesticide Law, Chapter 149A H.R.S., administered by the Hawaii Department of Agriculture, provides for the registration, licensing, certification, record-keeping, usage, and other activities related to the safe and efficacious use of pesticides. There are no specific provisions for groundwater protection at this time. However, Section 32 requires that the Chairperson of the Board of Agriculture may initiate action to determine whether the use of a pesticide constitutes an unreasonable adverse effect on the environment when residues of the pesticides are detected in drinking water. The Chairperson, in consultation with the Advisory Committee on

Pesticides and also with the approval of the Director of Health, must suspend, cancel, or restrict the use of a pesticide or specific uses of the pesticide when such usage is deemed to have an unreasonable adverse effect on the environment.

In order to ensure that there are no future problems, pesticide registration criteria should be developed to rate pesticides on their potential to migrate through soils and into groundwater. Pesticides that could pose a threat to drinking water should not be allowed to be registered in Hawaii or at least their use should be prohibited in groundwater recharge areas. Alternatives to pesticide use should continue to be developed. The Departments of Land and Natural Resources and Agriculture have been very successful in finding natural enemies of selected plant pests and implementing biological controls. A similar program is needed to find alternatives to the use of termaticides, either through biological controls or alternative construction methods. In addition, the use of low-toxicity, degradable, non-persistent chemicals for non-agricultural uses such as home gardens, commercial and public landscaping, and golf courses should be encouraged.

Fortunately, both geology and time are working to rectify past mistakes. Unlike mainland aquifers, the Pearl Harbor aquifer is not confined. There is a natural flushing action, as new fresh water flows in and replaces older water. If no additional amounts of EDB and DBCP are introduced into the system, the levels should drop and improvement to the groundwater will occur as a natural process.

Groundwater Quality Protection Strategy

The major policy document for protection of groundwater sources is the state groundwater quality protection strategy adopted by the Department of Health and approved by the Governor on March 12, 1990. The strategy is a workplan to develop:

- A clear description of the problems and issues being addressed and the goal and objectives to be achieved.

- A statewide program to protect groundwater resources, emphasizing both pollution prevention and a partnership among federal, state, and county governments for the regulation and management of groundwater quality.

- A short-term action plan and strategy for dealing with groundwater quality problems and long-term plans for resource protection.

- A greater recognition and understanding of groundwater quality problems in Hawaii through the gathering and analyses of data and a clear description of the problems and issues being addressed.

- A program to increase public awareness about groundwater quality and the human health risks resulting from groundwater contamination.

The goal of the strategy is to "protect human health and sensitive ecosystems through the protection and enhancement of the quality of groundwater throughout the State of Hawaii." It is recognized that adoption of the goal will not by itself automatically bring an end to undesirable discharges into the groundwater. It will guide policy decisions with a determination that no avoidable pollution is "acceptable." The goal establishes the basis for a program to prevent pollution and provide protection for the entire groundwater resource.

Anti-Degradation Policy

Hawaii's groundwater policy states that:

> . . .degradation of groundwater resources that may compromise existing or future beneficial uses will not be allowed or permitted within the State of Hawaii. As a matter of priority, all existing and projected future underground sources of drinking water will be given the highest levels of protection.
>
> Groundwater quality degradation shall be prevented by restricting activities that may threaten groundwater in areas where groundwater is vulnerable to contamination, and by requiring the utilization of best practical control technology to protect the public's health and sensitive ecological systems. The burden of proof that proposed activities will not degrade groundwater rests with the permit applicant. Any uncertainties will be resolved in favor of protecting groundwater resources. This policy shall be implemented by all regulatory programs which have a potential impact on groundwater quality.

Differential Management Strategy

The principal issue facing the program is to determine the level of protection that should be provided to each groundwater aquifer. Unlike the American continent where aquifers tend to be distinct and separate, fresh water lenses underlie virtually all of the major islands in Hawaii. To prevent all contaminants from entering the aquifers is not practical given there are no alternative places to conduct human activities.

While non-degradation of groundwater is an admirable goal, it is not a practical policy. Non-degradation cannot be accomplished unless all existing and future cesspools, seepage pits, septic tanks, land applications systems for recycling wastewater, and landfills are prohibited. However, the concept of preventing degradation through differential management is achievable.

A differential management strategy will be used to implement the groundwater

anti-degradation policy. Groundwater will be protected by restricting activities in areas where groundwater is vulnerable to contamination and by utilizing the best practicable control technology for activities that have a potential to pollute groundwater. Certain activities may be prohibited near wellheads and other special designation areas to prevent contamination of a well or aquifer.

Since it is recognized that all wastes are not equally hazardous, the strategy recognizes that priorities for groundwater protection must consider the toxicity of potential contaminants. Ground disposal of some types of wastes will be allowed in some areas. This does not include hazardous wastes. The state's policy on hazardous waste is that no hazardous waste will be allowed to be disposed of in Hawaii. Hazardous wastes must be reused or recycled. Residual hazardous materials that remain must be shipped out of the state to EPA-approved hazardous waste sites.

Priorities for protection will be based, in part, on the type of contaminating source involved. Both the Hazardous Waste Program, under the Resource Conservation and Recovery Act (RCRA), and the UIC program, under the Safe Drinking Water Act (SDWA), set forth requirements applicable to different contaminating sources. A different technical approach will be used for each source category and, where appropriate, sources will be grouped in ways that will simplify the promulgation of new regulations or the revision of old ones.

The strategy identifies a number of preventive mechanisms that may be utilized individually or in combination with each other. The state will first coordinate and integrate, where necessary, the preventive mechanisms currently available to existing environmental programs within the Department of Health and other state and county agencies. If necessary, new preventive mechanisms will be developed to supplement existing programs, including the following:

- Numerical and narrative standards for unregulated contaminants to be incorporated into the licensing and permitting of discharges.

- Facility design and treatment requirements to be no less stringent than best practical control technology as determined by the Department of Health.

- Better management practices for nonpoint sources of groundwater contamination

- Controlling and restricting land uses to protect groundwater.

Monitoring and trend analysis of results will be used to determine appropriate actions to be taken where contamination of drinking water sources has resulted from current or past activities. EPA maximum content levels and health advisories established for the Safe Drinking Water Branch will be used as reference points for decision-making. Trend analysis may indicate that regulatory action to restrict certain activities is necessary. Prior to the implementation of any regulatory standards, mitigation will be required if a threat to public health or sensitive ecosystems is found to exist.

A groundwater quality certification program to evaluate whether or not a proposed activity will violate applicable water quality standards may be developed and implemented similar to the existing water quality certification program for surface and coastal waters (Chapter 54, §11-54-09.1). This groundwater certification program would be coordinated and integrated with the control of nonpoint source pollution and other management plans.

As the cause and effect relationships of groundwater contamination become more clearly understood, further controls to address emergent problems and issues will be developed and implemented. Policies and strategies to protect groundwater will be reviewed for applicability and effectiveness every three years, and revised as appropriate.

Implementing Activities

The strategy identifies five areas for implementation. These are:

- Continue the implementation of the interim groundwater quality monitoring strategy to screen drinking water and other wells for contaminants likely to be present as a result of past and current land activities. This activity is planned to complement the monitoring of public water systems for regulated contaminants presently conducted by DOH.

- Identify the geographic distribution and concentration of groundwater contaminants in the state, including assessment of trends where problems are known to exist. Data quality assurance and quality control are essential in the characterization of groundwater resources, assessments to support regulatory activities, and response to site-specific problems. A centralized information system for groundwater quality data is planned for development.

- Develop criteria and a system for classifying groundwater, determine the levels of protection groundwaters and recharge areas are to receive, map groundwater bodies according to their classifications, and describe the ambient quality of each groundwater body.

- Define the roles and activities of existing state and county agencies that regulate or affect the regulation of groundwater. Identify potential program deficiencies and recommend changes to existing programs.

- Develop an educational program to provide information and technical assistance.

The key element for implementation of the groundwater quality protection strategy is the classification of Hawaii's aquifers according to hydrogeologic parameters and vulnerability to contamination, and of groundwater by quality characteristics relative to beneficial uses. Groundwater classification establishes the basis for a systematic

approach to designating areas where aquifers need to be protected and restricting activities that constitute a probable threat of pollution to groundwater.

This program is being undertaken for the Department of Health by the University of Hawaii's Water Resources Research Center which has developed a classification system applicable to all aquifers in the state. The classification system is based on hydrology, geology, existing use, quality, replaceability, vulnerability to contamination, and ecological importance.

Once aquifers are identified, they are placed in different categories with each assigned a different level of protection. Classification may be based on use, existing quality, vulnerability to contamination, quantity of water withdrawn from the aquifer and population served, and economic and social considerations. Aquifer classification establishes the basis for a systematic approach to siting activities that either pollute or constitute a probable threat of pollution to groundwater.

Aquifer identification and classification has been completed for Oahu and is attached as Appendix C. This document describes the system that will be used for all islands with groundwater resources. The document describing aquifer identification and classification for Maui is in final draft form. Aquifer identification and classification for Kauai is expected to be completed in 1991, with similar programs planned for Hawaii, Molokai and Lanai in subsequent years.

The classification of aquifers is consistent with present practices under the UIC program. Under the classification scheme, all aquifers on the makai (towards the ocean) side of the UIC line will be Class III groundwater, and those aquifers on the mauka (towards the mountains) side of the UIC line will be Class II. This second group of aquifers will be further divided to identify Class I aquifers. The proposed criteria for Class I, Class II, and Class III aquifers are described below.

Class I: Special Groundwaters. These are aquifers which are highly vulnerable to contamination because of the hydrologic characteristics of the areas where they occur. Class I aquifers are designated as either "irreplaceable" or "ecologically vital." Aquifers are designated irreplaceable where no reasonable alternative source of drinking water is available to substantial population. An ecologically vital aquifer provides the base flow for a particular sensitive ecological system or unique habitat that could be destroyed by pollution.

Class II: Current and Potential Sources of Drinking Water and Waters Having Other Beneficial Uses. These are all other groundwaters that are currently used or are potentially available for drinking water or other beneficial uses. Class II groundwaters have been identified by the state's UIC program as being all groundwaters mauka of the UIC line.

Class III: Groundwaters Not Reasonably Considered Potential Sources of Drinking Water and of Limited Beneficial Use. These are groundwaters that are heavily saline

(contain total dissolved solids levels over 5,000 mg/L), contaminated beyond levels that allow cleanup using methods reasonably employed in public water system treatments or situated at a depth or location that currently makes recovery of water for drinking water purposes economically or technologically impractical. These groundwaters must not migrate to Class I or II groundwaters, or have a discharge to surface water that could cause degradation. Class III groundwaters have already been identifies by the state's UIC program as being all groundwaters makai of the UIC line.

The proposed classification scheme definitions correspond to the definition of an "exempted aquifer" and an "underground source of drinking water," as shown in the following diagram.

UIC	Proposed Classification
Underground Source of Drinking Water	Class II (includes Class I)
(UIC Line)	
Exempted Aquifer	Class III

Further refinement of the existing classification for Class I groundwaters will be based primarily on the presence of physical conditions that provide some degree of natural protection from contamination. This will also identify particularly vulnerable situations as candidates for strict controls. Additional criteria may include rates and volumes of groundwater movement, as well as groundwater recharge. The second element of the classification scheme will be the groundwater's intrinsic value in terms of yield, water quality, and the availability of alternative water supplies in an area. The third and final element in the classification scheme will be the existing and potential use of the groundwater.

Because recharge area identification and protection have already been established by the counties and the Department of Land and Natural Resources through the designation of watersheds, the proposed aquifer classification scheme will be designed around existing recharge area (watershed) management programs. These areas will continue to receive the highest level of protection in order to prevent the degradation of groundwater quality.

Maps showing the existing UIC lines for each of the islands and the aquifer classification boundaries for Oahu are available from the Department of Health.

There are different minimum quality requirements for groundwater based on its intended use and the necessity for regulation can depend significantly upon the minimum quality requirement associated with a particular use. Examples of major use categories are: (1) drinking water; (2) irrigation; (3) source for surface flow; (4) livestock drinking water; (5) industrial cooling water; and (6) industrial processes and other water use.

Each groundwater classification will have its own regulatory framework. The highest levels of protection will be given to groundwaters that are important sources of drinking water, ecologically vital, particularly vulnerable to contamination, and intrinsically valuable in terms of their yield and quality. Lower levels of groundwater protection may be warranted where there are ample supplies of good quality surface water, where groundwaters are high in chlorides or are already contaminated, where the groundwater is of such low yield that it is not considered an economically feasible source, or where there is a high social value placed on the contaminating activity.

For example, to prevent the contamination of Class I groundwaters state policy could be to: (1) restrict or ban the site-specific use of pesticides that are known to leach through local soils into groundwater and may pose an unacceptable adverse effect on health or on the environment; (2) require the installation of containment, monitoring and recovery devices around underground storage tanks; and (3) designate the areas as "critical wastewater disposal areas" and phase out the use of cesspools and septic tanks in favor of sewers and sewage treatment plants. In Class II areas, the state could elect to: (1) ban the siting of new non-hazardous (Subtitle D) waste disposal facilities to obtain levels of protection consistent with Class I groundwaters; (2) prohibit the siting of hazardous waste treatment and storage facilities above the UIC line; and (3) restrict the application of waste oil for dust suppression on dirt roads. State policy presently bans the siting of hazardous (Subtitle C) waste disposal facilities anywhere in Hawaii and will continue to do so in the future. Alternative to on_island disposal include out-of-state disposal at permitted facilities or the use of a land-based hazardous waste incinerator (treatment). Protection for Class III areas could include: (1) the promulgation of groundwater or effluent standards for injection wells; (2) the mandatory installation of monitoring wells and leachate collection systems around landfills--in addition to other construction requirements; and (3) the installation of recovery devices to clean up leaks from underground storage tanks.

Other implementing activities that are planned or already in place include:

- Continuing the implementation of the interim groundwater quality monitoring strategy to screen drinking water and other groundwater wells for contaminants likely to be present as a result of past and current land use activities. This complements the monitoring conducted by the Department's Safe Drinking Water Branch of public water systems for regulated contaminants.

- Identifying the geographic distribution and concentration of groundwater contamination in the state, including the identification of potential problems. Data quality assurance and quality control are essential in the characterization of groundwater resources, assessment of known problems to support regulatory and standard-setting activities, and response to site-specific problems.

- Defining the roles and activities of existing state and county programs that regulate or affect the regulation of groundwater, identifying potential program deficiencies,

and recommending changes to existing programs in order to address the goal of the groundwater quality protection strategy.

- Developing and implementing a centralized information system to update and maintain soil and subsurface water quality data for the state.

The data collection, monitoring and analysis phase of the interim groundwater quality monitoring strategy will establish the dimensions of future water quality issues and dictate the need for further action.

Surface Waters

Point Sources

The policy for controlling point source discharges is to provide for prevention, abatement and control of new and existing sources of water pollution. Any industrial, public, or private project or development which could constitute a new source of pollution or an increased source of pollution is required, in its initial project design and subsequent construction, to provide the highest and best degree of waste treatment practicable under existing technology.

The water quality standards (Chapter 11-54) prohibit any waste discharge into Class 1 waters, and any discharge "which has not received the best degree of treatment or control compatible with the criteria established for this class" into Class 2 waters (See Appendix A).

Nonpoint Sources

"Nonpoint" sources of pollution include such items as soil erosion and urban stormwater runoff attributable to human activities. As noted in the previous chapter on water quality, the failure of surface water to meet water quality standards is generally attributable to these nonpoint sources, from both natural causes, such as excessive organic material and soil particles, or from diffuse or nonpoint sources of pollution such as agricultural runoff.

Human activities generally do not affect surface drinking water sources but could interfere with other beneficial uses of fresh water resources such as recreation and propagation of fish and other aquatic life.

Policies for urban stormwater management adopted in the "208" water quality management plans stress prevention and non-structural controls. These policies are as follows:

- Preventive controls at the source of pollution are preferred over "downstream" corrective controls.

- Voluntary approaches and procedures are preferred over regulatory controls wherever practicable, particularly for nonpoint source pollutant discharges.

- Non-structural measures or "natural" engineering techniques are generally favored over structures. "Natural" engineering techniques are those which capitalize on and are consistent with natural resources and processes, and preserve and enhance the natural features of a site, maximizing economic and environmental benefits. Engineering design should be used to improve the effectiveness of natural systems rather than negate, replace, or ignore them.

- Preferred pollution control measures are those which provide for groundwater recharge, prevention of downstream pollution and possible flooding, and retention of natural features. To the maximum extent possible, water falling on a given site should be absorbed or retained in the vicinity of the site so that after development, the quantity and rate of water leaving the area will not be significantly different than if the site had remained undeveloped.

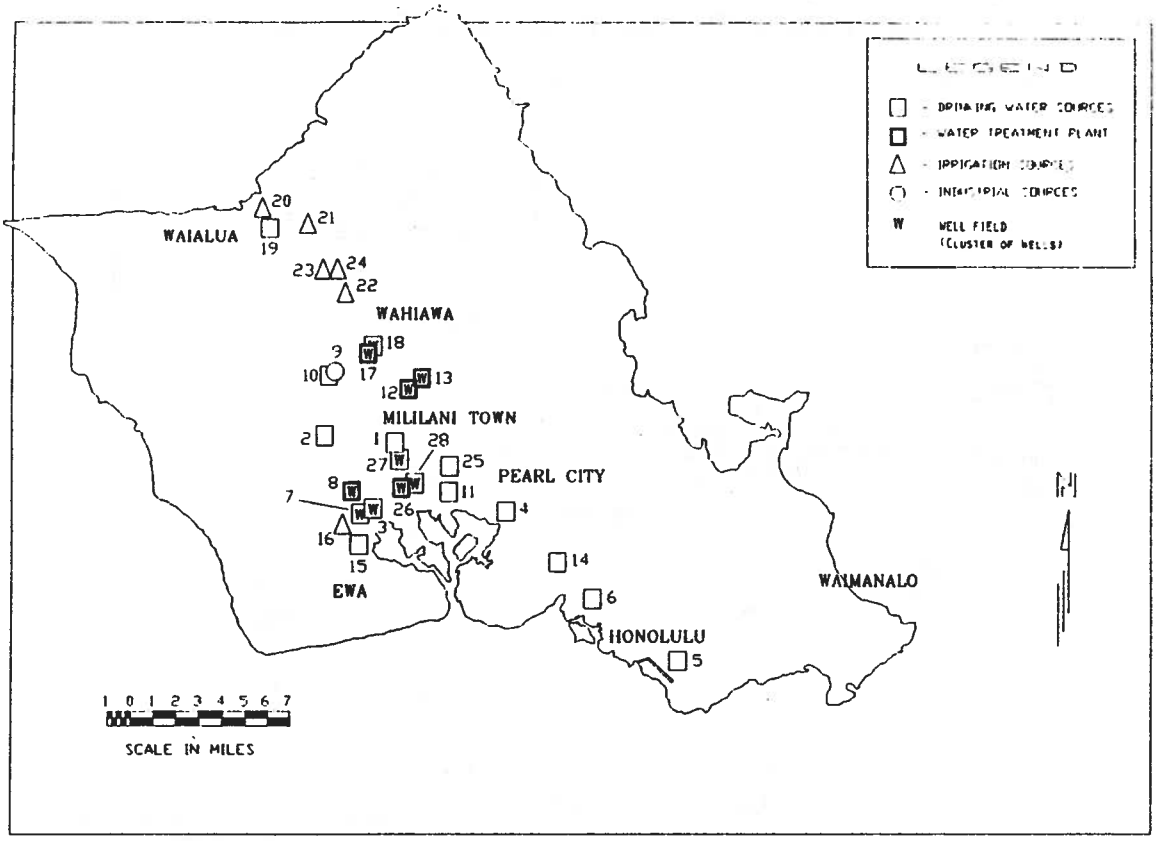
The basic strategy for controlling stormwater and other nonpoint sources is utilizing what are called "best management practices" or BMP's. These generally follow the policies outlined above, stressing on-site retention. They are most effective in preventing water quality problems. Strategies adopted in the "208" plans to address existing pollution from stormwater run-off have been implemented in new developments but not in existing urbanized areas, principally because of cost.

The 1987 amendments to the Clean Water Act require industries with stormwater discharges and municipalities with separate storm drains serving more than 250,000 people to apply for wastewater discharge permits by February 4, 1990. In response to this requirement, the City and County of Honolulu is preparing a discharge permit application for its storm drain system.

The other major category of nonpoint source pollution is erosion of soils and sediments loosened by earth-moving activities such as grading and grubbing and carried into water bodies by wind and rainfall.

Policies for erosion and sediment control are similar to those of stormwater management, stressing on-site retention and prevention. Because controls are mainly on new developments, progress in controlling erosion and sedimentation in urban areas has been much more successful than stormwater management. All of the counties have adopted and enforce ordinances to prevent water pollution from grading, grubbing, and stockpiling.

GROUNDWATER CONTAMINATION ON THE ISLAND OF OAHU



THIS MAP CONTAINS THE LAST CONFIRMED RESULTS FROM CONTAMINATED GROUNDWATER WELLS

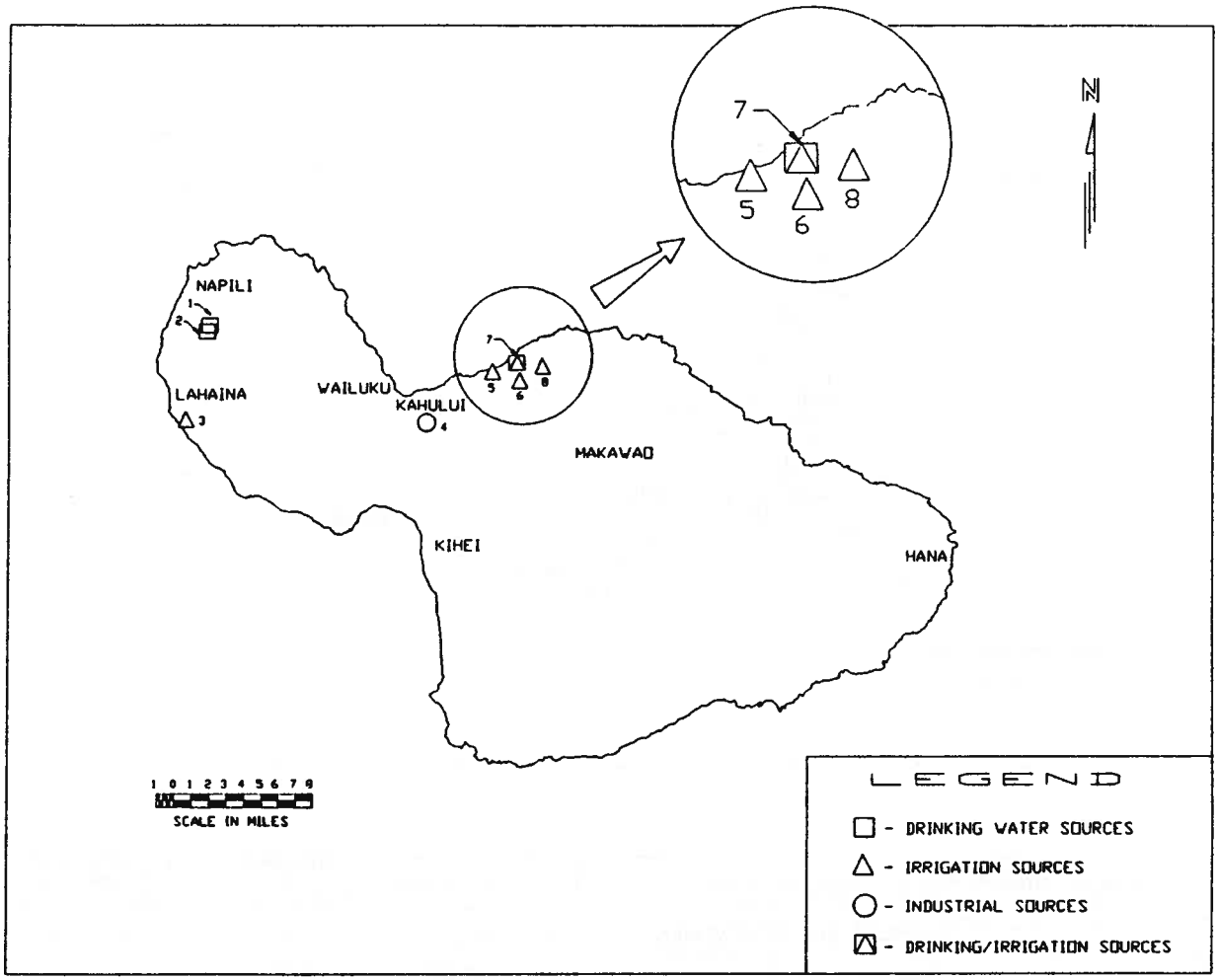
NO.	CONTAMINANT		DETECTED LEVEL (in ppb)	APPLICABLE DRINKING WATER STANDARDS (in ppb)	
1	TCE:		0.70	5.0	MCL
2	DBCP:		0.01	0.040	LTG
	PCE:		0.22	5.0	pMCL
3	Atrazine:		0.114	3.0	LHA
	TCP:		0.20	0.800	LTG
4	PCE:		0.03	5.0	pMCL
5	PCE:		0.03	5.0	pMCL
6	Dieldrin:		0.008	0.002	10(-6)
7	Atrazine:		0.083	3.0	LHA
	TCP:		0.65	0.800	LTG
8	DBCP:	influent	0.02		
		effluent	<0.02	0.04	LTG
	TCP:	influent	0.65		
		effluent	<0.20	0.800	LTG
9	PCE:		1.65	5.0	pMCL
	TCE:		3.70	5.0	MCL
10	Carbon Tetrachloride:		0.69	5.0	MCL
	DCE:		0.20	70.0	LHA
	TCE:		0.83	5.0	MCL
	PCE:		2.60	5.0	pMCL
11	PCE:		0.03	5.0	pMCL
12	DBCP:	influent	0.07		
		effluent	<0.02	0.040	LTG
	DCP:	influent	0.64		
		effluent	---	0.6	10(-6)
	TCP:	influent	1.50		
		effluent	<0.20	0.800	LTG
13	DBCP:	influent	0.07		
		effluent	<0.02	0.040	LTG
	DCP:	influent	0.74		
		effluent	---	0.6	10(-6)
	TCP:	influent	1.50		
		effluent	<0.20	0.800	LTG
14	Dieldrin:		0.009	0.002	10(-6)
15	Atrazine:		0.035	3.0	LHA
16	Atrazine:		0.100	3.0	LHA
17	TCE:	influent	8.50		
		effluent	<1.00	5.0	MCL
	PCE:	influent	0.37		
		effluent	<1.00	5.0	pMCL
18	Carbon Tetrachloride:		0.58	5.0	MCL
	PCE:		0.38	5.0	pMCL
19	TCP:		0.21	0.800	LTG
20	Lindane:		0.001	2.0	LHA
21	DBCP:		0.01	0.040	LTG
	TCP:		0.29	0.800	LTG
22	DBCP:		0.02	0.040	LTG
	TCP:		0.37	0.800	LTG
23	DBCP:		0.115	0.040	LTG
24	DBCP:		0.01	0.040	LTG
	TCP:		0.43	0.800	LTG
25	DBCP:		0.024	0.040	LTG
	TCP:		0.21	0.800	LTG
26	EDB:	influent	0.055		
		effluent	<0.02	0.002	LTG
	TCP:	influent	<0.20		
		effluent	<0.20	0.800	LTG
27	TCE:		0.55	5.0	MCL
	TCP:		0.25	0.800	LTG
28	TCP:		0.20	0.800	LTG

NOTES: Due to the number of wells in close proximity to each other, some sites are represented by wellfields and may contain several wells.

Possible natural contaminants such as nitrates have not been included.

Department of Health March 1989

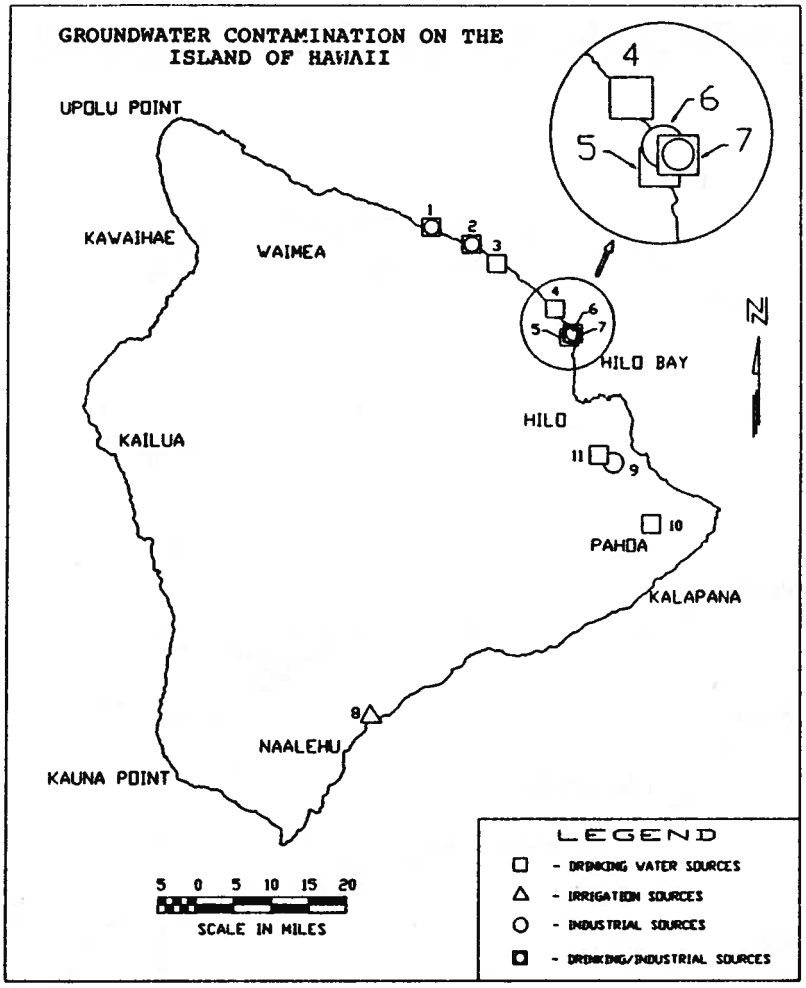
GROUNDWATER CONTAMINATION ON THE ISLAND OF MAUI



THIS MAP CONTAINS THE LAST CONFIRMED RESULTS FROM CONTAMINATED GROUNDWATER WELLS

NO.	CONTAMINANT	DETECTED LEVEL (in ppb)	APPLICABLE DRINKING WATER STANDARDS (in ppb)	
1	Trichloropropane:	0.200	0.800	LTG
2	Trichloropropane:	0.300	0.800	LTG
3	Atrazine:	0.110	3.0	LHA
4	Atrazine:	1.000	3.0	LHA
	Ethylene Dibromide:	0.040	0.002	LTG
5	Atrazine:	0.600	3.0	LHA
6	Ethylene Dibromide:	0.028	0.002	LTG
7	Trichloropropane:	0.430	0.800	LTG
8	DBCP:	0.091	0.040	LTG
	Ethylene Dibromide:	0.067	0.002	LTG
	Trichloropropane:	0.430	0.800	LTG

NOTES: Possible natural contaminants such as nitrates have not been included.

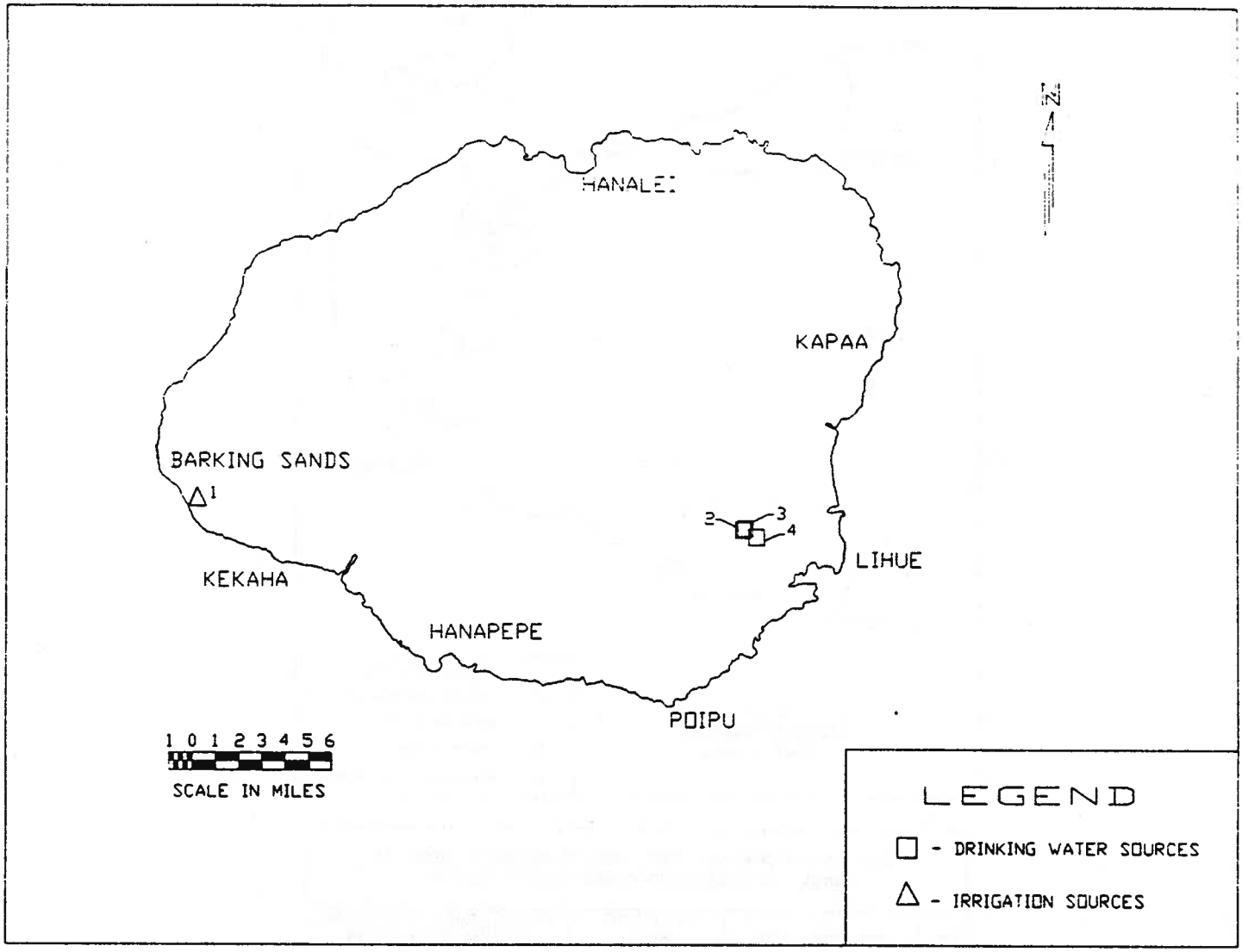


THIS MAP CONTAINS THE LAST CONFIRMED RESULTS FROM CONTAMINATED GROUNDWATER WELLS

NO.	CONTAMINANT	DETECTED LEVEL (in ppb)	APPLICABLE DRINKING WATER STANDARDS (in ppb)	
1	Atrazine:	0.270	3.0	LHA
	Hexazinone:	0.110	200.0	LHA
2	Atrazine:	0.270	3.0	LHA
3	Atrazine:	0.400	3.0	LHA
4	PCE:	0.130	5.0	pMCL
5	Atrazine:	0.300	3.0	LHA
	Hexazinone:	0.060	200.0	LHA
6	Atrazine:	0.400	3.0	LHA
	Hexazinone:	0.090	200.0	LHA
7	Atrazine:	1.300	3.0	LHA
	Hexazinone:	0.090	200.0	LHA
8	Atrazine:	0.140	3.0	LHA
9	Atrazine:	0.260	3.0	LHA
	Ametryn:	0.880	60.0	LHA
10	Atrazine:	0.300	3.0	LHA
11	Atrazine:	0.100	3.0	LHA

NOTE: Possible natural contaminants such as nitrates have not been included.

GROUNDWATER CONTAMINATION ON THE ISLAND OF KAUAI



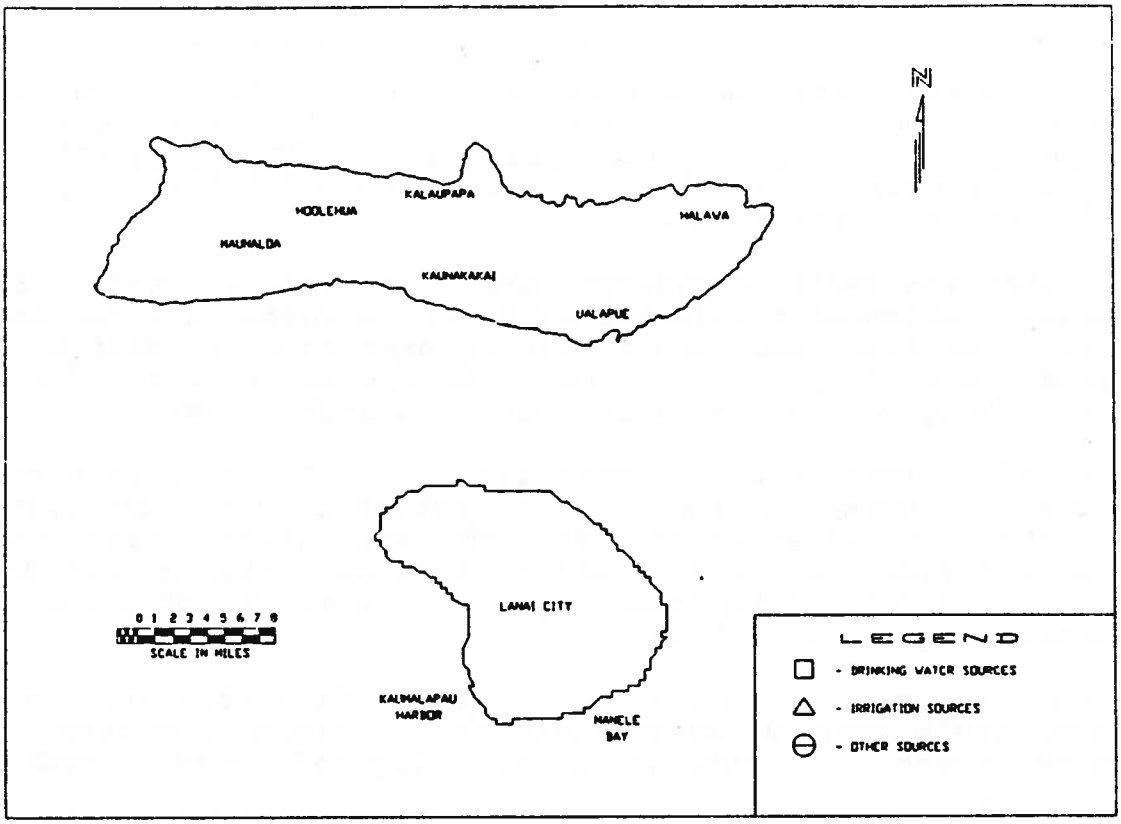
THIS MAP CONTAINS THE LAST CONFIRMED RESULTS FROM CONTAMINATED GROUNDWATER WELLS

NO.	CONTAMINANT	DETECTED LEVEL (in ppb)	APPLICABLE DRINKING WATER STANDARDS (in ppb)	
1	Atrazine:	2.500	3.0	LHA
	Ametryn:	0.800	60.0	LHA
	Simazine:	0.200	4.0	LHA
2	Atrazine:	0.060	3.0	LHA
3	Atrazine:	0.200	3.0	LHA
4	Atrazine:	0.100	3.0	LHA

NOTE: Possible natural contaminants such as nitrates have not been included.

DEPARTMENT OF HEALTH MARCH 1989

GROUNDWATER CONTAMINATION ON THE ISLANDS OF MOLOKAI AND LANAI



THIS MAP CONTAINS THE LAST CONFIRMED RESULTS FROM CONTAMINATED GROUNDWATER WELLS

NO.	CONTAMINANT	DETECTED LEVEL (in ppb)	APPLICABLE DRINKING WATER STANDARDS (in ppb)
NO CONFIRMED CONTAMINANTS DETECTED.			

Department of Health March 1989

DEFINITIONS OF APPLICABLE DRINKING WATER STANDARDS

"MCL" means a maximum contaminant level or the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. MCLs are the only federally enforceable drinking water standard. A "pMCL" means that EPA has proposed a MCL for that contaminant.

A "Lifetime Health Advisory" (LHA) describes a non-regulatory concentration of a drinking water contaminant at which adverse health effects would not be anticipated to occur over a lifetime exposure of 70 years duration. The advisories are based on data describing non-carcinogenic risk from such exposure.

"10(-6)" indicates those chemicals which EPA considers to be potential human carcinogens, EPA estimates a "cancer risk level" as the level at which an individual who consumes water over his or her lifetime (70 years) would have no more than a one-in-a-million chance of developing cancer as a direct result of drinking water containing the contaminant.

"LTG" (Long Term Goal) is the concentration that represents a desireable level at which lifetime (70 years) exposure is without significant risk, that is, a virtually safe dose. (Tardiff, 12/85)

Department of Health March 1989

POSSIBLE HEALTH EFFECTS and SOURCES OF GROUNDWATER CONTAMINATION

Common Name	Possible Noncarcinogenic Effects from Ingestion by Humans or Animals[1]	EPA (CAG) Carcinogen Rating[2]	Potential Contamination Sources
Ametryn	Liver damage	Unclassified	Herbicide
Atrazine	Heart and liver damage; fetal/ child development retarded	Possible	Herbicide
Carbon Tetrachloride	Liver, kidney, and lung damage	Probable	Solvent, dry cleaning agent
1,2-Dibromo-3-chloropropane (DBCP)	Male reproductive system, liver, and kidney damage	Probable	Pesticide (soil fumigant)
1,1-Dichloroethylene (DCE)	Central nervous system depression; a heart effect liver and kidney damage	Possible	Solvent
1,2-Dichloropropane (DCP)	Gastrointestinal irritation, liver and kidney damage	Probable	Pesticide, solvent
Dieldrin	Liver, central nervous system, kidney and adrenal gland damage	Probable	Pesticide
Ethylene dibromide (EDB)	Male reproductive system, liver gastointestinal, and adrenal gland damage	Probable	Gas additive, soil fumigant, solvent
Hexazinone	No known effects	Unclassified	Herbicide
Lindane	Nerve damage and central nervous system seizures; liver and kidney damage; suppression of the immune system	Possible	Insecticide
Simazine	Liver, kidney, and brain damage	Possible	Herbicide
Tetrachloroethylene (PCE)	Central nervous system depression; liver and kidney damage	Probable	Solvent, dry cleaning agent
Trichloroethylene (TCE)	Central nervous system depression; a heart effect; liver and kidney damage	Probable	Solvent
1,2,3-Trichloropropane (TCP)	Insufficient data	Unclassified	Solvent, trace contaminant in certain pesticides

(1) Based on the USEPA's Office of Drinking Water - Health Advisories.

(2) Based on the USEPA's Carcinogen Assessment Group.

August 1989

Chapter V

FUTURE RESEARCH NEEDS

New Programs

The Groundwater Quality Protection Strategy proposes a five-year (1989-1993) groundwater protection program development plan. Most of the projects identified in the development plan are extensions and refinements of existing programs described in Chapter IV and are already being implemented. A new program for protection of groundwater being considered by the DOH is the Wellhead Protection Program.

This program was created by Congress in 1986 through the amendments to the Safe Drinking Water Act. It is an optional program that would provide grants to states for establishment of wellhead protection areas.

As defined by P.L. 99-339, a wellhead protection area is a surface or subsurface area that surrounds an individual water well or wellfield that is used by a public water system. It is designed to incorporate the groundwater or surface water supplies that are likely to be drawn to the well system. The pumping of a well causes a conical "V"-shaped depression in the underlying water table that varies as a result of differing geographic and hydrologic conditions. The water within this zone of influence would be likely to reach the well at some time, and so would any groundwater contaminants within that zone. By restricting surface activities over these zones, protection of the resource is enhanced.

Each participating state has the responsibility of defining the wellhead protection areas. The intent of Congress is to afford maximum flexibility to the states in formulating a protection strategy. As such, a state is not required to develop a regulatory program unless it chooses to do so. The new program is not intended to authorize the federal, state, or local governments to regulate any withdrawal, beneficial use, or other existing water rights for groundwaters or surface waters.

EPA's role in the process is to provide technical guidance that states may use to determine protection areas. Under the amendments, if the EPA Administrator approves a state's program, the state can receive grants between 50 and 90 percent (determined by the Administrator) for costs incurred in developing and implementing the program.

Research Needs

Although knowledge about Hawaii's water resources has increased greatly over the last decade, there are still a number of areas that require further research. Some of these additional research needs are as follows:

Characterization of Aquifers: Characterization of ambient groundwater quality and aquifer delineation should be completed for all islands except Niihau and Kahoolawe.

Prediction of Pollutant Migration Through Soils: This type of activity has been initiated at the University of Hawaii Water Resources Research Center and College of Tropical Agriculture. The results of this type of research could form the basis for the strategy for the proposal for restricting pesticide registration.

Alternatives to Pesticide Use: The state's effort to find alternatives to the use of pesticides should be expanded, especially alternatives to the use of termaticides. Alternative building construction methods and biological control are of prime interest.

Well Design: Additional research on preventing pollution by improved well design, well drilling methods, and the design and operation of well-head facilities should be undertaken.

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APPENDIX A

Surface Water Quality Standards

"HAWAII ADMINISTRATIVE RULES

TITLE 11

DEPARTMENT OF HEALTH

CHAPTER 54

WATER QUALITY STANDARDS

Historical Note: Chapter 11-54 is based substantially on Public Health Regulations, Chapter 37-A, Water Quality Standards, Department of Health, State of Hawaii. [Eff 5/25/74; am 12/7/79; R 11/12/82.]

§11-54-01 Definitions. As used in this chapter:

"Ambient conditions" means the water quality conditions that would occur in the receiving waters if these waters were not influenced by the proposed new human activity.

"Best degree of treatment or control" means that treatment or control which is required by applicable statutes and regulations of the State of Hawaii and the Federal Water Pollution Control Act, as amended, (33 USC 1251, et seq.) or which is otherwise specified by the director considering technology or management practices currently available in relation to the public interest.

"Brackish waters" means waters with dissolved inorganic ions (salinity) greater than 0.5 parts per thousand, but less than thirty parts per thousand.

"Department" means department of health, State of Hawaii.

"Director" means the director of health, State of Hawaii, or the director's duly authorized agent.

"Fresh waters" means all waters with dissolved inorganic ions of less than 0.5 parts per thousand.

"Saline waters" means waters with dissolved inorganic ions greater than thirty parts per thousand.

"State waters" means all waters, fresh, brackish, or salt around and within the State of Hawaii which includes all the islands of the Hawaiian Archipelago together with their appurtenant reefs and waters except the Midway Islands. [Eff 11/12/82; comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-01.1 General policy of water quality antidegradation. Waters whose quality are higher than established water quality standards shall not be lowered in quality unless it has been affirmatively demonstrated to the director that the change is justifiable as a result of important economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently in, those waters. [Eff and comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-02 Classification of state waters. (a) This chapter applies to all state waters excluding the following: groundwater; and ditches, flumes, ponds, and reservoirs required as part of a pollution control system or which are used solely for irrigation, so long as they do not discharge into any waters of the State. State waters are classified as either inland waters or marine waters.

(b) Inland waters.

(1) All inland waters are either fresh waters, brackish waters, or saline waters;

(2) All inland fresh waters are classified as follows, based on their physical characteristics, ecological systems, and other natural criteria:

(A) Streams (perennial or intermittent);

(B) Springs and seeps, natural lakes, and reservoirs;

(C) Elevated wetlands;

(D) Low wetlands;

(3) All inland waters which are brackish waters or saline waters are classified as follows, based on their physical characteristics, ecological systems, and other natural criteria:

(A) Coastal wetlands;

(B) Estuaries; and

(C) Anchialine pools.

(c) Marine waters.

(1) All marine waters are either embayments, open coastal, or oceanic waters;

(2) All marine waters which are embayments or open coastal waters are also classified according to the following bottom subtypes:

(A) Sand beaches;

(B) Lava rock shorelines and solution benches;

(C) Marine pools and protected coves;

(D) Artificial basins;

(E) Reef flats and reef communities; and

(F) Soft bottom communities. [Eff 11/12/82; comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-03 Classification of water uses. (a) The following use categories in this section classify inland and marine waters for purposes of applying the standards set forth in this chapter and for the selection or definition of appropriate quality parameters and uses to be protected in these waters.

(b) Inland waters.

(1) Class 1.

It is the objective of class 1 waters that these waters remain in their natural state as nearly as possible with an absolute

minimum of pollution from any human-caused source. To the extent possible, the wilderness character of these areas shall be protected. Waste discharge into these waters is prohibited;

(2) Class 1.a.

The uses to be protected in class 1.a waters are scientific and educational purposes, protection of breeding stock and baseline references from which human-caused changes can be measured, compatible recreation, aesthetic enjoyment, and other nondegrading uses which are compatible with the protection of the ecosystems associated with waters of this class;

(3) Class 1.b.

The uses to be protected in class 1.b waters are domestic water supplies, food processing, the support and propagation of aquatic life, compatible recreation, and aesthetic enjoyment. Public access to waters in this class may be restricted to protect water quality;

(4) Class 2.

The objective of class 2 waters is to protect their use for recreational purposes, propagation of fish and other aquatic life, and agricultural and industrial water supplies, shipping, navigation and propagation of shellfish. The uses to be protected in this class of waters are all uses compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible with the criteria established for this class. No new sewage discharges shall be permitted within estuaries. No new industrial discharges shall be permitted within estuaries, with the exception of

acceptable non-contact thermal and floating drydock or marine railway discharges within Pearl Harbor, Oahu.

(c) Marine waters.

(1) Class AA.

It is the objective of class AA waters that these waters remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions. To the extent practicable, the wilderness character of these areas shall be protected. No zones of mixing shall be permitted in this class:

(A) Within a defined reef area, in waters of a depth less than ten fathoms; or

(B) In waters up to a distance of one thousand feet off shore if there is no defined reef area and if the depth is greater than ten fathoms.

The uses to be protected in this class of waters are oceanographic research, the support and propagation of shellfish and other marine life, conservation of coral reefs and wilderness areas, compatible recreation, and aesthetic enjoyment. The classification of any water area as Class AA shall not preclude other uses of the waters compatible with these objectives and in conformance with the criteria applicable to them;

(2) Class A.

It is the objective of class A waters that their use for recreational purposes and aesthetic enjoyment be protected. Any other use shall be permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible

with the criteria established for this class. No new sewage discharges will be permitted within embayments. No new industrial discharges shall be permitted within embayments, with the exception of acceptable non-contact thermal and floating drydock or marine railway discharges, in the following water bodies:

(A) Honolulu Harbor, Oahu;

(B) Barbers Point Harbor, Oahu;

(C) Keehi Lagoon Marina Area, Oahu;

(D) Ala Wai Boat Harbor, Oahu; and

(E) Kahului Harbor, Maui.

(d) Marine bottom ecosystems.

(1) Class I.

It is the objective of class I marine bottom ecosystems that they remain as nearly as possible in their natural pristine state with an absolute minimum of pollution from any human-induced source. Uses of marine bottom ecosystems in this class are passive human uses without intervention or alteration, allowing the perpetuation and preservation of the marine bottom in a most natural state, such as for nonconsumptive scientific research (demonstration, observation or monitoring only), nonconsumptive education, aesthetic enjoyment, passive activities, and preservation;

(2) Class II.

It is the objective of class II marine bottom eco-systems that their use for protection including propagation of fish, shellfish, and wildlife, and for recreational purposes not be limited in any way. The uses to be protected in this class of marine bottom ecosystems are all uses compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation.

Any action which may permanently or completely modify, alter, consume, or degrade marine bottoms, such as structural flood control channelization, (dams); landfill and reclamation; navigational structures (harbors, ramps); structural shore protection (seawalls, revetments); and wastewater effluent outfall structures may be allowed upon securing approval in writing from the director, considering the environmental impact and the public interest pursuant to sections 342D-4, 342D-5, 342D-6, and 342D-50, HRS in accordance with the applicable provisions of chapter 91, HRS. [Eff 11/12/82; am and comp 10/6/84; am and comp JAN 19 1990]
(Auth: HRS §342D-4, 342D-5) (Imp: HRS §342D-4, 342D-5)

§11-54-04 Basic water quality criteria applicable to all waters. (a) All waters shall be free of substances attributable to domestic, industrial, or other controllable sources of pollutants, including:

(1) Materials that will settle to form objectionable sludge or bottom deposits;

(2) Floating debris, oil, grease, scum, or other floating materials;

(3) Substances in amounts sufficient to produce taste or odor in the water or detectable off flavor in the flesh of fish, or in amounts sufficient to produce objectionable color, turbidity or other conditions in the receiving waters;

(4) High temperatures; biocides; pathogenic organisms; toxic, radioactive, corrosive, or other deleterious substances at levels or in combination sufficient to be toxic or harmful to human, animal, plant, or aquatic life, or in amounts sufficient to interfere with any beneficial use of the water;

(5) Substances or conditions or combinations thereof in concentrations which produce undesirable aquatic life;

(6) Soil particles resulting from erosion on land involved in earthwork, such as the construction of public works; highways; subdivisions; recreational, commercial, or industrial developments; or the cultivation and management of agricultural lands.

(b) To ensure compliance with paragraph (a)(4) above, all state waters are subject to monitoring and to the following standards for acute and chronic toxicity and the protection of human health.

(1) As used in this section:

(A) "Acute Toxicity" means the degree to which a pollutant, discharge, or water sample causes a rapid adverse impact to aquatic organisms. The acute toxicity of a discharge or receiving water is measured using the methods in section 11-54-10, unless other methods are specified by the director.

(B) "Chronic Toxicity" means the degree to which a pollutant, discharge, or water sample causes a long-term adverse

impact to aquatic organisms, such as a reduction in growth or reproduction. The chronic toxicity of a discharge or receiving water is measured using the methods in section 11-54-10, unless other methods are specified by the director.

(C) "Dilution" means, for discharges through submerged outfalls, the average and minimum values calculated using the models in the EPA publication, Initial Mixing Characteristics of Municipal Ocean Discharges (EPA/600/3-85/073, November, 1985).

(C) "No Observed Effect Concentration" (NOEC), means the highest percent concentration of a discharge or water sample, in dilution water, which causes no observable adverse effect in a chronic toxicity test. For example, an NOEC of 100 percent indicates that an undiluted discharge or water sample causes no observable adverse effect to the organisms in a chronic toxicity test.

(2) Narrative toxicity and human health standards.

(A) Acute Toxicity Standard: All state waters shall be free from pollutants in concentrations which exceed the acute standards listed in paragraph (3), below. All state waters shall also be free from acute toxicity as measured using the toxicity tests listed in section 11-54-10, or other methods specified by the director.

(B) Chronic Toxicity Standard: All state waters shall free from pollutants in concentrations which on average during any 24-hour period exceed the chronic standards listed in paragraph (3), below. All state waters shall also be free from chronic toxicity as measured using the toxicity tests listed in section 11-54-10, or other methods specified by the director.

(C) Human Health Standards: All state waters shall be free from pollutants in concentrations which, on average during any 30-day period, exceed the "fish consumption" standards for non-carcinogens in paragraph (3), below. All state waters shall also be free from pollutants in concentrations, which on average during any 12 month period, exceed the "fish consumption" standards for pollutants identified as carcinogens in paragraph (3), below.

(3) Numeric standards for toxic pollutants applicable to all waters. The freshwater standards apply where the dissolved inorganic ion concentration is less than 0.5 parts per thousand; saltwater standards apply above 0.5 parts per thousand. Values for metals refer to the dissolved fraction. All values are expressed in micrograms per liter.

	Freshwater		Saltwater		Fish
Pollutant	Acute	Chronic	Acute	Chronic	Consumption
Acenaphthene	570	ns	320	ns	ns
Acrolein	23	ns	18	ns	250
Acrylonitrile*	2,500	ns	ns	ns	0.21
Aldrin*	3.0	ns	1.3	ns	0.000026
Aluminum	750	260	ns	ns	ns
Antimony	3,000	ns	ns	ns	15,000
Arsenic	360	190	69	36	ns
Benzene*	1,800	ns	1,700	ns	13
Benzidine*	800	ns	ns	ns	0.00017
Beryllium*	43	ns	ns	ns	ns
Cadmium	3+	3+	43	9.3	ns
Carbon tetra-chloride*	12,000	ns	16,000	ns	2.3

Pollutant	Freshwater Acute	Freshwater Chronic	Saltwater Acute	Saltwater Chronic	Fish Consumption
Chlordane*	2.4	0.0043	0.09	0.004	0.000016
Chlorine	19	11	13	7.5	ns
Chloroethers-					
ethyl(bis-2)*	ns	ns	ns	ns	0.44
isopropyl	ns	ns	ns	ns	1,400
methyl(bis)*	ns	ns	ns	ns	0.00060
Chloroform*	9,600	ns	ns	ns	5.1
Chlorophenol(2)	1,400	ns	ns	ns	ns
Chlorpyrifos	0.083	0.041	0.011	0.0056	ns
Chromium (VI)	16	11	1,100	50	ns
Copper	6+	6+	ns	ns	ns
Cyanide	22	5.2	1	1	ns
DDT*	1.1	0.001	0.013	0.001	0.000008
metabolite TDE*	0.03	ns	1.2	ns	ns
Demeton	ns	0.1	ns	0.1	ns
Dichloro-					
benzenes	370	ns	660	ns	850
benzidine*	ns	ns	ns	ns	0.007
ethane(1,2)*	39,000	ns	38,000	ns	79
ethylene(1,1)*	3,900	ns	75,000	ns	0.60
phenol(2,4)	670	ns	ns	ns	ns
propane	7,700	ns	3,400	ns	ns
propene(1,3)	2,000	ns	260	ns	4.6
Dieldrin*	2.5	0.0019	0.71	0.0019	0.000025
Dinitro-					
o-cresol(2,4)	ns	ns	ns	ns	250
toluene*	110	ns	200	ns	3.0
Dioxin*	0.003	ns	ns	ns	0.000000005

Pollutant	Freshwater Acute	Freshwater Chronic	Saltwater Acute	Saltwater Chronic	Fish Consumption
Diphenyl-hydrazine(1,2)	ns	ns	ns	ns	0.018
Endosulfan	0.22	0.056	0.034	0.0087	52
Endrin	0.18	0.0023	0.037	0.0023	ns
Ethylbenzene	11,000	ns	140	ns	1,070
Fluoranthene	1,300	ns	13	ns	18
Guthion	ns	0.01	ns	0.01	ns
Heptachlor*	0.52	0.0038	0.053	0.0036	0.00009
Hexachloro-benzene*	ns	ns	ns	ns	0.00024
butadiene*	30	ns	11	ns	16
cyclohexane-alpha*	ns	ns	ns	ns	0.010
beta*	ns	ns	ns	ns	0.018
technical*	ns	ns	ns	ns	0.014
cyclopentadiene	2	ns	2	ns	ns
ethane*	330	ns	310	ns	2.9
Isophorone	39,000	ns	4,300	ns	170,000
Lead	29+	29+	140	ns	ns
Lindane*	2.0	0.08	0.16	ns	0.020
Malathion	ns	0.1	ns	0.1	ns
Mercury	2.4	0.55	2.1	ns	ns
Methoxychlor	ns	0.03	ns	0.03	ns
Mirex	ns	0.001	ns	0.001	ns
Naphthalene	770	ns	780	ns	ns
Nickel	5+	5+	75	8.3	33

Pollutant	Freshwater Acute	Freshwater Chronic	Saltwater Acute	Saltwater Chronic	Fish Consumption
Nitrobenzene	9,000	ns	2,200	ns	ns
Nitrophenols	77	ns	1,600	ns	ns
Nitrosamines*	1,950	ns	ns	ns	0.41
Nitroso-					
dibutylamine-N*	ns	ns	ns	ns	0.19
diethylamine-N*	ns	ns	ns	ns	0.41
dimethylamine-N*	ns	ns	ns	ns	5.3
diphenylamine-N*	ns	ns	ns	ns	5.3
pyrrolidine-N*	ns	ns	ns	ns	30
Parathion	0.065	0.013	ns	ns	ns
Pentachloro-					
ethanes	2,400	ns	130	ns	ns
benzene	ns	ns	ns	ns	28
phenol	20	13	13	ns	ns
Phenol	3,400	ns	170	ns	ns
2,4-dimethyl	700	ns	ns	ns	ns
Phthalate esters					
dibutyl	ns	ns	ns	ns	50,000
diethyl	ns	ns	ns	ns	590,000
di-2-ethylhexyl	ns	ns	ns	ns	16,000
dimethyl	ns	ns	ns	ns	950,000
Polychlorinated					
biphenyls*	2.0	0.014	10	0.03	0.000079
Polynuclear aromatic					
hydrocarbons*	ns	ns	ns	ns	0.01
Selenium	20	5	300	71	ns
Silver	1+	1+	2.3	ns	ns

Pollutant	Freshwater Acute	Freshwater Chronic	Saltwater Acute	Saltwater Chronic	Fish Consumption
Tetrachloro-					
ethanes	3,100	ns	ns	ns	ns
benzene(1,2,4,5)	ns	ns	ns	ns	16
ethane(1,1,2,2)*	ns	ns	3,000	ns	3.5
ethylene*	1,800	ns	3,400	145	2.9
phenol(2,3,5,6)	ns	ns	ns	440	ns
Thallium	470	ns	710	ns	16
Toluene	5,800	ns	2,100	ns	140,000
Toxaphene*	0.73	0.0002	0.21	0.0002	0.00024
Tributyltin	ns	0.026	ns	0.01	ns
Trichloro					
ethane(1,1,1)	6,000	ns	10,400	ns	340,000
ethane(1,1,2)*	6,000	ns	ns	ns	14
ethylene*	15,000	ns	700	ns	26
phenol(2,4,6)*	ns	ns	ns	ns	1.2
Vinyl chloride*	ns	ns	ns	ns	170
Zinc	22+	22+	95	86	ns

ns - No standard has been developed.

* - Carcinogen.

+ - The value listed is the minimum standard. Depending upon the receiving water $CaCO_3$ hardness, higher standards may be calculated using the respective formula in the U. S. Environmental Protection Agency publication Quality Criteria for Water (EPA 440/5-86-001, Revised May 1, 1987).

(4) The following are basic requirements applicable to discharges to state waters. These standards shall be enforced through effluent limitations or other conditions in discharge permits. The director may apply more stringent discharge requirements to any discharge if necessary to ensure compliance with all standards in paragraph (2), above.

(A) Continuous discharges through submerged outfalls. The No Observed Effect Concentration (NOEC), expressed as percent effluent, of continuous discharges through submerged outfalls shall not be less than 100 divided by the minimum dilution. In addition, such discharges shall not contain:

(i) pollutants in 24-hour average concentrations greater than the values obtained by multiplying the minimum dilution by the standards in paragraph (3), above, for the prevention of chronic toxicity.

(ii) non-carcinogenic pollutants in 30-day average concentrations greater than the values obtained by multiplying the minimum dilution by the standards in paragraph (3), above, for fish consumption.

(iii) carcinogenic pollutants in 12-month average concentrations greater than the values obtained by multiplying the average dilution by the standards in paragraph (3), above, for fish consumption.

(B) Discharges without submerged outfalls. The survival of test organisms in an undiluted acute toxicity test of any discharge shall not be less than 80 percent. In addition, no such discharge shall contain pollutants in concentrations greater than the standards in paragraph (3), above, for the prevention of acute toxicity to aquatic life. The director may make a limited allowance for dilution for a discharge in this category if it meets the following criteria: the discharge velocity is greater than

3 meters per second; the discharge enters the receiving water horizontally, and; the receiving water depth at the discharge point is greater than zero.

(c) Paragraph (a)(6) above shall be deemed met upon a showing that the land on which the erosion occurred or is occurring is being managed in accordance with soil conservation practices acceptable to the applicable soil and water conservation district and the director, and that a comprehensive conservation program is being actively pursued, or that the discharge has received the best degree of treatment or control, and that the severity of impact of the residual soil reaching the receiving body of water is deemed to be acceptable. [Eff 11/12/82; comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-05 Uses and specific criteria applicable to inland waters; definitions. As used in sections 11-54-05.1 and 11-54-05.2:

"Anchialine pools" means standing waters that vary in salinity and basin limits and are not surface connected to the ocean except in rare circumstances. These pools are natural brackish water exposures which are near coastlines in recent lavas and, rarely, in fossil reefs and which have tidal fluctuations. They are usually small, shallow pools of low salinity one to ten ppt (parts per thousand) with distinctive biota, but usually no fishes. The bottom of deeper pools may have higher salinities.

"Coastal wetlands" means natural or man-made ponds and marshes having variable salinity, basin limits, and permanence. These wetlands usually adjoin the coastline but are not surface connected to the ocean except in rare circumstances. They are usually without tidal fluctuations. Most are characterized by introduced biota, especially fishes.

"Deep" means greater than 6.6 feet or two meters.

"Elevated wetlands" means shallow standing water that is always fresh, in more or less indistinct basins such as natural bogs, ponds, and marshes. These wetlands are found in undisturbed areas, mainly remote uplands and forest reserves.

"Estuaries" means deep characteristically brackish coastal waters in well-defined basins with a continuous or seasonal surface connection to the ocean that allows entry of marine fauna. Estuaries may be either natural, occurring mainly at streams or river mouths; or developed, artificially or strongly modified from the natural state, such as dredged and revetted stream termini.

"Intermittent streams" means fresh waters flowing down altitudinal gradients in definite natural channels only during part of the year.

"Low wetlands" means shallow standing water that is always fresh, ponds or marshes. These wetlands are found in lowland areas near coasts or in valley termini modified by man. Their origin may be natural or man-made.

"Natural lakes" means deep standing water that is always fresh, in well-defined natural basins.

"Perennial streams" means fresh waters flowing down altitudinal gradients in definite natural channels, portions of which may be modified. In these streams, flowing water is present all year, though volume may vary. These streams may be continuous, with water flowing to the ocean all year, or interrupted, having flow with ecologically significant bodies of water only in parts of the channel, with seasonal discharge to the ocean.

"Reservoirs" means deep standing water that is always fresh, in well-defined artificially created impoundments.

"Shallow" means less than 6.6 feet or two meters.

"Springs and seeps" means small, perennial, relatively constant fresh water flows not in distinct channels, such as wet films or trickles over rock

surfaces, in which the water emanates from elevated aquifers. Springs and seeps may be either stream associated, occurring in deeply cut valleys and contributing to stream flow; or coastal, occurring on coastal cliffs and usually flowing into the ocean.

"Streams" means seasonal or continuous water flowing in all or part of natural channels as a result of either surface water runoff or ground water influx, or both. Streams may be either "perennial" or "intermittent."

[Eff 11/12/82; comp 10/6/84; am and comp JAN 18 1990]

(Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-05.1 Inland water areas to be protected. (a) Class 1.a.

(1) All inland waters in preserves, reserves, sanctuaries, and refuges established by the department of land and natural resources under chapter 195, HRS, or similar reserves for the protection of aquatic life established under chapter 195, HRS.

(2) All inland waters in national and state parks.

(3) All inland waters in state or federal fish and wildlife refuges.

(4) All inland waters which have been officially identified as a unique or critical habitat for threatened or endangered species.

(5) Waimanu Estuarine Sanctuary (Hawaii); Kilauea and Lumahai estuaries (Kauai).

(b) Class 1.b - All inland waters in protective subzones designated under chapter 13-2 of the state board of land and natural resources.

(c) Class 2 - All inland water areas not otherwise classified. Waipio (Hawaii) and Pearl Harbor estuaries are included in this class.

[Eff 11/12/82; comp 10/6/84; am and comp JAN 18 1990]

(Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-05.2 Inland water criteria. (a) Criteria for springs and seeps, natural lakes, reservoirs, low wetlands, coastal wetlands, and anchialine pools. Only the basic criteria set forth in section 11-54-04 apply to springs and seeps, natural lakes, reservoirs, low wetlands, coastal wetlands, and anchialine pools. Natural lakes and anchialine pools will be maintained in the natural state through Hawaii's "no discharge" policy for these waters. Waste discharge into these waters is prohibited (see paragraph 11-54-03(b)(1)).

(b) Specific criteria for streams.

(1) Water column criteria for streams shall be as provided in the following table:

Parameter	Geometric mean not to exceed the given value	Not to Exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total Nitrogen (ug N/L)	250.0* 180.0**	520.0* 380.0**	800.0* 600.0**
Nitrate + Nitrite Nitrogen (ug [NO_3+NO_2] -N/L)	70.0* 30.0**	180.0* 90.0**	300.0* 170.0**
Total Phosphorus (ug P/L)	50.0* 30.0**	100.0* 60.0**	150.0* 80.0**
Total Nonfilterable Residue (mg/L)	20.0* 10.0**	50.0* 30.0**	80.0* 55.0**
Turbidity (N.T.U.)	5.0* 2.0**	15.0* 5.5**	25.0* 10.0**

*Wet season - November 1 through April 30.

**Dry season - May 1 through October 31.

L = liter

N.T.U. = Nephelometric Turbidity Units. A comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. The higher the intensity of scattered light, the higher the turbidity.

ug = microgram or 0.000001 grams

pH Units - shall not deviate more than 0.5 units from ambient conditions and shall not be lower than 5.5 nor higher than 8.0

Dissolved Oxygen - Not less than eighty percent saturation.

Temperature - Shall not vary more than one degree Celsius from ambient conditions.

Specific Conductance - Not more than three hundred micromhos/centimeter.

(2) Bottom criteria for streams:

(A) Episodic deposits of flood-borne soil sediment shall not occur in quantities exceeding an equivalent thickness of five millimeters (0.20 inch) over hard bottom twenty-four hours after a heavy rainstorm.

(B) Episodic deposits of flood-borne soil sediment shall not occur in quantities exceeding an equivalent thickness of ten millimeters (0.40 inch) over soft bottoms twenty-four hours after a heavy rainstorm.

(C) In soft bottom material in pool sections of streams, oxidation-reduction potential (E_H) in the top ten centimeters (four inches) shall not be less than +100 millivolts.

(D) In soft bottom material in pool sections of streams, no more than fifty percent of the grain size distribution of sediment shall be smaller than 0.125 millimeter (0.005 inch) in diameter.

(E) The director shall prescribe the appropriate parameters, measures, and criteria for monitoring stream bottom biological communities including their habitat, which may be affected by proposed actions. Permanent benchmark stations may be required where necessary for monitoring purposes. The water quality criteria for this subsection shall be deemed to be met if time series surveys of benchmark stations indicate no relative changes in the relevant biological communities, as noted by biological community indicators or by indicator organisms which may be applicable to the specific site.

(c) Specific criteria for elevated wetlands: pH units shall not deviate more than 0.5 units from ambient conditions and shall not be lower than 4.5 nor higher than 7.0.

(d) Specific criteria for estuaries.

(1) The following table is applicable to all estuaries except Pearl Harbor:

Parameter	Geometric mean not to exceed the given value	Not to Exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total Nitrogen (ug N/L)	200.00	350.00	500.00
Ammonia Nitrogen (ug NH_4 - N/L)	6.00	10.00	20.00
Nitrate + Nitrite Nitrogen (ug [NO_3+NO_2] N/L)	8.00	25.00	35.00
Total Phosphorus (ug P/L)	25.00	50.00	75.00
Light Extinction Coefficient (k units)	0.40	0.80	1.00
Chlorophyll a (ug/L)	2.00	5.00	10.00
Turbidity (N.T.U.)	1.50	3.00	5.00

k units = the ratio of light measured at the water's surface to light measured at a particular depth.

L = liter

Light Extinction Coefficient is only required for dischargers who have obtained a waiver pursuant to Section 301(h) of the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251), as amended, and are required by EPA to monitor it.

N.T.U. = Nephelometric Turbidity Units. A comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same

conditions. The higher the intensity of scattered light, the higher the turbidity.

ug = microgram or 0.000001 grams

pH Units - shall not deviate more than 0.5 units from ambient conditions and shall not be lower than 7.0 nor higher than 8.6.

Dissolved Oxygen - Not less than seventy-five percent saturation.

Temperature - Shall not vary more than one degree Celsius from ambient conditions.

Salinity - Shall not vary more than ten percent from ambient conditions.

Oxidation - reduction potential (E_H) in the uppermost ten centimeters (four inches) of sediment shall not be less than -100 millivolts.

The following table is applicable only to Pearl Harbor Estuary.

Parameter	Geometric mean not to exceed the given value	Not to Exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total Nitrogen (ug N/L)	300.00	550.00	750.00
Ammonia Nitrogen (ug NH_4-N/L)	10.00	20.00	30.00
Nitrate - Nitrite Nitrogen (ug [NO_3+NO_2] N/L)	15.00	40.00	70.00
Total Phosphorus (ug P/L)	60.00	130.00	200.00
Light Extinction Coefficient (k units)	0.80	1.60	2.50
Chlorophyll a (ug/L)	3.50	10.00	20.00
Turbidity (N.T.U.)	4.00	8.00	15.00

k units = the ratio of light measured at the water's surface to light measured at a particular depth.

L = liter

Light Extinction Coefficient is only required for dischargers who have obtained a waiver pursuant to Section 301(h) of the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251), as amended, and are required by EPA to monitor it.

N.T.U. = Nephelometric Turbidity Units. A comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. The higher the intensity of scattered light, the higher the turbidity.

ug = microgram or 0.000001 grams

pH Units - shall not deviate more than 0.5 units from ambient conditions and shall not be lower than 6.8 nor higher than 8.8.

Dissolved Oxygen - Not less than sixty percent saturation.

Temperature - Shall not vary more than one degree Celsius from ambient conditions.

Salinity - Shall not vary more than ten percent from ambient conditions.

Oxidation - Reduction potential (E_H) in the uppermost ten centimeters (four inches) of sediment shall not be less than -100 millivolts.

[Eff 11/12/82; am and comp 10/6/84; am and comp JAN 18 1990]

(Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-06 Uses and specific criteria applicable to marine waters.

(a) Embayments.

(1) As used in this section:

"Embayments" means land confined and physically protected marine waters with restricted openings to open coastal waters defined by the ratio of total bay volume to the cross-sectional entrance area of seven hundred to one or greater.

"Total bay volume" is measured in cubic meters and "cross-sectional entrance area" is measured in square meters, and both are determined at mean lower low water.

(2) Water areas to be protected.

(A) Class AA.

(i)

Hawaii	Oahu	Kauai
Puako Bay	Waialua Bay	Hanalei Bay
Waiulua Bay	Kahana Bay	
Anaehoomalu Bay	Kaneohe Bay	
Kiholo Bay	Hanauma Bay	
Kailua Harbor		
Kealakekua Bay		
Honaunau Bay		

(ii) All embayments in preserves, reserves, sanctuaries, and refuges established by the department of land and natural resources under chapter 195 or chapter 190, HRS, or similar reserves for the protection of marine life established under chapter 190, HRS.

(iii) All waters in state or federal fish and wildlife refuges and marine sanctuaries.

(iv) All waters which have been officially identified as a unique or critical habitat for threatened or endangered species.

(B) Class A.

Hawaii	Maui	Lanai
Hilo Bay (inside breakwater)	Kahului Bay	Manele Boat Harbor
Kawaihae Harbor	Lahaina Boat Harbor	Kaumalapau Harbor
Honokohau Boat Harbor	Maalaea Boat Harbor	
Keauhou Bay		

Molokai	Oahu	Kauai
Hale o Lono Harbor	Kaiaka Bay	Hanamaulu Bay
Kaunakakai Harbor	Paiko Peninsula to Koko Head	Nawiliwili Bay
Kaunakakai Boat Harbor	Ala Wai Boat Harbor	Kukuiula Bay
	Kewalo Basin	Wahiawa Bay
	Honolulu Harbor	Hanapepe Bay (inside breakwater)
	Keehi Lagoon	Kikiaola Boat Harbor
	Barbers Point Harbor	Port Allen Boat Harbor
	Pokai Bay	
	Heeia Kea Boat Harbor	
	Waianae Boat Harbor	
	Haleiwa Boat Harbor	

(3) The following criteria are specific for embayments. (Note that criteria for embayments differ based on fresh water inflow.)

Parameter	Geometric mean not to exceed the given value	Not to Exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total Nitrogen (ug N/L)	200.00* 150.00**	350.00* 250.00**	500.00* 350.00**
Ammonia Nitrogen (ug NH_4-N/L)	6.00* 3.50**	13.00* 8.50**	20.00* 15.00**
Nitrate & Nitrite Nitrogen (ug [NO_3+NO_2] -N/L)	8.00* 5.00**	20.00* 14.00**	35.00* 25.00**
Total Phosphorus (ug P/L)	25.00* 20.00**	50.00* 40.00**	75.00* 60.00**
Light Extinction Coefficient (k units)	0.40* 0.15**	0.80* 0.35**	1.20* 0.60**
Chlorophyll a (ug/L)	1.50* 0.50**	4.50* 1.50**	8.50* 3.00**
Turbidity (N.T.U.)	1.50* 0.40**	3.00* 1.00**	5.00* 1.50**

*"Wet" criteria apply when the average fresh water inflow from the land equals or exceeds one percent of the embayment volume per day.

**"Dry" criteria apply when the average fresh water inflow from the land is less than one percent of the embayment volume per day.

Applicable to both "wet" and "dry" conditions:

pH Units - shall not deviate more than 0.5 units from a value of 8.1.

Dissolved Oxygen - Not less than seventy-five percent saturation.

Temperature - Shall not vary more than one degree Celsius from ambient conditions.

Salinity - Shall not vary more than ten percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

k units = the ratio of light measured at the water's surface to light measured at a particular depth.

L = liter

Light Extinction Coefficient is only required for dischargers who have obtained a waiver pursuant to Section 301(h) of the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251), as amended, and are required by EPA to monitor it.

N.T.U. = Nephelometric Turbidity Units. A comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. The higher the intensity of scattered light, the higher the turbidity.

ug = microgram or 0.000001 grams

(b) Open coastal waters.

(1) As used in this section:

"Open coastal waters" means marine waters bounded by the one hundred fathom (one hundred eighty-three meters or six hundred feet) depth contour and the shoreline, excluding bays named in subsection (a);

(2) Water areas to be protected:

(A) Class AA.

(i) Hawaii - The open coastal waters from Leleiwi Point to Waiulaula Point;

(ii) Maui - The open coastal waters between Nakalele Point and Waihee Point, and between Huelo Point and Puu Olai;

(iii) Kahoolawe - All open coastal waters surrounding the island;

(iv) Lanai - All open coastal waters surrounding the island;

(v) Molokai - The open coastal waters between the westerly boundary of Hale o Lono Harbor to Laau Point, and from Laau Point to Ilio Point and Lamaloa Head. Also, the open coastal waters from Cape Halawa to the easterly boundary of Kaunakakai Harbor;

(vi) Oahu - Waimanalo Bay from Makapuu Point to the southerly boundary of Kaiona Beach Park, and including the waters surrounding Manana and Kaohikaipu Islands. Also, Waialua Bay from Kaiaka Point to Puaena Point, and the open coastal waters along Kaena Point from a distance of three and one half miles (5.6 kilometers) towards Mokuleia and three and one half miles (5.6 kilometers) toward Makua;

(vii) Kauai - The open coastal waters between Hikimoe Valley and Makahoa Point. Also, the open coastal waters between the westerly boundary of Hoai Bay to Makahuena Point;

(viii) Niihau - All open coastal waters surrounding the island;

(ix) All other islands of the state - All open coastal waters surrounding the islands not classified in this section;

(x) All open waters in preserves, reserves, sanctuaries, and refuges established by the department of land and natural resources under chapter 195 or chapter 190, HRS or similar reserves for the protection of marine life established under chapter 190, HRS, as amended; or in the refuges or sanctuaries established by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service;

(B) Class A - All other open coastal waters not otherwise specified.

(3) The following criteria are specific for open coastal waters: (Note that criteria for open coastal waters differ, based on fresh water discharge.)

Parameter	Geometric mean not to exceed the given value	Not to Exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total Nitrogen (ug N/L)	150.00* 110.00**	250.00* 180.00**	350.00* 250.00**
Ammonia Nitrogen (ug NH_4-N/L)	3.50* 2.00**	8.50* 5.00**	15.00* 9.00**
Nitrate + Nitrite Nitrogen (ug [NO_3+NO_2] -N/L)	5.00* 3.50**	14.00* 10.00**	25.00* 20.00**
Total Phosphorus (ug P/L)	20.00* 16.00**	40.00* 30.00**	60.00* 45.00**
Light Extinction Coefficient (k units)	0.20* 0.10**	0.50* 0.30**	0.85* 0.55**
Chlorophyll a (ug/L)	0.30* 0.15**	0.90* 0.50**	1.75* 1.00**
Turbidity (N.T.U.)	0.50* 0.20**	1.25* 0.50**	2.00* 1.00**

*"Wet" criteria apply when the open coastal waters receive more than three million gallons per day of fresh water discharge per shoreline mile.

**"Dry" criteria apply when the open coastal waters receive less than three million gallons per day of fresh water discharge per shoreline mile.

Applicable to both "wet" and "dry" conditions:

pH Units - shall not deviate more than 0.5 units from a value of 8.1.

Dissolved Oxygen - Not less than seventy-five percent saturation.

Temperature - Shall not vary more than one degree Celsius from ambient conditions.

Salinity - Shall not vary more than ten percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

k units = the ratio of light measured at the water's surface to light measured at a particular depth.

L = liter

Light Extinction Coefficient is only required for dischargers who have obtained a waiver pursuant to Section 301(h) of the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251), as amended, and are required by EPA to monitor it.

N.T.U. = Nephelometric Turbidity Units. A comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. The higher the intensity of scattered light, the higher the turbidity.

ug = microgram or 0.000001 grams

(c) Oceanic waters.

(1) Definition - "Oceanic waters" means all other marine waters outside of the one hundred fathom (six hundred feet or one hundred eighty-three meters) depth contour;

(2) Water areas to be protected - Class A - All oceanic waters;

(3) The following criteria are specific for oceanic waters:

Parameter	Geometric mean not to exceed the given value	Not to Exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total Nitrogen (ug N/L)	50.00	80.00	100.00
Ammonia Nitrogen (ug NH_4-N/L)	1.00	1.75	2.50
Nitrate + Nitrite Nitrogen (ug [NO_3+NO_2] -N/L)	1.50	2.50	3.50
Total Phosphorus (ug P/L)	10.00	18.00	25.00
Light Extinction Coefficient (k units)	0.04	0.07	0.10
Chlorophyll a (ug/L)	0.06	0.12	0.20
Turbidity (N.T.U.)	0.03	0.10	0.20

k units = the ratio of light measured at the water's surface to light measured at a particular depth.

L = liter

Light Extinction Coefficient is only required for dischargers who have obtained a waiver pursuant to Section 301(h) of the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251), as amended, and are required by EPA to monitor it.

N.T.U. = Nephelometric Turbidity Units. A comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. The higher the intensity of scattered light, the higher the turbidity.

ug = microgram or 0.000001 grams

pH Units - shall not deviate more than 0.5 units from a value of 8.1.

Dissolved Oxygen - Not less than seventy-five percent saturation.

Temperature - shall not vary more than one degree Celsius from ambient conditions.

Salinity - Shall not vary more than ten percent from natural or seasonal changes considering hydrologic input and oceanographic factors. [Eff 11/12/82; am and comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-07 Uses and specific criteria applicable to marine bottom types. (a) Sand beaches.

(1) As used in this section:

"Sand beaches" means shoreline composed of the weathered calcareous remains of marine algae and animals (white sand), the weathered remains of volcanic tuff (olivine), or the weathered remains of lava (black sand). Associated animals are largely burrowers and are related to particle grain size, slope, and color of the beach;

(2) Water areas to be protected:

(A) Class I - All beaches on the Northwestern Hawaiian Islands. These islands comprise that portion of the Hawaiian archipelago which lies northwest of the island of Kauai and is part of the State of Hawaii; including Nihoa Island,

Necker Island, French Frigate Shoals, Brooks Banks, Gardiner Pinnacles, Dowsett and Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, Gambia Shoal, and Kure Atoll;

(B) Class II - All beaches not in Class I;

(3) The following criteria are specific to sand beaches:

(A) Episodic deposits of flood-borne sediment shall not occur in quantities exceeding an equivalent thickness of ten millimeters (0.40 inch) twenty-four hours after a heavy rainstorm;

(B) Oxidation - reduction potential (E_H) in the uppermost ten centimeters (four inches) of sediment shall not be less than +100 millivolts;

(C) No more than fifty percent of the grain size distribution of sediment shall be smaller than 0.125 millimeters in diameter.

(b) Lava rock shoreline and solution benches.

(1) As used in this section:

"Lava rock shorelines" means sea cliffs and other vertical rock faces, horizontal basalt, volcanic tuff beaches, and boulder beaches formed by rocks falling from above or deposited by storm waves. Associated plants and animals are adapted to the harsh physical environment and are distinctly zoned to the degree of wave exposure;

"Solution benches" means sea level platforms developed on upraised reef or solidified beach rock by the erosive action of waves and rains. Solution benches are distinguished by a thick algal turf and conspicuous zonation of plants and animals;

(2) Water areas to be protected:

(A) Class I - All lava rock shorelines and solution benches in preserves, reserves, sanctuaries, and refuges established by the department of land and natural resources under chapter 195 or chapter 190, HRS, or similar reserves for the protection of marine life established under chapter 190, HRS, as amended; or in refuges or sanctuaries established by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service;

(B) Class II

(i) All other lava rock shorelines not in Class I;

(ii) The following solution benches:

Maui	Oahu	Kauai
Kihei	Diamond Head	Near Hanapepe
Papaula Point	Manana Island	Salt Ponds
	Makapuu	Milolii
	Laie	Nualolo
	Kahuku	Makaha
	Mokuleia	Mahaulepu
	Makua	Kuhio Beach
	Makaha	Park (Kukuiula)
	Maile	
	Lualualei	
	Barbers Point	

(3) The following criteria are specific to lava rock shorelines and solution benches:

(A) Episodic deposits of flood-borne sediment shall not occur in quantities exceeding an equivalent thickness of five millimeters (0.20 inch) for longer than twenty-four hours after a heavy rainstorm;

(B) The director shall determine parameters, measures, and criteria for bottom biological communities which may be affected by proposed actions. The location and boundaries of each bottom-type class will be clarified when situations require their identification. For example, when a discharge permit is applied for or a waiver pursuant to section 301(h) of the Federal Water Pollution Control Act (33 U.S.C. §1311) is required. Permanent benchmark stations may be required where necessary for monitoring purposes. The water quality standards for this subsection shall be deemed to be met if time series surveys of benchmark station indicate no relative changes in the relevant biological communities, as noted by biological community indicators or by indicator organisms which may be applicable to the specific site.

(c) Marine pools and protected coves.

(1) As used in this section:

"Marine pools" means waters which collect in depressions on sea level lava rock outcrops and solution benches and also behind large boulders fronting the sea. Pools farthest from the ocean have harsher environments and less frequent renewal of water and support fewer animals. Those closest to the ocean are frequently renewed with water, are essentially marine, and support more diverse fauna;

"Protected coves" means small inlets which are removed from heavy wave action or surge;

(2) Water areas to be protected;

(A) Class I.

(i) All marine pools and protected coves in preserves, reserves, sanctuaries, and refuges established by the department of land and natural resources under chapter 195 or chapter 190, HRS, or similar reserves for the protection of marine life established under chapter 190, HRS, as amended; or in refuges or sanctuaries established by the U.S. Fish and Wildlife Service or the National Fisheries Service;

(ii) Hawaii

Honaunau

Kiholo

(B) Class II.

Hawaii	Maui	Molokai
Kalapana	Hana	Cape Halawa
Pohakuloa	Keanae	Kalaupapa
Kapalaoa	Napili	South Coast
Haenokalele	Puu Olai to	
Kapoho	Cape Hanamanioa	
King's Landing (Papai)	Kipahulu	
Hilo		
Leleiwi Point		
Wailua Bay		

Oahu	Kauai
Diamond Head	Kealia
Halona Blowhole	Mahaulepu
to Makapuu	Hanamaulu
Mokuleia	Poipu
Kaena Point	Puolo Point
Makua	
Punaluu	

(3) The following criteria are specific to marine pools and protected coves:

(A) In marine pools and coves with sand bottoms, oxidation - reduction potential (E_H) in the uppermost ten centimeters (four inches) of sediment shall not be less than +100 millivolts;

(B) In marine pools and coves with sand bottoms, no more than fifty percent of the grain size distribution of the sediment shall be smaller than 0.125 millimeters in diameter;

(C) Episodic deposits of flood-borne soil sediment shall not occur in quantities exceeding equivalent thicknesses for longer than twenty-four hours following a heavy rainstorm according to the following:

(i) No thicker than an equivalent of five millimeters (0.20 inch) on hard bottoms (other than living corals);

(ii) No thicker than an equivalent of ten millimeters (0.40 inch) on soft bottoms;

(D) The director shall determine parameters, measures, and criteria for bottom biological communities which may be affected by proposed actions. Permanent benchmark stations may be required where necessary for monitoring purposes. The water quality standards for this subsection

shall be deemed to be met if time series surveys or benchmark stations indicate no relative changes in the relevant biological communities, as noted by biological community indicators or by indicator organisms which may be applicable to the specific site.

(d) Artificial basins.

(1) As used in this section:

"Artificial basins" means dredged or quarried channels or harbors, and harbor-associated submerged structures. Many organisms can attach to the vertical structures, but the soft, shifting sediment bottoms of harbors may only be colonized by a few hardy or transient species.

(2) Class II water areas to be protected are as follows:

(A) Shallow draft harbors:

Hawaii	Maui	Lanai
Wailoa River Boat Harbor	Maalaea Boat Harbor	Manele Boat Harbor
Mahukona Harbor	Lahaina Boat Harbor	Kaumalapau Harbor
Keauhou Harbor	Hana Harbor	
Kailua-Kona Harbor		
Honokohau Boat Harbor		
Kawaihae Harbor		

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Molokai	Oahu	Kauai
Kalaupapa Anchorage	Heeia Kea Boat Harbor	Nawiliwili Small Boat Harbor
Kaunakakai Small Boat Harbor	Kaneohe Marine Corps Air Station	Kukuiula Boat Harbor
Hale o Lono Harbor	Kaneohe Yacht Club	Kikiaola Boat Harbor
	Hawaii Kai Marina (Kuapa Pond)	Port Allen Boat Harbor
	Pokai Bay	
	Waianae Harbor	
	Keehi Marine Center	
	La Mariana Sailing Club	
	Haleiwa Harbor	
	Makani Kai Marina	
	Ala Wai Boat Harbor	
	Keehi Boat Harbor	
	Hawaii Yacht Club	
	Waikiki Yacht Club	
	Ala Wai Fuel Dock	

(B) Deep draft commercial harbors:

Hawaii	Maui	Molokai
Kuhio Bay (Hilo Harbor)	Kahului Harbor	Kaunakakai Barge Harbor
Kawaihae Deep Draft Harbor		

Oahu	Kauai
Honolulu Harbor	Nawiliwili Harbor
Barbers Point Harbor	Port Allen Harbor
Kewalo Basin	

(3) Specific criterion to be applied - Oxidation - reduction potential (E_H) in the uppermost ten centimeters (four inches) of sediment shall not be less than -100 millivolts.

(e) Reef flats and reef communities.

(1) As used in this section:

"Nearshore reef flats" means shallow platforms of reef rock, rubble, and sand extending from the shoreline. Smaller, younger flats projected out as semicircular aprons while older, larger flats form wide continuous platforms. Associated animals are mollusks, echinoderms, worms, crustaceans (many living beneath the surface), and reef-building corals.

"Offshore reef flats" means shallow, submerged platforms of reef rock and sand between depths of zero to three meters (zero to ten feet) which are separated from the shoreline of high

volcanic islands by lagoons or ocean expanses. Dominant organisms are bottom-dwelling algae. Biological composition is extremely variable. There are three types: patch, barrier, and atoll reef flats; quite different from one another structurally. The presence of heavier wave action, water more oceanic in character, and the relative absence of terrigenous influences distinguish offshore reef flats.

"Protected reef communities" means hard bottom aggregations, including scattered sand channels and patches, dominated by living coral thickets, mounds, or platforms. They are found at depths of ten to thirty meters (thirty-two to ninety-six feet) along protected leeward coasts or in shallow water (up to sea level) in sheltered lagoons behind atoll or barrier reefs and in the calm reaches of bays or coves.

"Wave exposed reef communities" means aggregations, including scattered sand channels and patches, dominated by corals. They may be found at depths up to forty meters (approximately one hundred thirty feet) along coasts subject to continuous or heavy wave action and surge. Wave exposed reef communities are dominated biologically by benthic algae, reef-building corals, and echinoderms.

(2) Water areas to be protected:

(A) Class I.

(i) All reef flats and reef communities in preserves, reserves, sanctuaries, and refuges established by the department of land and natural resources under chapter 195 or chapter 190, HRS, or similar reserves

for the protection of marine life under chapter 190, HRS, as amended; or in refuges or sanctuaries established by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service;

(ii) Nearshore reef flats:

Hawaii	Maui	Lanai
Puako	Honolua	Northwest Lanai Reef
Molokai	**Oahu**	**Kauai**
Western Kalaupapa	Hanauma Bay	Nualolokai
Southeast Molokai Reef		Hanalei (Anini to Haena)
Honomuni Harbor		
Kulaalamihi Fishpond)		

(iii) Offshore reef flats:

Moku o Loe
(Coconut Island, Kaneohe Bay, Oahu)
Kure Atoll
Pearl and Hermes Atoll
Lisianski Island
Laysan Island
Maro Reef
French Frigate Shoals

(iv) Wave exposed reef communities:

Hawaii	Maui
1823 Lava Flow (Punaluu)	Hana Bay
1840 Lava Flow (North Puna)	Makuleia Bay
1868 Lava Flow (South Point)	(Honolua)
1887 Lava Flow (South Point)	
1955 Lava Flow (South Puna)	
1960 Lava Flow (Kapoho)	
1969 Lava Flow (Apuna Point)	
1970 Lava Flow (Apuna Point)	
1971 Lava Flow (Apuna Point)	
1972 Lava Flow (Apuna Point)	
1973 Lava Flow (Apuna Point)	

Molokini Island	Molokai
All wave exposed reef communities	Moanui Kahinapohaku
	Waikolu - Kalawao
	Halawa Bay

Oahu	Kauai
Sharks Cove (Pupukea)	Ke'e Beach (Kailio Point)
Moku Manu (Islands)	Poipu Beach
Outer Hanauma Bay	Kipu Kai
Waimea Bay	
Kawela Bay	
Kahana Bay	

Niihau	Lehua (off) Niihau
All wave exposed reef communities	All wave exposed reef communities

(v) Protected reef communities:

Hawaii	Maui
Puako	Honolua
Honaunau	Ahihi-La Perouse (including 1790 Lava Flow at Cape Kinau)
Kealakekua	
Kiholo	
Anaehoomalu	
Hapuna	
Kahaluu Bay	
Keaweula (North Kohala)	
Milolii Bay to Keawaiki	
Kailua-Kaiwi (Kona)	
Onomea Bay	
1801 Lava Flow (Keahole or Kiholo)	
1850 Lava Flow (South Kona)	
1859 Lava Flow (Kiholo)	
1919 Lava Flow (Milolii)	
1926 Lava Flow (Milolii)	

Molokini Island	Lanai
All protected reef communities	Manele
	Hulopoe

Molokai	Oahu
Southeast Molokai	Hanauma Bay
Kalaupapa	Moku o Loe
Honomuni Harbor	(Coconut Island, Kaneohe Bay)

Kauai

Hoai Bay (Poipu)

Northwestern Hawaiian Islands

Kure Atoll Lagoon
Pearl and Hermes Lagoon
Lisianski Lagoon
Maro Reef Lagoon
French Frigate Shoals Lagoon

(B) Class IL

(i) Existing or planned harbors may be located within nearshore reef flats showing degraded habitats and only where feasible alternatives are lacking and upon written approval by the director, considering environmental impact and the public interest pursuant to Section 342D-6, HRS.

Hawaii	Maui	Lanai
Blonde Reef (Hilo Harbor)	Lahaina Harbor	Manele
Kawaihae Small Boat Harbor	Kahului Harbor	

Molokai	Oahu
Kaunakakai Harbor	Keehi Boat Harbor
Hale o Lono Harbor	Ala Moana Reef
Palaau (1.5 mile/ 2.4 kilometers East Pakanaka Fishpond)	Honolulu Harbor
	Heeia Harbor
	Kaneohe Yacht Club
	Ala Wai Harbor
	Haleiwa Harbor
	Maunalua Bay
	Pearl Harbor
	Kaneohe Bay
	Kahe

All other nearshore reef flats not in Class I;

(ii) Offshore reef flats:

Oahu

Kapapa Barrier Reef

Kaneohe Patch Reefs (Kaneohe Bay)

(iii) All other wave exposed or protected reef communities not in Class I.

(3) Specific criteria to be applied to all reef flats and reef communities: No action shall be undertaken which would substantially risk damage, impairment, or alteration of the biological characteristics of the areas named herein. When a determination of substantial risk is made by the director, the action shall be declared to be contrary to the public interest and no other permits shall be issued pursuant to chapter 342, HRS.

(A) Oxidation-reduction potential (E_H) in the uppermost ten centimeters (four inches) of sand patches shall not be less than +100 millivolts;

(B) No more than fifty percent of the grain size distribution of sand patches shall be smaller than 0.125 millimeters in diameter;

(C) Episodic deposits of flood-borne soil sediment shall not occur in quantities exceeding equivalent thicknesses for longer than twenty-four hours after a heavy rainstorm as follows:

(i) No thicker than an equivalent of two millimeters (0.08 inch) on living coral surfaces;

(ii) No thicker than an equivalent of five millimeters (0.2 inch) on other hard bottoms;

(iii) No thicker than an equivalent of ten millimeters (0.4 inch) on soft bottoms;

(D) The director shall determine parameters, measures, and criteria for bottom biological communities which may be affected by proposed actions. The location and boundaries of each bottom-type class shall be clarified when situations require their identification. For example, the location and boundaries shall be clarified when a discharge permit is applied for or a waiver pursuant to section 301(h) of the

Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251 et seq.) is required. Permanent benchmark stations may be required where necessary for monitoring purposes. The water quality standards for this subsection shall be deemed to be met if time series surveys of benchmark stations indicate no relative changes in the relevant biological communities, as noted by biological community indicators or by indicator organisms which may be applicable to the specific site.

(f) Soft bottom communities.

(1) As used in this subsection:

"Soft bottom communities" means poorly described and "patchy" communities, mostly of burrowing organisms, living in deposits at depths between two to forty meters (approximately six to one hundred thirty feet). The particle size of sediment, depth below sea level, and degree of water movement and associated sediment turnover dictate the composition of animals which rework the bottom with burrows, trails, tracks, ripples, hummocks, and depressions.

(2) Water areas to be protected:

Class II - All soft bottom communities;

(3) Specific criteria to be applied - Oxidation-reduction potential (E_H) in the uppermost ten centimeters (four inches) of sediment should not be less than -100 millivolts. The location and boundaries of each bottom-type class shall be clarified when situations require their identification. For example, the location and boundaries shall be clarified when a discharge permit is applied for or a waiver pursuant to section 301(h) of the Act is required. [Eff 11/12/82; am and comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-08 Specific criteria for recreational areas. (a) In inland recreational waters:

(1) Fecal coliform content shall not exceed a geometric mean of two hundred per one hundred milliliters in ten or more samples collected during any thirty day period and not more than ten percent of the samples shall exceed four hundred per one hundred milliliters in the same period.

(2) Raw or inadequately treated sewage or other pollutants of public health significance, as determined by the director of health, shall not be present in natural public bathing or wading areas.

(b) In marine recreational waters within one thousand feet of the shoreline, including natural public bathing or wading areas, enterococci content shall not exceed a geometric mean of seven per one hundred milliliters in not less than five samples equally spaced over a thirty-day period. Raw or inadequately treated sewage or other pollutants of public health significance, as determined by the director of health, shall not be present in natural public bathing or wading areas. [Eff 11/12/82; am and comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-09 Zones of mixing. (a) As used in this section:

"Zones of mixing" means limited areas around outfalls and other facilities to allow for the initial dilution of waste discharges.

(b) Zones of mixing for the assimilation of domestic, agricultural, and industrial discharges which have received the best degree of treatment or control are recognized as being necessary. It is the objective of these limited zones to provide for a current realistic means of control over the placement and manner of discharges or emissions so as to achieve the highest attainable level of water quality or otherwise to achieve the

minimum environmental impact considering initial dilution, dispersion, and reactions from substances which may be considered to be pollutants.

(c) Establishment, renewal, and termination.

(1) Application for establishment of a zone of mixing shall be made concurrently with any discharge permits whenever applicable and the conditions of a zone of mixing shall be incorporated as conditions of the discharge permits. Every application for a zone of mixing shall be made on forms furnished by the director and shall be accompanied by a complete and detailed description of present conditions, how present conditions do not conform to standards, and other information as the director may prescribe;

(2) Each application for a zone of mixing shall be reviewed in light of the descriptions, statements, plans, histories, and other supporting information as may be submitted upon the request of the director, and in light of the effect or probable effect upon water quality standards established pursuant to this chapter;

(3) Whenever an application is approved, the director shall establish the zone of mixing, taking into account the environmental impact, including but not limited to factors such as the protected uses of the body of water, existing natural conditions of the receiving water, character of the effluent, and the adequacy of the design of the outfall and diffuser system to achieve maximum dispersion and assimilation of the treated or controlled waste with a minimum of undesirable or noticeable effect on the receiving water;

(4) Approval of a zone of mixing shall be made either after a public hearing is held by the director in the county where the source is situated, in accordance with chapters 91 and 92, HRS and the Rules of Practice and Procedures of the department, or after the public notification and comment process duly established for a

discharge permit in the case when the zone of mixing is being considered concurrently with the discharge permit;

(5) No zone of mixing shall be established by the director unless the application and the supporting information clearly show that:

(A) The continuation of the function or operation involved in the discharge by the granting of the zone of mixing is in the public interest;

(B) The discharge occurring or proposed to occur does not substantially endanger human health or safety;

(C) Compliance with the existing water quality standards from which a zone of mixing is sought would produce serious hardships without equal or greater benefits to the public; and

(D) The discharge occurring or proposed to occur does not violate the basic standards applicable to all waters, will not unreasonably interfere with any actual or probable use of the water areas for which it is classified, and has received (or in the case of a proposed discharge will receive) the best degree of treatment or control;

(6) Any zone of mixing or renewal thereof shall be established within the requirements of this section and for time periods and under conditions consistent with the reasons therefore and within the following limitations:

(A) If the zone of mixing is established on the grounds that there is no reasonable means known or available for the adequate prevention, control, or abatement of the discharge involved, it shall be allowed only until the necessary means for prevention, control or abatement become practicable, and subject to the taking of any substitute or alternative measures that the director may prescribe. No renewal of a

zone of mixing established under this subsection shall be allowed without a thorough review of known and available means of preventing, controlling, or abating the discharge involved;

(B) The director may issue a zone of mixing for a period not exceeding five years; and

(C) Every zone of mixing established under this section shall include, but not be limited to, conditions requiring the applicant to perform appropriate effluent and receiving water sampling including monitoring of bottom biological communities and report the results of each sampling to the director. A program of research to develop reasonable alternatives to the methods of treatment or control in use by the applicant may be required if research is deemed prudent by the director;

(7) Any zone of mixing established pursuant to this section may be renewed from time to time on terms and conditions and for periods not exceeding five years which would be appropriate on initial establishment of a zone of mixing, provided that the applicant for renewal had met all of the conditions specified in the immediately preceding zone of mixing, and provided further that the renewal and the zone of mixing established in pursuance thereof shall provide for the discharge not greater in quantity of mass emissions than that attained pursuant to the terms of the immediately preceding zone of mixing at its expiration. Any new zones of mixing or requests for zone of mixing renewals for wastewater treatment plants (WWTP) performing primary treatment shall comply with Section 301(h) of the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251). No renewal shall be allowed except upon application. Any renewal application

shall be made at least one hundred and eighty days prior to the expiration of the zone of mixing;

(8) No zone of mixing established pursuant to this part shall be construed to prevent or limit the application of any emergency provisions and procedures provided by law;

(9) The establishment of any zone of mixing shall be subject to the concurrence of the U.S. Environmental Protection Agency;

(10) Each mixing zone may be subject to revocation, suspension, or modification if, after notice and opportunity for a hearing pursuant to Chapter 91, HRS and the Rules of Practice and Procedures of the department, the director determines that the terms specified in chapter 342D-6, HRS have been violated. In taking any action, the director may consider operating records, compliance investigations, or other information regarding discharge quality or impact on receiving waters. The action shall be effected by giving written notice to the permittee, which shall contain the reasons for the action;

(11) The director shall be notified within thirty days of the permanent discontinuance of a discharge. The zone of mixing shall terminate thirty days after such notification has been received;

(12) Upon expiration of the period stated in the designation, the zone of mixing shall automatically terminate and no rights shall become vested in the designee. [Eff 11/12/82; am and comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1 Water quality certification. As used in sections 11-54-9.1.01 to 9.1.10:

"Act" means the Clean Water Act Amendments 1977 (33 U.S.C. 1251), et seq.

"Certifying agency" means the department of health.

"License or permit" means any license or permit granted by an agency of the federal government to conduct any activity which may result in any discharge into the navigable waters of the State of Hawaii.

"Licensing or permitting agency" means any agency of the federal government to which application is made for a license or permit.

"Regional administrator" means the administrator of region IX, environmental protection agency.

"Water quality certification" means a statement which asserts that a proposed discharge activity will not violate applicable water quality standards. A water quality certification is required by section 401 of the Act of any applicant for a federal license or permit to conduct any activity, including, but not limited to, the construction or operation of facilities which may result in any discharge into navigable waters of the United States.

"Water quality standards" means standards established pursuant to section 10(c) of the Act, and state-adopted water quality standards for navigable waters which are not interstate waters. [Eff and comp 1 8 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.01 Water quality certification; contents of certification. (a) A certification made by the department shall include the following:

(1) The name and address of the applicant;

(2) A statement that the director has either:

(A) Examined the application made by the applicant to the licensing or permitting agency (specifically identifying the number or code affixed to such application) and bases its certification upon an evaluation of the information contained in such application which is relevant to water quality considerations; or

(B) Examined other information furnished by the applicant, sufficient to permit the director to make the statement described in subparagraph 3;

(3) A statement that there is reasonable assurance that the activity will be conducted in a manner which will not violate applicable water quality standards;

(4) A statement of any conditions which the director deems necessary or desirable with respect to the discharge of the activity; and

(5) Such other information as the director may determine to be appropriate.

(b) If, after considering the complete application, comments received during the public comment period, the record of a public hearing held pursuant to section 09.1.03 and other information and data as the director deems relevant, should the director determine that there is reasonable assurance that applicable water quality standards will not be violated and the best practicable methods of control will be applied to a discharge which is the result of any activity including, but not limited to, the construction and operation of facilities, then the director shall so certify.

(c) The director may modify the certification prior to the issuance of the federal license or permit, after consideration of information presented by the applicant, licensing or permitting agency or other government agencies or interested parties. [Eff and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.02 Water quality certification; contents of application. An applicant for certification shall submit a complete description of the discharge involved in the activity for which certification is sought, with a request for certification signed by the applicant. Such description shall include the following:

(1) The name and address of the applicant;

(2) A description of the facility or activity, and of any discharge into state waters which may result from the conduct of any activity including, but not limited to, the construction or operation of the facility, including characteristics of the discharge, and the location or locations at which such discharge may enter state waters, as defined in section 11-54-02;

(3) If applicable, a description of the function and operation of equipment or facilities to control discharges, including specification of the methods of control to be used;

(4) The estimated date or dates on which the activity will begin and end and the date or dates on which the discharge(s) will take place;

(5) If applicable, a description of the methods and means being used or proposed to monitor the quality and characteristics of the discharge and the operation of equipment or facilities employed in the control of the proposed discharges;

(6) The director may require the submission of additional information after a certification application has been filed, and shall insure that, if a certification application is incomplete or otherwise deficient, processing of the application shall not be completed until such time as the applicant has supplied the missing information or otherwise corrected the deficiency. The director shall notify the applicant, in writing, within sixty days of the submission of an application, if an application is incomplete or otherwise deficient. A description of the type of additional information necessary to complete the application or correct the deficiency will be included with such a written notice. Failure to provide additional information or to correct a deficiency shall be sufficient grounds for denial of certification;

(7) The applicant will be informed, in writing, by the director, when a certification application is considered to be complete. The director shall act on a request for certification within a period which shall not exceed one year;

(8) The applicant is required to notify the department, in writing, of changes which may affect the application and certification process;

(9) Every applicant for water quality certification shall pay a filing fee of $100. This filing fee shall be submitted with the water quality certification application and shall not be refunded nor applied to any subsequent water quality certification application following final action of denial of a water quality certification application.

(A) Fees shall be made payable to the State of Hawaii;

(B) Any federal, state or county government agency shall be exempt from paying any filing fees. [Eff and comp DEC 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.03 Water quality certification; notice and hearing. The director may, upon request, provide the opportunity for public hearing(s) to consider the issuance of water quality certification. A notice shall be published in accordance with chapters 91 and 92, HRS. The director shall inform the applicant, in writing, that such action has been taken. All publication costs related to public hearing(s) notification(s) shall be paid by the applicant to the necessary and appropriate newspaper agency(ies) prior to publication date. Failure to do so may result in a delay in the certification process. [Eff and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.04 Water quality certification; waiver. If the director fails or refuses to act on a request for certification within a reasonable period of time (which shall not exceed one year) after receipt of a complete application, then the certification requirements of this section shall be waived with respect to federal applications.

If the discharge in question is the result of one of the activities which receives a nationwide permit for the discharge of dredge and fill materials, thereby fulfilling specific conditions of that permit pursuant to 33 CFR 330.5 and 330.6, then the director will determine, on a case-by-case basis, which projects are considered to be minor and non-controversial. Certification requirements of this section shall be waived for minor and non-controversial activities within one year of the receipt of a completed application. [Eff and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.05 Water quality certification; adoption of new water quality standards. (a) In any case where:

(1) A license or permit was issued without certification due to the absence of applicable water quality standards;

(2) Water quality standards applicable to the waters into which the licensed or permitted activity may discharge are subsequently established before the activity is completed;

(3) The director determines that such uncertified activity is violating water quality standards;

the director shall then notify the licensee or permittee of such violation. If the licensee or permittee fails within one hundred eighty days of the date of such notice to cease the violation, then the director shall notify the licensing or permitting agency that the licensee or permittee has failed to comply with such standards and that suspension of the applicable license or permit pursuant to section 401 of the Act is appropriate.

(b) Where a license or permit is suspended pursuant to subsection (a) and where the licensee or permittee subsequently takes action which in the director's opinion will not result in violating applicable water quality standards, the director shall then notify the licensing or permitting agency that there is reasonable assurance that applicable water quality standards will not be violated.

(c) This section shall not preclude the department from taking other enforcement action authorized by law. [Eff and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.06 Water quality certification; inspection of facility or activity before operation. Where any facility or activity has received certification pursuant to section 09.1.04 in connection with the issuance of a license or permit for construction, and where such facility or activity is not required to obtain an operating license or permit, the director, prior to the initial operation of such facility or activity, shall be afforded the opportunity to inspect such facility or activity for the purpose of determining if the manner in which such facility or activity will be operated or conducted will violate applicable water quality standards. [Eff and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.07 Water quality certification; notification to licensing or permitting agency. If the director, after an inspection pursuant to section 09.1.06 determines that operation of the proposed facility or activity will violate applicable water quality standards, the director shall so notify the applicant and the licensing or permitting agency. [Eff and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.08 Water quality certification; termination or suspension. Where a licensing or permitting agency, following a public hearing, suspends a license or permit after receiving the director's notice and recommendation pursuant to section 09.1.07, the applicant may submit evidence to the director, that the facility or activity has been modified so as not to violate applicable water quality standards. If the director

determines that the applicable water quality standards have not been violated, the director shall so notify the licensing or permitting agency. [Eff and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-09.1.09 Water quality certification; review and advice. The director may, and upon request shall, provide licensing and permitting agencies with determinations, definitions and interpretations to the meaning and content of state water quality standards. The director may, and upon request shall, also advise licensing and permitting agencies as to the status of compliance by dischargers with the conditions and requirements of applicable water quality standards. [Eff and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5, 342D-53) (Imp: HRS §§342D-4, 342D-5, 342D-6)

§11-54-10 Water quality analyses. (a) Laboratory analysis shall be performed by a laboratory approved by the department.

(b) Where applicable, analysis to determine compliance with these rules shall be by:

Parameter	Reference
Sample Collection (Phytoplankton and other Bioassay	Standard Methods for the Examination of Water and Waste Water, sixteenth edition, APHA.

Parameter	Reference
Sample Preservation and Holding Time, Bacteriological and Chemical Methodology	"Guidelines Establishing Test Procedures for Analysis of Pollutants," Federal Register, October 26, 1984 (40 CFR 136) and "Technical Amendments," Federal Register, June 30, 1986 (40 CFR 136).
Toxicity Test	EPA/600/4-85/014 Short-Term Methods For Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, December, 1985, or: EPA/600/4-85/013 Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms Cincinnati, Ohio, EMSL, March, 1985.
Quality Control (Bacteriological and Biology) and Chemistry	EPA/600/4-79-019, Handbook for Analytical Quality Control in Water and Wastewater Laboratories, March 1979, or: As otherwise previously specified or approved by the director.

[Eff 11/12/82; am and comp 10/6/84; am and comp JAN 18 1990]
(Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-11 Revision. These water quality criteria are based upon the best currently available data. Studies made in connection with the implementation program may suggest improvements to this chapter. For this reason, the chapter will be subject to periodic review and, where necessary, to change. Any change will be made only after public hearing, held in compliance with chapter 91, HRS and the Rules of Practice and Procedures of the department. [Eff 11/12/82; am and comp 10/6/84; am and comp JAN 18 1990] (Auth: HRS §§342D-4, 342D-5) (Imp: HRS §§342D-4, 342D-5)

§11-54-12 Severability. If any provisions of this chapter, or the application thereof to any person or circumstances, is held invalid, the invalidity does not affect other provisions or application of this chapter which can be given effect without the invalid provision or application, and to this end the provisions of this chapter are severable." [Eff 11/12/82; comp 10/6/84; comp JAN 18 1990] (Auth: HRS §§342D-4) (Imp: HRS §§342D-4)

The Department of Health authorized the adoption of Chapter 11-54 Hawaii Administrative Rules on Water Quality Standards, following public hearing held on Oahu on August 29, 1989, on Kauai on August 30, 1989, on Maui on August 31, 1989, on Hawaii in Kona on September 6, 1989, and in Hilo on September 7, 1989, after public hearing notice was given on July 14, 1989, in the Honolulu Advertiser, the Hawaii Tribune-Herald, West Hawaii Today, the Garden Isle and the Maui News.

Chapter 11-54 , Hawaii Administrative Rules shall take effect ten days after filing with the Office of the Lieutenant Governor.

JOHN C. LEWIN, M.D.
Director
Department of Health

Dated: NOV 30 1989

APPROVED:

JOHN WAIHEE
Governor
State of Hawaii

Dated: JAN 8 1990

APPROVED AS TO FORM:

Deputy Attorney General

Filed:

Effective Date:

JAN 9 11 33 AM '90

LIEUTENANT GOVERNOR
STATE OF HAWAII

APPENDIX B

Drinking Water Standards

RULES REPEALING PUBLIC HEALTH REGULATIONS CHAPTER 49, POTABLE WATER SYSTEMS DEPARTMENT OF HEALTH, STATE OF HAWAII

AND

ADOPTING CHAPTER 20 of TITLE 11, ADMINISTRATIVE RULES

SUMMARY

1. Public Health Regulations Chapter 49, Potable Water Systems, Department of Health, State of Hawaii, is repealed.

2. A new Chapter 20 of Title 11, Administrative Rules, entitled "Potable Water Systems," is adopted.

Public Health Regulations Chapter 49, Potable Water Systems, Department of Health, State of Hawaii, adopted on 8/26/77; REPEALED [12/26/81].

TITLE 11

DEPARTMENT OF HEALTH

CHAPTER 20

POTABLE WATER SYSTEMS

Historical Note: Chapter 20 of Title 11 Administrative Rules is based substantially upon Chapter 49 of the Public Health Regulations, Department of Health. [Eff. 8/16/77; R 12/26/81]

§11-20-1 Coverage. This chapter applies to each public water system, unless the public water system meets all of the following conditions:

(a) It consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(b) It obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;

(c) It does not sell water to any person; and

(d) It is not a carrier which conveys passengers in interstate commerce. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §142.10)

§11-20-2 Definitions. As used in this chapter:

"Act" means the Public Health Service Act, as amended by the Safe Drinking Water Act, P.L. 93-523.

"Administrator" means the administrator of the United States Environmental Protection Agency, or authorized representative.

"Community water system" means a public water system which serves at least fifteen service connections used by year-round residents or regularly serves at least twenty-five year-round residents.

"Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

"Department" means the department of health.

"Director" means the director of the department of health or his duly authorized representative.

"Disinfection" means any oxidant, including but not limited to chlorine, chlorine dioxide, chloramines, and ozone added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms.

"Dose equivalent" means the product of the absorbed dose from ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the International Commission on Radiological Units and Measurements (ICRU).

"Gross alpha particle activity" means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

"Gross beta particle activity" means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

"Halogen" means one of the chemical elements chlorine, bromine, or iodine.

"Man-made beta particle and photon emitters" means all radionuclides emitting beta particles or photons, or both, listed in Maximum Permissible Body Burdens and Maximum Permissible

Concentration of Radionuclides in Air or Water for Occupational Exposure, National Bureau of Standards Handbook 69, except the daughter products of thorium-232, uranium-235, and uranium-238.

"Maximum Contaminant Level" (or "MCL") means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

"Maximum Total Trihalomethane Potential" (or "MTTP") means the maximum concentration of total trihalomethanes produced in a given water containing a disinfectant residual after seven days at a temperature of 25°C. or above.

"Non-community water system" means a public water system that is not a community water system.

"Person" means an individual, corporation, company, association, partnership, county, city and county, state, or federal agency.

"Picocurie" (or "pCi") means that quantity of radioactive material producing 2.22 nuclear transformations per minute. "pCi/l" is a symbol for picocurie per liter.

"Public water system" means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least sixty days out of the year. Such term includes (1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (2) any collection or pretreatment storage facilities not under such control which are used primariy in connection with such system. A public water system may be privately or publicly owned or operated. A public water system is either a "community water system" or a "non-community water system."

"Rem" means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem" (or "mrem") is 1/1000 of a rem.

"Sanitary survey" means an on-site review of the water source, facilities, equipment, operation, and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation, and maintenance for producing and distributing safe drinking water.

"Standard sample" means the aliquot of finished drinking water that is examined for the presence of coliform bacteria.

"State" means the Hawaii State department of health.

"Supplier of water" means any person who owns or operates a public water system.

"Total trihalomethanes" (or "TTHM") means the sum of the concentration in milligrams per liter of the trihalomethane compounds (trichloromethane (chloroform)), dibromochloromethane, bromodichloro-

methane, and tribromomethane (bromoform)), rounded to two significant figures.

"Treatment technique requirement" means a requirement of the state primary drinking water regulations which specifies for a contaminant a specific treatment technique(s) known to the director which leads to a reduction in the level of such contaminant sufficient to comply with the requirements of these regulations.

"Trihalomethane" (or "THM") means one of the family of organic compounds, names as derivatives of methane, wherein three of the four hydrogen atoms in methane are each substituted by a halogen atom in the molecular structure.

"Turbidity" means suspended material such as clay, silt, finely divided organic material or other inorganic material in water. Turbidity is measured in turbidity units (TU). [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §142.10)

§11-20-3 Maximum contaminant levels—inorganic chemicals. (a) The MCL for nitrate is applicable to all public water systems except as provided by §11-20-3(d). The MCL for the other inorganic chemicals apply only to community water systems. Compliance with MCL for inorganic is calculated pursuant to §11-20-11.

(b) The following are the MCL for inorganic chemicals other than fluoride:

Contaminant	Level, Milligrams Per Liter (mg/1)
Arsenic	0.05
Barium	1.0
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.0
Selenium	0.01
Silver	0.05

(c) When the annual average of the maximum daily air temperatures for the location in which the community water system is situated is the following, the MCL for fluoride are:

Temperature, Degrees		Level Milligrams
Fahrenheit	Celsius	Per Liter (mg/1)
53.7 and below	12.0 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2

58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

Fluoride at optimum levels in drinking water has been shown to have beneficial effects in reducing the occurrence of tooth decay.

(d) At the discretion of the department, nitrate levels not to exceed twenty mg/l may be allowed in a non-community water system if the supplier of water demonstrates to the satisfaction of the department that:

(1) Such water will not be available to children under six months of age; and

(2) There will be continuous posting of the fact that nitrate levels exceed ten mg/l and the potential health effects of exposure; and

(3) Local and state public health authorities will be notified annually of nitrate levels that exceed ten mg/l; and

(4) No adverse health effects shall result. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §142.10, §142,11)

§11-20-4 Maximum contaminant levels—organic chemicals. The MCL for chlorinated hydrocarbons and chlorophenoxy organic chemicals apply to all community water systems, and is calculated pursuant to §11-20-12(a) to §11-20-12(d). The MCL for TTHM applies only to community water systems which serve a population of ten thousand or more individuals and which add a disinfectant (oxidant) to the water in any part of the drinking water treatment process. Compliance with the MCL for TTHM is calculated pursuant to §11-20-12(e).

(a) Chlorinated hydrocarbons:	Level Milligrams Per Liter (mg/l)
Endrin (1,2,3,4,20, 20-hexachloro-6, 7-epoxy-1,4,4a,5,6, 7,8,8a-octahydro-1,4-endo, endo-5,8-di-methanonaphthalene).	0.0002
Lindane (1,2,3,4,5,6-hexachloro-cyclohexane, gamma isomer).	0.004
Methoxychlor (1,1,1-Trichloro-2, 2-bis (p-metho-xyphenyl) ethane).	0.1
Toxaphene ($C_{20}H_{20}Cl_8$-Technical chlorinated camphene, 67-69	

	per cent chlorine).	0.005
(b)	Chlorophenoxys:	
	2,4-D, (2,4-Dichlorophenoxyacetic acid).	0.1
	2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid).	0.01
(c)	Total trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform)).	0.10

[Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §142.10, §141.12)

§11-20-5 Maximum contaminant levels—turbidity. The MCL for turbidity apply to all public water systems using surface water sources in whole or in part. The MCL, measured at a representative entry point(s) to the distribution system, are:

(a) One turbidity unit, as determined by a monthly average pursuant to §11-20-10 except that five or fewer turbidity units may be allowed if the supplier of water can demonstrate to the director that the higher turbidity does not do any of the following:

(1) Interfere with disinfection; or

(2) Prevent maintenance of an effective disinfectant agent throughout the distribution system; or

(3) Interfere with microbiological determinations.

(b) Five turbidity units based on an average for two consecutive days pursuant to §11-20-10. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.13, §142.10)

§11-20-6 Maximum contaminant levels—microbiological. (a) The MCL for coliform bacteria apply to all public water systems and are as follows:

(1) When the membrane filter technique pursuant to §11-20-9(a) is used, the number of coliform bacteria shall not exceed any of the following:

(A) One per one hundred milliliters as the arithmetic mean of all samples examined per compliance period pursuant to §11-20-9(b) or §11-20-9(c); or

(B) Four per one hundred milliliters in more than one sample when less than twenty are examined per month; or

(C) Four per one hundred milliliters in more than five per cent of the samples when twenty or more are examined per month.

(2) When the fermentation tube method and 10 milliliter standard portions pursuant to §11-20-9(a) are used, coliform bacteria shall not be present in any of the following:

(A) More than ten per cent of the portions (tubes) in any one month pursuant to §11-20-9(b) or §11-20-9(c); or

(B) Three or more portions in more than one sample when less than twenty samples are examined per month; or

(C) Three or more portions in more than five per cent of the samples when twenty or more samples are examined per month.

(3) When the fermentation tube method and 100 milliliter standard portions pursuant to §11-20-9(a) are used, coliform bacteria shall not be present in any of the following:

(A) More than sixty per cent of the portions (tubes) in any month pursuant to §11-20-9(b) or §11-20-9(c);

(B) Five portions in more than one sample when less than five samples are examined per month; or

(C) Five portions in more than twenty per cent of the samples when five or more samples are examined per month.

(4) At the director's discretion, systems required to take ten or fewer samples per month may be authorized to exclude one positive routine sample resulting in one or more positive tubes per month from the monthly calculation if:

(A) As approved on a case-by-case basis the director determines and indicates in writing to the public water system that no unreasonable risk to health existed under the conditions of this modification. This determination should be based upon a number of factors not limited to the following:

(i) The system provided and had maintained an active disinfectant residual in the distribution system,

(ii) The potential for contamination as indicated by a sanitary survey; and

(iii) The history of the water quality at the public water system (e.g. MCL or monitoring violations);

(B) The supplier initiates two consecutive daily check samples from the same sampling point within twenty-four hours after notification that the routine sample is positive, and each of these check samples is negative; and

(C) The original positive routine sample is reported and recorded by the supplier pursuant to §11-20-17(a) and §11-20-19(a)(1). The supplier shall report to the state its compliance with the conditions specified in this paragraph and report the action taken to resolve the prior positive sample result. If a positive routine sample is not used for

the monthly calculation, another routine sample must be analyzed for compliance purposes. This provision may be used only once during two consecutive compliance periods.

(b) For public water systems that are required to sample at a rate of less than four per month, compliance with paragraphs (1), (2), and (3) of §11-20-6(a) shall be based upon sampling during a three-month period, except that, at the discretion of the director, compliance may be based upon sampling during a one-month period.

(c) If an average MCL violation is caused by a single sample MCL violation, then the case shall be treated as one violation with respect to the public notification requirements of §11-20-18. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.14, §142.10)

§11-20-7 Maximum contaminant levels—radionuclides. (a) MCL for radium-226, radium-228, and gross alpha particle radioactivity, applicable to community water systems, are:

(1) Combined radium-226 and radium-228—5 pCi/1.

(2) Gross alpha particle activity (including radium-226 but excluding radon and uranium)—15 pCi/1.

(b) MCL for beta particle and photon radioactivity from man-made radionuclides, applicable to community water systems, are:

(1) The average annual concentration of such radioactivity shall not produce an annual dose equivalent to the total body or any internal organ greater than four millirem/year.

(2) Except for the radionuclides listed in Table A, the concentration of man-made radionuclides causing four mrem total body or organ dose equivalent shall be calculated as specified in 40 C.F.R. §141.16. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed four millirem/year.

Table A
Average annual concentrations assumed to produce
a total body or organ dose of four mrem/yr

Radionuclide	Critical Organ	pCi Per Liter
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

[Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.15, §141.16, §142.10)

§11-20-8 Sampling and analytical requirements. All sampling and analyses required by this chapter shall be performed in accordance with procedures approved by the department. In any case in which a provision of this chapter requires sampling and analysis to be performed by the supplier of water, such sampling may, at the discretion of the director, be performed by the department pursuant to prior notification to the water supplier by the director and under such conditions as the director may specify. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.21, §142.10)

§11-20-9 Microbiological contaminant sampling and analytical requirements. (a) Suppliers of water for public water systems shall analyze for coliform bacteria for the purpose of determining compliance with §11-20-6. Analyses shall be conducted in accordance with methods specified in 40 C.F.R. §141.21 using a standard sample size. The standard sample used in the membrane filter procedure shall be one hundred milliliters. The standard sample used in the five tube most probable number (MPN) procedure (fermentation tube method) shall be five times the standard portion. The standard portion is either ten milliliters or one hundred milliliters as described in §11-20-6(a)(2) and §11-20-6(a)(3). The samples shall be taken at points which are representative of the conditions within the distribution system.

(b) The supplier of water for a community water system shall take coliform density samples at regular time intervals, and in number proportionate to the population served by the system. In no event shall the frequency be less than as set forth below:

Population served:	Minimum Number of Samples Per Month
25 to 1,000	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 9,400	10
9,401 to 10,300	11
10,301 to 11,100	12
11,101 to 12,000	13
12,001 to 12,900	14
12,901 to 13,700	15
13,701 to 14,600	16
14,601 to 15,500	17
15,501 to 16,300	18

16,301 to 17,200	19
17,201 to 18,100	20
18,101 to 18,900	21
18,901 to 19,800	22
19,801 to 20,700	23
20,701 to 21,500	24
21,501 to 22,300	25
22,301 to 23,200	26
23,201 to 24,000	27
24,001 to 24,900	28
24,901 to 25,000	29
25,001 to 28,000	30
28,001 to 33,000	35
33,001 to 37,000	40
37,001 to 41,000	45
41,001 to 46,000	50
46,001 to 50,000	55
50,001 to 54,000	60
54,001 to 59,000	65
59,001 to 64,000	70
64,001 to 70,000	75
70,001 to 76,000	80
76,001 to 83,000	85
83,001 to 90,000	90
90,001 to 96,000	95
96,001 to 111,000	100
111,001 to 130,000	110
130,001 to 160,000	120
160,001 to 190,000	130
190,001 to 220,000	140
220,001 to 250,000	150
250,001 to 290,000	160
290,001 to 320,000	170
320,001 to 360,000	180
360,001 to 410,000	190
410,001 to 450,000	200
450,001 to 500,000	210
500,001 to 550,000	220
550,001 to 600,000	230
600,001 to 660,000	240
660,001 to 720,000	250
720,001 to 780,000	260
780,001 to 840,000	270
840,001 to 910,000	280
910,001 to 970,000	290
970,001 to 1,050,000	300

Based on a history of no coliform bacterial contamination and on a sanitary survey by the director showing the water systems to be supplied solely by a protected ground water source and free of sanitary defects, a community

water system serving twenty-five to one thousand persons, with written permission from the director, may reduce this sampling frequency, except that in no case shall it be reduced to less than one per quarter.

(c) The supplier of water for a non-community water system shall be responsible for sampling coliform bacteria in each calendar quarter that the system provides water to the public. The state can adjust the monitoring frequency on the basis of a sanitary survey, the existence of additional safeguards such as a protective and enforced well code, or accumulated analytical data. Such frequency shall be confirmed or modified on the basis of subsequent surveys or data. The frequency shall not be reduced until the non-community water system has performed at least one coliform analysis of its drinking water and shown to be in compliance with §11-20-6.

(1) Whenever the coliform bacteria in a single sample exceed four per one hundred milliliters §11-20-6(a)(1), at least two consecutive daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the director, until the results obtained from at least two consecutive check samples show less than one coliform bacterium per one hundred milliliters.

(2) Whenever coliform bacteria occur in three or more ten ml portions of a single sample §11-20-6(a)(2), at least two consecutive daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the director, until the results obtained from at least two consecutive check samples show no positive tubes.

(3) Whenever coliform bacteria occur in all five of the one hundred ml portions of a single sample §11-20-6(a)(3), at least two daily check samples shall be collected and examined from the same sampling point. Additional check samples shall be collected daily, or at a frequency established by the state, until the results obtained from at least two consecutive check samples show no positive tubes.

(d) The location at which the check samples were taken pursuant to paragraphs (1), (2), or (3) of §11-20-9(c) shall not be eliminated from future sampling without approval of the director. The results from all coliform bacterial analyses performed pursuant to this chapter, except those obtained from check samples and special purpose samples, shall be used to determine compliance with the MCL for coliform bacteria as established in §11-20-6. Check samples shall not be included in calculating the total number of samples taken each month to determine compliance with §11-20-9(b) or 9(c).

(e) When the presence of coliform bacteria in water taken from a particular sampling point has been confirmed by any check samples examined as directed in paragraphs (1), (2), or (3), of §11-20-9(c), the supplier of water shall report to the director within forty-eight hours.

(f) When a MCL set forth in §11-20-6(a)(1), §11-20-6(a)(2), or §11-20-6(a)(3) is exceeded, the supplier of water shall report to the director and

notify the public as prescribed in §11-20-17 and §11-20-18.

(g) Special purpose samples, such as those taken to determine whether disinfection practices following pipe placement, replacement, or repair have been sufficient, shall not be used to determine compliance with §11-20-6 or §11-20-9(b) or 9(c).

(h) The supplier of water for a public water system may, with the approval of the director and based upon a sanitary survey, substitute the use of chlorine residual monitoring for not more than seventy-five per cent of the samples required to be taken by §11-20-9(b), provided, that the supplier of water takes chlorine residual samples at points which are representative of the conditions within the distribution system at the frequency of at least four for each substituted microbiological samples. There shall be at least daily determinations of chlorine residual. When the supplier of water exercises the option provided in this subsection, he shall maintain no less than 0.2 mg/l free chlorine residual throughout the public water distribution system. When a particular sampling point has been shown to have a free chlorine residual less than 0.2 mg/l, the water at that location shall be retested as soon as practicable and in any event within one hour. If the original analysis is confirmed, this fact shall be reported to the director by telephone within forty-eight hours after confirmation. Also, if the analysis is confirmed, a sample for coliform bacterial analysis must be collected from that sampling point as soon as practicable and preferably within one hour, and the results of such analysis reported to the director by telephone within forty-eight hours after the results are known to the supplier of water. Analyses for residual chlorine shall be made in accordance with methods specified in 40 C.F.R. §141.21. Compliance with the MCL for coliform bacteria shall be determined on the monthly mean or quarterly mean basis specified in §11-20-6 including those samples taken as a result of failure to maintain the required chlorine residual level. The director may withdraw approval of the use of chlorine residual substitution at any time. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.21, §142.10)

§11-20-10 Turbidity sampling and analytical requirements. (a) Samples shall be taken by suppliers of water for public water systems using surface water sources in whole or in part. Samples shall be taken at a representative entry point(s) to the water distribution system at least once per day, for the purpose of making turbidity measurements to determine compliance with §11-20-5. If the director determines that a reduced sampling frequency in a non-community system will not pose a risk to public health, the director can reduce the required sampling frequency. The option of reducing the turbidity frequency shall be permitted only in those public water systems that practice disinfection and which maintain an active residual disinfectant in the distribution system, and in those cases where the director has indicated in writing that no unreasonable risk to health existed under the circumstances of this option. The turbidity measurements shall be made by the Nephelometric Method in accordance with the recommendations set forth in "Standard Methods for the

Examination of Water and Wastewater," 15th Edition, Method 214A, pp. 132-134; or Method 180.1,1-Nephelometric Method.

(b) If the result of a turbidity analysis indicates that the maximum allowable limit has been exceeded, the sampling and measurement shall be confirmed by resampling as soon as practicable and preferably within one hour. If the repeat sample confirms that the maximum allowable limit has been exceeded, the supplier of water shall report to the director within forty-eight hours. The repeat sample shall be the sample used for the purpose of calculating the monthly average. If the monthly average of the daily samples exceeds the maximum allowable limit, or if the average of two samples taken on consecutive days exceeds five TU, the supplier of water shall report to the director and notify the public as directed in §11-20-17 and §11-20-18. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.22, §142.10)

§11-20-11 Inorganic chemical sampling and analytical requirements. (a) Analyses for the purpose of determining compliance with §11-20-3, shall meet the following requirements:

(1) Analyses for all community water systems utilizing surface water sources shall be completed at least at yearly intervals.

(2) Analyses for all community water systems utilizing only ground water sources shall be completed at least every three years.

(3) For non-community water systems, whether supplied by surface or ground sources, analyses for nitrate shall be completed at intervals determined by the director based on the severity of the problem.

(b) If the result of an analysis made pursuant to §11-20-11(a) indicates that the level of any contaminant listed in §11-20-3 exceeds the MCL, the supplier of water shall report to the director in writing within seven days and initiate three additional analyses at the same sampling point within one month.

(c) When the average of four analyses made pursuant to §11-20-11(b), rounded to the same number of significant figures as the MCL for the substance in question, exceeds the MCL, the supplier of water shall notify the director pursuant to §11-20-17 and give notice to the public pursuant to §11-20-18. Monitoring after public notification shall be at a frequency designated by the director and shall continue until the MCL has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(d) The provisions of §11-20-11(b) and (c) notwithstanding, compliance with the MCL for nitrate shall be determined on the basis of the mean of two analyses. When a level exceeding the MCL for nitrate is found, a second analysis shall be initiated within twenty-four hours, and if the mean of the two analyses exceeds the MCL, the supplier of water shall report his findings to the director pursuant to §11-20-17 and shall notify the public pursuant to §11-20-18.

(e) Analyses conducted to determine compliance with §11-20-3 shall be made in accordance with the methods specified in 40 C.F.R., §141.23. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.23, §142.10)

§11-20-12 Organic chemical sampling and analytical requirements. (a) An analysis of substances for the purpose of determining compliance with §11-20-4 shall be made as follows:

(1) For all community water systems utilizing surface water sources, organic chemical samples shall be collected during the period of the year designated by the director as the period when contamination by the pesticide is most likely to occur in the water source. These analyses shall be repeated at intervals specified by the director but in no event less frequently than at three-year intervals.

(2) For community water system utilizing only ground water sources, analyses shall be completed by those systems specified by the director.

(b) If the result of an analysis made pursuant to §11-20-12(a) indicates that the level of any contaminant listed in §11-20-4 exceeds the MCL, the supplier of water shall report to the director in writing within seven days and initiate three additional analyses within one month.

(c) When the average of four analyses made pursuant to §11-20-12(b), rounded to the same number of significant figures as the MCL for the substance in question, exceeds the MCL, the supplier of water shall report to the director pursuant to §11-20-17 and shall notify the public pursuant to §11-20-18. Monitoring after public notification shall be at a frequency designated by the director and shall continue until the MCL has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(d) Analyses made to determine compliance with §11-20 4(a) and (b) shall be made in accordance with the methods specified in 40 C.F.R., §141.24.

(e) Analyses made to determine compliance with §11-20-4(c) shall be made in accordance with the method specified in 40 C.F.R., §141.30. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, §340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.24, §141.30, §142.10)

§11-20-13 Radionuclide sampling and analytical requirements. (a) Analytical methods for radioactivity.

(1) The methods specified in 40 C.F.R., §141.25, are to be used to determine compliance with §11-20-7(a) and §11-20-7(b) (radioactivity), except in cases where alternative methods have been approved in accordance with §11-20-14.

(2) For the purpose of monitoring radioactivity concentrations in drinking water, the required sensitivity of the radioanalysis is defined in terms of a detection limit. The detection limit shall be that concentration which can be counted with a precision of plus or minus one hundred per cent at the ninety-five per cent confidence level (1.96o where o is the standard deviation of the net counting rate of the sample).

(A) To determine compliance with §11-20-7(a)(1), the detection limit shall not exceed one pCi/l. To determine compliance with §11-20-7(a)(2), the detection limit shall not exceed three pCi/l.

(B) To determine compliance with §11-20-7(b), the detection limits shall not exceed the concentrations listed in Table B.

Table B
Detection Limits for Man-Made
Beta Particle and Photon Emitters

Radionuclide	Detection Limit
Tritium	1,000 pCi/l.
Strontium-89	10 pCi/l.
Strontium-90	2 pCi/l.
Iodine-131	1 pCi/l.
Cesium-134	10 pCi/l.
Gross beta	4 pCi/l.
Other radionuclides	1/10 of the applicable limit.

(3) To judge compliance with the MCL listed in §11-20-7(a) and §11-20-7(b), averages of data shall be used and shall be rounded to the same number of significant figures as the MCL for the substance in question.

(b) Monitoring frequency for radioactivity in community water systems.

(1) Monitoring requirements for gross alpha particle activity, radium-226 and radium-228 are as follows:

(A) Compliance with §11-20-7(a) shall be based on the analysis of an annual composite of four consecutive quarterly samples or the average of the analyses of four samples obtained at quarterly intervals.

(i) A gross alpha particle activity measurement may be substituted for the required radium-226 and radium-228 analysis provided, that the measured gross alpha particle activity does not exceed five pCi/l at a confidence level of ninety-five per cent (1.65o where o is the standard deviation of the net counting rate of the sample). In localities where radium-228 may be present in drinking water, the

director may require radium-226 and radium-228 analyses when the gross alpha particle activity exceeds two pCi/l.

(ii) When the gross alpha particle activity exceeds five pCi/l, the same or an equivalent sample shall be analyzed for radium-226. If the concentration of radium-226 exceeds three pCi/l the same sample or an equivalent sample shall be analyzed for radium-228.

(B) Suppliers of water shall monitor at least once every four years following the procedure required by §11-20-13(b)(1)(A). At the discretion of the director, when an annual record taken in conformance with §11-20-13(b)(1)(A), has established that the average annual concentration is less than half the MCL established by §11-20-7(a), analysis of a single sample may be substituted for the quarterly sampling procedure required by §11-20-13(b)(1)(A).

(i) More frequent monitoring shall be conducted when ordered by the director in the vicinity of mining or other operations which may contribute alpha particle radioactivity to either surface or ground water sources of drinking water.

(ii) A supplier of water shall monitor in conformance with §11-20-13(b)(1)(A) within one year of the introduction of a new water source for a community water system. More frequent monitoring shall be conducted when ordered by the director in the event of possible contamination or when changes in the distribution system or treatment processing occur which may increase the concentration of radioactivity in finished water.

(iii) A community water system using two or more sources having different concentrations of radioactivity shall monitor source water, in addition to water from a free-flowing tap, when ordered by the director.

(iv) Monitoring for compliance with §11-20-7(a) after the initial period need not include radium-228 except when required by the director, provided, that the average annual concentration of radium-228 has been assayed at least once using the quarterly sampling procedure required by §11-20-13(b)(1)(A).

(v) Suppliers of water shall conduct annual monitoring of any community water system in which the radium-226 concentration exceeds three pCi/l, when ordered by the director.

(C) If the average annual MCL for gross alpha particle activity or total radium as set forth in §11-20-7(a) is exceeded, the supplier of a community water system shall

give notice to the director pursuant to §11-20-17 and notify the public as required by §11-20-18. Monitoring at quarterly intervals shall be continued until the annual average concentration no longer exceeds the MCL or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(2) Monitoring requirements for man-made radioactivity in community water systems are as follows:

(A) Systems using surface water sources and serving more than 100,000 persons and such other community water systems as are designated by the director shall be monitored for compliance with §11-20-7(b) by analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. Compliance with §11-20-7(b) may be assumed without further analysis if the average annual concentration of gross beta particle activity is less than fifty pCi/l and if the average annual concentrations of tritium and strontium-90 are less than those listed in Table A, provided, that if both radionuclides are present the sum of their annual dose equivalents to bone marrow shall not exceed four millirem/year.

(i) If the gross beta particle activity exceeds fifty pCi/l, an analysis of the samples shall be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with §11-20-7(b).

(ii) Suppliers of water shall conduct additional monitoring, as ordered by the director, to determine the concentration of man-made radioactivity in principal watersheds designated by the director.

(iii) At the discretion of the director, suppliers of water utilizing only ground waters may be required to monitor for man-made radioactivity.

(B) After the initial analysis required by §11-20-13(b)(2)(A), suppliers of water shall monitor at least every four years following the procedure given in that subsection.

(C) The supplier of any community water system designated by the director as utilizing waters contaminated by effluents from nuclear facilities shall initiate quarterly monitoring for gross beta particle and iodine-131 radioactivity and annual monitoring for strontium-90 and tritium.

(i) Quarterly monitoring for gross beta particle activity shall be based on the analysis of monthly samples or the analysis of a composite of three monthly samples. The former is recommended. If the gross beta particle activity in a sample exceeds fifteen pCi/l, the same or an equivalent sample shall be

analyzed for strontium-89 and cesium-134. If the gross beta particle activity exceeds fifty pCi/l, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with §11-20-7(b).

(ii) For iodine-131, a composite of five consecutive daily samples shall be analyzed once each quarter. As ordered by the director, more frequent monitoring shall be conducted when iodine-131 is identified in the finished water.

(iii) Annual monitoring for strontium-90 and tritium shall be conducted by means of the analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. The latter procedure is recommended.

(iv) The director may allow the substitution of environmental surveillance data taken in conjunction with a nuclear facility for direct monitoring of man-made radioactivity by the supplier of water where the director determines such data is applicable to a particular community water system.

(v) If the average annual MCL for man-made radioactivity set forth in §11-20-7(b) is exceeded, the operator of a community water system shall notify the director pursuant to §11-20-17 and shall notify the public as required by §11-20-18. Monitoring at monthly intervals shall be continued until the concentration no longer exceeds the MCL or until a monitoring schedule as a condition to be variance, exemption or enforcement action shall become effective. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.25, §141.26, §142.10)

§11-20-14 Alternative analytical techniques. With the written permission of the director, concurred in by the administrator, an alternative analytical technique may be employed. An alternative technique shall be acceptable only if it is substantially equivalent to the prescribed test in both precision and accuracy as it relates to the determination of compliance with any MCL. The use of the alternative analytical technique shall not decrease the frequency of monitoring required by this chapter. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, §340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.27, §142.10)

§11-20-15 Approved laboratories. (a) For the purpose of determining compliance with §11-20-9 through §11-20-13, samples may be considered only if they have been analyzed by a laboratory approved by the director except that measurements for turbidity, free chlorine residual, temperature and pH may be performed by any person acceptable to the director.

(b) Nothing in this part shall be construed to preclude the director from taking samples or from using the results from such samples to determine compliance by a supplier of water with the applicable requirements of this part. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, §340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.18, §142.10)

§11-20-16 Monitoring of consecutive public water systems. When a public water system supplies water to one or more other public water systems, the director may modify the monitoring requirements imposed by this part to the extent that the interconnection of the systems justifies treating them as a single system for monitoring purposes. Any modified monitoring shall be conducted pursuant to a schedule specified by the director and concurred in by the administrator. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.29, §142.10)

§11-20-17 Reporting requirements. (a) Except where a shorter period is specified in this part, the supplier of water shall report to the director the results of any test measurements or analysis required by this part within:

(1) The first ten days following the month in which the result is received; or

(2) The first ten days following the end of the required monitoring period as stipulated by the director, whichever of these is shortest.

(b) Unless otherwise required by the director, the supplier of water shall report to the director by telephone within forty-eight hours the failure to comply with any primary drinking water regulation (including failure to comply with monitoring requirements) set forth in this chapter. The supplier shall also report such failure to the director in writing by letter within seven days or by sending to the department a copy of the public notice as required by §11-20-18(h).

(c) The supplier of water need not report analytical results to the director in cases where a state laboratory performs the analysis and reports the results to the state office which would normally receive such notification from the supplier.

(d) The water supply system, within ten days of completion of each public notification required pursuant to §11-20-18, shall submit to the director a representative copy of each type of notice distributed, published, posted, made available to the persons served by the system, and to the media.

(e) The water supply system shall submit to the state within the time stated in the request copies of any records required to be maintained under §11-20-19 hereof or copies of any documents then in existence which the state or the administrator is entitled to inspect pursuant to the authority of P.L. No. 95-10, §1445, or HRS §340E. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-6, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4; 40 C.F.R. Parts 141, 142, §141.31, §142.10)

§11-20-18 Public notification. (a) A supplier of water shall notify persons served by the supplier's public water system whenever the system:

(1) Fails to comply with an applicable MCL, treatment technique, monitoring, or testing procedure required by this chapter; or

(2) Is subject to a variance granted for an inability to meet an applicable MCL; or

(3) Is subject to an exemption; or

(4) Fails to comply with the requirements of any schedule prescribed pursuant to such a variance or exemption.

(b) In the case of a community water system, the supplier shall notify users in accordance with §11-20-18(a) as follows:

(1) Such notice shall be included in the first set of water bills of the system issued after the failure, or after the grant of the variance or exemption, and in any event by written notice within three months. Such notice shall be repeated at least once every three months so long as the failure, variance, or exemption continues. If the system issues water bills less frequently than quarterly, or does not issue water bills, the notice shall be made by or supplemented by another form of direct mail.

(2) Such notice shall also be published not less than three consecutive days in a daily newspaper of general circulation in the area served by the system, or in not less than three consecutive editions of a newspaper of general circulation in the area served by the system and which is published at least three times per week. Such notice shall be completed within fourteen days after the supplier of water learns of the failure or of the grant of the variance or exemption, and shall be repeated at least once every three months so long as the failure, variance or exemption continues.

(A) If the area served by the water system is not served by a newspaper of general circulation which is published daily or at least three times per week, the notice shall be given by publication on three consecutive weeks in a weekly newspaper of general circulation serving the area. Such notice shall be completed within fourteen days after the supplier of water learns of the failure or of the grant of the variance or exemption, and shall be repeated at least once every three months so long as the failure, variance or exemption continues.

(B) If the area served by the water system is not served by a daily, three-times-weekly, or weekly newspaper of general circulation, the notice shall be given by posting the notice in post offices within the area served by the system no later than fourteen days after the supplier of water learns of the failure or of the grant of the variance or exemption. Posting shall be repeated not less than once every three months so long as the failure, variance or exemption continues.

(3) The supplier shall furnish a copy of such notice to radio and television stations serving the area served by the system, and shall furnish the notice within seven days after the supplier learns of the failure or grant.

(4) In the case of failures to comply with microbiological or turbidity MCL or monitoring requirements, the notice required by §11-20-18(b)(2) and 18(b)(3) above shall, at a minimum, be given on the basis of a calendar month. The notice shall be completed within fourteen days for §11-20-18(b)(2) and seven days for 611-20-18(b)(3) after the supplier learns of the results of the last required microbiological or turbidity sample, as appropriate, which was taken for the supplier's water system for the calendar month. The notice shall address all failures to comply with all applicable microbiological or turbidity MCL or monitoring requirements which occurred during the calendar month. A supplier may, if appropriate, include failures to comply with both microbiological and turbidity-related requirements in the same notice.

(c) The requirements of §11-20-18(b) may be waived by the director if it determines that the violation has been corrected promptly after discovery, the cause of the violation has been eliminated, and there is no longer a risk to public health.

(d) In the case of a non-community water system, the supplier shall notify users or consumers as required by §11-20-18(a) by continuous posting in a location or locations, as appropriate, where the notice can be readily seen by consumers of water from the system, including, but not limited to, in food service areas and at water fountains.

(e) Notices given to users or consumers shall be written in a manner reasonably designed to inform fully and shall not use unduly technical language, unduly small print or other methods which would frustrate the purpose of the notice. The notice shall be conspicuous and disclose all material facts regarding the subject, including the nature of the problem and, when appropriate, a clear statement that the potable water system regulation has been violated and information which is made available to the supplier of water by the department regarding any preventive measures that should be taken by the public. Where appropriate, or where designated by the director, bilingual notice shall be given. Notices may include a balanced explanation of the significance or seriousness to the public health of the subject of the notice, a fair explanation of steps taken or being taken by the system to correct any problem of noncompliance and the results of any additional sampling.

(f) The director may order the supplier of water to provide additional notification when more immediate or broader notice is in the best interest of public health protection.

(g) Prior to issuing any notices pursuant to this section, the supplier of water shall consult with the department concerning the contents of the notice, and the notice shall be subject to the approval of the department. At the discretion of the director, the department may waive the requirement of consultation or approval, and may also issue notices to the public on behalf of the supplier.

(h) The supplier of water shall send to the department a copy of each notice issued by the supplier pursuant to this section on each occasion and at the same time that the notice is issued. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 304E-6, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4; 40 C.F.R. Parts 141, 142, §141.32, §142.10)

§11-20-19 Record maintenance. Any owner or operator of a public water system subject to the provisions of this chapter shall retain on its premises or at a convenient location near its premises the following records:

(a) Records of bacteriological analyses made pursuant to this chapter shall be kept for not less than five years. Records of chemical analyses made pursuant to this chapter shall be kept for not less than ten years. Actual laboratory reports may be kept, or data may be transferred to tabular summaries, provided that the following information is included:

(1) The date, place, and time of sampling, and the name of the person who collected the sample;
(2) Identification of the sample as to whether it was a routine distribution system sample, check sample, raw or process water sample or other special purpose sample;
(3) Date of analysis;
(4) Laboratory and person responsible for performing analysis;
(5) The analytical technique or method used; and
(6) The results of the analysis.

(b) Records of action taken by the system to correct violations of primary drinking water regulations shall be kept for a period not less than three years after the last action taken with respect to the particular violation involved.

(c) Copies of any written reports, summaries or communications relating to sanitary surveys of the system conducted by the system itself, by a private consultant, or by any county, state, or federal agency, shall be kept for a period of not less than ten years after completion of the sanitary survey involved.

(d) Records concerning a variance or exemption granted to the system shall be kept for a period ending not less than five years following the expiration of such variance or exemption.

(e) Records of any public notification made pursuant to §11-20-18 shall be kept for a period ending not less than five years following the date of such notification. [Eff. 12/26/81] (Auth: HRS §§340E-2,

340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4; 40 C.F.R. Parts 141, 142, §141.33, §142.10, §142.16)

§11-20-20 Requirements for a variance. (a) The director may grant one or more variances to any water system from any MCL requirement of an applicable state primary drinking water regulation upon a finding that:

(1) Because of characteristics of the raw water sources which are reasonably available to the system, the system cannot meet the MCL requirement despite application of the best technology, treatment techniques, or other means, which the director finds are generally available (taking costs into consideration); and

(2) The granting of a variance will not result in an unreasonable risk to the health of persons served by the system.

(b) The director may grant one or more variances to any public water system from any requirement of a specified treatment technique of an applicable state primary drinking water regulation upon a finding that the public water system applying for the variance has demonstrated that such treatment technique is not necessary to protect the health of persons because of the nature of the raw water source of such system. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4; 40 C.F.R. Parts 141, 142, §141.4, §142.10, §142.20)

§11-20-21 Variance request. A supplier of water seeking a variance shall submit a written request to the director. Suppliers of water may submit a joint request for variances when they seek similar variances under similar circumstances. Any written request for a variance or variances shall include the following information:

(a) The nature and duration of variance requested.

(b) Relevant analytical results of water quality sampling of the system, including sampling of raw water relevant to the variance request.

(c) For any request made under §11-20-20(a):

(1) Full discussion of, and supporting data regarding, the best available treatment technology and techniques, including evidence of the inability of the system to comply despite the application of such technology and techniques.

(2) Economic and legal factors relevant to ability to comply.

(3) A proposed compliance schedule, including the date each step toward compliance will be achieved. Such schedule shall include as a minimum the following dates:

(A) Date by which arrangement for alternative raw water source or for improvement of existing raw water source will be completed.

(B) Date by which the connection of the alternative raw water source or improvement of existing raw water source will be initiated.

(C) Date by which final compliance is to be achieved.

(4) A plan for the provision of safe drinking water in the case of an excessive rise in the contaminant level for which the variance is requested.

(5) A plan for interim control measures during the effective period of variance.

(d) For any request made under §11-20-20(b) a statement that the system will perform monitoring and other reasonable requirements prescribed by the director as a condition to the variance.

(e) Any other information the applicant believes to be pertinent.

(f) Such other information as the director may require. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-4; 40 C.F.R. Parts 141, 141.4, 142, §142.10, §142.20)

§11-20-22 Consideration of variance request. (a) In his consideration of whether the public water system is unable to comply with a contaminant level requirement of a state primary drinking water regulation because of the nature of the raw water source, the director shall consider such factors as he considers to be relevant, including the following:

(1) The availability, effectiveness, and reliability of treatment methods for the contaminant for which the variance is requested.

(2) Cost and other economic considerations such as for implementing treatment, improving the quality of the source water or using an alternate source.

(b) In his consideration of whether a public water system should be granted a variance to a required treatment technique because such treatment is unnecessary to protect the public health, the director shall consider such factors as the following:

(1) Quality of the water source including water quality data and pertinent sources of pollution.

(2) Susceptibility of the source to contamination and the source protection measures employed by the public water system. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4; 40 C.F.R. Parts 141, 142, §141.4, §142.10, §142.20)

§11-20-23 Requirements for an exemption. The director may exempt any public water system from any MCL requirement or any treatment technique requirement, or from both, of an applicable state primary drinking water regulation upon a finding that:

(1) Due to compelling factors (which may include economic factors), the public water system is unable to comply with such contaminant level or treatment technique requirement;

(2) The public water system was in operation on the effective date of such contaminant level or treatment technique requirement; and

(3) The granting of the exemption will not result in an unreasonable risk to health. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-5; 40 C.F.R. Parts 141, 142, §141.4, §142.10, §142.20)

§11-20-24 Exemption request. A supplier of water seeking an exemption shall submit a written request to the director. Suppliers of water may submit a joint request for exemptions when they seek similar exemptions under similar circumstances. Any written request for an exemption or exemptions shall include the following information:

(1) The nature and duration of exemption requested.

(2) Relevant analytical results of water quality sampling of the system.

(3) Explanation of the compelling factors such as time or economic factors which prevent such system from achieving compliance.

(4) A proposed compliance schedule, including the date when each step toward compliance will be achieved.

(5) Any other information the applicant believes to be pertinent.

(6) Such other information as the director may require. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-5; 40 C.F.R. Parts 141, 142, §141.4, §142.10, §142.20)

§11-20-25 Consideration of an exemption request. In his consideration of whether the public water system is unable to comply due to compelling factors, the director shall consider such factors as he determines to be relevant, including the following:

(1) Construction, installation, or modification of treatment equipment or systems.

(2) The time needed to put into operation a new treatment facility to replace an existing system which is not in compliance.

(3) Economic feasibility of compliance. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-5; 40 C.F.R. Parts 141, 142, §141.4, §142.10, §142.20)

§11-20-26 Disposition of a request for variance or exemption. (a) If the director determines that a request for a variance or exemption is inadequate or incomplete, he may deny the request. If he fails to act on a variance or exemption request within one hundred eighty days after the request is submitted, the request will be deemed to be granted.

(b) If the director proposes to grant a variance or exemption request submitted pursuant to §11-20-21 or §11-20-24, respectively, he shall notify the applicant of his decision in writing. Such notice shall identify the variance or exemption, the facility covered, and shall specify,

as appropriate, the period of time for which the variance will be effective or the termination date of the exemption.

(1) For the type of variance specified in §11-20-20(a) or for an exemption, such notice shall also provide that the variance or exemption will be terminated when the system comes into compliance with the applicable regulation, and may be terminated upon a finding by the director that the system has failed to comply with any requirements of a final schedule issued pursuant to §11-20-28.

(2) For the type of variance specified in §11-20-20(b) such notice shall provide that the variance may be terminated at any time upon a finding that the nature of the raw water source is such that the specified treatment technique for which the variance was granted is necessary to protect the health of persons or upon a finding that the public water system has failed to comply with monitoring and other requirements prescribed by the director as a condition to the granting of the variance.

(c) For a variance specified in §11-20-20(a)(1) or an exemption, the director shall propose a schedule for:

(1) Compliance (including increments of progress) by the public water system with each contaminant level requirement covered by the variance or each contaminant level and treatment technique covered by the exemption; and,

(2) Implementation by the public water system of such control measures as the director may require for each contaminant covered by the variance or exemption.

(d) The proposed schedule for compliance shall contain such conditions as the director may prescribe and shall specify dates by which steps towards compliance are to be taken, including, where applicable:

(1) Date by which arrangement for an alternative raw water source or improvement or existing raw water source will be completed.

(2) Date of initiation of the connection of the alternative raw water source or improvement of the existing raw water source.

(3) Date by which final compliance is to be achieved.

(e) The proposed schedule for compliance for a variance specified in §11-20-20(a)(1) may, if the public water system has no access to an alternative raw water source, and can effect or anticipate no adequate improvement of the existing raw water source, specify an indefinite time period for compliance until a new and effective treatment technology is developed at which time a new compliance schedule shall be prescribed by the director.

(f) The proposed schedule for implementation of interim control measures during the period of the variance shall specify interim treatment techniques, methods and equipment, and dates by which steps toward meeting the interim control measures are to be met.

(g) The schedule shall be prescribed by the director within one year after the granting of the variance or exemption, subsequent to provision of opportunity for hearing pursuant to §11-20-27.

(h) The director may prescribe reasonable conditions as part of any variance or exemption. [Eff. 12/26/81] (Auth: HRS §§340E-2,

340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4, 300g-5; 40 C.F.R. Parts 141, 142, §141.4, §142.10, §142.20)

§11-20-27 Public hearings on variances, variance schedules and exemption schedules. (a) Before a variance, variance schedule, or exemption schedule proposed by the director pursuant to §11-20-26 may take effect, the director shall provide notice and opportunity for public hearing on the variance, variance schedule or exemption schedule. A notice given pursuant to the preceding sentence may cover the granting of more than one variance, variance schedule or exemption schedule and a hearing held pursuant to such notice shall include each of the variances, variance schedules or exemption schedules covered by the notice. Such notice shall include a summary of the proposed variance, variance schedule or exemption schedule, and shall inform interested persons that they may submit written comments on the proposed variance, variance schedule or exemption schedule, and may request a public hearing.

(b) Public notice of an opportunity for hearing on a variance, variance schedule or exemption schedule shall be circulated in a manner designed to inform interested and potentially interested persons of the proposed variance, variance schedule or exemption schedule, and shall, in addition to compliance with HRS §92-41, include at least the following:

(1) Posting of a notice in the principal post office of each community or area served by the public water system, and publishing of a notice in a newspaper or newspapers of general circulation in the area served by the public water system; and

(2) Mailing of a notice to other appropriate state or local agencies at the director's discretion.

(c) Requests for hearing may be submitted by an interested person. Frivolous or insubstantial request for hearing may be denied by the director. Requests must be submitted to the director within thirty days after issuance of the public notices provided for in §11-20-27(b). Such requests shall include the following information:

(1) The name, address and telephone number of the individual, organization or other entity requesting a hearing;

(2) A brief statement of the interest of the person making the request in the proposed variance, variance schedule or exemption schedule and of information that the requesting person intends to submit at such hearing; and

(3) The signature of the individual making the request, or, if the request is made on behalf of an organization or other entity, the signature of a responsible official of the organization or other entity.

(d) The director shall give notice in the manner set forth in §11-20-27(b) of any hearing to be held pursuant to a request submitted by an interested person or on his own motion. Notice of the hearing shall also be sent to the persons requesting the hearing, if any. Notice of the hearing shall include a statement of the purpose of the hearing, information regarding the time and location for the hearing, and the address and telephone number of an office at which interested persons may obtain

further information concerning the hearing. Notice of the hearing shall be given not less than fifteen days prior to the time scheduled for the hearing.

(e) A hearing convened pursuant to §11-20-27(d) shall not be deemed to be a "contested case" hearing within the meaning of Chapter 91, Hawaii Revised Statutes. The hearing shall be conducted before a hearing officer to be designated by the director, or the director may conduct the hearing. The hearing shall be conducted by the hearing officer in an informal, orderly and expeditious manner. The hearing officer shall have authority to call witnesses, receive oral and written testimony and take such other action as may be necessary to assure the fair and efficient conduct of the hearing.

(f) The director may provide that the variance, variance schedule or exemption schedule shall become effective thirty days after notice of opportunity for hearing is given pursuant to §11-20-27(b) if no timely request for hearing is submitted and the director does not determine to hold a public hearing on his own motion. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4, 300g-5; 40 C.F.R. Parts 141, 142, §141.4, §142.10, §142.20)

§11-20-28 Final schedule. (a) Within sixty days after the termination of any public hearing held pursuant to §11-20-27, the director shall, taking into consideration information obtained during such hearing, and other relevant information which shall include any written comments submitted pursuant to the public notice specified in §11-20-27(a):

(1) With respect to a variance or variance schedule confirm, revise or rescind the proposed variance or schedule as necessary;

(2) With respect to an exemption schedule, confirm or revise the proposed schedule as necessary.

(b) The exemption schedule referred to in §11-20-28(a)(2) shall require compliance by the public water system with each contaminant level and treatment technique requirement prescribed as state regulations comparable to:

(1) Interim national primary drinking water regulations promulgated by the administrator pursuant to 40 C.F.R. Part 141, by no later than January 1, 1984; and

(2) Revised national primary drinking water regulations promulgated by the administrator pursuant to 40 C.F.R. Part 141, by no later than seven years after the effective date of such regulations.

(c) If the public water system has entered into an enforceable agreement to become a part of a regional public water system, as determined by the director, the schedule referred to in §11-20-28(a)(2) shall require compliance by the public water system with each contaminant level and treatment technique requirement prescribed by state regulations comparable to:

(1) Interim national primary drinking water regulations promulgated by the administrator pursuant to 40 C.F.R. Part 141, by no later than January 1, 1986; and

(2) Revised national primary drinking water regulations promulgated by the administrator pursuant to 40 C.F.R. Part 141, by no later than nine years after the effective date of such regulations. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-3, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4, 300g-5; 40 C.F.R. Parts 141, 142, §141.4, §142.10, §142.20)

§11-20-29 Use of new sources of raw water for public water systems. (a) No person shall use a new source of raw water to supply a public water system unless the source has been approved by the director.

(b) Any person proposing to use such a new raw water source shall submit plans and supporting data and information to the department. Such data and information shall include the following:

(1) Identification of all significant factors having potential for contaminating or reducing the quality of the water source or which could cause the quality of water delivered to users of the system to be in violation of any state primary drinking water regulation;

(2) Data relating to quality and quantity of the source waters under normal conditions and during stress periods or drought or heavy precipitation, as determined by field and laboratory analyses and investigations of available records; if records are not available or are inadequate to determine source quality under stress conditions, an estimate of expected quality and quantity during stress conditions should be established;

(3) If the proposed new water source is a surface source, identification of the:

(A) Proximity and effects of sources of pollution and the possibility of contamination due to operation of waste treatment facilities or waste disposal systems, accidental spills of hazardous materials, agricultural operations, and any other activities which could introduce contaminants into the water source;

(B) Factors affecting the time of travel of actual and potential pollution from its source to the water source;

(C) Actual and potential siltation problems; and

(D) Possible effects on water quality from existing or proposed upstream impoundments;

(4) If the proposed new water source is a well, spring, or infiltration gallery, identification of the:

(A) Nature of soil and stratum overlaying the water source, with special emphasis on identification of fissures and faults as it relates to the natural purification or treatment of percolating fluids from existing or future activities;

(B) Nature, distance, direction of flow and time of travel of contaminants from present and projected domestic,

industrial, and agricultural sources of pollution, and waste injection wells and other waste disposal facilities; and

(C) The probability and effect of surface drainage or contaminated underground water entering the subject water source.

(5) For each present and projected potential source of contamination, identification and evaluation of alternative control measures which could be implemented to reduce or eliminate the potential for contamination of the water source, including treatment of the water source if subject to contamination, and evaluation of the physical, economic and social effects of implementing such control measures; and

(6) Such other data and information as the director may require.

(c) If the information submitted to the director by the person proposing to use the new water source fails to demonstrate to the director's satisfaction that the proposed new water source is not subject to actual or potential contamination such as may result in the water not complying with any state primary drinking water regulation or as may otherwise adversely affect the health of persons, the director, after consultation with appropriate state and county officials, may deny, or approve with conditions which he determines to be appropriate to protect the public health, use of the proposed new water source to supply a public water system. In deciding whether to approve or deny the proposed use, the director may:

(1) Hold a public hearing on the proposed use, which hearing shall be subject to the provisions of public notice and hearing provided in §11-20-27 of these regulations; or

(2) Appoint a committee of such persons as he may determine to be appropriate to advise him in making his decision; or

(3) Take any other action which he may determine to be appropriate to obtain adequate data and information on which to base his decision.

(d) A county department of water or water supply may submit to the department a program plan for the development by the county of new water sources for public water systems. Such plan shall be sufficiently detailed to include the basic information required by §11-20-29, with special attention paid to projections of future land use and other activities as they may affect the susceptibility of the water source to contamination. When approved in writing by the director, the requirements of such program, rather than those of this §11-20-29, shall govern the development of new sources of water for public water systems in that county to the extent covered by that program. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §142.10)

§11-20-30 New and modified public water systems. (a) General requirements:

(1) No new or substantially modified existing public water system shall be used to deliver water to any user unless the supplier of water:

(A) Has first obtained a certificate from the department specifying that the director has examined the water intended to be delivered, the source of its supply, and the system of its distribution, and has determined that the system is capable of delivering water which will comply with the state primary drinking water regulations; and

(B) To the extent practicable, has avoided locating part or all of the new or substantially modified existing facility at a site which is subject to a significant risk from earthquakes, floods, tsunamis, fires, or other disasters which could cause a breakdown of the public water system or a portion thereof or which is, except for intake structures, within the floodplain of a hundred-year flood or is lower than any recorded high tide where appropriate records exist; and

(C) The department may waive issuance of the certificate required by §11-20-30(a)(1) when the appropriate county department of water or water supply has capability acceptable to the department to sample and analyze the water source and water to be delivered by the system such that the county department of water or water supply can satisfactorily demonstrate to the department that the system is capable of delivering water which will comply with the state primary drinking water regulations.

(2) For the purposes of §11-20-30, a "substantial modification" shall include, but not be limited to, such things as:

(A) Any physical modification to the source, storage, collection, treatment, or distribution facilities of the system which is determined by the department to have an actual or potential significant impact on the quality of water delivered to users of the system; and

(B) Any modification which will cause an existing system, which is not a public water system before such modification, to become a public water system.

(3) Any person proposing physical modification to a system which increases the number of service connections or population served by the system shall consult with the department prior to commencement of such modification for a determination by the department whether the proposed modification is a "substantial modification" subject to the requirements of §11-20-30.

(b) Review of plans by department:

(1) The department shall review plans for all proposed new and substantially-modified public water systems, except systems or modifications which are to be constructed by, or pursuant to a contract with, a county department of water or water supply, and systems or modifications which will be reviewed and

approved by a county department of water or water supply pursuant to applicable county department of water or water supply rules and regulations, county subdivision ordinance, or other applicable law.

(2) Before any person may commence construction of a new public water system or substantial modification to an existing public water system, which system or modification is subject to review by the department pursuant to §11-20-30(b)(1), that person shall:

(A) Submit plans, specifications and supporting information and documents to the department. Supporting information to be submitted for a new system shall include information on the quality of the raw water source and proposed treatment, if any, and information demonstrating that the system will be adequately operated and maintained. Supporting information to be submitted for a proposed modification to an existing system shall include analysis of the effect, if any, that the modification will have on the quality of water delivered by the system. Supporting information to be submitted for any new system or modification to an existing system shall include information demonstrating that the system or modifications will be located and constructed in conformance with all applicable state laws and county ordinances relating to floods, tsunamis, earthquakes, and fires.

(B) Make arrangements as required by the department to inspect the system or modification at appropriate stages of construction or implementation.

(C) The department may require payment of compensation for plan reviews and inspections.

(3) The department shall not approve plans for a new public water system if it determines that the system, including any proposed treatment facilities, has not been designed to assure that the system will be capable of complying with the state primary drinking water regulations. The department shall not approve plans for any proposed substantial modification to an existing public water system if it determines that the modification may result in the water to be delivered by the system failing to comply with the state primary drinking water regulations. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.5, §142.10)

§11-20-31 Use of trucks to deliver drinking water. (a) Before any person, other than a county department of water or water supply, may use a truck to deliver drinking water to supply a public water system, such person shall first notify the department and shall comply with procedures specified by the department to ensure that the water to be delivered will

not endanger the health of users of the water. Such procedures may relate to design and construction of the tank used to carry the water, to the prior use of the tank, to cleaning and disinfecting the tank, to monitoring of the quality of water delivered by the truck, or other appropriate requirements.

(b) The department may waive, with appropriate conditions, the above requirement of notification for a person who proposes to use a truck to deliver drinking water to supply a public water system on a regular basis, if satisfactory assurances that he or she will comply with procedures acceptable to the department to ensure that the water to be delivered will not endanger the health of users. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.5, §142.10)

§11-20-32 Penalties and remedies. Any person who violates any provision of this chapter, or any variance or exemption issued pursuant thereto, shall be subject to enforcement action by the director pursuant to HRS §340E-8. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-7, 340E-8, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §142.10)

§11-20-33 Entry and inspection. Whether or not the department has evidence that a public water system has violated an applicable legal requirement, the director or authorized representative, upon the presentation of his credentials, shall have the right:

(1) To enter premises on which any public water system is located;

(2) To inspect any equipment, operation, or sampling of any public water system;

(3) To take water samples from any public water system; and

(4) To have access to and copy any record required to be kept pursuant to this chapter. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2, 300g-4; 40 C.F.R. Parts 141, 142, §142.10)

§11-20-34 Special monitoring for sodium. (a) Suppliers of water for community public water systems shall collect and analyze one sample per plant at the entry point of the distribution system for the determination of sodium concentration levels; samples shall be collected and analyzed annually for systems utilizing solely surface water sources in whole or in part, and at least every three years for systems utilizing ground water sources. The minimum number of samples required to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with the director approval, be considered one treatment plant for determining the minimum number of samples. The supplier of water may be required by the director to collect and analyze water samples for sodium more frequently in locations where the sodium content is variable.

(b) The supplier of water shall report to the director the results of the analyses for sodium within the first ten days of the month following the month in which the sample results were received or within the first ten days following the end of the required monitoring period as stipulated by the director, whichever of these is first. If more than annual sampling is required, the supplier shall report the average sodium concentration within ten days of the month following the month in which the analytical results of the last sample used for the annual average was received.

(c) The supplier of water shall notify appropriate local and state public health officials of the sodium levels by written notice by direct mail within three months. A copy of each notice required to be provided by this paragraph shall be sent to the director within ten days of its issuance.

(d) Analyses for sodium shall be performed by the flame emission photometric method in accordance with the procedures described in "Standard Methods for the Examination of Water and Wastewater," 15th Edition, pp. 231-233, or by Method 273.1, Atomic Absorption—Direct Aspiration or Method 273.2, Atomic Absorption—Graphite Furnace, in "Methods for Chemical Analysis of Water and Waste," EMSL, Cincinnati, EPA, 1979; or by Method D1428-64(a) in Annual Book of ASTM Standards, part 31, Water. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.41, §142.10)

§11-20-35 Special monitoring for corrosivity characteristics. (a) Suppliers of water for community public water systems shall collect samples from a representative entry point to the water distribution system for the purpose of analysis to determine the corrosivity characteristics of the water.

(1) The supplier shall collect two samples per plant for analysis for each plant using surface water sources wholly or in part or more if required by the director; one during mid-winter and one during mid-summer. The supplier of the water shall collect one sample per plant for analysis for each plant using ground water sources or more if required by the director. The minimum number of samples required to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with the director's approval, be considered one treatment plant for determining the minimum number of samples.

(2) Determination of the corrosivity characteristics of the water shall include measurement of pH, calcium hardness, alkalinity, temperature, total dissolved solids (total filterable residue), and calculation of the Langelier Index in accordance with §11-20-35(c). The determination of corrosivity characteristics shall only include one round of sampling (two samples per plant for surface water and one sample per plant for ground water sources). However, the director may require more frequent monitoring as appropriate. In addition, the director has the

discretion to require monitoring for additional parameters which may indicate corrosivity characteristics, such as sulfates and chlorides. In certain cases, the Aggressive Index, as described in 11-20-35(c), can be used instead of the Langelier Index; the supplier shall request in writing to the director and the director will make this determination.

(b) The supplier of water shall report to the department the results of the analyses for the corrosivity characteristics within the first ten days of the month following the month in which the sample results were received. If more frequent sampling is required by the director, the supplier can accumulate the data and shall report each value within ten days of the month following the month in which the analytical results of the last sample was received.

(c) Analyses conducted to determine the corrosivity of the water shall be made in accordance to the following methods:

(1) Langelier Index—"Standard Methods for the Examination of Water and Wastewater," 15th Edition, Method 203, pp. 57-60.

(2) Aggressive Index—"AWWA Standard for Asbestos-Cement Pipe, 4 in. through 16 in. for Water and Other Liquids," AWWA C400-80, Revision of C400-77, AWWA, Denver, Colorado.

(3) Total Filtrable Residue—"Standard Methods for the Examination of Water and Wastewater," 15th Edition, Method 209B, pp. 93-94; or "Methods for Chemical Analysis of Water and Wastes," Method 160.1.

(4) Temperature—"Standard Methods for the Examination of Water and Wastewater," 15th Edition, Method 212, pp. 124-125.

(5) Calcium hardness—EDTA Titrimetric Method "Standard Methods for the Examination of Water and Wastewater," 15th Edition, Method 311C, pp. 185-186; or "Annual Book of ASTM Standards," Method D1126-67(8).

(6) Alkalinity—Methyl Orange and paint pH 4.5. "Standard Methods for the Examination of Water and Wastewater," 15th Edition, Method 403, pp. 253-257; or "Annual Book of ASTM Standards," Method D1067-70B; or "Methods for Chemical Analysis of Water and Wastes," Method 310.1.

(7) pH—"Standard Methods for the Examination of Water and Wastewater," 15th Edition, Method 423, pp. 402-408; or "Methods for Chemical Analysis of Water and Wastes," Method 150.1; or "Annual Book of ASTM Standards," Method D129378 A or B.

(8) Chloride—Potentiometric Method, "Standard Methods for the Examination of Water and Wastewater," 15th Edition, Method 407-C, pp. 273-275..

(9) Sulfate—Turbidimetric Method, "Methods for Chemical Analysis of Water and Wastes," pp. 277-278, EPA, Office of Technology Transfer, Washington, D.C. 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 15th Edition, Method 426C, pp. 439-440.

(d) Community water supply systems shall identify whether the following construction materials are present in their distribution system and report to the department:

(1) Lead from piping, solder, caulking, interior lining of distribution mains, alloys and home plumbing.
(2) Copper from piping and alloys, service lines, and home plumbing.
(3) Galvanized piping, service lines, and home plumbing.
(4) Ferrous piping materials such as cast iron and steel.
(5) Asbestos cement pipe.

In addition, the department may require identification and reporting of other materials of construction present in distribution systems that may contribute contaminants to the drinking water, such as:

(1) Vinyl lined asbestos cement pipe.
(2) Coal tar lined pipes and tanks. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.42, §142.10)

§11-20-36 Severability clause. If any provision of this chapter, or the application thereof to any person or circumstance, is held invalid, the invalidity does not affect other provisions of applications of this chapter which can be given effect without the invalid provision or application, and to this end the provisions of this chapter are severable. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §142.10)

§11-20-37 Time requirements. (a) Community water systems serving seventy-five thousand or more individuals shall comply with the TTHM MCL set forth in §11-20-4(c) by November 29, 1981. Community water systems serving ten thousand to seventy four thousand nine hundred ninety nine persons shall comply with the TTHM MCL by November 29, 1983.

(b) Community water systems serving seventy five thousand or more persons shall begin monitoring for trihalomethanes before November 29, 1980. Community water systems serving ten thousand to seventy four thousand nine hundred ninety nine persons shall begin monitoring before November 29, 1982. Systems that plan to make significant modification to their treatment process for the purpose of complying with the TTHM MCL shall obtain department approval of their treatment modification plans.

(c) Suppliers of community public water systems shall comply with §11-20-34 monitoring requirements by February 27, 1982. Said suppliers shall complete the first round of sampling and reporting by August 27, 1981.

(d) Suppliers of community public water systems shall comply with §11-20-35 monitoring requirements by February 27, 1982. Said suppliers shall comply completely with all requirements in §11-20-35 by August 27, 1983.

(e) All other duties imposed by this chapter apply immediately. [Eff. 12/26/81] (Auth: HRS §§340E-2, 340E-9) (Imp: HRS §§340E-2, 340E-9; 42 U.S.C. §§300g-1, 300g-2; 40 C.F.R. Parts 141, 142, §141.6, §142.10)

The Department of Health authorized the repeal of Chapter 49, Public Health Regulations, and the adoption of Chapter 20 of Title 11, Administrative Rules, on Potable Water Systems following a public hearing held on Maui on October 5, 1981, on Hawaii on October 6, 1981, on Oahu on October 7, 1981, and on Kauai on October 8, 1981, after public notice was given in the Honolulu Advertiser on August 19, 1981, in the Hawaii Tribune-Herald on August 19, 1981, in the Garden Isle on August 19, 1981, and in the Maui News on August 19, 1981.

Chapter 20 of Title 11, Administrative Rules and the repeal of Chapter 49, Public Health Regulations, shall take effect ten days after filing with the Office of the Lieutenant Governor.

GEORGE A. L. YUEN
Director of Health

NOV 25 1981

APPROVED:

GEORGE R. ARIYOSHI
GOVERNOR
State of Hawaii

Dated: Dec 17, 1981

APPROVED AS TO FORM:

PHILLIP F. MOON
Deputy Attorney General

Filed with the Lieutenant Governor: December 16, 1981

Effective Date: December 26, 1981

APPENDIX C

Groundwater Classification Criteria

Technical Report No. 179

AQUIFER IDENTIFICATION AND CLASSIFICATION FOR O'AHU: GROUNDWATER PROTECTION STRATEGY FOR HAWAI'I

John F. Mink
L. Stephen Lau

November 1987

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[12] ABSTRACT (PURPOSE, METHOD, RESULTS, CONCLUSIONS)

In response to the need to identify and describe aquifers for each island of the state of Hawaii to serve as a framework for groundwater protection strategy, a program has been initiated to classify and assign codes to the principal aquifers of the State. This first report provides Aquifer Codes and Status Codes for the island of Oahu. The Aquifer Codes incorporate locational and descriptive indices, while the Status Codes indicate the developability, utility, quality, uniqueness and vulnerability to contamination of the groundwater resources. The codes were generated for Hawaiian conditions of groundwater occurrence and behavior in preference to employing the DRASTIC approach suggested by the U.S. EPA. Each Aquifer Type within an Aquifer System is assigned an Aquifer Code consisting of an eight-digit number. An Aquifer Code is unique and non-repeatable in the State. Accompanying the Aquifer Code is a Status Code of five digits. A Status Code is specific to an Aquifer Code. The Oahu classification includes 6 Aquifer Sectors, 24 Aquifer Systems, and 87 Aquifer Types.

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AQUIFER IDENTIFICATION AND CLASSIFICATION FOR O'AHU:
Groundwater Protection Strategy for Hawai'i

John F. Mink
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Technical Report No. 179

November 1987

Project Completion Report
for
Identification of Class I: Special Groundwaters
Highly Vulnerable to Contamination, Oahu
Project No.: T-763
Principal Investigator: L. Stephen Lau
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ABSTRACT

In response to the need to identify and describe aquifers for each island of the state of Hawai'i to serve as a framework for groundwater protection strategy, a program has been initiated to classify and assign codes to the principal aquifers of the State. This first report provides Aquifer Codes and Status Codes for the island of O'ahu.

The Aquifer Codes incorporate locational and descriptive indices, while the Status Codes indicate the developability, utility, quality, uniqueness and vulnerability to contamination of the groundwater resources. The codes were generated for Hawaiian conditions of groundwater occurrence and behavior in preference to employing the DRASTIC approach suggested by the U.S. EPA.

Each Aquifer Type within an Aquifer System is assigned an Aquifer Code consisting of an eight-digit number. An Aquifer Code is unique and non-repeatable in the State. Accompanying the Aquifer Code is a Status Code of five digits. A Status Code is specific to an Aquifer Code. The O'ahu classification includes 6 Aquifer Sectors, 24 Aquifer Systems, and 87 Aquifer Types.

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GROUNDWATER CONTAMINATION VULNERABILITY

Until a few years ago, Hawai'i groundwater contamination problems were few in number and investigations comparatively minor in scale (Lau and Mink 1987). The quality of much of Hawai'i groundwater is outstanding; thus, water can be consumed safely without prior treatment. For this and other reasons, groundwater has been the prime source for municipal and general domestic supply throughout Hawai'i, especially on O'ahu, the most populous island in the State. It is not surprising, then, that the discovery of volatile organic chemicals in a number of wells in the Pearl Harbor Aquifer, one of the principal sources of potable groundwater in O'ahu, was a shock to the public as well as to the scientific and engineering community. The Hawaii State Department of Health responded to this discovery by initiating a groundwater protection strategy consistent with the goals of the U.S. Environmental Protection Agency. Aquifer identification and assignment of contamination vulnerability indices to groundwater are important phases of the protection program.

A fundamental objective of groundwater protection strategy is to classify aquifers according to hydrogeologic parameters, and groundwater by quality characteristics relative to beneficial uses. Natural groundwater quality is the result of hydrogeochemical processes; however, this pristine quality can be degraded by anthropogenic activities. Thus, the protection of groundwater resources must contend with land use practices. Aquifer identification and location is therefore fundamental to formulation of the protection strategy.

The quality of native groundwater is the result of the environments through which infiltration water passes and in which water moves and accumulates. Among the obvious contributors to the chemistry of groundwater in an aquifer are the quality of the original water that recharges into the ground, the chemical properties of soils and rocks through which the water passes, residence time of the water in the saturated zone, and quality of waters with which the new water mixes. Seawater intrusion also adds salts to all basal groundwater in Hawai'i.

Activities, such as irrigated agriculture and wastewater injection, may significantly alter groundwater quality. Moderate increases in concentrations of nitrate, chloride, sulfate, and silica are attributable to prolonged irrigation of sugarcane. Introduction of organic chemicals from pesticides, herbicides, and nematicides accompany modern agriculture. Virtually any large-scale use of the land can result in some degree of contamination.

Hawai'i has effectively used land management as a strategy to protect groundwater quality. A good example is the establishment of the Conservation District around the high rainfall zone of the Ko'olau Range on O'ahu. This region is retained in as natural a state as possible to enhance groundwater recharge and to protect the purity of the rainfall that percolates into the

subsurface. Another example is the State regulation that controls underground injection. A "no pass" line sets off regions in which direct injection of wastewater is prohibited.

Between these two lines—the Conservation District and the injection line—falls most of each island's land area. The unregulated areas are largely underlaid by unconfined aquifers that are potentially vulnerable to contamination. Urbanization and agriculture dominate land use. Manifestly, a strategy must be devised to prevent contamination by activities that range from dry cleaning to chemically based agriculture.

The aquifer classification scheme and contamination indices provided in this study are consistent with the U.S. EPA (1984) Groundwater Protection Guidelines. They are also consistent with and complementary to Hawaii State water quality regulations for protecting surface water. In Hawai'i, surface water is classified by ecosystem and associated water quality. In the strategy for groundwater, the resources are classified by hydrogeology and water quality.

INAPPLICABILITY OF DRASTIC RATING SYSTEM OF POLLUTION POTENTIAL IN HAWAI'I

Except in aquifers covered and confined by caprock, virtually all groundwater in O'ahu is accessible to contamination accompanying infiltration. In the Status Codes listed in Table 1, most Aquifer Types are rated as highly vulnerable to contamination.

Evaluating contamination vulnerability by using the DRASTIC approach suggested by EPA is not very useful for the aquifers of O'ahu, or the other islands of the state. DRASTIC is an acronym for a list of physical characteristics that describe a hydrogeological setting. These characteristics are D, depth to water; R, recharge; A, aquifer media; S, soil media; T, topography; I, infiltration in the vadose zone; and C, aquifer conductivity. Two sets of relative weights are assigned to each characteristic: one for areas where agriculture is the dominant land use; the other for mixed usage. The relative weights are as follows:

	Agriculture	Other
D	5	5
R	4	4
A	3	3
S	5	2
T	3	1
I	4	5
C	2	3

Weighting choices are inevitably subject to considerable arbitrariness.

To compute the pollution potential, each DRASTIC factor is divided into a range scale of 1 to 10, in which 1 assigns the least importance to the factor and 10 the most. Thus, the formula

TABLE 1. AQUIFER AND STATUS CODES FOR O'AHU, HAWAII

Sector	Aquifer System	Aquifer Code	Status Code
Honolulu	Palolo	30101121	11113
Honolulu	Palolo	30101111	21111
Honolulu	Palolo	30101212	11111
Honolulu	Palolo	30101116	23321
Honolulu	Nuuanu	30102121	11113
Honolulu	Nuuanu	30102111	21111
Honolulu	Nuuanu	30102212	11111
Honolulu	Nuuanu	30102116	13321
Honolulu	Kalihi	30103121	11113
Honolulu	Kalihi	30103111	11111
Honolulu	Kalihi	30103215	11111
Honolulu	Kalihi	30103116	13321
Honolulu	Moanalua	30104121	11113
Honolulu	Moanalua	30104111	11111
Honolulu	Moanalua	30104212	21111
Honolulu	Moanalua	30104116	23321
Honolulu	Waialae	30105121	21113
Honolulu	Waialae	30105111	11111
Honolulu	Waialae	30105212	11111
Honolulu	Waialae	30105116	23421
Pearl Harbor	Waimalu	30201121	12212
Pearl Harbor	Waimalu	30201111	11111
Pearl Harbor	Waimalu	30201212	13111
Pearl Harbor	Waimalu	30201116	12211
Pearl Harbor	Waiawa	30202121	12212
Pearl Harbor	Waiawa	30202111	11111
Pearl Harbor	Waiawa	30202212	21111
Pearl Harbor	Waiawa	30202116	12211
Pearl Harbor	Waipahu	30203121	12212
Pearl Harbor	Waipahu	30203111	11111
Pearl Harbor	Waipahu	30203116	12211
Pearl Harbor	Ewa	30204121	13213
Pearl Harbor	Ewa	30204111	11111
Pearl Harbor	Ewa	30204212	21111
Pearl Harbor	Ewa	30204116	13321
Pearl Harbor	Kunia	30205111	21112
Pearl Harbor	Kunia	30205212	21111
Waianae	Nanakuli	30301122	23423
Waianae	Nanakuli	30301112	23321
Waianae	Nanakuli	30301212	21121
Waianae	Nanakuli	30301116	23421
Waianae	Lualualei	30302122	23323
Waianae	Lualualei	30302112	23321
Waianae	Lualualei	30302212	11111
Waianae	Lualualei	30302116	13311
Waianae	Waianae	30303122	23223
Waianae	Waianae	30303112	11111
Waianae	Waianae	30303232	11111
Waianae	Waianae	30303116	13311
Waianae	Makaha	30304122	11113
Waianae	Makaha	30304112	11111
Waianae	Makaha	30304232	11111
Waianae	Makaha	30304116	13321
Waianae	Keaau	30305122	11212

TABLE 1.--*Continued*

Sector	Aquifer System	Aquifer Code	Status Code
Waianae	Keaau	30305112	21211
Waianae	Keaau	30305212	21111
Waianae	Keaau	30305116	33421
North	Mokuleia	30401121	11113
North	Mokuleia	30401111	11111
North	Mokuleia	30401212	21111
North	Mokuleia	30401116	13221
North	Waialua	30402121	11213
North	Waialua	30402111	11111
North	Waialua	30402116	12211
North	Kawailoa	30403121	12312
North	Kawailoa	30403111	11111
North	Kawailoa	30403112	11111
North	Kawailoa	30403122	21112
North	Kawailoa	30403212	11111
North	Kawailoa	30403116	12211
Central	Wahiawa	30501212	11111
Central	Koolau	30502212	11111
Windward	Koolauloa	30601121	12213
Windward	Koolauloa	30601111	11111
Windward	Koolauloa	30601212	11111
Windward	Koolauloa	30601122	21122
Windward	Koolauloa	30601116	12211
Windward	Kahana	30602122	11113
Windward	Kahana	30602112	11111
Windward	Kahana	30602212	11111
Windward	Kahana	30602116	12211
Windward	Koolaupoko	30603122	11122
Windward	Koolaupoko	30603212	11111
Windward	Koolaupoko	30603116	12211
Windward	Waimanalo	30604122	11113
Windward	Waimanalo	30604212	11111
Windward	Waimanalo	30604116	12211

becomes

$$D(w)D(r) + R(w)R(r) + \cdots + C(w)C(r) = \text{potential pollution}$$

in which w refers to the weight and r to the range.

The above may have utility where the surface-subsurface pathways of infiltration take place in a wide variety of natural environments, but in Hawai'i the range is limited and the pathways direct. Each of the DRASTIC factors are relatively simple to describe for Hawai'i conditions on a regional scale and may be capsulized as follows.

D (depth to water). The water table in all unconfined basal aquifers is 40 ft (12.19 m) or less above sea level. In confined basal aquifers the water surface is at the base of the caprock. Depth to water in high level aquifers is variable. For all unconfined aquifers, depth to water

does not significantly influence the removal of refractory contaminants, such as many volatile organic compounds. Microbiological pollutants, on the other hand, are commonly attenuated in the relatively thin surface soil.

R (recharge). Natural infiltration is directly related to rainfall, and the highest rainfall occurs at elevations between 1500 and 5000 ft (457.2 and 1 524 m). However, direct recharge to unconfined aquifers takes place everywhere, even in the driest parts of the islands. Nowhere in Hawai'i, no matter how low the average annual rainfall, suffers a complete absence of recharge.

A (aquifer media). Virtually every important potable groundwater aquifer in the Hawaiian Islands is composed of basalts that were extruded during the primary mountain building phase of volcanism. These basalts have similar aquifer properties. The only other regional aquifers are in limestones carrying nonpotable to brackish water. Aquifers in sediments and post erosional volcanics are small.

S (soil media). Soils formed in place on basalts are strikingly similar in being highly permeable and readily infiltrable. These are the most common soils above an elevation of about 100 ft (30.5 m). At lower elevations the hydromorphic soils are less permeable.

T (topography). Land configuration in Hawai'i is generally irrelevant as a direct influence on the recharge of groundwater. In steep topography the runoff-rainfall ratio is high, but even here significant infiltration takes place.

I (infiltration in vadose zone). In unsaturated rock beneath the soil-saprolite cover, infiltration follows a fairly direct path to the unsaturated zone.

C (conductivity of aquifer). All of the main Hawai'i aquifers in basalt are extremely permeable with hydraulic conductivities in excess of 1000 ft (304.8 m)/day on a regional scale. Limestone aquifers are also highly permeable, while sediments are generally poorly permeable. The alkalic series of volcanic rocks that followed the primary basalts are moderately permeable.

The DRASTIC method of estimating pollution potential in Hawai'i has limited applicability, but in a modified form it can be useful in organizing an environmental data base for examining contamination problems.

AQUIFER CLASSIFICATION AND AQUIFER CODES

Shortly before the Hawaii State Department of Health initiated the groundwater protection program, work had begun in classifying and systematizing groundwater occurrences by the University of Hawaii Water Resources Center (Mink and Sumida 1984). This work was a

follow-up to an earlier classification attempt sponsored by the Department of Health as part of the original Underground Injection Control program (First West Engineers 1978).

The classification scheme reported by Mink and Sumida (1984) is the starting point for developing an Aquifer Code. Classification is based on a hierarchy of descriptors beginning with general location by Island and Sector, to which belongs a set of Aquifer Systems, within which are a variety of Aquifer Types. Sectors primarily reflect broad hydrogeological features and, secondarily, geography. Aquifer Systems are more specifically defined by hydrogeologic continuity, in particular hydraulic connections among units; Aquifer Types are differentiated by distinctive features of hydrology and geology.

In brief, the hierarchy is as follows:

a. Island—The global locator
b. Sector—A large region with hydrogeological similarities.
c. System—An area within a Sector showing hydrogeological continuity
d. Type—Portions of a System having the same hydrological and geological features.

Islands are coded by number in conformance with the U.S. Geological Survey (1975) protocol. Each Sector is coded with a two-digit number and by a geographic name except where locational confusion might result, in which case the general locators North, South, East, and West, or a traditional geographic term such as Windward, are used. A two-digit number is applied to each Aquifer System, which also can be referred to by a geographic name. Three digits describe fundamental hydrology and geology to constitute the Aquifer Type.

The numerical code has the form, 1 11 11 111, in which the first number is the Island, the next two represent the Sector, the following two the System, and the last three the Type. Island numbers are 1 (Ni'ihau), 2 (Kaua'i), 3 (O'ahu), 4 (Moloka'i), 5 (Lāna'i), 6 (Maui), 7 (Kaho'olawe), and 8 (Hawai'i). Sector numbers start at 01 in each Island, and System numbers also start at 01 in each Sector.

Hydrology is uniquely described by a pair of digits and geology by a single digit. Identifying characteristics with their codes are as follows.

HYDROLOGY. Aquifer Types are defined as either basal or high level, and as either unconfined or confined. Their numbers with brief descriptions are as follows:

No.	Type	Description
1	Basal	Fresh water in contact with seawater
2	High Level	Fresh water not in contact with seawater
1	Unconfined	Where the water table is the upper surface of the saturated aquifer
2	Confined	Aquifer is bounded by impermeable or poorly permeable formations; top of the saturated

		aquifer is below the surface of the groundwater
3	Confined or Unconfined	Where the actual condition is uncertain.

Using the above coding, groundwater can be 11 or 12, or 21 or 22. Where confining conditions are unclear, the second digit is taken as 3.

GEOLOGY. Aquifers are categorized as occurring in the flank lavas of the volcanic domes, in rift zones characterized by dikes, on poorly permeable perching members, or within the sedimentary sequence. Flank aquifers normally are horizontally extensive and display the lowest heads and usually carry basal water; rift aquifers are segmented into compartments by dikes; perched aquifers lie on impermeable formations but are not ordinarily very extensive; and sedimentary aquifers are comprised of alluvial and marine sediments deposited by erosion and biogenic processes. The geologic codes are as follows:

No.	Type	Description
1	Flank	Horizontally extensive lavas
2	Dike	Aquifers in dike compartments
3	Flank/Dike	Indistinguishable
4	Perched	Aquifer on an impermeable layer
5	Dike/Perched	Indistinguishable
6	Sedimentary	Non-volcanic lithology

One of the above numbers attached to the two hydrology numbers defines the Aquifer Type.

The sequence of all numbers from Island through geology is called the Aquifer Code. Each Aquifer Type has an eight-digit code which is unique. An example of an Aquifer Code for groundwater occurrence in O'ahu is

3	O'ahu Island
01	Honolulu Sector
04	Moanalua Aquifer System
111	Basal Unconfined Flank

The Aquifer Code for the above is 30104111. There can be no repetition elsewhere in the State. The code is suited to computer data basing having great retrieval flexibility.

A variety of important information related to the aquifers can be appended to each Aquifer Code. Certain hydrogeological parameters and quantities, such as rainfall, infiltration, sustainable yield and storage, can be appended to the code to expand its utility. For example, items relevant to groundwater contamination can be expressed as a separate numerical code and attached to the Aquifer Code.

Table 1 lists the Aquifer Codes for the island of O'ahu along with Sector and Aquifer System names. O'ahu includes 6 Sectors, 24 Aquifer Systems, and 87 Aquifer Types. Also listed is the Status Code of each Aquifer Type. The Status Code, which is described in the next section, summarizes elements crucial to the groundwater protection strategy.

GROUNDWATER PROTECTION: STATUS CODE

Concepts of EPA's groundwater classification conforming to Hawai'i conditions are used to devise a groundwater Status Code that describes development stage, utility, salinity, uniqueness, and vulnerability to contamination of the aquifers. The Status Code is conveniently attached to the Aquifer Code, and the combination is an efficient representation of location, hydrology, geology, utility, water quality, and contamination potential of groundwater resources in every part of the island.

The five digit Status Code consists of a single number from each of five separate descriptive categories. The categories and their status elements with identifying numbers are as follows.

A. Development Stage
   1. Currently used
   2. Potential use
   3. No potential use

B. Utility
   1. Drinking
   2. Ecologically important
   3. Neither

C. Salinity (mg/l Cl^-)
   1. Fresh (<250)
   2. Low (250-1000)
   3. Moderate (1000-5000)
   4. High (5000-15,000)
   5. Seawater (>15,000)

D. Uniqueness
   1. Irreplaceable
   2. Replaceable

E. Vulnerability to Contamination
   1. High
   2. Moderate

3. Low
4. None

Only one number from each major category listed above is allowable in the Status Code. For instance, a currently developed groundwater source (1), used for drinking (1), having a salinity of less than 250 mg/l Cl^- (1), being irreplaceable (1) and highly vulnerable to contamination (1), would have the Status Code 11111. If it were ecologically important but not suitable for drinking with a salinity of 750 mg/l Cl^-, other categories the same, the code would be 12211.

The categories and their elements are derived from the U.S. EPA (1984) groundwater classification modified by fundamentals of the Hawaii ground-water environment. Application of a detailed vulnerability assessment, such as a modified form of DRASTIC, could be used in the Vulnerability to Contamination category.

Brief explanations of the Status Code categories and their elements are as follows.

DEVELOPMENT STAGE. Aquifers are differentiated according to those already being used (Currently Used), those with potential utility (Potential Use), and those having no potential developability.

UTILITY. Identifies aquifers by use. Groundwater classed as Drinking may also be ecologically important, but that classed as ecologically important may not be used for drinking. Drinking takes precedence over ecologically important.

SALINITY. The gradation of groundwater from fresh to seawater is a feature of all basal aquifers in Hawai'i. Basal aquifers comprise, by far, the most voluminous sources of groundwater. Chloride content is the class definer rather than total dissolved solids (TDS) because it is routinely reported in the Hawai'i literature. The class limits inevitably are somewhat arbitrary but incorporate the following logic.

1. Fresh (<250 mg/l): The upper limit of the standard for drinking water is 250 mg/l Cl^-.
2. Low (250-1000 mg/l): Much agriculture, in particular sugarcane, can be irrigated with water containing up to 1000 mg/l Cl^-.
3. Moderate (1000-5000 mg/l): Brackish water of this salinity may serve as feed water for desalinization in the future.
4. High (5000-15,000 mg/l): The high salinity class, not yet seawater, is arbitrarily designated for water that is between potentially economically valuable water and seawater.
5. Seawater: True seawater has a chloride content of 18,980 mg/l.

UNIQUENESS. The classes Irreplaceable and Replaceable are direct EPA derivatives. The island of O'ahu does not have any groundwater of value which could be classified as replaceable.

VULNERABILITY TO CONTAMINATION. In O'ahu because of the limits of the resources, interconnection among groundwater sources and the relatively rapid time of groundwater travel, aquifers can be described simply as being either vulnerable or not vulnerable to contamination. Most unconfined aquifers are vulnerable; confined aquifers may or may not be. A refinement in the degree of vulnerability may be instituted by employing some modified form of the DRASTIC, or similar, index. The one used in this classification (High, Moderate, Low, None) is based on familiarity with environmental conditions.

In summary, a groundwater classification scheme which includes source as well as status information has been created. The Aquifer Code consists of locators, hydrology and geology, and reads as follows: Island-Sector-Aquifer System-Aquifer Type. The code consists of eight digits: one for the Island, two each for Sector and System, and three for Type (hydrology and geology).

The Status Code contains five digits and, combined with the Aquifer Code, results in a 13-digit code. For example, the code 30104111 (11111) defines an aquifer in O'ahu, Honolulu Sector, Moanalua System, in which the groundwater is unconfined basal in flank lavas. The last five digits tell that the aquifer is currently used to supply drinking water having less than 250 mg/l Cl^-), and that it is an irreplaceable source highly vulnerable to pollution.

Although the original scope of the project referred specifically to Class I (Special) Groundwater, all other groundwaters in O'ahu have been classified. As a matter of interest, Class I Groundwater Status Codes are either 11111 (Drinking) or 12n11 (Ecologically Important), in which n is a number (1-5) defining the salinity range (<250->15,000 mg/l Cl^-).

AQUIFER CLASSIFICATION MAPS

Accompanying this explanation of Aquifer Codes and Status Codes are fifteen quadrangles for O'ahu (reduced from a scale of 1:24,000) on which are plotted Sector, System, and Type boundaries. Within each Aquifer Type the Aquifer Code is printed, to which is appended the Status Code within parentheses.

In coastal plains where sedimentary caprock aquifers rest on primary basalt aquifers, two Aquifer and Status Codes separated by a slash are printed. The numerator code is for the upper aquifer and the denominator for the lower aquifer.

REFERENCES

First West Engineers, Inc. 1978. Underground injection control study. Report prepared with J.F. Mink (special Consulting Hydrologist-Geologist) for Department of Health, State of Hawai'i, Honolulu (July). 71 p.

Lau, L.S., and Mink, J.F. 1987. Organic contamination of groundwater: A learning experience. *J. Am. Water Works Assoc.* 79(8):37-42.

Mink, J.F., and Sumida, S.T. 1984. Aquifer classification, state of Hawai'i. Tech. Memo. Rep. No. 75, Water Resources Research Center, University of Hawai'i at Manoa, Honolulu. 34 p.

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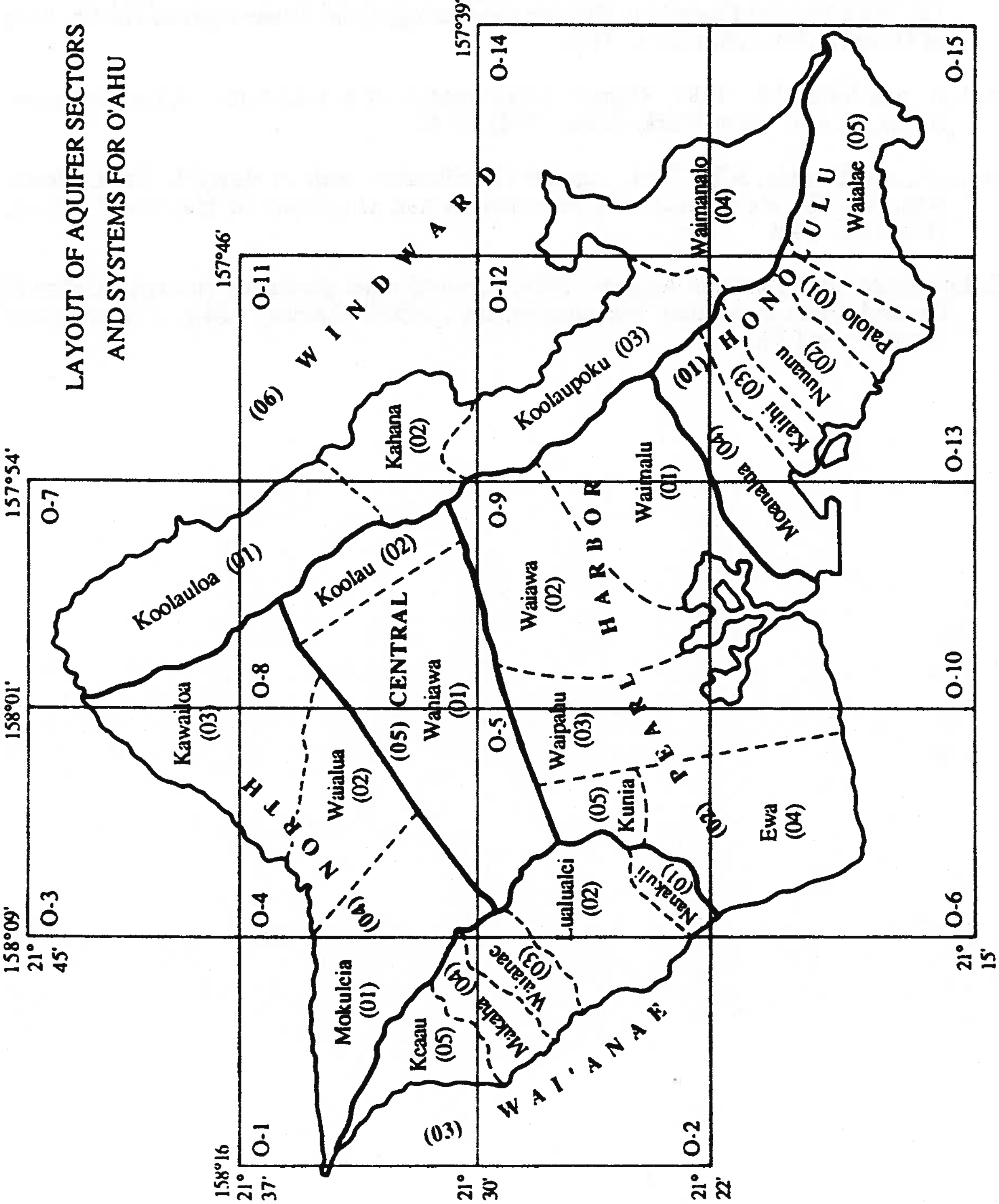
LAYOUT OF AQUIFER SECTORS AND SYSTEMS FOR O'AHU



AQUIFER CLASSIFICATION EXPLANATION

AQUIFER AND STATUS CODES*

Aquifer Code = Island + Sector
+ Aquifer System
+ Aquifer Type

Thus, 30104111 = Aquifer Code
where 3 = Oahu
01 = Honolulu
04 = Moanalua
1 = basal
1 = unconfined
1 = flank

and (11111) = Status Code
where 1 = currently used
1 = drinking
1 = fresh (<250 mg/l Cl⁻)
1 = irreplaceable
1 = high vulnerability to contamination

ISLAND	SECTOR		AQUIFER SYSTEM	
3	01	Honolulu	01	Palolo
			02	Nuuanu
			03	Kalihi
			04	Moanalua
			05	Waialae
	02	Pearl Harbor	01	Waimalu
			02	Waiawa
			03	Waipahu
			04	Ewa
			05	Kunia
	03	Waianae	01	Nanakuli
			02	Lualualei
			03	Waianae
			04	Makaha
			05	Keaau
	04	North	01	Mokuleia
			02	Waialua
			03	Kawailoa
	05	Central	01	Wahiawa
			02	Koolau
	06	Windward	01	Koolauloa
			02	Kahana
			03	Koolaupoko
			04	Waimanalo

*Where sedimentary caprock aquifers rest on primary basalt aquifers, two Aquifer and Status Codes separated by a slash indicate numerator code is upper aquifer and denominator is lower aquifer.

AQUIFER TYPE		HYDROLOGY†
1	Basal	Fresh water in contact with seawater
2	High Level	Fresh water not in contact with seawater
1	Unconfined	Where water table is upper surface of the saturated aquifer
2	Confined	Aquifer bounded by impermeable or poorly permeable formations, and top of saturated aquifer is below groundwater surface
3	Confined or Unconfined	Where actual condition is uncertain
		GEOLOGY‡
1	Flank	Horizontally extensive lavas
2	Dike	Aquifers in dike compartments
3	Flank/Dike	Indistinguishable
4	Perched	Aquifer on an impermeable layer
5	Dike/Perched	Indistinguishable
6	Sedimentary	Non-volcanic lithology

†Hydrologic descriptors (1st two digits from pts. 1,2).
‡Geologic descriptor (last digit).

STATUS CODE (GROUNDWATER)

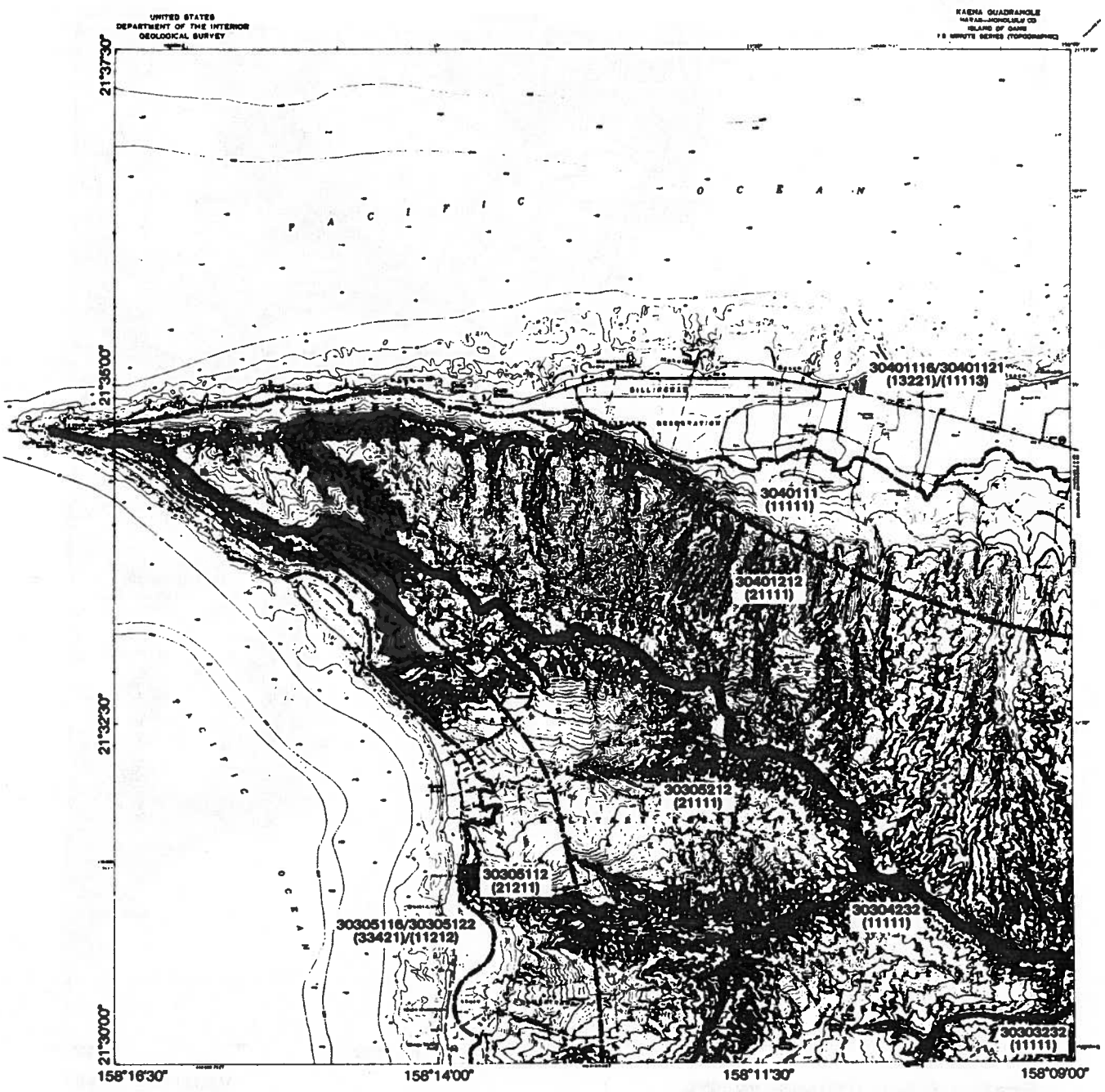
Development Stage
1 Currently used
2 Potential use
3 No potential use

Utility
1 Drinking
2 Ecologically vital
3 Neither

Salinity (mg/l Cl⁻)
1 Fresh (<250)
2 Low (250-1000)
3 Moderate (1000-5000)
4 High (5000-15,000)
5 Seawater (>15,000)

Uniqueness
1 Irreplaceable
2 Replaceable

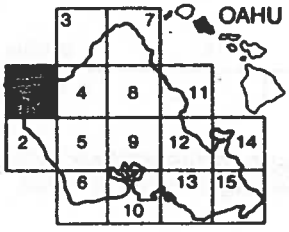
Vulnerability to Contamination
1 High
2 Moderate
3 Low
4 None



Base Map: USGS (1:24,000 series, rev. 1983).

KAENA, OAHU
O-1

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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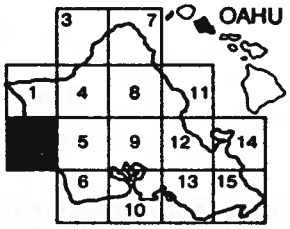
Base Map: USGS (1:24,000 series, rev. 1983).

WAIANAE, OAHU
O-2

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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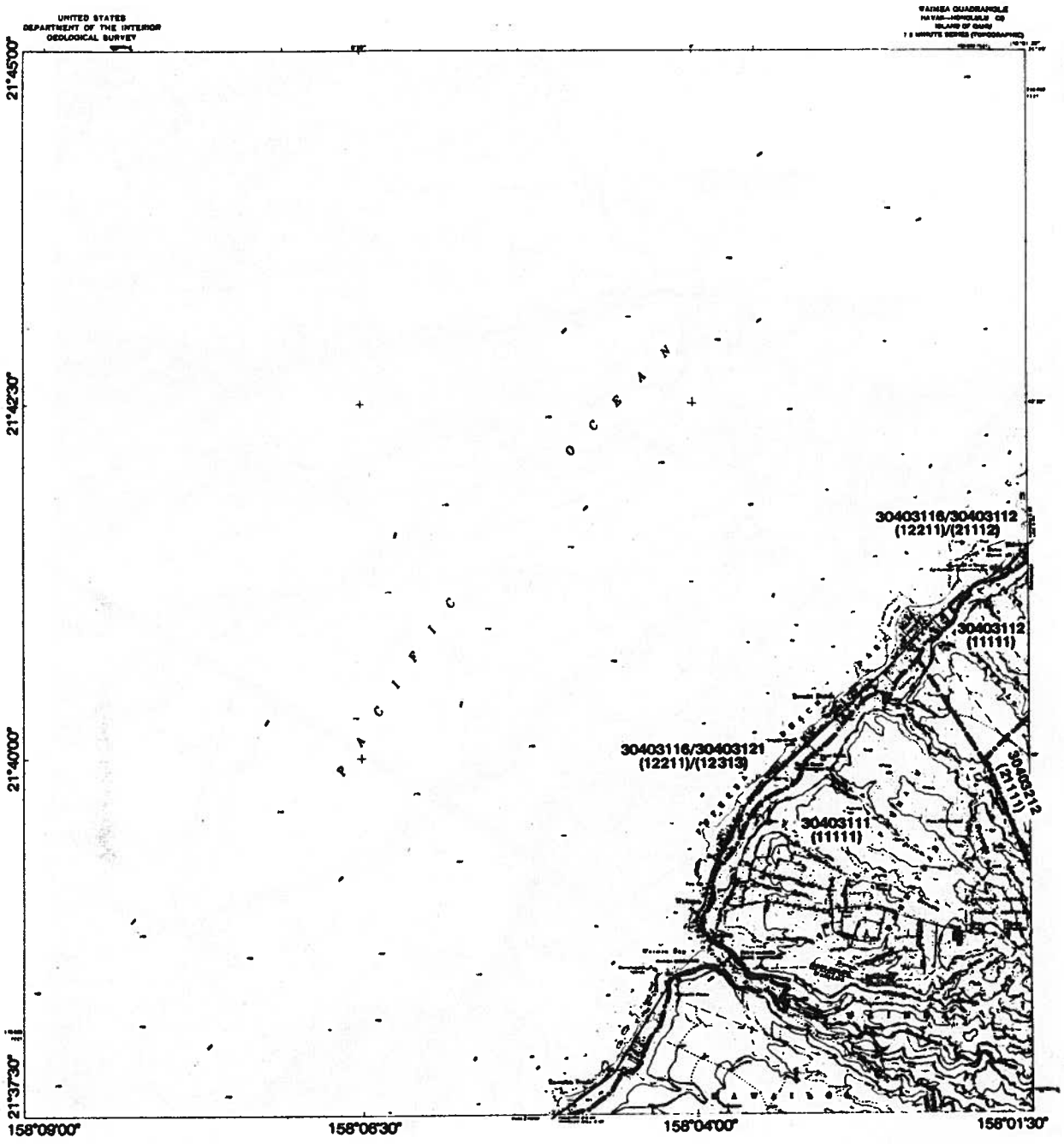

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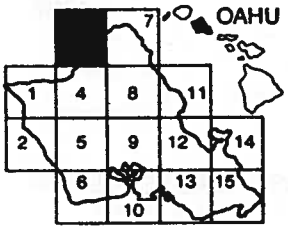
WAIMEA, OAHU
O-3

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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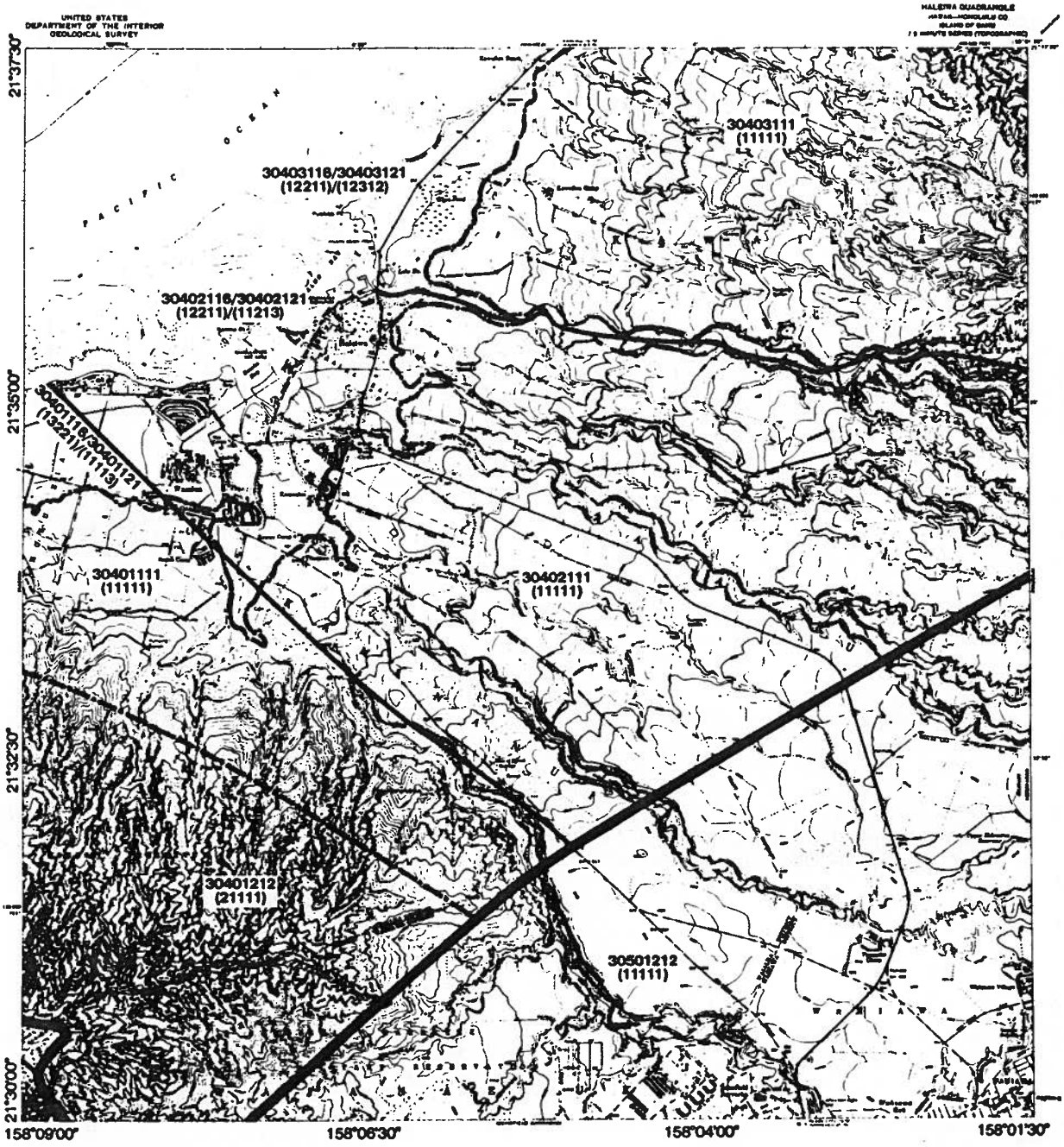
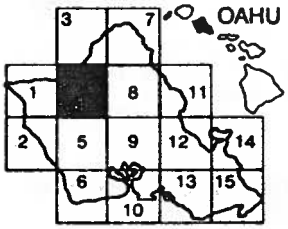
JUN 1989



Base Map: USGS (1:24,000 series, rev. 1983).

HALEIWA, OAHU
O-4

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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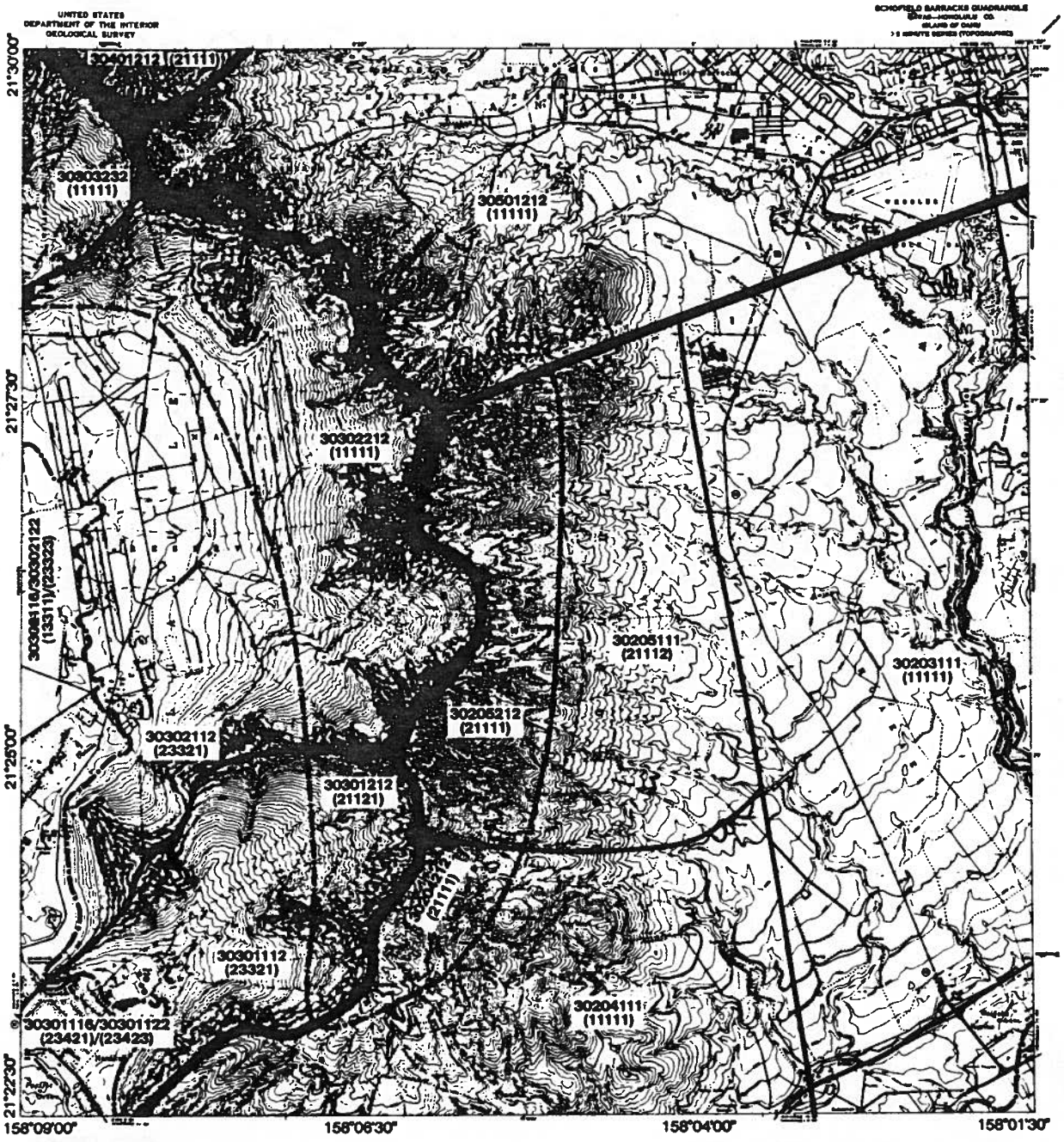
JUN 1989



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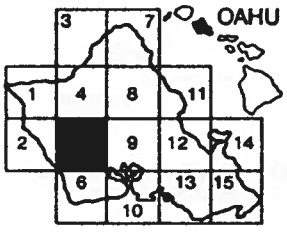
SCHOFIELD BARRACKS, OAHU
O-5

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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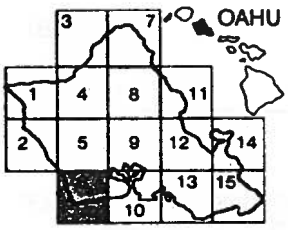
JUN 1989

Base Map: USGS (1:24,000 series, rev. 1983).

EWA, OAHU
O-6

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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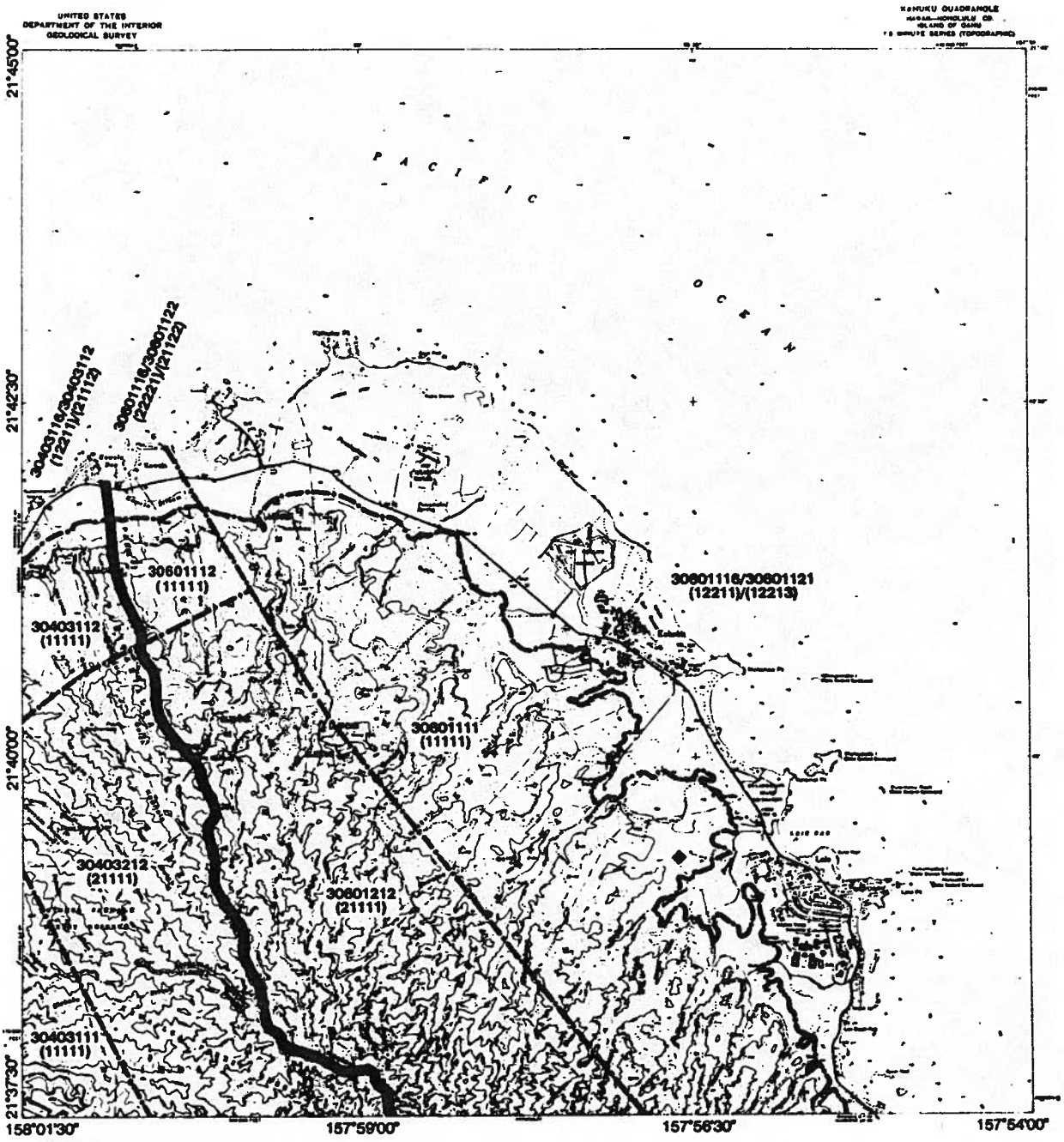

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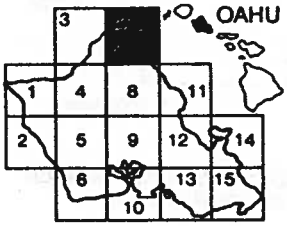
KAHUKU, OAHU
O-7

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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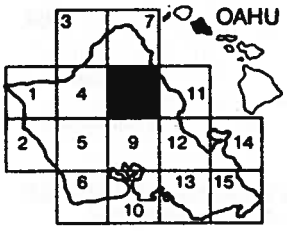
JUN 1989

Base Map: USGS (1:24,000 series, rev. 1983).

HAUULA, OAHU
O-8

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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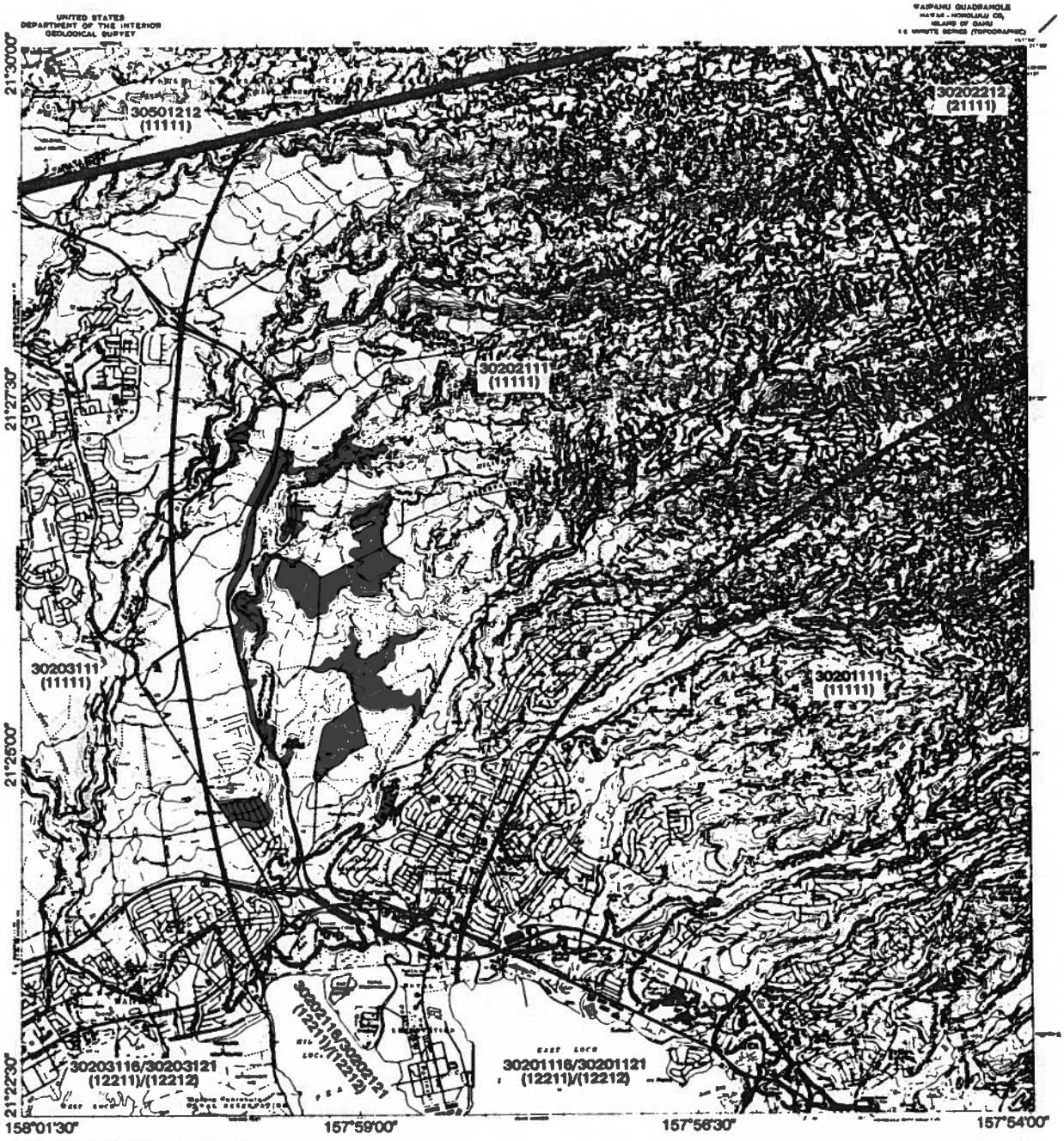
JUN 1989



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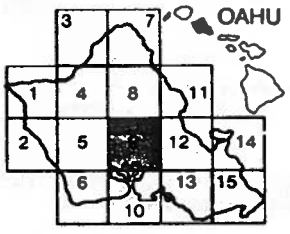
WAIPAHU, OAHU
O-9

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

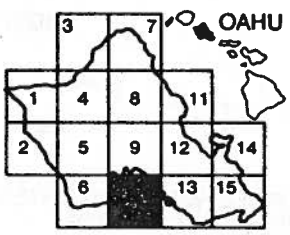
WATER RESOURCES RESEARCH CENTER
University of Hawaii at Manoa

JUN 1989

Base Map: USGS (1:24,000 series, rev. 1983).

PEARL HARBOR, OAHU
O-10

1987

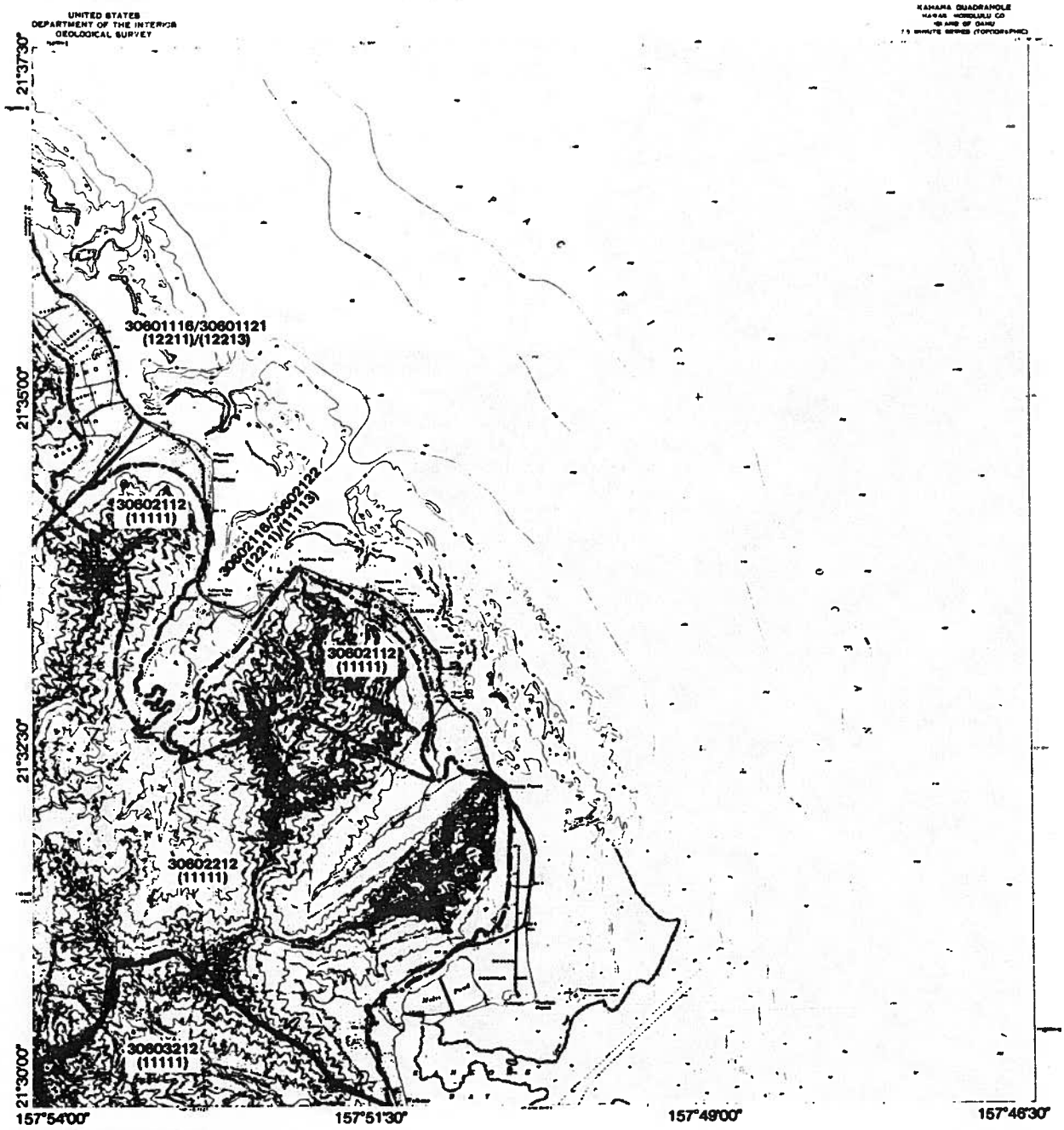


Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

WATER RESOURCES RESEARCH CENTER
University of Hawaii at Manoa

JUN 1989



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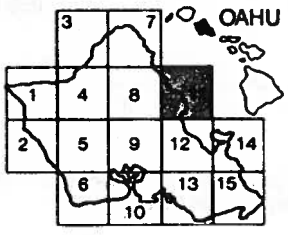
KAHANA, OAHU
O-11

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

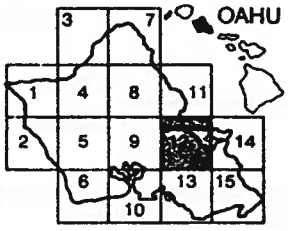
WATER RESOURCES RESEARCH CENTER
University of Hawaii at Manoa

JUN 1989

Base Map: USGS (1:24,000 series, rev. 1983).

KANEOHE, OAHU
O-12

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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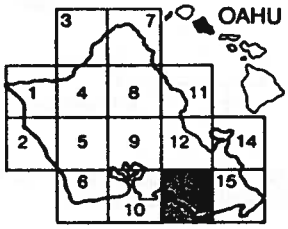
Base Map: USGS (1:24,000 series, rev. 1983).

HONOLULU, OAHU
O-13

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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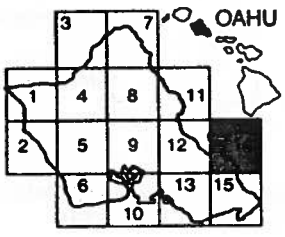
Base Map: USGS (1:24,000 series, rev. 1983).

MOKAPU, OAHU
O-14

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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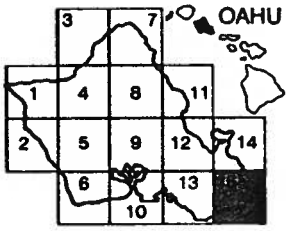
Base Map: USGS (1:24,000 series, rev. 1983).

KOKO HEAD, OAHU
O-15

1987



Sector
Aquifer System
Aquifer Type
30104111 Aquifer Code
(11111) Status Code

0 1 2 Miles
0 1 2 3 Kilometers

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