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.