HAWAII'S

COASTAL NONPOINT POLLUTION CONTROL PROGRAM

MANAGEMENT PLAN

Volume 1

Prepared By:

Hawaii Coastal Zone Management Program
Office of State Planning
P.O. Box 3540
Honolulu, Hawaii 96811-3540

June 1996

A publication of the Hawaii Office of State Planning, pursuant to National Oceanic and Atmospheric Administration Award Nos. NA47OZ0264 and NA57OZ0270. This document was prepared with the assistance of the Hawaii Department of Health, Pacific Environmental Research, Susan Miller and many others in government, the private sector, and non-governmental organizations.

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

List of Figures

List of Tables

Acronyms

ACP	USDA-CFSA's Agricultural Conservation Program
ADSC	Agricultural Diagnostic Service Center
AMS	Acceptable Management System (developed by USDA-NRCS)
BMP	Best Management Practice
BOD	Biological oxygen demand
C&C	City and County of Honolulu
C&CDPW	City and County of Honolulu Department of Public Works
CDUA	Conservation District Use Application
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act (42 USC §9601 et.seq.)
CES	University of Hawaii Cooperative Extension Service
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CMS	Conservation Management System (developed by USDA-NRCS)
CTAHR	University of Hawaii College of Tropical Agriculture and Human Resources
CWA	Clean Water Act
CWDA	Critical Wastewater Disposal Area
CWRM	Commission on Water Resource Management
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
CZM	Coastal Zone Management
DBEDT	Department of Business, Economic Development, and Tourism
DHHL	Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Resources
DLNR-DAR	DLNR Division of Aquatic Resources
DLNR-DOBOR	DLNR Division of Boating and Ocean Recreation
DLNR-DOFAW	DLNR Division of Forestry and Wildlife
DOA	Department of Agriculture
DOH	Department of Health
DOH-CWB	DOH Clean Water Branch
DOH-PRC	DOH Polluted Runoff Control Program
DOH-WWB	DOH Wastewater Branch
DPED	Department of Planning and Economic Development (predecessor of DBEDT)
DPS	Department of Public Safety
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FACTA	Food, Agriculture, and Conservation Trade Act of 1990
FIP	Forestry Incentive Program (NRCS)
FSA	USDA Farm Services Agency
GCA	General Contractors Association
GDSI	Geographic Decision Systems International
GIS	Geographic Information System
HACD	Hawaii Association of Conservation Districts

Acronyms (continued)

HAR	Hawaii Administrative Rules
HCC	Hawaii County Code
HFIA	Hawaii Forest Industry Association
HIOSH	Hawaii Occupational Safety and Health
HRS	Hawaii Revised Statutes
HSPA	Hawaiian Sugar Planters Association
IPM	Integrated Pest Management
KCC	Kauai County Code
LUC	Land Use Commission
MCC	Maui County Code
mgd	Million gallons per day
mg/L	Millgrams per liter
MLCD	Marine Life Conservation District
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSD	Marine Sanitation Device
NAR	Natural Area Reserve
NARS	Natural Area Reserve System
NMFS	U.S. National Marine Fisheries Service
NOAA	U.S. National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source (Pollution)
NRDC	Natural Resources Defense Council
NRCS	USDA Natural Resources Conservation Service
OCEA	DLNR Office of Conservation and Environmental Affairs
OEQC	Office of Environmental Quality Control
ORMA	Ocean Recreation Management Area
ORMP	Ocean Resources Management Plan
OSDS	On-Site Disposal System
OSP	Hawaii Office of State Planning
OSWM	DOH's Office of Solid Waste Management
PAH	Polynuclear aromatic hydrocarbons
PER	Pacific Environmental Research
PPP	Agricultural Pollution Prevention Plan
PSA	Public service announcement
RMS	Resource Management System (developed by USDA-NRCS)
ROH	Revised Ordinances of Honolulu
RUSLE	Revised Universal Soil Loss Equation
SCAP	Stream Channel Alteration Permit
SCUBA	Self-Contained Underwater Breathing Apparatus
SGES	University of Hawaii Sea Grant Extension Service
SIP	Stewardship Incentive Program (DLNR)
SMA	Special Management Area
SOEST	University of Hawaii School of Ocean and Earth Science and Technology
SPAM	Stream Protection and Management (Plan)

Acronyms (continued)

STP	Sewage treatement plant
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TORCH	The Ocean Recreation Council of Hawaii
TSS	Total suspended solids
UIC	Underground Injection Control (Line)
UH	University of Hawaii
USACOE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USCG	U.S. Coast Guard
USLE	Universal Soil Loss Equation
VTS	Vegetative Treatment System
VFS	Vegetative Filter Strip
WQLS	Water Quality Limited Segment
WRP	Wetland Reserve Program (NRCS)
WRRC	University of Hawaii Water Resources Research Center
WWTP	Wastewater treatment plant

Summary of Agencies Responsible for Management Measure Implementation

Agriculture

Erosion and Sediment Control Management Measure	county DPWs and SWCDs lead; NRCS, FSA, CES, DOH
Management Measure for Wastewater and Runoff from Confined Animal Facilities	DOH lead; NRCS, FSA, CES, SWCDs
Nutrient Management Measure	no clear lead; DOH, NRCS, FSA, CES, county DPWs, SWCDs
Pesticide Management Measure	DOA lead; DOH, SWCDs, NRCS, FSA, CES
Grazing Management Measure	SWCDs, NRCS, FSA, CES, DOH
Irrigation Water Management Measure	DOH lead; SWCDs, NRCS, FSA, CES

Forestry

Preharvest Planning Management Measure	DLNR lead; DOH, USFS, county planning departments
Streamside Management Zone	DLNR lead; DOH, USFS
Road Construction/Reconstruction Management Measure	no clear lead; county DPWs, DLNR, SWCDs, DOH, USFS, county planning departments
Road Management	no clear lead; DLNR, SWCDs, DOH, county planning departments, USFS
Timber Harvesting	no clear lead; DLNR, SWCDs, DOH, USFS, county planning departments
Site Preparation and Forest Regeneration Management Measure	no clear lead; DLNR, SWCDs, DOH, USFS, county DPWs, county departments of planning

Summary of Agencies Responsible for Management Measure Implementation (continued)

Fire Management	no clear lead; DLNR, DOH, SWCDs
Revegetation of Disturbed Areas	indirectly - DLNR, SWCDs, DOH, USFS, county DPWs, county planning depts.
Forest Chemical Management	DOA, DLNR, DOH
Wetlands Forest Management	DLNR lead; USACOE, USFWS

Urban Areas

New Development Management Measure	county DPWs and planning departments lead; DOH, DOT, CZM Program
Watershed Protection Management Measure	OSP, LUC, county planning departments, DLNR, CZM Program, DOH, DOT
Site Development Management Measure	county DPWs and planning departments, and DOT lead; DLNR, OSP, CZM Program, DOH
Construction Site Erosion and Sediment Control Management Measure	county DPWs lead; DOH, DOT, CZM Program
Construction Site Chemical Control Management Measure	DOA lead; DOH, county planning departments, CZM Program
Existing Development Management Measure	no clear lead; DOH, county DPWs, DLNR
New Onsite Disposal Systems Management Measure	DOH lead; county building depts.
Operating Onsite Disposal Systems Management Measure	DOH lead; county building departments
Pollution Prevention Management Measure	DOH lead; county DPWs, county police departments

Summary of Agencies Responsible for Management Measure Implementation (continued)

Golf Course Management Measure	DOH, DOA, CZM Program, DLNR, USACOE, county DPWs and planning departments
Management Measure for Planning, Siting and Developing Roads and Highways	refer to Site Development Management Measure
Management Measure for Bridges	refer to Water Protection Management Measure and Site Development Management Measure
Management Measure for Construction of Roads and Highways Management	refer to Construction Site Erosion and Sediment Control Measure
Management Measure for Construction Site Chemical Control for Roads and Highways	refer to Construction Site Chemical Control Management Measure
Management Measure for Operation and Maintenance of Roads and Highways	DOT lead; DOH, county DPWs, DOA
Management Measure for Roads, Highways and Bridge Runoff Systems	DOT lead

Marinas and Recreational Boating

Marina Flushing Management Measure	DLNR lead; CZM Program, DOH, USACOE, county planning departments
Water Quality Assessment Management Measure	DOH lead; CZM Program, DLNR, USACOE, county planning departments
Habitat Assessment Management Measure	DLNR lead; CZM Program, USFWS, NMFS, county planning departments
Shoreline Stabilization Management Measure	DLNR and county planning depts. lead; CZM Program
Storm Water Runoff Management Measure	DOH, CZM Program, DLNR, county planning departments

Summary of Agencies Responsible for Management Measure Implementation (continued)

Fueling Station Design Management Measure	DOH lead; DLNR, CZM Program, USACOE, USCG, NMFS, USFWS
Sewage Facility Management Measure	DOH lead; DLNR, CZM Program, USACOE, USCG, NMFS, USFWS
Solid Waste Management Measure	DLNR lead; DOH
Fish Waste Management Measure	DLNR lead; DOH
Liquid Material Management Measure	DLNR lead; DOH, USCG
Petroleum Control Management Measure	DLNR lead; DOH, USCG
Boat Cleaning Management Measure	DLNR lead; DOH, USCG
Public Education Management Measure	DBEDT, DOH, DLNR, SGES, SOEST, TORCH, USCG
Management of Sewage Facilities Management Measure	DLNR lead; DOH
Boat Operation Management Measure	DLNR lead; DOH, USCG, USFWS

Hydromodification - Channelization, Channel Modification, Dams, Streambank and Shoreline Erosion

Management Measure for Physical and Chemical Characteristics of Surface Waters	DOH lead; CWRM, DLNR, CZM Program, county planning departments
Instream and Riparian Habitat Restoration Management Measure	CWRM, DLNR, DOH, CZM Program, county planning departments
Management Measure for Erosion and Sediment Control of Dams	county DPWs, CWRM, DOH, DLNR, USACOE, CZM Program
Management Measure for Chemical and Pollutant Control from Dams	DOA lead; DOH, CWRM, DLNR, CZM Program, county planning departments

Summary of Agencies Responsible for Management Measure Implementation (continued)

Management Measure for Protection of Surface Water Quality and Instream and Riparian Habitat from Dams	DOH lead; CWRM, DLNR, CZM Program, county planning departments
Management Measure for Eroding Streambank and Shorelines	DLNR and counties lead; CWRM, CZM Program, DOH
Wetlands and Riparian Areas	
Management Measure for Protection of Wetlands and Riparian Areas	DOH, CWRM, DLNR, CZM Program, county planning departments, USACOE, USFWS
Management Measure for Restoration of Wetland and Riparian Areas	DLNR lead
Management Measure for Vegetated Treatment Systems	

This page deliberately left blank

HAWAII'S COASTAL NONPOINT POLLUTION CONTROL PROGRAM

MANAGEMENT PLAN
Executive Summary

Background

In recent years, it has become increasingly clear that the nation's coastal waters have serious water quality problems. Virtually everywhere, the problems result from what is commonly called *polluted runoff* or *nonpoint source pollution*. These terms both refer to pollutants that enter a body of water as a result of water flowing over the surface of the land, such as rainfall, irrigation, or snowmelt. Common nonpoint source pollutants include soil, fertilizers, animal wastes, oil, grease, litter, lawn clippings, and home lawn care chemicals. These and other pollutants end up in public waters all across the country.

The consequences of nonpoint source pollution are all too well known: increased risk of disease from water recreation, algae blooms, fish kills, destroyed aquatic habitats, and turbid waters. Though some polluted runoff results from natural causes, most results from people's activities on the land and water. Much nonpoint source pollution is preventable.

The importance of coastal water quality to the State of Hawaii cannot be overstated. Water quality is vital to Native Hawaiian cultural practices; leisure and recreation, such as swimming, boating, fishing, snorkeling, SCUBA diving, and surfing; tourism and economic strength; ecosystem and species health and diversity; fishing and other food-gathering activities; and research and technology. This document does not elaborate on why protecting water quality is important. Rather, its purpose is to describe existing mechanisms and proposed additional or revised mechanisms that will serve to restore impaired waterbodies and protect the overall water quality that is so vital to our State.

The Coastal Nonpoint Pollution Control Program

In 1990, the U.S. Congress adopted new requirements for states that have federally-approved coastal zone management (CZM) programs, of which Hawaii is one. The new requirements are designed to protect coastal waters from polluted runoff and restore coastal water quality that has deteriorated because of nonpoint source pollution.

What is Required: The new requirements specify that states with CZM programs must develop and implement ***coastal nonpoint pollution control programs*** to be approved by the federal National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA). State programs are to be developed jointly by the coastal zone management agency and the water quality agency. (In Hawaii, that means the Office of State Planning's

CZM Program and the Department of Health.) Programs developed by states are to be based on guidance developed by the EPA and NOAA.

The federal program requires that states implement a set of ***management measures*** based on guidance published by EPA. Management measures reflect the most effective approach using the best available and most cost-effective technology to prevent or minimize pollution that might result from a particular activity. As such, for a given activity, there is a given management measure or "goal" which may be implemented through specific ***best management practices*** (BMP). For example, in developing a new subdivision, an erosion control plan would be an appropriate management measure, which in turn might be implemented through the use of silt fences, phased land clearing, and other common erosion control practices.

EPA's guidance contains 56 management measures separated into six groups. There are measures for agricultural activities, for forestry activities, for urban areas, for marinas, for hydromodification activities, and for protecting wetland and stream areas. States must implement measures in conformity with all the measures in the guidance, or justify why they will not be implemented or why alternative measures have been developed. The 56 management measures are intended to be the foundation for state coastal nonpoint pollution control programs.

After measures in conformity with EPA's guidance are implemented, states must then implement additional measures for areas and activities that are a known threat to water quality. Hawaii's draft management plan reflects the belief that the 56 measures in the guidance need to be implemented and then monitored as to their effectiveness before considering the implementation of any additional measures. The draft management plan does identify coastal waters that are threatened or impaired as a result of nonpoint source pollution.

Coastal Nonpoint Pollution Control Program Boundary: The federal program requires that NOAA review the inland boundary of state coastal zone management areas to determine if application of the coastal nonpoint pollution control program in this CZM area will be sufficient to "restore and protect coastal waters."

Hawaii's CZM area is defined in Chapter 205A, Hawaii Revised Statutes (HRS), as "all lands of the State and the area extending seaward to the limit of the State's police power and management authority, including the U.S. territorial sea." This area obviously includes all 614 watersheds within the State as well as coastal waters. Therefore, Hawaii's coastal nonpoint pollution control program will be applied within the current CZM area.

Program Coordination: Hawaii has had an approved coastal zone management program since 1978. Hawaii has also had a federally-approved voluntary polluted runoff control program since 1987. The development of the coastal nonpoint pollution control program brings together the CZM Program's

experience in coordination, and land and water use control, and Department of Health's (DOH's) expertise in water pollution management.

The intent of the coastal nonpoint pollution control program is to build upon, rather than duplicate, existing programs. The array of existing programs will be loosely bound together in a "network" under the rubric of the coastal nonpoint pollution control program. Ultimately, there will be one statewide program for the management and control of polluted runoff, elements of which will be implemented by a number of existing agencies.

Coordination has been a central theme of the developing phases of the coastal nonpoint pollution control program in Hawaii. While the CZM Program has had the lead in coordinating the development of the overall program, the development of the separate program elements themselves has been a shared responsibility. The CZM Program and DOH, with significant assistance from other State, federal, and county agencies, non-governmental organizations, and individuals, have jointly developed Hawaii's coastal nonpoint pollution control program management plan. The coastal nonpoint pollution control program will continue to rely on the resources, expertise, programs, and authorities of other agencies and organizations during its continuing development and implementation. In addition, opportunities for public participation will continue to be a part of Hawaii's coastal nonpoint pollution control program.

Management Measures: As noted above, EPA/NOAA guidance -- which contains 56 management measures -- provides the foundation for state programs. Management measures are akin to goals which states must address through the implementation of regulatory or non-regulatory nonpoint source pollution control mechanisms and land or water users must implement through the application of BMPs. The management measures are to be based on technical and economic achievability, rather than on cause-and-effect linkages between particular land use activities and particular water quality problems. In this sense, coastal nonpoint pollution control programs are preventive rather than reactive. The legislative history made it clear that the intent of technology-based management measures was to allow states to concentrate their resources initially on developing and implementing measures that experts agree will reduce pollution significantly.

In its coastal nonpoint pollution control program management plan, a state must respond to each of the management measures contained in the EPA/NOAA guidance by either (1) providing for the implementation of that measure or a comparable alternative, or (2) justifying why the management measure is not included in the program. Hawaii is not excluding any management measures from its program at this time, though some alternative measures have been substituted for EPA measures. In their management plans, states must describe how they will ensure implementation of each management measure.

This Executive Summary outlines each land or water use category for which there are management measures, lists the management measures, and highlights the implementing actions that have been recommended to facilitate

effective implementation of the coastal nonpoint pollution control program. This information is provided by land or water use category.

Agriculture

In the past decade, the types and distribution of agricultural activities in Hawaii have changed significantly, changing from sugarcane and pineapple plantation agriculture to a more diversified agriculture. This transition brings with it some inherent economic and environmental uncertainties. New crops will bring new cultivation practices and will use different quantities and types of fertilizers and pesticides. This transition, albeit economically wrenching, also provides a critical opportunity to examine the practices farming operations currently use, or are likely to use, while diversified agricultural operations are being expanded and practices and activities are being defined.

There are management measures for *erosion and sediment control*; *wastewater and runoff from confined animal facility; nutrient management; pesticide management; grazing management;* and *irrigation water management.* The chapter on Agriculture describes the management measures, their applicability, appropriate management practices, existing implementation mechanisms, and recommended implementing actions.

Recommended Implementation: A non-regulatory agricultural Pollution Prevention Plan (PPP) Program is recommended for the implementation of the agriculture management measures. This new program would provide incentives to land users to develop [with assistance from Natural Resources Conservation Service and Cooperative Extension Service (CES)] and implement pollution prevention plans covering erosion control, nutrient and pesticide management, runoff from confined animal facilities, grazing management, and irrigation management, as applicable. These plans would specify the best management practices (BMPs) to be used to prevent or reduce polluted runoff from the lands covered by each plan. The following recommendations will be explored in more detail in the coastal nonpoint pollution control program implementation plan.

A. Establish Organizational Structure and Adequate Program Funding

- Draft and implement statutory and regulatory amendments, as needed, to implement this organizational structure and provide program funding. Establish incentive mechanisms to encourage participation in the non-regulatory PPP Program and enact a Bad Actor Law as a regulatory backup.
- Appropriate sufficient funding to the Soil and Water Conservation Districts (SWCD) to support at least one full-time technical staff and part-time clerical support *per district*.
- Draft formal Memoranda of Understanding (MOUs) between agencies having technical and management expertise with respect to agricultural practices and polluted runoff control to ensure their commitment to implementing this program.

B. Develop Education and Training Materials

- Develop an operator handbook of PPP Program requirements, benefits, specification for plans and plan components for each management measure, and incentives.
- Create model PPP plans for various crop categories that can be used by operators or plan preparers as the framework for drafting individual plans.
- Develop a BMP manual for agricultural practices appropriate to Hawaii.
- Develop easy-to-read educational materials in the various languages of Hawaii for wide distribution by extension agents, agricultural supplies stores, and others.
- Produce training materials for conducting trainings of operators and plan preparers, including local case studies, and island-specific soil and crop information.

C. Revise State Land Lease Requirements

- Include a requirement for development and implementation of PPPs for all land leases for crop cultivation and grazing.
- Classify State lands leased for grazing according to their carrying capacity and adjust lease rates for each parcel to reflect its stated carrying capacity.
- Establish natural resource criteria to be used to determine planning and treatment levels that meet acceptable parameters and/or conditions. The criteria should be stated in either qualitative or quantitative terms.
- Lengthen duration of leases to ensure that operators will realize the long-term economic benefits of installing costly improvements.

D. Develop Hawaii-Specific Soils Information

More Hawaii-specific soils research should be done to enhance publicly-available information and further develop Hawaii-specific BMPs for agriculture.

- Develop a database containing cross-referenced information for decision-making on suitable practices and products for a particular site.

E. Establish Inverted Water Rate Structure

- Emphasize an inverted water rate structure on a per acre basis when setting water rates.

F. Integrate the PPP Planning Process into Watershed Planning

- Encourage agricultural operators to participate in a watershed planning process. The PPP Program should be viewed as one component in a broader watershed planning process.

G. Change the Voting System for the SWCDs

- Change the voting structure of the SWCDs so that it is more equitable to the smaller farmers.

Forestry

At this time, commercial forestry operations in Hawaii are limited in scope and area. Due to the small base of operations, forestry in Hawaii is not a significant contributor to polluted runoff. However, the management measures for forestry

are still relevant to Hawaii because there is the potential for significant growth in the forest products industry in the near future. The acres of fallowed land left by the downsizing of Hawaii's sugar industry have created the potential for a growing commercial forestry industry. Many of the same attributes that made plantation sugar a viable industry are also conducive to commercial forestry. Since commercial forestry is not being undertaken on a large scale in Hawaii at this time, there are few mechanisms currently in place that specifically address forestry activities and their impacts on water quality.

There are management measures for *preharvest planning management*; *streamside management zones (SMZs)*; *road construction/reconstruction*; *road management*; *timber harvesting*; *site preparation and forest regeneration*; *fire management*; *revegetation of disturbed areas*; *forest chemical management*; and *wetlands forest management*. The chapter on Forestry describes the management measures, their applicability, appropriate management practices, existing implementation mechanisms, and recommended implementing actions..

Recommended Implementing Actions: It is recommended that the implementation of the forestry management measures build upon existing regulatory and non-regulatory mechanisms, with an emphasis on encouraging participation in voluntary, incentive-driven programs. It is also recommended that existing laws, regulations, and incentive programs be reviewed and amended to improve agency coordination and to optimize their effectiveness for forestry activities. As forestry activities increase and BMPs for forestry are further developed, other implementation mechanisms may be considered that more directly address forestry's contribution to polluted runoff. The following recommendations will be explored in more detail in the coastal nonpoint pollution control program implementation plan.

A. Develop tree farm property tax classification

- Work with the counties to develop a county tree farm property tax classification for land dedicated to sound forest management based on approved plans. This will provide a powerful incentive for land users to participate in the Tree Farm Program. While the County of Hawaii has already initiated this process, it needs to be completed. In addition, the value of existing or growing forest trees should be exempted from assessed value for property taxes, eliminating a tax incentive for premature harvest and recognizing the longer rotation ages needed for forest management.

B. Provide adequate financial support for research and development activities, education and technical assistance

- Support continued BMP development by forestry professionals.
- As BMPs are researched and trials are conducted to provide a sound basis for BMPs in Hawaii, develop a manual describing forestry BMPs.
- Seek FY97 funding of the Tropical Forestry Plan produced by the U.S. Department of Agriculture as required by the federal Hawaii Tropical Forestry Act. This Plan would provide funding to the U.S. Forestry Service (USFS), much of which would, in turn, be made available to the Department of

Land and Natural Resources (DLNR)-Division of Forestry and Wildlife (DOFAW) in grants.
- Consider developing a forestry extension system through University of Hawaii's CES to provide specialized assistance, training, and research.

C. Support coordination among agencies
- Draft formal MOUs between agencies having technical and management expertise with respect to forestry practices and polluted runoff control.
- Draft statutory or regulatory amendments, as needed, to implement the organizational structure, provide program funding, enact a Bad Actor Law, and establish incentive mechanisms.

D. Facilitate the direct lease of State lands
- Facilitate the direct lease of State lands most suited to forestry in order to encourage responsible forest management. A direct lease recognizes the high up-front costs and long-term return on investment inherent to forestry operations which normally work to a disadvantage during a bid process. In order to secure a direct lease on State lands, however, a land user should be required to develop and implement a management plan specifying BMPs for nonpoint source pollution control.

Urban

Oahu is by far the most urbanized of the Hawaiian Islands and has the highest population density. During urbanization, pervious spaces, including vegetated and open forested areas, are converted to land uses that usually have increased areas of impervious surface. This results in increased runoff volumes and pollutant loadings. In this manner, as population density increases, there is a corresponding increase in pollutant loadings generated from human activities. These pollutants typically enter surface waters via runoff without undergoing treatment.

There are management measures for *new development*; *site development (including roads, highways, and bridges)*; *construction site erosion and sediment control (including roads, highways, and bridges)*; *construction site chemical control (including roads, highways, and bridges)*; *existing development*; *new and operating on-site disposal systems (OSDSs)*; *pollution prevention*; *golf course management*; *operation and maintenance of roads, highways, and bridges*; and *road, highway, and bridge runoff systems.* The golf course management measure has been developed specifically for Hawaii and is not contained in EPA's guidance document. The chapter on Urban describes the management measures, their applicability, appropriate management practices, existing implementation mechanisms, and recommended implementing actions..

Recommended Implementing Action: The following recommendations will help strengthen the implementation of the urban management measures. In addition, please refer to the recommendations under "Hydromodifications."

A. Maintain Pre-development Runoff Rates

- Use existing flow models for peak discharge and total runoff to ensure that the portion of the 2-year/24-hour storm event that is designed to be discharged offsite does not exceed pre-development discharged flows. If pre-development discharge baseline data are not available for comparison, post-development modeled flows should be compared to modeled flows calculated using pre-development land use and drainage criteria.

B. Calibrate Existing Models

- Conduct research to calibrate computer runoff models so that they can be used reliably under a wide range of conditions and circumstances in Hawaii.

C. Minimize Development of Areas Susceptible to Erosion

- The County of Hawaii and City and County of Honolulu should consider adopting ordinances or other appropriate controls to minimize or avoid development of areas that are particularly susceptible to erosion or sediment loss. Such mechanisms could be modeled after those of Maui and Kauai counties.

D. Revise County Requirements for Erosion and Sediment Control Plans

- Require erosion and sediment control plans for projects on less than 5 acres which disturb over 5,000 square feet of land on the site. Currently, such projects must receive a grading permit but are not required to develop erosion and sediment control plans.
- Include, at a minimum, specific language for narrative performance standards to ensure that, to the extent practicable, sediment is retained onsite during and after construction.

E. Develop a BMP Manual of Construction Practices

- Develop a manual of Hawaii-appropriate BMPs for construction activities, including sections on practices for erosion and sediment control, and chemical usage and runoff control. A BMP manual would help to standardize acceptable practices and assist contractors in selecting appropriate practices that would be acceptable and applicable in all counties and for State projects.

F. Inspect Nonpoint Source Pollution Control Practices with Other Construction Activities

- Integrate inspections for erosion and sediment control, and chemical control practices with the standard construction inspection programs for all counties.

G. Revise Chapter 128D, HRS, to Include Prevention Program

- DOH should revise Chapter 128D, HRS, to include requirements for preventive actions such as a spill prevention program.

H. Provide Education for Construction Supervisors on Construction Chemicals and Require Trained Supervisors On-Site

- Require at least one construction supervisor who has completed an education program on construction chemical usage on-site at all times during the application or use of chemicals.

I. Clarify Coordination of Responsibilities Among Agencies

- Clarify responsibilities between the State and counties for erosion and sediment control to avoid duplications of effort or assumptions of responsibility. Currently, the responsibilities for erosion and sediment control with respect to construction activities are contained within four mechanisms.
- State and county agencies responsible for overseeing chemical usage and control for construction activities should coordinate to develop a standard and consistent set of guidelines and requirements. Consistent requirements and guidelines should include, but not be limited to, sections on allowable chemicals and acceptable disposal options.
- A coordinated effort between the state and counties is needed so that all county ordinances or other guidelines specify which permit(s) are required for which situations. A consistent set of requirements, guidelines and policies between all counties would avoid confusion for contractors who build in different counties.

J. Train Fertilizer Applicators

- Train fertilizer applicators on proper calibration of equipment and application. Soil analysis information should be used to determine fertilizer needs.

K. Develop a Watershed Analysis and Evaluation Program

- In cooperation with community representatives, researchers, and other agencies, DOH's Environmental Planning Office should develop a watershed analysis and evaluation program to target watersheds that have been defined in the latest Section 305(b) report as "Water Quality Limited Segments" (WQLSs) and are affected by urban runoff pollutants.

L. Add Illegal Disposal Clause to Chapter 11-62, HAR

- DOH should revise Chapter 11-62, HAR, to include language specifying that the improper disposal of household hazardous or toxic materials, such as motor oil and solvents, is illegal and subject to a stiff fine.

M. Enforce Single Family Zoning

- The counties should improve enforcement of single family zoning requirements. It is common for areas zoned "single family residential" to have multiple units within the same dwelling. However, the additional residents in these units add significant amounts of wastewater to On-Site Disposal Systems (OSDS) that are likely not designed to handle the increased loads.
- DOH should coordinate with the counties to ensure that OSDSs with adequate capacities are used by all dwellings.

N. Encourage Conversion of Cesspools
- DOH, in cooperation with the counties, should provide technical and financial incentives to encourage homeowners in CWDAs to convert existing cesspools.

O. Discourage the Use of Some Products
- DOH, in cooperation with the counties, should disseminate public informational materials to discourage residents from using products, such as phosphate detergents, acid or organic chemical additives, sodium hypochlorite-based drain cleaners, and certain other household chemicals, and garbage disposals, that can damage OSDSs and negatively affect the environment.

P. Encourage Conversion of Existing Fixtures to Low-Flow
- All counties should institute rebate programs to encourage home owners to convert existing inefficient toilets and other water fixtures to low flow fixtures. Consideration should be given to making a similar offer for more water-efficient replacements for other high water use appliances (*i.e.*, dishwashers and washing machines).

Q. Develop a Pollution Prevention Resource Guide
- Develop and distribute a Pollution Prevention Guide to residents of the State.

R. Reinstate and Enhance Hazardous Materials Collection
- Reinstate and enhance the "Amnesty Day" program for all islands.

S. Promote Use and Production of Electric and Hybrid Vehicles
- Consider tax credits for the purchase of electric or hybrid cars and motorcycles and for Hawaii-based companies doing research on making them more affordable and energy efficient.

T. Expand State Automobile Inspection
- Include an environmental inspection of a car's pollution potential as part of its annual safety inspection.

U. Explore Incentives for Reduced Automobile Use
- Consider an "environmental user fee" for the use of automobiles. Although there are many alternatives for this user fee, an added "environmental" gasoline tax of 5 to 10 cents or more is suggested.

V. Develop a BMP Manual for Golf Courses
- Develop a manual of golf course management practices appropriate for Hawaii's soils and micro-climates and distribute to golf course developers and superintendents.

W. Coordinate Water Quality Monitoring Adjacent to Golf Courses
- Extend water quality monitoring programs to areas adjacent to golf courses not currently being monitored and clarify the monitoring responsibilities of government agencies, university researchers, golf course developers, and other participants.

X. Explore Alternatives to Roadside Spraying

- The Department of Transportation (DOT) and the counties should explore alternatives to the use of pesticides for weed control along roadsides and in drainage systems.

Y. Identify and Implement Retrofit Projects, as Needed, to Address Polluted Runoff from Existing Roads, Highways, and Bridges

- DOT should identify priority and watershed pollutant reduction opportunities and establish schedules for implementing appropriate controls. Improvements to existing urban runoff control structures on roads, highways, and bridges adjacent to surface waterbodies will reduce polluted runoff into these waterbodies.

Marinas and Recreational Boating

The management measures for marinas are applicable to the facilities and their associated shore-based services that support recreational boats and boats for hire. The following operations/facilities are covered by these management measures:

- Any facility that contains 10 or more slips, piers where 10 or more boats may tie up, or any facility where a boat for hire is docked;
- Boat maintenance or repair yards that are adjacent to the water;
- Any federal, State, or local facility that involves recreational boat maintenance or repair that is on or adjacent to the water;
- Public or commercial boat ramps;
- Any residential or planned community marina with 10 or more slips; and
- Any mooring field where 10 or more boats are moored.

There are management measures for *marina flushing; water quality assessment; habitat assessment; shoreline stabilization; storm water runoff; fueling station design; sewage facility siting and design; solid waste management; fish waste management; liquid material management; petroleum control management; boat cleaning management; public education; maintenance of sewage facilities;* and *boat operation*. The chapter on Marinas and Recreational Boating describes the management measures, their applicability, appropriate management practices, existing implementation mechanisms, and recommended implementing actions.

Recommended Implementing Actions: The following recommendations suggest actions that will improve the implementation of the management measures for marinas and recreational boating.

A. Continue long-range planning and policy development efforts for marina development, and related efforts to develop marina siting, design, and construction guidelines for Hawaii

- OSP, in conjunction with DLNR, should continue to facilitate the long-range planning of marina development and expansion.
- Revise and implement the *Draft Planning and Evaluation Guidelines for Private Sector Marina Development* (OSP 1993) to provide design, siting, construction, and operations criteria for *both* private and public marinas.

- DOH should develop a standardized protocol for marine water quality monitoring before, during, and after any coastal construction, including marina development.
- The State should develop a manual of structural and non-structural BMPs for marinas that may be used to meet the criteria established in the State's guidelines for marina development and expansion.
- Develop a statewide marina operations and maintenance manual for new and existing marinas. This manual would provide descriptions of management measures and practices to reduce polluted and explain how marina users will benefit and can do their share.

B. Support and facilitate continuing public outreach and boater education efforts

- Develop a comprehensive public education program for marina operators and the boating community.
- Support public education seminars, workshops, and meetings instituted in conjunction with the dissemination of the guide.
- Investigate ways to most-effectively communicate with the boating and marina communities, including appropriate signage, community bulletin boards, and a computer "Boater/Fisher-Net."

C. Improve enforcement of existing boating regulations

- Provide adequate resources for enforcement officers, including additional staff and boats.

D. Pursue alternative funding mechanisms for managing and improving State boating facilities

DLNR-Division of Boating and Ocean Recreation (DOBOR) has initiated an investigation into ways to increase revenues for managing and improving the State's boating facilities. It is currently considering several options, including increasing existing slip and user fees, and instituting new fees for certain uses.

- Consider other revenue-generating alternatives, such as boat and trailer taxes, and the establishment of a special fund supported by ecology vanity license plates.

E. Undertake a statewide suitability analysis for marina siting

- Instigate a project to guide the location of new and expanding marinas and associated activities through a statewide suitability analysis. Such an analysis could designate areas that are and are not suitable for marina development, taking into account criteria for flushing and circulation, exposure and other navigational safety concerns, biological, water quality and habitat factors, and recreational and cultural values.
- Conduct comprehensive nearshore and reef surveys to identify additional areas of special shallow water habitats, and areas where turbidity may be of concern to biological resources.

F. Explore various public-private partnerships for managing and developing public boating facilities

- Encourage DLNR-DOBOR to work with harbor advisory committees to coordinate management efforts at existing facilities.
- Promote public-private partnerships in the management of existing marina facilities, expansion of these facilities, or construction of new public marinas in order to benefit from private sector expertise in marina management.

G. Improve coordination among federal, State, and county agencies that play a role in marina design, siting, construction, and operation and maintenance

- Improve coordination among existing regulatory programs to facilitate appropriate and efficient design, construction, and management of marinas.

Hydromodifications

According to EPA's guidance document, "hydromodification" means "alteration of the hydrologic characteristics of coastal and noncoastal waters, which in turn could cause degradation of water resources." In other words, any alteration to a stream or coastal waters, whether a diversion, channel, dam, or levee, is considered a hydromodification. Because of Hawaii's sub-tropical climate, "flashy" storm events consisting of high peak discharges and large volumes of runoff are common. In order to protect life and property located close to streams, county drainage standards were developed to safely handle these runoff volumes. Consequently, many streams, especially in urban areas, have been channelized in the form of concrete box culverts that drastically alter their physical, chemical, hydrological, and ecological characteristics. DLNR's Hawaii Stream Assessment (1990) concludes that over 19% of Hawaii's 376 perennial streams have been channelized to some degree, including most of those on Oahu. In recent years, the realization of the impacts of channelization on habitat and water quality has brought about a paradigm shift where the goal now is to balance flood control and nonpoint source pollution control.

The hydromodification management measures will affect all land use activities, especially those associated with agriculture, forestry, and urban development. Therefore, these management measures should be considered in conjunction with the management measures for agriculture, forestry, urban areas and, to a lesser extent, marinas. In addition, the management measures for other land use categories are also relevant to the protection of streams and riparian areas.

There are management measures for *physical and chemical characteristics of surface waters*; *instream and riparian habitat restoration*; *erosion and sediment control for dams*; *chemical and pollutant control for dams*; *protection of surface water quality and instream and riparian habitat*; and *eroding streambanks and shorelines*. The chapter on Hydromodifications describes the management measures, their applicability, appropriate management practices, existing implementation mechanisms, and recommended implementing actions.

Recommended Implementing Actions: The recommendations below are meant to address these concerns by eliminating the need for further channelization

through protection of the stream resources, effective land use planning, modification of engineering techniques to control runoff, and improved coordination of permit review.

A. Establish new development planning and drainage criteria to reduce runoff volumes.

The drainage standards implemented by all counties are based primarily on flood control and safety criteria, not environmental criteria. To reduce the need for channelization and to protect the natural drainage systems and riparian and aquatic habitats, the following changes to the county drainage standards should be considered.

- Revise and implement criteria for new urban development and drainage/flood control to encourage onsite retention of surface drainage using a series of management practices designed to increase infiltration, reduce peak runoff, and limit discharged runoff to pre-development levels.
- Drainage standards should address the incremental impacts on surface waters of siting new developments.

B. Define streamside management zones (SMZs) that would come under more intense management.

A useful management tool for watershed planning is the establishment of streamside management zones (SMZs) or "buffer areas" around all perennial streams in the State. A SMZ is a designated area that consists of the stream itself and an adjacent area of varying width where management activities that might affect water quality, fish, or other aquatic resources are modified to mitigate the adverse effects. The SMZ is not an area of exclusion, but an area of closely managed activity.

- Consider alternative management policies and implementation options for SMZs. At this time, the State does not have a general, statewide policy on SMZs. However, the CZM Program is currently exploring alternatives for such a policy, in cooperation with DLNR and other State, federal and county agencies. There are several possible mechanisms for implementing SMZs around streams or stream segments that will be developed and examined in more detail during the CZM Program's ongoing study.

C. Adopt and Implement Proposed Rules for a Stream Protection and Management System

- DLNR should support the adoption of the proposed changes to Chapter 13-169, HAR, to facilitate a coordinated and statewide approach to the management of streams and their ecosystems.
- Consider incorporating a long-range watershed planning and assessment approach into the Stream Protection and Management (SPAM) Plan for protecting perennial streams flowing into wetlands that serve as critical habitat for endangered waterbirds, as determined by USFWS and DLNR-DOFAW. The potential cumulative effects of development should be assessed using "build-out" scenarios guided by county general plans, development plans, current zoning, or other useful long-range planning tools.

D. Create a coordinated agency review process for development plans

- Designate a coordinating agency to "shepherd" permit applications through the agency review and comment process.
- Develop cooperatively a consistent and standardized routing process for review of permit applications between the relevant federal, State, and county agencies to ensure adequate opportunity for review and comment by agencies knowledgeable in assessing specific types of impacts.

E. Expand Operation and Maintenance Program for Existing Hydromodifications

- Include in the operation and maintenance program for existing modified channels provisions for the identification and implementation of opportunities to improve physical and chemical characteristics of surface waters in those channels, and to restore instream and riparian habitat.
- Include in the operation and maintenance programs for dams provisions for the assessment of surface water quality and instream and riparian habitat and potential for improvement of significant nonpoint source pollution problems that result from excessive surface water withdrawals.

F. Develop Instream Flow Standards

- CWRM should set instream flow standards or implement the instream flow program required under Chapters 174C-71(1) and 174C-71(4), HRS, respectively.

G. Ensure Consistency with County Erosion Control and Drainage Standards for State Dam Construction Projects

- Hawaii should ensure that the State dam construction projects follow appropriate erosion control and drainage standards. The State could articulate a consistent policy to follow the county grading and drainage standards for the county in which the dam is being constructed, or develop State grading and drainage standards that are at least as stringent as the standards in the most stringent county.
- DLNR should revise Chapter 13-190, HAR, or develop another mechanism to provide erosion and sediment control guidelines for dams. The chapter's provision for inspection of dams every five years should also be revised to include nonpoint source pollution-related erosion and sediment control criteria.

H. Implement Mechanisms to Ensure Proper Use, Handling, Storage, Transportation, and Disposal of Construction Chemicals and Provide Adequate Spill Prevention and Response Planning

I. Consider Alternative Streambank Vegetation Control Methods

- The counties should consider alternative methods to control streambank vegetation. Streambank erosion and stream water pollutant loadings could be reduced by replacing the use of herbicides for vegetation management with weed-whacking or other mechanical methods.

Wetlands and Riparian Areas

Wetlands and riparian areas can play a critical role in reducing nonpoint source pollution, by intercepting surface runoff, subsurface flow, and certain groundwater flows. Their role in quality improvement includes processing, removing, transforming, and storing such pollutants as sediment, nitrogen, phosphorus, and certain heavy metals. In general, wetlands in Hawaii vary substantially from wetland environments found in the continental United States. Hawaii's wetlands comprise some 110,800 acres. Of these, more than 80% are classified as palustrine scrub-shrub and forest wetlands, located at middle to high elevations as bogs and rainforest ecosystems. However, the majority of wetland protection and restoration efforts has focused on coastal wetlands.

There are management measures for *protection of wetlands and riparian areas*; *restoration of wetland and riparian areas*; and *vegetated treatment systems*. The chapter on Hydromodifications describes the management measures, their applicability, appropriate management practices, existing implementation mechanisms, and recommended implementing actions.

Recommended Implementing Actions: The absence of a clearly defined authority or policy direction at the State level, combined with the problem of conflicting definitions and assessments used by various agencies regarding wetlands and riparian areas, currently hinders the effectiveness of local planning and regulatory activities. Although new wetland and riparian area data-gathering and management efforts continue to be developed by State agencies and private organizations, the fragmented and sometimes conflicted nature of activities has precluded the development of clear and usable information for planning and management purposes at both the State and local levels.

The following recommendations suggest actions that will improve the implementation of the management measures for wetland and riparian areas.

A. Designate the CZM Program as Coordinator for Wetlands Management

- Designate the CZM Program as facilitator and coordinator for wetlands management in Hawaii. The State's CZM law, Chapter 205A, HRS, addresses the management of wetlands. While the CZM Program has limited in-house expertise on wetlands, it can tap into the broad range of expertise residing in its networked agencies. The cross-agency, cross-organizational approach can greatly expand resources and collaborative efforts in addressing wetland issues.
- Establish a comprehensive permit review function for wetlands within the CZM Program.

B. Establish and Coordinate an Interagency Wetlands Council

- As the coordinator for wetland management, the CZM Program should establish and coordinate an Interagency Wetlands Council.

C. Integrate the CZM Program's New Wetland Functions within OSP Planning Efforts

- Integrate above recommended approaches to improving wetland policy and planning within a broader statewide, watershed- or regionally-focused planning initiative by OSP.
- Within this structure, involve community groups in the implementation of State wetlands and watershed policies and plans.
- Allocate sufficient resources to implement the above recommendations. In addition, additional resources should be provided to DOH and DLNR, which play key roles in wetlands management.

Hawaii's Coastal Nonpoint Pollution Control Program Implementation Strategy

Hawaii's experience with pollution control suggests that a voluntary approach - information and education, technical assistance and demonstration projects - is probably the key to resolving most pollution problems. Regulatory and program enforcement mechanisms also have their place in the State's efforts to protect coastal water quality. Hawaii should be able to implement its coastal nonpoint pollution control program through a mix of regulatory and non-regulatory mechanisms. Effective program implementation will depend largely on effective interagency communication and coordination.

Where Do We Go From Here?

The intent of the coastal nonpoint pollution control program is to ensure that land and water uses in the coastal zone do not degrade water quality to the point where beneficial water uses are affected. And since every land and water use has *some* potential to result in pollution, the coastal nonpoint pollution control program should be comprehensive. However, a comprehensive approach to reducing polluted runoff will require several years to implement. Fortunately, the states have several years to implement their coastal nonpoint programs.

As noted above, Hawaii's program will require development of regulatory and non-regulatory mechanisms to implement several of the required management measures. Not all of these tasks can be accomplished at once. The highest priority problems will be addressed first. Coordination with other programs and organizations that share the objectives of the coastal nonpoint pollution control program will also be an early and an ongoing priority.

The coastal nonpoint pollution control program management plan is being submitted to NOAA and EPA for their review and approval.

During the next year, the State intends to develop an implementation plan that will specify how each of the recommendations will be accomplished, quantify fiscal and human resources needed to implement program changes, prioritize implementation, and establish timelines for implementation subject to availability of resources. It will also identify lead agencies and their roles, and provide draft language, as necessary, to enable these program changes. In addition, funding sources must be identified and internal agency work plans developed before implementation of new coastal nonpoint pollution control program components can occur. The implementation plan will be developed with extensive input from

federal, State, and county agencies, non-governmental organizations, and interested individuals, using a number of mechanisms for public participation.

For More Information

For more information about the coastal nonpoint pollution control program, call the Hawaii CZM Program at 587-2880 or 1-800-468-4644 x72880 from the Neighbor Islands.

PART I - INTRODUCTION

In recent years, it has become increasingly clear that the nation's coastal waters have serious water quality problems. Virtually everywhere, the problems result from what is commonly called ***polluted runoff*** or ***nonpoint source pollution***. These terms both refer to pollutants that enter a body of water as a result of water flowing over the surface of the land, such as rainfall, irrigation or snowmelt. Common nonpoint source pollutants include soil, fertilizers, animal wastes, oil, grease, litter, lawn clippings, and home lawn care chemicals. These and other pollutants end up in public waters all across the country.

The consequences of nonpoint source pollution are all too well known: increased risk of disease from water recreation, algae blooms, fish kills, destroyed aquatic habitats, and turbid waters. Some polluted runoff results from natural causes. Most, however, results from people's activities on the land and water. Much nonpoint source pollution is preventable.

The importance of coastal water quality to the State of Hawaii cannot be overstated. Water quality is vital to Native Hawaiian cultural practices; leisure and recreation, such as swimming, boating, snorkeling, SCUBA diving, and surfing; tourism and economic strength; ecosystem and species health and diversity; fishing and other food-gathering activities; and research and technology. This document does not elaborate on why protecting water quality is important. Rather, its purpose is to describe existing mechanisms and proposed additional or revised mechanisms that will serve to restore impaired waterbodies and protect the overall water quality that is so vital to our State.

Geneology of Section 6217, CZARA: Between 1972 to 1974, the U.S. Congress passed several significant laws to protect the nation's environment. These included: the National Environmental Policy Act; the Marine Mammal Protection Act; the Marine Protection, Research, and Sanctuaries Act; the Endangered Species Act; the Federal Safe Drinking Water Act; the Clean Water Act; and the Coastal Zone Management Act.

In 1987, Congress amended the Clean Water Act (CWA) to place new emphasis on controlling polluted runoff. Section 319, CWA, for example, requires states to develop nonpoint source pollution control programs and submit assessment and management plans. Section 303(d), CWA, requires each state to identify waterbodies not achieving water quality standards [water quality limited segments (WQLSs)], categories and subcategories of nonpoint source pollutants, and state water pollution control programs. Section 305(b), CWA, requires states to monitor water quality.

In 1990, the U.S. Congress enacted the Coastal Zone Act Reauthorization Amendments (CZARA), modifying the Coastal Zone Management (CZM) Act of 1972. CZARA added a new Section 6217, entitled "Protecting Coastal Waters," requiring states with CZM programs to develop and implement coastal nonpoint pollution control programs to be approved by the federal National Oceanic and

Atmospheric Administration (NOAA) and Environmental Protection Agency (EPA). Federal funding for approved programs will come from EPA, under Section 319, CWA, and NOAA under section 306 of the CZM Act. To receive these funds, states must provide matching funds for their programs.

Section 6217, CZARA, seeks to strengthen links between federal, State, and local coastal zone management and water quality programs in order to protect coastal water quality from nonpoint source pollution and restore polluted waterbodies. To achieve this goal, Section 6217 requires states to implement management measures developed by EPA ["(g) measures"], or comparable alternatives developed by individual states, to control polluted runoff. In addition, Section 6217 requires states to develop, if necessary, additional management measures to help achieve and maintain applicable water quality standards. To receive approval from NOAA and EPA, each state must submit a coastal nonpoint pollution control program management plan. The purpose of this management plan is to describe the mechanisms and programs that are currently being implemented or need to be implemented in order to address the management measures for the control of polluted runoff.

Hawaii's Coastal Nonpoint Pollution Control Program Management Plan: This Hawaii coastal nonpoint pollution control program management plan seeks to meet the program components required under Section 6217, CZARA. This part describes Hawaii's environment, defines the program's management area, and highlights types and sources of nonpoint source pollution in Hawaii. Part II outlines mechanisms for coordinating the coastal nonpoint pollution control program. Part III describes the means of implementing the management measures for agriculture, forestry, urban, hydromodification, and marina activities, and for the protection and restoration of wetland and riparian areas. Part IV summarizes the requirements for developing additional management measures, describes the State's threatened and endangered waterbodies, and outlines the requirements for technical assistance. Part V describes the opportunities for public participation in the program development and implementation processes, and highlights public educational efforts throughout the State. Part VI outlines the federal, State, and local agencies that play a role in implementing the coastal nonpoint pollution control program. Part VII describes the State's monitoring efforts. Part VIII is a glossary. Part IX provides references.

1. Hawaii's Environment

Hawaii, the fiftieth state, possesses unique geographical, economic, and cultural features. The Hawaiian islands are shield volcanoes formed by lava flows that have eroded to varying extents. Rainfall from the interior parts of the islands have created streams that carved out steep valleys and gulches. The geographic isolation of the islands kept them free from human contact until the first Polynesians settled in the islands approximately 1,300 years ago.

During the nineteenth century, Hawaii's economy grew from a subsistence to a global economy, dependent on international trade. Sandalwood harvesting, whaling, and sugar production fueled this transformation. In the twentieth century, sugar and pineapple production, military expenditures, and tourism have dominated the economy. The decline of large-scale sugar and pineapple plantations, and in military expenditures positions tourism as the State's major industry as the islands head into the 21st century.

1.a. Geography

The Hawaiian Islands are the most isolated archipelago in the world, stretching over 1500 miles near the center of the Pacific Ocean. Eight major and 124 minor islands make up the Hawaiian Island chain. The main islands of Niihau, Kauai, Oahu, Molokai, Maui, Lanai, Kahoolawe, and Hawaii make up over 99% of the State's total land area of 6,425 square miles and most of its 1,052 miles of coastline. The rest are collectively known as the "Northwestern Hawaiian Islands" and make up only 6 square miles of land area. There is no land area in Hawaii that is more than 29 miles from the ocean (DBEDT 1994).

The islands are part of a partially exposed volcanic mountain range. All the islands in the archipelago were formed successively, starting with the northwest islands and progressing southeast to Hawaii. Kauai, approximately 3 million years old, is the oldest of the major islands, displaying advanced erosion of its mountain ranges, extensive fringing coral reef development offshore, and numerous sandy beaches along its coast. At the southeastern end of the chain is the island of Hawaii, still growing as a result of volcanic activity, with gently sloping but tall peaks, relatively little soil over one-third of the island, poorly developed coral reefs, and few sandy beaches.

Hawaii's subtropical climate has a normal average annual temperature of 77_ F and average annual rainfall of approximately 73 inches. Rainfall varies dramatically by specific location from as much as 444 inches per year at Mt. Waialeale on Kauai to less than 9 inches per year at Kawaihae on Hawaii. Most of the year, trade winds blow clouds against the northeast sides of Hawaii's mountains, giving windward areas substantially more rain than leeward areas.

Watersheds in Hawaii: Unlike the contiguous U.S., the islands of Hawaii have no major river basin systems comparable, for example, to the Missouri River or Ohio River basins. Each of the major islands is a discrete hydrological system of streams and related drainage areas. Furthermore, each hydrographic area consists of a large number of small watersheds generally not larger than one or two square miles and river courses not longer than a few miles. Typically, watersheds are steep, with highly permeable volcanic rocks and soils, and short, flashy streams.

The Hawaii CZM Program recently commissioned a project to delineate the watersheds of the eight main Hawaiian Islands (GDSI 1994). The watersheds were delineated in a format compatible with the State's geographic information system (GIS), and this information has been incorporated into the GIS. The maps delineate 614 watersheds ranging in size from less than 0.1 acre (one tenth of an

Figure I-1

Watershed Delineations

acre) to over 53,000 acres. (See Figure I-1 for general map.) The distribution of watershed sizes is quite skewed. Of Hawaii's 614 delineated watersheds, 566 (about 92%) are less than 2,000 acres (about 3.1 square miles), and 594 (about 97%) are less than 4,000 acres (about 6.2 square miles). Many of these small watersheds are undeveloped and drain the steep *pali* cliffs on the windward sides of the islands. A far smaller fraction of the watersheds are developed and, therefore, contain land uses that would need extensive management under the coastal nonpoint pollution control program.

Because many of the components of Hawaii's coastal nonpoint pollution control program go beyond the scope and resources of government agencies, communities in individual watersheds will play important roles in helping to implement the program.

Hawaiian Ahupua'a: The Hawaiian ***ahupua'a*** is a traditional ancestor of the modern-day watershed concept. The court of the Hawaiian Kingdom described the *ahupua'a* principle of land use in the case of In Re Boundaries of Pulehunui, 4 Haw. 239, 241 (1879) as follows:

> A principle very largely obtaining in these divisions of territory [*ahupua'a*] was that a land should run from the sea to the mountains, thus affording to the chief and his people a fishery residence at the warm seaside, together with the products of the high lands, such as fuel, canoe timber, mountain birds, and the right of way to the same, and all the varied products of the intermediate land as might be suitable to the soil and climate of the different altitudes from the sea soil to mountainside or top.

The Hawaiians consider the land and ocean to be integrally connected and that the *ahupua'a* also include the shoreline, as well as inshore and offshore ocean areas such as fishponds, reefs, channels, and deep sea fishing grounds. *Ahupua'a* were further divided into subzones, in both the land areas and sea areas (from Handy, Handy and Pukui, 1972: 54-56):

Mauka - land areas
kuahiwi, mountain range
wao akua, forests of the gods
wao kele, rain forests
wao kanaka, forests accessible by man
wao la'au, inland forested region
kahawai, please having water, valleys
ko kula uka, upland slope
ko kula kai, seaward slope
ko kaha kai, shoreline

Makai - sea areas
pu'eone, sandy edge, inshore dune, sand bar
po'ina nalu, point where the waves break
kai kohola, reef lagoon
kai pualena, yellowish sea at the mouth of a stream
kai ele, dark sea
kai uli, deep blue sea
kai popolohua mea a Kane, purplish-blue, reddish brown sea of Kane, far reaches of the immeasurable sea

Because many people associate themselves with the *ahupua'a* in which they live, this traditional watershed concept will also play an important role in the implementation of the coastal nonpoint pollution control program.

Streams in Hawaii: Hawaii does not have major river systems like those found on the U.S. mainland. Rather, it has numerous streams, the majority of which are active only during heavy rainfall. Hawaii has about 350 perennial streams on the five largest islands. The longest stream in the State is 33 miles in length. Typically, streams occur on the steep northeast slopes of the islands. A significant percentage of these perennial streams have some form of water diversion. On Oahu, for example, 53% of the perennial streams have been diverted (C&C of Honolulu 1990). Hawaii's flashy and perennial streams flow directly into the sea or into small drainage basins (MacDonald, *et. al.* 1983).

Stream flows consist of all the waters which accumulate and travel in a stream channel. Flows include direct surface runoff, bank storage, and groundwater seepage. Direct surface runoff comes from rainfall that moves over land and into the stream. In Hawaii, direct surface runoff is associated with a particular storm and rarely lasts more than a few days. Bank storage is the infiltration that remains near the surface above the unsaturated zone and drains by gravity into the stream. Groundwater seepage is infiltration which accumulates in a saturated aquifer passing through an unsaturated zone. Once in a zone of saturation, groundwater moves seaward unless it is interrupted by a stream channel which acts as a drain (DLNR 1992b, p. 175).

For the purposes of the coastal nonpoint pollution control program, the following definitions will be used.

- A ***stream*** is any natural water course in which water usually flows in a defined bed or channel, whether or not the flow is constant, uniform, or uninterrupted, and regardless of whether the stream has been altered or channelized. In distinguishing between a stream and other water features such as gullies, the most significant feature of a stream is the existence of a streambed that has graded or sorted deposits consisting primarily of sand, gravel, and boulders.
- A ***perennial stream*** carries water all the time.
- An ***intermittent stream*** carries water most of the time but ceases to flow occasionally because evaporation or seepage into its bed and banks exceed the available streamflow. For the purposes of this management measure, intermittent streams will also include:
  - ***ephemeral streams*** that carry water only after rains; and
  - ***interrupted streams*** that carry water generally through their length but may have sections with dry streambeds.

Hawaii classifies surface waters as "inland" or "marine" and water below land as "groundwater." Inland waters include streams and lakes and account for 25 square miles of area. There are only four lakes in the State. Marine waters include embayments, open coastal waters, and oceanic waters (DOH 1990a). Hawaii has substantial groundwater resources. Ninety percent of public water

supplies come from basal aquifers. The principal source of freshwater for the State is the Ghyben-Herzberg lens which floats on denser salt water beneath the islands (University of Hawaii 1983).

The chemical quality of Hawaii's surface waters is excellent (DOH 1993a, p. VIII-1; DLNR 1992b, p. 193) near the headwater, as evidenced by low conductivity, but surface waters can accumulate significant amounts of dissolved solids, nutrients, and bacteria from groundwater discharge, sewage effluent, industrial wastes, irrigation practices, and urban runoff before reaching the ocean. At lower elevations, the ecosystems of many natural streams have been adversely affected by channel modification, diversion of flows for irrigation, and the introduction of exotic species.

Hawaii's Soils: The soils in Hawaii are mainly of volcanic origin. To a minor extent, they are of coralline origin, or are a mixture of the two materials. Volcanic soils include volcanic ash, residual, alluvial, and colluvial soils. Most soils in Hawaii have been formed from basaltic and, to some extent, andesitic lavas and derivatives such as cinders and ash (MacDonald *et.al.* 1983). In relatively small areas near the ocean, soils have been derived from marine deposits or reef rocks. The age of the surface layer varies from a few months to many thousands of years, depending on the history of volcanic activity. This age factor, combined with the varied climatic conditions of the islands, has produced soils that differ widely in their stages of development (Masa Fujioka & Associates 1995). (See pp.20-28 of Masa Fujioka & Associates 1995 and USDA-NRCS Soil Surveys for greater information on Hawaii's soils.)

1.b. Land Uses and Ownership

The State has 4,100,000 acres of land, of which 1,419,000 acres are in forest, 923,000 acres are in pasture, 347,000 acres are in crops, and 157,000 acres are in urban or developed areas. Twelve percent of the total land area is too steep for development. (University of Hawaii 1983; DBEDT 1994)

The State of Hawaii owns 29.8%, the Federal government owns 8.4%, and private landowners (mostly a few large landowners) own 61.8% of all lands. The State leases one-fourth of its lands, principally for pasture and sugarcane production. The Department of Hawaiian Home Lands manages 187,413 acres in trust for the Hawaiian people. These lands may be exempt from most State and county land use laws, rules, and ordinances. Chapter 205, Hawaii Revised Statutes (HRS), places all land in the State into four districts - Conservation, Agriculture, Urban, and Rural. These districts comprise 47.6% (1,959,000 acres), 47.6% (1,956,000 acres), 4.6% (188,000), and less than 1% (10,000 acres), respectively, of all land in the State (University of Hawaii 1983; DBEDT 1994).

1.c. Resources/Economy

In 1990, the population of Hawaii was 1,108,229 people, with a growth rate estimated to be slightly over two percent per year. Of the total State population, 986,172 residents live in urban areas (89%) and 122,058 residents (11%) live in rural areas. The City and County of Honolulu, which encompasses the island of Oahu, has the largest population of all the islands and the highest percentage of

urban population. There are 836,231 people on Oahu, with 806,429 (96.4%) in urban areas and 29,802 (3.6%) in rural areas. Hawaii County, which encompasses the island of Hawaii, has 120,317 residents, of which 73,343 (61%) live in urban areas and 47,182 (39%) live in rural areas. Kauai County, which includes the islands of Kauai and Niihau, has the highest percentage of rural residents. Of 51,177 residents, 28,264 (55%) live in urban areas, while 22,913 (45%) live in rural areas. Maui County, which includes the islands of Molokai, Lanai, and Maui, has 100,504 residents, with 78,343 (78%) in urban areas and 22,161 (22%) in rural areas.

The 1992 Gross State Product for Hawaii was $29 billion. In 1990, tourism ($9.4 billion), defense ($3.2 billion), sugarcane production ($329 million), and pineapple production ($216 million) were the State's major industries. In 1993, 6.1 million visitors came to Hawaii, with an average daily visitor count of 148,800 (DBEDT 1994).

In 1992, there were 4,500 farms in Hawaii, occupying 1.7 million acres and generating $435 million in crop sales. Sugar, with $154 million in sales, covered the largest acreage, followed by pineapple, with $102 million in sales. Flowers and nursery products generated $70 million in sales, while macadamia nuts generated $33 million. Other diversified crops include coffee, fruits, vegetables, and taro, which collectively produced $176 million in sales. Livestock operations accounted for $88 million in sales (DBEDT 1994).

Forests, fisheries, and minerals are other major resources. Forest and water reserves occupy 1.7 million acres, with 700,000 acres in timberlands. In 1993, 3,836 commercial fishers landed 25 million pounds of fish with a value of $60 million. Aquaculture aggregate value was $7 million. Mineral production, mostly cement and crushed stones, was valued at $135 million in sales (DBEDT 1994).

Hawaii has valuable coastal ecosystems, including wetlands, reef flats, embayments, sheltered coves, sand beaches, and coral reefs. Because of Hawaii's geographical isolation, hundreds of species of flora and fauna found nowhere else in the world occupied the islands in historical times. The increase in alien species brought to the islands, especially over the past two hundred years, has seriously reduced native species populations. The *Federal Register* lists more than 500 species and subspecies of native fauna and flora for inclusion on endangered, threatened, or extinct organisms lists (DBEDT 1994; OSP 1990).

Hawaii has a significant number of recreational areas, many of which depend on good water quality. Of the 56 miles of sandy beaches in the State, for example, 24.4 miles are considered accessible, safe, and suitable for swimming. There are more than 1,600 recognized surfing sites around the State. Hawaii also has facilities to moor over 3,000 recreational vessels. Additionally, the State has 7 national parks, 76 State parks, and 569 county parks. Almost half of the peak weekend recreational activities in Hawaii occur at offshore or shoreline areas (DBEDT 1994; NOAA and DPED 1978).

1.d. Culture

Historians estimate that more than 300,000 Hawaiians occupied the Hawaiian Islands when Captain James Cook first arrived in 1778. During the 19th century, the population of native Hawaiians declined sharply because of diseases brought by the growing number of American and European missionaries and merchants. Also during the 19th century, sugar plantation owners brought indentured Chinese laborers to work on their plantations. By the early 20th century, sugar and pineapple plantation owners began to replace these workers with Japanese, Portuguese, Puerto Rican, Korean, and Filipino contract laborers. Since then, other immigrant groups, namely Samoans, have come to Hawaii in increasing numbers.

The major ethnic groups in Hawaii are Caucasians (24%), Japanese (20%), Filipinos (11%), and Chinese (5%). Persons of mixed race are the largest population group, making up 31% of the population, including part-Hawaiians who make up 20%. Filipinos are the fastest growing ethnic group. The presence of these and other ethnic groups leads to a remarkable variety of religious backgrounds and affiliations, cultures and customs, and languages and dialects in Hawaii (DBEDT 1994).

2. Coastal Nonpoint Pollution Control Program Management Area

Hawaii has recognized the need to coordinate management of all land and water areas of the State in order to protect its coastal resources. Thus, Hawaii's coastal zone management area is defined in Chapter 205A-1, HRS, to include "all lands of the State and the area extending seaward to the limit of the State's police power and management authority, including the United States territorial sea." Obviously, as a state comprising relatively small islands of volcanic origin, virtually all land areas of the State drain to the ocean. Therefore, for the purposes of the coastal nonpoint pollution control program, its management area will parallel the coastal zone management area of the State.

3. Types and Sources of Nonpoint Pollution in Hawaii

Nonpoint sources of pollution in Hawaii include sediments, nutrients, toxic chemicals, pathogens, acidity, and freshwater inflows. Sediments from eroded soils increase turbidity in coastal waters and can accumulate on critical habitats such as coral reefs. Researchers have estimated the sediments generated by each island to be 182,944 tons/year for Hawaii, 294,300 tons/year for Kauai, 138,320 tons/year for Lanai, 207,020 tons/year for Maui, 214,560 tons/year for Molokai, and 102,700 tons/year for Oahu, for a total of 1,139,844 tons per year (Technical Committee on Nonpoint Source Pollution Control 1978). Nutrients, including fertilizers, washed into coastal waters may lead to eutrophication -- the increased decomposition of organic materials in coastal waters leading to a depletion of oxygen. Toxic chemicals, including metals, petroleum-based products, and pesticides, can pose a significant risk to coastal water quality and marine

organisms. Coastal waters containing significant amounts of pathogens -- disease-causing organisms such as bacteria, viruses, and parasites -- pose a threat to humans health. Acidic waters are unusual in the State, although volcanic activity on the island of Hawaii causes some waters to be acidic. This type of polluted runoff is natural and will not be addressed by the coastal nonpoint pollution control program. Freshwater inflows are unique to Hawaii, stemming primarily from the seepage of fresh groundwater through porous lava rocks and tubes into the ocean and are also considered a natural source of runoff (DOH 1990a).

Land-based activities are the primary source of polluted runoff problems statewide. Agricultural, forestry, urban, marina, and hydromodification activities cause most of these problems. Storms and heavy rains generate runoff which picks up the nonpoint sources of pollution associated with these activities and carries them downstream to the coastal waters. In addition, when land-based activities degrade wetlands and riparian areas, they damage important natural areas that would otherwise absorb and filter polluted runoff before it reaches coastal waters.

(a) Agriculture: Agricultural activities, such as soil disturbances, grazing, nutrient and pesticide applications, irrigation, and cane washing contribute significant amounts of nonpoint source pollutants to coastal waters, especially during heavy rains. Agricultural activities are major sources of sediments, nutrients, toxic chemicals (pesticides, herbicides, and insecticides), and pathogens (DOH 1990a; DOH 1975; University of Hawaii 1969).

Sediment is the most prevalent and visible source of polluted runoff from agricultural lands. The amount of rainfall, erodibility of soils, slopes, field layout, cultivation practices, conservation practices, and vegetation cover are factors that determine the amount of soil erosion (with attached nutrients and pesticides) from agricultural lands. In 1992, the U.S. Department of Agriculture identified 38,900 acres of cultivated land in Hawaii that are "highly erodible" and required conservation practices to be implemented on these lands to reduce the potential for soil erosion (USDA 1992). Improper grazing management techniques in several areas have also resulted in high erosion rates (DOH 1990a).

(b) Forested Lands: Erosion from commercial silviculture activities can lead to increased sedimentation of surface and coastal waters. Pathogens from and erosion caused by feral pigs on forested lands also contribute to polluted runoff. Silvicultural operations may damage riparian areas, increasing or decreasing natural stream flows and harming important habitats. Excessive debris from these operations may increase the organic matter in both surface and coastal waters, which depletes dissolved oxygen, and may also disrupt stream flows. Nutrients from forestry fertilizers, including nitrogen and phosphorus, and chemicals used in silvicultural operations may accumulate in surface and coastal waters. Because there are no large-scale commercial forestry operations taking place in the State at this time, polluted runoff from forestry is not currently considered a major water quality problem in Hawaii. However, management measures for forestry are addressed in this document because, with increasingly

silvicultural activities, forestry has the potential to generate increasing amounts of polluted runoff.

(c) Urban Areas: Urban areas are primary sources of pathogens and sediments in coastal waters. Wastewater, stormwater runoff, and cesspool seepage can be major sources of pathogens and inorganic solids; construction activities can be major sources of sedimentation. These activities can increase turbidity and eutrophication rates in coastal waters, and decrease dissolved oxygen levels and aquatic life.

Other nonpoint source pollutants from urban areas include nutrients (organics, sulfates, sulfides, and phosphates) and toxic chemicals (heavy metals, oil, grease, gasoline, and pesticides). Many of these pollutants originate from household, lawn, and backyard activities. Wastewater and stormwater wash them into coastal waters. Stormwater runoff also washes pollutants from roads and industrial areas into coastal waters. In most urban areas, flood control structures channel stormwater directly into the ocean. These discharges may create imbalances in salinity which limit the growth of coral reefs (DOH 1990a; MBA International 1993; DOH 1975; University of Hawaii 1969).

(d) Marinas and Recreational Boating: The major source of nonpoint pollution associated with marinas and recreational boating is wastes discharged from vessels. These wastes include organic and inorganic materials, petroleum products, and paint shavings. Other activities, such as boat washing and painting, deposit pollutants into marinas (DOH 1990a; DOH 1975).

(e) Hydromodifications (Channelization, Channel Modification, Dams, and Streambank and Shoreline Erosion): As of 1990, over 19% of Hawaii's 376 perennial streams had been altered in some way (DLNR 1990). Urban development resulting from population growth and the expansion of diversified agriculture may lead to more hydromodifications throughout the State. These modifications to flowing water affect wetlands, riparian habitats, and other coastal ecosystems. Stream channelization in urban areas increases runoff flows into coastal waters such as Hilo Bay and Kaneohe Bay. Nutrients and sediments, previously filtered out by riparian areas, now pollute the waters in these bays.

4. Hawaii's Coastal Nonpoint Pollution Control Program Development

The goal of Hawaii's coastal nonpoint pollution control program is to protect coastal waters from polluted runoff. Maintaining good water quality throughout the State is important to Hawaii's economy and way of life. To attain this goal, the CZM Program seeks to coordinate all programs within the State designed to control polluted runoff. It seeks to manage significant land and water use activities in the coastal zone that may contribute to polluted runoff.

A priority of the coastal nonpoint pollution control program development process has been to develop a comprehensive program that is realistic and implementable

in Hawaii. To date, the CZM Program has undertaken the following activities in developing the coastal nonpoint pollution control program:

- established working and focus groups to assist in the program development process (See Part V for a detailed description of the composition and activities of these groups.);
- held public informational meetings and made presentations around the State to educate the public about the program requirements;
- contracted consultants to conduct research necessary for program development and to write a preliminary draft program management plan which was the basis for this draft coastal nonpoint pollution control program management plan;
- facilitated agency and public review and comment on this draft management plan; and
- revised the management plan based on agency and public comments, and prepared responses to public comments.

The CZM Program and DOH will now submit the coastal nonpoint pollution control program management plan to EPA and NOAA for their review and approval.

During the next year, the State intends to develop an implementation plan that will specify how each of the recommendations described in this management plan will be accomplished, quantify fiscal and human resources needed to implement program changes, prioritize implementation, and establish timelines for implementation subject to availability of resources. It will also identify lead agencies and their roles, and provide draft language, as necessary, to enable these program changes. In addition, funding sources must be identified and internal agency work plans developed before implementation of new coastal nonpoint pollution control program components can occur. The implementation plan will be developed with extensive input from federal, State, and county agencies, non-governmental organizations, and interested individuals, using a number of mechanisms for public participation.

PART II - PROGRAM COORDINATION

Section 6217(a)(2) of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 requires state coastal zone management and water quality programs to jointly develop that state's coastal nonpoint pollution control program. Specifically, the federal statute states that:

> *A State program under this section shall be coordinated closely with State and local water quality plans and programs developed pursuant to sections 208, 303, 319, and 320 of the Federal Water Pollution Control Act (33 USC 1288, 1313, 1329, and 1330) and with State plans developed pursuant to the Coastal Zone Management Act of 1972, as amended by this Act. The program shall serve as an update and expansion of the State nonpoint source management program developed under section 319 of the Federal Water Pollution Control Act, as the program under that section relates to land and water uses affecting coastal waters.*

The intent of the coastal nonpoint pollution control program is to build upon, rather than duplicate, existing programs. The array of existing programs will be loosely bound together in a "network" under the rubric of the coastal nonpoint pollution control program. Ultimately, there will be one statewide program for the management and control of polluted runoff, elements of which will be implemented by a number of existing agencies. The development of this program brings together the Coastal Zone Management (CZM) Program's experience in coordination, and land and water use control, and the Department of Health's (DOH) expertise in water pollution management.

1. Coordination With Water Quality Program

Hawaii's Clean Water Act (CWA) Section 319 program is administered by DOH, Environmental Planning Office, and provides matching grant assistance for nonpoint source pollution prevention and control projects. Priorities for funding are developed by DOH staff in consultation with the various federal, State, and county agencies with responsibilities for nonpoint source pollution control. Program priorities include both geographic and programmatic priorities.

The basic principles and strategies for nonpoint source pollution control developed by the DOH are directly applicable to the coastal nonpoint pollution control program. Basic strategies include assessing the resources affected by nonpoint source pollution, providing education and technical assistance, supporting demonstration projects, and, in appropriate instances, enforcing water quality standards and regulations.

2. Coordination With Coastal Management Program

Hawaii's CZM Program coordinates a network of State and county agencies implementing land and water use controls, resource management, and environmental protection. In developing the CZM Program in 1977, the legislature recognized that an array of regulatory mechanisms already existed, and, rather than add to existing layers of bureaucracy, the CZM Program could bind the existing network of management controls to achieve coastal management objectives. The core coastal program contains objectives and policies concerning recreational resources; historic resources; scenic and open space resources; coastal ecosystems, including coastal, surface, and ground water quality; economic uses; coastal hazards; managing development; public participation; and marine resources. This networked arrangement enables the CZM Program to address coastal and marine resources management in a holistic manner.

The CZM network is a coordinating device intended to ensure that State and county agencies address coastal management objectives and policies. To implement the network, Chapter 205A, Hawaii Revised Statutes (HRS), requires that coastal zone objectives and policies be binding on all agencies. As a result, at least 58 State laws and county ordinances and rules are incorporated into the Hawaii CZM Program. State agencies included in Hawaii's CZM network are DOH, the Land Use Commission, the Department of Land and Natural Resources, the Office of Environmental Quality Control, the Department of Transportation, the Department of Business, Economic Development, and Tourism, and the Department of Agriculture.

In addition to the various State agencies, a series of State-mandated county regulatory programs are incorporated into Hawaii's CZM Program. These include erosion control programs subject to review and approval by DOH (Chapter 180C, HRS) and programs to ensure beach access and park dedication (Chapter 46-6, HRS). Most importantly, the county planning departments play a major role in implementing the CZM Program through the Special Management Area (SMA) and shoreline setback provisions, as provided for in Chapter 205A, HRS.

The fundamental role of core CZM Program staff is to coordinate all of the several and various parties that have some interest in the use and management of a particular coastal resource. The desired outcome of coordination efforts is to arrive at State and local policies and implementation mechanisms for managing scarce and valuable resources. For example, the Hawaii CZM Program staff currently have fundamental responsibilities for coordinating interests, projects, initiatives, and the development of policies related to managing ocean resources, mitigating natural coastal hazards, managing beaches, and protecting coral reef ecosystems.

3. Hawaii's Coastal Nonpoint Pollution Control Program Development

The coastal nonpoint pollution control program is yet another coastal resources management initiative that is mostly a coordination mechanism involving those agencies which are already part of the CZM network. When Hawaii first received the draft program guidance documents from the National Oceanic and Atmospheric Administration (NOAA) and Environmental Protection Agency (EPA), the CZM Program immediately initiated a process to coordinate the various parties and agencies interested in and affected by the new mandate. This coordination has remained a hallmark of the developing phases of the coastal nonpoint pollution control program in Hawaii.

Ultimately, while the CZM Program has had the lead in coordinating the development of the State's overall coastal nonpoint pollution control program, the development of the separate program elements themselves has been a shared responsibility. The CZM Program and DOH, with significant assistance from other State, federal and county agencies, non-governmental organizations, and individuals, have jointly developed Hawaii's coastal nonpoint pollution control program management plan. The coastal nonpoint pollution control program will continue to rely on the resources, expertise, programs, and authorities of other agencies and organizations during its continuing development and implementation.

Actual development of the program has been a collaborative effort involving (see complete listing in Appendix A):

- citizens
- business owners
- environmental organizations
- industry organizations
- professional associations
- county planning departments
- county departments of public works
- Hawaii CZM Program
- Hawaii Department of Health
- Hawaii Department of Land and Natural Resources
- Hawaii Department of Agriculture
- Hawaii Department of Transportation
- Hawaii Department of Business, Economic Development and Tourism
- Hawaii Department of Hawaiian Home Lands
- Office of Hawaiian Affairs
- University of Hawaii
- Cooperative Extension Service
- Soil and Water Conservation Districts
- U.S. Department of Agriculture
- Natural Resources Conservation Service
- National Marine Fisheries Service
- U.S. Forest Service

- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- Hickam Air Force Base
- U.S. Coast Guard

Hawaii's program submittal reflects the results of collaborative discussions on the management measures and how they should be implemented in Hawaii. Developing Hawaii's coastal nonpoint pollution control program has also involved describing existing programs, and collaborating in the recommendation of new or revised program components, where necessary, to meet federal requirements. The successful implementation of this program will require continued coordination among agencies, organizations, and land and water users.

PART III - MANAGEMENT MEASURES for HAWAII

Section 6217(b) of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 requires state coastal nonpoint pollution control programs to provide for the implementation, at a minimum, of management measures in conformity with guidance published by the National Oceanic and Atmospheric Administration (NOAA) and Environmental Protection Agency (EPA).

Section 6217(g)(5), CZARA, defines "***management measures***" as:

> *economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives.*

In other words, management measures are akin to goals which states must address through the implementation of regulatory or non-regulatory nonpoint source pollution control mechanisms and land and water users must implement through the application of best management practices. The management measures are to be based on technical and economic achievability, rather than on cause-and-effect linkages between particular land and water use activities and particular water quality problems. In this sense, coastal nonpoint pollution control programs are preventive rather than reactive. The legislative history made it clear that the intent of technology-based management measures was to allow states to concentrate their resources initially on developing and implementing measures that experts agree will reduce pollution significantly.

According to NOAA and EPA's *Program Development and Approval Guidance*, states must provide for implementation of management measures for each of the nonpoint source categories and sub-categories identified in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* to protect coastal waters generally. States must also provide for the implementation of management measures specified for wetlands and riparian area protection.

In its coastal nonpoint pollution control program management plan, a state must respond to each of the management measures contained in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* by either (1) providing for the implementation of that measure or a comparable alternative, or (2) justifying why the management measure is not included in the program. A state must also describe how it will ensure implementation of each management measure. While Hawaii is not excluding any management measures from its program at this time, many management

measures have been changed to better adapt them to suit Hawaii's unique physical and social environment.

Current Hawaii State and county regulations directly or indirectly address, in some form, all of the management measures for the coastal nonpoint pollution control program. Nevertheless, the implementation of many management measures can be strengthened through changes to existing programs and regulations and/or the development of new regulatory and non-regulatory program elements. Some administrators cite inadequate fiscal and staff resources as major impediments to effective implementation of these management measures. Others express concern over long-standing nonpoint source pollution problems that have not been resolved despite implementation of existing measures. In some cases, agencies may need to promulgate regulations to implement statutes. Ambiguity also exists in some statutes over which agency has the lead in enforcing water quality mandates. Finally, there is a need for better coordination among agencies charged with implementing and enforcing measures (Pacific Environmental Research 1994).

Land and water users will use "***best management practices***" to implement the coastal nonpoint pollution control program management measures. Best management practices (BMPs) are structural and non-structural techniques that are implemented on-site to control polluted runoff. EPA anticipated that the management measures typically would be implemented by applying one or more management practices appropriate to the source, location, and climate. While EPA lists and describes management practices in its guidance docment, it is left to the individual states to determine the spectrum of BMPs that will be used individually or in combination to address the management measures in their state. Because there is often site-specific variability in the selection of appropriate practices, as well as in the design constraints and pollution control effectiveness of practices, specific practices are not mandated by the management measures. This flexibility enables a site-specific selection of appropriate BMPs and "updating" of BMPs as technologies and economic conditions change.

CHAPTER 1: Introduction

This Part consists of eight chapters - this introduction (Chapter 1), six chapters discussing specific management measures for Hawaii (Chapters 2 through 7), and a chapter describing general recommendations for implementation (Chapter 8). Chapters 2-7 correspond to the land and water use activities and chapters used in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. These chapters are:

- Chapter 2: Agriculture
- Chapter 3: Forestry
- Chapter 4: Urban Areas
- Chapter 5: Marinas and Recreational Boating
- Chapter 6: Hydromodifications - Channelization, Channel Modifications, Dams, Streambank and Shoreline Erosion
- Chapter 7: Wetland and Riparian Areas

1.a. Organization of Chapters

Each chapter normally begins with an introduction that discusses the character of the specific land and water use activity in Hawaii, provides relevant background information on the potential nonpoint source pollution problems associated with the land or water use activity (condensed from the EPA guidance document), and describes other information relevant to the chapter.

Each chapter contains a section for each management measure for that land or water use activity. These management measures may either be ones provided in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* or alternatives adapted for Hawaii. In many cases, the information on the management measures was developed in coordination with the focus group for that land or water use activity. If the recommendations for implementing the management measures for a specific land or water use activity are organized around one existing or proposed program, then these recommendations are outlined at the end of the chapter. Otherwise, specific recommendations for implementation follow each management measure.

1.b. Organization of Management Measure Sections Within Chapters

Each management measure is laid out in a consistent manner, generally similar to the layout in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. Each management measure section begins with the management measure itself, whether it be the EPA's or the State's alternative. Where the State is proposing an alternative management measure, EPA's management measure is shown, with additions indicated by underlined type (*e.g.*, addition), and deletions indicated by brackets around and strikethru across the deleted text (*e.g.*, [~~deletion~~]).

Under each management measure, the following information is provided:

- **Description** - This reference section generally explains the nonpoint source pollution problems associated with the land or water use activity

and why the management measure is needed. This description is generally condensed from EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. When the State has developed an alternative management measure, a justification for that alternative is also described.

- **Applicability** - The applicability of the management measure is described in terms of specific land and water use activities, or size and types of land and water uses that are affected by the management measure.

  ***NOTE**: Historically, there have been some ambiguities in what constitutes a point and a nonpoint source of water pollution. For the purposes of the coastal nonpoint pollution control program, any storm water runoff that ultimately is regulated under a Clean Water Act Section 402(p) National Pollutant Discharge Elimination System (NPDES) permit is no longer subject to this program once the permit is issued.*

- **Management Practices** - Management practices that can be used on-site to implement the management measure are listed and, in some cases, described.

- **Implementation of Management Measure** - The current implementation of the management measure is described. This description includes the existing organizational structure (which agencies have lead and supporting roles), the existing regulatory and non-regulatory mechanisms, and, where appropriate, additional needs for management measure implementation.

CHAPTER 2: Agriculture

I. INTRODUCTION

I.1. Agriculture of Hawaii

In the past decade, the types and distribution of agricultural activities in Hawaii have changed significantly, shifting from sugarcane and pineapple plantation agriculture to a more diversified agriculture. A large amount of land that was under pineapple or sugarcane cultivation since 1985 is now experiencing a major transition to diversified crops. Other land has been converted to urban developments and still other land now lies fallow.

Pineapple: Since the mid-1980s, pineapple operations have been completely eliminated or reduced on Molokai, Lanai and Oahu. There are ongoing efforts to develop diversified agriculture to fill the void left by the demise of pineapple. These efforts have had limited success, and many former pineapple lands lie idle.

Sugarcane: Sugarcane operations have also been dramatically reduced in Hawaii in recent years. After many decades with a successful sugar industry, thousands of acres of sugarcane land on Kauai, Oahu, and Hawaii Island have been taken out of production. Some of this land has gone into other crops, such as coffee or macadamia nuts. Agroforestry is being considered for other former sugarcane land. Nonetheless, a majority of these lands are either in pasture or lay fallow.

crop	peak year	peak year	acreage for current yr	acreage for current yr
pineapple	1960 (earliest statistics available)	75,000	22,300	1994
sugarcane	1932	254,563	75,000	1995

Diversified Agriculture: Due to the ongoing transition in the type of agriculture in Hawaii, the crop and acreage composition will continue to shift in favor of diversified agriculture. Diversified agriculture in Hawaii includes flowers and nursery products, vegetables and melons, macadamia nuts, cattle, milk, fruits (excluding pineapples), poultry, forage, grain, forest products, hogs, coffee, taro, and other livestock. The current composition of agricultural uses is listed in Table III-1 below.

The transition in Hawaiian agriculture brings with it some inherent economic and environmental uncertainties. New crops will bring new cultivation practices and will use different quantities and types of fertilizers and pesticides. The effects of these changes on coastal water quality are uncertain. This transition, albeit economically wrenching, also provides a critical opportunity to examine the practices farming operations currently use, or are likely to use, while diversified agricultural operations are being expanded and practices and activities are being defined. This unique set of circumstances requires a cooperative and creative

process to incorporate agricultural, environmental, public, and agency concerns. This process must account for the inherent economic uncertainties of the changing face of agriculture in Hawaii, and have the ability to reward innovative and cooperative activities that protect coastal water quality. In addition, it must be able to weed out ineffective and destructive activities before they become codified into common practice.

Table III-1: 1993 Acreage for Major Agricultural Activities in Hawaii

Agricultural Activity	Acreage
Sugarcane	132,200
Pineapple	22,000
Coffee	7,000
Landscape/Recreation	12,000
Nurseries	2,495
Ranching/Pasture	1,092,000
Forestry (commercial, proposed)	10,000 to 60,000
Seed Industry	1,250
Vegetables	5,300
Fruits	6,900
Feed	1,126
Macadamia Nuts	20,500

Source: DOA 1994

Most of the nonpoint source pollution problems associated with agricultural activities are related to the intrinsic problems with the activity, including the systematic disturbance of the land and the use of fertilizers and pesticides. To this extent, agriculture in Hawaii is not inherently different from the U.S. mainland. However, there are some physical and economic characteristics that are singularly and in combination unique to Hawaii. These include year-round intensive agriculture, small watersheds, significant use of marginal lands, significant amount of leased land, and higher cost of land, goods and services.

Year-round intensive agriculture - Due to Hawaii's year-round sub-tropical temperatures, agriculture *can* be practiced year-round. This possibility together with the high cost of land leads to year-round cultivation to maximize production. Year-round cultivation means year-round land disturbance and year-round use of fertilizers and pesticides.

Small watersheds - Watersheds in Hawaii are typically small, and storms are high intensity. Physical controls such as retention/detention basins generally require a significant amount of land area. Since land prices in Hawaii are high and the amount of available land area is limited, operators may be more reluctant to use retention/ detention basins than on the U.S. mainland.

Significant use of marginal lands - Because land prices in Hawaii are high and the available land area is limited, agricultural production is often maximized by cultivating even marginal lands. These lands are often steep and may require additional best management practices (BMPs) to meet pollution prevention goals. Additional BMPs may not be economically achievable in many cases.

Significant amount of leased land - A significant amount of the land used by agricultural operations in Hawaii are leased from either the State or large private land owners. There are relatively few land *owners* and a large number of land *lessees*. This can lead to less incentive for lessees to install permanent structures and to take on other long-term stewardship responsibilities.

Higher cost of land, goods and services - Hawaii's average property values for agricultural lands are comparable to urban land in other states. Because of the islands' distance from mainland sources, a majority of goods must be shipped in, therefore adding significantly to their cost. Labor costs are also higher than comparable agriculture industries in other states.

I.2. Types of Polluted Runoff Associated with Agriculture

The primary agricultural nonpoint source pollutants are nutrients, sediment, animal wastes, salts, and pesticides. These pollutants are described in more detail under the relevant management measure. Agricultural activities also have the potential to directly impact the habitat of aquatic species through physical disturbances caused by livestock or equipment, or through the management of water.

I.3. Existing Programs Addressing Agricultural Sources of Polluted Runoff

A. State Department of Agriculture: The Hawaii Department of Agriculture (DOA) is made up of a number of divisions that take care of a specific regulatory or developmental area to help assure the quality of the State's agricultural products both for export and for local consumption. The Agricultural Loan Division promotes agricultural development by stimulating, facilitating, and granting loans to qualified farmers and aquaculturists. The Plant Industry Division's programs are designed to protect Hawaii's agricultural industries, natural resources, and the public from the entry and establishment of detrimental plants, animals, insects, weeds, and other pests; and to assure the safe and efficient use of pesticides in Hawaii. The Marketing Division inspects and grades commodities in wholesale and retail establishments, monitors current market conditions, collects and publishes agricultural statistics, promotes locally grown and manufactured products, and monitors the production, processing and selling of milk. The Agricultural Resource Management Division administers the development and management of the State's irrigation systems, and manages the State's agricultural parks. The Animal Industry Division safeguards Hawaii's livestock and poultry industries by controlling and preventing the entry and spread of pests and diseases.

B. State Department of Land and Natural Resources (DLNR), Soil and Water Conservation Districts (SWCDs): There are 16 local SWCDs in Hawaii. Their roles are to apply available technical, financial and educational resources to meet conservation needs of local land users. In this regard, the SWCDs initiate conservation projects; help implement the State's nonpoint source water pollution management plan (DOH); and approve conservation plans mandated by the federal Food Security Act, administered by the USDA Natural Resources Conservation Service (NRCS). Most importantly, agricultural activities are exempt from the county grading ordinances if a conservation plan is approved by the local SWCD. A list of approved plans are sent by each local SWCD to the respective county department of public works. These tasks are accomplished through the cooperation of the land users and the SWCDs, rather than through governmental regulations.

Chapter 180, HRS, administered by the Department of Land and Natural Resources (DLNR), provides the authority to establish SWCDs as governmental subdivisions of the State. To achieve their mission, Chapter 180 permits the SWCDs to aid land users with equipment and materials for conservation work; conduct surveys and investigations; initiate, construct, improve or maintain projects; sell, acquire or manage properties; effect agreements or litigation; develop or approve conservation programs and plans; establish fees for services; and as a condition to extend benefits, require or receive materials, services or funds.

Each SWCD is governed by five directors: three elected by agricultural land users or owners of respective districts and two appointed by the Board of Land and Natural Resources. All directors have three year terms. The directors are assisted by associate directors and directors emeritus. All directors and associates work as volunteers to provide agricultural land users with conservation assistance, including conservation plan reviews and approvals.

The SWCDs work with federal (NRCS, FSA) and State (DOH, the CZM Program, CES) agencies to help implement government programs. They, in turn, are assisted by these agencies with technical resources and funding. The counties' departments of public works engage the services of their respective districts to implement the grading ordinances in agricultural areas. Maui County districts are responsible for all areas, not just agricultural lands.

C. University of Hawaii Cooperative Extension Service (CES): The CES is the extension unit of the College of Tropical Agriculture and Human Resources at the University of Hawaii. Its mission is to enable people to improve their lives through an educational process that uses scientific knowledge to address issues and needs. This process involves transferring and expressing scientifically-based research knowledge in practical, usable educational programs, presentations, and services.

Hawaii CES is dedicated to supporting and fostering the efforts of agricultural practitioners and communities to transform Hawaii's agriculture into an appropriate, sustainable, diversified agriculture that contributes to Hawaii's

economy, is safe for consumers and the environment, and enhances Hawaii's appeal for tourism. CES provides a number of services at the local level, with offices and technical experts on all islands.

D. U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS): The NRCS administers programs designed to protect and improve land and water resources. The mission is carried out through two major activities: (1) conservation operations; and (2) watershed and flood prevention operations. Legislative authority allows NRCS to undertake the following activities in Hawaii: provide technical assistance to land users relating to soil and water resource concerns; develop plans for erosion control; work with communities to develop watershed plans; provide disaster assistance; map soils and publish soil surveys; and administer incentive programs such as the Wetland Reserve and Forestry Incentive Programs.

In Hawaii, NRCS works through the 16 SWCDs. The SWCDs cover approximately 98% of the State and are serviced through seven NRCS field offices located around the State in Lihue, Honolulu, Wailuku, Hoolehua, Hilo, Kamuela, and Kealakekua.

NRCS is a non-regulatory agency that primarily assists agriculture land users in developing plans to treat existing and potential resource (soil, water, plant, air, animal) problems, with emphasis on considering the entire watershed and the human element as part of the planning process. Although plans may be all-encompassing, the implementation of the plans is strictly voluntary for land users. NRCS partners with other agencies to find solutions to resource problems. NRCS has working agreements with the following agencies: CES, Department of Health (DOH), DOA, Department of Hawaiian Home Lands (DHHL), the CZM Program, DLNR, Rural Economic and Community Development, FSA, and U.S. Army.

NRCS will continue to provide planning assistance to agricultural operations based on its priorities. However, NRCS does not foresee an increase in resources or funding to work with *all* the agricultural operators in the State. Therefore, its participation in the Pollution Prevention Plan (PPP) Program described in this chapter will be on a limited basis. NRCS will continue to assist in developing PPPs and also continue to train others to prepare these plans based on funding, resources, and priorities.

E. U.S. Department of Agriculture, Farm Service Agency (FSA), Agricultural Conservation Program (ACP): The Agricultural Conservation Program is administered by FSA as a joint effort by agricultural producers, federal and State agencies, and other groups to restore and protect the nation's land and water resources, and preserve the environment. ACP provides cost-sharing with farmers and ranchers in carrying out conservation and environmental protection practices on agricultural lands that result in long-term public benefits. ACP is designed to help prevent soil erosion and water pollution, protect and improve productive farm and ranch land, conserve water used in agriculture, preserve and develop wildlife habitat, and encourage energy

conservation measures. Only those practices that significantly contribute to these objectives and that are not required as a condition of receiving assistance through other federal programs are eligible for cost-share assistance. ACP funds are authorized annually by Congress. The maximum cost-share limitation for ACP is $3,500 per person per fiscal year. (A person is defined as an individual, group, partnership, corporation, or other legal entity owning or operating a farm or ranch.)

II. MANAGEMENT MEASURES

The following management measures apply generally to agricultural lands around the State. Specific applicability is described under each management measure. During the implementation plan development process, the State will define a farm size below which the agricultural management measures will not apply. This definition will be based on pollution potential and recognized State and/or county definitions of "farm" and/or "agricultural operation."

A. Erosion and Sediment Control Management Measure

Apply [~~the erosion component of a Conservation Management System (CMS) as defined in the Field Office Technical Guide of the U.S. Department of Agriculture - Soil Conservation Service~~] any combination of conservation practices and management that achieves an acceptable level of treatment[(i)] to minimize the delivery of sediment from agricultural lands to surface waters, or

Design and install a combination of management and physical practices to settle the settleable solids[(ii)] and associated pollutants in runoff delivered from the contributing area for storms of up to and including a 10-year, 24-hour frequency.

II.A.1. Description

Sediment is the result of erosion. It is the solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, or gravity. The types of erosion associated with agriculture that produce sediment are (1) sheet and rill erosion, and (2) gully erosion. Soil erosion can be characterized as the transport of particles that are detached by rainfall, flowing water, or wind. Eroded soil is either redeposited on the same field or transported from the field in runoff.

The fine soil and organic products comprising sediment can be held in suspension in water and deposited in a stream, estuary, embayment, or open coastal waters. In addition to smothering corals and other benthic species, sediments can create unsightly and odorous mud flats in enclosed bays.

Sediments also transport chemical substances (*e.g.*, pesticides, nitrate, and ammonium) bound to the eroded soils.

The problems associated with soil erosion are the movement of sediment and associated pollutants by runoff into a waterbody. Application of this management measure will reduce the mass load of sediment reaching a waterbody and improve water quality and the possible uses of the water resource. The measure can be implemented by using one of two different strategies or a combination of both. The first, and most desirable, strategy would be to implement practices on the field that would prevent erosion and the transport of sediment from the field. Practices that could be used to accomplish this are conservation tillage, field road stabilization, contour strip-cropping, terraces, and critical area planting.

The second strategy is to route runoff from fields through practices that remove sediment. Practices that could be used to accomplish this are filter strips, field borders, grade stabilization structures, sediment retention ponds, floculants, water and sediment control basins, and terraces. Site conditions will dictate the appropriate combination of practices for any given situation.

This management measure is an alternative management measure to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

***Justification for Alternative Management Measure**: The agriculture focus group proposed this alternative management measure because of biogeophysical and economic circumstances that are, either singularly or in combination, unique to Hawaii. It was the opinion of the agriculture focus group that these circumstances would render the (g) measure unimplementable in Hawaii for the following reasons.*

- *(i) Conservation Management System (CMS): The (g) measure refers to applying the erosion control component of an NRCS Conservation Management System (CMS). The CMS developed by NRCS was intended for use as part of a voluntary program of natural resources management. A CMS has two levels of treatment. The first is a Resource Management System (RMS). Currently, in order for a farmer to meet the criteria for a RMS, that farm must have an annual soil rill and sheet erosion rate that is less than "T" as determined by the Universal Soil Loss Equation (USLE) or the Revised Universal Soil Loss Equation (RUSLE). The USLE or RUSLE was never intended to provide absolute soil loss numbers and its reliability on steeper lands under high rainfall conditions is questionable. Rather, it was meant to be used as an erosion prediction tool that estimates soil erosion for planning purposes. A RMS, as part of a voluntary program, sets an erosion control goal for a land user to strive towards, rather than establishing an enforceable level of treatment. In Hawaii, many farms are unable to achieve a RMS level of treatment due to rainfall and slope conditions. Recognizing this, NRCS has established a second level of treatment called an Acceptable Management System (AMS) that may be implemented as it is needed. An AMS sets an erosion control goal for the*

specific resource use which is achievable in view of social, cultural, and economic constraints of the area. For NRCS planning purposes, the State Conservationist approves the AMS level for erosion control.

This alternative management measure provides the State the flexibility to apply the combination of conservation practices and management that achieves an acceptable level of treatment. This will enable Hawaii to determine the acceptable level of treatment, based not only on nonpoint source pollution control but also on economic, social, cultural and geographic criteria. Establishing the process for determining an acceptable level of treatment will be undertaken during FY 96-97, providing resources are available.

- *(ii) Settling the Settleable Solids: Rainstorms in Hawaii can be "flashy" and intense. Rainfall statistics for Hawaii show that it is not unusual for major agricultural areas to receive 10 to 14 inches of rainfall during 10-year, 24-hour storm events. The volumes of water that must be contained from such events and the limited land available for containment will likely lead to some physical and economic constraints in implementing the erosion and sediment control management measure. In addition, annual median rainfall in Hawaii ranges from about 7 to over 450 inches per year. Locations with large differences in annual rainfall can easily be within sight of one other, leading to extreme rainfall gradients. Annual rainfall in the agricultural region of central Maui, for instance, ranges from about 12 to over 75 inches per year within about 12 miles. A single large parcel of land may require significantly different management practices in different locations. Such extreme rainfall gradients may cause problems for operators in developing effective pollution prevention practices that would be applicable to all their lands.*

  Settleable solids is defined in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters as: "Solids in a liquid that can be removed by stilling a liquid. Settling times of 1 hour or more are generally used." Hawaiian soils are generally finer-grained soils than those found on the U.S. mainland due to basaltic parent material and intense chemical weathering. Thus, physical control structures such as detention/retention basins may be less effective because only the coarsest fraction of the eroded sediment would settle out. Although detention/retention basins have been successfully used by agricultural operations in Hawaii, finer-grained soils combined with the limited size of Hawaiian watersheds would likely make this type of physical control less effective than on the U.S. mainland.

  These factors, in combination, may make it difficult to contain the volume of water generated by a 10-year, 24-hour storm event long enough to settle all the settleable solids, given the clayey nature of Hawaiian soils. Therefore, the percentage of settleable solids that must be removed in order to address this management measure will be determined by the State during FY96-97, provided resources are available.

II.A.2. Applicability

This management measure applies to activities that cause erosion on agricultural land and on land that is converted from other land uses to agriculture. Agricultural lands include:

- Cropland;
- Irrigated cropland;
- Range and pasture;
- Orchards;
- Permanent hayland;
- Managed forests;
- Specialty crop production; and
- Nursery crop production.

The intent of the management measure is to protect surface and ground water quality. Some waterbodies, such as farm ponds, have been created to water livestock. Protecting the water quality of these artificial water storage areas does not have the same priority as protecting natural streams and waterbodies.

II.A.3. Management Practices

The management practices listed below are representative of those currently in use. Numbers in parentheses indicate NRCS management practice numbers. These management practices are described in detail in the NRCS National Handbook of Conservation Practices or Field Office Technical Guide.

a. Conservation cover (327): Establishing and maintaining perennial vegetative cover to protect soil and water resources on land retired from agricultural production.
b. Conservation cropping sequence (328): An adapted sequence of crops designed to provide adequate organic residue for maintenance or improvement of soil tilth.
c. Conservation tillage (329): Any tillage or planting system that maintains at least 30 percent of the soil surface covered by residue after planting to reduce soil erosion by water; or, where soil erosion by wind is the primary concern, maintains at least 1,000 pounds of flat, small-grain residue equivalent on the surface during the critical erosion period.
d. Contour farming (330): Farming sloping land in such a way that preparing land, planting, and cultivating are done on the contour. This includes following established grades of terraces or diversions.
e. Contour orchard and other fruit area (331): Planting orchards, vineyards, or small fruits so that all cultural operations are done on the contour.
f. Cover and green manure crop (340): A crop of close-growing grasses, legumes, or small grain grown primarily for seasonal protection and soil improvement. It usually is grown for 1 year or less, except where there is permanent cover as in orchards.
g. Critical area planting (342): Planting vegetation, such as trees, shrubs, vines, grasses, or legumes, on highly erodible or critically eroding areas (does not include tree planting mainly for wood products).
h. Crop residue use (344): Using plant residues to protect cultivated fields during critical erosion periods.

i. Delayed seed bed preparation (354): Any cropping system in which all of the crop residue and volunteer vegetation are maintained on the soil surface until approximately 3 weeks before the succeeding crop is planted, thus shortening the bare seedbed period on fields during critical erosion periods.
j. Diversion (362): A channel constructed across the slope with a supporting ridge on the lower side.
k. Field border (386): A strip of perennial vegetation established at the edge of a field by planting or by converting it from trees to herbaceous vegetation or shrubs.
l. Filter strip (393): A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and wastewater.
m. Grade stabilization structure (410): A structure used to control the grade and head cutting in natural or artificial channels.
n. Grassed waterway (412): A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff.
o. Sediment basins (350): Basins constructed to collect and store debris or sediment from runoff.
p. Contour stripcropping (585): Growing crops in a systematic arrangement of strips or bands on the contour to reduce water erosion.
q. Field strip-cropping (586): Growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion.
r. Terrace (600): An earthen embankment, a channel, or combination ridge and channel constructed across the slope.
s. Water and sediment control basin (638): An earthen embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and water detention basin.

II.A.4. Implementation of Management Measure

The erosion and sediment control management measure will be implemented as a part of a single non-regulatory Agricultural Pollution Prevention Plan (PPP) Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: The county departments of public works are the lead agencies for implementing this management measure because they administer the county grading ordinances. The Soil and Water Conservation Districts (SWCDs) are also major players because they approve conservation plans which allow agricultural operations to receive an exemption from the county grading ordinances. Other federal and State agencies involved in implementation include:

- USDA-NRCS, which provides information and technical assistance on management practices;

- USDA-FSA, which provides cost-share funds for implementing management practices;
- University of Hawaii, CES, which provides information and technical assistance on management practices;
- DOH, which funds demonstration projects to develop, test and implement best management practices tailored to Hawaii's environment.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Soil Erosion and Sediment Control
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-54	Water Quality Standards
HCC	Chapter 10	Soil Erosion and Sediment Control (Hawaii County)
KCC	Chapter 22-7	Grading, Grubbing, and Stockpiling (Kauai County)
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion and Sediment Control (City and County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

The following programs encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning:

1. Cooperative Extension Service Education and Technical Assistance
2. EPA Environmental Education Grants
3. FSA Agricultural Conservation Program
4. FSA Emergency Conservation Program
5. Farmers Home Administration (FHA) Soil and Water Loans and Technical Assistance
6. FHA Resource Conservation and Development Loans
7. NRCS Conservation Operations Program
8. NRCS Small Watershed Protection Program
9. NRCS Emergency Watershed Protection Program
10. NRCS Resource Conservation and Development Program
11. NRCS Water Quality Initiative Projects
12. NRCS Conservation Reserve Program
13. NRCS Food Security Act Conservation Compliance Requirements
14. NRCS Wetland Reserve Program
15. DLNR Soil and Water Conservation Districts
16. DOH Nonpoint Source Pollution Control Program Demonstration Projects
17. State of Hawaii Agricultural Parks - Provisions in the State's agricultural park land leases require each land user to obtain an approved conservation plan with the local SWCDs.

18. Maui County Agricultural Parks - Agreements exist between the County of Maui and local SWCDs to approve conservation plans for the county's agricultural parks.
19. State DOA Farm Loan Program
20. DOH State Revolving Fund Low Interest Loan

Currently, all earthmoving activities, such as plowing, are regulated under the four county grading ordinances. Except for Oahu, these grading ordinances require land users to obtain a grading permit for any disturbances of lands greater than 1 acres. The City and County of Honolulu requires a grading permit if the disturbed area is 15,000 square feet or more. Under Chapter 180C, HRS, all county grading ordinances allow an exemption for agricultural grading conducted under an actively pursued conservation plan, which the local SWCDs approve. The NRCS and CES normally provide technical assistance to land users in developing their conservation plans, while the FSA provides cost-share funds to assist land users in installing best management practices (BMPs) as specified in their conservation plans. The non-regulatory Pollution Prevention Plan (PPP) Program envisioned by the agriculture focus group builds upon the existing non-regulatory structure of the SWCDs.

B[~~1~~]. Management Measure for Wastewater and Runoff from Confined Animal Facility [~~(Large Units)~~]

Limit the discharge from the confined animal facility to surface waters by:

(1) [~~Storing~~] Containing both the wastewater *and* the contaminated runoff from confined animal facilities that is caused by storms up to and including a 25-year, 24-hour frequency storm event. Storage structures should[~~:~~] be of adequate capacity to allow for proper wastewater utilization and constructed so they prevent seepage to groundwater;
[~~(a) Have an earthen lining or plastic membrane lining, or~~
~~(b) Be constructed with concrete, or~~
~~(c) Be a storage tank;~~]

and

(2) Managing stored contaminated runoff and accumulated solids from the facility through an appropriate waste utilization system.

[~~B2. Management Measure for Wastewater and Runoff from Confined Animal Facility (Small Units)~~]

~~**Design and implement systems that collect solids, reduce contaminant concentrations, and reduce runoff to minimize the discharge of contaminants in both facility wastewater and in runoff that is caused by sotrms up to and including a 25-year, 24-hour frequency storm. Implement these systems to substantially reduce significant increases in pollutant loadings to groundwater.**~~

~~**Manage stored runoff and accumulated solids from the facility through an appropriate waste utilization system.]**~~

II.B.1. Description

Animal waste (manure) includes the fecal and urinary wastes of livestock and poultry; process water (such as from a milking parlor); and the feed, bedding, litter, and soil with which they become intermixed. Pollutants that may be contained in manure and associated bedding materials include oxygen-demanding substances; nitrogen, phosphorus, and minor nutrients; organic solids; salts; bacteria, viruses, and other microorganisms; and sediments.

The decomposition of organic materials can deplete dissolved oxygen supplies in water, resulting in anoxic or anaerobic conditions. Methane, amines, and sulfide are produced in anaerobic waters, causing the water to acquire an unpleasant odor, taste, and appearance. Such waters can cause fish kills and be unsuitable for drinking, fishing and other recreational uses.

The goal of this management measure is to minimize the discharge from confined animal facilities of contaminants in both wastewater and runoff that is caused by storms up to and including a 25-year, 24-hour frequency storm. This would be accomplished by using management practices that reduce runoff and protect groundwater.

The problems associated with animal facilities result from runoff, wastewater, and manure. Application of this management measure will greatly reduce the volume of runoff, manure, and wastewater reaching a waterbody, thereby improving water quality and the use of the water resource. The measure can be implemented by using practices that divert runoff water from upslope sites and roofs away from the facility, thereby minimizing the amount of water to be stored and managed. Runoff water and wastewater should be routed through a settling structure or debris basin to remove solids, and then stored in a pit, pond, or lagoon for application on agricultural land. If manure is managed as a liquid, all manure, runoff, and wastewater can be stored in the same structure and there is no need for a debris basin.

This management measure does *not* require manure storage structures or areas, nor does it specify required manure management practices. This management measure does, however, address the management of *runoff* from manure storage areas. Manure may be stacked in the confined lot or other appropriate area as

long as the storage and management of runoff from the confined lot are in accordance with this management measure. If manure is managed as a solid, any drainage from the storage area or structure area or structure should be routed to the runoff storage system.

It is possible that implementation of this measure may increase the potential for movement of water and soluble pollutants through the soil profile to the groundwater. However, it is not the intent of this measure to address a surface water problem at the expense of groundwater. Wastewater and runoff control systems for animal facilities can and should be designed to protect groundwater.

This management measure is an alternative management measure to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. It also combines that management measures for large and small confined animal facility management.

***Justification for Alternative Management Measure**: The agriculture focus group proposed this alternative management measure for the following reasons.*

- *(i) Facility Size: The EPA guidance document proposes two management measures, one for "large" facilities and another for "small" facilities. The agriculture focus group recommends that only one management measure apply for all sizes, for the following reasons. First, State law does not differentiate between large and small facilities. Second, polluted runoff problems are cumulative in a watershed. Therefore, ALL facilities which may contribute to pollution problems share the responsibility for improving waste management.*

- *(ii) Facility Types: The list of storage facility types given in the (g) measure is too restrictive. Other alternatives may be viable to keep waste from leaving the confined animal facility. It is important that the storage facility be sized to provide flexibility in the operator's decision on when to apply waste to land.*

- *(iii) Containing and Managing Contaminated Runoff: The (g) measure implies that all runoff is to be contained, regardless of whether or not it is polluted. The intent of the management measure, however, is to contain and treat contaminated runoff. This alternative management measure clarifies this intent. By diverting runoff from upslope sites and roofs away from areas used to grow or house the animals, areas used for processing and storage of products, manure and runoff storage areas, and silage storage areas, the amount of runoff water to be stored and managed can be minimized.*

II.B.2. Applicability

This management measure applies to all new confined animal facilities regardless of size and to all existing confined animal facilities that contain the following number of head or more:

	Head	Animal Units[1]
Beef Feedlots	50	50
Stables (horses)	100	200
Dairies	20	28
Layers	5,000	50[2]
		165[3]
Broilers	5,000	50[4]
		165[5]
Turkeys	5,000	900
Swine	100	40

except those facilities that are required by Federal regulation 40 CFR 122.23 to apply for and receive discharge permits. That section applies to "concentrated animal feeding operations," which are defined in 40 CFR Part 122, Appendix B. In addition, 40 CFR 122.23(c) provides that the Director of a National Pollutant Discharge Elimination System (NPDES) discharge permit program may designate any animal feeding operation as a concentrated animal feeding operation upon determining that it is a significant contributor of water pollution. This has the effect of subjecting the operation to the NPDES permit program requirements. If a confined animal facility has a NPDES permit, then it is exempt from this management measure.

Facilities containing fewer than the number of head listed above are not subject to the requirements of this management measure.

A *confined animal facility* is a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

- Animals (other than aquatic animals) have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and
- Crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

---

[1]Animal unit: A unit of measurement for any animal feeding operation calculated by adding the following numbers: the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 25 kilograms (approximately 55 pounds) multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0 (40 CFR Part 122, Appendix B).

[2]If facility has a liquid manure system, as used in 40 CFR Section 122, Appendix B.

[3]If facility has continuous overflow watering, as used in 40 CFR Section 122, Appendix B.

Two or more animal facilities under common ownership are considered, for the purposes of these guidelines, to be a single animal facility if they adjoin each other or if they use a common area or system for the disposal of wastes.

Confined animal facilities, as defined above, include areas used to grow or house the animals, areas used for processing and storage of product, manure and runoff storage areas, and silage storage areas.

Wastewater and runoff from confined animal facilities are to be controlled under this management measure. Runoff includes any precipitation that comes into contact with any manure, litter, or bedding. Wastewater is water discharged in the operation of an animal facility as a result of any or all of the following: animal or poultry watering; washing, cleaning, or flushing pens, barns, manure pits, or other animal facilities; washing or spray cooling of animals; and dust control.

II.B.3. Management Practices

Most of the management practices listed below are described in more detail in DOH's *Draft Guidelines for Livestock Waste Management* (June 1995).

a. Buffer Zones for Operations: Livestock feeding operations, and its waste collection, transfer, treatment and storage facilities should provide a minimum buffer distance of 1000 feet from public drinking water resources, and 50 feet from surface water resources.
b. Buffer Zones for Waste Products: Livestock waste products should not be applied to land within 150 feet from public drinking water resources, and 50 feet from surface water resources.
c. State and County Land Use Codes: All activities must be consistent with appropriate State and County land use codes.
d. Critical Wastewater Disposal Areas: Livestock facilities and waste systems should be located, if at all possible, within designated Non-Critical Wastewater Disposal Areas ("Non-CWDA") and below the Underground Injection Control ("UIC") Line, "No Pass" Line, or Drinking Water Protection Line.
e. Waste and Runoff Containment: Animal feeding operations should be designed and operated to contain all process-generated waste plus the runoff from a 25 year, 24 hour rainfall event that comes in contact with the waste. The full 25 year, 24 hour storage provision should always be restored as soon as favorable weather and site conditions permit.
f. Waste Storage Structures: Waste storage structures designed to receive waste contaminated runoff, or designed to overflow during catastrophic or chronic rainfall precipitation events should be provided with an overflow spillway and flow contour so as to provide the best overflow discharge location, flow direction, and outfall area having the least public and environmental impact.
g. Rainfall Diversion: Rainfall diversion drainage and overflow discharge contours subject to scouring should be provided with soil erosion and sediment control measures.
h. Lined Soil Surfaces: Soil surfaces serving the confined feeding operation, or the waste system collection, transfer conduit, treatment, or storage foundation for process generated waste containing drainable liquids should be

of material "impervious" to liquid infiltration. Soil surfaces serving heavy use areas such as manure storage/composting area, or other waste system collection, transfer, treatment, or storage foundation for dry livestock waste residuals exposed to weather should be of material restrictive to liquid infiltration.

i. County Building Code: Proposed facilities must be consistent with appropriate County building code requirements.
j. Process Waste and Runoff Management: Management of all process generated waste and runoff, including dead animals or animal parts, should be provided on a reliable basis until its final disposal, reuse, or removal and transfer to a legitimate second party recipient.
k. Record Disposition of Wastes: Waste disposal, reuse, or transfer to second party recipients should be recorded.
l. Storage Structure Level Indicator: Storage structures receiving process generated waste and/or rainfall runoff should be provided with a level indicator which can readily determine the volume in storage, storage volume available, minimum storage volume, and critical 25 year, 24 hour storage volume.
m. Proper Equipment and Equipment Operators: Equipment, and equipment operators capable of performing waste system operation and management tasks without damage to pollution prevention plan measures should be readily available.
n. Soil Erosion and Sediment Control: Soil erosion and sediment control measures should be maintained on soil surfaces subject to scouring and runoff effects.
o. Waste Transport: Waste residues should be transported in spill proof vessels.
p. Reuse Land Application: Proper land application of wastes should be followed.
q. Facilities Operation and Maintenance: Holding ponds and treatment lagoons should be operated such that the design storm volume is available for storage of runoff. Facilities filled to or near capacity should be drawn down as soon as all site conditions permit the safe removal and appropriate use of stored materials. Solids should be removed from solids separation basins as soon as possible following storm events to ensure that needed solids storage volume is available for subsequent storms. Diversions will need periodic reshaping and should be free of trees and brush growth. Gutters and downspouts should be inspected annually and repaired when needed. Established grades for lot surfaces and conveyance channels are to be maintained at all times.
r. Facilities Abandonment: Upon abandoning, retiring or permanently discontinuing use of a commercial animal operation, the owner should render it safe and free of vectors; all waste residues should be removed and properly disposed/reused; excavated facilities such as waste conveying ditches should be dewatered, desludged and filled completely with soil, sand, gravel or similar non-organic matter; and appropriate vegetation should be established for erosion and sediment control purposes.
s. Streamside Buffer: Provide a 50-foot natural buffer on all undeveloped stream corridors.
t. Manure Storage: Store accumulated manure on high ground to prevent rainwater ponding.

II.B.4. Implementation of Management Measure

The management measure for facility wastewater and runoff from confined animal facilities will be implemented as a part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: DOH, Environmental Management Division, is the lead agency for implementing this management measure because it implements programs for wastewater management, water pollution control, safe drinking water, and solid waste management. Other federal and State agencies involved in implementation include:

- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices specified in land-user conservation plans;
- University of Hawaii, CES, which provides information and technical assistance on management practices; and
- SWCDs, which provide technical assistance on best management practices on agricultural lands.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 322	Nuisances; Sanitary Regulations
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-11	Sanitation
HAR	Chapter 11-23	Underground Injection Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-55	Water Pollution Control
HAR	Chapter 11-58.1	Solid Waste Management Control
HAR	Chapter 11-62	Wastewater Systems
DOH	Draft Guidelines for Livestock Waste Management (June 1995)	

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

The DOH *Draft Guidelines for Livestock Waste Management* (June 1995) outline roles and responsibilities of the livestock industry, their assisting agencies/consultants and DOH in the concerted effort to reduce and prevent water

pollution. The guidelines also provide guidance to owners of livestock operations in obtaining approval from DOH to construct and operate livestock facilities and waste systems. The document is termed "guidelines" because it may be modified, as permitted by regulation, until a clear and workable program among the livestock industry, assisting agencies/ consultants, and DOH is established. This gives planners, resource managers, and the livestock industry flexibility and time to evaluate and modify the document. DOH may elect to develop administrative rules from these guidelines at a future date.

The approval to construct and operate a livestock feeding or processing operation and its waste system is obtained through a plan review and approval process conducted by DOH. The review and approval process is intended to provide DOH an opportunity to ensure that the application of demonstrated pollution control technology, processes, and operation and maintenance practices reflects the standards of performance required by rule. It also ensures that the owner of the facility is informed of and agrees to the pollution prevention plan measures under which they are allowed to operate.

The approval to construct a commercial livestock feeding or processing operation, and/or its waste system, requires a site plan, design plan, and pollution prevention plan. These plans are submitted to DOH, Environmental Management Division, and must be of sufficient scope and depth for determining the standard of performance of the planned measures. Prior to the introduction of livestock, DOH must conduct a site inspection of the completed construction and be satisfied that the facilities, waste systems, and pollution prevention measures are constructed in accordance with the approved plan specifications. The approval to operate is based on the condition that the livestock operation, its waste systems and pollution control measures will be operated and maintained in accordance with the approved plan measures.

In addition, Chapter 11-11, HAR, administered by DOH, requires that animal manure is disposed of in a sanitary manner and animal enclosures are kept clean and free from accumulation of excreta and other filth, and pests. Chapter 11-23, HAR, also administered by DOH, classifies exempted aquifers and underground sources of drinking water. Unless expressly exempted, all aquifers are considered underground sources of drinking water. Underground Injection Control (UIC) maps indicate the boundary line of exempted aquifers. No large municipal or community serving systems can use injection wells above the UIC line. Certain activities are also prohibited interior of the line.

C. Nutrient Management Measure

Develop, implement, and periodically update a nutrient management plan to: (1) apply nutrients at rates necessary to achieve realistic crop yields, (2) improve the timing of nutrient application, and (3) use agronomic crop production technology to

increase nutrient use efficiency. When the source of the nutrients is other than commercial fertilizer, determine the nutrient value [~~and the rate of availability of the nutrients~~]. Determine and credit the nitrogen contribution of any legume crop. Soil and/or plant tissue testing should be used [~~routinely~~] at a suitable interval. Nutrient management plans contain the following core components:

(1) Farm and field maps showing acreage, crops, soils, and waterbodies.

(2) Realistic yield expectations for the crop(s) to be grown, based [~~primarily on the producer's actual yield history, State Land Grant University yield expectation for the soil series, or NRCS Soils-5 information for the soil series~~] on achievable yields for the crop. Individual producer constraints and other producer's yields would be considered in determining achievable yields.

(3) A summary of the soil condition and nutrient resources available to the producer, which at a minimum would include:
- **[~~Soil test results for pH, phosphorus, nitrogen, and potassium~~] An appropriate mix of soil (pH, P, K) and/or plant tissue testing or historic yield response data for the particular crop;**
- **Nutrient analysis of manure, sludge, mortality compost (birds, pigs, etc.), or effluent (if applicable);**
- **Nitrogen contribution to the soil from legumes grown in the rotation (if applicable); and**
- **Other significant nutrient sources (e.g., irrigation water).**

(4) An evaluation of field limitations based on environmental hazards or concerns, such as:
- **[~~Sinkholes~~] Lava tubes, shallow soils over fractured bedrock, and soils with high leaching or runoff potential,**
- **[~~Lands near~~] Distance to surface water,**
- **Highly erodible soils, and**
- **Shallow aquifers.**

(5) [~~Use of the limiting nutrient concept to establish the mix of nutrient sources and requirements for the crop based on a realistic yield expectation~~] Best available information is used in developing recommendations for the appropriate mix of nutrient sources and requirements for the crops.

(6) Identification of timing and application methods for nutrients to: provide nutrients at rates necessary to achieve realistic crop yields; reduce losses to the environment; and avoid applications

as much as possible [~~to frozen soils and~~] during periods of leaching or runoff.

(7) Methods and practices used to prevent soil erosion or sediment loss.

[~~(7)~~] (8) Provisions for the proper calibration and operation of nutrient application equipment.

II.C.1. Description

Nitrogen and phosphorus are the two major nutrients from agricultural land that may degrade water quality. Nutrients are applied to agricultural land in several different forms and come from various sources, including commercial fertilizers, manure from animal production facilities, effluent and sludge from (domestic) wastewater treatment plants, legumes and crop residue, irrigation waters, and atmospheric deposition.

All plants require nutrients for growth. In aquatic environments, nutrient availability usually limits plant growth. Nitrogen and phosphorus generally are present at background or natural levels below 0.3 and 0.05 mg/L, respectively. When these nutrients are introduced into a stream, lake, or estuary at higher rates, aquatic plant productivity may increase dramatically. This process, referred to as cultural eutrophication, may adversely affect the suitability of the water for other uses.

The goal of this management measure is to minimize edge-of-field delivery of nutrients and minimize leaching of nutrients from the root zone. Nutrient management is pollution prevention achieved by developing a nutrient budget for the crop, applying nutrients at the proper time, applying only the types and amounts of nutrients necessary to produce a crop, and considering the environmental hazards of the site. Nitrogen is the major agricultural nutrient of concern with respect to nonpoint source pollution. Phosphorus as a nonpoint source pollutant can be minimized by controlling erosion in most areas.

This measure may result in some reduction in the amount of nutrients being applied to the land, thereby reducing the cost of production as well as protecting both groundwater and surface water quality. However, application of the measure may in some cases cause more nutrients to be applied where there has not been a balanced use of nutrients in the past. This will usually allow all the nutrients to be used more efficiently, thereby reducing the amount of nutrients that will be available for transport from the field during the non-growing season. While the use of nutrient management should reduce the amount of nutrients lost with surface runoff to some degree, the primary control for the transport of nutrients that are attached to soil particles will be accomplished through the implementation of erosion and sediment control practices.

Nutrient management plans should be reviewed and updated at least once every 3 years, or whenever a crop rotation or nutrient source is changed. Application equipment should be calibrated and inspected for wear and damage periodically, and repaired when necessary. Records of nutrient use and sources should be

maintained along with other management records for each field. This information will be useful when it is necessary to update or modify the management plan.

This management measure amends the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

***Justification for Alternative Management Measure**: The agriculture focus group proposed this alternative management measure for the following reasons.*

- *(i) Rate of Availability of the Nutrients: There is currently limited use of organic nutrient sources and almost no data on nutrient availability from these sources under Hawaiian conditions.*

- *(ii) Soil testing: Nutrient applications for various crops in Hawaii are based on soil and/or plant tissue testing, depending on crop. Soil testing is not very useful in Hawaii to determine nitrogen availability. Nitrogen recommendations need to be based on realistic yield estimates and nitrogen uptake data. Soil testing, however, is essential to make recommendations for other nutrients, in order to assure that they do not limit nitrogen efficiency ("limiting nutrient concept").*

  In addition, much of the soil response data necessary to implement the (g) measure is currently not available for many crops in Hawaii. Most of the agricultural land in Hawaii has been farmed exclusively in pineapple and sugarcane for decades. Therefore, what soil testing data that does exist (such as nutrient availability and yield response) are for only those crops. Further, these data have been seen as proprietary and have not been generally available. Since agriculture in Hawaii is quickly shifting to diversified crops, much of the soil testing data necessary to implement the (g) measure for many crops is limited.

  Some crops, such as tree crops, do not rely on soil testing; rather, tissue analysis is used instead.

- *(iii) Testing Intervals: Suitable intervals for nutrient testing vary greatly for various crops and soils.*

- *(iv) Yield Expectations: Basing yield expectations on yield histories would limit potential yields. In addition, there are no Land Grant University or NRCS Interpretation Record data on potential yields in Hawaii.*

- *(v) Environmental Hazards: Sink holes do not exist in Hawaii. However, lava tubes can be considered an important environmental hazard.*

- *(vi) Nutrient Recommendations: Using the limiting nutrient concept is restrictive. Best available information for development recommendations for*

the appropriate mix of nutrient sources and requirements for the crop can include nutrient ratios and crop logging for various crops. This information can take into account more than a single limiting nutrient or other growth factor at a time.

- *(vii) Frozen Soils: No periodically frozen soils are farmed in Hawaii.*

- *(viii) Preventing Nutrient Losses Due to Soil Erosion: An additional component for nutrient management plans was added as (7). Using methods and practices to prevent soil erosion and sediment loss is important to prevent nutrient losses, since nutrients bind to soil particles and can become a nonpoint source pollution problem when sediment-laden runoff enters surface and coastal waters.*

II.C.2. Applicability

This management measure applies to activities associated with the application of nutrients, including both manures and commercial fertilizers, to agricultural lands.

II.C.3. Management Practices

The following general management practices should be adapted and refined to specific crops. The following crop categories may have different sets of BMPs or management strategies: leafy vegetables; other vegetables; root crops; flowers and other ornamentals; foliage; grain crops (non-legumes); legumes; forage crops; tree crops (including banana); and turf grass.

a. Soil sampling (should not be required for all crops until necessary calibration data is available);
b. Plant tissue testing (should not be required for all crops until necessary calibration data is available);
c. Timing of fertilizer applications to maximize plant utilization and minimize loss to environment;
d. Fertilizer placement;
e. Nutrient credits for previous crops and green manures;
f. Animal manure/compost management;
g. Base fertilizer applications on realistic yields;
h. Irrigation systems management;
i. Slow-release fertilizers;
j. Variable fertility management;
k. Improve soil properties;
l. Control soil erosion;
m. Identify environmentally-sensitive areas;
n. Buffer areas to protect environmentally-sensitive areas;
o. Provide a 50-foot natural buffer on all undeveloped stream corridors;
p. Consider the surface loss and leaching potential of soils.

II.C.4. Implementation of Management Measure

The nutrient management measure will be implemented as part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural

management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: No one agency clearly has the lead in implementing this management measure at this time. Federal and State agencies involved in implementation include:

- DOH, Environmental Management Division, which implements programs for water pollution control and safe drinking water;
- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices;
- University of Hawaii, CES, which provides information and technical assistance on management practices;
- County departments of public works, which administer the county grading ordinances; and
- SWCDs, which approve conservation plans that allow agricultural operators to receive an exemption from the county grading ordinances.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Soil Erosion and Sediment Control
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-54	Water Quality Standards
HCC	Chapter 10	Soil Erosion and Sediment Control (Hawaii County)
KCC	Chapter 22-7	Grading, Grubbing, and Stockpiling (Kauai County)
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion and Sediment Control (City and County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

At present, there are no enforceable mechanisms that specifically address the management of agricultural nutrients. Nutrients are addressed generally under the State's water pollution control statutes. While Chapter 342E, HRS, addresses polluted runoff control, administrative rules have not yet been developed to implement it. These rules will be developed in conjunction with the further development and implementation of the coastal nonpoint pollution control program. Chapter 11-54, HAR - the administrative rules that implement much of

Chapter 342D, HRS - has no procedures in place to enforce the water quality standards it sets forth. Further, there is almost no monitoring in place that would be capable of enforcing any of these regulatory mechanisms.

Nutrient management on agricultural lands in Hawaii has been undertaken on a voluntary basis. Land users work with the NRCS and CES to develop appropriate nutrient management practices. As part of its resource conservation planning, NRCS now addresses nutrient and pesticide management, especially in relation to environmentally-sensitive areas. While NRCS does not make recommendations on types of fertilizers, rates or application methods, the CES does. A computerized system is being developed by CES to assist in making general fertilizer recommendations. The Hawaiian Sugar Planters Association makes fertilizer recommendations for sugarcane and the pineapple companies provide recommendations for pineapple crops.

Assessing the effectiveness of nutrient management plans may be challenging. Unlike soil conservation planning, for which the Universal Soil Loss Equation is used, there are no viable quantitative criteria known to the agriculture focus group for evaluating an appropriate mix of BMPs for nutrient management.

The following laboratories currently undertake soil and plant tissue analysis: the University of Hawaii's Agricultural Diagnostic Service Center (ADSC); Mainland facilities; HC&S Plantation (Maui); and Maui Land and Pine. HC&S and Maui Land and Pine have laboratories for analysis of company samples only. Because of limited local facilities, there are problems getting timely results from soil analyses in Hawaii. As a result, many growers send their samples outside of the State to get more timely results. However, the Mainland labs are not familiar with Hawaiian soils, and the soil extractants used for analysis in Mainland labs may be inappropriate for Hawaii soil samples. Manure and compost analysis is also not readily available in Hawaii.

Realistic yield expectation data are available primarily for plantation crops such as sugarcane, pineapple and, to a lesser extent, macadamia nuts and coffee. There are currently inadequate data to guide nutrient recommendations for most other crops. Likewise, soil analysis calibration data are most available for plantation crops and are limited or absent for other crops in Hawaii. Tissue sample data are available for most important tree crops, and data generated outside Hawaii can be used with care for other crops. However, the amount of nutrients to be applied to the soil for adequate plant levels may vary widely with soil type, particularly for phosphorus.

D. Pesticide Management Measure

[~~To reduce contamination of surface water and ground water from pesticides:~~

~~**(1) Evaluate the pest problems, previous pest control measures, and cropping history;**~~
~~**(2) Evaluate the soil and physical characteristics of the site including mixing, loading, and storage areas for potential leaching or runoff of pesticides. If leaching or runoff is found to occur, steps should be taken to prevent further contamination;**~~
~~**(3) Use integrated pest management (IPM) strategies that:**~~
~~**(a) Apply pesticides only when an economic benefit to the producer will be achieved (i.e., applications based on economic thresholds); and**~~
~~**(b) Apply pesticides efficiently and at times when runoff losses are unlikely;**~~
~~**(4) When pesticide applications are necessary and a choice of registered materials exists, consider the persistence, toxicity, runoff potential, and leaching potential of products in making a selection;**~~
~~**(5) Periodically calibrate pesticide spray equipment; and**~~
~~**(6) Use anti-backflow devices on hoses used for filling tank mixtures.**~~**]**

To eliminate the unnecessary release of pesticides into the environment and to reduce contamination of surface water and ground water from pesticides:

(1) Use integrated pest management strategies where available that minimize chemical uses for pest control.
(2) Manage pesticides efficiently by:
(a) calibrating equipment;
(b) using appropriate pesticides for given situation and environment;
(c) using alternative methods of pest control; and
(d) minimizing the movement of pest control agents from target area.
(3) Use anti-backflow devices on hoses used for filling tank mixtures.
(4) Enhance degradation or retention by increasing organic matter content in the soil or manipulating soil pH.

II.D.1. Description
The term *pesticide* includes any substance or mixture of substances used for preventing, destroying, repelling, or mitigating any pest or intended for use as a

plant regulator, defoliant, or desiccant. The principal pesticidal pollutants are the active and inert ingredients and any persistent degradation products. Both the degradation and adsorption characteristics of pesticides are highly variable.

The goal of this management measure is to reduce contamination of surface water and ground water from pesticides. The basic concept of the pesticide management measure is to foster effective and safe use of pesticides without causing degradation to the environment. The most effective approach to reducing pesticide pollution of waters is, first, to release fewer pesticides and/or less toxic pesticides into the environment and, second, to use practices that minimize the movement of pesticides to surface water and ground water. In addition, pesticides should be applied only when an economic benefit to the producer will be achieved. Such an approach emphasizes using pesticides only when, and to the extent, necessary to control the target pests. This usually results in some reduction in the amount of pesticides being applied to the land, plants, or animals, thereby enhancing the protection of water quality and possibly reducing production costs as well.

At a minimum, effective pest management requires evaluating past and current pest problems and cropping history; evaluating the physical characteristics of the site; applying pesticides only when an economic benefit to the producer will be achieved; applying pesticides efficiently and at times when runoff losses are unlikely; selecting pesticides (when a choice exists) that are the most environmentally benign; using anti-backflow devices on hoses used for filling tank mixtures; and providing suitable mixing, loading, and storage areas.

Pest management practices should be updated whenever the crop rotation is changed, pest problems change, or the type of pesticide used is changed. Application equipment should be calibrated and inspected for wear and damage each spray season, and repaired when necessary. Anti-backflow devices should also be inspected each spray season and repaired when necessary.

This management measure is an alternative management measure to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

> ***Justification for Alternative Management Measure**: The agriculture focus group proposed this alternative management measure because it felt that the (g) measure contained specific best management practices rather than providing overall goal statements. The alternative management measure provides general objectives for pesticide reduction and improved use-efficiency which can be implemented through various combinations of management practices.*

II.D.2. Applicability

This management measure applies to activities associated with the application of pesticides to agricultural lands.

II.D.3. Management Practices

a. Topography/hydrogeology. Determine the physical characteristics of the site:
- lava tubes, depth of soil, type of soil, slope;
- depth to groundwater;
- proximity to surface water, wetlands, or sensitive ecosystems;
- location of wells, well protection areas;
- prevailing wind direction and potential for erosion;
- water erosion potential;
- determine if the site is in a state pesticide management area either for groundwater or for endangered species; and
- review resource conservation plan.

b. Storage Area. Use already available printed material.

c. Keep storage area locked.
- Provide containment of spills.
- Provide ventilation.

d. Provide safety equipment.
- Provide shelf for Materials Safety Data Sheet (MSDS) information.
- Provide media for spill treatment.
- Post phone numbers for medical service.

e. Mixing, handling, clean-out, disposal of containers.

f. Follow recommendations of National Agricultural Chemicals Association.

g. Site History. Determine the vegetative cover and site history of the site:
- previous vegetative cover;
- current vegetative cover;
- soil information, such as soil series and slope range, pH, permeability, available water holding capacity, organic matter, etc., depending on historical plant growth and or proposed production;
- acres/area;
- rainfall distribution, amount; and
- method of irrigation.

h. Pest History. Determine the pest history of the site:
- pest problem(s) requiring action;
- previous pest control practices;
- describe practice if non-chemical;
- records of chemical control, including product name (EPA registration number), rate of application, amount, approximate date of application, location (annual summary);
- recommended pest control practice(s); and
- method of application.

i. Pest Management - Biological Control.
- Use integrated pest management techniques where practical.
- Eliminate routine preventive practices that may generate pollutants.
- Introduce and foster natural enemies.
- Use scouting to determine pest populations.
- Release sterilized male insects.
- Use biorational materials (*e.g.*, Bt).
- Use cover crop(s) to reduce surface run off, herbicide use, and leaching.
- Establish refuges (*i.e.*, ground cover, hedges) to harbor beneficial insects.
- Use trap crops to attract and contain pests.

- Use living sods to mask crops and provide barriers to pesticide movement.
- Provide ground covers to harbor beneficial insects (orchards).
- Rotate crops.
- Employ intensive crop rotations using broadcast planted ground covers to aid in breaking pest life cycles.
- Use field sanitation techniques to minimize harboring pests.

j. Pest Management - Cultural Control.

- Optimize crop vigor.
- Use resistant crop cultivars or varieties.
- Preserve predator habitats.
- Use vegetative filter strips.
- Use conservation tillage, such as no-till or ridge-tillage.
- Time crop production to coincide with lower insect population.

k. Pest Management - Chemical Control.

Pheromone Control:

- Aid in monitoring pest populations.
- Mass trapping.
- Disrupt mating or other behaviors of pests.
- Attract predators/parasites.

Pesticides:

- Apply the lowest effective rate as specified on the label or as determined and documented locally by testing.
- Minimize rates and/or runoff through appropriate timing of applications (*i.e.*, during optimum life cycle of pest for control, not before rainfall event, not in high winds).
- Determine economic threshold of pest population by field when scouting techniques are available and established for local pest/crop situation.
- Use efficient application methods and properly trained personnel.
- Consider the addition of drift-reducing agents.
- When choices of products exist, consider the following factors in making the final selection:
  - target efficacy;
  - toxicity of product to non-target organisms;
  - leaching and runoff potential;
  - persistence/bioaccumulation;
  - frequency of applications;
  - quantity required; and
  - previous detections off target within similar site circumstances.
- Use application equipment appropriate to the task.
- Calibrate application equipment frequently to assure correct application rates (replace worn or damaged nozzles, verify pump pressure and/or sprayer speed for proper application rate).
- Use alternate pesticide products when and where feasible to reduce the development of resistance and/or persistence in the environment.
- Use tested tank mixes to minimize number of applications and increase efficacy.
- Efficiently employ non-synthetic pesticides such as those used in organic farming.

l. Pest Management - Physical/Mechanical Control.

- rotary weed hoe;
- between-row cultivation;
- flaming with tractor mounted burners;
- weeder geese, shielded foraging (animal foraging restricted and/or controlled by physical means);
- organic mulch plastic film, solarization with clear plastic;
- woven plastic fabric.

II.D.4. Implementation of Management Measure

The pesticide management measure will be implemented as a part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: While most of the management practices of this management measure are implemented on a voluntary basis by land users, some regulatory controls exist over the use and distribution of pesticides. The Department of Agriculture (DOA), Pesticides Branch, is the lead agency for implementing those measures regulating pesticides. Other federal and State agencies involved in implementation include:

- SWCDs, which provide technical assistance on BMPs for agricultural lands;
- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices;
- University of Hawaii, CES, which provides information and technical assistance on management practices; and
- DOH, which funds demonstration projects to develop, test and implement management practices tailored to Hawaii's environment.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 149A	Hawaii Pesticides Law
HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 4-66	Pesticides
HAR	Chapter 11-21	Cross-Connection and Back-Flow Control
HAR	Chapter 11-54	Water Quality Standards

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education,

technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

Chapter 149A, HRS, administered by DOA, states that "no person shall: (1) use any pesticide in a manner inconsistent with its label; (2) use, store, transport or discard any pesticide or pesticide container in any manner which would have unreasonable adverse effects on the environment; ....(6) fill with water, through a hose, pipe, or other similar transmission system, any tank, implement, apparatus, or equipment used to disperse pesticides, unless the tank, implement, apparatus, equipment, hose, pipe or other similar transmission system is equipped with an air gap or a reduced pressure principle backflow device meeting the requirements under section 340-2 [Safe Drinking Water Law] and the rules adopted thereunder" (§149A-31). Any person who violates Chapter 149A, HRS, or its rules may be issued civil penalties, including fines ranging from not more than $5,000 to not more than $1,000 (depending on whether the violator is a business or private entity) or criminal penalties, including misdemeanor charges and fines ranging from not more than $25,000 to not more than $1,000 (depending on whether the violator is a business or private entity).

Chapter 11-21, HAR, administered by DOH, requires that a reduced pressure principal back-flow preventer or air gap separation be installed as part of any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system [§11-21-7(a)(4), HAR]. Chapter 11-21, HAR, also requires that all back-flow prevention devices be approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research and are tested, periodically inspected, and properly maintained.

Chapter 4-66, HAR, administered by DOA, relates to the registration, licensing, certification, recordkeeping, usage, and other activities related to the safe and effective use of pesticides. It requires that those who apply or directly supervise others who apply restricted use pesticides be certified. This certification requires some understanding of the environmental concerns of using pesticides. This requirement is implemented under the CES/DOA Pesticide Applicator Program. Certification under Category 1 for agricultural applicators is required [§4-66-56(1), HAR]. Certification is not required for those using pesticides that are not classified as "restricted use."

E. Grazing Management Measure

Protect range, pasture and other grazing lands:

(1) By implementing one or more of the following to protect sensitive areas (such as streambanks, wetlands, estuaries, ponds, lake shores, <u>near coastal waters/ shorelines,</u> and riparian zones):

(a) Exclude livestock,
(b) Provide stream crossings or hardened watering access for drinking,
(c) Provide alternative drinking water locations,
(d) Locate salt and additional shade, if needed, away from sensitive areas, or
(e) Use improved grazing management (e.g., herding) to reduce the physical disturbance and reduce direct loading of animal waste and sediment caused by livestock; *and*

(2) By achieving either of the following on all range, pasture, and other grazing lands [~~not addressed under (1)~~]:
(a) Implement range and pasture [~~components of a Conservation Management System (CMS) as defined in the Field Office Technical Guide of the USDA-NRCS by applying the progressive planning approach of the USDA-NRCS~~] conservation and management practices that achieve an acceptable level of treatment to reduce erosion, or
(b) Maintain range, pasture, and other grazing lands in accordance with activity plans established by [~~either the Bureau of Land Management of the U.S. Department of the Interior or~~] the Division of Land Management of DLNR, [~~the Forest Service of USDA~~] federal agencies managing grazing land, or other designated land management agencies.

II.E.1. Description
The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water, and vegetation. Improper livestock grazing and equipment use may damage stream banks and shores, riparian vegetation, channels and the water column.

While the focus of the grazing management measure is on the riparian zone and shoreline areas, the control of erosion from range, pasture, and other grazing lands above these areas is also encouraged. Application of this management measure will reduce the physical disturbance to sensitive areas and reduce the discharge of sediment, animal waste, nutrients, and chemicals to surface waters.

For any grazing management system to work, it must be tailored to fit the needs of the vegetation, terrain, class or kind of livestock, and particular operation involved.

Special attention must be given to grazing management in riparian and wetland areas if management measure objectives are to be met. For purposes of this guidance, riparian areas are defined as:

> *vegetated ecosystems along a waterbody . Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent waterbody.*

The health of the riparian system, and thus the quality of water, is dependent on the use, management, and condition of the related uplands. Therefore, the proper management of riparian and wetland ecosystems will involve the correct management of livestock grazing and other land uses in the total watershed.

Most riparian areas in Hawaii are bordered by steep cliffs and are fenced primarily to keep animals from falling into gulches rather than to save the vegetation from the animals. All islands have some grazable flood plains, but Kauai, as the oldest island, has a higher percentage. Floods along these grazable areas are common and generally unpredictable. Frequent flooding often makes permanent fences parallel to streams uneconomical. Such fences are prone to being washed out and deposited downstream or along beaches. Instead, most of these areas have minimal "knockdown," easy to repair, fences running perpendicular to the stream. Streams are used both as a boundary fence and watering source.

This management measure amends the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

Justification for Alternative Management Measure: *Changes were made to (2) of the (g) measure to make the management measure parallel the one for erosion and sediment control and to render it more applicable to Hawaii:*

- *(i) Conservation Management System (CMS): The (g) measure refers to applying the erosion control component of an NRCS Conservation Management System (CMS). The CMS developed by NRCS was intended for use as part of a voluntary program of natural resources management. A CMS has two levels of treatment. The first is a Resource Management System (RMS). Currently, in order for a farmer to meet the criteria for a RMS, that farm must have an annual soil rill and sheet erosion rate that is less than "T" as determined by the Universal Soil Loss Equation (USLE) or the Revised Universal Soil Loss Equation (RUSLE). The USLE or RUSLE was never intended to provide absolute soil loss numbers and its reliability on steeper lands under high rainfall conditions is questionable. Rather, it was meant to be used as an erosion prediction tool that estimates soil erosion for planning purposes. A RMS, as part of a voluntary program, sets an erosion control goal for a land user to strive towards, rather than establishing an enforceable level of treatment. In Hawaii, many farms are unable to achieve a RMS level of treatment due to rainfall and slope conditions. Recognizing this, NRCS has established a second level*

of treatment called an Acceptable Management System (AMS) that may be implemented as it is needed. An AMS sets an erosion control goal for the specific resource use which is achievable in view of social, cultural, and economic constraints of the area. For NRCS planning purposes, the State Conservationist approves the AMS level for erosion control.

This alternative management measure provides the State the flexibility to apply any combination of conservation practices and management that achieves an acceptable level of treatment. This will enable Hawaii to determine the acceptable level of treatment, based not only on nonpoint source pollution control but also on economic, social, cultural and geographic criteria. Establishing the process for determining an acceptable level of treatment will be undertaken during FY 96-97, provided resources are available.

- *(ii) Maintaining grazing lands in accordance with activity plans established by relevant agencies: The U.S. Department of Interior's Bureau of Land Management (BLM) does not have federal lands in Hawaii to lease for grazing. Therefore, BLM was eliminated from (2)(b) and replaced with Hawaii DLNR's Land Management Division, which does lease State lands for grazing. Similarly, USDA's Forest Service does not lease land, so this reference was deleted and replaced with "federal agencies managing grazing land." In addition, the clause "or other designated land management agencies" was added to (2)(b) to provide the State flexibility to designate other land management agencies, if appropriate.*

II.E.2. Applicability

The management measure applies to activities on range, irrigated and non-irrigated pasture, and other grazing lands used by domestic livestock. Range is those lands on which the native vegetation (climax or natural potential plant community) is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing use. Range includes natural grassland, savannas, many wetlands, some deserts, tundra, and certain forb and shrub communities. Pastures are those lands that are primarily used for the production of adapted, domesticated forage plants for livestock. Other grazing lands include woodlands, native pastures, and croplands producing forages.

The major differences between range and pasture are the kind of vegetation and level of management that each land area receives. In most cases, range supports native vegetation that is extensively managed through the control of livestock rather than by agronomy practices, such as fertilization, mowing, irrigation, etc. Range also includes areas that have been seeded with introduced species, but which are extensively managed like native range. Pastures are represented by those lands that have been seeded, usually with introduced species or in some cases with native plants, and which are intensively managed using agronomy practices and control of livestock.

The intent of the management measure is to protect surface and ground water quality. Some waterbodies, such as farm ponds, have been created to water

livestock. Protecting the water quality of these artificial water storage areas does not have the same priority as protecting natural streams and waterbodies.

II.E.3. Management Practices

The management practices listed below are representative of those currently in use. Numbers in parentheses indicate NRCS management practice numbers. These management practices are described in detail in the NRCS National Handbook of Conservation Practices or Field Office Technical Guide.

a. Planned Grazing System (556): A practice in which two or more grazing units are alternately rested and grazed in a planned sequence for a period of years, and rest periods may be throughout the year or during the growing season of key plants. This practice includes pasture management, leader/follower grazing, woodland grazing, and fire control grazing.
b. Deferred Grazing (352): Postponing grazing or resting a paddock for a prescribed period.
c. Proper Grazing Use (528): Grazing at an intensity that will maintain enough cover to protect the soil and maintain or improve the quantity of desirable vegetation.
d. Pasture and hayland management (510): Proper treatment and use of pasture or hayland.
e. Pipeline (516): Pipelines installed for conveying water for livestock or other purposes.
f. Ponds (378): A water impoundment made by constructing a dam or an embankment or by excavation of a pit or dugout.
g. Trough or Tank (614): A trough or tank, with needed devices for water control and wastewater disposal, installed to provide drinking water for livestock.
h. Spring Development (574): Improving springs and seeps by excavating, cleaning or providing collection and storage facilities.
i. Water-Harvesting/Catchment (636): Catchments are structures were rain water is trapped, channeled then collected, usually but not always, in a tank set below the catchment structure.
j. Fencing (382): Enclosing an area of land with a suitable fence that acts as a barrier to livestock, game or humans. Such fences may include barb wire, net wire, electric, rock, wood, or natural barriers such as *pali* (cliffs) or lava.
k. Livestock Exclusion (472): Excluding livestock from an area not intended for grazing.
l. Access Road (560): A fixed route of travel to move livestock, equipment and supplies. An access for proper operation, maintenance, and management of conservation enterprises.
m. Pasture Planting (512): Establishing long term stands of adapted species of forage plants. This includes reseeding eroded areas.
n. Critical Area Planting (342): Planting vegetation or seeds on highly erodible or critically eroding areas.
o. Brush and Weed Management (314): Managing and manipulating stands of brush and weeds on grasslands by mechanical, chemical, prescribed burning, or biological means. This includes grazing to control undesirable plants without significantly damaging desirable ones. This is primarily

accomplished with goats, often with sheep, occasionally with cattle and seldom with horses.

p. Prescribed Burning (338): Applying fire to predetermined areas under conditions which control the intensity and spread of fire.

q. Stock Trails and Walkways (575): Providing or improving access to forage and water to permit proper grazing use and planned grazing systems.

II.E.4. Implementation of Management Measure

The grazing management measure will be implemented as a part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: Currently, this management measure is implemented on a voluntary basis by land users, with technical assistance from a number of agencies, supplemented with more general State authorities with respect to water pollution control. Federal and State agencies involved in implementation include:

- SWCDs, which provide technical assistance on BMPs on agricultural lands;
- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices;
- University of Hawaii, CES, which provides information and technical assistance on management practices; and
- DOH, which funds demonstration projects to develop, test and implement BMPs tailored to Hawaii's environment.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-54	Water Quality Standards

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

Nonpoint source pollution is generally addressed under the State's water pollution control statutes. See page III-28 for a brief discussion of Chapters 342D and 342E, HRS.

F. Irrigation Water Management Measure

To reduce nonpoint source pollution of surface waters caused by irrigation:

(1) Operate the irrigation system so that the timing and amount of irrigation water applied match crop water needs. This will require, as a minimum: (a) the [~~accurate~~] measurement of soil-water depletion volume and the volume of irrigation water applied; [~~and~~] (b) uniform application of water; and (c) application rate which does not exceed infiltration rate in the field.

(2) When chemigation is used, include backflow preventers for wells, minimize the harmful amounts of chemigated waters that discharge from the edge of the field, and control deep percolation. In cases where chemigation is performed with furrow irrigation systems, a tailwater management system may be needed.

The following limitations and special conditions apply:

(1) In some locations, irrigation return flows are subject to other water rights or are required to maintain stream flow. In these special cases, on-site reuse could be precluded and would not be considered part of the management measure for such locations.

(2) By increasing the water use efficiency, the discharge volume from the system will usually be reduced. While the total pollutant load may be reduced somewhat, there is the potential for an increase in the concentration of pollutants in the discharge. In these special cases, where living resources or human health may be adversely affected and where other management measures (nutrients and pesticides) do not reduce concentrations in the discharge, increasing water use efficiency would not be considered part of the management measure.

(3) [~~In some irrigation districts, t~~]The time interval between the order for and the delivery of irrigation water to the farm may limit the irrigator's ability to achieve the maximum on-farm application efficiencies that are otherwise possible.

(4) In some locations, leaching is necessary to control salt in the soil profile. Leaching for salt control should be limited to the leaching requirement for the root zone.

(5) Where leakage from delivery systems or return flows supports wetlands or wildlife refuges, it may be preferable to modify the system to achieve a high level of efficiency and then divert the "saved water" to the wetland or wildlife refuge. This will improve the quality of water delivered to wetlands or wildlife refuges by preventing the introduction of pollutants from irrigated lands to such diverted water.

(6) In some locations, sprinkler irrigation is used for [~~frost or freeze protection, or~~] crop cooling <u>or other benefits (*e.g.*, watercress)</u>. In these special cases, applications should be limited to the amount necessary for crop protection, and applied water should [~~remain on site~~] <u>not contribute to erosion or pollution</u>.

<u>II.F.1. Description</u>

The goal of this management measure is to reduce nonpoint source pollution of surface waters caused by irrigation. For the purposes of this management measure, "harmful amounts" are those amounts that pose a significant risk to aquatic plant or animal life, ecosystem health, human health, or agricultural or industrial uses of the water. A problem associated with irrigation is the movement of pollutants from the land into ground or surface water.

Return flows, pipe or hose leaks, runoff, and leachate from irrigated lands may transport the following types of pollutants: sediment and particulate organic solids; particulate-bound nutrients, chemicals, and metals, such as phosphorus, organic nitrogen, a portion of applied pesticides, and a portion of the metals applied with some organic wastes; soluble nutrients, such as nitrogen, soluble phosphorus, a portion of the applied pesticides, soluble metals, salts, and many other major and minor nutrients; and bacteria, viruses, and other microorganisms.

Since irrigation is a consumptive use of water, any pollutants in the source waters that are not consumed by the crop (*e.g.*, salts, pesticides, nutrients) can be concentrated in the soil, concentrated in the leachate or seepage, or concentrated in the runoff or return flow from the system. Salts that concentrate in the soil profile must be removed for sustained crop production.

Application of this management measure will reduce the waste of irrigation water, improve the water use efficiency, and reduce the total pollutant discharge from an irrigation system. It is not the intent of this management measure to require the replacement of major components of an irrigation system. Instead, the expectation is that components to manage the timing and amount of water applied will be provided where needed, and that special precautions (*i.e.*, backflow

preventers, prevent tailwater, and control deep percolation) will be taken when chemigation is used.

This management measure makes minor amendments to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

Justification for Changes to Management Measure: *These changes were made for the following reasons.*

- *(i) Application Rate: With few exceptions that application rate of irrigation water should not exceed the infiltration rate of the soil. Therefore, (1)(c) was added to the first part of this management measure.*

- *(ii) Irrigation Districts: Because Hawaii does not have irrigation districts, the reference to irrigation districts was deleted in (3) of the second part of the management measure.*

- *(iii) Frost or Freeze Protection: The reference to frost and freeze protection was deleted in (6) of the second part of the management measure because it is not applicable to Hawaii. Sprinkler irrigation does provide other benefits in Hawaii (such as insect control in watercress) so an additional phrase was added.*

- *(iv) Applied Water Remaining on Site: Item (6) of the second part of the management measure refers to applied irrigation water remaining on site. This was changed to indicate that applied water should not contribute to erosion or pollution. This change was made because crops such as watercress require continually flowing water through the production area. Also, in taro production, flowing water helps to control plant diseases by keeping water temperatures low.*

II.F.2. Applicability

This management measure applies to activities on irrigated lands, including agricultural crop and pasture land (except for isolated fields of less than 10 acres in size that are not contiguous to other irrigated lands); orchard land; specialty cropland; and nursery cropland. Those land users already practicing effective irrigation management in conformity with the irrigation water management measure may not need to purchase additional devices to measure soil-water depletion or the volume of irrigation water applied, and may not need to expend additional labor resources to manage the irrigation system.

II.F.3. Management Practices

a. Irrigation water management (449): Determining and controlling the rate, amount, and timing of irrigation water in a planned and efficient manner.
b. Water-measuring device: An irrigation water meter, flume, weir, or other water-measuring device installed in a pipeline or ditch.

c. Soil and crop water use data: From soils information the available water-holding capacity of the soil can be determined along with the amount of water that the plant can extract from the soil before additional irrigation is needed.
d. Irrigation system, drip or trickle (441): A planned irrigation system in which all necessary facilities are installed for efficiently applying water directly to the root zone of plants by means of applicators (orifices, emitters, porous tubing, or perforated pipe) operated under low pressure. The applicators can be placed on or below the surface of the ground.
e. Irrigation system, sprinkler (442): A planned irrigation system in which all necessary facilities are installed for efficiently applying water by means of perforated pipes or nozzles operated under pressure.
f. Irrigation system, surface and subsurface (443): A planned irrigation system in which all necessary water control structures have been installed for efficient distribution of irrigation water by surface means, such as furrows, borders, contour levees, or contour ditches, or by subsurface means.
g. Irrigation field ditch (388): A permanent irrigation ditch constructed to convey water from the source of supply to a field or fields in a farm distribution system.
h. Irrigation land leveling (464): Reshaping the surface of land to be irrigated to planned grades.
i. Irrigation water conveyance, ditch and canal lining (428)
j. Irrigation water conveyance, pipeline (430)
k. Structure for water control (587)
l. Irrigation system, tailwater recovery (447): A facility to collect, store, and transport irrigation tailwater for reuse in the farm irrigation distribution system.
m. Filter strip (393): A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and waste water.
n. Surface drainage field ditch (607): A graded ditch for collecting excess water in a field.
o. Subsurface drain (606): A conduit, such as corrugated plastic tile, or pipe, installed beneath the ground surface to collect and/or convey drainage water.
p. Water table control (641): Water table control through proper use of subsurface drains, water control structures, and water conveyance facilities for the efficient removal of drainage water and distribution of irrigation water.
q. Controlled drainage (335): Control of surface and subsurface water through use of drainage facilities and water control structures.
r. Backflow devices: The American Society of Agricultural Engineers recommends, in standard EP409, safety devices to prevent backflow when injecting liquid chemicals into irrigation systems (ASAE 1989).

II.F.4. Implementation of Management Measure

The irrigation management measure will be implemented as a part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page

III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: DOH, Environmental Management Division, is the lead agency for implementing this management measure because it implements programs for water pollution control, safe drinking water and wastewater management. Other federal and State agencies involved in implementation include:

- SWCDs, which provide technical assistance on BMPs on agricultural lands;
- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices; and
- University of Hawaii, CES, which provides information and technical assistance on management practices.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-21	Cross-Connection and Back-Flow Control
HAR	Chapter 11-54	Water Quality Standards

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

Chapter 11-21, HAR, administered by DOH, requires that a reduced pressure principal back-flow preventer or air gap separation be installed as part of any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system (§11-21-7(a)(4), HAR). Chapter 11-21, HAR, also requires that all back-flow prevention devices be approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research and are tested, periodically inspected, and properly maintained.

Nonpoint source pollution is generally addressed under the State's water pollution control statutes. See page III-28 for a brief discussion on Chapter 342D and 342E, HRS.

III. RECOMMENDED IMPLEMENTING ACTIONS

III.1. Proposed PPP Program Implementation

A. General Organizational Structure: A non-regulatory agricultural Pollution Prevention Plan (PPP) Program is being proposed for the implementation of the agriculture management measures (See Figure III-1). This new program would provide incentives to land users to develop (with assistance from NRCS, SWCDs, and CES) and implement pollution prevention plans covering erosion control, nutrient and pesticide management, runoff from confined animal facilities, grazing management and irrigation management, as applicable. These plans would specify the BMPs to be used to prevent or reduce nonpoint source pollution on the lands covered by each plan.

The agriculture focus group recommended addressing all agriculture management measures under one PPP Program, rather than developing individual mechanisms for erosion and sediment control, management of confined animal facilities, nutrient management, pesticide management, grazing management, and irrigation management. This holistic approach will be less cumbersome to both new and existing agricultural operations. It will facilitate coordination among existing programs and sharing of resources. In addition, it will maximize the technical assistance and monitoring and enforcement efforts provided by various agencies. A non-regulatory program emphasizing technical assistance to land users will build upon existing management structures and will likely lead to a greater level of cooperation and compliance.

Individual pollution prevention plans would be developed by operators with assistance from NRCS, SWCDs, CES and other persons with technical expertise. Model plans for various crop categories would be developed to assist land users and plan preparers. These PPPs would specify BMPs to be used to prevent or reduce nonpoint source pollution on the lands covered by each plan. Participating agricultural operations would only be required to have plan components for each management measure that applies to their operations (*e.g.*, operations without confined animal facilities would be exempted from requirements for that management measure).

PPPs would be submitted to the local SWCD for review and approval, limiting responsibilities and paperwork to a single local entity that already has substantial acceptance within each local agricultural community. This process would be similar to the existing process whereby land users develop agricultural soil conservation plans for approval by the local SWCDs in order to get exemptions from having to apply for grading permits every time they plow their fields. The PPP Program simply extends the planning process to include additional planning components for confined animal facilities, nutrient and pesticide applications, grazing management, and irrigation operations. It also provides additional incentives to participate in the program. The PPP Program will also strengthen the State's enforcement mechanisms with the development of a Bad Actor Law, described below.

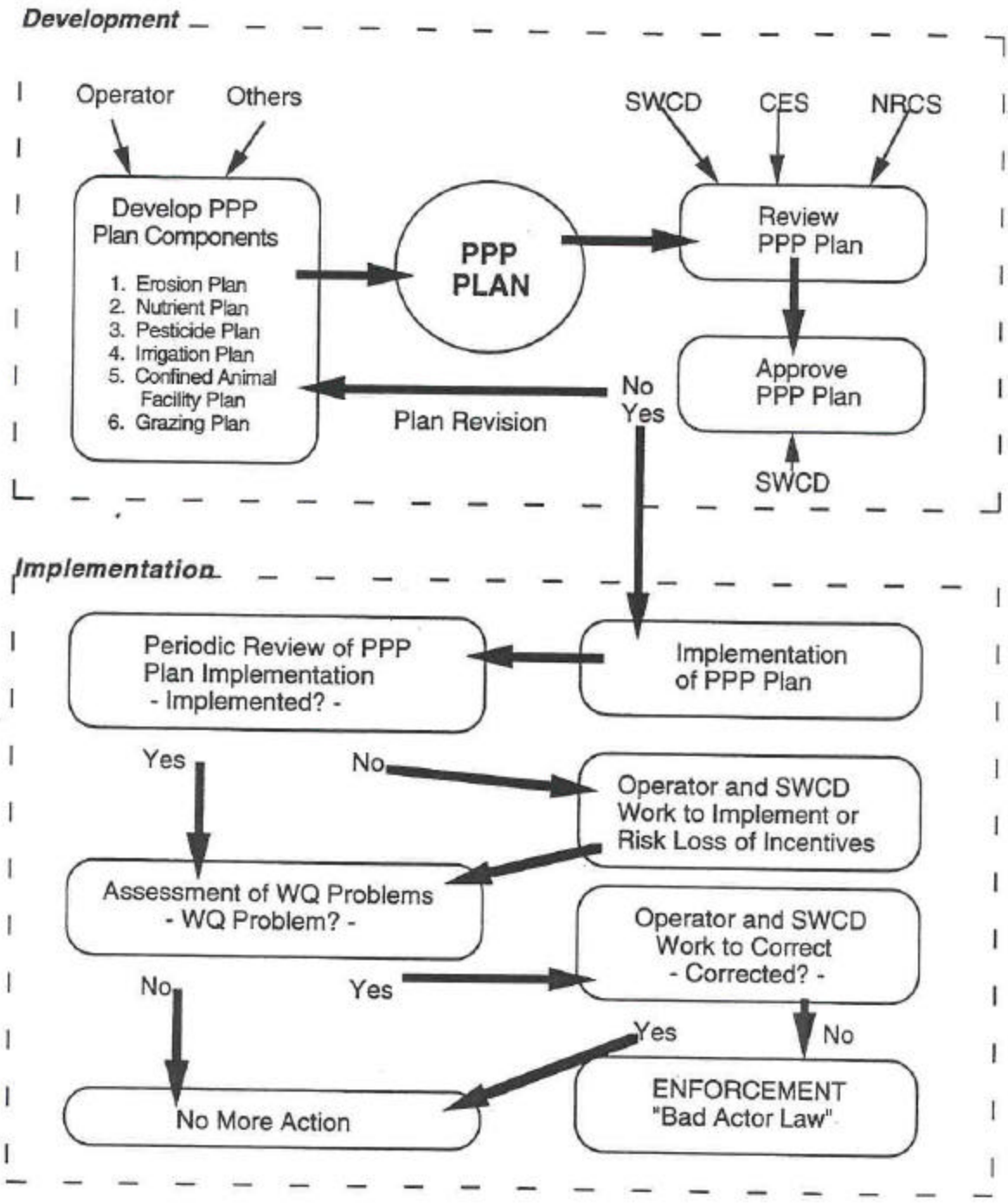
Review of plans would be undertaken through cooperative arrangements by a team consisting of SWCD directors, and staff from NRCS, CES, and DOH. Final approval of reviewed plans would be given by the SWCD to ensure that the plan meets conditions and criteria specific to the location. This local knowledge is particularly important for agricultural operations in Hawaii because of the extreme gradients in rainfall, the diversity of microclimates, and the variability of watershed conditions found across each island and the State as a whole.

Since each PPP would be developed for a fairly specific cropping pattern or type of animal operation, any new or revised agricultural operation would require the operator to prepare a new plan. Although the definition of what constitutes a "new or revised agricultural operation" should be defined by the coordinating agency, a new PPP would be required if the change required different amounts or types of chemical or nutrient inputs (*e.g.*, a change from vegetable crops to orchard; or from ornamental flowers to a fruit crop). In the absence of any changes such as these, operators would be required to revise and/or update existing plans every three to five years. This schedule would allow current information and improved BMPs to be incorporated into PPPs in a timely manner.

If an agricultural operator has an approved NRCS conservation plan with all the appropriate components in place addressing the agricultural management measures, then this plan would be acceptable as a Pollution Prevention Plan under the PPP Program.

As a non-regulatory program, the PPP Program will rely heavily on education, training, and technical assistance to ensure that land users understand its overall requirements. In this way, the land users will develop PPPs that comply with the requirements and intent of each agriculture management measure, and select management practices that adequately control nonpoint source pollution. It is recommended that the State offer training courses to land users and others who wish to prepare agriculture pollution prevention plans. These training sessions would offer the collective agricultural polluted runoff control expertise of federal and state agencies, and knowledgeable professionals in a single focused program. The coordinating agency would assemble knowledgeable personnel from agencies such as DOA, DOH, NRCS, CES, University of Hawaii, and the SWCDs.

Figure III-1: Agricultural PPP Plans - Operators Flowchart



Prepared by PER (1995)

B. Monitoring and Enforcement: The most realistic and cost-effective means to protect coastal water quality from nonpoint source pollution from agricultural activities is likely to be "compliance through tracking" rather than "enforcement through monitoring." This implementation methodology is complementary to the BMP concept itself, which is based on the principle that the best available technologies or management practices (defined as BMPs) are already known to be effective. Thus, if BMPs are adequately implemented or installed, water quality will improve. Thus, *tracking* the implementation of the BMPs as specified in approved PPPs will ultimately protect coastal water quality. The SWCD will monitor or track compliance by undertaking spot checks and periodic reviews of approved plans, and assessing reported problems.

If, despite installation of BMPs as specified in the operator's pollution prevention plan, there is still a polluted runoff problem, then the operator has an opportunity to work with the SWCD, along with NRCS and CES assistance, to correct the problem. A Bad Actor Law, implemented by DOH, would take effect against polluters who have not cooperated with the PPP Program and made a good faith effort to improve their operations.

Water quality monitoring would be used as a method to track the effectiveness of the overall PPP Program rather than as a method of enforcement. Thus, monitoring would be used as a tool to evaluate the effectiveness of the agricultural PPP Program. Monitoring results would then be used to revise BMPs and the intensity of their implementation, and to further enhance the PPP Program, as needed. Monitoring, however, would continue to be used in enforcement actions against those few operators who are in violation of the intent of the management measures and persistently resist requests to modify their management practices appropriately to protect coastal water quality.

In compliance with federal requirements, the State will evaluate the effectiveness of the non-regulatory PPP Program in implementing the agriculture management measures. If the voluntary program is not successfully implementing the management measures, then regulatory measures will be considered at that time.

C. Incentives for Participation in the PPP Program: A number of incentives have been proposed to encourage land users to participate in this non-regulatory PPP Program. The possible consequences of these proposals need to be explored more thoroughly and the process for their establishment outlined during the development of the coastal nonpoint pollution control program implementation plan.

Continued "Dedicated Agriculture" Status - Only agricultural operations that have an approved pollution prevention plan would continue to be eligible to have those lands in "dedicated agriculture" status and be able to receive substantial property tax benefits.

Ability to Lease State Lands - In order to be eligible to lease State lands for crop cultivation, confined animal facilities or grazing, operators would have to

factor the cost of developing a pollution prevention plan and of implementing best management practices into their bids. PPPs would be implemented and BMPs installed according to a schedule determined by the State upon approval of the bid. Failure to implement the PPP as specified would result in the termination of the lease agreement. This proposal would apply only to new leases awarded after the effective date of this program.

Continued FSA Participation - Agricultural operators who are actively applying their approved PPP would continue to be eligible to receive federal assistance for conservation and water quality practices, assistance from the commodity programs, federal crop insurance, and operational and land loans from federal agencies.

Avoid Financial Liability - Agricultural operators that have been and continue to be in compliance with an approved plan would be assumed to be in compliance with the intent of the management measures and would, therefore, be exempted from financial liability and other enforcement actions related to compliance with these management measures. However, to continue to be exempt, operators would be required to cooperate with the SWCD in revising their PPP, as needed, to meet the intent of the management measures.

D. Failure to Participate in the Non-Regulatory PPP Program: The success of this non-regulatory program depends on the voluntary cooperation of agricultural land users. If a voluntary program is not successful in encouraging the implementation of the agriculture management measures, then a regulatory program will likely be developed. Individual operators who do not participate may jeopardize the PPP Program's effectiveness and, thus, the very existence of the program for all operators. In addition, operators who choose not to participate in the non-regulatory pollution prevention plan program will endure greater scrutiny and immediate action from DOH if found contributing to water pollution.

Schedule for General Implementation:

July 1996	Initiate implementation of measures identified under III.2.
June 1997	Establish process for determining acceptable level of treatment for erosion and sediment control on agricultural lands, based not only on nonpoint source pollution control but also on economic and geographic criteria.
June 1997	Determine percentage of settleable solids that must be removed in order to address erosion and sediment control management measure.
July 1998	Land users begin submitting pollution prevention plans for review and approval.
July 1998	Begin compliance tracking and water quality monitoring.
December 2001	Evaluate effectiveness of non-regulatory program in terms of compliance and water quality protection.
2004	Complete program implementation of management measures.

III.2. Implementing Actions

The PPP Program would be designed to phase-in all components to allow for long-term agency planning and ensure the easiest possible transition for both operators and agencies. The implementation schedule should include provisions to phase in the costs of the program, interagency coordination and cooperative responsibilities, and operator responsibilities. Timing of implementation will depend, in part, on fiscal and personnel resources made available. The following recommendations will be explored in more detail in the coastal nonpoint pollution control program implementation plan.

A. Establish Organizational Structure and Adequate Program Funding

- Draft and implement statutory and regulatory amendments, as needed, to implement this organizational structure and provide program funding. Establish incentive mechanisms to encourage participation in the non-regulatory Pollution Prevention Plan Program and enact a Bad Actor Law as a regulatory backup. These amendments must be submitted for consideration by the legislature and relevant agencies.

- Appropriate sufficient funding to the SWCDs to support at least one full-time technical staff and part-time clerical support *per district*. The major burden of implementing the PPP Program will fall on the 16 regional SWCDs. Current DLNR funding for all 16 SWCDs, totaling roughly $60,000 for operating expenses, is wholly inadequate to account for the increased responsibilities to review, approve and oversee the PPP plans within each district. In addition, it is unrealistic to expect the volunteer SWCD directors to undertake the administration of this new PPP Program on a voluntary basis. Although the proposed increase in funding for the SWCDs is substantial relative to current funding, the expected results in polluted runoff control represent an extremely efficient use of resources to implement such a statewide program.

- Draft formal Memoranda of Understanding (MOUs) between agencies having technical and management expertise with respect to agricultural practices and polluted runoff control to ensure their commitment to implementing this program. A number of State, federal and county agencies will provide administrative and/or technical support for the implementation of the PPP Program, including DOH, NRCS, DLNR, DOA, SWCDs, CZM Program and CES. These agreements should specify the levels of financial, personnel and technical commitment to develop and implement the PPP Program.

  Schedule for Implementation:

December 1996	Draft MOU between participating agencies.
December 1997	Develop needed statutory or regulatory amendments and submit for consideration to legislature and agencies.
phase in	Increase funding for DLNR's SWCDs.

B. Develop Education and Training Materials

The non-regulatory PPP Program will rely heavily on education, training and technical assistance materials. Although many of these resource materials

already exist within various agencies and programs, they should be compiled and expanded to meet the needs of the PPP Program.

- Develop an operator handbook of PPP Program requirements, benefits, specification for plans and plan components for each management measure, and incentives.

- Create model PPP plans for various crop categories that can be used by operators or plan preparers as the framework for drafting individual plans.

- Develop a BMP manual for agricultural practices appropriate to Hawaii. This manual should be easy-to-read, flexible, and expandable, so that it can be revised as needed and as new information and more effective practices are developed.

- Develop easy-to-read educational materials in the major languages of Hawaii for wide distribution by extension agents, agricultural supplies stores, and others.

- Produce training materials for conducting trainings of operators and plan preparers, including local case studies, and island-specific soil and crop information. The trainers could also help develop appropriate training methodologies such as types of presentation materials, sites for trainings, field trips to demonstration farms, and could suggest procedures for evaluating the effectiveness of BMPs. This cooperative process would use the collective expertise of different entities to develop the best Hawaii-specific materials and methodologies to train operators in pollution prevention practices.

  Schedule for Implementation:
  June 1997 Develop operator handbook.
  June 1997 Develop model PPP plans for various crop categories.
  June 1997 Develop BMP manual for agricultural practices.
  June 1998 Develop training materials for conducting trainings of operators and plan preparers.
  July 1998 Begin training operators and plan preparers.

C. Revise State Land Lease Requirements

To effectively carry out the agriculture management measures and help resolve some of the problems inherent to the high proportion of leased land in Hawaii, several revisions to the State's land lease requirements are recommended. These proposals would apply to new leases awarded after changes to implementing regulations.

- Include a requirement for development and implementation of Pollution Prevention Plans for all land leases for crop cultivation and grazing. All leases should have provisions for reasonable inspections of leased parcels to track compliance with PPP Program requirements. Failure to implement a PPP should result in termination of the associated lease.

- Classify State lands leased for grazing according to their carrying capacity and adjust lease rates for each parcel to reflect its stated carrying capacity. Lease requirements should stipulate the maximum number of animal units to be grazed on the parcel and make it clear that exceeding this limit would result in a substantial fine. A gross violation of the specified carrying capacity would result in the cancellation of the lease at the end of the current year.

- Establish natural resource criteria to be used to determine planning and treatment levels that meet acceptable parameters and/or conditions. The criteria should be stated in either qualitative or quantitative terms.

- Lengthen duration of leases to ensure that operators will realize the long-term economic benefits of installing costly improvements such as retention/detention basins, terraces, and replanting/construction of riparian buffer strips. If operators are confident they will recover the costs and receive the benefits of implementing Pollution Prevention Plans, they are more likely to act as good stewards of the leased land.

  Schedule for Implementation:
  December 1997 Develop needed statutory or regulatory changes and submit for consideration.

D. Develop Hawaii-Specific Soils Information

More Hawaii-specific soils research should be done to enhance publicly-available information and further develop Hawaii-specific BMPs for agriculture. Existing resources include the HENRIS geographic information system (GIS) and related data developed at the University of Hawaii, the Hawaii Pesticide Information and Retrieval System (HPIRS) pesticide database, and NRCS soils maps and attribute information. HPIRS, developed and maintained by the University of Hawaii Department of Environmental Biochemistry, is an index to the agricultural-use pesticide product labels licensed for sale in the State by DOA.

- Develop a database containing cross-referenced information for decision-making on suitable practices and products for a particular site. The database should include soil family chemical and physical properties, hydrologic and reactive properties, pesticide leachability characteristics, and site-specific physical geographic information such as rainfall and slope. The database should be made available both as a paper document and a searchable computerized database. A paper document would be most accessible and should contain information relating soils types and pesticides with their associated properties, characteristics, and risks, as well as maps delineating probable risks of erosion, and pesticide leaching and transport. Database materials linked with a GIS interface designed for the task would allow operators, SWCDs, CES personnel, and others to perform sophisticated planning and "what-if" scenarios using specific products and management activities and site-specific soil characteristics.

  Schedule for Implementation:
  June 1998 Develop soils database.

E. Establish Inverted Water Rate Structure

- Emphasize an inverted water rate structure on a per acre basis when setting water rates. Because water is the transport vehicle for pollutants, efficient irrigation should be of prime concern to ensure that runoff and leach water is kept to a minimum. If water is used efficiently, pollutants such as sediment, nutrients, and pesticides are kept on site and provide their intended benefits. Care should be taken not to penalize large agriculture operations that, by virtue of their large land holdings, would use large total amounts of water. Therefore, it is important that any inverted rate structure be on a "per acre" basis.

F. Integrate the PPP Planning Process into Watershed Planning

- Encourage agricultural operators to participate in a watershed planning process. The Pollution Prevention Plan Program should be viewed as one component in a broader watershed planning process. The wider perspective will benefit both agricultural operator and other land users in the watershed. A collaborative approach to solving polluted runoff problems will enable lessons learned in one land use sector to be shared with other land users. A watershed approach also facilitates targeting efforts to control major sources of polluted runoff in a cooperative manner. Finally, if community members are educated about the nonpoint source pollution control efforts made by agricultural operators, they may be less likely to blame agriculture for all polluted runoff problems in a watershed.

G. Change the Voting System for the Soil and Water Conservation Districts

- Change the voting structure of the SWCDs so that it is more equitable to the smaller farmers. Current assessments indicate that while 90% of the State's agricultural lands are covered by SWCD conservation plans, only 60% of agricultural operators are participating in their local SWCDs. Some of the smaller farmers may not be participating in their local district because the voting system is based on acreage (*i.e.*, one acre - one vote). In effect, one or two large land owners can control virtually all of the activities of the SWCD. Although a "one operator- one vote" structure may not be tenable, some kind of change may help bring these smaller operators into the SWCD system.

CHAPTER 3: Forestry

I. INTRODUCTION

Forestry, or silviculture, is defined in the Forestry Handbook, Second Edition, as:

> *...the science and art of cultivating forestry crops..., the theory and practice of controlling the establishment, composition ... and growth of forests." Silviculture as applied to forest ecology - a means of protecting and enhancing range, wildlife, water, and soil resources, as well as timber crops. It is the manipulation of forest vegetation for human purposes. Silvicultural treatments are increasingly designed to meet several forest uses simultaneously. Silvicultural knowledge and techniques are applied to forest land through prescriptions. The prescription is a record of the examination, diagnosis, and treatment regimes recommended for forest lands.*

I.1. Forestry in Hawaii

At this time, commercial forestry operations in Hawaii are limited in scope and area. The acres of fallowed land left by the downsizing of Hawaii's sugar industry, however, have created the potential for a growing commercial forestry industry. Many of the same attributes that made plantation sugar a viable industry are also conducive to commercial forestry.

Most of the forestry operations envisioned for Hawaii are plantation-style forestry rather than logging of undisturbed, native forests. There are four broad commercial forest management scenarios being considered by the Department of Land and Natural Resources' (DLNR) Division of Forestry and Wildlife (DOFAW): (1) short-rotation (6-12 years) sustainable forest plantations of large-yielding wood fiber; (2) long-rotation (25-50 years) sustainable forest plantations of high quality wood; (3) afforestation of *mauka* pasture lands and enhancement of degraded native forests; and (4) agroforestry[1]. A strategic mix of a short rotation crop to recoup initial investments and help carry a longer rotation crop of higher value hardwoods will probably be needed on former sugar lands to attract needed outside investment.

Because forestry is a promising replacement for agriculture, there is a potential for improved water quality and lessened nonpoint source pollution owing to that land use change. Where conversion from agriculture to forestry has been studied, water quality has improved when compared to the previous agricultural practices. Related research in Hawaii has compared soil properties of natural forest areas and areas under pineapple and sugarcane cultivation (Wood 1977). This research indicated that forest-covered soils accepted and stored appreciably more water than the same soils planted in sugarcane or pineapple. Wood (1977) concluded that the likelihood of surface water runoff will be less on a given soil

[1]Agroforestry is defined, in the case of Hawaii, as grazing cattle under either long-rotation trees or afforested *mauka* pasture lands.

under forest cover than on land cultivated in sugarcane, pineapple, or pasture, and that erosion rates would also be less for soils under forest cover.

In addition, because of the difference in the amount and intensity of mechanized harvesting, the conversion of land from sugarcane cultivation to forestry may yield significant water quality improvements. Mechanized, clear-cut harvesting of sugarcane requires travel over 100% of the planted area every 2-3 years. Mechanized, clear-cut harvesting of trees, on the other hand, requires travel over 10-20% of the land area every 6-8 years for fiber production and every 20-50 years for high quality logs.

There are currently no commercial forestry operations on State lands. However, the State is in the process of negotiating a lease to a commercial forestry operation on several thousand acres of former sugar land. In addition, special projects have taken place on State lands, such as chipping wood and salvaging trees along roadsides being cleared as firebreaks, and cutting koa killed by Hurricane Iniki and stimulating regeneration of koa in stands now dominated by non-native weeds.

Private operations are almost exclusively salvage operations, and the vast majority of this is harvesting of dead and senescent *Acacia koa*, a high-value native specialty hardwood. Because these operations are small and scattered, the acreage directly affected by planting and harvesting operations each year is not known. Estimates range between 200 to 500 acres annually [DLNR-DOFAW and the Hawaii Forest Industry Association (HFIA)].

Because of the type of forestry undertaken in Hawaii, acreage may not be the best indicator of the extent of forestry operations. Instead, a better indicator may be total harvested volumes. HFIA estimates annual production for the past decade to be:

Time period	**Annual Production (million board feet)**
Mid 1980's	1.20 - 1.50
About 1990	0.75
Presently	0.50 - 0.60

There are approximately 52,000 acres of planted forests on commercial forest land in Hawaii. The islands of Hawaii and Maui have 62% of the planted forests. Approximately 39,000 acres of these plantations are commercial forest types. The remaining 13,000 are non-commercial forest types. Approximately 60% of the area of planted commercial forests is made up of eucalypts. About 26% of the planted commercial forests are other hardwood species, including Australian toon, nepal alder, and albizzia. Conifer species make up the remaining 14% of planted commercial forests.

The major private owner engaged in forestry is Kamehameha Schools Bishop Estate. According to their forester, 10,500 acres in Honaunau in South Kona have been selectively logged for a period of years. There has also been a forest project in

existence at Keauhou Ranch near Volcano since 1977. (Peter Simmons, Forester, Kamehameha Schools Bishop Estate, pers.comm., Oct. 1993)

Forestry in Hawaii has been viewed primarily as a diversified agricultural industry. The Hawaii Constitution, the State land use law [Chapter 205, Hawaii Revised Statutes (HRS)], and the State conservation district regulations all consider forestry an agricultural activity. While forestry operations in the State conservation district, like many other activities, require a Conservation District Use permit, most private operations take place in the State agricultural district. Tree planting and harvesting, in this case, are treated like other agricultural activities and could be exempted from the county grading ordinances, provided land users have conservation plans approved by the local Soil and Water Conservation Districts (SWCDs).

I.2. Types of Polluted Runoff Associated with Forestry

Without adequate controls, forestry operations may degrade several water quality characteristics in waterbodies receiving drainage from forest lands. Sediment concentrations can increase due to accelerated erosion; water temperatures can increase due to removal of overstory riparian shade; slash and other organic debris can accumulate in waterbodies, depleting dissolved oxygen; and organic and inorganic chemical concentrations can increase due to harvesting, and fertilizer and pesticide applications. These potential increases in water quality contaminants are usually proportional to the severity of site disturbance. Silvicultural impacts on water quality depend on site characteristics, climatic conditions, and the management practices employed.

Sediment: Sediment is often the primary pollutant associated with forestry activities. Sediments consist of fine soil products held in suspension in water and deposited in a stream, estuary, embayment, or open coastal waters. In addition to smothering corals and other benthic species, sediments can create unsightly and odorous mud flats in enclosed bays. Sediments also transport nutrients and other chemical substances, such as pesticides, bound to the eroded soils.

Nutrients: Nitrogen and phosphorus are the two major nutrients from forest lands that may degrade water quality. Sudden removal of large quantities of vegetation through harvesting can increase leaching of nutrients from the soil system into surface and ground waters by disrupting the nitrogen cycle. Excessive amounts of nutrients may cause enrichment of waterbodies, stimulating algal blooms.

Forest Chemicals: Herbicides, insecticides, and fungicides used to control forest pests and undesirable plant species can be toxic to aquatic organisms. Pesticides that are applied to foliage or soils, or are applied by aerial means, are most readily transported to surface and ground waters. Other chemicals that may be released during forestry operations include fuel, oil, and coolants used in equipment for harvesting and road-building operations.

Organic Debris: Organic debris includes residual logs, slash, litter, and soil organic matter generated by forestry activities. Organic debris can result in decreased dissolved oxygen levels in watercourses, and logs and slash can form dams and alter streamflows.

Temperature: Increased temperatures in streams and waterbodies can result from vegetation removal in the riparian zone by either harvesting or herbicide use. These temperature increases can adversely affect aquatic species and habitats and decrease the dissolved oxygen holding capacity of a waterbody.

Stream Flow: Increased stream flow caused by vegetation removal can scour channels, erode streambanks, increase sedimentation, and increase peak flows.

I.3. Existing Programs Addressing Forestry

A. DLNR: Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. DNLR-DOFAW administers this Tree Farm Program. The "Right to Harvest" condition under the Tree Farm Program assures landowners that they can harvest commercially grown timber in a manner consistent with conservation concerns. Eligible lands must be within the State Agricultural District, or on degraded forest and pasture lands within the permitted State Conservation District subzone designated for forest use. The "Right to Harvest" covers new trees grown according to a management plan that has been approved by DLNR.

In addition, once land users have completed an approved tree farm management plan with DLNR, they will be able to petition the county to qualify for a property tax assessment established for tree farms. DLNR is currently working with the County of Hawaii to establish this tax incentive.

DLNR-DOFAW also administers several federal- and State-funded assistance programs for private land users who have an interest in managing their forest lands and native ecosystems. The Forest Stewardship Program is one such program. This program, established under Chapter 195F, HRS, enables DLNR-DOFAW to provide cost-share funding of up to 50% for implementation of approved forest stewardship management practices and activities. To qualify, landowners must be a private individual, group, or association; or a private corporation whose business is not exclusively the production of forest products. Landowners prepare stewardship management plans for approval by DLNR. The Forest Stewardship Program receives dedicated State funding through a portion of the conveyance tax, as well as U.S. Forest Service funding.

B. U.S. Forest Service: The Institute of Pacific Islands Forestry, U.S. Department of Agriculture's (USDA) Forest Service (USFS), provides research and extension services to its constituents in Hawaii and several island groups in the Western Pacific. Locally, USFS research is conducted on State land in collaboration with DLNR-DOFAW. USFS does not own land or have land management responsibilities in Hawaii.

The Institute's Forest Management Services unit provides a broad range of extension services that include technology transfer to reduce nonpoint source pollution. Staff are available for consultation, advice, and participation on committees such as the forestry focus group. The unit provides technical advice on forest management practices and offers grants through DLNR-DOFAW for reforestation on State and private lands. The unit can also help secure mainland USFS technical assistance in farm and forest road engineering to reduce erosion.

C. DLNR, SWCDs: There are 16 local SWCDs in Hawaii. Their roles are to take available technical, financial and educational resources and focus them to meet the conservation needs of the local land users. For more information, please refer to the description of the SWCDs on page III-8 under Chapter 1: Agriculture.

D. University of Hawaii Cooperative Extension Service (CES): The CES is the organized extension unit of the College of Tropical Agriculture and Human Resources at the University of Hawaii. For more information on the role of CES, please refer to the description on page III-8 under Chapter 1: Agriculture.

E. USDA, Natural Resources Conservation Service (NRCS): The NRCS administers programs designed to protect and improve land and water resources. The mission is carried out through two major activities: (1) conservation operations; and (2) watershed and flood prevention operations. For more information on NRCS's services, please refer to the description on page III-8 under Chapter 1: Agriculture.

II. MANAGEMENT MEASURES

Due to the small base of operations, forestry in Hawaii is not a significant contributor to polluted runoff at this time. However, the management measures for forestry are still relevant to Hawaii because there is potential for significant growth in the forest products industry in the near future.

Since commercial forestry is not being undertaken on a large scale in Hawaii at this time, there are few mechanisms currently in place that specifically address forestry activities and their impacts on water quality. In anticipation of forestry becoming a more viable industry in the State, such mechanisms will likely be further developed in the near-future. Other mechanisms do exist that will affect forestry operations in certain areas.

A. Preharvest Planning Management Measure

Perform advance planning for forest harvesting that includes the following elements, where appropriate:

(1) Identify the area to be harvested including location of waterbodies and sensitive areas such as wetlands, threatened

or endangered aquatic species habitats, or high erosion-hazard areas (landslide-prone areas) within the harvest unit.

(2) Time the activity for the season or moisture conditions when the least impact occurs.

(3) Consider potential water quality impacts and erosion and sedimentation control in the selection of silvicultural and regeneration systems, especially for harvesting and site preparation.

(4) Reduce the risk of occurrence of landslides and severe erosion by identifying high erosion-hazard areas and avoiding harvesting in such areas, to the extent practicable.

(5) Consider additional contributions from harvesting or roads to any known existing water quality impairments or problems in watersheds of concern.

Perform advance planning for forest road systems that includes the following elements, where appropriate:

(1) Locate and design road systems to minimize, to the extent practicable, potential sediment generation and delivery to surface waters. Key components are:
- **locate roads, landings, and skid trails to avoid, to the extent practicable, steep grades and steep hillslope areas, and to decrease the number of stream crossings;**
- **avoid, to the extent practicable, locating new roads and landings in Streamside Management Zones (SMZs); and**
- **determine road usage and select the appropriate road standard.**

(2) Locate and design temporary and permanent stream crossings to prevent failure and control impacts from the road system. Key components are:
- **size and site crossing structures to prevent failure;**
- **for fish-bearing streams, design crossings to facilitate fish passage.**

(3) Ensure that the design of road prism and the road surface drainage are appropriate to the terrain and that road surface design is consistent with the road drainage structures.

(4) Use suitable materials to surface roads planned for all-weather use to support truck traffic.

(5) Design road systems to avoid high erosion or landslide hazard areas. Identify these areas and consult a qualified specialist for design of any roads that must be constructed through these areas.

Each State should develop a process (or utilize an existing process) that ensures that the management measures in this chapter are implemented. Such a process should include appropriate notification, compliance audits, or other mechanisms for forestry activities with the potential for significant adverse nonpoint source effects based on the type and size of operation and the presence of stream crossings or SMZs.

II.A.1. Description

The objective of this management measure is to ensure that silvicultural activities, including timber harvesting, site preparation, and associated road construction, are conducted without significant nonpoint source pollutant delivery to streams and coastal areas. Road system planning is an essential part of this management measure, since roads have consistently been shown to be the largest cause of sedimentation resulting from forestry activities. Good road location and design can greatly reduce the sources and transport of sediment. Road systems should generally be designed to minimize the number of road miles/acres, the size and number of landings, the number of skid trail miles, and the number of watercourse crossings, especially in sensitive watersheds. Timing operations to take advantage of favorable seasons or conditions, avoiding wet seasons prone to severe erosion or spawning periods for fish, is effective in reducing impacts to water quality and aquatic organisms.

Preharvest planning is the collection of information about the area to be harvested and the synthesis of that information into an effective preharvest plan. This plan will consider the silvicultural prescription for the species and site, the best estimate of the time and method of harvest, and any post-harvest site preparation and reforestation activities.

An effective preharvest plan will take into consideration all aspects of a timber harvest that may lead to water quality degradation and plan for the implementation of best management practices (BMPs) which will minimize or void the adverse effects of the operation. The objective of preharvest planning is to determine which BMPs are necessary to protect water quality and how those BMPs will be implemented.

II.A.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. The planning process components of this management measure apply to commercial harvesting on areas greater than 5 acres and any associated road system construction or reconstruction conducted as

part of normal silvicultural activities. The component for ensuring implementation of this management measure applies to harvesting and road construction activities that are determined to be of a sufficient size to potentially impact the receiving water or that involve SMZs or stream crossings. This measure does not apply to harvesting conducted for precommercial thinning or noncommercial firewood cutting.

II.A.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

a. Develop a written pre-harvest plan that includes the following information about the physical and administrative details of the site, and management activities to be used:
   - property and administrative boundaries;
   - topography;
   - location of streams and drainages;
   - location of SMZs and buffer strips;
   - location of all roads, skid trails, and landings prior to harvest;
   - forest types;
   - soil types;
   - environmental concerns (botanical, archaeological, biological, visual quality);
   - road and landing design;
   - construction techniques;
   - felling and bucking techniques;
   - yarding systems and layout;
   - planned stream crossings;
   - disposal of waste materials (machine lubricants);
   - post-harvest site preparation; and
   - reforestation activities.

b. Use topographic maps, road maps, aerial photos, forest type maps, and soil surveys in combination with field reconnaissance to determine the site conditions and plan operations. Field reconnaissance with an individual who is knowledgeable about the area being harvested is recommended.

c. Identify, at a minimum, known sites of threatened and endangered aquatic species habitats.

d. Preliminary planning should consider the maintenance of existing drainage patterns and the location of environmentally-sensitive areas such as streams, wetlands, and high erosion-hazard areas.

e. The location and design of roads, skid trails, and landings should be integrated to minimize their impact.

f. The grade of logging roads and skid trails should be less than 10% when possible, with 3-5% being the most desirable. Avoid long, straight grades and occasionally break the grade to provide surface drainage.

g. Preharvest planning should include full consideration of silvicultural prescriptions, site preparation, and reforestation activities.

II.A.4. Implementation of Management Measure

The preharvest planning management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: DLNR-DOFAW is the lead agency for implementation of this management measure. Other federal, State, and local agencies involved in implementation include:

- DOH, Environmental Management Division, which implements programs for water pollution control;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, and research and extension services; and
- County departments of planning, which administer the Shoreline Management Area (SMA) permit and shoreline setback provisions, if a forestry operation is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. DNLR-DOFAW administers this Tree Farm Program. In order to receive tree farm classification, land users must develop management plans that specify BMPs to be installed during all phases of the forestry operation. The requirements of this management plan would appear to address those of a preharvest plan, as specified in this management measure.

The "Right to Harvest" condition under the Tree Farm Program assures landowners that they can harvest commercially grown timber in a manner consistent with conservation concerns. Eligible lands must be within the State Agricultural District, or on degraded forest and pasture lands within the permitted State Conservation District subzone designated for forest use. The

"Right to Harvest" covers new trees grown according to a management plan that has been approved by DLNR.

In addition, only after a forestry operation has completed an approved management plan can the land user petition the county to qualify for the property tax rate for tree farms. The County of Hawaii is interested in promoting forestry activities, and is in the process of establishing a property tax rate for tree farms. Once this lower, more favorable rate is established, it will provide a tremendous incentive for land users to prepare and implement forestry management plans in order to qualify for the tax savings.

At present, a Conservation District Use Application (CDUA) permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, appears to be the only regulatory mechanism that deals directly with preharvest planning in some situations. A CDUA permit would be required before forestry operations were conducted in the State conservation district. Such an application would require some kind of preharvest plan, though CDUA requirements are not currently designed to meet the requirements of this preharvest planning management measure. However, since most potential forestry operations are likely to be started on agricultural lands, a CDUA permit would not be required. In addition, lands under the administration of the State Department of Hawaiian Home Lands (DHHL) may be exempt from the CDUA and other State and county permit requirements.

Under Chapter 171-54, HRS, the Board of Land and Natural Resources may issue land licenses for use of public lands, including harvesting of forest lands. While such licenses have not been issued for some time, they may be issued in the future. Conditions could be placed on these licenses requiring land users to implement BMPs, as specified by DLNR-DOFAW.

Water quality is generally addressed under the State's water pollution control statutes. While Chapter 342E, HRS, addresses nonpoint source pollution control, administrative rules have not yet been developed to implement it. These rules will be developed in conjunction with the further development and implementation of the coastal nonpoint pollution control program. Chapter 11-54, HAR - the administrative rules that implement much of Chapter 342D, HRS - has no procedures in place to enforce the water quality standards it sets forth. Further, there is almost no monitoring in place capable of enforcing any of these regulatory mechanisms.

B. Streamside Management Zones (SMZs)

Establish and maintain a streamside management zone along surface waters, which is sufficiently wide and which includes a sufficient number of canopy species to buffer against detrimental changes in the temperature regime of the waterbody, to provide bank stability, and to withstand wind damage. Manage the SMZ in

such a way as to protect against soil disturbance in the SMZ and delivery to the stream of sediments and nutrients generated by forestry activities, including harvesting. Manage the SMZ canopy species to provide a sustainable source of large woody debris needed for instream channel structure and aquatic species habitat.

II.B.1. Description

A SMZ is a designated area that consists of the stream itself and an adjacent area of varying width where management activities that might affect water quality, fish, or other aquatic resources are modified to mitigate the adverse effects. The SMZ is not an area of exclusion, but an area of closely managed activity.

The SMZ is also commonly referred to as a streamside management area or riparian management area or zone. SMZs are widely recognized to be highly beneficial to water quality and aquatic habitat. Vegetation in SMZs reduces runoff and traps sediments generated from upslope activities, and reduces nutrients in runoff before they reach surface waters. Canopy species provide shading to surface waters, which moderates water temperature and provides the detritus that serves as an energy source for stream ecosystems. Trees in the SMZ also provide a source of large woody debris to surface waters. SMZs provide important habitat for aquatic organisms (and terrestrial species), while preventing excessive logging-generated slash and debris from reaching waterbodies.

II.B.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to surface waters bordering or within the area of operation. SMZs should be established for perennial waterbodies as well as for intermittent streams that are flowing during the time of operation.

For the purposes of this management measure, the following definitions will be used.

- ***Perennial waterbodies*** include lakes, ponds, springs, wetlands, and perennial streams listed in the Hawaii Stream Assessment.
- A ***stream*** is any natural water course in which water usually flows in a defined bed or channel, whether or not the flow is constant, uniform, or uninterrupted, and regardless of whether the stream has been altered or channelized. In distinguishing between a stream and other water features such as gullies, the most significant feature of a stream is the existence of a streambed that has graded or sorted deposits consisting primarily of sand, gravel, and boulders.
- A ***perennial stream*** carries water all the time.
- An ***intermittent stream*** carries water most of the time but ceases to flow occasionally because evaporation or seepage into its bed and banks exceed the available streamflow. For the purposes of this management measure, intermittent streams will also include:
    - ***ephemeral streams*** that carry water only after rains; and

- ***interrupted streams*** that carry water generally through their length but may have sections with dry streambeds.

Manmade structures that may function as streams and other natural waterbodies, such as livestock ponds, swales, and water distribution systems (i.e., irrigation), are not considered perennial waterbodies or streams, as defined above.

II.B.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

a. The width of SMZs may vary, depending on the following conditions: slope of land adjacent to stream, soil erodibility, precipitation, knowledge of particular area, sensitivity of stream, etc. These factors can be obtained from soil maps, on-the-ground evaluation and measurements, weather data, etc.
b. SMZs should be designed on a case-by-case basis. Most important is that SMZs be consistent with stream characteristics and wide enough to protect water quality.
c. Partial harvesting is acceptable in SMZs. A minimum of 50% of the original crown cover or 50 square feet of basal area per acre, evenly distributed, should be retained in the SMZ. This may be adjusted to meet on-site conditions.
d. Clearcutting is always prohibited within the SMZ.
e. Designate SMZs to provide stream shading, soil stabilization, sediment and water filtering effects, and wildlife habitat. Trees on the south and west banks provide the most critical shading of water.
f. Within the SMZ, the immediate vicinity of the stream shall be more protected, with trees rarely harvested and understory disturbances kept to a minimum. The "immediate vicinity" shall include unstable slopes and areas annually flooded.
g. Access roads should cross perennial or intermittent streams at or near a right angle.
h. Drainage structures such as ditches, cross drain culverts, water bars, rolling dips, and broad-based dips should be used on all roads prior to their entrance into an SMZ to intercept and properly discharge runoff waters.

II.B.4. Implementation of Management Measure

At this time, the State does not have a general, statewide policy on SMZs. However, the CZM Program is currently exploring alternatives for such a policy, in cooperation with DLNR and other State, federal, and county agencies. An ongoing riparian area management study will recommend specific riparian area BMPs that would significantly reduce the potential for polluted runoff into the State's surface waters, and a phased strategy for implementing the recommended BMPs in Hawaii's political, social, and economic context. While EPA's SMZ management measure applies only to lands where forestry operations are planned or conducted, the CZM Program hopes to expand the coverage to include areas where other land use activities are conducted. Therefore, the SMZ management measure for forestry may evolve into a more general recommendation for the establishment of SMZs throughout the State, regardless

of land use activity, where they can effectively mitigate the effects of polluted runoff on surface water quality.

(i) Existing Organizational Structure: DLNR is the lead agency for implementing this management measure because it administers the Stream Channel Alteration Permit (SCAP) under the Commission on Water Resources Management (CWRM), and the Forest Stewardship and Tree Farm programs under DOFAW. Other federal and State agencies involved in implementation include:

- DOH, Environmental Management Division, which implements programs for water pollution control; and
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water

Chapter 13-169, HAR, administered by DLNR, states that no stream channel shall be altered without first obtaining a SCAP from CWRM. Section 174C-3 of the Hawaii Water Code provides a definition for "stream." Generally speaking, the definition of stream includes perennial and intermittent streams, but streams must be natural watercourses which contain sufficient water to support instream uses as defined in the Code.

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for streamside management zones.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and a requirement to establish and maintain a SMZ could be included as a permit condition.

C. Road Construction/Reconstruction Management Measure

(1) Follow preharvest planning (as described under Management Measure A) when constructing or reconstructing the roadway.
(2) Follow designs planned under Management Measure A for road surfacing and shaping.
(3) Install road drainage structures according to designs planned under Management Measure A and regional storm return period and installation specifications. Match these drainage structures with terrain features and with road surface and prism designs.
(4) Guard against the production of sediment when installing stream crossings.
(5) Protect surface waters from slash and debris material from roadway clearing.
(6) Use straw bales, silt fences, mulching, or other favorable practices on disturbed soils on unstable cuts, fills, etc.
(7) Avoid constructing new roads in SMZs, to the extent practicable.

II.C.1. Description

The goal of this management measure is to minimize delivery of sediment to surface waters during road construction/reconstruction projects as part of forestry operations. Disturbance of soil and rock during road construction/reconstruction creates a significant potential for erosion and sedimentation of nearby streams and coastal waters. Some roads are temporary or seasonal-use roads, and their construction does not involve the high level of disturbance generated by permanent, high-standard roads. However, temporary or low-standard roads still need to be constructed in such a way as to prevent disturbance and sedimentation.

Although there are many commonly practiced techniques to minimize erosion during the construction process, the most meaningful are related to how well the work is planned, scheduled, and controlled by the road builder and those responsible for determining that work satisfies design requirements and land management resource objectives.

II.C.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to road construction/ reconstruction operations for silvicultural purposes, including:

- *Clearing phase* - clearing to remove trees and woody vegetation from road right-of-way;

- *Pioneering phase* - excavating and filling the slope to establish road centerline and approximate grade;
- *Construction phase* - final grade and road prism construction and bridge, culvert, and road drainage installation; and
- *Surfacing phase* - placement and compaction of roadbed, road fill compaction, and surface placement and compaction (if applicable).

II.C.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Planning, Design, and Location:

a. Use a design to minimize damage to soil and water quality.
b. Roads should be designed no wider than necessary to accommodate the immediate anticipated use.
c. Design cut and fill slopes to minimize massive soil movement.
d. Provide culverts, dips, water bars, and cross drainages to minimize road bed erosion.
e. Design bridge and culvert installations using stream flow data, with a margin of safety proportional to the importance of the road and the protected resources.
f. Provide drainage where surface and groundwater cause slope instability.
g. Avoid diverting water from natural drainage ways. Dips, water bars, and cross drainage culverts should be placed above stream crossings so that water can be filtered through vegetative buffers before entering streams.
h. Locate roads to fit the topography, and minimize alterations to the natural features.
i. Avoid marshes and wetlands.
j. Minimize the number of stream crossings.
k. Cross streams at right angles to the stream channel.
l. Roads should not be located in SMZs, except where access is needed to a water crossing, or where there is no feasible alternative. Roads in any SMZs must be designed and located to minimize adverse effects on fish habitat and water quality.

Construction:

m. A final pre-harvest site review should be conducted so that road alignments and other considerations can be visually checked prior to road construction. The reconnaissance plan should be modified, as necessary, to make desirable adjustments based on the final site review.
n. Construct roads when moisture and soil conditions are not likely to result in excessive erosion or soil movement. Avoid construction during wet periods, when possible, to minimize unnecessary soil disturbance and compaction.
o. The boundaries of all SMZs should be defined on the ground prior to the beginning of any earth-moving activity.
p. Construct roads sufficient to carry the anticipated traffic load with reasonable safety and minimum environmental impact.
q. When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety.

r. Road grades should be kept at less than 10%, except where terrain requires short, steep grades.
s. Minimize the number of stream crossings. Except at crossings, construct roads as far as practicable from streams.
t. Stream crossing construction should minimize disturbance of the area in which the crossing is being constructed.
u. As slope increases, additional diversion ditches should be constructed to reduce the damages caused by soil erosion; ditches, adequate culverts, cross drains, etc., should be installed concurrent with construction.
v. To control erosion, cut and fill slopes should conform to a conservative design appropriate for the particular soil type and topography.
w. Stumps, logs, and slash should be disposed outside of the road prism; in no case should they be covered with fill material and incorporated into road beds.
x. Stabilize the side banks of a road during construction to aid in the control of erosion and road deterioration; this may require mesh or other stabilizing material in addition to planting and/or seeding and other structural measures.
y. Water bars should be located to take advantage of existing wing ditches and cross drainage. Water bars should be constructed at an angle of 30 to 45 degrees to the road. Water bars should be periodically inspected, and damage or breeches should be promptly corrected. Install water bars at recommended intervals to provide drainage.
z. Bridges and overflow culverts should be constructed to minimize changes in natural stream beds during high water.
zz. Culverts on perennial streams should be installed low enough to allow passage of aquatic life during low water.

II.C.4. Implementation of Management Measure:

The road construction/reconstruction management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: No one agency clearly has the lead in implementing this management measure. Federal, State, and local agencies involved in implementation include:

- County departments of public works, which administer the grading ordinances, requiring land users to obtain a grading permit for any disturbances of land greater than a specified area;
- DLNR, which implements the CDUA permit process, the voluntary Stewardship Incentive and Tree Farm programs, and the Hawaii Water Code;
- SWCDs, which help implement the county grading ordinances on agricultural lands;

- DOH, Environmental Management Division, which implements programs for water pollution control;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water
HCC	Chapter 10	Soil Erosion and Sediment Control (Hawaii County)
KCC	Chapter 22-7	Grading, Grubbing and Stockpiling (Kauai County)
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion and Sediment Control (City & County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for road construction/ reconstruction.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and a requirement to establish and maintain a SMZ could be included as a permit condition.

While all earthmoving activities, such as road-building, greater than a specified area[2] are regulated under the four county grading ordinances, the SWCDs may

[2] In Kauai County, this specified amount is 100 cu.yds. In Maui County, the threshold is 4 acres or a vertical cut of 50ft. or greater. A grubbing permit is required if grubbing over 1 acre. In Hawaii County, a permit is required if a project alters a drainage pattern, disturbs more than 100 cu.yds., or entails a cut and fill over 5-ft. In the City and County of Honolulu, a permit is required if a project alters a drainage pattern, requires more than 50 cu.yds. of excavation or 50 cu.yds. of fill, or involves grubbing an area in excess of 15,000 sq.ft.

approve conservation plans which allow agricultural operations to receive an exemption from the grading ordinances (Chapter 180C, HRS). If forestry is considered an agricultural operation, then forestry activities, such as road construction/reconstruction could be exempted from the county grading ordinances *provided* the land users have conservation plans approved by the local SWCDs.

Descriptions of Chapter 13-169, HAR, and Chapter 171-54, HRS, both relevant under this management measure are found on pages III-67 and III-64, respectively.

D. Road Management

(1) Avoid using roads, where possible, for timber hauling or heavy traffic during wet periods on roads not designed and constructed for these conditions.

(2) Evaluate the future need for a road and close roads that will not be needed. Leave closed roads and drainage channels in a stable condition to withstand storms.

(3) Remove drainage crossings and culverts if there is a reasonable risk of plugging or failure from lack of maintenance.

(4) Following completion of harvesting, close and stabilize temporary spur roads and seasonal roads to control and direct water away from the roadway. Remove all temporary stream crossings.

(5) Inspect roads to determine the need for structural maintenance. Conduct maintenance practices, when conditions warrant, including cleaning and replacement of deteriorated structures and erosion controls, grading or seeding of road surfaces, and, in extreme cases, slope stabilization or removal of road fills, where necessary to maintain structural integrity.

(6) Conduct maintenance activities, such as dust abatement, so that chemical contaminants or pollutants are not introduced into surface waters, to the extent practicable.

(7) Properly maintain permanent stream crossings and associated fills and approaches to reduce the likelihood that (a) stream

overflow will divert onto roads, and (b) fill erosion will occur if the drainage structures become obstructed.

II.D.1. Description

The objective of this management measure is to manage existing roads to maintain stability and utility and to minimize sedimentation and pollution from runoff-transported materials. Roads that are actively eroding and providing significant sediment to waterbodies, whether in use or not, must be managed. If roads are no longer in use or needed in the foreseeable future, an effective treatment is to remove drainage crossings and culverts if there is a risk of plugging or failure from lack of maintenance. In other cases (*e.g.*, roads in use), it may be more economically viable to periodically maintain crossing and drainage structures.

Sound planning, design, and construction measures often reduce the future levels of necessary road maintenance. Roads constructed with a minimum width in stable terrain and with frequent grade reversals or dips require minimum maintenance. However, older roads remain one of the greatest sources of sediment from forest land management. In some locations, problems associated with altered surface drainage and diversion of water from natural channels can result in serious gully erosion or landslides. Smaller erosion features, such as gullies and deep ruts, are far more common than landslides and very often are related to road drainage.

Drainage of the road prism, road fills in stream channels, and road fills on steep slopes are the elements of greatest concern in road management.

II.D.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to active and inactive roads constructed or used for silvicultural activities.

II.D.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Maintenance:

a. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.
b. Keep culverts, flumes, and ditches functional before and during the rainy season to diminish danger of clogging and the possibility of washouts. Provide for practical and scheduled preventive maintenance programs for high risk sites that will address the problems associated with high intensity rainfall events.
c. Conduct road surface maintenance, as necessary, to minimize erosion of the surface an subgrade.

d. During operations, keep the road surface crowned or outsloped, and keep the downhill side of the road free from berms, except those intentionally constructed for protection of fill.
e. Avoid using roads during wet periods if such use will likely damage road drainage features.
f. Water bars should be inspected after major rainstorms, and damage or breeches should be promptly corrected.

Harvesting - Temporary Access Roads and Landings:

g. The location of temporary access roads (logging roads) should be planned before operations begin.
h. Road construction should be kept to a minimum.
i. Landings should be located to minimize the adverse impacts of skidding on natural drainage patterns.
j. Logging roads and landings should be located on firm ground.
k. Landings should be kept as small an area as possible.
l. When operations are completed, provisions should be made to divert water runoff from roads and landings.

II.D.4. Implementation of Management Measure

The road management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: No one agency clearly has the lead in implementing this management measure. Federal, State, and local agencies involved in implementation include:

- DLNR, which implements the CDUA permit process, the voluntary Stewardship Incentive and Tree Farm Programs, and the Hawaii Water Code;
- SWCDs, which provide technical assistance on best management practices on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control;
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is planned in the SMA; and
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for road management.

At present, there are no enforceable mechanisms that specifically address the road management measure for forestry. Water quality is generally addressed under the State's water pollution control statutes. Please refer to page III-64 for more information on Chapters 342D and 342E, HRS.

E. Timber Harvesting

The timber harvesting management measure consists of implementing the following:

(1) Timber harvesting operations with skid trails or cable yarding follow layouts determined under Management Measure A.

(2) Install landing drainage structures to avoid sedimentation, to the extent practicable. Disperse landing drainage over sideslopes.

(3) Construct landings away from steep slopes and reduce the likelihood of fill slope failures. Protect landing surfaces used during wet periods. Locate landings outside of SMZs. <u>Minimize size of landing areas.</u>

(4) Protect stream channels and significant ephemeral drainages from logging debris and slash material.

(5) Use appropriate areas for petroleum storage, draining, dispensing. Establish procedures to contain and treat spills.

Recycle or properly dispose of all waste materials in accordance with State law.

For cable yarding:

(1) Limit yarding corridor gouge or soil plowing by properly locating cable yarding landings.
(2) Locate corridors for SMZs following Management Measure B.
(3) Cable yarding should not be done across perennial or intermittent streams, except at improved stream crossings.

For groundskidding:

(1) Within SMZs, operate groundskidding equipment only at stream crossings, to the extent practicable. In SMZs, fell and endline trees to avoid sedimentation.
(2) Use improved stream crossings for skid trails which cross flowing drainages. Construct skid trails to disperse runoff and with adequate drainage structures.
(3) On steep slopes, use cable systems rather than groundskidding where groundskidding may cause excessive sedimentation.
(4) Groundskidding should not be done across perennial or intermittent streams, except at improved stream crossings.

II.E.1. Description

The goal of this management measure is to minimize sedimentation resulting from the siting and operation of timber harvesting, and to manage petroleum products properly. Locating landings for both groundskidding and cable yarding harvesting systems according to preharvest planning minimizes erosion and sediment delivery to surface waters.

Also, any chemicals or petroleum products spilled in harvest areas can be highly mobile, adversely affecting the water quality of nearby surface waters. Correct spill prevention and containment procedures are therefore necessary to prevent petroleum products from entering surface waters.

This management measure makes minor amendments to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

***Justification for Changes to Management Measure**: The forestry focus group proposed these changes for the following reasons.*

- *(i) Minimize Size of Landing Areas: Not only is it important to construct landings away from steep slopes, reduce the likelihood of fill slope failures,*

protect landing surfaces used during wet periods, and locate landings outside SMZs, but it is also important to minimize the size of the landing areas in order to reduce the amount of land disturbance. This sentence was added to (3) under the first paragraph.

- *(ii) Dispose of Wastes According to State Law: It is important to recycle and properly dispose of all waste materials, in accordance with State law. This phrase was added to (5) under the first paragraph.*
- *(iii) Cable Yarding and Groundskidding Across Streams: Cable yarding and groundskidding should not be done across perennial or intermittent streams, except at improved stream crossings. This sentence was added as (3) under cable yarding and (4) under groundskidding.*

II.E.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all harvesting, yarding, and hauling conducted as part of normal silvicultural activities on harvest units larger than 5 acres. This measure does not apply to harvesting conducted for precommercial thinnings or noncommercial firewood cutting.

II.E.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

a. Careful felling can minimize the impact of subsequent phases of logging operations.
b. Trees should not be felled into streams, except where no safe alternative exists. In the latter case, such trees should be removed promptly.
c. Skidding should be done so as to avoid disrupting natural drainage and to prevent excessive soil displacement.
d. Stream channels and road ditches should not be used as skid trails.
e. Skid trails on steep slopes should have occasional water bars.
f. Servicing of equipment involving fuel, lubricants, or coolants should be performed in places where these materials cannot enter streams. Spent oil should be collected for proper disposal and never poured on the ground.
g. Upon completion of logging, erosion-prone areas should be mulched or seeded.
h. Logging debris in streams should be removed immediately.
i. Debris from landings should not be pushed into drains, streams, or SMZs.
j. All trash associated with logging operations should be promptly removed (not buried) and hauled to a legal disposal site.

II.E.4. Implementation of Management Measure

The timber harvesting management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the

changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: No one agency clearly has a regulatory lead in implementing this management measure. DLNR implements the Forest Stewardship and Tree Farm Programs, CDUA permit process, and Hawaii Water Code. Other federal, State, and local agencies involved in implementation include:

- SWCDs, which provide technical assistance on best management practices on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control, solid and hazardous waste management, and used oil disposal;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is conducted in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship Program
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 342H	Solid Waste Pollution
HRS	Chapter 342I	Lead Acid Battery Recycling
HRS	Chapter 342L	Underground Storage Tank
HRS	Chapter 342N	Used Oil
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for timber harvesting.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and conditions pertaining to timber harvesting could be attached to the permit.

Descriptions of Chapter 13-169, HAR, and Chapter 171-54, HRS, which may be relevant under this management measure, are found on pages III-67 and III-64, respectively.

Chapter 342L, HRS, administered by DOH, discusses petroleum storage. Chapter 342N, HRS, also administered by DOH, prohibits the discharge of new, used, or recycled oil into sewers, drainage systems, surface or groundwaters, watercourses, marine waters, or onto the ground. Chapter 342I, HRS, also administered by DOH, describes the procedures and prohibitions for disposing and recycling of lead acid batteries.

F. Site Preparation and Forest Regeneration Management Measure

Confine on-site potential nonpoint source pollution and erosion resulting from site preparation and the regeneration of forest stands. The components of the management measure for site preparation and regeneration are:

(1) Select a method of site preparation and regeneration suitable for the site conditions.
(2) Conduct mechanical tree planting and ground-disturbing site preparation activities on the contour of [~~sloping~~] <u>erodible</u> terrain.
(3) Do not conduct mechanical site preparation and mechanical tree planting in SMZs.
(4) Protect surface waters from logging debris and slash material.
(5) Suspend operations during wet periods if equipment used begins to cause excessive soil disturbance that will increase erosion.
(6) Locate windrows at a safe distance from drainages and SMZs to control movement of the material during high runoff conditions.
(7) Conduct bedding operations in high water-table areas during dry periods of the year. Conduct bedding in [~~sloping~~] <u>erodible</u> areas on the contour.

(8) Protect small ephemeral drainages when conducting mechanical tree planting.

II.F.1. Description

Regeneration of harvested forest lands not only is important in terms of restocking a valuable resource, but also is important to provide water quality protection from disturbed soils. Tree roots stabilize disturbed soils by holding the soil in place and aiding soil aggregation, decreasing slope failure potential. The presence of vegetation on disturbed soils also slows runoff, which, in turn, decreases erosion.

Leaving the forest floor litter layer intact during site preparation operations for regeneration minimizes mineral soil disturbance and detachment, thereby minimizing erosion and sedimentation. Maintenance of an unbroken litter layer prevents raindrop detachment, maintains infiltration, and slows runoff. Mechanical site preparation can potentially impact water quality in areas that have steep slopes and erodible soils, and where the prepared site is located near a waterbody. Natural regeneration, hand planting, and direct seeding minimize soil disturbance, especially on steep slopes with erodible soils.

This management measure amends the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

> ***Justification for Alternative Management Measure**: Though erosion is normally a problem associated with sloping lands, there are soils in Hawaii that are highly resistant to erosion despite their sloping characteristics. In order to more accurately reflect this point, the word "sloping" was changed to "erodible" in Items (2) and (7) of this management measure.*

II.F.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all site preparation and regeneration activities conducted as part of normal silvicultural activities on harvested units larger than 5 acres.

II.F.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Mechanical Site Preparation:

a. Avoid excessive soil compaction.
b. Minimize erosion and the movement of sediment into waters.
c. Prevent accumulation of debris in ponds, streams, or rivers.
d. Windrows, disking, bedding, and planting with "furrow" type mechanical planters should follow contours.
e. Avoid complete disking of steep slopes with extremely erodible soil.
f. Plant trees on contour.

II.F.4. Implementation of Management Measure

The site preparation and forest regeneration management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: No one agency clearly has the lead in implementing this management measure. Federal, State, and local agencies involved in implementation include:

- DLNR, which implements the CDUA permit process, the voluntary Forest Stewardship Program, Tree Farm Program, and Hawaii Water Code;
- SWCDs, which help implement the county grading ordinances on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services;
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is planned in the SMA; and
- County departments of public works, which administer the grading ordinances, requiring land users to obtain grading permits for any disturbances of land greater than a specified area.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship Program
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water
HCC	Chapter 10	Soil Erosion and Sediment Control (Hawaii County)

KCC	Chapter 22-7	Grading, Grubbing and Stockpiling (Kauai County)
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion and Sediment Control (City & County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for site preparation and forest regeneration.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and conditions pertaining to site preparation and forest regeneration could be attached to the permit.

While earthmoving activities greater than a specified area are regulated under the four county grading ordinances, the SWCDs are allowed to exempt agricultural operations from the grading ordinance if the operations have approved conservation plans (Chapter 180C, HRS). If forestry is considered an agricultural operation, then forestry activities that involve grading, grubbing, or other earthmoving could be exempted from the county grading ordinances *provided* land users have conservation plans approved by the local SWCDs.

Descriptions of Chapter 13-169, HAR, and Chapter 171-54, HRS, which may be relevant under this management measure, are found on pages III-67 and III-64, respectively.

G. Fire Management

Prescribe fire [~~for site preparation and control~~] or suppress wildfire in a manner which reduces potential nonpoint source pollution of surface waters:

(1) [~~Intense p~~]Prescribed fire should not cause excessive sedimentation due to the combined effect of removal of canopy species and the loss of soil-binding ability of subcanopy and herbaceous vegetation roots, especially in SMZs, in streamside vegetation for small ephemeral drainages, or on very steep slopes.

(2) Prescriptions for [~~prescribed~~] fire should protect against excessive erosion or sedimentation, to the extent practicable.

(3) All bladed firelines, for prescribed fire and wildfire, should be plowed on contour or stabilized with water bars and/or other

appropriate techniques if needed to control excessive sedimentation or erosion of the fireline.

(4) Wildfire suppression and rehabilitation should consider possible nonpoint source pollution of watercourses, while recognizing the safety and operational priorities of fighting wildfires.

II.G.1. Description

The goal of this management measure is to minimize potential nonpoint source pollution and erosion resulting from prescribed fire and from the methods used for presuppression and suppression activities.

Prescribed burning is aimed at reducing fuel loading and competition for nutrients among seedlings and protecting against wildfire. Slash burning destroys vegetation that reduces nitrogen-nitrate loadings. If uncontrolled, the burn may impact SMZs or highly erodible soils, causing increased sedimentation and erosion. Prescribed burning causes changes in the chemical cycling of elements by influencing biological and microclimatic changes, volatilization, and mineralization processes.

The intensity and severity of burning and the proportion of the watershed burned are the major factors affecting the influence of prescribed burning on stream flow and water quality.

This management measure makes minor amendments to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

***Justification for Changes to Management Measure**: The forestry focus group proposed these changes for the following reasons.*

- *(i) Fire for Site Preparation: Fire is not used for site preparation for forestry operations in Hawaii. Therefore, that clause has been eliminated from the management measure.*
- *(ii) Intense Prescribed Fire: No prescribed fire should cause sedimentation, whether or not it is "intense." Therefore, the word "intense" has been removed from (1).*
- *(iii) Redundancy: It is redundant to state "prescriptions for prescribed fire." Therefore, the word "prescribed" has been removed from (2).*

II.G.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all prescribed burning conducted as part of normal activities on all management units for wildfire suppression and rehabilitation on forest, brush, and watershed lands.

II.G.3. Management Practices

The first and foremost concern in wildfire control is to prevent harm or damage to people and property. Fireline best management practices should incorporate

minimum impact strategies, which meet land and resource management objectives. The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Wildfire Control and Reclamation:

a. Areas with bare mineral soils should be revegetated and areas where vegetative cover has been killed or severely degraded should be regenerated with plant species appropriate for the soil conditions.
b. First priority for revegetation/reforestation should be given to banks of surface waterbodies so that SMZs are reestablished.
c. Firelines should be stabilized and, if necessary, revegetated. Erodible areas altered by suppression equipment activities should be repaired and revegetated, as necessary.
d. Access road surfaces should be repaired and stabilized, as necessary.
e. Whenever possible, avoid using fire suppression chemicals over watercourses, and prevent their runoff into watercourses. Do not clean application equipment in watercourses or locations that drain into watercourses.
f. Provide advance planning and training for firefighters that considers water quality impacts when fighting wildfires. This can include increasing awareness so direct application of fire suppression chemicals to waterbodies is avoided and firelines are appropriately placed.
g. Include rehabilitative practices as part of suppression and post-suppression tactics and strategies to mitigate nonpoint source pollution.

Fireline Construction and Maintenance:

h. Firelines should be constructed on the perimeter of the burn area and along the boundaries of SMZs. The purpose of protecting SMZs from fire is to safeguard the filtering effects of tree litter and organic matter.
i. Firelines should follow the guidelines established for logging trails and skid trails, with respect to waterbars and wing ditches, and should be only as wide and as deep as needed to permit safe prescribed burns or fire suppression.
j. Firelines which would cross a drainage should be turned parallel to the stream or have a wing ditch or other structure allowing runoff in the line to be dispersed rather than channeled directly into the stream.
k. All firelines should be assessed after the fire is controlled for appropriate stabilization, and, if necessary, proper rehabilitation should be done while equipment and people are in place.

Prescribed Burn:

l. Intense prescribed fire for site preparation shall be conducted only if it achieves desired results with minimum impacts to water quality.
m. Burning on steep slopes or highly erodible soils should be conducted only when it is absolutely necessary and should follow carefully planned prescriptions.
n. Carefully plan burning to adhere to time of year, weather, topography, and fuel conditions that will help achieve the desired results and minimize impacts on water quality. With proper planning, prescribed fires should not cause excessive sedimentation due to the combined effect of removal of canopy

species and the loss of soil-binding ability of the subcanopy and herbaceous vegetation roots, especially in SMZs, in streamside vegetation for small ephemeral drainages, or on very steep slopes.

II.G.4. Implementation of Management Measure

The fire management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: No one agency clearly has the lead in implementing this management measure. State and local agencies involved in implementation include:

- DLNR, which implements the CDUA permit process, Forest Stewardship Program, and Tree Farm Program;
- SWCDs, which provide technical assistance on best management practices on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control and air quality standards; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if the forestry operation is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation District
HRS	Chapter 185	Land Fire Protection Law
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-60	Air Pollution Control
HAR	Chapter 13-169	Protection of Instream Uses of Water
HCC	Chapter 10	Soil Erosion and Sediment Control (Hawaii County)
KCC	Chapter 22-7	Grading, Grubbing and Stockpiling (Kauai County)
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion and Sediment Control (City & County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

Chapter 185, HRS, administered by DLNR, has provisions to protect wildlands from the destructive impacts of uncontrolled fire. The law provides for an organized approach to the prevention, presuppression, and suppression of fires which threaten forest, grass, brush, and watershed lands. The threat of wildfire is minimized by a permitting system established under Chapter 185-7, HRS. It also has provisions for those who willfully, maliciously, or negligently set fires.

Department of Health administers an Agricultural Burning Permit, required under Chapter 11-60, HAR. DOH issues permits for prescribed fire in support of fuel reduction in the interest of public safety. While this permit is designed primarily to meet air quality standards, the permit system also allows control of burning activities other than agricultural activities statewide.

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for fire management.

Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, regulate land use within the State's conservation districts. According to conditions normally imposed during the CDUA permit process, applicants are required to exercise care and identify a means to prevent and suppress wildfires.

Please refer to page III-71 for a brief description of Chapter 180C, HRS, related to erosion and sediment, which may be relevant under this management measure.

H. Revegetation of Disturbed Areas

Reduce erosion and sedimentation by rapid revegetation of areas disturbed by harvesting operations or road construction:

(1) Revegetate disturbed areas (using seeding or planting) promptly after completion of the earth-disturbing activity. Local growing conditions will dictate the timing for establishment of vegetative cover.
(2) Use mixes of species and treatments developed and tailored for successful vegetation establishment for the region or area.
(3) Concentrate revegetation efforts initially on priority areas such as disturbed areas in SMZs or the steepest areas of disturbance near drainages.

II.H.1. Description

Revegetation of areas of disturbed soil can successfully prevent sediment and pollutants associated with the sediment (such as phosphorus and nitrogen) from entering nearby surface waters. The vegetation controls soil erosion by dissipating the erosive forces of raindrops, reducing the velocity of surface runoff, stabilizing soil particles with roots, and contributing organic matter to the soil, which increases soil infiltration rates.

Vegetation can trap and prevent dry ravel from moving further downslope, and it produces organic matter that is incorporated into the soil, increasing infiltration rates. Nutrient and soil losses to streams and lakes also can be reduced by revegetating burned, cut over, or otherwise disturbed areas. In some cases, double plantings are used: an early planting to establish erosion protection quickly and a later planting to provide more permanent protection.

II.H.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all disturbed areas resulting from harvesting, road building, and site preparation conducted as part of normal silvicultural activities. Disturbed areas are those localized areas within harvest units or road systems where mineral soil is exposed or agitated (*e.g.*, road cuts, fill slopes, landing surfaces, cable corridors, or skid trail ruts).

II.H.3. Management Measures

There are currently no BMPs described by DLNR-DOFAW that pertain directly to revegetation of disturbed areas.

II.H.4. Implementation of Management Measure

The management measure for revegetation of disturbed forestry areas will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: There are currently no regulatory and non-regulatory mechanisms that directly pertain to this management measure. Federal, State, and local agencies indirectly involved in its implementation include:

- DLNR, which implements the CDUA permit process and the voluntary Forest Stewardship and Tree Farm Programs;
- SWCDs, which provide technical assistance on best management practices and help implement the county grading ordinances on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control;

- County departments of public works, which administer the grading ordinances, requiring land users to obtain grading permits for any disturbances of land greater than a specified area;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HCC	Chapter 10	Soil Erosion and Sediment Control (Hawaii County)
KCC	Chapter 22-7	Grading, Grubbing and Stockpiling (Kauai County)
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion and Sediment Control (City & County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for revegetation of disturbed areas.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and conditions pertaining to revegetation of disturbed areas could be attached to the permit.

Please refer to page III-71 for a brief description of Chapter 180C, HRS, related to erosion and sediment, which may be relevant under this management measure.

I. Forest Chemical Management

Use chemicals when necessary for forest management in accordance with the following to reduce nonpoint source pollution impacts due to the movement of forest chemicals off-site during and after application:

(1) Conduct applications by skilled and, where required, licensed applicators according to the registered use, with special consideration given to impacts to nearby surface and ground waters.

(2) Carefully prescribe the type and amount of pesticides appropriate for the insect, fungus, or herbaceous species.

[(4)] (3) Establish and identify buffer areas for surface waters. (This is especially important for aerial applications.)

[(3)] (4) Prior to applications of pesticides and fertilizers, inspect the mixing and loading process and the calibration of equipment, and identify the appropriate weather conditions, the spray area, and buffer areas for surface waters.

(5) Immediately report accidental spills of pesticides or fertilizers into surface waters to the appropriate State agency. Develop an effective spill contingency plan to contain spills.

II.I.1. Description

Chemicals used in forest management are generally pesticides (insecticides, herbicides, and fungicides) and fertilizers. Since pesticides may be toxic, they must be mixed, transported, loaded, and applied properly and their containers disposed of properly in order to prevent potential nonpoint source pollution. Since fertilizers may also be toxic or may shift the ecosystem energy dynamics, depending on the exposure and concentration, they must also be properly handled and applied.

Although pesticides and fertilizers are used infrequently in forest operations, they can still pose a risk to the aquatic environment, depending on the application technique used. Most adverse water quality effects related to the application of pesticides and fertilizers result from direct application of chemicals to surface waters or from chemical spills. Researchers also found that providing buffer areas around streams and other waterbodies effectively eliminated adverse water quality effects from forestry chemicals.

This management measure makes minor amendments to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

***Justification for Changes to Management Measure**: The forestry focus group proposed these changes for the following reasons.*

- *(i) Adding Groundwater: It is important to protect groundwater, as well as surface water, from impacts due to forestry chemical applications. Therefore, groundwater was added to (1) of this management measure.*
- *(ii) Reordering (3) and (4): The order of (3) and (4) was switched, since it is important to establish buffer areas before applying pesticides and fertilizers.*

II.I.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all fertilizer and pesticide applications (including biological agents) conducted as part of normal silvicultural activities.

II.I.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Pesticide Selection:

a. When the decision is made to use pesticides, choose products suitable for use on the target species and registered for the intended uses. Use only pesticides registered by EPA. Prior to using any pesticide, carefully read and follow all label directions.
b. When selecting pesticide options, more than effectiveness and cost should be evaluated. Consideration should also be given to site factors, application conditions and techniques and products that can influence impacts to water quality.
c. Three main characteristics can greatly affect a pesticide's potential to contaminate surface or ground water. They are solubility, absorption and breakdown rate. In a given situation, pesticides with the highest water solubilities, greatest persistence, lowest affinities for absorption to organic matter, and highest application rates have the greatest potential for movement in surface or ground water. An alternative means of minimizing the potential movement of a pesticide is to select a non-broadcast application technique for the same pesticide that reduces the amount of the chemical applied directly to the soil.

Procedures for Pesticide Use:

d. Transportation
    - Use common sense and care when transporting pesticides;
    - Inspect all containers prior to loading and ensure all caps, plugs, and bungs are tightened;
    - Handle containers carefully when loading onto vehicles;
    - Secure containers properly to prevent shifting during transport;
    - Check containers periodically en route;
    - Limit access to containers during transport to prevent tampering;
    - Consider potential impacts on water quality when selecting transportation routes;

- Educate and inform the driver of the proper transportation precautions; and
- Never transport pesticides unless arrangements have been made to receive and store them properly.

e. Storage

- Chemicals should be used and stored in accordance with all applicable federal, state, and local regulations;
- All containers should be labeled in accordance with applicable federal, state, and local regulations;
- Store pesticides in their original containers with labels intact;
- Do not store pesticides for extended periods in buildings that will not contain a complete spill from the largest container being stored;
- Check containers prior to storage and periodically during storage to ensure that they are properly sealed;
- Locate pesticide storage facilities at sites that minimize the possibility of impacts on water quality in case accidents or fires occur;
- Use storage buildings that have floors constructed of concrete or other impermeable materials so that spills are easy to clean up;
- Ensure that storage facilities can be secured under lock and key; and
- Post a list of chemicals and quantities stored at storage areas and notify the fire department about storage.

f. Mixing/Loading

- Review label before opening the container to ensure familiarity with current use directions;
- Exercise care and caution during mixing and loading;
- Replace pour caps and close bags or other containers immediately after use; and
- Mix chemicals and clean equipment only where possible spills would not enter streams, lakes, or ponds.

g. Application

- Chemicals should not be applied where stream pollution is likely to occur through aerial drift;
- Use a spray device capable of immediate shutoff;
- Refer to label directions before making a pesticide application;
- Check all application equipment carefully, particularly for leaking hoses and connections and plugged or worn nozzles. Calibrate spray equipment periodically to achieve uniform distribution and rate;
- Apply pesticides under favorable weather conditions. Never apply a pesticide when there is a likelihood of significant drift; and
- Always use pesticides in accordance with label instruction, and adhere to all federal and State policies and regulations governing pesticide use.

h. Cleanup and Disposal

- Before disposal, containers should be rinsed as described in equipment cleanup;

- Cleanup should be in a location where chemicals will not enter any stream, pond, or where stream pollution might occur;
- Rinse empty pesticide containers and mixing apparatus three times. This flushing should be applied in spray form to the treated area, NOT into the ground; and
- Dispose of pesticide wastes and containers according to federal and State laws. Some pesticide wastes are specifically identified as hazardous wastes by law and must be handled and disposed of in accordance with hazardous waste regulations.

Other chemicals:
Improper storage and handling of oil products and fuel can be a water quality hazard. Improper disposal of oil or fuel can contaminate ground water and seep into streams.

i. Locate storage and disposal facilities away from streams, and be prepared to clean up spills.
j. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances.
k. Do not transport, handle, store, load, apply, or dispose of any hazardous substance or fertilizer in such a manner as to pollute water supplies or cause damage or injury to humans, desirable plants and animals.
l. Do not store, mix, or rinse hazardous substances or fertilizers within SMZs or where they might enter streams or waterways.
m. Develop a contingency plan for hazardous substance spills, including cleanup procedures.
n. Report all spills to DOH.

II.I.4. Implementation of Management Measure:
The forest chemical management measure will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: DOA, Pesticides Branch, is the lead agency for implementing those measures that relate to regulating pesticides. At present, there are no enforceable mechanisms that specifically address the application of forestry fertilizers. Therefore, no one agency clearly has the lead in implementing that component of the management measure. Other agencies involved in implementation include:

- DLNR-DOFAW, which implements the Forest Stewardship and Tree Farm Programs; and

- DOH, Environmental Management Division, which implements programs for water pollution control and safe drinking water.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 149A	Hawaii Pesticides Law
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 4-66	Pesticides
HAR	Chapter 11-54	Water Quality Standards

Chapter 149A, HRS, administered by DOA, states that "no person shall: (1) use any pesticide in a manner inconsistent with its label; (2) use, store, transport, or discard any pesticide or pesticide container in any manner which would have unreasonable adverse effects on the environment; ... (6) fill with water, through a hose, pipe, or other similar transmission system, any tank, implement, apparatus, or equipment used to disperse pesticides, unless...transmission system is equipped with an air gap or a reduced pressure principle backflow device meeting the requirements under section 340-2 [Safe Drinking Water Law] and the rules adopted thereunder" (§149A-31). Any person who violates Chapter 149A or its rules may be issued civil penalties, including fines ranging from not more than $5,000 to not more than $1,000 (depending on whether the violator is a business or private entity) or criminal penalties, including misdemeanor charges and fines ranging from not more than $25,000 to not more than $1,000 (depending on whether the violator is a business or private entity).

Chapter 4-66, HAR, administered by DOA, relates to the registration, licensing, certification, recordkeeping, usage, and other activities related to the safe and effective use of pesticides. It requires that those who apply or directly supervise others who apply restricted use pesticides be certified. Certification requires some understanding of the environmental concerns of using pesticides. This requirement is implemented under the CES/DOA Pesticide Applicator Program. Certification under Category 2 for commercial applicators is required for forest pest control [§4-66-56(2), HAR]. Certification is not required for those using pesticides that are not classified as "restricted use."

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for forest chemical management.

Forestry pesticides and nutrients are addressed generally under the State's water pollution control statutes. While Chapter 342E, HRS, addresses nonpoint source pollution control, administrative rules have not yet been developed to implement

it. These rules will be developed in conjunction with the further development and implementation of the coastal nonpoint pollution control program. Chapter 11-54, HAR - the administrative rules that implement much of Chapter 342D, HRS - has no procedures in place to enforce the water quality standards it sets forth. Further, there is almost no monitoring in place capable of enforcing any of these regulatory mechanisms.

Finally, the Hawaii Occupational Safety and Health (HIOSH) regulations require that all commercial pesticide applications either be done by or be directly supervised by a certified pesticide applicator.

J. Wetlands Forest Management

Plan, operate, and manage normal, ongoing forestry activities (including harvesting, road design and construction, site preparation and regeneration, and chemical management) to adequately protect the aquatic functions of forested wetlands.

II.J.1. Description

Forested (palustrine) wetlands provide many beneficial functions that need to be protected. Among these are floodflow alteration, sediment trapping, nutrient retention and removal, habitat for fish and wildlife, and provision of timber products.

The primary difference between forestry activities on wetland sites and activities on upland sites is the flooding that occurs in most wetlands during some or most of the year. Potential impacts of forestry operations in wetlands include: sediment production as a result of road construction and use and equipment operation; drainage alteration as a result of improper road construction; stream obstruction caused by failure to remove logging debris; soil compaction caused by operation of logging vehicles during flooding periods or wet weather; contamination from improper application and/or use of pesticides; habitat degradation; and damage to existing timber stands.

In an effort to prevent these adverse effects, Section 404 of the Federal Water Pollution Control Act requires use of appropriate BMPs for road construction and maintenance in wetlands so that flow and circulation patterns, and chemical and biological characteristics are not impaired. Additional Section 404(f) BMPs specific to forestry can be found at 40 CFR 232.3.

II.J.2. Applicability

This management measure is intended for forested wetlands where silvicultural or forestry operations are planned or conducted. It applies specifically to forest management activities in forested wetlands and to supplement the previous management measures by addressing the operational circumstances and management practices appropriate for forested wetlands.

This management measure applies specifically to forest management activities in forested wetlands, including those currently undertaken under the exemptions of Section 404(f) of the Federal Water Pollution Control Act (40 CFR, Part 232). Many normal, ongoing forestry activities are exempt under Section 404(f)(1) unless recaptured under the provisions of Section 404(f)(2). This management measure is not intended to prohibit these silvicultural activities but to reduce incidental or indirect effects on aquatic functions as a result of these activities.

II.J.3. Management Practices

If the wetland is located along a stream, pond, perennial flowing natural spring, or a spring or reservoir serving as a domestic water supply, then the BMPs for SMZs would apply (see Streamside Management Zone Management Measure above). Otherwise, there are currently no BMPs described by DOFAW that pertain directly to wetland forest areas.

II.J.4. Implementation of Management Measure

Some of the major forested wetland areas in Hawaii (Alakai, Waikamoi, Hanawi, Kipahulu) are in various forms of protected area status. In addition, Waimanu on the Big Island is a National Estuarine Research Reserve. Because these forested wetlands are within protected areas, it is unlikely that forestry or silvicultural operations will be conducted on a commercial basis. However, salvage operations (*e.g.*, as a result of hurricanes) or other maintenance kinds of activities are sometimes conducted in these areas.

(i) Existing Organizational Structure: DNLR is the lead agency for implementing this management measure. Other agencies involved in implementation include:

- USACOE, which administers the Section 404, CWA, dredge and fill permit process; and
- USFWS, which is consulted on any federal action, including permit decisions, with respect to Section 7 of the Endangered Species Act.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 173A	Acquisition of Resource Value Lands
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195	Natural Area Reserve
HRS	Chapter 195D	Conservation of Aquatic Life, Wildlife and Land Plants
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 198	Conservation Easements
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards

Chapter 173A, HRS, enables DLNR to acquire lands and waters having environmental value for public use. Chapter 198, HRS, authorizes DLNR to acquire conservation easements to preserve natural lands and waters.

DLNR is authorized under Chapter 183, HRS, "to manage and regulate all lands which may be set apart as forest reserves and to devise ways and means of protecting, extending, increasing, and utilizing the forests and forest reserves, more particularly for protecting and developing the springs, streams, and sources of water supply to increase and make the water supply available for use." A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, would be required before forestry operations were conducted in the State Conservation District. Chapter 183D, HRS, authorizes DLNR to "manage and administer the wildlife and wildlife resources of the State."

Under Chapter 195, HRS, DLNR is responsible for the management of NARS, which should "preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawaii." It also empowers DLNR to establish NARS for areas with unique wetland values and native species.

The conservation of aquatic life, wildlife, and land plants pursuant to Chapter 195D, HRS, is also the responsibility of DLNR. This chapter authorizes DLNR to acquire habitat for endangered species restoration.

Under Chapter 171-54, HRS, the Board of Land and Natural Resources may issue land licenses for use of public lands, including harvesting of forest lands. While such licenses have not been issued for some time, they may be issued in the future. Conditions could be placed on these licenses requiring land users to implement best management practices, as specified by DLNR-DOFAW.

The Nature Conservancy of Hawaii (TNC) currently co-manages with several other organizations and agencies approximately 30,000 acres of wetlands, upland bogs, riparian stream corridors, and streams. TNCs conservation efforts have largely entailed acquisition programs, and the promotion of incentive programs for landowners to manage their resources for the long-term. TNC has also engaged in management and research, has lobbied Congress for acquisition funding for Hawaii, and worked to educate the public and lawmakers about the importance of acquiring and managing State Natural Area Reserves. TNC plans to increase its incentive programs for private landowners, and to promote additional partnership ventures, in order to leverage critically-needed resources for the future.

III. RECOMMENDATIONS for IMPLEMENTATION

III.1. Proposed Program Implementation

A. General Organizational Structure: At this time, forestry operations in Hawaii are occurring on an extremely small scale. A number of agencies and

officials at the State and county levels, however, would like to see the forestry industry expand and provide a viable alternative to the dying sugar industry. Plantation forestry is viewed as a practical alternative, particularly for the Hamakua coast of Hawaii. When the transition from plantation agriculture to forestry does occur, the scale and nature of these new operations will require attention to improved safeguards against potential nonpoint source pollution. At the same time, it must be recognized that forestry, as a land use, is likely to produce less pollution than most other current and potential land uses. While agencies and officials want to ensure that forestry does not contribute to water pollution, many also want to provide an organizational regime that will encourage investment in tree planting.

Therefore, the forestry focus group recommended that the implementation of the forestry management measures build upon existing regulatory and non-regulatory mechanisms, with an emphasis on encouraging participation in voluntary, incentive-driven programs. BMPs implementing the forestry management measures can be incorporated into CDUA permits, timber land licenses, and management plans developed and implemented under the Forest Stewardship and Tree Farm programs. It is also recommended that existing laws, regulations, and incentive programs be reviewed and amended to improve agency coordination and to optimize their effectiveness for forestry activities. As forestry activities increase and BMPs for forestry are further developed, other implementation mechanisms may be considered that more directly address forestry's contribution to polluted runoff.

Assuming that the majority of forestry operations will be undertaken on agricultural lands, DLNR's Forestry Stewardship and Tree Farm Programs appears to be the most logical mechanisms through which to implement the management measures initially. These programs provide incentives for land users to develop and implement management plans that could specify BMPs to reduce forestry's potential adverse effects on the environment. BMPs for nonpoint source pollution control can be encouraged as part of individual plans.

Because of the close relationship between forestry and agriculture in Hawaii, the agencies and organizations that support both of these industries will have expertise to assist forestry operators in developing and implementing management plans. While DLNR-DOFAW, USFS, and HFIA can contribute their expertise in forest management, NRCS, local SWCDs, DOA, and CES can contribute complementary expertise in erosion and sediment control, and nutrient and pesticide management. Coordination among these programs will maximize their technical assistance resources. A voluntary program emphasizing technical assistance to land users will build upon existing management structures and will likely lead to a greater level of cooperation and compliance.

B. Monitoring and Enforcement: The most realistic and cost-effective means to protect coastal water quality from nonpoint source pollution from forestry activities is likely to be "compliance through tracking" rather than "enforcement through monitoring." This implementation methodology is

complementary to the BMP concept itself, which is based on the principle that the best available technologies or management practices (defined as BMPs) are already known to be effective. Thus, if BMPs are adequately implemented or installed, water quality will improve. Thus, *tracking* the implementation of the BMPs specified in approved management plans to assure that the BMPs are being implemented as specified will ultimately protect coastal water quality. DLNR-DOFAW will monitor or track compliance by undertaking spot checks and periodic reviews of approved plans, and assessing reported problems.

If, despite installation of BMPs as specified in the operator's management plan, a polluted runoff problem develops, then the operator has an opportunity to work with DLNR-DOFAW and others to correct the problem. A Bad Actor Law, implemented by DOH, would take affect against polluters who are not cooperative and have not made a good faith effort to improve their operations.

Water quality monitoring would be used as a method to track the effectiveness of the BMPs implemented, rather than as a method of enforcement. Monitoring results would then be used to revise BMPs and the intensity of their implementation, and to further enhance forest management, as needed. Monitoring, however, would continue to be used in enforcement actions against those few operators who are in violation of the intent of the management measures and persistently resist requests to appropriately modify their management practices to protect coastal water quality.

In compliance with federal requirements, the State will evaluate the effectiveness of voluntary programs in implementing the forestry management measures. If voluntary programs are not successfully implementing the management measures, then regulatory measures will be considered. Individual operators who do not participate in a voluntary program may jeopardize its effectiveness and, thus, the very existence of the programs for all operators. In addition, operators who choose not to participate in a voluntary program will endure greater scrutiny and immediate action from DOH if found generating water pollution.

The schedule for implementing the forestry management measures depends primarily on the evolution of the forestry industry in Hawaii and will be developed when the need arises. The implementation schedule will include provisions to phase in the costs of the program, and to outline the interagency coordination and responsibilities of the operators. In addition, timing of implementation will depend, in part, on fiscal and personnel resources made available.

III.2. Implementing Actions

In order for the forestry management measures to be successfully implemented under existing programs such as DLNR's voluntary Forest Stewardship and Tree Farm Programs, a number of changes in governmental policies must be considered. The following recommendations will be explored in more detail in the coastal nonpoint pollution control program implementation plan.

A. Develop tree farm property tax classification

- Work with the counties to develop a county tree farm property tax classification for land dedicated to sound forest management based on approved plans. This will provide a powerful incentive for land users to participate in the Tree Farm Program. While the County of Hawaii has already initiated this process, it needs to be completed. In addition, the value of existing or growing forest trees should be exempted from assessed value for property taxes, eliminating a tax incentive for premature harvest and recognizing the longer rotation ages needed for forest management.

B. Provide adequate financial support for research and development activities, education and technical assistance

The forestry focus group recognized that the BMPs developed by DLNR-DOFAW do not fully address the management measures set forth by EPA. Similarly, existing regulatory and non-regulatory mechanisms are not comprehensive. It is the focus group's opinion that further development of BMPs and implementation mechanisms should be supported by sound science and practical experience in Hawaii and developed in tandem with supporting extension systems.

- Support continued BMP development by forestry professionals. In this development process, it must be recognized that there is limited local experience with large-scale forestry operations and limited local forestry research capacity. Additional assistance for BMP development should be provided through consultation with other states experienced in the implementation of BMPs. Local forestry staff should work on a cross-reference system for stream and soil classification. Additional applied research in other key areas will also be needed.

- As BMPs are researched and trials are conducted to provide a sound basis for BMPs in Hawaii, develop a manual describing forestry BMPs. This manual should be easy-to-read, flexible, and expandable, so that it can be revised as needed and as new information and more effective practices are developed.

  Schedule for Implementation:
  As BMPs are research Develop BMP manual for forestry practices.

- Seek FY97 funding of the Tropical Forestry Plan, produced by the U.S. Department of Agriculture as required by the federal Hawaii Tropical Forestry Act. This Plan would provide funding to the USFS, much of which would, in turn, be made available to DLNR-DOFAW in grants. It would be beneficial to have increased funding for service forester positions for DLNR-DOFAW to provide technical forestry support to private landowners and to monitor commercial forestry operations.

- Consider developing a forestry extension system through University of Hawaii's CES to provide specialized assistance, training and research.

Schedule for Implementation:	
as resources are available	Increase funding for DLNR and other relevant agencies.

C. Support coordination among agencies

- Draft formal MOUs between agencies having technical and management expertise with respect to forestry practices and polluted runoff control. A number of State and federal agencies, and industry organizations will provide administrative and/or technical support for the implementation of the forestry management measures, including DLNR, DOH, DOA, USFS, NRCS, SWCDs, CES, and HFIA. The MOUs should specify levels of financial, personnel and technical commitment to developing and implementing the program.

- Draft statutory or regulatory amendments, as needed, to implement the organizational structure, provide program funding, enact a Bad Actor Law, and establish incentive mechanisms.

Schedule for Implementation:	
December 1996	Draft MOU between participating agencies.
As Needed	Develop statutory or regulatory changes, as needed, and submit for consideration.

D. Facilitate the direct lease of State lands

- Facilitate the direct lease of State lands most suited to forestry in order to encourage responsible forest management. A direct lease recognizes the high up-front costs and long-term return on investment inherent to forestry operations which normally work to a disadvantage during a bid process. In order to secure a direct lease on State lands, however, a land user should be required to develop and implement a management plan specifying BMPs for nonpoint source pollution control. These plans should be implemented and BMPs installed according to a schedule determined by the State upon approval of the lease. Failure to implement the plan as specified should result in the termination of the lease agreement.

Schedule for Implementation:	
December 1997	Develop needed statutory or regulatory changes and submit for consideration.

CHAPTER 4: Urban Areas

I. INTRODUCTION

Although there are 7 major islands that make up the State of Hawaii, the vast majority of the State's population is concentrated on the island of Oahu. Oahu is by far the most urbanized of the Hawaiian Islands and has the highest population density. While the 1992 resident population of Hawaii was estimated as 1,155,700 people, the State receives an additional 6-7 million tourists annually, increasing Hawaii's *de facto* population to an estimated 1,272,100 people. The distribution of resident and *de facto* populations, by county, is outlined in Table III-2 below.

Table III-2. Distribution of resident and *de facto* populations for Hawaii, by county.

Entity	**Resident Population (1992 Est.)**	***De Facto* Population (1992 Est.)**	***De Facto* Pop. Density (people/mi²)**
City & County of Honolulu	863,100	913,800	1,513
County of Hawaii	130,400	145,500	34
County of Kauai	54,200	65,900	109
County of Maui	108,000	146,800	118
State of Hawaii	**1,155,700**	**1,272,100**	**194**

Sources: *The State of Hawaii Data Book* (DBEDT 1994), Tables 1.6, 1.7, and 1.9.

For the population of the State as a whole, the vast majority of residents (89.0%) live in areas classified as urban. However, urban areas account for only 10% of all land areas of the State. With the highest population density, Oahu has the greatest concentration of urban lands. Land and population statistics for Hawaii urban areas are listed, by county, in Table III-3 below.

Table III-3. Percent of land area in urban use and population in urban areas, by county.

Entity	**Percent of Land Area in Urban Use**	**Percent of Population in Urban Areas**
City & County of Honolulu*	33.0%	96.4%
County of Hawaii	8.0%	60.8%
County of Kauai	4.5%	55.2%
County of Maui +	8.2%	78.0%
State of Hawaii	**10.0%**	**89.0%**

* Island of Oahu only (excludes the Northwestern Hawaiian Islands from Nihoa to Kure Atoll)
\+ includes Kalawao County

Source: *The State of Hawaii Data Book* (DBEDT 1994), Table 1.16.

I.1. Urbanization and Its Impacts

Nationwide, urbanization first occurred in coastal areas and this historical trend continues. Approximately 80% of the Nation's population lives in coastal areas. The negative impacts of urbanization on coastal and estuarine waters have been well-documented in a number of sources, including the Nationwide Urban Runoff Program, and local Clean Water Act Section 305(b) and Section 319 reports.

During urbanization, pervious spaces, including vegetated and open forested areas, are converted to land uses that usually have increased areas of impervious surface. This has resulted in increased runoff volumes and pollutant loadings. In this manner, as population density increases, there is a corresponding increase in pollutant loadings generated from human activities. These pollutants typically enter surface waters via runoff without undergoing treatment.

(a) Changes in Hydrology: As urbanization occurs, changes to the natural hydrology of an area are inevitable. Hydrologic and hydraulic changes occur in response to site clearing, grading, and the addition of impervious surfaces and maintained landscapes. Most problematic are the greatly increased runoff volumes and the ensuing erosion and sediment loadings to surface waters that accompany these changes to the landscape.

Hydrological changes to a watershed are magnified after construction is completed. Impervious surfaces, such as rooftops, roads, parking lots, and sidewalks, decrease the infiltrative capacity of the ground and result in greatly increased volumes of runoff. Elevated flows also necessitate the construction of runoff conveyances or the modification of existing drainage systems to avoid erosion of streambanks and steep slopes. Changes in stream hydrology resulting from urbanization include the following:

- Increased peak discharges compared to predevelopment levels;
- Increased volume of urban runoff produced by each storm in comparison to predevelopment conditions;
- Decreased time needed for runoff to reach the stream, particularly if extensive drainage improvements are made;
- Increased frequency and severity of flooding;
- Reduced streamflow during prolonged periods of dry weather due to reduced level of infiltration in the watershed; and
- Greater runoff velocity during storms due to the combined effects of higher peak discharges, rapid time of concentration, and the smoother hydraulic surfaces that occur as a result of development.

(b) Changes in Water Quality: Urban development also causes an increase in pollutants. The pollutants that occur in urban areas vary widely, from common organic materials to highly toxic metals. Some pollutants, such as insecticides and fertilizers, are intentionally placed in the urban environment. Other pollutants, such as oil drippings from trucks and cars, are the indirect result of urban activities. Many researchers have linked urbanization to degradation of urban waterways.

I.2. Types of Nonpoint Source Pollution Associated with Urban Activities

The major pollutants found in runoff from urban areas include sediment, nutrients, oxygen-demanding substances, heavy metals, petroleum hydrocarbons, pathogenic bacteria, and viruses. Table III-4 describes potential sources of urban runoff pollutants.

Sediments: Sediments consist of fine soil products held in suspension in water and deposited in a stream, estuary, embayment, or open coastal waters. In addition to smothering corals and other benthic species, sediments create unsightly and odorous mud flats in enclosed bays. Sediments also transport nutrients and other chemical substances, such as pesticides, bound to the eroded soils.

Table III-4. Sources of Urban Runoff Pollutants (Adapted from Woodward-Clyde 1990)

Source	Pollutants of Concern
Erosion	Sediment and attached soil nutrients, organic matter, and other adsorbed pollutants
Atmospheric deposition	Hydrocarbons emitted from automobiles, dust, aromatic hydrocarbons, metals, and other chemicals released from industrial and commercial activities
Construction materials	Metals from flashing and shingles, gutters and downspouts, galvanized pipes and metal plating, paint, and wood
Manufactured products	Heavy metals, halogenated aliphatics, phthalate esters, PAHs, other volatiles, pesticides, and phenols from automobile use, pesticide use, industrial use, and other uses
Plants and animals	Plant debris and animal excrement
Non-storm water connections	Inadvertent or deliberate discharges of sanitary sewage and industrial wastewater to storm drainage systems
Onsite disposal systems	Nutrients and pathogens from failing or improperly sited systems

Nutrients: Nitrogen and phosphorus are the two major nutrients from urban lands that may degrade water quality. Excessive nutrient loading to marine ecosystems can result in eutrophication and depressed dissolved oxygen levels due to elevated phytoplankton populations. This, in turn, can result in fish kills and widespread destruction of benthic habitats.

Oxygen-Demanding Substances: Data have shown that urban runoff with high concentrations of decaying organic matter can severely depress dissolved oxygen levels in receiving waters after storm events.

Pathogens: Urban runoff typically contains elevated levels of pathogenic organisms which may result in closed beaches, contaminated drinking water sources, and shellfish bed closings. This problem may be especially prevalent in areas with porous or sandy soils.

Hydrocarbons: Most of the hydrocarbons found in urban runoff come from motor vehicles that leak oil and from home mechanics who empty used oil into storm drains. Oil and grease contain a wide variety of hydrocarbon compounds. Some polynuclear aromatic hydrocarbons (PAHs) are known to be toxic to aquatic life at low concentrations. Hydrocarbons have a high affinity for sediment, and they collect in bottom sediments where they may persist for long periods of time and result in adverse impacts on benthic communities.

Heavy Metals: The most prevalent heavy metals found in urban runoff are copper, lead and zinc. Chromium and cadmium are also found. Heavy metals may be introduced into the environment as a result of a wide variety of urban activities. For example, chromium is a waste product of metal-plating shops; and lead is a component found in old paint and batteries.

Toxics: Many different toxic compounds (EPA-designated priority pollutants) have been associated with urban runoff. Nationwide Urban Runoff Program (NURP) studies indicate that at least 10% of urban runoff samples contained toxic pollutants.

II. URBAN RUNOFF

***NOTE**: Because of the wide range of sources of polluted runoff associated with urban activities and the accompanying range of recommended actions, general recommendations are not included at the end of the Urban chapter. Instead, recommended implementing actions are noted at the end of each management measure section.*

A. New Development Management Measure

(1) By design or performance:
- **(a) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid (TSS) loadings by 80%. For the purposes of this measure, an 80% TSS reduction is to be determined on an average annual basis,* or**
- **(b) Reduce the postdevelopment loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings, and**

(2) To the extent practicable, maintain postdevelopment peak runoff rate and average volume at levels that are similar to predevelopment levels.

Sound watershed management requires that both structural and nonstructural measures be employed to mitigate the adverse impacts of storm water. Nonstructural Management Measures

II.B and II.C can be effectively used in conjunction with Management Measure II.A to reduce both the short- and long-term costs of meeting the treatment goals of this management measure.

*** Based on the average annual TSS loadings from all storms less than or equal to the 2-year/24-hour storm. TSS loadings from storms greater than the 2-year/24-hour storm are not expected to be included in the calculation of the average annual TSS loadings.**

II.A.1. Description

This management measure is intended to accomplish the following: (1) decrease the erosive potential of increased runoff volumes and velocities associated with development-induced changes in hydrology; (2) remove suspended solids and associated pollutants entrained in runoff that result from activities occurring during and after development; (3) retain hydrological conditions to closely resemble those of the predisturbance condition; and (4) preserve natural systems including in-stream habitat. For the purposes of this management measure, "similar" is defined as "resembling though not completely identical."

Several issues require clarification to fully understand the scope and intent of this management measure. First, this management measure applies only to postdevelopment loadings and not to construction-related loadings. Management measure options II.A.(1)(a) and (b) both apply only to the TSS loadings that are generated after construction has ceased and the site has been properly stabilized using permanent vegetative and/or structural erosion and sediment control practices. Second, for the purposes of this guidance, the term ***predevelopment*** refers to the sediment loadings and runoff volumes/velocities that exist onsite immediately before the planned land disturbance and development activities occur. Predevelopment is not intended to be interpreted as that period before any human-induced land disturbance activity has occurred. Third, management measure option II.A.(1)(b) is not intended to be used as an alternative to achieving an adequate level of control in cases where high sediment loadings are the result of poor management of developed sites (not "natural" sites), *e.g.*, farmlands where the erosion control components of the USDA conservation management system are not used or sites where land disturbed by previous development was not permanently stabilized.

During the development process, both the existing landscape and hydrology can be significantly altered. As development occurs, the following changes to the land may occur: soil porosity decreases; impermeable surfaces increase; channels and conveyances are constructed; slopes increase; vegetative cover decreases; and surface roughness decreases. These changes result in increased runoff volume and velocities, which may lead to increased erosion of streambanks, steep slopes, and unvegetated areas. In addition, destruction of in-stream and riparian habitat, increases in water temperature, streambed scouring, and downstream siltation of streambed substrate, riparian areas, estuarine habitat, and reef systems may occur. Various methods are available to compute peak runoff rates.

The annual TSS loadings can be calculated by adding the TSS loadings that can be expected to be generated during an average 1-year period from precipitation

events less than or equal to the 2-year/24-hour storm. The 80% standard can be achieved by reducing, over the course of the year, 80% of these loadings. EPA recognizes that 80% cannot be achieved for each storm event and understands that TSS removal efficiency will fluctuate above and below 80% for individual storms.

II.A.2. Applicability

This management measure applies to control urban runoff and treat associated pollutants generated from new development, redevelopment, and new and relocated roads, highways, and bridges. For design purposes, postdevelopment peak runoff rate and average volume should be based on the 2-year/24-hour storm.

II.A.3. Management Practices

a. Develop training and education programs and materials for public officials, contractors, and others involved in the design, installation, operation, inspection, and maintenance of urban runoff facilities.
b. Educate the public about the importance of runoff management facilities.
c. Ensure that all urban runoff facilities are operated and maintained properly.
d. Infiltration devices, such as infiltration trenches, infiltration basins, filtration basins, and porous and concrete block pavement, rely on absorption of runoff to treat urban runoff discharges. Infiltration practices are favorable in Hawaii because of the generally high permeabilities of its geologies (Masa Fujioka & Associates 1995). However, infiltration basins may have too high a space requirement for wide use in Hawaii because of high land costs and land scarcity.
e. Filtration practices such as filter strips, grassed swales, and sand filters treat sheet flow by using vegetation or sand to filter and settle pollutants. In some cases infiltration and treatment in the subsoil may also occur.
f. Detention practices temporarily impound runoff to control runoff rates, and settle and retain suspended solids and associated pollutants. Extended detention ponds and wet ponds fall within this category. While these types of practices are used to a certain extent in Hawaii, they are less effective at sediment removal in Hawaii because of the clayey nature of Hawaii's soils and the difficulty of settling fine soils from stormwater (Masa Fujioka & Associates 1995).

II.A.4. Implementation of Management Measure

(i) Organizational Structure: The counties have the lead in implementing this management measure. The approval of plans for new developments is the responsibility of the county planning departments. Storm drainage standards are implemented through the departments of public works. State agencies involved in implementation include:

- Department of Health (DOH), which administers NPDES stormwater permits for new developments greater than 5 acres;
- Department of Transportation (DOT), which has responsibilities and standards related to stormwater runoff from highways and bridges, as prescribed in its NPDES stormwater permit; and

- Hawaii Coastal Zone Management (CZM) Program, which reviews for consistency with CZM objectives and policies.

(ii) Regulatory and Non-Regulatory Mechanisms:

HAR	Chapter 11-55	Water Pollution Controls
HCC	Chapter 23	Subdivision
HCC	Chapter 10	Erosion and Sediment Control
HCC	Chapter 22	Streets and Sidewalks
MCC	Chapter 15-04	Rules for the Design of Storm Drainage
KCC	Chapter 8	Comprehensive Zoning

Storm drainage standards were originally developed by the City and County of Honolulu in 1959 and underwent a major update in 1969. These standards have been adapted, in part, by the other counties, with individual maps and discharge curves for each respective jurisdiction. All of the existing drainage standards are designed for flood control purposes and not for nonpoint source pollution control. As a general principle, all drainage structures must be able to safely carry 1-year to 100-year storm events, depending on the size of the development being drained. The most recent revision dates for county storm drainage standards are as follows: County of Hawaii, 1970; City and County of Honolulu, 1988; County of Kauai, 1972; County of Maui, 1995.

Section 23-92, "Land Surface Drainage," of the Hawaii County Code (HCC) specifies that drainage requirements shall be those deemed necessary by the Chief Engineer. Currently, the Chief Engineer does not allow runoff to leave the boundaries of a new subdivision. For projects that are not part of a subdivision, there is similar language requiring drainage structures that are deemed necessary by the Chief Engineer in Chapter 10, HCC, "Erosion and Sediment Control" (specifically, section 10-25, "Drainage") and Chapter 22, HCC, "Streets and Sidewalks" (specifically, section 22-56, "Appurtenances; drainage; retaining walls and structural openings").

City and County of Honolulu Resolution No. 94-296 states that, as a goal, there will be no increases is runoff from new developments. There is currently a bill before the City Council (No. 116 sponsored by Steve Holmes) that would require no gain in stormwater runoff from development over predevelopment rates.

The County of Maui has adopted new rules entitled "Rules for the Design of Storm Drainage Facilities in the County of Maui" (Section 15-04, MCC). These drainage rules became effective in November 1995.

As a part of its Comprehensive Zoning Ordinance (Chapter 8, KCC), the County of Kauai has defined Drainage Districts along rivers, streams, stormwater channels and outfall areas defined in the County's General Plan, as well as other areas. Although the development requirements within a drainage district are designed to prevent increases in stream flow that would overflow existing streambanks or otherwise increase downstream flooding, they are not designed to limit drained runoff to pre-development levels.

According to Chapter 11-55, HAR, DOH is the lead agency in permitting new developments greater than 5 acres that discharge into State waters. Activities less than 5 acres are not subject to DOH oversight but may be subject to rules applicable to the individual county standards. DOH is responsible for issuing municipal stormwater permits to municipalities that fit the federal EPA criteria.

DOT is responsible for managing stormwater runoff from State highways and bridges, as required by its NPDES stormwater permit issued by DOH. The permit prescribes what can be discharged from roadways under DOT jurisdiction into receiving waters, limitations on receiving waters, and provisions on management and BMP implementation, modifications, and reporting.

II.A.5. Additional Recommended Implementing Actions

The counties believe they can meet the TSS requirements for Part (1) of the management measure but are concerned that the peak flow rate requirements specified in Part (2) may not be achievable. The counties will attempt to achieve the TSS requirements in Part (1) by limiting average post-development runoff flow to pre-development levels.

A. Maintain Pre-development Runoff Rates

- Use existing flow models for peak discharge and total runoff to ensure that the portion of the 2-year/24-hour storm event that is designed to be discharged offsite does not exceed pre-development discharged flows. NRCS's curve number method and computer programs TR55 and TR20 are examples of flow models. The standards for each county should be followed when estimating runoff and peak discharge. For example, the City and County of Honolulu uses the rational method to estimate runoff. If pre-development discharge baseline data are not available for comparison, post-development modeled flows should be compared to modeled flows calculated using pre-development land use and drainage criteria.

B. Calibrate Existing Models

- Conduct research to calibrate computer runoff models so that they can be used reliably under a wide range of conditions and circumstances in Hawaii. The accuracy of many existing runoff models has not been confirmed for use under Hawaii conditions.

B. Watershed Protection Management Measure

Develop a watershed protection program to:

(1) Avoid conversion, to the extent practicable, of areas that are particularly susceptible to erosion and sediment loss;

(2) Preserve areas that provide important water quality benefits and/or are necessary to maintain riparian and aquatic biota; and

(3) Site development, including roads, highways, and bridges, to protect to the extent practicable the natural integrity of waterbodies and natural drainage systems.

II.B.1. Description

The purpose of this management measure is to reduce the generation of nonpoint source pollutants and to mitigate the impacts of urban runoff and associated pollutants that result from new development or redevelopment, including the construction of new and relocated roads, highways, and bridges. The measure is intended to provide general goals developing comprehensive programs for guiding future development and land use activities in a manner that will prevent and mitigate the effects of polluted runoff.

A watershed is a geographic region where water drains into a particular receiving waterbody. As discussed in the introduction, comprehensive planning is an effective nonstructural tool available to control polluted runoff. Where possible, growth should be directed toward areas where it can be sustained with a minimal impact on the natural environment. Poorly planned growth and development have the potential to degrade and destroy entire natural drainage systems and surface waters. Defined land use designations and zoning direct development away from areas where land disturbance activities or pollutant loadings from subsequent development would severely impact surface waters. Defined land use designations and zoning also protect environmentally sensitive areas such as riparian areas, wetlands, and vegetative buffers that serve as filters and trap sediments, nutrients, and chemical pollutants.

Areas such as streamside buffers and wetlands may also have the added benefit of providing long-term pollutant removal capabilities without the comparatively high costs usually associated with structural controls. Conservation or preservation of these areas is important to water quality protection. Levels of suspended solids increase at a slower rate in stream channel sections with well-developed riparian vegetation.

II.B.2. Applicability

This management measure applies to new development or redevelopment including construction of new and relocated roads, highways, and bridges that generate nonpoint source pollutants.

II.B.3. Management Practices

Watershed Protection Practices:

a. Resource Inventory and Information Analysis.
b. Development of Watershed Management Plan.
c. Plan Implementation -
   - Development of ordinances or regulations requiring nonpoint source pollution controls for new development and redevelopment.
   - Infrastructure planning.
   - Local ordinances.
   - Limits on impervious surfaces, encouragement of open space, and promotion of cluster development.

d. Setback (buffer zone) standards.
e. Slope restrictions.
f. Site plan reviews and approvals.
g. Designation of an entity or individual who is responsible for maintaining the infrastructure, including the urban runoff management systems.
h. Official mapping.
i. Environmental impact assessment statements.

Land or Development Rights Acquisition Practices:
j. Fee Simple Acquisition/Conservation Easements.
k. Transfer of Development Rights.
l. Purchase of Development Rights.
m. Land Trusts.
n. Agricultural and Forest Districts.
o. Cost and Effectiveness of Land Acquisition Programs.

II.B.4. Implementation of Management Measure

(i) Organizational Structure: Land use planning responsibilities with which to implement this management measure are shared among several State and county agencies:

- Office of State Planning (OSP), which supports the Land Use Commission in administering the State land use law;
- Counties, which administer the Shoreline Management Area (SMA) permit and shoreline setback provisions, and zoning ordinances;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies;
- DOT, which is responsible for planning, design and siting of roads, highways and bridges, and has BMPs in place for its bridge maintenance program;
- DOH, which implements programs for water pollution control and watershed planning; and
- DLNR, which implements the CDUA permit process, and the Natural Area Reserves System (NARS).

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation Districts
HRS	Chapter 195	Natural Area Reserves System
HRS	Chapter 205	State Land Use Law
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 343	Environmental Impact Statement
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 13-2	Conservation Districts

Hawaii Standard Specifications for Road, Bridges and Public Works Construction

KCC	Chapter 8	Comprehensive Zoning Ordinance
MCC	Chapter 19	Comprehensive Zoning Ordinance
ROH	Chapter 21	Land Use Ordinance

Originally passed in 1961, Chapter 205, HRS, is the State Land Use Law. This statute divides Hawaii's lands into four land use district classifications: urban, agriculture, conservation, and rural. The urban district includes lands presently in urban use and a reserve for foreseeable urban growth. The counties issue permits for development through their ordinances or regulations. The agricultural district includes lands used for cultivation and grazing as well as related uses. When the use requires less than 15 acres, a county may permit "unusual and reasonable uses...other than those for which the district is classified." For projects larger than 15 acres, the LUC must review and approve a county's permit and may add more conditions or deny the application. The conservation district includes areas necessary to protect resources specified in the law. The Board of Land and Natural Resources governs the uses in the conservation district through the CDUA. The rural district includes a minute portion of the State's land area, primarily on Maui and Kauai for small farms and rural subdivisions that would not be appropriate in either the agricultural and urban districts. These small areas are governed like the agricultural district.

The counties of Hawaii, Maui, and Kauai, and the City and County of Honolulu are responsible for planning and zoning in urban districts, local transportation, solid waste disposal, subdivision and grading regulation, recreation, and water supply development. They have additional responsibilities which include state-mandated county regulatory programs dealing with erosion control, urban design, beach access, and park dedication.

In addition, they are also responsible for delineating the boundaries of their respective Special Management Areas (SMAs) and for ensuring all development (with some minor exceptions) are consistent with the Hawaii CZM Program. Although each county has its own procedures for administering SMA permits, the requirements and review processes for SMA applications are similar for all four counties. Each county requires a permit applicant to describe the proposed development in terms of the State CZM objectives and policies, and SMA guidelines. In addition, all counties have established specific legal authority to require special studies, as necessary, including water quality analysis. The counties also administer and enforce the shoreline setback law.

The County of Kauai avoids conversion of areas particularly susceptible to erosion and sediment loss through the Comprehensive Zoning Ordinance (Chapter 8, KCC). Articles 14 and 15 implement "Slope Constraint Districts" and "Soils Constraint Districts" which are officially defined areas on county maps. These districts have physical characteristics that make standard requirements for development inadequate and provide for further requirements. Some activities in these districts are prohibited, while others are restricted. Slope Constraint Districts address sloping areas susceptible to erosion and siltation of downstream waters and the protection of ecological functions. Soils Constraint Districts

address other related soil characteristics such as percolation rates, surface drainage, and erosion.

The County of Maui limits conversion of areas susceptible to erosion and sediment loss through the Comprehensive Zoning Ordinance (Chapters 19.70 through 19.90, MCC). These chapters define "Project Districts" for specified areas of the county. Where a project district is defined and areas susceptible to erosion or sediment loss exist, the chapter specifies restrictions as to the amount of development that can occur. Most of these restrictions are with respect to steeply sloping lands.

II.B.5. Additional Recommended Implementing Actions

To strengthen the overall effectiveness of this management measure, the following measure should be implemented:

A. Minimize Development of Areas Susceptible to Erosion

- The County of Hawaii and City and County of Honolulu should consider adopting ordinances or other appropriate controls to minimize or avoid development of areas that are particularly susceptible to erosion or sediment loss. Such mechanisms could be modeled after those of Maui and Kauai counties. These provisions should be applicable at the zoning level to ensure that all restrictions and provisions would be applicable at the earliest possible stages in a proposed or potential development project.

B. Protect Integrity of Natural Drainage Systems and Riparian and Aquatic Habitats

- Implement recommendations outlined in Chapter 6 "Hydromodifications" on page III-205.

C. Site Development Management Measure

Plan, design, and develop sites to:

(1) Protect areas that provide important water quality benefits and/or are particularly susceptible to erosion and sediment loss;
(2) Limit increases of impervious areas, except where necessary;
(3) Limit land disturbance activities such as clearing and grading, and cut and fill to reduce erosion and sediment loss; and
(4) Limit disturbance of natural drainage features and vegetation.

II.C.1. Description

The goal of this management measure is to reduce the generation of polluted runoff and to mitigate the impacts of urban runoff and associated pollutants from all site development, including activities associated with roads, highways, and bridges. It is intended to provide guidance for controlling polluted runoff through the proper design and development of individual sites. This management

measures differs from Management Measure II.A, which applies to postdevelopment runoff, in that this management measure is intended to provide controls and policies that are to be applied during the site planning, review and development processes. While the goals of the Watershed Protection Management Measure (II.B) are similar, this management measure is intended to apply to individual sites rather than watershed basins or regional drainage basins. The goals of both the Site Development and Watershed Protection Management Measures are, however, intended to be complementary, and the measures should be used within a comprehensive framework to reduce polluted runoff.

The use of site planning and evaluation can significantly reduce the cost of providing structural controls to retain sediment on the development site. Long-term maintenance burdens may also be reduced. Good site planning not only can attenuate runoff from development, but also can improve the effectiveness of the conveyance and treatment components of an urban runoff management system.

II.C.2. Applicability

This management measure applies to all site development activities including those associated with roads, highways, and bridges.

II.C.3. Management Practices

Control of Erosion During Site Development:

a. Erosion and Sediment Control Plans and Programs.
b. Phasing and Limiting Areas of Disturbance.
c. Require vegetative stabilization.
d. Minimum Disturbance/Minimum Maintenance.

Site Planning Practices:

e. Clustering.
f. Performance Criteria.
g. Site Fingerprinting.
h. Preserving natural drainage features and natural depressional storage areas.
i. Minimizing imperviousness.
j. Reducing the hydraulic connectivity of impervious surfaces.
k. Xeriscape Programs.

Roads, Highways and Bridges:

l. Consider type and location of permanent erosion and sediment controls during the planning phase.
m. Assess and establish adequate setback distances near wetlands, waterbodies, and riparian areas to ensure protection from encroachment in the vicinity of these areas.
n. Avoid locations requiring excessive cut and fill, if possible.
o. Avoid locations subject to subsidence, sink holes, landslides, rock outcroppings, and highly erodible soils.
p. Size rights-of-way to include space for siting runoff pollution control structures as appropriate.

q. Plan residential roads and streets in accordance with local subdivision regulations, zoning ordinances, and other local site planning requirements.
r. Select the most economic and environmentally sound route location.
s. Comply with all federal, State and local requirements.
t. Coordinate the design of pollution controls with appropriate State and federal environmental agencies.
u. Develop local official mapping to show location of proposed highway corridors.
v. Avoid highway locations requiring numerous river crossings.
w. Restrict the use of scupper drains on bridges less than 400 feet in length and on bridges crossing very sensitive ecosystems.

II.C.4. Implementation of Management Measure

(i) Organizational Structure: The county planning departments and departments of public works have the lead in implementing this management measure. DOT is responsible for planning, design and siting of roads, highways and bridges and has BMPs in place for its bridge maintenance program. Other agencies involved in implementation include:

- OSP, which supports the Land Use Commission in administering the State land use law;
- DOH, which implements programs for water pollution control;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies; and
- DLNR, which implements the CDUA permit process, and NARS.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation Districts
HRS	Chapter 205	State Land Use Law
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statement
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 13-169	Protection of Instream Uses of Water

Hawaii Standard Specifications for Road, Bridge and Public Works Construction

HCC	Chapter 10	Soil Erosion and Sediment Control
HCC	Chapter 23	Subdivisions
KCC	Chapter 8	Comprehensive Zoning Ordinance

KCC	Chapter 9	Subdivision Ordinance
KCC	Chapter 22-7	Grading, Grubbing and Stockpiling
ROH	Chapter 14-13	Provisions for Grading, Soil Erosion & Sediment Control
MCC	Chapter 18.16	Subdivisions-Design Standard
MCC	Chapter 19.70	Comprehensive Zoning Ordinance
MCC	Chapter 20.08	Soil Erosion and Sediment Control

Typically, prospective developments must undergo numerous permit processes, with their associated environmental assessments and extensive public review. Developments in the conservation district trigger a CDUA permit; developments within the counties' SMAs must seek an SMA permit. Chapter 343, HRS, and Chapter 11-200, HAR, both about the Environmental Impact Statement law, require the preparation of an environmental assessment (EA) and/or environmental impact statement (EIS) for proposed activities that trigger the environmental review process. The trigger conditions are as follows: (1) use of State or county lands or funds; (2) use within the conservation district; (3) use within a shoreline setback area; (4) use within the Waikiki special district; (5) use within an historic site; (6) reclassification of conservation lands; (7) amendment to a county general plan; and (8) construction of helicopter facilities.

Chapter 180C, HRS, administered by DOH, mandates that counties enact ordinances to control soil erosion from land disturbing activities. Each county has adopted grading ordinances, administered by the departments of public works, which require land users to obtain grading permits for any grading, grubbing, or stockpiling.

Chapter 10, HCC, prohibits grading, grubbing or stockpiling without a permit. The maximum area of land that may be cleared for grading and grubbing is 20 acres at one time (§10-20) and all permits must conform to erosion and sedimentation control standards and guidelines established by the Department of Public Works (§10-26). Whenever feasible, natural vegetation should be retained [§10-22(b)]. Chapter 23, HCC, outlines the requirements for subdividing land for further development. Where a subdivision is traversed by a natural water course, drainage way, channel, or stream, a drainage easement or drainage right-of-way must be provided (§23-30). In addition, construction plans and specifications are required which show details of road construction, drainage structures, sewers, water mains and all other utilities proposed to be installed (§23-79).

Chapter 9, KCC, states that "subdivisions shall be planned, designed and constructed to require the minimum feasible amounts of land coverage, and minimum feasible disturbance to soil and site by grading, excavation and other land alteration" [§9-2.2(a)(1)]. This chapter further states that existing natural drainage channels are to be protected and preserved to the greatest extent feasible [§9-2.6(a)(1)]. Chapter 22-7, KCC, requires grading permit for grading, stockpiling and grubbing. There are additional requirements for areas of one acre or more or where slopes equal or exceed 20%.

Chapter 18.16, MCC, states that where a subdivision is traversed by a natural water course, drainage way, channel, or stream, a drainage easement or drainage right-of-way must be provided (§18.16.190). In addition, drainage systems in all subdivisions must be planned, designed and constructed according to Department of Public Works standards. Chapter 19.45, MCC, requires that, in project districts as designated on adopted community plans of the County, a preliminary site plan which includes proposals for drainage, grading, landscaping, construction phasing, open spaces, and land uses be prepared during phase II of the approval process. Site plans must also include an assessment of potential environmental impacts.

Chapter 20.08, MCC, provides minimum standards to regulate and control grading and grubbing. Permit application must be accompanied by plans and specifications, including a plot plan describing soil, details and locations of proposed land drainage patterns, drainage structures, drainage pipes, and retaining walls. If an area is more than one acre, a drainage and erosion control plan must be prepared by an engineer, showing the scheme for controlling erosion and disposal of runoff water. All drainage and erosion control plans must be submitted to the applicable SWCD for review and approval (§20.08.080). Maui is currently forming a committee to review Chapter 20, MCC. Committee members will include contractors, engineers, and personnel from the County of Maui, DOH, and NRCS.

Chapter 14-14, ROH, prohibits grading, grubbing, or stockpiling without a permit. If the area involved is 15,000 square feet or more, then a grading plan and specifications are required. If the area involved is one acre or more, then an additional drainage and erosion control plan is required (§14-14.2). If the proposed grading is on land with slopes exceeding 15%, or if any fill is to be placed over a swamp, pond, gully or lake, an engineer's soils report must be submitted [§14-14.2(a)(9)].

Chapter 13-169, HAR, administered by DLNR, states that no stream channel shall be altered without first obtaining a Stream Channel Alteration Permit (SCAP) from the Commission on Water Resources Management (CWRM). Section 174C-3 of the Hawaii Water Code provides a definition for "stream." Generally speaking, the definition of stream includes perennial and intermittent streams, but streams must be natural watercourses which contain sufficient water to support instream uses as defined in the Code.

Water quality is generally addressed under the State's water pollution control statutes. While Chapter 342E, HRS, addresses nonpoint source pollution control, administrative rules have not yet been developed to implement it. These rules will be developed in conjunction with the further development and implementation of the coastal nonpoint pollution control program. Chapter 11-54, HAR - the administrative rules that implement much of Chapter 342D, HRS - has no procedures in place to enforce the water quality standards it sets forth. Further, there is almost no monitoring in place capable of enforcing any of these regulatory mechanisms.

II.C.5. Additional Recommended Implementing Actions
To strengthen the overall effectiveness of this management measure, the following measure should be implemented:

A. Minimize Impervious Areas of Residential Lots

- The counties should consider adopting ordinances that restrict the amount of each residential lot covered by impervious materials. These could be modeled after the County of Kauai which has a 50% impervious limitation for residential lots.

B. Consider Alternatives to Paved Driveways and Parking Areas

- All counties should consider making provisions for semi-pervious and other surfaces and materials for urban parking areas and driveways. Currently, county standards generally dictate that urban parking areas be paved with an impervious or all-weather surface, which can increase the potential for polluted runoff.

III. CONSTRUCTION ACTIVITIES

***NOTE**: Because of the wide range of sources of polluted runoff associated with urban activities and the accompanying range of recommended actions, general recommendations are not included at the end of the Urban chapter. Instead, recommended implementing actions are noted at the end of each management measure section.*

A. Construction Site Erosion and Sediment Control Management Measure

(1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction, and

(2) Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.

III.A.1. Description
Runoff from construction sites is by far the largest source of sediment in urban areas under development. The goal of this management measure is to reduce the sediment loadings from construction sites in coastal areas that enter surface waterbodies. This measure requires that coastal States establish new or enhance existing State erosion and sediment control programs and/or require such programs at the local level. It is intended to be part of a comprehensive land use or watershed management program, as previously detailed in the Watershed and Site Development Management Measures. It is expected that State and local programs will establish criteria determined by local conditions (*e.g.*, soil types, climate, meteorology) that reduce erosion and sediment transport from construction sites.

III.A.2. Applicability

This management measure applies to all construction activities on sites less than 5 acres in areas that do not have an NPDES permit in order to control erosion and sediment loss from those sites. This applicability includes new, replaced, restored, and rehabilitated road, highway, and bridge construction projects. This management measure does not apply to construction that disturbs less than 5,000 square feet of land on a site.

***NOTE**: Construction projects disturbing more than 5 acres that discharge stormwater to State waters are covered by a general permit under Chapter 11-54-34, HAR (NPDES regulations), administered by DOH.*

III.A.3. Management Practices

Erosion control:

a. Write erosion and sediment control requirements into project plans, specifications and estimates and develop erosion control plans for earth-disturbing activities.
b. Schedule projects so clearing and grading are done during the time of minimum erosion potential.
c. Stage construction.
d. Clear only areas essential for construction.
e. Locate potential nonpoint pollutant sources away from steep slopes, waterbodies, and critical areas.
f. Route construction traffic to avoid existing or newly planted vegetation.
g. Protect natural vegetation with fencing, tree armoring, and retaining walls or tree wells.
h. Stockpile topsoil and reapply to revegetate site, and cover stockpile to prevent dust.
i. Cover or stabilize topsoil stockpiles.
j. Use wind erosion control.
k. Intercept runoff above disturbed slopes and convey it to a permanent channel or storm drain.
l. On long or steep, disturbed, or man-made slopes, construct benches, terraces, or ditches at regular intervals to intercept runoff.
m. Use retaining walls.
n. Provide linings for urban runoff conveyance channels.
o. Use check dams.
p. Seed and fertilize.
q. Use seeding and mulch/mats.
r. Use sodding.
s. Use bonded-fiber matrices.
t. Provide wash-out areas for vehicles before they leave the site.

Sediment control: In general, these practices capture sediment that is transported in runoff in order to prevent the sediment from reaching environmentally-sensitive areas. Filtration and detention (gravitational settling) are the main processes used to remove sediment from urban runoff. Practices based on sediment removal rather than prevention of erosion and sedimentation

are less favorable for application in Hawaii due to the difficulty in removing fine soil particles that are chemical weathering products.

u. Sediment basins.
v. Sediment traps.
w. Filter fabric fences.
x. Straw bale barriers.
y. Inlet protection.
z. Construction entrance.
aa. Vegetated filter strips.

III.A.4. Implementation of Management Measure

(i) Organizational Structure: The county departments of public works have the lead in implementing this management measure. Other agencies involved in implementation include:

- DOH, which implements programs for water pollution control and issues NPDES permits;
- DOT, which is responsible for road, highway and bridge construction projects; and
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-54	Water Quality Standards

Hawaii Standard Specifications for Road, Bridge and Public Works Construction

HCC	Chapter 10	Soil Erosion and Sediment Control
KCC	Chapter 22-7	Grading, Grubbing and Stockpiling
ROH	Chapter 14-13	Provisions for Grading, Soil Erosion & Sediment Control
MCC	Chapter 20.08	Soil Erosion and Sediment Control

Chapter 180C, HRS, administered by DOH, mandated that counties enact ordinances to control soil erosion from land disturbing activities. Specifically, Chapter 180C-2, HRS, read:

"(a) The county governments, in cooperation with the soil and water conservation districts and other appropriate federal and state agencies, shall enact ordinances for the purpose of controlling soil erosion and sediment.
(b) The ordinance for erosion and sediment control shall include but not be limited to the following:

(1) Be based on relevant physical and developmental information concerning the watersheds and drainage basins in the county and/or State including but not limited to data relating to land use, soil, hydrology and geology, size of land area being disturbed, approximate water bodies and their characteristics, transportation, and public facilities and services.
(2) Include such survey of land and waters as may be deemed appropriate by the county or required by applicable law to identify areas including multi-jurisdictional and watershed areas with critical erosion and sediment problems.
(3) Contain standards for various types of soil and land uses, which standards shall include criteria, techniques, and methods for the control of erosion and sediment resulting from land disturbing activities.
(4) Include a provision whereby standards shall be deemed met if it can be shown that the land is being managed in accordance with soil conservation practices acceptable to the applicable soil and water conservation district directors, and that a comprehensive conservation program is being actively pursued."

Since the counties have all adopted grading ordinances, Chapter 180C, HRS, has been repealed. The county grading ordinances, administered by the departments of public works, require land users to obtain grading permits for any grading, grubbing, or stockpiling.

Chapter 10, HCC, prohibits grading, grubbing or stockpiling without a permit. The maximum area of land that may be cleared for grading and grubbing is 20 acres at one time (§10-20) and all permits must conform to erosion and sedimentation control standards and guidelines established by the Department of Public Works (§10-26). Whenever feasible, natural vegetation should be retained [§10-22(b)].

Chapter 22-7, KCC, requires grading permit for grading, stockpiling and grubbing. There are additional requirements for areas of one acre or more or where slopes equal or exceed 20%.

Chapter 20.08, MCC, provides minimum standards to regulate and control grading and grubbing. Permit application must be accompanied by plans and specifications, including a plot plan describing soil, details and locations of proposed land drainage patterns, drainage structures, drainage pipes, and retaining walls. If an area is more than one acre, a drainage and erosion control plan must be prepared by an engineer, showing the scheme for controlling erosion and disposal of runoff water. All drainage and erosion control plans must be submitted to the applicable soil and water conservation district for review and approval (§20.08.080).

Chapter 14-14, ROH, prohibits grading, grubbing, or stockpiling without a permit. If the area involved is 15,000 square feet or more, then a grading plan and specifications are required. If the area involved is one acre or more, then an additional drainage and erosion control plan is required (§14-14.2). If the proposed grading is on land with slopes exceeding 15%, or if any fill is to be placed

over a swamp, pond, gully or lake, an engineer's soils report must be submitted [§14-14.2(a)(9)].

DOT, Highways Division, uses the "Hawaii Standard Specifications for Road, Bridge and Public Works Construction" when authorizing contracts for road and bridge construction. Projects in which 5 or more acres are disturbed require a State NPDES industrial stormwater permit. Site-specific erosion control measures (BMPs) are kept at the construction site.

Hawaii Standard Specifications, Section 107.17, Protection of Rivers, Streams, Impoundments, Forests and Archaeological and Paleontological Findings, states that:

"• contractor shall exercise reasonable precaution to prevent the silting of rivers, streams, etc.;
- contractor shall provide for temporary erosion control measures during suspension of construction operations for any appreciable time;
- contractor shall act immediately to bring siltation under control should erosion control measures fail and an appreciable quantity of material begins to erode into a stream, river, etc.;
- excavation shall not be deposited near rivers, streams, etc. such that it will be washed away by high water or runoff;
- frequent fording of live streams with construction equipment will not be permitted; and
- contractor shall take all reasonable precautions to prevent pollution of rivers, streams, etc."

The Hawaii Standard Specifications, Section 201, Clearing and Grubbing, have been amended to state that the total area to be exposed shall not exceed the limits of Section 639 (See following.).

Section 639, Temporary Project Water Control (Soil Erosion), calls for an Erosion Control Conference prior to start of construction and requires contractor to submit diagrams and plans of each erosion control feature for approval. This section further states that:

"• contractor shall limit the surface area of earth material exposed by grubbing, excavation, etc. to that which is necessary to perform the next operation within a given area and his capability and progress in keeping the mulching, seeding, and other pollution control measures current (The State also has the authority to limit the surface area of erodible earth exposed by clearing and grubbing);
- the surface area of earth material exposed shall not at any time exceed 750,000 square feet without prior approval of the State;
- any area remaining bared or cleared for more than 15 days which is not within the limits of active construction or excavation shall be hydro-mulch seeded or remedied within 3 days;
- the Contractor shall, at the end of each work operation in any one day, shape the earthwork in such a manner as to control and direct the runoff of rainwater;

- controlled discharges shall be provided for all waters impounded, directed or controlled by project activities or erosion control measures;
- cut slopes shall be shaped, topsoiled and planted or finished as specified as the work progresses unless otherwise directed by the Engineer;
- in no case shall exposed surface of cut slopes be greater than 15 feet in height;
- fill slopes shall be finished in accordance with the requirements of cut slopes; and
- in the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal or State or local agencies, the more restrictive laws, rules, or regulations shall apply."

When a road, highway or bridge project involves federal funds, State specifications approved by the Federal Highways Administration are used for design and construction.

III.A.5. Additional Recommended Implementing Actions

To strengthen the overall effectiveness of this management measure, the following measures should be implemented.

A. Revise County Requirements for Erosion and Sediment Control Plans

- Require erosion and sediment control plans for projects on less than 5 acres which disturb over 5,000 square feet of land on the site. Currently, such projects must receive a grading permit but are not required to develop erosion and sediment control plans. A revision to Chapter 180C, HRS, containing all the necessary requirements to fulfill the management measure definition and applicability, will require changes to the county grading ordinances.

- Include, at a minimum, specific language for narrative performance standards to ensure that, to the extent practicable, sediment is retained onsite during and after construction. Such language could be:

> *The contractor shall show, through design and supporting documentation or accepted calculation methodology, that runoff and associated sediment from the 2-year, 24-hour event will be retained on the construction site.*

The City and County of Honolulu is currently revising its sediment and erosion control guidelines to comply with its NPDES municipal storm drain permit. Since these revisions will, in all likelihood, be based on Hawaii-specific criteria, other counties could pattern much of their new guidelines from these revisions.

B. Develop a BMP Manual of Construction Practices

- Develop a manual of Hawaii-appropriate BMPs for construction activities, including a section on practices for erosion and sediment control. A BMP manual would help to standardize acceptable practices and assist contractors in selecting appropriate practices that would be acceptable and applicable in all counties and for State projects.

C. Inspect Erosion and Sediment Control Plans with Other Construction Activities

- Integrate inspection for erosion and sediment control plans required by this management measure with the standard construction inspection program for all counties. Since inspections must be done at other stages of construction, such as for footers, foundations, framing, electrical, plumbing, it seems that including inspections for erosion and sediment control would be minimally disruptive of existing procedures. Erosion and sediment control would then simply be another aspect of the construction process that must be inspected and signed-off as completed. In this process, erosion and sediment control plans should be the first item inspected. Other construction activities should not be allowed to proceed until practices detailed in the approved erosion and sediment control plan have been installed. After construction is completed, another inspection should confirm that permanent erosion and sediment control practices are in place. The records of these inspections should be kept as permanent records as are other records of inspections for construction projects.

D. Clarify Coordination of Responsibilities Among Agencies

- Clarify responsibilities between the State and counties for erosion and sediment control to avoid duplications of effort or assumptions of responsibility. Currently, the responsibilities for erosion and sediment control with respect to construction activities are contained within four mechanisms: grading permits required by each county; NPDES permits for construction activities for sites greater than five acres; construction activities regulated within the City and County of Honolulu's municipal storm drain area (as a part of its NPDES municipal storm drain permit); and the Hawaii Standard Specifications for Road, Bridge and Public Works Construction. In the future, there will be the additional responsibilities included in this construction site erosion and sediment control management measure. This sharing of responsibility may create overlaps and gaps in erosion control efforts. For example, at least one county assumes that if DOH has issued an NPDES permit for a site greater than 5 acres, then it will assume all the responsibility for inspection and monitoring of the site. The county does not inspect those sites even though a grading permit has been issued.

- Further, a coordinated effort between the state and counties is needed so that all county ordinances or other guidelines specify which permit(s) are required for which situations. A consistent set of requirements, guidelines and policies between all counties would avoid confusion for contractors who build in different counties. The City and County of Honolulu's revisions to their erosion and sediment control guidelines will likely help to clarify some of the potential confusion. Other counties could help build a consistent set of requirements and guidelines by patterning their revised guidelines, where possible, on the City and County's revisions.

B. Construction Site Chemical Control Management Measure

(1) Limit application, generation, and migration of toxic substances;
(2) Ensure the proper storage and disposal of toxic materials; and
(3) Apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface waters.

III.B.1. Description

The purpose of this management measure is to prevent the generation of polluted runoff from construction sites due to improper handling and usage of nutrients and toxic substances, and to prevent the movement of toxic substances from the construction site.

Many potential pollutants other than sediment are associated with construction activities. These pollutants include pesticides (insecticides, fungicides, herbicides, and rodenticides); fertilizers used for vegetative stabilization; petrochemicals (oils, gasoline, and asphalt degreasers); construction chemicals such as concrete products, sealers, and paints; wash water associated with these products; paper; wood; garbage; and sanitary wastes.

The variety of pollutants present and the severity of their effects depend on a number of factors:

- The nature of the construction activity. For example, potential pollution associated with fertilizer usage may be greater along a highway or at a housing development than it would be at a shopping center development because highways and housing developments usually have greater landscaping requirements.
- The physical characteristics of the construction site. The majority of all pollutants generated at construction sites are carried to surface waters via runoff. Therefore, the factors affecting runoff volume (such as the amount, intensity, and frequency of rainfall; soil infiltration rates; surface roughness; slope length and steepness; and area denuded) all contribute to pollutant loadings.
- The proximity of surface waters to the nonpoint pollutant source. As the distance separating pollutant-generating activities from surface waters decreases, the likelihood of water quality impacts increases.

III.B.2. Applicability

This management measure applies to all construction sites less than 5 acres in area and to new, resurfaced, restored, and reconstructed road, highway, and bridge construction projects. This management measure does not apply to construction that disturbs less than 5,000 square feet of land on a site.

***NOTE**: Construction projects disturbing more than 5 acres that discharge stormwater to State waters are covered by a general permit under Chapter 11-55-34, HAR (NPDES rules), administered by DOH.*

III.B.3. Management Practices

a. Properly store, handle, apply, and dispose of pesticides.
b. Properly store, handle, use and dispose of petroleum products.
c. Establish fuel and vehicle maintenance staging areas located away from all drainage courses, and design these areas to control runoff.
d. Provide sanitary facilities for construction workers.
e. Store, cover and isolate construction materials, including topsoil and chemicals, to prevent runoff of pollutants and contamination of groundwater.
f. Develop and implement a spill prevention and control plan. Agencies, contractors, and other commercial entities that store, handle, or transport fuel, oil, or hazardous materials should develop a spill response plan.
g. Maintain and wash equipment and machinery in confined areas specifically designed to control runoff.
h. Develop and implement nutrient management plans.
i. Provide adequate disposal facilities for solid waste, including excess asphalt, produced during construction.
j. Educate construction workers about proper materials handling and spill response procedures. Distribute or post informational material regarding chemical control.

III.B.4. Implementation of Management Measure

(i) Organizational Structure: DOA, Pesticides Branch, is the lead agency for implementing those measures that relate to regulating pesticides. At present, there are no enforceable mechanisms that specifically address the application of nutrients. Other State and local agencies involved in implementation include:

- DOH, which implements programs for water pollution control, safe drinking water, and pollution prevention and hazardous waste management;
- Counties, which administer the SMA permit and shoreline setback provisions, and zoning ordinances; and
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 128D	Hawaii Environmental Response Law
HRS	Chapter 149A	Pesticides Law
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 460J	Pest Control Operators
HAR	Chapter 1-2	Special Management Areas/ Shoreline Areas
HAR	Chapter 4-66	Pesticides
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-451	State Contingency Plan

Chapter 149A, HRS, administered by DOA, states that "no person shall: (1) use any pesticide in a manner inconsistent with its label; (2) use, store, transport or discard any pesticide or pesticide container in any manner which would have unreasonable adverse effects on the environment; ... (6) fill with water, through a hose, pipe, or other similar transmission system, any tank, implement, apparatus, or equipment used to disperse pesticides, unless...transmission system is equipped with an air gap or a reduced pressure principle backflow device meeting the requirements under section 340-2 [Safe Drinking Water Law] and the rules adopted thereunder" (§149A-31). Any person who violates Chapter 149A, HRS, or its rules may be issued civil penalties, including fines ranging from not more than $5,000 to not more than $1,000 (depending on whether the violator is a business or private entity) or criminal penalties, including misdemeanor charges and fines ranging from not more than $25,000 to not more than $1,000 (depending on whether the violator is a business or private entity).

Chapter 4-66, HAR, administered by DOA, relates to the registration, licensing, certification, recordkeeping, usage, and other activities concerning the safe and effective use of pesticides. It requires that those who apply or directly supervise others who apply restricted use pesticides be certified. This certification requires some understanding of the environmental concerns of using pesticides. This requirement is implemented under the CES/DOA Pesticide Applicator Program. Certification under Category 7 is required for industrial, institutional, and structural pest control (§4-66-56(7), HAR). Certification is not required for those using pesticides that are not classified as "restricted use."

Water quality is generally addressed under the State's water pollution control statutes. See page III-116 for a brief discussion of Chapters 342D and 342E, HRS.

The Hawaii Occupational Safety and Health (HIOSH) regulations require that all commercial pesticide applications either be done by or directly supervised by a certified pesticide applicator.

Chapter 128D, HRS, the Hawaii Environmental Response Law, is administered by DOH. It requires DOH to adopt rules establishing the quantity of a hazardous substance, pollutant or contaminant that must be reported if it is released, as well as the time periods during which the release must be reported. Chapter 128D, HRS, also requires DOH to adopt a Hawaii contingency plan which includes methods and criteria for evaluating the degree of hazard present at a site with releases of hazardous substances or pollutants or contaminants, including whether the site poses an imminent or substantial hazard, whether it is a priority site, and whether response actions are feasible and effective (§128D-7). In September 1995, DOH promulgated administrative rules (HAR §11-451) to implement Chapter 128D, HRS.

Finally, the General Contractor's Association (GCA) currently has two committees working with the City and County of Honolulu and the State of Hawaii to standardize specifications for the use and disposal of construction chemicals. The results of these undertakings will assist contractors in complying with whatever consistent set of specifications arise.

III.B.5. Additional Recommended Implementing Actions

There are several regulatory and non-regulatory actions that could be taken individually or in combination to ensure proper use, handling, storage, transportation, and disposal of construction chemicals and to provide for adequate spill prevention and response planning. Implementation of the following measures would strengthen the overall effectiveness of this management measure.

A. Revise Chapter 128D, HRS, to Include Prevention Program

- DOH should revise Chapter 128D, HRS, to include requirements for preventive actions such as a spill prevention program. This program should include education of all persons who would be responsible for handling, transporting, applying, and disposing of fuel, oil, and hazardous chemicals during construction and other activities.

B. Provide Education for Construction Supervisors on Construction Chemicals and Require Trained Supervisors On-Site

- Require at least one construction supervisor who has completed an education program on construction chemical usage on-site at all times during the application or use of chemicals. A trained supervisor is vital to providing guidance and authority in the adherence of the BMPs relating to chemical usage. Education programs should be provided for all construction supervisors on the BMPs for construction chemical usage, such as nutrient applications, pesticide applications, and vehicle maintenance.

C. Develop a BMP Manual of Construction Practices

- Develop a manual of Hawaii-appropriate BMPs for construction activities, including a section on chemical usage and runoff control. Hazardous waste minimization and pollution prevention practices should also be included in such a manual.

D. Inspect Chemical Control Practices with Other Construction Activities

- Integrate inspection for chemical control practices required by this management measure with the standard construction inspection program for all counties. Refer to recommendation "C" on p. III-123 for more information on this concept.

E. Coordinate Responsibilities Among Agencies

- State and county agencies responsible for overseeing chemical usage and control for construction activities should coordinate to develop a standard and consistent set of guidelines and requirements. Consistent requirements and guidelines should include, but not be limited to, sections on allowable chemicals and acceptable disposal options. While some differences may remain between State and county requirements after such coordination, a set of substantially similar requirements and guidelines would assist contractors in complying with chemical usage and control regulations with a minimum of confusion.

F. Train Fertilizer Applicators

- Train fertilizer applicators on proper calibration of equipment and application. Soil analysis information should be used to determine fertilizer needs.

IV. EXISTING DEVELOPMENT

***NOTE**: Because of the wide range of sources of polluted runoff associated with urban activities and the accompanying range of recommended actions, general recommendations are not included at the end of the Urban chapter. Instead, recommended implementing actions are noted at the end of each management measure section.*

A. Existing Development Management Measure

Develop and implement watershed management programs to reduce runoff pollutant concentrations and volumes from existing development:

(1) Identify priority local and/or regional watershed pollutant reduction opportunities, e.g., improvements to existing urban runoff control structures;
(2) Contain a schedule for implementing appropriate controls;
(3) Limit destruction of natural conveyance systems; and
(4) Where appropriate, preserve, enhance, or establish buffers along surface waterbodies and their tributaries.

IV.A.1. Description

The purpose of this management measure is to protect or improve surface water quality by developing and implementing watershed management programs that pursue the following objectives:

- Reduce surface water runoff pollution loadings from areas where development has already occurred;
- Limit surface water runoff volumes in order to minimize sediment loadings resulting from the erosion of streambanks and other natural conveyance systems; and
- Preserve, enhance, or establish buffers that provide water quality benefits along waterbodies and their tributaries.

Maintenance of water quality becomes increasingly difficult as areas of impervious surface increase and urbanization occurs. For the purpose of this plan, urbanized areas are those areas where the presence of "man-made" impervious surfaces results in increased peak runoff volumes and pollutant

loadings that permanently alter one or more of the following:[1] stream channels, natural drainageways, and in-stream and adjacent riparian habitat so that predevelopment aquatic flora and fauna are eliminated or reduced to unsustainable levels and predevelopment water quality has been degraded.

Through the use of watershed management, States and local governments can identify local water quality objectives and focus resources on control of specific pollutants and sources. Watershed plans typically incorporate a combination of nonstructural and structural practices. An important nonstructural component of many watershed management plans is the identification and preservation of buffers and natural systems. These areas help to maintain and improve surface water quality by filtering and infiltrating urban runoff. In areas of existing development, natural buffers and conveyance systems may have been altered as urbanization occurred. Where possible and appropriate, additional impacts to these areas should be minimized and if degraded, the functions of these areas restored.

IV.A.2. Applicability

This management measure applies to all urban areas and existing development in order to reduce surface water runoff pollutant loadings from such areas.

IV.A.3. Management Practices

a. Priority nonpoint source pollutants should be targeted, and implementation strategies for mitigating the effects of nonpoint source pollutants developed.
b. Policies, plans, and organizational structures that ensure that all surface water runoff management facilities are properly operated and maintained should be developed. Periodic monitoring and maintenance may be necessary to ensure proper operation and maintenance.
c. Developed areas in need of local or regional structural solutions should be identified and put in priority order.
d. Regional structural solutions, retrofit opportunities, and non-structural alternatives should be identified, inventoried, and put in priority order.
e. Where possible, modify existing surface water runoff management structures to address water quality.
f. As capital resources allow, implement practices such as: protection and restoration of riparian forests and wetland areas.

IV.A.4. Implementation of Management Measure

(i) Organizational Structure: No one agency clearly has the lead in implementing this management measure at this time. State and local agencies involved in implementation include:

- DOH, which implements programs for water pollution control, watershed management, waste minimization and pollution prevention;
- DLNR, which administer the SCAP; and

[1]Changes resulting from dam building and "acts of God" such as earthquakes, hurricanes, and unusual natural events (*e.g.*, a 100-year storm), as well as natural predevelopment riverine behavior that results in stream meander and deposition of sediments in sandbars or similar formations, are excluded from consideration in this definition.

- County departments of public works, which are responsible for existing urban runoff control structures.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Stream Channel Alteration Permit

Chapter 13-169, HAR, administered by DLNR, requires a SCAP for all modifications of a stream channel except "routine streambed and drainageway maintenance activities and maintenance of existing facilities." These sections provide that "Stream channels shall be protected from alteration whenever practicable to provide for fishery, wildlife, recreational, aesthetic, scenic, and other beneficial uses." Where such alterations, including channelization, are to be done, a SCAP is required. Section 13-169-52(c)(1), HAR, further specifies that "Channel alterations that would adversely affect the quantity and quality of the stream water or the stream ecology should be minimized or not be allowed."

Water quality is generally addressed under the State's water pollution control statutes. See page III-116 for a brief discussion of Chapters 342D and 342E, HRS.

IV.A.5. Additional Recommended Implementing Actions

To strengthen the overall effectiveness of this management measure, the following measures should be implemented:

A. Develop a Watershed Analysis and Evaluation Program

- In cooperation with community representatives, researchers, and other agencies, DOH's Environmental Planning Office should develop a watershed analysis and evaluation program to target watersheds that have been defined in the latest Section 305(b) report as "Water Quality Limited Segments" (WQLSs) and are affected by urban runoff pollutants. This program could be implemented individually or as a part of the broader-based Watershed Management and Planning recommendations described in Appendix C. The program could spearhead the following efforts:

  - A working group composed of community, research, and agency representatives would identify the detrimental pollutants that should be assessed in each problem watershed.

  - The working group would compile existing information on the watershed, and conduct a reconnaissance survey to ascertain all land use activities and potential sources of pollution.

- Through a combination of consolidating existing research, modeling, and monitoring, loadings for the identified pollutants would be approximated for all the principal land use activities in the watershed.

- From this research, the working group would identify primary land use activities likely responsible for significant loadings. These land use activities could then be targeted with an appropriate combination of public education/information, community programs, industry training, enforcement, and regulatory enhancements to reduce the loadings of the specified pollutants.

B. Develop Streamside Management Zones (SMZs) Around Hawaii's Streams

- Implement recommendations regarding SMZs outlined in Chapter 6 "Hydromodifications" on page III-234.

V. ONSITE DISPOSAL SYSTEMS

***NOTE**: Because of the wide range of sources of polluted runoff associated with urban activities and the accompanying range of recommended actions, general recommendations are not included at the end of the Urban chapter. Instead, recommended implementing actions are noted at the end of each management measure section.*

A. New Onsite Disposal Systems Management Measure

(1) Ensure that new Onsite Disposal Systems (OSDS) are located, designed, installed, operated, inspected, and maintained to prevent the discharge of pollutants to the surface of the ground and to the extent practicable reduce the discharge of pollutants into ground waters that are closely hydrologically connected to surface waters. Where necessary to meet these objectives: (a) discourage the installation of garbage disposals to reduce hydraulic and nutrient loadings; and (b) where low-volume plumbing fixtures have not been installed in new developments or redevelopments, reduce total hydraulic loadings to the OSDS by 25%. Implement OSDS inspection schedules for preconstruction, construction, and postconstruction;

(2) Direct placement of OSDS away from unsuitable areas. Where OSDS placement away from unsuitable areas is not practicable, ensure that the OSDS is designed or sited at a density so as not to adversely affect surface waters or ground water that is closely hydrologically connected to surface water. Unsuitable areas include, but are not limited to, areas with poorly or excessively drained soils; areas with shallow water

tables or areas with high seasonal water tables; areas overlaying fractured bedrock that drain directly to ground water; areas within floodplains; or areas where nutrient and/or pathogen concentrations in the effluent cannot be sufficiently treated or reduced before the effluent reaches sensitive waterbodies;

(3) Establish protective setbacks from surface waters, wetlands, and floodplains for conventional as well as alternative OSDS. The lateral setbacks should be based on soil type, slope, hydrologic factors, and type of OSDS. Where uniform protective setbacks cannot be achieved, site development with OSDS so as not to adversely affect waterbodies and/or contribute to a public health nuisance;

(4) Establish protective separation distances between OSDS system components and groundwater which is closely hydrologically connected to surface waters. The separation distances should be based on soil type, distance to ground water, hydrologic factors, and type of OSDS;

(5) Where conditions indicate that nitrogen-limited surface waters may be adversely affected by excess nitrogen loadings from ground water, require the installation of OSDS that reduce total nitrogen loadings by 50% to groundwater that is closely hydrologically connected to surface water.

V.A.1. Description

The purpose of this management measure is to protect land and waters from pollutants discharged by OSDS. The measure requires that OSDS be sited, designed, and installed so that impacts to waterbodies will be reduced to the extent practicable. Factors such as soil type, soil depth, depth to water table, rate of sea level rise, and topography must be considered in siting and installing conventional OSDS.

In addition to soil criteria, setbacks, separation distances, and management and maintenance requirements need to be established to fulfill the requirements of this management measure. Guidance on design factors to consider in the installation of OSDS is available in EPA's *Design Manual for Onsite Wastewater Treatment and Disposal Systems* (1980), currently under revision.

EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* defines "on-site disposal system (OSDS)" as "sewage disposal system designed to treat wastewater at a particular site. Septic tank systems are common OSDS." For the purposes of this management measure, "individual wastewater system," as defined by Chapter 11-62, HAR, will be

assumed to have the same meaning as "OSDS" as defined by the management measure.

In Hawaii, OSDSs are used to contain and treat wastewater from individual properties and small groups of properties that are not connected to sanitary sewer systems. Unsewered areas for each major island are as follows:

- Oahu - North Shore, Waimanalo, and part of Manoa Valley
- Maui - all areas except central Maui, Lahaina, and Kihei
- Hawaii - all areas except part of Hilo and Kailua-Kona, and some resort properties in North Kona and South Kohala
- Kauai - all areas except Lihue, Koloa and Poipu
- Molokai - all areas except Kaunakakai
- Lanai - all areas except Lanai City

V.A.2. Applicability

This management measure applies to all new OSDSs, including package plants and small-scale or regional treatment facilities not covered by NPDES regulations, in order to manage the siting, design, installation, and operation and maintenance of all such OSDSs.

V.A.3. Management Practices

a. Develop setback guidelines and official maps showing areas where conditions are suitable for conventional septic OSDS installation.
b. OSDS should be sited, designed, and constructed so that there is sufficient separation between the soil absorption field and the seasonal high water table or limiting layer, depending on site characteristics, including but not limited to hydrology, soils and topography.
c. Require assessments of site suitability prior to issuing permits for OSDS.
d. If OSDS are sited in areas where nitrogen-limited waters may be adversely affected by excessive nitrogen loading, minimize densities of development in those areas and require use of denitrification systems.
e. Develop and implement local plumbing codes that require practices that are compatible with OSDS use.
f. In areas suitable for OSDS, select design, and construct the appropriate OSDS that will protect surface waters and groundwater.
g. Design sites so that an area for a backup soil absorption field is planned for in case of failure of the first field.
h. During construction of OSDS, soils should not be compacted in the primary or the backup soil absorption field area.
i. Perform post construction inspection of OSDS.

V.A.4. Implementation of Management Measure

(i) Organizational Structure: DOH is the lead agency in implementing this management measure because it administers the regulatory programs for wastewater systems and safe drinking water. The county building departments administer the plumbing codes.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 321	General Department of Health
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-23	Underground Injection Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-62	Wastewater Systems
ROH	Section 14-8	Sewer Fund
ROH	Chapter 19	Plumbing Code
ROH	Section 30-4	Water Conservation Measures
HCC	Chapter 17	Plumbing
MCC	Section 16.20A	Universal Plumbing Code
KCC	Chapter 14	Plumbing

Chapter 11-62, HAR, administered by DOH, outlines the requirements for locating, building and operating wastewater treatment systems and individual wastewater systems. Subchapter 3 outlines requirements of individual wastewater systems. Section 11-62-03 defines an "individual wastewater system" as "a facility which is designed to receive and dispose of no more than 800 gallons per day of domestic wastewater. Individual wastewater systems may involve treatment processes and include, but are not limited to, septic tanks and household aerobic units with disposal systems and cesspools. Each individual wastewater system shall be an independent system and shall have all of its plumbing, treatment (if any), and disposal components separate from any other wastewater system."

These general requirements are applicable to all OSDSs:

- The plans and specifications for all new or expanded OSDSs must be approved by DOH before construction can begin [§11-62-08(b)]; and
- All OSDS require postconstruction inspection by DOH before operation can begin [§11-62-31.1(f)].

Chapter 11-62, HAR, also specifies that:

- A minimum lot size of 10,000 ft^2 is required for each OSDS per single dwelling unit [§11-62-31.1(a)(2)];
- No OSDS can be located within 50 feet of a stream bank, bank of lake or pond, or the ocean at the vegetation line; and
- No cesspool, seepage pit or soil absorption system can be located within 1000 feet of a potable drinking water well (§11-62-32).

Under Chapter 11-62, HAR, Critical Wastewater Disposal Areas (CWDAs) were designated by DOH in 1990 for all counties. These areas offer the primary control on the location and allowable type of OSDSs. CWDAs were designated using one or more of the following criteria [§11-65-05(a)]: high water table; impermeable soil formation; steep terrain; flood zone; highly permeable substructure adjacent to

surface water bodies; known high cesspool failure; and groundwater contamination. In a CWDA, the following restrictions apply:

- Cesspools shall be severely restricted or prohibited [§11-62-05(c)]; and
- DOH may require more stringent requirements than those specified in these rules for wastewater treatment systems [§11-62-05(b)].

Wastewater advisory committees were organized for each county to designate CWDAs. These recommendations include practices and guidance in addition to those outlined in Chapter 11-62, HAR:

- Generally, CWDAs should be designated, without exceptions, below the 100-foot elevation or 1000-feet laterally from the coastline on all islands;
- Generally, CWDAs should be designated, without exceptions, above the UIC line on all islands except Kauai;
- All ground disposal should be prohibited above the UIC line and within the CWDA for the entire island of Oahu;
- Practically the entire island of Maui should be designated a CWDA;
- Lots sized less than 1 to 5 acres should be treated as CWDAs for specific areas of the island of Hawaii; and
- Lots sized less than 1 acre should be treated as CWDAs for almost all areas above the 100-foot elevation or 1000-feet laterally from the coastline on Kauai.

Chapter 11-23, HAR, also administered by DOH, classifies exempted aquifers and underground sources of drinking water. Unless expressly exempted, all aquifers are considered underground sources of drinking water. UIC maps indicate the boundary line of exempted aquifers. No large municipal or community serving systems can use injection wells above the UIC line. Certain activities are also prohibited interior of the line.

Chapter 19-4.1(46), ROH, administered by the Building Department, is a local addendum to the Universal Plumbing Code, Section 1010. This addendum requires that all new plumbing fixtures be "ultra low flow" fixtures. This requirement applies to all new residential developments and to all upgraded or replaced fixtures. Section 30-4, ROH, requires all non-residential properties (except municipal buildings) to have ultra low flow fixtures as defined in Chapter 19, ROH, unless granted an exemption. This requirement applies to all new and existing non-residential properties (existing properties generally must have retrofitted all plumbing fixtures by mid-1994). Finally, Section 14-8, ROH, mandates the Board of Water Supply to offer a $25 rebate for home owners who replace their existing toilets with an ultra-low flow toilet.

Section 16.20A, MCC, administered by the Department of Public Works and Waste Water Management, requires that, as of December 31, 1992, only ultra low flow plumbing fixtures be offered for sale or installed in the County of Maui.

Chapter 14-4.1, KCC, require the use of low flow plumbing fixtures. This code section modifies the Uniform Plumbing Code, Section 1010.

Chapter 17, HCC, has modified the Uniform Plumbing Code, Section 1010, to require the use of low flow plumbing fixtures.

B. Operating Onsite Disposal Systems Management Measure

(1) Establish and implement policies and systems to ensure that existing OSDS are operated and maintained to prevent the discharge of pollutants to the surface of the ground and to the extent practicable reduce the discharge of pollutants into ground waters that are closely hydrologically connected to surface waters. Where necessary to meet these objectives, encourage the reduced use of garbage disposals, encourage the use of low-volume plumbing fixtures, and reduce total phosphorus loadings to the OSDS by 15% (if the use of low-level phosphate detergents has not been required or widely adopted by OSDS users). Establish and implement policies that require an OSDS to be repaired, replaced, or modified where the OSDS fails, or threatens or impairs surface waters;

(2) Inspect OSDS at a frequency adequate to ascertain whether OSDS are failing;

(3) Consider replacing or upgrading OSDS to treat influent so that total nitrogen loadings in the effluent are reduced by 50%. This provision applies only:

- **(a) where conditions indicate that nitrogen-limited surface waters may be adversely affected by significant groundwater nitrogen loadings from OSDS, and**
- **(b) where nitrogen loadings from OSDS are delivered to groundwater that is closely hydrologically connected to surface water.**

V.B.1. Description

The purpose of this management measure is to minimize pollutant loadings from operating OSDSs. This management measure requires that OSDSs be modified, operated, repaired, and maintained to reduce nutrient and pathogen loadings in order to protect and enhance surface waters.

V.B.2. Applicability

This management measure applies to all operating OSDSs.

V.B.3. Management Practices

a. Perform regular inspections of OSDS.
b. Perform regular maintenance of OSDS.
c. Retrofit or upgrade improperly functioning systems.
d. Use denitrification systems where conditions indicate that nitrogen-limited surface waters may be adversely affected by excessive nitrogen loading.
e. Discourage the use of phosphate in detergents.

f. Eliminate the use of garbage disposals.
g. Discourage or ban the use of acid and organic chemical solvent septic system additives.
h. Promote proper operation and maintenance of OSDS through public education and outreach programs.

V.B.4. Implementation of Management Measure

(i) Organizational Structure: DOH is the lead agency in implementing this management measure because it administered the regulatory programs for wastewater systems and safe drinking water. The county building departments administer the plumbing codes.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 321	General Department of Health
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-23	Underground Injection Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-62	Wastewater Systems
ROH	Section 14-8	Sewer Fund
ROH	Chapter 19	Plumbing Code
ROH	Section 30-4	Water Conservation Measures
MCC	Section 16.20A	Universal Plumbing Code
KCC	Chapter 14	Plumbing
HCC	Chapter 17	Plumbing

Chapter 11-62, HAR, administered by DOH, requires that no wastewater system (including OSDSs) be operated in such a way that it creates or contributes to: wastewater spill, overflow, or discharge onto the ground or surface waters; or contamination, pollution or endangerment of drinking water [§11-62-06(g)]. Chapter 11-62, HAR, also requires compliance with the Ten States Standards with respect to maintenance and inspections of OSDS. Further, OSDS owners are required to follow the procedures in maintenance manuals that must be submitted to DOH for approval.

As described on p. III-135, all counties require the use of low flow plumbing fixtures.

V.B.5. Additional Recommended Implementing Actions

To strengthen the overall effectiveness of this management measure, the following measures should be implemented:

A. Add Illegal Disposal Clause to Chapter 11-62, HAR

- DOH should revise Chapter 11-62, HAR, to include language specifying that the improper disposal of household hazardous or toxic materials, such as motor oil and solvents, is illegal and subject to a stiff fine. Although the

improper disposal of these substances is illegal under other statutes, Chapter 11-62, HAR, should be revised for consistency. OSDSs are not designed to treat these materials, and every effort should be made to ensure that they are not "dumped" into OSDSs.

B. Enforce Single Family Zoning

- The counties should improve enforcement of single family zoning requirements. Because of the price of housing in Hawaii, basement or other attached units are seen as good sources of revenue to homeowners. Therefore, it is common for areas zoned "single family residential" to have multiple units within the same dwelling. However, the additional residents in these units add significant amounts of wastewater to OSDSs that are likely not designed to handle the increased loads.

- DOH should coordinate with the counties to ensure that OSDSs with adequate capacities are used by all dwellings. At a minimum, an owner of a dwelling with multiple units on a single OSDS that is not designed for multiple units should be required to show that the existing OSDS has a design flow that meets or exceeds the combined volume for the total number of existing bedrooms. If the OSDS cannot adequately handle the estimated combined volume, the homeowner should be required to: install ultra low flow water fixtures, if the resulting estimated combined flows can be handled by the existing OSDS; or upgrade or retrofit the existing OSDS.

C. Encourage Conversion of Cesspools

- DOH, in cooperation with the counties, should provide technical and financial incentives to encourage homeowners in CWDAs to convert existing cesspools.

D. Discourage the Use of Some Products

- DOH, in cooperation with the counties, should disseminate public informational materials to discourage residents from using various products, especially if their homes are connected to OSDSs. These are products, such as phosphate detergents, acid or organic chemical additives, sodium hypochlorite-based drain cleaners and certain other household chemicals, and garbage disposals, that can damage OSDSs and negatively affect the environment. Public education activities at both the county and State levels should also include information on what materials can be safely disposed in an OSDS.

E. Encourage Conversion of Existing Fixtures to Low-Flow

- Counties should institute rebate programs to encourage home owners to convert existing inefficient toilets and other water fixtures to low flow fixtures. Currently, all counties require new plumbing fixtures to be low flow fixtures. However, only the City and County of Honolulu offers incentives for homeowners to replace *existing* inefficient fixtures, and currently the incentive extends only to toilets.

- Consideration should be given to making a similar offer for more water-efficient replacements for other high water use appliances (*i.e.*, dishwashers

and washing machines). This incentive would help to reduce the flows to both OSDSs and municipal sewer systems, as well as assisting in water conservation in general.

VI. POLLUTION PREVENTION

***NOTE**: Because of the wide range of sources of polluted runoff associated with urban activities and the accompanying range of recommended actions, general recommendations are <u>not</u> included at the end of the Urban chapter. Instead, recommended implementing actions are noted at the end of each management measure section.*

A. Pollution Prevention Management Measure

Implement pollution prevention and education programs to reduce nonpoint source pollutants generated from the following activities, where applicable:

(a) The improper storage, use, and disposal of household hazardous chemicals, including automobile fluids, pesticides, paints, solvents, etc.;
(b) Lawn and garden activities, including the application and disposal of lawn and garden care products, and the improper disposal of leaves and yard trimmings;
(c) Turf management on golf courses, parks, and recreational areas;
(d) Improper operation and maintenance of onsite disposal systems;
(e) Discharge of pollutants into storm drains including floatables, waste oil, and litter;
(f) Commercial activities including parking lots, gas stations, and other entities not under NPDES purview; and
(g) Improper disposal of pet excrement.

<u>VI.A.1. Description</u>

This management measure is intended to prevent and reduce nonpoint source pollutant loadings generated from a variety of activities within urban areas not addressed by other management measures in this chapter. Source reduction is considered preferable over waste recycling for pollution reduction. Everyday activities have the potential to contribute to nonpoint source pollutant loadings. Some of the major sources include households, garden and lawn care activities, turf grass management, diesel and gasoline vehicles, OSDS, illegal discharges to urban runoff conveyances, commercial activities, and pets and domesticated

animals. By reducing pollutant generation, adverse water quality impacts from these sources can be decreased.

Everyday household activities generate numerous pollutants that may affect water quality. Common household nonpoint source pollutants include paints, solvents, lawn and garden care products, detergents and cleansers, and automotive products such as antifreeze and oil. The improper use and disposal of these products can be chronic sources of pollution. Failing or improperly sited, designed, or used OSDS may contribute both pathogens and nutrients to surface waters. Pollutants and litter are sometimes dumped into storm drains under the mistaken assumption that treatment will occur at the sewage treatment plant.

VI.A.2. Applicability

This management measure is intended to be applied to reduce the generation of polluted runoff in all areas within the coastal nonpoint pollution control program management area. The adoption of the Pollution Prevention Management Measure does not exclude applicability of other management measures to those sources covered by this management measure.

VI.A.3. Management Practices

a. Promote public education programs regarding proper use and disposal of household hazardous materials and chemicals.
b. Establish programs such as Amnesty Days to encourage proper disposal of household hazardous chemicals.
c. Develop used oil, used antifreeze, and hazardous chemical recycling programs and site collection centers in convenient locations.
d. Encourage proper turf management and landscaping.
e. Encourage proper onsite recycling of yard trimmings.
f. Encourage use of biodegradable cleaners and other alternatives to hazardous chemicals.
g. Manage pet excrement to minimize runoff into surface waters.
h. Use storm drain stenciling in appropriate areas.
i. Encourage alternative designs and maintenance strategies for impervious parking lots.
j. Control commercial sources of nonpoint pollutants by promoting pollution prevention assessments and developing nonpoint source pollution reduction strategies or plans and training materials for the workplace.
k. Utilize integrated pest management practices on golf courses to minimize use of water, fertilizers, and pesticides.
l. Promote water conservation.
m. Discourage use of septic system additives.
n. Encourage litter control.
o. Promote programs such as Adopt-a-Stream to assist in keeping waterways free of litter and other debris.
p. Promote proper operation and maintenance of OSDS through public education and outreach programs.

VI.A.4. Implementation of Management Measure

(i) Organizational Structure: DOH is the lead agency in implementing this management measure because it administers both regulatory and non-regulatory programs for pollution prevention. The counties administer ordinances that prohibit littering.

(ii) Regulatory Mechanisms:

HRS	Chapter 339	Litter Control
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 342G	Integrated Solid Waste Management
HRS	Chapter 342I	Lead Acid Battery Recycling
HRS	Chapter 342J	Hazardous Waste
HRS	Chapter 342N	Used Oil Law
HAR	Chapter 11-58.1	Solid Waste Management Control
HAR	Chapter 11-62	Wastewater Systems

DOH Guidelines for Golf Course Development

HCC	Chapter 4	Animals (pet wastes)
HCC	Chapter 20	Refuse (Litter)
KCC	Chapter 20	Litter Prohibited
MCC	Chapter 6.04	Dog Control
MCC	Chapter 8.04	Refuse Collection
MCC	Chapter 20.20	Litter Control
ROH	Chapter 14-12	Drainage, Flood and Pollution Control
ROH	Chapter 29-4	Streets, Sidewalks, Malls and other Public Places - Litter Control

Chapter 339, HRS, administered by DOH, DLNR, and the county police departments, prohibits littering in public places, on private property, or in state waters, directing the disposal of wastes to designated places, litter receptacles, and litter bags.

Chapter 342G, HRS, administered by DOH, sets forth solid waste management priorities and goals of the State and establishes the Office of Solid Waste Management (OSWM) to promote and coordinate solid waste management at the State and county levels. It also requires county planning and preparation of detailed integrated solid waste management plans. These plans are to include waste stream assessment, source reduction, recycling, special waste, hazardous household waste, and public education components. These plans must be submitted for State review and approval. Chapter 342G, HRS, also establishes an Environmental Management Special Fund for partial funding of OSWM operations, for education, demonstration and marketing programs, and for training municipal solid waste operators. This statute provides for fines up to $10,000 per offense (Chapter 342G-71, HRS).

Chapter 342I, HRS, administered by DOH, describes the procedures and prohibitions for disposing and recycling of lead acid batteries. In general, the

only legal option for disposing of a lead acid battery is to return it to a retailer of such batteries or to an authorized collection or recycling facility which accepts batteries. Retailers of lead acid batteries must accept as many lead acid batteries for recycling as they sell. Retailers must also post signs displaying the following phrases: "it is illegal to discard a motor vehicle battery or other lead acid battery"; "recycle your used batteries"; and "State law requires us to accept used motor vehicle batteries or other lead acid batteries for recycling, in exchange for new batteries purchased." This statute authorizes fines up to $10,000 for each separate offense, and fines of $2,000 for retailers not posting notices.

Chapter 342J, HRS, administered by DOH, states that the hazardous waste management program of the State shall be preventive as well as regulatory. The program's priorities include: the establishment of a public education program to promote awareness of what constitutes hazardous waste and the dangers of improper disposal of these wastes; the promotion of hazardous waste minimization, reduction, recycling, exchange, and treatment as the preferred methods of managing hazardous waste, with disposal used as a last resort; and the coordination of hazardous waste management efforts among the counties.

Chapter 342N, HRS, administered by DOH, prohibits the discharge of new, used or recycled oil into sewers, drainage systems, surface or groundwaters, watercourses, marine waters, or on to the ground. It does not apply to inadvertent, normal discharges from vehicles or from maintenance or repair activities, provided that appropriate measures are taken to minimize releases. This chapter outlines enforcement procedures and penalties.

Chapter 11-58.1, HAR, administered by DOH, establishes minimum standards governing the design, construction, installation, operation and maintenance of solid waste disposal, recycling, reclamation and transfer systems.

Chapter 4, HCC, administered by the county police department, prohibits pet owners from allowing their pets to defecate on public streets, including sidewalks, passageways, or bypasses, or on any play areas, parks, or places where people congregate or walk, or on any public property, or on any private property without the permission of the owner of the property, unless the pet owner immediately picks up and properly disposes of the feces. Chapter 20, HCC, administered by the department of public works, prohibits littering on any highway, street, road, alley sidewalk, sea beach, public park, or other public place in the county. Litter is broadly defined to include, among others, dirt, paper, wrappings, cigarettes, yard clippings, leaves, wood, scrap metal, and any other waste materials (§20-1, HCC).

Chapter 20, KCC, administered by the department of public works, prohibit the throwing or depositing of litter in public places, which include public roads, bays, ponds, streams, lakes and other bodies of water.

Chapter 6.04, MCC, administered by the office of the mayor, describes responsibilities of dog owners for disposing of animal waste and establishes penalties for failing to comply. Chapter 8.04, MCC, administered by the department of public works, defines "garbage" and specifies collection

requirements. Chapter 20.20, MCC, administered by the local police department and department of public works, prohibits littering on public or private places, and public roadways, and prohibits people from allowing their pets to improperly excrete upon public and private property (§20.20.050). All three ordinances contain penalty provisions.

Chapter 14-12, ROH, provides drainage and flood control measures to mitigate the threat of severe damage to property and to lessen the possibility of injury to residents in the event of heavy rains and periodic flooding.

Chapter 29-4, ROH, prohibits littering of any kind on private and public property, and the department of public works, department of parks and recreation, building department, and the Honolulu police department are all authorized to enforce this prohibition. Owners and occupants are held responsible for the removal of any litter on their properties and adjoining sidewalks. Fines and penalties are provided for violations, and a litter control fund is established for promoting the cleanup of litter.

(iii) Non-Regulatory Mechanisms:

(a) Storm Drain Stenciling: Storm-drain stenciling involves painting a message next to storm drains to remind people that anything disposed into storm drains will ultimately end up in the ocean. Stenciled messages feature a sketch of the humuhumunukunukuapuaa (Hawaii State fish), and read: *Dump no waste, goes to beach; or Kokua, no dumping - goes to ocean.* The project is coordinated through DOH's Polluted Runoff Control Program (DOH-PRC), and is being undertaken by volunteers in cooperation with State and county agencies. Stenciling materials are provided by DOH. The City and County of Honolulu has also been coordinating storm drain stenciling efforts around Oahu.

(b) Educational Materials and Programs Related to Storm Drains: The City and County of Honolulu, Department of Public Works (C&CDPW), is in the process of implementing a pollution prevention program in connection with its NPDES municipal storm drain permit program. Programs and materials include:

- Training videos on a number of issues related to polluted runoff.
- A video entitled "*Protect our Waters for Life*" is in the final stages of production.
- City bus display ads and posters on nonpoint source pollution issues are in the final stages of development.
- Refrigerator magnets and door-cards carrying polluted runoff control information and critical phone numbers are distributed to local residents.
- Adopt-a-Stream and Clean Streams programs provide outreach to neighborhood boards and other community groups. When stream clean-ups and other maintenance activities are done by communities, C&CDPW provides curb pick-up of the large volumes of debris removed from streams.

(c) General Polluted Runoff Control Educational Materials and Programs: Several types of materials and programs have been produced or are under development by DOH-PRC and cooperating agencies, including:

- A quarterly *NPS Newsletter* that provides current information on nonpoint source pollution issues.
- *Apoha: The Fish Story* (Coloring Book);
- *Apoha: The Fish Story* (Video);
- Apoha the Oopu (fish costume), which appears at community functions championing public and community awareness of water quality and polluted runoff;
- Nonpoint source curriculum for 4th grade students and educators;
- Nonpoint source curriculum for 6th grade students and educators (under development);
- Public Service Announcements (PSAs) on water quality for television and radio, developed in cooperation with NRCS;
- Clean Water Action Packet;
- Clean Water Contest to distribute an informal survey to learn what people did and did not know about polluted runoff. Completed questionnaires were used in door prize drawings (prizes provided by area merchants.); and
- Large color poster entitled "Help Control Nonpoint Source Pollution."

(d) Household Hazardous Waste Educational Materials and Programs: DOH's Solid and Hazardous Waste Branch has developed public educational materials and programs related to the minimization of hazardous wastes that may otherwise become sources of nonpoint pollution. A Pollution Prevention Interdepartmental Working Group, made up of representatives from many federal, State, and county agencies, meets monthly to discuss a variety of pollution prevention issues.

- A brochure entitled "*Hawaii's Hazardous Waste Minimization Program*" describes Hawaii's Hazardous Waste Minimization Program and the resources available to help in waste minimization and regulatory compliance.
- Bulletins describe information, assistance, and advice on many topics including environmental agency contacts, educational and analytical laboratories, painting operations, parts cleaning, printing operations, and dry cleaning.
- A 44-page directory entitled "*Waste Management Services in Hawaii*" lists businesses providing waste management services from asbestos removal to water oil recycling, and everything in between.
- The Hawaii Materials Exchange (HIMEX) newsletter and catalog are available for distribution. HIMEX, a private operation started with DOH seed money, also has a computer bulletin board system (BBS) that acts as a statewide database for the exchange of materials that are no longer usable by the owner.
- Newsletters providing information on regulatory issues and waste minimization are available for distribution.
- A manual entitled "*Reducing and Managing Painting Contractor Wastes*" contains information on waste reduction opportunities, waste disposal options, and resources to assist in regulatory compliance.
- A pamphlet entitled "*Alternatives to Household Hazardous Waste*" lists many household hazardous waste products used around the house, and

commonly found in storage sheds and garages. The problems with some of these products are described and alternative products suggested.

- A household hazardous waste/product guidebook is in the final stages of production. It will provide detailed descriptions of the problems associated with a wide variety of hazardous household products. Proper maintenance procedures, alternative products or actions, and proper disposal options are highlighted.

DOH's Solid and Hazardous Waste Branch also provides public displays at fairs, schools and other events. In addition, various materials, such as video and display packages, are loaned to schools and other organizations. These materials deal primarily with recycling and building with plastic materials. Materials on backyard composting may be produced soon to encourage reductions in green waste and minimize the need to use chemical fertilizers on lawns and gardens.

(e) U.S. Coast Guard Environmental Awareness Program: The USCG has implemented a nationwide environmental awareness program on marine pollution caused by non-degradable plastics. The local USCG, in cooperation with other federal, State, and local agencies, and organizations has developed an educational video on the hazards of marine pollution. This video, entitled "*E Malama Kakou I Ke Kai: Be the Solution to Ocean Pollution*," shows how people can unconsciously contribute to the problem of marine debris by following the path of rubbish from land to sea.

(f) Road Cut Revegetation Demonstration Project: This demonstration project was organized around a site within the Pearl Harbor Watershed on the H-1 freeway, a site of concern to DOT because of significant erosion. The Pearl Harbor Estuary Program Interagency Committee (PHEPIC), involving DOH, DOT, NRCS, and the Hawaii Association of Conservation Districts (HACD) designed the demonstration project for revegetation. A total of 26 species of vegetation are being tested at the site, some donated by the Halawa Xeriscape Garden, Hoomaluhia Botanical Garden, National Tropical Botanical Garden, and Waimea Arboretum. Volunteers helped plant the vegetation. DOT staff were present to assist and guide the volunteers and have been maintaining the site since planting.

VI.A.5. Additional Recommended Implementing Actions

To strengthen the overall effectiveness of this management measure, the following measures should be implemented:

A. Develop a Pollution Prevention Resource Guide

- Develop and distribute a Pollution Prevention Guide to residents of the State. Most people are not aware of their contributions to polluted runoff or, at least, the magnitude of their effects. Additionally, many people are not aware of the State laws and county ordinances that already regulate the disposal of a variety of everyday wastes. A serious public education and information distribution campaign that draws attention to the cause and effect relationships between polluting actions and environmental degradation may substantially reduce many sources of pollution.

The Pollution Prevention Guide would provide a considerable amount of valuable information on pollution prevention and direct residents to existing programs and entities. DOH's Environmental Planning Office and the C&CDPW have already developed much the necessary materials for the Guide. The Guide would simply assemble all of the information into one easily-distributable and readily-available format. The Guide would contain the following types of information:

- Information on the cause and effect relationship between people's actions and polluted runoff problems, and would include sections on basic maintenance of OSDS, the proper times to apply lawn fertilizers and pesticides, proper disposal of motor oil, the need for automobile maintenance, proper disposal of pet droppings, and proper disposal (and/or composting) of yard wastes.
- List of common household toxics (solvents, paints, cleaners, pesticides, and many automobile products), the problems they can cause, and alternative less-toxic products. The Guide would also discuss proper disposal options for household toxics.
- Locations of recycling operations that accept used motor oil, as well as paper, aluminum cans, glass, etc. Many people would use these facilities if they knew their locations and accepted materials.
- A list of existing pollution prevention programs and organizations from which the public could get assistance and information. Through these groups, people could have opportunities to get involved. For instance, the City and County of Honolulu has programs to pick up large bulky items (the Bulky Items Pick-up Program) and to take away abandoned motor vehicles. The public is often unaware of which State or county agency handles complaints for different situations. The Guide would list the agencies and the services they provide.

A smaller version of a Pollution Prevention Resource Guide has already been produced by C&CDPW as a part of its NPDES stormwater permit pollution reduction program. This guide has been distributed on Oahu as a separate booklet along with the telephone book. It is recommended that this booklet be expanded to be a full resource guide with narratives and color drawings. A good model is the "Bay Book," originally conceived by the Maryland State Soil Conservation Committee and produced under EPA funding by the Alliance for the Chesapeake Bay in cooperation with many Maryland state agencies. This guide is an 8.5 x 11 inch, user-friendly, colorful, 32-page staple-bound booklet. It would be most useful to have Hawaii's Pollution Prevention Resource Guide bound directly into the State's telephone directories, with the State and counties sharing the extra costs of printing the directories. (These costs would likely be less than publishing a separate documents for distribution to all households.)

B. Reinstate and Enhance Hazardous Materials Collection

- Reinstate and enhance the "Amnesty Day" program for all islands. This program, which was recently discontinued, provided several days per year when residents could bring hazardous, or presumed hazardous, materials,

such as banned pesticides and unknown solvents, to collection points. Since it is in the best interest of the community as a whole to get these chemicals out of circulation as fast as possible, the collection program should be expanded to include a more comprehensive and better advertised neighborhood-based drop-off program. An even more aggressive hazardous materials collection campaign might include a once-a-month pick-up program similar to a bulky items pick-up program. Residents would call and sign-up for a certain date when a collection vehicle would stop and pick up the materials.

C. Promote Use and Production of Electric and Hybrid Vehicles

- Consider tax credits for the purchase of electric or hybrid cars and motorcycles and for Hawaii-based companies doing research on making them more affordable and energy efficient. Honolulu's urban area with its relatively slow traffic may be suitable for these vehicles.

D. Expand State Automobile Inspection

- Include an environmental inspection of a car's pollution potential as part of its annual safety inspection. This inspection would include checks on oil leaks, wheel alignment, and the condition of brake drums/discs. Motor oil contains many heavy metals from the wear of internal bearings and other engine parts. Excessive wear of tires results from poor wheel alignment or damaged ball joints and bushings. Likewise, excessive wear of brake shoes and pads results from damaged, warped, or excessively worn brake drums or pads. Because of Hawaii's unique hydrology and persistent rainfall, automobile pollutants are easily washed into streams.

E. Explore Incentives for Reduced Automobile Use

- Consider an "environmental user fee" for the use of automobiles. These fees should realistically be seen as a way of helping to internalize more of the total costs of pollution by the constant use of automobiles. Although there are many alternatives for this user fee, an added "environmental" gasoline tax of 5 to 10 cents or more is suggested. The more the car is actually used, the more the user pays. If the car is left at home in lieu of alternative means of transportation, the user pays nothing, regardless of the size of the car. If the driver uses a fuel-efficient car and, thus, presumably a less environmentally damaging car, less gasoline is needed and the user pays less. An annual fee on cars or a heftier fee on larger cars would likely not be as effective because it becomes an ownership fee, not a user fee.

  The proceeds of the environmental user fee could offset operational costs for buses, provide facilities for bicycles, fund other pollution reduction opportunities related to reduced automobile usage, or support polluted runoff control programs.

B. Golf Course Management Measure

(1) Develop and implement grading and site preparation plans to:
- **(a) Design and install a combination of management and physical practices to settle solids and associated pollutants in runoff from heavy rains and/or from wind;**
- **(b) Prevent erosion and retain sediment, to the extent practicable, onsite during and after construction;**
- **(c) Protect areas that provide important water quality benefits and/or are environmentally-sensitive ecosystems;**
- **(d) Avoid construction, to the extent practicable, in areas that are susceptible to erosion and sediment loss;**
- **(e) Protect the natural integrity of waterbodies and natural drainage systems by establishing streamside buffers; and**
- **(f) Follow, to the extent practicable, the amended U.S. Golfing Association (USGA) guidelines for the construction of greens.**

(2) Develop nutrient management guidelines appropriate to Hawaii for qualified superintendents to implement so that nutrients are applied at rates necessary to establish and maintain vegetation without causing leaching into ground and surface waters.

(3) Develop and implement an integrated pest management plan. Follow EPA guidelines for the proper storage and disposal of pesticides.

(4) Develop and implement irrigation management practices to match the water needs of the turf.

VI.B.1. Description

Because Hawaii is a major tourist destination, there are numerous golf courses on most islands, and many more are planned. According to PER (1995), there are more golf courses than would be expected for its resident or *de facto* populations. Eighty golf courses have already been built in Hawaii, and 76 more are either under construction or planned. Assuming an average of 150 acres per 18-hole course, this land use occupies approximately 12,000 acres in golf courses already built and 23,400 total acres if all those planned and approved were to be built. This intensively managed and landscaped acreage, often located adjacent to the coast, represents a significant land use.

The goal of this management measure is to minimize and prevent the migration of nonpoint source pollutants from golf courses into ground, surface, and coastal waters.

This management measure has been developed specifically for Hawaii and is not contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

Justification for Additional Management Measure: *Regardless of the current state and quality of management and maintenance of golf courses, this land use has the potential to be a significant source of polluted runoff due to the proportion of land area involved, the intensity of its management and the quantity of chemicals used.*

Golf courses have the potential to be a nonpoint source of pollution. During the construction of a golf course, for example, erosion is a primary concern. Without adequate drainage and erosion control measures, water or wind may transport sediments off-site and into surface waters. In addition, golf course superintendents apply nutrients to the soil to make up for nutrient deficiencies. They primarily apply Nitrogen (N), Phosphorus (P) and Potassium (K) to the soil. Without proper management, these nutrients may leach into groundwater or run off into streams and coastal waters. Pesticides, including herbicides, insecticides and fungicides, are another potential contributor to nonpoint source pollution if they leach into surface, ground or coastal waters. In a survey of 37 golf courses in Hawaii, researchers identified 30 different pesticides in use (Brennan et.al. 1992).

VI.B.2. Applicability

This management measure applies to all golf courses in Hawaii that are in operation, under construction, or to be built in the future. It should be noted that the other urban management measures also apply to the construction and operation of golf courses.

VI.B.3. Management Practices

These BMPs are based on state-of-the-art management practices currently being implemented by golf course superintendents.

Soil and erosion control during construction:

a. A golf course developer should design and implement an erosion control plan.
b. Maintain natural drainage features wherever possible.
c. Screen and test imported soils for pesticide residue and pests.
d. Retain existing ground cover until the latest date before construction.
e. Minimize the duration of construction.
f. Install sedimentation basin at the onset of grading operations.
g. Develop drainage control features early during construction phase.
h. Use temporary berms and cut-off ditches, where needed, to control erosion.
i. Use temporary sprinklers, where practical, in non-active construction areas when ground cover is removed.
j. Station water truck on site during construction periods to provide for immediate sprinkling as needed in active construction zones.
k. Thoroughly water graded areas after construction activities have ceased for the day or for the weekend.

l. Sod or plant all cut and fill slopes immediately after final grading work has been complete.
m. After final grading, plant grass on exposed areas.
n. Place and maintain adequate soil depth on fairways.
o. Divert drainage from greens and tees into catchment areas to filter pollutants from the water.
p. Encourage the use of plants that use little irrigation.
q. In dry areas, xeriscape with appropriate low-water plants.
r. Identify sensitive ecosystems during the design of the golf course.
s. Develop habitat to encourage native flora and fauna.
t. Establish appropriate buffers zones around and along intermittent and perennial streams, wetlands, anchialine pools, and shorelines that filter pollutants and prevent run-off.
u. Establish appropriate buffers zones next to endangered species habitats to filter pollutants and prevent runoff.

Use of Nutrients:

v. A qualified golf course superintendent should administer the nutrient management guidelines.
w. If necessary, consult the University of Hawaii Cooperative Extension Service (CES) or other qualified agronomists for further guidance.
x. Schedule fertilizer application so that the chance of leaching and run-off of soluble fertilizers is minimized.
y. Apply slow release fertilizers that will release nitrogen at a rate comparable to the rate at which it is used by the turf.
z. Apply slow release nitrogen fertilizer in an insoluble form.
aa. Calibrate fertilizer application equipment regularly.

Use of pesticides:

bb. Design and implement an integrated pest management (IPM) plan that identifies, among other things, the pesticides, herbicides, and fungicides to be used and emergency response procedures to be undertaken in the event of a spill or accident. A qualified golf course superintendent, should administer this plan.
cc. Ensure that golf course superintendents have taken the Department of Agriculture's certification course for the application of restricted-use pesticides as required under Chapter 4-66, HAR (Category 3 - Ornamental Plants and Turf Management).
dd. If necessary, consult CES or other qualified specialist for further guidance.
ee. Apply pesticides in conformance with the IPM plan.
ff. Design the golf course to minimize pesticide use by selecting pest resistant grasses and multiple types of grasses where possible.
gg. When pesticide applications are necessary, consider the persistence, toxicity, runoff potential, and leaching potential of available products. Use these criteria to select the product that is both adequate to control the pest and has the least overall potential for creating nonpoint source pollution.
hh. Use pesticides that are for targeted organisms whenever possible (*i.e.*, baits for insects) and use mulches and other non-chemical techniques where appropriate.

ii. Encourage the use of alternative pesticides and biological controls where appropriate.
jj. Evaluate the soil and physical characteristics of the site including mixing and loading areas for potential leaching and run-off.
kk. Avoid applying pesticides in areas where there is a high potential for leaching.
ll. Avoid locating greens and tees that may require high amounts of pesticides near residential areas.
mm. Avoid applying pesticides near well heads.
nn. Follow the label instructions of all pesticides.
oo. Apply pesticides when runoff losses are unlikely.
pp. Apply pesticides that are sprayed at a lowest possible height and only when the wind speed is slow (if possible, during wind speeds from 3 to 10 miles/hour).
qq. Use coarse nozzle and low pressure spray equipment.
rr. Calibrate pesticide spray equipment regularly.
ss. Use adjuvant additives where appropriate.
tt. Use non-volatile or low volatile chemicals, when appropriate.
uu. Date pesticide containers and keep an inventory.
vv. Purchase only the amount needed for the season because pesticides have a limited shelf life.
ww. Determine the area to be sprayed and mix only the amount of pesticides that are needed.
xx. Properly rinse and dispose of pesticide containers and equipment.
yy. Use up supplies according to the directions on the label. If excess supplies will not be used, use the material exchange program within a reasonable amount of time.
zz. Ensure proper storage of pesticides.
1. Locate storage areas away from floodplains, water run-off areas and streams;

Irrigation:

2. A qualified golf course superintendent should administer the irrigation system.
3. Use appropriate methods to measure the evapotransportation rate of water in the soil. Schedule irrigation on the basis of these measurements.
4. Avoid excessive irrigation where pesticides were recently applied.
5. Where appropriate, determine the amount of salts in the soils before irrigating.
6. Encourage the use of R-1 and R-2 reclaimed water classifications, where appropriate, for irrigation.

VI.B.4. Implementation of Management Measure

(i) Organizational Structure: This management measure is currently implemented under existing regulations. A number of State and county agencies implement components of the management measure, depending on where the proposed golf course is to be located.

- DOH, which administers programs for groundwater protection, water quality, polluted runoff control, and the NPDES permit process;
- DOA, which regulates pesticide distribution and use under Chapter 149A, HRS, and Chapter 4-66, HAR;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies under Chapter 205A, HRS;
- DLNR, which administers the CDUA permit process;
- U.S. Army Corps of Engineers (USACOE), which administers the Section 404, CWA, permit process; and
- Counties, which administer the SMA permit and shoreline and anchialine pool setback provisions, and the grading ordinances.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 149A	Pesticides Law
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation Districts
HRS	Chapter 205	State Land Use
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statement
HAR	Chapter 1-2	Special Management Area/Shoreline Areas
HAR	Chapter 4-66	Pesticides
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HCC	Chapter 10	Soil Erosion and Sediment Control
KCC	Chapter 22-7	Grading, Grubbing, and Stockpiling
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion & Sediment Control
MCC	Chapter 20.08	Soil Erosion and Sediment Control

Typically, prospective golf course developments must undergo numerous permit processes, with their associated environmental assessments and extensive public review. Golf course developments within the State's conservation district trigger a CDUA permit under Chapter 183, HRS. Golf course developments with the counties' SMAs must seek an SMA permit. Chapter 343, HRS, and Chapter 11-200, HAR, both about the Environmental Impact Statement law, require the preparation of an environmental assessment (EA) and/or environmental impact statement (EIS) for proposed activities that trigger the environmental review process. The trigger conditions are as follows: (1) use of State or county lands or funds; (2) use within the conservation district; (3) use within a shoreline setback area; (4) use within the Waikiki special district; (5) use within an historic site; (6) reclassification of conservation lands; (7) amendment to a county general plan; and (8) construction of helicopter facilities.

Proposed golf course developments that may affect water quality and wetlands must obtain a permit from the USACOE under Section 404, CWA. These permit applicants are required to obtain Section 401, CWA, water quality certifications from DOH and Hawaii CZM federal consistency determinations prior to being issued a permit by the USACOE. NRCS and USFWS may review, comment, request conditions, or recommend to deny the Section 401 permit while the USACOE is reviewing the permit application.

Golf courses are only permitted in agricultural areas with soils other than class A or B. If proposed in an area with A and B lands, the development is reviewed by the County and the State's Land Use Commission (LUC). If proposed on soils classified as C, D, and E, then counties have sole jurisdiction at this time. While counties approve all golf courses in the urban district, State rules and policies also apply.

DOH monitors ground water and coastal water quality. DOH also regulates NPDES permits. DOH recommends 10 guidelines applicable for golf course development in Hawaii. These are often attached as permit conditions during the various permit processes.

Chapter 180C, HRS, and the corresponding county ordinances require golf courses to obtain grading and grubbing permits before construction.

A bibliography of recommended reading related to golf course design, construction and maintenance is contained in Appendix B.

VI.B.5. Additional Recommended Implementing Actions

To strengthen the overall effectiveness of this management measure, the following measures should be implemented:

A. Support Collaborative Processes for Technical Assistance and Dissemination of Information

- DOH-PRC should work closely with the local chapters of the Golf Course Superintendents Association to provide assistance and information to implement this management measure.

- Resort and golf course planners should bring developers and superintendents together to collaborate early on in the design and development of golf courses. Polluted runoff control should be one of the issues they jointly address.

B. Develop a BMP Manual for Golf Courses

- Develop a manual of golf course management practices appropriate for Hawaii's soils and micro-climates and distribute to golf course developers and superintendents.

C. Coordinate Water Quality Monitoring Adjacent to Golf Courses

- Extend water quality monitoring programs to areas adjacent to golf courses not currently being monitored and clarify the monitoring responsibilities of government agencies, university researchers, golf course developers, and

other participants. A number of golf course development around the State already implement water quality monitoring programs. These programs indicate no reduction in the water quality of receiving waters near golf courses where superintendents use appropriate management practices.

VII. ROADS, HIGHWAYS, AND BRIDGES

NOTE: *Because of the wide range of sources of polluted runoff associated with urban activities and the accompanying range of recommended actions, general recommendations are not included at the end of the Urban chapter. Instead, recommended implementing actions are noted at the end of each management measure section.*

A. Management Measure for Planning, Siting, and Developing Roads and Highways

Plan, site, and develop roads and highways to:

(1) Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss;
(2) Limit land disturbance such as clearing, grading and cut and fill to reduce erosion and sediment loss; and
(3) Limit disturbance of natural drainage features and vegetation.

VII.A.1. Description

The best time to address control of polluted runoff from roads and highways is during the initial planning and design phase. New roads and highways should be located with consideration of natural drainage patterns and planned to avoid encroachment on surface waters and wet areas. Where this is not possible, appropriate controls will be needed to minimize the impacts of nonpoint source pollution runoff on surface waters.

This management measure emphasizes the importance of planning to identify potential nonpoint source problems early in the design process. This process involves a detailed analysis of environmental features most associated with nonpoint source pollution, erosion and sediment problems such as topography, drainage patterns, soils, climate, existing land use, estimated traffic volume, and sensitive land areas. Highway locations selected, planned, and designed with consideration of these features will greatly minimize erosion and sedimentation and prevent nonpoint source pollutants from entering watercourses during and after construction. An important consideration in planning is the distance between a highway and a watercourse that is needed to buffer the runoff flow and prevent potential contaminants from entering surface waters. Other design elements such as project alignment, gradient, cross section, and the number of stream crossings also must be taken into account to achieve successful control of erosion and nonpoint sources of pollution.

VII.A.2. Applicability

This management measure is virtually identical to the Urban Runoff Site Development Management Measure (II.C). The Urban Runoff Site Development Management Measure applies to activities associated with roads, highways and bridges; therefore, this management measure seems redundant and will not be addressed here. Please refer to II.C. Site Development Management Measure on page III-112.

B. Management Measure for Bridges

Site, design, and maintain bridge structures so that sensitive and valuable aquatic ecosystems and areas providing important water quality benefits are protected from adverse effects.

VII.B.1. Description

This measure requires that NPS runoff impacts on surface waters from bridge decks be assessed and that appropriate management and treatment be employed to protect critical habitats, wetlands, fisheries, shellfish beds, and domestic water supplies. The siting of bridges should be a coordinated effort among the counties, State, FHWA, U.S. Coast Guard, and Army Corps of Engineers. Locating bridges in coastal areas can cause significant erosion and sedimentation, resulting in the loss of wetlands and riparian areas. Additionally, since bridge pavements are extensions of the connecting highway, runoff waters from bridge decks also deliver loadings of heavy metals, hydrocarbons, and toxic substances to surface waters as a result of discharge through scupper drains with no overland buffering. Bridge maintenance can also contribute heavy loads of lead, rust particles, paint, abrasive, solvents, and cleaners into surface waters. Protection against possible pollutant overloads can be afforded by minimizing the use of scuppers on bridges traversing very sensitive waters and conveying deck drainage to land for treatment. Whenever practical, bridge structures should be located to avoid crossing over sensitive fisheries and shellfish-harvesting areas to prevent washing polluted runoff through scuppers into the waters below. Also, bridge design should account for potential scour and erosion, which may affect shellfish beds and bottom sediments.

VII.B.2. Applicability

The intent of this management measure is addressed in the Watershed Protection Management Measure (II.B.) and the Urban Runoff Site Development Management Measure (II.C). These management measures apply to activities associated with roads, highways and bridges; therefore, this management measure seems redundant and will not be addressed here. Please refer to II.B. Water Protection Management Measure on p.III-108 and II.C. Site Development Management Measure on p.III-112.

C. Management Measure for Construction Projects

(1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction and
(2) Prior to land disturbance, prepare and implement an approved erosion control plan or similar administrative document that contains erosion and sediment control provisions.

VII.C.1. Description

Erosion and sedimentation from construction of roads, highways, and bridges, and from unstabilized cut-and-fill areas, can significantly impact surface waters and wetlands with silt and other pollutants including heavy metals, hydrocarbons, and toxic substances. Erosion and sediment control plans are effective in describing procedures for mitigating erosion problems at construction sites before any land-disturbing activity begins.

Bridge construction projects include grade separations (bridges over roads) and waterbody crossings. Erosion problems at grade separations result from water running off the bridge deck and runoff waters flowing onto the bridge deck during construction. Controlling this runoff can prevent erosion of slope fills and the undermining failure of the concrete slab at the bridge approach. Bridge construction over waterbodies requires careful planning to limit the disturbance of streambanks. Soil materials excavated for footings in or near the water should be removed and relocated to prevent the material from being washed back into the waterbody. Protective berms, diversion ditches, and silt fences parallel to the waterway can be effective in preventing sediment from reaching the waterbody.

Wetland areas will need special consideration if affected by highway construction, particularly in areas where construction involves adding fill, dredging, or installing pilings. Highway development is most disruptive in wetlands since it may cause increased sediment loss, alteration of surface drainage patterns, changes in the subsurface water table, and loss of wetland habitat. Highway structures should not restrict tidal flows into coastal wetland areas. To safeguard these fragile areas, the best practice is to locate roads and highways with sufficient setback distances between the highway right-of-way and any wetlands or riparian areas. Bridge construction also can impact water circulation and quality in wetland areas, making special techniques necessary to accommodate construction.

VII.C.2. Applicability

This management measure is identical to the Construction Site Erosion and Sediment Control Management Measure (III.A). The Construction Site Erosion and Sediment Control Management Measure applies to activities associated with roads, highways and bridges; therefore, this management measure seems redundant and will not be addressed here. Please refer to III.A. Construction Site Erosion and Sediment Control Management Measure on page III-117.

D. Management Measure for Construction Site Chemical Control

(1) Limit the application, generation, and migration of toxic substances;
(2) Ensure the proper storage and disposal of toxic materials; and
(3) Apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface water.

VII.D.1. Description

The objective of this measure is to guard against toxic spills and hazardous loadings at construction sites from equipment and fuel storage sites. Toxic substances tend to bind to fine soil particles; however, by controlling sediment mobilization, it is possible to limit the loadings of these pollutants. Proper management and control of toxic substances and hazardous materials should be the basis for erosion and sediment control plans for all construction projects. In addition, some substances such as fuels and solvents are hazardous and excess applications or spills during construction can pose significant environmental impacts.

VII.C.2. Applicability

This management measure is identical to the Construction Site Chemical Control Management Measure (III.B). The Construction Site Chemical Control Management Measure applies to activities associated with roads, highways and bridges; therefore, this management measure seems redundant and will not be addressed here. Please refer to Construction Site Chemical Control Management Measure on p.III-123.

E. Management Measure for Operation and Maintenance

Incorporate pollution prevention procedures into the operation and maintenance of roads, highways, and bridges to reduce pollutant loadings to surface waters.

VII.E.1. Description

Substantial amounts of eroded material and other pollutants can be generated by operation and maintenance procedures for roads, highways, and bridges, and from sparsely vegetated areas, cracked pavements, potholes, and poorly operating urban runoff control structures. This measure is intended to ensure that pollutant loadings from roads, highways, and bridges are minimized by the development and implementation of a program and associated practices to ensure that sediment and toxic substance loadings from operation and maintenance activities do not impair surface and coastal waters.

VII.E.2. Applicability

This management measure applies to existing, restored, and rehabilitated roads, highways, and bridges.

VII.E.3. Management Practices

a. Seed and fertilize, seed and mulch, and/or sod any damaged vegetated areas and slopes.
b. Establish pesticide/herbicide use and nutrient management programs.
c. The use of chemicals such as soil stabilizers, dust palliatives, sterilants, and growth inhibitors should be limited to the best estimate of optimum application rates. All feasible measures should be taken to avoid excess application and consequent intrusion of such chemicals into surface runoff.
d. Sweep residential/urban streets and parking lots.
e. Collect and remove road debris.
f. Maintain retaining walls and pavements to minimize cracks and leakage.
g. Repair potholes.
h. Encourage litter and debris control management.
i. Develop an inspection program to ensure that general maintenance is performed on urban runoff and nonpoint source pollution control facilities.
j. Ensure that energy dissipaters and velocity controls to minimize runoff velocity and erosion are maintained.
k. Dispose of accumulated sediment collected from urban runoff management and pollution control facilities, and any wastes generated during maintenance operations, in accordance with local, State and federal regulations.
l. Use techniques to reduce, to the extent practicable, the delivery to surface waters of pollutants used or generated during bridge maintenance (*e.g.*, paint, solvents, scrapings).
m. Develop education programs to promote the practices listed above.

VII.E.4. Implementation of Management Measure

(i) Organizational Structure: The Department of Transportation (DOT) is the lead agency in implementing this management measure because it is responsible for planning, design and siting of roads, highways and bridges and has BMPs in place for its bridge maintenance program.. Other State and local agencies involved in implementation include:

- DOH, which administers programs for groundwater protection, water quality, nonpoint source pollution, and the NPDES permit process;
- Counties, which administer the ordinances pertaining to excavation and repair of streets and sidewalks, and conduct street sweeping, storm drain cleaning and stream maintenance; and
- DOA, which regulates pesticide distribution and use under Chapter 149A, HRS, and Chapter 4-66, HAR.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 27	State Functions and Responsibilities
HRS	Chapter 149A	Pesticides Law
HRS	Chapter 264	Highways

HRS Chapter 205A	Coastal Zone Management
HRS Chapter 286	Highway Safety
HRS Chapter 291C	Statewide Traffic Code
HRS Chapter 342D	Water Pollution
HRS Chapter 342E	Nonpoint Source Pollution Control
HRS Chapter 342J	Hazardous Waste
HAR Chapter 4-66	Pesticides
HAR Chapter 11-54	Water Quality Standards
HCC Chapter 22	Streets and Sidewalks
KCC Chapter 18	Excavation and Repair of Streets and Sidewalks
ROH Chapter 14-17	Excavation and Repairs of Streets and Sidewalks
MCC Chapter 12.04	Street and Highway Excavation

"Public highways" is defined by Chapter 264, HRS, to mean "all roads, alleys, streets, ways, lanes, trails, bikeways, and bridges in the State, opened, laid out, or built by the government" (§264-1). Chapter 264, HRS, further states that "specifications, standards and procedures to be followed in the installation and construction of connections for streets, roads and driveways, concrete curbs and sidewalks, structures, drainage systems, landscaping or grading within the highway rights-of-way, excavation and backfilling of trenches or other openings in state highways, and *in the restoration, replacement, or repair of the base course, pavement surfaces, highway structures, and other highway improvements* [emphasis added] shall be prescribed by the director of transportation" (§264-8).

Chapter 27-31, HRS, states that the governor may enter into contracts with the counties for their services in the repair and maintenance of state highways, which may include roadway maintenance, structures maintenance, street lights, street sweeping, landscaping, and cantoneering.

Chapter 22, HCC, administered by the County of Hawaii Department of Public Works, states that standard specifications outlining procedures to be followed in the restoration or replacement of the public highway, street, alley, sidewalk, or any other public place shall be prescribed by the County Engineer (§22-46). Similarly, Chapter 18, KCC, Chapter 12.04, MCC, and Chapter 14-17, ROH, all administered by the local departments of public works, address controls on excavations and repairs to public highways, streets, alleys, sidewalks and other public places.

The Road Maintenance Divisions within the county departments of public works are responsible for street sweeping, storm drain cleaning, and stream maintenance. DOT's District Maintenance Sections maintain the roadway rights-of-way.

Chapter 286, HRS, administered by DOT, addresses highway safety. It mandates that Hawaii annually adopt federal hazardous material regulations adopted by the U.S. Department of Transportation and that all transportation operators immediately report incidents of releases of hazardous materials.

Chapter 291C, HRS, enforced by the county police departments, requires that vehicle loads be covered to prevent contents from spilling or blowing onto the highways. Sand may be dropped for purposes of securing traction and water or other substances may be sprinkled on a highway for purposes of cleaning and maintenance. (§291C-131) This statute also prohibits littering from vehicles (§291C-132). Chapter 291C, HRS, establishes penalties both for spilling loads on highways and littering from vehicles.

Hazardous waste products, such as lead-based paints, generated from the cleaning or maintenance of roads, highways, and bridges must be properly disposed, according to Chapter 342J, HRS, and Chapters 260-280, HAR.

VII.E.5. Additional Recommended Implementing Actions

To strengthen the overall effectiveness of this management measure, the following measure should be implemented:

A. Explore Alternatives to Roadside Spraying

- DOT and the counties should explore alternatives to the use of pesticides for weed control along roadsides and in drainage systems. A pilot project has been undertaken in North Kohala on the Big Island.

F. Management Measure for Road, Highway, and Bridge Runoff Systems

Develop and implement runoff management systems for existing roads, highways, and bridges to reduce runoff pollutant concentrations and volumes entering surface waters.

(1) Identify priority and watershed pollutant reduction opportunities (e.g., improvements to existing urban runoff control structures); and
(2) Establish schedules for implementing appropriate controls.

VII.F.1. Description

This measure requires that operation and maintenance systems include the development of retrofit projects, where needed, to collect nonpoint source pollutant loadings from existing, reconstructed, and rehabilitated roads, highways, and bridges. Poorly designed or maintained roads and bridges can generate significant erosion and pollution loads containing heavy metals, hydrocarbons, sediment, and debris that run off into and threaten the quality of surface waters and their tributaries. In areas where such adverse impacts to surface waters can

be attributed to adjacent roads or bridges, retrofit management projects to protect these waters may be needed (*e.g.*, installation of structural or nonstructural pollution controls).

VII.F.2. Applicability

This management measure applies to existing, resurfaced, restored, and rehabilitated roads, highways, and bridges that contribute to adverse effects in surface waters.

VII.F.3. Management Practices

a. Locate runoff treatment facilities within existing rights-of-way or in medians and interchange loops.
b. Develop multiple-use treatment facilities on adjacent lands (*e.g.*, parks and golf courses).
c. Acquire additional land for locating treatment facilities.
d. Use underground storage where no alternative is available.
e. Maximize the length and width of vegetated filter strips to slow the travel time of sheet flow and increase the infiltration rate of urban runoff.

IV.A.4. Implementation of Management Measure

(i) Organizational Structure: DOT is the lead agency for implementation of this management measure because it has responsibilities and standards related to stormwater runoff from highways and bridges, as prescribed in its NPDES stormwater permit.

(ii) Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-55	Water Pollution Controls

DOT is responsible for managing stormwater runoff from highways and bridges, as prescribed by its NPDES stormwater permit issued by DOH. The permit prescribes what can be discharged from roadways under DOT jurisdiction into receiving waters, limitations on receiving waters, and provisions on management and BMP implementation, modifications, and reporting.

Water quality is generally addressed under the State's water pollution control statutes. See page III-116 for a brief discussion of Chapters 342D and 342E, HRS.

VII.F.5. Additional Recommended Implementing Actions

To strengthen the overall effectiveness of this management measure, the following measure should be implemented:

A. Identify and Implement Retrofit Projects, as Needed, to Address Polluted Runoff from Existing Roads, Highways, and Bridges

- DOT should identify priority and watershed pollutant reduction opportunities and establish schedules for implementing appropriate controls.

Improvements to existing urban runoff control structures on roads, highways, and bridges adjacent to surface waterbodies will reduce polluted runoff into these waterbodies.

CHAPTER 5: Marinas and Recreational Boating

I. INTRODUCTION

The management measures for marinas are applicable to the facilities and their associated shore-based services that support recreational boats and boats for hire. The following operations/ facilities are covered by these management measures:

- Any facility that contains 10 or more slips, piers where 10 or more boats may tie up, or any facility where a boat for hire is docked;
- Boat maintenance or repair yards that are adjacent to the water;
- Any federal, State, or local facility that involves recreational boat maintenance or repair that is on or adjacent to the water;
- Public or commercial boat ramps;
- Any residential or planned community marina with 10 or more slips; and
- Any mooring field where 10 or more boats are moored.

I.1. Marinas and Recreational Boating in Hawaii

Currently, ocean recreation in Hawaii (boating, fishing, and other activities) constitutes a roughly $600 million a year industry which is growing at a rate of between 5% and 6% annually (MacDonald *et al.* 1995). In general, commercial activities associated with marinas and recreational boating are focused on tourism-related activities rather than commercial fishing. In addition, noncommercial recreation is also growing with local residents spending increasingly more time engaging in coastal water recreational activities, including swimming, boating, fishing, snorkeling, SCUBA diving, and surfing.

Hawaii is unique among coastal states in that it is entirely made up of islands. This geography, combined with natural siting constraints, imposes certain physical limitations on marina development. Very few natural, protected, and accessible bays exist which are conducive to marina development. As a result, in order to create small boat harbors, basins are blasted and dredged from fast lands. Hawaii does not have the numerous large-scale boat harbors common in other coastal states. By contrast, facilities tend to be smaller in size and more widely scattered. Moreover, Hawaii has one highly urbanized island, Oahu, and the five relatively non-urbanized islands of Maui, Kauai, Hawaii, Molokai, and Lanai.

Recent data show that there are 14,857 vessels registered with the Department of Land and Natural Resources--Division of Boating and Ocean Recreation (DLNR-DOBOR) and another 1,600 documented with the U.S. Coast Guard (USCG) (Lal and Clark, 1991). Of these, 70% are registered on Oahu. There are currently 68 public and private small boat facilities statewide. Of these, 27 are boat launching ramps only, and 35 are small-boat harbors and marinas providing a variety of services and functions. The remaining 6 facilities are piers and anchorages. 20 of these marinas are State facilities. Oahu is the only island in Hawaii with private facilities, of which there are 8, and military marina facilities, of which

there are 4. Several private facilities have recently been proposed for the islands of Hawaii, Kauai, and Lanai.

Berthing and mooring capacity for all State, military, and private facilities around the State is approximately 3,600 spaces. About 2,500 (or 75%) of these are located on Oahu. The present demand for recreational boating storage space, moorage space, and boater access exceeds the supply. The demand for additional slip space at State marina facilities, for example, exceeds the existing supply by 100% (Lal and Clark, 1991). All State harbors have a waiting list. For State and private facilities, waiting times for slips and moorages may range from 3 to 15 years. For military facilities, waiting times may be considerably less. Over 80% of all boats in the State are trailerable. As a result, boat cleaning, fueling, and maintenance commonly take place in residential neighborhoods.

Both the State and the private sector have pending proposals for new and expanded marina facilities. It is expected that increasing demand will continue to drive proposals for numerous additional private marina and other shoreline boating facility developments throughout the State. Private facilities currently proposed for Oahu are Ewa Marina (1400 proposed slips) and an expansion of Hawaii Kai Marina. At Ko'Olina on Oahu, the marina basin has been constructed and proposals for development of an approximately 400 private slip marina facility are being sought. The State Kawaihae small boat harbor has begun construction of an expanded breakwater and will provide 90 additional slips. Other proposed facilities and expansions include Haleolono on West Molokai, and Kukuiula Resort on Kauai. Proposed expansions at State facilities include those at Keehi Harbor, Oahu; Honokohau Harbor, Hawaii; Maalaea Harbor, Maui; and Manele Harbor, Lanai.

Over the last decade, interest in developing marinas and water-based features in association with residential and resort developments has steadily increased. These private projects and additional State facilities offer opportunities to capture economic benefits that could accrue to the State. The State currently lacks an effective plan to meet this growing demand, especially in terms of anticipating and meeting long range environmental management needs. Responsibility for regulating and managing coastal developments, marina operations, and boating activities is fragmented among federal, State and county agencies, with no clearly designated lead agency or coherent policy established to coordinate marinas and boating activities. Counties also currently lack specific regulations or guidelines to assist them in evaluating marina design and development, and rely primarily on federal and State permit coverage and a coordinated statewide permit review process.

The State faces constraints in the day-to-day management and improvement of its own facilities because of insufficient fiscal and human resources. Most existing State marinas were built in the 1970s and, as they age, are increasingly unequipped to accommodate the growing volume and variety of public recreational needs. As such, many State facilities may need upgraded sanitation, waste disposal, cleaning, fueling, and/or repair facilities.

A further constraint is enforcement. Enforcement of Chapters 13-230 to 13-256, Hawaii Administrative Rules (HAR), pertaining to Small Boat Harbors, Boating and Ocean Waters, Navigable Streams, and Beaches, falls under the jurisdiction of DLNR. Because vessel operations are a shared jurisdiction in Hawaii, the USCG and other federal agencies may assist with enforcement activities. In light of the elimination of the majority of Hawaii's Marine Patrol agency, the roles and responsibilities of all enforcement agencies are being reevaluated.

Despite these constraints, some important steps towards improving the planning and management of small boat harbors have occurred. First, the Hawaii CZM Program has engaged in activities promoting long range planning for marina development. Marinas, harbors, and boating are important elements encompassed within the CZM Program's objectives and policies, as outlined in the 1990 *Hawaii Coastal Zone Management Program* summary document. A number of the State's CZM policies and objectives promote long-range planning for public and private coastal facilities and improvements, including their appropriate siting, design, and construction. CZM policies and objectives call also for improved coordination and funding of coastal recreation planning and management, including the protection of coastal water quality and ecosystems.

In 1991, the Hawaii *Ocean Resources Management Plan* (ORMP), developed by the legislatively-established Hawaii Ocean and Marine Resources Council, recommended objectives, policies, and implementing actions relating to recreational harbor development. These include the protection of marine water quality, development of boater and tourist education programs, development of a coordinated planning framework for small boat harbor development, development of a clear overall State policy on marina development, and control of shoreline erosion, among other things. The plan has been formally adopted by the State legislature and implementation by the various State agencies involved in the planning and management of marinas and boating activities is being coordinated by the CZM Program under Act 104 of the 1995 Legislature that amended Chapter 205A, HRS.

Also in 1991, the Department of Business, Economic Development, and Tourism (DBEDT), Ocean Resources Branch; the Department of Transportation (DOT), Harbors Division; and the University of Hawaii Sea Grant Extension Service co-sponsored a Hawaii Marina Seminar, a forum for discussing issues of marina development in Hawaii. This seminar convened local, State, and national governmental and non-governmental interests to address issues of marina planning, design, development, and operation.

More recently, the Office of State Planning (OSP) launched a statewide initiative to develop planning and development guidelines for new and expanding marina facilities, as a result of widespread demand for additional boating facilities. The *Draft State Planning and Evaluation Guidelines for Private Sector Marina Development* (OSP 1993) sets forth a framework for guiding development of new private marinas. More specifically, it recommends siting, construction, and operations criteria that should be incorporated into marina development plans submitted to State and county agencies during permitting processes. It also

recommends that the State undertake an affirmative management posture in accordance with the "public trust doctrine" to secure appropriate public benefits for the use of public trust lands and resources for marina purposes. The CZM Program was selected to take the lead for the State in determining and negotiating "public benefits packages" which outline benefits that could be considered as compensation to the public for use of public trust resources. The public benefits packages may vary depending on the type of marina proposed, its location, impacts, and degree of public use, and the benefit to and/or burden on the community as a whole.

I.2. Types of Polluted Runoff Associated with Marinas and Recreational Boating

Because marinas are located right at the water's edge, there is often no buffering of the release of pollutants to waterways. Adverse environmental impacts may result from the following sources of pollution associated with marinas and recreational boating:

- poorly flushed waterways where dissolved oxygen deficiencies exist;
- pollutants discharged from boats;
- pollutants transported in stormwater runoff from parking lots, roofs, and other impervious surfaces;
- the physical alteration or destruction of wetlands and of shellfish and other bottom communities during the construction of marinas, ramps, and related facilities; and
- pollutants generated from boat maintenance activities on land and in the water.

A brief summary of some of the impacts that can be associated with marinas and boating activities is presented below.

Toxicity in Marina Water Column, Aquatic Organisms, and Sediments: Pollutants from marinas can result in toxicity in the water column, both lethal and sublethal, related to decreased levels of dissolved oxygen and elevated levels of metals and petroleum hydrocarbons. These pollutants may enter the water through discharges from boats or other sources, spills, or stormwater runoff. Accumulation of organic material (from sewage discharges) in sediment will result in a sediment oxygen demand that can negatively impact the dissolved oxygen in the water column, which in turn can result in fish kills. Metal and metal-containing compounds have many functions in boat operation, maintenance, and repair, but are generally toxic to aquatic and benthic organisms. Elevated concentrations of petroleum products in marinas can be attributed to refueling activities and bilge or fuel discharges from nearby boats and are often toxic to marine organisms.

Boats can also be a significant source of fecal coliform bacteria in areas with high boat densities and low hydrologic flushing.

Disruption of Sediment and Habitat: Boat operation and marina dredging can destroy habitat; resuspend bottom sediment (resulting in the reintroduction of

toxic substances into the water column); and increase turbidity, which affects the photosynthetic activity of algae and estuarine vegetation.

Shoaling and Shoreline Erosion: Shoaling and shoreline erosion result from the physical transport of sediment due to waves and/or currents. These waves and currents may be natural (wind-induced, rainfall runoff, etc.) or human-induced (alterations in current regimes, boat wakes, etc.). Factors influencing vessel-generated shoreline erosion include the distance of the boat from shore, boat speed, side slopes, sediment type, and depth of the waterway.

II. SITING AND DESIGN

Siting and design are among the most significant factors affecting a marina's potential for water quality impacts. The location of a marina -- whether it is open (located directly on a river, bay, or barrier island) or semi-enclosed (located in an embayment or other protected area) -- affects its circulation and flushing characteristics. Circulation and flushing can also be influenced by the basin configuration, orientation to prevailing winds, as well as groundwater flowing into the marina basin on the inland side. Circulation and flushing play important roles in the distribution and dilution of potential contaminants. The final design is usually a compromise that will provide the most desirable combination of marina capacity, services, and access, while minimizing environmental impacts, dredging requirements, protective structures, and other site development costs. The objective of the marina siting and design management measures is to ensure that marinas and ancillary structures do not cause direct or indirect adverse water quality impacts or endanger fish, shellfish, and wildlife habitat both during and following marina construction.

A. Marina Flushing Management Measure

Site and design marinas such that tides and/or currents will aid in flushing of the site or renew its water regularly.

II.A.1. Description

The term *flushing* or *residence time* is often misused in that a single number (*e.g.*, 10 days) is sometimes given to describe the flushing time of an estuary or harbor. In actuality, the flushing time ranges from zero days at the boundary to possibly several weeks, depending on location within the marina waterbody.

Maintaining water quality within a marina basin depends primarily on flushing as determined by water circulation within the basin. If a marina is not properly flushed, pollutants will concentrate to unacceptable levels in the water and/or sediments, resulting in impacts to biological resources. In tidal waters, flushing is primarily due to tidal advective mixing and is controlled by the movement of the tidal prism into and out of the marina waterbody.

The degree of flushing necessary to maintain water quality in a marina should be balanced with safety, vessel protection, and sedimentation. Wave energy should be dissipated adequately to ensure boater safety and the protection of vessels. The protected nature of marina basins can result in high sedimentation rates in waters containing high concentrations of suspended solids.

II.A.2. Applicability

This management measure applies to the siting and design of new and expanding marinas.

II.A.3. Management Practices

a. Site and design new marinas such that the bottom of the marina and the entrance channel are not deeper than adjacent navigable waters unless it can be demonstrated that the bottom will support a natural population of benthic organisms.
b. Design new marinas with as few segments as possible to promote circulation within the basin.
c. Design and locate entrance channels to promote flushing.
d. Do not allow structures which alter prevailing currents.
e. Designate areas that are and are not suitable for marina development.

II.A.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR is the lead agency for implementing this management measure. The State's Conservation District Use Application (CDUA) permit process, administered by DLNR, is triggered by any proposed marina construction project because submerged lands are included within the State Conservation District. Other federal, State, and local agencies involved in implementation include:

- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies, and recommends public benefits packages for private marina developments;
- DOH, which reviews permits for certification pursuant to Section 401 of the Clean Water Act (CWA);
- U.S. Army Corps of Engineers (USACOE), which administers the Section 404, CWA, and Section 10, Rivers and Harbors Act, permit processes; and
- Counties, which administer the SMA permits and shoreline setback provisions.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 190	Marine Life Conservation Program

HRS	Chapter 200	Ocean Recreation and Coastal Areas
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards

This marina management measure is addressed, to a great extent, within a number of federal, State and county permit review processes. All new marina facilities require a CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR (Conservation Districts), administered by DLNR. Although flushing and circulation concerns are typically addressed within the CDUA permit review process as part of the overall concern for coastal ecosystem protection, coastal hazards, recreation, and safety for both State and private marina developments, there are currently no uniform standards or criteria pertaining to marina flushing and circulation. The Section 404, CWA, permit process also entails the review of design and construction factors to ensure that marina development does not degrade coastal water quality vis-a-vis the State's water quality standards. DOH monitors physical water quality measurements on an ongoing basis, which can be used to determine the adequacy of marina flushing and circulation.

In the siting and design of State-owned marinas, DLNR-DOBOR has informally adopted, as guidelines, national standards established by the International Marina Institute, USACOE, and the States Organization for Boating Access. OSP's *Draft Planning and Evaluation Guidelines for Private Sector Marina Development* (OSP 1993) also are used informally by agencies during their reviews of marina development permit applications.

B. Water Quality Assessment Management Measure

Assess water quality as part of marina siting and design.

II.B.1. Description

Assessments of water quality may be used to determine whether a proposed marina design will result in poor water quality. This may entail predevelopment and/or postdevelopment monitoring of the marina or ambient waters, numerical or physical modeling of flushing and water quality characteristics, or both. Historically, water quality assessments have focused on two parameters: dissolved oxygen (DO) and pathogen indicators. The impacts of low DO concentrations are reflected in an unbalanced ecosystem, fish mortality, and odor and other aesthetic nuisances. DO levels may be used as an indicator of the general health of the aquatic ecosystem. Coastal states use pathogen indicators, such as fecal coliform bacteria (*Escherichia coli*) and enterococci, for assessing

risk to public health through ingestion of contaminated water or shellfish and through bathing.

II.B.2. Applicability

This management measure applies to the siting and design of new and expanding marinas.

II.B.3. Management Practices

a. Perform pre-construction inspection, water quality monitoring, and assessment.
b. Use water quality monitoring data and modeling to predict post-construction water quality conditions.
c. Reconcile predictions with post-construction monitoring data.

II.B.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DOH is the lead agency for implementing this management measure. Water quality assessments for new marina developments are required under the Section 401, CWA, Water Quality Certification process, administered by DOH and required in conjunction with the USACOE Section 404, CWA, permits. Other federal, State, and local agencies involved in implementation include:

- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies, and recommends public benefits packages for private marina developments;
- DLNR, which administers the CDUA permit process;
- USACOE, which administers the Section 404, CWA, and Section 10, Rivers and Harbors Act, permit processes; and
- Counties, which administer the SMA permits and shoreline setback provisions.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards

This marina management measure is addressed, to a great extent, through the Clean Water Act Section 401 and 404 certification and permit processes, normally required in association with the State's CDUA permit process. In addition, county SMA permits can require water quality and marine life monitoring programs for groundwater, marina basin water, and adjacent coastal waters as a permit condition. Water quality assessments may entail pre-development and/or post-development monitoring of the marina or ambient waters, numerical or physical modeling of flushing and water quality characteristics, or both.

All State marine waters are classified as either Class A or Class AA. Section 11-54-03, HAR, states that "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 action" [§11-54-03(c)(1)]. The objective of class A waters is 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" [§11-54-03(c)(2)]. Most of the State's marine waters are designated the more protective Class AA. Development of a marina in Class AA waters would be prohibited, unless a variance from Section 11-54, HAR, was obtained from DOH.

An NPDES permit under Chapter 342D, HRS, and associated dewatering permit are also required for any drainage pit used when blasting for new marina construction from fast lands. This permit is administered by DOH.

C. Habitat Assessment Management Measure

Site and design marinas to protect against adverse effects on coral reefs, shellfish resources, wetlands, submerged aquatic vegetation, or other important riparian and aquatic habitat areas as designated by local, State, or federal governments.

II.C.1. Description

Biological siting and design provisions for marinas should be based on the premise that marinas should not destroy important aquatic habitat, should not diminish the harvestability of organisms in adjacent habitats, and should accommodate the same biological uses (*e.g.*, reproduction, migration) for which the source waters have been classified.

Important classes of shallow water habitats found on the U.S. mainland (such as sea-grass beds and shellfish beds) are not present in Hawaii. However, algae, or *limu*, can be considered a submerged aquatic vegetation and is still an important food resource for the inhabitants of Hawaii. In addition, there are dozens of different types of shellfish in the coastal waters of Hawaii, and they are sought after as food resources by many Hawaiians and non-Hawaiians. These shellfish

resources include *opae'ula* residing in coastal anchialine ponds, *opihi* or limpets, *wana* (sea urchins) of many types, *hee*, and *pipipi.* Other areas of concern in Hawaii include coral reefs, areas where threatened green sea turtles and other important species forage, shallow-water recruitment areas, and other nearshore ecosystems and resources of special cultural, geophysical, or other significance.

Hawaii's nearshore and shallow water habitats have not been comprehensively inventoried or assessed. The full extent to which marinas and recreational boating activities have an impact on various shallow-water resources and habitats in Hawaii is likewise unknown. As nearshore habitats are assessed, the State's geographic information system (GIS) shows promise as a method to convey important habitat and other siting information to marina developers and environmental managers. The GIS system is limited, however, in its ability to correlate boat operations with habitat impacts.
This management measure makes minor amendments to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

***Justification for Changes to Management Measure**: Because of the importance of coral reefs as a nearshore habitat in Hawaii, the management measure has been expanded to include coral reefs.*

II.C.2. Applicability

This management measure applies to the siting and design of new and expanding marinas where site changes may have an impact on important marine species, coral reefs, wetlands, or other important habitats. The habitats of non-indigenous nuisance species are not considered important habitats.

II.C.3. Management Practices

a. Conduct surveys and characterize the project site.
b. Redevelop coastal waterfront sites that have been previously disturbed; expand existing marinas or consider alternative sites to minimize potential environmental impacts.
c. Employ rapid bioassessment techniques to assess impacts to biological resources.
d. Assess historic habitat function (*e.g.*, spawning area, nursery area, migration pathway) to minimize indirect impacts.
e. Minimize disturbance to indigenous vegetation in the riparian area.
f. Encourage the redevelopment or expansion of existing marina facilities that have minimal environmental impacts instead of new marina development in habitat areas that local, State, or federal agencies have designated as important.
g. Develop a marina siting policy to discourage development in areas containing important habitat as designated by local, State or federal agencies.

II.C.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the

changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR is the lead agency for implementing this management measure. The State's CDUA permit process, administered by DLNR, is triggered by any proposed marina construction project because submerged lands are included within the State Conservation District. Other federal, State, and local agencies involved in implementation include:

- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies, and recommends public benefits packages for private marina developments;
- U.S. Fish and Wildlife Service (USFWS), which is consulted on any federal action, including permit decisions, with respect to Section 7 of the Endangered Species Act;
- U.S. National Marine Fisheries Service (NMFS), which is consulted on the affects of a proposed development on marine mammals such as whales, seals, and turtles; and
- Counties, which administer the SMA permits and shoreline setback provisions.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 187A	Aquatic Resources
HRS	Chapter 190	Marine Life Conservation Program
HRS	Chapter 195	Natural Area Reserves System
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 13-28 - 13-38	Marine Life Conservation Districts
HAR	Chapter 13-256	Ocean Recreation Management Areas

Typically, prospective marina developments must undergo numerous permit processes, with their associated environmental assessments and extensive public review. Marina developments automatically trigger a CDUA because they involve submerged lands; marina developments that affect coastal lands within the counties' SMAs must seek an SMA permit. Chapter 343, HRS, and Chapter 11-200, HAR, both about the Environmental Impact Statement law, require the preparation of an environmental assessment (EA) and/or environmental impact statement (EIS) for proposed activities that trigger the environmental review process. The trigger conditions are as follows: (1) use of State or county lands or funds; (2) use within the conservation district; (3) use within a shoreline setback

area; (4) use within the Waikiki special district; (5) use within an historic site; (6) reclassification of conservation lands; (7) amendment to a county general plan; and (8) construction of helicopter facilities. Preliminary surveys and assessment of future biological impacts are required.

The State has mechanisms in place to protect specific areas containing nearshore habitats of important resource values. Chapter 190, HRS, enables DLNR to establish Marine Life Conservation Districts (MLCDs) to protect unique areas of the marine environment by prohibiting activities that disturb, degrade, or alter it. Thus far, eleven MLCDs have been designated, with associated administrative rules (Chapters 13-28 through 13-38, HAR) for managing these areas, including restrictions on boating activities. Chapter 195, HRS authorizes DLNR to establish Natural Area Reserves (NARs) to protect and preserve unique natural assets of the State, including distinctive marine plants and animals. Only one NAR includes a marine component (Ahihi-Kinau on Maui). Some Ocean Recreation Management Areas (ORMAs) established under Chapter 13-256, HAR, are designated to prohibit operation of certain types of watercraft during the winter season when humpback whales are present. Other areas are closed for protection of sea turtle habitats. ORMAs are managed by DLNR-DOBOR.

All State marine bottom ecosystems are classified as either Class I or Class II. HAR Section 11-54-03 states that "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..." [§11-54-03(d)(1)]. The objective of class II marine bottom ecosystems is that "their use for protection including propagation of fish, shellfish, and wildlife, and for recreational purposes not be limited in any way." Any actions that may permanently or completely modify, alter or degrade the marine bottom, including navigational structures such as harbors and ramps, may be allowed in class II bottoms provided approval is secured from the Department of Health [§11-54-03(d)(2)]. The areas of class I and II bottoms are listed by marine bottom type in Section 11-54-07, HAR.

D. Shoreline Stabilization Management Measure

Where shoreline erosion is a serious nonpoint source pollution problem, shorelines [~~should~~] may need to be stabilized. Vegetative methods are strongly preferred. Structural methods may be necessary where vegetative methods cannot work and where they do not interfere with natural beach processes or harm other sensitive ecological areas. [~~unless structural methods are more cost effective, considering the severity of wave and wind erosion, offshore bathymetry, and the potential adverse impact on other shorelines and offshore areas.~~]

II.D.1. Description

The establishment of vegetation as a primary means of shore protection has shown the greatest success in low-wave-energy areas where underlying soil types provide the stability required for plants and where conditions are amenable to sustaining plant growth. Under suitable conditions, an important advantage of vegetation is its relatively low initial cost. The effectiveness of vegetation for shore stabilization varies with the amount of wave reduction provided by the physiography and offshore bathymetry of the site or with the degree of wave attenuation provided by structural devices. Identification of the cause of the erosion problem is essential for selecting the appropriate technique to remedy the problem.

Structural methods to stabilize shorelines and navigation channels are designed to dissipate incoming wave energy. With Hawaii's exposure to strong wave surge, especially on the north and east shores, marinas are usually provided more protective benefits from structural rather than vegetative measures. However, while such structures can provide shoreline protection, unintended consequences may include accelerated scouring in front of the structure, as well as increased erosion of unprotected downstream shorelines.

This management measure is an alternative management measure to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters:

> *Justification for Alternative Management Measure: Hawaii's environment has suffered as a result of the proliferation of hardening projects. Structural methods have resulted in channelized streams and hardened shorelines which have degraded environmental quality and increased nonpoint source pollution problems. This alternative measure will improve the protection of water quality and sensitive ecosystems.*

II.D.2. Applicability

This management measure applies to siting and design of new and expanding marinas where site changes may result in shoreline erosion.

II.D.3. Management Practices

Vegetative and structural management practices appropriate to Hawaii will be developed at a later time.

II.D.4. Implementation of Management Measure

The CZM Program has been discouraging the hardening of natural shorelines in Hawaii because of its negative effects on adjacent and down -current areas. Recent proposals for marina developments in Hawaii are somewhat different from those developments on the U.S. mainland in that they would require blasting and dredging of fast lands for the marina basin. This normally requires hardening or capping of the basin walls. These stabilization activities are described within the EISs required for CDUA and SMA permits.

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: Because erosion can affect lands under both State and county jurisdictions, implementation of this management measure is shared between DLNR and the counties. The State's CDUA permit process, administered by DLNR, is triggered by any proposed marina construction project because submerged lands are included within the State Conservation District. The counties administer the SMA permits and shoreline setback provisions. Other agencies involved in implementation include:

- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies, and recommends public benefits packages for private marina developments.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts

Typically, prospective marina developments must undergo numerous permit processes, with their associated environmental assessments and extensive public review. Marina developments automatically trigger a CDUA because they involve submerged lands; marina developments that affect coastal lands within the counties' SMAs must seek an SMA permit. Chapter 343, HRS, and Chapter 11-200, HAR, both about the EIS law, require the preparation of an EA and/or EIS for proposed activities that trigger the environmental review process. The trigger conditions are as follows: (1) use of State or county lands or funds; (2) use within the conservation district; (3) use within a shoreline setback area; (4) use within the Waikiki special district; (5) use within an historic site; (6) reclassification of conservation lands; (7) amendment to a county general plan; and (8) construction of helicopter facilities.

E. Storm Water Runoff Management Measure

Implement effective runoff control strategies which include the use of pollution prevention activities and the proper design of hull maintenance areas.

Reduce the average annual loadings of total suspended solids (TSS) in runoff from hull maintenance areas by 80%. For the purposes of this measure, an 80% reduction of TSS is to be determined on an average annual basis.

II.E.1. Description

The principal pollutants in runoff from marina parking areas and hull maintenance areas are suspended solids and organics (predominately oil and grease). Toxic metals from boat hull scraping and sanding are part of, or tend to become associated with, the suspended solids. Practices for the control of these pollutants can be grouped into three types: (1) filtration/ infiltration, (2) retention/detention, and (3) physical separation of pollutants. The proper design and operation of the marina hull maintenance area is a significant way to prevent the entry of toxic pollutants from marina property into surface waters. Marina operators and patrons also can visit the Keehi Marine Education Center and learn and be exposed to the most recent technology for marina pollution prevention measures.

The annual TSS loadings can be calculated by adding together the TSS loadings that can be expected to be generated during an average 1-year period from precipitation events less than or equal to the 2-year/24-hour storm. The 80% standard can be achieved, by reducing over the course of the year, 80% of these loadings. EPA recognizes that 80% cannot be achieved for each storm event and understands that TSS removal efficiency will fluctuate above and below 80% for individual storms.

II.E.2. Applicability

This management measure applies to new and expanding marinas, and to existing marinas for *at least* the hull maintenance areas. (Hull maintenance areas are areas whose primary function is to provide a place for boats during the scraping, sanding, and painting of their bottoms.) If boat bottom scraping, sanding, and/or painting is done in areas other than those designated as hull maintenance areas, the management measure applies to those areas as well.

This measure does not apply to runoff that enters the marina property from upland sources. Upland sources are addressed by the management measures for agriculture, forestry, urban areas, hydromodifications, and wetland and riparian areas.

***NOTE**: This management measure does not apply to existing, new, or expanding facilities that have a NPDES permit for their stormwater discharges.*

II.E.3. Management Practices

a. Design boat hull maintenance areas to minimize contaminated runoff.
b. Implement source control practices (*e.g.*, vacuums, sanders with vacuum attachments).
c. Sand Filter (also known as filtration basins)
d. Infiltration Basin/Trench
e. Chemical and Filtration Treatment Systems
f. Vegetated Filter Strip
g. Grassed Swale
h. Porous Pavement
i. Oil-Grit Separators
j. Holding Tanks
k. Swirl Concentrator
l. Catch Basins or Catch Basin with Sand Filter
m. Adsorbents in Drain Inlets

II.E.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DOH, Environmental Management Division, is generally responsible for implementing this management measure because it administers the State's water pollution control program. However, there are no direct mechanisms in place to implement this management measure. Other agencies involved in implementation include:

- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies, and recommends public benefits packages for private marina developments;
- DLNR, which administers the CDUA permit process; and
- Counties, which administer the SMA permits and shoreline setback provisions.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts

This management measure is generally addressed under the State's water pollution control statutes. While Chapter 342E, HRS, addresses polluted runoff control, administrative rules have not yet been developed to implement it. These rules will be developed in conjunction with the further development and implementation of the coastal nonpoint pollution control program. Chapter 11-54, HAR - the administrative rules that implement much of 342D, HRS - has no procedures in place to enforce the water quality standards it sets forth.

Typically, prospective marina developments must undergo numerous permit processes, with their associated environmental assessments and extensive public review. Marina developments automatically trigger a CDUA because they involve submerged lands; marina developments that affect coastal lands within the counties' SMAs must seek an SMA permit. Chapter 343, HRS, and Chapter 11-200, HAR, both about the EIS law, require the preparation of an EA and/or EIS for proposed activities that trigger the environmental review process. The trigger conditions are as follows: (1) use of State or county lands or funds; (2) use within the conservation district; (3) use within a shoreline setback area; (4) use within the Waikiki special district; (5) use within an historic site; (6) reclassification of conservation lands; (7) amendment to a county general plan; and (8) construction of helicopter facilities.

Not all marinas in Hawaii have hull maintenance areas, and most existing State facilities lack sufficiently graded, paved, and/or covered areas necessary to implement the management measure. Further the State lacks sufficient funds to retrofit its existing maintenance and cleaning areas. Therefore, DLNR-DOBOR has announced its intent to phase out its existing self-service maintenance facilities, so that hull maintenance and cleaning activities will be transferred to several better-equipped existing private facilities. Most of these private facilities, such as Ala Wai Marine and Gentry Marine, have NPDES permits for their hull maintenance areas.

F. Fueling Station Design Management Measure

Design fueling stations to allow for ease in cleanup of spills.

II.F.1. Description

Spillage is a source of petroleum hydrocarbons in marinas. Most petroleum-based fuels are lighter than water and thus float on the water's surface. This property allows for their capture if petroleum containment equipment is used in a timely manner.

II.F.2. Applicability

This management measure applies to new and expanding marinas where fueling stations are to be added or moved.

II.F.3. Management Practices

The location and design of fueling stations should allow for booms to be deployed to surround a spill.

a. Locate and design fueling stations so that spills can be contained in a limited area.
b. Design a spill contingency plan.
c. Design fueling stations with containment equipment.
d. Design fueling stations for spill mitigation.

II.F.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DOH, Environmental Management Division, has the lead in implementing this management measure because it administers the State's water pollution control programs. Other agencies involved in implementation include:

- DLNR, which administers the CDUA permit process;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies, and recommends public benefits package for private marina developments;
- USCG, which is responsible for toxic spill response and clean-up;
- USACOE, which administers the Section 404, CWA, and Section 10, Rivers and Harbors Act, permit processes;
- NMFS, which reviews for impacts on marine mammals and fisheries;
- USFWS, which reviews for impacts on turtles and seabirds; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 12-75	Marine Service Stations
HAR	Chapter 13-2	Conservation Districts

Typically, prospective public and private marina developments must undergo numerous permit processes, with their associated environmental assessments and extensive agency and public review. Please refer to page III-178 for a brief description of these processes.

Any construction in coastal, tidal waters requires a permit from the USACOE under Section 10, Rivers and Harbors Act. Any discharge of dredge or fill material into coastal and stream waters, among other things, requires a permit from the USACOE under Section 404, CWA. Permit applicants are required to obtain Section 401, CWA, water quality certifications and Hawaii CZM federal consistency determinations prior to being issued a permit by the USACOE.

Although uniform guidelines and criteria for the design and operation of fueling facilities are currently lacking, marina projects typically must address safety issues during the CDUA process, as part of the overall concerns for coastal ecosystem protection, coastal hazards, and recreation, among others. The Section 404, CWA, permit process does entail the review of design and construction factors to ensure that marina development does not degrade coastal water quality vis-a-vis the State's water quality standards.

In the siting and design of State-owned marinas, DLNR-DOBOR has informally adopted, as guidelines, national standards established by the International Marinas Institute, the U.S. Army Corps of Engineers, and the States Organization for Boating Access. OSP's *Draft Planning and Evaluation Guidelines for Private Sector Marina Development* (OSP 1993) also are used informally by agencies during their reviews of marina development permit applications.

G. Sewage Facility Management Measure

Install pumpout, dump station, and restroom facilities where needed at new and expanding marinas to reduce the release of sewage into surface waters. Design these facilities to allow ease of access and post signage to promote use by the boating public.

II.G.1. Description

Vessels are not required to be equipped with a Marine Sanitation Device (MSD). If a boat does have a MSD, however, the MSD has to meet certain standards set by EPA, as required by Section 312, CWA.

EPA Region I determined that, in general, a range of one pumpout facility per 300-600 boats with holding tanks [type III marine sanitation devices (MSDs)] should be sufficient to meet the demand for pumpout services in most harbor areas. EPA Region 4 suggested one facility for every 200 to 250 boats with holding tanks and provided a formula for estimating the number of boats with holding tanks.

Three types of onshore collection systems are available for marina sewage facilities: fixed point systems, portable/mobile systems, and dedicated slipside systems.

Two of the most important factors in successfully preventing sewage discharge are (1) providing "adequate and reasonably available" pumpout facilities and (2) conducting a comprehensive boater education program.

II.G.2. Applicability

This management measure applies to new and expanding marinas in areas where adequate marine sewage collection facilities do not exist. Marinas that do not provide services for vessels that have MSDs do not need to have pumpouts, although dump stations for portable toilets and restrooms should be available. This measure does not address direct discharges from vessels covered under Section 312, CWA.

II.G.3. Management Practices

a. Fixed-point collection systems: these systems include one or more centrally located sewage pumpout stations. A flexible hose is connected to the wastewater fitting in the hull of the boat, and pumps or a vacuum system move the wastewater to an onshore holding tank, a public sewer system, a private treatment facility, or another approved disposal facility. In cases where the boats in the marina use only small, portable (removable) toilets, a satisfactory disposal facility could be a dump station.
b. Portable/mobile collection systems: these systems include a portable unit with a pump and a small storage tank. The unit is connected to the deck fitting on the vessel, and wastewater is pumped from the vessel's holding tank to the pumping unit's storage tank. When the storage tank is full, its contents are discharged into a municipal sewage system or a holding tank for removal by a septic tank pumpout service.
c. Dedicated slipside systems: these systems provide continuous wastewater collection at a slip.
d. Adequate signage, and educational handouts and other materials.

II.G.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DOH, Environmental Management Division, has the lead in implementing this management measure because it administers the State's water pollution control programs. Other agencies involved in implementation include:

- DLNR, which administers the CDUA permit process;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies, and recommends public benefits package for private marina developments;
- USACOE, which administers the Section 404, CWA, and Section 10, Rivers and Harbors Act, permit processes;
- USCG, which is responsible for toxic spill response and clean-up;

- NMFS, which reviews for impacts on marine mammals and fisheries;
- USFWS, which reviews for impacts on turtles and seabirds; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 344	State Environmental Policy
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 13-231	Boat Operation, Boat Harbors, and Permits

Typically, prospective public and private marina developments must undergo numerous permit processes, with their associated environmental assessments and extensive agency and public review. Please refer to page III-178 for a brief description of these processes.

Any construction in coastal, tidal waters requires a permit from the USACOE under Section 10, Rivers and Harbors Act. Any discharge of dredge or fill material into coastal and stream waters, among other things, requires a permit from the USACOE under Section 404, CWA. Permit applicants are required to obtain Section 401, CWA, water quality certifications and Hawaii CZM federal consistency determinations prior to being issued a permit by the USACOE.

Currently, there are no rules specifying that marinas must install sewage pumpout facilities. In addition, uniform guidelines and criteria for the design and operation of sewage facilities are currently lacking. Marina projects typically must address water quality during the CDUA process, as part of the overall concerns for coastal ecosystem protection, coastal hazards, and recreation, a mong others. The CWA Section 404 permit process does entail the review of design and construction factors to ensure that marina development does not degrade coastal water quality vis-a-vis the State's water quality standards.

In the siting and design of State-owned marinas, DLNR-DOBOR has informally adopted, as guidelines, national standards established by the International Marina Institute, the USACOE, and the States Organization for Boating Access. OSP's *Draft Planning and Evaluation Guidelines for Private Sector Marina Development* (OSP 1993) also are used informally by agencies during their reviews of marina development permit applications.

DOBOR has also received a $21,250 grant under the Federal Clean Vessel Act of 1992. The grant will be used for: (1) survey and development of a public education

program of vessel pumpout facilities; (2) design and construction of a pumpout facility at Kailua-Kona Wharf, Hawaii; (3) design and construction of a pumpout facility at Keehi Boat Harbor, Oahu; and (4) design and construction of a pumpout facility at Nawiliwili Boat Harbor, Kauai.

Chapter 13-235, HAR, administered by DLNR, requires marine toilets to be present and operational on vessels mooring or anchoring in waters of the State. Chapter 13-243-2, HAR, requires all vessels in the State with a MSD to comply with federal 33 CFR Part 159, which in turn prescribes regulations governing the design and construction of MSDs and procedures for certifying that MSDs meet the regulations and standards of the EPA promulgated under Section 312 of 33 USC 1322, to eliminate the discharge of untreated sewage from vessels into the waters of the United States, including the territorial seas.

III. MARINA AND BOAT OPERATION AND MAINTENANCE

During the course of normal marina operations, various activities and locations in the marina can generate pollution. Such activities include waste disposal, boat fueling, and boat maintenance and cleaning; such locations include storage areas for materials required for these activities and hull maintenance areas. Of special concern are substances that can be toxic to aquatic biota, pose a threat to human health, and/or degrade water quality. Examples include paint sandings and chippings, oil and grease, fuel, detergents, and sewage.

It is important that marina operators and patrons take steps to control or minimize the entry of these substances into marina waters. For the most part, this can be accomplished with simple preventative measures such as performing these activities on protected sites, locating servicing equipment where the risk of spillage is reduced, providing adequate and well-marked disposal facilities, and educating the boating public about the importance of pollution prevention. The benefit of effective pollution prevention to the marina operator can be measured as the relative low cost of pollution prevention compared to potentially high environmental clean-up costs. Marina operators and patrons also can visit the Keehi Marine Education Center and learn and be exposed to the most recent technology for marina pollution prevention measures.

A. Solid Waste Management Measure

Properly dispose of solid wastes produced by the operation, cleaning, maintenance, and repair of boats to limit entry of solid wastes into surface waters.

III.A.1. Description

The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), the international agreement to which the United States is a signatory, requires adequate waste disposal facilities at harbor facilities. This is

implemented through federal requirements to which the State must comply. The State's small-boat harbors do provide covered waste receptacles. However, there are problems with lack of access to recycling and hazardous waste collection facilities, people illegally using dumpsters, and abandonment of waste oil and batteries around marinas.

Marina operators should be responsible for determining what types of wastes will be generated at the marina and ensuring proper disposal. Marina operators are thus responsible for the contents of their dumpsters and the management of solid waste on their property. Hazardous waste should never be placed in dumpsters. Liquid waste should not be mixed with solid waste but rather disposed of properly by other methods (see Liquid Waste Management Measure).

In addition, since a majority (over 80%) of boats in the State are trailerable, it is likely that some boat cleaning and maintenance is also conducted in residential and other areas outside of the marina. Trailerable boats, however, are not likely to have anti-fouling bottom paint or significant amounts of bottom build-up. Such boats are often rinsed and cleaned at the boat ramp after exiting the water. Residential cleaning and repair, therefore, is not likely to be a problem in and of itself. In addition, since controlling the release of hull scrapings and other wastes to county stormwater collection systems from home repairs and cleaning is likely problematical, improved boat owner education is probably the most effective means of addressing this issue and minimizing such waste.

III.A.2. Applicability

This management measure applies to the operation and maintenance of new and expanding marinas.

III.A.3. Management Practices

a. Perform boat maintenance/cleaning above the waterline in such a way that no debris falls into the water.
b. Provide and clearly mark designated work areas for boat repair and maintenance. Do not permit work outside designated areas.
c. Clean hull maintenance areas regularly to remove trash, sandings, paint chips, etc.
d. Perform abrasive blasting within spray booths or plastic tarp enclosures to prevent residue from being carried into surface waters. If tarps are used, blasting should not be done on windy days.
e. Provide proper disposal facilities to marina patrons. Covered dumpsters or other covered receptacles are preferred.
f. Provide facilities for the eventual recycling of appropriate materials.

III.A.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR, Division of Boating and Ocean Recreation (DOBOR), is the lead agency for implementing this management measure. Other State and local agencies involved in implementation include:

- DOH, which administers the State's water pollution control programs.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 200	Ocean Recreation and Coastal Areas Programs
HRS	Chapter 266	Harbors (Enforcement)
HRS	Chapter 321	General Department of Health
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 342H	Solid Waste Pollution
HRS	Chapter 342I	Lead Acid Battery Recycling
HRS	Chapter 342J	Hazardous Waste
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-232	Boat Operation, Boat Harbors, and Permits
HCC	Chapter 20	Refuse
KCC	Chapter 20	Litter Prohibited
MCC	Chapter 20.20	Litter Control
ROH	Chapter 29-4	Streets, Sidewalks, Malls and Other Public Places - Litter Control

Chapter 13-232, HAR, administered by the DLNR, prohibits littering on land areas and in waters within small boat harbors. Litter - defined as all types of debris and substances, whether liquid or solid, and materials, such as garbage, refuse, rubbish, glass, cans, bottles, paper, wrappings, fish, or animal carcasses, or any other nauseating or offensive matter or any machinery - must be deposited in receptacles designated for the disposal of such materials. Chapter 200-14, HRS, states that any person violating boat operation, boat harbors, and permit rules shall be fined not more than $10,000 for each violation. The court can also deprive an offender of the privilege of operating or mooring a vessel in State waters for up to two years.

While Chapter 13-232, HAR, does not prohibit hauling out on beaches, it does prohibit activities that litter or pollute. Therefore, major repair and maintenance work should be performed in specific work areas. DLNR-DOBOR is increasing its enforcement against boat maintenance and repair activities that pollute beaches, other land areas, and waters within small-boat harbors.

Enforcement of Chapter 13-232, HAR, is under the jurisdiction of DLNR. DLNR's harbor agents conduct inspections, have the power to revoke or deny permits, and may issue warnings regarding violations. In addition, the boating community tends to be self-policing, and generally informs DLNR when violations occur and often assists in clean-ups.

State marina facilities with repair areas or hull maintenance areas require permits for do-it-yourself boat cleaning and maintenance operations. Only certain areas are allowed to be used for these operations. An applicant may use the designated area for 2 weeks free of charge. As a condition of the permit, the boat owner must clean up all scrapings. Sandblasting is becoming less used, and planer-vacuum systems and hydroblasting more widely incorporated. In the future, the State plans to close its cleaning and maintenance areas and, thus, discontinue this service. At that time, boat owners will be required to use a private or other repair facility for boat cleaning and maintenance. This will direct boat cleaning and repairs to newer facilities better equipped to accommodate and regulate these uses.

In 1989, the USCG implemented the pollution prevention requirements of Annex V of MARPOL 73/78. Countries signatory to this international agreement prohibit the discharge of plastics by any type of vessel anywhere in the world. Non-signatory country vessels must comply within U.S. waters. There are also specific restrictions for the dumping of other litter in the oceans, depending on the distance from shore and the size/type of trash. Although the USCG and other authorities have focused on education and awareness, there is a $25,000 civil penalty for each violation of these regulations (33 CFR 151). USCG is currently increasing spot checks and investigating releases of rubbish, liquids, and hull scrapings, particularly in Oahu's harbor areas.

The marinas and recreational boating focus group considered public education critical to the effective implementation of this management measure. Some marina operators are currently working with the Department of Health to address pollution prevention issues. A public information booklet entitled *Managing Boat Wastes: A Guide for Hawaii Boaters* was produced by the University of Hawaii Sea Grant Extension Service (SGES) in conjunction with DOH, DLNR-DOBOR and others to educate the public about the importance of proper boat cleaning and maintenance practices. This effort could be expanded through the development of a comprehensive public education program for marinas operators and the boating community.

B. Fish Waste Management Measure

Promote sound fish waste management through a combination of fish-cleaning restrictions, public education, and proper disposal of fish waste.

III.B.1. Description

Fish waste can result in water quality problems at marinas with large numbers of fish landings or at marinas that have limited fish landings but poor flushing. The amount of fish waste disposed of into a small area such as a marina can exceed that existing naturally in the water at any one time. Fish waste decomposes, which requires oxygen. In sufficient quantity, disposal of fish waste can thus be a cause of dissolved oxygen depression as well as odor problems.

At this time, fish waste is not considered a significant problem in Hawaii. However, fish waste can sometimes become a nuisance in marinas and swimming areas. Episodic instances of high-frequency fishing, such as tournament fishing, create the largest amounts of fish waste. Most commercial catches are sold whole to buyers, who transport them to processing sites.

III.B.2. Applicability

This management measure applies to marinas where fish waste is determined to be a source of water pollution.

III.B.3. Management Practices

a. Post signs advising that unauthorized disposal of fish waste violates state pollution prevention laws and providing information about proper disposal methods at places where fish waste is determined to be a source of water pollution.
b. Construct fish cleaning stations at popular locations, with appropriate disposal facilities.
c. Make facilities available for disposal of fish carcasses and other solids.
d. Educate boaters about the need to protect waters from the problems caused by fish wastes and the importance of proper fish-cleaning practices.

III.B.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR-DOBOR is the lead agency for implementing this management measure. Other State and local agencies involved in implementation include:

- DOH, which administers the State's water pollution control programs.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 200	Ocean Recreation and Coastal Areas Programs
HRS	Chapter 266	Harbors (Enforcement)
HRS	Chapter 321	General Department of Health
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 342H	Solid Waste Pollution
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-232	Boat Operation, Boat Harbors, and Permits

Chapter 13-232, HAR, administered by the DLNR, prohibits littering on land areas and in waters within small boat harbors. Please refer to p. III-184 for a description of this administrative rule and its enforcement provisions. The disposal of fish wastes and animal carcasses is regulated under this rule.

Chapter 200-14, HRS, states that any person violating boat operation, boat harbors, and permit rules shall be fined not more than $10,000 for each violation. The court can also deprive an offender of the privilege of operating or mooring a vessel in State waters for up to two years.

C. Liquid Material Management Measure

Provide and maintain appropriate storage, transfer, containment, and disposal facilities for liquid material, such as oil, harmful solvents, antifreeze, and paints, and encourage recycling of these materials.

III.C.1. Description

This management measure minimizes entry of potentially harmful liquid materials into marina and surface waters through proper storage and disposal. Marina operators are responsible for the proper storage of liquid materials for sale and for final disposal of liquid wastes, such as waste fuel, used oil, spent solvents and spent antifreeze. Marina operators should decide how liquid waste material is to be placed in the appropriate containers and disposed of and should inform their patrons.

Common problems associated with liquid waste management at Hawaii's marinas include a shortage of recycling and disposal facilities at marinas, mishandling and mixing of liquid wastes (generating hazardous wastes requiring expensive disposal), and abandonment of used oil and other liquid wastes dockside.

III.C.2. Applicability

This management measure applies to the operation and maintenance of marinas where liquid materials used in the maintenance, repair, or operation of boats are stored.

III.C.3. Management Practices

a. Build curbs, berms, or other barriers around areas used for the storage of liquid material to contain spills. Store materials in areas impervious to the type of material stored.
b. Provide and clearly label separate containers for the disposal of waste oil, waste gasoline, used antifreeze, waste diesel, kerosene, and mineral spirits.
c. Provide information to marina users as to the proper disposal of all liquid materials using signs, mailings, and other means.

III.C.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR-DOBOR is the lead agency for implementing this management measure. Other State and local agencies involved in implementation include:

- DOH, which administers the State's water pollution control programs; and
- USCG, which is responsible for toxic spill response and clean-up.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 128D	Environmental Response Law
HRS	Chapter 200	Ocean Recreation and Coastal Areas Programs
HRS	Chapter 266	Harbors (Enforcement)
HRS	Chapter 321	General Department of Health
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 342J	Hazardous Waste
HRS	Chapter 342N	Used Oil
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-451	State Contingency Plan
HAR	Chapter 12-75	Flammable and Combustible Liquids
HAR	Chapter 13-232	Boat Operation, Boat Harbors, and Permits

Chapter 13-232-26, HAR, administered by DLNR, states that "no person shall dump, discharge, or pump oil, spirits, gasoline, distillate, any petroleum product, or any other flammable material into the waters of a small boat harbor or designated offshore mooring area." Any unauthorized discharge, dumping or abandoning in any State boating facility or State waters of any petroleum product, hazardous material, or sewage in violation of State water quality standards established by DOH will result in maximum fines of $10,000 for each day of violation (Chapter 13-230-4, HAR; Chapter 200-14, HRS). Enforcement of Chapter 13-232, HAR, is under the jurisdiction of DLNR.

Title 40, CFR, Part 302, discusses designation, reportable quantities, and notification requirements of the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). In implementing CERCLA , DOH is responsible for regulating the release of hazardous substances, pollutants or contaminants into the environment under the Hawaii Environmental Response Law, Chapter 128D, HRS. DOH must adopt rules establishing the releasable quantities of designated hazardous substances and the time periods during which the release of such substances must be reported. Failure to report such a release within the designated timeframe may result in a civil penalty not to exceed $10,000 for each day of failure to report. In September 1995, DOH promulgated administrative rules (HAR §11-451) to implement Chapter 128D, HRS.

The building of berms and curbs to contain oil or hazardous materials falls under the purview of the Environmental Protection Agency. Federal regulations for the proper disposal of oil and hazardous materials is found in the federal Resource,

Conservation, and Recovery Act. DOH is EPA's agent in Hawaii, with respect to implementation and enforcement of these federal regulations.

Chapter 342J, HRS, administered by DOH, outlines the general standards, policies, permits, and prohibitions for facilities generating, transporting, storing and disposing of hazardous wastes. Chapter 342N, HRS, Used Oil Transport, Recycling and Disposal, administered by DOH, outlines the procedures to obtain and maintain a permit for the transport, management and waste disposal of used motor oil. Chapter 342N-30 states that "new, used or recycled oil shall not be discharged into sewers, drainage systems, surface or groundwaters, watercourses, marine waters, or on to the ground." (This does not apply to inadvertent, normal discharges from vehicles or from maintenance or repair activities, provided that appropriate measures are taken to minimize releases.) Maximum penalties for repeatedly violating the provisions of this chapter are a $20,000 fine and misdemeanor conviction. First offenses may result in a maximum fine of $10,000 and a petty misdemeanor conviction.

Chapter 12-75, HAR, administered by DOT, regulates the design and operation of dispensing, pumping, and piping of fuels and other liquids at or around marine service stations. This chapter includes design requirements for areas where Class I liquids are to be stored and dispensed.

Illegal discharges of oil and hazardous chemicals should be reported to the National Response Center at 1-800-424-8802.

The marinas and recreational boating focus group felt that, in general, adequate regulatory measures exist at the federal and State levels to minimize releases of potentially-harmful liquid materials, by requiring proper storage, containment and disposal. However, these measures are not being implemented in a uniform or coordinated manner. In general, building of curbs, berms and other barriers around storage areas is being done in compliance with federal regulation. Also, where disposal facilities for oil, gas, antifreeze, etc. are provided, they are generally serviced by an outside hazardous waste disposal contractor in compliance with federal regulations. However, no guidelines or regulations exist at the State level that address the combined concerns of storing liquid materials for sale and final disposal of liquid wastes (waste fuel, used oil, spent solvents, etc.) at marinas.

D. Petroleum Control Management Measure

Reduce the amount of fuel and oil from boat bilges and fuel tank air vents entering marina and surface waters.

III.D.1. Description

Fuel and oil are commonly released into surface waters during fueling operations through the fuel tank air vent, during bilge pumping, and from spills directly into

surface waters and into boats during fueling. Oil and grease from the operation and maintenance of inboard engines are a source of petroleum in bilges.

Outboard-powered vessels are the most common vessels in Hawaiian waters. They account for approximately 59% of all vessels, followed by inboard-outboard vessels at about 15%. Approximately 7% are inboard only, with another 8% being combination of sails and motors (both inboard and outboard). The remaining 11% are sail only, manual, or other types. (Lal and Clark, 1991)

III.D.2. Applicability

This management measure applies to boats that have inboard fuel tanks.

III.D.3. Management Practices

a. Use automatic shut-off nozzles and promote the use of fuel-air separators on air vents or tank stems of inboard fuel tanks to reduce the amount of fuel spilled into surface waters during fueling of boats.
b. Promote the use of oil-absorbing materials in the bilge areas of all boats with inboard engines. Examine these materials at least once a year and replace as necessary. Recycle, if possible, or dispose in accordance with petroleum disposal regulations.

III.D.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR-DOBOR is the lead agency for implementing this management measure. Other State and local agencies involved in implementation include:

- DOH, which administers the State's water pollution control programs; and
- USCG, which is responsible for toxic spill response and clean-up.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 128D	Environmental Response Law
HRS	Chapter 200	Ocean Recreation and Coastal Areas Programs
HRS	Chapter 266	Harbors (Enforcement)
HRS	Chapter 321	General Department of Health
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 12-75	Flammable and Combustible Liquids
HAR	Chapter 13-232	Boat Operation, Boat Harbors, and Permits

Under Chapter 200-10, HRS, in order to renew State marina slip permits, the owner of a vessel must provide a marine surveyor's inspection no more than two years old, certifying that the surveyor has inspected the vessel and considers it to fulfill the requirements set by DLNR. One requirement on the DLNR's inspection checklist is that boats have oil absorbents on board (Chapter 13-232-26(b), HAR). Fuel tank vents are also inspected for proper operation, to ensure that they do not allow spillover.

USCG strictly prohibits the use of any type of hydrocarbon in the water, subject to a civil penalty of $10,000 or more. The amount necessary for a penalty is the production of a visible sheen. The spraying of dispersants (like dish soap) on oil is also strictly prohibited under federal regulation. Many boaters are under the impression that putting something on oil already in the water is permissible. In fact, they are making matters worse and are liable for another civil penalty.

Chapter 13-232, HAR, administered by DLNR, prohibits the discharge of oil, spirits, gasoline, distillate, any petroleum product, or any other flammable material into the waters of a small boat harbor or designated offshore mooring area. Any unauthorized discharge, dumping or abandoning in any State boating facility or State waters of any petroleum product, hazardous material, or sewage in violation of State water quality standards established by DOH will result in maximum fines of $10,000 for each day of violation (Chapter 13-230-4, HAR; Chapter 200-14, HRS).

Chapter 13-232, HAR, also states that all vessels equipped with an inboard motor which is moored in a small boat harbor or designated offshore mooring area must maintain an oil absorbent pad in the bilge. Furthermore, this chapter requires that the fueling of vessels at small boat harbors occurs only at established marine fueling stations. It also states that after fueling is completed, fill openings must be closed and spilled fuel wiped up.

Illegal discharges of oil and hazardous chemicals should be reported to the National Response Center at 1-800-424-8802.

Chapter 12-75, HAR, administered by DOT, regulates the dispensing, pumping and piping of fuels and other liquids at or around marine service stations, and requires automatic shut-off nozzles at commercial harbors.

USCG regulates tank trucks fueling vessels with a capacity greater than 250 bbls. (10,500 gallons). Any permit issued for tank truck refueling must comply with federal and State regulations.

E. Boat Cleaning Management Measure

For boats that are in the water, perform cleaning operations to minimize, to the extent practicable, the release to surface waters of harmful cleaners, solvents and paint from in-water hull cleaning.

III.E.1. Description

This measure minimizes the use and release of potentially harmful cleaners and bottom paints to marina and surface waters. Marina employees and boat owners use a variety of boat cleaners, such as teak cleaners, fiberglass polishers and detergents. Boats are cleaned over the water or onshore adjacent to the water. This results in a high probability of some of the cleaning material entering the water. Boat bottom paint is released into marina waters when boat bottoms are cleaned in the water.

III.E.2. Applicability

This management measure applies to marinas where boat topsides are cleaned and marinas where hull scrubbing in the water has been shown to result in water or sediment quality problems.

III.E.3. Management Practices

a. Wash the boat hull above the waterline by hand. Where feasible, remove the boat from the water and perform cleaning where debris can be captured and properly disposed of.
b. Detergents and cleaning compounds used for washing boats should be phosphate-free and biodegradable, and amounts used should be kept to a minimum.
c. Discourage the use of detergents containing ammonia, sodium hypochlorite, chlorinated solvents, petroleum distillates, or lye.
d. Discourage in-the-water hull scraping or any process that occurs underwater to remove paint from the boat hull.

III.E.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR-DOBOR is the lead agency for implementing this management measure. Other State and local agencies involved in implementation include:

- DOH, which administers the State's water pollution control programs; and
- USCG, which is responsible for toxic spill response and clean-up.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 200	Ocean Recreation and Coastal Areas Programs
HRS	Chapter 266	Harbors (Enforcement)
HRS	Chapter 321	General Department of Health
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-54	Water Quality Standards

HAR Chapter 13-232 Boat Operation, Boat Harbors, and Permits

Chapter 13-232, HAR, administered by the DLNR, prohibits littering on land areas and in waters within small boat harbors. Please refer to page III-184 for a description of this administrative rule and its enforcement provisions.

While Chapter 13-232, HAR, does not prohibit hauling out on beaches, it does prohibit activities that litter or pollute. Therefore, major repair and maintenance work should be performed in specific work areas. DLNR-DOBOR is increasing its enforcement against boat maintenance and repair activities that pollute beaches, other land areas, and waters within small-boat harbors.

State marina facilities with repair areas or hull maintenance areas require permits for do-it-yourself boat cleaning and maintenance operations. Only certain areas are allowed to be used for these operations. An applicant may use the designated area for 2 weeks free of charge. As a condition of the permit, the boat owner must clean up all scrapings. Sandblasting is becoming less used, and planer-vacuum systems and hydroblasting more widely incorporated. In the future, the State plans to close its cleaning and maintenance areas and, thus, discontinue this service. At that time, boat owners will be required to use a private or other repair facility for boat cleaning and maintenance. This will direct boat cleaning and repairs to newer facilities better equipped to accommodate and regulate these uses.

In 1989, the USCG implemented the pollution prevention requirements of Annex V of MARPOL 73/78. Countries signatory to this international agreement prohibit the discharge of plastics by any type of vessel anywhere in the world. Non-signatory country vessels must comply within U.S. waters. There are also specific restrictions for the dumping of other litter in the oceans, depending on the distance from shore and the size/type of trash. Although the USCG and other authorities have focused on education and awareness, there is a $25,000 civil penalty for each violation of these regulations (33 CFR 151). USCG is currently increasing spot checks and investigating releases of rubbish, liquids, and hull scrapings, particularly in Oahu's harbor areas.

Some marina operators are currently working with DOH and other agencies to address this issue. A public information booklet entitled *Managing Boat Wastes: A Guide for Hawaii Boaters* was produced in 1994 by SGES, in conjunction with DOH, DLNR-DOBOR, and others to educate the public about the importance of proper boat cleaning and maintenance practices. This popular booklet includes sections on alternative cleaners as well as environmentally-sound boat and deck washing methods. DOH, SGES and DOBOR are currently considering expanding boater education programs.

F. Public Education Management Measure

Public education/outreach/training programs should be instituted for boaters, as well as marina owners and operators, to prevent improper disposal of polluting material.

III.F.1. Description

The best method of preventing pollution from marinas and boating activities is to educate the public about the causes and effects of pollution and methods to prevent it. Creating a public education program should involve user groups and the community in all phases of program development and implementation. The program should be suited to a specific area and should use creative promotional material to spread its message.

III.F.2. Applicability

This management measure applies to all environmental control authorities in areas where marinas are located.

III.F.3. Management Practices

a. Signage
b. Recycling/trash reduction programs
c. Pamphlets or flyers, newsletters, inserts in billings
d. Meetings/presentations

III.F.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: A number of government agencies and organizations engage in public education and outreach efforts for marinas and recreational boating:

- DBEDT, Ocean Resources Branch;
- DOH, Solid and Hazardous Waste Branch;
- DLNR - DOBOR;
- University of Hawaii, SGES;
- University of Hawaii, School of Ocean and Earth Science and Technology (SOEST); and
- The Ocean Recreation Council of Hawaii (TORCH).

These agencies also allocate funding on a project-by-project basis for marinas and recreational boating-related education.

(ii) Existing Regulatory and Non-Regulatory Mechanisms: Public education and outreach activities range from signage provided by state agencies

and private organizations, to pollution prevention seminars, tourist education, and informational pamphlets, flyers and brochures. To date, the following educational materials are available:

- *Managing Boat Wastes: A Guide for Hawaii Boaters*. 1994. SGES, SOEST, DOH-Office of Solid Waste Management, DLNR-DOBOR.
- *'94 Directory: Waste Management Services in Hawaii.* November 1994. DOH-Solid and Hazardous Waste Branch. (Directory)
- *Boating and Ocean Recreation Permit Requirements*. 1993. DBEDT-Ocean Resources Branch. (Document)
- "Alternatives to Household Hazardous Products." 1995. DOH-Environmental Health Administration. (Informational flyer)
- "Resource Enforcement and Conservation Hawaii (REACH)." 1993. SGES, DBEDT-Ocean Resources Branch, TORCH. (Informational flyer compiling resources for marine and coastal environmental protection)
- *1994-1995 Hawaii Marine Directory*. 1994. DBEDT. (Directory)

G. Maintenance of Sewage Facilities Management Measure

Ensure that sewage pumpout facilities are maintained in operational condition and encourage their use.

III.G.1. Description

The purpose of this measure is to reduce the release of untreated sewage into marina and surface waters.

Most of Hawaii's State boating facilities were designed and built prior to 1976. Many of these facilities lack adequate sanitation systems and maintenance on those systems. Similarly, many private marinas lack adequate sewage disposal facilities.

The state is currently working to add sewage facilities to all their sites. Thus far, pumpout facilities have been installed at several state harbors (Nawiliwili, Waianae, Ala Wai, Lahaina, and Keehi), but accessibility to these pumpout facilities is variable, as is public willingness to use them. Maintenance of the pumpout facilities has also been problematical.

III.G.2. Applicability

This management measure applies to marinas where marine sewage disposal facilities exist.

III.G.3. Management Practices

a. Arrange maintenance contracts with contractors competent in the repair and servicing of pumpout facilities.
b. Develop regular inspection schedules.
c. Maintain a dedicated fund for repair and maintenance of State pumpout facilities.

d. Add language to slip leasing agreements mandating the use of pumpout facilities and specifying penalties for failure to comply.

III.G.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR-DOBOR is the lead agency for implementing this management measure. Other federal, State and local agencies involved in implementation include:

- DOH, which administers the State's water pollution control programs.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 200	Ocean Recreation and Coastal Areas Programs
HRS	Chapter 266	Harbors (Enforcement)
HRS	Chapter 321	General Department of Health
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-232	Sanitation and Fire Safety
HAR	Chapter 13-235	Offshore Mooring Rules and Areas
HAR	Chapter 13-243	Vessel Equipment Requirements
33 USC 1322	§312	Marine Sanitation Devices

Chapter 13-232, HAR, administered by DLNR, prohibits the discharge of untreated sewage directly or indirectly into the waters of a small boat harbor (HAR §13-232-8). Any unauthorized discharge, dumping or abandoning in any State boating facility or State waters of any petroleum product, hazardous material, or sewage in violation of State water quality standards established by DOH will result in maximum fines of $10,000 for each day of violation (Chapter 13-230-4, HAR; Chapter 200-14, HRS).

Chapter 13-235, HAR, administered by DLNR, requires marine toilets to be present and operational on vessels mooring or anchoring in waters of the State. Chapter 13-243-2, HAR, requires all vessels in the State with a MSD to comply with federal 33 CFR Part 159, which in turn prescribes regulations governing the design and construction of MSDs and procedures for certifying that MSDs meet the regulations and standards of the EPA promulgated under Section 312 of 33 USC 1322, to eliminate the discharge of untreated sewage from vessels into the waters of the United States, including the territorial seas.

By law, the Hawaii Boating Special Fund must be used for the operation and maintenance of the State boating program, including the operation and

maintenance of pumpout facilities. This fund is derived mainly from boat registrations, harbor use fees, marine fuel taxes, and land rentals. In addition, DOBOR has received a $21,250 grant under the Federal Clean Vessel Act of 1992. The grant will be used for: (1) survey and development of a public education program of vessel pumpout facilities; (2) design and construction of a pumpout facility at Kailua-Kona Wharf, Hawaii; (3) design and construction of a pumpout facility at Keehi Boat Harbor, Oahu; and (4) design and construction of a pumpout facility at Nawiliwili Boat Harbor, Kauai.

DLNR-DOBOR is encouraging regular use of sewage pumpout facilities by providing educational materials and citing vessels without toilets during its annual inspections of recreational boats. The U.S. Coast Guard is also increasing its number of inspections and imposing fines for MSD violations.

H. Boat Operation Management Measure (applies to boating only)

Restrict boating activities where necessary to decrease turbidity and physical destruction of shallow-water habitat.

III.H.1. Description

Boat operation can resuspend bottom sediment, resulting in the reintroduction of toxic substances into the water column. It can increase turbidity, which affects the photosynthetic activity of algae. Boat operation may also damage coral reefs and cause other habitat destruction.

Important classes of shallow water habitats found on the U.S. mainland (such as sea-grass beds) are not present in Hawaii. Instead, areas of concern in Hawaii include shallow-water coral reefs, algal flats, areas where threatened green sea turtles and other important species forage, shallow-water recruitment areas, and other special nearshore ecosystems and resources.

Hawaii's nearshore and shallow water habitats have not been comprehensively inventoried or assessed. The full extent to which recreational boating activities affect various shallow-water resources and habitats in Hawaii is likewise unknown. As nearshore habitats are assessed, the State's GIS would serve as a method to convey important habitat and other siting information to marina developers and environmental managers. The GIS system is limited, however, in its ability to correlate boat operations with habitat impacts.

III.H.2. Applicability

This management measure applies in non-marina surface waters where evidence indicates that boating activities are impacting shallow-water habitats.

III.H.3. Management Practices

a. Speed limits.
b. No-wake zones.

c. Motorboat restrictions.
d. Day-use moorings.

III.H.4. Implementation of Management Measure

A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section IV "Recommended Implementing Actions" on page III-201 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the marina management measures.

(i) Existing Organizational Structure: DLNR-DOBOR is the lead agency for implementing this management measure. Other federal, State and local agencies involved in implementation include:

- DOH, which administers the State's water pollution control programs;
- USCG, which is responsible for marine safety, and toxic spill response and clean-up; and
- USFWS, which reviews for impacts on turtles and seabirds.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 188	Fishing Rights and Regulations
HRS	Chapter 190	Marine Life Conservation Program
HRS	Chapter 195	Natural Area Reserves System
HRS	Chapter 200	Ocean Recreation and Coastal Areas Programs
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-28 - 13-38	Marine Life Conservation Districts
HAR	Chapter 13-244	Rules of the Road; Local and Special Rules
HAR	Chapter 13-256	Ocean Recreation Management Areas

This management measure is implemented through a number of overlapping regulatory measures, which restrict access to specified ecologically sensitive areas, limit boat speed in nearshore shallows, prohibit destructive activities, and restrict certain types of recreational uses to delimited areas and times.

Chapter 188, HRS, administered by DLNR, prohibits the intentional damaging, breaking or taking of any stony coral or live reef (rock or coral to which marine life of any type is attached). Penalties are provided on a per-violation as well as per-specimen basis.

The State has mechanisms in place to protect specific areas containing nearshore habitats of important resource values. Chapter 190, HRS, enables DLNR to establish MLCDs to protect unique areas of the marine environment by prohibiting activities that disturb, degrade or alter it. Thus far, eleven MLCDs have been designated, with associated administrative rules (Chapters 13-28 through 13-38, HAR) for managing these areas, including restrictions on boating

activities. Chapter 195, HRS authorizes DLNR to establish NARs to protect and preserve unique natural assets of the State, including distinctive marine plants and animals. Only one NAR includes a marine component. Ocean Recreation Management Areas (ORMAs), established under Chapter 13-256, HAR, are designated to limit certain ocean recreational activities, both commercial and sport, to specifically designated locations and time periods, and to limit equipment types used. ORMAs are managed by DLNR-DOBOR.

All State marine bottom ecosystems are classified as either Class I or Class II. Section 11-54-03, HAR, states that "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..." [§11-54-03(d)(1)]. The objective of class II marine bottom ecosystems is that "their use for protection including propagation of fish, shellfish, and wildlife, and for recreational purposes not be limited in any way." Any actions that may permanently or completely modify, alter or degrade the marine bottom, including navigational structures such as harbors and ramps, may be allowed in class II bottoms provided approval is secured from the Department of Health [§11-54-03(d)(2)]. The areas of class I and II bottoms are listed by marine bottom type in Section 11-54-07, HAR.

Chapter 200, HRS, administered by DLNR, provides authority for Chapter 13-244, HAR, which establishes local and special navigational rules. These rules set speed restrictions on boating, requiring no-wake slow speed within 200 feet of any shoreline or marina, and more restrictive speed limits in some areas; prohibit operation or anchorage of any vessel which injures or damages marine life or geological features and specimens within Kealakekua Bay; restrict boats from the ocean waters of the Ahihi-Kinau, Maui Natural Area Reserve; restrict boats from the ocean waters of the Manele Bay-Hulopoe (Lanai) Marine Life Conservation District; and restrict boating speeds and activities in numerous other areas reserved for swimming, bathing, snorkeling and diving.

IV. RECOMMENDED IMPLEMENTING ACTIONS

The following recommendations suggest actions that will improve the implementation of the management measures for marinas and recreational boating.

A. Continue long-range planning and policy development efforts for marina development, and related efforts to develop marina siting, design, and construction guidelines for Hawaii

- OSP, in conjunction with DLNR, should continue to facilitate the long-range planning of marina development and expansion.

- Revise and implement the *Draft Planning and Evaluation Guidelines for Private Sector Marina Development* (OSP 1993) to provide design, siting, construction, and operations criteria for *both* private and public marinas. Present the marina guidelines to the Board of Land and Natural Resources for their formal adoption. These criteria should then be included as conditions to the CDUA permits issued for new marina development and existing marina expansion. The adherence of marina developments to the criteria established in the guidelines, as specified in their CDUA permit conditions, should be monitored and enforced by DLNR. The various counties' planning departments should also utilize these guidelines during SMA permit application and review.

- DOH should develop a standardized protocol for marine water quality monitoring before, during, and after any coastal construction, including marina development. This protocol should be made a standard provision on any water quality and/or CDUA permit. The protocol should specify sampling parameters, frequency, sites, data reporting requirements, and emergency response to non-compliance.

- The State should develop a manual of structural and non-structural best management practices (BMPs) for marinas that may be used to meet the criteria established in the State's guidelines for marina development and expansion. It is also recommended that the State include, as a condition to the lease of public marina facilities to private concessions, the requirement of the use of BMPs to protect coastal water quality. BMPs for marinas should be tailored to Hawaii's environment.

  Schedule for Addressing Additional Needs:

June 1997:	Formally adopt guidelines for marina development and expansion.
June 1997:	Develop standardized protocol for marine water quality monitoring.
December 1997:	Develop manual of marina best management practices.

- Develop a statewide marina operations and maintenance manual for new and existing marinas. This manual would provide descriptions of management measures and practices to reduce polluted and explain how marina users will benefit and can do their share. The manual would also identify relevant agencies and their functions. The manual should also contain a comprehensive and clear set of guidelines on the proper storage and use of liquid materials, disposal of liquid wastes, and clean-up of spills for marina operators.

B. Support and facilitate continuing public outreach and boater education efforts

The marina and recreational boating focus group considered public education critical to the effective implementation of the marina and recreational boating management measures. This educational effort should also be extended to regulators, legislators, and the judiciary.

- Develop a comprehensive public education program for marina operators and the boating community. This program could be jointly developed by DOH, DLNR, DBEDT-Ocean Resources Branch, SGES, University of Hawaii Marine Options Program, Waikiki Aquarium, TORCH, the Pacific Whale Foundation, and other relevant agencies and organizations. As a key component of this program, a Pollution Prevention Resource Guide should be developed and distributed to boaters, and marina owners and operators, to prevent improper disposal of polluting materials. This guide would provide information on pollution prevention and direct the public to existing laws, authorities, programs and resources. Much of this information is already available through SGES, DBEDT-Ocean Resources Branch, DOH, and DLNR-DOBOR. In addition, ample materials are available from other states.

- As another important component of a comprehensive statewide boater education program, support public education seminars, workshops, and meetings instituted in conjunction with the dissemination of the guide. In the past, public outreach seminars and workshops have been used successfully for several waste minimization and pollution prevention programs in Hawaii.

- Investigate ways to most-effectively communicate with the boating and marina communities, including appropriate signage, community bulletin boards, and a computer "Boater/Fisher-Net." Other potential outreach avenues include:

  - Hawaii Marine Directory
  - Mailouts for boat and trailer registration (attach materials)
  - Annual boat inspections
  - Television shows about fishing, including 'Let's Go Fishing'
  - *Hawaii Fishing News, Honolulu Advertiser/Star Bulletin*
  - Videos
  - Clubs and organizations (*e.g.*, yacht clubs, sailing clubs, dive clubs, paddling clubs, boy scouts, fishing clubs, TORCH)
  - Harbors Advisory Boards
  - Neighborhood Boards on Oahu
  - Posters and signage at marinas
  - Novelties
  - Yacht club and other organizational newsletters
  - Boat sellers guides

C. Improve enforcement of existing boating regulations

- Provide adequate resources for enforcement officers, including additional staff and boats.

D. Pursue alternative funding mechanisms for managing and improving State boating facilities

DLNR-DOBOR has initiated an investigation into ways to increase revenues for managing and improving the State's boating facilities. It is currently considering several options, including increasing existing slip and user fees, and instituting new fees for certain uses.

- Consider other revenue-generating alternatives, such as boat and trailer taxes, and the establishment of a special fund supported by ecology vanity license plates.

E. Undertake a statewide suitability analysis for marina siting

- Instigate a project to guide the location of new and expanding marinas and associated activities through a statewide suitability analysis. Such an analysis could designate areas that are and are not suitable for marina development, taking into account criteria for flushing and circulation, exposure and other navigational safety concerns, biological, water quality and habitat factors, and recreational and cultural values. The preferences and needs of the community in which the site is located should also be included in the analysis criteria. The maps generated by the suitability analysis could be used by State and county agencies to direct development of marinas and associated activities to appropriate areas.

- Conduct comprehensive nearshore and reef surveys to identify additional areas of special shallow water habitats, and areas where turbidity may be of concern to biological resources. Such an effort to identify areas potentially impacted by marina development and boating could build upon previous nearshore surveys conducted by USACOE, DOH, and others.

F. Explore various public-private partnerships for managing and developing public boating facilities

- Encourage DLNR-DOBOR to work with harbor advisory committees to coordinate management efforts at existing facilities. Volunteer efforts and educational programs are among the activities the advisory committee can pursue.

- Promote public-private partnerships in the management of existing marina facilities, expansion of these facilities, or construction of new public marinas in order to benefit from private sector expertise in marina management.

G. Improve coordination among federal, State and county agencies that play a role in marina design, siting, construction, and operation and maintenance

- Improve coordination among existing regulatory programs to facilitate appropriate and efficient design, construction and management of marinas. DLNR-DOBOR, DOH, the CZM Program, DBEDT-Ocean Resource Branch, DOT-Harbors Planning Division, USACOE, USCG, county departments of planning and public works, SGES, Hawaii Community Development Authority, and military marina operators should all be involved in this effort.

CHAPTER 6: Hydromodifications - Channelization, Channel Modification, Dams, Streambank and Shoreline Erosion

I. INTRODUCTION

According to the Environmental Protection Agency's (EPA) *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters,* ***hydromodification*** means "alteration of the hydrologic characteristics of coastal and noncoastal waters, which in turn could cause degradation of water resources" (p 6-90). In other words, any alteration to a stream or coastal waters, whether a diversion, channel, dam, or levee, is considered a hydromodification.

The hydromodification management measures will affect all land use activities, especially those associated with agriculture, forestry and urban development. Therefore, these management measures should be considered in conjunction with the management measures for agriculture, forestry, urban areas and, to a lesser extent, marinas. In addition, the management measures for other land use categories are also relevant to the protection of streams and riparian areas. These management measures include:

- Forestry - II.B. - Streamside Management Zones
- Forestry - II.J. - Wetland Forests
- Wetlands - II.A. - Protection of Wetlands and Riparian Areas
- Wetlands - II.B. - Restoration of Wetlands and Riparian Areas
- Wetlands - II.C. - Vegetated Treatment Systems

For the purposes of this chapter, the following definitions will be used.

- A ***stream*** is any natural water course in which water usually flows in a defined bed or channel. The flow can be constant, uniform, or uninterrupted, regardless of whether the stream has been altered or channelized.
- A ***perennial stream*** carries water at all times.
- An ***intermittent stream*** carries water most of the time but periodically ceases to flow when evaporation or seepage into the stream's bed and banks exceed the available streamflow. For the purposes of this management measure, intermittent streams will also include:
  - ***ephemeral streams*** that carry water only after rains; and
  - ***interrupted streams*** that carry water generally through their length but may have sections with dry streambeds.
- A ***channel*** is a natural or constructed waterway that continuously or periodically passes water.
- A ***streambank*** is the side slopes of a channel between which the streamflow is normally confined.

An ongoing riparian area management study will recommend specific riparian area BMPs that would significantly reduce the potential for polluted runoff into the State's surface waters, and a phased strategy for implementing the recommended BMPs in Hawaii's political, social and economic context. While EPA's management measure for Streamside Management Zones (SMZs) applies only to lands where forestry operations are planned or conducted, the CZM Program hopes to expand the coverage to include areas where other land use activities are conducted. Therefore, the SMZ management measure for forestry may evolve into a more general recommendation for the establishment of SMZs throughout the State, regardless of land use activity, where they can effectively mitigate the effects of polluted runoff on surface water quality.

I.1. Hydromodifications in Hawaii

Hawaii has 376 perennial streams, distributed among the islands as shown below:

Island	Perennial Streams
Kauai	61
Oahu	57
Molokai	36
Maui	90
Lanai	0
Hawaii	132
TOTAL	376

Hawaii generally has small watersheds with a limited amount of usable land area. Given this limited land area and various development pressures, land prices are very high. These factors have contributed to the development of closely-spaced housing and other intensive land uses neighboring streams.

Because of Hawaii's sub-tropical climate, "flashy" storm events consisting of high peak discharges and large volumes of runoff are common. County drainage standards were first developed in the 1960s to safely handle these runoff volumes, in order to protect life and property located close to streams. Consequently, many streams, especially in urban areas, have been channelized in the form of concrete box culverts that drastically alter the physical, chemical, hydrological, and ecological characteristics of streams. The Hawaii Stream Assessment (DLNR 1990) concluded that "over 19% of Hawaii's 376 perennial streams have been channelized to some degree, including most of those on Oahu. Approximately 34 have been lined with concrete or other material: one on Kauai, 26 on Oahu, four on Maui, and three on Hawaii (p 98)."

Hawaii has 129 structures that fit the size criteria for dams specified in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. Of these, 54 are considered unsafe (DLNR 1994).

I.2. Effects of Channelization and Channel Modification Activities

Channel modification activities have deprived wetlands and estuarine shorelines of enriching sediments, changed the ability of natural systems to both absorb hydraulic energy and filter pollutants from surface waters, and caused interruptions in the different life stages of aquatic organisms. Channel modification activities can also alter instream water temperature and sediment characteristics, as well as the rates and paths of sediment erosion, transport, and deposition. A frequent result of channelization and channel modification activities is a diminished suitability of instream and riparian habitat for fish and wildlife. Hardening of banks along waterways has eliminated instream and riparian habitat, decreased the quantity of organic matter entering aquatic systems, and increased the movement of nonpoint source pollutants from the upper reaches of watersheds into coastal waters.

I.3. Existing Mechanisms that Relate to the Control of Hydromodification Impacts

A number of State and county mechanisms generally address hydromodification activities and the mitigation of their impacts. These are described here and will be referenced in the management measure sections.

(a.) Section 401, Clean Water Act (CWA), administered by DOH: The Section 401, CWA, water quality certification is administered by DOH. Section 401 permits are required for proposed projects which must obtain the following permits: (1) federal permit to construct or operate a facility that may discharge polluted waters into navigable waters; (2) Section 404, CWA, dredge and fill permits administered by the U.S. Army Corps of Engineers (USACOE); (3) Section 10, Harbors and Rivers Act, permits; (4) U.S. Coast Guard (USCG) bridge permit; and Section 402, CWA, permits NOT issued or administered by the State. (All State-issued Section 402 permits do not require a Section 401 permit.)

(b) Hawaii Water Code, administered by DLNR: Chapter 13-169, HAR, administered by DLNR, states that no stream channel shall be altered without first obtaining a SCAP from CWRM. Section 174C-3 of the Hawaii Water Code provides a definition for "stream." Generally speaking, the definition of stream includes perennial and intermittent streams, but streams must be natural watercourses which contain sufficient water to support instream uses as defined in the Code.

(c) State Environmental Impact Statement Law: Chapter 343, HRS, and Chapter 11-200, HAR, both relating to the Environmental Impact Statement law, require the preparation of an environmental assessment (EA) and/or environmental impact statement (EIS) for proposed activities that trigger the environmental review process. The trigger conditions are as follows: (1) use of State or county lands or funds; (2) use within the conservation district; (3) use within a shoreline setback area; (4) use within the Waikiki special district; (5) use within an historic site; (6) reclassification of conservation lands; (7) amendment to a county general plan; and (8) construction of helicopter facilities. If a project may significantly affect the environment, an agency or applicant must prepare a full EIS. Otherwise, only an environmental assessment is required.

(d) Coastal Zone Management Law: Chapter 205A, HRS and Chapter 1-2, HAR, delegate responsibility for implementing permit applications and reviewing and approving projects within the State's SMAs and shoreline setback areas to the counties. The goals are to preserve, protect, and where possible, restore the natural resources of the coastal zone of Hawaii, recognizing that special development controls within the shoreline area are necessary to avoid permanent loss of access and use. The Maui Planning Department adds restrictions for retention basins for many SMA permit applications and actively applies the EA significant criteria (Chapter 11-200, HAR) to the review of all zoning and SMA permit applications. Maui County also has set drainage requirements and other stream impact criteria for some zoning districts under Title 19, MCC.

(e) Kauai Constraint Districts: Kauai County has implemented "Constraint Districts" to mitigate the impact of developments in six specific districts: drainage, flood, shore, slope, soil, and tsunami. These constraint districts are designed to (a) identify areas where particular biological, physical, and ecological characteristics of the land, water, and atmosphere indicate that standard requirements for development, modification, or use may be inadequate to ensure general health or maintenance of established physical, geologic, and ecological forms and systems; (b) to ensure development, modification, or use will not create substantial threats to health or maintenance of established physical, geologic, and ecological forms and systems; and (c) to permit development, modification, or use when it can be shown that ecological interrelationships will be improved or not significantly depreciated.

(f) State Water Pollution Control Statutes: Water quality is generally addressed under the State's water pollution control statutes. While Chapter 342E, HRS, addresses nonpoint source pollution control, administrative rules have not yet been developed to implement it. These rules will be developed in conjunction with the further development and implementation of the coastal nonpoint pollution control program. Chapter 11-54, HAR - the administrative rules that implement much of Chapter 342D, HRS - has no procedures in place to enforce the water quality standards it sets forth.

(g) Stream Water Quality Standards: DOH establishes and enforces the State water quality standards (Chapter 11-54, HRS). The inland waters - streams, lakes, and wetlands - are separated into three classifications:

> Class 1: [are to] 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 discharged into these waters is prohibited. Any conduct which results in a demonstrable increase in levels of point or nonpoint source contamination in class 1 waters is prohibited.
>
> Class 1(a): [Uses protected in class 1.a. waters] are scientific and educational, protection of breeding stock... compatible recreation, aesthetic enjoyment, and other nondegrading uses....

Class 1(b): [Uses protected in class 1.b. waters in addition to the uses protected in class 1.a. waters] are domestic water supplies....

Class 2: [Class 2 waters are to be protected] for recreational purposes... agricultural and industrial water supplies....

The existing Class I waters in the State are specifically described in Section 11-54-05.1, HAR.

DOH, Environmental Planning Office, is currently preparing proposed amendments to the stream water quality standards.

II. CHANNELIZATION AND CHANNEL MODIFICATION MANAGEMENT MEASURES

One form of hydromodification is ***channelization*** or ***channel modification***. These terms (used interchangeably) describe river and stream channel engineering systems that facilitate flood control, navigation, drainage improvement, and reduction of channel migration potential. Activities such as straightening, widening, deepening, or relocating existing stream channels and clearing or snagging operations fall into this category. These forms of hydromodification typically result in more uniform channel cross-sections, steeper stream gradients, and reduced average pool depths.

The terms *channelization* and *channel modification* are also used in this chapter to refer to the excavation of borrow pits, canals, underwater mining, or other practices that change the depth, width, or location of waterways or embayments in coastal areas. Excavation of marina basins is addressed separately under the marina and recreational boating management measures in Chapter 5.

A. Management Measure for Physical and Chemical Characteristics of Surface Waters

(1) Evaluate the potential effects of proposed channelization and channel modification on the physical and chemical characteristics of surface waters in coastal areas;
(2) Plan and design channelization and channel modification to reduce undesirable impacts; and
(3) Develop an operation and maintenance program for existing modified channels that includes identification and implementation of opportunities to improve physical and chemical characteristics of surface waters in those channels.

II.A.1. Description

The physical and chemical characteristics of surface waters that may be influenced by channelization and channel modification include sediment, turbidity, salinity, temperature, nutrients, dissolved oxygen, oxygen demand, and contaminants. Implementation of this management measure is intended to occur concurrently with the implementation of Management Measure B (Instream and Riparian Habitat Restoration) of this chapter. The purpose of this management measure is to ensure that the planning process for new hydromodification projects addresses changes to physical and chemical characteristics of surface waters that may occur as a result of the proposed work. The programs to maintain existing channels should make use of any opportunities to improve the physical and chemical characteristics of the surface waters.

II.A.2. Applicability

This management measure applies to public and private channelization and channel modification activities to prevent the degradation of physical and chemical characteristics of surface waters from such activities. This management measure applies to any proposed channelization or channel modification projects, including levees, as well as existing modified channels.

II.A.3. Management Practices

a. Use models/methodologies as one means to evaluate the effects of proposed channelization and channel modification projects on the physical and chemical characteristics of surface waters. Evaluate these effects as part of watershed, land use, and new development plans.

II.A.4. Implementation of Management Measure

A list of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section V "Recommended Implementing Actions" on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organizational Structure: The Department of Health (DOH), Environmental Management Division, is the lead agency for implementation of this management measure because of its responsibilities for water pollution control. Water quality assessments are required under the Section 401, Clean Water Act (CWA), a water quality certification process administered by DOH. Other federal, State, and local agencies involved in implementation include:

- Commission on Water Resource Management (CWRM), which administers the Stream Channel Alteration Permit (SCAP);
- Department of Land and Natural Resources (DLNR), which administers the Conservation District Use (CDUA) permit, and reviews for modification of stream channels;
- Hawaii Coastal Zone Management (CZM) Program, which reviews for consistency with CZM objectives and policies; and

- County departments of planning, which administer the Shoreline Management Area (SMA) permit and shoreline setback provisions, if a stream channel project is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 13-104	Forest Reserves
HAR	Chapter 13-169	Protection of Instream Uses of Water
ROH	Chapter 23	Shoreline Setbacks
ROH	Chapter 25	Shoreline Management
MCC	Chapter 19	Zoning

The Section 401, CWA, Water Quality Certification process; Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are all relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

The counties (Section 46-11.5, HRS) are responsible for the maintenance of channels, streams, streambanks, and drainageways which may remove sources of nonpoint pollution. For lands comprising the channels, streams, streambanks, and drainageways that are privately owned or owned by the State, the respective owner is responsible for maintenance. Hawaii and Kauai counties use Chapter 46-11.5, HRS, to implement stream maintenance responsibilities. Hawaii County conducts stream cleaning operations upon request or in response to a complaint. Kauai County cleans streams in response to complaints and as needed based on the results of inspections every two years.

Maui County and the City and County of Honolulu use county requirements to enforce and complement Chapter 46-11.5, HRS. Maui County (Chapter 12.12, MCC, and Chapter 46-11.5, HRS) conducts stream cleaning operations by request, in response to a complaint, or on an 'as needed' basis. City and County of Honolulu (Section 41-26.3, ROH, and Chapter 46-11.5, HRS) currently requires land owners to maintain streams and remove silt, vegetation, debris, and other items that may interfere with the natural flow of the water. Stream channel mouths are cleaned at a minimum of once every five years (flood prevention related maintenance only). The City and County of Honolulu maintains that streambank cleanup is the responsibility of property owners. The County enforces

clean-ups by giving 30-day notice, by cleaning the stream itself and billing the owner, and/or by contracting the cleanup and billing the owner.

Chapter 13-104, HAR, administered by DLNR, addresses all activities in forest reserves, including general pollution concerns. Within a forest reserve, it is prohibited to drain, dump, or leave any material which pollutes or is likely to cause pollution in the forest reserve, its streams, and other water sources. This includes any litter, animal waste, or animal remains.

B. Instream and Riparian Habitat Restoration Management Measure

(1) Evaluate the potential effects of proposed channelization and channel modification on instream and riparian habitat in coastal areas;
(2) Plan and design channelization and channel modification to reduce undesirable impacts; and
(3) Develop an operation and maintenance program with specific timetables for existing modified channels that includes identification of opportunities to restore instream and riparian habitat in those channels.

II.B.1. Description

The impacts of channelization and channel modification projects can and have had detrimental effects on instream and riparian habitats. Fortunately there are management measures that can prevent or correct the impact of channelization. Levees can be constructed to allow for overbank flooding which provides surface water contact to streamside areas (including wetlands and riparian areas). Compound-channel designs, consisting of an incised, narrow channel to carry surface water during low (base)-flow periods, a staged overbank area into which the flow can expand during design flow events, and an extended overbank area, sometimes with meanders, for high-flow events can lessen the impact on instream and riparian habitats.

II.B.2. Applicability

This management measure applies to any proposed channelization or channel modification project to determine changes in instream and riparian habitats and to existing modified channels to evaluate possible improvements to these environments.

II.B.3. Management Practices

a. Use models/methodologies to evaluate the effects of proposed channelization and channel modification projects on instream and riparian habitats and to determine the effects after such projects are implemented.
b. Identify and evaluate appropriate best management practices (BMPs) for use in the design of proposed channelization or channel modification projects or

in the operation and maintenance program of existing projects. Identify and evaluate positive and negative impacts of selected BMPs and include costs.

II.B.4. Implementation of Management Measure

A list of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section V "Recommended Implementing Actions" on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organization Structure: Various agencies are involved in evaluating the effects of channelization and planning channelization projects to minimize their impacts. Federal, State and local agencies involved in implementation include:

- DOH, Environmental Management Division, which administers the water quality certification process under Section 401, CWA;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies;
- CWRM, which administers the SCAP;
- DLNR, which administers the CDUA permit and reviews for modification of stream channels; and
- County planning departments, which administer the SMA permit and shoreline setback provisions, when channelization projects are planned within the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 46-11	Maintenance of Channels, Streambeds, Streambanks, and Drainageways
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-104	Forest Reserves
HAR	Chapter 13-169	Stream Channel Alteration
ROH	Chapter 41-26	Regulated Activities Within the City
ROH	Chapter 2	Shoreline Setbacks
ROH	Chapter 25	Shoreline Management
MCC	Chapter 12.12	Street and Highway Excavations
MCC	Chapter 19	Zoning

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone

Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are all relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

The only existing State or county mechanisms that directly address instream and habitat restoration *per se* is the State Water Code. Section 174C-71, HRS, of the Hawaii Water Code mandates that an instream flow program be established to protect, enhance, and re-establish, where practicable, beneficial instream uses of water. However, to date, no such program has been implemented.

The counties (Section 46-11.5, HRS) are responsible for the maintenance of channels streams, streambanks, and drainageways which may remove sources of nonpoint pollutants. See page III-211 for a description of county, State and private responsibilities.

III. DAMS MANAGEMENT MEASURES

Dams are defined in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* as constructed impoundments that are either: (1) 25 feet or more in height *and* greater than 15 acre-feet in capacity; or (2) 6 feet or more in height *and* greater than 50 acre-feet in capacity.[1] This definition of a dam would apparently also include large retention/detention/ siltation basins if any of these structures meet the specified size criteria in the applicability statements.

A. Management Measure for Erosion and Sediment Control

(1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction, and
(2) Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.

III.A.1. Description

The purpose of this management measure is to prevent sediment from entering surface waters during construction or maintenance of dams. This measure should be incorporated into existing State erosion and sediment control programs at the local level. Erosion and sediment control is intended to be part of a comprehensive land use or watershed management program. Refer to the

[1]This definition is consistent with the federal definition at 33 CFR 222.8(h)(1) (1991).

Watershed and Site Development Management Measures in Chapter 4, which cover urban areas.

III.A.2. Applicability

This management measure applies to the construction and maintenance of dams. Dams are defined as constructed impoundments which are either:

(a) 25 feet or more in height *and* greater than 15 acre-feet in capacity, or
(b) six feet or more in height *and* greater than 50 acre-feet in capacity.

Hawaii has 129 structures that fit the size criteria for the management measures for dams.

III.A.3. Management Practices

a. Preserve trees and other vegetation that already exist near the dam construction site.
b. Control runoff from the construction site and construction-related areas.
c. Control soil and surface water runoff during construction

III.A.4. Implementation of Management Measure

A list of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section V "Recommended Implementing Actions" on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organization Structure: Responsibility for implementing this management measure is shared among the following county, State and federal agencies:

- County departments of public works, which administer the grading ordinances;
- CWRM, which administers the SCAP;
- DOH, Environmental Management Division, which implements programs for water pollution control;
- USACOE, which administers the Section 404, CWA, permit process;
- DLNR, which administers the CDUA permit, and reviews for modification of stream channels;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, for projects planned within the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements

HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-55	Water Pollution Control
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-104	Forest Reserves
HAR	Chapter 13-169	Stream Channel Alteration
HAR	Chapter 13-190	Dams and Reservoirs
HCC	Chapter 10	Soil Erosion and Sediment Control
KCC	Chapter 22-7	Grading, Grubbing and Stockpiling
ROH	Chapter 14	Public Works Infrastructure Requirements
ROH	Chapter 14-13	Provisions for Grading, Soil Erosion & Sediment Control
MCC	Chapter 20.08	Soil Erosion and Sediment Control

Chapter 180C, HRS, administered by DOH, mandated that counties enact ordinances to control soil erosion from land disturbing activities. Each county has adopted grading ordinances, administered by the departments of public works, which require land users to obtain grading permits for any grading, grubbing, or stockpiling. Chapter 180C, HRS, was repealed once counties promulgated their grading ordinances.

Chapter 10, HCC, prohibits grading, grubbing, or stockpiling without a permit. The maximum area of land that may be cleared for grading and grubbing is 20 acres at one time (§10-20) and all permits must conform to erosion and sediment control standards as well as guidelines established by the County of Hawaii Department of Public Works (§10-26). Whenever feasible, natural vegetation should be retained on-site [§10-22(b)].

Chapter 22-7, KCC, requires a grading permit for grading, stockpiling, and grubbing. There are additional requirements for areas of one acre or more, or where slopes equal or exceed 20%.

Chapter 20.08, MCC, provides minimum standards to regulate and control grading and grubbing. Permit application must be accompanied by plans and specifications, including a plot plan describing soil, details, and locations of proposed land drainage patterns, drainage structures, drainage pipes, and retaining walls. If an area is more than one acre, a drainage and erosion control plan must be prepared by an engineer, showing the scheme for controlling erosion and disposal of runoff water. All drainage and erosion control plans must be submitted to the applicable soil and water conservation district (SWCD) for review and approval (§20.08.080).

Chapter 14-14, ROH, prohibits grading, grubbing, or stockpiling without a permit. If the area involved is 15,000 square feet or more, a grading plan and specifications are required. If the area involved is one acre or more, an additional drainage and erosion control plan is required (§14-14.2). If the proposed grading is on land with slopes exceeding 15%, or if any fill is to be placed over a swamp, pond, gully or lake, an engineer's soils report must be submitted [§14-14.2(a)(9)].

While State and federal dam projects are not required to follow the county grading and drainage requirements, they usually follow the county standards because they lack their own standards. Further, if State and federal projects do not follow county grading and drainage standards, they risk refusal to tie into county services. Maui County, for example, will not allow any project to tie into its storm drain system or any other facility unless Maui County permits are issued and County standards are followed.

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

DLNR inspects dams every five years, but this applies only to safety concerns. It is believed, however, that implementing these provisions would also help control erosion.

B. Management Measure for Chemical and Pollutant Control

(1) Limit application, generation, and migration of toxic substances;
(2) Ensure the proper storage and disposal of toxic materials; and,
(3) Apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface waters.

III.B.1. Description

The purpose of this management measure is to prevent downstream contamination from pollutants associated with dam construction activities.

Although suspended sediment is the major pollutant generated at a construction site (EPA 1973), other pollutants include:

- Pesticides - insecticides, fungicides, herbicides, rodenticides;
- Petrochemicals - oil, gasoline, lubricants, asphalt;
- Solid wastes - paper, wood, metal, rubber, plastic, roofing materials;
- Construction chemicals - acids, soil additives, concrete-curing compounds;
- Wastewater - aggregate wash water, herbicide wash water, concrete-curing water, core-drilling wastewater, or clean-up water from concrete mixers;
- Garbage;
- Cement;
- Lime;
- Sanitary wastes; and
- Fertilizers.

III.B.2. Applicability

This management measure applies to construction and maintenance activities. Dams are defined as constructed impoundments which are either:

(a) 25 feet or more in height *and* greater than 15 acre-feet in capacity, or
(b) 6 feet or more in height *and* greater than 50 acre-feet in capacity.

This management measure addresses fuel and chemical spills associated with dam construction, as well as concrete washout and related construction activities. Hawaii has 129 structures that fit the size criteria of the management measures for dams.

III.B.3. Management Practices

a. Develop and implement a spill prevention and control plan. Agencies, contractors, and other commercial entities associated with the dam construction project that store, handle, or transport fuel, oil, or hazardous materials should have a spill response plan, especially if large quantities of oil or other pollution liquid materials are used.
b. Maintain and wash equipment and machinery in confined areas specifically designed to control runoff.
c. Locate fuel and vehicle maintenance staging areas away from surface waters and all drainages leading to surface waters, and design these areas to control runoff.
d. Store, cover, and isolate construction materials, refuse, garbage, sewage, debris, oil, and other petroleum products, mineral salts, industrial chemicals, and topsoil to prevent runoff of pollutants and contamination of ground water.

III.B.4. Implementation of Management Measure

A list of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section V "Recommended Implementing Actions" on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organizational Structures: The Department of Agriculture (DOA), Pesticides Branch, is the lead agency for implementing those measures that relate to regulating pesticides. At present, there are no enforceable mechanisms that specifically address the application of nutrients. Other State and local agencies involved in implementation include:

- DOH, which implements programs for water pollution control and safe drinking water;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies;
- CWRM, which administers the SCAP;
- DLNR, which administers the CDUA permit, and reviews for modification of stream channels; and

- Counties, which administer the SMA permit and shoreline setback provisions, and zoning ordinances.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 128D	Hawaii Environmental Response Law
HRS	Chapter 149A	Pesticides Law
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 460J	Pest Control Operators
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 4-66	Pesticides
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 11-451	State Contingency Plan
HAR	Chapter 13-169	Stream Channel Alteration
HAR	Chapter 13-190	Dams and Reservoirs

Chapter 149A, HRS, administered by DOA, states that "no person shall: (1) use any pesticide in a manner inconsistent with its label; (2) use, store, transport, or discard any pesticide or pesticide container in any manner which would have unreasonable adverse effects on the environment; ... (6) fill with water, through a hose, pipe, or other similar transmission system, any tank, implement, apparatus, or equipment used to disperse pesticides, unless...transmission system is equipped with an air gap or a reduced pressure principle backflow device meeting the requirements under section 340-2 [Safe Drinking Water Law] and the rules adopted thereunder" (§149A-31). Any person who violates Chapter 149A, HRS, or its rules may be issued civil penalties, including fines ranging from not more than $5,000 to not more than $1,000 (depending on whether the violator is a business or private entity) or criminal penalties, including misdemeanor charges and fines ranging from not more than $25,000 to not more than $1,000 (depending on whether the violator is a business or private entity).

Chapter 4-66, HAR, administered by DOA, relates to the registration, licensing, certification, recordkeeping, usage, and other activities concerning the safe and effective use of pesticides. It requires that those who apply or directly supervise others who apply restricted use pesticides be certified. This certification requires some understanding of the environmental concerns of using pesticides. This requirement is implemented under the University of Hawaii Cooperative Extension Service (CES)/DOA Pesticide Applicator Program. Certification under Category 7 is required for industrial, institutional, and structural pest control (§4-66-56(7), HAR). Certification is not required for those using pesticides that are not classified as "restricted use."

The Hawaii Occupational Safety and Health (HIOSH) regulations require that all commercial pesticide applications either be done by, or directly supervised by a certified pesticide applicator.

Chapter 128D, HRS, the Hawaii Environmental Response Law, is administered by DOH. It requires DOH to adopt rules establishing the quantity of a hazardous substance, pollutant, or contaminant that must be reported should it be released, as well as establishing the time periods during which the release must be reported. Chapter 128D, HRS, also requires DOH to adopt a Hawaii state contingency plan that includes methods and criteria for evaluating the degree of hazard present at a site with regard to hazardous substance, pollutant, or contaminant releases. In addition, it should be determined whether the site poses an imminent or substantial hazard, whether it is a priority site, and whether response actions are feasible and effective (§128D-7). In September 1995, DOH promulgated administrative rules (Chapter 11-451, HAR) to implement Chapter 128D, HRS.

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are also relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

C. Management Measure for Protection of Surface Water Quality and Instream and Riparian Habitat

Develop and implement a program to manage the operation of dams in coastal areas that includes an assessment of:

(1) Surface water quality and instream and riparian habitat and potential for improvement and
(2) Significant nonpoint source pollution problems that result from excessive surface water withdrawals.

III.C.1. Description

The purpose of this management measure is to protect the quality of surface waters and aquatic habitat in reservoirs and in the downstream portions of rivers and streams that are influenced by the releases (tailwaters) from reservoir impoundments. Impacts from the operation of dams to surface water quality and aquatic and riparian habitats should be assessed and the potential for improvement evaluated. Additionally, new upstream and downstream impacts to surface water quality and aquatic and riparian habitat caused by the implementation of practices should also be considered. The overall program approach is to produce a set of practices that can be applied individually or in combination to protect and improve surface water quality and aquatic habitat.

Implementation of the most cost-effective operations should then be done where economically feasible.

A variety of approaches, described below, have been developed and tested for their effectiveness at improving or maintaining acceptable levels of dissolved oxygen, temperature, phosphorus, and other constituents in reservoirs and tailwaters.

III.C.2. Applicability

This management measure applies to dam operations that result in the loss of desirable surface water quality, and of desirable instream and riparian habitat. Dams are defined as constructed impoundments which are either:

(a) 25 feet or more in height *and* greater than 15 acre-feet in capacity, or
(b) 6 feet or more in height *and* greater than 50 acre-feet in capacity.

Hawaii has 129 structures that fit the size criteria for the management measures for dams.

***NOTE**: This measure does not apply to projects that fall under NPDES jurisdiction.*

III.C.3. Management Practices

Aeration of Reservoir Waters and Releases:

a. Pumping and Injection Practices
b. Turbine Venting

Improving Oxygen Levels in Tailwaters:

c. Grated Conduits
d. Spillways
e. Spillway Modifications
f. Reregulation Weir
g. Labyrinth Weir

Adjustments in the Operational Procedures of Dams for Improvement of Water Quality:

h. Selective Withdrawal
i. Turbine Operation

Watershed Protection:

j. Land Use Planning
k. Nonpoint Source Screening and Identification
l. Soil Erosion Control
m. Groundwater Protection
n. Quarry Reclamation
o. Animal Waste Control
p. Failing Septic Systems

Restore or Maintain Aquatic and Riparian Habitat:
q. Flow Augmentation
r. Riparian Improvements
s. Aquatic Plant Management

Maintain Fish Passage:
t. Behavioral Barriers
u. Physical Barriers
v. Fish Collection Systems
w. Fish Diversion Systems
x. Spill and Water Budgets
y. Fish Ladders

III.C.4. Implementation of Management Measure

A list of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section V "Recommended Implementing Actions" on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organizational Structure: DOH, Environmental Management Division, is the lead agency for implementing this management measure. Other agencies involved in implementation include:

- CWRM, which administers the SCAP;
- DLNR, which administers the CDUA permit, and reviews for modification of stream channels;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies; and
- Counties, which administer the SMA permit and shoreline setback provisions, and zoning ordinances.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-169	Stream Channel Alteration
HAR	Chapter 13-190	Dams and Reservoirs

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are all relevant to this

management measure. These mechanisms are described briefly on pages III-207 - III-209.

IV. STREAMBANK AND SHORELINE EROSION MANAGEMENT MEASURE

Streambank erosion is used in this report to refer to the loss of fastland along nontidal streams and rivers. ***Shoreline erosion*** is used in this report to refer to the loss of beach or fastland in tidal portions of coastal bays or estuaries. Erosion of ocean coastlines is not regarded as a substantial contributor of nonpoint source pollution in coastal waterbodies and will not be considered in this report.

A. Management Measure for Eroding Streambanks and Shorelines

(1) Where streambank or shoreline erosion is a serious nonpoint source pollution problem, streambanks and shorelines may need to [~~should~~] be stabilized. Vegetative methods are strongly preferred. Structural methods may be necessary where vegetative methods cannot work and where they do not interfere with natural beach processes or harm other sensitive ecological areas. [~~unless structural methods are more cost-effective, considering the severity of wave and wind erosion, offshore bathymetry, and the potential adverse impact on other streambanks, shorelines, and offshore areas.~~]

(2) Protect streambank and shoreline features with the potential to reduce nonpoint source pollution.

(3) Protect streambanks and shorelines from erosion due to uses of either the shorelands or adjacent surface waters.

(4) Where artificial fill is eroding into adjacent streams or coastal waters, it should be removed.

IV.A.1. Description

Several streambank and shoreline stabilization techniques will be effective in controlling coastal erosion wherever it is a source of nonpoint pollution. Techniques involving marsh creation and vegetative bank stabilization ("soil bioengineering") will usually be effective at sites with limited exposure to strong currents or wind-generated waves. In other cases, the use of engineering approaches, including beach nourishment or coastal structures, may need to be considered. In addition to controlling those sources of sediment input to surface waters which are causing nonpoint source pollution, these techniques can halt the destruction of wetlands and riparian areas located along the shorelines of surface waters. Once these features are protected, they can serve as a filter for

surface water runoff from upland areas, or as a sink for nutrients, contaminants, or sediment already present as nonpoint source pollution in surface waters.

Stabilization practices involving vegetation or coastal engineering should be properly designed and installed. These techniques should be applied only when there will be no adverse effects to aquatic or riparian river habitats, or to the stability of adjacent shorelines, from stabilizing a shoreline sediment source. In addition, it is the intent of this measure to promote institutional measures that establish minimum set-back requirements or that allow a buffer zone to reduce concentrated flows and to promote infiltration of surface water runoff in areas adjacent to the shoreline.

This management measure amends the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

> *Justification for Alternative Management Measure: Hawaii's environment has suffered as a result of the proliferation of hardening projects. Structural methods have resulted in channelized streams and hardened shorelines which have degraded environmental quality and increased nonpoint source pollution problems. This alternative measure will improve the protection of water quality and sensitive ecosystems.*

IV.A.2. Applicability

This management measure applies to eroding shorelines in coastal bays and to eroding streambanks in coastal streams. The measure does not imply that all shoreline and streambank erosion must be controlled. Some amount of natural erosion is necessary to provide the sediment for beaches in estuaries and coastal bays, for point bars and channel deposits in rivers, and for substrate in tidal flats and wetlands. The measure, however, applies to eroding shorelines and streambanks that constitute a nonpoint source pollution problem in surface waters. It is not intended to hamper the efforts of any States or localities to retreat rather than to harden the shoreline.

IV.A.3. Management Practices

a. Use soil bioengineering and other vegetative techniques to restore damaged habitats along shorelines and streambanks wherever conditions allow.
b. Use properly designed and constructed engineering practices for shore erosion control in areas where practices involving marsh creation and soil bioengineering are ineffective.
c. In areas where existing protection methods are being flanked or are failing, implement properly designed and constructed shore erosion control methods such as returns or return walls, toe protection, and proper maintenance or total replacement.
d. Plan and design all streambank, shoreline, and navigation structures so that they do not transfer erosion energy or otherwise cause visible loss of surrounding streambanks or shorelines.
e. Establish and enforce no-wake zones to reduce erosion potential from boat wakes.

f. Establish setbacks to minimize disturbance of land adjacent to streambanks and shorelines to reduce other impacts. Upland drainage from development should be directed away from bluffs and banks so as to avoid accelerating slope erosion.

IV.A.4. Implementation of Management Measure

A list of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section V "Recommended Implementing Actions" on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organizational Structure: The CZM Program has been discouraging the hardening of natural shorelines in Hawaii due to its negative effects on adjacent and down-current areas. Because erosion can affect lands under both State and county jurisdictions, implementation of this management measure is shared between DLNR and the counties. Other agencies involved in implementation include:

- CWRM, which administers the SCAP;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies; and
- DOH, which administers the State's water pollution control programs.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 200	Ocean Recreation and Coastal Areas
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-169	Stream Channel Alteration
HAR	Chapter 13-190	Dams and Reservoirs

Chapter 200-3, HRS, requires DLNR to "assist in controlling shoreline erosion." Repairing coastal protective structures and seawalls under the jurisdiction of the State are also the responsibility of DLNR.

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are also relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

V. RECOMMENDED IMPLEMENTING ACTIONS

As stated earlier, because Hawaii has a limited amount of usable land area, there is a tendency to intensively use as much of the available land as possible for any given project. This has often led to the development of closely-spaced housing and other intensive land uses neighboring streams. Because of Hawaii's sub-tropical climate, "flashy" storm events generate large volumes of runoff in short periods of time. County drainage standards have been developed to safely handle these runoff volumes in order to protect life and property located with close proximity to streams. The confluence of these interests has led to the inevitable channelization of many streams, often in the form of concrete box culverts that drastically alter the physical, chemical, hydrological, and ecological characteristics of streams. The recommendations below are meant to address these concerns by eliminating the need for further channelization through protection of the stream resources, effective land use planning, modification of engineering techniques to control runoff, and improved coordination of permit review.

A. Establish new development planning and drainage criteria to reduce runoff volumes. The drainage standards implemented by all counties are based primarily on flood control and safety criteria, not environmental criteria. Existing drainage criteria address structural requirements for runoff volumes, but only after runoff reaches the existing or proposed drainage system. Limiting or controlling the effects of channelization is linked to limiting the need for channelization itself. To reduce the need for channelization and to protect the natural drainage systems and riparian and aquatic habitats, the following changes to the county drainage standards should be considered:

- Revise and implement criteria for new urban development and drainage/flood control to facilitate onsite retention of surface drainage using a series of management practices designed to increase infiltration, reduce peak runoff, and limit discharged runoff to pre-development levels. (See management practices under II.A. New Development Management Measure in Chapter 4, "Urban Areas.")

- Drainage standards should address the incremental impacts on surface waters of siting new developments. Perennial streams flowing into those wetlands that serve as critical habitat for endangered waterbirds, as determined by USFWS or DLNR-DOFAW, should be given special consideration based on long-term watershed planning. These watersheds should be assessed for potential cumulative impacts of development under "build-out" scenarios.

B. Define streamside management zones (SMZs) that would come under more intense management. A useful management tool for watershed planning is the establishment of streamside management zones (SMZs) or "buffer areas" around all perennial streams in the State. A SMZ is a designated area that consists of the stream itself and an adjacent area of varying width where management activities that might affect water quality, fish, or other aquatic resources are modified to

mitigate the adverse effects. The SMZ is not an area of exclusion, but an area of closely managed activity.

- Consider alternative management policies and implementation options for SMZs. At this time, the State does not have a general, statewide policy on SMZs. However, the CZM Program is currently exploring alternatives for such a policy, in cooperation with DLNR and other State, federal and county agencies. There are several possible mechanisms for implementing SMZs around streams or stream segments that will be developed and examined in more detail during the CZM Program's ongoing study:

  - Rezone stream buffer areas to the State conservation district, as suggested in the most recent State Land Use District Boundary Review undertaken by OSP;
  - Include stream buffers within the county SMAs; or
  - Create overlay districts for SMZs.

  There are several obvious consequences of these choices. A rezoning to the conservation district would provide a higher level of stream protection than the SMA alternative. Although the conservation district alternative would require an extensive process of delineation and rezoning, the precedent and processes for that rezoning are already in place. Once rezoned, activities in the SMZs would require a CDUA permit, which redirects the approval and control of land use activities from county to State authority. This alternative would be less desirable for watershed areas that are already urbanized.

  The inclusion of SMZs within county SMAs would result in a zoning overlay that would bring activities near streams under far more scrutiny than at present, but would likely result in less stream protection than the conservation district alternative. Chapter 205A, HRS, may have to be revised to specifically allow for the designation of SMZs within county SMAs in order to protect coastal water quality. Approval authority for SMA applications would remain at the county level.

  The third option would require creating new overlay districts around streams to protect their water quality.

  One of the above alternatives may be more applicable to a particular stream or stream segment than the others. In fact, the most realistic solution may be a combination of alternatives, each applied where it is most applicable.

C. Adopt and Implement Proposed Rules for a Stream Protection and Management System

- DLNR should support the adoption of the proposed changes to Chapter 13-169, HAR, to facilitate a coordinated and statewide approach to the management of streams and their ecosystems.

Section 174C-31(c)(4), HRS, states that the Commission on Water Resources Management (CWRM) shall "identify rivers or streams, or portions of a river or stream, which appropriately may be placed within a wild and scenic river system, to be preserved and protected as part of the public trust." CWRM defined "wild and scenic rivers" as "rivers or streams, or portions of the [same], of high natural quality or possess significant scenic value, including, but not limited to, rivers and streams which are within the natural area reserves system."

In response, CWRM appointed and convened the Stream Protection and Management (SPAM) task force comprising eight members representing diverse interests. In 1994, after information gathering, field trips, and statewide meetings, the task force published its recommendations and suggestions. CWRM staff produced additional recommendations.

The proposed changes to Chapter 13-169, HAR, create a Stream Protection and Management System that establishes categories of "heritage streams" and "valuable stream segments." Criteria for nominating and adopting streams for such status, and management provision are outlined in the proposed changes. Another proposed amendment addresses polluted runoff control: "Recognition shall be given to the direct effect of activities within a watershed on the quality of stream water and the health of the stream ecosystem. Accordingly, where practicable, the protection of riparian lands as buffers shall be supported in order to reduce the amount of non-point source pollution entering a stream." The proposed amendments further state that: "Channelization is discouraged in areas that are not yet urbanized. Accordingly, in an area that is not yet urbanized, a permit should not be granted unless it is deemed necessary to protect existing life or property and effective mitigation measures are proposed to reduce undesirable impacts."

At this time, the draft rules for the SPAM System have been adopted for public review by CWRM and the Governor.

- Consider incorporating a long-range watershed planning and assessment approach into the SPAM Plan for protecting perennial streams flowing into wetlands that serve as critical habitats for endangered waterbirds, as determined by USFWS and DLNR-DOFAW. The potential cumulative effects of development should be assessed using "build-out" scenarios guided by county general plans, development plans, current zoning, or other useful long-range planning tools. In these build-out scenarios, the cumulative effects of runoff, sediment loads, and loads of different pollutants could be assessed according to existing land use designations and zoning. If these effects are unacceptable, mitigative action can be implemented *before* specific developments are proposed. Such long-range assessments are essential to setting appropriate development policy for these watersheds and to address potential problems prior to development.

D. Create a coordinated agency review process for development plans

- Designate a coordinating agency to "shepherd" permit applications through the agency review and comment process. The intent of a coordinating agency is to: (a) ensure that a variety of agencies have the opportunity to comment in their fields of technical expertise as part of a review continuum; and (b) provide checks and balances to increase the chances of catching and resolving potential problem issues early in the permit application process.

- Cooperatively develop a consistent and standardized routing process for review of permit applications between the relevant federal, State, and county agencies. This can ensure adequate opportunity for review and comment by agencies knowledgeable in assessing specific types of impacts.

E. Expand Operation and Maintenance Program for Existing Hydromodifications

- Include in the operation and maintenance program for existing modified channels provisions for the identification and implementation of opportunities to improve physical and chemical characteristics of surface waters in those channels, and to restore instream and riparian habitats. Some mechanism, possibly as an amendment to the Hawaii Water Code (Chapter 174C, HRS), should be developed to include specific language for such provisions.

- Dam operation and maintenance programs should include provisions for the assessment of surface water quality and instream and riparian habitats as well as the assessment of potential for improvement of significant nonpoint source pollution problems that result from excessive surface water withdrawals. Chapter 13-190, HAR, should be revised to incorporate these specifications or another mechanism developed.

F. Develop Instream Flow Standards

- CWRM should set instream flow standards or implement the instream flow program required under Chapters 174C-71(1) and 174C-71(4), HRS, respectively.

G. Ensure Consistency with County Erosion Control and Drainage Standards for State Dam Construction Projects

- Hawaii should ensure that the State dam construction projects follow appropriate erosion control and drainage standards. The State could articulate a consistent policy to follow grading and drainage standards for dam construction in each county, or develop State grading and drainage standards that are in keeping with the most stringent county standards. Memoranda of agreement between the State and counties could be used to ensure adherence to proper standards.

- DLNR should revise Chapter 13-190, HAR, or develop another mechanism to provide erosion and sediment control guidelines for dams. The chapter's

provision for inspection of dams every five years should also be revised to include nonpoint source pollution-related erosion and sediment control criteria.

H. Implement Mechanisms to Ensure Proper Use, Handling, Storage, Transportation, and Disposal of Construction Chemicals and Provide Adequate Spill Prevention and Response Planning

- Refer to recommendations under III.B. Construction Site Chemical Control Management Measure in Chapter 4, "Urban Areas." on p. III-124 - III-126.

I. Consider Alternative Streambank Vegetation Control Methods

- The counties should consider alternative methods to control streambank vegetation. Streambank erosion and stream water pollutant loadings could be reduced by replacing the use of herbicides for vegetation management with weed-whacking or other mechanical method.

CHAPTER 7: Wetlands, Riparian Areas, and Vegetated Treatment Systems

I. INTRODUCTION

For the purposes of Hawaii's coastal nonpoint pollution control program, ***wetlands*** are defined as:

> *Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*[1]

For the purposes of the coastal nonpoint pollution control program, ***riparian areas*** are defined as:

> *Vegetated ecosystems along a waterbody through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent waterbody. These systems encompass wetlands, uplands, or some combination of these two land forms. They will not in all cases have all of the characteristics necessary for them to be classified as wetlands.*[2]

Wetlands and riparian areas can play a critical role in reducing polluted runoff by intercepting surface runoff, subsurface flow, and certain groundwater flows. Their role in quality improvement includes processing, removing, transforming, and storing such pollutants as sediment, nitrogen, phosphorus, and certain heavy metals. Thus, wetlands and riparian areas buffer receiving waters from the effects of pollutants, or they prevent the entry of pollutants into receiving waters. See Table III-5 for more information.

I.1. Wetlands in Hawaii

In general, wetlands in Hawaii vary substantially from wetland environments found in the continental United States. The islands' small size, relatively steep topography, and unique soils and microclimates engender different types and distributional patterns of wetlands than those traditionally encountered on the mainland U.S. For example, Hawaii tends to have fewer lakes, reservoirs, deep ponds, and other large-scale lacustrine systems typically associated with areas of flat topography. Hawaii also has 148 anchialine pond sites located in coastal areas. Today, Hawaii's wetlands comprise some 110,800 acres. Of these, more

---

[1] This definition is consistent with the federal definition at 40 CFR 230.3, promulgated December 24, 1980. As amendments are made to the wetland definition, they will be considered applicable to this program.

[2] This definition is adapted from the definitions offered previously by Mitsch and Gosselink (1986) and Lowrance *et.al.* (1988).

Table III-5: Range of Functions of Wetlands and Riparian Areas

Function	Example
Flood conveyance	Riverine wetlands and adjacent floodplain lands often form natural floodways that convey floodwaters from upstream to downstream areas.
Protection from storm waves and erosion	Coastal wetlands and inland wetlands adjoining larger lakes and rivers reduce the impact of storm tides and waves before they reach upland areas.
Flood storage	Inland wetlands may store water during floods and slowly release it to downstream areas, lowering flood peaks.
Sediment control	Wetlands reduce flood flows and the velocity of floodwaters, reducing erosion and causing floodwaters to release sediment.
Habitat for fish and shellfish	Wetlands are important spawning and nursery areas and provide sources of nutrients for commercial and recreational fin and shellfish industries, particularly in coastal areas.
Habitat for waterfowl and other wildlife	Both coastal and inland wetlands provide essential breeding, nesting, feeding, and refuge sites for many forms of waterfowl, other birds, mammals, and reptiles.
Habitat for rare and endangered species	Almost 35% of all rare and endangered animal species either are located in wetland areas or are dependent on them, although wetlands constitute only about 5% of the coterminous United States.
Recreation	Wetlands serve as recreation sites for fishing, hunting, and observing wildlife.
Source of water supply	Wetlands are important in replacing and maintaining supplies of ground water and surface water.
Natural products	Under proper management, forested wetlands are an important source of timber, despite the physical problems of timber removal. Under selected circumstances, natural products such as timber and furs can be harvested from wetlands.

Preservation of historic, archaeological values	Some wetlands are of archaeological interest. Native American settlements were sometimes located in coastal and inland wetlands, which served as sources of fish and shellfish.
Education and research	Tidal, coastal, and inland wetlands provide educational opportunities for nature observation and scientific study.
Source of open space and contribution to aesthetic values	Both tidal and inland wetlands are areas of great diversity and beauty, and they provide open space for recreational and visual enjoyment.

than 80% are classified as palustrine scrub-shrub and forest wetlands, located at middle to high elevations as bogs and rainforest ecosystems. However, the majority of wetland protection and restoration efforts in Hawaii has focused on coastal wetlands, and upon concerns of native waterfowl habitat and recreation. According to U.S. Fish and Wildlife Service (USFWS) estimates for 1990, Hawaii has about 15,474 acres of coastal plains wetlands today, as compared with an estimated 22,475 acres of wetlands existing around 1780. Today, there is estimated to be less than 700 acres in wetland agriculture. Although, in general, active use of Hawaii's wetlands is discouraged by State and federal agencies, wetlands are used to a limited extent for recreational uses, such as fishing, gathering of shellfish and shrimps, boating, sightseeing, bird watching and nature study. Currently, major categories of concern for Hawaii's wetlands include loss to urban and agricultural development; loss of supplying waters from diversions for agriculture, drinking water and urban uses; and channelization of river and stream beds.

I.2. Existing Programs Addressing Wetlands and Riparian Areas

(a) State Department of Land and Natural Resources (DLNR): DLNR administers the Natural Area Reserve System (NARS), the establishment of wildlife sanctuaries, and the Hawaii Biodiversity Joint Venture. The Commission on Water Resource Management (CWRM) administers the Stream Channel Alteration Permit (SCAP) process.

(b) State Department of Health (DOH): The Section 401, CWA, Water Quality Certification process is administered by DOH. Section 401 permits are required for proposed projects which must obtain the following permits: (1) federal permit to construct or operate a facility that may discharge polluted waters into navigable waters; (2) Section 404, CWA, dredge and fill permits administered by the U.S. Army Corps of Engineers (USACOE); (3) Section 10, Harbors and Rivers Act, permits; (4) U.S. Coast Guard (USCG) bridge permit; and Section 402, CWA, permits NOT issued or administered by the State. (All State-issued Section 402 permits do not require a Section 401 permit.)

DOH establishes and enforces the State water quality standards (Chapter 11-54, HRS). The inland waters - streams, lakes, and wetlands - are separated into three classifications:

> Class 1: [are to] 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 discharged into these waters is prohibited. Any conduct which results in a demonstrable increase in levels of point or nonpoint source contamination in class 1 waters is prohibited.
>
> Class 1(a): [Uses protected in class 1.a. waters] are scientific and educational, protection of breeding stock... compatible recreation, aesthetic enjoyment, and other nondegrading uses....
>
> Class 1(b): [Uses protected in class 1.b. waters in addition to the uses protected in class 1.a. waters] are domestic water supplies....
>
> Class 2: [Class 2 waters are to be protected] for recreational purposes... agricultural and industrial water supplies....

The existing Class I waters in the State are specifically described in Section 11-54-05.1, HAR.

DOH, Environmental Planning Office, is currently preparing proposed amendments to the stream water quality standards.

(c) Hawaii Coastal Zone Management Program: Chapter 205A, HRS and Chapter 1-2, HAR delegate responsibility for implementing permit applications, and reviewing and approving projects within the State's SMAs and shoreline setback areas to the counties. The goals are to preserve, protect, and where possible, to restore the natural resources of the coastal zone of Hawaii, including wetlands, recognizing that special development controls within the shoreline area are necessary to avoid permanent losses of access and use.

(d) Counties: The counties may become involved in the management of wetlands through the implementation of their grading ordinances and other permit or approval processes. One county, the City and County of Honolulu, has incorporated into its Special Management Area (SMA) ordinance (Chapter 25, ROH, "Shoreline Management") provisions for wetland protection in the permitting process, and for rulemaking and enforcement pertaining to the conservation, protection, and restoration of wetlands.

Federal agency involvement in the management of wetlands and riparian areas is typically more reactive than proactive, and may be triggered by proposed activities affecting various functions and criteria, such as migratory birds, endangered species, anadromous fish (USFWS), interstate commerce (USACOE), farmed agricultural wetlands (NRCS), and special habitats (National Park Service).

(e) U.S. Department of Interior, Fish and Wildlife Service (USFWS): USFWS provides funding for the acquisition of lands for wildlife refuges and Natural Area Reserves, in conjunction with the National Park Service, USACOE, and DLNR.

(f) U.S Department of Agriculture, Natural Resources Conservation Service (NRCS): Pertaining to agricultural wetlands, these programs build upon the Swampbuster provision of the Farm Bill (Food Security Act of 1985) which establishes that farmers lose eligibility for federal farm benefits if activities impact on wetlands. There has been an internal movement within NRCS toward watershed and ecosystem planning approaches, and the Swampbuster provisions are currently being tied to Clean Water Act provisions through a process of national Memoranda of Agreement (MOAs). Under Swampbuster, NRCS offers education and assistance to farmers for wetland determinations and in negotiating regulatory processes. In its Wetlands Reserve Program, which aims for the protection, restoration and construction of wetlands, NRCS is highlighting water quality as a key function. NRCS also offers cooperative and cost-sharing arrangements with other organizations, individuals and agencies for the restoration of degraded agricultural wetlands.

(g) U.S. Department of Defense, Army Corps of Engineers (USACOE): USACOE administers the Section 404, CWA, dredge and fill permit process.

(h) The Nature Conservancy of Hawaii (TNC): The Nature Conservancy of Hawaii currently co-manages with several other organizations and agencies approximately 30,000 acres of wetlands, upland bogs, riparian stream corridors, and streams. TNC's conservation efforts have largely entailed land acquisition and the promotion of incentive programs for landowners to manage their resources for the long-term. However, TNC has also engaged in management and research, has lobbied Congress for acquisition funding for Hawaii, and has worked to educate the public and lawmakers about the importance of acquiring and managing State Natural Area Reserves. TNC plans to increase its incentive programs for private landowners and to promote additional partnership ventures, in order to leverage critically-needed resources for the future.

(i) Ducks Unlimited, Inc.: Ducks Unlimited has recently published its Hawaiian Islands Conservation Plan. The organization's goal is to protect and restore key wetland habitats through acquisition, restoration, and technical assistance. Future commitments include: (a) developing and providing assistance to State and federal agencies on wetland restoration and enhancement projects; (b) technical expertise in wetland restoration and management; and (c) initiatives to enhance privately-owned wetland habitats.

(j) The Hawaii Biodiversity Joint Venture: The Hawaii Biodiversity Joint Venture is an organization composed of representatives of natural resource organizations statewide. Support includes funding of cooperative projects and assistance with conservation planning. Two of this organization's five primary action goals pertain to wetlands restoration and the protection of necessary water supplies for wetlands.

II. MANAGEMENT MEASURES

A. Management Measure for Protection of Wetlands and Riparian Areas

Protect from adverse effects wetlands and riparian areas that are serving a significant nonpoint source pollution abatement function and maintain this function while protecting the other existing functions of these wetlands and riparian areas as measured by characteristics such as vegetative composition and cover, hydrology of surface water and ground water, geochemistry of the substrate, and species composition.

II.A.1. Description

The purpose of this management measure is to protect the existing water quality improvement functions of wetlands and riparian areas as a component of polluted runoff control programs. The overall approach is to establish a set of practices that maintains functions of wetlands and riparian areas and prevents adverse impacts to areas serving a nonpoint source pollution abatement function. The ecosystem and water quality functions of wetlands and riparian areas serving a pollution abatement function should be protected by a combination of programmatic and structural practices.

The term ***pollution abatement function*** refers to the ability of a wetland or riparian area to remove pollutants from runoff passing through the wetland or riparian area. Acting as a sink for phosphorus and converting nitrate to nitrogen gas through denitrification are two examples of the important pollution abatement functions performed by wetlands and riparian areas.

This management measure provides for pollution abatement through the protection of wetland and riparian functions. The permit program administered by USACOE, EPA, and approved states under Section 404, CWA, regulates the discharge of dredged or fill material into waters of the United States, including wetlands. The measure and Section 404 program complement each other, but the focus of the two is different.

The measure focuses on nonpoint source problems in wetlands, as well as on maintaining the functions of wetlands that are providing pollution abatement. The nonpoint source problems addressed include impacts resulting from upland development and upstream channel modifications that erode wetlands, change salinity, kill existing vegetation, and upset sediment and nutrient balances. The Section 404 program focuses on regulating the discharge of dredged or fill materials in wetlands, thereby protecting wetlands from physical destruction and other pollutant problems that could result from discharges of dredged or fill material.

The pollution abatement functions performed by wetlands and riparian areas are most effective as parts of an integrated land management system that combines nutrient, sediment, and soil erosion control. These areas consist of a complex organization of biotic and abiotic elements. Wetlands and riparian areas are effective in removing suspended solids, nutrients, and other contaminants from upland runoff. In addition, some studies suggest that wetland and riparian vegetation acts as a nutrient sink, taking up and storing nutrients. This function may be related to the age of the wetland or riparian area. The processes that occur in these areas include sedimentation, microbial and chemical decomposition, organic export, filtration, adsorption, complexation, chelation, biological assimilation, and nutrient release.

Pollutant-removal efficiencies for a specific wetland or riparian area may be the result of a number of different factors linked to the various removal processes: frequency and duration of flooding; types of soils and slope; vegetation type; the nitrogen-carbon balance for denitrifying activity (nitrate removal); and the edge-to-area ratio of the wetland or riparian area. Watershed-specific factors include land use practices and the percentage of watershed dominated by wetlands or riparian areas.

II.A.2. Applicability

This management measure applies to protect wetlands and riparian areas from adverse nonpoint source pollution impacts.

II.A.3. Management Practices

a. Consider wetlands and riparian areas and their polluted runoff control potential on a watershed or landscape scale.
b. Identify existing functions of those wetlands and riparian areas with significant polluted runoff control potential when implementing management practices. Do not alter wetlands or riparian areas to improve their water quality function at the expense of other functions.
c. Conduct permitting, licensing, certification, and non-regulatory nonpoint source pollution control.
d. Use appropriate pretreatment practices such as vegetated treatment systems or detention or retention basins to prevent adverse impacts to wetland functions that affect pollution abatement from hydrologic changes, sedimentation or contaminants.

II.A.4. Implementation of Management Measure

None of the above practices have been implemented *per se*. Preliminary inventories of wetlands and riparian areas included assessments of water quality and other functions on a limited scale. However, their polluted runoff control potential on a watershed or landscape scale has not been assessed. Nor have the categorical sources of existing nonpoint source problems in existing wetlands (such as impacts resulting from upland development and upstream channel modifications) been comprehensively addressed. With the exception of certain programs aimed explicitly at managing a specified wetland, permitting, licensing, certification, and non-regulatory nonpoint source pollution abatement activities in the State have generally not been conducted in a manner that

effectively protects wetland functions or ensures the continuation of source water flows which maintain wetlands.

(i) Existing Organizational Structure: No one agency has the lead in implementing this management measure. Federal, State and local agencies involved in implementation include:

- DOH, Environmental Management Division, which implements programs for water pollution control;
- CWRM, which administers the SCAP;
- DLNR, which administers the Conservation District Use (CDUA) permit;
- Hawaii Coastal Zone Management (CZM) Program, which reviews for consistency with CZM objectives and policies;
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a development affecting a wetland or riparian area is planned in the SMA;
- USACOE, which administers the Section 404, CWA, and Section 10, Rivers and Harbors Act, permit processes; and
- USFWS, which reviews for impacts on birds and other species.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protecting for Instream Uses of Water

DOH administers the Section 401, CWA, Water Quality Certification process which ensures water quality is maintained during modification of existing wetlands. Federal agency involvement is triggered by other functions/criteria such as migratory birds, endangered species, farmed agricultural wetlands, anadromous fish, and interstate commerce. In these instances, the Section 401, CWA, water quality certification requirement is triggered, and the certification process may include attached conditions for wetland protection. DOH also has the authority to impose fines for violations of the conditions imposed during the Section 401 certification.

A Section 404, CWA, general permit from USACOE is required for discharge of dredged or fill material into waters of the United States, including wetlands. This permit is required in navigable waters or where depletion of commercial fish species by overharvesting or pollution of waters occurs.

Chapter 13-169, HAR, administered by DLNR, states that no stream channel shall be altered without first obtaining a SCAP from CWRM. Section 174C-3 of the Hawaii Water Code provides a definition for "stream." Generally speaking, the definition of stream includes perennial and intermittent streams, but streams

must be natural watercourses which contain sufficient water to support instream uses as defined in the Code. This permit is not specifically aimed at water quality protection, nor does it address upstream/downstream water quality impacts on wetlands. CWRM defers water quality conditions if a Section 401, CWA, certification has been granted. CWRM also defers on wetlands/water quality issues if the Section 404, CWA, process has been triggered.

The State Water Code (Chapter 174C, HRS) is the only existing mechanism that directly addresses instream and habitat restoration *per se*. Section 174C-71, HRS, mandates that an instream flow program be established to protect, enhance, and reestablish, where practicable, beneficial instream uses of water. However, to date, no such program has been implemented.

Counties get involved in wetlands or riparian area regulation primarily through the grading ordinance, development permits or approvals, and reviews of general plan amendments, rezoning applications, State land use boundary change applications, environmental assessments and impact statements, dredge and fill permit applications, and so forth. The counties tend to defer to NRCS, USACOE, USFWS, and DOH for decision-making and enforcement. The City and County of Honolulu is an exception in that it requires the consideration of wetland impacts, provides for protection and enforcement, and allows for the development of rules concerning wetlands within its SMA ordinance (Chapter 25, ROH).

B. Management Measure for Restoration of Wetland and Riparian Areas

Promote the restoration of the pre-existing functions in damaged and destroyed wetlands and riparian systems in areas where the systems will serve a significant nonpoint source pollution abatement function.

II.B.1. Description

Restoration of wetlands and riparian areas refers to the recovery of a range of functions that existed previously by reestablishing the hydrology, vegetation, and structure characteristics. A restoration management measure should be used in conjunction with other measures addressing the adjacent land use activities and, in some cases, water activities as well.

Restoration of wetlands and riparian areas is a holistic approach to water quality that addresses nonpoint source problems while meeting the goals of the Clean Water Act to protect and restore the chemical, physical, and biological integrity of the Nation's waters. Full restoration of complex wetland and riparian functions may be difficult and expensive, depending on site conditions, the complexity of the system to be restored, the availability of native plants, and other factors. Specific practices for restoration must be tailored to the specific ecosystem type and site conditions.

II.B.2. Applicability

This management measure applies to restore the full range of wetland and riparian functions in areas where the systems have been degraded and destroyed, and where they can serve a significant nonpoint source pollution abatement function.

II.B.3. Management Practices

a. Provide a hydrologic regime similar to that of the type of wetland or riparian area being restored.
b. Restore native plant species through either natural succession or selected planting.
c. Plan restoration as part of naturally occurring aquatic ecosystems.

II.B.4. Implementation of Management Measure

(i) Existing Organizational Structure: DLNR is the lead agency for implementing this management measure.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 173A	Acquisition of Resource Value Lands
HRS	Chapter 183	Conservation District
HRS	Chapter 195	Natural Area Reserves System
HRS	Chapter 195D	Conservation of Aquatic Life, Wildlife, and Land Plants
HRS	Chapter 198	Conservation Easements
HRS	Chapter 205	Land Use Commission
HRS	Chapter 343	Environmental Impact Statements

Chapter 173A, HRS, enables DLNR to acquire lands and waters having environmental value for public use. Chapter 198, HRS, authorizes DLNR to acquire conservation easements to preserve natural lands and waters.

DLNR is authorized under Chapter 183, HRS, "to manage and regulate all lands which may be set apart as forest reserves and to devise ways and means of protecting, extending, increasing, and utilizing the forests and forest reserves, more particularly for protecting and developing the springs, streams, and sources of water supply to increase and make that water supply available for use." Chapter 183D, HRS, authorizes DLNR to "manage and administer the wildlife and wildlife resources of the State."

Under Chapter 195, HRS, DLNR is responsible for the management of the NARS, which should "preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawaii". It also empowers DLNR to establish NARS for areas with unique wetland values and native species.

The conservation of aquatic life, wildlife, and land plants pursuant to Chapter 195D, HRS, is also the responsibility of DLNR. This chapter authorizes DLNR to acquire habitat for endangered species restoration.

As described on page III-235, Ducks Unlimited, Inc. and the Hawaii Biodiversity Joint Venture are involved in wetland and riparian area restoration in Hawaii.

C. Management Measure for Vegetated Treatment Systems

Promote the use of engineered vegetated treatment systems such as constructed wetlands or vegetated filter strips where these systems will serve a significant nonpoint source pollution abatement function.

II.C.1. Description

Vegetative treatment systems (VTS), include vegetated filter strips and constructed wetlands. Although these systems are distinctly different, both are designed to reduce nonpoint source pollution. They need to be properly designed, correctly installed, and diligently maintained in order to function properly. Filtering sediment and sediment-borne nutrients and converting nitrate to nitrogen gas are examples of the important nonpoint source pollution abatement functions performed by vegetated treatment systems.

The purpose of ***vegetated filter strips*** (VFS) is to remove sediment and other pollutants from runoff and wastewater by filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization, thereby reducing the amount of pollution entering surface waters. Vegetated filter strips are appropriate for use in areas adjacent to surface water systems that may receive runoff containing sediment, suspended solids, and/or nutrient runoff. Vegetated filter strips can improve water quality by removing nutrients, sediment, suspended solids, and pesticides. However, VFS are most effective in the removal of sediment and other suspended solids.

VFS are designed to be used under conditions in which runoff passes over the vegetation in a uniform sheet flow. Such a flow is critical to the success of the filter strip. If runoff is allowed to concentrate or channel, the VFS is easily inundated and will not perform as it was designed to function. Vegetated filter strips need the following elements to work properly: (1) a device such as a level spreader that ensures that runoff reaches the VFS as a sheet flow (berms can be used for this purpose if they are placed at a perpendicular angle to the VFS area to prevent concentrated flows); (2) a dense vegetative cover of erosion-resistant plant species; (3) a gentle slope of no more than 5%; and (4) a length at least as long as the adjacent contributing area. If these requirements are met, VFS have been shown to remove a high degree of particulate pollutants. The effectiveness of VFS at removing soluble pollutants is not well documented.

Constructed wetlands typically are engineered complexes of saturated substrates, emergent and submergent vegetation, animal life, and water that simulate wetlands for human use and benefits. Constructed wetlands typically have four principal components that may assist in pollutant removal:

- Substrates with various rates of hydraulic conductivity;
- Plants adapted to water-saturated anaerobic substrates;
- A water column (water flowing through or above the substrate); and
- Aerobic and anaerobic microbial populations.

II.C.2. Applicability

This management measure applies in cases where engineered systems of wetlands or vegetated treatment systems can treat polluted runoff. Constructed wetlands and vegetated treatment systems often serve a significant pollution abatement function.

II.C.3. Management Practices

a. Construct vegetated filter strips in areas adjacent to waterbodies that may be subject to suspended solids and/or nutrient runoff.
b. Construct properly engineered systems of wetlands for polluted runoff control. Manage these systems to avoid negative impacts on surrounding ecosystems or groundwater.

II.C.4. Implementation of Management Measure

This management measure is not being implemented on a regular and consistent basis in Hawaii. Engineered VTS and VFS may be used in site-specific cases, such as the development of water features on golf courses to serve as retention and treatment basins for runoff.

III. RECOMMENDED IMPLEMENTING ACTIONS

The absence of a clearly defined authority or policy direction at the State level, combined with the problem of conflicting definitions and assessments used by various agencies regarding wetlands and riparian areas, currently hinders the effectiveness of local planning and regulatory activities. Although new wetland and riparian area data-gathering and management efforts continue to be developed by State agencies and private organizations, the fragmented and sometimes conflicted nature of activities has precluded the development of clear and usable information for planning and management purposes at both the State and local levels. County agencies, the public, and landowners are often confused by inconsistent or conflicting information regarding the regulation and use of wetlands. This represents a serious void, particularly because many wetlands having significant nonpoint source problems as well as those providing significant nonpoint source pollution abatement functions, are located in coastal, urbanized areas of high development value, where intense pressures for multiple, often competing land uses prevail. Strong pressures also exist for appropriation of waters supplying wetlands for new development purposes.

A. Designate CZM Program as Coordinator for Wetlands Management

- Designate the CZM Program as facilitator and coordinator for wetlands management in Hawaii. The State's CZM law, Chapter 205A, HRS, addresses the management of wetlands. While the CZM Program has limited in-house expertise on wetlands, it can tap into the broad range of expertise

residing in its networked agencies. The cross-agency, cross-organizational approach can greatly expand resources and collaborative efforts in addressing wetland issues. It is important that federal, State and county agencies all contribute their expertise to general and site-specific wetland issues.

- Establish a comprehensive permit review function for wetlands within the CZM Program. Under the CZM Program's federal consistency authority, there should be established additional review criteria for CZM Program review of USACOE Section 404, CWA, permits. Under this provision, no Section 404 permit would be approved without prior consistency review and compliance with wetland protection criteria established by the CZM Program. The CZM program could work directly with developers to ensure consistency with coastal nonpoint pollution control and other CZM program requirements. Under this arrangement, the CZM program would be able to impose such conditions and requirements as necessary to ensure coastal nonpoint pollution control program objectives are met. Requirements might include the use of best management practices (BMPs), mitigation agreements, or conformance with a project master planning process if a proposed development project would affect directly or indirectly large areas of wetlands.

B. Establish and Coordinate an Interagency Wetlands Council

- As the coordinator for wetland management, the CZM Program should establish and coordinate an Interagency Wetlands Council. This Council would consist of representatives from all relevant resource agencies, including USFWS, USACOE, National Park Service, NRCS, NMFS, Hawaii CZM Program, DOH, CWRM, DLNR-Division of Aquatic Resources, DLNR-Division of Forestry and Wildlife, County Planning Departments (and Honolulu's Department of Land Utilization), County Public Works Departments, and County Boards of Water Supply. As coordinator, the CZM Program could conduct quarterly or semi-annual interagency group meetings (whose location could rotate between the islands to ensure adequate participation). This Interagency Wetlands Council would serve several key functions:

  - Develop consistent wetland definitions for Hawaii that can be used by federal, State and county resource agencies.
  - Identify information needed to improve management of wetlands and riparian areas and develop ways to fill these data gaps. These data gaps include the location, carrying capacities and nonpoint source pollution abatement and other functions of wetlands and riparian areas in Hawaii. The Council could draw upon existing resources such as the State's Geographic Information System database, a 1994 MOA between NRCS, USFWS, USACOE and EPA concerning wetland mapping conventions and procedures, CWRM's Hawaii Stream Assessment, the USFWS National Wetlands Inventory, and The Nature Conservancy's Heritage Database for assistance.
  - Serve as a preliminary review and discussion forum for proposed projects affecting wetland areas. Proposed projects could be discussed prior to the

permitting stage. Multiple agency concerns about proposed actions affecting wetlands could be addressed simultaneously, conflicts identified, and management or mitigative actions proposed.

- Review and evaluate existing permitting, licensing, certification and other regulatory mechanisms to ensure they protect an array of wetland functions. The Council could then make recommendations for program changes, as necessary.
- Identify gaps and overlaps between agency functions, and assist in developing clear and consistent guidelines for wetlands management at the State and county levels. The Council could also assist in developing conflict-resolution procedures, and establishing, where needed, written agreements among key agencies and groups.
- Address ways of improving existing enforcement, and enhancing public involvement and education.

C. Integrate CZM Program's New Wetland Functions within OSP Planning Efforts

- Integrate above recommended approaches to improving wetland policy and planning within a broader statewide, watershed- or regionally-focused planning initiative by OSP. Of all management categories addressed in this plan, wetlands management - where water-based and land-based human uses converge - perhaps bests illustrates the numerous, important linkages between all of the management measures, and the associated need for integrated management systems to adequately address these linkages. Integrating the management measures for all the various land uses would entail a much larger effort overall, but would also provide increased opportunities for more holistic, long-range planning and for improved polluted runoff control statewide.

- Within this structure, involve community groups in the implementation of State wetlands and watershed policies and plans. Communities could be supported in incorporating as nonprofit organizations (via Neighborhood Boards, *ahupua'a* or watershed councils, or other organizational unit) for wetlands protection and/or management. The State could also work with communities to promote and facilitate the development of specific community projects such as Adopt-a-Wetlands or Adopt-a-Stream programs, or volunteer water quality monitoring programs. OSP could also convene a series of State policy and management workshops to educate the public and help guide future wetlands planning efforts.

- Allocate sufficient resources to implement the above recommendations. In addition, additional resources should be provided to DOH and DLNR, which play key roles in wetlands management. Staff in these agencies must be able to anticipate, not only respond to, problems and opportunities. Additional staff and funding would enable these agencies to conduct long-overdue and critically-needed studies, participate more effectively in permit review processes, and provide needed resource planning, management and enforcement functions statewide. In particular, more district personnel are needed to conduct evaluations, monitoring, and management on all islands, since it is difficult to effectively manage resources statewide from Oahu.

CHAPTER 8: General Recommendations for Implementation

I. INTRODUCTION

The management measures in Chapters 2 through 7 address polluted runoff problems sectorally by land use categories and subcategories. These chapters also describe specific recommended implementation actions, generally on a sector-specific basis. Because the coastal nonpoint pollution control program will be implemented by a network of State and county agencies, it is also important to look at those general recommendations that cross all sectors. These are recommendations that will help define roles and responsibilities, streamline administrative processes, and provide opportunities to pool resources. The implementation of these recommendations will require close collaboration among State and county agencies and officials, the Legislature, the Judiciary, land users and owners, non-governmental organizations and interested citizens, and long-term public, political, and institutional support.

To varying degrees, the Office of State Planning (OSP) addresses these four mechanisms through its current policy initiatives. The Coastal Zone Management (CZM) Program may incorporate other components of these mechanisms into its policy initiatives. These mechanisms include: strengthening existing regulations; improving coordination and enforcement among State, federal, and county agencies; continuing to develop and implement best management practices (BMPs) to control or reduce polluted runoff; and supporting and facilitating community-based watershed management efforts. They are described in more detail below.

1. Strengthening Existing Regulations

Hawaii's coastal nonpoint pollution control program emphasizes a mix of regulatory and voluntary approaches to control polluted runoff, building on existing statutes, rules, regulations, ordinances, and programs. There is still a need, however, to review the State's regulatory programs to ensure that they are effective. This review will allow the State to update, clarify, and strengthen its polluted runoff control mechanisms. There are several areas in which nonpoint source pollution control regulations can be strengthened.

(a) Include nonpoint source pollution control mechanisms in State land leases: At a minimum, all lands owned by the State should be in compliance with the goals and objectives of the coastal nonpoint pollution control program. The Department of Land and Natural Resources (DLNR) and other appropriate State and county officials and/or legislators, and State leaseholders should work together to accomplish this goal. Within this process, the following measures should be considered:

- State land leases should include minimum polluted runoff control performance standards and require development and implementation of management plans specifying management practices to be installed and maintained.
- Because the front-end, capital expenses of installing some BMPs (particularly for erosion control) can be significant, the length of some State land leases should be increased to allow enough time for the lessees to recover their costs of installing nonpoint source pollution control structures. Longer leases would ensure long-term stewardship of the land.
- The fee structure for leasing State lands should be re-examined. Through different fee levels, the State may be able to develop incentives for low impact uses and/or disincentives for high impact uses.

(b) Review regulatory and non-regulatory mechanisms and programs:
Chapters 2 through 7 identify a spectrum of regulatory and non-regulatory mechanisms which implement aspects of Hawaii's coastal nonpoint pollution control program. It is already apparent that some existing mechanisms will have to be amended and new regulatory and non-regulatory mechanisms and programs developed in order to fully address the management measures specified in this program management plan. There may be other mechanisms and programs, however, that under closer examination will reveal impediments, such as inadequate staffing and funding levels, to carrying out their intent relative to the coastal nonpoint pollution control program. A critical review and discussion of existing mechanisms will not only point out weaknesses, but also reveal duplications among existing mechanisms, the resolution of which may facilitate improved coordination among agencies.

Such an evaluation of regulatory and non-regulatory mechanisms and programs comprising the coastal nonpoint pollution control program network will be most successfully accomplished through a collaborative effort among State and county officials. The Executive Planning Council, consisting of the Governor and the four County mayors, may provide a forum in which to discuss issues relevant to the implementation of the coastal nonpoint pollution control program. The CZM Program's Marine And Coastal Zone Management Advisory Group may be another appropriate forum for these discussions.

2. Improving Coordination and Enforcement Among State, Federal, and County Agencies

Past assessments indicate that Hawaii's environmental and resource management agencies have sufficient legal authority, but often lack the financial and human resources necessary to implement and/or enforce their mandates (OSP 1991). Consequently, there is a need for the State to improve coordination among State agencies responsible for environmental management programs, including the coastal nonpoint pollution control program.

(a) Clearly define the roles and responsibilities of each agency: As discussed in Part II, the coastal nonpoint pollution control program will be implemented by a network of State, federal, and county agencies. Chapters 2 through 7 describe the lead and supporting agencies for each management measure, though some of the management measures have no one clear agency with the lead role. Individual agency roles and responsibilities for both program implementation and enforcement need to be clarified and agree upon. It is critical that the CZM Program, as network coordinator, provide a forum through which agencies can discuss shared responsibilities, exchange information, resolve conflicts, and undertake collaborative efforts. This type of collaborative mechanism will also be useful in planning and implementing regional and watershed projects, and in seeking federal and private grants to fund specific program elements.

(b) Facilitate and formalize interagency agreements: A majority of the State, federal, and county agencies that will be implementing the coastal nonpoint pollution control program participated in its development through their involvement on the Section 6217 working group and focus groups discussed in Part V. And while these groups provided opportunities for agencies to coordinate their efforts at the staff level, there is a need to develop cooperative arrangements among agencies at the director level. The CZM Program should facilitate the development of necessary agreements and arrangements between agencies to implement the program. This includes building upon existing memoranda of agreement and understanding, if appropriate.

In the future, there may also be interest in formalizing collaborative arrangements with non-governmental organizations that are assisting in the implementation of the coastal nonpoint pollution control program.

(c) Create a coordinated agency review process for development plans: A coordinating agency should be designated to "shepherd" permit applications through the agency review and comment process. The intent of a coordinating agency is to (1) ensure that a variety of agencies have the opportunity to comment in their fields of technical expertise as part of a continuum of review, and (2) provide checks and balances to increase the chances of identifying and resolving potential problem issues early in the permit application process.

In addition, a consistent and standardized routing process for review of permit applications between the relevant federal, State, and county agencies should be developed to ensure adequate opportunity for review and comment by agencies knowledgeable in assessing specific types of impacts.

(d) Improve enforcement mechanisms: Enforcement of regulations is an important part of the coastal nonpoint pollution control program. County agencies indicate that lack of enforcement often undermines the effectiveness of their permitting processes and the use of conditional permits (OSP 1991). State, federal, and county officials, in a forum or collaborative process described above, should develop strategies to improve compliance monitoring. State and county agencies could monitor for compliance by tracking permits (*i.e.*, ensuring that appropriate management practice and mitigative measures are in place). The

Department of Health (DOH) should also monitor or require land users to monitor water quality near project sites.

It is also recommended that the CZM program educate the State Judiciary about the coastal nonpoint pollution control program and about the value of levying appropriate penalties against individuals who violate nonpoint source pollution regulations.

3. Developing and Implementing Best Management Practices

The focus of Hawaii's coastal nonpoint pollution control program is on encouraging or requiring the use of BMPs to control polluted runoff from specific land and water use activities. The assumption is that if land and water users install and maintain appropriate BMPs, then polluted runoff will be minimized and water quality will improve. Many land and water users already implement BMPs. Often, these practices are even economical for land users. An objective of Hawaii's program is to develop readily-available BMP manuals and training programs for land and water users. These resources will help ensure that individuals do not pollute out of ignorance.

(a) Develop BMPs and BMP manuals specific to Hawaii's environment: Because Hawaii's climate, geology, and ecosystems differ significantly from those of other states, the coastal nonpoint pollution control program should ensure the continued development of BMPs appropriate for Hawaii. Where possible, government officials, land and water users, local experts, and university extension agents and researchers should work together to develop BMPs for specific land use activities in Hawaii. While BMPs developed in other states can be used as models, they should be tested for their appropriateness in Hawaii and tailored to local conditions. BMP manuals for each land use categories should be developed that describe appropriate BMPs. Although the development of BMPs and BMP manuals should be a cooperative process, overall coordination of this process should be managed by DOH, which has significant technical expertise in nonpoint source pollution control.

Where possible, BMP manuals should not only include a catalog of practices, but also workbook and/or decision tree sections with sample calculations, multiple objective decision-making criteria, etc. Documents combining manual and workbook would provide not only the information of what practices to use, but also information on how to choose appropriate practices for local conditions and how to implement a set of practices to accomplish specified goals.

(b) Determine the costs of implementing BMPs: The focus groups concluded that if BMPs are not cost-effective for land or water users, then their application will be limited. Nevertheless, the focus groups also concluded that, in many cases, BMPs reduce long-term operation costs. Thus, an important component in the process of developing Hawaii-specific BMPs is to determine the costs of their installation and the value of the long-term benefits derived. This information should be included in the BMP manuals.

(c) Develop a process to determine effectiveness of BMPs: A process for evaluating the effectiveness of BMPs should be developed and undertaken by appropriate agency and university personnel and knowledgeable land and water users. Both the effectiveness of BMPs in controlling polluted runoff and their cost-effectiveness should be evaluated. This information may then be used to revise BMPs.

4. Encouraging and Facilitating Community-Based Watershed Management

Because many of the components of Hawaii's coastal nonpoint pollution control program go beyond the scope and resources of government agencies, communities in individual watersheds will play important roles in helping to implement the program. One of the program's objectives should be to build a sense of community and stewardship among individuals within watersheds. Community-based watershed management projects provide opportunities for resource managers to comprehensively address nonpoint source pollution problems within watersheds and involve communities in being part of the solution. Watershed planning and management approaches can involve agencies and law-makers from different levels of government, as well as land owners, land users, non-governmental organizations, and interested citizens. Citizens can work cooperatively with government to prioritize and address pollution problems within their communities.

Several different types of community-based watershed management efforts are already being undertaken in Hawaii. For more information on local watershed management projects, see Appendix C. In implementing the coastal nonpoint pollution control program, DOH and the CZM Program should: (1) identify the roles of communities in watershed management; (2) identify ways to duplicate the successful components of current and past projects in other watersheds; and (3) encourage the development of other community-based watershed management projects that will help protect coastal water quality.

This page deliberately left blank.

PART IV - CRITICAL COASTAL AREAS AND ADDITIONAL MANAGEMENT MEASURES

Section 6217(b) of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 requires states to implement management measures in addition to those contained in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* [the "(g) measures"]. In general, the purpose of this "second tier" of management measures is to address water quality problems that continue despite the implementation of the (g) measures. According to the Environmental Protection Agency's (EPA) and the National Oceanic and Atmospheric Administration's (NOAA) *Program Development and Approval Guidance*, "these additional measures apply both to existing land and water uses that are found to cause or contribute to water quality impairment and to new or substantially expanding land uses within critical coastal areas adjacent to impaired or threatened coastal waters" (p. 22).

Specifically, the State must identify its threatened or impaired coastal waters and the land uses that cause or threaten these waters; delineate critical coastal areas; develop a process for determining whether additional measures are necessary to attain or maintain water quality standards in the threatened or impaired waters; describe the additional management measures the State will apply to the identified land uses and critical coastal areas; and develop a program to ensure the implementation of additional management measures. These elements are discussed in greater detail below.

1. Identification of Threatened or Impaired Coastal Waters

First, states must identify coastal waters that are not attaining or maintaining applicable water quality standards or protecting designated uses, or that are threatened by reasonably foreseeable increases in pollution loadings from new or expanding sources [§6217(b)(1)].

EPA and NOAA's *Program Development and Approval Guidance* specifies how the State's threatened and impaired waterbodies are to be identified. The State must include, at a minimum:

- coastal waters identified in the State's most recent report under Section 305(b), Clean Water Act (CWA), as "partially meeting" or "not meeting" designated uses or as "threatened";
    - coastal waters listed by the State in accordance with the requirements of Section 303(d)(1)(a), CWA, requiring Total Maximum Daily Load calculations if listing is due at least in part to nonpoint sources;
    - coastal waters listed by the State under Section 304(1), CWA, as impaired by nonpoint source pollution; and

- coastal waters identified by the State as impaired or threatened by nonpoint source pollution in an assessment submitted to EPA under Section 319, CWA, or in any updates of the assessment.

1.a. Criteria for Identification of Threatened or Impaired Waterbodies

There are two definitions of water quality. One is the general definition set forth as a goal in Section 101, CWA, to maintain "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water." This definition is commonly referred to as "fishable, swimmable waters." The second manner in which water quality is defined is by water quality standards that set forth specific numerical criteria for each body of water. The standards are set by the states, following criteria set forth by the EPA. In Hawaii, the standards are set by the Department of Health (DOH). The process for setting standards is outlined in Sections 303(a), (b), and (c), CWA.

The mechanism to determine whether a given waterbody is impaired is the segment classification system outlined in Section 303(d), CWA. An "impaired" waterbody is one where existing water quality does not meet water quality standards and will not meet applicable water quality standards even after effluent limitation requirements on point source discharges are applied. Waterbodies are "threatened" where there is reason to believe that violations of water quality standards exist but monitoring data are insufficient to establish impaired water quality.

The most important reference documents for water quality in Hawaii are the Water Quality Management Plans (WQMP), sometimes referred to as the "208" plans because they were prepared to comply with Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (also referred to as PL 92-500), further amended by the Clean Water Act of 1987. WQMPs for all four counties were first published and adopted in 1978. Revised versions reflecting public and EPA comments were published in 1980. In 1989, the City and County of Honolulu, in cooperation with DOH, undertook a complete revision and update of its Plan. DOH completed an update of the "208" WQMPs for Kauai, Maui, and Hawaii counties in November 1993. Except where noted, the following descriptions of the characteristics and quality of Hawaii's waters are taken from the most recent WQMP documents.

1.b. Water Quality Standards

The criteria for measuring the quality of coastal waters are set forth in the State Water Quality Standards, Title 11, Chapter 54 of the DOH Administrative Rules.

The standards account for the natural differences and varieties of waters in the State by establishing two general classifications, inland waters and marine waters. Inland waters consist of two water types: freshwater and mixohaline-saline waters. Seven ecological subtypes are also identified for inland waters. Four subtypes are assigned under freshwater and three under mixohaline-saline water types. Each of the ecological subtypes for inland waters is described by environmental features and characteristic biota (distinguishing species) along with information on relative abundance and distribution. Marine waters consist

of three water types: embayment, open coastal waters, and oceanic waters. Six bottom subtypes are identified under embayments and open coastal waters.

Marine water types are categorized by physical and biological characteristics. Open coastal waters extend from the shoreline to the 100-fathom (600 foot) depth contour. Waters beyond the 100-fathom contour are defined as oceanic waters. Embayments are defined as 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 hundreds to one or greater. The biological characteristics of marine water types are categorized on the basis of phytoplankton biomass and/or parameters which affect biomass (*i.e.*, primary productivity or photosynthesis which is influenced by growth rate factors such as sunlight and nutrients). The water types are characterized by their water chemistry, hydrography, and distinguishing biota. Marine bottom subtypes consist of six categories which are based on physical substrate, and species composition and diversity. Species are grouped in assemblages and communities that generally exhibit the same tolerances to their physical, chemical, and biological environment.

Water quality parameters and criteria used in the standards are based on the following considerations: ecological significance, sensitivity to small changes, ease of measurement in the field, available data base, and sufficient sensitivity to indicate water quality problems. Water quality parameters are designated for inland or marine waters, and bottom types. Separate criteria are established for open coastal waters and embayments whose water quality is primarily influenced by rainfall and surface water runoff. Groundwater flow through upwelling, however, is not considered (DOH 1993a, p. VI-7).

The standards include a number of different chemical, physical, and biological parameters as well as the basic standards guidelines of biological oxygen demand (BOD), suspended solids, and dissolved oxygen developed by the National Technical Advisory Committee's (NTAC) "Water Quality Criteria" (DOH 1993a, p. VI-2). Numerical criteria are set forth for total nitrogen, ammonia nitrogen, nitrate and nitrite nitrogen, total phosphorus, chlorophyll a, and turbidity. The standards also include numeric criteria for 104 toxic pollutants, including metals and organic chemicals. Appropriate narrative criteria are established for pH, dissolved oxygen, temperature, salinity, and marine bottom types. The "Basic Freedom" criteria of the NTAC (*e.g.*, floatables, settleables, oil, grease, etc.) are used in the standards, which include erosion of soil particles resulting from construction activities on land. Bottom criteria for streams are also written in narrative format.

Numerical criteria in the standards also account for variability of water quality influenced by natural conditions. Water column criteria are therefore expressed as the geometric mean of all measurements not to be exceeded by a given value. Also, 10% of the measurements are not to exceed an intermediate value; and 2% are not to exceed a given limiting value.

Microbiological criteria are established for inland waters and marine recreational waters within 1,000 feet of the shoreline. The water quality of recreational waters is expressed statistically using fecal coliform bacteria as indicators for inland waters and enterococci as indicators for marine recreational waters.

The designations of beneficial uses for water under Section 101(a)(2), CWA, provide for the protection of fish, shellfish, wildlife, and recreation. Other beneficial uses include public water supplies, propagation of fish and wildlife, recreational, agricultural, industrial, and other purposes. The uses also take into consideration utility and value of the waterbody for navigation. EPA regulations [40 CFR 131.10(Q)] require that a "use attainability analysis" be conducted for non-attainable fishable/swimmable uses as specified in Section 101(a)(2), CWA. The Hawaii State water quality standards are equal to or more stringent than EPA requirements.

The standards were most recently revised in October 1992. The revisions included clarification of definitions of terms and extended narrative descriptions of policies intended to limit pollution in inland and coastal waters. A complete description of the history and basis for Hawaii's water quality standards, and planned future revisions, is contained in Chapter VI or the November 1993 "208" Water Quality Management Plans.

1.c. Land-Water Relationships

As noted previously, Hawaii has no major river basin systems comparable to those in the continental United States. Unfortunately for Hawaii, PL 92-500 was written to address river problems and does not recognize or address the unique geomorphologic, hydrographic, and climatic features which are prevalent in island environments. When the EPA promulgated regulations to implement Section 303(e) of the Act which requires each State to assess the extent of their water pollution, stream segments were used as the mechanism for this classification. Segment classification is intended for use as a management tool for improving water quality. For nonpoint source pollution control, strategies for cleanup can be developed by relating water segments to existing adjacent land uses.

Improving the segment classification system became one of the major objectives of the State of Hawaii's "208" planning program that began in 1976. A study was designed to analyze and evaluate water quality data in relation to land uses in order to define water quality problems in a better way and to improve nonpoint source controls. This took the form of a two-part prototype study. The objectives of the first part were to describe statistically the existing water quality characteristics of Hawaiian coastal waters and to gather data on land characteristics and on coastal transport. This work had the two-fold purpose of providing a comparison of existing water quality with the then newly proposed water quality criteria and of providing background information for the possible development of a quantitative relationship between land use and adjacent water quality characteristics. The second part of the study was directed at determining

the cause and effect relationships between land use and water quality, utilizing information gathered in the first part of the investigation.

The study indicated what had been suspected, that there is no strong relationship between open coastal water quality characteristics and the characteristics of the adjacent land. Although the nearshore waters have significantly greater concentrations of various constituents than open ocean waters, this effect occurs over a large area. The localized reversals cause an integration of the effects of a point source over an area encompassing from one-fourth to one-half of an island's total shoreline.

The study concluded that the oceanographic characteristics of mixing and current structure are the significant factors in open coastal water quality. The longshore current structure distributes the land effect relatively quickly over a long stretch of coastline so that the quality of water immediately adjacent to a particular coastal area does not directly reflect the land characteristics of that drainage area. The study noted that this was especially true when time and space were being considered in averaging water quality parameters. This makes it difficult to assess impacts of nonpoint source pollution discharges on other than an islandwide basis.

The results of the study demonstrated that the existing defined coastal water quality segments, developed primarily from land characteristics, did not adequately reflect the actual open coastal water quality conditions. Embayments and estuaries, on the other hand, act somewhat like lakes and rivers in that there are longer residence times which enhance the effects of land uses in the drainage area upon waters in the embayment. In such areas, significant correlations were found between land characteristics and several water quality parameters, including phosphorus, nitrogen, and turbidity.

The prototype study provided the basis for redefining Water Quality Limited Segments (WQLS) and Effluent Limitation Segments (ELS). The revised classification system was restricted to embayments and estuaries except for South Molokai (and in 1993, West Maui and Kihei). In making the designations, current and historic monitoring data and results of water quality studies were gathered from the literature and statistical compilations obtained for comparison with water quality standards. Water quality parameters such as turbidity, nitrogen and phosphorus, which generally exceeded the standards in embayments, were closely examined. The variability in water quality among various embayments was also evaluated to distinguish natural functions from man-related activities which influence water quality.

1.d. Water Quality Limited Segments

As noted in the previous section, all the coastal waters of the State have been divided into segments, and designated by DOH as either WQLSs or ELSs. This was done in 1973 as part of the State Continuing Planning Process to meet the requirements of Section 303(d)(1) and 303(e) of PL 92-500. Despite their limited value, as discussed in the description of the prototype study, these segments were

used as planning areas for the 1976 Phase I Basin Plans and Section "208" plans, and continue to be used in the current plans.

Each coastal water segment is linked with an associated land area. Each island is divided into hydrographic areas based on surface topography. Subareas are defined by the related drainage area, stream system, geography, and coastal water segment. A coastal water quality limited or effluent limitation segment coincides with those coastal waters that receive discharges from point and nonpoint sources located within that defined area.

WQLSs are defined in Section 303, CWA, and EPA regulations as those water areas where existing water quality does not meet, and will not meet, applicable water quality standards even after effluent limitation requirements on point source discharges are applied. ELSs are defined as those water areas where existing water quality either meets or will meet water quality standards after effluent limitation requirements on point source discharges are applied. All coastal water areas that are not designated as WQLSs are, by definition, ELSs (DOH 1993a, p. VII-3).

The segments have been designated by DOH on the basis of common hydrological characteristics, existing water quality, and water quality standards. Population distribution, sewer districts, and water distribution were also used to determine segment boundaries. Segment designation as either WQLS or ELS reflects the amount of flow, type and quantity of pollutants, the degree of violation of water quality standards, and the interactive and dispersive capacity of the receiving waters. In addition, consideration is given to public health hazards, the actual uses of the receiving waters, the impediments to controlling pollutant discharges, and compliance with water quality limited and effluent limitation requirements, based on the best available data and information. *In every instance, the reason a segment is designated as WQLS is the high mass pollution emissions discharged by nonpoint sources* (DOH 1993a, p. VIII-3).

Section 319, added to the Clean Water Act in 1987, specifically addresses nonpoint sources. It requires each state to identify navigable waters which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain state water quality standards. Since nonpoint source pollution is the reason for designation of specific waterbodies as WQLSs, all waterbodies to be identified under the Section 319 requirement in Hawaii are WQLSs.

The WQLSs identified by DOH in 1973 to meet the requirements of Section 303(e) of the Federal Water Pollution Control Act of 1972, were later incorporated into State of Hawaii reports required by Section 305(b) of the Act. These biennial 305(b) reports are the mechanism by which states report on the status of their water quality. The report describes the nature and extent of state water pollution and, along with other requirements, identifies WQLSs. Hawaii's most recent 305(b) report identifies 14 WQLSs in the State. Since the report was published, West Maui and Kihei have been designated by the DOH as the 15th and 16th WQLSs

because of the macroalgae blooms that have occurred in the nearshore waters (DOH 1993a, p. VIII-5).

The 16 segments were selected by DOH from areas where the State had sufficient information to make judgments about water quality. Two levels of assessments were used: segment identification based on ambient water quality monitoring, and segment identification based on other information. Areas which are not identified as WQLSs are identified as ELSs and are assumed to meet or will likely meet applicable water quality standards after point source discharge controls are applied. Table IV-1 provides information regarding types and sources of pollutants for the 16 recognized WQLSs.

TABLE IV-1
Type and Sources of Pollutants Affecting
Water Quality Limited Segments

Segment/ Location	***Frequently Violated Parameters or Expected Violation***	***Major Source Contributing to Violation***
Ala Wai Canal Oahu	all parameters except dissolved oxygen (including floatable, visual objects)	urban runoff, storm drains, construction dewatering
Hanapepe Bay Kauai	total phosphorus, total Kjeldahl nitrogen, turbidity	stormwater runoff (major river), agriculture
Hilo Bay Hawaii	nitrate-nitrite N, total Kjeldahl nitrogen, coliform bacteria	natural groundwater flow, sediment resuspension, cesspools
Honolulu Harbor Oahu	total Kjeldahl nitrogen total phosphorus, turbidity	industrial, stormwater, residential runoff
Kahana Bay Oahu	turbidity, suspended solids, nitrogen	stormwater, residential runoff
Kahului Bay Maui	total Kjeldahl nitrogen, phosphates, suspended solids, turbidity	industrial, commercial, urban stormwater runoff
Kaneohe Bay Oahu	turbidity, suspended solids, nutrients (South Bay)	stormwater, urban runoff, small farms, nutrient cycling
Keehi Lagoon Oahu	turbidity, suspended solids	stormwater, urban runoff, industrial runoff

TABLE IV-1 (continued)
Type and Sources of Pollutants Affecting
Water Quality Limited Segments

Segment/ Location	*Frequently Violated Parameters or Expected Violation*	*Major Source Contributing to Violation*
Kihei Maui	nitrate-nitrite N, total Kjeldahl nitrogen, ammonia nitrogen	stormwater runoff, agricultural, natural groundwater flow
Kewalo Basin Oahu	nitrogen, phosphorus, turbidity, suspended solids	stormwater, urban runoff, commercial runoff
Nawiliwili Bay Kauai	nitrate-nitrite N, Kjeldahl nitrogen suspended solids	stormwater runoff natural (mangrove), turbidity, agricultural runoff
South Molokai Maui	phosphates, nitrate-nitrite N, turbidity, suspended solids	wind/water erosion, stormwater, agricultural runoff
Pearl Harbor Oahu	phosphorus, nitrogen, turbidity	stormwater runoff, agricultural, construction
Waialua-Kaiaka Bay, Oahu	total phosphorus, total Kjeldahl nitrogen, nitrate-nitrite N	agricultural, stormwater runoff
Waimea Bay Kauai	turbidity, suspended solids, total phosphorus, chlorophyll a, nitrate-nitrite N	erosion (major river flows), agricultural runoff, resuspension of bottom deposits
West Maui Maui	nitrate-nitrite N, total Kjeldahl nitrogen, ammonia nitrogen	stormwater runoff, agricultural, natural groundwater flow

Source: INALAB, Inc. 1992, with addition of West Maui and Kihei per DOH action.

Originally, the WQLSs were given rankings based on "recoverability." That is, the segment which was thought to be the most difficult to address was ranked the highest. In 1988, following a thorough review by the DOH's Water Quality Standards (Technical) Advisory Committee, all segments were ranked again based on the value and importance of the segment and its prognosis for improvement. The highest "value and importance" ranking was given to waterbodies which are frequently used and are therefore more likely to pose a

potential threat to human health. Segments were also categorized as belonging to one of the following groups, reflective of their "prognosis for improvement":

- segments that are perceived to be amenable to improvement;
- segments that may be amenable to improvements; and
- segments that, for all practical purposes, are unlikely to show significant improvement.

Rather than assigning rank numbers to specific segments, segments have instead been placed in groups according to their usage characteristics and amenability to improvement:

<u>High use areas amenable to improvements</u>
- Hilo Bay, Hawaii
- Kaneohe Bay, Oahu
- Keehi Lagoon, Oahu

<u>Medium use areas which are amenable to improvements</u>
- Hanapepe Bay, Kauai
- Waimea Bay, Kauai
- Waialua-Kaiaka Bay, Oahu
- South Molokai, Molokai
- West Maui, Maui
- Kihei, Maui

<u>Areas which may be amenable to improvements</u>
- Ala Wai Canal, Oahu
- Honolulu Harbor, Oahu
- Kewalo Basin, Oahu
- Pearl Harbor, Oahu
- Kahului Bay, Maui

<u>Areas where improvements would be difficult to attain</u>
- Nawiliwili Bay, Kauai
- Kahana Bay, Oahu

DOH notes that the ranking system is subject to correction as a result of future monitoring data and better information on nonpoint source pollution (DOH 1993a, p. VIII-6).

Hanauma Bay and Kawela Bay on Oahu, and Hanalei Bay on Kauai, have been identified for consideration as future WQLSs. These segments are suspected to experience frequent violations of water quality standards due to nonpoint sources of pollution; thus, these are "threatened" waterbodies. Additional information is needed, however, to confirm the classification of these segments as "impaired" WQLSs.

A summary description of each of the 16 WQLSs identified by DOH and the reasons they are so identified follows. The information for Oahu is taken from the

1990 update of the City and County of Honolulu's "208" Plan, while the information for the Neighbor Islands is taken from the 1993 report updates. New information from studies not included in the Plans is provided, as appropriate. This list will be revised when DOH updates its Section 303(d), CWA, list of impaired waterbodies. In January 1996, DOH began soliciting nominations from the public for impaired waterbodies, and conducting an assessment on each nominated waterbody.

(i) OAHU:
The following descriptions of the WQLSs on Oahu are based on information contained in the *Water Quality Management Plan for the City and County of Honolulu* prepared jointly by the City Department of Public Works and DOH (C&C of Honolulu 1990), supplemented by information from the DOH's *Hawaii's Assessment of Nonpoint Source Pollution Water Quality Problems* (DOH 1990a). There are eight WQLSs on Oahu. The segments include most of the embayments and estuaries on Oahu except Hanauma Bay, portions of Maunalua Bay, and Barbers Point Harbor. The City and County of Honolulu has developed specific information on each of the segments, including the frequently violated parameters and sources of pollutants.

Kahana Bay - Kahana Bay is a drowned river valley, located on the northeast coast of Windward Oahu. Its boundary is the 30-foot depth contour from Mahie Point to where the 30-foot and 18-foot contours converge. One mile of Kahana Stream is also included. The bay has a total area of 294 acres (DOH 1990a, p. V-7). The Kahana State Park, with an area of 7.96 square miles, covers almost the entire drainage area of 8.33 square miles. The offshore boundary of the segment extends from Mahie Point northward to the 30-foot depth contour, then westward along the 30-foot contour following northward until the 30-foot and 18-foot contours converge to meet the shoreline (C&C of Honolulu 1990, p. 8-16).

Kahana Bay is a natural embayment, used for swimming, boating, and other water recreational sports (C&C of Honolulu 1990, p. 8-16). It is an example of a waterbody where natural events have a greater influence on water quality than human activities. The entire valley is a State Park. It is essentially a pristine area, with only limited development at the lower end of the valley (DOH 1990a, p. V-7).

There are no point source discharges into the bay. Several native Hawaiian families are living in Kahana Valley and are served by residential cesspools. The resident population is estimated to be 130 people living in 30 households. Currently, most of the families living in the valley are in the process of building new homes out of the flood plain. These homes will have septic tanks and leach fields. The existing cesspools will be eliminated. Public convenience stations are located in the State Park and the City Beach Park and discharge wastes into cesspools. Sediments and nutrients are transported into the bay by Kahana Stream and overland routes (C&C of Honolulu 1990, p. 8-18).

Total freshwater runoff into the bay is estimated at 30 million gallons per day (mgd). Of the eight parameters tested by the DOH at its monitoring station, five

parameters have values exceeding the maximum criteria allowed for that parameter. Major violations have been found for ammonia nitrogen, total nitrogen, total phosphorus, turbidity, and chlorophyll (C&C of Honolulu 1990, p. 8-16). The high levels of nitrogen and phosphorus are primarily due to the lush vegetative growth in the valley and the stream estuary. According to a 1977 study, the increase of solids concentration is attributable to tidal flux and overland flows. Increases in nutrient levels are attributed to 1) accumulation from overland flows; 2) release through sediment desorption; and 3) products of biological decay of organic matter. The low velocity of flows in the bay allow deposition of sediment with absorbed nutrients and for desorption to occur (C&C of Honolulu 1990, pp. 8-16 and 8-18).

Kaneohe Bay - Kaneohe Bay is the largest embayment in the State of Hawaii with a surface area of 18 square miles. It is 7.9 miles long and 2.6 miles wide and has a volume of 70,263 million gallons. Mean depth is 27 feet. The land area of the basin is 40 square miles and average stream flows are 64 mgd. Subareas of Kaneohe Bay include Heeia Boat Harbor, Kaneohe Yacht Club, and Kaneohe Marine Corps Air Station Harbor. The water quality limited segment boundary extends northwestward from Pyramid Rock along the 18-foot depth contour to Chinaman's Hat, and westward to Kualoa Point (C&C of Honolulu 1990, p. 8-19).

Historically, Kaneohe Bay teemed with marine life. Major problems arose as a result of the introduction of hoofed animals, and more significantly, because of the extensive farming of pineapple prior to 1940. Pineapple cultivation caused extensive sedimentation of the bay. Also the bay itself was severely stressed by a massive (about 11 million cubic yards) coral reef dredging between 1939 and 1942 as part of seaplane landing area construction. Most of this material was used for landfill in the bay, primarily at what is now known as the Kaneohe Marine Corps Air Station. The bay was again stressed by the construction of a sewage disposal outfall in the center of the south bay which introduced unnaturally large amounts of nutrients. Following these stresses came urbanization in the late 1950s through the 1970s. One major problem was uncontrolled grading which exacerbated the stresses of erosion and sedimentation from pineapple cultivation, and brought new sediments to the bay. It is now well documented that major inflows of freshwater from high intensity rainfall can build up in the bay, creating a lens which can reach up to 5 feet in depth floating on the surface of the bay. Runoff problems are compounded by channelization in the watershed, the paving over of formerly permeable surfaces in the basin, and the filling and loss of wetlands and fishponds along the shores, which acted in the past to detain stormwater runoff.

The bay has shown improvement in water quality over the past decade, and today is somewhat stabilized. Elimination of all municipal effluent discharges into the bay has been accomplished. There is still one small private sewage treatment plant (STP) in the upper Kaneohe Stream watershed at Hawaii Pacific University's Hawaii Loa campus. The effluent from the STP is used for spray irrigation or discharged into injection wells. The only other injection well in the basin is at Kualoa Park. Most of Kaneohe, Ahuimanu, and Kahaluu are served by municipal sewers, but the rural areas from Ahuimanu to Waikane are still

being served by household cesspools. The estimated number of cesspools in the drainage basin prior to Kahaluu's sewer development in 1995 was 2,880, serving a population of 10,160 people. Since Kahaluu has been sewered, there are approximately 270 remaining cesspools in the Waiahole and Waikane areas (C&C of Honolulu 1990, p. 8-21).

There has been a dramatic decline in phosphorus and turbidity since 1979, when sewage discharge was diverted from the bay (C&C of Honolulu 1990, p. 7-6). The termination of sewage discharges and better management of construction activities have resulted in improved survival of some species of coral and other organisms. However, urban runoff continues to be a major source of pollution to the bay (DOH 1990a, p. V-10).

DOH maintains five water quality monitoring stations in the Bay: two onshore stations and one station each in the south, middle, and north sectors. The parameters frequently violated are turbidity and nitrogen during winter storms. The major sources affecting turbidity and suspended solids parameters are natural runoff, urban stormwater, and small farming. The same sources plus winter storms affect the nitrogen parameters. Direct groundwater seepage into the bay is estimated to be 60 mgd and storm runoff, 40 mgd (C&C of Honolulu 1990, p. 8-19).

Runoff from the numerous streams during winter storms conveys large quantities of silt and other material which settle into the bay. The entire bay is affected by suspended particles, especially in the southern section of the bay where the residence time with respect to the ocean has been estimated to be almost 24 days. Estimates of sediment loading into Kaneohe Bay from storm runoff range from 33,000 to 131,000 tons per year (C&C of Honolulu 1990, p. 8-22).

Ala Wai Canal - The Ala Wai Canal is a manmade canal extending southeast by northwest from Kapahulu Avenue to Ala Moana Park. The Ala Wai Boat Harbor is located at the mouth of the canal. The canal was completed in 1929 to reclaim marsh lands fed by the perennial Manoa and Palolo streams and to control mosquitoes. The marsh, located in what is now the McCully-Kapiolani District, consisted of taro patches, rice paddies, and duck and fish ponds. The canal was originally dredged to Kewalo Basin, and then out to the sea. Later in the 1950s, the present channel at the Ala Wai Boat Harbor was dredged and the channel along Ala Moana Park was filled in (C&C of Honolulu 1990, P. 8-22).

The canal is 9,770 feet long. Its width varies from 160 to 260 feet and depth from -15.0 feet to -6.0 feet. The area of the canal and boat harbor is 126 acres. The water quality limited segment includes the entire length of the canal, the boat harbor, and the boat channel to the 30-foot depth contour. The harbor is recognized as an embayment. A portion of the canal is an estuary (C&C of Honolulu 1990, p. 8-22).

The principal drainage area is 12.3 square miles in size. Other drainage areas are: Waikiki-Kapahulu, 0.73 square miles; Makiki District, 2.57 square miles; and Ala Moana-Kalia, 0.71 square miles. The entire drainage area consists of 16.28 square miles. In addition, the Piikoi-Pensacola drain, serving an area of

0.75 square miles discharges about one half of its peak discharge of 1,260 cubic feet per second (cfs) into the Ala Wai Boat Harbor. The other half is discharged into Kewalo Basin (C&C of Honolulu 1990, p. 8-22).

Extensive field measurement programs to assess the physical, biological, and water quality conditions of the canal were undertaken in 1992 as part of the Ala Wai Improvement project. The programs included a bathymetry survey, current measurements within the canal and the nearshore coastal areas, a dye flushing test, tidal measurements, and biological and water quality surveys (Edward K. Noda & Associates 1992a, p. v).

The major contributions come from erosion in the forest reserve areas at the upper end of Manoa Valley; groundwater inflow; storm runoff from residential and commercial developments; direct runoff from Ala Wai Field, Park, and Golf Course; dumping of household and yard wastes into the Manoa and Palolo streams; and two minor point source discharges, washwater from the Ala Wai Marine Railway dry dock operation (only under emergency conditions), and 2.60 mgd discharge of warm water from the air conditioning system of the Yacht Harbor Condominium. The entire drainage area is served by municipal sewers except for the Crater Road area of West Kaimuki and Makiki-Puowaina. These areas have household cesspools and serve an estimated population of 1,341 people (C&C of Honolulu 1990, p. 8-24).

The Ala Wai serves as a sedimentation basin for its tributary streams and receives storm runoff from Manoa, Palolo, Makiki, Waikiki and other areas. The average stream flow into the canal is estimated to be between 20-30 mgd. Sediments are deposited in the Ala Wai Canal because the low flow velocity in the canal is less than the settling velocity of the sediment. Large quantities of sediment are believed to be generated in the watershed areas by natural erosion process. The canal was dredged by the City in 1966 and again by the State in the late 1970s (C&C of Honolulu 1990, p. 8-24). From the results of present and past studies of sediments in the canal, it is estimated that the rate of siltation has been relatively consistent at 9,000 to 11,000 cubic yards per year (Edward K. Noda & Associates 1992b, p. 4). Without the canal, much of this sediment would be released into coastal waters.

As the collecting point for the Makiki, Manoa, Palolo, and Kapahulu watersheds, the canal accumulates sediments, nutrients, some heavy metal contaminants, and solid waste trash. As a result, water in the canal is discolored by phytoplankton growth, suspended sediments, and visually objectionable trash. In addition, some incidences of bacterial infections have been reported (Edward K. Noda & Associates 1993, p. 2-6). Water circulation from the point where the Manoa Stream meets the canal to the end of the canal near Kapahulu is poor. Floating debris collect under the *makai* side of the McCully Street Bridge, creating an unsightly mess.

The *Ala Wai Canal Improvement Feasibility Report* (Edward K. Noda & Associates 1992a) recommends the injection of 20 to 30 cfs of sea water into the Kapahulu end of the canal from either deep water wells or via a pipeline from the

ocean. This small amount of additional water would increase the flow sufficiently to disrupt phytoplankton growth and restore clarity to the canal. A *Management Plan for the Ala Wai Canal Watershed* (Edward K. Noda & Associates 1992b) contains recommendations to reduce the amounts of trash, debris, and other pollutants entering the canal. *A Maintenance Plan for the Ala Wai Canal* (Edward K. Noda & Associates 1992c) recommends that dredging be done as soon as possible to prevent flooding, and at shorter intervals and different places in the future, to maintain water quality in the canal at lower costs. The dredging should take place before the seawater system is constructed.

Kewalo Basin - Kewalo Basin is a manmade harbor, approximately 78 acres in area. Constructed by the U.S. Navy in 1945, it is home port for the local tuna fleet, chartered sport fishing boats, and excursion craft serving the tourist industry. Facilities adjacent to the basin include the U.S. Fish and Wildlife Service (USFWS), University of Hawaii's Kewalo Look Marine Lab, and Ala Moana Park. The basin is surrounded by shopping centers, a major highway, and the light industrial areas, commercial shops and restaurants of Kakaako and Kewalo. Kewalo Basin is classified as an embayment. The water quality segment encompass the entire basin and channel out to the 30-foot depth contour (C&C of Honolulu 1990, pp. 8-25 and 8-26).

Low levels of dissolved oxygen and unsatisfactory levels of pH have been measured at the outlet of the Ala Moana Park drains to the northeast sector of the basin. It is suspected that allowable limits for the nitrogen, phosphorus, and turbidity parameters are exceeded during periods of heavy storm runoff. Circulation of water in the basin is hindered by its design. As a result, the urban pollutants that collect in the basin remain concentrated for extended periods (DOH 1990a, pp. V-11 and V-12).

The primary sources of pollutants entering Kewalo Basin are the drains collecting urban runoff from commercial, industrial, and residential sectors of Honolulu. There are seven drains of which three serve major facilities including Ala Moana Park drain (canal), Ward Avenue drain, and Kakaako drain. About one half of the peak discharge from Ala Moana Park canal enters Kewalo Basin, the other half drains into Ala Wai Boat Harbor (C&C of Honolulu 1990, p. 8-26).

There are two injection wells or seepage pits in the drainage area. The nature of the discharges is not known. Municipal sewers are available for the entire drainage basin. Street debris, oil, chemicals, nutrients, and heavy metals are transported by urban runoff into Kewalo Basin. There are no discharges of any sediments from streams since the drainage area is entirely urbanized (C&C of Honolulu 1990, p. 8-27).

Keehi Lagoon - Keehi Lagoon, with an area of 1,116 acres, is the largest lagoon in the State. It is located in a heavily industrialized area between Kapalama-Sand Island and Honolulu International Airport in the east-west direction. The Mapunapuna and Shafter Flats industrial parks and the Middle Street interchange of H-1 are located to the north. Keehi Boat Harbor and Keehi Marine Drydock are located along the Kapalama shoreline and serve boating and sailing

interests. Kalihi Stream from the northeast and Moanalua Stream from the northwest meet at the head of the lagoon at Keehi Lagoon Beach Park. Keehi Lagoon is classified as an embayment; Keehi Harbor and Keehi Drydock Boat Harbor are classified as shallow draft recreational harbors. The water quality segment encompasses the entire lagoon to the 30-foot depth contour (C&C of Honolulu 1990, p. 8-27).

The lagoon is used intensely for nehu bait fishing, crabbing, water skiing, recreational fishing, and other water contact sports. Boating activities are especially heavy during weekends and holidays. A boat washing facility is part of the boat harbor (C&C of Honolulu 1990, p. 8-27).

Although circulation in Keehi Lagoon is good, it regularly experiences violations of water quality parameters for phosphorus and turbidity. Currents may transport polluted waters from Honolulu Harbor into the lagoon and recirculate suspended matter within it (DOH 1990a, p. V-11). Other pollutant sources are sediments deposited in the lagoon by Moanalua and Kalihi streams; storm runoff from industrial areas of Mapunapuna, Shafter Flats, Kapalama, and Kalihi Kai; and the resuspension of settled sediments in shoals by boating activities (C&C of Honolulu 1990, pp. 8-27 and 8-28).

The elimination of the municipal and U.S. Army raw sewage discharges in nearshore waters off Sand Island and the airport outfall of Ahua Point have greatly improved water quality in the lagoon. The number of cesspools receiving commercial and industrial wastes in the Mapunapuna and Kapalama areas is not known. Considering the number of lots in the tracts, the number of cesspools could amount to 150. There are at least three or more injection wells within the airport area. Young Laundry discharges 0.48 mgd of laundry wastes in its airport well (C&C of Honolulu 1990, p. 8-28). The Honolulu Airport Fueling Facility at the airport has an emergency discharge permit. The discharge of industrial wastes from Hawaiian Construction & Dredging Sand Island Plant into the lagoon is considered a minor discharge and is limited to 0.01 mgd (C&C of Honolulu 1990, p. 8-28).

Nutrients, plant cuttings, and sediment loads are discharged in Keehi Lagoon by Kalihi and Moanalua streams. In residential areas, plant cuttings and yard debris are frequently dumped in the stream channel and reach the lagoon. Policing of illegal dumping is difficult because it can occur at any time (C&C of Honolulu 1990, p. 8-28).

Honolulu Harbor - Honolulu Harbor is the largest commercial deep draft harbor in the State. The harbor is crescent shaped, with a water surface area of 537 acres. It is about 2 miles long and from 600 to 2,900 feet wide. Coral reefs and Sand Island, a 500-acre manmade island, protect the harbor from the open ocean. Goods and freight processed at the harbor cover the entire spectrum, from pineapple and cattle to automobiles and petroleum products. The harbor handles over 11 million tons of cargo annually (C&C of Honolulu 1990, p. 8-30).

Honolulu Harbor is classified as an embayment. The water quality segment encompasses the entire harbor from Keehi Lagoon to the Fort Armstrong main channel entrance to the 30-foot depth contour (C&C of Honolulu 1990, p. 8-30). Both Nuuanu and Kapalama streams discharge into the harbor. Nuuanu Stream extends from Pier 15 to its watershed area at the Koolau Range. The drainage area of 8.4 square miles consists of industrial, commercial, and residential developments. Kapalama is an interrupted stream with a drainage area of 2.6 square miles (C&C of Honolulu 1990, p. 8-31).

The most frequently violated parameters are total nitrogen, total phosphorus, turbidity, dissolved oxygen, and pH. Prior to about 1972, the pineapple canneries and Gasco discharged 10.3 mgd of industrial wastes into Kapalama Canal and Honolulu Harbor. The BOD load was equivalent to a raw sewage discharge from 150,000 people. Since that time, the wasteload into Kapalama has been limited to the discharge of thermal water. The current flow from Hawaiian Electric Company's Honolulu Power Plant is 304 mgd (C&C of Honolulu 1990, pp. 8-30 and 8-31).

Although municipal sewers are available, DOT maintains its own sewers within the docks and piers in some areas. Between Piers 19 and 29, DOT maintains several cavitette systems. The effluents are discharged into cesspools. Because the systems are failing, DOT plans to eliminate the cavitette-cesspool systems and redirect the flows to the municipal sewers (C&C of Honolulu 1990, p. 8-31).

Studies of the harbor indicate that nitrogen, phosphorus, and turbidity levels in the water regularly exceed State water quality standards. Significant levels of copper, zinc, chromium, nickel, lead, chlordane, and dieldrin have been identified in DOH sampling (DOH 1990a, p. V-6). Pollutants enter the harbor mainly from nonpoint sources. Kapalama Stream (canal) discharges into Kapalama Basin at Pier 39, and the larger Nuuanu Stream enters the main basin at Pier 15, upstream of Pier 11. Storm drain outlets discharge into the harbor throughout the periphery of the harbor (C&C of Honolulu 1990, p. 8-31).

Most of the sediments deposited in Honolulu Harbor comes from Nuuanu and Kapalama streams. No data are available, but the U.S. Army Corps of Engineers (USACOE) estimated that 50,000 cubic yards of sediments are discharged in the harbor each year from all sources. According to USACOE, the sediments are composed of high percentages of land derived silty clays and a small percentage of sand. The harbor is dredged at about five year intervals (C&C of Honolulu 1990, p. 8-32).

Pearl Harbor - Pearl Harbor is the State's largest harbor. The naval shipyard, maintenance supply center, public works center, ammunition depot, and other ancillary facilities are located around the harbor. It is headquarters for CINCPAC and the 14th Naval District. The harbor consists of East Loch, Middle Loch, West Loch, and Southeast Loch and Ford Island, and has a water surface area of about 8 square miles. More than 12 miles of docks and four drydocks are available for ship repairs (C&C of Honolulu 1990, p. 8-34).

Pearl Harbor is classified as a developed estuary. The segment area include the entire harbor and the mouths of perennial streams discharging into the harbor. The offshore boundary of the segment extends to the 30-foot depth contour between the Reef Runway to Oneula Beach (C&C of Honolulu 1990, p. 8-32).

By its geologic origin, Pearl Harbor has been the "sink" of the southern coastal plain of Oahu. Its three lochs represent the drowned valleys of three major stream systems. These "valleys" have been altered in shape by marine erosion and sediment. The most drastic changes to the harbor are those which occurred during and after World War II (DOH 1990a, p. V-14).

Five streams -- Halawa, Aiea, Kalauao, Waimalu, and Pearl City -- are tributary to East Loch. Waiawa enters Middle Loch, and Waikele and Honouliuli drain into West Loch. The drainage area for the lochs are 23.7, 26.4, and 60 square miles, respectively, for a total of 111 square miles (C&C of Honolulu 1990, p. 8-32).

Beneficial uses identified for Pearl Harbor include bait fish and shellfish propagation in West and East Lochs, shipping, navigation, industrial water supply in East Loch, and water fowl habitat in Middle and West Lochs (C&C of Honolulu 1990, p. 8-34).

The major spring complex seeping into the harbor includes Kapakahi Springs (3.0 mgd) into West Loch; Waiawa Spring (9.1 mgd) and Wailani Spring (1.1 mgd) into Middle Loch; and Kalauao Spring (15.8 mgd) and Waiau-Waimano Spring (13.2 mgd) into East Loch. The total average fresh water discharge from spring and streams into the lochs is 35.8, 28.2, and 45.3 mgd, respectively, or 109.3 mgd for the harbor (C&C of Honolulu 1990, p. 8-34).

There are five point source discharges within the harbor operated by the U.S. Navy and one (Fort Kamehameha STP) discharging at the main ship channel. The Fort Kamehameha discharges include the supernatant from the Industrial Waste Treatment Plant. Flows from Pearl City Fuel Annex, Shipyard Drydock, and the three air compressor plants are intermittently discharged to the harbor (C&C of Honolulu 1990, p. 8-36). The two nonmilitary point sources, Waiau Power Plant, and the C&H Sugar Refinery at Aiea Heights, discharge thermal water. Most of the urban areas between Aiea-Halawa and Waipahu are served by municipal sewers. The number of household cesspools in Aiea-Waiau and Waipahu is estimated to be 400 (C&C of Honolulu 1990, p. 8-36).

The parameters that are frequently violated in Pearl Harbor include nitrogen, phosphorus, turbidity, fecal coliform, temperature, and chlorophyll a. The last dredging of Pearl Harbor was undertaken in 1979. In 1986, USACOE estimated that 257,000 cubic yards of bottom sediment in Middle Loch needed to be dredged (C&C of Honolulu 1990, p. 8-37).

Waialua-Kaiaka Bay - This WQLS includes two adjacent waterbodies on the North Shore of Oahu. Kaiaka Bay is classified as an embayment, while the much broader Waialua Bay is classified as marine waters. Haleiwa Boat Harbor, located at the original mouth of Anahulu River, is also an embayment. The

WQLS's boundary extend westerly from Puaena Point to the 60-foot depth, then along the 60-foot depth contour towards Kaena Point past Kaiaka Bay, then southwest toward the shore at Kaimana Place (C&C of Honolulu 1990, p. 8-39).

Both bays receive drainage from major streams. The Poamoho and Kaukonahua streams are tributaries of Kiikii Stream which flows into Kaiaka Bay together with Paukauila Stream which includes Helemano and Opaeula streams. The area of the drainage basin is 79.8 square miles and extends eastward to the Koolau mountain range and southward to the Waianae mountain range (C&C of Honolulu 1990, p. 8-39).

Leakage of fresh water through caprock into Opaeula, Helemano, Poamoho, and Kaukonahua streams and the bay is estimated to be 7.05 mgd. Peak storm flows (100 year storm) estimated for Kiikii Stream are 39,000 cfs; and for Paukauila Stream, 18,700 cfs. As much as 70% of the streams are diverted to over 30 plantation reservoirs (C&C of Honolulu 1990, p. 8-39). Anahulu River and its tributaries (Kawaiiki and Kawainui streams) discharge into Waialua Bay. At Waialua Bay, Anahulu River has a drainage area of 16.0 square miles and a 100-year peak discharge of 16,200 cfs. Fresh water leakage through the caprock into Anahulu River and into the bay is estimated to be 4,79 mgd (C&C of Honolulu 1990, p. 8-39).

Data collected at the DOH monitoring station indicate that the maximum criteria of most parameters are exceeded except for dissolved oxygen. Most noteworthy are total phosphorus, nitrate and nitrite nitrogen, chlorophyll a, and turbidity (C&C of Honolulu 1990, pp. 8-39 and 8-41). The major sources of pollutants discharging into the embayments are sediments from the drainage basins, household cesspools, injection wells from treatment plants, and a point source discharge of thermal water. There are 13 private STPs and one municipal wastewater treatment plant (WWTP) in the Waialua and Haleiwa communities. The effluents from these plants are discharged into seepage pits or injection wells. Combined flows from the plants are 0.141 mgd. The Waialua Sugar Company discharges 14.0 mgd of thermal water into Kiikii Stream near Waialua Beach Road (C&C of Honolulu 1990, p. 8-41).

There are 2,312 household cesspools in the Waialua and Haleiwa area, serving a population of 7,232 people. The estimated 0.578 mgd discharge into the groundwater eventually reaches the coastal waters. The 0.310 mgd effluent from the Naval Communication Center, Wahiawa, is discharged in Poamoho Gulch and eventually reaches Kaiaka Bay (C&C of Honolulu 1990, p. 8-41). Areas of cesspools in Waialua and Haleiwa will be served by municipal sewers in the future and private STPs and the Paalaa Kai will be eliminated, with flows diverted into the City system (C&C of Honolulu 1990, p. 8-41).

(ii) MAUI:

The following descriptions of the WQLSs on Maui and Molokai are based on information contained in the Department of Health's *Assessment of Nonpoint Source Pollution* (DOH 1990a), supplemented by information from the *Water Quality Management Plan for the County of Maui* prepared jointly by DOH and

the County of Maui (DOH 1993c). There are four WQLSs in Maui County, three on the island of Maui and one on Molokai. The four WQLSs and their watersheds are described below.

Kahului Bay - Kahului Bay is located on the north coast of the Island of Maui between the slopes of two volcanoes, Haleakala and West Maui. It covers an area of 242 acres and is bounded by the breakwaters which extend from the west and east shores at about right angles to each other. Kahului Harbor is located on the southern portion of the Bay (DOH 1990a, p. V-8).

Drainage into Kahului Bay is largely in the form of runoff from the urban centers of Wailuku and Kahului. In addition, ship and barge traffic, the Kahului airport, lands used for sugarcane cultivation, and east portions of the West Maui mountains (forest land) contribute pollutants. No streams or springs enter Kahului Bay; however, a lens of less saline water resides on the surface of the bay. The presence of this lens suggests extrusion from basal groundwater sources (DOH 1990a, p. V-8).

State monitoring of Kahului Bay indicates that water quality standards for nitrogen, phosphorus, and turbidity are regularly exceeded. Incidents of bacterial contamination which result from cruise ship spills and storm drain outputs have been reported. For the most part, the waters of the bay are generally poor in quality (DOH 1990a, p. V-8). The powerful longshore current, which sweeps around the north tip of East Maui, likely affects the residence time of pollution in Kahului Bay. Waters at the mouth of the harbor are generally turbid, and underwater visibility is generally poor due to strong winds which keep waters turbulent and murky (DOH 1990a, p. V-8).

A number of activities occur in Kahului Bay. Kahului Harbor is the Island's main port. An estimated 98.9% of all goods coming into Maui are transported through Kahului Harbor. Harbor activities include ship operation and maintenance, oil handling and bunkering, warehousing, trucking, storage, stevedoring, marine repair, and limited drydocking (DOH 1990a, p. V-9). In addition, a cluster of hotels, beaches, the Kahului Breakwater Park, and a public boat ramp border the Bay. The bay's shoreline access is excellent. People fish along the piers, breakwaters, and the coast between the harbor and Nehe Point. Large surf breaks in the harbor during periods of North Pacific swells (DOH 1990a, p. V-9).

West Maui - The West Maui area was designated as a WQLS in 1992 primarily because of the algal blooms that have been occurring there and which are suspected to be caused by excessive nutrients from runoff. Violations in this area are all for nitrogen parameters -- total Kjeldahl nitrogen, nitrate-nitrite N, and ammonia nitrogen (DOH 1993c, p. VIII-13). A study now in progress includes the assessment and ranking of nutrient loads entering coastal waters from selected West Maui watersheds. A second study will investigate whether or not secondary-treated sewage effluent injected into disposal wells on land is discharging into nearshore waters with its nutrient loads intact (DOH 1993c, p. VIII-13).

Federal funds obtained by EPA and NOAA are being used to support a West Maui watershed coordinator, as well as additional applied research projects on the link between land use activities and surface and ground water quality. DOH will utilize its Geographic Information System to prepare maps and information layers for selected West Maui watersheds to provide an integrated view of activities contributing nutrient loads to adjacent coastal waters. DOH intends to incorporate the results from these projects into nutrient/sediment watershed management plans for West Maui and similar sensitive coastal areas throughout the State (DOH 1993c, p. VII-14).

Kihei - The Kihei WQLS was designated at the same time as West Maui, for the same reasons. Violations in this area are also similar: total Kjeldahl nitrogen, nitrate-nitrite N, and ammonia nitrogen (DOH 1993c, p. VIII-13).

South Molokai - The South Molokai segment is bounded by the 18-foot depth contour from Laau Point eastward to Pohakuloa and covers an area of 11,417 acres (DOH 1990a, p. V-15). The area which drains into South Molokai extends from Laau Point to Mauna Loa, then to Kualapuu, and ends just west of Kaunakakai. Streams within this area are perennial in their upper reaches and intermittent or nonexistent at the coastline. During heavy rains, however, these streams will fill with water, overflow their banks, and flood the entire southern coastline with turbid runoff. Runoff transported by these streams are generated from abandoned pineapple fields, cropland, pastures, a State highway system, a network of dirt roads, and the town of Kaunakakai. Of particular concern are the dirt pineapple field roads and poorly managed pasture land (DOH 1990a, p. V-15).

On Molokai, drought conditions and incessant strong winds reduce soil moisture, preventing the growth of adequate cover. When rains do occur, they are often intense and heavy, creating immense amounts of runoff which can transport sediments and pollutants. Flows into South Molokai are heaviest into the Palaau coastal plains located just west of Kaunakakai (DOH 1990a, p. V-15).

The waters of South Molokai are classified as open coastal waters. State monitoring of South Molokai shows significant violations of water quality standards for suspended solids and nutrients (especially orthophosphate). Suspended solids have been noted to exceed the standard by 100 times over (DOH 1990a, p. V-15).

Mudflats predominate on the island's south coast where there were once a large number of fishponds. Dense stands of mangroves limit offshore activity. Although water activities of the southern coast are minimal, the area retains value as an important wildlife area and supports park facilities (DOH 1990a, p. V-16). Parks and recreational facilities on Molokai's south shore include: Kakahaia National Wildlife Refuge, One Alii Beach Parks 1 & 2, and Malama Park.

(iii) KAUAI:

The following descriptions of the WQLSs on Kauai are based on information contained in the Department of Health's *Assessment of Nonpoint Source Pollution* (DOH 1990b) supplemented by information from the *Water Quality Management*

Plan for the County of Kauai prepared jointly by DOH and the County of Kauai (DOH 1993b). There are three WQLSs on Kauai. A description of the segments and their drainage areas follows.

Nawiliwili Bay - Nawiliwili Bay is located on the southeast coast of Kauai, two miles from Lihue. It is a well-developed embayment of 333 acres, bounded by an imaginary line from Kukii Point to the breakwater. It is formed by the confluence of three streams, Huleia, Puali, and Nawiliwili. Huleia is the largest stream, arising from the Waialeale-Kawaikini mountains in central Kauai. It flows through forest, agricultural, pasture, and other lands. The lower part of Huleia Stream widens into a significant estuary. Although the Nawiliwili and Puali streams drain flatter and less erosive lands they also contribute nonpoint pollutants. A rock quarry located on the Nawiliwili Stream is a major contributor of sediment to the bay (DOH 1993b, p. V-12).

Although there are no longer any point source discharges into Nawiliwili Bay, State monitoring shows that water quality standards for nitrogen and turbidity are regularly exceeded. These levels are suspected to be the product of vegetative growth along the river and seasonal input from storm water sources. Dense growths of *hau* and American (red) mangrove decompose and introduce considerable amounts of organic material into the bay. In addition, heavy rains transport silt and nutrients from sugarcane land into the bay and give it, at times, a brown color (DOH 1993b, p. V-13).

Nawiliwili Bay supports a deep draft commercial harbor and a small boat harbor with charter fishing operations. The bottom consists of fine sand and silt. Depths range from 70 to 100 feet; periodic dredging is required to maintain navigable depths in the harbor (DOH 1993b, p. V-13). Recreational activities include fishing and crabbing in the bay and adjoining Huleia River, and surfing and canoe paddling in the area fronting Kalapaki Beach on the north shore of the bay (DOH 1993b, p. V-14).

Hanapepe Bay - Hanapepe Bay is located on the southwest corner of Kauai, between Hanapepe and Port Allen. The boundary of the Hanapepe Bay segment extends along the 1,000 foot long breakwater on the eastern shore and the 30-foot depth contour to a point south of Pualo Point, enclosing 297 acres of water surface (DOH 1993b, p. V-3).

The Hanapepe River begins in forest uplands and travels through pasture and range land, sugar cane lands, and the small towns of ʻEleele, Port Allen, and Hanapepe. Hydrologic modifications have greatly affected the bay. Erosion of the western end of the one-half-mile-long beach at the head of the bay has been accelerated because of construction of a breakwater (DOH 1993b, p. V-3).

State water monitoring records indicate that the waters of the bay regularly exceed State standards for turbidity. Discoloration of the bay as a result of flood flow discharges is a common occurrence. However, the waters generally clear rapidly (DOH 1993b, pp. V-3 and V-4).

An important Hawaiian salt production area and salt marshes with great wildlife value are located on the east banks of the bay. Some commercial activity occurs at Port Allen in Hanapepe Bay but for the most part, activity in the bay is recreational. Activities include swimming, pole and line fishing, and small boating (DOH 1993b, p. V-4).

Waimea Bay - The Waimea Bay WQLS is located on the southeast coast of Kauai. It is bounded by the 18-foot contour from Oomano Point to Koki Point and includes the Waimea River and Kikiaolo Boat Harbor. It comprises 1,214 acres. Two rivers flow into the bay, the Waimea and the Makaweli. The lower course of the Waimea River is estuarine for approximately two miles (DOH 1993b, p. V-17).

Historically, three sugar mills discharged cane trash and wastewater into the coastal waters of southern Kauai. These discharges contained silt that were carried by ocean currents to Waimea Bay. Bagasse is now used as a fuel source and the mill wastewater is returned to sugar cane fields for irrigation. The only remaining discharges are of irrigation tailwater (DOH 1993b, p. V-17).

There are no water quality monitoring stations in the area. However, the inshore waters of Kekaha Beach are often observed to be turbid. This is caused by the redistribution of mud discharged from the Waimea River during flood seasons. A bottom sediment sample dredged at a depth of 180 feet offshore of the Waimea River mouth indicated thick mud deposits. If the muddy condition of Waimea Bay is found to be primarily due to resuspension of sediments, DOH will consider removing the designation of the bay as a WQLS (DOH 1993b, p. V-17).

There is a boat launching ramp at Kikiaola light draft vessel harbor. Uses of Waimea Bay include pole and line fishing, throw netting, board surfing, canoe paddling, limu gathering, gill netting, and torching (DOH 1993b, p. V-18).

(iv) HAWAII:

The following description of the WQLS on Hawaii is based on information contained in the DOH's *Assessment of Nonpoint Source Pollution* (DOH 1990a), supplemented by information from the *Water Quality Management Plan for the County of Hawaii* prepared jointly by the Hawaii State Department of Health and the County of Hawaii (DOH 1993a). Hilo Bay is the only WQLS on Hawaii.

Hilo Bay - Hilo Bay is located on the northeast coast of the Island of Hawaii. It is bounded by the 30-foot depth contour, from the tip of the 10,079-foot long breakwater to Paukaa Point, and covers an area of 1,788 acres. Included in the segment is the Waiakea Pond and Wailoa River (DOH 1990a, p. V-4).

Five natural discharges enter into the Hilo Bay segment: Wailoa River, Wailuku River, Pukihae Stream, Pohakaunanaka (intermittent stream), and Maili Stream. These rivers and their tributaries originate on the slopes of Mauna Kea and Mauna Loa, and drain forests, pasture and range land, agricultural fields, and urban areas. In the higher elevations, eucalyptus trees are raised. Cattle graze the Puu Oo area above the forest reserve and the mauka fringe of the city of Hilo. Sugar, the principal crop of the island, is grown in the Hilo Bay watershed

along the rural areas north of Hilo along the Belt Highway. A major agricultural change is the conversion of 8,000 acres of sugar cane land to macadamia nut orchard. Cattle, hogs, poultry, vegetables, flowers, and landscaping plants are also grown in the area surrounding Hilo. Urban areas which drain into the bay include Hilo's parks, business and residential zones, infrastructure, and harbor (DOH 1990a, p. V-4).

The Wailuku (300 mgd) and Wailoa rivers (100 mgd to 300 mgd), compose the major discharges or water and sediment to the bay. It is estimated that in 1979, the Wailuku River discharged over 36,900 tons of suspended sediment (DOH 1990a, p. V-4). Large surface and subsurface flows enter the bay and form a fresh water layer on the surface of the bay. The vertical stratification which is maintained by the prevailing shoreward trade winds of the area prolongs the residence time of water in the bay and encourages the growth of phytoplankton in its upper fresh water layer. In addition, the slow seaward movement of the bay's lower waters are generally insufficient to flush out suspended silts from the bay. Silt and mud which accumulate contribute to the bay's turbidity (DOH 1990a, p. V-5).

Nutrient rich waters increase the growth of microscopic life and algae which enter as both surface and subsurface flows, contributing to the turbidity of the bay. Nutrient rich flows include the surface flows of the Wailoa River as well as subsurface flows from sources near Reeds Bay, Coconut Island, and the Keaukaha area. Subsurface flows contribute flow volumes as high as 200 mgd.

State monitoring of water for Hilo Bay shows frequent violations of water quality standards for nitrogen, phosphorus, and turbidity. In 1978, Hilo Bay was included as a survey site for a DOH study on the occurrence of heavy metals, chlorinated pesticides, and polychlorinated biphenyls (PCBs) in the Hawaiian environment. The study found exceptionally high levels of arsenic in sediments in Hilo Bay and, in particular, from Waiakea Pond. Other contaminants found in Hilo Bay included lead, zinc, chromium, chlordane residues, and PCBs (DOH 1990a, p. V-5). Despite these high levels, however, there is no indication of any health hazard.

The high levels of arsenic in the bay and in Waiakea Pond have resulted from waste discharges containing arsenic trioxide, a compound used to treat fiber boards to prevent termite damage at the former Hawaiian Cane Products plant. Sediment core samples taken in Waiakea Pond, at the former site of the plant, have been found to contain the highest levels of arsenic. Hilo Bay sediments, however, show considerably lower arsenic levels from the entrance of the Wailoa River to the outer parts of the harbor.

Hilo Bay is also affected by seepage from cesspools. Water quality analyses conducted by DOH in the Waiakea and Ice Ponds have shown high counts of fecal coliform in the past. As the sewer system is expanded and cesspool use is discontinued, water quality in these and similar areas is expected to improve (DOH 1993a, p. X-4).

A recent study focused on sewage pollution in the bay. The study confirmed DOH monitoring results and notes that Hilo Bay, its estuaries and adjacent marine waters are subject to chronic nonpoint source sewage pollution. The data in the study report indicate that high bacterial counts are not the result of sewage treatment plant failures but rather sewage contained in freshwater runoff, with the ultimate source commercial and residential cesspools [Dudley and Hallacher (n.d.), pp. 32-34].

In spite of its water quality problems, Hilo Bay is an important wildlife and fishery area. Hilo Bay, in addition, is highly visible to residents and tourists and supports a fair amount of recreational boating (DOH 1990a, p. V-6).

1.e. Other Waterbodies That May Be Impaired or Threatened

As previously noted, DOH has identified Hanauma Bay and Kawela Bay on Oahu, and Hanalei Bay on Kauai, for consideration as future WQLSs. These segments are suspected of being subject to frequent violations of water quality standards due to polluted runoff. Additional information is needed, however, to confirm the classification of these segments as WQLSs.

As part of a national program to clean up and protect waterways across the country, EPA in 1989 required every state to conduct surveys and submit lists of those waters not meeting water quality standards for toxic substances. DOH compiled a list of 21 bodies of water that either showed evidence or were suspected of being contaminated. Chemical or metal pollutants, not bacteriological or organic contaminants, were the main concern. The waterbodies listed generally have high levels of commercial or industrial activity, or are in areas where runoff from urban or agricultural districts contribute to toxic substance problems (*Honolulu Star-Bulletin* 4 June 1989).

Fourteen of the 21 waterways listed in 1989 were then, and continue to be, designated as WQLSs. These have already been discussed. An additional four are subparts of already-designated segments, *e.g.*, Kapalama Canal, draining into Honolulu Harbor/Keehi Lagoon; Wailoa and Wailuku rivers, draining into Hilo Bay; and Waimea River on Kauai, emptying into Waimea Bay. Only three of the waterbodies identified as having problems in 1989 are not part of a WQLS: Kailua Bay, Wahiawa Reservoir, and Waimanalo Bay on Oahu. These are discussed below.

Kailua Bay - Kailua Bay has been the subject of some controversy. Several environmental groups -- Hawaii's Thousand Friends, Save Our Bays and Beaches, and the Sierra Club -- blame the two-mile long sewage treatment outfall off Mokapu Point for discoloration of the water in Kailua Bay and swimmers' illnesses, while the City and County of Honolulu blames nonpoint source pollution from Kaelepulu Steam and Kawainui Channel *(Windward Sun Press* 26 December 1991 to 1 January 1992).

A study of Kailua Bay conducted by the University of Hawaii Water Resources Research Center (WRRC) which began in July 1990 and continued through June

1993 took samples at 13 sites along Kaelepulu Stream and pond, at the Mokapu outfall, and at Kawainui Channel. Results indicate that deterioration of water quality along the beach at Kailua Bay is primarily affected by the streams. The polluted runoff comes from soil, nutrients, and wastes from the marsh and residences adjacent to the streams; storm drains; raw sewage from sewer breaks and emergency bypasses from the Enchanted Lake emptying into Kaelepulu Stream; and feces from birds in the wetlands (*Honolulu Star-Bulletin* 6 Feb. 1992; *Windward Sun Press* 9-15 April 1992).

Wahiawa Reservoir (Lake Wilson) - Waters from Kaukonahua Stream have been impounded in Wahiawa Reservoir (Lake Wilson) since 1906 by Waialua Sugar Company for the irrigation of its mauka sugar cane fields. The entire Kaukonahua Stream flow of 39 mgd from a drainage basin of 10 square miles is stored for irrigation. In addition to irrigation, the reservoir is used for recreation, fish propagation, and wastewater reclamation. The reservoir is a public fishing area and now supports natural population freshwater game fishes. In addition to channel catfish and tucunare, there are also large-mouth bass, small-mouth bass, bluegill sunfish and oscar, along with non-game species such as tilapia, carp, and others (C&C of Honolulu 1990, pp. 10-62 and 10-63).

Secondary treated effluent from Wahiawa WWTP has been discharged into the South Fork of the reservoir since 1928, and from Whitmore Village WWTP into the North Fork since 1968. Chlorination of the effluent from both plants is carefully monitored to prevent potential fish kills from chlorine residuals (C&C of Honolulu 1990, p. 10-63).

The quality of the effluent is excellent (C&C of Honolulu 1990, p. 10-61). However, a number of fish kills have occurred in the reservoir, especially during the summer months when the reservoir water level was low. The demand for irrigation water is greatest during the summer months when drawdown from the reservoir has been known to interfere with the reoxygenation capacity of the water. Consequently, low dissolved oxygen levels were contributing factors to anoxia of the fishes (C&C of Honolulu 1990, p. 10-63).

According to the DNLR's Division of Aquatic Resources, fish kills during high water levels did not occur prior to 1986. Since May 1986, there have been eight documented incidents of fish kills involving up to about 9,000 fishes. All of the fish kills have occurred in the immediate vicinity of the Wahiawa WWTP discharge. A toxic substance is suspected by the State, but the actual causal agent(s) remain unknown (C&C of Honolulu 1990, p. 10-63).

Studies by the WRRC for the City and County of Honolulu indicated that the reservoir may be in an eutrophic condition. The principal sources of nutrients are wastewater effluent and storm runoff on the ratio of 3 to 1. Sediments in the streams and reservoir serve as a sink for phosphorus under both aerobic and anaerobic conditions. Nitrogen is released from the sediment during anaerobic conditions. Surface nutrient concentrations are higher during low water levels due to lower dilution ratio, mixing, and resuspension of sediments (C&C of Honolulu 1990, p. 10-63).

A number of different treatment and diversion alternatives have been considered by the City to mitigate the impacts of the Wahiawa WWTP discharge into the reservoir, including additional treatment at the WWTP and diversion of the effluent outside of the reservoir. Although the additional alternatives would mitigate conditions in the reservoir, nutrient inflow will continue from urban runoff and sediment desorption. A total in-lake management program including mechanical aeration at the forebay basin at selected depths to promote vertical mixing of lake water, removal of nutrients from the lake by "biotic" harvesting of undesirable fishes such as tilapia and threadfin shad, and controlling fish population has also been considered (C&C of Honolulu 1990, pp. 10-64 and 10-65).

A major factor in resolving the water quality problems of Lake Wilson is the planned closure of Waialua Sugar Company. Lake Wilson is not considered to be State waters because its waters are used solely for irrigation water of the plantation. If the demise of the plantation occurs, the reservoir could be classified Class 2 inland water, with specific water quality criteria applicable for streams (C&C of Honolulu 1990, p. 10-67).

Waimanalo Bay - The Waimanalo Bay community has been concerned about water quality in the bay, particularly since 1991 when heavy rains caused Meadow Gold Dairies' wastewater containment facilities to overflow into Inoaole Stream which empties into the ocean at Bellows Beach. A lawsuit against the dairy resulted in a settlement that will fund a five-year monitoring project of water quality in the bay. Meadow Gold has since spent $1.3 million improving its wastewater containment facilities and budgeted and additional $300,000 to complete the project (*Honolulu Advertiser* 30 June 1993; *Windward Sun Press* 1-7 July and 22-28 July 1993).

WRRC has received grant funds to undertake a project that will assist the Waimanalo Neighborhood Board in developing a work plan for the Waimanalo Community Water Quality Project's five-year monitoring program (John Harrison, pers. comm., October 1993).

From the above descriptions, it is evident that further monitoring and information-gathering need to be carried out in order to determine whether any of the mentioned waterbodies or segments should be classified as a WQLS. For a number of the indicated waterbodies, the process of gathering the new information needed to make such a determination has already begun.

2. Identification of Land and Water Uses

Once threatened and impaired waters are identified, states must identify the land or water uses that "individually or cumulatively" cause or contribute to these coastal water quality impairments. The "preferred source" of information on the correlation between land or water uses and water quality is "refereed" technical journals, though other sources may be acceptable to fill gaps caused by a shortage of information. NOAA and EPA encourage states to use maps to display identified land and water uses.

Hawaii has not yet formally undertaken this task, though some of this information is likely available from a variety of sources.

3. Identification of Critical Coastal Areas

Next, Section 6217, CZARA, requires that states delineate critical coastal areas adjacent to threatened and impaired waters and where new or expanding land or water uses will contribute to a future threat or impairment of coastal waters. Areas already established under existing authorities may be suitable for designation as critical coastal areas. Critical coastal areas should be of sufficient size such that, when additional management measures are implemented in these areas, the reduction in nonpoint source pollution entering the adjacent waterbodies should enable these waterbodies to meet State water quality standards.

Hawaii has not yet undertaken this task.

4. Implementation of Additional Management Measures

Finally, once the land and water uses and critical coastal areas have been identified, states must describe and implement additional management measures applicable to those land or water uses and areas in order to address the sources of polluted runoff.

EPA and NOAA's *Program Development and Approval Guidance* identifies two categories of additional management measures: those to be implemented immediately and those to be implemented after the effect of implementing the (g) measures[1] is known.

For the waters identified as threatened or impaired, states must evaluate the relative contributions from point and nonpoint sources of pollution. If a problem is due to nonpoint sources, then the state should judge whether existing pollution prevention activities and/or the implementation of the (g) measures will be adequate to address the threat or impairment. If existing information indicates that the implementation of the (g) measures will not be adequate to address the sources, then those land or water uses or critical coastal areas are to be subject immediately to additional measures. Otherwise, the state should just monitor the effectiveness of the (g) measures and verify whether water quality standards are being attained or maintained and designated uses protected. If there is no significant water quality improvement after a sufficient schedule of monitoring (by 2006, according to recent EPA and NOAA guidelines), then the State will need to provide for the implementation of additional management measures.

[1](g) measures are those described in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* or comparable alternatives developed by the State. These management measures for Hawaii are described in Part III.

The State has not yet undertaken the task of evaluating the relative contributions from point and nonpoint sources of pollution, nor judged whether existing pollution prevention activities and/or the implementation of the (g) measures will be adequate to address the threat or impairment to coastal waters. Consequently, Hawaii will not describe additional management measures or develop a program to ensure implementation of the additional management measures at this time. These tasks will be completed as resources and staffing permit.

5. Technical Assistance

Section 6217(b)(4), CZARA, requires states to provide "technical and other assistance to local governments and the public for implementing" additional management measures. Technical assistance may include assistance in developing ordinances and regulations, technical guidance, modeling to predict and assess the effectiveness of measures, training, financial incentives, demonstration projects, and other innovations to protect coastal water quality and designated uses.

Hawaii intends not only to provide technical assistance relating to additional management measures, but also relating to the (g) measures or comparable alternatives developed by the State. Through its Clean Water Act Section 319 nonpoint source pollution control grants, Hawaii has been providing technical assistance to local governments and the public since 1987. That Section 319 grant program will continue as long as funding is provided by Congress and the State.

Technical assistance relating to additional management measures will be developed after additional management measures have been adopted.

PART V - PUBLIC PARTICIPATION

Section 6217(b)(5) of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 requires that states provide opportunities for public participation in all aspects of the program. Congress intended the public to have the opportunity to be extensively involved in both the development and implementation of coastal nonpoint pollution control programs.

1. Opportunities for Public Participation During the Program Development Process

Opportunities have been provided for public participation in all phases of development of Hawaii's coastal nonpoint pollution control program. The processes and activities used to provide for public involvement are described below.

a. Statewide Public Informational Meetings

(i) August-September 1993: The Hawaii Coastal Zone Management (CZM) Program, and the Department of Health's Polluted Runoff Control Program (DOH-PRC)[1], in cooperation with the local Natural Resources Defense Council (NRDC), organized public informational meetings in 1993 on nonpoint source pollution and Hawaii's coastal nonpoint pollution control program. At these meetings, the problems associated with polluted runoff were described, the Section 6217, CZARA, requirements were outlined, and opportunities for public involvement in the program development process were enumerated. The meetings were announced through press releases to local papers around the State and through flyers sent to agencies, organizations, and individuals compiled from a variety of mailing lists. Participants were provided with copies of "Section 6217 In a Nutshell," summarizing the EPA and NOAA guidance documents in a more "user-friendly" format. Emphasis was given to enabling people to get involved in the program development process from its very beginning.

Thirteen meetings were held around the State during the months of August and September 1993. Meetings were held in the following sequence (city, island):

Kona, Hawaii	August 2
Hilo, Hawaii	August 3
Mililani, Oahu	August 9
Ewa Beach, Oahu	August 10
Lihue, Kauai	September 7
Hanalei, Kauai	September 8
Lahaina, Maui	September 15
Wailuku, Maui	September 16
Lanai City, Lanai	September 21

[1]Department of Health's Nonpoint Source Pollution Control Program has changed its name to the Polluted Runoff Control (PRC) Program.

Kaunakakai, Molokai	September 22
Hawaii Kai, Oahu	September 23
Kaneohe, Oahu	September 28
Honolulu, Oahu	September 29

(ii) June 1995: In June 1995, a second round of public informational meetings was held to provide an update and progress report on the development of the State's coastal nonpoint pollution control program. In total, seven evening meetings were held on six islands:

Kahului, Maui	June 5
Lanai City, Lanai	June 6
Honolulu, Oahu	June 7
Kaunakakai, Molokai	June 13
Kapaa, Kauai	June 14
Kailua-Kona, Hawaii	June 19
Hilo, Hawaii	June 20

These meetings were publicized through display advertisements in the Sunday edition of the *Honolulu Advertiser/Star Bulletin* and major local newspapers. In addition, press releases were sent to the smaller newspapers and local radio stations.

(iii) January-February 1996: In January and February 1996, after the draft management plan had been released for public review and comment, seven evening meetings were conducted around the State to summarize the draft management plan's key recommendations and to provide people an opportunity to verbally comment on the draft plan. Both written and verbal comments have been responded to in this coastal nonpoint pollution control program management plan.

b. Presentations

Hawaii CZM Program, DOH-PRC, University of Hawaii Cooperative Extension Service (CES), Natural Resources Conservation Service (NRCS) staff have made numerous presentations around the State on nonpoint source pollution and the coastal nonpoint pollution control program to government officials, industry, and environmental, and community organizations, and at local conferences and workshops. The presentation varies according to the audience or the particular polluted runoff issue.

The CZM Program's presentations on the coastal nonpoint pollution control program include:

- 11/10/92 Hawaii Association of Environmental Professionals (Oahu)
- 2/18/93 Hawaii Agricultural Leadership Foundation (Oahu)
- 6/23/93 Workshop for sugar plantation managers, sponsored by AMFAC/JMB Hawaii, Inc. (Oahu)
- 7/8/93 Pearl Harbor Watershed Committee (Oahu)

- 8/30/93 Stream Protection and Management Task Force of the Commission on Water Resources Management (Oahu)
- 9/9/93 Soil Nutrient Management Workshop sponsored by the University of Hawaii College of Tropical Agriculture and Human Resources, University of Hawaii (workshop intent was to provide extension agents, specialists, researchers, and other CES clients state-of-the-art information on soil/plant nutrient testing and fertilizer management)
- 9/23/93 Presentation at Soil Conservation Service Field Office (Molokai) to Soil and Water Conservation District cooperators, the Department of Hawaiian Home Lands, the Department of Transportation, and DOH
- 9/27/93 Hawaii County Council and staff (Hilo)
- 11/17/93 Hawaiian Sugar Technologists Conference (Oahu)
- 2/3/94 Hawaii Water Pollution Control Association Annual Conference (Oahu)
- 2/12/94 West Maui Community Forum on Runoff and Soil Erosion (organized as part of the West Maui Watershed Management Project, with community members and land users attending).
- 3/7/94 University of Hawaii, Environmental Law 520 class (Oahu)
- 3/23/94 Interagency Water Quality Training Session (Oahu) (an annual training session on nonpoint source pollution control which draws over 100 people from government, industry, non-governmental organizations, etc.).
- 4/26/94 "Eight Bells" luncheon presentation series (Oahu) (focus on commercial/recreational marinas and boating issues and attended by recreational boaters, U.S. Coast Guard, marina and harbor personnel, etc.).
- 8/3/94 Hawaiian Homelands Livestock Producers Symposium sponsored by CES (Hawaii)
- 8/19/94 Hawaii State Cattleman's Association annual meeting (Maui)
- 3/15/95 Workshop entitled "Management and Protection of Estuaries and Coastal Waters: Tools for Local Government," sponsored by EPA (Maui)
- 3/17/95 University of Hawaii, Water Resources Research Center seminar (Oahu)
- 3/30/95 Annual Ornamental Short Course (Maui) (included participants from the landscape and golf course industries).
- 4/5/95 Conference entitled "Hawaii Agriculture: Positioning for Growth," focusing on issues facing Hawaii's diversification of agriculture (Oahu)
- 5/20/95 Hawaii State Cattlemen's Association meeting (Hawaii)
- 6/2/95 Hawaii Agricultural Leadership Foundation (Hawaii)
- 8/3/95 Kailua Neighborhood Board meeting (Oahu)
- 9/1/95 Hawaii Conference of Planning Officials (Kauai)
- 1991-present Hawaii Association of Conservation Districts quarterly and annual meetings held around the State

Susan Miller, consultant to NRDC, has also conducted numerous interviews and small group meetings around the State. The DOH Pollution Prevention Program conducts presentations and charrettes to the construction building industry.

c. Contacts and Mailing Lists

A mailing list was developed prior to the first round of informational meetings. It included a broad range of public officials, government agencies, and individuals, businesses and organizations identified as having some connection to or interest in nonpoint pollution issues. Names of attendees at informational meetings and presentations were added to the mailing list, as were the names of persons requesting information about the coastal nonpoint pollution control program. Section 6217 working and focus group members were also included on the mailing list. The mailing list currently has over 1,200 contacts listed.

d. Working and Focus Group Meetings

A working group and five focus groups were formed over the course of the program development process. Each group was an informal, advisory group, and members served on a voluntary basis. Participants represented a broad range of interests, including the public sector, private sector, industry, environmental and community organizations, and private citizens. From the outset, it was made clear that participation on any given focus group or working group did not necessarily mean ultimate concurrence with the contents of the management plan. While all meetings were held in Honolulu because of budget constraints, they were open to anyone who wished to participate, and members represented a broad geographic distribution from around the State. The working group addressed the broader issues of program development and those issues that cut across all land use categories. The individual focus groups assessed the management measures for their particular land use categories (agriculture, forestry, urban, marinas, and stream systems) with respect to appropriateness and applicability to Hawaii. The focus groups also identified existing regulatory and non-regulatory mechanisms, best management practices, and possible alternative or coordinating mechanisms with which to more effectively implement the management measures. The number of people on the respective mailing lists and meeting dates are listed for the working group and each focus group.

(i) Section 6217 Working Group: (104 people on mailing list)

April 27, 1993	June 22, 1993
September 10, 1993	October 6, 1993
December 9, 1993	January 6, 1994
April 14, 1994	January 17, 1995
February 24, 1995	April 26, 1996

(ii) Agriculture Focus Group (95 people on mailing list): The agriculture focus group formed sub-groups to address each specific management measure. These sub-groups met on numerous occasions outside the forum of the focus group, and reported their findings at each agriculture focus group meeting. The sub-group meeting dates are *not* included in the following list.

November 18, 1993	January 11, 1994
February 8, 1994	March 8, 1994
April 19, 1994	May 24, 1994
June 28, 1994	July 19, 1994
August 23, 1994	September 27, 1994
October 18, 1994	December 13, 1994
January 24, 1995	February 21, 1995
April 11, 1995	April 25, 1996

(iii) Forestry Focus Group (67 people on mailing list):

November 18, 1993	January 11, 1994
May 24, 1994	August 2, 1994
October 17, 1994	December 7, 1994
February 8, 1995	March 7, 1995
April 4, 1995	May 9, 1995
April 25, 1995	

(iv) Urban Focus Group (76 people on mailing list):

November 19, 1993	January 6, 1994
March 8, 1994	August 2, 1994
October 17, 1994	November 21, 1994
January 23, 1995	March 6, 1995
April 26, 1996	

(v) Marinas and Recreational Boating Focus Group (72 people on mailing list):

January 12, 1994	March 9, 1994
May 25, 1994	July 18, 1994
October 27, 1994	April 23, 1996

(vi) Stream Systems Focus Group (72 people on mailing list): A focus group was initially formed to discuss hydromodifications. At its first meeting, the group decided that the management measures for hydromodifications, and the protection and restoration of wetland and riparian areas should be discussed together. Hence, the stream systems focus group evolved to address the alteration, protection, and restoration of natural stream and wetland systems.

November 19, 1993	January 12, 1994
March 9, 1994	April 19, 1994
July 19, 1994	October 18, 1994
November 21, 1994	January 23, 1995
March 9, 1995 (Brainstorming)	March 29, 1995 (Brainstorming)
April 24, 1995 (Wetlands)	April 23, 1996 (Brainstorming)

e. Newsletters and Other Outreach

DOH-PRC, CZM Program, and NRDC have collaborated on a quarterly newsletter, *Hawaii NPS News*, which contains articles about nonpoint source

pollution control efforts around the State and the ongoing coastal nonpoint pollution program development process. Supported in part by Section 319, Clean Water Act, monies, several issues have been distributed since the beginning of 1995, and it is expected to serve a continuing function of providing information on the drafting and implementation phases of the management plan. The approximately 1,200 contacts on the nonpoint source mailing list receive this newsletter.

f. Consultants' Role in Public Participation Process

In assisting the State to develop its draft coastal nonpoint pollution control program management plan, Pacific Environmental Research (PER) examined ways to further increase public participation in the program development process. A concern had been identified that the Section 6217 working and focus group meetings were held exclusively on Oahu during working hours, thereby constraining extensive neighbor island, small business, and community participation. While some neighbor islanders did participate in the working and focus groups, and CZM Program and DOH-PRC staff did make numerous presentations at community and industry meetings, and at conferences on the neighbor islands, PER sought to expand neighbor island participation even further.

PER established a toll-free, inter-island telephone number, with an informational message, and voice mail and fax capabilities; developed and disseminated flyers and brochures; and prepared articles for the *NPS News*. These resources were used to provide information on the coastal nonpoint pollution control program development process, provide contact numbers, and describe opportunities for involvement. In addition, a scoping process was conducted to identify additional groups and individuals not previously included in the planning process. This process yielded additional contacts, and, where these individuals had specific land or water use category related concerns, they were provided with a packet of informational materials.

During the spring of 1995, the consultants made presentations, conducted interviews and provided informational materials at numerous meetings and events. The consultants briefed representatives of a variety of organizations including conservation organizations, environmental and land use organizations, community water quality monitoring groups, traditional and alternative agriculture groups, landscape industry professionals, federal, State, and county field offices, golf course superintendents, boating associations, university research programs, land use attorneys, professional mediators, community associations and neighborhood boards, and educational organizations.

g. Public Comment Period

A 45-day public comment period was open between December 1995 and early February 1996. The availability of the draft management plan and/or executive summary for review was publicized in all the major newspapers around the State. Copies of the document were available in all State public libraries and upon request from the CZM Program.

2. Future Opportunities for Public Involvement

As the various State and county agencies develop programs and policies to fill the remaining gaps, there will be additional opportunities for public involvement, including participation on advisory groups and involvement in any rulemaking processes that are required.

a. Sustaining Opportunities for Public Participation

The identification of stakeholders is critical to the success of program development and implementation. The very nature of nonpoint source pollution implies seeking as inclusive a process as possible. But how successfully stakeholders become genuine participants depends considerably on whether the process meets their levels of interest:

- at the abstract and general rule-making stage of identifying appropriate management measures;
- in the application of management measures in the form of specific practices (*e.g.,* in projects and demonstrations);or
- in the issue-based "on the ground" focus that community groups are more likely to express their need for involvement. These issues include the marine sanctuary designation process, golf course development and other resort decisions, water resource allocation decisions, land use planning processes, zoning changes, stream assessments, and many others.

An important administrative challenge to program development and implementation will be to create and sustain opportunities to define nonpoint source pollution management at each of these levels, and to maintain effective linkages between them in order to encourage participation at multiple levels by the same interests.

It is recommended that the CZM Program invest significant planning and energy in the short-term review process as this is a potential seed for longer-term participation in on-going implementation of the plan. The long-term process may take the form of on-going participation in focus groups, watershed and regional planning, watershed councils, or other bodies that bring community, agency, and other interests together to examine and solve local nonpoint source pollution problems.

b. Implementation Plan Development Process

During the next year, the State intends to develop an implementation plan that will specify how each of the management plan's recommendations will be accomplished, quantify fiscal and human resources needed to implement program changes, prioritize implementation, and establish timelines for implementation subject to availability of resources. The implementation plan will also identify lead agencies and their roles, and provide draft language, as necessary, to enable these program changes. The development of this implementation plan will provide another opportunity for public involvement in

the development and implementation of the coastal nonpoint pollution control program.

3. Public Education

Effective public education will be critical to the successful implementation of the coastal nonpoint pollution control program. Many public educational efforts are already underway statewide. Other educational mechanisms will be developed during the next several years.

a. Ongoing Public Education

The goals of the DOH-PRC's public education and outreach efforts are to make a positive change in the knowledge, attitudes, skills, and behavior of people, and encourage the application of management measures to address nonpoint source pollution.

DOH-PRC has a myriad of public education and outreach activities to address nonpoint source pollution. In addition, other agencies such as the Hawaii Association of Conservation Districts (HACD), City and County of Honolulu, (CES), CZM Program, and NRCS promote public educational efforts. Outreach efforts utilize a variety of tools to reach companies and individuals such as public presentations, videos for children and adults, newsletters, brochures, a children's coloring book, public displays, and public service announcements (PSAs). A summary of current nonpoint source pollution control educational activities within the State follows.

(i) Volunteer Water Quality Monitoring: Water quality monitoring by volunteers not only provides useful scientific information for an agency but it also educates the participants and the broader group with which they interact on nonpoint source pollution issues. Currently volunteer water quality monitoring is sponsored by DOH in the Kailua-Waimanalo Watersheds and a school based effort is underway in the Ala Wai Canal Watershed.

(ii) Kaiaka-Waialua Bay HUA Projects: This USDA project was developed to address water quality issues in the Kaiaka-Waialua Hydrologic Unit Area (HUA). Public education to citizens and land users is a major goal of the project. The Classroom Augmentation Program is a successful effort to promote water quality awareness by reaching children ages 6-14 residing in that watershed. The Natural Resource Assessment and Action Program encourages participants' assessment, interpretation, and action on environmental issues within the watershed. Both programs were implemented by the CES extension agent to the area and were assisted by the cooperating agencies of the HUA project's Local Advisory Committee and the Interagency Coordinating Committee. From October 1, 1994, to September 30, 1995, 226,620 contacts were made with people through the outreach programs (208,289: media and other indirect contacts; 18,431: face-to-face contacts).

(iii) Nonpoint Source Control Projects Publicity: The DOH-PRC Program has sponsored over 20 nonpoint source control implementation or demonstration projects. These have been sponsored through the Clean Water Act Section 319(h) funds. Final reports and findings are distributed to relevant organizations as projects are completed. Press releases, articles, field site tours, and presentations at local industry meetings or conferences are utilized to share this information with others (media, land owners and operators, legislators).

(iv) NPS Public Service Announcements: In 1992, DOH-PRC and the Soil Conservation Service (now known as NRCS) developed a public service announcement about polluted runoff. It is periodically shown on network television. In 1995, the City and County of Honolulu Department of Public Works (C&CDPW) created a different PSA that focuses on similar nonpoint source pollution issues.

(v) CARE Program: The Community Ahupua'a Resource Education (CARE) program was a single year project developed by NRDC to educate Windward Oahu citizens about urban runoff. The project's goal was to develop a model for empowering a community in an urban *ahupua'a* (watershed) to manage and control sources of nonpoint source pollution and, thus, protect streams and coastal waters.

(vi) Storm Drain Stenciling: This project, sponsored by DOH-PRC with Section 319(h), CWA, funding, began in the fall of 1992. The objective is to educate Hawaii citizens that items thrown or carried into storm drains travel to inland and coastal waters and can impair the quality of these waters. Storm drain stenciling is an effective control on urban runoff as a contributor to nonpoint source impairment. Currently, the City and County of Honolulu and DOH both coordinate this effort. Volunteers are recruited and supplied with materials to paint the message "Dump No Waste, Drains to Ocean" above each storm drain.

(vii) Cleanup days: DOH-PRC and C&CDPW work together to assist local community groups and elected officials with cleaning streams and stenciling storm drains in selected neighborhoods. In 1995, outings have been held in the Ala Wai Canal watershed, in Kailua near Kaiwainui Marsh, and in Upper Kalihi Valley. Several hundred people participated in each event, building camaraderie and increasing environmental awareness. Television stations and newspapers have provided excellent human-interest reports about this citizen participation, the amount of trash collected, and the number of storm drains stenciled.

(viii) Adopt-a-Stream: C&CDPW coordinates a volunteer effort for community groups or individuals to adopt portions of streams to oversee and to collect trash. This is an urban control measure that complements the storm drain stenciling effort.

(ix) Adopt-a-Park: The City and County of Honolulu Department of Parks and Recreation coordinates volunteers who adopt specific county parks and do periodic trash cleanups.

(x) State Farm Fair: Since 1993, DOH-PRC has sponsored an information booth at the annual State farm fair. This booth has evolved to include all DOH-Environmental Health Administration programs that benefit from public outreach. Educational activities are available for both children and adults. NRCS also participates in the Farm Fair, showcasing some of its watershed projects.

(xi) Earth Day: The DOH-Environmental Health Administration programs sponsor an informational and interactive display at the annual Earth Day event. All ages are targeted. In addition, the county departments of public works participate in similar events on their respective islands. NRCS also has an information booth at the Earth Day event.

(xii) Interagency Water Quality Action Program: The Interagency Water Quality Action Program (IAWQAP) includes members from all agencies and organizations interested in controlling polluted runoff. For four years, training sessions were held to teach members about controlling pesticide use, erosion, and other topics. In addition, the IAWQAP Education Committee meets periodically to share information about each organization's nonpoint source pollution outreach activities.

(xiii) Nonpoint Source Pollution Contest: Three contests have been held to find out what people know and do not know about nonpoint source pollution. About 400 people participated in the 1992 (statewide), and 1994 (Oahu only) contests. 834 people participated in the 1995 statewide contest. DOH and C&CDPW have worked on these contests together. Participants are encouraged to answer questions to the best of their ability to be eligible for door prize drawings. Results of the contest show people generally have a greater understanding of polluted runoff, but their level of knowledge reflects the amount of information presented in the media prior to the contest.

(xiv) Interactive Television Programs: The DOH-PRC public participation coordinator worked with the Hawaii Department of Education and Moanalua Gardens Foundation in 1995 to present nonpoint source pollution information on two statewide interactive television broadcasts. In April, fourth-grade students learned about polluted runoff and what they could do to prevent it. They also asked questions to Apoha the Oopu fish mascot. In June, the DOH-PRC public participation coordinator participated in a talk show for educators about water quality. Viewers requested many educational materials following the shows.

(xv) Television News Coverage: Local television stations have aired nonpoint source pollution stories about the following: Storm Drains and You contest; Richard Chamberlain as spokesperson for C&CPDW nonpoint source pollution control efforts; Ala Wai cleanup; Kaiwainui Marsh cleanup; Ala Wai Canal watershed tracking study; red dye study in Ala Wai Canal; and demonstration projects to control soil runoff into Waialua Bay.

(xvi) Environmental Telephone Information Line: Updates about DOH's environmental and public health activities are recorded each month for Hawaii

residents to access via a toll-free telephone number. Pollution prevention and waste minimization tips and invitations to stencil storm drains are frequently included.

(xvii) Collateral Materials Available: Each of the following organizations has educational and promotional materials for distribution to targeted audiences:

- DOH-PRC program:
  * Apoha: A Fish Story coloring book and video
  * Nonpoint Source Pollution brochure and poster
  * Clean Water Action Packet
  * Management Plan about Nonpoint Source Pollution

- City and County of Honolulu Department of Public Works:
  * Water quality door hangers, bus signs, posters and magnets
  * PSAs featuring spokesperson Richard Chamberlain

(xviii) Hawaii Environmental Education Association: The Hawaii Environmental Education Association (HEEA) is a statewide resource for information on K-12 environmental curricula; descriptions and activities of Hawaii environmental organizations, including contact information, programs, and lists of publications; listings of environmental educators and resources; and State and national environmental conservation and research programs.

In 1995, the DOH-PRC public participation coordinator represented DOH on the HEEA board of directors. She joined professionals from throughout the State to draft a master plan for strengthening environmental education in Hawaii so people can learn about environmental issues (including controlling polluted runoff) throughout their lives. The DOH-PRC public participation coordinator also works with other Oahu boards of directors to coordinate a statewide annual conference. At this event, people interested in environmental education network with one another and learn about watershed management, pollution prevention, and environmental education teaching strategies.

(xix) Adopt-A-Highway: DOT coordinates a volunteer effort for community groups to keep the State highways litter-free. DOT erects "Adopt-A-Highway" signs along the roadway shoulder with the name of the volunteering organization. This program increases public awareness.

b. Future Educational Efforts

DOH is in the process of developing a nonpoint source pollution outreach advisory committee which will establish a long-range communication and outreach plan. This plan will integrate additional public outreach efforts required to facilitate the implementation of the State's coastal nonpoint pollution control program management plan. It will also accommodate and incorporate relevant portions of associated educational efforts by the DOH Pollution Prevention Plan and the goals and objectives of the HACD Education Committee.

This page deliberately left blank.

PART VI - ADMINISTRATIVE COORDINATION

Section 6217(b)(6) of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 requires "the establishment of mechanisms to improve coordination among State agencies and between State and local officials responsible for land use programs and permitting, water quality permitting and enforcement, habitat protection, and public health and safety, through the use of joint project review, memorandum of agreement, or other mechanisms."

EPA and NOAA's *Program Development and Approval Guidance* elaborates on this requirement:

> *For program approval, the coastal nonpoint program must include administrative coordination mechanisms. At a minimum, the coastal nonpoint program must include a list of state, regional and local agencies that will play a role in developing and implementing the state nonpoint program. The list should describe the mission, structure and operation of the agencies as they relate to nonpoint source pollution control, and identify the specific role to be played by each agency in the coastal nonpoint program* (p. 33).

The following four items characterize the philosophy underlying the administrative coordination efforts to be undertaken by Hawaii in implementing the coastal nonpoint pollution control program:

a. All federal, State and local agencies that have a role in coastal nonpoint pollution control and related issues, whether regulatory or non-regulatory, will be included;

b. The coordination process will rely, to the maximum extent possible, on already existing processes or, where needed, modifications to those existing processes or structures;

c. The presumption is that the full range of coordination mechanisms -- those listed in EPA and NOAA's *Program Development and Approval Guidance* and others -- will be used to coordinate among agencies and others. As such, there will not be one exclusive method for assuring coordination; and

d. An important element of the coordination process will be the development of a method to review and discuss the effectiveness of the coordination efforts of various groups and agencies. This will highlight effective measures for use by others, and provide opportunities for improving those coordination mechanisms that fail to achieve their goals.

Numerous federal, State, and county agencies are responsible for implementing components of the coastal nonpoint pollution control program. The lists of agencies and groups noted below-- whether federal, State or local -- include organizations that will have widely varying levels of involvement in the coastal

nonpoint pollution control program. The intent of the following listing is to characterize the range of parties who need to be advised of the development of the coastal nonpoint pollution control program and to develop, over time, the linkages and contact with agencies at all levels of government that will assure that those who have an interest in or can contribute to the improvement of coastal water quality are not left behind.

1. Involved Federal Agencies

(a) U.S. Environmental Protection Agency (EPA): EPA administers the Clean Water Act and the Federal Insecticide, Fungicide, and Rodenticide Act. EPA jointly administers the federal implementation of the coastal nonpoint pollution control program with the National Oceanic and Atmospheric Administration (NOAA). EPA also implements a number of watershed planning projects, including the joint EPA and State of Hawaii Department of Health West Maui Watershed Planning Project. In addition, EPA, either directly or through State and local governments, manages a number of other water quality programs aimed at reducing polluted runoff.

(b) U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA):

(i) Coastal Zone Management Program: For more than twenty years, this program has been a vehicle for protecting and managing coastal resources. With the addition of the coastal nonpoint pollution control program, a new emphasis has been placed on the evaluation and control of polluted runoff in the coastal zone and on merging the water quality interests of the CZM Program and the Clean Water Act nonpoint source pollution control program.

(ii) National Marine Fisheries Service (NMFS): NMFS provides management and research for the protection and rational use of living marine resources for their aesthetic, economic, and recreational value. One of the noteworthy responsibilities of NMFS is the administration of the Endangered Species Act (ESA) as it relates to some marine species such as the humpback whale.

(c) U.S. Department of Interior:

(i) U.S. Fish and Wildlife Service (USFWS): USFWS administers the Endangered Species Act (ESA) and the Fish and Wildlife Coordination Act. It provides comments on federal and State permit applications regarding potential impacts on endangered species, anadromous fish, and migratory birds and their habitats. Federal projects that modify waterbodies require consultation with USFWS. Projects that may affect endangered species or their habitats require approval from USFWS before the project may begin.

(ii) U.S. Geologic Survey (USGS): USGS provides scientific information on he Nation's water, energy and mineral resources. A major part of their mission is to assess the quantity and quality of the Nation's water resources and to

provide information to assist resource managers and policy-makers at the federal, State and local levels in making sound management decisions.

(d) U.S. Department of Agriculture:

(i) Natural Resources Conservation Service (NRCS): NRCS, formerly known as the Soil Conservation Service or SCS, provides technical assistance primarily to land owners and users on privately-owned agricultural lands. They assist their clients in inventorying the natural resources on their land, in preparing conservation plans for their property, in assisting with the implementation of best management practices, and in promoting community resource management. During their planning process, they consider the effects of their conservation practices on soil, water, animals, plants, and air while also addressing the human element. They work closely with the 16 Soil and Water Conservation Districts in the State to promote stewardship of the land. The programs administered by NRCS are non-regulatory. Land users have the option of participating in these programs.

(ii) Farm Services Agency (FSA): This newly reorganized agency is responsible for most of the federal financial support of farming activities, such as the implementation of farm plans to reduce erosion or control animal impacts on water.

(iii) U.S. Forest Service (USFS): The USFS has the responsibility for national leadership in forestry. Their Institute of Pacific Islands Forestry provides research and extension services to its constituents in Hawaii and several island groups in the Western Pacific. Locally, USFS research is conducted on State land in collaboration with the State Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW). USFS does not own land or have land management responsibilities in Hawaii. The Institute's Forest Management Services unit provides a broad range of extension services that include technology transfer to reduce polluted runoff. The unit also provides technical advice on forest management practices and offers grants through DLNR-DOFAW for reforestation on State and private lands.

(e) U.S. Department of Defense: The Departments of the Navy, Air Force, and Army are signatories to a Memorandum of Understanding (MOU) relating to the Pearl Harbor Estuary Program. The purpose of the MOU is to define the roles and responsibilities of each agency in the Pearl Harbor Estuary Program Interagency Committee.

(i) U.S. Army Corps of Engineers (USACOE): USACOE administers Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. As part of these responsibilities, it regulates construction activities in navigable waters and the dredging of harbors. It also regulates the discharge of dredge and fill materials in wetlands and the waters of the United States. In addition, it regulates the transportation and ocean disposal of dredged soils. Finally, the USACOE conducts various water quality studies.

(f) U.S. Department of Transportation (USDOT):

(i) U.S. Coast Guard (USCG): The Coast Guard administers a maritime protection program to prevent and control pollution in U.S. navigable waters. The Coast Guard also enforces laws against individuals and companies that pollute marine waters.

2. Involved State Agencies

As discussed in Part III of this document, all of the following State agencies noted below are already part of the Hawaii CZM network. As such, their rules, programs and activities must comply with the CZM objectives and policies pursuant to Chapter 205A, HRS. A short description of each State agency's role and responsibilities pertaining to the coastal nonpoint pollution control program follows. For more information on specific regulatory and non-regulatory mechanisms, please refer to the *Review and Inventory of Regulatory and Non-Regulatory Nonpoint Source Pollution Control Mechanisms in Hawaii*, prepared by Pacific Environmental Research for the Office of State Planning.

(a) Hawaii Coastal Zone Management (CZM) Program: The CZM Program administers Chapter 205A, HRS, and is implemented through a network of State and county plans, policies, laws, ordinances and programs. The CZM network, as it exists and, in some instances, as it will be strengthened, forms the framework within which many of the requirements of the coastal nonpoint pollution control program are or will be met.

(b) Hawaii Department of Health (DOH): DOH is responsible for regulating sewage treatment and disposal systems, hazardous and solid waste, noise, and air and water quality. As the water quality agency for the State, it is a lead agency for both point and nonpoint source pollution control. It also administers the National Pollutant Discharge Elimination System (NPDES) permit process; prepares the State's Section 305(b), Clean Water Act (CWA), water quality monitoring reports; and assists the counties in preparing the Section 208, CWA, water quality management plans. DOH also administers the Section 319, CWA, nonpoint source pollution control grants program.

The following statutes contain provisions that authorize DOH to implement polluted runoff control measures:

- Chapter 149A HRS "Hawaii Pesticide Law"
- Chapter 180C HRS "Soil and Erosion Control"
- Chapter 339 HRS "Litter Control"
- Chapter 340E HRS "Safe Drinking Water"
- Chapter 342D HRS "Water Pollution"
- Chapter 342E HRS "Nonpoint Source Pollution Management and Control"
- Chapter 342G HRS "Integrated Solid Waste Management"
- Chapter 342H HRS "Solid Waste Pollution"

- Chapter 342I HRS "Lead Acid Battery Recycling"
- Chapter 342J HRS "Hazardous Waste"
- Chapter 342L HRS "Underground Storage Tanks"
- Chapter 342N HRS "Used Oil Transport, Recycling, and Disposal"

DOH also administers Chapter 11-54, Hawaii Administrative Rules (HAR), which establishes State water quality standards, and Chapter 11-55, HAR, which establishes point source water pollution control measures. DOH is the agency responsible for enforcing and revising water quality standards.

Chapter 342E, HRS, authorizes DOH, through the Environmental Planning Office, to administer a Polluted Runoff Control (PRC)[1] Program. Administrative rules have not yet been developed to implement Chapter 342E, HRS. These rules will be developed in conjunction with the further development and implementation of the coastal nonpoint pollution control program. DOH-PRC, which started in 1987, administers regulatory, non-regulatory, and public participation programs to control polluted runoff. This program has and will continue to rely heavily on voluntary efforts to correct pollution problems. It works closely with several interagency committees, local advisory committees, and task forces that address nonpoint source pollution problems. Current watershed projects include the Pearl Harbor estuary, Kaiaka-Waialua Bay, and the West Maui watersheds. This program has also assisted the CZM Program in developing Hawaii's coastal nonpoint pollution control program.

DOH also established the Hawaii Technical Committee on Nonpoint Source Pollution Control, which conducts its meetings in conjunction with Hawaii Association of Conservation Districts (HACD) meetings. The committee advises DOH staff on strategies to control polluted runoff and assists DOH in increasing public awareness and understanding about nonpoint source pollution problems. The committee also assists DOH in facilitating interagency efforts to implement effective nonpoint source pollution management programs. Furthermore, it provides a forum for agencies and groups to share information, improve coordination, and plan strategies to address polluted runoff problems.

DOH has developed MOUs to coordinate polluted runoff control programs with all 16 of the State's Soil and Water Conservation Districts (SWCDs). It has a MOU with numerous agencies to carry out the Coordinated Resource Management Plan for the Kaiaka-Waialua Bay Hydrologic Unit Area Project. DOH also has a MOU for the Pearl Harbor Estuary Program. Recently, DOH developed a MOU with HACD, NRCS, and EPA Region IX to work together to reduce polluted runoff and improve water quality. On Maui, DOH developed a MOU with the Molokai-Lanai, Hana, Olinda-Kula, Central Maui, and West Maui SWCDs and the County of Maui Department of Public Works to support a nonpoint source pollution research project.

[1]Department of Health's Nonpoint Source Pollution Control Program has recently changed its name to Polluted Runoff Control (PRC) Program.

DOH implements components of the urban, marinas and recreational boating, hydromodifications, and wetland management measures for the coastal nonpoint pollution control program.

(c) Hawaii Department of Land and Natural Resources (DLNR): DLNR is the State's principal agency for the management of state-owned terrestrial and submerged lands, and the regulation of uses in designated conservation districts. Under the direction of the Board of Land and Natural Resources, DLNR manages and administers state parks, historic sites, forests, fish and game reserves, recreational boating program and ocean recreation management plan, endangered species, and all public lands.

In addition to regulating uses in the conservation district, DLNR administers the State's designated marine life conservation districts (MLCDs), marine and freshwater fisheries management areas (FMAs), wildlife sanctuaries, and natural area reserves (NARs). DLNR also provides funding to the 16 local SWCDs through the Hawaii Association of Conservation Districts.

The following statutes contain provisions that authorize the DLNR to administer polluted runoff control measures:

- Chapter 174C HRS "Hawaii Water Code"
- Chapter 180 HRS "Soil and Water Conservation Districts"
- Chapter 183 HRS "Land Use Activities in Conservation District"
- Chapter 190 HRS "Marine Life Conservation Program"
- Chapter 200 HRS "Ocean Recreation and Coastal Areas Program"
- Chapter 339 HRS "Litter Control"

A number of divisions within DLNR administer rules and programs that pertain to the management measures addressed by the coastal nonpoint pollution control program. DLNR's Water and Land Development Branch regulates well construction and maintenance, and dam safety (hydromodifications and wetland management measures). The Commission on Water Resource Management (CWRM) administers the Hawaii Water Code. It has oversight responsibilities for activities that affect surface and ground waters (hydromodification management measures). The Division of Forestry and Wildlife (DOFAW) has broad responsibilities related to public and private forest lands in the State (forestry management measures). The Division of Aquatic Resources (DAR) manages components of the hydromodification management measures. The Division of Boating and Ocean Recreation (DOBOR) establishes boating regulations and rules to control littering and pollution from boaters (marinas and recreational boating management measures).

(d) Soil and Water Conservation Districts (SWCDs): Chapter 180, HRS, establishes Soil and Water Conservation Districts around the State as quasi-agencies. While these non-regulatory SWCDs receive funding from DLNR, they are directed by volunteer directors and associate directors. Since 1978, the SWCDs have provided technical assistance for land users in agricultural areas. They promote the conservation of soil and water by assisting land users in developing conservation

plans. They also conduct educational programs for polluted runoff control. The local SWCDs approve conservation plans which allow agricultural operations to receive an exemption from the county grading ordinances. These SWCDs will play a critical role in the proposed implementation of the agriculture management measures.

There are currently sixteen SWCDs around the State:

- Hamakua SWCD
- Mauna Kea SWCD
- Puna SWCD
- Kona SWCD
- Kau SWCD
- Waiakea SWCD
- Molokai-Lanai SWCD
- Hana SWCD
- Olinda-Kula SWCD
- West Maui SWCD
- Central Maui SWCD
- Windward Oahu SWCD
- South Oahu SWCD
- West Oahu SWCD
- East Kauai SWCD
- West Kauai SWCD

(e) Office of Environmental Quality Control (OEQC): OEQC administers the Environmental Impact Statement (EIS) system established under Chapter 343, HRS. It coordinates and directs State agencies in matters concerning environmental quality. Its functions include recommending programs for long-range implementation of environmental quality control, initiating public educational programs, reporting on environmental conditions, and providing staff support for the Environmental Quality Council.

(f) Hawaii Department of Transportation (DOT): State transportation facilities, including public highways and trails, airports, and commercial harbors, are under the jurisdiction of DOT, who is responsible for developing and maintaining a State transportation policy and a comprehensive long-range plan for a multi-modal transportation system for the State. Through the highway division, DOT is responsible for the planning, construction and maintenance of State highways., and will be involved in developing and implementing strategies to control polluted runoff from transportation facilities.

The following statutes contain provisions that authorize DOT to enforce polluted runoff control mechanisms for commercial harbors, highways, roads, and bridges:

- Chapter 266 HRS "Harbors Enforcement"
- Chapter 286 HRS "Highway Safety"
- Chapter 291C HRS "Statewide Traffic Code"

DOT may enforce provisions during the planning and construction of infrastructure projects. It may also enforce provisions prohibiting or requiring specific activities (*i.e.*, prohibiting littering or requiring individuals to immediately report and clean-up spills or releases of hazardous substances into highways, streets, storm drains, gutters, waterways, canals, lakes, and ocean shorelines).

(g) Hawaii Department of Agriculture (DOA): DOA carries out programs to conserve, develop and utilize the agricultural resources of the State. It enforces laws, and formulates and enforces rules and regulations to further control the management of these resources. DOA regulates activities to protect agricultural industries and natural resources against insects, diseases and pests; controls all eradication services directed against weed and insect pests; and controls the sale and use of pesticides.

Specifically, Chapter 149A, HRS, authorizes DOA to establish standards and guidelines for the use of pesticides. These standards and guidelines specify pesticide uses that have adverse effects on the environment. Chapter 4-66, HAR, establishes the rules for the registration, licensing, certification, record-keeping, and other activities related to the safe and effective use of pesticides. DOA and DOH implement and enforce most of these rules.

(h) Department of Business, Economic Development, and Tourism (DBEDT): Chapter 228, HRS, "Ocean Resources Management," directed DBEDT to encourage sound environmental development of ocean resources. The Hawaii Ocean and Marine Resource Council, with staff support from the Ocean Resources Branch, developed a Hawaii Ocean Resources Management Plan (ORMP) that includes recommendations for comprehensive coastal resource planning and management, with recommendations for protecting coastal water quality. Act 104 of the 1995 legislative session incorporates the implementation of the ORMP into the Hawaii CZM Law (Chapter 205A, HRS) by adding an objective and supporting policies pertaining to marine resources. DBEDT, however, remains a CZM coordinating agency.

(i) Land Use Commission (LUC): The LUC is a quasi-judicial body administratively assigned to DBEDT. The Commission designates all land in the State into one of four land use classifications: urban, rural, agricultural, or conservation, and administrates changes between districts, etc.

(i) University of Hawaii Cooperative Extension Service (CES) and Sea Grant Program: As one of 19 land-grant and sea-grant universities in the United States, the University of Hawaii has a special responsibility for education and research. The CES has a delivery system that reaches a large number of land users and is the extension unit of the College of Tropical Agriculture and Human Resources (CTAHR) at the University of Hawaii. Its mission is to enable people to improve their lives through an educational process that uses scientific knowledge to address issues and needs. This process involves transferring and expressing scientifically-based research knowledge in practical, usable educational programs, presentations, and services.

Hawaii CES is dedicated to supporting and fostering the efforts of agricultural practitioners and communities to transform Hawaii's agriculture into an appropriate, sustainable, diversified agriculture that contributes to Hawaii's economy, is safe for consumers and the environment, and enhances Hawaii's appeal for tourism. CES provides a number of services at the local level, with offices and technical experts on all islands.

The University of Hawaii Sea Grant Program's mission is to increase understanding of the marine and coastal environment to facilitate better management and wise decision-making with regard to ocean and coastal resources. Hawaii Sea Grant serves a geographic area that includes the Hawaiian archipelago and the U.S.-affiliated Pacific Islands. During the past 25 years, it has supported science that is beneficial to industry while promoting public education and transferring technology to Hawaii and the Pacific Region. The emphasis of the program has changed over the years to reflect shifting State and national priorities. Currently, Hawaii Sea Grant supports research and extension efforts in three broad areas: marine technology, coastal ecosystem health, and deep ocean environments.

3. Involved County Agencies

The counties of Hawaii, Maui, Kauai and the City and County of Honolulu are responsible for planning and zoning in urban districts, local transportation, solid waste disposal, subdivision and grading regulation, recreation, and water supply development. They have additional responsibilities which include state-mandated county regulatory programs dealing with erosion control, urban design, beach access, and park dedication.

In addition, they are also responsible for delineating the boundaries of their respective Special Management Areas (SMAs) and for ensuring all development (with some minor exceptions) are consistent with the Hawaii CZM Program. Although each county has its own procedures for administering SMA permits, the requirements and review processes for SMA applications are similar for all four counties. Each county requires a permit applicant to describe the proposed development in terms of the State CZM objectives and policies, and SMA guidelines. In addition, all counties have established specific legal authority to require special studies as necessary, including water quality analysis. The counties also administer and enforce the shoreline setback law.

The components of the coastal nonpoint pollution control program to be administered by the counties include management measures for urban activities and hydromodifications, and, to a lesser extent, some for agriculture, forestry, and marinas and recreational boating. The county planning departments and departments of public works will have the primary responsibilities.

(a) Maui County: The following regulations provide the legal framework for Maui County to implement polluted runoff control measures:

- Chapter 291C HRS "Statewide Traffic Code"
- Chapter 339 HRS "Litter Control"
- Chapter 6.04 MCC "Dog Control"
- Chapter 8.04 MCC "Refuse Collection"
- Chapter 19 MCC "Comprehensive Zoning Ordinance"
- Chapter 20.08 MCC "Soil Erosion and Sediment Control"
- Chapter 20.20 MCC "Litter Control"

The Maui County Planning Department and the Department of Public Works are the primary agencies responsible for implementing these mechanisms. Maui County recently received a Section 319, CWA, grant from EPA to revise its grading ordinance and train inspectors to inspect for erosion controls. Maui County will also revise its drainage standards. In addition, Title 19 of the Maui County Code, relating to the Comprehensive Zoning Ordinance, is currently under revision. Other zoning concepts are being explored, including performance zoning which includes impervious surface ratio as a development standard.

(b) Kauai County: The following regulations provide the legal framework for Kauai County to implement polluted runoff control measures:

- Chapter 291C HRS "Statewide Traffic Code"
- Chapter 339 HRS "Litter Control"
- Chapter 8 KCC "Comprehensive Zoning Ordinance"
- Chapter 9 KCC "Subdivision Ordinance"
- Chapter 15 KCC "Building and Construction Code"
- Chapter 20 KCC "Litter Control"
- Chapter 21 KCC "Grading, Grubbing, and Stockpiling Ordinance"
- Chapter 22 KCC "Safety and Welfare Code"

The Kauai County Planning Department and the Department of Public Works are the primary agencies responsible for implementing these mechanisms.

(c) Hawaii County: The following regulations provide the legal framework for Hawaii County to implement polluted runoff control measures:

- Chapter 291C HRS "Statewide Traffic Code"
- Chapter 339 HRS "Litter Control"
- Chapter 4 HCC "Animals Code"
- Chapter 5 HCC "Building Code"
- Chapter 10 HCC "Erosion and Sediment Control"
- Chapter 20 HCC "Refuse Disposal"
- Chapter 23 HCC "Subdivisions"

The Hawaii County Planning Department and the Department of Public Works are the primary agencies responsible for implementing these mechanisms.

(d) City and County of Honolulu: The following regulations authorize the Department of Land Utilization and the Department of Public Works of the City and County of Honolulu to implement polluted runoff control mechanisms:

- Chapter 291C HRS "Statewide Traffic Code"
- Chapter 339 HRS "Litter Control"
- Chapter 2 ROH "Executive Agencies"
- Chapter 9 ROH "Collection and Disposal of Refuse"
- Chapter 14 ROH "Public Works Infrastructure Requirements"
- Chapter 16 ROH "Building Code"
- Chapter 21 ROH "Land Use Ordinance"
- Chapter 23 ROH "Shoreline Setbacks"
- Chapter 24 ROH "Development Plans"
- Chapter 25 ROH "Shoreline Management"
- Chapter 29 ROH "Litter Control"
- Chapter 41 ROH "Maintenance of Channels, Streambeds, Streambanks, and Drainageways"

The Department of Public Works also administers volunteer programs such as the "Adopt a Stream" program, which organizes public clean-up of streams, and a volunteer water quality monitoring program for streams.

4. Coordination Strategies

(a) Land and Water Use Planning Program:

(i) Local Plans and Periodic Update Process: Hawaii's State and county agencies have approximately 20 years experience in land use planning under State laws. The Hawaii State Plan provides the overall policy framework to guide future development in the State (Chapter 226, HRS). It is a comprehensive document consisting of three parts: Part I provides the general theme, goals, objectives and policies of the State; Part II establishes the statewide planning system and its coordination and implementation; and Part III contains the priority guidelines of statewide concern. The Plan coordinates the State's planning process through functional plans, agencies and departments, boards, commissions, and county general and development plans.

The State Plan requires the development of State functional plans for specific areas. To date, there are 12 functional plans for the following areas: (1) agriculture; (2) conservation lands; (3) education; (4) energy; (5) health; (6) higher education; (7) historic preservation; (8) housing; (9) recreation; (10) tourism; (11) transportation; and (12) water resources. These functional plans implement State Plan objectives and provide the "link" between State policy and the various agency and departmental programs and activities. The plans identify major statewide priority concerns; define current strategies for each functional area; identify major relationships among these areas; provide the direction and strategies for agency and departmental policies, programs and priorities; provide a guide for allocating resources to carry out various State activities; and assist in coordinating State and county roles and responsibilities in implementing the State Plan.

Implementation of both the State and functional plans is carried out by a number of governmental agencies through an elaborate management system. At the apex of this system is the Hawaii Land Use Law which places all land in the State into one of four districts - urban, rural, agricultural and conservation - and establishes a Land Use Commission (LUC), appointed by the governor, to review petitions for changes in district boundaries submitted by landowners or public agencies (Chapter 205, HRS).

Each of the State land use districts in characterized by different permissible uses. The rural district consists of those areas primarily in small farms mixed with low-density residential lots. The agricultural district includes lands with a high capacity for intensive cultivation. The conservation district includes lands in forest and water reserves, national or state parks, lands with a general slope of 20% or more, and marine waters and offshore islands. The urban district consists of those lands already in urban use with a reserve to accommodate foreseeable growth. Permissible uses in the urban district are defined primarily by the counties through their plans and zoning and subdivision ordinances and regulations, but are subject to conditions imposed by the LUC at the time the land is classified as Urban. As of 1994, about 4.6% of all State land is in the urban district (188,000 acres), 47.6% percent in agriculture (1,956,000 acres), 47.6% percent in conservation (1,959,000 acres), and less than 1% percent in rural (10,000 acres).

The four counties exercise the full panoply of planning, zoning, subdivision and other development controls. Coordination of the State Plan at the county level is through the county general and development plans. County general plans are authorized by county charters and provide a framework based on the unique needs of each county. They direct various activities and specify further the State Plan's objectives and policies. County development plans provide detailed guidelines to implement the objectives and policies of the general plans and direct development and population distribution consistent with those general plans. Ordinances, programs and activities at the county level must also be consistent with the State coastal zone management objectives and policies.

(ii) Federal Consistency Provisions of the Coastal Zone Management Act: One of the hallmarks of the Coastal Zone Management Act is the requirement that federal actions in the coastal zone be consistent with the State's coastal zone management objectives and policies. As the State's CZM Program is updated to reflect new approaches or requirements for water quality management, it is expected that federal agencies will assure that their actions comply with the program. In this regard, the federal managers of the coastal nonpoint pollution control program - EPA and NOAA - can be instrumental in helping to keep federal agencies apprised of the development and requirements of the plan.

(b) Interagency Initiatives:

(i) Marine and Coastal Zone Management Advisory Group: Act 104, Session Laws of Hawaii 1995, provides for the establishment of a marine and coastal zone management advisory group. The advisory group, which is comprised of individuals from State and county agencies and the general public, and which utilizes the expertise and advise of several ex officio federal agency representatives, advises the CZM Program, and State and county agencies on planning and management policy issues related to coastal and ocean resources in Hawaii. The advisory group will deal with the broader resource planning and program issues including: reviewing CZM annual workplans; facilitating implementation of the Ocean Resources Management Plan; reviewing proposed State and federal coastal legislation; informal monitoring of State and county coastal management programs for potential problems; and anticipating and addressing critical, emerging issues and potential problems in coastal and marine resources management.

(ii) Executive Planning Council: Given the limited fiscal resources of the counties and State, there is a real need for greater coordination of planning and programming activities among State agencies and between State and county governments. The Office of State Planning (OSP) has initiated development of a planning system that promotes State and county partnerships, identifies State program priorities, and enhances efficiency and accountability in the delivery of services that will ensure better use of public resources. As part of this initiative, an Executive Planning Council, comprised of the Governor and mayors of the four counties, has been developed to work on State and county priorities and concerns and to resolve intergovernmental conflicts.

(c) Memoranda of Understanding (MOUs): There are instances where two or more agencies continually interact to develop or implement certain programs. Often these relationships do not call for the active participation of the governor, or agency boards or commissions in that policy issues have been resolved and policy direction given. What remains is the need for consistent application of that policy direction in ways understood by all parties. Interagency MOUs can be a good way to memorialize the process and to provide standards against which to measure the performance of the parties. The following are examples of instances where a MOU will be used to help accomplish the desired results from the coastal nonpoint pollution control program.

(i) DOH/NRCS/SWCDs MOUs: In 1988, DOH and NRCS entered into MOUs with each SWCD to establish a cooperative relationship for polluted runoff control, to promote soil and water conservation, and to improve water quality. These MOUs facilitated DOH's efforts to develop and successfully complete its nonpoint source pollution assessment and management plan.

(ii) DOH/SWCDs/County DPWs MOUs: In 1991, DOH, along the department of public works for each county entered into MOUs with the SWCDs of each island. A total of five MOUs were developed. These MOUs fostered a

cooperative effort to conduct the Nonpoint Source Pollution Research Project. This project was designed to determine how well the land users comply with each county's grading ordinance and what additional resources, if any, were needed to implement the program.

(iii) DOH/SWCDs/NRCS MOUs: In 1991, another set of MOUs were developed with the same purpose of conducting a Nonpoint Source Pollution Research Project. DOH, along with NRCS, entered into MOUs with the SWCDs of each island. A total of five MOUs were developed. These MOUs fostered a cooperative effort to conduct the Nonpoint Source Pollution Research Project. This project was designed to determine how well the land users comply with each county's grading ordinance and what additional resources, if any, were needed to implement the program.

(iv) DOH/HACD/NRCS/EPA Region IX MOU: In 1994, a MOU was developed between DOH, HACD, NRCS, and EPA which further established a cooperative effort among the agencies to reduce polluted runoff and improve water quality (together with associated ecosystems), benefiting the environment, economy, lifestyle, and future.

(v) DOH/NRCS/HACD/ South Oahu SWCD/ West Oahu SWCD/ USGS/ USFWS/ U.S. Navy/ U.S. Army/ U.S. Air Force/ USACOE/ DLNR/ CTAHR/ University of Hawaii Water Resources Research Center (WRRC)/ DOT Highway Division/ City and County of Honolulu Department of Public Works/ City and County of Honolulu Board of Water Supply MOU: The purpose of this MOU is to define roles and responsibilities of each member organization of the Pearl Harbor Estuary Program Interagency Committee. The mission of this committee is to develop pollution runoff prevention projects, seek funding for these projects, and guide project implementation and evaluation. It was implemented in 1993.

(vi) West Oahu SWCD/ USDA-FSA/ USDA-NRCS/ CTAHR/ WRRC/ DOH/ DLNR/ DOA/ USGS/ U.S. Army/ USFWS/ Hawaii Sugar Planters Association MOU: The purpose of this MOU is to coordinate resources and personnel of the signatory agencies in carrying out the Coordinated Resource Management Plan for the Kaiaka-Waialua Bay HUA project. It was implemented in 1992.

(d) Agency Permitting and Rule-making Processes:

(i) Administrative Procedures Act Requirements (Chapter 91, HRS): One of the opportunities for involvement in State agency activities is at the point of adoption of specific policies in the form of rules. At that time, the Administrative Procedures Act requires that notice of the activity be given in a standard form and place. In addition to the required notice, most agencies maintain and rely on specific mailing lists to notify interested parties and agencies of their undertaking. This not only provides other State agencies an opportunity to review and comment on the rules under consideration, but it also provides the same opportunity to all interested parties. Agency rules

must also be reviewed for compliance with the CZM objectives and policies as appropriate.

(ii) Specific Statutory Requirements: In addition to the coordination engendered by the Administrative Procedures Act in rule-making generally, there are natural resources decisions where the enabling State or federal law not only defines who the managing agency is, but also establishes a specific statutory process to guarantee that other agencies have the opportunity to be aware of and participate in the decision. Examples of such specific statutory processes are:

- DOH NPDES Permits and Section 401, CWA, Certification Process
- CZM Federal Consistency
- Environmental impact statement review

This page deliberately left blank

PART VII - MONITORING AND TRACKING TECHNIQUES

Section 6217(g) of the Coastal Zone Act Reauthorization Amendments (CZARA) requires a description of any necessary monitoring techniques to accompany the management measures to assess over time the success of the measures in reducing pollution loads and improving water quality. EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* provides:

(1) Guidance for measuring changes in pollution loads and in water quality that may result from the implementation of management measures; and
(2) Guidance for ensuring that management measures are implemented, inspected, and properly maintained.

Each of the above stated guidance will be discussed further in separate chapters within this Part. Included in each of those chapters will be a description of a plan to fulfill these guidance goals.

By tracking management measures and water quality simultaneously, Hawaii will be in a position to evaluate the performance of those management measures implemented under the coastal nonpoint pollution control program. Management measure tracking will provide the necessary information to determine whether pollution controls have been implemented, operated, and maintained adequately. This is needed so that the State can determine whether these management measures are effective and whether additional ones are needed in specific waterbodies to improve water quality.

Water quality monitoring is the most direct and defensible tool available to evaluate water quality and its response to management and other factors (Coffey and Smolen 1990). The Department of Health (DOH) is the lead agency for water quality monitoring and enforcement of State water quality standards. Hawaii is in the process of revising its water quality monitoring plan so that it can be used in planning and support of water quality management programs, compliance reporting, status and trend assessment, and other purposes. The overall objective of the monitoring design is to integrate a combination of data and information to serve both regional and site specific information needs, specifically for target waterbodies on the Section 303(d), Clean Water Act (CWA), list; Section 319, CWA, Nonpoint Source Assessment; and Section 304(I), CWA, Toxic Substance List. Currently, DOH is revising its inland water quality standards and monitoring protocols, its section 303(d) list of impaired waterbodies, and its ambient water quality monitoring strategy. Current monitoring strategy, methodology and monitoring stations may be revised pending finalization.

As mentioned in the above paragraph, DOH is in the process of revising its inland water quality standards and various monitoring components. Despite the fact that these monitoring items are in the process of being revised, these items are included in this coastal nonpoint pollution control program management plan.

This is so that all components of the plan can be assessed together, even if some components are still in draft form. Sections 1, 2 and 3 of this Part are from DOH's draft "Hawaii Ambient Water Quality Monitoring Strategy." This Part will be revised pending EPA's recommended revisions to that monitoring strategy.

Environmental Indicator

The monitoring program will be guided by environmental indicator goals that identify environmental and ecosystem quality, in addition to providing evidence of progress. The monitoring program will focus on three broad areas: nonpoint source pollution, public health, and ambient water quality. A combination of environmental and water specific indicators (*e.g.*, phytoplankton, turbidity, suspended solids, sediment toxicity, fish tissue contaminant, stream alteration, flow diversion, and physical habitat modification) will be considered in quantifying and addressing pollution effects.

Data and Information Sharing

DOH will continue to use the Environmental Protection Agency's (EPA's) STORET and Waterbody System as the primary database and information system. In addition to the ambient water quality data collected, selected monitoring data resulting from the Section 401, CWA, National Pollutant Discharge Elimination System (NPDES) and Zone of Mixing permits will be entered into STORET. A database will be established for environmental indicators meeting quality assurance and quality control (QA/QC) and data quality requirements.

Other government agencies also produce water quality information. These sources include the U.S. Army Corps of Engineers (USACOE), U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS), City and County of Honolulu, and private consultants. Coordination with other monitoring programs will be a program goal. Sharing and verifying data from other water quality monitoring programs will assist in achieving a more comprehensive water quality data information base both for water quality parameters and geographical scope. For instance, volunteer water quality monitoring programs have been or will be instituted in the Kailua-Waimanalo and Ala Wai watersheds. In addition, universities and community colleges conduct monitoring as a component of specific studies or classroom curriculum.

Water body assessments will use the most current data and information from the STORET system. The end users of the STORET data system are government agencies, consultants, students, and the general public.

1. Monitoring Plan

The management of polluted runoff is often complicated by the difficult and costly task of defining the specific sources and pollutants causing an adverse impact on receiving waters. To detect and verify statistically a particular agent as the cause of a nonpoint pollution problem requires the isolation of the most probable source and the application of a monitoring program designed to link the source to the impact. This procedure is highly resource-intensive and costly to institute

(Reinelt *et. al.* 1988). The monitoring plan for Hawaii's coastal nonpoint pollution control program needs to coincide with existing State resources.

As mentioned at the beginning of this Part, the National Oceanic and Atmospheric Administration (NOAA) and EPA gave general guidance on monitoring and tracking techniques to accompany management measures. The first monitoring goal identified in the guidance is to measure changes in pollution loads and in water quality that may result from the implementation of management measures. This goal can be achieved through the implementation of the draft revised monitoring plan proposed by the DOH's Clean Water Branch (DOH-CWB). The draft monitoring plan will incorporate four water quality monitoring categories: core network, recreational bathing waters, watershed protection, and toxic contaminant screening. The scope and indicators of these four monitoring categories meet the first objective of NOAA and EPA's monitoring guidance. Therefore, it is recommended that information related to changes and trends in water quality be provided from the existing monitoring activities conducted by DOH-CWB.

A. DOH Water Quality Monitoring Framework

DOH-CWB is currently revising the existing water quality monitoring network to include watershed protection, in addition to public health protection of recreational waters and ambient water quality monitoring activities. As part of the revision, existing ambient monitoring stations will be relocated or eliminated in order to utilize limited resources more efficiently and re-focus waterbody-specific needs consistent with the water quality management goals. These areas will include waterbodies where Total Maximum Daily Load calculations (TMDLs) are lacking. Areas that need greater protection of beneficial uses are also targeted, particularly in watersheds where pollution control strategies for nonpoint sources are badly needed. Other sites include areas where violations in water quality standards occur, but meaningful data for water quality decisions are lacking. The overall goal is to focus available resources to the most critical needs, avoiding duplication of monitoring sites and undefined target populations.

The revised water quality monitoring plan will consist of four main categories, as shown in Table VII-1. The scope or coverage, indicators, and regulatory basis are identified.

Section 305(b), CWA, requires each state to submit a biennial (5-year cycle beginning 1996) report to EPA describing the quality of its navigable waters. The report includes an analysis of the physical, chemical, and biological integrity of the State's waters and the extent to which it supports the protected uses, among other information on water quality. Section 303(d)(3), CWA, requires each State to identify all waters where violations of water quality standards occur, and more data must be collected or a pollution control strategy developed.

B. Developing Criteria for Prioritizing Waterbodies

The next critical step in the strategy is to select the criteria for prioritizing waterbodies and establishing TMDLs for these areas. This step is necessary to

determine water quality priorities based on existing water quality needs. The priority listing will be part of the State's review and selection process established for listing of water quality limited segments (WQLSs) in accordance with Section 303(d), CWA. The selection criteria will focus on critical problems and needs determined by the DOH water quality management program. Water quality problems will be identified in totality of valued resources. The critical factors will be based on citizen concerns and regulatory issues involving public health, public recreation, groundwater protection, wastewater management, nonpoint source pollution, and aquatic/marine life protection.

TABLE VII-1. WATER QUALITY MONITORING CATEGORY

Type	Scope	Indicator	Regulatory Requirements
Core Network	Regional	Ambient; Long Term Trend; Baseline Data	CWA 305(b) Report; Annual State Report
Recreational Bathing Waters	Site-Specific; Shoreline; and Nearshore	Compliance; Cause & Effects; Sewage Spills	CWA 305(b) Report; Annual State Report; Chapter 11-54
Watershed Protection	Watersheds and Receiving Waters	Complex Trends or Patterns; Cause & Effects; Compliance; TMDLs; Multi-Media and Parameter Relationships; Impacts on Biological & Physical Habitat	CWA 305(b) Report; CWA 303(d)(3)
Toxic Contaminants Screening	Site Specific	Health Risk; Sediment Toxicity; Bioaccumulation	CWA 305(b) Report

The existing WQLSs will be reviewed and revisions made as deemed appropriate. The final approval of the listed segments will be determined by a State-Regional process for identifying the State's priority waterbodies. By September 1996, the State will revise this list, pending assessments of waterbodies according to the Section 303(d) criteria.

C. Developing Workplans

Workplan development is the most important step in the monitoring strategy. The workplan consists of monitoring activities that are covered in the following chapter for each monitoring category shown in Table VII-1 (Core Network, Recreational Bathing Waters, Watershed Projects, and Toxic Contaminants Screening).

The monitoring activities under Watershed Assessment are a new addition to the

DOH-CWB monitoring program. The monitoring activities will be part of DOH's watershed protection program. The role of DOH-CWB is to provide monitoring support and available resources as part of the watershed team.

The remaining monitoring programs are on-going. These monitoring activities are also discussed in more detail in Section 2. Although annual workplans for each are subject to change with priorities, the workplans for watershed projects will be most subject to change. The watershed projects are selected through a State-Regional grant process and will be the main thrust of the State's monitoring program. Selected watershed projects may last from 1 to 3 years, depending on critical problem needs and available resources. The workplans will be part of the DOH water quality management effort in the overall planning process. The monitoring workplan will be jointly determined and approved through the annual State-Regional agreement.

The workplans for watershed monitoring activities will, therefore, play a key role in the DOH-CWB monitoring activities. For the purposes of this document, the details of the current watershed project are highlighted in this strategy. The monitoring plan will describe the water monitoring workplans of the listed monitoring categories shown in Table VII-1.

Depending on the nature and scope of the monitoring project, the workplan elements will:

1. Identify and describe the project goal or goals.
2. Define data quality objectives for each goal.
3. Identify and describe the geographic boundaries.
4. Identify and describe monitoring parameters, markers or environmental indicators, etc.
5. Establish reference or baseline conditions.
6. Determine the relative contributions of various sources (point/nonpoint) of pollutants and compliance with water quality standards.
7. Report status and trends.

It is widely recognized that nonpoint sources are the major contributors to Hawaii's water pollution problems. Therefore, workplans developed for the monitoring plan will emphasize water quality activities that are consistent with management goals and objectives to minimize nonpoint source pollution. The design and approach of workplans will stress data and information that are useful in making decisions and answering resource management questions.

This element of the monitoring strategy will serve as a working tool for the monitoring program. Monitoring workplans will be designed and integrated with various watershed activities developed for the targeted waterbodies. The Ala Wai Canal, for example, is designated as a priority waterbody (WQLS), with the Ala Wai Canal Watershed Project currently initiated to address watershed issues. A monitoring program will address the issues related to the watershed problems. As a priority waterbody, the Ala Wai Canal Watershed Project is the current focal point of the monitoring workplan.

D. Implementation of Workplan

Following approval of watershed projects through the State-Regional process for designating priority waterbodies, workplans will be implemented as part of the water monitoring program and overall strategy. DOH-CWB will implement the annual workplan as designed and approved. The findings and data will be reported in the annual State Water Quality Report, as well as in the State's Section 305(b), CWA, Reports.

2. Overview of Water Quality Monitoring Workplan

This section provides a framework for the monitoring program, and can be used as the basis for developing monitoring workplans. This phase of the monitoring strategy briefly describes the annual monitoring activities and the monitoring goals for each of the four monitoring categories identified in Table VII-1.

The specific draft workplans that outline the water quality monitoring activities of DOH's Core Network, Recreational Bathing Waters, and Toxic Contaminants Screening Program follow. The proposed monitoring plan designed for a watershed (The Ala Wai Canal Watershed Workplan) emphasizes polluted runoff control.

A. Core Network

(1) Description: The Core Network consists of permanent stations located in open coastal and oceanic waters that are designed to collect long-term monitoring data to determine status and trends in water quality. Water column samples taken from offshore waters are located in selected waterbodies on Kauai, Oahu, Maui, and Hawaii. They provide benchmark data reflecting normal or seasonal variations, as well as trends over a period of time. Water chemistry parameters are measured for nutrients and physical-chemical properties such as total phosphorus, total nitrogen, nitrate-nitrite nitrogen, temperature, pH, salinity, dissolved oxygen, etc. Sampling frequencies vary from once per month on Oahu to once per quarter on the neighbor islands.

DOH Core Network Station locations on each island are as follows:

Kauai	Oahu	Maui	Hawaii
1. Hanapepe Bay	1. Pokai Bay	1. Kahului Bay	1. Hilo Bay
2. Nawiliwili Bay	2. Mamala Bay		2. Keahole Point
	3. Hanauma Bay		3. Kealakekua Bay
	4. Maunalua Bay		
	5. Kaneohe Bay		

In addition, the Core Network utilizes selected water quality data that are reported under the NPDES and Zone of Mixing discharge permits. The permit programs that require water quality monitoring also serve as a valuable source of data and information for use in the State Annual Report and the Section 305(b), CWA, reports. Since the permittees are required to routinely measure ambient water quality throughout the permit's 5-year life span, long term water quality impacts can be evaluated. The NPDES reports are submitted to the DOH-CWB

either monthly, quarterly or annually, depending on the permit requirements.

Most of the major discharge permits are for domestic sewage that is discharged from deep ocean outfalls. The various types of discharge and general locations where monitoring activities are conducted are as follows:

Domestic Sewage:
1. Kauai: Wailua Wastewater Treatment Plant, Wailua
2. Oahu: Honouliuli Wastewater Treatment Plant, Barbers Point
3. Oahu: Sand Island Wastewater Treatment Plant, Honolulu
4. Oahu: East Honolulu Comm. Svc. Wastewater Treatment Plant, Hawaii Kai
5. Oahu: Kailua Wastewater Treatment Plant, Mokapu
6. Oahu: Fort Kamehameha Wastewater Treatment Plant, Pearl Harbor
7. Oahu: Waianae Wastewater Treatment Plant, Waianae
8. Hawaii: Hilo Wastewater Treatment Plant, Hilo

Oil Refinery:
1. Oahu: Chevron U.S.A., Barbers Point

Thermal Cooling Water:
1. Kauai: Citizen Electric, Port Allen
2. Oahu: Hawaiian Electric Industries, Kahe
3. Oahu: Hawaiian Electric Industries, Waiau
4. Oahu: Hawaiian Electric Industries, Honolulu
5. Maui: Maui Electric, Kahului
6. Hawaii: Hawaii Electric Company, Hilo

(2) Purpose: The Core Network provides long-term data on ambient water quality of regional scope. The primary purpose is to assess status and trends in water quality. The data serve as an indicator of environmental impacts attributed to both point and nonpoint sources. Since monitoring data are collected from water quality segments that receive point source discharge, the Core Network monitoring serves as a means to determine the relative compliance with ambient water quality standards. In addition, the monitoring program provides quantifiable data as a basis for making monitoring program changes and decisions to address resource management issues.

All water quality data collected by DOH-CWB, including selected Zone of Mixing and NPDES monitoring data, are maintained in the EPA STORET system. Water quality data are shared with the general public, private consultants, government agencies, the academic community, public interest groups, and volunteer monitoring organizations. The uses of data are for a wide variety purposes among which include: environmental assessments, government statistical reports, student papers, environmental impact statements, enforcement actions, water quality standards revisions, problem assessments, and program evaluation. DOH-CWB uses the data primarily for its water quality reports, such as the State Annual Water Quality Report and the Section 305(b), CWA, Report.

(3) Data Quality Objectives: The Core Network monitoring provides answers to

questions about ambient water quality on a larger regional scale. Water column measurements of open ocean waters are made that ensure collection of representative background data for making such determinations. It determines if water quality is changing over time and explains the existing conditions. Where major point source discharges occur, the Core Network data also serve to identify waterbodies impacted by point sources. The results of monitoring data provide the basis for decisions on enforcement actions, permit revisions, mixing zone reviews, and for any permit-related action as determined appropriate and necessary.

The Core Network monitoring also provides decision-makers with benchmark data that form the basis for setting program priorities. The data will be used to answer questions on whether nonpoint source impacts occur in a given area, where they occur, and at what level they occur. Determinations are made on whether they occur on a regional or site-specific scale, and whether impairments are limited to water quality column or the biological communities and beyond (*e.g.*, sediment toxicity, bioaccumulation, etc.). Water monitoring program directions and priorities will be established from these findings. In addition, the Core Network database is used in program planning and resource management, such as allocating limited resources where it is most needed.

Field sampling for each test is performed nearly identically for each site, such as location siting (visual triangulation method or GPS) and water column depth (HydroLab DataSonde). The DataSonde is a multiparameter instrument used for *in situ* measurements on pH, salinity, dissolved oxygen, and temperature at each 10 meters. Water column samples are collected with a Van Dorn water sampler lowered at three depths: surface, middle and bottom. Specific depths for each location vary depending on the bottom depth. Data are recorded and stored automatically into the system and down -loaded to a personal computer in the office.

To protect sample integrity, all samples are kept chilled with "blue ice" in ice chests during handling and transport to the laboratory. The holding time, container and preservation requirements are carried out for each test. Calibration, operation and maintenance inspection of the instrument are made one day prior to sampling. Factory servicing is made yearly, as needed.

B. Recreational Bathing Waters

(1) Description: Marine recreational waters are extensively monitored for the safety and protection of public health against risks associated with sewage discharge. Enterococci and *Clostridium perfringens* are used as the indicator organisms to measure water quality. Research studies in Hawaii have shown that enterococci are prevalent in Hawaiian soils, and that *Clostridium perfringens* is a preferred indicator of human sewage.

Water sampling is performed at fixed stations located in shoreline waters of popular bathing beaches throughout the State. There are a total of 161 monitoring stations routinely monitored on six of the eight major islands in Hawaii. The total numbers on each island vary as follows: Kauai 28, Oahu 43, Maui 48, Molokai 2,

Lanai 2, and Hawaii 38. The sampling frequencies vary depending on sampling logistics and available resources on each island. Oahu, with the largest population among the islands, also has the most heavily-used beaches.

With the largest land area of the islands serviced by municipal sewer systems, surface waters on Oahu also have the highest potential for raw sewage contamination. Sewage spills that enter storm drains and streams could reach recreational beaches, thereby resulting in temporary closures. There are no combined storm sewer systems in the State; therefore, storm drains under normal conditions do not discharge human sewage. Municipal raw sewage is treated and the effluent from most wastewater treatment plants is discharged from deep ocean outfalls. The threat of sewage from deep ocean outfalls is not so critical due to their treatment, outfall efficiency, and distance away from recreational areas.

(2) Purpose: The purpose of this monitoring is to quantify levels of bacteria and to assess the health risk of swimmers exposed to bacteria levels exceeding State standards.

(3) Data Quality Objectives: The concern over public health safety is an intense issue whenever raw sewage spills contaminate marine recreational waters. Of nearly equal importance to the concerned public is swimming in waters with high bacteria levels, caused not by sewage spills but from nonpoint sources. The issue is raised where surface runoff and runoff into storm drains cause indicator bacteria levels to exceed State standards, invariably during wet weather periods. Marine recreational waters that are seasonally impaired by high bacterial counts include highly popular areas such as Hanauma Beach, Kuhio Beach in Waikiki, and Kailua Beach (Kaelepulu Stream).[1] The data quality objective is to ensure that the monitoring data are adequate in making informed decisions on the potential health risk associated with point and nonpoint source contaminants.

In addition to the use of enterococci data, *C. perfringens* provides information for making assessments and decisions on when to clear beaches that are closed for swimming after sewage spill events. The use of two indicators reduces the risk of making incorrect decisions, in view of the inherent weakness of enterococci as a reliable indicator. Further, background data from fixed stations are compared before and after spills for added assurance in making correct decisions. Upon returning to normal background levels, decision can be made to remove warning signs. Beaches are not closed due to elevated bacteria levels caused by nonpoint sources; however, waters that exhibit chronic violations will have warning signs posted. Existing signs, notifying the public of such chronic conditions, are posted at the Ala Wai Canal and Kaelepulu Stream at Kailua Beach Park. DOH is working with the County of Hawaii to consider posting warning signs at Honolii Cove, a popular surfing area near Hilo.

As with all field sampling activity, QA/QC measures are thoroughly observed. The samples are collected at the same place and in the same manner on a regular

[1] In addition, water quality standards have been frequently exceeded in this areas for nutrients and turbidity, attributed to nonpoint sources.

schedule. Samples are properly documented, recorded for sample custody, stored in ice chests, and transported to the laboratory within six hours of collection.

C. Watershed Protection

(1) Description: Workplans for Watershed Protection projects consist of planned activities for watersheds that are selected as part of the annual State-Regional federal grant agreement.

The Ala Wai Canal, a WQLS, is an example where DOH-CWB will address water quality monitoring needs for controlling polluted runoff (*e.g.,* the Ala Wai Canal Watershed Project). The Ala Wai Canal's water quality has been impaired by high nutrients and enterococci level recorded since the start of the monitoring program in 1971. More recently, elevated levels of synthetic organic compounds and trace metals were found in biota sampled in 1992. Bottom sediments have not been sampled in recent years, but a 1971 survey showed elevated levels of toxic metals and chlorinated hydrocarbons.

One of the most persistent component that contributes to the aesthetic quality of the Ala Wai Canal is the heavy phytoplankton population that adversely reduces water clarity. A suggested solution for improving water clarity is to increase the rate of flushing of the canal so that it exceeds the rate of phytoplankton growth. However, the sources contributing to their growth would remain uncontrolled by this approach alone, regardless of light or other limiting nutrients.

(2) Purpose: For the purpose of reducing or controlling phytoplankton blooms and ultimately improving water clarity, the sources contributing nutrients that can stimulate phytoplankton growth also must be identified, if regulatory action is necessary or water quality management programs are to remain cost-effective in providing the long-term benefits. Therefore, the purpose of the proposed monitoring workplan is to carry out the following tasks:

a. Locate land areas and identify the sources (point and nonpoint) that contributes to nutrient loadings.
b. Quantify levels of nutrients by each stream segment and tributary that contributes to the total nutrient load in Ala Wai Canal.
c. Identify management options that may provide for effective controls in reducing the amount of nutrients in receiving waters.
d. Establish benchmarks and provide a long term basis for comparing water quality improvements in the Ala Wai Canal. This will also serve as a basis for measuring the effectiveness of management controls.

(3) Data Quality Objectives: The details of data quality objectives for Watershed Protection projects cannot be described for all projects since the appropriate objectives vary with each survey. In this example of the Ala Wai Canal Watershed Project, the scope of work is specified and therefore the level of data quality necessary for making informed decisions can be determined.

The sampling will be designed to determine the amounts of nutrients in the natural environment. The data are necessary to identify benchmark levels that

determine whether or not it would be difficult to control. Sampling data will further quantify watersheds segments and their in-stream contribution of nutrients. The sampling will be designed to yield data to identify locations and sources contributing significant levels of nutrients. (The data will not quantify the relationship between nutrients and phytoplankton growth in the Ala Wai Canal, which is beyond the scope of this project.)

The Ala Wai Canal is identified as a WQLS as defined by the CWA. To date, no final TMDL has been adopted for the Ala Wai Canal. New monitoring data for the Ala Wai Canal may be useful in calculating TMDLs.

D. Toxic Contaminants Screening

This section is included as part of the monitoring strategy as an option that will be implemented as funding becomes available. DOH-CWB has conducted a screening program over the years; however, due to budget constraints and the high cost of the screening program, CWB is forced to restrict this activity, including many on-going programs.

(1) Description: The main objective of toxic contaminants screening is to identify waterbodies in the State where levels of chemical contaminants in biota indicate the potential for significant health risk to consumers. The primary target animals will be those that are commonly consumed locally.

The sampling strategy is a two-tiered screening process, similar to the screening programs performed in the past:

a. Conduct statewide surveys on selected chemical contaminants found in fish and shellfish that are consumed by the local population.
b. Conduct site-specific surveys of either known existing problems or potentially significant contamination.

(2) Purpose: The main objective of the screening program is to identify locations of toxic contamination and determine levels of contaminants that are harmful to consumers of fish and shellfish.

(3) Data Quality Objectives: With either approach selected for screening toxic contaminants, the data quality objectives will ensure management needs as follows:

a. The results are useful in making fish consumption advisories based on health risk assessments.
b. The sampling data are adequate to describe specific contaminant levels found on the basis of critical biological and environmental factors.
c. The design of the sampling program provides for acceptable hypothesis testing based on appropriate statistical analysis.
d. The outcome of the survey meets public health objectives in the most cost-effective manner.

3. Specific Workplans for Water Quality Monitoring Activities

Over the past two years, the State's Water Quality Monitoring Program has undergone major changes resulting from severe budget restrictions and monitoring staff reductions. Monitoring activities were scaled down and/or eliminated completely. Combined with other spending restrictions and reductions in federal funding, the monitoring program has been required to make major shifts in program priorities.

The following Sections A-D specify the draft workplans for the water quality monitoring activities of the Core Network, Recreational Bathing Waters, and Toxic Contaminants Screening Program. Despite the many changes taking place in the monitoring program, the major emphasis will be on specific issues that address both human health and environmental concerns.

A. Core Network Monitoring Program

The Core Network monitoring is currently an on-going program. The ambient water quality database for the Core Network will be expanded to include more data from sources outside DOH. Most of these data will come from the NPDES permit program. Although some data from this source are currently being utilized, additional new data are available to fill data gaps in the existing monitoring program.

With the expanded database, the Core Network monitoring program will serve three main purposes. First, it will provide data and information on ambient water quality characteristics to determine compliance with the State's water quality standards (Table VII-2). Secondly, the additional monitoring stations will serve as benchmarks for ambient water quality on a regional scale to give a historic perspective on the long-term effects on water quality. Also, as a cost-saving measure and benefit to the program, the Core Network is designed to assess additional State waters that are monitored by other sources. Thirdly, as benchmark stations, they will provide comprehensive information about the natural range in variability of waterbodies that is expected to occur over the wet and dry seasons. The data will be essential in dealing with water quality issues and in describing the sources that may cause water quality to exceed State standards.

The sampling objective of the monitoring workplan is to collect long-term ambient data at representative locations throughout the State. The components of water quality will be characterized for three different types of waterbodies: embayment, open coastal and oceanic waters, for which applicable standards are adopted. The bottom depths at these sites range from 30 to greater than 60 meters. Water quality will be sampled at three depths (surface, middle, bottom) at a frequency of either monthly or quarterly for all parameters identified in the State Water Quality Standards. The neighbor island samples will be collected quarterly.

TABLE VII-2
MONITORING PARAMETERS AND WATER QUALITY STANDARDS

Water Quality Parameters	Embayment		Open Coastal		Oceanic
	Wet	Dry	Wet	Dry	
Column Depth[1](m)	n/a	n/a	n/a	n/a	n/a
Temperature[2] (C)					
pH[3] (S.D.)					
Conductivity[1]					
Salinity[4] (PPT)					
Dissolved O2[5] (ppm)					
Turbidity (NTU)	1.5[7]	0.4	0.5	0.2	3.0
	3.0	1.0	1.25	0.5	0.1
	5.0	1.5	2.0	1.0	0.2
Total N (ug/L)	200	150	150	110	50
	350	250	350	180	80
	500	350	250	250	100
NH4 (ug/L)	6.0	3.5	3.5	2.0	
	13.0	8.5	8.5	5.0	
	20.0	15.0	15.0	9.0	
NO3+NO2 (ug/L)	8.0	5.0	5.0	3.5	
	20.0	14.0	14.0	10.0	
	35.0	25.0	25.0	20.0	
Total P (ug/L)	25.0	20.0	20.0	16.0	
	50.0	40.0	40.0	30.0	
	75.0	60.0	60.0	45.0	
Light Extinction[6]	n/a	na/	0.2	0.1	n/a
(K units)	0.5	0.3			
	0.85	0.55			
Chlorophyll-a (ug/L)	1.0	0.5	0.3	0.15	
	4.5	1.5	0.9	0.5	
	8.5	3.0	1.75	1.0	

[1]Standards not applicable (n/a).
[2]Shall not vary more than one degree Celsius from ambient conditions.
[3]Shall not deviate more than 0.5 units from a value of 8.1.
[4]Shall not vary more than 10 percent from natural or seasonal changes.
[5]Not less than seventy-five percent saturation.
[6]Required for discharges with Section 301(h) waivers.
[7]Values are Geometric Mean; Not to Exceed 10% and 2% of the time, respectively.

Discharge monitoring data generated by the NPDES and Zone of Mixing requirements provide both site-specific (outfall areas) and regional water quality characteristics. Monitoring reports submitted by dischargers will be used in making the annual assessment of State waters. Datasets that represent the two areas will be evaluated for water quality standards compliance and long-term trend analysis. The main source of data for the Core Network comes from the City and County of Honolulu. Other sources are from various counties, including private and government facilities.

B. Recreational Bathing Waters Monitoring Program

The bacteria monitoring program focuses on water quality monitoring for the purpose of assuring recreational safety of swimmers at popular bathing beaches throughout the State. It is an on-going program with an established database that covers over 20 years of monitoring. Bacteriological assays have been conducted at nearly 95% of the total number of sampling sites established throughout the State. (Of these sites, nearly 37% were also concurrently analyzed for water chemistry.) Sampling frequencies for recreational waters vary between weekly, bi-weekly, and monthly intervals.

Enterococci and *Clostridium perfringens* are used as indicator organisms which estimate the health risk associated with swimming in marine waters. Although it is not included in the State's water quality standards, *C. perfringens* is used as a choice indicator for several reasons. Studies in Hawaii have shown that enterococci occur naturally in Hawaiian soils and most outdoor environments, making it a less reliable indicator of water pollution. In contrast, *C. perfringens* is more closely associated with sewage contamination. *C. perfringens* is also known to have a longer environmental survival time in seawater, and their presence, therefore, resembles many of the pathogens that they index.

(1) Sampling Objective and Data Quality: The purpose of sampling is to quantify levels of bacteria to determine the potential human health risks associated with swimming in recreational waters. The regulatory objective is to identify water quality violations. Since nonpoint sources are primarily responsible for water quality impairment in recreational waters, the relationship between rainfall events and water quality impacts can be identified. The long-term objective is to detect trends in bacteria levels. Samples are drawn uniformly at the shoreline in a manner that keeps sampling error to a minimum by adhering to quality assurance protocols. As part of the QA/QC Plan, the sampling protocols are described in the field manual issued to the monitoring staff. The sampling protocols require that the specified sampling method be implemented at the highest level of effectiveness.

The data quality objective is to ensure that the monitoring data are adequate and reliable in making informed decisions on the potential health risk associated with point and nonpoint source contaminants. Routine data checks are required as part of the data screening and validation process. In addition, periodic checks are performed by visual examination and plotting techniques (use of statistical software) for data consistency. Data are compared with historical records for a given location. Spot checks and comparison of data sets provide for identification

of individual values that fall outside the normal range. Historical consistency can be maintained by this process.

The use of multiple indicators facilitates making assessments and decisions on when to clear beaches that are closed for swimming after sewage spill events. Water samples tested for *C. perfringens* reduce the risk of making incorrect decisions, due to the inherent weakness of enterococci as an indicator for sewage contamination. Background data from fixed stations are compared before and after spills for added assurance in making informed decisions. Once background levels are reliably attained, an "all-clear" notification is then declared.

(2) Network Design Criteria: The sampling design is based on a space-time framework, with water samples taken at pre-defined locations (fixed-stations). The locations are considered representative of the target population, although some compromise is necessary with regard to sampling time due to sampling logistics (*i.e.*, cost effectiveness, imposed conditions on sample holding time, site accessibility, and resource constraints). In addition, the design considerations include sources and patterns of contamination (*e.g.*, storm drains, fresh water streams, circulation and current patterns).

As a result of the latest DOH-CWB cut-backs, the monitoring program has revised the monitoring design to reflect existing resources and monitoring priorities. As part of the monitoring strategy, a set of criteria will be used to further modify the sampling network if further cuts are required. Although a few fixed-stations will be archived in the event of further cutbacks, in most cases sampling frequencies will be reduced, using the criteria as follows:

- Chronic Violations: sampling sites with high visibility and historically-elevated bacteria levels will be retained while others will be temporarily de-activated or sampling frequencies reduced;
- Popular Bathing Beaches: sampling sites at areas with high recreational use among both local and visitors will be retained;
- Nonpoint Source Pollution: sampling sites in recreational waters that are heavily impacted by nonpoint sources will be kept;
- Benchmarks: only certain established benchmark stations that reflect long-term status and trend will remain active; and
- Logistical Consideration: the site selection and/or sampling frequency will be evaluated and travel and time factors that significantly reduce monitoring cost will be taken into consideration.

(3) Maps of Sampling Stations: The locations of sampling stations will be shown on attached maps of each island and identified to their general locations. The STORET data system has been updated to identify each station by its latitude and longitude grid coordinates. This information can be down-loaded at any time. Sampling site survey and documentation (hard copy file) with photographs is now 85% completed for the State. This file contains information unique to the sampling site or land characteristics that may influence sampled data or reflect a particular water quality condition. As with all STORET data and any water quality information, this file is available for inspection by the general public.

C. Toxic Contaminants Screening Monitoring Program

Toxic contaminants screening is included in the monitoring strategy to identify site-specific areas in the State where concentrations of chemical contaminants in fish and shellfish may be potentially harmful to human consumers. Screening surveys have been done in the past to identify those sites where specific chemicals have been found in bottom sediments and fish tissues.

The toxic contaminants screening program is currently in abeyance due to the budget cuts. However, this component of the monitoring program is considered an important activity in future plans involving public health protection. The general approach has been described earlier as a two-tiered strategy. The first level is to conduct another statewide survey paralleling the work done in 1971. The second and less costly approach is to conduct site-specific studies, for example, as part of the Ala Wai Canal Watershed Project. Although a fish consumption advisory for the Ala Wai Canal was issued four years ago, the present levels of toxic contaminants are unknown. Not only will the current data ensure that the general public is adequately warned, but a determination can be made on whether a toxic management strategy can be an appropriate element of this watershed project.

In addition, this and other parts of the workplan will serve as a guidance document for use by the laboratory in their program management and support functions. Laboratory needs can be adequately met if such a plan is documented in advance for future budget and planning purposes. It is recognized that the Toxic Contaminant Screening Program will require special commitment of resources. Therefore, it is the overall goal of this document to enable the laboratory and other related programs to reasonably allocate and effectively use limited resources.

(1) Data Quality Objectives: Among some of the data quality objectives for toxic contaminants screening are to: (1) quantify levels of target analytes in fish and shellfish; (2) define survey boundaries for an area of concern or determine the target population of the study area; (3) ensure that the sampling design is adequately structured to test statistical hypotheses; (4) collect data that are reliable in making risk-based consumption advisories; and (5) develop sampling designs that are cost-effective without compromising data quality.

The primary aim is to identify significant sources of contaminants and to link the sources with the potential to contaminate target species. The following steps are simplified for this discussion only. A more detailed description will be presented for selected annual workplans. In general, the initial approach will be to test water samples to determine if the target pollutant exceeds the water quality standards. The next target medium of concern will include bottom sediments that may be the actual source or may act as sinks for pollutants. The extent (bioavailability potential) to which the contaminants are associated with sediments (interstitial layer) will be assessed. Generally, the bond between the water layer in contact with the bottom sediment will ultimately lead to biological exposure. The project boundary will be determined by the extent of contamination or distribution of target pollutants. Following this step, actual pollutant

concentrations in target species will be identified. *(It should be noted here that the scope of a sediment contaminant protocol may vary if the project falls under CERCLA or RCRA regulations.)*

(2) Target Species: Some of the target species that will be considered for this screening program are commonly found in the State. These include mullet *(Mugil cephalus)*, aholehole *(Kuhlia sandvicensis),* tilapia *(Tilapia spp.)*, Hawaiian crab *(Podophthalmus vigil*), blue claw crab *(Thalamita crenata)*, and white crab *(Portunus sanguinolentus*). Table VII-3 shows a list of some of the toxic screening undertaken in the past.

The selection of target species is primarily based on the ethnic and cultural preferences of local consumers with respect to fish and shellfish. The listed target species in Table VII-3 are unique to the State, although they may not represent a complete selection of both bottom and predator species that should be among the desired test animals for the screening program. Predator fish species that are not listed include ulua or jack *(Carangiodes sp. and Caranx spp.)*, kaku *(Sphyraena barracuda)* and popular game fishes such as the Pacific blue marlin (Au). For bottom feeders, the screening program may select weke or goatfish species such as weke pueo *(Upeneus arge*), weke ʻulua *(Mulloidichthys auriflamma)*, moano *(Parupeneus multifasciatus)* or kumu *(Parupeneus porphyreus).*

TABLE VII-3
DOH TOXIC CONTAMINANTS SCREENING for 1991

Sampling Site	Target Species	Target Analyte[1]
Ala Wai Canal #1	*Thalamita creanata*	Metals and Syn. Org.
Ala Wai Canal #2	*Thalamita creanata*	Metals and Syn. Org.
Ala Wai Canal #3	*Thalamita creanata*	Metals and Syn. Org.
Ala Wai Canal #4	*Thalamita creanata*	Metals and Syn. Org.
Manoa Stream, Oahu	*Tilapia mosambique*	Metals and Syn. Org.
Kaneohe Bay, Oahu	*Elops hawaiiensis*	Metals and Syn. Org.
Kalihi Stream, Oahu	*Tilapia sp.*	Metals and Syn. Org.
Kaelepulu Stream, Oahu	*Albula sp.*	Metals and Syn. Org.
Waikele Stream, Oahu	*Tilapia sp.*	Metals and Syn. Org.
Waikoloa Pond, Kona	*Halocardina rubra*	Metals and Syn. Org.
Kukio Pond, Kona	*Halocardina rubra*	Metals and Syn. Org.
Maunalani Pond, Kona	*Halocardina rubra*	Metals and Syn. Org.
Waiakea Pond, Hilo	*Mugil cephalus*	Metals and Syn. Org.
Hilo Bay	*Portunus sanguinolentus*	Metals and Syn. Org.

[1] Metals include Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn.
Synthetic organic compounds include chlordane isomers, chloropyrifos, dieldrin, DDT isomers, heptachlor, PCBs.

DOH fish tissue analyses have been performed in the past by the California Department of Fish and Game Laboratory. DOH anticipates that all future analyses for the Toxic Screening Program will be conducted at the new laboratory facility on Oahu, pending sufficient funding and resources.

D. Ala Wai Canal Watershed Monitoring Program

The following is a proposed monitoring plan that is meant to augment activities related to the Ala Wai Canal Watershed Plan. This monitoring workplan for the Ala Wai Canal Watershed is meant to serve as a model for the details required for watershed monitoring within the State.

(1) Background: The Ala Wai Canal watershed covers the Makiki-Manoa and Palolo drainage areas of approximately 4,300 hectares (10,060 acres). The various land uses in the drainage area include: conservation, forest and residential lands in Manoa and Palolo Valleys; various multi-residential and business districts in Makiki, Kaimuki, McCully; and the resort district of Waikiki. Surface runoff from these areas has a major influence on the water quality of the Ala Wai Canal. DOH monitoring of the canal since 1971 has shown high levels of bacteria, nutrients, and turbidity, including chlorophyll a, that exceed State Water Quality Standards. DOH also found elevated levels of metals and synthetic organic compounds in bottom sediments and biota tissues. The major cause of pollution in the Ala Wai Canal is polluted runoff.

The Ala Wai Canal is used primarily for non-contact water recreation such as canoe paddling and kayaking, although at times recreational fishing and crabbing occurs. DOH has issued pollution warnings, with signs posted on land where canoes and kayaks are launched.

(2) Purpose and Goal: The existing ambient water quality monitoring program has recorded water quality data for the Ala Wai Canal since 1971. The primary goal of this program is to report the status and trends in water quality. As part of the monitoring workplan for the Ala Wai Canal watershed project, the data will serve as a benchmark from which to identify measurable changes in water quality and assess the relative effectiveness of land management and pollution control practices.

The short-term goal of the workplan is to quantify in-stream components of water quality and identify reaches of streams that contribute the most pollutants. Each reach of stream may be grouped by size (*e.g.*, percent of total area) in each hydrologic sub-unit (3 to 4). This approach may be used as the basis for determining where effective land-based management policies or pollution control measures are most desirable. Another method of defining boundaries would be to group areas by the total linear miles of storm drains within hydrographic sub-units. This process will also allow polluted runoff control programs to select and evaluate solutions that are most appropriate and practical for the targeted area.

(3) Hypotheses: The in-stream monitoring data from each reach will be assessed to determine if there is a significant relationship between water quality and the

hydrologic pathways of pollutants. It is reasonable to assume that the more conduits (drainage systems) in any part of the stream, the greater the impact of in-stream pollutants on water quality.

Hypothesis A: A test hypothesis, for example, is that in-stream waters in the watershed where natural (permeable) hydrologic pathways occur are less contaminated than in areas with manmade conduits. The key parameters of interest are turbidity, total suspended solids, total nitrogen and bacteria (enterococcus and *Clostridium perfringens*).

Also, the assumption is that the benchmark ambient sampling statistics are acceptable population parameter estimates. The implications are that future water quality will be improved as a result of efforts to mitigate water pollution by whatever means selected. A past study performed for the State on the Ala Wai Canal has proposed flushing the canal as one of the remedial options to reduce excessive phytoplankton growth. A way to determine whether the long-term goal for the Ala Wai Canal has been met is to implement water quality monitoring specifically for this purpose.

Hypothesis B: A hypothesis to be tested will be that the ambient phytoplankton population in the Ala Wai Canal is significantly lower after management practices have been implemented. DOH-CWB will continue monitoring the canal to provide long-term monitoring data for this purpose. The results, of course, will not be available until several years later.

In addition to its current sampling sites, three benchmark sites in the Ala Wai Canal will be selected to monitor specifically for water clarity. The parameters that will be measured are chlorophyll-a, light extinction, turbidity and suspended solids. Secchi disk readings will also be made. Limited resources are a major constraint in carrying out some of these and other laboratory analyses. Since the laboratory is already performing at a maximum workload, some tradeoff will be necessary. This tradeoff will mean that certain fixed sampling stations (Core Network) will be dropped and/or sampling frequencies adjusted.

(4) Data Quality Objectives: In order to assess the inherent variability of in-stream parameters, certain critical factors will be considered in the sampling design. The workplan will take into account the dynamic variables and factors that influence data quality. It is therefore imperative that samples at each station are collected under uniform wet/dry conditions, with particular attention to the following:

- Antecedent dry days prior to sampling.
- Precipitation (duration and intensity).
- Stream flow (total volume of runoff).
- Frequency and time of sampling.
- Location and number of sampling points.

Due to the randomness of storm events, the data quality goal is to achieve maximum uniformity of precision. Sampling stations with high variation will

have low precision in contrast with stations with low variation. Hence, sampling frequencies will be increased in cases with high variation in order to obtain uniform precision. The decisions to be made, therefore, will be to select between proportional sampling frequencies (*i.e.*, to obtain uniform levels of information) and equal or constant sampling frequencies that are more practical in regulatory monitoring (*i.e.*, to determine violation in water quality standards). A third option is a statistical compromise between the previous two options. The data quality objective is to obtain the most statistically-sound information as possible. Improper sampling design and analysis will invalidate sampling results that are critical in making valid conclusions.

(5) Methods: Water samples will be tested for various water quality parameters that are found in the State Water Quality Standards, as well as other useful markers. The monitoring parameters are: temperature, salinity, pH, dissolved oxygen, turbidity, total suspended solids, chlorophyll a, and dissolved nutrients (silicate, phosphate, ammonia, nitrate-nitrite nitrogen). Both dissolved and particulate phosphates will be tested to determine how much of the phosphate is unavailable. No attempt will be made to quantify the relationship between phosphorus and phytoplankton growth due to the many possible variables of the canal environment.

Sampling frequencies will vary with the monitoring option selection and subject to change according with the variability of individual samples as discussed earlier. Since the watershed sampling work of the monitoring plan requires a substantial commitment of laboratory resources, the laboratory's final approval will be needed.

(6) Monitoring Sites: The following locations in the watershed are identified as possible monitoring sites where samples will be collected. Each selected site will be described in more detail in the final report. Thirty sampling stations are identified for various streams and tributaries within the watershed. Numbers in parenthesis indicate the number of stations at each site.

Palolo Stream - *Kaoli Road, St. Louis Drive, Palolo Ave., Kalua Rd., Kiwila St.(5)*
Tributaries:
Pukele Stream - *10th Ave. , End of Ipule Place*. (2)
Waiamao Stream - *10th Ave. Place. (1)*

Manoa Stream - *Pinao St., Kahaloa Dr., Lowrey Ave., Woodlawn Ave., Dole St., King St., Date St. (7)*
Tributaries:
Waihi Stream - *Waaloa Pl. (1)*
Aihualama Stream - *Manoa Falls Trail, Lower Waakaua (2)*
Waiakeakua Stream - *Middle Waakaua (1)*
Waalua Stream - *Upper Waakaua (1)*
Naniuapo Stream (0)

Makiki Stream - *Fern St., King St., Wilder Ave. (near Foodland) (3)*
Isenberg/Hausten St. Drainage Canal - *Kapiolani Blvd., Lime St., Date St. (3)*
Ala Wai Canal - *Library end, Golf Driving Range, McCully St., Ala Moana St. (4)*

(7) Quality Assurance: The sampler will implement the methods and procedures described in the field protocol, Water Quality Monitoring Program Basic Water Chemistry, Sampler's Manual, prepared by DOH. (Laboratory QA/QC procedures will not be described in the workplan. Specific methods and procedures for laboratory analyses are detailed in DOH's QA/QC Manual.)

(8) Monitoring Plan Options: A major constraint in the Monitoring Plan is the additional workload for the chemistry laboratory. A concession will be made by dropping some of the existing Core Network stations to make up for the additional sampling and analyses. However, the monitoring tradeoff by itself is not sufficient without additional laboratory support to implement one of the four monitoring options that are being proposed. The final acceptance and approval will be made between the DOH Clean Water Branch and Laboratories Division.

Option 1: This option will include a sampling program for all the tributaries of Manoa and Palolo Streams, including Makiki Stream, Apukehau Stream and the Ala Wai Canal. Both in-stream chemical and physical-chemical properties will be tested. The frequency of tests will vary between weekly physical-chemical measurements for all stream segments and the Ala Wai Canal. Samples for water chemistry will be collected monthly at all stream stations and twice per month at the Ala Wai Canal.

Option 2: Rather than taking samples at all in-stream stations, Option 2 will include only water chemistry measurements at all stations identified in Option 1. No physical-chemical properties are included. Sampling frequencies remain the same as in Option 1.

Option 3: The third option includes monitoring of the Ala Wai Canal only. Both water chemistry and physical-chemical properties are included; sampling frequencies are the same as in the other options. This is the recommended option, if the workload is acceptable to the laboratory. A modified version of Option 3 would reduce the sampling frequency to monthly.

Option 4: The last option may include only physical-chemical measurements in the Ala Wai Canal. Only laboratory analyses for total suspended solids (TSS) and chlorophyll-a would be required. This option may be modified by changing sampling frequency from weekly/bi-weekly to bi-weekly/monthly field and laboratory analyses, respectively.

(9) Field Sampling: Hydrographic boundaries and stream segments will be identified on maps that specify stream sampling locations. Water samples will be collected and tested at fixed stations using identical methods and procedures. Field instruments will be calibrated each sampling day to ensure accuracy of measurements. Grab samples for tests required in the laboratory will be collected, stored in ice chests, kept cold with blue ice, and transported as soon as possible to prevent degradation. If required, composite samples will be taken at time intervals with automatic samplers that are calibrated on flow rated basis.

(10) Chain of Custody: The official record of sample custody will be processed for

each sample collection. The record will indicate the project ID., sampler ID. (with signature), station location, date, collection time, type of sample, container, and the required analyses. When samples are transferred to the next custodian, two signatures (deliverer/receiver) will be necessary for the record, including the date and time of transfer. Appropriate copies will be kept on file.

4. Tracking Management Measure Implementation

The tracking of management measure implementation is the second goal of the coastal nonpoint pollution control program monitoring component. EPA and NOAA have provided guidance to ensure that management measures are implemented, inspected, and maintained properly. Under their coastal nonpoint pollution control programs, states will apply management measures to a wide range of sources including agriculture, forestry, urban activities, marinas and recreational boating, and hydromodification. Water quality monitoring will look at long-term trends to see if management measure implementation has had a positive effect on water quality. States must also track the implementation of management measures.

For the planned control of polluted runoff to be successful, a mechanism needs to be developed to ensure land users are properly implementing BMPs that address the applicable management measures in the Hawaii coastal nonpoint pollution control program management plan. By tracking management measure implementation and water quality simultaneously, Hawaii will be in a position to evaluate the performance of management measures implemented under its program.

One method for ensuring implementation of management measures is the use of "site inspectors" or "extension agents." The site inspector's duties may include making random site visits to a particular land use area to identify implementation of appropriate best management practices consistent with the type of land use activity. These "inspectors" would work as extension agents and try to cooperatively work with the land user to properly install and maintain particular BMPs. This "inspector" would be part of the agency that has oversight or enforcement authority over a particular management measure. Such personnel would be costly, but may provide better compliance and assist land users in meeting water quality goals. Given restricted State and county budgets it seems this approach may not be possible at this time. Rather, the alternative, initially, may be to inspect initially only where persistent water quality violations are occurring.

PART VIII: GLOSSARY

10-year, 24-hour storm - A rainfall event of 24-hour duration and 10-year frequency that is used to calculate the runoff volume and peak discharge rate to a best management practice (BMP).

25-year, 24-hour storm - A rainfall event of 24-hour duration and 25-year frequency that is used to calculate the runoff volume and peak discharge rate to a BMP.

Adsorption - The adhesion of one substance to the surface of another.

Ahupua'a - In ancient Hawaii, the division of land known as an ahupua'a generally ran from the sea to the mountains. A principle very largely obtaining in these divisions of territory was that a land should run from the sea to the mountains, thus affording to the chief and his people a fishery residence at the warm seaside, together with the products of the high lands, such as fuel, canoe timber, mountain birds, and the right of way to the same, and all the varied products of the intermediate land as might be suitable to the soil and climate of the different altitudes from sea soil to mountainside or top.

Animal Unit - A unit of measurement for any animal feeding operation calculated by adding the following numbers: the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 25 kilograms (approx. 55 pounds) multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0.

Animal waste - Animal waste (manure) includes the fecal and urinary wastes of livestock and poultry; process water (such as from a milking parlor); and the feed, bedding, litter, and soil with which they become intermixed.

Backflow prevention device - A safety device used to prevent water pollution or contamination by preventing flow of water and/or chemicals in the opposite direction of that intended.

Benthic - Associated with the sea bottom.

Berm - A low earth fill constructed in the path of flowing water to divert its direction, or constructed to act as a counterweight beside the road fill to reduce the risk of foundation failure (buttress).

Best Management Practice (BMP) - A practice or combination of practices that are determined to be the most effective and practicable (including technological, economic, and institutional considerations) means of controlling point and nonpoint pollutants at levels compatible with environmental quality goals.

Biochemical oxygen demand (BOD) - the quantity of dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter and oxidizable inorganic matter by aerobic biological action.

Cable logging - A system of transporting logs from stump to landing by means of steel cables and winch. This method is usually preferred on steep slopes, wet areas, and erodible soils where tractor logging cannot be carried out effectively.

Channel - A natural or constructed waterway that continuously or periodically passes water.

Channelization or ***channel modification*** - These terms (used interchangeably) describe river and stream channel engineering systems that facilitate flood control, navigation, drainage improvement, and reduction of channel migration potential. Activities such as straightening, widening, deepening, or relocating existing stream channels and clearing or snagging operations fall into this category.

Chemigation - The addition of one or more chemicals (fertilizers or pesticides) to the irrigation water.

Confined animal facility - A lot or facility (other than an aquatic animal production facility) where the following conditions are met:

- Animals (other than aquatic animals) have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and
- Crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

Constructed wetland - Engineered systems designed to simulate natural wetlands to exploit the water purification functional value for human use and benefits. Constructed wetlands consist of former upland environments that have been modified to create poorly drained soils and wetlands flora and fauna for the primary purposes of contaminant or pollutant removal from wastewaters or runoff. Constructed wetlands are essentially wastewater treatment systems and are designed and operated as such even though many systems do support other functional values.

Contour - An imaginary line on the surface of the earth connecting points of the same elevation. A line drawn on a map connecting the points of the same elevation.

Conveyance system - The drainage facilities, both natural and human-made, which collect, contain, and provide for the flow of surface water and urban runoff from the highest points on the land down to a receiving water. The natural elements of the conveyance system include swales and small drainage courses, streams, rivers, lakes, and wetlands. The human-made elements of the conveyance system include gutters, ditches, pipes, channels, and most retention/ detention facilities.

Culvert - A metal, wooden, plastic, or concrete conduit through which surface water can flow under or across roads.

Cumulative effect - The impact on the environment that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such action.

Dams - Constructed impoundments that are either: (1) 25 feet or more in height *and* greater than 15 acre-feet in capacity; or (2) 6 feet or more in height *and* greater than 50 acre-feet in capacity.

Denitrification - The chemical or biochemical reduction of nitrate or nitrite to gaseous nitrogen, either as molecular nitrogen or as an oxide of nitrogen.

Deposition - The accumulation of material dropped because of a slackening movement of the transporting material - water or wind.

Dissolved oxygen (DO) - The concentration of free molecular oxygen in the water column.

Diversion - A channel, embankment, or other man-made structure constructed to divert water from one area to another.

Ecosystem - The complex of a community and its environment functioning as an ecological unit in nature; a basic functional unit of nature comprising both organisms and their nonliving environment, intimately linked by a variety of biological, chemical, and physical processes.

Erosion - Wearing away of the land surface by running water, glaciers, winds, and waves. Erosion occurs naturally from weather or runoff but can be intensified by land-clearing practices related to farming, residential or industrial development, road building, or timber cutting. The term erosion is usually preceded by a definitive term denoting the type or source of erosion such as gully erosion, sheet erosion, or bank erosion.

Fallow - Allowing cropland to lie idle, either tilled or untilled, during the whole or greater portion of the growing season.

Fecal coliform - Bacteria present in mammalian feces, used as an indicator of the presence of human feces, bacteria, viruses, and pathogens in the water column.

Fertilizer - Any organic or inorganic material of natural or synthetic origin that is added to a soil to supply elements essential to plant growth.

Filtration - The process of being passed through a filter (as in the physical removal of impurities from water) or the condition of being filtered.

Ground water - Subsurface water occupying the zone of saturation. In a strict sense, the term is applied only to water below the water table.

Habitat - The place where an organism naturally lives or grows.

Hydromodification - An alteration of the hydrologic characteristics of coastal and noncoastal waters, which in turn could cause degradation of water resources. In other words, any alteration to a stream or coastal waters, whether a diversion, channel, dam or levee, is considered a hydromodification.

Impervious surface - A hard surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development and/or a hard surface area that causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, rooftops, walkways, patios, driveways, parking lots, storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam, or other surfaces that similarly impede the natural infiltration of urban runoff. Open, uncovered retention/ detention facilities shall not be considered as impervious surfaces.

Impoundment - The collection and confinement of water as in a reservoir or dam.

Infiltration - The penetration of water through the ground surface into subsurface soil or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

Integrated Pest Management (IPM) - A pest population management system that anticipates and prevents pests from reaching damaging levels by using all suitable tactics including natural enemies, pest-resistant plants, cultural management, and the judicious use of pesticides, leading to an economically and environmental safe agriculture.

Intermittent stream - Stream that carries water most of the time but ceases to flow occasionally because evaporation or seepage into its bed and banks exceed the available streamflow. For the purposes of this management plan, intermittent streams will also include:

> ***ephemeral streams*** that carry water only after rains; and
> ***interrupted streams*** that carry water generally through their length but may have sections with dry streambeds.

Irrigation - Application of water to lands for agricultural purposes.

Leaching - The removal from the soil-in-solution of the more soluble materials by percolating waters.

Management measure - An economically achievable measure for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflects the greatest degree of pollutant

reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives.

NPDES - National Pollutant Discharge Elimination System. A permitting system for point source polluters regulated under Section 402 of the Clean Water Act.

Nutrients - Elements, or compounds, essential as raw materials for organism growth and development, such as carbon, nitrogen, phosphorus, etc.

On-site disposal system (OSDS) - A sewage disposal system designed to treat wastewater at a particular site. Septic tank systems are common OSDS.

Pasture - Grazing lands planted primarily to introduced or domesticated native forage species that receives periodic renovation and/or cultural treatments such as tillage, fertilization, mowing, weed control, and irrigation. Not in rotation with crops.

Percolation - The downward movement of water through the soil.

Perennial stream - A stream that carries water all the time.

Permeability - The quality of a soil horizon that enables water or air to move through it; may be limited by the presence of one nearly impermeable horizon even though the others are permeable.

Persistence - The relative ability of a pesticide to remain active over a period of time.

Pesticide - This term includes any substance or mixture of substances used for preventing, destroying, repelling, or mitigating any pest or intended for use as a plant regulator, defoliant, or desiccant.

Pollutant - Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water (Section 502(6) of The Clean Water Act as amended by the Water Quality Act of 1987, PL 100-4).

Pollution abatement function - The ability of a wetland or riparian area to remove pollutants from runoff passing through the wetland or riparian area.

Postdevelopment peak runoff - Maximum instantaneous rate of flow during a storm, after development is complete.

Predevelopment - This term refers to the sediment loadings and runoff volumes/ velocities that exist onsite immediately before the planned land disturbance and

development activities occur. Predevelopment is not intended to be interpreted as that period before any human-induced land disturbance activity has occurred.

Prescribed burning - Skillful application of fire to natural fuels that allows confinement of the fire to a predetermined area and at the same time produces certain planned benefits.

Range - Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing. Range includes natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, wet meadows, and riparian areas.

Residence time - The length of time water remains in a waterbody. Generally the same as ***flushing time***.

Right-of-way - The cleared area along the road alignment that contains the roadbed, ditches, road slopes, and back slopes.

Riparian areas - Vegetated ecosystems along a waterbody through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent waterbody. These systems encompass wetlands, uplands, or some combination of these two land forms; they will not in all cases have all of the characteristics necessary for them to be classified as wetlands.

Root zone - The part of the soil that is, or can be, penetrated by plant roots.

Runoff - That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into the receiving waters.

Sediment - Sediment is the result of erosion. It is the solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, or gravity.

Settleable solids - Solids in a liquid that can be removed by stilling a liquid. Settling times of 1 hour or more are generally used.

Shoreline erosion - This term is used in this report to refer to the loss of beach or fastland in tidal portions of coastal bays or estuaries.

Silt fence - A temporary barrier used to intercept sediment-laden runoff from small areas.

Skid trail - A temporary, nonstructural pathway over forest soil used to drag felled trees or logs to the landing.

Stream - Any natural water course in which water usually flows in a defined bed or channel, whether or not the flow is constant, uniform, or uninterrupted, and regardless of whether the stream has been altered or channelized. In distinguishing between a stream and other water features such as gullies, the most significant feature of a stream is the existence of a streambed that has graded or sorted deposits consisting primarily of sand, gravel, and boulders.

Streambank - The side slopes of a channel between which the streamflow is normally confined.

Streambank erosion - This term is used in this report to refer to the loss of fastland along nontidal streams and rivers.

Streamside management zone (SMZ) - A designated area that consists of the stream itself and an adjacent area of varying width where management activities that might affect water quality, fish, or other aquatic resources are modified to mitigate the adverse effects. The SMZ is not an area of exclusion, but an area of closely managed activity.

Suspended sediment - The very fine soil particles that remain in suspension in water for a considerable period of time.

Suspended solids - Solid materials that remain suspended in the water column.

Tilth - The physical condition of the soil as related to its ease of tillage, its fitness as a seedbed, and its impedance to seedling emergence and root penetration.

Turbidity - A cloudy condition in water due to suspended silt or organic matter.

Urban runoff - That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, underflow, or channels or is piped into a defined surface water channel or a constructed infiltration facility.

Vegetated buffer - Strips of vegetation separating a waterbody from a land use with potential to act as a nonpoint pollution source; vegetated buffers (or simply buffers) are variable in width and can range in function from a vegetated filter strip to a wetland or riparian area.

Vegetated filter strip (VFS) - Created areas of vegetation designed to remove sediment and other pollutants from surface water runoff by filtration, deposition, infiltration, adsorption, decomposition, and volatilization. A vegetated filter strip is an area that maintains soil aeration as opposed to a wetland, which at times exhibits anaerobic soil conditions.

Vegetative treatment system (VTS) - A system that consists of a vegetated filter strip, a constructed wetland, or a combination of both.

Watershed - A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, lake, or ocean at a lower elevation.

Wetlands - Areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions; wetlands generally include swamps, marshes, bogs, and similar areas.

Yarding - Method of transport (of felled trees) from harvest area to storage landing.

PART IX: REFERENCES

ASAE. 1989. *Standards, Engineering Practices and Data Developed and Adopted by the American Society of Agricultural Engineers*. Standard EP409. St. Joseph, MI: ASAE.

Brennan, B.M., A.K. Higashi, and C.L. Murdoch. 1992. *Estimated Pesticide Use on Golf Courses in Hawaii* (Research Extension Series). Honolulu: University of Hawaii, 16 pp.

City and County of Honolulu, Department of Public Works, and Hawaii Department of Health. 1990. *Water Quality Management Plan for the City and County of Honolulu*. Prepared for the U.S. Environmental Protection Agency.

Coffey, S.W. and M.D. Smolen. 1990. *The Nonpoint Source Manager's Guide to Water Quality Monitoring - Draft*. Developed under EPA Grant Number T-9010662. U.S. Environmental Protection Agency, Water Management Division, Region 7, Kansas City, MO.

Dudley and Hallacher. n.d. *Progress Report - Tier One: Distribution and Dispersion of Sewage Pollution in Hilo Bay and Contiguous Waters*. University of Hawaii at Hilo.

Edward K. Noda & Associates. 1992a. *Ala Wai Canal Improvement Feasibility Report*. For the Department of Land and Natural Resources. October 1992.

_____. 1992b. *A Management Plan for the Ala Wai Canal Watershed*. For the Department of Land and Natural Resources. October 1992.

_____. 1992c. *A Maintenance Plan for the Ala Wai Canal*. For the Department of Land and Natural Resources. October 1992.

_____ with KRP Information Services. 1993. *Ala Wai Canal Improvement Environmental Assessment*. For the Department of Land and Natural Resources. April 1993.

Handy, E.S. Craighill, E.G. Handy, and M.K. Pukui. 1972. *Native Planters in Old Hawaii: Their Life, Lore, and Environment*. Honolulu: Bishop Museum Press.

Hawaii Department of Agriculture. 1994. *Statistics of Hawaii Agriculture*. Prepared by the Hawaii Agriculture Statistical Service.

Hawaii Department of Business, Economic Development and Tourism (DBEDT). 1994. *Hawaii Data Book 1993-94: A Statistical Abstract*. Honolulu: DBEDT, 571 pp.

_____, Ocean Resources Branch. 1993. *Boating and Ocean Recreation Permit Requirements*. Honolulu: DBEDT.

_____, Ocean Resources Branch. 1994. *1994-1995 Hawaii Marine Directory*. Honolulu: DBEDT.

Hawaii Department of Health (DOH). 1975. *Water Quality*. Hawaii Water Resources Regional Study Element Report, Study Element Team 3.7. Honolulu.

_____. 1989. *Hawaii's Assessment of Nonpoint Source Pollution Water Quality Problems*. Prepared for the U.S. Environmental Protection Agency.

_____. 1990a. *Hawaii's Assessment of Nonpoint Source Pollution Water Quality Problems*. Honolulu.

_____. 1990b. *Hawaii's Nonpoint Source Water Pollution Management Plan*. Honolulu.

_____ and County of Hawaii. 1993a. *Water Quality Management Plan for the County of Hawaii.* Honolulu.

_____ and County of Kauai. 1993b. *Water Quality Management Plan for the County of Kauai*. Honolulu.

_____ and County of Maui. 1993c. *Water Quality Management Plan for the County of Maui.* Honolulu.

_____, Solid and Hazardous Waste Branch. 1994. *'94 Directory: Waste Management Services in Hawaii*. Honolulu: DOH.

_____, Environmental Health Administration. 1995. *Alternatives to Household Hazardous Products* (Informational flyer). Honolulu: DOH.

_____, Wastewater Branch. 1995. *Draft Guidelines for Livestock Waste Management*. Honolulu: DOH.

_____, Clean Water Branch. 1995. *Draft Hawaii Ambient Water Quality Monitoring Strategy*. Honolulu.

Hawaii Department of Land and Natural Resources (DLNR), Commission of Water Resource Management. 1990. *Hawaii Stream Assessment: A Preliminary Appraisal of Hawaii's Stream Resources*. Report R-84, prepared by Hawaii Cooperative Park Service Unit.

_____. Division of Water and Land Development. 1994. *Dams within the Jurisdiction of the State of Hawaii.* Circular C-122. In association with Association of State Dam Safety Officials and the Federal Emergency Management Agency.

_____, Commission on Water Resources Management. 1994. *Stream Protection and Management Plan*. Honolulu.

Hawaii Office of State Planning (OSP). 1990. *Hawaii Coastal Zone Management Program*. Honolulu: CZM Program, 65 pp.

_____. 1992. *Golf Course Development in Hawaii: Impacts and Policy Recommendations*. Honolulu.

_____. 1993. *Draft State Planning and Evaluation Guidelines for Private Sector Marina Development*. Honolulu: OSP.

INALAB, Inc. 1992. *305(b) Water Quality Report*. For Department of Health, State of Hawaii, Honolulu.

Lal, Padma Narsey and Athline Clark. 1991. *Personal Recreation Boating Industry in Hawaii: Physical Characteristics and Economic Contribution*. UHIHI-SEAGRANT-ME-91-01, University of Hawaii Sea Grant College Program, Honolulu. Contribution No. 94, DBEDT, Ocean Resources Branch, Honolulu.

Lowrance, R.R., S. McIntyre, and C. Lance. 1988. Erosion and Deposition in a Field/Forest System Estimated Using Cesium-137 Activity. *Journal of Soil and Water Conservation*, 43(2): 195-199.

MacDonald, C.D., H.E. Deese, E. Corbin, and A.M. Clark. 1995. New projections for Hawaii's ocean industries: A strategic orientation. In *OCEANS '95 Proceedings*, October 9-12, 1995, San Diego, CA. IEEE and Marine Technology Society, Washington, D.C.

MacDonald, G.A., A.T. Abbott, and F.L. Peterson. 1983. *Volcanoes in the Sea: The Geology of Hawaii.* Honolulu: University of Hawaii Press.

Masa Fujioka & Associates. 1995. *Urban Nonpoint Source Pollution Control in the Pacific Islands: Applicability of Pollution Control BMPs*. Prepared for the Environmental Protection Agency.

MBA International. 1993. *Background Studies of Nonpoint Source Pollution in the State of Hawaii*. Prepared for the Coastal Zone Management Program, State of Hawaii, Honolulu.

Mitsch, W.J. and J.G. Gosselink. 1986. *Wetlands*. New York: Van Nostrand Reinhold Co.

Pacific Environmental Research (PER). 1994. *Review and Inventory of Regulatory and Non-Regulatory Nonpoint Source Pollution Control Mechanisms in Hawaii*. Prepared for the Coastal Zone Management Program, Office of State Planning, State of Hawaii, Honolulu.

_____. 1995. *Preliminary Draft: Hawaii Coastal Nonpoint Pollution Control Program Management Plan*. Prepared for the Coastal Zone Management Program, Office of State Planning, State of Hawaii, Honolulu.

Reinelt, L.E. *et.al.* 1988. Nonpoint source pollution monitoring program design. In *Journal of Water Resources Planning and Management*, Vol. 114, No. 3, May.

Technical Committee on Nonpoint Source Pollution Control. 1978. *Nonpoint Source Pollution in Hawaii: Assessments and Recommendations*. Honolulu: Department of Health.

University of Hawaii, Department of Geography. 1983. *Atlas of Hawaii.* Honolulu: University of Hawaii Press, 238 pp.

_____, Sea Grant Extension Service, Department of Business, Economic Development and Tourism (DBEDT), Ocean Resources Branch, and The Ocean Recreation Council of Hawaii (TORCH). 1993. *Resource Enforcement and Conservation Hawaii (REACH)* (Informational flyer compiling resources for marine and coastal environmental protection). Honolulu.

_____, Sea Grant Extension Service, Department of Health, Office of Solid Waste Management, Department of Land and Natural Resources, Division of Boating and Ocean Recreation. 1994. *Managing Boat Wastes: A Guide for Hawaii Boaters*. Honolulu.

_____, Water Resources Research Center. 1969. *Estuarine Pollution in the State of Hawaii. Part I: Statewide Study*. Technical Report No. 31, Contract No. 14-12-446, Federal Water Pollution Control Administration, Department of the Interior.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1994. *National Food Security Act Manual, Third Edition*. (180-V NFSAM, Third Ed.)

_____, 1993. *Erosion and Sediment Control: Guide for Hawaii*. March 1981, revised July 1993.

_____, 1992. *Natural Resources Inventory*.

_____, 1973. *Soil Survey of Island of Hawaii, State of Hawaii.*

_____, 1972. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) and Hawaii Department of Planning and Economic Development (DPED). 1978. *State of Hawaii Coastal Zone*

Management Program and Final Environmental Impact Statement. Washington D.C. and Honolulu.

_____, National Oceanic and Atmospheric Administration (NOAA). 1993. *Program Development and Approval Guidance.* Washington, D.C.

U.S. Environmental Protection Agency (EPA). 1973. *The Control of Pollution from Hydrographic Modifications*. Washington D.C.: EPA.

_____. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. EPA 840-B-92-002.

Wood, H.B. 1977. Hydrologic differences between selected forested and agricultural soils in Hawaii. *Soil Science Society of America Journal*, Volume 41 (1): 132-136.

Woodward-Clyde. 1990. *Urban Targeting and BMP Selection: An Information and Guidance Manual for State Nonpoint Source Staff Engineers and Managers*. Prepared for the U.S. Environmental Protection Agency, Region 5, Water Division, Chicago, IL, and the Office of Water Regulations and Standards, Washington, D.C.

This page deliberately left blank.

APPENDIX A - WORKING AND FOCUS GROUP PARTICIPANTS

	Carl Bredhoff	[A]
@	Kip Dunbar	[W]
	Rick Gaffney	[M]
	Toby Hazel	[A/F/U/S/M]
@	Earl Hinz	[M/W]
	Howard Horiuchi	[F]
	Charles Kokes	[A/F/U/S/M/W]
@	Pat Lee	[U/W]
@	Charlie Reppun (represented by Paul Reppun)	[A/S]
	Earl Spence	[A]
@	Representative David A. Tarnas	[W]
	Representative Cynthia Thielen	[W]
@	Les Vasconcellos	[M]
@	Carol Wilcox	[S/M]
	Edward Winkler	[F]
@	Gary O`Donnell 15 CES/CEVP	[W]
	Staff Sergeant Dye 15th CES/DED	[U/S/W]
	Robert Leong 15th Civil Engineering Squadron/DEV	[U/S/W]
@	Major Steve Payne 15th MG/SGPB	

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

	Commander 25th Infantry Division	[W]
	Jeff Faulkner A&B Properties	[U]
@	Steve Lewis Ala Wai Marine, Ltd.	[M/W]
	Scott Matsuura Manager, Government Affairs Alexander and Baldwin	[A/F/U/S/M/W]
	President American Inst. of Architects	[U]
@	Daniel Chun American Institute of Architects	[U]
@	Dr. Linda Hihara-Endo Amer. Society of Civil Engineers, Hawaii Section	[U/W]
@	Don Gerbig AMFAC/JMB Hawaii, Inc., Agricultural Operations	[A/S]
	Stanley Fujiyama Administrator Bank of Hawaii, Agricultural Loans	[A]
	Karl Bromwell Barrett Consulting Group	[U]
	Edward G. Hitti Barrett Consulting Group	[U]
	Clifford Lum Barrett Consulting Group	[U]
	F. David Hoffman, Jr. BHP Petroleum Americas (Hawaii) Inc.	[M]
	George Kahumoku, Jr. Big Island Pork Industry Ass'n	[A]
	Thomas Schubert Bioenergy Development Corp.	[F]

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

Michael Wilson [A/F/U/S/M/W]
Chairman
Board of Land & Natural Resources

@ Peter Bunn [A]
Brewer Environmental Industries

@ Elroy Chun [U]
Building Industry Ass'n of Hawaii

Jim Andrasick [F]
C. Brewer & Co., Ltd.

@ Douglas MacCluer [A/W]
Chairman
Central Maui SWCD

@ Patrick T. Onishi [A/F/U/S/M/W]
Director
City & County of Honolulu
Department of Land Utilization
(represented by Art Challacombe, Ardis Shaw-Kim)

@ Alex H.C. Ho [A/F/U/S/M/W]
City & County of Honolulu
Department of Public Works

Kenneth Sprague [A/F/U/S/M/W]
Director
City & County of Honolulu
Department of Public Works

Felix Limtiaco [A/F/U/S/M/W]
Director
City & County of Honolulu
Department of Wastewater Management

Ed Pier [A/F/U/S/M/W]
City & County of Honolulu
Department of Wastewater Management

@ Michael Lee [S/M/W]
Chief, Operations Div.
COE, Department of the Army

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

	Rae Loui Deputy Director Commission on Water Res. Mgmt.	[F/S/W]
@	Sallie Edmunds Planner Commission on Water Res. Mgmt.	[S]
	President Consulting Engineers Council of Hawaii	[U]
	Michael Duponte Cooperative Extension Service	[A]
@	Burt Smith Cooperative Extension Service	[A/W]
	Glen K. Fukumoto Cooperative Extension Service	[A]
	Margarita Hopkins County of Hawaii, Dept. of Research & Development	[A]
	Donna Fay Kiyosaki Chief Engineer County of Hawaii, Department of Public Works	[A/F/U/S/M/W]
@	Paul Nash County of Hawaii, Department of Public Works	[A/F/U/S/M/W]
@	Virginia Goldstein Director County of Hawaii, Planning Department (represented by Alice Kawaha and Norman Olesen)	[A/F/U/S/M/W]
	Steven Oliver Chief Engineer County of Kauai, Department of Public Works	[A/F/U/S/M/W]
	Kiyoji Masaki County of Kauai, Department of Public Works	[A/F/U/S/M/W]
@	Dee Crowell Director County of Kauai, Planning Department (represented by George Kalisik, Barbara Pendragon)	[A/F/U/S/M/W]

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@ Francis Cerizo [W]
County of Maui, Department of Public Works

Charles Jencks [A/F/U/S/M/W]
Director
County of Maui, Department of Public Works

@ Aaron Shinmoto [A/F/U/S/M]
County of Maui, Department of Public Works

@ David Blaine [A/F/U/S/M/W]
Director
County of Maui, Planning Department
(represented by Gwen Ohashi, Julie Higa)

Ernest Souza [A]
Dairy Producers Association

@ Craig Macdonald, Ph.D. [M]
Chief
DBEDT, Ocean Resources Branch
(represented by Athline Clark)

@ James Nakatani [A/W]
Chairperson
Department of Agriculture
(represented by Paul Schwind, TuckSeng Yang)

Dick Bower [A]
Department of Agriculture & Resource Economics, U.H.

Seiji Naya, Ph.D. [M]
Director
Department of Business, Econ. Dev. & Tourism

Kali Watson [A/F/U/W]
Chairman
Department of Hawaiian Home Lands

Lawrence Miike, M.D. [A/F/U/S/M/W]
Director
Department of Health

Bruce Anderson, Ph.D. [A/F/U/S/M/W]
Deputy Director
Department of Health

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@ Rick Eichor, Esq. [W]
Deputy Attorney General
Department of the Attorney General

@ Laurence Lau [W]
Deputy Attorney General
Department of the Attorney General

Commanding General (LE) [U/S/W]
Department of the Navy, Marine Corps Base Hawaii

Kazu Hayashida [U/W]
Director
Department of Transportation

@ Joe Chu [A/U]
Chief
DHHL, Planning Office
(represented by Charley Ice)

@ Randy Honebrink [S]
Coordinator
DLNR, Aquatic Res. Education
(represented by Randy Harr)

Donald Heacock [S]
Aquatic Biologist
DLNR, Division of Aquatic Resources

@ Dave Parsons [M/W]
Administrator
DLNR, Division of Boating and Ocean Recreation
(represented by Paul Dolan, Larry Uyehara)

William Aila, Jr. [M]
Harbor Agent
DLNR, Division of Boating and Ocean Recreation

Nick Giaconi [M]
Harbor Agent
DLNR, Division of Boating and Ocean Recreation

@ Michael Buck [F/S/W]
Administrator
DLNR, Div. Forestry & Wildlife
(represented by Ronald Walker)

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@ Carl Masaki [F/W]
Forestry Program Manager
DLNR, Div. of Forestry & Wildlife

Manabu Tagomori [S/W]
Manager/Chief Engineer
DLNR, Div. Water & Land Development

@ Wayne Ching [F]
Resource Management Forester
DLNR, DOFAW

David Smith [W]
Manager
DLNR, DOFAW, Oahu Wildlife Mgmt. Section

Administrator [A/U]
DLNR, Land Management Division
(represented by Glenn Abe, Mason Young)

Betsy Gagne [W]
Executive Secretary
DLNR, Natural Area Reserve System Commission

@ Paul Conry [S]
Nongame Biologist
DLNR, Division of Forestry and Wildlife

William Devick [S]
Program Manager
DLNR-DAR, Recreational Fisheries

@ Karl dalla Rosa [F]
DLNR-DOFAW

@ Earl Yamamoto [A/W]
DOA, Planning and Development Office

@ Denis Lau [A/F/U/S/M/W]
Chief
DOH, Clean Water Branch
(represented by Alec Wong)

@ Randall Rush
Planner
DOH, Environmental Planning Office

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@ June Harrigan-Lum, Ph.D. [A/F/U/S/M/W]
Manager
DOH, Environmental Planning Office

@ Dennis Tulang [A/U/M/W]
Chief
DOH, Wastewater Branch
(represented by Lori Kajiwara, David Yamamoto)

@ Wendy Wiltse [A/F/U/S/M/W]
Manager
DOH, West Maui Watershed Management Project

Sara Russell [U/M]
Pollution Prevention Coordinator
DOH-EPO

Carolyn McCabe [U/M]
DOH, Office of Solid Waste Management

Jane Dewell [U/M]
DOH, Solid & Hazardous Waste Branch

@ Hugh Ono [U/W]
Administrator
DOT, Highways Division
(represented by Roy Sakamoto)

@ Glenn Soma [U/M]
DOT, Harbors Planning Office
(represented by Harry Murakami)

Andrew Engilis [S]
Regional Biologist
Ducks Unlimited, Inc.

Alvin Char [U/S/W]
Chief
Environmental Office

President [A]
Florist Association of Hawaii

Wayne Salcedo [A]
President
Fresh Milk Industry of Hawaii

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@ Robert McEldowney [U/W]
General Contractors Assn.

Gary Lambert [M]
Gentry's Kona Marina

@ Denis Shimamoto [A/W]
Governor's Agriculture Coordinating Committee

Thomas Crabb [F]
Chair
Hamakua SWCD

@ Alan M. Suwa [M]
Haseko (Ewa) Inc.

@ Stephanie Whalen, Ph.D. [A/F/W]
President
Hawaii Agricultural Research Center

@ Valerie L. Mendes [A/S/W]
Hawaii Assn. of Conservation Districts
Windward Oahu SWCD
(represented by Rochelle Shim Fairbairn, Joyceline Lee, Lawana Mendes)

Francis Pacheco [A/S/W]
President
Hawaii Assn. of Conservation Districts

James Casel [A]
President
Hawaii Banana Industry Association

Robbie Hind [A]
President
Hawaii Cattlemen's Association

Alan Wall [A]
President
Hawaii Cattlemen's Council

Steve Cayetano [U/W]
President
Hawaii Chapter, Amer. Society of Civil Engineers

Larry Leopardi [U/M]
Hawaii Community Development Authority

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

	Walt Southward Executive Director Hawaii Contractors Ass'n	[U]
	Roy Kaneshiro President Hawaii Egg Producers Association	[A]
@	Wendell Koga Executive Director Hawaii Farm Bureau Federation	[A/S/W]
@	Michael Robinson Executive Director Hawaii Forest Industry Ass'n	[F/W]
	Ernest Morgado President Hawaii Fryer's Council	[A]
@	H. Peter L'Orange President Hawaii Leeward Planning Conf.	[A/U/W]
	President Hawaii State Coffee Association	[A]
	Myron E. Murakami Hawaii Tropical Flowers & Foliage Ass'n	[A]
@	Donna Wong Executive Director Hawaii's Thousand Friends	[A/F/U/S/M/W]
@	Rodney Asada Supvsg Land Agent Hawaiian Home Lands, Land Mgmt Branch	[F]
@	Win Bui Hawaiian Sugar Planters' Ass'n	[A/W]
@	Nick Dudley Hawaiian Sugar Planters' Ass'n	[F]
@	Robert Osgood Hawaiian Sugar Planters' Ass'n	[A/F/W]

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

	Ms. Vicki Borges Hill & Knowlton	[W]
	Kenneth A. Hoganson Mechanical Engineer Hoganson Companies	[U]
@	David Oya Honolulu Marine Inc.	[M]
@	Representative Jim Shon Chair House Comm. on Energy & Environmental Protection	[W]
	Representative Alex Santiago Chair House Comm. on Ocean Recreation & Marine Resources	[W]
	Alan Gottlieb Kahua Ranch	[A]
@	Monty Richards Kahua Ranch	[A]
	Norwood Conner President Kahuku Farmers Association	[A]
	Mr. Sereno General Manager KS/BE, Asset Management Group	[A/F/U]
@	Peter Simmons Kamehameha Schools/Bishop Estate	[F/W]
	Commodore Kaneohe Yacht Club	[M]
	Karen Taketa Executive Director Kauai Contractors Ass'n	[U]
	Rodney Haraguchi Kauai Taro Growers' Assn.	[A/S]

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@	Lee Fielder Yard Manager Keehi Marine Center	[M]
	Fred Namura Keehi Marine Center	[M]
	Marty L. Stevenson Pacific Regional Manager Kinnetic Laboratories Inc.	[A/U/M]
@	Jacqueline Parnell KRP Information Services	[A/F/U/S/M/W]
@	William Campbell Kukui`ula Development Co.	[M]
	Tom Shigemoto Kukui`ula Development Co., Inc.	[M]
	Donnell Tate Lahaina Port Captain	[M]
	Steve Snow Lana`i Company, Inc.	[A]
@	Melissa Anderson Land Use Research Foundation	[A/F/U/S/M/W]
@	Dan Davidson Executive Director Land Use Research Foundation (represented by Gordon Arakaki, Karen Piltz)	[A/U/W]
	Jay Nobriga Maui Cattlemen's Association	[A]
	Carolyn Hedemann Executive Director Maui General Contractors	[U]
	Richard Lafond Maui Tomorrow	[A/U/S/M]
@	Sam Araki Mauna Kea SWCD	[A]

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@ Susan Elliott Miller [A/F/U/S/M/W]
Natural Resources Defense Council

@ David Martin [F/S/W]
Native Hawaiian Advisory Council

Arnold Lum [M]
Native Hawaiian Legal Corporation

@ Stanley Uehara [W]
Naval Facilities Eng. Command, Pacific Division

@ John Naughton [M/W]
Pacific Islands Environ. Coord.
NMFS, Pacific Area Off., Southwest Region

Allen Tom [M]
NMSP, Hawaiian Islands Humpback Whale Sanctuary

Karl Takumi [U]
Norman Saito Engineering

Robert Leinau [W]
North Shore Neighborhood Board

@ Gary Gill [S/W]
Director
Office of Environmental Quality Control

Administrator [A/W]
Office of Hawaiian Affairs

@ Luis A. Manrique [A/W]
Office of Hawaiian Affairs, Land & Natural Resources Div.

Mary Lou Kobayashi [F]
Office of State Planning

Rebecca Alakai [S]
Planner
Office of State Planning

James Yamamoto [W]
Office of State Planning

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@	Carolyn Stewart Planner OSP, Coastal Zone Management Program	[A/F/U/S/M/W]
	Jerry Norris Executive Director Pacific Basin Development Council	[W]
	William Freeman Pacific Environmental Research	[A/F/U/S/M/W]
	Paul H. Forstell, Ph.D. Research Director Pacific Whale Foundation	[U/S/M]
@	Captain R. A. White Paradise Cruises, Ltd.	[M]
@	Jeffrey Peterson Peterson Farms	[A]
	Pono von Holt Ponoholo Ranch	
@	Catherine A. Courtney, Ph.D. PRC Environmental Management, Inc.	[W]
@	Project Reefkeeper, Pacific Region	[A/F/U/S/M]
	Clara Olds Save Our Bays and Beaches	[A/F/U/S/M]
	Senator Rod Tam Chair Senate Comm. on Ecology & Environmental Protection	[W]
	Denise E. Antolini Managing Attorney Sierra Club Legal Defense Fund	[W]
	Diane Amuro Sierra Club, Hawaii Chapter	[A/F/U/S/M]
@	Robert A. Merriam Society of American Foresters, Hawaii Chapter	[F/W]

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@ Sumner Erdman [A]
President
State Sheep Producers Association

@ Kim Harris [F]
Government Affairs Coordinator
The Nature Conservancy of Hawaii

Jim Hollyer, Ph.D. [W]
U.H. Department of Ag. & Resource Economics

Tom Burke [M]
U.H. Dept of Soils and Agronomy

@ Carl Evensen, Ph.D. [A/F/W]
Extension Agent
U.H. Department of Agronomy & Soil Science

@ Helena Zaleski, Ph.D. [A]
U.H. Department of Animal Science

James Parrish, Ph.D. [S]
Unit Leader
U.H., Hawaii Cooperative Fishery Research Unit

@ Peter Rappa [S/M/W]
U.H., Seagrant Extension Service

@ Chris Woolaway [M]
U.H., Seagrant Extension Service

@ Roger Fujioka, Ph.D. [S]
U.H., Water Resources Research Center
(represented by Ed Murabayashi)

@ Jovita Pajarillo [W]
U.S. EPA, Region 9

@ Karen Evans [S]
U.S. Fish and Wildlife Service

@ Robert P. Smith [S/W]
Manager
U.S. FWS Pacific Islands Ecoregion
(represented by Christine Willis)

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

Rick Fontaine [S/W]
U.S. Geological Survey

@ Michael Wong [S/W]
U.S. Geological Survey

William "Biff" Capune [M]
Marine Environment Protection Branch
U.S.C.G., Marine Safety Office Honolulu

Mark Russell [A/F/U]
United Horticultural Supply

Kimberly Clark [W]
Univ. of Hawaii, AREC

Patrick Ching [F/W]
USAG-HI, DOW

@ Jo-Anna Nakata [A/W]
Director
USDA, Consolidated Farm Home Service

@ Katie Stearns Friday [F/W]
USDA, Forest Service

@ Len Newell [F/W]
USDA, Forest Service

Daniel E. Ko [F/W]
USDA, Natural Resources Conservation Service

Kenneth Kaneshiro [A/F/U/S/W]
State Conservationist
USDA, Natural Resources Conservation Service

@ Dudley Kubo [S]
USDA, Natural Resources Conservation Service

@ Mike Tulang [A/F/U/S/W]
Resource Conservation & Development
USDA, Natural Resources Conservation Service

@ Larry Yamamoto [A/F/U/S/W]
State Resource Conservationist
USDA, Natural Resources Conservation Service
(represented by Lauren Bjorkman)

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

@	Rick Eveleth Waialua Sugar Co., Inc. (represented by Mike McLean)	[A]
	Carol Hopper Director of Education Waikiki Aquarium	[M]
	Dennis Hwang, Esq. Watanabe, Ing & Kawashima	[A/F/U/S]
	Warren Iwasa Executive Director Water Code Review Commission	[W]
@	Daniel Janik County Extension Agent Water Quality Program, CES	[W]
	Peter Gibson Chair West Oahu SWCD	[F]

List is in alphabetical order by organization, if given, or by last name is no organization listed; @ indicates attendance at one or more working or focus group meetings, in person and/or by representative; letters in [] show which group mailing list an individual was on: A=agriculture, F=forestry, U=urban, S=stream systems, M=marinas and recreational boating, and W=working.

This page left deliberately blank.

APPENDIX B - GOLF COURSE MANAGEMENT BIBLIOGRAPHY

These following reference materials, both local and general reference guides, can provide a significant amount of technical assistance for pollution prevention with respect to golf courses:

Balogh, J.C. and W.J. Walker (eds). 1992. *Golf Course Management and Construction: Environmental Issues*. Ann Arbor: Lewis Publishers, 951 pp.

Brennan, B.M., A.K. Higashi, and C.L. Murdoch. 1992. *Estimated Pesticide Use on Golf Courses in Hawai*i (Research Extension Series). Honolulu: University of Hawaii, 16 pp.

Crosby, D. *Toxic Chemicals in Relation to Hawaii's Golf Courses*.

Danneberger, T.K. 1993. *Turfgrass Ecology and Management*. Cleveland: Franzak and Foster G.I.E. Inc., pp. 201.

Faust, R. *What Do We Really Know About the Impact of Golf Course Chemicals on Our Islands?*

Harker, D., S. Evans, M. Evans, and K. Harker. 1993. *Landscape Restoration Handbook*. Ann Arbor: Lewis Publishers, 98 pp.

Hawaii Department of Health. 1993. *Guidelines for the Treatment and Use of Reclaimed Water*. Honolulu: DOH Wastewater Branch, 224 pp.

Hawaii Department of Health. 1994. *Guidelines Applicable to Golf Courses in Hawaii*. Honolulu: DOH, 2 pp.

Hawaii Office of State Planning. 1992. *Golf Course Development in Hawaii*. Honolulu: OSP, 110 pp.

Journal of Pesticide Reform. "Golf Course Pesticide Use" (Northwest Coalition for Alternatives to Pesticides).

Klein, R.D. 1990. *Protecting the Aquatic Environment from the Effects of Golf Courses*. Maryland: Community and Environmental Defense Associates, 60 pp.

Michigan Department of Natural Resources. 1993. *Checklist of Recommended Golf Course Management Procedures to Protect Water Resources*. Lansing: MDNR, 19 pp.

Michigan Department of Natural Resources. 1993. *Manual of Recommended Golf Course Management Procedures to Protect Water Resources*. Lansing: MDNR, 16 pp.

New Jersey Department of Environmental Protection and Energy. *Guidance Manual for Design and Maintenance of Environmentally Sensitive Golf Courses in New Jersey*. Trenton: NJDEPE, 65 pp.

Penn State "The Effects of Nutrients and Pesticides Applied to Turf on the Quality of Run-off and Percolating Water"

Professional Grounds Management Society. 1991. *Grounds Maintenance Management Guidelines* (Fourth Edition).

Rottier, B., et.al. 1988. *Evaluation of Pesticides Impacts on Golf Course Wetlands and Riparian Habitats*. New York State Adirondack Park Agency.

U.S. Environmental Protection Agency. 1982. *Final Report on the Results of a National Survey of Pesticide Usage on Golf Courses in the United States*.

This page deliberately left blank.

APPENDIX C: REGIONAL and WATERSHED APPROACHES

1. Watershed-Based Management Activities

Since the goal of the coastal nonpoint pollution control program is the protection of coastal water quality, a coordinated management system is needed to address a myriad of land use, social, economic, geologic, biological and technological factors. A comprehensive management system needs to include a coordinated governance structure, integrate planning across all levels (State, regional, County, and sector), and incorporate better planning approaches. One effective way to address the goals and requirements of the coastal nonpoint pollution control program planning process is to collectively address all uses and activities upstream from coastal waters employing an integrative regional and/or watershed framework. Such an approach can integrate coastal and land based resources management, rather than approaching management sectorally. Thus, the goal of the watershed/regional approach is not to supersede existing planning and management efforts, but to provide a broader framework for integrating and extending such efforts. It can maximize the use of human and financial resources by providing a framework for more effective agency coordination and for linking planning and management activities within a specific area, as well as ensuring compatibility among existing plans and policies.

Such a planning approach would also consider and address the impact of external plans, activities and forces outside the specified area. Where environmental management has in many places become too large a task for government agencies alone to manage, a watershed and/or regional approach provides a more inclusive process of management, encouraging the collaboration of local residents. With its focus on local watersheds, this approach can also build upon a strong sense of community identification with specific regions or watersheds that commonly occurs throughout Hawaii.

2. Watershed Planning and NPS Pollution Control: The Roles of Community

Communities have important roles to play in many practical aspects of watershed management and monitoring. They should be involved in decision making processes in watershed planning, protection and management. It is also possible and advantageous to cooperate with community members when conducting research into many scientific aspects of watershed processes and dynamics. Active public participation in the development and implementation of pollution reduction projects is seen by the Environmental Protection Agency (EPA) and others as an effective supplement and alternative to solutions based solely on engineering structures and imposed government programs.

From an overall nonpoint source pollution management perspective, communities in Hawaii need to be involved. Community involvement is an essential component in the development of holistic and long-term regional or watershed plans and policies which are locally pertinent, and can effectively protect Hawaii's water quality. As a key element in the design of strategies to reduce polluted runoff, community cooperation could be a major component in Hawaii's future watershed and regional management schemes.

Hawaii's topography and cultural landscape reinforce this concept. Many communities in Hawaii are situated in clearly distinguishable and discrete watersheds, with short and well-defined stream systems that drain distinct basins, and which contain an assortment of land uses. Communities themselves often have a strong knowledge of and sense of identity with the valley or watershed in which they live. In this respect, many of Hawaii's watersheds are ideally suited for the design of comprehensive watershed management schemes, as they naturally form well-defined hydrological units with interrelationships specific to those resident communities. There are a number of roles communities may play in watershed and regional approaches to planning:

(a) Research and Monitoring: Trained volunteers represent a skilled labor force capable of collecting a wide range of watershed related data, such as the characterization and classification of stream corridor habitat, chemical and biological sampling, stream flow, rainfall, and turbidity. Coordinated sampling efforts can yield important data from activities related to the monitoring activity, such as sighting and protection of endangered species, and gathering of historical and cultural information (land use, local knowledge of rainfall patterns, tidal action, etc.). An extraordinary breadth of monitoring and research activities is being carried out by communities around the United States, as described in the EPA's 1994 *National Directory of Volunteer Environmental Monitoring Programs.*

(b) Watchdogs and Stewards: Self-policing qualities emerge from the involvement of communities in their own watershed resource management . In addition to being less costly in the long term, these have the added benefit of being likely to identify and respond to problems in a more timely matter than centrally managed controls. They may react to problems before they escalate into crisis proportions. People are often all too aware of the polluting actions going on around them. They often know the areas better than government officials do. By rooting the public involvement campaign in the community and letting the community define as much as possible the problems and mechanisms for a solution, the program begins and stays as a community program rather than a government program in which the community is allowed to participate.

(c) Education: In the case studies explored below, there is ample evidence of the educational benefits to communities through involvement in nonpoint source pollution management. Beyond the more obvious examples of the involvement of students of all ages in the monitoring of stream quality, mapping and other exercises, there are other dimensions to the process that are more subtle. Protecting aquatic resources raises awareness, and a sense of stewardship

beyond the core individuals involved. By exemplifying for others that educating oneself and acting on that awareness is meaningful and possible within the community, nonpoint source pollution activities generated locally also have a community development component as well.

(d) Collaboration: A collaborative approach has proven effective in improving the rapport between community members, landowners, governmental agencies, scientists and other relevant groups. This collaboration can be advantageous for all parties concerned, enabling enhanced flows of information, and creating a forum where complex multi-faceted polluted runoff problems can be discussed. Building this type of communications network also provides a means by which to resolve conflicts. Creating a forum which allows for direct public involvement in the design of watershed management policies accomplishes the need to be sensitive to local needs and community concerns.

Another level of collaboration is possible in cooperative efforts to reduce polluted runoff. This includes combined efforts in reducing nonpoint source pollution loads through collective research and mitigation measures, and collaborating in identifying needed behavioral changes. Community-based approaches to watershed management are perhaps best known for their ability to develop and mobilize an organized and enthusiastic volunteer labor force for stream clean-ups, beach litter pick ups, and habitat enhancement. Communities are a source of people power, and if provided the tools of trained expertise combined with local knowledge, represent strong allies in the effort to control polluted runoff.

3. Case Studies: Community Based Watershed Management in Hawaii

This section presents several case studies of community watershed management efforts in Hawaii. This compilation is not an exhaustive treatment of all activities, nor does it uniformly address the details of each individual study. Rather, it is a preliminary effort to bring together and examine some key aspects of the Hawaii experience. Efforts were made to gather material on a variety of approaches, differing in the nature of their origins, goals, the types of collaboration achieved, their sources of funding, and their geographic location and scope. Taken together the details of these case studies provide a broad brush picture of current community watershed management activities around the state. Beyond these case studies, however, it remains clear that numerous other cases await evaluation and documentation.

A. Waimanalo Community Water Quality Protection Activities, Oahu

Waimanalo is a case in which a community has been drawn together around a common concern: the continuing deterioration of water quality in Waimanalo Bay. In particular, the community was concerned about the highly visible polluting activities of several local agricultural businesses. The Waimanalo story is one of successful networking, community-building and education, but also one

of variable success in enlisting agency support, as well as frustrated collaboration efforts.

In 1990 Waimanalo community residents worried about local water quality, expressed to the Waimanalo Neighborhood board their continuing concerns about the deteriorating water quality of the Waimanalo Bay, and the persistent violation of water pollution laws by the Meadow Gold Dairy. These community concerns were carried by the Neighborhood Board to the Department of Health (DOH). Some time thereafter, DOH issued a notice of violation to Meadow Gold Dairy and posted polluted water signs along Waimanalo stream. The Waimanalo Neighborhood Board also requested that DOH assess civil penalties against Meadow Gold Dairy for water pollution violations, although no action ensued.

In 1991, Waimanalo community resident members of the Sierra Club and the Surfrider Foundation next asked both of these organizations, represented by the Sierra Club Legal Defense Fund, to pursue legal action against the Dairy for its water polluting violations. Shortly after the Sierra Club Legal Defense Fund filed its intent to sue, DOH announced a proposed settlement for water pollution violation by the Dairy. Also during this period, the Waimanalo Neighborhood Board established a Water Resources Committee to 1) identify current and potential sources of water pollution, 2) gather information from previous water quality studies and on regulatory policies, 3) establish a dialogue with state/city agencies and elected officials, and 4) expand water quality monitoring and clean-up activities.

In 1992, this Water Resources Committee submitted comments against DOH proposed settlement. The Court subsequently rejected the proposed settlement. The Court also granted Sierra Club and Surfrider Foundation status as plaintiffs-intervenors for the same water pollution violations alleged by the State against Meadow Gold Dairy. Meanwhile, the Water Resources Committee also authored a House Concurrent Resolution requesting DOH to prepare a plan to strengthen the water quality sampling program for Waimanalo Bay and to develop a citizen water monitoring program (H.C.R. 363). Representative Jackie Young submitted House Concurrent Resolution 363 which passed the 1992 Legislative session. DOH was requested to collaborate with the Waimanalo Water Resources Committee and the Water Resources Research Center of the University of Hawaii in the preparation of the plan. This plan was never prepared.

In 1993, the Water Resources Committee authored a $45,000 grant proposal, for a grant subsequently awarded by the USGS through the University of Hawaii Water Resources Research Center, and administered by the University of Hawaii Environmental Center, to develop a Master Plan for water quality assessment in Waimanalo. The plan was to also initiate a project which included: 1) community education to reduce water pollution, 2) training community volunteers in sampling techniques, 3) compilation of previous water quality studies, and 4) range finding and baseline water quality monitoring utilizing community volunteers and University of Hawaii graduate students. The one-year grant was awarded. However, the project did not achieve the stated goal to develop a Master Plan for water quality assessment in Waimanalo, and the

project reports were not shared with the Waimanalo community. The project also did not conduct community education activities to reduce water pollution, train community volunteers in sampling techniques, or baseline water quality monitoring.

Meanwhile a second proposed settlement was filed to resolve all of the water pollution violation claims against Meadow Gold Dairy. The proposed settlement included a $130,000 gift for Waimanalo water quality activities to be administered by the Hawaii Community Foundation. This proposed settlement was accepted by the court. Also, Representative Jackie Young worked with Save Our Bays & Beaches (SOBB) and the Waimanalo Resources Committee to author Bill 1563 requesting the Department of Health to establish a pilot program to create and test a model of water quality surveying and sampling using volunteers in Kailua and Waimanalo, and to appropriate $45,000. This bill passed, and DOH subsequently contracted with University of Hawaii Sea Grant Extension Service to develop a Kailua & Waimanalo Water Quality Monitoring Program. The goals of the program include: 1) to help develop educated and involved community members that are committed to preserving and protecting Hawaii's water resources, 2) to organize community volunteers to collect usable water quality information relating to the local watershed and bays, 3) to develop community-based solutions to pollution problems and 4) to develop a program that can be replicated elsewhere in Hawaii. An advisory council was formed to design and implement the program, facilitated by Sea Grant. Four stream teams were established to monitor water quality using Hach test kits. These stream teams are still informally continuing monitoring and other efforts.

In both 1994 and 1995, bills to continue and expand the pilot program to create and test a model of water quality surveying and sampling using volunteers were submitted to the Legislature but did not pass. The Kailua and Waimanalo Volunteer Water Quality Monitoring Program also submitted an unsuccessful $10,000 grant submittal to DOH for EPA §319 monies for continuation of the project. Recently, however, Waimanalo Community Development Corporation and Waimanalo Health Center have been awarded a $60,000 one-year grant to establish a Waimanalo Watershed Council for 1) community education, 2) volunteer water quality monitoring, 3) watershed management plan, and 4) stream stewardship. They have also submitted an additional proposal to develop and support this project.

Contact: Nancy Glover, Ph.D., Water Resource Committee Chair, Waimanalo Neighborhood Board, and Waimanalo Community Development Corporation (808)259-8946

B. Kailua & Waimanalo Bays Volunteer Water Quality Monitoring Program, Oahu

Over the past few years, there has been increasing public concern over the quality of both Kailua Bay and Waimanalo Bay. Both these Bays have experienced periods of poor water quality caused by point and nonpoint sources of pollution. These water quality problems were initially thought to be caused by failing

cesspools, antiquated sewer lines, and a waste water treatment plant that periodically flooded during heavy rains. However, a DOH assessment of the area's coastal waters pointed to a more complex picture, with bacteriological counts indicating that polluted runoff was playing a far greater role than previously thought.

Agreed upon by all parties involved was the need for comprehensive information on the impact of point and nonpoint pollution the area's coastal and riparian environments. This required frequent sampling of the streams, ponds and bays of the Kailua and Waimanalo watershed areas to provide the baseline data on the sources and impact of area pollution. Unfortunately, the state lacked the necessary funds for such a long-term sampling program. Additionally, given the current and planned housing and agricultural developments in Waimanalo further community educational efforts were sorely needed to achieve any long term reduction of nonpoint source pollution. Representative Jackie Young worked with SOBB and the Waimanalo Water Resources Committee to author Bill 1563 requesting DOH to establish a pilot program to create and test a model of water quality surveying and sampling using volunteers in Kailua and Waimanalo, and to appropriate $45,000. This bill passed, and DOH subsequently contracted with University of Hawaii Sea Grant Extension Service to develop a Kailua & Waimanalo Water Quality Monitoring Program. See page C- 5 for a description of the program goals. An advisory council was formed to design and implement the program, facilitated by Sea Grant. Four stream teams were established to monitor water quality using Hach test kits. These stream teams still informally continue monitoring and other efforts.

Excerpts from Kailua & Waimanalo Bay Project Report to Legislature, 1994

On neutral venues for meetings:

"Given the need to hold meetings in situations which were neutral and open to any member of the community, regular meetings took place in public venues easily accessible and acceptable to the participants. These venues included public libraries and school meeting rooms, rather than volunteer's private residences."

On collaboration:

"Close collaboration was sought between governmental agencies, the scientific community, and community members. When initially soliciting the help of potential scientific cooperators, we emphasized that the project was a collaborative effort between community, landowners, government, private industry, academics and scientists. This usually served to mitigate many of the suspicions and skeptical attitudes some experts have towards volunteers and the community. We also stressed that the volunteers were able to assist the scientists in their field of research, and that the program aimed to work with government researchers and community in a mutually beneficial and cooperative manner.""

Partnership defined:
"It is important to emphasize that this was a partnership among government, private landowners, university, and concerned volunteers. This was not a vigilante environmental program. Private property rights were respected, and every effort was made to include landowners in the program. Also, all community meetings were conducted by a trained facilitator to ensure effective and highly participatory interaction."

Beginning in October of 1993, the Pilot Program sought to determine what volunteers could realistically and usefully do in monitoring water quality, what training and education programs work in Hawaii, and how a community could collaborate with governmental agencies and the scientific community to cooperatively manage watershed areas. The project was judged successful in educating community members to assist in the protection of water resources. The education and training of community volunteers empowered those members to take an active and collaborative role in the management of their water resources and environment. Collaboration between government agencies, scientific cooperators, and community members was a key element to the success of this aspect of the program.

The Pilot Program was also judged successful in producing a training manual, based on mainland models, but designed for Hawaii's watersheds and stream ecosystems. This manual was developed as a guide for other communities seeking to establish their own volunteer water quality monitoring programs. This manual is presently available in draft form. Upon its completion, it can serve to guide future similar programs in other areas of Hawaii.

Contact: Nancy Glover, Ph.D., Water Resource Committee Chair, Waimanalo Neighborhood Board, and Waimanalo Community Development Corporation (808) 259-8946

C. Kawai Nui Marsh, Community Wetlands Protection, Oahu

Kawai Nui Marsh is the largest wetland on the island of Oahu, and is home to all of Hawaii's four endangered waterbird species (the Hawaiian Stilt, Hawaiian Coot, Hawaiian Duck and Hawaiian Gallinule). A portion of the marsh has been designated as protected habitat for the recovery of these endangered species. In the late 1950's, several Kailua groups began advocating use of Kawai Nui's periphery for public park purposes. By the late 1960s, the Lani-Kailua Branch of the Outdoor Circle (LKOC) led a lobby for the City and County of Honolulu's acquisition for a park site, in place of a proposed housing development requiring massive dredge and fill. Tests proved the housing development to be unfeasible and repeated flooding ultimately forced the City to purchase 750 acres of the Marsh for flood basin management. An earthen dike was built by the U.S. Army Corps of Engineers (USACOE) along its *makai* (ocean side) perimeter. By 1973, the City proposed acquisition of an additional 2509 acres lying *mauka* (mountain side), ostensibly for park purposes, and Kawai Nui's four native waterfowl were

declared to be Endangered. The landowner responded by proposing plans for a large shopping center. At this point, LKOC moved at once to form a large coalition of community organizations on behalf of public park acquisition. Their "ad hoc Committee for Kawai Nui," led by homemakers, students, *kupuna* (elders), scientists, and academicians, reached out to diverse groups, ranging from Life of the Land, the Conservation Council of Hawaii, the Sierra Club, Hawaii Audubon Society, American Pen Women, the Kaho'olawe 'Ohana, the Congress of the Hawaiian People, and others.

Planners and scientists presently revealed that the supposed park plans of the City were actually intentions to develop a massive landfill. The ad hoc Committee developed a educational slide show (a critically acclaimed program funded by The Outdoor Circle, and shown by volunteers over 300 times) to educate politicians and community groups statewide. Meanwhile Board members of the LKOC developed a comprehensive resource inventory for the State Land Use Commission, which led to the re-designation of some of the additional wetlands in Kawai Nui from urban zoning to conservation zoning. In subsequent years, three other subdivision proposals, a second proposed Honolulu landfill, and proposed interceptor sewer lines through the Marsh were defeated by a highly mobilized, informed community, precluding further development.

Aims and Objectives of the Kawai Nui Heritage Foundation

*Continue to support the current Directional Plan and its democratic scientific process so the focus is on the whole and not its parts

*Continue to oppose inappropriate watershed developments impacting the Marsh

*Investigate impacts of residual sewage sludge from treatment plants formerly dumping in the Marsh

*Investigate residual and continuing leachate from Kapa'a Landfill overhanging marsh at 250' elevation

*Investigate unchecked insiltation from Kapa'a Quarry, Kapa'a Landfill, and Maunawilii development

*Keep existing waters and flows in the Marsh system (Kawai Nui source may be threatened at headwaters by Board of Water Supply transfers), and to continue flows to the sea

*Control nutrients and introduced vegetation, and investigate appropriateness of flood control dike height for Coconut Grove

*Comprehensive attention to all functions of the marsh, not just flood control in planning

*Monitor effect and impact of chemical runoff from adjacent golf course

*Continue providing speakers, tours, educational programs and materials

*Improve Kawai Nui's estuarine values for two endangered native species of goby

*Improve productive waters into Kailua Bay.

By 1976, when the Kawai Nui Heritage Foundation (KHF) was formed, 52 local and statewide community groups and public agencies (plus petitions with 30,000 signatures) had participated in and endorsed a consensus "Directional Plan," begun in 1974 by local volunteer architect/planner Robert A. Herlinger. In July of 1976, provided with materials furnished by KHF (aided by Bishop Museum's Department of Anthropology), on request of the National Park Service, Kawai Nui was declared eligible as a National Cultural, Archaeological and Historic District. In the early 1980s, KHF and LKOC received a CZM grant ($100,000 augmented by another $25,000 from the USACOE) for three years of studies by the Department of Planning and Economic Development, culminating in 1983's "Kawainui Management Plan," which made sweeping protective recommendations based on a body of knowledge provided by the public(s), the State, and volunteer scientists. Concurrently, the University's Environmental Center held a Kawai Nui interdisciplinary practicum and monitored the State's work. Between 1983 and 1990, KHF assisted the State in obtaining funds, and in condemnation proceedings to acquire lands fronting the marsh. In 1990, DLNR was given responsibility to develop implementation plans for Kawai Nui. Subsequent state-funded plans have been evaluated by the public using KHF's most recent "Direction Plan" for Kawai Nui.

Contact: Keith Kruger , Kawainui Heritage Foundation (808) 239-5958
Muriel Seto, Kawainui Heritage Foundation (808) 262-4900

D. Manoa Valley Streamside Park and Water Quality Studies, Oahu

A 1984 biota study by the U.S. Fish and Wildlife Service (USFWS) of 117 streams from Hawaii, Alaska, and the continental U.S. revealed that fish from Manoa Stream, Honolulu, not only had the highest concentrations of the pesticides chlordane, dieldrin and heptachlor, but the levels were over twice the concentrations found in fish from any other stream sampled in the survey. Additionally, the Manoa Stream fish contained three times the levels of lead as compared with fish from any other stream in the study. These and other findings have spurred community groups to action. Groups within the Manoa neighborhood organization Malama O Manoa have formed to address stream water quality issues in the watershed, and to develop plans for a new Manoa streamside park. The Manoa stream water quality group has divided responsibilities along professional skills and interests represented in the group,

covering chemical pollution issues, microbiological pollution issues, communications to disseminate sampling results and water quality action advisories to the community, and coordination with the larger organization board and outside organizations. The second group is presently working to establish a community linear park along a portion of the stream. The group has worked closely with the City and County of Honolulu, and land owners to build commitment and support for the park. Thus far $227,000 has been allocated by the City and County of Honolulu City Council for park design. The County Departments of Transportation Services and Parks and Recreation have also committed themselves to the planning and ongoing operation and maintenance of the park.

Malama O Manoa groups have sponsored stream water quality awareness campaigns and clean-ups, with one very successful effort having taken place last October 22. Malama O Manoa also convened a workshop last year, and will hold another this fall, gathering support from DOH environmental health administrators and the City and County of Honolulu's City Council. Participants included representatives from the University of Hawaii, the City Departments of Public Works, and Parks and Recreation, USFWS, DOH, CZM Program, and others. Malama O Manoa members have participated in several nonpoint source pollution control activities and programs sponsored by City and State agencies. Perhaps most notable amongst these activities are those for improvements of the Ala Wai Canal (the receiving body of water from Manoa Stream and nearby Palolo Stream).

Contact: Chuck Pearson (808) 521-9400 or Eric DeCarlo (808) 956-6473

E. CARE: Community Ahupua`a Resource Education, Kaneohe, Oahu

A Natural Resources Defense Council (NRDC) proposal was developed for a pilot project in urban nonpoint source pollution education (based on coastal nonpoint pollution control program development). The goal of the project was to develop a model that would empower a community in an urban *ahupua'a* to manage and control its sources of nonpoint pollution and thus protect its streams and coastal waters. The project duration was from October 1994- August 1995, with funding provided by Harold K.L. Castle foundation and Cooke Foundation, Ltd.

The *ahupua`a* of Kaneohe, which is extensively urbanized and includes a variety of land activities and three stream systems (both channelized and natural), was chosen as the location of the pilot activity because of its existing level of community education and involvement, including: Friends of Heeia State Park, Marine Education Program and their plan to restore native vegetation in the *ahupua`a*; Kaneohe Bay Master Plan and supporting Kaneohe Bay Regional Council; Kaneohe Urban Planning Committee: Vision 2020; and active Kaneohe and Kahaluu Neighborhood Boards.

Community members were recruited through presentations to these groups and to condominium associations, High School environmental clubs, the Windward Community College Marine Options program, local churches, youth groups, and

adult service clubs. Participants attended 5 monthly sessions to learn about the natural and cultural history of the *ahupua`a*, the impacts of land use activities and their effect on pollution of stream and coastal waters, and best management practices to reduce them. The project produced a number of products, including photo reconnaissance of 3 stream systems displayed as a map tied to pictures and as slides; a participants' collective map of community assets and problems; worksheets of nonpoint source pollution BMPs and BMPs appropriate to observed problems; a Project report (August 1995), and A "How /How Not To Do It" Manual.

Contact: Susan Miller, (808) 533-1075 ; or Maile Bay (808) 947-1523

F. Kaiaka Bay -Waialua Hydrologic Unit Area Project, Oahu

In 1991, the Kaiaka Bay-Waialua Hydrologic Unit Area (HUA) project on Oahu began. This five year project was established under a national USDA program to address water quality through interagency and public collaboration. The Kaiaka Bay-Waialua Bay HUA has a population of 53,650 people and covers about 70,700 acres. Urban/military lands make up 17% of the area, while the remainder is in forest reserve, and cropland, and pasture.

This project receives direction through an Interagency Coordinating Committee (ICC) whose members are representatives of CES, NRCS, DOH, USGS, HACD, DLNR, DOA, and FSA. In addition, a Local Advisory Committee provides community input and guidance. The goals of the project are to:

- Reduce agricultural chemical pollution of the Waialua Aquifer by promoting the wise use of nutrients and pesticides;
- Control sediment sources by reducing rill, sheet, and gully erosion on agricultural, conservation, urban, and military lands;
- Develop and implement an effective education and public involvement program;
- Implement a monitoring program to provide for ongoing water quality assessment; and
- Evaluate the effectiveness of implemented management practices on water quality.

Assistance provided to the HUA includes:

- Cost-sharing on the implementation of best management practices (FSA);
- Information and educational materials (CES Environmental Issues Office);
- Technical assistance (NRCS and West Oahu SWCD); and
- Monitoring activities in the bay (UH Leeward Community College, College Oceanography Lab).

Informational products available to the general public include a brochure providing a Kaiaka-Waialua Bay HUA Project overview and a four page newsletter called the *Kaiaka-Waialua Bay News* which is published quarterly. Four polluted runoff control projects have received Section 319(h), CWA, funding through DOH's Polluted Runoff Control Program. The total Section 319(h) grant

monies received for use in the HUA is $157,000; in-kind contributions provide an additional $130,000 from non-federal sources.

Contact: Cooperative Extension Service (808)956-4122; USDA/Natural Resources Conservation Service (808) 861-8523; or USDA/FSA (808) 541-2642

G. West Maui Watershed Management Project, Maui

The West Maui Watershed Management Project began in 1993. The primary goal of the project is to develop community-based watershed management, using an interest-based, collaborative approach to protect the water quality and ocean resources of West Maui.

The origins of this watershed Management Project are rooted in community action. In 1989 and 1990, algae blooms clouded the water off West Maui, smothering corals and causing reef die-off. Local residents took action in calling state and national attention to the problems. Eventually the community garnered Senator Daniel Inouye's support, and when Inouye wrote to the EPA, requesting help, a response ensued. EPA, NOAA, and DOH monies were allocated to 1) determine the cause of the algae blooms; and 2) find a solution.

Meanwhile the County of Maui and community members initiated an Algae Task Force to scope out the problem. The report of the Task Force, published in 1992, recommended on-site coordination, cleaning of beaches, and the control and management of nutrients in the watersheds emptying into the West Maui shoreline. In addition, the task force noted a need to address nuisance algae washing up on the shoreline. As a temporary measure, the county has agreed to remove piles of algae from shoreline areas if community volunteers rake and pile it up. Another related problem was noted in July 1993, when a rainstorm caused massive amounts of sediment to be transported into the waters off West Maui. The nearshore ocean waters remained red and turbid for four months before winter swells removed the sediment.

The West Maui Watershed Management Project involves the collaboration of many people. A project Coordinator works with the community at large and with an advisory committee composed of a broad spectrum of community and government agency representatives. The Advisory Committee is currently working toward developing specific project objectives, and will involve the community in developing initiatives for water quality management, stormwater management, fertilizer use and prevention of soil erosion, and identifying at a more general level the combination of regulatory tools and voluntary actions needed to protect West Maui's coastal waters and ecosystems. Twelve scientific studies were launched to examine a variety of aspects of the problem, such as algae population dynamics, assessment of erosion and nutrient loads from various land uses, storm water and drainage management planning, feasibility of algae clean-up, and others. DOH's Polluted Runoff Control Program has targeted Section 319(h), CWA, implementation project funding to the West Maui

SWCD to assist it in carrying out particular water quality management recommendations that have resulted from this watershed management project.

In addition to the Advisory Committee activities and the array of scientific studies, the WMWMP has included ongoing agency coordination, public education and outreach efforts, presentations, brainstorming sessions, workshops and fora. The WMWMP has also established a new Volunteer Monitoring Coordinator position to promote citizen monitoring in the watershed.

Contact: Wendy Wiltse, Ph.D. project coordinator (808) 661-7856

H. Pelekane Bay Watershed Management Project, Hawaii

The Pelekane Bay Watershed Management Project is a multi-agency planning effort involving federal, state, and local government agencies, private landowners, and some community organizations. It represents a coordinated attempt to address the complexities of interagency planning and cooperation on a watershed-based issue. The goal is the protection and recovery of the increasingly degraded receiving waters of Pelekane Bay, through careful management of lands throughout the entire watershed feeding into the Bay. The effort is being led by a project coordinator based at the Mauna Kea SWCD supported through funding from NRCS.

Pelekane Bay is located on the northwest corner of the Island of Hawaii, just south of the Kawaihae Harbor and adjacent to the Puukohola Heiau National Historic Site. Its watershed includes the drainages of the Pauahi, Makeahua, Luahine, Palihae, and Makahuna Gulches in the center of the Kohala Coast. The bay is important as marine fish habitat, and has cultural and historical significance due to the submerged Hale o Ka o Puni Heiau and other cultural sites. In recent years, degradation of fish habitat and underwater cultural resources due to sediment loads contributed from agricultural runoff from extensive ranchlands in the watershed has been documented. In order to halt further degradation of Pelekane Bay and to restore the bay's productivity, both watershed management measures and sediment removal will be necessary. It is estimated that some 16,500 cubic yards of sediment, approximately two to three meters in depth, need to be removed from Pelekane Bay.

Due to widespread concern over the impacts of sediments on Pelekane Bay, a large coalition of local, State, and Federal agencies, private landowners, and other citizens are developing a long-term watershed management and marine recovery plan.

Pelekane Bay and its watershed and tributaries have not been designated as a WQLS and Pelekane Bay is designated a Class A water. However, several compelling factors contribute to the priority attention being given to water quality and watershed management issues in this area, including:

- The proposed project area has been designated by NMFS/USACOE *Marine Fish Habitat Restoration and Creation Program for the Pacific Islands* as the most appropriate project in the Pacific Islands.

- The submerged Hale o Ka o Puni Heiau in Pelekane Bay has important historical significance for the Hawaiian community, other local residents, and the National Park Service.

- The fish breeding habitat of the Bay and estuarine areas is unique and significant, supporting populations of mullet, aholehole, awa, and nehu. The Bay is one of the few locations which supports populations of the Black-tipped Reef Shark. This habitat is seriously compromised by the impacts of sedimentation.

- The close proximity of Spencer Beach Park and the Puukohola Heiau National Park contribute to making Pelekane Bay an important resource for cultural, recreational and tourism opportunities.

- A new boat harbor has been proposed which would involve the building of a new breakwater in the bay, with possible implications for sedimentation in nearshore waters.

The primary objective of the project is to reduce nonpoint source pollution from sediments entering Pelekane Bay, primarily through installing BMPs to control sediment loading in the low elevation, low rainfall region of the watershed. BMPs being considered include: improving vegetative cover through range management, livestock exclusion, and reseeding of grasslands; reducing wildfire hazards (and resulting loss of soil cover) through installing a firebreak system; regenerating forest cover in selected areas through tree planting and livestock exclusion; and installing sediment retention basins to reduce runoff velocities and allow remaining sediments to settle out before reaching Pelekane Bay. The ancillary objective is to renew productivity of the Pelekane Bay marine ecosystem through removal of some 16,500 cubic yards of existing sediments.

The following agencies, organizations, and groups have shown an interest in the Pelekane Bay Project: Mauna Kea SWCD, Queen Emma Foundation, DLNR-DOFAW, DOH, DLNR-DAR, DOT, DOA, DHHL, County of Hawaii, University of Hawaii at Hilo, Parker Ranch, USACOE, National Park Service, NMFS, USFWS, and NRCS. Although discussions have taken place concerning the project, specific contributions and roles have not been finalized.

Concern for the recovery of Pelekane Bay and management of upland watersheds has been expressed by diverse groups including local, state, and federal agencies, individual citizens, businesses, and cultural and other interest groups. Watershed management and bay recovery efforts will require coordinated planning and in-kind technical assistance from all of the interested and concerned parties.

Intensive involvement by community groups and other interested members of the public will be sought and encouraged throughout the project cycle. Such involvement will include planning and assessment activities, assistance with joint monitoring programs, and involvement in educational activities including development of materials and the creation and conduct of public forums for information and feedback.

Thus far, sources of funds for the Pelekane Bay Project include:

a. Agency in-kind contributions and volunteer efforts;
b. NRCS funds allocated to the Mauna Kea SWCD to hire a planning coordinator;
c. Section 319(h), CWA, Federal Nonpoint Source Pollution Control funds of $40,000. Private and agency in-kind contributions make up 40% of the total cost of this polluted runoff control project.

Technical assistance and other in-kind support is being sought from numerous agencies and private landowners. Numerous educational materials and activities are planned, including brochures, displays, fact sheets, newsletters, newspaper articles, public forums, and field trips.

Contact: Jim Trump (Island Harvest), Project Coordinator for the Pelekane Bay Watershed Project under the jurisdiction of the Mauna Kea SWCD (808) 884-5118 (fax: 884-5049).

I. The Natural Areas Working Group and Pilot Regional Forest Management Advisory Councils, Hawaii

The Regional Forest Management Advisory Councils (RFMACs) are a pilot effort to include community representatives in land-use planning efforts addressing management of state-owned lands. These lands do not necessarily represent distinct watershed units, but rather parcels of state land in which nearby communities have an active stake and interest. This effort to involve community members in intensive planning efforts regarding the management of state lands is one important outcome of a facilitated conflict-resolution process entitled the Natural Areas Working Group, or NAWG, whose initial phase took place from March 1994 - March 1995. NAWG discussions are ongoing.

The conflict which led to the NAWG meetings was a sharp difference in opinion between state agencies and various community interests, especially pig hunters, regarding conservation strategies on state-owned lands. The particular issue which inflamed the community was the building of fences to control feral pigs in portions of several Natural Area Reserves to promote better protection of endangered native ecosystems. The new RFMAC pilot will be tested during 1995 to determine whether a formal, long-term planning body involving community representatives can be set up to address the wide variety of interests in the management of state lands on the Big Island.

RFMACs being initiated in mid-1995 are a pilot community-based planning effort being tested during 1995 in Kohala on the Big Island. RFMACs are envisioned as one way to involve a diverse set of interests in the coordinated management of state lands under the jurisdiction of DLNR. Several important issues remain under discussion, such as the exact representation on each RFMAC, the number of RFMACs that should be established, regions to be involved in RFMACs, and the timing of the planning efforts.

The RFMAC pilot meetings are one significant outcome of a year-long facilitated conflict resolution process among several stakeholders who have long been at odds regarding the best way to manage state forest lands on the Big Island, especially the Natural Area Reserves (NARs). In this section, the history of the NAWG process will be discussed, to provide a detailed look into a process which has involved some of the most controversial resource management questions in the state.

While the pilot RFMACs and the NAWG discussions do not focus explicitly on watershed management or water-quality issues, these efforts represent an important example of the processes which can be used for in-depth, substantive public participation in resource management planning. In this case, parties with diametrically opposed views on resource management methods gradually came to appreciate one another's points of view, and look for ways in which the needs of all the concerned parties could be addressed. The NAWG process and the upcoming RFMAC pilot planning effort can be seen as a useful model of possibilities for public participation in integrated watershed-based management. And while the RFMAC process is not strictly focused on watershed conservation or nonpoint source pollution, management strategies which result are also likely to have a positive effect on nonpoint source pollution control in the regions under consideration.

(a) Origins of the NARS Controversy and the NAWG process: The NAWG had its origins in long and volatile disputes among various groups with apparently competing interests in management of the Natural Area Reserves (NARS) and other State-owned lands on the Big Island. Hunters, environmentalists, and other interested parties found themselves "on opposite sides of the fence," as debates raged over whether to enclose portions of several Natural Area Reserves and reduce or eliminate pig populations within the fenced areas. As a result of this conflict, the State House of Representatives passed two resolutions in May 1993, intended to move interested parties along toward agreement:

- House Concurrent Resolution 183, House Draft 1: requested that DLNR hold facilitated public information meetings concerning management objectives and activities in the Pu`u o `Umi Natural Area Reserve.
- House Concurrent Resolution 185, House Draft 1: requested DLNR to accommodate the needs and interests of hunters in developing strategies to manage pig populations in the Laupahoehoe Natural Area Reserve.

Following these resolutions, two professional mediation facilitators from the Center for Alternative Dispute Resolution (Office of the Judiciary) were hired by

DLNR to work with agency representatives and representatives of diverse community interests in the Natural Areas Working Group. A series of facilitated meetings then took place from March 1994 through March 1995, in which the widely divergent positions of those involved gradually inched toward a consensus on recommendations. The NAWG continues to meet, primarily to oversee the development of the initial pilot Regional Forest Management Advisory Councils. Meetings will continue to be held regularly by both bodies at least through 1995.

The NAWG involved representation from diverse groups including hunters, Hawaiian culture preservationists, scientists, resource land managers, environmentalists, and other community members. Technical assistance has also been provided periodically by invited guests.

Groups and agencies participating in NAWG during 1994-95:
Wildlife Conservation Association of Hawaii
North Hilo Community Council
The Nature Conservancy of Hawaii
National Biological Service
DLNR Division of Forestry and Wildlife (DOFAW)
Pig Hunters of Hawaii
Waimea Puu Kapu Agriculture Association, and
Sierra Club Legal Defense Fund (SCLDF)

(b) Community Forest Mapping as a Tool for Public Participation in Land Use Planning and Management: To facilitate the sharing of local perspectives on these land use issues, a facilitator worked with two separate hunter's associations represented in the NAWG to conduct a "community forest mapping" activity. Through this process, the hunters were able to describe and map their understanding of various issues related to pig hunting in the areas with which they were familiar. These maps and summary papers were then presented to the NAWG group as a whole as part of the overall information-gathering phase of deliberations. Several important issues were brought out through this process concerning Seasonal pig migration patterns, increased erosion along fence lines caused by pigs using them as travel corridors; and increased risk factors to pig breeding areas due to fencing.

Observations and questions such as these suggest areas where more in-depth research and discussion are needed before appropriate land and game management plans can be finalized. The success of using the Community Forest Mapping tool with community members previously unfamiliar with mapping provides a good example of the viability of using such community-based analytical tools in general watershed-based planning. It is often the case that community members, farmers, and others who are in close, regular contact with forests or other watershed areas have a great deal of information about the natural

resources of a specific region. If this information can be tapped and summarized in forms which can be shared in a wider planning process, a much greater richness of information is available for use in decisions regarding land and water management.

At this time, the pilot RFMAC for 1995 is focusing on the Kohala Region. Future RFMACs are likely to concentrate on areas close to the original sites of controversy, such as the Hamakua area and forest areas in the upper Puna/South Hilo region (including federal, state, and other areas such as the Hawaii Volcanoes National Park, the Olaa Forest Reserve, Puu Makaala Natural Area Reserve, and the Upper Waiakea Forest).

(c) NAWG and RFMAC Objectives and Goals: The NAWG goal statement, was developed by the group in a consensus fashion. The NAWG goal reads as a question:

> *"How do we fairly balance and accommodate the various interests that have a stake in the Natural Area Reserves System (NARS) and maintain a healthy forest and social community?"*

With the successful completion of one year's worth of meetings and negotiations, the NAWG group's resulting list of 45 "recommendations" and a series of proposed "actions" represent the beginnings of an answer to their self-posed question

The pilot RFMACs are still in the formative stages at this time in terms of organization, membership, process, jurisdiction, and other major structural questions. Given the technical and political complexity of the tasks at hand for the RFMACs, it will be interesting to discover what forms of cooperative community-based planning may emerge. As a broad-based effort originating in and fueled by community concerns, the RFMAC idea may hold great promise as a model for other efforts in integrated watershed planning and management.

Overview of the NAWG Negotiation Process

The professional facilitation of the NAWG meetings by trained mediators had a powerful positive impact on the process and outcome of the effort. In early meetings, the facilitators set the tone of a consensual discussion process through techniques such as:
proposing "ground rules" and "rules of the road" regarding how to participate in group discussions amicably, with a tone of cooperation and respect, and with a commitment to long-term consensus-building
creating "guiding principles" that set the conceptual stage for the work at hand, setting up some basic directions and areas of agreement at an early stage as points to build upon;

preparing "group memory" notes of every meeting, which were circulated before the next meeting for contemplation and further discussion. These notes differ from standard "meeting minutes" in that they seek to record the process and content of actual points made during meetings, generally in the participant's own words;
using standard group facilitation techniques to keep discussions "on-track," helping people move toward areas of agreement.

The "Rules of the Road" of the Negotiation Process :

Use the broadest interest, not just personal view.
State when you are speaking on behalf of your organization.
Think consensus.
Be at every meeting.
All agreements are provisional until the end.

"Ground Rules" of the Negotiation Process:

- Everyone can participate
- It is OK to disagree
- Extend common courtesies
- No interruptions
- Ask questions first, comments will be taken afterwards.

(d) Recommendations and Actions Resulting from the NAWG: Recommendations drafted by the NAWG members were debated by the group until a list of consensus recommendations was arrived upon. The 45 recommendations are organized into three main categories: Resource Management, Community Participation, and Education. In addition to the recommendations list, "proposed actions" were also developed, for ongoing action and legislative attention.

Highlights of the recommendations include many ways to address the diverse interests of the community in land use planning and management. Under the "Resource Management" recommendations, there was a strong emphasis on involving the community in all stages of resource management, including mapping, resource assessments, research, monitoring efforts, maintenance programs, game management activities, habitat management, and public education. Such principles are examples of the degree of public involvement which might be possible or desirable in other integrated watershed management efforts.

The recommendations under the headings "community participation" and "education" are particularly exemplary in this light. These are:

- Monitor the growth of native species, introduce or add more native species in the appropriate areas, and get community groups (including those groups that work with school children) directly involved in both activities.
- Develop mechanisms for joint monitoring (community and government agencies) for birds, medicinal plants, water, weeds, native plants, cultural sites, etc.
- Develop and implement a mechanism that coordinates existing public and private stewardship/partnerships with the goals and interests of the community, such as the NAWG process.
- Look at increasing community participation in game management by having the various interests represented in the Animal Species Advisory Commission and island councils.
- Create a position in DLNR-DOFAW for a Volunteer Coordinator on each island.
- Work on statutory changes so that the community has more control over board, commission, and committee appointments. A beginning step could be voicing who the community recommends as a representative.

The education recommendations include:

- Create a forum (perhaps making the NAWG a non-profit entity) to carry on the task of working with the public on natural resource issues.
- Develop a "hands-on" educational program that includes all facets of the forests including both pig hunting activities and conservation efforts.
- Bring information gathered in the NAWG process back to the general public.
- Lobby for the creation of an Education/Information Specialist within the Big Island DLNR-DOFAW office.
- Modify and expand existing efforts and develop new ways to heighten public awareness of the dangers of alien pest species introductions.
- Expand and modify the Hunter Education Program to include conservation needs, and increase opportunities for participation.
- Develop a mechanism to convey information to the public regarding existing NARS activities and cooperative activities that are NARS-related.

Besides the list of Recommendations, the NAWG report includes a series of "Proposed Actions. The first and most detailed action is the establishment of pilot RFMACs, as outlined earlier. In addition, resolutions to the State Legislature were proposed, including:

- encouraging better enforcement of hunting and other regulations on DLNR lands;
- initiating an audit of the State's game management program;
- developing a joint monitoring program including public volunteers;
- involving the hunting community in the creation and management of game management plans;
    - establishing a structure for ongoing dialogue on game management between DOCARE and the hunting community;
    - expressing support for the NAWG process; and

- increasing community outreach through increased information and exchange between DLNR-DOFAW and Big Island communities.

(e) Lessons from the NAWG Process: The Natural Areas Working Group involved an extremely diverse group of people with nearly opposite points of view on how to manage lands in which they each have a strong stake. Both community members and agency representatives were involved, and many different communications styles and perspectives reflected strong cultural and other differences among the members. Nevertheless, using an intensive process led by highly-skilled facilitators, eventually a sense of mutual interests and potential compromises was achieved. While there were certainly aspects of the NAWG process and outcomes which were not well-received, the overall outcome appeared quite positive.

In any watershed-based planning process involving community members it is likely that many diverse points of view will be represented, sometimes in a highly polarized and charged fashion. The processes used by the NAWG, and the relative success it exhibited, provide one example of how a planning process genuinely representative of community interests might take place.

A few interesting insights from this project might be helpful to in other watershed-based planning efforts:

- While the initial impetus of the NAWG revolved around one issue (fencing) and one type of State-managed land (Natural Area Reserves), it quickly became clear that the interests involved were quite complex and "holistic," and readily cut across political and conceptual boundaries. Successful watershed-based planning must accommodate interests which do not follow property lines or lines of agency responsibility. Agencies and program representatives must be willing to discuss topics that may at first appear to fall outside of their strict areas of responsibility, in order to reach a mutual goal in everyone's best interests.
- Management questions and other information needs held by community members should be carefully addressed, and not glossed over with rapid or overly technical answers.
- Although community members may not be formally trained in specialties respected by agency professionals, their knowledge of particular resources in their own areas is often based upon decades of direct observation and experience, and can be very rich. Agency representatives must be willing to understand and appreciate the wisdom and experience of community members, even if it appears to differ from the perspectives with which they are familiar.
- The use of community-based analytical tools such as Community Forest Mapping is an important resource in an integrated planning effort. There is often a huge gap in communication styles between agency representatives and the community at large, since technical and cultural backgrounds often differ greatly. It is therefore critical that the community have the use of tools

which can help to crystallize and articulate their knowledge and points of view.

- When all participants in a multi-party planning process take the time to genuinely understand the information and experience offered by others, regardless of differences in cultural and communications styles, differences in opinion regarding how to manage specific areas can often be bridged.
- Joint research and management efforts involving community members side-by-side with agency representatives are often in everyone's best interests. By working together on practical tasks, differences in knowledge and perspective can be more readily overcome.

Contact: Bill Stormont, Hawaii Manager (Hilo) of the Natural Areas Program in the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) (808) 933-4221.

4. Community-Based Watershed Planning Management in Other Regions

In examining the actual practices and projects under way in Hawaii, there is ample evidence to suggest that significant roles exist for community and non-government institutions in the monitoring, education, assessment and planning related to nonpoint pollution control. Outside of the Hawaiian experiences, and at a variety of levels of governance, watershed based management has been conceptualized as requiring involvement of aspects of community control. These are often functional strengths for which "top down" approaches are less well suited, including such processes as: developing the lines of communication and collaboration between local interests and stakeholders; localizing the level of general information available toward specific needs and contexts; guiding planning along interest-based consensus building paths; managing long term and site-specific monitoring; and fulfilling objectives of stewardship, such as stream clean-up and restoration efforts through the coordination of volunteers. Two case studies are presented below which illustrate extensive community-based watershed planning efforts; one in Napa California, and one in Hunter Valley, Western Australia.

A. Napa County Resource Conservation District's Land Stewardship Approach, Napa, California

It is with the identification of an overarching goal of watershed wide management on the part of the Napa Valley Resource Conservation District (RCD), and a specific set of tools to encourage interest-based land stewardship watershed planning that Napa Valley has distinguished itself as an example for other groups to explore. The framework for integrated resource management is outlined in the *Napa River Watershed Owner's Manual* (1994):

> *"Historically, natural resource management planning has been done based on one resource only, or to deal with a single problem. This*

plan is an attempt to begin integrating the many parts of the watershed through recommendations for land use practices and programs developed with the complexity of the system in mind. Stated problems are presented as interests to be addressed, rather than as the purpose of planning. Voluntary implementation of t he recommendations in this plan will not only help deal with identified problems, but will prevent others from occurring. Thus, this type of watershed planning is intended more as preventative maintenance than as an "after the fact" clean-up or mitigation program. Solutions to problems identified by citizens, agencies, public interest groups, etc., are more easily realized when problems are treated as interests to be addressed instead of positions to be defended. This plan is meant to provide the basis for a voluntary effort of the citizens of the Napa Valley to jointly address the concerns expressed while protecting and preserving their natural and community resources in an economically reasonable manner. As with personal health or home maintenance, preventative care is the least burdensome and least expensive way of keeping a watershed healthy."

Water resource planning and management in the state of California is facilitated by a structure of a State Water Resources Control Board, and nine Regional Water Quality Control Boards which carry regulatory authority. Of these nine, the San Francisco Bay Regional Water Quality Control Board was one of the first to carry out a region-wide water quality assessment. A database was compiled on each waterbody's current water quality condition, including the nature and source of possible impairments and potential threats. In 1990 the Napa River was designated as impaired over 40 of its 55 mile length, due to eutrophication, excess sedimentation, and fisheries habitat degradation.

The Regional Board adopted a Water Quality Control Plan for the San Francisco Bay Basin, listing the present and potential future beneficial uses of surface waters within the Basin that the Regional Plan must protect. The Napa Valley was selected as a first watershed to focus its efforts on watershed management planning. Thirteen beneficial uses were designated for principal water bodies within the 426 square mile watershed. These are:

- Municipal and Domestic Supply
- Fresh Water Replenishment
- Water Contact Recreation
- Warm Freshwater Habitat
- Wildlife Habitat
- Marine Habitat
- Preservation of Rare /Endangered Species
- Agricultural Supply
- Navigation
- Noncontact Water Recreation
- Cold Freshwater Habitat
- Fish Migration
- Fish Spawning

The Napa Valley's nonpoint source pollution problems stem from a wide variety of sources, especially erosion and sedimentation coming from hillside vineyards and other agricultural activities. These vary greatly depending on the type of farming practices used.

With the backdrop of these growing pressures on the water quality of the watershed, and an especially heavy rainfall event in 1989 creating substantial erosion, a new County Conservation Ordinance was passed in Napa County with recommendations on practices expected to significantly reduce the erosion and other pollutants entering the river system. Dennis Bowker, of the Napa County RCD, suggested that new hillside developments in compliance with the ordinance should only produce soil losses of around 5 tons/acre/year .

(a) Interest-based planning: The application of land stewardship concepts: Dennis Bowker has been active in presenting the Napa Valley's RCD approach to Land Stewardship Watershed Plan Development to other conservation districts around California, and increasingly beyond the region, having also brought these experiences to audiences in Hawaii.[1] In February of 1995, he conducted a two-day workshop on Maui, teaching through case examples and scenarios the fundamental concepts and tools of Stewardship approaches to planning and Watershed Based Approaches. Subsequent to the workshop, the consultants explored the connection between the watershed-based planning approach and the community involvement component:

"They play with each other well...they are both necessarily whole systems approach. The more complexity in the system, the more opportunity there is to find options. ..The Regional Board, while making progress on the question of water balance, came to support the whole basin (watershed) basis for the negotiation. They recognized that habitat, water quality, wetlands, nonpoint pollution and land use were all inter-connected, and this gave impetus to using local involvement in management planning and implementation"

In California, the basis of land use decisions is at the local level; this together with a lack of government funding for management and a related inability to focus on bad guys, gave way to "Regulation out, Cooperation in" ways of thinking about the problem and led to them to deal with the system within an interest- based process. Stated in another manner, the Napa County Resource Conservation District has taken issue with the prevailing approach of adversarial relationships and regulation-based planning, which have not produced the long term results necessary to shepherd the nation's natural environment into a healthy 21st century.

"Land stewardship concepts allow development of long term planning and implementation that is based on the concerns and interests of landowners, agencies and other stakeholders instead of predetermined practices, programs, or legal decisions. Planning is done more completely, with all aspects of a watershed or other ecological system considered simultaneously. Technical resolutions to social problems are more likely, real solutions replace

[1] Invited in 1995 to speak at the Hawaii Association of Conservation Districts annual meeting , to the North Kona/ Kohala SWCD, to Kauai, and to Maui audiences.

compromises and the enhanced cooperation develops long term commitment to resource protection, instead of short term compliance with regulations or court edicts"

Land stewardship groups have been coordinated in a number of sub-watersheds by the Napa County RCD. These groups voluntarily agree to implement practices to protect the resources of their local watershed, and are assisted by a wide variety of cost-sharing programs that support environmentally sound management practices. One example is the Huichica Creek Land Stewardship, which was formed in 1988, and is formed of 63 landowners of the Huichica Creek basin, and over a dozen Federal, State, and local agencies. A watershed-wide natural resource protection and land management plan has been developed for Huichica Creek Watershed, and as a result of the cooperative efforts, demonstration programs and other stewardship efforts, the RCD was able to purchase a 21 acre parcel of land in the basin with a grant from the State Coastal Conservancy. On this parcel are combined demonstration projects and an educational facility for resource sensitive agriculture. Additional grants to support this effort come from the State Water Resources Control Board Division of Water Quality, the State Coastal Conservancy, and the California Department of Forestry and Fire Protection Forest Stewardship Program.

B. Hunter Valley Watershed Management and Community Planning, Australia

Perhaps owing due to varying degrees of water availability, a revealing difference in terminology exists between North Americans and Australians: the latter describe their watersheds as *catchments,* while the former describe them as water*sheds.* Whether getting 'rid of' or 'catching' water, concepts similar to the need for a more *integrated* and *participatory* watershed management approach as described in the Napa Valley case have strong adherents on the other side of the Pacific as well. In 1984 the New South Wales government began basing its planning upon a framework and policy collectively known as Total Catchment Management (TCM).

The TCM policy was initiated as a result of a national consensus between environmental groups, landholder representatives, the National Farmers Federation, and government that the of environmental problems resulting from agriculture - particularly, extensive and severe land degradation from soil erosion and salinization, needed to be addressed comprehensively and locally.

Out of this consensus then emerged a parallel federal program in Western Australia to work with rural groups in collaborative ways to address local land degradation issues. Launched as a Community Landcare Sub-Program of the National Soil Conservation Program, funding was subsequently provided to the states to implement their own Landcare programs. As part of the conditions of funding, states were required to draft plans for Landcare activities over the coming decade. While Landcare took many forms and was seen primarily as an institutional approach to rural environmental issues such as soil conservation, revegetation, wetland and habitat conservation and vermin and weed control, the interpretation of Landcare by NSW in their Draft Landcare Plan was more embracing both in the range of environmental concerns (i.e., in the inclusion of

urban and coastal issues, ground and surface water quality) and in the institutional focus (including rural people in its fulfillment).

The catchcry of TCM is "Community and Government Working Together". Along with the implementation of Landcare and its focus on local participatory action, community participation has clearly become an espoused cornerstone of natural resource management policy in NSW. The nature of the Total Catchment Management policy was such that its implementation was largely dependent on the initiative of government bodies and community groups within watershed areas. With the aim of improving communities' ability to implement the philosophy of TCM - *to make significant progress in dealing with land degradation in a manner leading to sustainable land use, while considering the welfare of individuals and community groups* - funding was sought from the Australian National Soil Conservation Program (NSCP) to work towards strategies for implementation. A multi-year project was begun in 1988, involving the Hunter Valley Conservation Trust (HVCT), a flood mitigation authority in New South Wales with a thirty-five year history , and a team of faculty and students of Agriculture and Rural Development at the University of Western Sydney, Hawkesbury. Numerous questions were examined concerning the application of integrated watershed principles and the inclusion of substantial community roles in a resource management process.

The Hawkesbury group entered into an unusual partnership with the Hunter Valley Conservation Trust, placing a high value on developing relationships and projects 'on the ground'. Their approach was to perform an extensive survey of the concerns and perceptions of multiple groups within the valley, utilizing techniques such as Rapid Rural Appraisal, workshops, individual interviews, and the collection of background data on the natural environment.[2] Numerous

---

2 Hawkesbury's team embraced an approach known variously as Action Research, or Participatory Action Research, and provide the following interpretation of what distinguishes this from a more conventional approach to research:

A simple model of action research is one in which people who are concerned or involved in an issue and collaborate in the activities of planning, acting, reflecting, and evaluating in an ongoing way to improve a practical problem...It is in sharp distinction to the research often advocated as being needed for our current environment problems where "it is important that we research the issues first and when we are certain, we can act"...Action research, as a cyclical process and methodology, takes into account the uncertainty and the impossibility of accurate long term planning.

Essentially, this methodology emphasizes taking a variety of informed actions at the appropriate community level rather than waiting to develop a grand plan. These actions are reflected on, evaluated, and then further planning can take place. This cyclical process ensures informed action on the problem as well as generating learning for the participants and public knowledge for dissemination. As such, action research has in common many of the characteristics of "adaptive muddling"...which emphasizes a variety of explorations at the appropriate community level within a stable, supportive environment and applying the notion of distributive leadership within a group.

Action research, however, attempts to go further by emphasizing the process of learning and researching and, with that, constantly reflecting on the process used in specific situations. Thus, the aim of action research is not just improving the situation at hand but also improving the way the situation was improved (*i.e.*, the methodology or process used). Action research also incorporates the notions of public critique of process for the validation of knowledge generated by research. The basic tenet of action research is that it is self-critical through its emphasis on reflection on process and public critique of generated theories and methodologies. This leads to a sustainable methodology that is flexible, creative,

sub-projects, of prior origin or newly stemming from the partnership, were joined and carried out, and later served to work back toward the formation of a bigger picture of the question of how to implement TCM. These included:

- A review of the state of environmental information available on the catchment, with respect to its accessibility, consistency, amount, type, and other variables, and efforts to integrate and collate this information into a more usable form;
- A study of soil conservation efforts in a district with a 20 year history of farmer participation, surveying farmer attitudes and documenting processes of adoption of practices;
- A collaboration with a Senior Town Planner in developing a management strategy for a sub-catchment, holding workshops to bring government and farmer representatives together to work on land management issues;
- A Trees on Farm riverbank revegetation project, with field days, improved liaison with government agencies responsible for water and soil conservation;
- Interviews of farmers in discussion of landcare, TCM, and coordination with government departments.
- Work with local Department of Agriculture extension agents in establishing interest groups to discuss extension strategy and dynamics, and sustainable land use practices.
- Providing a seminar on the Role of Extension Staff in Supporting Landcare Groups to staff of HVCT, the Department of Agriculture, and the Soil Conservation Service

Reporting on the initial outcomes of the pilot projects in the Hunter Valley, the project organizers gained insights into many of the difficulties and apparent contradictions inherent in the meeting of government resource management policies (top-down) and the goals of including community (bottom-up) in a significant capacity. They made the following observations:

- There is a greater success with extension projects and activities that are initiated locally rather than government initiated and funded.
- Relationship building within groups, between farmers, and between farmers and extension officers is an important basis for effective, sustainable, self-help extension.
- There is a mismatch between some of the espoused philosophy to do with community action groups and the action that actually occurs in community groups and from their coordinating government organizations.
- Coordinating has to do with an internal attitude as well as an external structure. Participant attitudes towards communicating and sharing ideas and information (soft coordination) must accompany institutional coordinating structures.
- There is some mistrust "on the ground" of government policy makers and any grass-roots participation in policy making needs to be encouraged by "someone on the ground." The connection between government and

and evolutionary, it is not a template or a recipe but an approach that takes into account particular circumstances and draws widely from both the sciences and the arts as "ways of doing."

community needs to be established through persons with their roots in the particular community.

- Preparing a plan is not practical; ultimately it is a matter of an ongoing process of flexible and dynamic planning and monitoring.
- Often conflict is introduced into an area or a group by, for example, a new policy or a researcher discussing ideas and can be viewed positively as an important indicator of potential change.
- Grass-roots or bottom-up activity needs to be enabled from the top. Government organizations have a leadership role in providing structures and engaging in processes and practices that help grass-roots activity to be autonomous yet coordinated.

In examining the approaches taken toward watershed management, Peter Martin, of the faculty of Agriculture and Rural Development at Hawkesbury proposed a vision for environmental care into the future, naming it the "Communicative Catchment". He sought to capture the dominant thinking, policy initiatives, extension approaches and kinds of professional competence required of a series of catchment management perspectives, which pass from 'reduced' to 'mechanical' to 'complex' before reaching 'communicative', while accumulating greater recognition of complexity and demanding new skills of those involved, and increasing community responsibility and action. While there has been apparently little or no cross-fertilization of this vision with the Napa Valley Resource Conservation District's work of encouraging the formation of Land Stewardship Groups within watersheds, there is remarkable similarity between them. Martin explains this vision:

The communicative catchment is our vision of catchment management for the future and it incorporates the approaches developed through viewing catchments as reduced, mechanized, and evolving...this conception incorporates community in the management of the catchment as participants. Resource managers have a role as action researchers, facilitating and coordinating community involvement and action. In this catchment we see environmental issues being dealt with in a cooperative, strategic, and integrated way, emphasizing community responsibility and participation. This approach emphasizes effective communicative processes between individuals, as well as within and between institutions. People are encouraged to take responsibility for their own resource care and learn about their environment in an experiential way. This type of learning and problem solving encourages "sensitization" to environmental change and promotes contextual planning and problem solving as opposed to 'grand design" planning imposed from government.

Particularly with regard to designing a management plan for nonpoint source pollution, with its inherently diffuse and complex nature, the conclusions made by the Hunter Valley researchers with respect to the need to shift perceptions and relationships of power and authority are of special significance. Included here are some of their more far reaching observations:

"The view of environmental problems being a result of an interaction between people and their environment rather than simply problems of the environment suggests that effective action emerges from a sensitization of people's perceptions to environmental change. Community involvement with these issues provides the experiential base for people to become more aware of their environment and can help to develop peoples' perceptual sensitivity to problems that occur slowly or are spatially distant."

"The development of community involvement requires the parallel change of our social institutions from the government level down to the community. The communicative catchment will not develop if government agencies do not refocus their roles away from centralized planning and control towards coordination and facilitation of community action. Similarly, the devolvement of power to people requires the community to be able to be responsible for their actions. The development of the communicative catchment is not a "grand" plan for the future but rather a vision that integrates our ethical principles of sustainability, participatory democracy, and community empowerment. "

5. Regional and Watershed Approaches: An Integrated Framework for Hawaii

(a) Nonpoint Source Pollution Responsibilities and the Regional and Watershed Approach: OSP is the State planning agency mandated with the responsibility of overall land use planning and policy. As the State planning office, OSP is also mandated with the responsibility to implement the Coastal Zone Management (CZM) Program, including the coastal nonpoint pollution control program responsibilities. Given that these mandates and responsibilities effectively link the causes and effects between land activities and ocean resources and includes a multiplicity of land uses, stakeholders, and interests, an integrated approach to polluted runoff control planning and management is needed. Because of OSP's unique position it would be the most likely agency to coordinate and facilitate the development of any integrated approach. Regional and watershed approaches are an integrated approach which have been used with a considerable amount of success.

Regional and Watershed Approach - Since the goal of the coastal nonpoint pollution control program is the protection of coastal water quality, a management approach must be able to address a wide variety of pollutant sources, land uses, and activities affecting the waterbody. A regional/watershed approach provides an integrative and cost-effective framework for evaluating and managing the totality of processes and agents affecting a waterbody.

- A regional/watershed approach enables a more inclusive process of management, where management agencies, land users, and residents can work together, pool talent, and share resources, ideas, and information.

- A regional/watershed approach enables managers to simultaneously assess the potential risks and problems of multiple land uses, allowing the analysis of absolute and relative pollutant loadings (a TMDL type of approach) so that relative risks from different land use problems can be compared.
- Since a regional/watershed approach can account for pollutant loadings from all land uses in a region or watershed, synergistic, linked, and cumulative effects of many activities can more easily be assessed and mitigated. For the same reasons, a regional/watershed approach to land use planning would be better able to anticipate the types and magnitudes of cumulative nonpoint source pollution problems.
- Since a regional/watershed approach can account for pollutant loads from different land uses, the approach allows for innovative mitigative practices such as the swapping of pollution control credits between land uses and forging partnership agreements or community contracts between agencies, communities and larger land users.
- Since a regional/watershed approach allows for relative pollution problems to be assessed, the land uses with the higher potential of nonpoint source pollution problems and/or the highest potential for cost-effective management can be prioritized for early implementation.

(b) Coastal Nonpoint Pollution Control Program Requirements and the Regional/ Watershed Approach: "Nonpoint pollution requires a nonpoint solution." Since virtually all of us are part of the problem, we all must be part of the solution. This requires a knowledgeable public, preferably working through a cooperative approach with everyone working towards a common goal. Since we cannot have pollution cops on every corner, it is clear that a regulatory approach alone will not work.

Government agencies are already underfunded in their management activities and often have more responsibilities than they can implement or enforce. Consequently, more regulation and regulatory enforcement, while sometimes needed, is not necessarily a solution. There is a vital need for a more efficient process that does not depend solely on agency staff and resources for statewide agency management.

The approach supports the sense of community that naturally stems from identification with a regional or watershed. Regions and watersheds in Hawaii are often the basis of community identification. As a few examples among many, residents of Palolo and Manoa watersheds on Oahu or Kau and Kona districts on the Big Island are generally proud to identify themselves by their watershed or region.

There is a willingness on the part of the community to share in cooperative management responsibilities if they can be recognized as partners in the decision-making process and if they can obtain some technical and financial assistance. Although communities provide a work force willing to build "sweat equity" to protect their environment, there are often "hard costs" that, while small, are often larger than neighborhoods can easily bear. Polluted runoff control requires some

training, education, and financial support that agencies or business interests can more easily supply.

In recognizing a sense of community in a regional/watershed process, all the agencies, residents and land users have the potential to be involved in planning and management. With a collaborative decision-making process, there is a sense of ownership of the decisions and a greater likelihood of self-policing to ensure compliance with locally-defined goals and standards set in the regional or watershed processes. With the development of stewardship as a mindset, the need for many individual mitigative actions or public education activities would likely be greatly reduced.

(c) Goals, Roles, and Expectations from Community Collaborations: Polluted runoff control requires the ability to anticipate, recognize, and manage problems statewide. These goals are beyond the capabilities of government agencies alone. Nonetheless, the regional/watershed process should not be viewed by agencies, land users or the community as a broad "take-over" of agency responsibilities. Instead, such an approach would augment existing agency planning and management tools. The regional/watershed process is an opportunity to more effectively accomplish nonpoint source pollution goals that are a priority for agencies, land users, and community members alike. Given that this is a new relationship between these entities, there needs to be a recognition of the reasonable expectations of the roles and responsibilities of all the parties.

As discussed above, community regional and watershed management approaches have successfully addressed polluted runoff problems. These successes collectively suggest a number of important roles for communities. These include support roles to assist agencies, as well as leadership roles in community projects that are coordinated with agency assistance. The potential community roles are collaboration, local expertise, research and monitoring, watchdog and stewardship, and education, as described at the beginning of this appendix.

(d) Supporting Regional and Watershed Approaches - An Agenda for Hawaii: The details of any regional/watershed-focused project would generally need to be defined within the implementation process itself. For example, specific actions would likely be dictated by the potential problems in the region or watershed, the dominant land uses, the existing knowledge, expertise and experience of the participants, and other site-specific factors. However, as a part of the coastal nonpoint pollution control program planning process, OSP can initiate the development of key components necessary to support regional/watershed planning and management in Hawaii. These first steps might include the following:

- Promote Regional/Watershed Approaches - Invitations to speak at neighborhood boards, land use management forums and other presentations and workshops are opportunities to promote regional/watershed approaches, and to be educated on the land use and nonpoint source pollution issues important to the community.

- Establish a Forum - OSP could take the initiative to open a dialog with the community, land users, and other state and county agencies to promote regional/ watershed approaches and discuss the issues and options for potential structures to implement the approach. OSP may want to accomplish this through a collaborative project with one of many community-organized institutions that already have recognition in the community. Such institutions might include the People's Water Conference or the Ahupua`a Action Alliance. The forum could be a watershed planning and management workshop or series of seminars designed to present the concepts of stewardship and regional / watershed approaches, identify key agencies and actors, existing projects, and stimulate discussion of the possible collaborative activities and structures.
- Initiate Partnerships - OSP could take some first steps to initiate partnerships on a case-by-case basis. This could be in the form of allocating some funding specifically as assistance funding to community-sponsored projects that meet a general set of criteria. This might be done through a "request for proposals" or other competitive bid process with an upper limit of funding for any one project. A preliminary objective might be to encourage collaborative projects that work at the watershed level to control nonpoint source pollution.
- Support Interest-Based Approaches and Conflict Resolution - OSP could help to present and outline conflict resolution processes. The workshop forum could be used to present alternative dispute resolution techniques and other conflict resolution processes that promote "win-win" solutions.
- Interagency Coordination - OSP could explore the further potential for collaboration and interagency coordination structures. These structures could help to solidify agency goals and policies, avoid duplication of programs, and determine the manner and extent to which agencies can collaborate. This would include defining roles supportive of community projects and potential avenues in which communities can assist agencies to carry out their nonpoint source pollution control mandates.

6. References

Faculty of Agriculture and Rural Development, University of Western Sydney-Hawkesbury, Australia.. *Extension Strategies for the Implementation of Total Catchment Management in the Hunter Valley* . Papers on project design, information gathering approach, critique of bureaucratic approach.

Bowker, Dennis, 1993. "Land Stewardship Watershed Plan Development". Workshop handout materials, Napa County Resource Conservation District.

Josayma, Cynthia. 1995. *Merging Mediation and Community Forestry to Resolve Land Use Conflicts in Hawaii's Natural Area Reserve System*. (Thesis in Political Science, University of Hawaii at Manoa) May 1995

Martin, Peter, Tarr, Shane and Lockie, Stewart, 1991. "The Decade of Landcare: Draft Plan" State Catchment Management Coordinating committee. Analyzed in "Participatory Environment Management in NSW: State Policy and Practice"

Martin, Peter 1991. "Environmental Care in Agricultural Catchments: Toward the Communicative Catchment", in *Environmental Management* Vol.15, No.6, pp.773-783. New York, Springer-Verlag, Inc.

Napa County Resource Conservation District 1994. *A Napa River Watershed Owner's Manual. A Framework fir Integrated Resource Management.* Napa, California, Napa County RCD.

Oregon Department of Environmental Quality and Oregon Department of Land Conservation and Development, 1994. *Nonpoint Source Pollution Control Guidebook for Local Government*

Report and Recommendations of the Natural Areas Working Group (NAWG), March 31, 1995.

State of Hawaii Department of Health. 1994. *Annual Report to the Eighteenth Legislature, State of Hawaii on The Kailua and Waimanalo Bays Volunteer Water Quality Monitoring Pilot Program*. Prepared by David Tarnas, Adam Rose, Arvin Wu, and Daniel Sailer, UH Manoa, Sea Grant Extension Service, School of Ocean & Earth Science & Technology

State of Hawaii, Department of Land and Natural Resources(DLNR), Division of Forestry and Wildlife (DOFAW),Natural Area Reserves System (NARS) 1995. *Report and Recommendations of the Natural Areas Working Group (NAWG), March 31, 1995.* [Available from the Bill Stormant, Hawaii Manager (Hilo) of NARS]

United States Environmental Protection Agency. 1994. *National Directory of Volunteer Environmental Monitoring Programs.* (January) EPA Document EPA841-B-94-001

Water Engineering and Technology, Inc. (JWET) 1990. *Napa Country Wine industry Growth, Master Environmental Assessment.* Section 5: water Quality.